April 28, 2023

Mr. Nathan Mueller
Johnson County Planning, Development, and Sustainability
913 S. Dubuque Street, Ste. 204
Iowa City, IA 52240-4273

**Re: Application for Zoning Amendment, Lone Tree Solar Project, Johnson County, Iowa**

Dear Mr. Mueller,

PCR Investments SP2 LLC (PCR) prepared this application package for the Lone Tree Solar Project in Johnson County, Iowa (project or project area), a proposed utility-scale solar energy facility to be located in Johnson County on land currently zoned as Agriculture (A). This application is being submitted in accordance with the requirements of the Johnson County Unified Development Code (UDO) and the Johnson County Zoning Ordinance (8.1.23BB [Utility Scale Solar Developments]) (zoning ordinance).

The project is a proposed utility-scale solar energy facility to be located on two parcels totaling 50 acres of land located northwest of the intersection of Iowa Highway 22 and Sioux Avenue SE in Johnson County (see Attachment A). The project area is currently zoned as Agriculture (A) (Parcels 1801476001 and 1801401003). With this application, PCR is requesting to reclassify the 50 acres of the proposed project area as RE-Renewable Energy on the Johnson County Zoning Map. Pursuant to the Johnson County UDO, this cover letter and application serves as PCR's letter of intent to develop, construct and operate the project in Johnson County and provides the application materials required by Johnson County for utility-scale solar development projects.

## PROJECT DESCRIPTION

The Lone Tree Solar Project, a proposed 7.5-megawatt (MW) alternating current (AC) photovoltaic (PV) solar facility, will be located on two properties (approximately 50 acres in size) approximately three miles northwest of the town of Lone Tree, Iowa (see Attachment A for location figure). The project will interconnect to the Lone Tree Substation, which is owned and operated by the Central Iowa Power Cooperative (CIPCO). Construction of the project is anticipated to begin within 12 months of Johnson County permit approvals with a projected Commercial Operation Date (COD) of December 2024. The project is expected to operate for approximately 30 years from COD at which time it is anticipated the project will be decommissioned.

### Project Components

Solar Panels, Arrays, and Racking

The currently selected PV module is the ZXM7-SHLDD-144-550 Bifacial model, manufactured by ZNShine Solar. It has a peak power of 555.0 W, and the technology of the cells is Si-mono. Details and specifications of this module type are found in the design report included in Attachment B. The proposed panels to be used for the project (see description of project components in **Attachment B**) will have a minimum ground clearance of 19.8 inches in compliance with Johnson County requirements.

Solar panel technology is continually making advancements in both manufacturing and efficiency and the final selection of PV modules is subject to commodity pricing based on the current market demand and available stock.

The Project PV modules will be mounted on approximately 302 single-axis, galvanized steel, horizontal tracker mounting systems supported by over 2,780 steel piles. The current design consists of three power blocks and a switchgear and meter station. The number of single axis trackers varies per block but is anticipated to be approximately 100. Each power block includes 21 inverters and is connected to approximately 5,436 PV modules. The final design will be developed during the detailed engineering phase and in accordance with the applicable National Electric Safety Code ("NESC") and National Electric Code ("NEC") provisions and any generating certificate or permit conditions.

Foundations or supports will be installed to a minimum depth of five (5) feet below the ground surface to minimize impacts from freezing and thawing conditions. Exact embedment depth for the driven pile on which the solar panels are mounted will be determined with final engineering.

Electrical Collection System

Underground 12.47 kilovolt (kV) collector circuits are proposed for the Project. Underground collector circuits are an industry standard method to route the collection cables while eliminating interference with other above ground infrastructure within the Project Area. The total length of AC collection lines installed for the Project will be approximately 0.44 mile (2,325 feet). This includes 0.34 mile (1,813 feet) of AC collection lines within the PV array connecting to the medium voltage (MV) power stations, switchgear, and metering station and a 512-foot generator tie line connecting the PV array area to the Lone Tree Substation. No overhead collector circuit runs are proposed for the Project.

Access Roads

Gravel access roads will connect the facility to existing public roads and provide access to project equipment during facility operations and maintenance as well as to accommodate emergency access. Permanent internal access roads within the project area are expected to be approximately 1.49 miles (7,890.9 feet) in total length and are approximately 12 feet wide. The permanent access road outside the project area which will provide access to the site from Sioux Avenue SE is expected to be approximately 23 feet in total length and is approximately 20 feet wide.

O&M Room, Switchgear Room and MV Power Stations

The project is not expected to have an on-site O&M building. If a building is needed in the future to host technicians and spare parts, it will be permitted separately as it may be a more centralized building for multiple projects.

The project will use driven pier foundations and concrete foundations. The skids for the transformers, switchgears, MV power stations, and metering will likely be installed on driven pier foundations but could be placed on concrete foundations if required by soil and geotechnical conditions. The typical pier foundation will be from five (5) feet to 10 feet deep. For driven pier foundations, no excavation is required. For the concrete foundations, soil excavation quantities will be determined in the detailed engineering phase.

Foundation dimensions will be determined in the detailed engineering phase. The preliminary design includes one Switchgear Room foundation approximately 13 feet by 46 feet in size, four MV Power Stations approximately 13 feet by 25 feet in size, and one Operation and Maintenance Room approximately 13 feet by 46 feet in size (see Appendix B).

Security Fencing

PCR will utilize fencing around the PV solar arrays that is consistent with all applicable codes, including NEC and North American Electric Reliability Council Critical Infrastructure Protection requirements. Fencing is required to safeguard the public health. Array fencing will consist of seven-foot-high woven-wire exclusion fence with wood fenceposts. Fenceposts will be driven into the ground. No concrete foundations will be used for the fenceposts.

Road Use

Public roads anticipated to be used for the transport of equipment and materials for project construction, operation, and/or maintenance activities are anticipated to include Interstate 80, Iowa Highway 218 and Iowa Highway 22, and Sioux Avenue Southeast (Johnson County). These roads are depicted on a route map included in Attachment B.

**APPLICATION REQUIREMENTS**

This application addresses the requirements of the Johnson County Zoning Ordinance (8.1.23BB) specific to Utility Scale Solar Developments and includes:

**Attachment B - Site Plan and Design Report**

Pursuant to the zoning ordinance, Attachment B addresses:

- **Setbacks** - Setbacks for all structures will adhere to setback standards for the Agricultural district (A) which require a minimum structure setback of 100 feet from the centerline of any public roads and 100 feet from inhabitable structures (Ordinance 12-22-20-02 – Amendment; Solar Energy Systems, Utility Scale). The setbacks are depicted in the Preliminary Layout for the project provided in **Attachment B**.
- **Security Fencing**. A woven wire security fence at least seven (7) feet tall will encircle the boundaries of the project and is depicted on the site plan in **Attachment B**. Warning/no trespassing signs will be posted within sight of all points of the fence line or no greater than fifty (50) feet apart as required by Johnson County. At each access point, the fence will have a gate with a locking mechanism on the primary access side. Security fences, gates, and warning signs will be maintained in good condition until the project is decommissioned. More information about project decommissioning is provided below.
- **Panel Clearance.** The proposed panels to be used for the project (see description of project components in **Attachment B**) will have a minimum ground clearance of 19.8 inches in compliance with Johnson County requirements.
- **Roads.** PCR is currently coordinating with Johnson County regarding access road and utility right-of-way permit applications. The access road has been designed in compliance with Johnson County requirements. In addition, this attachment includes a map depicting anticipated routes to be used as part of construction, operation, and maintenance of the project and a resolution affirming the stability of the road system. **Attachment B**.

**Attachment C. Adjacent Property Information**

Pursuant to the zoning ordinance, Attachment C includes:

- A map depicting the requested area to be rezoned (outlined in red) and properties within 500 feet of the project (outlined in blue)
- Solar easement agreement (legal description of what will be rezoned in this request below)
- Adjacent property information (Landowners within 500 feet of the project)

Legal Description of Property

A fifty (50) acre portion of the Southeast Quarter of Section 1, Township 77 North, Range 6, West of the 5th Principal Meridian, Johnson County, Iowa, described as follows:

Tract 1:

The South 456.85 feet of the Northeast Quarter of the Southeast Quarter of Section l, Township 77 North, Range 6, West of the 5th Principal Meridian, Johnson County, Iowa, containing approximately 13.6 acres.

Parcel Number 1801401003

Tract 2:

The Southeast Quarter of the Southeast Quarter of Section l, Township 77 North, Range 6, West of the 5th Principal Meridian, Johnson County, Iowa, containing approximately 36.4 acres.

Parcel Number 1801476001

**Attachment D. Vegetation Management Plan**

A Vegetation Management Plan was prepared to document ground cover standards as required by Johnson County. A landscape plan, if needed, will be prepared in coordination with Johnson County and affected landowners as the project moves closer to construction.

**Attachment E. Agricultural Impact Mitigation Plan (AIMP)**

The AIMP identifies measures that PCR and its contractors will take to avoid, mitigate, repair, and/or compensate for potential agricultural impacts that may result from the construction, operation, and eventual decommissioning of the project. A grading plan prepared for the project is included in the AIMP.

**Attachment F. Glare Hazard Analysis**

A glare hazard analysis was conducted, and the results provided in Attachment F. Based on the results of this analysis, glare mitigation is not proposed; however, if needed, PCR will coordinate with Johnson County and affected landowners to develop a mitigation plan as the project moves closer to construction.

**Attachment G. Operations and Maintenance (O&M) Plan and Emergency Response Plan**

PCR prepared an O&M Plan that generally applies to PCR facilities in both Iowa and Illinois (Attachment G). The O&M plan generally describes soil erosion and sediment controls, ground cover standards and buffer areas, and general procedures for operation and maintenance of the facilities, including maintaining safe access and ongoing maintenance and repair. Operation and maintenance of the project will be conducted in compliance with Johnson County requirements. Attachment G also includes PCR's Emergency Response Plan for the project.

Prior to construction, PCR or its contractors will prepare and submit a Notice of Intent (NOI) application to the Iowa Department of Natural Resources (DNR) for coverage of construction site stormwater runoff under a NPDES General Permit No. 2, per Iowa requirements. The submittal will include a copy of the completed NOI application and a project-specific Stormwater Pollution Prevention Plan (SWPPP), which will be included in the O&M Plan and provided to Johnson County once completed.

An on-site O&M building is not proposed for this project. Operation of the Lone Tree project will be monitored remotely, with onsite maintenance occurring periodically, as needed, to maintain the equipment.

**Attachment H. Decommissioning Plan**

**The** decommissioning plan describes the anticipated project timeline, project components, and decommissioning activities, site restoration, and decommissioning costs. A draft performance agreement is also included with Attachment H.

**Attachment I. Sensitive Areas Analysis (Chapter 8:3.5 of the UDO)**

A Sensitive Areas Analysis Report is provided in Attachment I and referred to in the AIMP prepared for the project (Attachment E). The results of the Sensitive Areas Analysis are summarized below.

**Attachment J. Stormwater Management Plan**

A stormwater management plan was prepared for the project and is included in Attachment J. Full stormwater management planning in accordance with section 8:3.6 of the Johnson County UDO will be provided prior to construction, including a designation of a surface type as impervious or pervious in accordance with the Iowa Stormwater Management Manual.

As mentioned above, prior to construction, PCR or its contractors will prepare and submit an NOI to the Iowa DNR for coverage of construction site stormwater runoff under a NPDES General Permit No. 2, per Iowa requirements. The submittal will include a copy of the completed NOI application and a project-specific Stormwater Pollution Prevention Plan (SWPPP), which will be included in the O&M Plan and provided to Johnson County once completed.

**Attachment K. Erosion Control Plan**

An erosion control plan was prepared for the project and is included in Attachment K.

## ADDITIONAL INFORMATION

**Sensitive Areas Analysis**

A Sensitive Areas Analysis was conducted for the project (Attachment I). The results include:

- No critical wildlife habitat is present within the project area.
- No bat habitat is present within the project area given the lack of trees.
- The project is not located within a 100-year floodplain or floodway.
- A Phase I archaeological survey was conducted for the project. No further cultural resources investigations were recommended as a result of that survey.
- No prairies or prairie remnants, savannas, or woodland communities are located within the project area.

- A review of topographical data available for the project did not identify any critical slopes (slopes within a grade of 25 to 35 percent) or protected slopes (grades exceeding 35 percent).
- Approximately 0.43 acre of wetland and one unnamed tributary to Otter Creek was identified within the project area.
- The site plan for the project (Attachment B) was amended to include a 50-foot buffer of the wetland and a 30-foot buffer of the stream.

**Public Health Zoning Application**

An application to the Public Health Department was filed on December 6, 2022; however, the application fee is currently being refunded because the project does not include septic or sanitary sewer construction. PCR is currently coordinating with Johnson County to ensure this process is documented to meet Johnson County requirements.

**Compliance with Local, State and Federal Regulations.**

The project will comply with applicable local, state, and federal laws and regulations.

I appreciate Johnson County's review of this application and attachments and look forward to continuing to work with you through the application process.

Sincerely,

Cynthia Schuchner

**Attachments**

A. Project Location Map
B. Project Components, Detailed Site Plan, and Road Use
C. Adjacent Property Information and Legal Description
D. Vegetation Management Plan
E. Agricultural Impact Mitigation Plan
F. Glare Hazard Analysis
G. Operations and Maintenance Plan
H. Decommissioning Plan and Draft Performance Agreement
I. Sensitive Areas Analysis
J. Stormwater Management Plan
K. Erosion Control Plan

**Attachment A:**
**Project Location Map**

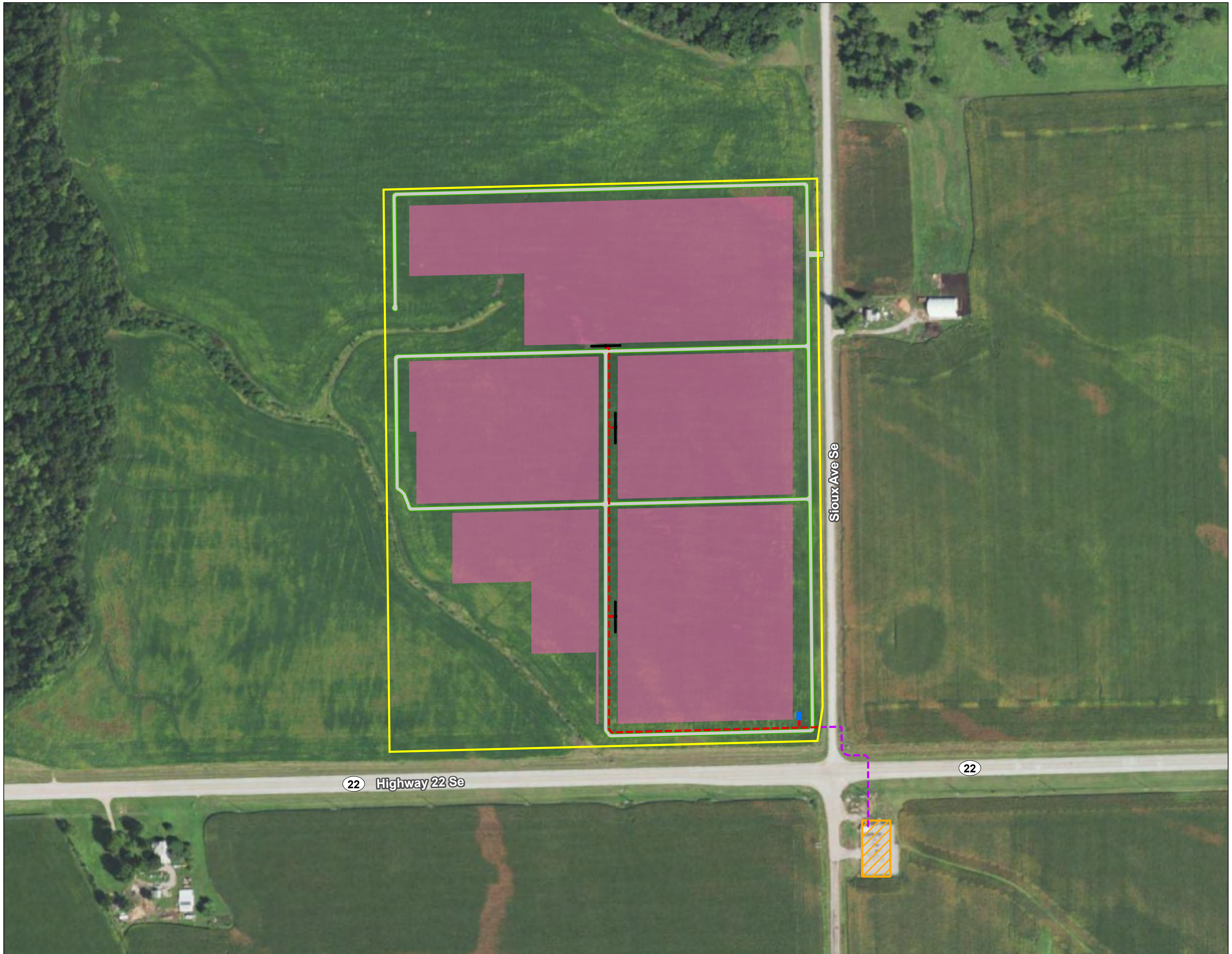



*Figure No.*

**1**

*Title*

## Project Location

*Client/Project* 193709077

PCR Investments LLC
Lone Tree Substation Solar Project

*Project Location*
Township of Freemont
Johnson County, IA

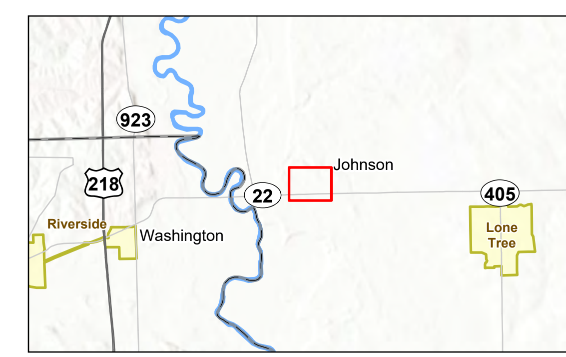
Prepared by JDS on 2022-08-03
TR by MZ on 2022-08-04
IR by SP on 2022-08-18

N

0 150 300 Feet
(At original document size of 11x17)
1:3,600

Legend

- Project Boundary
- Electrical Collection System
- Generator Tie Line
- Access Roads
- Solar Array
- Transformers, Switchgear, and Power Station
- Switchgear & Metering
- Substation




***Notes***
**1.** Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
**2.** Data Sources: Stantec, PCR Investments LLC, USGS, NADS
**3.** Background: NAIP 2021

Stantec





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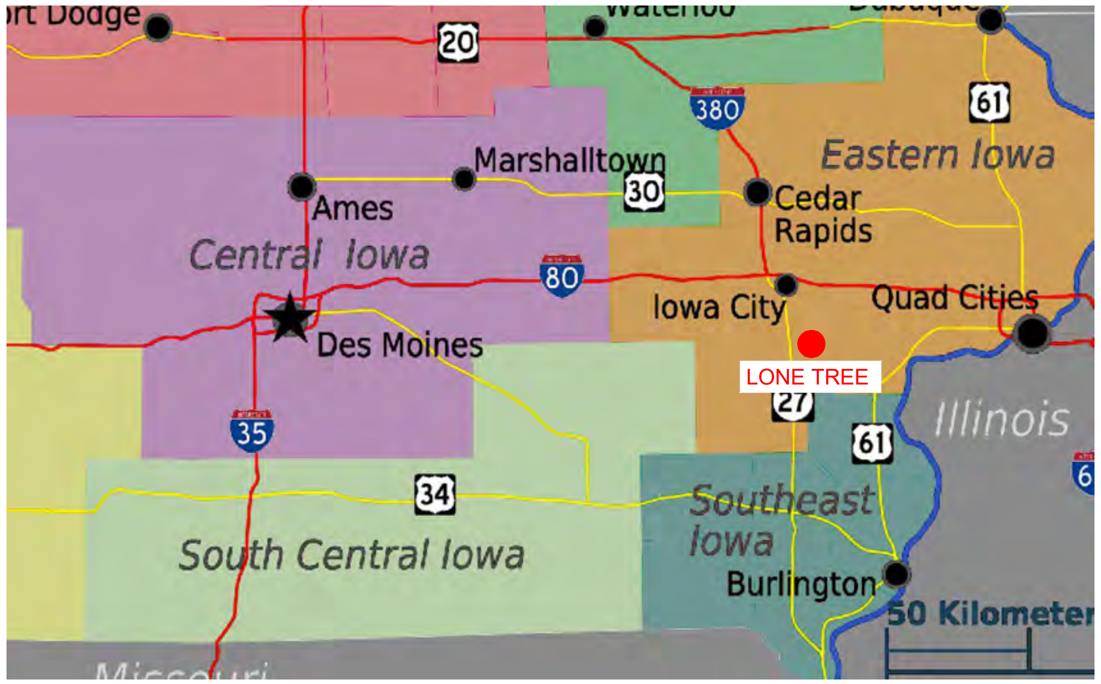
# Attachment B:
# Project Components, Detailed Site Plan, and Road Use

# LONE TREE PROJECT

# Lone Tree, IOWA

# SITE PLAN

| Lone Tree Solar Project | | | | |
|---|---|---|---|---|
| MW ac | MW dc | ratio | MWh/y | Acres |
| 7,50 | 8,97 | 1,20 | 15338 | 50 |




| Contact Information | | | |
|---|---|---|---|
| Mariano Brandi | CEO | mbrandi@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |
| Cynthia Schuchner | Chief Construction and Engineering Officer | cschuchner@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |

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| 03 | | |
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| 01 | | |
| 00 | 04/25/23 | Preliminary |

REVISIONS

PCR

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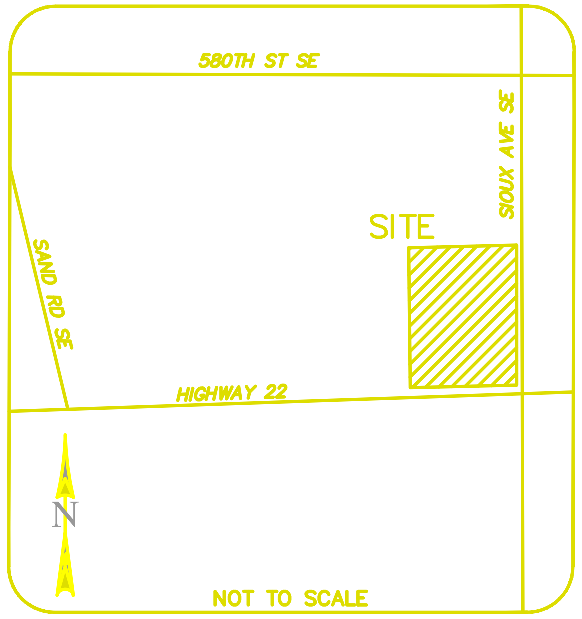
|---|---|
| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Sheet: | 01/08 |
| Utility: | CIPCO |
| Scale | |
| Rev: | |
| File: | Site Plan Lone Tree.dwg |


# BOUNDARY SURVEY

PART OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER AND PART OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 1, TOWNSHIP 77, RANGE 6 EAST, ALL IN JOHNSON COUNTY, IOWA.




VICINITY MAP

| | |
|---|---|
| | PROPERTY LINE |
| | ADJACENT PROPERTY LINE |
| | RIGHT OF WAY LINE |
| | SURVEY TIE LINE |
| | CONTOURS |
| | STORM DRAIN LINE |
| | FOUND MONUMENT (AS NOTED) |
| | FLARED END SECTION |
| | TELEPHONE PEDESTAL |
| IR | IRON ROD |
| (M&R) | MEASURED & RECORD |
| S.F. | SQUARE FEET |
| BC | BACK OF CURB |

## BASIS OF BEARINGS

THE SOUTH LINE OF THE SOUTHEAST QUARTER; ASSUMED BEARING S88°32'17"W PER STATE PLANE IOWA SOUTH

| Rev. | Date (MM/DD/YY) | COMMENTS |
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| 04 | | |
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| 00 | 04/25/23 | Preliminary |

REVISIONS

PCR

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|---|---|---|
| Project: | LONE TREE | |
| Sector: | JOHNSON, IOWA, USA | |
| Owner: | PCR INVESTMENTS SP2 LLC | |
| Title: | SITE PLAN | Sheet: 02/08 |
| Utility: | CIPCO | Scale / Rev: |
| File: | Site Plan Lone Tree.dwg | |


| POINT | LAT | LONG |
|---|---|---|
| A | 41.49670229 | -91.48829677 |
| B | 41.49670967 | -91.48362429 |
| C | 41.49698140 | -91.48355875 |
| D | 41.50128520 | -91.48348608 |
| E | 41.50127748 | -91.48822008 |

- Property Boundary (50ac)
- 1V54 Single-axin N-S Tracker
- Fence
- MV Underground Cable 12.47 kV
- Wetland
- Centerline Public Rd
- Internal Roads

| SOLAR PANEL | |
|---|---|
| Brand | ZNshine Solar |
| Model | ZXM7-SHLDD-144-550 |
| Power | 550 Wp - Bifacial |
| Dimensions (W x L x D) | 1134 x 2278 x 30 mm |
| **INVERTER** | |
| Brand | SMA |
| Model | Sunny Highpower SHP125-US-20-PEAK3 |
| Power | 125 kW |
| Output Voltage | 480 V |
| **LV Cables (INV - TR)** | |
| Model | EXZHELLENT COMPACT 1000V Prysmian |
| Type | 0,6/1,1kV Cu 3x2/0AWG XLPE |
| Section | 2/0 AWG |
| Rate Current | 167 A |
| R | 0,16 ohm/km |
| V/A km | 0.34 |
| **MV Cables (TR - SW)** | |
| Type(2) | 12.5 kV Al 3x1x250MCM XLPE |
| Section(2) | 250 MCM |
| Rate Current MVS 1\|2\|3 | 120\|240\|360 A |
| R | 0,568 ohm/km |
| X | 0,194 ohm/km |
| B | 0,156 mF/km |
| Length MV 1\|2\|3 | 267\|596\|950 ft |
| **COMPONENTS** | |
| Total Inverters | 62 |
| Total Trackers 1V54 | 302 |
| Total Modules | 16308 |
| **GCR** | **22.03%** |

*NOTES:*

1. *Dimensions shown are approximate and may change based on final equipment selections*
2. *MV underground cable gauge TBD*
3. *TBD if outdoor or indoor solution*

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| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 03/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |


| MV Cables (Interconnection) | |
|---|---|
| Type(2) | 12.5kV Al 3x1x250MCM XLPE |
| Section(2) | 250 MCM |
| Rate Current | 480 A |
| R | 0,211 ohm/km |
| X | 0,175 ohm/km |
| B | 0,212 mF/km |
| Length | 0.1 miles |
| **Power Factor @POI** | **95%** |

Boundaries Lone Tree CIPCO

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| Owner: | PCR INVESTMENTS SP2 LLC |
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| Utility: | CIPCO |
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Scale

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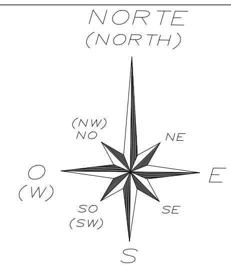


| Angle min., ° | Angle max., ° | Distribution, % | Color |
|---|---|---|---|
| 0.00 | 0.00 | 10.25 | |
| 0.00 | 1.75 | 84.28 | |
| 1.75 | 3.50 | 4.13 | |
| 3.50 | 5.25 | 0.90 | |
| 5.25 | 7.00 | 0.26 | |
| 7.00 | 8.75 | 0.11 | |
| 8.75 | 10.50 | 0.06 | |
| 10.50 | 12.25 | 0.02 | |
| 12.25 | 14.00 | 0.00 | |
| 14.00 | 55.00 | 0.00 | |

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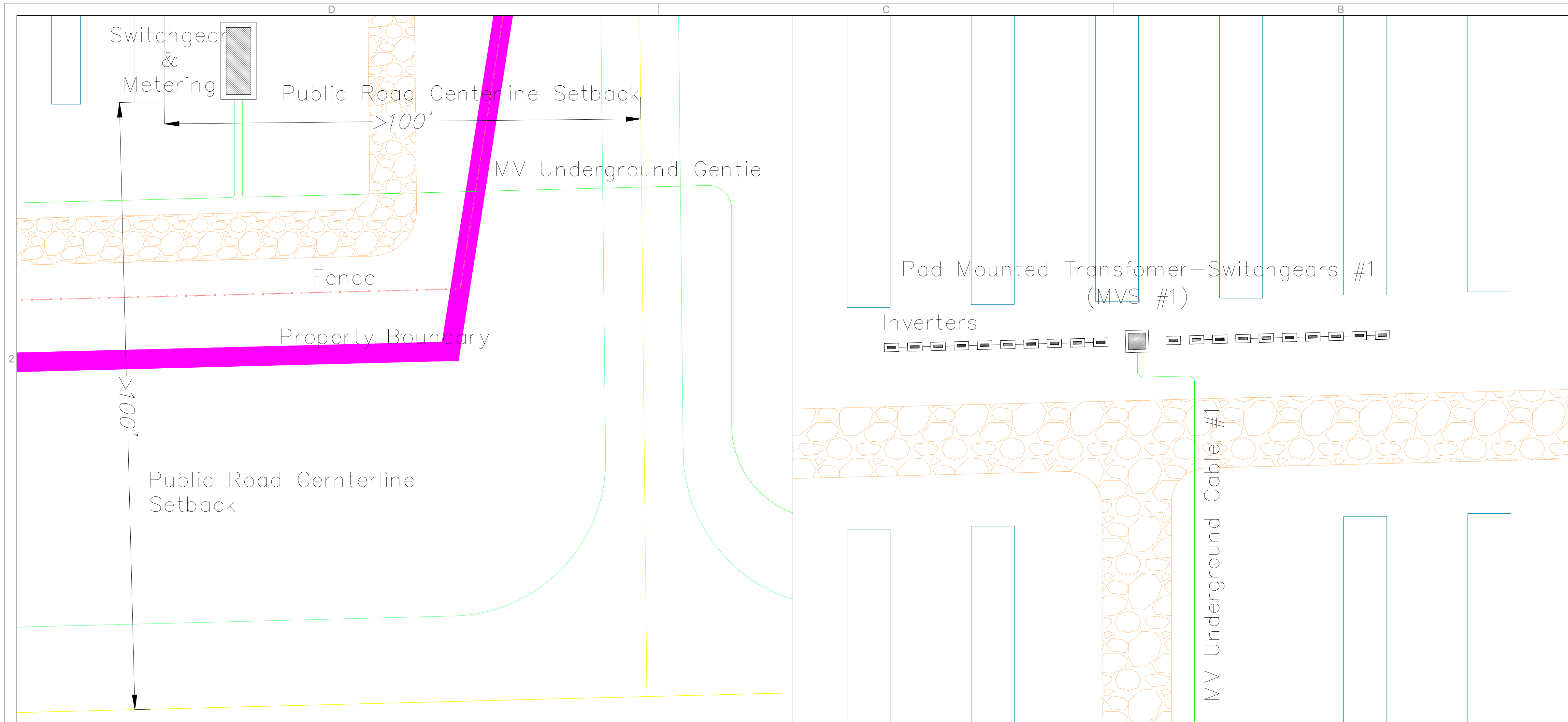
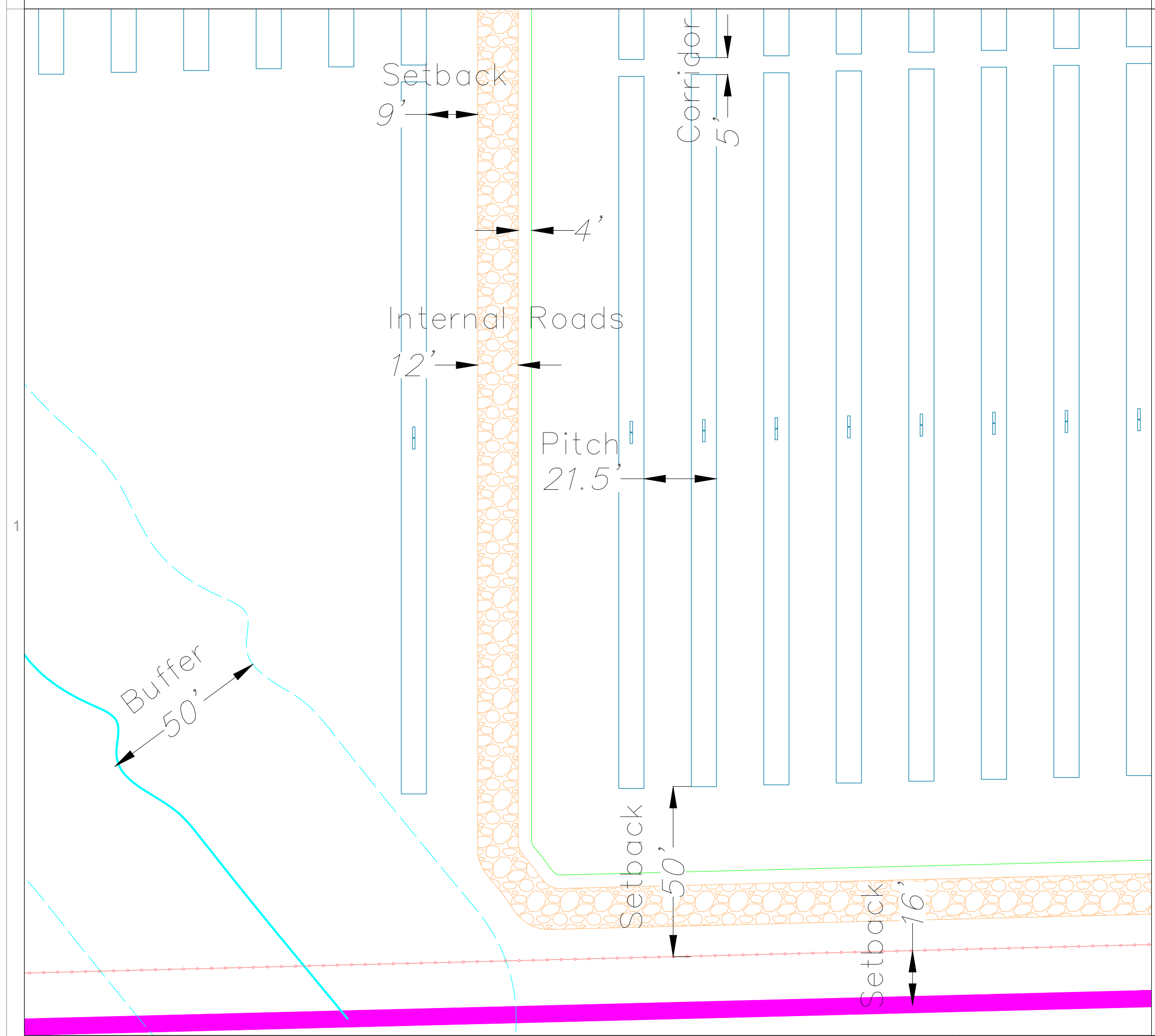
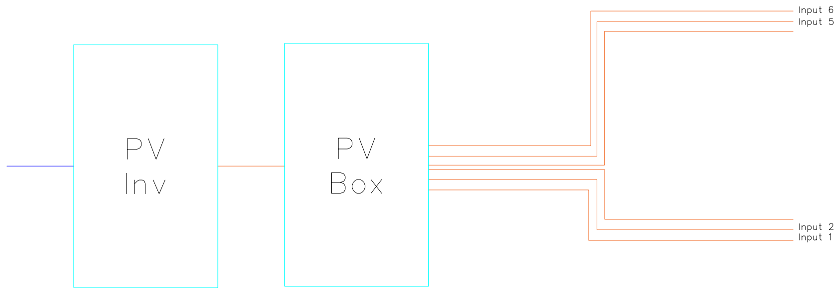



| Voltage | |
|---|---|
| | AC 0,48kV |
| | DC 1500V |

| Inverter | |
|---|---|
| MPPT conected | 1 |
| Strings conected | 10 |
| Modules/String | 27 |
| Strings/Tracker | 2 |




NOTES:
1. A BLA Harness design for the DC cabling may modify the need of installing PV Boxes

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| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
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Scale
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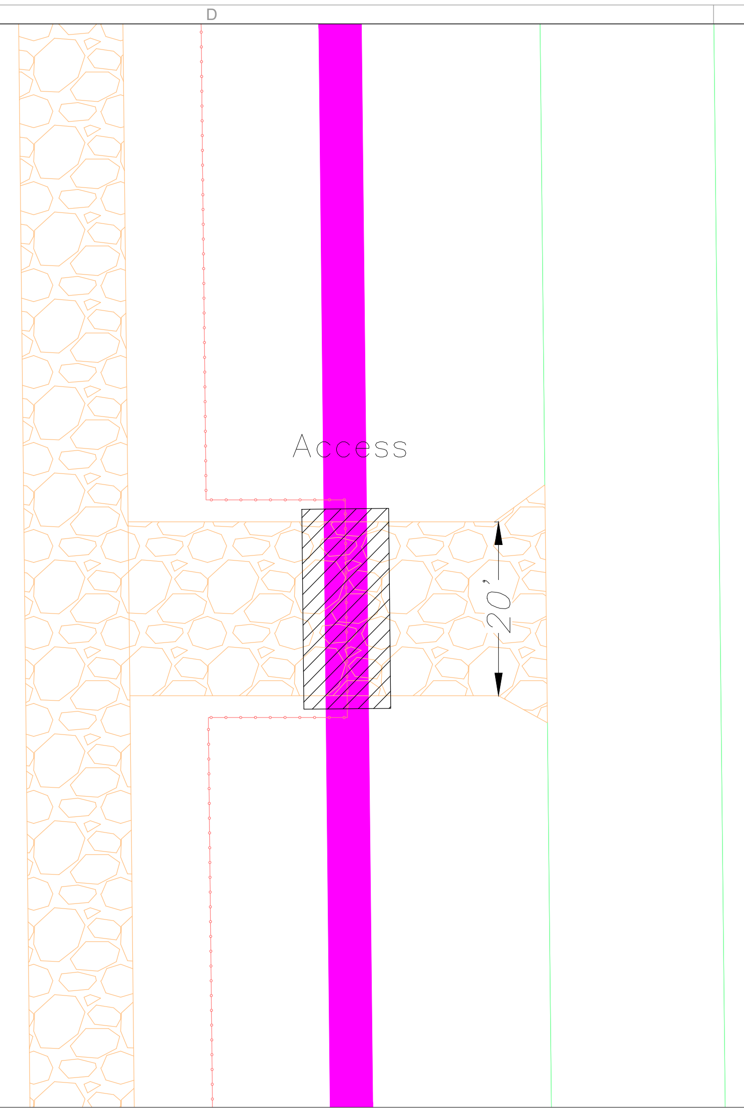
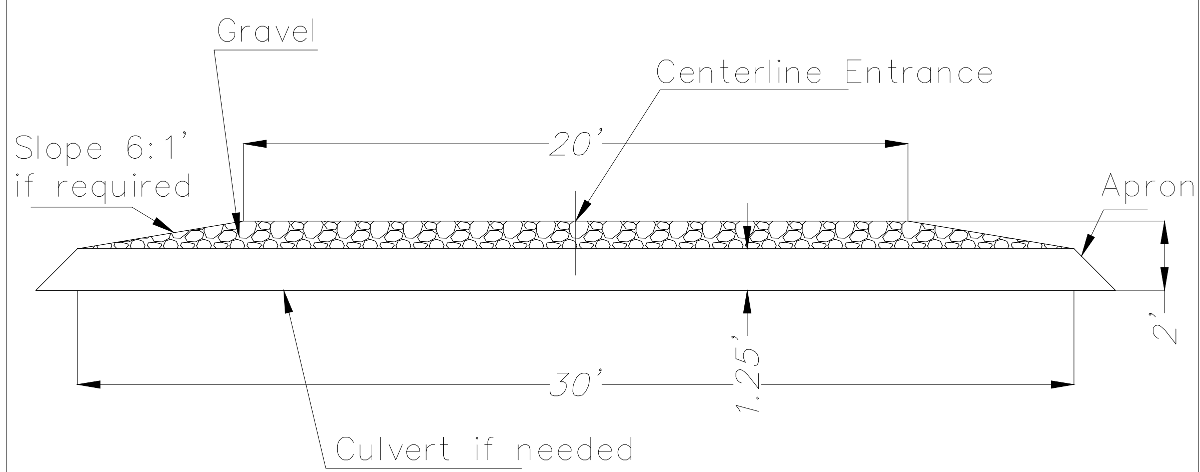



## DETAIL - ACCESS FRONT VIEW




NOTES:

1. Heavy Loads:
   - * MVS ~ 10 tn
   - * 40 ft PV Container ~ 7 tn

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| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 07/08 |
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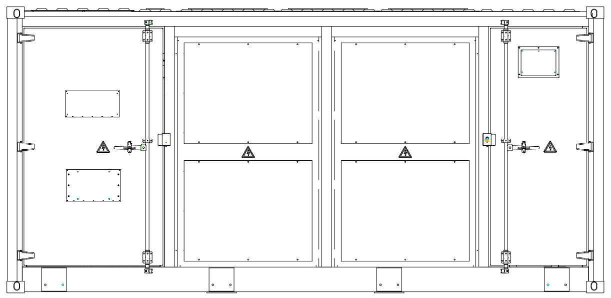
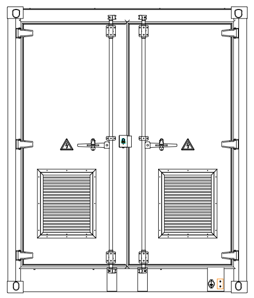
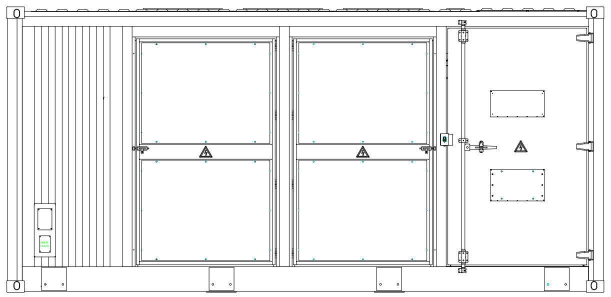
# SW & METERING ROOM[(1)]



Front View

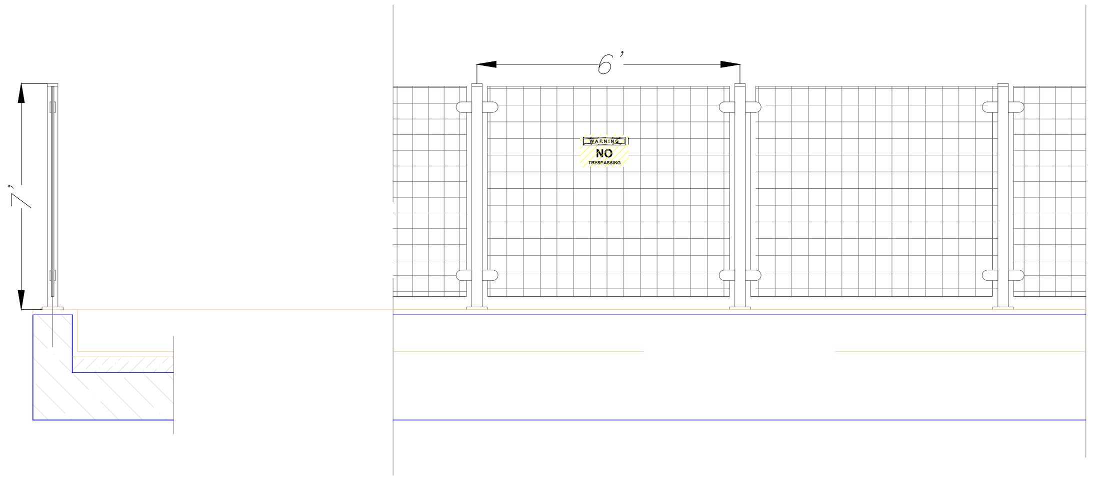


Right View



Back View

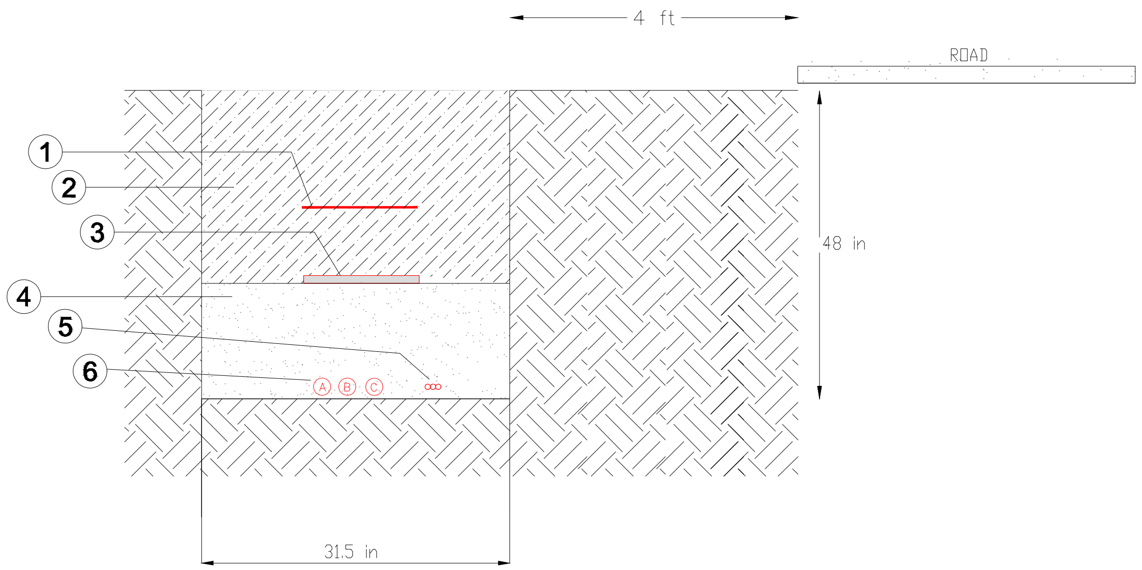
# SITE BOUNDARY FENCE




NOTES:

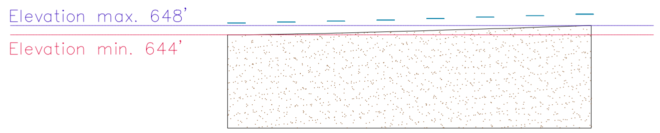
1. 20 ft container solution for indoor option, pad mounted for outdoor alternative
2. Fence warning signs spaced 66 ft
3. Wire opening size TBD
4. All lighting will comply with downcast lighting standards, and all signage will comply with the County's sign standards

DETAIL UNDERGROUND MV CABLE

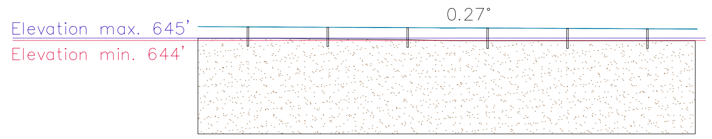



(1) Warning sign
(2) Filled with excavated land
(3) Protection plate
(4) Filled with excavated land
(5) Tritube (FO)
(6) MV 12.47kV Al 3x1x250MCM XLPE

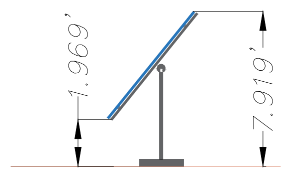
CROSS SECTION VIEW (e.g.)



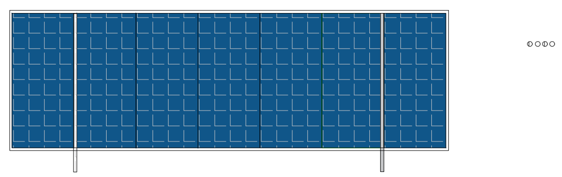

FRONT VIEW (e.g.)




Frame parameters
- Framing type: single-axis trackers
- Module orientation: portrait
- Rows: 1
- Columns: 54
- Turning angle range, °: 52.00
- Horizontal gap between modules, ft: 0.066
- Vertical gap between modules, ft: 0.066
- Motor gap size, ft: 6.562
- Number of joint gaps : 0
- Joint gap size, ft: 1.640
- Overhang left, ft: 0.000
- Overhang right, ft: 0.000
- Pole reveal, ft: 4.914
- Reference height, ft: 1.969
- Frame height at highest point, ft: 7.919
- Frame power, kWp: 29.700




SINGLE AXIS N-S



TRACKER 1-PORTRAIT 54 MODULES

| Rev. | Date (MM/DD/YY) | COMMENTS |
|---|---|---|
| 04 | | |
| 03 | | |
| 02 | | |
| 01 | | |
| 00 | 04/25/23 | Preliminary |

REVISIONS

PCR

| | | | |
|---|---|---|---|
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 08/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |

# Project Description

## Lone Tree PV Plant

Prepared for: PCR

03/09/2023

# TABLE OF CONTENTS

# 1. INTRODUCTION

The objective of this report is to describe the specifications and design of the solar photovoltaic plant Lone Tree. The current description of the project could be subject to changes in the next stages of the project development.

The rated power of the PV Plant is 7.5 MWac and the peak power is 8.97 MWdc resulting in a DC/AC ratio of 1.196. The main characteristics of the project are shown in Table 1.

*Table 1. Project Characteristics*

| Lone Tree Solar Project | |
|---|---|
| **Main characteristics** | |
| Location | Johnson County, Iowa |
| Rated power (AC) | 7.50 MWac |
| Peak power (DC) | 8.97 MWdc |
| Ratio DC/AC | 1.196 |
| **Civil characteristics** | |
| Suitable plot area | 50 acre |
| Ground coverage ratio (GCR) | 21.85 % |
| Structure type | One-axis tracker |
| Pitch distance | 21.5 ft |
| **Electrical characteristics** | |
| PV Modules (550.0 Wp) | 16308 |
| MV station (up to 3 MVA) | 3 |
| Number of inverters (up to 125 kVA) | 62 |

The general layout of the PV plant is shown in Figure 1.

Figure 1. General layout

# 2. SITE

## 2.1. Location

The PV Plant location has the characteristics shown in Table 2

*Table 2. Location characteristics*

| PV Plant location characteristics | |
|---|---|
| City / Town | Lone Tree |
| Region | Iowa |
| Country | United States |
| Latitude | +41.5° N |
| Longitude | -91.48° W |
| Altitude | 197 m |
| Timezone | UTC -6 |

The project location is shown in Figure 2. A closer view of the region is shown in Figure 3.


*Figure 2. Location of PV Plant in the region of Iowa, in United States*

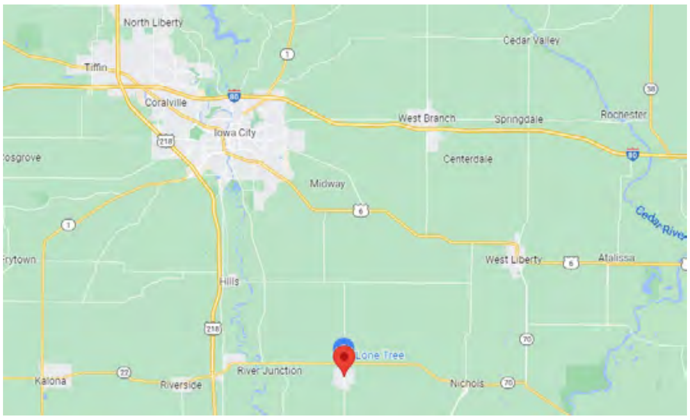



*Figure 3. Closer view of the PV plant in the region of Iowa*

## 2.2. Plot Areas

The area where the PV plant is to be built consists of 1 available area, with a total surface area of 50 acres. A total of 2 restricted area are not suitable for the installation of PV modules. The final available area covers a surface of 49.70 acres.

The size of each area and the total suitable area for installation purposes is shown in Table 3.

*Table 3. Size of plot areas of the project.*

| Area name | Surface |
|---|---|
| **Available areas** | |
| Area | 49.7 acres |
| **Restricted areas** | |
| Area 1 | 0.2 acre |
| Area 2 | 0.1 acre |
| **Total area** | **50.0 acres** |

The substation (blue), the plot area(s) (magenta) and, if any, the restricted area(s) (cyan) are shown in Figure 4.


*Figure 4. Plot Areas of the Lone Tree PV Plant*

## 2.3. Horizon profile

The solar irradiance reaching the photovoltaic modules will change if there are hills or mountains on the horizon. These physical obstructions will block the beam component of the irradiance during some periods of the day and will have an impact on the diffuse component as well. Therefore, the horizon profile directly impacts the energy yield of the photovoltaic plant.

The horizon line has an average elevation of 0.5° and a maximum elevation of 1.5°. Throughout the year, the Sun will be blocked by the horizon line for a total of 57 hours. The data source for the horizon line was the PVGIS 5 database.

The blocked elevations over the complete azimuth range are shown in Figure 5.

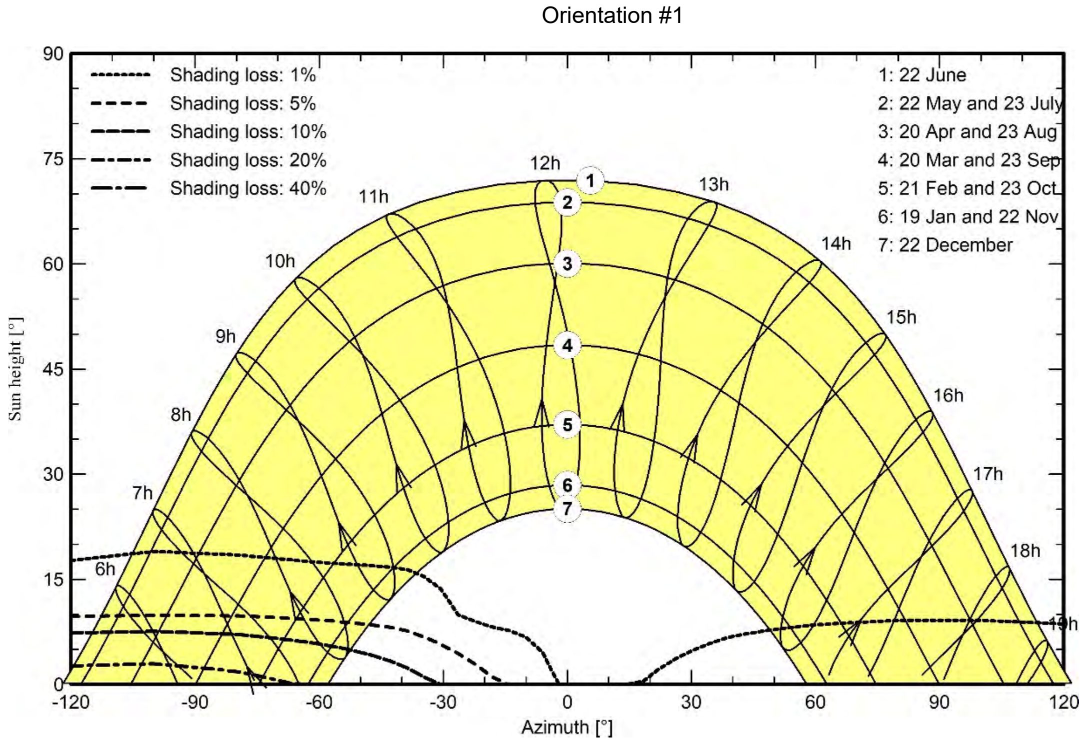



*Figure 5. Horizon profile (data source: PVGIS 5)*

# 3. SOLAR RESOURCE

The aim of the solar resource analysis is to provide an estimation of the solar energy the photovoltaic plant would receive throughout a typical year.

The solar resource is usually given as a series of hourly values for the irradiance and temperature, for a period of one year. This series is called the Typical Meteorological Year (TMY).

The source used to generate the TMY was the PVGIS database. It includes meteorological data ranging from 2005 to the present (the actual period used may vary depending on the location) and has a spatial resolution of 4 km by 4km. The uncertainty of the PVGIS data varies between ±3% to ±10%, depending on the location.

The hourly temperature values found in the TMY yield the following aggregates:

- Minimum temperature: -4.74 °C.
- Maximum temperature: 23.78 °C.
- Average temperature: 10.45°C.

The results of the solar resource analysis are shown in Table 4.

Balances and
main results

| | GlobHor kWh/m² | DiffHor kWh/m² | T_Amb °C | GlobInc kWh/m² | GlobEff kWh/m² | EArray GWh | E_Grid GWh | PR ratio |
|---|---|---|---|---|---|---|---|---|
| **January** | 58.6 | 25.76 | -4.74 | 83.2 | 77.1 | 0.744 | 0.708 | 0.949 |
| **February** | 81.0 | 29.78 | -3.26 | 114.1 | 107.8 | 1.027 | 0.979 | 0.956 |
| **March** | 121.8 | 46.35 | 4.20 | 164.5 | 159.5 | 1.437 | 1.367 | 0.927 |
| **April** | 144.2 | 79.40 | 10.85 | 180.3 | 174.7 | 1.558 | 1.415 | 0.875 |
| **May** | 175.9 | 84.69 | 17.16 | 224.3 | 216.7 | 1.853 | 1.765 | 0.877 |
| **June** | 187.6 | 75.63 | 21.70 | 240.4 | 231.6 | 1.942 | 1.849 | 0.858 |
| **July** | 192.4 | 84.49 | 23.78 | 250.0 | 244.3 | 2.045 | 1.861 | 0.830 |
| **August** | 170.3 | 73.44 | 22.47 | 222.7 | 212.8 | 1.801 | 1.717 | 0.860 |
| **September** | 131.7 | 52.26 | 18.32 | 178.7 | 174.3 | 1.489 | 1.419 | 0.885 |
| **October** | 96.0 | 44.21 | 11.55 | 127.6 | 123.4 | 1.101 | 1.051 | 0.919 |
| **November** | 60.6 | 26.60 | 4.66 | 83.0 | 77.7 | 0.711 | 0.676 | 0.909 |
| **December** | 49.4 | 26.72 | -2.20 | 65.0 | 59.9 | 0.582 | 0.530 | 0.909 |
| **Year** | 1469.7 | 649.33 | 10.45 | 1933.7 | 1859.9 | 16.290 | 15.338 | 0.884 |

*Table 4. Solar resource monthly values*

# 4. MAIN EQUIPMENT

The main equipment used to convert the solar energy to electricity is:

- Photovoltaic modules, which convert the solar radiation into direct current.
- The single-axis tracker, which supports and orients the PV modules to minimize the angle of incidence between the incoming sun rays and the PV modules surface during the day.
- The string combiner boxes, which consolidate the output of the strings of photovoltaic modules before reaching the inverter.
- Central inverters, which convert DC from solar field to AC.
- Power Transformers, which raise the voltage level from low to medium.
- MV Stations or Power Stations, which hold the necessary equipment to convert the DC power to AC and evacuating to the desired voltage level.
- Switchgear Room, indoor medium voltage room with metering used to control, protect, and isolate the whole pv plant and inject to the grid.

The electrical configuration of the PV plant can be seen in Figure 7.

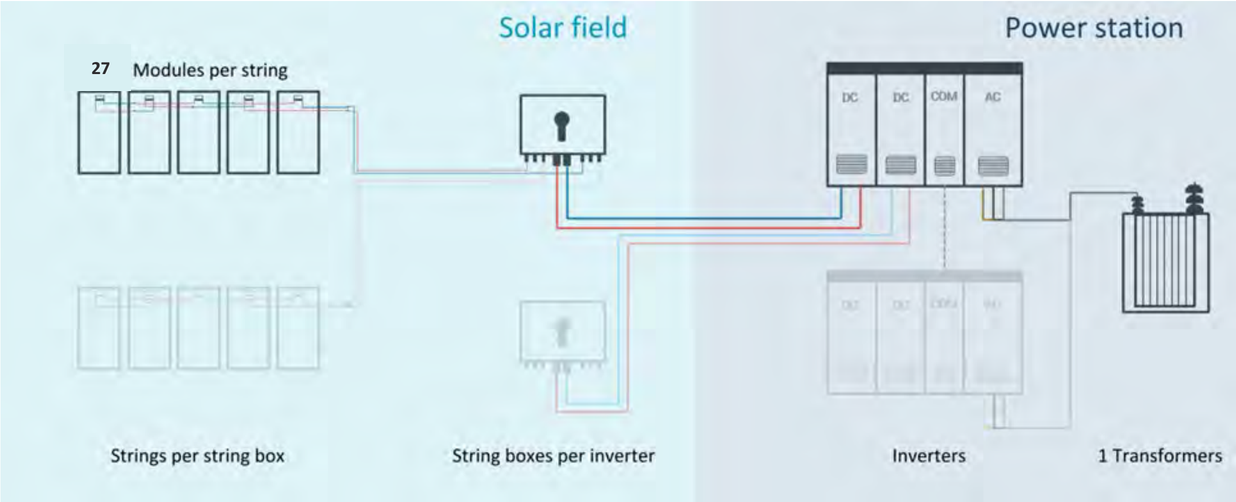



*Figure 7. Simplified electrical configuration diagram*

## 4.1. Photovoltaic module

The selected photovoltaic module is the ZXM7-SHLDD-144-550 Bifacial model, manufactured by ZNshine Solar. It has a peak power of 550.0 W, and the technology of the cells is Si-mono.

The features of the photovoltaic module are shown in Table 5.

The module has a bifaciality factor of 65.00 %.

*Table 5. Photovoltaic module characteristics*

| Photovoltaic module characteristics | |
|---|---|
| **Main characteristics** | |
| Module model | ZXM7-SHLDD-144-550 |
| Manufacturer | ZNshine Solar |
| Technology | Si-mono |
| Type of module | Bifacial |
| Maximum voltage | 1500 V |
| **Standard test conditions (STC)** | |
| Peak power | 550.0 W |
| Efficiency | 21.28 % |
| MPP voltage | 41.90 V |
| MPP current | 13.13 A |
| Open circuit voltage | 50.20 V |
| Short circuit current | 13.89 A |
| **Temperature coefficients** | |
| Power coefficient | -0.35 %/°C |
| Voltage coefficient | -0.29 %/°C |
| Current coefficient | 0.050 %/°C |
| **Mechanical characteristics** | |
| Length | 2279mm |

| | |
|---|---|
| Width | 1134mm |
| Thickness | 35mm |
| Weight | 33.5 kg |

An example picture of a Bifacial Si-mono module is shown in Figure 8.

*Figure 8. Example of a Bifacial Si-mono photovoltaic module*

## 4.2. Single axis N-S tracker

The PV solar modules will be mounted on North-South oriented one-axis solar trackers, integrated on metallic structures combining galvanized steel and aluminum parts, forming a structure fixed to the ground. An example of a single-axis tracker is shown in Figure 9.

*Figure 9. Example of single-axis tracker*

Single-axis trackers are designed to minimize the angle of incidence between the incoming sun rays and the photovoltaic panel plane of array. The tracking system consists of an electronic device capable of following the sun through the day. The main features of the tracking system are summarized in Table 6.

*Table 6. Main characteristics of the single-axis trackers*

| Single-axis tracker characteristics | |
|---|---|
| Model | Sky Line |
| Manufacturer | Arctech |
| Technology | Single-row |
| Configuration | 1V |

| | |
|---|---|
| Tracking angle limits | +52 / -52 ° |
| Number of modules per row | 54 modules (maximum 60 modules) |
| Pitch distance | 21.5 feet |
| Minimum ground clearance | 1.97 feet |

## 4.3. String combiner box

The string boxes collect the power generated by the DC array, connect the strings in parallel to the inverter, and provide electrical protection to the PV field. To match the number of inputs of the inverters, several parallel strings will be concentrated to function as a single circuit. Junction boxes shall be installed with a fuse per string to protect each array. Overvoltage DC dischargers will be installed, and one DC switch will be situated in the output line. Additionally, a communication system may be installed to monitor the string current and voltage.

An example of a string box is shown in Figure 10.

*Figure 10. Example string box*

The string boxes will be installed in a shaded area and shall be easily accessible to facilitate maintenance. They will be placed behind the PV modules and use existing structure poles if possible so that they remain shaded and prevent damage caused by rainwater or other meteorological phenomena.

## 4.4 String inverter

The inverter converts the direct current produced by the photovoltaic modules to alternating current. It is composed of the following elements:

- One or several DC-to-AC power conversion stages, each equipped with a maximum power point tracking system (MPPT). The MPPT will vary the voltage of the DC array to maximize the production depending on the operating conditions.
- Protection components against high working temperatures, over or under voltage, over or under-frequencies, minimum operating current, mains failure of the transformer, anti-islanding protection, protection against voltage gaps, etc. In addition to the protections for the safety of the staff personnel.

- A monitoring system, which has the function of relaying data regarding the inverter operation to the owner (current, voltage, power, etc.) and external data from monitoring of the strings in the DC array (if a string monitoring system is present).

In Figure 11 a commonly used photovoltaic inverter for utility-scale PV plants is shown.


*Figure 11. Example of central photovoltaic inverter*

The main characteristics of the selected inverter are shown in Table 7.

*Table 7. Inverter characteristics*

| Inverter characteristics | |
|---|---|
| **Main characteristics** | |
| Inverter model | Sunny Highpower Peak3 125-US |
| Inverter type | String |
| Manufacturer | SMA |
| Maximum DC to AC conversion efficiency | 98.5 % |
| **Input side (DC)** | |
| MPPT search range | 705 - 1450 V |
| Maximum input voltage | 1500 V |
| **Output side (AC)** | |
| Rated power | 125 kVA |
| Power at 30 C (datasheet) | 125 kVA |
| Power at 50 C (datasheet) | 125 kVA |
| Output voltage | 480 V |
| Output frequency | 60 Hz |

## 4.5. Power transformer

The power transformer raises the voltage of the inverter AC output to achieve a higher efficiency transmission in the power lines of the photovoltaic plant. An example of a power transformer is shown in Figure 12.

*Figure 12. Example of power transformer*

The main features of the power transformer are shown in Table 8.

*Table 8. Power transformer characteristics*

| Power transformer characteristics | |
|---|---|
| Rated power | 3000 kVA |
| Voltage ratio | 0.48/12.47kV |
| Cooling system | ONAN |
| Tap changer | 2.5%, 5%, 7.5%, 10% |
| Short circuit (Xcc) | 0.08 |

## 4.5. Switchgear Room

The switchgear room is an indoor building or containers. An example is shown in Figure 13.

*Figure 13. Example of an Indoors Switchgear Room*

The switchgear room shall be supplied with medium voltage switchgears that include one transformer protection unit, one direct incoming feeder unit, one direct outcoming feeder unit and electrical boards.

The main features of the default switchgear room are shown in Table 10.

*Table 10. Switchgear room characteristics*

| Switchgear room characteristics | |
|---|---|
| Voltage ratio | 12.47 kV |
| Service | Indoor |

An outdoor solution could also be an alternative.

# 5. PV PLANT SIZING

## 5.1. Electrical configuration

The photovoltaic generator array consists of photovoltaic modules connected in serial and parallel associations. This configuration is defined by the module and inverter technical features, the power system requirements, and the meteorological conditions of the specific location in United States.

The methodology used to define the electrical configuration consists of sizing the strings of modules, electrical junction boxes (if present), wiring and inverters to find an electrical configuration that satisfies the DC/AC ratio goal. Some of the design criteria considered were:

- Reaching the maximum DC voltage possible, staying below the maximum rated voltage of the photovoltaic modules, 1500 V. This is done to minimize the DC power transmission losses.
- The photovoltaic generator array (DC field) is oversized with respect to the rated power of the AC system, to maximize the energy yield.

The AC system was designed to meet a power factor requirement at the substation input. The required power factor at the substation input is 0.950. To meet this requirement, it was determined that the power factor at the inverter output will be 0.932.

The main features of the electrical configuration are shown in Table 11.

*Table 11. Electrical configuration characteristics*

| Electrical configuration characteristics | |
|---|---|
| Plant rated power | 7.50 MWac |
| Plant peak power | 8.97 MWdc |
| DC/AC Ratio | 1.196 |
| Modules per string | 27 |

The medium voltage network connecting the PV plant to the substation operates at 12.47 kV. It is composed of 1 medium voltage branch.

## 5.2. Electrical Cabling Design

The goal when calculating the characteristics of the electrical wiring is to minimize the cable lengths and sections. The sections are selected according to the NFPA 70 National Electrical Code.

When selecting a cable cross section, the current carrying capacity, the voltage drop, and the short circuit current were considered. The maximum allowed voltage drop was 1.5% for the DC side, and 0.5% for the AC cables of the MV network.

A 1 AWG earthing cable is used for the low voltage and medium voltage trenches, while a 1/0 AWG earthing cable is used in the case of the MV stations.

A summary of the selected cable sections and their installation method is shown in Table 12.

*Table 12. Summary of the selected cable sections*

| Section | Conducting material | Insulating material | Installation type |
|---|---|---|---|
| **Strings to Inverter** | | | |
| 10 AWG | Cu | XHHN | Fastened to structure |
| 12 AWG | Cu | XHHN | Fastened to structure |
| **Inverter to PS** | | | |
| 350 kcmil | Al | XHHN | Buried in trench |
| **PS to MV switchgear** | | | |
| 500 kcmil | Al | XHHN | Buried in trench |
| 350 kcmil | Al | XHHN | Buried in trench |

## 5.3. Civil works

Some of the parameters considered for the civil works required to build the photovoltaic plant are shown in Table 13.

*Table 13. Civil works*

| Civil works | |
|---|---|
| Pitch distance | 21.5 ft |
| Distance between consecutive rows | 5 ft |
| Road width | 12 ft |
| LV trench maximum section | 4.31 ft2 |
| MV trench maximum section | 12.92 ft2 |

For the design of the PV plant under study, roads of 12 ft have been used. These roads run a total area of 2.5 acres.

Road ditches used for drainage and for channeling water are placed on one side of the roads.

A total perimeter of 5909 ft of woven wire fence will surround the different areas of the PV plant. The fence has at least 7 ft of height and 6 ft between posts. For every 164.04 ft of the fence, a light post of 13.12 ft of height and a microwave barrier system are installed. For every 328.08 ft of the fence, a video camera post of 19.69 ft of height is installed.

Low-voltage cables from string inverters to the MV Stations have been directly buried in trenches. Various rows of cables may be included inside the same trench. Low-voltage and medium-voltage trenches are separated.

The minimum depth at which the low-voltage cables are placed is 23.62 in. These cables are horizontally in touch. The vertical separation between the low-voltage cables is 1.97 in.

A simplified trench cross section of the LV trenches is shown in Figure 14.

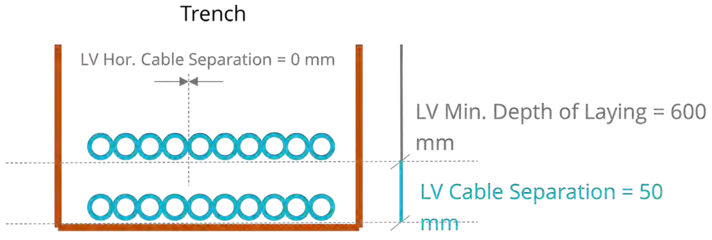



*Figure 14. Simplified LV trench cross section*

The minimum depth at which medium voltage cables are placed is 27.56 in. These cables are separated horizontally by 7.87 in. The vertical separation between them is 7.87 in.

A simplified trench cross section of the MV trenches is shown in Figure 15.

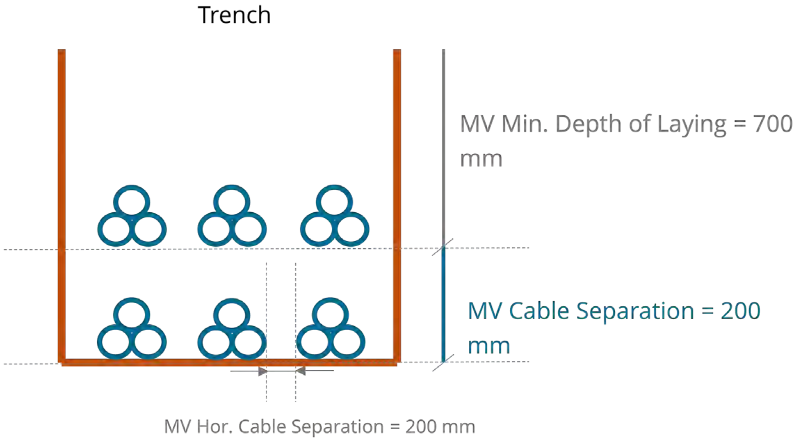
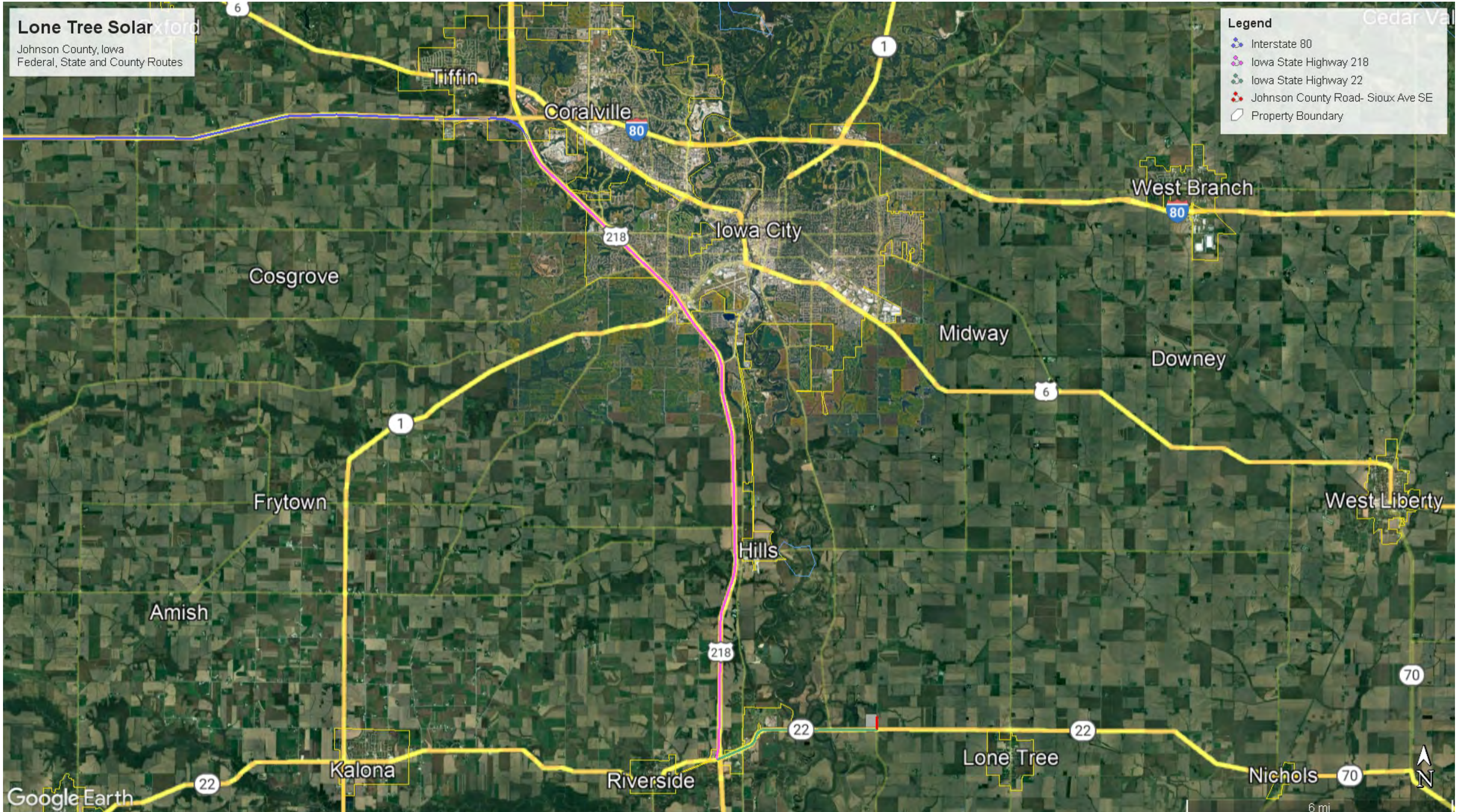



*Figure 15. Simplified MV trench cross section*

The offset horizontal space between the cable rows and the trench boundaries is 1.97 in.



Lone Tree Solar
Johnson County, Iowa
Federal, State and County Routes
Legend
Interstate 80
Iowa State Highway 218
Iowa State Highway 22
Johnson County Road- Sioux Ave SE
Property Boundary
Tiffin
Coralville
Iowa City
West Branch
Cosgrove
Midway
Downey
Frytown
West Liberty
Hills
Amish
Lone Tree
Nichols
Kalona
Riverside
Google Earth
6 mi
N

**RESOLUTION 04-19-90-2**
**AFFIRMING THE STABILITY OF THE ROAD SYSTEM**

Whereas Johnson County is one of the counties in the State of Iowa that is increasing in its population; and

Whereas there is a growing tendency for persons in Johnson County to prefer to develop lots for building purposes; and

Whereas improvement of currently non-improved roads to standards dictated by the state of Iowa for Secondary roads is expensive;

Now, therefore be it resolved that any person who develops a rezoned and subdivided lot in Johnson County should first be aware of the existing secondary road conditions serving that tract of land, and should act under the presumption that said road in all probability will continue in its present condition. Private interests or adjacent landowners may underwrite the costs to bring said road up to minimum state standards which includes providing the necessary right-of-way, moving fences, grading, culverts, surfacing, and other items that may be needed to provide an improved road. These improvements can be achieved by permission of Johnson County per the **Iowa Code**, Section 319.14, and by Johnson County Resolution 08-10-89-2. However, if this tract of land is located on a road that has been designated as a Level B road per Resolution 04-05-90-1, Johnson County will provide no more services than stated in Johnson County Ordinance 02-08-90-1. If possible, consideration should be given to the prospect of agreeing that said road be closed by Johnson County and maintained by the residents owning land abutting said road to county subdivision standards as a private lane.

My (our) signature on this document indicates that I have read the above road policy of Johnson County, Iowa, and understand the contents of the above shown policy, and that the zoning, or subdivision, action that is being taken by me (us) would be subject to the above Resolution by the Johnson County Board of Supervisors.

Mariano Brandi
Signature of Owner, Contract Owner, Option Purchaser

1334 Brittmoore rd. Houston Texas. 77043. 8329703352
Address and Phone Number

Subscribed and sworn to before me on this 12th day of January, 2023.

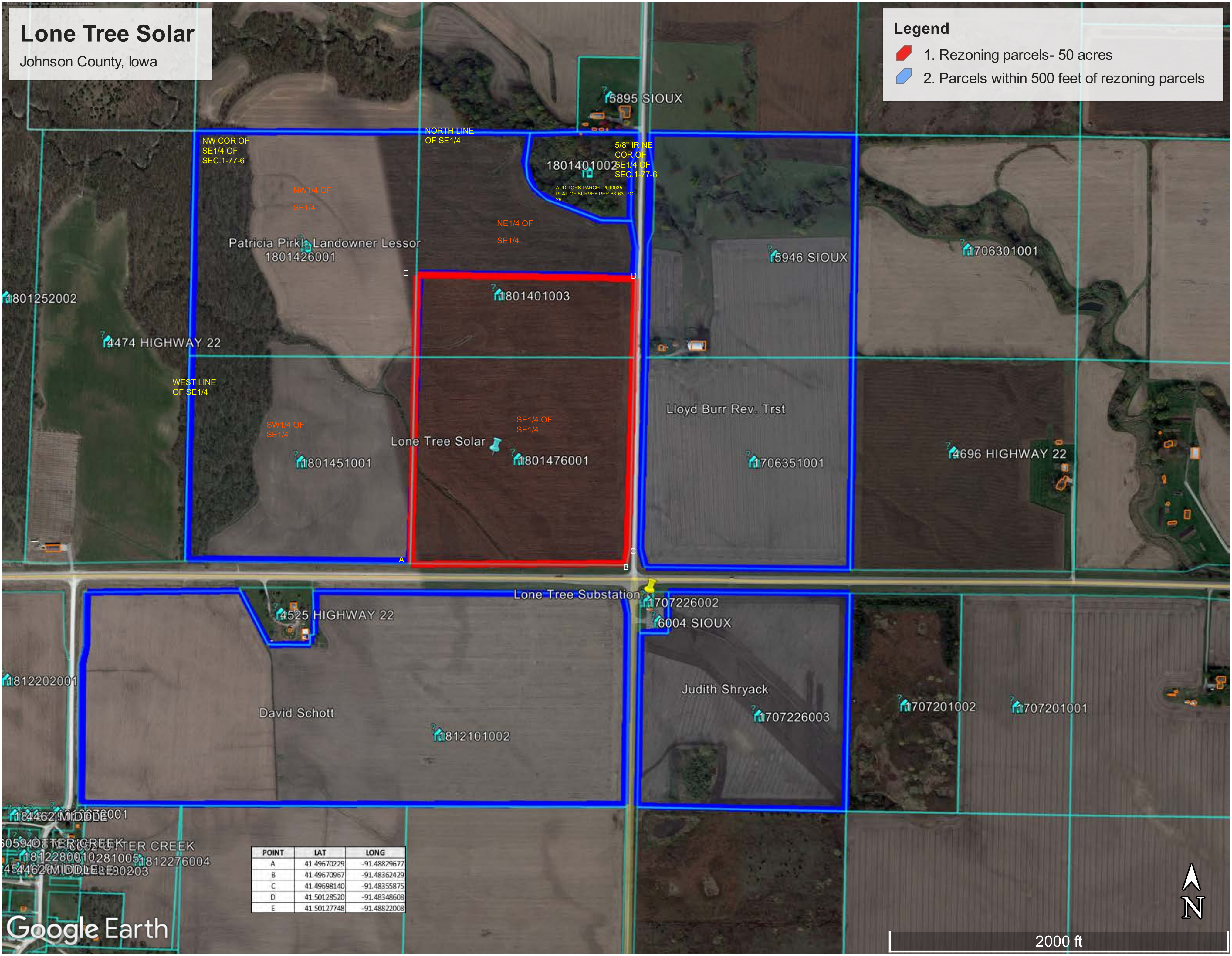
Dimma Wright
Notary Public, in & for the State of Texas

DIMMA WRIGHT
Notary ID #132837858
My Commission Expires
December 22, 2024
NOTARY PUBLIC STATE OF TEXAS

This notarial act was an online notarization

h\application forms\road stability
02/07/2007

**Attachment C:**
**Adjacent Property Information and Legal Description**




| POINT | LAT | LONG |
|---|---|---|
| A | 41.49670229 | -91.48829677 |
| B | 41.49670967 | -91.48362429 |
| C | 41.49698140 | -91.48355875 |
| D | 41.50128520 | -91.48348608 |
| E | 41.50127748 | -91.48822008 |

**Prepared by and**
**after recording return to:**
Dutmy SP 2 LLC
c/o Danny Kach
Litwin Kach LLP
200 N. LaSalle, Suite 1550
Chicago, IL 60601

THIS SPACE FOR RECORDERS USE ONLY

## MEMORANDUM OF SOLAR EASEMENT AGREEMENT

THIS MEMORANDUM OF SOLAR EASEMENT AGREEMENT (this "**Memorandum**"), is made, dated and effective as of JAN 3, 2022 (the "**Effective Date**"), between Patricia Pirkl Revocable Living Trust (together with its successors, assigns and heirs, "**Owner**"), whose address is 2718 340th St. SW Tiffin, IA 52340 , and Dutmy SP 2, LLC, a Delaware limited liability company (together with its transferees, successors and assigns, "**Grantee**"), whose address is Dutmy SP 2 LLC, c/o Danny Kach, Litwin Kach LLP, 200 N. LaSalle, Suite 1550, Chicago, IL 60601, with regards to the following:

1. Owner and Grantee did enter into that certain SOLAR EASEMENT AGREEMENT dated JAN 3, 2022 (the "**Agreement**"), which encumbers the real property located in Johnson County, Iowa, as more particularly described in Exhibit A attached hereto (the "**Property**"). Capitalized terms used and not defined herein have the meaning given the same in the Agreement.

2. The Agreement grants, and Owner hereby grants, Grantee, among other things, (a) the exclusive right to develop and use the Property, including, without limitation, (i) for the determining the feasibility of a solar project, (ii) constructing, laying down, installing, using, replacing, relocating, reconstructing and removing from time to time, and monitoring, maintaining, repairing and operating Solar Facilities, and (iii) converting solar energy into electrical energy and collecting and transmitting the electrical energy so converted; (b) an exclusive easement to capture, use and convert the unobstructed solar flux over and across the Property from all angles and from sunrise to sunset at the Property during each day of the Term; and (c) an exclusive easement for electromagnetic, audio, visual, glare, electrical or radio interference attributable to the Solar Facilities or Site Activities.

2. The Agreement contains, among other things, certain Owner and third party use and development restrictions on the Property, including restrictions on mineral rights holders.

3. The Agreement shall be for (a) an initial due diligence period of up to one (1) year, (b) a development term of up to two (2) years, (c) a construction term of up to two (2) years, (d) an operations term of thirty (30) years, and (e) one (1) extended term of ten (10) years if the terms and conditions of the Agreement are met.

4. This Memorandum does not supersede, modify, amend or otherwise change the terms, conditions or covenants of the Agreement, and Owner and Grantee executed and are recording this Memorandum for the purpose of providing constructive notice of the Agreement and Grantee's rights thereunder. The terms, conditions and covenants of the Agreement are set forth at length in the Agreement and are incorporated herein by reference as though fully set forth herein. This Memorandum shall not, in any manner or form whatsoever, alter, modify or vary the terms, covenants and conditions of the Agreement.

5. This Memorandum shall also bind and benefit, as the case may be, the heirs, legal representatives, assigns and successors of the respective parties hereto, and all easements, covenants, conditions and agreements contained herein shall be construed as covenants running with the land.

6. Except as otherwise set forth in the Agreement, Owner shall have no ownership, lien, security or other interest in any Solar Facilities installed on the Property, or any profits derived therefrom, and Grantee may remove any or all Solar Facilities at any time.

7. This Memorandum may be executed in counterparts, each of which shall be deemed an original and all of which when taken together shall constitute one and the same document.

[signature page to follow]

IN WITNESS WHEREOF, the parties have executed this Memorandum as of the Effective Date first written above.

OWNER:

Patricia Pirkl Revocable Living Trust

By: Patricia Pirkl
Name: Patricia Pirkl
Title: Trustee

GRANTEE:

Dutmy SP2, LLC
a Delaware limited liability company

By: 
Name: DAVID BOYCE
Title: AUTHORIZED REPRESENTATIVE

STATE OF IOWA )
) SS:
COUNTY OF JOHNSON )

The foregoing Agreement was acknowledged and sworn before me this 20th of December 2021, by Patricia Pirkl, Trust of Patricia Pirkl Revocable Living Trust an Iowa Trust.

[SEAL]

TIMOTHY S. GRADY
Commission Number 139912
My Commission Expires
July 3, 2022

Notary Public
Commission expires: 7/3/2022

STATE OF ILLINOIS )
) SS:
COUNTY OF DuPage )

The foregoing Agreement was acknowledged and sworn before me this 3rd of January 2022, by David Boyce of Dutmy SP2, LLC, a Delaware limited liability company.

[SEAL]

NINA PATEL
Official Seal
Notary Public – State of Illinois
My Commission Expires Feb 4, 2022

Nina Patel
Notary Public
Commission expires: 2/4/2022

**EXHIBIT A TO MEMORANDUM OF SOLAR EASEMENT AGREEMENT**

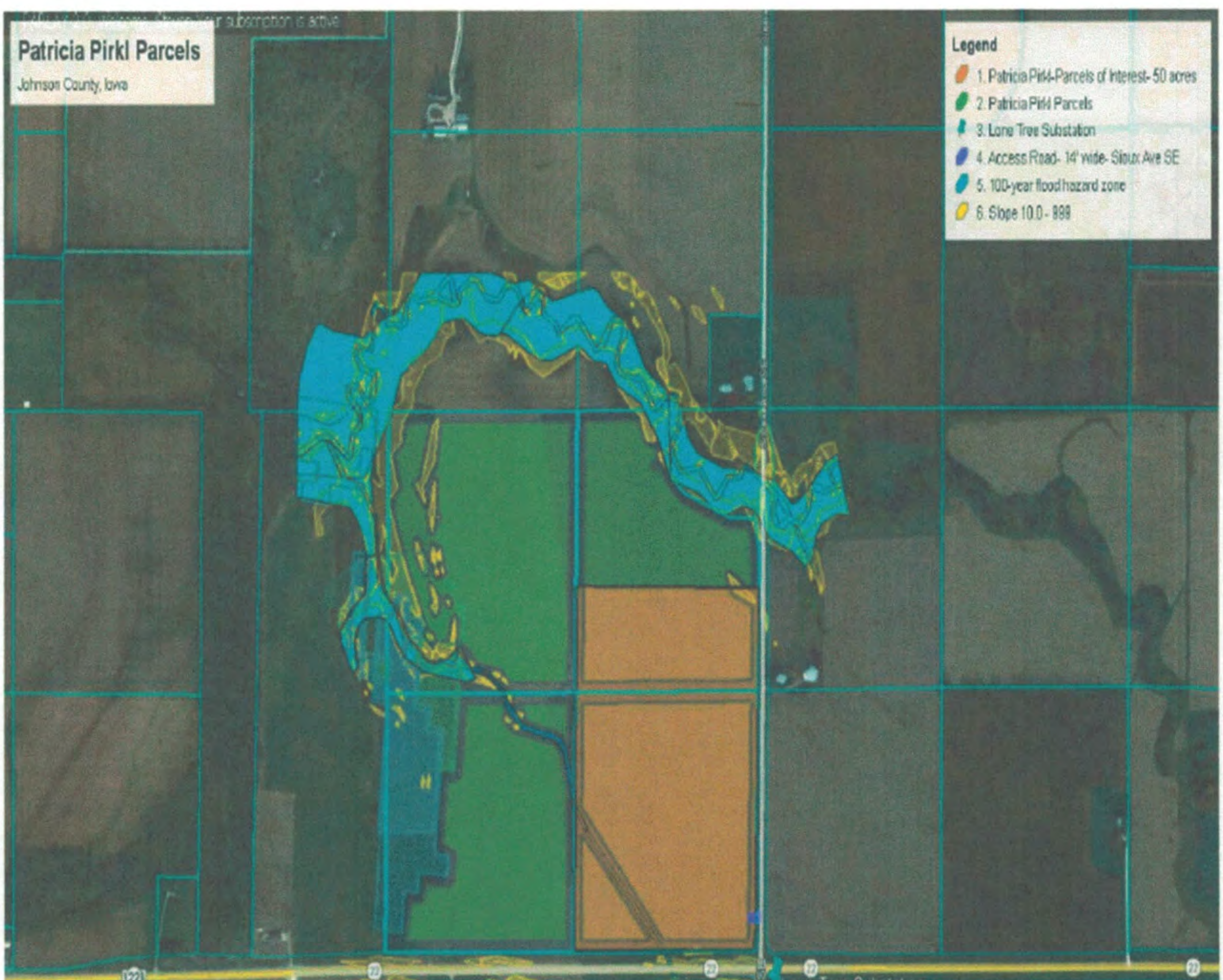
LEGAL DESCRIPTION OF THE PROPERTY

A fifty (50) acre portion of the Southeast Quarter of Section 1, Township 77 North, Range 6, West of the 5th Principal Meridian, Johnson County, Iowa containing the following Parcel Numbers:

1801426001
1801451001
1801401003
1801476001

Center Mass Coordinates: 41.499538°,-91.485915°

DEPICTION OF THE PROPERTY



# <u>Lone Tree Solar</u>

A. Adjacent houses within 500 feet:

Unoccupied farmhouse at 5946 Sioux Ave SE
Parcel ID: 1706326001
Landowner: Lloyd F. Burr Jr. Revocable Trust
Address: 5408 540th St. SE, Lone Tree, IA 52755

B. Adjacent Landowners with 500 feet:

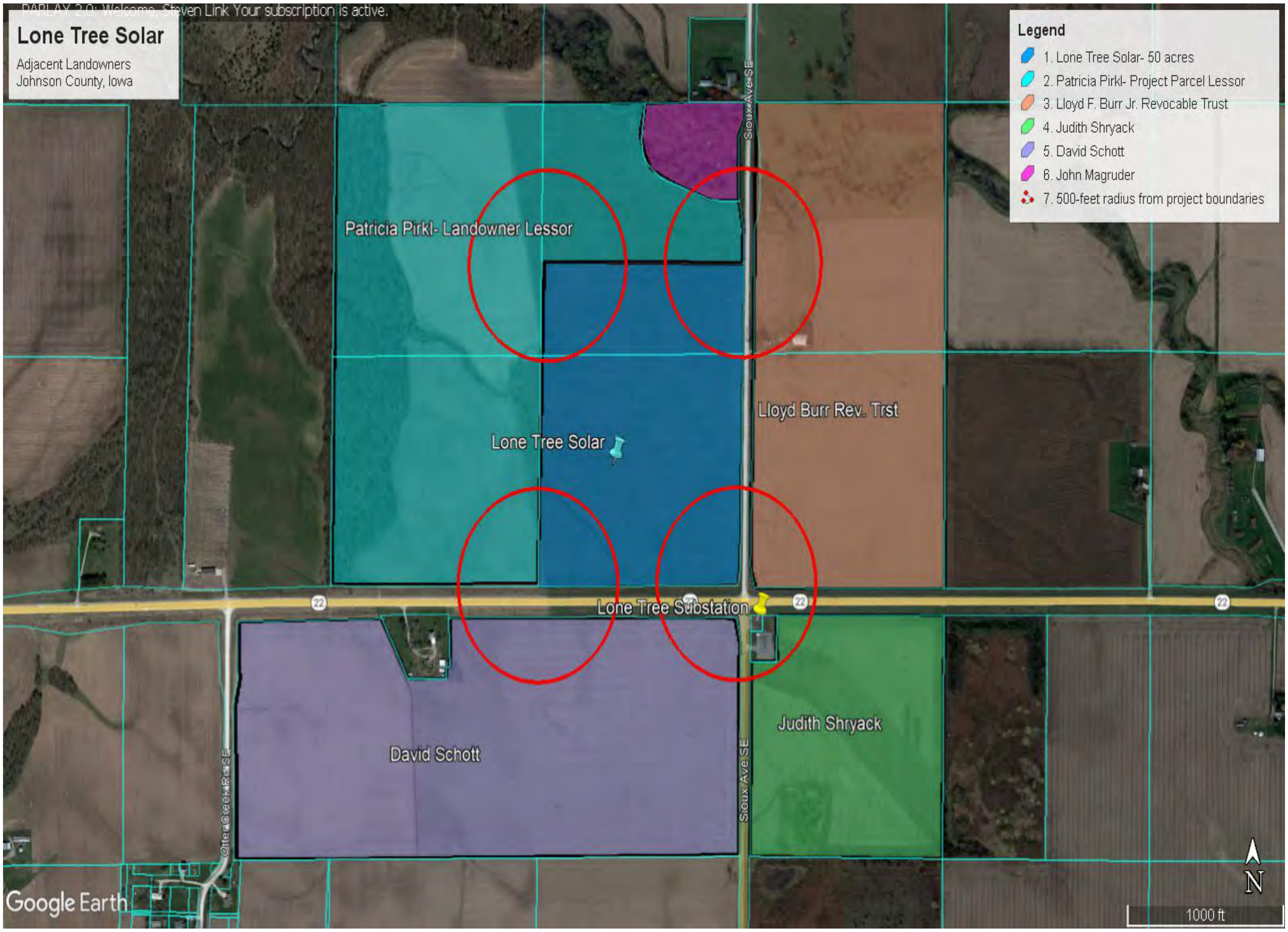
1. Landowner: <u>Lloyd F. Burr Jr. Revocable Trust</u>
   Address: Lloyd F & Mary A Burr
   5408 540th St. SE. Lone Tree IA 52755
   Parcel IDs: 1706326001, 1706351001

2. Landowner: <u>Judith A Shryack</u>
   Address: Judith Shryack
   5408 19th Ave. Moline IL 61265
   Parcel ID: 1707226003

3. Landowner: <u>John Magruder</u>
   Address: John W & Wanda Magruder
   5895 Sioux Ave. SE. Lone Tree, IA 52755
   Parcel ID: 1801401002

4. Landowner: <u>David J. Schott</u>
   Address: David J & Sherri L Schott
   5505 Oakcrest Hill Rd. SE. Riverside, IA 52327
   Parcel ID: 1812101002

C. Map on following page:


PARLAY 2.0: Welcome, Steven Link Your subscription is active.
Lone Tree Solar
Adjacent Landowners
Johnson County, Iowa
Legend
1. Lone Tree Solar- 50 acres
2. Patricia Pirkl- Project Parcel Lessor
3. Lloyd F. Burr Jr. Revocable Trust
4. Judith Shryack
5. David Schott
6. John Magruder
7. 500-feet radius from project boundaries
Patricia Pirkl- Landowner Lessor
Lone Tree Solar
Lloyd Burr Rev. Trst
Lone Tree Substation
Sioux Ave SE
Judith Shryack
David Schott
Otter Creek Rd SE
22
N
1000 ft
Google Earth

D.

**Attachment D:**
**Vegetation Management Plan**

# Vegetation Management Plan

Lone Tree Solar Project

Lone Tree, Iowa Johnson County

Stantec Project No: 193709077

March 17, 2023

Prepared for:

PCR Investments SP2 LLC
1334 Brittmoore Rd. Suite 1327
Houston, TX 77043

Prepared by:

Stantec Consulting Services Inc.
6605 West Steger Road
Unit A
Monee, IL 60449
Phone: (708) 534-3450
Fax: (708) 534-3480

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# Executive Summary

PCR Investments SP2 LLC (PCR) is proposing to construct and operate the Lone Tree Solar Project (the "project") which is a 7.5-megawatt (MW) alternating current (AC) photovoltaic (PV) solar project in Lone Tree, Iowa in Johnson County. Proposed project developments, including ancillary facilities, will consist of solar panels and tracking systems, access roads, a project substation, underground collector cables, inverters, and junction boxes. All equipment will be Tier 1 quality.

This Vegetation Management Plan (VMP) is intended for use alongside an Erosion Control and Sediment Control Plan (ECSCP) and Stormwater Management Plan (SMP) and provides further guidance on site seeding preparation, custom site-specific seed mixes, seed installation, and vegetation management activities over the 30-year lifespan of the facility and will fully comply with the requirements set forth in section 8:1.23.BB.5 of the Johnson County Unified Development Ordinance (UDO). Site preparation typically consists of soil amendments, such as discing to reduce soil compaction from solar construction activities and create a seedbed to facilitate robust germination of compatible vegetation. Management of noxious and invasive plant species, if any, and other weedy species may also be conducted to reduce competition and improve establishment of permanent seed mixes. Temporary seed mixes consist of annual grasses for soil erosion control during or immediately after construction. A permanent seed mix compatible with project vegetation objectives and suitable to local environmental conditions will be installed in the appropriate seeding windows available in coordination with the construction schedule, and include low growing pollinator friendly (native and non-native grasses and grass-like plants and flowers) to be planted in the solar array areas and buffer

Following permanent seeding, ongoing management of regulated noxious and invasive plant species, and other weedy species may be required for compliance with the Johnson County UDO and to maintain project compatibility. Vegetation management activities typically consist of cutting (mowing) and targeted herbicide applications over the 30-year window. The custom designed seed mixes are also suitable for small ruminant grazing, (e.g., sheep), which is emerging as an alternative to mowing.

*Photo 1. Vegetation management at solar sites can promote habitat for pollinators like the monarch butterfly.*

# 1.0 PLAN GOALS

Specific goals of this Plan include the following:

- Compatibility, adaptability and compliance with a SUDAS-compliant Project Erosion and Sediment Control Plan (ECSCP) and Stormwater Management Plan (SMP) once written;
- Compliance with post-construction re-vegetation requirements per subchapter 8:1.23.BB.5 of the Johnson County UDO;
- Maintain soil health so that project lands may potentially be returned to productive agricultural land use after project decommissioning;
- Manage populations of existing noxious and invasive species within the project, as feasible;
- Develop and install permanent seed mixes that supports the following objectives:
  - Low growth, low maintenance, shade tolerant grasses for areas under panels and between panel rows,
  - Species adapted to site specific environmental parameters including soils, drainage, anticipated shade, and local climate,
  - Compatible with engineering objectives including height restrictions as well as capacity to form continuous, dense vegetation stands; and
  - Use of native species, including pollinator-friendly plantings.
- Prepare seed beds and employ seed installation methods suitable for temporary and permanent seed as required; and
- Establish and maintain vegetation for the project through the anticipated 30-year life span of the facility.

*Photo 2. Black-eyed Susan is a common species found in pollinator seed mixes.*

# 2.0 PROJECT OVERVIEW

PCR is proposing the Lone Tree Solar Site in Lone Tree, Iowa near the intersection of Highway 22 and Sioux Ave. The project is a 7.5-megawatt (MW) alternating current (AC) solar project that includes solar array blocks containing PV panels attached to a single-axis tracking system mounted to steel piles. The PV panels will track the sun during the day. Direct current (DC) electricity from the PV panels will be routed underground through collection wiring to inverters located throughout the PV array areas. The PV array area will be fenced and have gated access at the road entrances. Constructed access roads will be gravel and approximately 12 feet wide to 20 feet wide at the entrances). Construction is anticipated to start approximately 12 months after Johnson County permit approvals, and the duration of construction is estimated to be 8 months with an anticipated COD in late 2024.

The Solar Facility portion of the project area is approximately 50 acres. Areas that are disturbed for project purposes will be re-vegetated per the Erosion Control and Sediment Control Plan (ECSCP) and Stormwater Management Plan (SWP) that will be prepared prior to construction once the project design is finalized. This plan will supplement and does not replace the guidance provided in the ECSCP and SMP.

The typical minimum leading-edge height between the PV panels and the ground is 30 inches. Post-to-post spacing between rows is approximately 21.5 feet. Final spacing within the arrays will be determined once equipment selection is finalized and the detailed engineering plan is complete. The installation of low-growing plant species and performance of vegetation management practices within the PV panel areas will be conducted to minimize vegetation touching and overshadowing PV panels.

## 2.1 SITE CONDITIONS

### 2.1.1 Topography

Project area topography consists of relatively level uplands that slope down towards natural drainage channels. Most of the project area consists of 0% to 6% slopes. project area slope precents are as follows:

- Project Area at 0% - 6% slopes = 98%
- Project Area at 6% - 12% slopes = 2%

### 2.1.2 Soils

Project area soils, based on United States Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS) soil maps and interpretations, very deep, somewhat poorly drained soils formed in loess on uplands, fertile silt-loams conducive for vegetation establishment and cover and are mostly cultivated. Corn, soybeans, small grains, and meadow are the major crops, while some areas are used for pasture. Native vegetation was mixed prairie grass and hardwood trees. USDA-NRCS soil maps indicate 99% of project area soils consist of the soils identified in Table 1 below.

**Table 1. Soil Types in Project Area**

| Map Unit Symbol | Map Unit Name | Hydric Rating | Percent of Project |
|---|---|---|---|
| 121B | Tama silt loam, 2 to 5 percent slopes | 7.4 | 15.70% |
| 122 | Sperry silt loam, depressional, 0 to 1 percent slopes | 16.7 | 35.60% |
| 160 | Walford silt loam, 0 to 2 percent slopes | 6.5 | 13.80% |
| 175B | Dickinson fine sandy loam, 2 to 5 percent slopes | 1.2 | 2.50% |
| 291 | Atterberry silt loam, 1 to 3 percent slopes | 11.2 | 23.90% |
| M162B | Downs silt loam, till plain, 2 to 5 percent slopes | 3.9 | 8.40% |
| M162C2 | Downs silt loam, till plain, 5 to 9 percent slopes, eroded | 0 | 0.10% |

The primary soil hydrology associated with the project area constrains vegetation selection to species suitable for wet to medium mesic soils. Seed mixes ratios between moist and dry species will shift towards the drier spectrum. However, soil compaction during solar construction decreases drainage efficiency while increasing water holding capacity that favors species adapted to higher moisture conditions.

Soil matrices composed of primarily loams and silt increases the risk for erosion. All soil work, including grading and tilling, requires immediate soil stabilization to minimize the potential for soil erosion. Soil stabilization includes planting temporary cover crop, planting cover crop and permanent seed mixes, or covering bare soils with straw mulch. Severe erosion will compromise project construction efficiency and long-term maintenance.

### 2.1.3 Shade

Project area solar intensities at ground layer are currently in full sun. Solar array construction will create shade under the PV solar panels while full sun conditions will continue in areas outside PV panels. Hence, following construction, solar intensities at the ground layer will range between full sun, to partial shade, to full shade.

### 2.1.4 Current Vegetation

Project area vegetation is currently comprised of agricultural crops which could include corn (*Zea mays*), soybean (Glycine *max*), and alfalfa (*Medicago sativa*). Agricultural crop fields provide a good medium for planting solar project-compatible vegetation. However, agricultural crop field fertility has the potential to facilitate excessive weed growth. We have listed different preconstruction soil preparation strategies for each agricultural crop type in Section 3. Noxious weed management strategies and tactics are also described in Section 3.

# 3.0 SITE PREPARATION

## 3.1 PRE-CONSTRUCTION SOIL PREPARATION

### 3.1.1 Current Existing Vegetation / Site Preparation Considerations

All site preparation activities are contingent upon the construction schedule and construction start dates. Upon confirmation of the construction schedule, a memo outlining the selected products and methods for site preparation will be submitted to Johnson County for approval.

Existing field crops, including corn (*Zea mays*), soybean (*Glycine max*), and alfalfa (*Medicago sativa*), require different preconstruction treatments prior to solar construction and temporary cover crop installation. These recommendations are meant to increase overall project construction and vegetation management. Soybean fields, small-grain fields (e.g., oat, wheat, cereal rye), and forage crop fields (e.g., alfalfa and corn silage) provide low crop residue soil surfaces and non-compacted soils conducive to both vegetation and construction objectives. Cornfields, grown for grain, can create excessive crop residue and compacted soils that impede both vegetation establishment, management, and solar construction. For these reasons, we advise working with current land managers to help determine final crops planted before solar construction begins. Our advice for final crops prior to solar construction are, from best to worst, soybeans, small grains, forage crops (e.g., hay, alfalfa, or corn silage), and in the least desirable case, grain-corn.

### 3.1.2 Temporary Cover Crop Consideration

The following information provides guidance for installing preconstruction temporary cover crops into existing crop fields conditions. Temporary cover crop types, and associated planting schedules are found in Appendix A, Tables. It is recommended that temporary cover crops should be installed if soils are idled for periods greater than 14 days or overwintered prior to solar construction. Idled agricultural fields, for extended periods of time, can be severely impacted by erosion and noxious weeds. Both soil erosion and noxious weeds will hinder vegetation establishment, management, and solar construction. The greatest potential for severe erosion in occurs in late winter / early spring when surface soils thaw while subsoils remain frozen, and rain occurs. Under these conditions, gully formation on associated unprotected soils and slopes, is rapid. Seeding cover crops into idled agriculture fields will help prevent erosion, maintain soil nutrients, provide competition against noxious weeds, reduce soil compaction, and help increase solar construction efficiency.

Existing field crops, such as soybeans, small grains, forage crops and corn, require different site preparation treatments prior to temporary cover crop installation. Excessive field crop residue and associated soil compaction will hinder cover crop installation, and ongoing vegetation and construction activities. The following information provides guidance for final field crop preparation that provide good conditions for cover crop installation and future vegetation management and solar construction.

### 3.1.3 Soybean Fields

Soybean fields are harvested in late-September through early-October. Harvested soybean fields provide good conditions for seeding temporary cover crops, permanent seed, and ongoing solar construction. Harvested soybean fields on sloping soils are susceptible to erosion that will impede ongoing vegetation management and solar construction. Therefore, it is not recommended soybean fields stand bare for long periods and should not go bare over winter. Harvested soybean fields, not scheduled for fall solar construction, should be stabilized seeded with temporary cover-crop before winter, preferably before mid-October.

Temporary cover crops, and when applicable permanent seed can be directly no-till drill seeded into soybean stubble. Temporary cover crop seed can also be broadcast seeded if followed by a packer (e.g., Brillion seeder, cultipacker or roller). Unharvested soybean fields should be mowed short or treated with an appropriate herbicide before seeding and solar construction.

### 3.1.4 Small Grain Fields (Oats, Wheat, Cereal Rye)

Small grains are harvested in mid-August. Harvested small grain crop fields can require surface residue reduction via straw baling to provide good conditions for seeding temporary cover crops, permanent seed, and ongoing solar construction activities. Without straw baling, excessive crop residue can impede seeding and solar construction. Small grain crop fields are more resilient to erosion and can stand bare for longer periods than soybean fields. However, small grain crop fields, not scheduled for fall solar construction, should be stabilized with temporary cover crops before winter, preferably before mid-October, to avoid severe spring erosion.

Following straw baling, temporary cover crops, and when applicable permanent seed can be directly no-till drill seeded into small grain stubble. Temporary cover crop seed can also be broadcast seeded, but this seeding method requires a shallow discing prior to broadcast seeding and a packing procedure following broadcast seeding. Unharvested small grain fields should be mowed short or treated with an appropriate herbicide before seeding and solar construction. Small grains, treated with herbicide, require biomass reduction, such as mowing before additional vegetation management of solar construction continues.

### 3.1.5 Forage Crop Fields

Forage crop fields, such as alfalfa-hay, are harvested throughout the year. Forage crop fields require some additional site preparation to provide good conditions for seeding temporary cover crops, permanent seed, and ongoing solar construction. Final site preparation includes a harvest (i.e., haying) to remove excess residue and a herbicide treatment to suppress existing vegetation and potential weeds. Herbicide application should occur approximately 20 – 30 days following haying, to allow remaining vegetation time to recover and regreen. Vegetation should reach 3 inches to 5 inches in height before herbicide is applied. Forage crop fields, prior to herbicide treatment, are resistant to erosion. Following herbicide treatment, soil erosion resistance decays, and forage crop fields should be seeded within 30 days following herbicide treatment.

Following herbicide treatment, and based on herbicide manufacturer’s recommendations, temporary cover crops, and when applicable permanent seed, can be directly no-till drill seeded into forage crop stubble. Temporary cover crop seed can also be broadcast seeded, but this seeding method requires a shallow discing prior to broadcast seeding and a packing procedure following broadcast seeding.

### 3.1.6 Cornfields (Corn Silage and Grain Corn)

Regionally, corn is grown for either silage or grain. Corn harvested for silage provides good conditions for seeding temporary cover crops, permanent seed, and ongoing solar construction. Temporary cover crops, and when applicable permanent seed can be directly no-till drill seeded into corn silage stubble. Temporary cover crop seed can also be broadcast seeded, but this seeding method requires a shallow discing prior to broadcast seeding and a packing procedure following broadcast seeding.

Corn grown for grain produces excessive crop residue and severe soil compaction that makes ongoing site preparation and solar construction difficult. Excessive crop residue in combination with soil compaction decreases both evaporation and drainage, and in wet periods, ponding, mud, and rutting conditions persist. These conditions exacerbate vegetation management and solar construction. Adequate seedbed preparation for grain corn fields begins with mowing corn stubble, baling and removing plant residue, and/or discing soils prior to seeding.

Grain corn is the last regional crop to be harvested, usually in November, and often too late for cover crop germination. To avoid muddy compacted soils during solar construction, we advise grain cornfields be mowed and baled in the fall immediately following harvest. Unless solar construction begins immediately following harvest, we advise cover crops to be installed before winter freezes soils. Winter cover crops will germinate in early spring. Cover crops will help mitigate drainage and compaction issues associated with grain cornfields, plus provide protection against erosion and nutrient sloughing. Cover crop installation requires corn stubble to be mowed, residue baled and removed, and soils lightly disced prior to seeding.

Harvested grain corn fields are resistant to erosion; however, severe soil compaction prohibits water infiltration and therefore exacerbates downslope erosion.

### 3.1.7 Temporary Cover Crop Termination

Temporary cover crops can produce excessive crop residue that impede ongoing vegetation management and solar construction. Therefore, temporary cover crop installation requires planning for terminating cover crops before they produce excessive residue or how to deal with the excessive residue once its produced. Cover crops planted with permanent seed are terminated with regular ongoing management mowing.

If necessary, Fall installed temporary cover crops, consisting of winter wheat (*Triticum aestivum*) and annual rye grass (*Lolium multiflorum*) (Table A.1-A), can be treated with glyphosate or mowed short in the mid-spring before ongoing solar construction and vegetation management procedures proceed. Chemical and mowing cover crop termination should occur when cover crop has achieved 6 inches in height but is less than 12 inches tall.

If necessary, Spring installed temporary cover crops, consisting of oats (*Avena sativa*) and annual rye grass (*Lolium multiflorum*) (Table A.1-C), can be treated with glyphosate, or mowed short in the early-summer before ongoing solar construction and vegetation management procedures proceed. Chemical and mowing cover crop termination should occur when cover crop has achieved 6 inches in height but is less than 12 inches tall.

An alternative to mowing or treating cover crops with glyphosate is haying. Haying has the advantage of leaving behind a clean soil surface that is highly desirable to ongoing solar construction and vegetation management. Haying also has the advantage of reducing excess soil nitrogen; therefore, reducing the potential for noxious weed recruitment. The haying procedure allows the temporary cover crop to reach the beginning stages of flowering (boot stage). The cover crop is cut green and harvested for silage or hay. Green cover crops provide local farmers a quality forage crop.

## 3.2 POST-CONSTRUCTION SOIL PREPARATION

Most project soils will be impacted by solar construction and require post-construction soil preparation to develop a seedbed suitable for robust germination and compatible cover while providing a smooth surface for long-term vegetation management. Severe soil compaction caused by solar construction and tight spaces between panels makes post-construction seedbed preparation challenging. Soil preparation will require a minimum one deep tilling with an off-set disc, chisel plow or soil-ripper to fracture compacted soils. Following deep tillage, soils will require at least one pass with a drag harrow to create a smooth, firm, and friable seedbed that offers good germination and recruitment potentials. All seeded areas require a final packing to increase seed germination and reduce erosion potentials.

**Table 2. Soil Preparation Procedures Based on Existing Vegetation and Project Construction Phase**

| Existing Conditions | Erosion Potential | Pre-seeding Preparation | Suitable for No-till Drill Seeding | Suitable for Broadcast seeding | Post-seeding Preparation Work |
|---|---|---|---|---|---|
| Harvested Soybean Field | High | None | Yes | Yes | Pack soils following seeding |
| Harvested Small Grain Field | Low | Reduce crop residue (e.g., bale straw)<br>Shallow disc soils before broadcast seeding | Yes | Yes | Pack soils following seeding |
| Standing Forage Hay Field | Low | Final harvest to reduce biomass<br>Herbicide treat forage<br>Shallow disc soils before broadcast seeding | Yes | Yes | Pack soils following seeding |
| Harvested Corn Silage Field | Moderate | Shallow disc soils before broadcast seeding | Yes<br>Disc soils prior to drilling seeding | Yes | Pack soils following seeding |
| Harvested Corn Grain Field | Moderate | Mow corn stubble.<br>Bale corn residue<br>Disc soils | No<br>Disc soils prior to drilling seed | Yes | Pack soils following seeding |
| Post Solar Construction Bare Soils<br>Within array field | High | Disc or chisel plow to reduce soil compaction (1-2 passes)<br>Drag soils smooth firm Seed immediately | No<br>Drill seeding not recommended in array field, inadequate seed coverage | Yes | Pack soils following seeding |
| Post Solar Construction<br>Outside array field | Low | Disc or chisel plow to reduce soil compaction (1-2 passes)<br>Drag soils smooth firm Seed immediately | Yes | Yes<br>Increase seeding rates by 20% | Pack soils following seeding |
| Post Construction Noxious Weeds<br>Within array field | Moderate | Treat weeds with appropriate herbicide<br>Disc or chisel plow to reduce soil compaction (1-2 passes)<br>Drag soils smooth firm Seed immediately | No<br>Drill seeding not recommended in array field, inadequate seed coverage | Yes<br>Follow herbicide label for seeding post herbicide treatment | Pack soils following seeding |

| Existing Conditions | Erosion Potential | Pre-seeding Preparation | Suitable for No-till Drill Seeding | Suitable for Broadcast seeding | Post-seeding Preparation Work |
|---|---|---|---|---|---|
| Post Construction Noxious Weeds<br><br>Outside array field | Moderate | Treat weeds with appropriate herbicide<br><br>Disc or chisel plow to reduce soil compaction (1-2 passes)<br><br>Drag soils smooth firm Seed immediately | Yes<br><br>Follow herbicide label for seeding post herbicide treatment | Yes<br><br>Follow herbicide label for seeding post herbicide treatment | Pack soils following seeding |

### 3.2.1 Soil Seedbed Preparation

A primary failure to establish compatible vegetation between and under PV panels is inadequate seedbed preparation. One reason is soil compaction that occurs during solar construction. Site preparation objectives seek to fracture soils to a minimum of 2.5 inches. This requires a minimum of one pass with either a heavy duty off-set disk or chisel plow (aka soil ripper / subsoiler). Following discing or chisel plowing, soils should be drag-harrowed to create smooth, firm, and friable soils suitable for seeding. Soil harrowing requires a minimum of one pass. Soil fracturing and harrowing is not possible completely under PV panels; however, seed rates and species selection can be designed to mitigate the lack of seed bed preparation in these areas.

### 3.2.2 Develop Contingencies for Erosion

Excessive post-construction soil compaction coupled to extensive PV panel dripline, creates the potential for rill and gully erosion during the soil preparation and early seed establishment phases. For these reasons, contractors and subcontractors should have in place plans and resources to correct. This might include filling in washouts, reworking soils to prepare an adequate seed bed, and over seeding impacted areas.

### 3.2.3 Invasive and Weed Species Management

Despite the clean appearance of recently harvested agricultural fields, several noxious weeds, such as Canada thistle (*Cirsium arvense*) and giant ragweed (*Ambrosia trifida*) can persist and thrive in abandoned agriculture fields. When ceasing agricultural activities, noxious weeds are released and can quickly come to dominate large areas. These weeds can compromise project vegetation compatibility objectives and State and / or local Noxious weed laws. A list of noxious weeds in Iowa can be found on the USDA website here: https://plantsorig.sc.egov.usda.gov/java/noxious?rptType=State&statefips=19

For this plan, invasive and weed species are defined under the following two categories:

1. Compliance - includes species covered under State of Iowa Noxious Weed Law: Chapter 317. These species will be referred to as 'noxious weeds.'
2. Compatibility – includes species that are not legally defined as noxious or 'invasive' but may interfere with the solar panels due to plant height, may interfere with ecological goals and the establishment of native species, or may pose vegetation management concerns. These species will be referred to as 'weeds.'

Invasive and weed species management will be conducted as needed to:

- Minimize the spread of noxious weeds from existing populations, if present,
- Prepare the seeding areas for permanent vegetation to reduce competition and improve

establishment and success of the permanent seed mixes, and

- Reduce vegetation impacts to the PV panels and solar facility infrastructure. Flowering non-native species that are not considered noxious and do not have heights that interfere with the project operations and do not outcomptete the originally designated plantings will not be actively managed.

Noxious weed species management may consist of spot cutting, mowing, and herbicide treatments.

### 3.2.4 Cutting and Mowing

Vegetation cutting shall be appropriately timed to assist with control of invasive and weedy species (e.g., mow biennial species during flowering but prior to seed production) and to remove vegetation to assist with site seedbed preparation. Methods will be selected based on aerial extent of vegetation and site accessibility.

### 3.2.5 Herbicides

#### 3.2.5.1 Purpose

Herbicide treatments are recommended for management of perennial noxious species, as mowing alone is not typically sufficient for adequate control. Ongoing management of invasive species may be required for compliance with existing invasive plant species regulations. Herbicides are also used to remove undesirable vegetation to prepare seeding areas for permanent seed installation. Insecticides, like neonicotinoids, are not necessary and will not be part of any vegetation management protocol in accordance with the Johnson County UDO (8:1.23.BB.5.c.i.).

#### 3.2.5.2 Herbicide Types

There are three general types of herbicides that are applicable for use within the project: 1. Non-selective, 2. Broadleaf-selective, and 3. grass-selective.

*Non-Selective Herbicides*

Non-selective herbicides injure or kill all types of vegetation, including broadleaves, grasses, sedges, rushes, and woody plants. Glyphosate is commonly used to remove all vegetation to prepare areas for permanent seeding.

*Broadleaf-Selective Herbicides*

Broadleaf-selective herbicides are intended to injure or kill only broadleaf plants. There are many types of broadleaf herbicides. Two types commonly used in natural settings include 2,4-D and triclopyr. Both 2,4-D and triclopyr are used to remove broadleaf plants from grass-stands and turf lawns. Some broadleaf herbicides are highly selective, for example, the active ingredient clopyralid is very effective for controlling noxious Canada thistle (*Cirsium arvense*), giant ragweed (*Ambrosia trifida*) and weedy legumes (Fabaceae). These herbicides are all appropriate for controlling invasive broadleaf weeds within the PV panel arrays where only graminoid (grass and grass-like plants such as sedges and rushes) species will be installed. Extra caution should be taken to avoid injury to desirable graminoid species by waiting to apply herbicides after graminoid seedlings have matured for at least 90 days or have flowered at least once.

*Grass-Selective Herbicides*

Grass-selective herbicides are intended to injure or kill only grasses. The most common grass- selective herbicide is clethodim. It is used to selectively target undesirable grasses growing among desirable broadleaf plants. These herbicides may be appropriate for controlling certain invasive grasses in areas with pollinator-friendly vegetation.

#### 3.2.5.3 Herbicide Application Methods and Timing

There are two primary methods to apply herbicides: low volume/spot applications and broadcast applications. Methods and timing should be based on a site-specific evaluation of target species, vegetation composition, and sensitivity of adjacent areas to herbicide applications.

*Low Volume/Spot Applications*

This method utilizes a hand-held sprayer mounted to small (3.5 to 25 gallon) tanks to selectively deliver herbicide to individual plants or small clumps of plants. Backpack sprayers are suitable for small areas while pistol sprayers mounted to an all-terrain vehicle or utility terrain vehicle (UTV) are suitable for larger areas or large clumps of vegetation. Wicks may also be used for ultra-low volume delivery of herbicide to undesirable plants growing in sensitive ecological areas. This method may be appropriate for managing discrete populations of weedy and invasive species before and during construction.

*Broadcast Applications*

This method utilizes a boom or boomless sprayer tanks mounted to a UTV or tractor to broadcast herbicide to large areas. This method is appropriate for large-scale site preparation to remove weedy and invasive vegetation from large areas using a non-selective herbicide.

#### 3.2.5.4 Proposed Herbicides

The herbicides that may be used in the project are listed below in Table 1. These herbicides are frequently used in natural area settings to assist with management of species that would be expected to occur in the project area. These herbicides have a relatively short half-life and moderate to very unlikely potential to reach shallow groundwater.

**Table 3. Environmental Information for Proposed Herbicides**

| Active Ingredient | Herbicide Type | Potential Uses | Rate (Ounces/ Acre) | Environmental Fate[1,2] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Water Solubility | Soil Half- life | Mineral Soil Sorption Coefficient KOC / FAO Mobility Classification 3 | Groundwater Ubiquity Score (GUS)[4] / Potential to Reach Shallow Groundwater |
| Glyphosate | Non-selective systemic foliar | Non-selective treatment of grasses and broadleaf plants | 64 - 96 | Very soluble | 3.6 days | 33,025 in sandy soils / Hardly mobile | -0.29 in sandy soils / Very unlikely |
| 2,4-D | Broadleaf systemic foliar | Selective treatment of weedy and invasive broadleaf plants | 48 – 80 | Moderately soluble | 2.9 days | 73 in sandy soils / Mobile | 0.99 in sandy soils / Unlikely |
| Aminopyralid | Broadleaf selective foliar<br>Species selective | Specific noxious and invasive weeds | 5 - 9 | Very soluble | 81.5 days - | 2.33 in | 6.94 in |
| Clopyralid | Broadleaf selective foliar<br>Species selective | Specific noxious and invasive weeds<br>Asters and legumes | 9 - 12 | Very soluble | 12.8 days | 12.9 in sandy soils / Mobile[5] | 3.96 in silt loam / Likely[5] |
| Clethodim | Grass-selective systemic foliar | Selective treatment of weedy and invasive grasses | 12 - 16 | Very soluble | 3 days in unknown soil | 137.5 in unknown soil / Moderately mobile | 0.89 in unknown soil / Unlikely |

[1] Information from Herbicide Properties Tool at the National Pesticide Information Center – Oregon State University. Accessed online on 10/28/2020 at http://npic.orst.edu/HPT/#.

[2] Reported for sandy soils unless otherwise stated in the Herbicide Properties Tool search results.

[3] Based on FAO Mobility Classification in *Guidance for Reporting on the Environmental Fate and Transport of the Stressor Concern in Problem Formulations*. Accessed online on 10/28/2020 at https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/guidance-reporting-environmental-fate-and-transport#II_C.

[4] Potential to Reach Shallow Groundwater based on discussion in the Herbicide Properties Tool search results.

5 Appropriate for low volume foliar herbicide applications targeting individual plants or clumps of plants.

#### 3.2.5.5 Herbicide Adjuvants

Adjuvants are typically added to herbicide mixes to improve herbicide performance. Adjuvants typically used for natural areas management include hard water treatment additives, surfactants, and penetrants. Herbicide labels should be consulted for recommendations on the types of adjuvants to add to a mix. In general, aquatic-approved adjuvants should be used to minimize potential impacts on wildlife, including pollinators. Aquatic-approved adjuvants should always be used in and near areas of standing water.

#### 3.2.5.6 Herbicide Standard Industry Practices

Herbicides are a valuable vegetation management tool when used according to manufacturer's instructions and following standard industry practices. The following practices are recommended when using herbicides to manage undesirable vegetation:

1. Vegetation managers should apply principles of integrated vegetation management. Herbicides will be used as one of several available 'tools in the toolbox' to manage vegetation and habitats in an ecologically sensitive manner, in addition to cutting, engineering controls, and cultural controls.
2. Herbicide labels and Safety Data Sheets should be read prior to mixing, loading, and application.
3. The appropriate volume of herbicides and adjuvants necessary to complete a vegetation management task should be utilized. This includes targeted application techniques when practicable and use of properly calibrated equipment to minimize environmental effects.
4. The appropriate concentrations of herbicides and adjuvants as recommended by product labels are used to achieve intended outcomes. Applying herbicide lower than recommended rates might result in herbicide resistance. Applying herbicides above recommended rates may result in "top-killing" the plant before the herbicide translocations through the root system killing the entire plant instead of only the above ground structure.
5. Selective herbicides are used to limit effects on non-target plants.
6. Persistent noxious weeds typically require several treatments, such as a spring, fall, spring treatment regime.
7. Herbicide applications should be conducted during favorable weather conditions to maximize herbicide efficiency and minimize off-site drift and run-off. These weather conditions include:
    a. Ambient air temperatures are below $78^0$ degrees Fahrenheit ($26^0$ Celsius) and above $38^0$ Fahrenheit ($3^0$ Celsius)
    b. Average weather conditions have prevailed for a minimum of two weeks prior to herbicide application (e.g., avoid herbicide application during persistent heat, drought, freezing or wet conditions).
8. Herbicide should be applied to plants when plants are most physiologically prone to injury by active ingredients. Plants are most prone to herbicide injury when they are actively growing. Plant life cycles targetable for herbicide application include the flower bud-stage and the cool season photosynthesizing rosette stage. Plants that have senesced following flowering or are inactive due to high heat or drought should not be treated.

Additional practices may be developed, as needed, based on project area conditions.

#### 3.2.5.7 Herbicide Permitting

Herbicide treatments shall be performed by individuals with a current Commercial Pesticide Applicator certification and license issued through Iowa Department of Agriculture & Land Stewardship, and in accordance with all applicable laws, regulations, and herbicide label instructions.

# 4.0 VEGETATION INSTALLATION

## 4.1 SEEDING PLAN

The proposed Lone Tree Seeding plan intends to establish the Low Grow Native/Non-Native PV Panel and Perimeter seed mix (Figure 1; Table A.2) throughout all areas currently not vegetated with perennial species within the footprint of the project. The methods of establishment will be determined by the construction schedule, seeding windows and work plans. The methods described in the vegetation installation section cover the typical means and methods that may be employed to achieve the establishment goals.

Pollinator Refuge and Wetland Pollinator Refuge seed mixes (Tables A.3 and A.4) are not expected to be utilized on this project but are included as a reference for future seed mix development if required due to site conditions, considerations, or integrated vegetation management needs. Final installed mixes will be approved by the Zoning Administrator.

Section 4 provides information on custom seed mixes and planting methods. Seed mix information covers both temporary and permanent seed mixes. Planting methods includes final seedbed preparation, seeding methods (e.g., drilled and broadcast seeded) and post seeding procedures (e.g., packing) for temporary and permanent seed mixes. This information is designed to increase compatible vegetation establishment, long-term vegetation management objectives, and overall project construction efficiency. All site seeding activities maintain compliance with the ECSCP and SMP. Many variables contribute to seed installation timing and this plan covers procedures for a wide variety of scenarios. Given the cost, performance and conditions arising from panel array construction, we recommend that all sites be seeded with the perennial final seed mix before construction begins.

### 4.1.1 General Seed Mix Information

Knowledge of site environmental constraints coupled to project vegetation compatible goals allows us to design custom site-specific mixes for both temporary and permanent seed. These seed mixes are customized to meet the environmental constraints that develop following PV panel installation. Seed mixes consist of fast to establish, low-growing species that thrive in mesic and moist-mesic soil conditions under a variety of sunlight levels This multi-species seed mix and corresponding seeding rates allows robust coverage and rapid establishment for a variety of site-specific environmental parameters throughout the project area. Seed mixes included for Lone Tree Solar Project were developed by Chip DeAngelo, a Restoration Ecologist/Environmental Project Manager at Stantec. Chip earned a Bachelor of Arts in in Environmental Science at Calvin College in Grand Rapids Michigan and has 22 years of experience designing, planting, establishing, and maintaining native communities in the Midwest.

Seed mix specifications for temporary cover crops are found in Appendix A, Table A.1-A – Table A.1-D. Seed mix specifications for permanent vegetation is found in Appendix A, Table A.2 – A.4.

### 4.1.2 General Seed Installation (Seeding) Information

Seed installation for both preconstruction and post-construction project phases are described in this section. Preconstruction seeding primarily involves installation of temporary cover crops, and when appropriate, permanent seed mixes. Preconstruction seed installation methods are dependent upon preexisting conditions and timing. For example, some preexisting conditions, such as soybean fields, are suitable for direct no-till seeding. Other preexisting conditions, such as small grain crops (oats, wheat, rye, barley) corn silage, forage crops, and grain corn require additional site preparation prior to seeding. Site preparation for different preexisting conditions is detailed in Section 3 and summarized in Table 1.

There are two primary seed installation methods: drill seeding and broadcast seeding. Appendix C, Table 1.C provides a comparison summary of proposed seeding methods. Drill seeding requires less soil preparation and less seed. However, drill seeding is difficult in tight spaces and lacks the ability to spread seed under solar panels. Broadcast seeding requires greater soil preparation, increased seed amounts (e.g., >20%), and post-seeding packing to ensure adequate soil to seed contact and germination.

Differences between drill and broadcast seed installation dictates which method is preferable under pre-construction and post construction project phases. Drill seeding is the preferred method to install preconstruction temporary cover crops and, when applicable, permanent seed mixes, across the entire project area. Drill seeding is also the preferred method in larger post-construction areas (e.g., > 1 acre) outside the PV panel arrays, including designated perimeter, pollinator refuge, and buffer areas.

Broadcast seeding is the preferred method to install post-construction temporary and permanent seed mixes between PV panels. It is important to note, that while broadcast seeding covers more acres per hour, it requires two additional procedures, including pre-seeding soil tilling and post seeding packing to ensure adequate germination and establishment.

Packing soils following broadcast seeding is required to achieve good soil to seed contact. Although drill seeders do not require soil packing post seed installation, drilled seed still benefits from packing. In all cases, packing soils following seeding ensures good soil to seed contact, smoother soil surfaces, and reduction in potential erosion.

#### 4.1.2.1 Seed Depth

Seed depth is another important general consideration. A primarily failure in seed recruitment is planting too deep. This is especially true when soils are shallow disced prior to seeding. The key term in shallow discing is shallow. In the best-case scenario, all seed should be incorporated into the soils between 1/16$^{th}$ and 1/4 inches deep. Large seed, such as cover crop seed can be seeded deeper, up to ½ inch deep. The permanent seed mixes are dominated by small-seed species that should be seeded between 1/16$^{th}$ and 1/4 inches deep. Some permanent seed species are very small and perform best when left on the surface. We have included very small seed species that are shade tolerant for under PV panels where soil preparation is impossible. The best way to ensure seed is not installed too deep is to drag-harrow or pack soils following soil fracturing and before seeding. Drag harrowing or packing soils prior to seeding creates a firm friable seedbed that prevents seed from being planted too deep.

#### 4.1.2.2 Fertilizer

We recommend no fertilizer be applied to soils before, during or following seeding of both temporary cover crops and permanent seed mixes. Soils in the project area have been cropped with nitrogen fixing legumes, including soybeans and alfalfa, and augmented with nitrogen fertilizer for corn. Therefore, project soils provide adequate fertility to establish robust project compatible vegetation.

For sites developed on infertile soils, or on highly disturbed soils, the addition of legumes in cover crops can enhance fertility for permanent seed mixes. As such, legumes included in cover crops are not necessary for this project. Also, non-native legumes, including white clover (*Trifolium repens*) and red clover (*Trifolium pratense*) are included in the permanent seed mixes and native legumes are included in the permanent Pollinator Refuge seed mixes.

#### 4.1.2.3 Seed Mix Vendors

Seed should be purchased from vendors that supply quality local sourced seed, or at a minimum, seed that has proven successful in local environmental parameters. All seed, including temporary cover crop and permanent seed mixes, require seed tags that indicate seed weight, pure live seed, region of origin, and noxious weed content. Native seed should indicate seed source tags that indicate genetic origin not greater than 250 miles from the project site. Stantec maintains an in-house native seed nursery capable of providing seed for this project. Prices available on request.

## 4.2 TEMPORARY COVER CROPS

Temporary seeding of cover crops is employed to stabilize soils following removal from agriculture production and soils disturbed by project construction that are not ready for permanent seed and will be idled for extended periods, over winter, or as otherwise specified in the ECSCP and SMP.

Temporary cover crops are replaced by permanent vegetation prior to or following installation of PV panels. Temporary cover crop seeding rates (e.g., seeds per square foot) are higher when permanent seed is not installed to provide adequate vegetative cover and protection from soil erosion. Cover crop seed mixes are designed to meet two primary objectives:

1. Compliance with the ECSCP and SMP and
2. Stabilization of soils to assist with establishment of permanent vegetation.

Cover crops are composed of annual grasses that establish quickly, provide erosion control, establish residue for later permanent seedings, build soil organic matter, maintain soil nutrients, reduce soil compaction, and assist with weed suppression. Three annual grasses – winter wheat (*Triticum aestivum*), seed oats (*Avena sativa*), and annual rye grass (*Lolium multiflorum*) are utilized, depending on installation timing. Each of these species is listed on the Iowa Construction Site Erosion Control Manual – Chapter 2. Vegetation and Soil Stabilization Control Measures and each species has a relatively wide tolerance of soil conditions.

Specific species and installation rates are selected based on installation timing, mechanism (drilled versus broadcast seeded), and whether cover crops are installed with or without permanent seed. Cover crop mixes, rates, and timings are provided in Tables A.1-A through A.1-D (Appendix A).

#### 4.2.1.1 Solar Production Area

The solar production area is comprised of areas under and between the PV panel arrays. Temporary seeding in this area is completed in phases, starting concurrently with site preparation, and as follows:

- Phase 1 Fall (late-September to mid-November).: Temporary cover crop seeding occurs following final crop harvest. The temporary fall cover crop seed mix (Table A.1-A) is installed to establish vegetation cover that will overwinter and provide residue for additional temporary seeding in the 2022 growing season. Installation by drilling into exposed soils is the preferred method for seed establishment, but broadcast seeding is also acceptable method; however, broadcast seeding will increase the amount of seed needed by 20% and broadcasted seed needs to be incorporated into the soils via either a shallow drag-harrow or cultipacker.
- Phase 2 – Spring (mid-April-June). The temporary cover crop seeding occurs in early spring to early summer. Cover crops for this time period are listed in (Table A.1-C).
- Phase 3 – Spring-fall (mid-April-September). Aforementioned cover crop seed mixes (Tables A.1-A and A.1-C) will be installed, as needed, to revegetate areas disturbed by construction activities.

## 4.3 PERMANENT SEED

One permanent seed mix is proposed for the project area as follows:

- Low Grow Native / Non-Native Seed Mix for PV Panel and Perimeter Areas (Table A.2)

A general description of this seed mix is described in greater detail below. Recommended species and rates for this mix are listed in Appendix A, Table A.2. Final seed mix design will occur when tentative seeding dates are known, and actual species composition and rates will be based on supply and cost just prior to seeding.

Pollinator Refuge and Wetland Pollinator Refuge seed mixes (Tables A.3 and A.4) are not expected to be utilized on this project but are included as a reference for future seed mix development if required due to site conditions, considerations, or integrated vegetation management needs. Final installed mixes will be approved by the Zoning Administrator. Installation and maintenance for this mix is comparable to that of the Low Grow Native/Non-Native Seed mix.

### 4.3.1 Low Grow Native / Non-Native Seed Mix for PV Panel and Perimeter Areas (Table A.2)

This seed mix is intended to provide a cost-effective permanent low maintenance, low stature, ECSCP and SMP compliant, project compatible vegetation over a variety of environmental conditions throughout the project area. This mix blends both native and non-native graminoids with a mix of native forbs that bloom across a wide range of seasons and common low growing clovers. Non-native cool-season grass species in this mix, such as bluegrass (*Poa* spp.), bent grass, (*Agrostis* spp.), and fescue grass (*Festuca* spp.) act as surrogates for historic native cool season species, and are intended to provide competition against cool-season invasive and weedy species. Together, the proposed species ensemble is adapted to compacted soils, moist soils, well drained soils, wet and drought conditions, sun and shade, cool and warm seasons, and cold and hot weather. Once established, this mix will provide multiple ecosystem services. Immediate ecological benefits include reductions in soil erosion, run off, nutrient sloughing, and soil compaction. Long term benefits include increase in soil health, nutrient regulation, water infiltration, water purification, biodiversity, pollinator habitat, and wildlife habitat including nesting habitat for grassland birds. None of the species are considered invasive or noxious under State of Iowa Noxious Weeds law (Chapter 317).

### 4.3.2 Pollinator Refuge Native Prairie Seed Mix – Select Perimeter Areas (Table A.3)

This mix contains native grasses, sedges, rushes, and wildflowers. The mix is intended to promote a diversity of wildflowers, with flowering occurring over each of the three blooming periods (spring, summer, and fall), along with native grasses and sedges that provide benefits to pollinators and other wildlife. The seed mix is intended to be cost-effective, provide short to medium stature native plant cover and diversity, and improve long-term soil health. None of the species are considered invasive or noxious under State of Iowa Noxious Weed Law: Chapter 317.

The Pollinator Refuge Native Prairie Mix is designed to be installed in select portions of perimeter areas. Areas intended for pollinator refuge mixes should be at least 0.5 acres in size and not to exceed 3:1 ratio between length and width to reduce surface area. Pollinator refuge areas also require occasional mowing and other management services, so these areas should be accessible by small tractors and skid-steers. More precise pollinator areas will be defined after the final site design is complete.

The two proposed custom permanent seed mixes are compared in Table 4 below.

**Table 4. Permanent Seed Mix Comparison**

| Attributes | Low Grow Native / Non-Native Graminoid Mix (Table A.2) | Pollinator Refuge Native Prairie Mix (Table A.3) |
|---|---|---|
| Dominated by non-native species | **No** | **No** |
| Dominated by native species | **Yes** | **Yes** |
| Growth height below 30 inches | **Yes** | **Yes** |
| Wildflowers / multi-season blooms | **Yes** | **Yes** |
| Pollinator habitat | **Yes** | **Yes** |
| Wildlife habitat | **Yes** | **Yes** |
| For moderately to poorly drained soils | **Yes** | **Yes** |
| For well drained soils | **Yes** | **Yes** |
| Shade tolerant | **Yes** | **No** |
| Sun tolerant | **Yes** | **Yes** |
| ECSWMP Compliant | **Yes** | **Yes** |
| Project Compatible | **Yes** | **Yes** |
| Contributes to Soil Health | **Yes** | **Yes** |

### 4.3.3 Permanent Seed Installation

Permanent seed will be installed either preconstruction or following construction and seedbed preparation. During solar construction, soils are frequently compacted, rutted, and soil erosion can occur. Therefore, prior to permanent seed installation, soils typically require additional soil preparation procedures as described in Section 3. Permanent seed installation should occur immediately following final soil preparation.

Seeding can be accomplished by either a drill seeder, broadcast seeder, or packer seeder (e.g., Brillion seeder). There are positives and negatives associated with each seeding method, as described earlier in Section 4, and summarized in Appendix C, Table 1.

Ultimately, based on the ability to install seed under PV panels and seed in tight spaces, all permanent seeding between PV panels will occur via broadcast seeding. All broadcast seeding should be followed by packing or at minimum a shallow drag-harrowing, to help increase germination rates, decrease soil erosion potentials, and provide a smooth level soil surface conducive to long term management.

Native plantings, such as Pollinator Refuge seed mixes, can be either drill-seeded or broadcast seeded. Drill seeding native mixes requires a specialized drill designed to plant native seed (e.g., Truax Drill). Native seed can also be seeded via broadcast seeding, but this method requires soils be shallow disced, followed by firming with a drag harrow or packer, and then seeded, and then finished by an additional packing or light drag-harrowing.

The most efficient method for seeding larger areas (> 1 acre) outside the solar array areas is by drill seeding. These areas might include buffer and perimeter areas and Pollinator Refuge areas.

Post-seeding packing by a cultipacker or roller benefits both drill and broadcast seeding. These benefits include: 1. Increase soil to seed contact, 2. Increase germination rates, 3. Decreases erosion potential, 4. Provides a finished soil surface conducive to on-going vegetation maintenance and management.

#### 4.3.3.1 Timing

Permanent Low Grow Native / Non-Native Seed Mixes for PV Panel and Perimeter Areas (Table A.2) can be seeded anytime between April 10th and September 30. There are preferred seeding dates within this contextual period, based on historic precipitation/evaporation ratios. The preferred dates for seeding permanent seed mixes are during the spring, between April 1 – June 15, and again in late summer between September 15 – October 15. Dormant season seeding in late fall through winter is not recommended for Permanent Low Grow Native / Non-Native PV Panel seed mixes. Associated compacted soils can encounter severe rill erosion during winter rains or rapid snow melt that can wash seed away. These areas can be difficult and expensive to re-seed and repair especially in between PV panels. For best results, seed should be planted during times that facilitates seed germination. The sooner the seed germinates, the less washing occurs, the more successful results. If dormant season seeding is the only option, permanent seed rates should be increased by 20%, a dormant season cover crop should be installed (Table A.1-B), and a contingency for over-seeding bare areas should be agreed upon between the contractor and service provider. If dormant seeding is selected as the seeding method, Johnson County will be consulted on plans to ensure successful establishment.

The Pollinator Refuge Seed Mix (Table A.3) is best installed in spring through early summer approximately between March 15 – June 15, and again in late summer between September 15 – October 15. Pollinator Refuge seed mixes can also be installed during the dormant season via frost seeding between November 30 to snow cover or during a period of light snow cover in the winter. Dormant season seeding seed rates should be increased by 20%. Areas with highly compacted soils should not be dormant season seeded to avoid washing.

Cover crop seed mixes should be installed with the permanent seed. If permanent seed is installed during fall through winter, the cover crop should consist of winter wheat and annual ryegrass (Table A.1-B). If permanent seeding occurs in the spring through early summer, the cover crop should consist of oats and annual ryegrass (Table A.1-D). Cover crop is installed at a lower rate when combined with permanent seed.

# 5.0 MONITORING AND MAINTENANCE PLAN

Section 5 provides information on post seed installation monitoring and maintenance that promotes the establishment of a desirable vegetation compatible with project objectives. Monitoring and maintenance activities seek to establish and maintain compliance with the ECSCP, SMP, and the Johnson County UDO.

Per Johnson County Code of Ordinances all required vegetative cover will be monitored on an annual basis for 5 years following construction after which a request for reduced frequency will be submitted to the Zoning administrator. Any vegetative cover that fails to establish or dies during the life of the project will be replaced.

All areas will require ongoing maintenance to establish and maintain desirable vegetation that is compatible with PV panels, project objectives, and in compliance with noxious weed laws. Maintenance is expected to be most intensive in the establishment phase, or approximately the first two growing seasons following seeding as desirable species germinate, grow, and mature. In general, native species take longer to mature than non-native species. Vegetation cutting and herbicide applications are typical management activities as discussed below. Monitoring will occur to confirm compatibility of vegetation with project goals concurrently with routine vegetation maintenance activities.

## 5.1 VEGETATION CUTTING

Cutting, by mowing or hand-trimming, is the primary management tool used to aid in the establishment of desirable vegetation. Cutting is employed to reduce height, reduce flowering of undesirable vegetation, and maintain sunlight at the ground surface to encourage germination and growth of desirable species. Mowing using a deck mower is applicable in areas that are accessible with a small tractor and mower. Flail mowers are preferred but rotary mowers are acceptable if significant clumping of grass clippings is minimized. A 3-point side-mounted trimmer mower attached to a small tractor may also be used to cut vegetation around steel piles and under panels if areas are accessible with equipment.

### 5.1.1 Mowing Frequency and Timing

**Establishment Phase**
Frequent cutting is required in all seeding areas during the establishment phase (post-seeding years 1 and 2) to reduce fast-growing (annual and biennial) weeds, minimize vegetation height under the PV panels, and assist growth of desirable species. Following permanent seeding, anticipate establishment mowing to occur 4 weeks following seeding and about every 4-6 weeks thereafter from mid-spring to mid-fall. A minimum of three mowings should occur during the first establishment year and a minimum of 2 mowings should occur during the second establishment year.

**Transition Phase**
By the third growing season, desirable vegetation should be established. Years 3-5 represent a transition phase where desirable vegetation becomes increasingly established but remains susceptible to weed invasion. The frequency of cutting is reduced, and in the best-case scenario, mowing targets only specific areas of weed growth and to minimize vegetation height under the PV panels.

**Long-Term Maintenance**
Over the long-term (years 6-30), mowing should occur on an annual or biennial basis. Annual or biennial mows should occur during the dormant season late fall or early spring, or in mid-summer. The goal of annual / biennial mows is to reduce thatch, encourage lateral growth, encourage root development, and minimize the establishment of woody vegetation. Actual mowing frequency is dependent upon soil moisture; wet areas and wet weather requires more frequent mowing while dry areas and dry weather reduces mowing frequency.

### 5.1.2 Mowing Height

Specific recommendations for mowing height vary by seed mix.

**Low Grow Native / Non-Native Graminoid Seed Mix for PV Panel and Perimeter Areas (Table A.2)**
During the establishment phase (post-seeding years 1 and 2), areas seeded with this mix should be mowed when vegetation reaches a height of 8-12 inches and be cut back to a height of 4-6 inches. Expect to mow the vegetation three to four times during the first growing season, two times during the second growing season and once or twice per year thereafter. Installed species within this mix will likely stay below 18 inches in height (typically 8-12 inches) at maturity. Mowing this mix to the height of 4-6 inches will help invigorate the grasses and clover while discouraging weeds and trees.

**Pollinator Refuge Native Prairie Seed Mix – Select Perimeter Areas (Table A.3)**
In general, areas planted with the Pollinator Refuge Mix should be mowed when vegetation reaches a height of 8-12 inches, starting within 4-6 weeks post seeding and continuing at a 4–6-week interval throughout the first growing season, or whenever the vegetation reaches 8-12 inches in height. Taller vegetation will compete for sunlight and water and suppress desirable vegetation. Likewise, mowing taller vegetation creates excessive clumping that smothers desirable plants. Vegetation in Pollinator Refuge Mix plantings should be cut to a height of 6-8 inches during the first growing season.

During the second growing season, Pollinator Refuge plantings should be mowed two times, once in June and once in September–November. Mowing height should be 6-8 inches.

During the third growing season (Transition Phase), as native plants mature, mowing height should be raised to 10-12 inches and done selectively in June-July, to target tall and/or invasive and weedy species. A dormant season mowing at the end of the third growing season (October–November) offers spring emerging native species abundant sun to rapidly control state dynamics.

Long-term maintenance mowing should be conducted on an annual or biennial basis, during the dormant season, March-April, and September–November, and vegetation should be cut back to 6-8 inches. Summer mowing can be conducted to maintain project vegetation compatibility. Summer mowing should maintain 6–8-inch mower height, and not exceed one mowing per-growing season.

## 5.2 HERBICIDE APPLICATIONS

Herbicides may be used for long-term maintenance of areas planted with each seed mix. Herbicide type and method of application are highly dependent on target species and vegetation maintenance goals. Low volume / spot applications are appropriate for use in all areas during the establishment period (years 1 and 2) to spot treat invasive and incompatible species. Beyond the establishment period, this method is also appropriate for use in areas planted in pollinator-friendly seed mixes to minimize impacts on desirable vegetation and wildlife. Broadcast applications are generally not appropriate in areas planted with the native species and near PV panels. A combination of herbicides and application techniques is typically required to manage large areas. Herbicide use will be minimized to the extent practicable and will be conducted by trained and licensed personnel in accordance with label directions and standard industry practices.

# 6.0 PRELIMINARY SCHEDULE OF ACTIVITIES

The table below provides a preliminary schedule of activities that will occur up to permanent seed installation, however, the schedule is dependent upon Johnson County permit approval. Construction is anticipated to start approximately 12 months after Johnson County permit approval, and the duration of construction is estimated to be 8 months with an anticipated COD in late 2024.

**Table 5. Preliminary Schedule of Vegetation Management Activities**

| Activity | Timeframe[1] |
| --- | --- |
| Start of construction | Q2 2024 |
| Initial permanent or temporary cover-crop seed installation following vegetation removal, grading, and as-needed seed bed preparation (Table A. 1-C) | Q2 2024 |
| Initial permanent or temporary cover-crop seed installation following vegetation removal, grading, and as-needed seed bed preparation (Table A. 1-A) | Q3 - Q4 2024 |
| As needed, install secondary temporary cover-crop seed for construction areas. | Q2 2025 |
| Install permanent native seed mixes (Mixed Native & Non- Native Graminoid Seed Mix, and Upland Pollinator-friendly Seed Mix). Dormant season seeding rates should be increased by 20%. Dormant season cover crops are installed with permanent seed (Table A.1-B) | Q4 2024-Q1 2025 |
| Install permanent native seed mixes (Mixed Native & Non- Native Graminoid Seed Mix, and Upland Pollinator-friendly Seed Mix). Cover crop for permanent seed and seeding during the growing season is found in (Table 1 A. 1-C). | Q4 2024 – Q2 2025 |
| Project COD, start of 30-year facility life period | Q2 2025 |
| Maintain permanent vegetation | Q2 2025 – Q3 2055 |

[1] Timing for vegetation management activities may be based on construction sequencing. Actual schedules for temporary seed installation, seed bed preparation, and permanent seeding may be based on construction timing within each array area.

# 7.0 SUMMARY

This plan was prepared to outline vegetation removal at the start of construction and revegetation tasks after construction of the project area. This plan also provides guidance to PCR on 30 years of maintenance following the installation of permanent vegetation at the Lone Tree Solar Project. The plan includes the installation of one permanent seed mix:

- Low Grow Native / Non-Native Graminoid Seed Mix for installation under and between the PV panels. This mix is anticipated to be compatible with minimum leading-edge height of 30 to 42 inches and shading from the panels, as well as provide low maintenance and hardy vegetative cover. This mix will also be planted in the bulk of the perimeter areas.

The implementation and maintenance tasks provided in this plan will assist PCR in maintaining compliance with agency requirements for project revegetation. It is anticipated that the planting plan will result in improved plant species diversity and soil health compared to the pre-construction agricultural land use conditions.

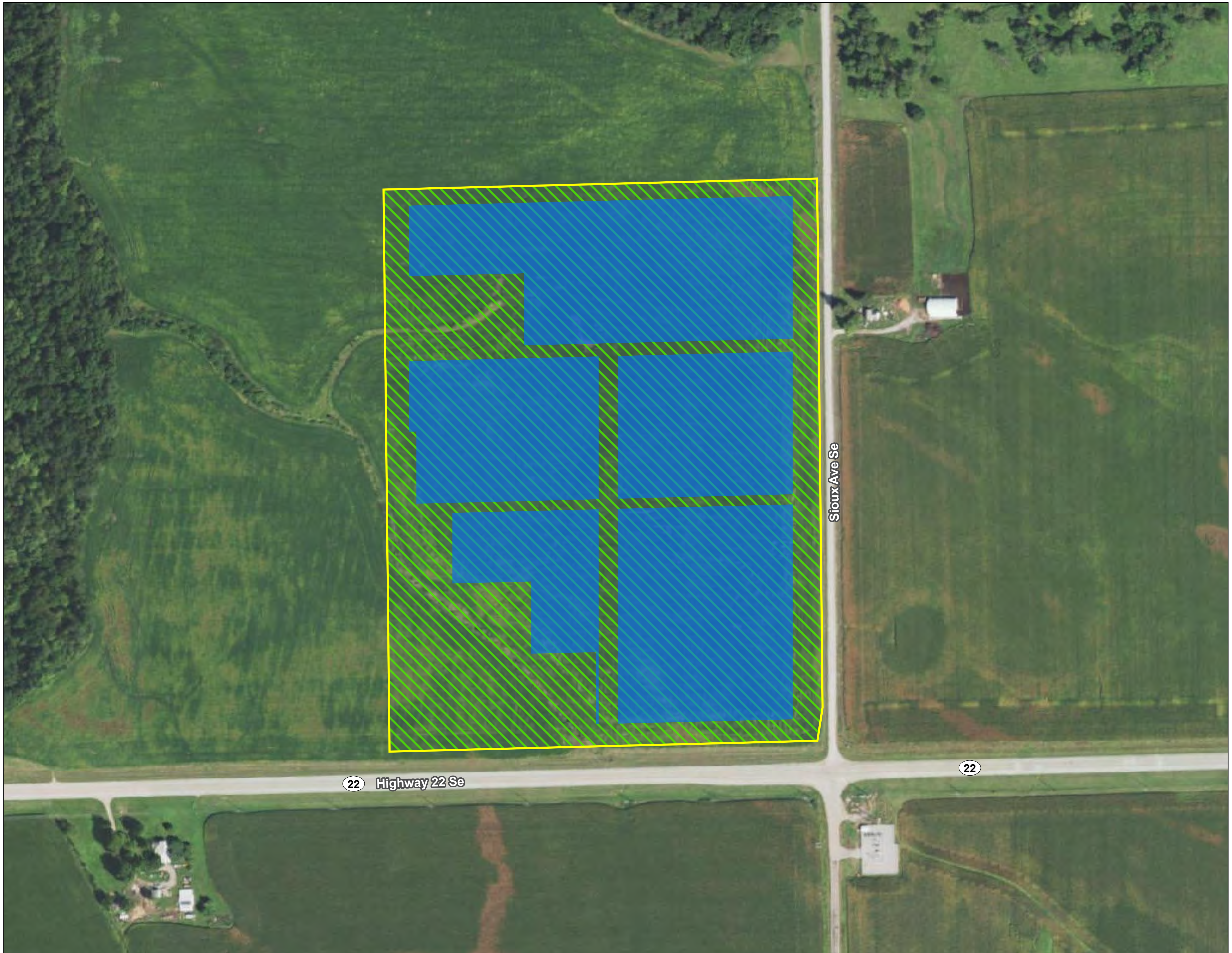



Figure No.
**1**

Title
## Lone Tree Solar Seeding Plan

Client/Project — 193709077
PCR Investments SP2 LLC
Lone Tree Solar Project
Vegetation Management Plan

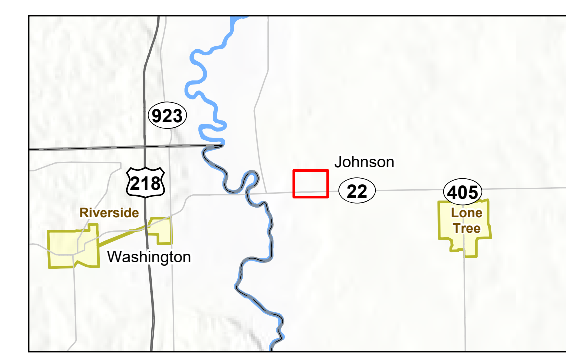
Project Location
Township of Freemont
Johnson County, IA

Prepared by JDS on 2023-03-20
TR by CD on 2023-03-20
IR by SP on 2023-03-20

N

0 150 300 Feet
(At original document size of 11x17)
1:3,600

Legend
- Project Boundary
- Solar Array
- Low Grow Native / Non-Native Seed Mix for PV Panel and Perimeter Areas (Table A.2)




***Notes***
**1.** Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
**2.** Data Sources: Stantec, PCR Investments LLC, USGS, NADS
**3.** Background: NAIP 2021

Stantec

\\Corp.ads\data\Virtual_Workspace\workgroup\1937\Active\193709073-193709081_PCR_Investments_Solar\03_data\gis_cad\gis\mxds\vmp\193709077_LoneTreeSub_VMP.aprx Revised: 2023-03-20 By: jseibel

# APPENDIX A: SEED MIX TABLES

**Table A.1-A – Table A.1-D. Temporary Cover Crop Seed Mixes***

| Table A.1-A Temporary Fall (Late August – Early November) Project Area Cover Crop Seed Mix without Permanent Seed* | |
|---|---|
| **Scientific Name** | **Common Name** |
| *Triticum aestivum* | Winter Wheat |
| *Lolium multiflorum* | Annual Rye |

| Table A.1-B Temporary Fall (Late August – Early November) Project Area Cover Crop Seed Mix with Permanent Seed* | |
|---|---|
| **Scientific Name** | **Common Name** |
| *Triticum aestivum* | Winter Wheat |
| *Lolium multiflorum* | Annual Rye |

| Table A.1-C Temporary Spring-Summer (Mid-April – Mid-August) Project Area Cover Crop Seed Mix without Permanent Seed* | |
|---|---|
| **Scientific Name** | **Common Name** |
| *Avena sativa* | Seed Oats |
| *Lolium multiflorum* | Annual Rye |

| Table A.1-D Spring-Summer and Early Fall (Mid-April – Mid-August) Project Area Cover Crop Seed Mix with Permanent Seed* | |
|---|---|
| **Scientific Name** | **Common Name** |
| *Avena sativa* | Seed Oats |
| *Lolium multiflorum* | Annual Rye |

*All seed mixes calculated at Pure Live Seed (PLS). Seeding rates are designed for drilling seed in spring through summer. Broadcasting seed and seeding during the dormant season will require 20% increase in PLS rates. Broadcast seed should be packed or harrowed into the soils.

**Table A.2 Low Grow Native / Non-Native Graminoid Seed Mix for PV Panel and Perimeter Area***

| Common Name | Scientific Name | Ounces per Acre |
|---|---|---|
| Western Wheatgrass | Pascopyrum smithii Endophyte Free Variety | 15 |
| Path Rush | Juncus tenuous | 0.2 |
| Side Oats | Bouteloua curtipendula | 32 |
| Little Bluestem | Schizachyrium scoparium | 32 |
| Prairie June Grass | Koeleria macrantha | 2 |
| Kentucky Bluegrass | Poa pratensis Balin Endophyte Free Variety | 7 |
| Redtop | Agrosostis alba/Agrostis gigantea R Endophyte Free Variety | 1 |
| Creeping Red Fescue | Festuca rubra Endophyte Free Variety | 20 |
| Plains Oval Sedge | Carex brevior | 2 |
| Canada Wild Rye | Elymus canadensis Endophyte Free Variety | 4 |
| Common Spiderwort | Tradescantia ohiensis | 0.1 |
| Roundhead Lespedeza | Lespedeza capitata | 0.1 |
| Purple Coneflower | Echinacea pallida | 0.1 |
| Stiff Goldenrod | Oligoneuron rigidum | 0.1 |
| Nodding Wild Onion | Allium cernuum | 0.5 |
| Partridge Pea | Chamaecrista fasciculata | 4 |
| Sand Coreopsis | Coreopsis lanceolata | 4 |
| White Prairie Clover | Dalea candida | 2 |
| Purple Prairie Clover | Dalea purpurea | 2 |
| Black-eyed Susan | Rudbeckia hirta | 6 |
| Purple Coneflower | Echinacea purpurea | 2 |
| Golden Alexanders | Zizia aurea | 1 |
| Mexican hat | Ratiba columnaris | 2 |
| Clover | Trifolium spp. | 8 |

*This mix represents the designed and intended list to be installed, final species composition and rates subject to minor alterations due to market availability and Zoning Administrator approval.

**Table A.3 Pollinator Refuge Prairie Seed Mix – Reference***

| Scientific Name | Common Name |
|---|---|
| **Grasses and Sedges** | |
| *Agropyron smithiii* | Western Wheat Grass |
| *Bouteloua curtipendula* | Side oats Grama |
| *Bouteloua gracilis* | Blue Grama Grass |
| *Bromus kalmii* | Prairie Brome |
| *Calamagrostis canadensis* | Blue Joint Grass |
| *Carex annectens* | Yellow-headed Fox Sedge |
| *Carex bicknellii* | Copper Sedge |
| *Carex brevior* | Plains Oval Sedge |
| *Danthonia spicata* | Poverty Oat Grass |
| *Deschampsia cespitosa* | Tufted Hair Grass |
| *Elymus canadensis* | Canada Wild Rye |
| *Elymus trachycaulus* | Slender Wheat Grass |
| *Festuca rubra* | Red Fescue |
| *Festuca subverticillata* | Nodding Fescue |
| *Poa compressa* | Canada Bluegrass |
| *Poa pratensis* | Kentucky Bluegrass (var. Park) |
| *Schizachyrium scoparium* | Little Bluestem |
| *Sorghastrum nutans* | Golden Grass |
| *Sporobolus compositus* | Rough Dropseed |
| *Sporobolus heterolepis* | Prairie Dropseed |
| **Forbs** | |
| *Agastache foeniculum* | Blue Hyssops |
| *Allium cernuum* | Nodding Onion |
| *Amorpha canescens* | Lead Plant |
| *Anaphalis margaritacea* | Everlasting |
| *Anemone cylindrica* | Thimbleweed |
| *Artemisia ludoviciana* | Sage |
| *Asclepias tuberosa* | Butterfly Milkweed |
| *Asclepias syriaca* | Common Milkweed |
| *Asclepias verticillata* | Whorled Milkweed |
| *Astragalus canadensis* | Canadian Milk Vetch |

**Table A.3 (cont.) Pollinator Refuge Prairie Seed Mix – Non Panel Areas***

| Scientific Name | Common Name |
|---|---|
| **Forbs** | |
| *Baptisia alba* | White Wild Indigo |
| *Chamaecrista fasciculata* | Partridge Pea |
| *Coreopsis lanceolata* | Lanceleaf Coreopsis |
| *Coreopsis palmata* | Prairie Coreopsis |
| *Dalea candida* | White Prairie Clover |
| *Dalea purpurea* | Purple Prairie Clover |
| *Drymocallis arguta* | Prairie Cinquefoil |
| *Echinacea pallida* | Pale Purple Coneflower |
| *Echinacea purpurea* | Purple Coneflower |
| *Geum aleppicum* | Yellow Avens |
| *Lespedeza capitata* | Prairie Bush Clover |
| *Liatris aspera* | Rough Blazing Star |
| *Lupinus perennis* | Wild Lupine |
| *Monarda punctata* | Spotted Beebalm |
| *Oenothera rhombipetala* | Sand Primrose |
| *Oligoneuron rigidum* | Stiff Goldenrod |
| *Penstemon digitalis* | Foxglove Beardtongue |
| *Penstemon grandiflorus* | Large Flowered Penstemon |
| *Ratibida pinnata* | Yellow Coneflower |
| *Rosa arkansana* | Prairie Rose |
| *Rosa blanda* | Meadow Rose |
| *Rudbeckia hirta* | Black-eyed Susan |
| *Solidago juncea* | Early Goldenrod |
| *Solidago rigida* | Stiff Goldenrod |
| *Symphyotrichum ericoides* | Heath Aster |
| *Symphyotrichum laeve* | Smooth Blue Aster |
| *Symphyotrichum oolentangiense* | Sky Blue Aster |
| *Teucrium canadense* | Germander |
| *Tradescantia ohiensis* | Ohio Spiderwort |
| *Verbena stricta* | Hoary Verbena |
| *Zizia aptera* | Heart Golden Alexandria |

*This mix represents recommended species to be included if additional pollinator diversity is required during the life of the project. Final species composition and rates subject to minor alterations due to market availability and Zoning Administrator approval.

**Table A.4 Pollinator Refuge Wetland Seed Mix – Non Panel/Wetland Buffer Areas***

| Scientific Name | Common Name |
|---|---|
| **Grasses and Sedges** | |
| *Agropyron smithiii* | Western Wheat Grass |
| *Agrostis gigantea* | Red Top |
| *Beckmannia syzigachne* | Slough Grass |
| *Calamagrostis canadensis* | Blue Joint Grass |
| *Carex scoparia* | Lance-fruited Oval Sedge |
| *Carex stipata* | Common Fox Sedge |
| *Carex vulpinoidea* | Brown Fox Sedge |
| *Deschampsia cespitosa* | Tufted Hair Grass |
| *Eleocharis obtusa* | Bald Spikerush |
| *Festuca rubra* | Red Fescue |
| *Glyceria striata* | Fowl Manna Grass |
| *Juncus dudleyi* | Dudley's Rush |
| *Poa palustris* | Meadow Bluegrass |
| *Poa pratensis* | Kentucky Bluegrass (var. Park) |
| **Forbs** | |
| *Asclepias incarnata* | Marsh Milkweed |
| *Asclepias syriaca* | Common Milkweed |
| *Astragalus canadensis* | Canadian Milk Vetch |
| *Bidens cernua* | Nodding Bur Marigold |
| *Bidens frondosa* | Common Beggar's Ticks |
| *Boltonia asteroides* | False Aster |
| *Coreopsis lanceolata* | Lanceleaf Coreopsis |
| *Coreopsis palmata* | Prairie Coreopsis |
| *Eupatorium perfoliatum* | Boneset |
| *Geum aleppicum* | Yellow Avens |
| *Helenium autumnale* | Sneezeweed |
| *Liatris spicata* | Marsh Blazing Star |
| *Lobelia siphilitica* | Blue Lobelia |
| *Monarda fistulosa* | Wild Bergamot |
| *Penstemon digitalis* | Foxglove Beardtongue |
| *Penthorum sedoides* | Ditch Stonecrop |
| *Persicaria pensylvanica* | Pinkweed |
| *Pycnanthemum virginianum* | Mountain Mint |

| Scientific Name | Common Name |
|---|---|
| **Forbs** | |
| *Rudbeckia hirta* | Black-eyed Susan |
| *Zizia aurea* | Golden Alexanders |

*This mix represents recommended species to be included if areas present wetter conditions during the life of the project where pollinator species are desired. Final species composition and rates subject to minor alterations due to market availability and Zoning Administrator approval.

# APPENDIX B: COMPARISON OF SEEDING METHODS

**Table B.1 Comparison Summary Between Drill and Broadcast Seeding Methods**

| Circumstance | Drill Seeding | Broadcast Seeding | Post Seeding Packing |
|---|---|---|---|
| **Soil to Seed Contact** | High | Low | Increase soil seed contact |
| **Germination Efficiency** | High | Low | Increase germination rates |
| **Extra Seed Required to Achieve Compatibility** | No | ≥ 20% | No extra seed required |
| **Seedbed Preparation** | Low | High | Decreases soil preparation |
| **Soil Finishing (packing or rolling)** | Low | High | N.A. |
| **Efficiency in Tight Spaces** | Low | High | Low |
| **Ability to Seed Under PV Panels** | No | High | No |
| **Impact on Erosion Potential** | Decrease | Increase | Decreases erosion potentials |
| **Harvested Soybean Field** | Yes | Yes | Increase germination rates |
| **Harvested Corn Field (followed by mowing, baling, and light discing)** | Yes | Yes | Increase germination rates |
| **Harvested Forage (hay or silage) Field** | Yes | Yes | Increase germination rates |
| **Post-construction Seeding Within Array Field** | Not advised | Advised | Advised |
| **Potential for Second Seeding Event** | Low | High | Decreases |

**Attachment E:**
**Agricultural Impact Mitigation Plan**

# Agricultural Impact Mitigation Plan

Lone Tree Substation Solar Project

Johnson County, Iowa

Stantec Project #:193709077

March 17, 2023

Prepared for:

PCR Investments SP 2 LLC
1334 Brittmoore Rd. Suite 1327
Houston, TX 77043

Prepared by:

Stantec Consulting Services Inc.
2300 Swan Lake Boulevard
Suite 202
Independence IA 50644-9708

**AGRICULTURAL IMPACT MITIGATION PLAN**

| Revision | Description | Author | | Quality Check | | Independent Review | |
|---|---|---|---|---|---|---|---|
| 0 | AIMP | AH | 8/8/23 | JK | 8/10/23 | SP | 8/10/23 |
| 1 | AIMP | ZB | 3/14/23 | JK | 3/14/23 | | |
| | | | | | | | |

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**Aaron Hyams, SSIT, Environmental Scientist**

Reviewed by ________________________________
(signature)
**Jennifer Kamm, Senior Environmental Scientist**

Approved by ________________________________
(signature)
**Stacey Parks, Senior Associate/Senior Scientist**

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**LIST OF APPENDICES**

**APPENDIX A**

# Abbreviations

| | |
|---|---|
| AC | Alternating current |
| AIMP | Agricultural Impact Mitigation Plan |
| BMP | best management practices |
| CIPCO | Central Iowa Power Cooperative |
| DC | direct current |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Risk Map |
| EPC | engineering, procurement, and construction contractor |
| GIS | Geographic Information System |
| IDNR | Iowa Department of Natural Resources |
| IPL | Interstate Power and Light Company |
| LCC | Land Capability Class |
| MV | medium voltage |
| Mw | Megawatt |
| NEC | National Electric Code |
| NESC | National Electric Safety Code |
| NRCS | Natural Resources Conservation Service |
| PCR Investments | PCR Investments SP 2 LLC |
| POI | point of interconnection |
| Project | Lone Tree Substation Solar Project |
| PV | photovoltaic |

| | |
|---|---|
| Stantec | Stantec Consulting Services Inc. |
| Stormwater General Permit | General Permit to Discharge under an Iowa Pollutant Discharge Elimination System IPDES Permit |
| SSURGO | Soil Survey Geographic Database |
| UDO | Unified Development Ordinance |
| VMP | Vegetation Management Plan |

# 1.0 PURPOSE AND APPLICABILITY OF PLAN

The objective of this Agricultural Impact Mitigation Plan (AIMP) is to identify measures that PCR Investments SP 2 LLC (PCR Investments) and its contractors will take to avoid, mitigate, repair, and/or compensate for potential agricultural impacts that may result from the construction, operation, and eventual decommissioning of the Lone Tree Substation Solar Project (Project). A 50.8-acre Project Area was analyzed for this AIMP as shown on Figure 1, Site Location Map (Appendix A). Although agricultural operations would temporarily cease on most of the land on which the Project is constructed during the life of the Project, this Plan outlines measures to ensure the land may be returned to future agricultural use following decommissioning of the Project. This AIMP describes the Best Management Practices (BMPs) that will be used during construction, operation, and decommissioning to minimize long-term impacts to soil.

PCR Investments will obtain authorization under the Iowa Department of Natural Resources (IDNR) General Permit to Discharge under an Iowa Pollutant Discharge Elimination System IPDES Permit (IDNR Stormwater General Permit) prior to the commencement of construction. Temporary stormwater BMPs will be used during Project construction, and construction will be completed in accordance with the IDNR Stormwater General Permit and a site-specific Erosion Control and Storm Water Management Plan to be developed for the Project.

The site-specific Vegetation Management Plan (VMP) developed for the Project describes the vegetation management practices, including seed mixtures, planting plans and methodologies, and maintenance practices to be conducted during the construction and operational phases of the Project. Permanent perennial vegetative cover will be established throughout the Project Area to manage erosion and increase stormwater infiltration within the Project Area.

This AIMP is separated into six sections: Section 2 provides an overview of the proposed Project and its components. Section 3 identifies soil limitations and suitability within the Project Area; Section 4 describes the BMPs that will be used during construction and operation of the Project; Section 5 summarizes key components of the Vegetative Management Plan in relation to agricultural impact mitigation; Section 6 describes Project Decommissioning and restoration/reclamation of the site.

# 2.0 PROJECT OVERVIEW

The PCR Investments Lone Tree Substation Project consists of a 7.5-Megawatt (MW) alternating current (“AC”) solar power generating facility sited on approximately 50.8 acres of land zoned Agricultural (AG) and located approximately 3 miles northwest of the Town of Lone Tree, in Johnson County, Iowa. The Project will interconnect to the adjacent Lone Tree Substation, which is owned and operated by the Central Iowa Power Cooperative (CIPCO). PCR Investments selected this site due to capacity at the point of interconnection (“POI”), land availability, existing transmission facilities, existing road infrastructure, environmental considerations, and constructability (i.e., restrictions due to slopes, soils, wetlands, and waterways).

PCR Investments is responsible for all land acquisition, lease agreements, and easements required to build the Project facilities within the Project Area.

## 2.1 PROJECT COMPONENTS

The Project facilities will include the following major components or systems:

### 2.1.1 Solar Panels, Arrays, and Racking

Solar panel technology is continually making advancements in both manufacturing and efficiency and is subject to commodity pricing based on the current market demand and available stock. Therefore, the final photovoltaic (PV) module selection will be made when detailed engineering is completed and ordering of the PV modules is possible. At the time of construction, several PV module offerings from different suppliers will be evaluated, and a selection will be made based on the most cost-effective option. The technologies that may be considered are thin-film, polycrystalline silicon, and monocrystalline silicon (including bifacial PV modules), and the final supply of modules may contain a mix of several similar wattages.

Depending on final manufacturer selection, the Project will be designed for between +550W and +650W photovoltaic (“PV”) modules with a generating capacity of 7.5 MW AC (8.97 MW DC). The Project PV modules will be mounted on approximately 302 single-axis, galvanized steel, horizontal tracker mounting systems supported by over 2,780 steel piles. The current design consists of three (3) power blocks and a switchgear and meter station. The number of single axis trackers varies per block but is anticipated to be approximately 100. Each power block includes 21 inverters and is connected to approximately 5,436 PV modules. The final design will be developed during the detailed engineering phase and in accordance with the applicable National Electric Safety Code (“NESC”) and National Electric Code (“NEC”) provisions and any generating certificate or permit conditions.

Foundations or supports will be installed to a minimum depth of five (5) feet below ground surface to minimize impacts from freezing and thawing conditions. Exact embedment depth for the driven pile on which the solar panels are mounted will be determined with final engineering.

### 2.1.2 Electrical Collection System

Underground 12.47 kilovolt (kV) collector circuits are proposed for the Project. Underground collector circuits are an industry standard method to route the collection cables while eliminating interference with other above ground infrastructure within the Project Area. The total length of AC collection lines installed for the Project will be approximately 0.44 mile (2,325 feet). This includes 0.34 mile (1,813 feet) of AC collection lines within the PV array connecting to the medium voltage (MV) power stations, switchgear, and metering station and a 512-foot generator tie line connecting the PV array area to the Lone Tree Substation. No overhead collector circuit runs are proposed for the Project.

### 2.1.3 Access Roads

Gravel access roads will connect the facility to existing public roads and provide access to Project equipment during facility operations and maintenance as well as to accommodate emergency access. Permanent internal access roads within the Project Area are expected to be approximately 1.49 miles (7,890.9 feet) in total length and are approximately 12 feet wide. Permanent access road outside the Project Area which will provide access to the site from Sioux Avenue SE is expected to be approximately 23 feet in total length and is approximately 20 feet wide.

### 2.1.4 Transformer, Switchgear, MV Power Stations, and Metering

The Project will use driven pier foundations and concrete foundations. The skids for the transformers, switchgears, MV power stations, and metering will likely be installed on driven pier foundations but could be placed on concrete foundations if required by soil and geotechnical conditions. The typical pier foundation will be from five (5) feet to 10 feet deep. For driven pier foundations, no excavation is required. For the concrete foundations, soil excavation quantities will be determined in the detailed engineering phase. Foundation dimensions will be determined in the detailed engineering phase. The location and footprint of these facilities within the Project Area for the preliminary design is shown in Figure 1.

### 2.1.5 Security Fencing

PCR Investments will utilize fencing around the PV solar arrays that is consistent with all applicable codes, including NEC and North American Electric Reliability Council Critical Infrastructure Protection requirements. Fencing is required to safeguard the public health. Array fencing will consist of seven-foot-high woven-wire exclusion fence with wood fenceposts. Fenceposts will be driven into the ground. No concrete foundations will be used for the fenceposts.

## 2.2 CONSTRUCTION

The Project will be designed in conformance with the version of the International Building Code as required by the authority having jurisdiction, state, and local requirements. The Project will select an engineering, procurement, and construction contractor (EPC) to manage engineering, procurement, and construction of the Project; subcontractors will be selected to perform all necessary work to construct the Project. Project construction follows a construction sequence in accordance with a construction plan, which will be developed and finalized prior to the start of construction, in conjunction with the selected contractors. The following provides a general description of the staging and construction sequence for the Project:

- Tracking pads at construction entry and exit points, and erosion control and stormwater best management practices (BMPs) will be installed as outlined in the Erosion Control Plan prepared for the Project.
- Vegetation removal (crop removal) will start in areas where initial staging and lay-down areas will be located. Vegetation removal will continue across the site, sequenced to proceed in an organized and cost-efficient manner. Limited tree and brush clearing will commence in a similar fashion. Bare ground will be re-seeded, if necessary, in accordance with the Erosion Control Plan and IDNR requirements.
- Staging and lay-down areas will be developed to receive and store construction materials and equipment. The lay-down areas will also house trailers and parking for personnel and construction-related vehicles.
- Installation of access roads to facilitate continued clearing operations and construction of the facility (limited grading is anticipated as roads will be constructed at grade when possible).
- Delivery of equipment, including piles, aluminum supports/mounting structures, tracking systems, and inverters. The Project will be constructed in blocks and multiple blocks will be constructed simultaneously over time. Deliveries will continue over time in advance of construction of the blocks.
- Solar block construction in sequence, starting with driving pile foundations, then installing aluminum supports/mounting structures onto the piles.
- Delivery of collection system equipment and installation via trenching and directional drilling.
- Delivery and installation of solar PV modules.
- Stabilization and revegetation of disturbed areas will occur in stages as construction of the solar blocks and collection trenches are completed. Bare ground will be re-seeded, if necessary, in accordance with the Erosion Control Plan and IDNR requirements.
- Connect Project Switchgear and Metering and Lone Tree substation and transmission infrastructure.
- Conduct interconnection inspections and testing and Project commissioning.

Site access will be controlled for personnel and vehicles. Permanent security fencing will be installed in advance of or in conjunction with site preparation activities (e.g., grading, mowing, etc.) in advance of large component deliveries. All temporary disturbance areas will be restored in accordance with the Project specific Vegetation Management Plan.

During construction, temporary utilities will serve the construction offices, laydown area, and Project Area. Temporary construction power before the construction of permanent distribution power will either be provided via a local distribution line extended to the Project Area or by temporary diesel generators. Temporary area lighting will be provided and strategically located for safety and security.

The Project on-site workforce will consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. The construction crews will have approximately 90 to100 direct workers for the Project. Construction of the Project will generally occur between 7:00 a.m. and 5:00 p.m., Monday through Friday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. During the start-up phase of the Project, some activities (such as equipment and system testing) may continue 24 hours per day, 7 days per week. Construction hours will comply with local permit requirements.

Construction of the Project is currently expected to require approximately 8 months, which includes mobilization, construction/installation, and commissioning/testing to achieve the targeted commercial operations date of December 2024 (dependent upon Johnson County permit approvals).

The Project will require different equipment types depending on the phase of construction. The first phase consisting of civil work and road building will require dozers, motor graders, and rollers. The pile-driving phase will utilize pile drivers. After pile driving, the installation of racking and panels will be supported mainly by skid steers and telehandlers. Directional drilling equipment for installation of the collection line will be mobilized to the site on low-profile flatbed trailers. For other Project components including the transformers, switchgears, MV power stations, and metering; small cranes, bucket trucks, and forklifts will be used to place equipment. Other support equipment such as skid steers, ATVs, and forklifts will also be used.

Delivery trucks will consist of standard, legal load (80,000 pounds or less) over-the-road flatbed and box trucks and will have standard turning radii. Vehicles used inside the arrays will be suitable for the engineered internal access roads and turn-arounds. Equipment typically used in construction and operation of utility scale solar facilities are generally similar in weight or less than equipment typically used in annual agricultural operations. Construction equipment distributes loads widely resulting in similar tire pressure distribution and contact pressures. During construction of a solar facility, the number of vehicle passes in the same wheel tracks is limited, with the exception of vehicles on internal access roads. During construction there will be a concentration of vehicle passes near the site entrances.

### 2.2.1 Site Preparation and Clearing

The Solar Production Area is defined as all portions of the Project facilities located inside the proposed fencing of the site. These areas include the panels and associated facilities such as medium voltage power stations, access roads, and underground collector lines. During construction most of these areas will be used for accessing panel locations and for temporarily staging materials and equipment.

Under existing conditions, the Project Area consists of active agriculture under row crop production with two herbaceous wetland drainage swales. Prior to the commencement of construction, site vegetation will be evaluated to determine which areas will be mowed, left undisturbed or will require pre-seeding. Areas with limited vegetation due to past farming operations or disruption of vegetation due to civil construction activities will be seeded and stabilized in a timely manner. Portions of the site not utilized for the Project facilities or not impacted during construction will remain vegetated however may be overseeded to promote additional vegetation as described in the VMP.

Anti-tracking pads will be installed at the construction exits. Temporary perimeter sediment controls and diversions will be installed concurrent with the progress of land clearing and grubbing activities. Prior to any clearing, the limit of disturbance will be surveyed and marked in the field. This limit constitutes the limit of soil disturbance. Work will not be conducted within wetlands unless authorized by permit from the IDNR and U.S. Army Corps of Engineers. Based on the preliminary design, the two wetlands within the Project Area have been avoided and no impacts to wetlands are proposed.

A land surveyor will obtain or calculate Project benchmark, grades, elevations and alignment data from final design plans and detail drawings which inform control staking to establish the Project alignments in advance of construction commencement. During construction, these alignment control points will be reestablished as needed.

### 2.2.2 Grading

Site grading activities will only occur in select areas where elevations need to be modified to accommodate tracker/racking system slope tolerances, site drainage, access roads, laydown areas; and foundations for the transformers, switchgears, MV power stations, and metering. This approach to grading minimizes impacts and/or preserves existing soil and root structures, topsoil nutrients, seed base, and pre-construction site hydrology.

Grading consists of excavation and soil stabilization of earth as required to meet solar array design load requirements. Grading within the solar array area will match existing grades as closely as possible, however some existing contours may require smoothing for access purposes. To the extent practical, grading of an area will take place shortly before trenching and then again post installation of Project components to minimize the area of open, uncovered ground present at all times during construction. The portions of the Project Area that need to be graded are expected to result in a balanced cut-and-fill quantity of grading to maintain the existing conditions to the extent practical for the protection of the equipment and facilities. Where grading occurs on site, topsoil will be salvaged in areas where cut will be greater than the topsoil depths and those areas where subsoil fill will be placed. Once all cut/fill is completed the topsoil will be replaced.

Materials suitable for soil stabilization and backfill will be stockpiled at designated locations using appropriate segregation and erosion control methods. Materials unsuitable for compaction, such as debris and large rocks, will be stockpiled at designated locations for disposal at an acceptable off-site location. Contaminated materials are not anticipated, but if any are encountered during excavation, they will be disposed of in accordance with applicable laws, ordinances, regulations, and standards.

### 2.2.3 Access Road Construction

Permanent access roads will consist of either an improved aggregate base or the existing compacted, vegetated soil surface. Roads will be constructed as close to existing grade as possible so that existing sheet flow and drainage patterns are maintained. Erosion control devices will be maintained throughout grading and stabilization according to the Erosion Control Plan. Permanent access roads will be maintained for the life of the Project.

Permanent aggregate base access roads will be constructed by first removing the topsoil and organic material, compacting the subgrade, and constructing the road according to civil design requirements. Topsoil will be windrowed to the edges of the road area and distributed along the roadway edge after fill and aggregate installation. Geotextile matting will be installed prior to placement of aggregate to prevent mixing with native subsoil. A layer of road base will then be added and compacted. Road aggregate or fill will be a local pit run aggregate material. Upon completion of detailed engineering, the aggregate specifications will be available for construction quality assurance.

Access roads developed as native compacted soil will be created with existing in-situ soils unless soils are not suitable for roadway construction. In creating native soil compacted roadways a similar approach to aggregate road construction will be employed. Cut / fill areas will have topsoil returned, where applicable, and seeded within 14 days of completion of the cut / fill / grading activities.

### 2.2.4 Solar Array Construction

Once grading activities are complete, the racking system supports will be constructed using steel piles driven into the ground. Driven steel pile foundations are typically used where high load bearing capacities are required. The pile is driven using a pile driver (hydraulic ram), which requires two workers. Soil disturbance would be restricted to the hydraulic ram machinery, about the size of a small tractor, temporarily disturbing soil at each pile insertion location.

Tracker mounting assemblies may be assembled at the Project laydown yard and transported to the array blocks prepared for installation; they can also be assembled at the point of installation. Tracker mounts are then fixed to prepared support foundations using forklifts and tractors. During array and racking assembly, multiple crews and various types of vehicles will be working within the Project Area.

These vehicles include flatbed trucks for transporting array components, small all-terrain vehicles, and pick-up trucks used to transport equipment and workers throughout the Project Area. Modules will be staged in advance throughout the Project Area and be brought to specific work areas for installation by wagon-type trailers pulled by skid steers. The Solar modules will be installed by multiple crews using hand tools.

### 2.2.5 Electrical Collection System

Collection system cabling will be installed in upland areas using one of three methods as needed: a chain-driven trenching machine, excavator, cable laying plow, MV cable trailer, or plow equipment pulled by a bulldozer. The trencher will cut an exposed trench approximately 1 foot wide by 3 to 4 feet deep depending on the type of cable installation. Soil disturbance from the trenching machines would be restricted to the trenching machine tracks. Once cables are installed, the trenches would be backfilled using a grader or small bulldozer and a compaction machine. See Section 4.6 for further description of BMP measures to be implemented during trenching activities.

The horizontal directional drill method will be used to install collection system under two public roadways, Sioux Avenue SE and Highway 22 SE, as described in Section 4.7.

### 2.2.6 Transformers, Switchgears, MV Power Stations, and Metering

The transformers, switchgears, MV power stations, and metering will be placed on footers with gravel pad foundations that will be designed to specifications necessary to meet the local geotechnical conditions. Each component will sit on top of a slab foundation with rebar on center in each direction. A pull box for cable penetrations will be located directly under the transformer, switchgear, MV power station, and metering to facilitate through-floor cable connections. After the collection system is installed and foundations are poured, the transformer, switchgear, MV power station, and metering units will be installed into position. Transformer, switchgear, MV power station, and metering units will be lifted by crane off the manufacturer's delivery truck and set directly onto the pre-poured foundation.

The Contractor will use an appropriately sized rough-terrain crane to lift and set each unit. After the unit is properly set and anchored, the Contractor will connect the collection cabling previously installed in the adjacent trenches to the unit.

### 2.2.7 Project Security Fencing

Array fencing will consist of seven-foot-high woven-wire exclusion fence with wood fenceposts. Fenceposts will be driven into the ground. No concrete foundations will be used for the fenceposts. Final fence and post specifications will be determined by the EPC.

# 3.0 SOIL LIMITATIONS AND SUITABILITY WITHIN THE SITE

Soil varies considerably in its physical and chemical characteristics that strongly influence the suitability and limitations that soil has for construction, reclamation, and restoration. Major soil properties include:

- soil texture;
- soil slope;
- drainage and wetness;
- fertility and topsoil characteristics; and
- presence of stones, rocks, and shallow bedrock.

Interpretative limitations and hazards for construction and reclamation are based to a large degree on the dominant soil properties, and include:

- prime farmland status;
- hydric soil status;
- susceptibility to wind and water erosion;
- susceptibility to compaction;
- fertility and plant nutrition; and
- drought susceptibility and revegetation potential.

## 3.1 IMPORTANT SOIL CHARACTERISTICS

The Soil Survey Geographic Database (SSURGO) is the digitized county soil survey and provides a Geographic Information System (GIS) relating soil map unit polygons to component soil characteristics and interpretations. Soil map unit polygons in the SSURGO database were clipped to the Project Area and major Project components including:

- Solar Array Area
- Electrical Collection Line
- Generator Tie Line
- Access Roads
- Switchgear and Metering
- Transformer, Switchgear, and MV Power Station
-

The acreage of major Project component physical properties, classifications, and limitation interpretations important for construction, use, revegetation, and reclamation were determined by spatial query of the SSURGO. A Custom Soil Resource Report for the Project Area which includes a SURRGO Map and descriptions of each map unit is provided Appendix A.

### 3.1.1 Physical Characteristics

Selected physical characteristics of site soils are broken down by acreage with the 50.8-acre Project Area in Table 1.

Soil texture affects water infiltration and percolation, drought tolerance, compaction, rutting, and revegetation among other things. Soil texture is described by the soil textural family which indicates the range of soil particle sizes averaged for the whole soil. Most of the soils within the Project Area (49.9 acres, 98.2 percent) are classified as silt loams indicating soils dominated by soil particles in the fine silt fraction, and ≤28 percent clay particles and 20-50 percent sand particles.

Slope affects constructability, water erosion, revegetation, compaction and rutting, among other properties. Approximately 50.7 acres, (99.8 percent) of the soils within the Project Area are nearly level soils with representative slopes falling within the 0 to 5 percent slope range. The remainder of the soils (0.1 acres, 0.2 percent) have representative slopes in the >5 to 8 percent class. No soils within the Project Area have representative slopes greater than 8 percent.

Soil drainage indicates the wetness in the soil profile along with the speed at which internal water moves. Soil Drainage affects constructability, erosion by wind and water, and revegetation success. Approximately 37.7 acres (74.2 percent) of the soils within the Project Area are either somewhat poorly drained, poorly drained, or very poorly drained, indicating low infiltration rates due to landscape positions and or clay percentages. The remaining 13.1 acres (25.8 percent) are well drained.

Topsoil depth affects soil plant nutrition and surface soil structure. To maintain soil productivity, soils with thick topsoil will require larger areas for storage of larger volume of topsoil stripped from permanent infrastructure footprints such as permanent access roads, transformers, switchgear, MV Stations, and metering. Approximately 24.3 acres (47.8 percent) of the soils within the Project Area contain 6 to 12 inches of topsoil. 26.5 acres (52.2 percent) of the soils contain 12 to 18 inches of topsoil. Topsoil depth is also correlated to soil order. The most abundant soil order within the Project Area are Alfisols (30.6 acres, 60.2 percent), and are characterized by moderately leached soils that have relatively high native fertility. Mollisols are characterized by a significant accumulation of organic matter in the topsoil and comprise 20.2 acres, or 39.8 percent).

The presence of bedrock near the soil surface and rocks and stones in the soil profile affects constructability and revegetation. No soils in the Project Area are shallow to bedrock or have stones at the soil surface or within the soil profile

## Table 1. Soil Physical Characteristics by Project Facility

| Project Facilities | Total Acres[1] | Textural Class[2] | Slope Range[3] | | Drainage Class[4] | | | | Topsoil Thickness[5] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Silt loam | 0-5 | >5-8 | W | SP | P | VP | >6-12 | >12-18 |
| | Acres | | | | | | | | | |
| Access Roads | 2.2 | 2.2 | 2.2 | <0.1 | 0.6 | 0.5 | 0.3 | 0.8 | 1.9 | 0.3 |
| Collection Line | <0.1 | <0.1 | <0.1 | 0.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Generator Tie Line | 0.5 | 0.5 | 0.5 | 0.0 | <0.1 | 0.1 | 0.3 | 0.1 | 0.5 | <0.01 |
| Perimeter Area Outside the Solar Array Area | 1.7 | 1.6 | 1.6 | <0.1 | 0.5 | 0.1 | 0.3 | 0.8 | 1.4 | 0.3 |
| Perimeter Area Inside the Solar Array Area | 15.1 | 14.3 | 15.1 | <0.1 | 4.2 | 2.7 | 1.0 | 7.2 | 4.8 | 10.3 |
| Switchgear and Metering | <0.01 | <0.01 | <0.01 | 0.0 | <0.01 | 0.0 | <0.01 | 0.0 | <0.01 | <0.01 |
| Solar Array | 31.0 | 31.0 | 31.0 | 0.0 | 7.8 | 8.5 | 4.6 | 10.1 | 15.7 | 15.3 |
| Substation | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | <0.01 | 0.0 | 0.3 | 0.0 | 0.3 |
| Transformer, Switchgear, MV Power Stations | <0.1 | <0.1 | <0.1 | 0.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| **Total** | **50.8** | **49.9** | **50.7** | **0.1** | **13.1** | **11.9** | **6.5** | **19.3** | **24.3** | **26.5** |

[1] Total acres of Project features that are anticipated to be disturbed by supporting construction equipment traffic, excavation, and grading. Data obtained by merging project facility polygons with the SSURGO spatial data in ArcGIS.
[2] Data available directly from the Natural Resources Conservation Service SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data.
[3] Representative slope values are taken directly from the SSURGO database. The SSURGO2 database provides representative slope values for all component soil series. Slope classes represent the slope class grouping in percent that contains the representative slope value for a major component soil series. For example, a soil mapped in the 2-6% slope class has an average slope of 4%, which is within the 0-5% slope range.
[4] Drainage class as taken directly from the SSURGO database: “E” Excessively drained; “SE” Somewhat excessively drained; “W” Well drained, “MW” Moderately well drained; “VP” Very poorly drained; “P” Poorly drained; “SP” Somewhat poorly drained.
[5] Topsoil thickness is the aggregate thickness of the A horizons described in the SSURGO database.

### 3.1.2 Selected Soil Classification

Selected classification information for site soils is broken down by acreage with the 50.8-acre Project Area in Table 2.

Natural Resources Conservation Service (NRCS)-designated prime farmland soils have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses. 50.8, (100 percent) of the soils in the Project Area are classified as Prime Farmland and Prime Farmland if Drained.

The NRCS also recognizes farmlands of statewide importance, which are defined as lands other than prime farmland that are used for production of specific high-value food and fiber crops (e.g., citrus, tree nuts, olives, fruits, and vegetables). Farmlands of statewide importance have the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Farmland of statewide importance is similar to prime farmland but with minor shortcomings such as greater slopes or less ability to store soil moisture. The methods for defining and listing farmland of statewide importance are determined by the appropriate State agencies, typically in association with local soil conservation districts or other local agencies. In addition to the 50.8 acres of Prime Farmland, <0.1 acres (<0.2 percent) of soils in the Project Area are classified as farmland of statewide importance.

Land Capability Class (LCC) is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time. Capability classes are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are designated by adding a letter, e, w, s, or c, to the class numeral. The letter e shows the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation; s shows limitation due to shallow, droughty, or stony soil; and c, shows limitation due to climate that is very cold or very dry. In class 1 there are no subclasses because the soils of this class have few limitations.

Soils within the Project Area are in LCC 1, 2w, 2e, 3w, and 3e. Approximately 19.3 acres (38.0 percent) are in LCC 3w and have severe limitations due to water in or on the soil surface. 0.9 acres (1.8 percent) of soils are in LCC 3e and have severe limitations to parent material and susceptibility to wind erosion. There are 6.5 acres (12.8 percent) and 12.2 acres (24.0 percent) in LCC's 2w and 2e. 11.9 acres (23.4 percent) are in LCC 1.

Hydric soils are soils in poorly drained to very poorly drained drainage classes and are rated as hydric, predominantly hydric, partially hydric, predominantly non-hydric, and non-hydric. Hydric soils are a component of regulated wetlands and can be used to indicate areas with potential jurisdictional wetlands. Approximately half of the soils are hydric (25.12-acres, 50.12 percent), with (25.5 acres, 50.8 percent) being considered non-hydric soils.

## Table 2. Selected Soil Classifications by Project Facility

| Project Feature | Total Acres[1] | Prime Farmland[2] | Farmland of Statewide Importance | Land Capability Class[3] | | | | | Hydric Soil[4] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2w | 2e | 3w | 3e | |
| | Acres | | | | | | | | |
| Access Roads | 2.2 | 2.2 | <0.1 | 0.5 | 0.3 | 0.6 | 0.8 | <0.1 | 1.1 |
| Collection Line | <0.1 | <0.1 | 0.0 | <0.1 | <0.01 | <0.1 | <0.01 | 0 | <0.1 |
| Generator Tie Line | 0.5 | 0.5 | 0.0 | 0.1 | 0.3 | <0.01 | 0.1 | 0 | 0.4 |
| Perimeter Area Outside the Solar Array Area | 1.7 | 1.7 | <0.1 | 0.1 | 0.3 | 0.4 | 0.8 | 0.1 | 1.1 |
| Perimeter Area Inside the Solar Array Area | 15.1 | 15.1 | <0.1 | 2.7 | 1 | 3.4 | 7.2 | 0.8 | 8.2 |
| Switchgear and Metering | <0.01 | <0.01 | <0.01 | 0 | <0.01 | <0.01 | 0 | 0 | <0.01 |
| Solar Array | 31.0 | 31.0 | 0.0 | 8.5 | 4.6 | 7.8 | 10.1 | 0 | 14.7 |
| Substation | 0.3 | 0.3 | 0.0 | 0 | 0 | 0 | 0.3 | 0 | 0.3 |
| Transformer, Switchgear, MV Power Stations | <0.1 | <0.1 | 0.0 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Total** | **50.8** | **50.8** | **<0.1** | **11.9** | **6.5** | **12.2** | **19.3** | **0.9** | **25.8** |

1 Total acres of Project features that are anticipated to be disturbed by supporting construction equipment traffic, excavation, and grading. Data obtained by merging project facility polygons with the SSURGO spatial data in ArcGIS.

2 Data available directly from the NRCS SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data. Includes all areas Prime Farmland and Prime farmland if drained or irrigated.

3 Capability subclasses are designated by adding a letter, e, w, s, or c, to the class numeral. The letter e shows the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation; s shows limitation due to shallow, droughty, or stony soil; and c, shows limitation due to climate that is very cold or very dry.

4 Data available directly from the NRCS SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data. Includes Hydric, Predominantly hydric, and Partially hydric soil.

### 3.1.3 Construction-Related Interpretations

Selected construction-related interpretative data for site soils are broken down by acreage within the Project Area in Table 3.

For the purposes of this report, a highly erodible rating consists of soils with an NRCS Soil Erodibility Factor (Kw) rating of 0.4 to 0.69. Soil Erodibility Factor (Kw) describes the susceptibility of soil detachment by water runoff or raindrop impact and predicts long-term average soil loss from sheet and rill erosion. The Kw is affected by soil texture, organic matter content, size and stability of soil aggregates, permeability, and depth to a restrictive layer. Soil erosion potential is also influenced by slope and exposure to erosion mechanisms. Soil erosion increases in inverse proportion to the effectiveness of vegetation cover (i.e., soils with denser vegetation cover are less susceptible to erosion). Removal of vegetation associated with construction activities, whether by direct stripping or by other mechanical means, greatly increases erosion potential. 50.0 acres (98.4 percent) of the project area contains soil moderate Kw, with 0.8 acres (1.60 percent) of the Project Area being has low water erodibility.

Wind erosion was evaluated using the wind erodibility group. Highly wind erodible soils are medium textured, relatively well drained soils with poor soil aggregation, resulting in soils with soil surfaces dominated by particles that can be dislodged and carried by the wind. None of soils within the Project area are highly wind erodible.

Soils prone to compaction and rutting are subject to adverse changes in soil porosity and structure as a result of mechanical deformation caused by loading by equipment during construction. Factors considered are soil texture, soil organic matter content, soil structure, rock fragment content, and the existing bulk density. Each of these factors contributes to the soil's ability to resist compaction and rutting. Compaction and rutting are not anticipated to be significant issues because the soils are coarse textured and are typically excessively drained. 50.8 acres (100 percent) of wet soils may be inherently susceptible to rutting.

Two basic methods for installing ground-based solar array systems are installation via pilings or anchoring via precast footing or ballasted trays. The penetrating method includes driven piles, screw augers, or concrete piers that into the soil to provide a stable foundation. The anchoring system utilizes precast ballasted footings or ballasted trays on the soil surface to make the arrays too heavy to move. Project Area site conditions and cost dictate which method is employed. Installation of these systems requires some power equipment for hauling components and either driving piles, turning helices, or boring holes to install the anchoring apparatus.

Soil suitability ratings for Ground-based Solar Panel Arrays include “Not Limited”, “Somewhat Limited”, or “Very Limited”, depending on the type of solar array construction methods. Overall, 49.9 acres (100 percent) of the soils within the Project Area are rated as Very Limited. The limitations of the site-specific soils are not due to the other construction-related soil interpretations. Rather, the limitations are due to frost action in the topsoil, low soil strength, a shallow depth to a saturated zone, and shrink-swell activities as a result of soil mineralogy. A geotechnical survey conducted by a qualified geotechnical firm can determine the most suitable installation method.

The final analyzed soil limitation is drought susceptibility. Even under relatively normal precipitation, some soils are prone to having drought stress occur in the plants growing on them. Soil may have an inherently low ability to store water which is typical of sandy or shallow soils or soils having a high content of rock fragments. Drought ratings include severely drought vulnerable, drought vulnerable, moderately drought vulnerable, somewhat drought vulnerable, and slightly drought vulnerable.

In the severely drought vulnerable rating, the soil and site properties are such that the plants growing on the soil must be very drought tolerant even in years with normal amounts of rainfall. The soil may have very low water storage capacity. In the drought vulnerable rating, drought conditions generally occur every year and the soil may have low water storage capacity. Under moderately drought vulnerable soils, annual precipitation is generally adequate for plant growth. In dry years some water stress may occur. Slightly drought vulnerable soils are either in low-lying parts of the landscape where plant roots may exploit near-surface ground water or are in areas where precipitation is much higher than potential evapotranspiration. In an extremely dry year plants may be water stressed on these soils.

Soils susceptible to drought include coarse textured soils in moderately well to excessive drainage classes. Revegetation during seed germination and early seedling growth is severely compromised during dry periods on droughty soils. Approximately 0.9 acres (1.8 percent) of the soils within the Project Area are moderately susceptible to drought. The remaining 49.9 acres (98.2 percent) of the soils within the Project Area are either slightly or somewhat susceptible to drought.

### Table 3. Soils in Selected Construction-related Interpretations by Project Facility

| Project Facility | Total Acres[1] | Kw[2] | Wind Erodibility[3] | Compaction Prone[4] | Rutting Hazard[5] | | Solar Array[6] | Drought Vulnerable[7] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Moderate | High | | Moderate | Severe | Very Limited | Slightly Vulnerable | Somewhat Vulnerable | Moderately Vulnerable |
| | Acres | | | | | | | | | |
| Access Roads | 2.2 | 2.2 | 0.0 | 2.2 | 0.0 | 2.2 | 2.2 | 1.6 | 0.6 | 0.0 |
| Collection Line | <0.1 | <0.1 | <0.1 | <0.1 | 0.0 | <0.1 | <0.1 | <0.1 | <0.1 | 0.0 |
| Generator Tie Line | 0.5 | 0.5 | 0.0 | 0.5 | 0.0 | 0.5 | 0.5 | 0.5 | <0.01 | |
| Perimeter Area Outside the Solar Array Area | 1.7 | 1.7 | 0.0 | 1.7 | 0.1 | 1.6 | 1.6 | 1.2 | 0.4 | 0.1 |
| Perimeter Area Inside the Solar Array Area | 15.1 | 14.3 | 0.0 | 15.1 | 0.8 | 14.3 | 14.3 | 10.9 | 3.4 | 0.8 |
| Switchgear and Metering | <0.01 | <0.01 | <0.01 | <0.01 | 0.0 | <0.01 | <0.01 | <0.01 | <0.01 | 0.0 |
| Solar Array | 31.0 | 31.0 | 0.0 | 31.0 | 0.0 | 31.0 | 31.0 | 23.2 | 7.8 | 0.0 |
| Substation | 0.3 | 0.3 | 0.0 | 0.3 | 0.0 | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 |
| Transformer, Switchgear, MV Power Stations | <0.1 | <0.1 | <0.01 | <0.1 | 0.0 | <0.01 | <0.01 | <0.01 | <0.01 | 0.0 |
| **Total** | **50.8** | **50.0** | **0.0** | **50.8** | **0.9** | **49.9** | **49.9** | **37.7** | **12.2** | **0.9** |

1 Total acres of Project features that are anticipated to be disturbed by supporting construction equipment traffic, excavation, and grading. Data obtained by merging solar facilities and easement polygons with the SSURGO spatial data in ArcGIS.

2 Erosion Factor Kw indicates the susceptibility of a whole soil to sheet and rill erosion by water, and is a function of percent silt, sand, organic matter, soil structure, and hydraulic conductivity (Ksat). For the purposes of this report, values range from 0.02 and 0.69. A rating of 0.0-0.24 is Low, a rating of 0.25-0.40 is Moderate, and a rating of 0.40-0.69 is High.

3 Highly Erodible Wind Includes soils in wind erodibility groups 1 and 2.

4 Soils are rated Low, Medium, or High based on their susceptibility to compaction from the operation of ground-based equipment for planting, harvesting, and site preparation activities when soils are moist. For soils with a Low rating, the potential for compaction is insignificant. For soil with a Medium rating, the potential for compaction is significant and the growth rate of seedlings may be reduced following compaction. For soil with a High rating, the potential for compaction is significant and the growth rate of seedlings will be reduced following compaction. Soils with a Medium or High rating are represented in this table.

5 Rutting potential hazard based on the soil strength as indicated by engineering texture classification, drainage class, and slope. In general, soils on low slopes in wetter drainage classes, and comprised of sediments with low strength will have potential rutting hazards.

6 Soils are placed into interpretive rating classes of Not limited, Somewhat limited, or Very limited.

7 Soils are rated Slightly vulnerable, Somewhat drought vulnerable, Moderately drought vulnerable, Drought vulnerable, and Severely drought vulnerable. Soils rated as Somewhat drought vulnerable and Moderately drought vulnerable are represented in this table. No soils within the Project Area are rated as Drought vulnerable, and Severely drought vulnerable.

### 3.1.4 Summary of Major Soil Limitations

#### 3.1.4.1 Water Erodibility "Kw"

The predominant rating for soil susceptibility to water erosion was moderate and is a result of the silt-loam composition in the Project Area's soils. These soils have generally lower particle cohesive forces and detach and erode easily with water movement. Loss of topsoil, whether on stockpiles, nearby areas, or slopes, may be lost and transported into waterways or wetlands furthering potential environmental impairment. Therefore, protecting the soil surface via plant residues, perennial plant cover, cover crops, contouring to control water flows, or water and sediment control structures must be implemented. Runoff and sediment control structures (or BMPs) that can mitigate impacts to water erodible soils include silt fences, straw wattles, or check dams as described in Section 4.10 and the Project-specific Erosion Control Plan. Initial post-construction revegetation efforts and maintenance of vegetation during operations and maintenance will need to consider selecting appropriate vegetation to grow quickly and include regular inspections of erosion controls after precipitation events as described in the VMP.

#### 3.1.4.2 Land Capability Classification

The predominant LCC in the Project Area is 3w, suggesting severe limitations to land use and conservation practices and an added susceptibility to excess water below and above the ground, agreeing with Section 3.1.4.3. These soil interpretations underline the importance of utilizing suitable revegetation and soil conservation methods as described in the VMP.

#### 3.1.4.3 Solar Arrays

Soils within the Project Area are primarily silt loam, somewhat poorly to poorly drained, fine-textured soils. The primary limitations for the soils during construction, operations and maintenance, and decommissioning include saturated soil, frost action, low strength, and corrosion of steel. A geotechnical investigation would identify appropriate methods required for installation of the racking systems and foundations within these soil types.

#### 3.1.4.4 Compaction & Rutting

PCR Investments will design construction access and manage construction passes to minimize the number of trips occurring on a given soil and will implement wet weather procedures any time that rutting is observed. Deep compaction is not anticipated to be a significant problem as the number of construction equipment passes over a given area is limited, and construction equipment consists of smaller, low-ground- pressure tracked vehicles. Practices to be implement to decompact soils are described in Section 4.2 and the project specific VMP. Factors to be considered regarding wet weather conditions are described in Section 4.3. Rutting will be avoided by use of temporary construction matting as described in Section 4.9. Care will especially be taken to avoid rutting within jurisdictional wetlands as rutting in wetlands is a regulated activity. Based on the preliminary design, the two wetlands within the Project Area have been avoided and no impacts to wetlands are proposed.

# 4.0 BMPS DURING CONSTRUCTION AND OPERATION

The Project will be constructed and operated on property leased by PCR Investments. No direct impacts to adjacent land are expected. The Project is located on farmland occupying a flat to gently rolling sandy glacial terrace above the current floodplain of the Otter Creek in east central Iowa. 50.8 acres, (100 percent) of the farmland within the Project Area is considered prime farmland and <0.1 acres, (<0.1 percent) are considered farmland of statewide importance.

The prevailing topography of the Project Area will not be substantially changed by construction activities, including installation of the foundations for the tracking systems and trenching for the collection system. It is anticipated that panel arrays will be designed and constructed to conform to the existing topography to minimize the need for significant grading. However, some localized grading may be necessary to meet racking tolerances and to construct other project facilities such as the transformer, switchgear, MV power station, and metering. Access roads will be constructed as close to existing grade as possible, maintaining preconstruction hydrologic flow patterns. Upon completion of construction activities, the areas temporarily impacted due to construction activities will be returned to their pre-construction topography.

The sections below describe the best management practices that PCR Investments will implement to maintain soil health, slope stabilization, and infiltration and avoid sedimentation, erosion, spill-related impacts, and encroachment of noxious weeds within the Project Area due to construction and operation of the Project.

## 4.1 ENVIRONMENTAL MONITOR

PCR Investments will engage a weekly inspection onsite to monitor earthmoving activities during the initial phase of Project construction to ensure appropriate measures are taken to properly segregate and handle the topsoils. The Monitor will have a variety of duties, including but not limited to:

- Perform regular inspections during the major earthmoving phases of Project construction, including trenching, and during activities in the below bullets;
- Observe construction crews and activities to ensure that topsoil is being segregated and managed appropriately;
- Monitor the site for areas of potential soil compaction (except within access roads) and make specific recommendations for decompaction;
- Make recommendations to PCR Investments' construction manager;
- Assist in determining if weather events have created "wet weather" conditions and provide recommendations to the construction manager on the ability to proceed with construction; and
- Submit reports of PCR Investments' adherence to soil BMPs during the major earthmoving phase of Project construction and upon completion of earthmoving activities to document Erosion Control Plan compliance.

- Reports will be submitted to Johnson County every thirty (30) days during construction, in accordance with the Johnson County Unified Development Ordinance (UDO).

Potential issues with BMPs will be reported directly to PCR Investments' construction manager who will use discretion to either correct the activity or stop work.

## 4.2 SOIL SEGREGATION AND DECOMPACTION

During construction, PCR Investments will work to protect and preserve topsoil within the Project Area. Protective measures will include separation of the topsoil from subgrade/subsoil materials when earthmoving activities or excavation are conducted during grading, road construction, cable installation, and foundation installation. The depth of the topsoil to be stripped will be a maximum depth of 12 inches or actual depth of topsoil if less than 12 inches or as agreed upon with the landowner. The results of a soil analysis will be conducted and assessed to determine the topsoil depths in accordance with Section 8:1.23.BB.6.A.ii. of the Johnson County UDO.

The stored topsoil and subsoil will have sufficient separation to prevent mixing during the storage period. A thin straw mulch layer or geotextile fabric may be used as a buffer between the subsoil and topsoil to facilitate separation of the subsoil and topsoil during the excavation backfill process. Topsoil will not be used to construct field entrances or drives, will not be stored or stockpiled at locations that will be used as a traveled way by construction, or be removed from the property.

During the activities that require temporary excavations and backfilling (i.e., trenching activities) the subgrade material will be replaced into the excavations first and compacted as necessary, followed by replacement of topsoil to the approximate locations from which it was removed. Topsoil will then be graded to the approximate pre-construction contour. PCR Investments will avoid compaction in other areas where it is not required by the design.

Following grading activities that require segregation of topsoils/subsoils, topsoil materials will be re-spread on top of the backfilled and disturbed areas to maintain the overall integrity and character of the pre-construction farmland. Any excess topsoil material would be re-spread within the Project Area at pre-established locations and not relocated off-site. The location and amount of topsoil will be documented to facilitate re-spreading of topsoil after decommissioning.

Stripped topsoil and subsoil that will be necessary for future reclamation for components such as access road installation and the transformer, switchgear, MV power station, and metering will be removed to suitable locations near the site of removal and spread across existing topsoil for storage.

## 4.3 WET WEATHER CONDITIONS

Construction in wet soil conditions will not commence or continue at times when or locations where the passage of heavy construction equipment may cause rutting to the extent that the topsoil and subsoil are mixed, or underground drainage structures may be damaged.

During construction, certain activities may be suspended in wet soil conditions, based on consideration of the following factors:

- extent of surface ponding;
- extent and depth of soil erosion, rutting, compaction, and mixing of soil horizons;
- areal extent and location of potential rutting and compaction (i.e., can traffic be rerouted around wet area);
- damage to drain tiles if present; and
- type of equipment and nature of the construction operations proposed for that day.

If adverse wet weather construction impacts cannot be minimized to the satisfaction of PCR Investments, the EPC will cease work in the applicable area until PCR Investments determine that site conditions are such that work may continue.

## 4.4 INITIAL GRADING/ROAD CONSTRUCTION/ARRAY CONSTRUCTION

Micro-grading or site leveling will likely be necessary prior to array installation to accommodate slope tolerances allowed for by the solar array design. The appropriate depth of topsoil that should be stripped and segregated from other materials during initial grading activities is described in Section 4.2.

During civil work, topsoil will be removed from the cut/fill areas and stored in designated locations for later use. Once topsoil is removed from the cut/fill areas, the sub-grade materials will be removed as required from higher ground elevations and relocated on-site at lower elevations. Prior to relocating sub-grade materials to the lower elevations, topsoil in the low areas will be stripped and set aside before the fill is added, then respread over the new fill. The stored topsoil will be re-spread over the reconditioned sub-grade areas. Newly spread topsoil will be loosely compacted and/or “tracked” and the erosion and sedimentation prevention BMPs will be implemented as described in Section 4.10 and in accordance with the Project Erosion Control Plan.

After the majority of the micro-grading activities have been completed, internal access roads will be constructed. Topsoil will be stripped from the roadbeds to a depth of at least 12 inches and will be windrowed to the edges of the roadbed. Windrowing will consist of pushing materials into rows of spoil piles adjacent to the road which will be loosely compacted and/or “tracked” with stormwater and wind erosion BMPs in place. The sub-grade materials will then be compacted. After gravel is installed and compacted to engineers’ requirements, the Contractor will shape drainage ditches identified on the final grading plan. Roads shall be constructed at grade to allow for existing sheet flow so that existing drainage patterns are maintained. Previously windrowed topsoil material will be respread around the new gravel material along the road shoulders.

Once grading and road construction is complete, the Contractor can begin the installation of foundation piles for the PV array racking system. This work will consist of directly driving the pile into the soil with pile drivers. These vehicles would operate on the existing surface of the ground and impacts would be limited to what is typical when vehicles drive over the soil surface. Very little soil disturbance is expected from this activity.

Dust abatement measures may include restriction of vehicle speeds, watering of active areas, watering of stockpiles, watering on public roadways, the application of calcium chloride (or other similarly approved product), track-out control at site exits, and other measures.

## 4.5 FOUNDATIONS

The skids for the transformer, switchgear, MV power station, and metering will likely be installed on driven pier foundations but could be placed on concrete foundations if required by soil and geotechnical conditions. The Contractor will strip topsoil off the area for the foundation, install the pier-type foundations, compact sub-grade materials, re-grade spoils around the foundation area, and then install clean washed rock on the surface. All topsoil stripped from these areas will be pushed outside of the work area and collected into designated spots for later use. These topsoil piles will be windrowed or piled and loosely compacted and/or “tracked” with stormwater and wind erosion BMPs in place. Once construction is advanced, the topsoil piles would be distributed in a thin layer adjacent to the foundation area.

If concrete foundations are used, the foundations will be dug using a rubber-tire backhoe and then rebar and concrete installed and left to cure. After cure and testing of concrete strength is completed, the subgrade spoils will be compacted around the foundations. After the solar equipment is set, the adjacent topsoil will be re-spread around the foundation.

## 4.6 TRENCHING

Construction of the Project may require trenching for the installation of both DC and AC collection lines. The typical burial depth for collector circuits is 36 inches. The width of the trench is dependent upon the number of circuits. Typical trench widths are as follows:

- Single Feeder trench width: 12 to 18 inches
- Two Feeder trench: three (3)-foot spacing and three (3) to six-(6) foot trench width
- Four Feeder trench: three (3)-foot spacing and 15-foot to 16-foot trench width

During trenching, topsoil and subgrade materials would be excavated from the trench using typical excavating equipment or backhoes and segregated as described in Section 4.2. The bottom of each trench may be lined with clean fill to surround the cables. PCR Investments anticipates that native subsoil will be rock free, and that no foreign fill will be necessary. After cables have been installed on top of bedding materials in the trench, 1 foot of screened, native backfill will be placed on the cables followed by additional 2 feet of unscreened native backfill trench spoil. This material would be compacted as necessary. The last 1 foot of each trench will then be backfilled with topsoil material only to return the surface to its finished grade.

## 4.7 HORIZONTAL DIRECTIONAL DRILL

The horizontal directional drill method will be used to install collection system under two public roadways, Sioux Avenue SE and Highway 22 SE. Bore pits will be setback at least 10 feet from wetland boundaries. Based on the preliminary design, the two wetlands within the Project Area have been avoided and no impacts to wetlands are proposed. Proper sediment, erosion control, and invasive species control Best Management Practices (BMPs) will be installed/utilized prior to and during construction activities.

HDD boring equipment will be stored either in the Project laydown yard or near the location of the proposed boring. If the boring cannot be completed in one day, overnight storage of equipment will be in upland agricultural areas within 50 feet of the bore pits. Appropriate BMPs and contaminant management (oil absorbent booms, etc.) materials will be put in place prior to leaving the boring area for the day.

A typical bore pit is approximately 10 feet by 20 feet by 6 feet deep. Approximately 1,200 cubic feet (45 cubic yards) of material may be excavated for each pit. The boring will require two bore pits, one on each side of the road being crossed. All materials removed from bore pits will be stored adjacent to the boring with appropriate BMPs installed. Once the boring is completed, the excavated material will be reused as backfill of the pit. Once a final grade is reached, the area will be seeded with a cover crop and permanent seed mixture with appropriate erosion control devices installed (silt fence, erosion matting, etc.), if necessary.

## 4.8 DEWATERING

Dewatering may be required for excavations such as bore pits. PCR Investments will develop a Dewatering Plan and provide training to personnel directly involved with discharge activities. PCR Investments shall ensure that on-site personnel directly involved with discharge activities have access to the Dewatering Plan at all times while at the discharge location(s). Dewatering will be performed in accordance with applicable appropriation and discharge permits, and at a minimum, will comply with the following procedures:

- Floats will be placed on pump intakes.
- The excavation will be dewatered into a well-vegetated upland area with an appropriate energy-dissipation device. Whenever possible, the slope at the point of discharge will be away from any streams or wetlands. Soils in the vicinity of the discharge point will be assessed before discharge. Topography

between the discharge point and the nearest receiving waters will be evaluated for erosion potential.

- If the flow of a discharge cannot be kept out of streams, wetlands, drainage ditches, etc., the discharge shall be filtered by one of the methods described below. Dewatering discharge will be directed into a sediment filter bag or a straw bale/silt fence dewatering structure which discharges into a vegetated area to prevent heavily silt-laden water from flowing into wetlands and waterbodies.
- Only non-woven fabric filter bags will be used for dewatering.
- Filter bags and dewatering structures must be maintained in a functional condition throughout dewatering activity (e.g., clogged or ripped bags must be replaced) and will be attended at all times during active pumping. Accumulated sediment from the filter bags shall be spread in an approved upland location.
- PCR Investments will comply with applicable permit requirements, including tracking volumes of water pumped, obtaining water samples (if needed) for testing, and taking necessary measures to meet effluent limitations.

## 4.9 TEMPORARY EROSION AND SEDIMENT CONTROL

PCR Investments will prevent excessive soil erosion on lands disturbed by construction by adhering to an Erosion Control Plan required under the NPDES permitting requirement that will be administered by the IDNR and under the Johnson County UDO. Prior to construction, the Project's Engineer of Record will outline the reasonable methods for erosion control and prepare the Erosion Control Plan.

These measures would primarily include silt fencing on the downside of all hills and near wetlands. This silt fencing would control soil erosion via stormwater. Check dams and straw waddles will also be used to slow water during rain events in areas that have the potential for high volume flow. In addition, the Contractor can use erosion control blankets on any steep slopes, although given the site topography, this BMP will not likely be required. Lastly, as outlined above, topsoil and sub-grade material will be piled and loosely compacted and / or "tracked" while stored. The BMPs employed to mitigate wind and stormwater erosion on these soil stockpiles will include installing silt fence on the downward side of the piles as needed and installation of straw waddles if these spoil piles are located near waterways.

The Erosion Control Plan will designate onsite Erosion Control Plan inspectors to be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the Erosion Control Plan. The Erosion Control Plan will consider wind erodibility and best practices as such including methods such as wetting exposed soils to minimize dust during construction activity and maintaining good vegetative cover (both cover crops and permanent vegetation).

Engineered Erosion Control Plan will be submitted to the IDNR prior to construction start and designated onsite Erosion Control Plan inspectors will be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the Erosion Control Plan.

## 4.10 DRAIN TILE IDENTIFICATION, AVOIDANCE AND REPAIR

PCR Investments or its EPC contractor will work to identify existing drain tile systems within the Project Area and may include the use of local drain tile contractor. Existing tile will be located by analyzing existing documentation, reviewing aerial photography, and interviewing Project participating landowners and adjacent landowners to identify approximate or expected locations of the tile lines. If the location of the existing tile system is not accurately determined, a physical tile location effort will be undertaken. Physical location of tile will be attempted using ground penetrating radar in the areas of suspected tile locations, or GPS-enabled line scope. If visible surface inlets are identified, a tile probe will be used to locate the tile line and determine its direction from the inlet. The tile line will then be mapped with a GPS locator so it can be avoided during construction.

Care will be taken during construction to: a) avoid drain tile locations within the Project Area, b) re-route drain tile away from locations which could be damaged during construction, or c) in the case of fields with pattern tile networks, work with applicable landowners to establish acceptable criteria for rerouting, replacing or abandoning in place drain tile that is within a photovoltaic (PV) array.

If non-abandoned drain tile is damaged, the damaged segment will be repaired in place or, if necessary, relocated as required by the condition and location of the damaged tile. In the event drain tile damage becomes apparent after commercial operation of the Project, the drain tile will be repaired in a manner that restores the operating condition of the tile at the point of repair and will have the capacity, depth, and appropriate slope to ensure the new tile line performs adequately for the line it is replacing. All repair, relocation, or rerouting referenced above will be consistent with these policies: a) materials will be of equal or better quality to those removed or damaged; b) work will be completed as soon as practicable, taking into consideration weather and soil conditions; c) work will be performed in accordance with industry-accepted, modern methods; and d) in the event water is flowing through a tile when damage occurs, temporary repairs will be promptly installed and maintained until such time that permanent repairs can be made. PCR Investments will minimize interruption of any drainage on site or on any neighboring farms that may drain through the property.

Repairs or rerouting will be performed using a small to mid-sized excavator. Laser equipment will be used to ensure proper grading of the tile. In the event a line of significant size and length needs to be rerouted or installed; a commercial drainage plow could be used. The drainage plow typically utilizes GPS-grade control to ensure tile is installed to specified slopes. The following considerations will also apply:

- Tiles will be repaired with materials of the same or better quality as that which was damaged.

- Tiles repairs will be conducted in a manner consistent with industry-accepted methods.
- Before completing permanent tile repairs, tiles will be examined within the work area to check for tile that might have been damaged by construction equipment. If tiles are found to be damaged, they will be repaired so they operate as well after construction as before construction began.
- PCR Investments will make efforts to complete permanent tile repairs within a reasonable timeframe, considering weather and soil conditions.

## 4.11 CENTER-PIVOT IRRIGATION WELL IDENTIFICATION AND AVOIDANCE

If center-pivot irrigation systems are present within the Project Area, the systems and the water/utility lines servicing them within the Project Area will be decommissioned and left in place. If wells are located within the solar array area, they will either be marked with flagging and a five-foot buffer around them will be fenced to protect these structures, or fully decommissioned. If PCR Investments identifies a need for wells during operations, these wells may be uncapped or new wells may be installed.

# 5.0 VEGETATIVE MANAGEMENT PLAN

PCR Investments is committed to minimizing impacts to soil within the Project Area so that the site may be returned to active agricultural production upon decommissioning. In accordance with the VMP, PCR Investments will establish a permanent vegetative cover throughout the Project Area including areas beneath and around arrays. This will manage erosion by increasing stormwater infiltration and reducing runoff. Stormwater infiltrates soil at a higher rate on perennially vegetated ground cover than on cultivated cropland. The transition to permanent perennial vegetation will manage additional runoff resulting from the solar modules and access roads. Permanent perennial vegetative cover also provides connectivity to existing adjacent wildlife habitats.

# 6.0 CONTROLING SPREAD OF UNDESIREABALE SPECIES

During construction and operation, appropriate BMPs will be used to manage and limit the spread of invasive and noxious weed species. Invasive and noxious weed control practices to be conducted during pre-construction, construction and operation of the project, soil handling, and equipment cleaning are described in the VMP.

Equipment will be cleaned before mobilization to the site to prevent introduction of invasive species from off-site sources. The equipment will be manually cleaned of plant materials between work zones within the Project Site. Project Plan details can be found in the Vegetation Management Plan developed for the Project.

# 7.0 SENSITIVE AREAS PLAN

PCR Investments conducted an analysis for sensitive areas within the Project Area as required by Johnson County. This analysis included review for critical wildlife habitat, floodplain and floodway, historic properties, prairie and prairie remnants, savanna and savanna remnants, significant slopes, stream corridors, watercourses, surface water bodies, wetlands, and woodlands. No sensitive area features were identified with the exceptions of a Class 3 wetland and an unnamed tributary.

The wetland totaled approximately 0.43 acre, and based on the Johnson County wetland classification system, this wetland would be classified as a Class 3 wetland and would require a 50-foot buffer. Wetland exhibits and wetland determination forms are included in the Sensitive Areas Analysis Report prepared for the Project (provided under separate cover).

The unnamed tributary is an intermittent stream, running in a northwest to southeast orientation, transecting the southwest corner of the site. No Federal Emergency Management Agency (FEMA) Flood Insurance Risk Map (FIRM) floodway is associated with the tributary. Based on the classification of the stream, a 30-foot natural buffer has been established around the stream corridor.

At this time, there are no planned impacts to the identified sensitive areas. The buffers and area of disturbance are shown on the Site Plan provided in Appendix A. PCR Investments will implement best management practices to prevent soil erosion and sedimentation from impacting sensitive areas by adhering to the site-specific Erosion Control Plan required under the NPDES permitting administered by the IDNR and under the Johnson County UDO.

# 8.0 DECOMMISSIONING

At the end of the Project's useful life, anticipated to be 30 to 35 years, PCR Investments will either take necessary steps to continue operation of the Project (such as re-permitting and retrofitting) with an opportunity for a project lifetime of 50 years or more, or will decommission the Project and remove facilities. PCR Investments reserves the right to extend operations instead of decommissioning at the end of the site permit term. Refer to the Project's Decommissioning Plan for additional details.

In general, most of the decommissioned equipment and materials will be recycled or sold on the secondary market. Any materials that cannot be recycled will be disposed of at approved facilities. PCR Investments anticipates contracting with the panel manufacturer to accept panels for recycling at their end of life and/or contract recycling services. At or before the end of solar project's operations, PCR Investments will notify Johnson County of its intent to decommission the project. In general, site decommissioning and equipment removal can take 6 to 12 months. Therefore, access roads, fencing, and electrical power facilities will remain in place for use by

the decommissioning and restoration workers until no longer needed. Demolition debris will be placed in temporary on-site storage area(s) pending final transportation and disposal/recycling.

## 8.1 RESTORATION/RECLAMATION OF FACILITY SITE

Once the solar facilities are removed, the site would be restored to agricultural use or to another use if the economic conditions and landowner intentions at that time indicate another use is appropriate for the site. Restoration activities will be conducted in accordance with the Decommissioning Plan and VMP.

After steel pier foundations, fence posts, concrete foundations, re-claimed access road corridors and other equipment are removed the site will be returned to original the original topography to the extent practicable and will be restored with either stockpiled soil or by supplemental soil. Soils will be decompacted if necessary. The method of decompaction will depend on how compacted the soil has become. Soils will be de-compacted by using a tractor and disc to a 12-inch depth or a tractor and a deep subsoiler, if necessary. Grading and other soil disturbance activities conducted during decommissioning will be minimized to the extent necessary to effectively decommission the site and to maintain the soil benefits realized during the long-term operation of the Project.

# APPENDIX A

# Appendix A

## A.1 SITE LOCATION MAP

## A.2 USDA NRCS SOIL SURVEY REPORT

## A.3 GRADING PLAN

## A.4 SITE PLAN

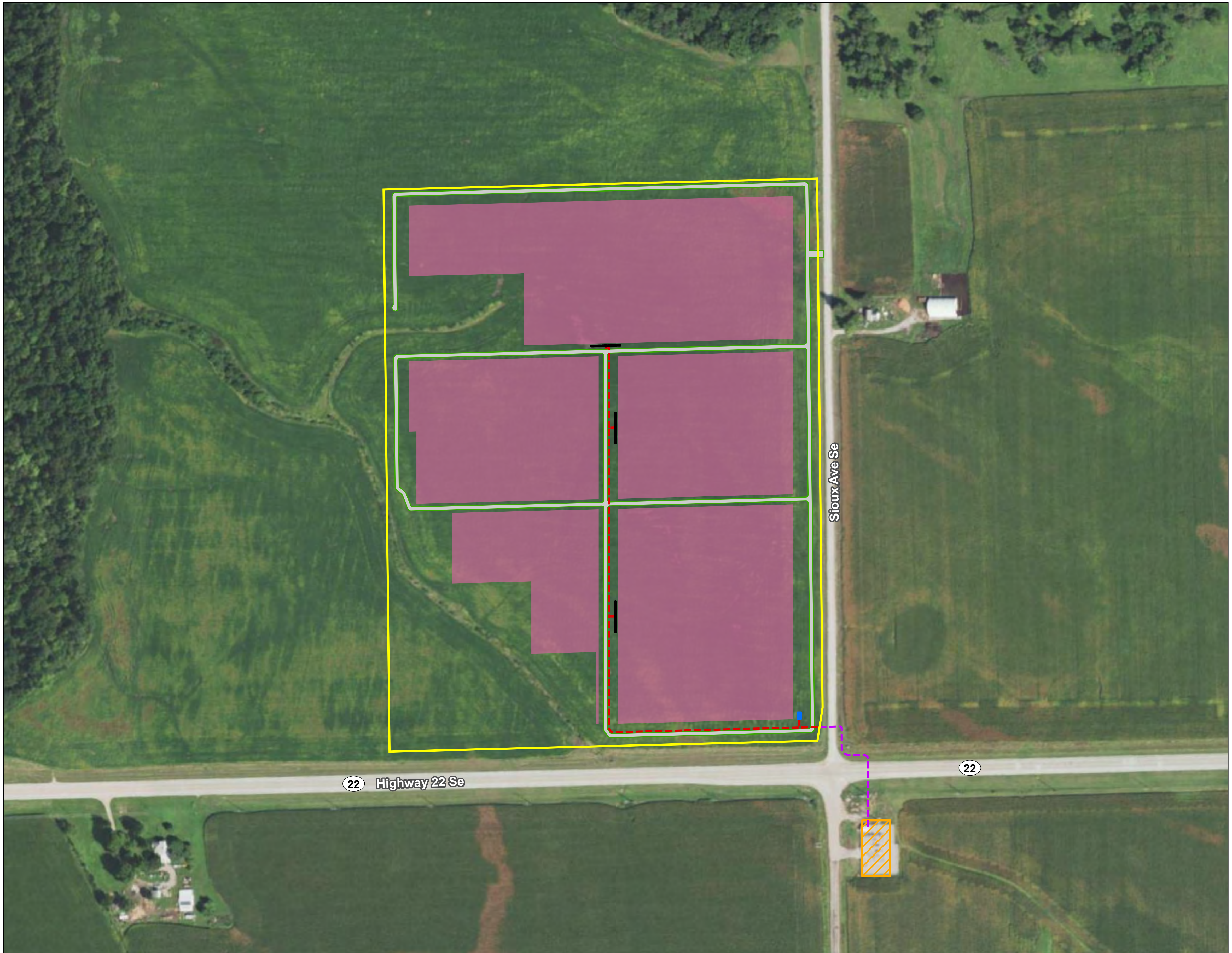



Figure No.

**1**

Title

## Project Location

Client/Project 193709077

PCR Investments LLC

Lone Tree Substation Solar Project

*Project Location*

Township of Freemont

Johnson County, IA

Prepared by JDS on 2022-08-03

TR by MZ on 2022-08-04

IR by SP on 2022-08-18

N

0 150 300 Feet

(At original document size of 11x17)

1:3,600

Legend

Project Boundary

Electrical Collection System

Generator Tie Line

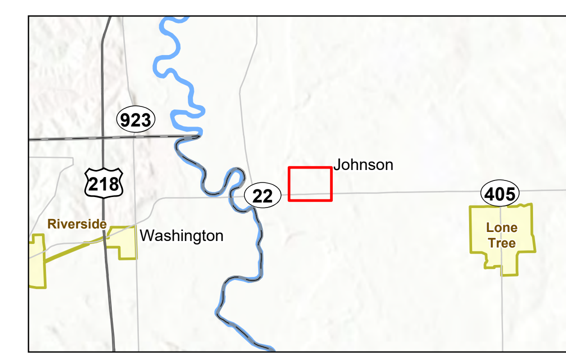
Access Roads

Solar Array

Transformers, Switchgear, and Power Station

Switchgear & Metering

Substation




***Notes***

**1.** Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet

**2.** Data Sources: Stantec, PCR Investments LLC, USGS, NADS

**3.** Background: NAIP 2021

Stantec



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United States Department of Agriculture

NRCS

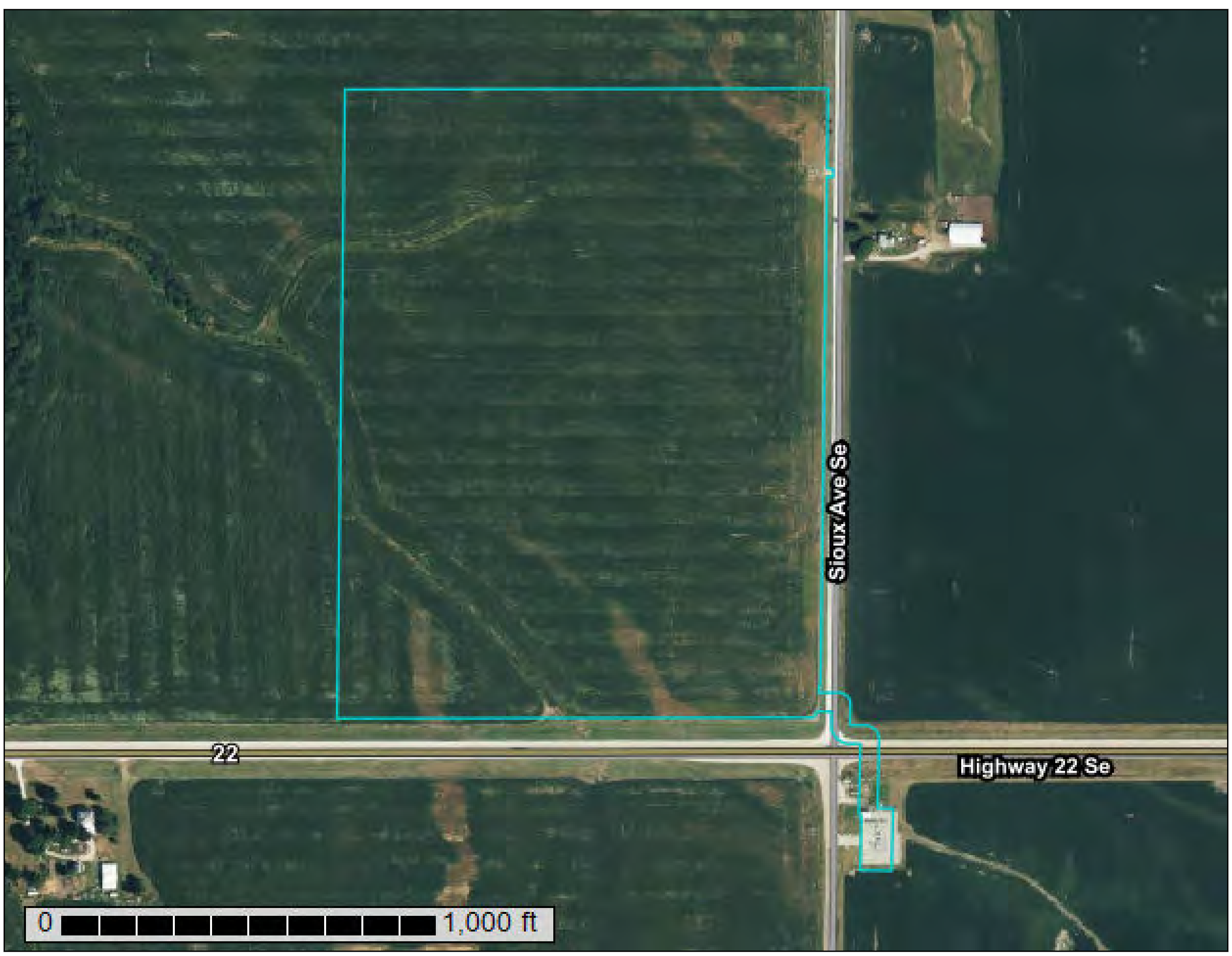
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

# Custom Soil Resource Report for

# Johnson County, Iowa

## Lone Tree Substation




March 13, 2023

# Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

# How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

## Soil Map


Map Scale: 1:3,730 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

**Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

**Water Features**
- Streams and Canals

**Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

**Background**
- Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Iowa
Survey Area Data: Version 25, Sep 2, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 119 | Muscatine silt loam, 0 to 2 percent slopes | 0.0 | 0.0% |
| 121B | Tama silt loam, 2 to 5 percent slopes | 8.0 | 15.7% |
| 122 | Sperry silt loam, depressional, 0 to 1 percent slopes | 19.3 | 38.0% |
| 160 | Walford silt loam, 0 to 2 percent slopes | 6.5 | 12.7% |
| 175B | Dickinson fine sandy loam, 2 to 5 percent slopes | 0.9 | 1.8% |
| 291 | Atterberry silt loam, 1 to 3 percent slopes | 11.9 | 23.5% |
| M162B | Downs silt loam, till plain, 2 to 5 percent slopes | 4.1 | 8.1% |
| M162C | Downs silt loam, till plain, 5 to 9 percent slopes | 0.0 | 0.1% |
| M162C2 | Downs silt loam, till plain, 5 to 9 percent slopes, eroded | 0.0 | 0.1% |
| **Totals for Area of Interest** | | **50.8** | **100.0%** |

# Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

# Johnson County, Iowa

## 119—Muscatine silt loam, 0 to 2 percent slopes

### Map Unit Setting

*National map unit symbol:* 2wm7t
*Elevation:* 630 to 860 feet
*Mean annual precipitation:* 35 to 37 inches
*Mean annual air temperature:* 48 to 51 degrees F
*Frost-free period:* 160 to 170 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Muscatine and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Muscatine

#### Setting

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve, crest
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Fine-silty loess

#### Typical profile

*Ap - 0 to 7 inches:* silt loam
*A - 7 to 16 inches:* silty clay loam
*AB - 16 to 20 inches:* silty clay loam
*Btg - 20 to 42 inches:* silty clay loam
*BCg - 42 to 79 inches:* silt loam

#### Properties and qualities

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* About 12 to 42 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 15 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 11.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 1
*Hydrologic Soil Group:* C/D
*Ecological site:* R108XC516IA - Wet Loess Upland Flat Prairie
*Hydric soil rating:* No

**Minor Components**

**Garwin**

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Ecological site:* R108XC516IA - Wet Loess Upland Flat Prairie
*Hydric soil rating:* Yes

## 121B—Tama silt loam, 2 to 5 percent slopes

**Map Unit Setting**

*National map unit symbol:* 2thlz
*Elevation:* 560 to 1,210 feet
*Mean annual precipitation:* 35 to 39 inches
*Mean annual air temperature:* 49 to 53 degrees F
*Frost-free period:* 174 to 205 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**

*Tama and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Tama**

**Setting**

*Landform:* Interfluves
*Landform position (two-dimensional):* Shoulder, summit, backslope
*Landform position (three-dimensional):* Interfluve, side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Parent material:* Fine-silty loess

**Typical profile**

*Ap - 0 to 6 inches:* silt loam
*A1 - 6 to 10 inches:* silty clay loam
*A2 - 10 to 14 inches:* silty clay loam
*BA - 14 to 18 inches:* silty clay loam
*Bt1 - 18 to 32 inches:* silty clay loam
*Bt2 - 32 to 45 inches:* silty clay loam
*BC - 45 to 60 inches:* silty clay loam

**Properties and qualities**

*Slope:* 2 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained

*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 11.4 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* R108XC503IA - Loess Upland Prairie
*Hydric soil rating:* No

### Minor Components

#### Muscatine

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Shoulder, summit
*Landform position (three-dimensional):* Interfluve, side slope
*Down-slope shape:* Convex
*Across-slope shape:* Linear
*Ecological site:* R108XC516IA - Wet Loess Upland Flat Prairie
*Hydric soil rating:* No

## 122—Sperry silt loam, depressional, 0 to 1 percent slopes

### Map Unit Setting

*National map unit symbol:* 2vw4c
*Elevation:* 610 to 1,120 feet
*Mean annual precipitation:* 34 to 38 inches
*Mean annual air temperature:* 47 to 52 degrees F
*Frost-free period:* 153 to 179 days
*Farmland classification:* Prime farmland if drained

### Map Unit Composition

*Sperry, depressional, and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Sperry, Depressional

#### Setting

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Microfeatures of landform position:* Closed depressions

*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Loess

**Typical profile**

*Ap - 0 to 10 inches:* silt loam
*E - 10 to 17 inches:* silt loam
*Btg1 - 17 to 28 inches:* silty clay loam
*Btg2 - 28 to 36 inches:* silty clay
*Btg3 - 36 to 47 inches:* silty clay
*Btg4 - 47 to 63 inches:* silty clay loam
*BCtg - 63 to 79 inches:* silty clay loam

**Properties and qualities**

*Slope:* 0 to 1 percent
*Depth to restrictive feature:* 14 to 24 inches to abrupt textural change
*Drainage class:* Very poorly drained
*Runoff class:* Negligible
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.01 in/hr)
*Depth to water table:* About 0 inches
*Frequency of flooding:* None
*Frequency of ponding:* Frequent
*Calcium carbonate, maximum content:* 5 percent
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 3.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3w
*Hydrologic Soil Group:* D
*Ecological site:* R108XC515IA - Ponded Upland Depression Sedge Meadow
*Hydric soil rating:* Yes

### Minor Components

**Taintor**

*Percent of map unit:* 3 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Ecological site:* R108XC516IA - Wet Loess Upland Flat Prairie
*Hydric soil rating:* Yes

**Garwin**

*Percent of map unit:* 2 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Ecological site:* R108XC516IA - Wet Loess Upland Flat Prairie
*Hydric soil rating:* Yes

## 160—Walford silt loam, 0 to 2 percent slopes

### Map Unit Setting

*National map unit symbol:* 2yvk1
*Elevation:* 520 to 1,310 feet
*Mean annual precipitation:* 23 to 41 inches
*Mean annual air temperature:* 43 to 54 degrees F
*Frost-free period:* 155 to 210 days
*Farmland classification:* Prime farmland if drained

### Map Unit Composition

*Walford and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Walford

#### Setting

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Parent material:* Fine-silty loess

#### Typical profile

*Ap - 0 to 8 inches:* silt loam
*E - 8 to 22 inches:* silt loam
*Btg - 22 to 50 inches:* silty clay loam
*BCg - 50 to 63 inches:* silty clay loam
*Cg - 63 to 79 inches:* silt loam

#### Properties and qualities

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Poorly drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* About 0 to 12 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 11.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* C/D
*Ecological site:* R108XC517IA - Wet Loess Upland Flat Savanna

*Hydric soil rating:* Yes

### Minor Components

#### Sperry, depressional

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Microfeatures of landform position:* Closed depressions
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Ecological site:* R108XC515IA - Ponded Upland Depression Sedge Meadow
*Hydric soil rating:* Yes

## 175B—Dickinson fine sandy loam, 2 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 2vw4z
*Elevation:* 550 to 1,390 feet
*Mean annual precipitation:* 34 to 39 inches
*Mean annual air temperature:* 44 to 51 degrees F
*Frost-free period:* 145 to 180 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Dickinson and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Dickinson

#### Setting

*Landform:* Stream terraces, dunes
*Landform position (two-dimensional):* Backslope, summit, shoulder
*Landform position (three-dimensional):* Interfluve, tread
*Down-slope shape:* Convex
*Across-slope shape:* Linear, convex
*Parent material:* Sandy eolian deposits

#### Typical profile

*Ap - 0 to 9 inches:* fine sandy loam
*A - 9 to 18 inches:* fine sandy loam
*Bw - 18 to 30 inches:* fine sandy loam
*BC - 30 to 36 inches:* loamy sand
*C - 36 to 79 inches:* sand

#### Properties and qualities

*Slope:* 2 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained

*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to very high (1.42 to 14.17 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Low (about 5.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* A
*Ecological site:* R108XC506IA - Sandy Upland Prairie
*Hydric soil rating:* No

### Minor Components

#### Sparta

*Percent of map unit:* 5 percent
*Landform:* Stream terraces, dunes
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve, tread
*Down-slope shape:* Convex
*Across-slope shape:* Linear, convex
*Ecological site:* R108XC506IA - Sandy Upland Prairie
*Hydric soil rating:* No

## 291—Atterberry silt loam, 1 to 3 percent slopes

### Map Unit Setting

*National map unit symbol:* 2yvk2
*Elevation:* 520 to 1,310 feet
*Mean annual precipitation:* 23 to 41 inches
*Mean annual air temperature:* 43 to 54 degrees F
*Frost-free period:* 155 to 210 days
*Farmland classification:* All areas are prime farmland

### Map Unit Composition

*Atterberry and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Atterberry

#### Setting

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear

*Across-slope shape:* Linear
*Parent material:* Fine-silty loess

**Typical profile**

*Ap - 0 to 8 inches:* silt loam
*E - 8 to 14 inches:* silt loam
*BE - 14 to 17 inches:* silt loam
*Bt - 17 to 24 inches:* silty clay loam
*Btg - 24 to 48 inches:* silty clay loam
*BCg - 48 to 55 inches:* silty clay loam
*Cg - 55 to 79 inches:* silt loam

**Properties and qualities**

*Slope:* 1 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat poorly drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* About 12 to 42 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 11.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 1
*Hydrologic Soil Group:* C/D
*Ecological site:* R108XC517IA - Wet Loess Upland Flat Savanna
*Hydric soil rating:* No

### Minor Components

**Walford**

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Ecological site:* R108XC517IA - Wet Loess Upland Flat Savanna
*Hydric soil rating:* Yes

## M162B—Downs silt loam, till plain, 2 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 2tgr8
*Elevation:* 580 to 1,230 feet
*Mean annual precipitation:* 35 to 39 inches
*Mean annual air temperature:* 48 to 51 degrees F

*Frost-free period:* 170 to 205 days
*Farmland classification:* All areas are prime farmland

**Map Unit Composition**
*Downs and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Downs**

**Setting**
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Fine-silty loess

**Typical profile**
*Ap - 0 to 8 inches:* silt loam
*E - 8 to 12 inches:* silt loam
*BE - 12 to 17 inches:* silt loam
*Bt1 - 17 to 24 inches:* silty clay loam
*Bt2 - 24 to 33 inches:* silty clay loam
*Bt3 - 33 to 39 inches:* silty clay loam
*BC1 - 39 to 48 inches:* silt loam
*BC2 - 48 to 79 inches:* silt loam

**Properties and qualities**
*Slope:* 2 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 10.7 inches)

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2e
*Hydrologic Soil Group:* C
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

**Minor Components**

**Greenbush**
*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Convex

*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

**Atterberry**

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Ecological site:* R108XC517IA - Wet Loess Upland Flat Savanna
*Hydric soil rating:* No

## M162C—Downs silt loam, till plain, 5 to 9 percent slopes

### Map Unit Setting

*National map unit symbol:* 2tgrb
*Elevation:* 600 to 1,060 feet
*Mean annual precipitation:* 35 to 38 inches
*Mean annual air temperature:* 48 to 51 degrees F
*Frost-free period:* 170 to 205 days
*Farmland classification:* Farmland of statewide importance

### Map Unit Composition

*Downs and similar soils:* 90 percent
*Minor components:* 10 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Downs

#### Setting

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Fine-silty loess

#### Typical profile

*Ap - 0 to 8 inches:* silt loam
*E - 8 to 12 inches:* silt loam
*BE - 12 to 17 inches:* silt loam
*Bt1 - 17 to 24 inches:* silty clay loam
*Bt2 - 24 to 33 inches:* silty clay loam
*Bt3 - 33 to 39 inches:* silty clay loam
*BC1 - 39 to 48 inches:* silt loam
*BC2 - 48 to 79 inches:* silt loam

#### Properties and qualities

*Slope:* 5 to 9 percent
*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 10.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

### Minor Components

#### Downs, eroded

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

#### Greenbush

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

## M162C2—Downs silt loam, till plain, 5 to 9 percent slopes, eroded

### Map Unit Setting

*National map unit symbol:* 2tgrc
*Elevation:* 570 to 1,200 feet
*Mean annual precipitation:* 35 to 38 inches
*Mean annual air temperature:* 48 to 51 degrees F
*Frost-free period:* 170 to 205 days
*Farmland classification:* Farmland of statewide importance

**Map Unit Composition**

*Downs, eroded, and similar soils:* 95 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Downs, Eroded**

**Setting**

*Landform:* Interfluves
*Landform position (two-dimensional):* Summit, shoulder
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Convex
*Across-slope shape:* Convex
*Parent material:* Fine-silty loess

**Typical profile**

*Ap - 0 to 6 inches:* silt loam
*BE - 6 to 12 inches:* silt loam
*Bt1 - 12 to 24 inches:* silty clay loam
*Bt2 - 24 to 33 inches:* silty clay loam
*Bt3 - 33 to 39 inches:* silty clay loam
*BC1 - 39 to 48 inches:* silt loam
*BC2 - 48 to 79 inches:* silt loam

**Properties and qualities**

*Slope:* 5 to 9 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.14 to 1.42 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* High (about 10.6 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

**Minor Components**

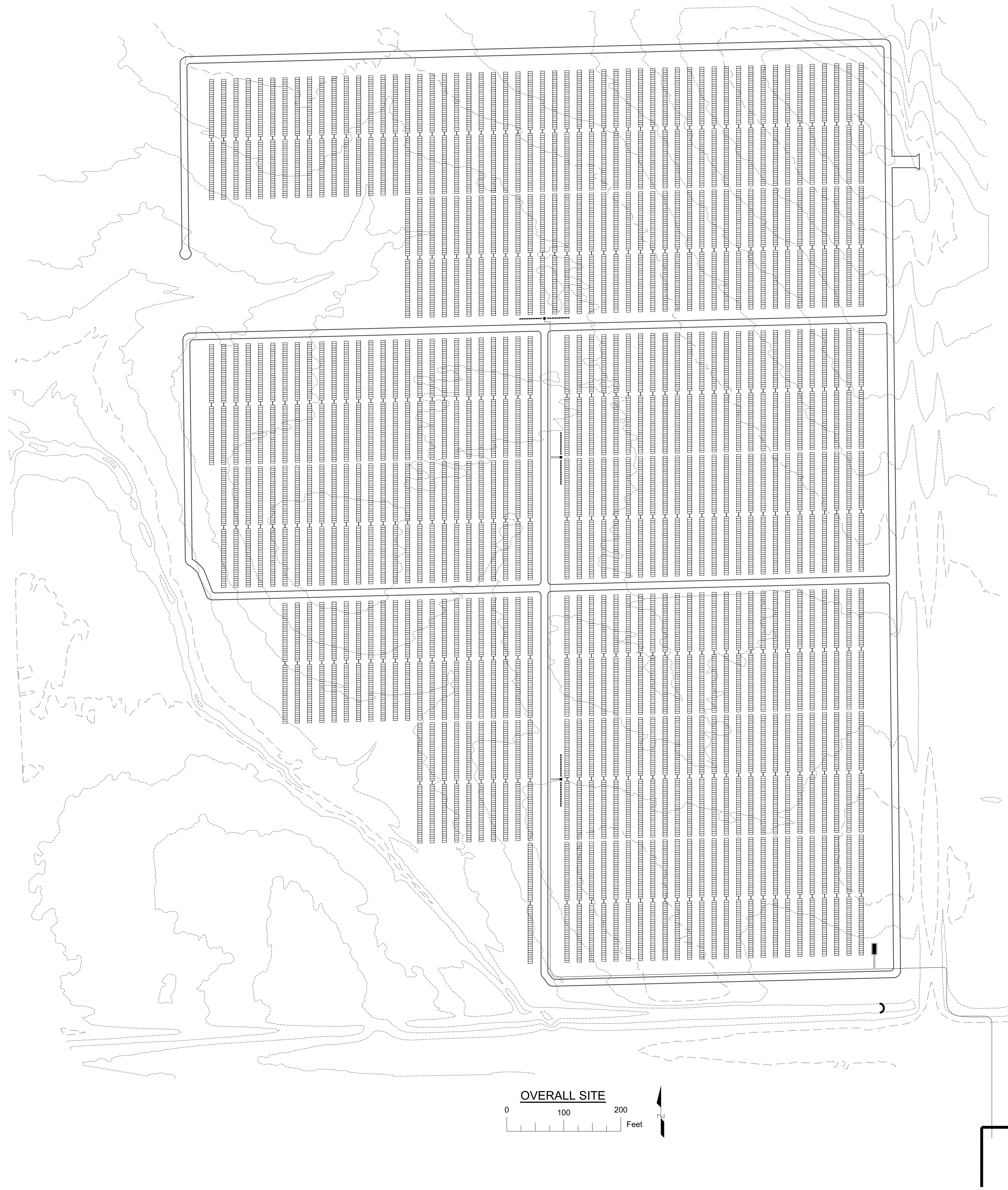
**Greenbush, eroded**

*Percent of map unit:* 5 percent
*Landform:* Interfluves
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Convex
*Ecological site:* R108XC504IA - Loess Upland Savanna
*Hydric soil rating:* No

GRADING NOTES:

1. THE PROPOSED IMPROVEMENTS SHALL BE CONSTRUCTED ACCORDING TO JOHNSON COUNTY, IOWA SPECIFICATIONS, AND SHALL MEET ALL APPLICABLE LOCAL, STATE, AND FEDERAL LAWS AND REQUIREMENTS.
2. THE CONTRACTOR SHALL MAINTAIN SITE DRAINAGE THROUGHOUT CONSTRUCTION. THIS MAY INCLUDE THE EXCAVATION OF TEMPORARY DITCHES OR PUMPING TO ALLEVIATE WATER PONDING.
3. SILT FENCE AND OTHER EROSION CONTROL FACILITIES MUST BE INSTALLED PRIOR TO CONSTRUCTION OR ANY OTHER LAND DISTURBING ACTIVITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL EROSION CONTROL FACILITIES ONCE THE THREAT OF EROSION HAS PASSED WITH THE APPROVAL OF THE GOVERNING AGENCY.
4. THE CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR THE COMPUTATIONS OF ALL GRADING AND FOR ACTUAL LAND BALANCE, INCLUDING UTILITY TRENCH SPOIL. THE CONTRACTOR SHALL IMPORT OR EXPORT MATERIAL AS NECESSARY TO COMPLETE THE PROJECT.
5. GRADING SHALL CONSIST OF CLEARING AND GRUBBING EXISTING VEGETATION, STRIPPING TOPSOIL, , IMPORTING OR EXPORTING MATERIAL TO ACHIEVE AN ON-SITE EARTHWORK BALANCE, GRADING THE PROPOSED EQUIPMENT PADS AND PAVEMENT AREAS, SCARIFYING AND FINAL COMPACTION OF THE PAVEMENT SUBGRADE, AND PLACEMENT OF TOPSOIL.
6. NO FILL SHALL BE PLACED ON A WET OR SOFT SUBGRADE. THE SUBGRADE SHALL BE PROOF-ROLLED AND INSPECTED BY THE ENGINEER BEFORE ANY MATERIAL IS PLACED.
7. ALL FILL SHALL BE CONSIDERED STRUCTURAL FILL AND SHALL BE PLACED ACCORDINGLY.

NOTE:
NO CHANGE TO THE EXISTING GRADE IS PROPOSED FOR THIS SITE. MINOR ADJUSTMENTS TO GRADE MAY BE REQUIRED DURING CONSTRUCION TO ACCOMODATE PROPOSED IMPROVEMENTS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY OF ANY NECESSARY CHANGES TO GRADE GREATER THAN 6-INCHES.




OVERALL SITE

NOT FOR CONSTRUCTION

SHEET ISSUE:
3/20/23

REVISIONS:


Stantec
11311 AURORA AVE.
DES MOINES, IA 50322
www.stantec.com

PCR ENERGY
1334 BRITTMOORE RD., SUITE 1327
HOUSTON, TX 77043
CONTACT: CYNTHIA SCHUCHNER
CSCHUCHNER@PCR.ENERGY - (832) 955-1979


GRADING PLAN FOR :
LONE TREE PROJECT
JOHNSON COUNTY, IOWA

JOB NUMBER:

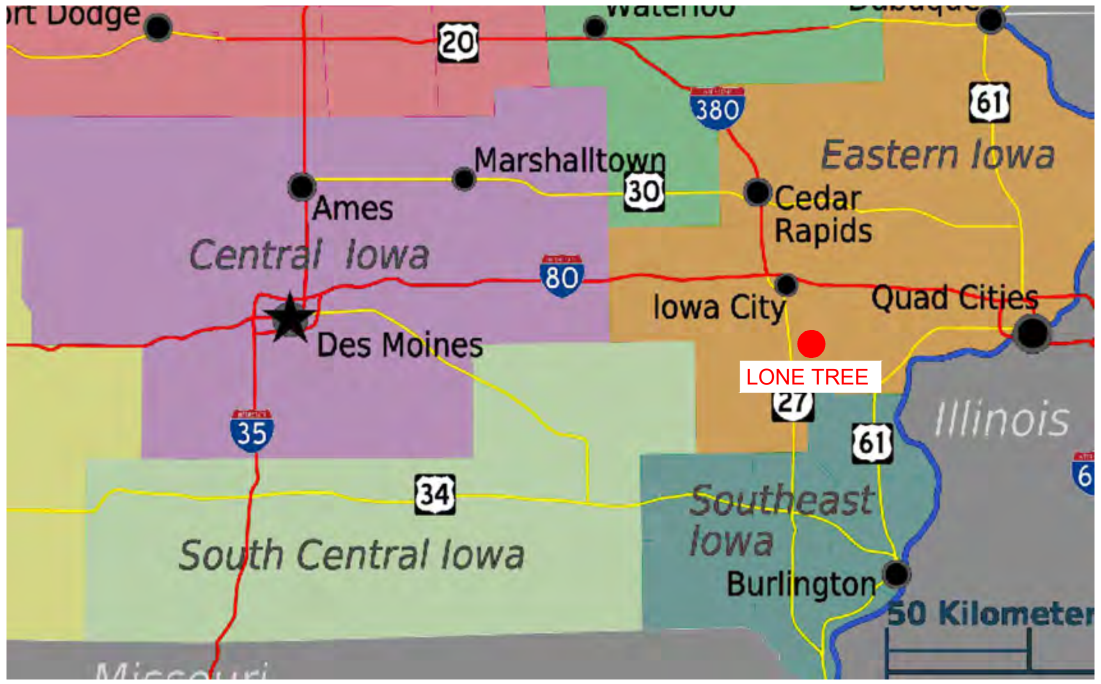
SHEET

# LONE TREE PROJECT

# Lone Tree, IOWA

# SITE PLAN

| Lone Tree Solar Project | | | | |
|---|---|---|---|---|
| MW ac | MW dc | ratio | MWh/y | Acres |
| 7,50 | 8,97 | 1,20 | 15338 | 50 |




| Contact Information | | | |
|---|---|---|---|
| Mariano Brandi | CEO | mbrandi@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |
| Cynthia Schuchner | Chief Construction and Engineering Officer | cschuchner@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |

| Rev. | Date (MM/DD/YY) | COMMENTS |
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| 04 | | |
| 03 | | |
| 02 | | |
| 01 | | |
| 00 | 04/25/23 | Preliminary |

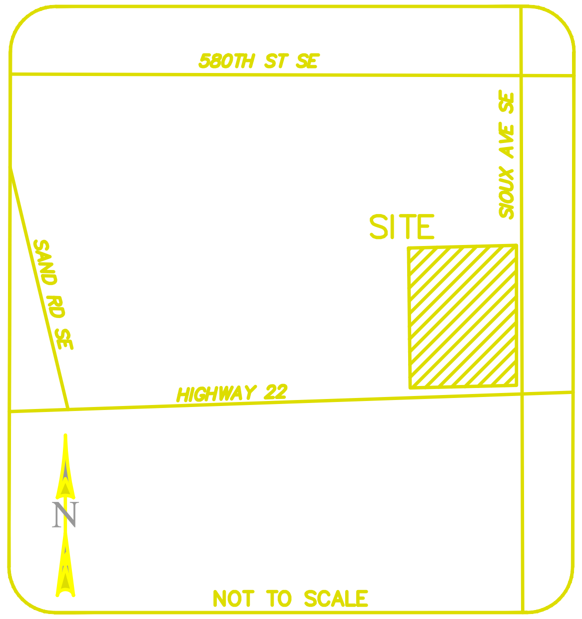
REVISIONS

PCR

| | | | |
|---|---|---|---|
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: 01/08 | |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |


# BOUNDARY SURVEY

PART OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER AND PART OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 1, TOWNSHIP 77, RANGE 6 EAST, ALL IN JOHNSON COUNTY, IOWA.




VICINITY MAP

| | |
|---|---|
| | PROPERTY LINE |
| | ADJACENT PROPERTY LINE |
| | RIGHT OF WAY LINE |
| | SURVEY TIE LINE |
| | CONTOURS |
| | STORM DRAIN LINE |
| | FOUND MONUMENT (AS NOTED) |
| | FLARED END SECTION |
| | TELEPHONE PEDESTAL |
| IR | IRON ROD |
| (M&R) | MEASURED & RECORD |
| S.F. | SQUARE FEET |
| BC | BACK OF CURB |

## BASIS OF BEARINGS

THE SOUTH LINE OF THE SOUTHEAST QUARTER; ASSUMED BEARING S88°32'17"W PER STATE PLANE IOWA SOUTH

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REVISIONS

PCR

| | | | |
|---|---|---|---|
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 02/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |


| POINT | LAT | LONG |
|---|---|---|
| A | 41.49670229 | -91.48829677 |
| B | 41.49670967 | -91.48362429 |
| C | 41.49698140 | -91.48355875 |
| D | 41.50128520 | -91.48348608 |
| E | 41.50127748 | -91.48822008 |

Property Boundary (50ac)

1V54 Single-axin N-S Tracker

Fence

MV Underground Cable 12.47 kV

Wetland

Centerline Public Rd

Internal Roads

| | |
|---|---|
| **SOLAR PANEL** | |
| Brand | ZNshine Solar |
| Model | ZXM7-SHLDD-144-550 |
| Power | 550 Wp - Bifacial |
| Dimensions (W x L x D) | 1134 x 2278 x 30 mm |
| **INVERTER** | |
| Brand | SMA |
| Model | Sunny Highpower SHP125-US-20-PEAK3 |
| Power | 125 kW |
| Output Voltage | 480 V |
| **LV Cables (INV - TR)** | |
| Model | EXZHELLENT COMPACT 1000V Prysmian |
| Type | 0,6/1,1kV Cu 3x2/0AWG XLPE |
| Section | 2/0 AWG |
| Rate Current | 167 A |
| R | 0,16 ohm/km |
| V/A km | 0.34 |
| **MV Cables (TR - SW)** | |
| Type(2) | 12.5 kV Al 3x1x250MCM XLPE |
| Section(2) | 250 MCM |
| Rate Current MVS 1\|2\|3 | 120\|240\|360 A |
| R | 0,568 ohm/km |
| X | 0,194 ohm/km |
| B | 0,156 mF/km |
| Length MV 1\|2\|3 | 267\|596\|950 ft |
| **COMPONENTS** | |
| Total Inverters | 62 |
| Total Trackers 1V54 | 302 |
| Total Modules | 16308 |
| **GCR** | **22.03%** |

NOTES:
1. Dimensions shown are approximate and may change based on final equipment selections
2. MV underground cable gauge TBD
3. TBD if outdoor or indoor solution

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REVISIONS

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| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
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| Sheet: | 03/08 |
| Scale | |
| Rev: | |


| MV Cables (Interconnection) | |
|---|---|
| Type[2] | 12.5kV Al 3x1x250MCM XLPE |
| Section[2] | 250 MCM |
| Rate Current | 480 A |
| R | 0,211 ohm/km |
| X | 0,175 ohm/km |
| B | 0,212 mF/km |
| Length | 0.1 miles |
| **Power Factor @POI** | **95%** |

Boundaries Lone Tree CIPCO

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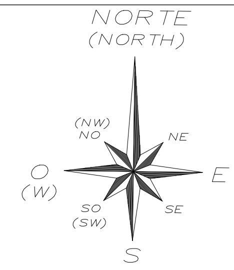
| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |

Sheet:

Scale

Rev:




| Angle min., ° | Angle max., ° | Distribution, % | Color |
|---|---|---|---|
| 0.00 | 0.00 | 10.25 | |
| 0.00 | 1.75 | 84.28 | |
| 1.75 | 3.50 | 4.13 | |
| 3.50 | 5.25 | 0.90 | |
| 5.25 | 7.00 | 0.26 | |
| 7.00 | 8.75 | 0.11 | |
| 8.75 | 10.50 | 0.06 | |
| 10.50 | 12.25 | 0.02 | |
| 12.25 | 14.00 | 0.00 | |
| 14.00 | 55.00 | 0.00 | |

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REVISIONS

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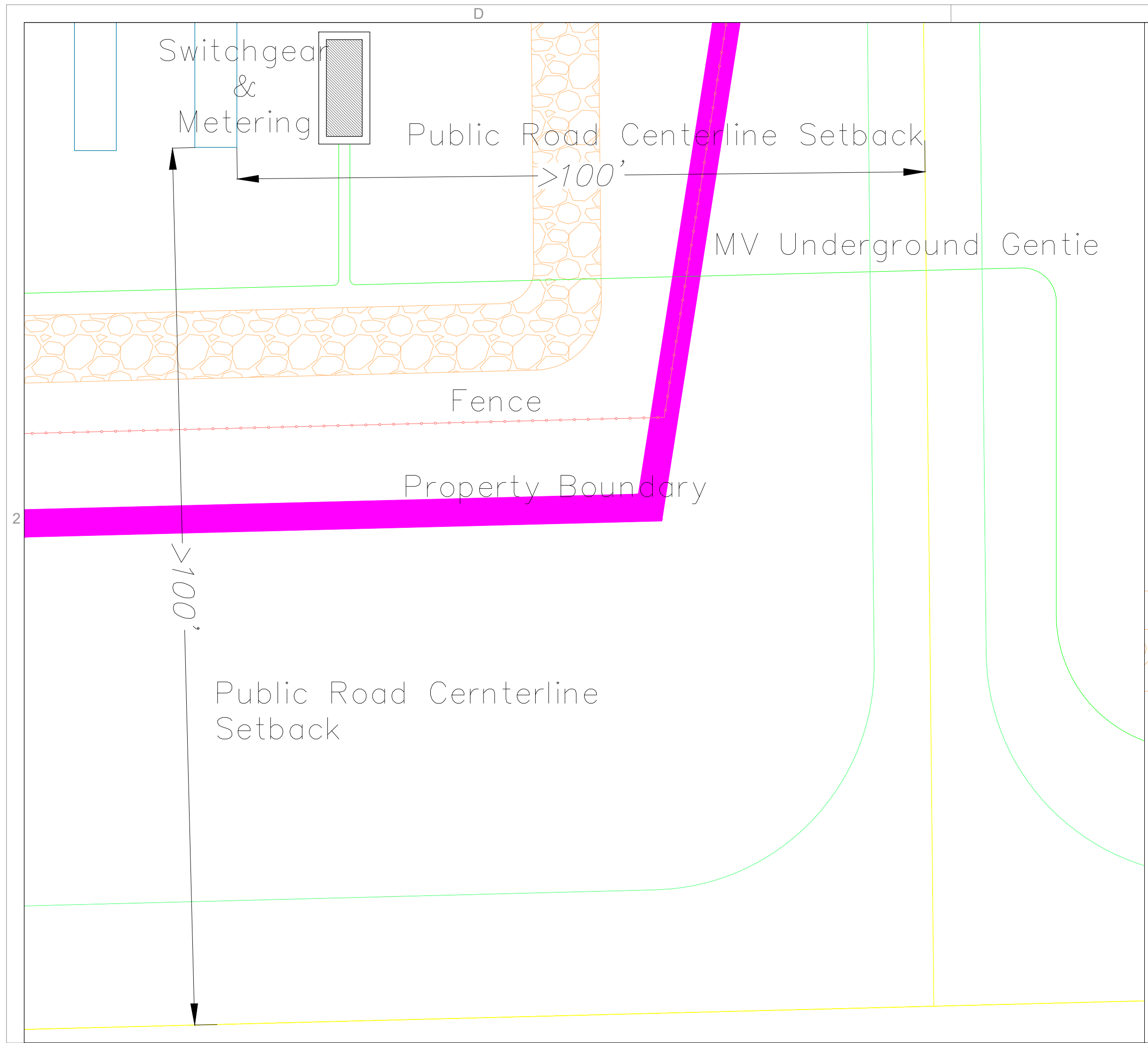
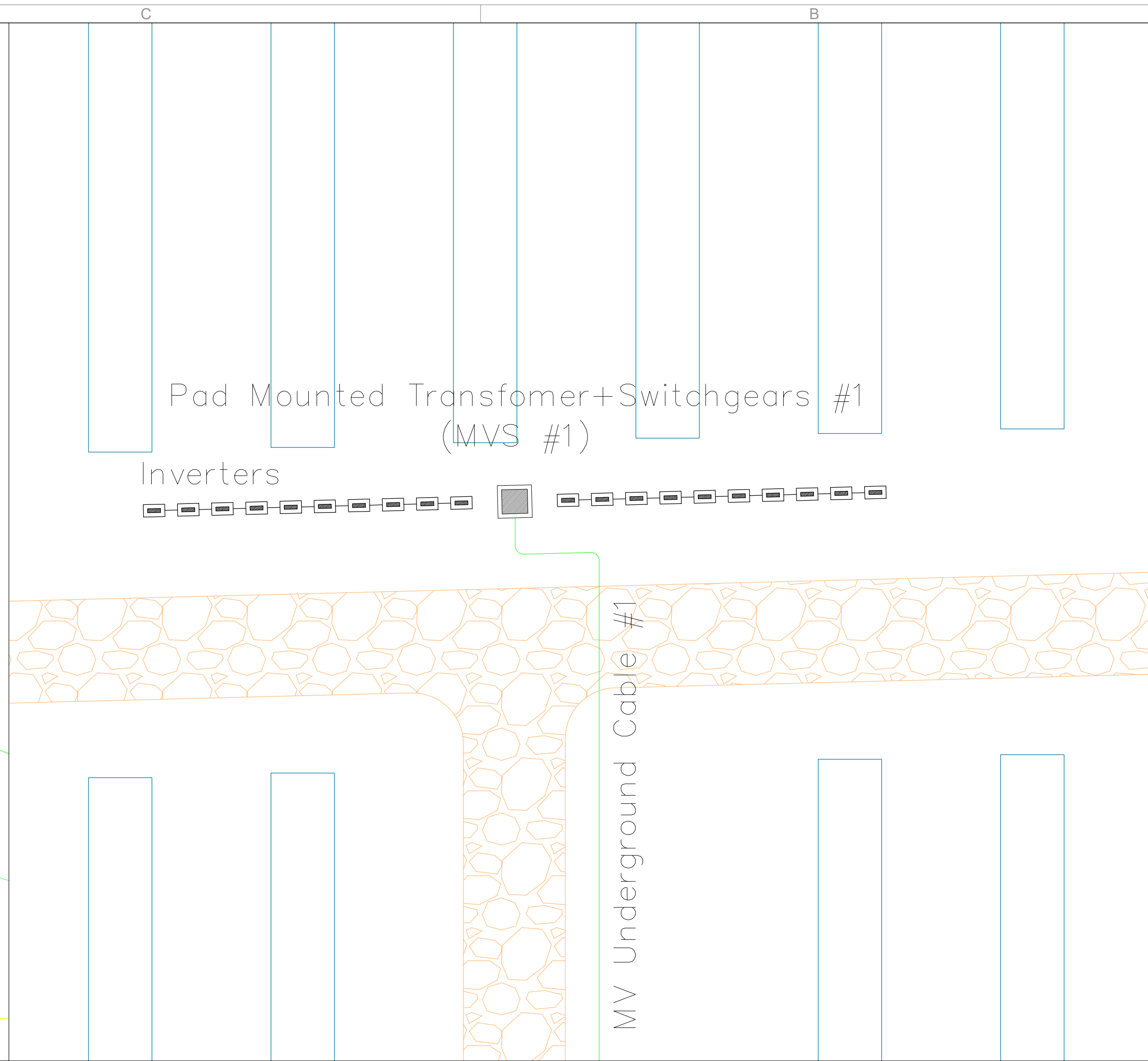
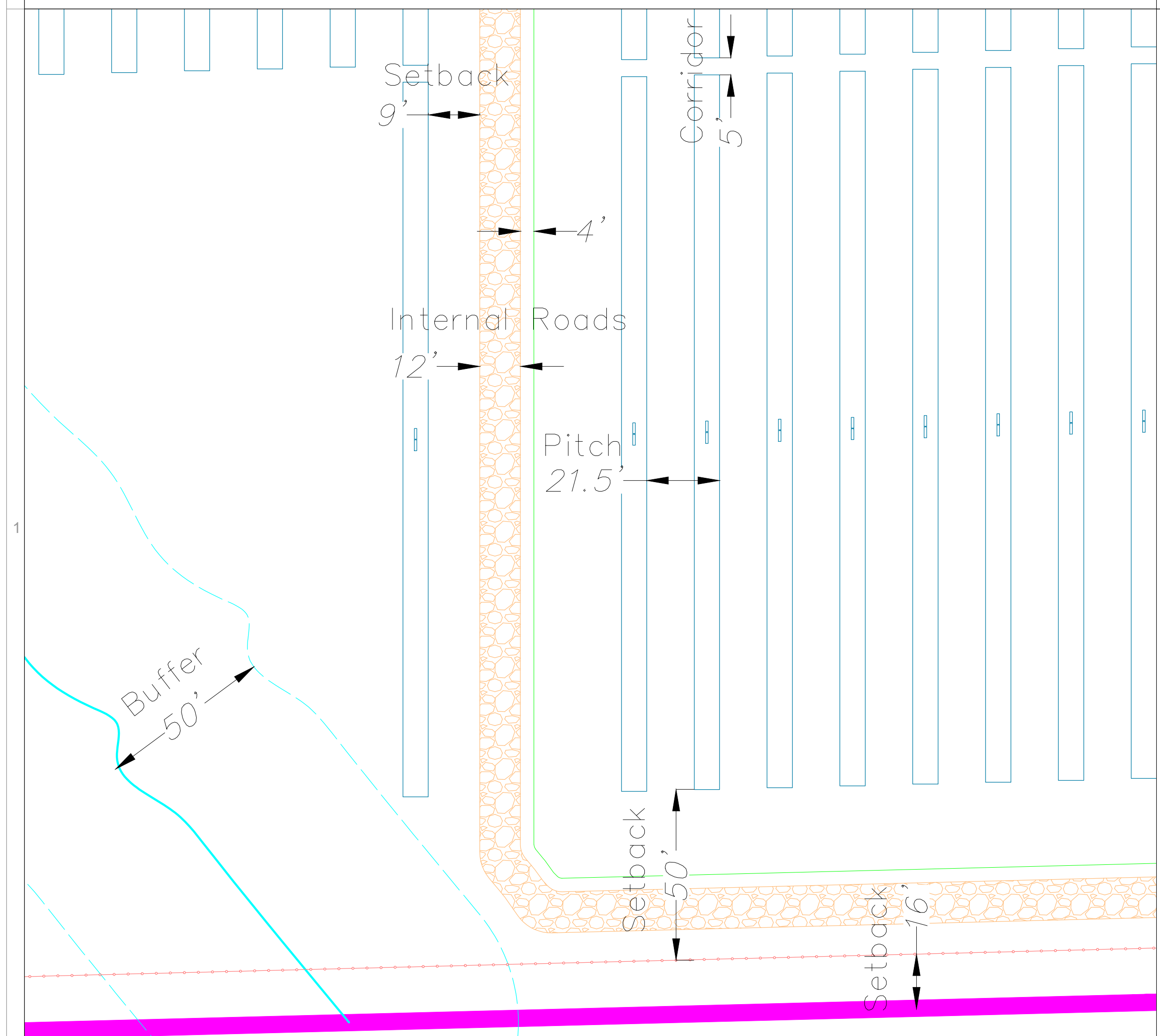
|---|---|
| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |
| Sheet: | 05/08 |
| Scale | |
| Rev: | |

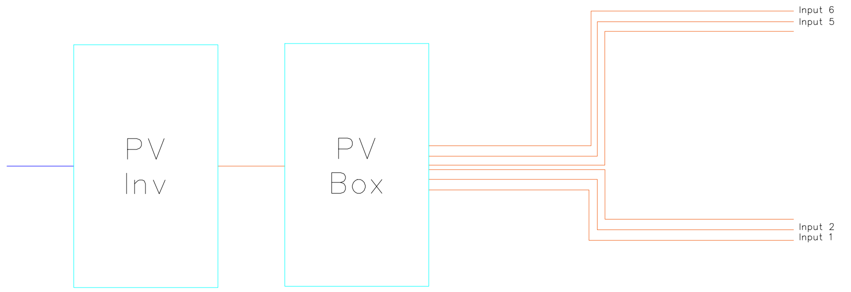



| Voltage | |
|---|---|
| | AC 0,48kV |
| | DC 1500V |

| Inverter | |
|---|---|
| MPPT conected | 1 |
| Strings conected | 10 |
| Modules/String | 27 |
| Strings/Tracker | 2 |




NOTES:
1. A BLA Harness design for the DC cabling may modify the need of installing PV Boxes

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REVISIONS

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| Project: | LONE TREE |
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| Owner: | PCR INVESTMENTS SP2 LLC |
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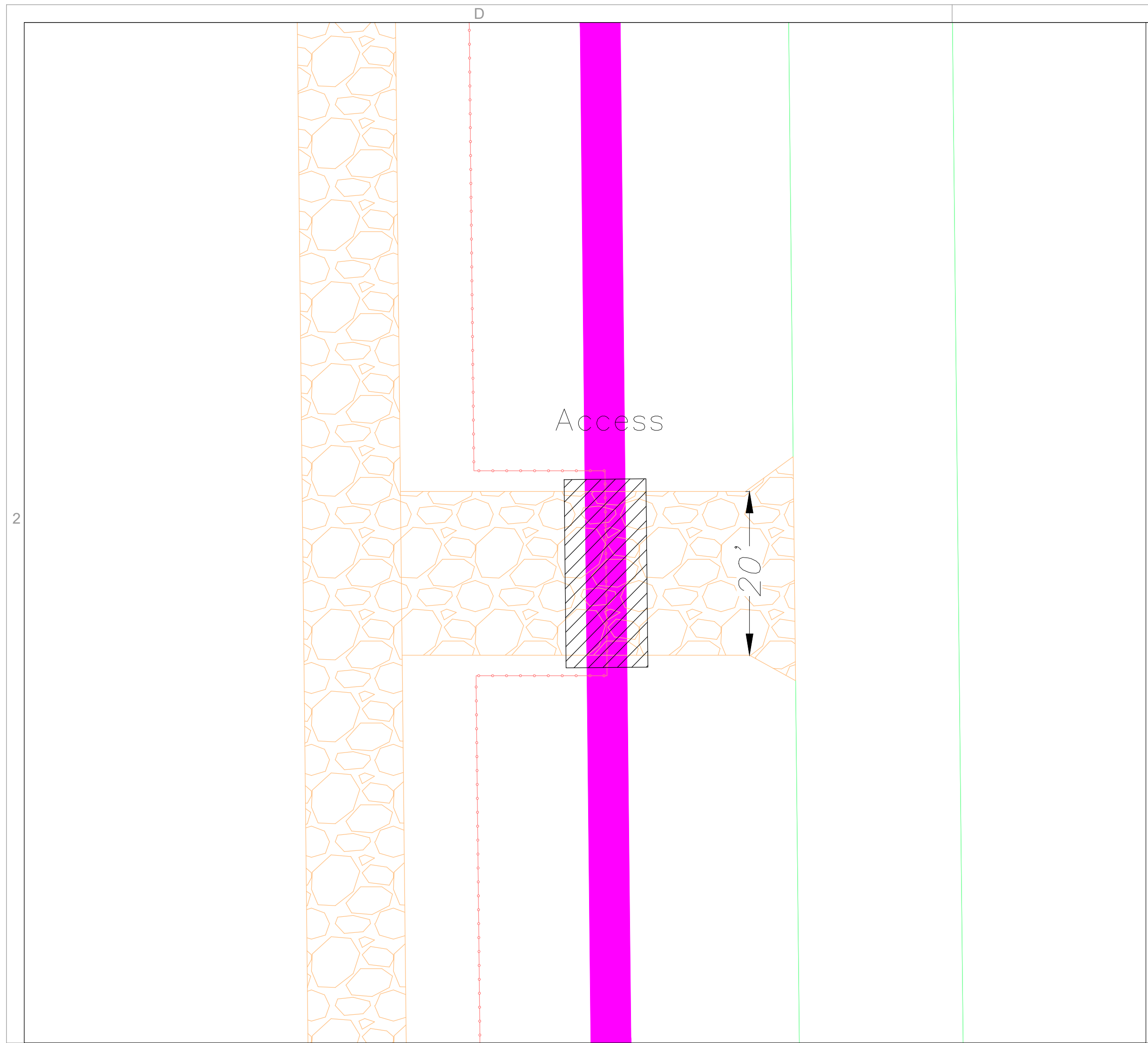
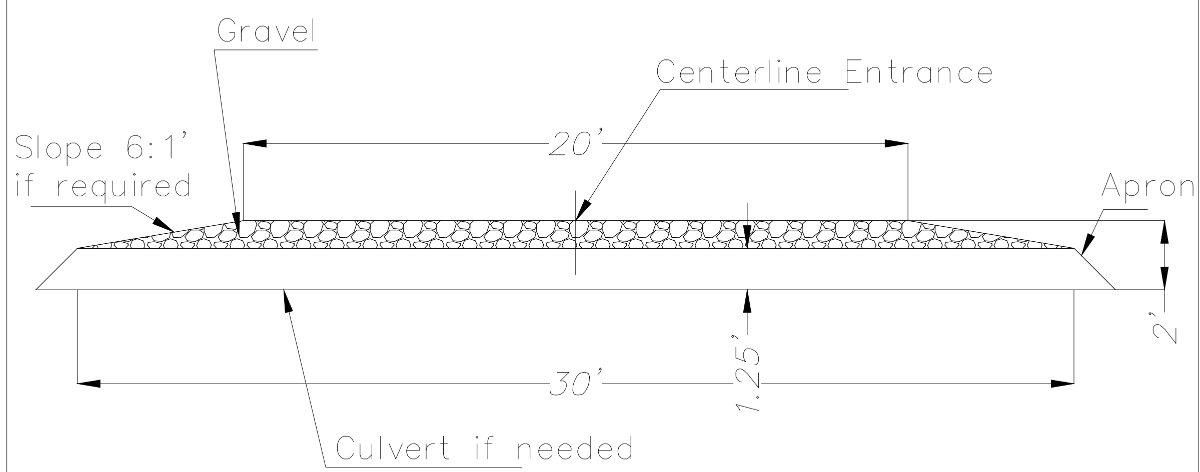



# DETAIL - ACCESS FRONT VIEW




NOTES:

1. Heavy Loads:
   - * MVS ~ 10 tn
   - * 40 ft PV Container ~ 7 tn

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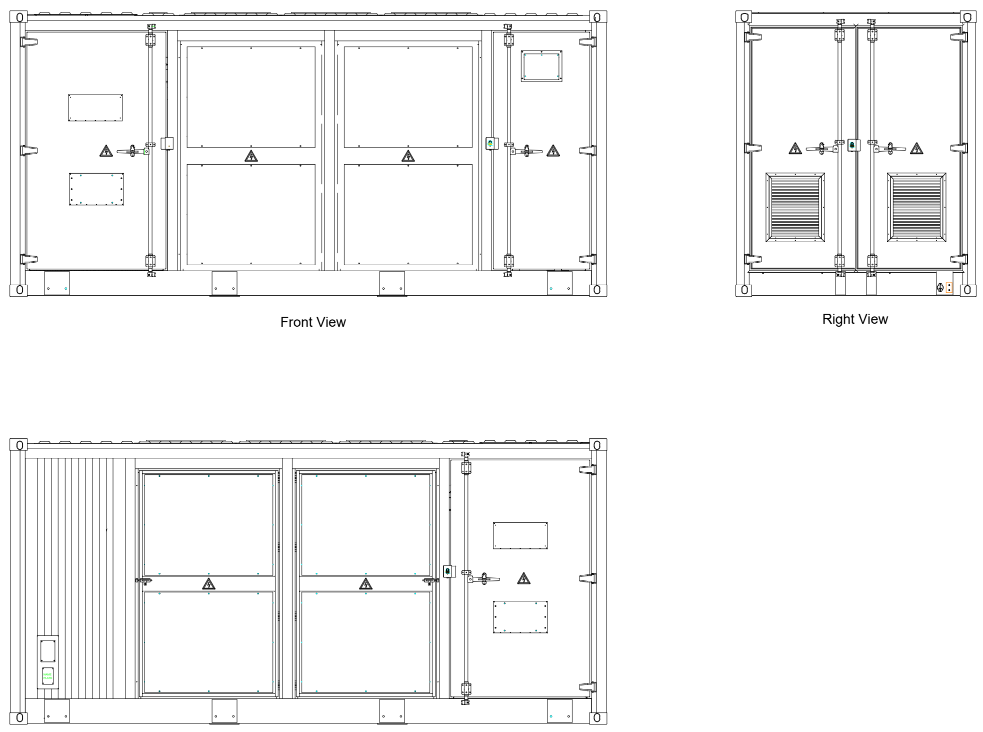
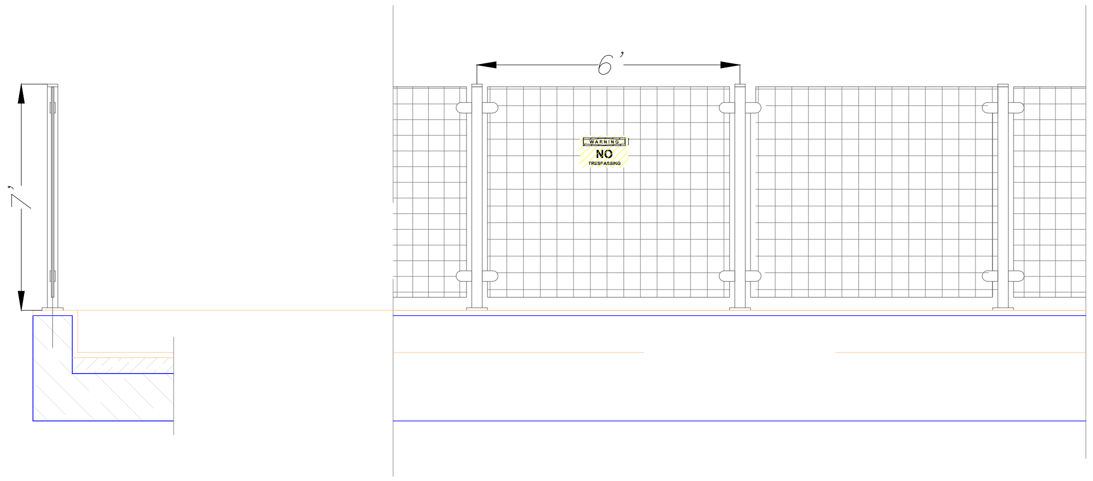
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 07/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |

# SW & METERING ROOM[1]

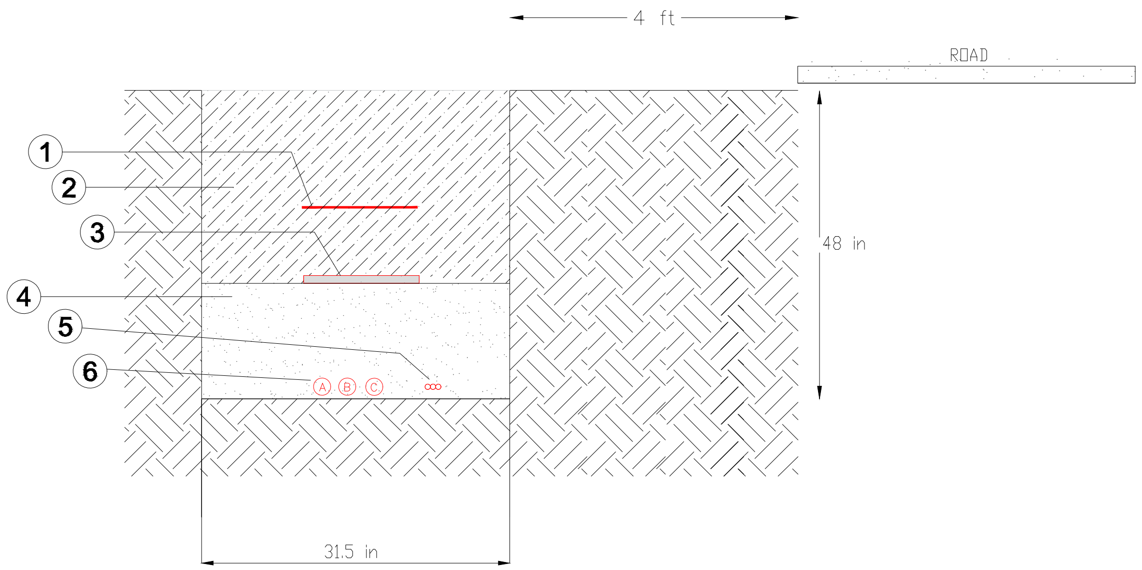



# SITE BOUNDARY FENCE



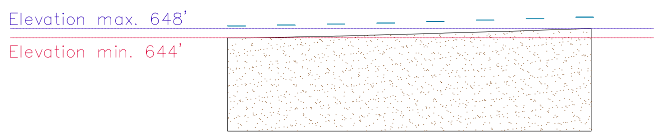

NOTES:
1. 20 ft container solution for indoor option, pad mounted for outdoor alternative
2. Fence warning signs spaced 66 ft
3. Wire opening size TBD
4. All lighting will comply with downcast lighting standards, and all signage will comply with the County's sign standards

DETAIL UNDERGROUND MV CABLE

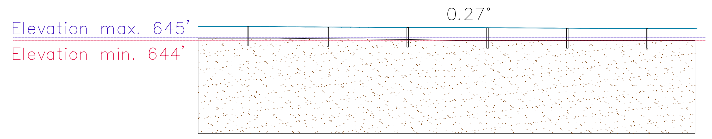



1. Warning sign
2. Filled with excavated land
3. Protection plate
4. Filled with excavated land
5. Tritube (FO)
6. MV 12.47kV Al 3x1x250MCM XLPE

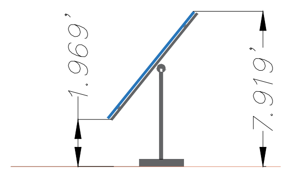
CROSS SECTION VIEW (e.g.)



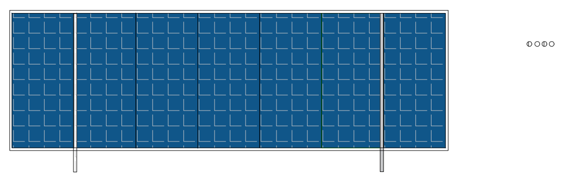

FRONT VIEW (e.g.)




Frame parameters
- Framing type: single-axis trackers
- Module orientation: portrait
- Rows: 1
- Columns: 54
- Turning angle range, °: 52.00
- Horizontal gap between modules, ft: 0.066
- Vertical gap between modules, ft: 0.066
- Motor gap size, ft: 6.562
- Number of joint gaps : 0
- Joint gap size, ft: 1.640
- Overhang left, ft: 0.000
- Overhang right, ft: 0.000
- Pole reveal, ft: 4.914
- Reference height, ft: 1.969
- Frame height at highest point, ft: 7.919
- Frame power, kWp: 29.700




SINGLE AXIS N–S



TRACKER 1–PORTRAIT 54 MODULES

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REVISIONS

PCR

| | | | |
|---|---|---|---|
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 08/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |

**Attachment F:**
**Glare Hazard Analysis**

# Glare Hazard Analysis

PCR Lone Tree
Johnson County, Iowa

August 2, 2022

Prepared for:

PCR Investments SP 2 LLC
1334 Brittmoore Road, Suite 1327
Houston, TX 77043

Prepared by:

Stantec Consulting Services Inc.
2300 Swan Lake Boulevard, Suite 202
Independence, IA 50644

## Table of Contents



**LIST OF TABLES**



**LIST OF FIGURES**



**LIST OF APPENDICES**

# Executive Summary

Stantec Consulting Services, Inc. (Stantec) utilized the web-based ForgeSolar glare hazard analysis program to analyze the potential for glare from the proposed PCR Lone Tree solar project (Project), a 9.9-megawatt (MW), utility-scale, solar-powered electric generating facility located in Johnson County, Iowa **(Figure 1)**. The Project will include photovoltaic (PV) solar panels mounted on a racking system to maximize solar energy capture and electric generation of the array. The Project area will encompass approximately 50 acres in an agricultural area located approximately 2.5 miles northwest of the community of Lone Tree in central Iowa. The ForgeSolar program identifies the three following types of glare (no color indicates no glare predicted):

GREEN - Low potential for temporary after-image.
YELLOW - Potential for temporary after-image.
RED - Potential for permanent eye damage.

Based on the solar array parameters provided and the current site design, glare from the Project is not predicted to impact pilots landing at two airports located within a 10-mile radius of the Project, including the Iowa City VORTAC Airport and the Iowa City Municipal Airport. The results of the ForgeSolar analysis determined that glare from the Project is not predicted to occur for drivers of vehicles on two road segments adjacent to the Project, including Sioux Avenue Southeast and Route 22.

The analysis was completed at two viewing heights for roadways: five feet for cars and small trucks and nine feet for semi-trucks. Glare is not predicted for 6 structures, primarily residences, that were analyzed within proximity to the Project area. All routes and structures were analyzed using 4.5-foot and 9-foot panel heights. The analysis was conducted using the ‘shade-slope’ methodology, which simulates backtracking of panels at night to return panels to the resting positions, and during the daytime to account for operational measures used to avoid shading effects, as well as tilt caused by the topography of the land.

*****It should be noted that a ‘resting angle’ of 60 degrees was used for the panels in the analysis. If panels are rotated back to a 0-degree position once they reach their maximum rotation, but before sunset, they will be facing up at sunrise and sunset, which results in a high likelihood of glare (see Figure 2 below). Panels should therefore not be returned to a 0-degree position prior to sunset and should be in place at 60 degrees to the east prior to sunrise.***

# Abbreviations

| | |
|---|---|
| AGL | above ground level |
| deg | degrees (0 is due north, 180 is due south) |
| DNI | direct normal irradiance |
| FAA | Federal Aviation Administration |
| FP | flight path (landing path from threshold to two miles out) |
| ft | Foot |
| kW | Kilowatt |
| kWh | kilowatt hour |
| m | Meters |
| mi | Mile |
| min | Minutes |
| mrad | Milliradian |
| MW | Megawatt |
| MSL | mean sea level |
| OP | observation point (e.g., control tower, vehicle location) |
| PV | Photovoltaic |
| $W/m^2$ | Watts per square meter |

# Glossary

| | |
|---|---|
| Eye Focal Length [meter (m)] | Typical distance between the cornea and the retina of the human eye, default is 0.017, though some sources indicate that the typical length is 0.022. |
| Glide Slope [degrees (deg)] | Angle at which the plane approaches the runway during landing (default is 3 deg from horizontal). |
| Maximum Tracking Angle (deg) | Rotation limit of panels in either direction. Full rotation is 2×maximum tracking angle. E.g., maximum tracking angle of 60 deg indicates full panel rotation range of 120 deg. |
| Resting Angle (deg) | Angle modules return to after maximum angle is reached. |
| Observation Point | A specific location, such as a control tower or vehicle, from which an observer might experience glare. |
| Ocular Transmission Coefficient | Related to the ability of the eye to transmit light, set by at 0.5 by ForgeSolar. |
| Offset angle of module (deg) | Additional tilt/elevation angle between the tracking axis and the panel. |
| Orientation of Tracking Axis (deg) | Azimuthal position of tracking axis measured clockwise from true north. Tracking systems in the northern hemisphere are typically oriented near 180 deg. Tracking systems in the southern hemisphere are typically oriented near 0 deg. |
| Peak DNI ($W/m^2$)** | This value is set at 1,000 by ForgeSolar and is the amount of solar radiation per unit surface area by a surface perpendicular to the sun's rays in a straight line from the direction of the sun at its current position in the sky. |
| Pupil Diameter (m) | Typical pupil diameter for observer, default is 0.002 m. |
| PV Array Axis Tracking | Panel tracking mode, if any. Panel can be set to track along one (single) or two (dual) axis tracking. This parameter affects the positioning of the panels at every time step when the sun is up. |
| PV Array Panel Material | Surface material of panels, including use of anti-reflective coating (ARC). Options include smooth glass without ARC, smooth glass with ARC, light-textured glass without ARC, light-textured glass with ARC, and deeply textured glass. |
| Rated Power (kilowatts) | Power rating of the solar array - used to estimate the energy output per year of the array (optional). |
| Slope Error (mrad) | Accounts for beam scatter of sunlight on the array. Default is 8.43 mrads for smooth glass with anti-reflective coating, but the value may be adjusted based on the panel material type. |
| Subtended Angle of Sun (mrad) | The angle above horizontal at which the viewer observes the sun, default value is 9.3 mrad. |
| Threshold | The physical beginning of the runway. Aircraft are typically expected to be 50 feet above ground at this point. |

| | |
|---|---|
| Time Interval (minutes) | Time step intervals used by the program for analyses. Default is set to analyze for glare at every one-minute interval throughout the year. |
| Time zone | Time zone difference from Greenwich Mean Time at the location of the analysis. |
| Tilt of Tracking Axis (deg) | The elevation angle of the tracking axis upon which panels rotate (e.g., torque tube), measured from flat ground. 0 deg implies the axis is on level, flat ground. Values between 0 and 30 deg are typical. |
| Vary Reflectivity | Varies panel reflectivity with sun position at each time step. |
| Maximum Downward Viewing Angle (deg) | The angle extending downward from the horizon indicating the maximum downward viewing angle from the cockpit. Used to determine whether glare is visible by the pilot along the flight path. Default is 30 degrees. |

Sources:
Ho, Clifford, K., Cianan A. Sims, Julius E. Yellowhair. 2015. Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v. 2H. Sandia National Laboratories.

ForgeSolar – PV Planning & Glare Analysis. https://www.forgesolar.com/

** http://www.3tier.com/en/support/solar-prospecting-tools/what-direct-normal-irradiance-solar-prospecting/

# 1.0 INTRODUCTION

On behalf of PCR Lone Tree solar project, Stantec Consulting Services Inc. utilized the web-based ForgeSolar glare hazard analysis program to complete a glare analysis for the Project to determine the potential effect of glint and/or glare (glare) from the photovoltaic (PV) solar panels on pilots and airport operations, residents in the area, and drivers in the vicinity of the Project Area. The Project is approximately 2.5 miles northwest of the community of Lone Tree in Johnson County, central Iowa (**Figure 1**).

ForgeSolar is an interactive tool that provides a quantified assessment of (1) when and where glare will occur throughout the year for a prescribed solar project and (2) potential effects on the human eye at locations where glare occurs. Glare can occur from the reflection of sunlight on the PV solar panels of utility-scale solar-powered electric generating facilities. While PV solar panels absorb direct sunlight, some reflection can occur when the panels are directed close to horizontal, which mainly occurs during sunset and sunrise when the incidence angle of the panels is highest, as depicted in **Figure 2** below.

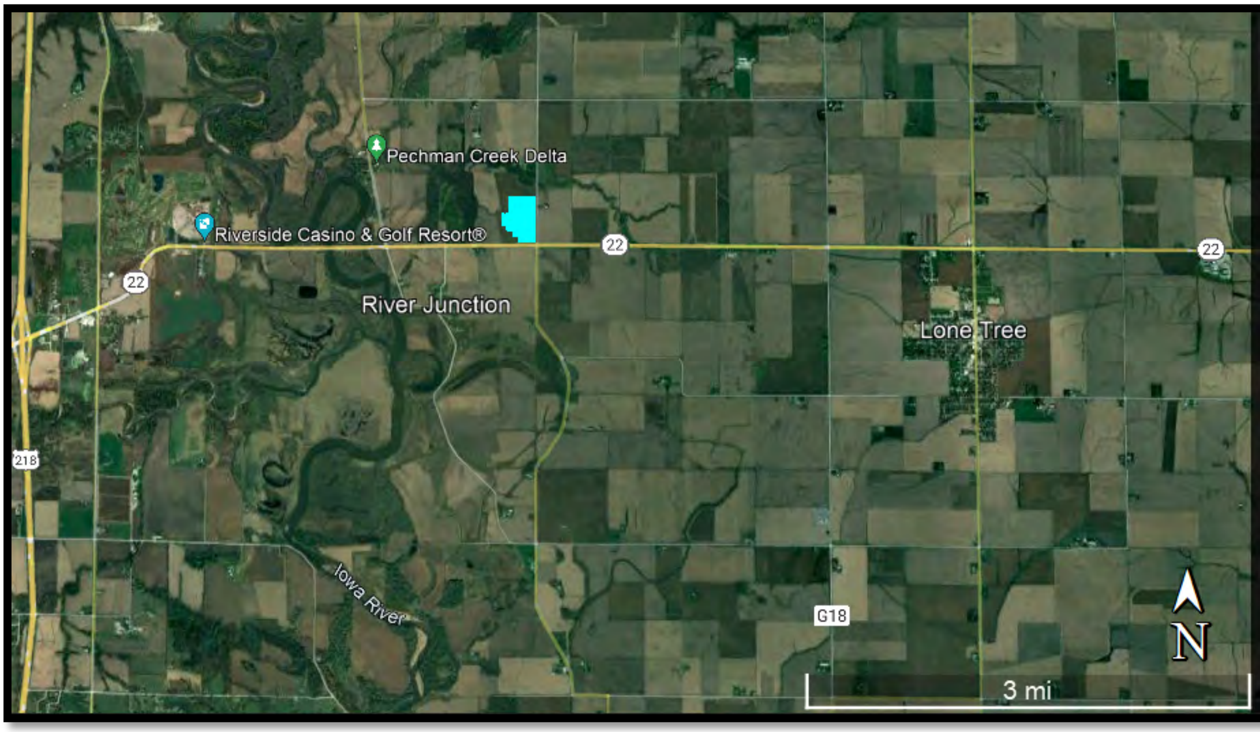
ForgeSolar uses an interactive Google map for site location, mapping the proposed PV array(s) and specifying observer locations, vehicular travel routes, and flight paths. Latitude, longitude, and elevation are automatically recorded through the Google interface, providing necessary information for sun position and vector calculations. Additional information regarding the orientation and tilt of the PV solar panels, reflectance, environment, and ocular factors are entered by the user.

If glare is found, ForgeSolar calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards ranging from temporary after-image to retinal burn. The results are presented in a plot that specifies when glare will occur throughout the year, with color codes indicating the potential ocular hazard.

This study analyzes potential glare for pilots landing on all available approach paths at two airports located within 10 miles of the Project area (**Figure 3**). Glare analyses were also conducted for drivers of vehicles at five feet (ft) above ground level (AGL) for cars and small trucks and nine feet AGL for semi-truck viewing heights on two road segments adjacent to the PV panels (**Figure 4**).

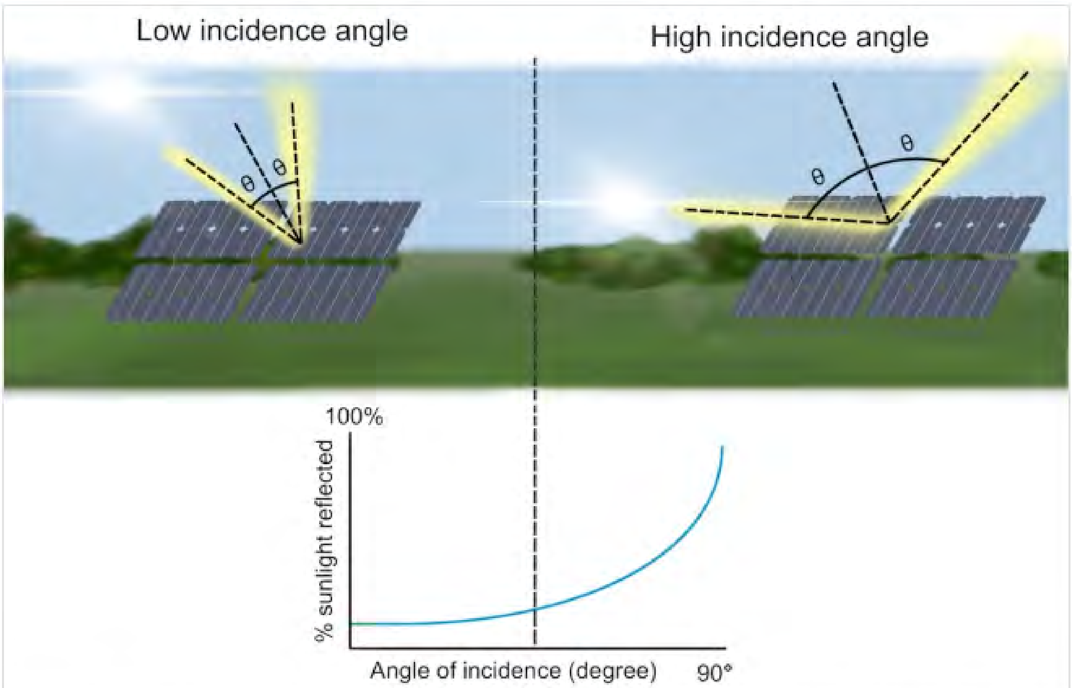
The analysis also included potential glare to viewers at 6 unique structures, primarily residences, in the vicinity of the Project using a 16-ft AGL viewing height which is a conservative viewing height for one- and two-story structures (**Figure 4**). The airports, roadways, and structures were analyzed using 4.5-ft and 9-ft AGL panel heights. The arrays used in the analysis program were drawn to be conservative in the glare analysis by analyzing slightly more area than the panels will occupy.

**Figure 1. PCR Lone Tree Solar Project Location Map***




***Project location is shown in blue.** Source: Google Earth Imagery

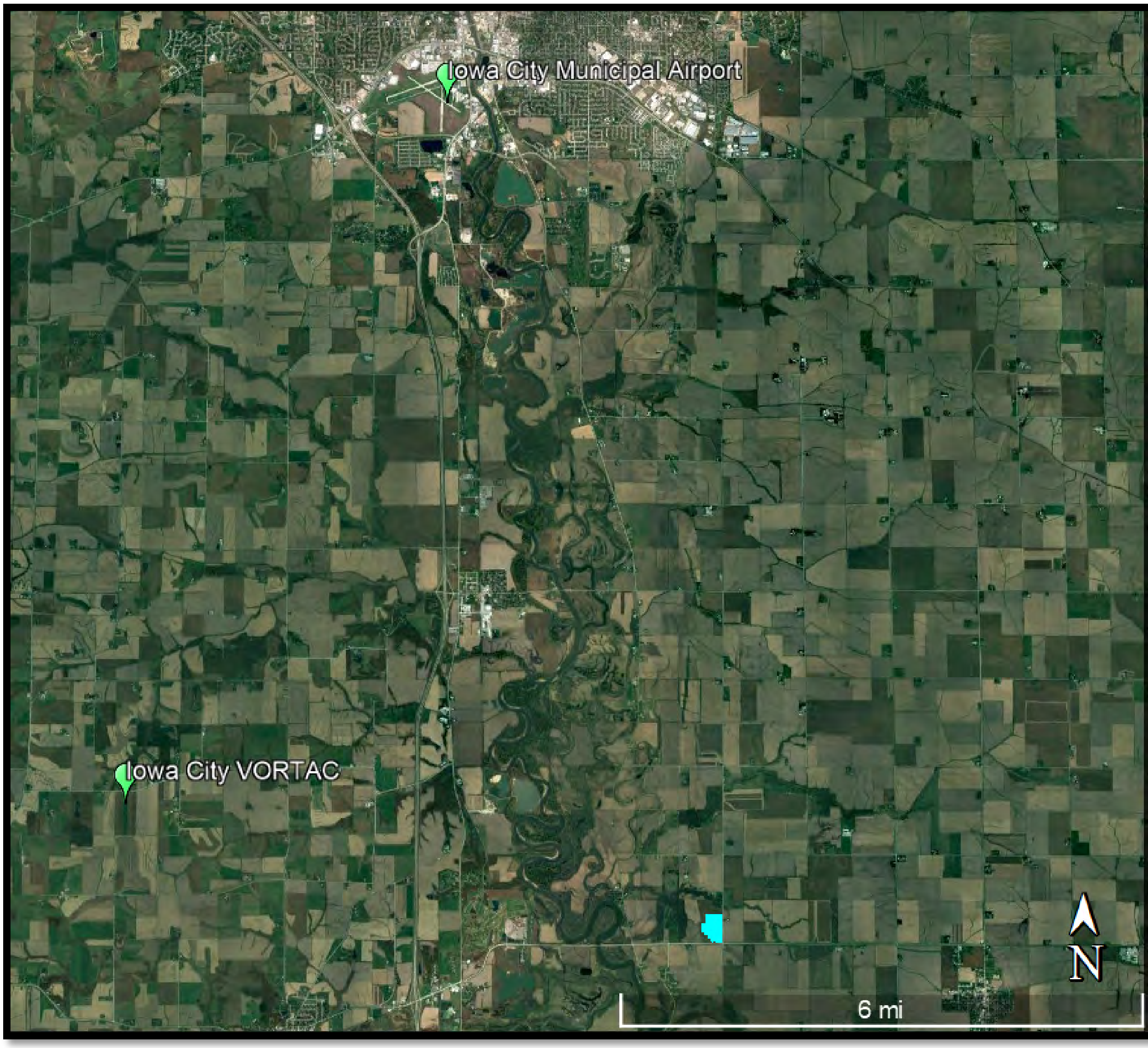
**Figure 2. Reflectivity Differences Between Low and High Incidence Angles**




*PV panel reflectance depends on incidence angle between panel normal (i.e. facing) and sun position. Large incidence angle yields more reflected sunlight.*

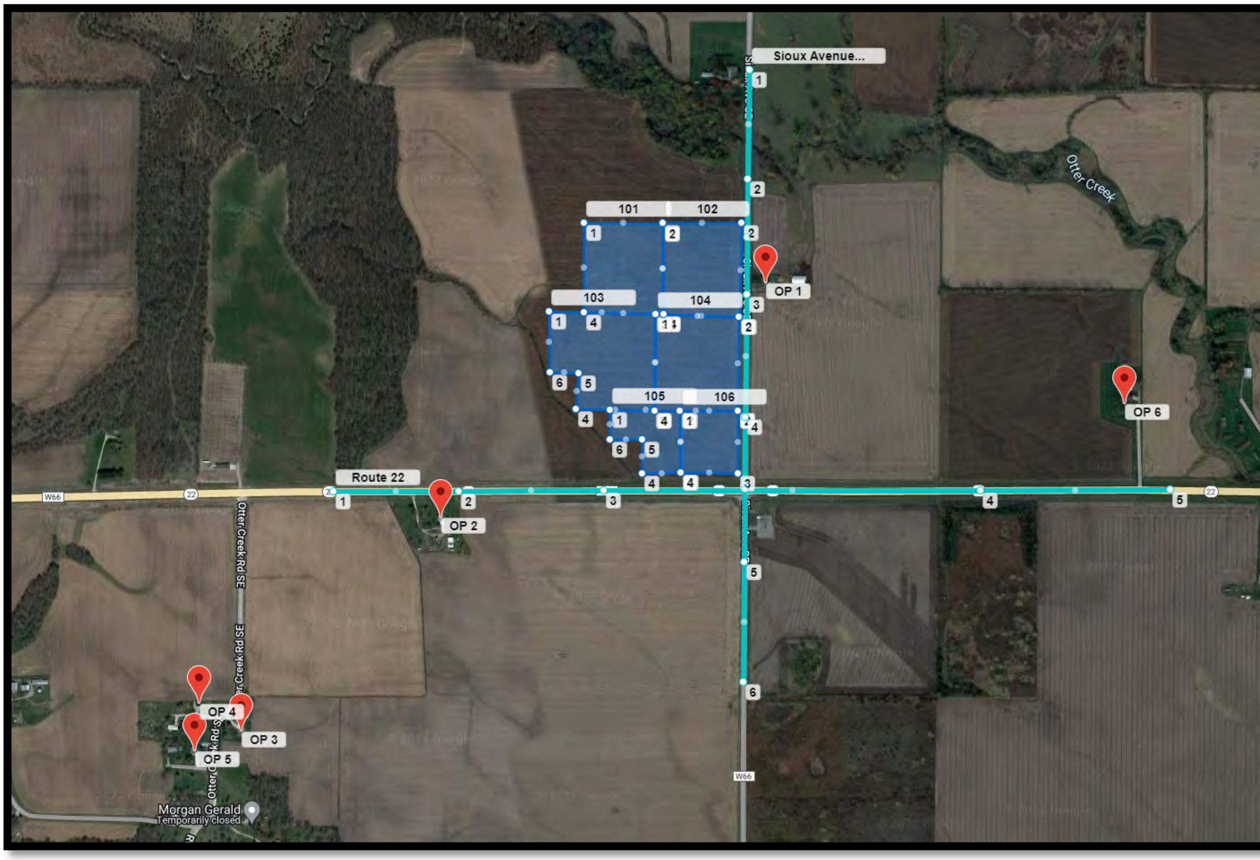
Source: ForgeSolar 2022

**Figure 3. Airports Within Vicinity of the PCR Lone Tree Solar Project***




*Project location is shown in blue. Source: Google Earth Imagery

**Figure 4: Analysis Area, Structures, and Roadways***




*Red markers indicate structures, turquoise lines indicate roads, and blue polygons indicate PV arrays. Source: ForgeSolar, Google Earth Imagery

# 2.0 DATA INPUT SUMMARY

The parameters used for the analyses is listed in **Table 1** below. "Default" indicates the default parameter value set by ForgeSolar and is considered the most conservative value for the parameter. "Chosen" parameters were selected to perform the most conservative analysis concerning glare potential. "Provided" parameters are Project specific information provided by the client.

## 2.1 SOLAR ARRAY

The location of the solar array and array parameters used for the analyses is based on information provided by PCR Investments SP 2 LLC (**Table 1**). The analyses described below were conducted using 4.5-ft and 9-ft panel heights AGL. A detailed description of each parameter is provided in the Glossary.

**Table 1: Solar Panel Parameters Used for Glare Analysis**

| Parameter | Value Used | Default, Chosen or Provided? |
|---|---|---|
| Axis tracking | Single | Provided |
| Tracking Axis Tilt (deg) | Varies – determined by ForgeSolar | Shade-Slope Analysis Method Used |
| Tracking Axis Orientation (deg) | 180.0 | Provided |
| Tracking Axis Panel Offset (deg) | 0.0 | Default |
| Maximum Tracking Angle (deg) | 60.0 | Provided |
| Resting Angle (deg) | 60.0 | Provided |
| Rated Power (kW) | Not Used | NA |
| Vary reflectivity? | Yes | Default |
| Panel material | Smooth glass with Anti-Reflective Coating | Provided |
| Time zone offset | -6 | Based on site location |
| Subtended angle of sun (mrad) | 9.3 | Default |
| Peak DNI (W/m$^2$) | 1,000 | Default |
| Ocular transmission coefficient | 0.5 | Default |
| Pupil diameter (m) | 0.002 | Default |
| Eye focal length (m) | 0.017 | Default |
| Time interval (min) | 1 | Default |
| Correlate slope error with surface type? | Yes | Default |
| Slope error (mrad) | 8.43 | Default |

## 2.2 AIRPORT APPROACH PATHS AND AIR TRAFFIC CONTROL TOWER

Two airports were found to be located within 10 miles of this project, including the Iowa City Municipal Airport and the Iowa City VORTAC Airport. There are no Air Traffic Control Towers (ATCTs) associated with either airport.

## 2.3 ROADWAYS AND PROPERTIES LOCATED ADJACENT TO THE SOLAR ARRAYS

This analysis included potential glare to vehicles traveling on two road segments in the vicinity of the Project Area. The ForgeSolar program sets the default viewing angle of the array at 50 degrees from the driver's direct line of sight when looking forward. The Federal Aviation Administration (FAA) has determined that glare beyond 50 degrees from the line of sight will not impact the viewer[1].

Potential glare to drivers was evaluated for both passenger vehicles and semi-trucks, where the passenger vehicles were assumed to have a maximum viewing height of five feet AGL, while the viewing height for drivers of semi-trucks was assumed to be a maximum of nine feet AGL. The location of the roadway routes analyzed is shown as blue-green route lines in **Figure 4**.

Analyses for each array block was run twice, once for 5-ft car heights and once for 9-ft truck heights, and once again for each of the two-panel heights (4.5-ft and 9-ft AGL).

Potential glare to viewers from 6 unique structures in the vicinity of the Project was also analyzed at 16-ft AGL viewing heights.

[1] Rogers, J. A., et al. (2015). Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach, Federal Aviation Administration (link )

# 3.0 GLARE ANALYSES RESULTS

The web-based ForgeSolar program was used to analyze glare potential in one-minute increments throughout the year. The program identifies the three following types of glare (no color indicates no glare predicted):

GREEN - Low potential for temporary after-image.
YELLOW - Potential for temporary after-image.
RED - Potential for permanent eye damage.

## 3.1 AIRPORT APPROACH PATHS

Glare is not predicted for pilots approaching any of the airport runways at the airports depicted in **Figure 3**, at any time of the day, any time throughout the year based on the input parameters described above.

## 3.2 AIR TRAFFIC CONTROL TOWERS

There are no ATCTs associated with either airport included in this analysis and therefore no impacts are predicted to ATCT staff as a result of this Project.

## 3.3 ROADWAYS AND PROPERTIES LOCATED ADJACENT TO THE SOLAR ARRAYS

Glare is not predicted for drivers along any of the two road segments analyzed that are adjacent to the Project area. The potential for glare for a range of driver conditions was evaluated for viewing heights of five feet for cars and small trucks and nine feet for semi-trucks. Glare is also not predicted for 6 unique structures analyzed at 16-ft viewing heights, as shown in **Figure 4**.

# 4.0 CONCLUSIONS

Based on the solar array parameters provided, glare is not predicted for planes approaching the Iowa City Municipal Airport or the Iowa City VORTAC Airport (**Figure 3**). Glare is not predicted for drivers of vehicles on either of the roadways adjacent to the Project area, including Sioux Avenue Southeast and Route 22, at viewing heights of five feet for cars and small trucks and nine feet for semi-trucks. Glare is also not predicted for 6 unique structures with 16-ft viewing heights (**Figure 4**). All receptors were analyzed using 4.5-ft and 9-ft AGL panel heights.

# APPENDIX A

## ForgeSolar Reports

# Lone Tree

## 5ft vehicles 4_5ft panels

**Created** July 19, 2022
**Updated** July 19, 2022
**Time-step** 1 minute
**Timezone offset** UTC-6
**Site ID** 72737.12762

**Project type** Advanced
**Project status:** active
**Category** 5 MW to 10 MW


### Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

## Summary of Results No glare predicted!

| PV Name | Tilt | Orientation | "Green" Glare | "Yellow" Glare | Energy Produced |
|---|---|---|---|---|---|
| | deg | deg | min | min | kWh |
| 101 | SA tracking | SA tracking | 0 | 0 | - |
| 102 | SA tracking | SA tracking | 0 | 0 | - |
| 103 | SA tracking | SA tracking | 0 | 0 | - |
| 104 | SA tracking | SA tracking | 0 | 0 | - |
| 105 | SA tracking | SA tracking | 0 | 0 | - |
| 106 | SA tracking | SA tracking | 0 | 0 | - |

## Component Data

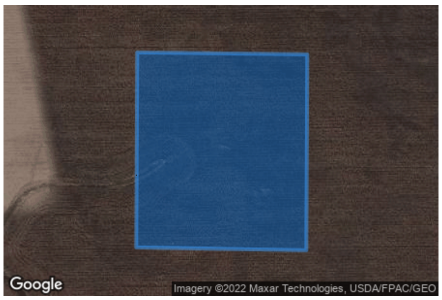
## PV Array(s)

**Total PV footprint area:** 37.8 acres

**Name**: 101
**Footprint area**: 7.0 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.487308 | 645.40 | 4.50 | 649.90 |
| 2 | 41.501254 | -91.485420 | 649.57 | 4.50 | 654.07 |
| 3 | 41.499631 | -91.485431 | 644.12 | 4.50 | 648.62 |
| 4 | 41.499655 | -91.487319 | 642.11 | 4.50 | 646.61 |



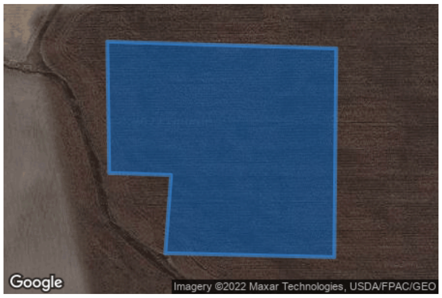

**Name**: 102
**Footprint area**: 7.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.485431 | 649.53 | 4.50 | 654.03 |
| 2 | 41.501262 | -91.483543 | 651.08 | 4.50 | 655.58 |
| 3 | 41.499575 | -91.483586 | 650.83 | 4.50 | 655.33 |
| 4 | 41.499623 | -91.485409 | 644.12 | 4.50 | 648.62 |

**Name**: 103
**Footprint area**: 9.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad




| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499679 | -91.488156 | 640.90 | 4.50 | 645.40 |
| 2 | 41.499623 | -91.485613 | 643.79 | 4.50 | 648.29 |
| 3 | 41.497887 | -91.485635 | 643.87 | 4.50 | 648.37 |
| 4 | 41.497919 | -91.487512 | 638.25 | 4.50 | 642.75 |
| 5 | 41.498570 | -91.487448 | 643.68 | 4.50 | 648.18 |
| 6 | 41.498586 | -91.488135 | 637.90 | 4.50 | 642.40 |

**Name**: 104
**Footprint area**: 7.8 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499623 | -91.485592 | 643.80 | 4.50 | 648.30 |
| 2 | 41.499575 | -91.483607 | 650.81 | 4.50 | 655.31 |
| 3 | 41.497895 | -91.483628 | 644.57 | 4.50 | 649.07 |
| 4 | 41.497895 | -91.485624 | 643.83 | 4.50 | 648.33 |

**Name**: 105
**Footprint area**: 3.4 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497911 | -91.486686 | 641.09 | 4.50 | 645.59 |
| 2 | 41.497895 | -91.485002 | 644.80 | 4.50 | 649.30 |
| 3 | 41.496778 | -91.484980 | 648.00 | 4.50 | 652.50 |
| 4 | 41.496762 | -91.485924 | 641.17 | 4.50 | 645.67 |
| 5 | 41.497373 | -91.485924 | 644.88 | 4.50 | 649.38 |
| 6 | 41.497373 | -91.486697 | 639.95 | 4.50 | 644.45 |


**Name**: 106
**Footprint area**: 3.5 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497887 | -91.485012 | 644.75 | 4.50 | 649.25 |
| 2 | 41.497895 | -91.483618 | 644.61 | 4.50 | 649.11 |
| 3 | 41.496770 | -91.483628 | 644.83 | 4.50 | 649.33 |
| 4 | 41.496778 | -91.484991 | 648.08 | 4.50 | 652.58 |

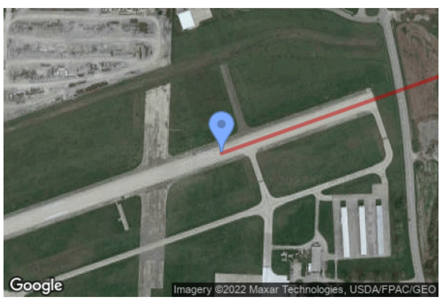
## 2-Mile Flight Path Receptor(s)

**Name**: Iowa City Municipal Airport Runway 12
**Description**:
**Threshold height** : 50 ft
**Direction**: 124.9 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641881 | -91.552672 | 658.27 | 50.00 | 708.27 |
| 2-mile point | 41.658402 | -91.584459 | 734.65 | 527.08 | 1261.73 |


**Name**: Iowa City Municipal Airport Runway 25
**Description**:
**Threshold height** : 50 ft
**Direction**: 250.5 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641981 | -91.543386 | 651.95 | 50.00 | 701.95 |
| 2-mile point | 41.651642 | -91.506878 | 688.37 | 567.03 | 1255.41 |




**Name**: Iowa City Municipal Airport Runway 30
**Description**:
**Threshold height** : 50 ft
**Direction**: 301.1 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

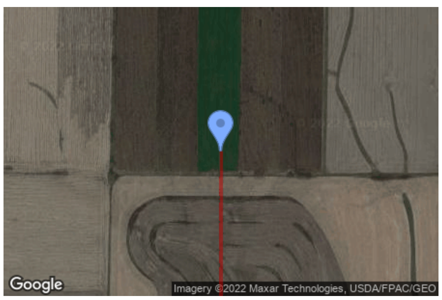
| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.635859 | -91.541074 | 645.76 | 50.00 | 695.76 |
| 2-mile point | 41.620912 | -91.507921 | 654.79 | 594.42 | 1249.22 |

**Name**: Iowa City Municipal Airport Runway 7
**Description**:
**Threshold height** : 50 ft
**Direction**: 70.7 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total elevation ft |
|---|---|---|---|---|---|
| Threshold | 41.638252 | -91.557687 | 679.31 | 50.00 | 729.31 |
| 2-mile point | 41.628682 | -91.594236 | 777.41 | 505.36 | 1282.76 |


**Name**: Iowa City VORTAC Northbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 0.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total elevation ft |
|---|---|---|---|---|---|
| Threshold | 41.514682 | -91.615792 | 755.02 | 50.00 | 805.02 |
| 2-mile point | 41.485769 | -91.615792 | 689.57 | 668.91 | 1358.48 |




**Name**: Iowa City VORTAC Southbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 180.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total elevation ft |
|---|---|---|---|---|---|
| Threshold | 41.521398 | -91.615792 | 759.29 | 50.00 | 809.29 |
| 2-mile point | 41.550310 | -91.615792 | 746.13 | 616.62 | 1362.75 |

## Route Receptor(s)

**Name**: Route 22
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.496439 | -91.493315 | 645.65 | 5.00 | 650.65 |
| 2 | 41.496447 | -91.490311 | 645.49 | 5.00 | 650.49 |
| 3 | 41.496463 | -91.486846 | 645.02 | 5.00 | 650.02 |
| 4 | 41.496459 | -91.477801 | 652.83 | 5.00 | 657.83 |
| 5 | 41.496471 | -91.473263 | 650.93 | 5.00 | 655.93 |

**Name**: Sioux Avenue Southeast
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.504006 | -91.483348 | 653.02 | 5.00 | 658.02 |
| 2 | 41.502052 | -91.483383 | 638.86 | 5.00 | 643.86 |
| 3 | 41.499975 | -91.483420 | 653.91 | 5.00 | 658.91 |
| 4 | 41.497781 | -91.483445 | 645.65 | 5.00 | 650.65 |
| 5 | 41.495169 | -91.483477 | 646.31 | 5.00 | 651.31 |
| 6 | 41.493024 | -91.483488 | 649.06 | 5.00 | 654.06 |

## Discrete Observation Receptors

| Number | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total Elevation<br>ft |
|---|---|---|---|---|---|
| OP 1 | 41.500190 | -91.482968 | 659.51 | 16.00 | 675.51 |
| OP 2 | 41.495973 | -91.490753 | 649.49 | 16.00 | 665.49 |
| OP 3 | 41.492142 | -91.495540 | 651.72 | 16.00 | 667.72 |
| OP 4 | 41.492636 | -91.496554 | 647.79 | 16.00 | 663.79 |
| OP 5 | 41.491784 | -91.496656 | 660.04 | 16.00 | 676.04 |
| OP 6 | 41.498026 | -91.474356 | 657.90 | 16.00 | 673.90 |

## Summary of PV Glare Analysis

*PV configuration and total predicted glare*

| PV Name | Tilt | Orientation | "Green" Glare | "Yellow" Glare | Energy Produced | Data File |
|---|---|---|---|---|---|---|
| | deg | deg | min | min | kWh | |
| 101 | SA tracking | SA tracking | 0 | 0 | - | |
| 102 | SA tracking | SA tracking | 0 | 0 | - | |
| 103 | SA tracking | SA tracking | 0 | 0 | - | |
| 104 | SA tracking | SA tracking | 0 | 0 | - | |
| 105 | SA tracking | SA tracking | 0 | 0 | - | |
| 106 | SA tracking | SA tracking | 0 | 0 | - | |

## PV & Receptor Analysis Results

*Results for each PV array and receptor*

### 101 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

### 102 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 103 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 104 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 105 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 106 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

# Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

# Lone Tree

## 5ft vehicles 9ft panels 60 rest

**Created** July 19, 2022
**Updated** July 19, 2022
**Time-step** 1 minute
**Timezone offset** UTC-6
**Site ID** 72738.12762

**Project type** Advanced
**Project status:** active
**Category** 5 MW to 10 MW


### Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

## Summary of Results No glare predicted!

| PV Name | Tilt<br>deg | Orientation<br>deg | "Green" Glare<br>min | "Yellow" Glare<br>min | Energy Produced<br>kWh |
|---|---|---|---|---|---|
| 101 | SA tracking | SA tracking | 0 | 0 | - |
| 102 | SA tracking | SA tracking | 0 | 0 | - |
| 103 | SA tracking | SA tracking | 0 | 0 | - |
| 104 | SA tracking | SA tracking | 0 | 0 | - |
| 105 | SA tracking | SA tracking | 0 | 0 | - |
| 106 | SA tracking | SA tracking | 0 | 0 | - |

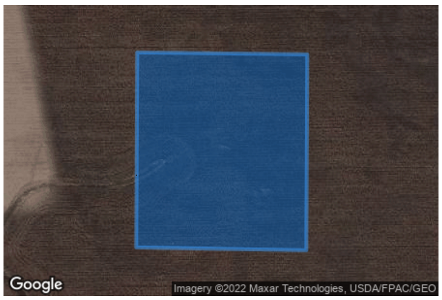
## Component Data

## PV Array(s)

**Total PV footprint area:** 37.8 acres

**Name**: 101
**Footprint area**: 7.0 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad




| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.487308 | 645.40 | 9.00 | 654.40 |
| 2 | 41.501254 | -91.485420 | 649.57 | 9.00 | 658.57 |
| 3 | 41.499631 | -91.485431 | 644.12 | 9.00 | 653.12 |
| 4 | 41.499655 | -91.487319 | 642.11 | 9.00 | 651.11 |

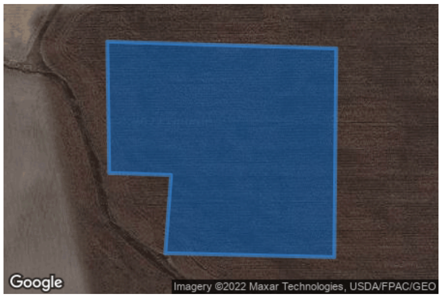
**Name**: 102
**Footprint area**: 7.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.485431 | 649.53 | 9.00 | 658.53 |
| 2 | 41.501262 | -91.483543 | 651.08 | 9.00 | 660.08 |
| 3 | 41.499575 | -91.483586 | 650.83 | 9.00 | 659.83 |
| 4 | 41.499623 | -91.485409 | 644.12 | 9.00 | 653.12 |

**Name**: 103
**Footprint area**: 9.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad




| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499679 | -91.488156 | 640.90 | 9.00 | 649.90 |
| 2 | 41.499623 | -91.485613 | 643.79 | 9.00 | 652.79 |
| 3 | 41.497887 | -91.485635 | 643.87 | 9.00 | 652.87 |
| 4 | 41.497919 | -91.487512 | 638.25 | 9.00 | 647.25 |
| 5 | 41.498570 | -91.487448 | 643.68 | 9.00 | 652.68 |
| 6 | 41.498586 | -91.488135 | 637.90 | 9.00 | 646.90 |

**Name**: 104
**Footprint area**: 7.8 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499623 | -91.485592 | 643.80 | 9.00 | 652.80 |
| 2 | 41.499575 | -91.483607 | 650.81 | 9.00 | 659.81 |
| 3 | 41.497895 | -91.483628 | 644.57 | 9.00 | 653.57 |
| 4 | 41.497895 | -91.485624 | 643.83 | 9.00 | 652.83 |

**Name**: 105
**Footprint area**: 3.4 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497911 | -91.486686 | 641.09 | 9.00 | 650.09 |
| 2 | 41.497895 | -91.485002 | 644.80 | 9.00 | 653.80 |
| 3 | 41.496778 | -91.484980 | 648.00 | 9.00 | 657.00 |
| 4 | 41.496762 | -91.485924 | 641.17 | 9.00 | 650.17 |
| 5 | 41.497373 | -91.485924 | 644.88 | 9.00 | 653.88 |
| 6 | 41.497373 | -91.486697 | 639.95 | 9.00 | 648.95 |

**Name**: 106
**Footprint area**: 3.5 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497887 | -91.485012 | 644.75 | 9.00 | 653.76 |
| 2 | 41.497895 | -91.483618 | 644.61 | 9.00 | 653.61 |
| 3 | 41.496770 | -91.483628 | 644.83 | 9.00 | 653.83 |
| 4 | 41.496778 | -91.484991 | 648.08 | 9.00 | 657.08 |

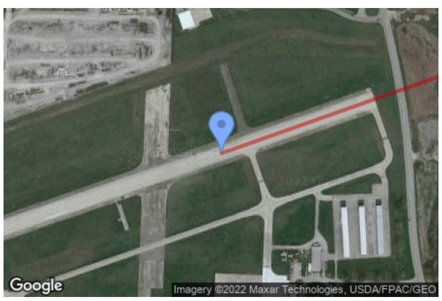
## 2-Mile Flight Path Receptor(s)

**Name**: Iowa City Municipal Airport Runway 12
**Description**:
**Threshold height** : 50 ft
**Direction**: 124.9 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641881 | -91.552672 | 658.27 | 50.00 | 708.27 |
| 2-mile point | 41.658402 | -91.584459 | 734.65 | 527.08 | 1261.73 |


**Name**: Iowa City Municipal Airport Runway 25
**Description**:
**Threshold height** : 50 ft
**Direction**: 250.5 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641981 | -91.543386 | 651.95 | 50.00 | 701.95 |
| 2-mile point | 41.651642 | -91.506878 | 688.37 | 567.03 | 1255.41 |




**Name**: Iowa City Municipal Airport Runway 30
**Description**:
**Threshold height** : 50 ft
**Direction**: 301.1 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

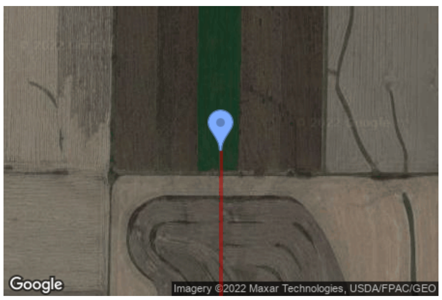
| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.635859 | -91.541074 | 645.76 | 50.00 | 695.76 |
| 2-mile point | 41.620912 | -91.507921 | 654.79 | 594.42 | 1249.22 |

**Name**: Iowa City Municipal Airport Runway 7
**Description**:
**Threshold height** : 50 ft
**Direction**: 70.7 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.638252 | -91.557687 | 679.31 | 50.00 | 729.31 |
| 2-mile point | 41.628682 | -91.594236 | 777.41 | 505.36 | 1282.76 |


**Name**: Iowa City VORTAC Northbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 0.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.514682 | -91.615792 | 755.02 | 50.00 | 805.02 |
| 2-mile point | 41.485769 | -91.615792 | 689.57 | 668.91 | 1358.48 |




**Name**: Iowa City VORTAC Southbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 180.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.521398 | -91.615792 | 759.29 | 50.00 | 809.29 |
| 2-mile point | 41.550310 | -91.615792 | 746.13 | 616.62 | 1362.75 |

## Route Receptor(s)

**Name**: Route 22
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.496439 | -91.493315 | 645.65 | 5.00 | 650.65 |
| 2 | 41.496447 | -91.490311 | 645.49 | 5.00 | 650.49 |
| 3 | 41.496463 | -91.486846 | 645.02 | 5.00 | 650.02 |
| 4 | 41.496459 | -91.477801 | 652.83 | 5.00 | 657.83 |
| 5 | 41.496471 | -91.473263 | 650.93 | 5.00 | 655.93 |

**Name**: Sioux Avenue Southeast
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.504006 | -91.483348 | 653.02 | 5.00 | 658.02 |
| 2 | 41.502052 | -91.483383 | 638.86 | 5.00 | 643.86 |
| 3 | 41.499975 | -91.483420 | 653.91 | 5.00 | 658.91 |
| 4 | 41.497781 | -91.483445 | 645.65 | 5.00 | 650.65 |
| 5 | 41.495169 | -91.483477 | 646.31 | 5.00 | 651.31 |
| 6 | 41.493024 | -91.483488 | 649.06 | 5.00 | 654.06 |

## Discrete Observation Receptors

| Number | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total Elevation<br>ft |
|---|---|---|---|---|---|
| OP 1 | 41.500190 | -91.482968 | 659.51 | 16.00 | 675.51 |
| OP 2 | 41.495973 | -91.490753 | 649.49 | 16.00 | 665.49 |
| OP 3 | 41.492142 | -91.495540 | 651.72 | 16.00 | 667.72 |
| OP 4 | 41.492636 | -91.496554 | 647.79 | 16.00 | 663.79 |
| OP 5 | 41.491784 | -91.496656 | 660.04 | 16.00 | 676.04 |
| OP 6 | 41.498026 | -91.474356 | 657.90 | 16.00 | 673.90 |

## Summary of PV Glare Analysis

*PV configuration and total predicted glare*

| PV Name | Tilt<br>deg | Orientation<br>deg | "Green" Glare<br>min | "Yellow" Glare<br>min | Energy Produced<br>kWh | Data File |
|---|---|---|---|---|---|---|
| 101 | SA tracking | SA tracking | 0 | 0 | - | |
| 102 | SA tracking | SA tracking | 0 | 0 | - | |
| 103 | SA tracking | SA tracking | 0 | 0 | - | |
| 104 | SA tracking | SA tracking | 0 | 0 | - | |
| 105 | SA tracking | SA tracking | 0 | 0 | - | |
| 106 | SA tracking | SA tracking | 0 | 0 | - | |

## PV & Receptor Analysis Results

*Results for each PV array and receptor*

### 101 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

### 102 no glare found

| Component | Green glare (min) | Yellow glare (min) |
| --- | --- | --- |
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 103 no glare found

| Component | Green glare (min) | Yellow glare (min) |
| --- | --- | --- |
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 104 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 105 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 106 no glare found

| Component | Green glare (min) | Yellow glare (min) |
| --- | --- | --- |
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

# Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

# Lone Tree

## 9ft vehicles 4_5ft panels

**Created** July 18, 2022
**Updated** July 19, 2022
**Time-step** 1 minute
**Timezone offset** UTC-6
**Site ID** 72597.12762

**Project type** Advanced
**Project status:** active
**Category** 5 MW to 10 MW


### Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

## Summary of Results No glare predicted!

| PV Name | Tilt<br>deg | Orientation<br>deg | "Green" Glare<br>min | "Yellow" Glare<br>min | Energy Produced<br>kWh |
|---|---|---|---|---|---|
| 101 | SA tracking | SA tracking | 0 | 0 | - |
| 102 | SA tracking | SA tracking | 0 | 0 | - |
| 103 | SA tracking | SA tracking | 0 | 0 | - |
| 104 | SA tracking | SA tracking | 0 | 0 | - |
| 105 | SA tracking | SA tracking | 0 | 0 | - |
| 106 | SA tracking | SA tracking | 0 | 0 | - |

## Component Data

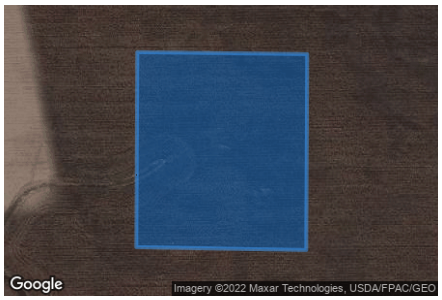
## PV Array(s)

**Total PV footprint area:** 37.8 acres

**Name**: 101
**Footprint area**: 7.0 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.501270 | -91.487308 | 645.40 | 4.50 | 649.90 |
| 2 | 41.501254 | -91.485420 | 649.57 | 4.50 | 654.07 |
| 3 | 41.499631 | -91.485431 | 644.12 | 4.50 | 648.62 |
| 4 | 41.499655 | -91.487319 | 642.11 | 4.50 | 646.61 |




**Name**: 102
**Footprint area**: 7.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

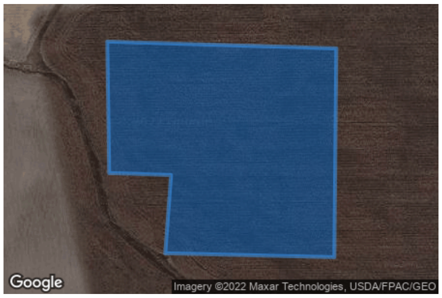
**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.501270 | -91.485431 | 649.53 | 4.50 | 654.03 |
| 2 | 41.501262 | -91.483543 | 651.08 | 4.50 | 655.58 |
| 3 | 41.499575 | -91.483586 | 650.83 | 4.50 | 655.33 |
| 4 | 41.499623 | -91.485409 | 644.12 | 4.50 | 648.62 |

**Name**: 103
**Footprint area**: 9.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.499679 | -91.488156 | 640.90 | 4.50 | 645.40 |
| 2 | 41.499623 | -91.485613 | 643.79 | 4.50 | 648.29 |
| 3 | 41.497887 | -91.485635 | 643.87 | 4.50 | 648.37 |
| 4 | 41.497919 | -91.487512 | 638.25 | 4.50 | 642.75 |
| 5 | 41.498570 | -91.487448 | 643.68 | 4.50 | 648.18 |
| 6 | 41.498586 | -91.488135 | 637.90 | 4.50 | 642.40 |




**Name**: 104
**Footprint area**: 7.8 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.499623 | -91.485592 | 643.80 | 4.50 | 648.30 |
| 2 | 41.499575 | -91.483607 | 650.81 | 4.50 | 655.31 |
| 3 | 41.497895 | -91.483628 | 644.57 | 4.50 | 649.07 |
| 4 | 41.497895 | -91.485624 | 643.83 | 4.50 | 648.33 |

**Name**: 105
**Footprint area**: 3.4 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497911 | -91.486686 | 641.09 | 4.50 | 645.59 |
| 2 | 41.497895 | -91.485002 | 644.80 | 4.50 | 649.30 |
| 3 | 41.496778 | -91.484980 | 648.00 | 4.50 | 652.50 |
| 4 | 41.496762 | -91.485924 | 641.17 | 4.50 | 645.67 |
| 5 | 41.497373 | -91.485924 | 644.88 | 4.50 | 649.38 |
| 6 | 41.497373 | -91.486697 | 639.95 | 4.50 | 644.45 |

**Name**: 106
**Footprint area**: 3.5 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497887 | -91.485012 | 644.75 | 4.50 | 649.25 |
| 2 | 41.497895 | -91.483618 | 644.61 | 4.50 | 649.11 |
| 3 | 41.496770 | -91.483628 | 644.83 | 4.50 | 649.33 |
| 4 | 41.496778 | -91.484991 | 648.08 | 4.50 | 652.58 |

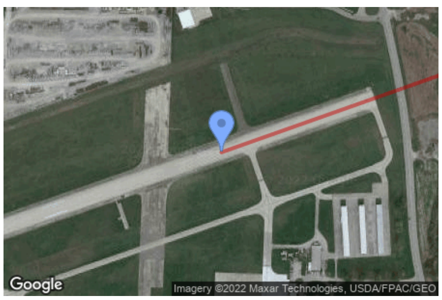
## 2-Mile Flight Path Receptor(s)

**Name**: Iowa City Municipal Airport Runway 12
**Description**:
**Threshold height** : 50 ft
**Direction**: 124.9 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641881 | -91.552672 | 658.27 | 50.00 | 708.27 |
| 2-mile point | 41.658402 | -91.584459 | 734.65 | 527.08 | 1261.73 |


**Name**: Iowa City Municipal Airport Runway 25
**Description**:
**Threshold height** : 50 ft
**Direction**: 250.5 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641981 | -91.543386 | 651.95 | 50.00 | 701.95 |
| 2-mile point | 41.651642 | -91.506878 | 688.37 | 567.03 | 1255.41 |




**Name**: Iowa City Municipal Airport Runway 30
**Description**:
**Threshold height** : 50 ft
**Direction**: 301.1 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

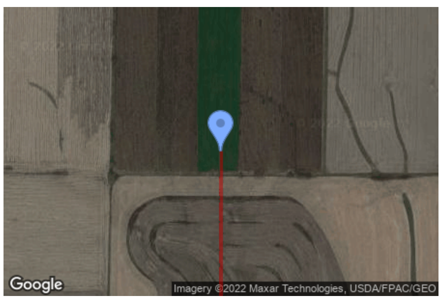
| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.635859 | -91.541074 | 645.76 | 50.00 | 695.76 |
| 2-mile point | 41.620912 | -91.507921 | 654.79 | 594.42 | 1249.22 |

**Name**: Iowa City Municipal Airport Runway 7
**Description**:
**Threshold height** : 50 ft
**Direction**: 70.7 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.638252 | -91.557687 | 679.31 | 50.00 | 729.31 |
| 2-mile point | 41.628682 | -91.594236 | 777.41 | 505.36 | 1282.76 |


**Name**: Iowa City VORTAC Northbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 0.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.514682 | -91.615792 | 755.02 | 50.00 | 805.02 |
| 2-mile point | 41.485769 | -91.615792 | 689.57 | 668.91 | 1358.48 |




**Name**: Iowa City VORTAC Southbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 180.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.521398 | -91.615792 | 759.29 | 50.00 | 809.29 |
| 2-mile point | 41.550310 | -91.615792 | 746.13 | 616.62 | 1362.75 |

## Route Receptor(s)

**Name**: Route 22
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total elevation ft |
|---|---|---|---|---|---|
| 1 | 41.496439 | -91.493315 | 645.65 | 9.00 | 654.65 |
| 2 | 41.496447 | -91.490311 | 645.49 | 9.00 | 654.49 |
| 3 | 41.496463 | -91.486846 | 645.02 | 9.00 | 654.02 |
| 4 | 41.496459 | -91.477801 | 652.83 | 9.00 | 661.83 |
| 5 | 41.496471 | -91.473263 | 650.93 | 9.00 | 659.93 |

**Name**: Sioux Avenue Southeast
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total elevation ft |
|---|---|---|---|---|---|
| 1 | 41.504006 | -91.483348 | 653.02 | 9.00 | 662.02 |
| 2 | 41.502052 | -91.483383 | 638.86 | 9.00 | 647.86 |
| 3 | 41.499975 | -91.483420 | 653.91 | 9.00 | 662.91 |
| 4 | 41.497781 | -91.483445 | 645.65 | 9.00 | 654.65 |
| 5 | 41.495169 | -91.483477 | 646.31 | 9.00 | 655.31 |
| 6 | 41.493024 | -91.483488 | 649.06 | 9.00 | 658.06 |

## Discrete Observation Receptors

| Number | Latitude deg | Longitude deg | Ground elevation ft | Height above ground ft | Total Elevation ft |
|---|---|---|---|---|---|
| OP 1 | 41.500190 | -91.482968 | 659.51 | 16.00 | 675.51 |
| OP 2 | 41.495973 | -91.490753 | 649.49 | 16.00 | 665.49 |
| OP 3 | 41.492142 | -91.495540 | 651.72 | 16.00 | 667.72 |
| OP 4 | 41.492636 | -91.496554 | 647.79 | 16.00 | 663.79 |
| OP 5 | 41.491784 | -91.496656 | 660.04 | 16.00 | 676.04 |
| OP 6 | 41.498026 | -91.474356 | 657.90 | 16.00 | 673.90 |

## Summary of PV Glare Analysis

*PV configuration and total predicted glare*

| PV Name | Tilt | Orientation | "Green" Glare | "Yellow" Glare | Energy Produced | Data File |
|---|---|---|---|---|---|---|
| | deg | deg | min | min | kWh | |
| 101 | SA tracking | SA tracking | 0 | 0 | - | |
| 102 | SA tracking | SA tracking | 0 | 0 | - | |
| 103 | SA tracking | SA tracking | 0 | 0 | - | |
| 104 | SA tracking | SA tracking | 0 | 0 | - | |
| 105 | SA tracking | SA tracking | 0 | 0 | - | |
| 106 | SA tracking | SA tracking | 0 | 0 | - | |

## PV & Receptor Analysis Results

*Results for each PV array and receptor*

### 101 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

### 102 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 103 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 104 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 105 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 106 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

# Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, no discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

# Lone Tree

## 9ft vehicles 9ft panels 60 rest

**Created** July 19, 2022
**Updated** July 19, 2022
**Time-step** 1 minute
**Timezone offset** UTC-6
**Site ID** 72739.12762

**Project type** Advanced
**Project status:** active
**Category** 5 MW to 10 MW


### Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

## Summary of Results No glare predicted!

| PV Name | Tilt | Orientation | "Green" Glare | "Yellow" Glare | Energy Produced |
|---|---|---|---|---|---|
| | deg | deg | min | min | kWh |
| 101 | SA tracking | SA tracking | 0 | 0 | - |
| 102 | SA tracking | SA tracking | 0 | 0 | - |
| 103 | SA tracking | SA tracking | 0 | 0 | - |
| 104 | SA tracking | SA tracking | 0 | 0 | - |
| 105 | SA tracking | SA tracking | 0 | 0 | - |
| 106 | SA tracking | SA tracking | 0 | 0 | - |

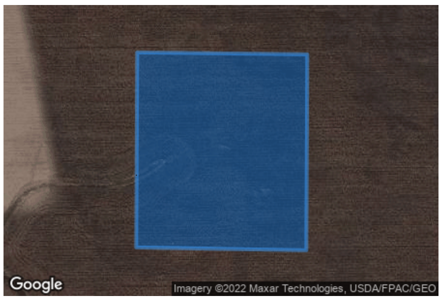
## Component Data

## PV Array(s)

**Total PV footprint area:** 37.8 acres

**Name**: 101
**Footprint area**: 7.0 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad




| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.487308 | 645.40 | 9.00 | 654.40 |
| 2 | 41.501254 | -91.485420 | 649.57 | 9.00 | 658.57 |
| 3 | 41.499631 | -91.485431 | 644.12 | 9.00 | 653.12 |
| 4 | 41.499655 | -91.487319 | 642.11 | 9.00 | 651.11 |

**Name**: 102
**Footprint area**: 7.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

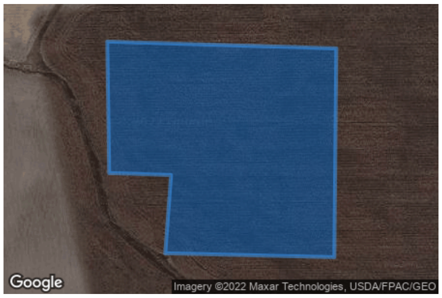
**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.501270 | -91.485431 | 649.53 | 9.00 | 658.53 |
| 2 | 41.501262 | -91.483543 | 651.08 | 9.00 | 660.08 |
| 3 | 41.499575 | -91.483586 | 650.83 | 9.00 | 659.83 |
| 4 | 41.499623 | -91.485409 | 644.12 | 9.00 | 653.12 |

**Name**: 103
**Footprint area**: 9.1 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499679 | -91.488156 | 640.90 | 9.00 | 649.90 |
| 2 | 41.499623 | -91.485613 | 643.79 | 9.00 | 652.79 |
| 3 | 41.497887 | -91.485635 | 643.87 | 9.00 | 652.87 |
| 4 | 41.497919 | -91.487512 | 638.25 | 9.00 | 647.25 |
| 5 | 41.498570 | -91.487448 | 643.68 | 9.00 | 652.68 |
| 6 | 41.498586 | -91.488135 | 637.90 | 9.00 | 646.90 |




**Name**: 104
**Footprint area**: 7.8 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad

| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.499623 | -91.485592 | 643.80 | 9.00 | 652.80 |
| 2 | 41.499575 | -91.483607 | 650.81 | 9.00 | 659.81 |
| 3 | 41.497895 | -91.483628 | 644.57 | 9.00 | 653.57 |
| 4 | 41.497895 | -91.485624 | 643.83 | 9.00 | 652.83 |

**Name**: 105
**Footprint area**: 3.4 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497911 | -91.486686 | 641.09 | 9.00 | 650.09 |
| 2 | 41.497895 | -91.485002 | 644.80 | 9.00 | 653.80 |
| 3 | 41.496778 | -91.484980 | 648.00 | 9.00 | 657.00 |
| 4 | 41.496762 | -91.485924 | 641.17 | 9.00 | 650.17 |
| 5 | 41.497373 | -91.485924 | 644.88 | 9.00 | 653.88 |
| 6 | 41.497373 | -91.486697 | 639.95 | 9.00 | 648.95 |

**Name**: 106
**Footprint area**: 3.5 acres
**Axis tracking**: Single-axis rotation
**Backtracking**: Shade-slope
**Tracking axis orientation**: 180.0 deg
**Maximum tracking angle**: 60.0 deg
**Resting angle**: 60.0 deg
**Ground Coverage Ratio**: 0.5

**Rated power**: -
**Panel material**: Smooth glass with AR coating
**Vary reflectivity with sun position?** Yes
**Correlate slope error with surface type?** Yes
**Slope error**: 8.43 mrad


| Vertex | Latitude | Longitude | Ground elevation | Height above ground | Total elevation |
|---|---|---|---|---|---|
| | deg | deg | ft | ft | ft |
| 1 | 41.497887 | -91.485012 | 644.75 | 9.00 | 653.76 |
| 2 | 41.497895 | -91.483618 | 644.61 | 9.00 | 653.61 |
| 3 | 41.496770 | -91.483628 | 644.83 | 9.00 | 653.83 |
| 4 | 41.496778 | -91.484991 | 648.08 | 9.00 | 657.08 |

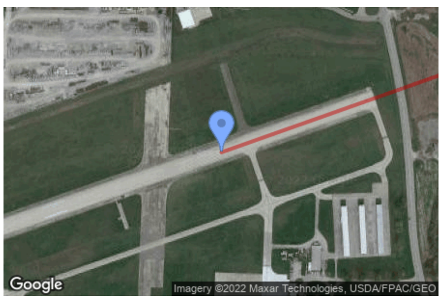
## 2-Mile Flight Path Receptor(s)

**Name**: Iowa City Municipal Airport Runway 12
**Description**:
**Threshold height** : 50 ft
**Direction**: 124.9 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641881 | -91.552672 | 658.27 | 50.00 | 708.27 |
| 2-mile point | 41.658402 | -91.584459 | 734.65 | 527.08 | 1261.73 |


**Name**: Iowa City Municipal Airport Runway 25
**Description**:
**Threshold height** : 50 ft
**Direction**: 250.5 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.641981 | -91.543386 | 651.95 | 50.00 | 701.95 |
| 2-mile point | 41.651642 | -91.506878 | 688.37 | 567.03 | 1255.41 |




**Name**: Iowa City Municipal Airport Runway 30
**Description**:
**Threshold height** : 50 ft
**Direction**: 301.1 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

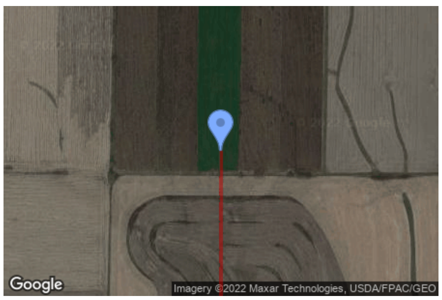
| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.635859 | -91.541074 | 645.76 | 50.00 | 695.76 |
| 2-mile point | 41.620912 | -91.507921 | 654.79 | 594.42 | 1249.22 |

**Name**: Iowa City Municipal Airport Runway 7
**Description**:
**Threshold height** : 50 ft
**Direction**: 70.7 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.638252 | -91.557687 | 679.31 | 50.00 | 729.31 |
| 2-mile point | 41.628682 | -91.594236 | 777.41 | 505.36 | 1282.76 |


**Name**: Iowa City VORTAC Northbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 0.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.514682 | -91.615792 | 755.02 | 50.00 | 805.02 |
| 2-mile point | 41.485769 | -91.615792 | 689.57 | 668.91 | 1358.48 |




**Name**: Iowa City VORTAC Southbound
**Description**:
**Threshold height** : 50 ft
**Direction**: 180.0 deg
**Glide slope**: 3.0 deg
**Pilot view restricted?** Yes
**Vertical view restriction**: 30.0 deg
**Azimuthal view restriction**: 50.0 deg

| Point | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| Threshold | 41.521398 | -91.615792 | 759.29 | 50.00 | 809.29 |
| 2-mile point | 41.550310 | -91.615792 | 746.13 | 616.62 | 1362.75 |

## Route Receptor(s)

**Name**: Route 22
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.496439 | -91.493315 | 645.65 | 9.00 | 654.65 |
| 2 | 41.496447 | -91.490311 | 645.49 | 9.00 | 654.49 |
| 3 | 41.496463 | -91.486846 | 645.02 | 9.00 | 654.02 |
| 4 | 41.496459 | -91.477801 | 652.83 | 9.00 | 661.83 |
| 5 | 41.496471 | -91.473263 | 650.93 | 9.00 | 659.93 |

**Name**: Sioux Avenue Southeast
**Route type** Two-way
**View angle**: 50.0 deg


| Vertex | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total elevation<br>ft |
|---|---|---|---|---|---|
| 1 | 41.504006 | -91.483348 | 653.02 | 9.00 | 662.02 |
| 2 | 41.502052 | -91.483383 | 638.86 | 9.00 | 647.86 |
| 3 | 41.499975 | -91.483420 | 653.91 | 9.00 | 662.91 |
| 4 | 41.497781 | -91.483445 | 645.65 | 9.00 | 654.65 |
| 5 | 41.495169 | -91.483477 | 646.31 | 9.00 | 655.31 |
| 6 | 41.493024 | -91.483488 | 649.06 | 9.00 | 658.06 |

## Discrete Observation Receptors

| Number | Latitude<br>deg | Longitude<br>deg | Ground elevation<br>ft | Height above ground<br>ft | Total Elevation<br>ft |
|---|---|---|---|---|---|
| OP 1 | 41.500190 | -91.482968 | 659.51 | 16.00 | 675.51 |
| OP 2 | 41.495973 | -91.490753 | 649.49 | 16.00 | 665.49 |
| OP 3 | 41.492142 | -91.495540 | 651.72 | 16.00 | 667.72 |
| OP 4 | 41.492636 | -91.496554 | 647.79 | 16.00 | 663.79 |
| OP 5 | 41.491784 | -91.496656 | 660.04 | 16.00 | 676.04 |
| OP 6 | 41.498026 | -91.474356 | 657.90 | 16.00 | 673.90 |

## Summary of PV Glare Analysis

*PV configuration and total predicted glare*

| PV Name | Tilt<br>deg | Orientation<br>deg | "Green" Glare<br>min | "Yellow" Glare<br>min | Energy Produced<br>kWh | Data File |
|---|---|---|---|---|---|---|
| 101 | SA tracking | SA tracking | 0 | 0 | - | |
| 102 | SA tracking | SA tracking | 0 | 0 | - | |
| 103 | SA tracking | SA tracking | 0 | 0 | - | |
| 104 | SA tracking | SA tracking | 0 | 0 | - | |
| 105 | SA tracking | SA tracking | 0 | 0 | - | |
| 106 | SA tracking | SA tracking | 0 | 0 | - | |

## PV & Receptor Analysis Results

*Results for each PV array and receptor*

### 101 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

### 102 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 103 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 104 no glare found

| Component | Green glare (min) | Yellow glare (min) |
| --- | --- | --- |
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 105 no glare found

| Component | Green glare (min) | Yellow glare (min) |
| --- | --- | --- |
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## 106 no glare found

| Component | Green glare (min) | Yellow glare (min) |
|---|---|---|
| FP: Iowa City Municipal Airport Runway 12 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 25 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 30 | 0 | 0 |
| FP: Iowa City Municipal Airport Runway 7 | 0 | 0 |
| FP: Iowa City VORTAC Northbound | 0 | 0 |
| FP: Iowa City VORTAC Southbound | 0 | 0 |
| OP: OP 1 | 0 | 0 |
| OP: OP 2 | 0 | 0 |
| OP: OP 3 | 0 | 0 |
| OP: OP 4 | 0 | 0 |
| OP: OP 5 | 0 | 0 |
| OP: OP 6 | 0 | 0 |
| Route: Route 22 | 0 | 0 |
| Route: Sioux Avenue Southeast | 0 | 0 |

*No glare found*

## Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, no discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

**Attachment G:**
**Operations and Maintenance Plan**

# Operations and Maintenance Plan

PCR Energy Solar Projects
Iowa and Illinois

August 12, 2022

Prepared for:

PCR Energy
1334 Brittmoore Rd. Suite 1327
Houston, TX 77043

Prepared by:

Stantec Consulting Services Inc.
2300 Swan Lake Boulevard, Suite 202
Independence, IA 50644

## Table of Contents



**LIST OF TABLES**



**LIST OF APPENDICES**

# 1.0 INTRODUCTION

This Operations and Maintenance Plan (O&M Plan) is prepared for PCR Energy for the PCR Energy Solar Projects (Projects) in Iowa and Illinois. This O&M Plan describes soil erosion and sediment controls, ground cover and buffer areas, and general procedures for operation and maintenance of the facilities, including maintaining safe access and ongoing maintenance and repair.

The main text of this O&M Plan applies generally to the Projects in Iowa and Illinois. The appendices include project-specific information that addresses the specific design and location of one of the projects. A project-specific preliminary layout is provided in Appendix A.

# 2.0 SOIL EROSION AND SEDIMENT CONTROL

The Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) established by the Clean Water Act provides the framework of requirements for compliance to discharge stormwater from a construction site. Because the Projects will disturb more than 1 acre of land during construction, the Projects are required to have construction site stormwater runoff permit coverage.

For sites in Iowa, prior to construction, PCR or its contractors will prepare and submit a Notice of Intent (NOI) application to Iowa Department of Natural Resources (DNR) for coverage of construction site stormwater runoff under a NPDES General Permit No. 2, per Iowa requirements. The submittal will include a copy of the completed NOI application and a project-specific Stormwater Pollution Prevention Plan (SWPPP).

For sites in Illinois, prior to construction, PCR or its contractors will prepare and submit an NOI application for coverage of construction site stormwater runoff under the General NPDES Permit No. ILR10, per Illinois requirements. Applications must be filed with Illinois Environmental Protection Agency (IEPA). The submittal will include a copy of the completed NOI application and a project-specific SWPPP.

The SWPPP is for implementation by PCR or its contractors (specifically, the person or persons with either operational control of construction project plans and specifications, or day-to-day operational control of activities necessary to ensure compliance with storm water NPDES permit conditions) during all roadwork and site development work. The SWPPP describes how erosion and sedimentation on a project site will be managed to minimize sediment discharge offsite or to a water of the state. The SWPPP also addresses management of potential pollutant-generating activities during construction, such as refueling. The SWPPP will also address post-construction land use. The SWPPP will be prepared closer to the start of construction, to reflect final project design and once project disturbance limits are known for each project. Once prepared, the project-specific SWPPP will be added to Appendix B of this O&M Plan.

# 3.0 VEGETATION MANAGEMENT PLAN

The ground around and under the solar arrays and in the border areas within each the project fence line will be planted and maintained in perennial vegetated ground cover. A project-specific vegetation management plan has been prepared and is attached in Appendix C.

Topsoil will not be removed from the project's property boundaries during development (unless part of a remediation effort). Perennial vegetation will be planted and maintained in a density sufficient to prevent erosion, manage runoff, and build soil. The seed mix and see density is described in the attached plan. Monitoring and maintenance practices also are described in the attached plan.

# 4.0 OPERATIONS AND MAINTENANCE

The Owner anticipates that its facilities will be staffed with full-time technicians and that, accordingly, physical site monitoring will occur on a regular, ongoing basis. Visual and planned maintenance of the solar arrays, balance of plant, and substation, combined with ad hoc troubleshooting of inverters, solar arrays, substation, and other components will ensure that technicians are aware of the physical conditions on a regular basis. The table below describes the standard operations, maintenance, and monitoring activities for the Projects (Table 1). Maintenance shall include, but not be limited to, painting, structural repairs, and integrity of security measures. Depending on facility needs and industry best practices for operations and maintenance, the scheduled services may change in both frequency and scope over the facility's expected life of at least 30 years. Any retrofit, replacement or refurbishment of equipment shall adhere to all applicable local, state and federal requirements.

**Table 1. Standard operations, maintenance, and monitoring activities for the PCR sites in Iowa and Illinois**

| Description | Frequency | Scope of Work |
|---|---|---|
| **Administration, Planned Maintenance, Safety, & Monitoring** | | |
| Remote Monitoring and Site Dispatch | Ongoing | Remotely monitor Project 24/7/365. To include remote monitoring of inverters and substation vitals, interaction with ISO and off-taker, coordinate with onsite personnel for onsite reactive maintenance work and troubleshooting per OEM guidelines. |
| | Ongoing | Real time analysis of asset performance and interaction with site crew to remediate observed underperformance. |
| | As needed | Remotely dispatch facility setpoints based on ISO and off-taker scheduled outages, unscheduled outages, and curtailment events. Quantify impact of outages and events. |
| Facility Performance and Administrative Reporting | Monthly | Generate reports inclusive of site generation, resource adjusted generation, inverter and outage events, performance ratio calculations, warranty administration progress, NERC related events (if applicable), and balance of plant status (including vegetation, security, roads, fencing). |
| | As needed | Implement a Performance Analytics program to monitor and report any observed underperformance in real time or in a recurring report format. Assess soiling rates, DC health, inverter availability and efficiency, and other key metrics associated with site performance. |
| | Daily | Integrate facility with CMMS system to track and manage all site activities related to equipment maintenance. |
| | As needed | Implement a software system to manage equipment inventory inclusive of spare parts inventory, major equipment inventory (padmounts, substation equipment), inclusive of semi-annual inventory audits. |
| Site Management and Personnel | Ongoing | Site to be staffed with technicians to complete visual inspections, planned maintenance, and support reactive maintenance on an as-needed basis. |
| | As needed | Provide vehicles, safety equipment and tooling to onsite personnel. |
| General Operations | Per Manufacturer specifications and O&M Manual | Recurring inspections of facility and facility site, including the substation, breakers, padmount transformers, GSUs, capacitor banks (if applicable), all switches, SCADA System, electrical infrastructure, the modules, inverters, and trackers. |

| Description | Frequency | Scope of Work |
|---|---|---|
| | Per Manufacturer specifications and O&M Manual | Planned maintenance shall include racking system inspections, junction box, combiner box, perimeter fencing, roads, pest control, and erosion. |
| | Per Manufacturer specifications | Inspect and test all safety equipment |
| | Monthly; As needed | Monitor, troubleshoot, and review communications equipment, weather equipment and site control equipment. |
| | As needed | Manage, review, and contract Subcontractor work, completion and warranty administration, coordinate and oversee all scheduled outages and Subcontractor interventions onsite |
| | As needed | Paint operations and maintenance building. |
| | Ongoing | Compliance with Applicable Law. |
| Warranty Administration | As needed | Identify, assess, document, and submit warranty claims with O&M. |
| Road Maintenance | As needed | Repair roads to remediate excessive erosion, washout, and other damage. |
| Safety | Ongoing | Prepare and enforce a safety program, to include relevant signage, safety attire, and site security. |
| | Periodic; Per Manufacturer specifications | Perform periodic site audits and inspect safety equipment. |
| Administrative Responsibilities | As needed | Prepare and complete filings related to NERC, ISOs, off-takers, local/state/federal permits, insurance, wildlife and environmental, and any other compliance related items. |
| **Preventative Maintenance and Balance of Plant[1]** | | |
| Vegetation Management | As needed | Comply with the vegetation management plan outlining the expected frequency of mowing and spraying, and consistent with site safety procedures. |
| Miscellaneous Balance of Plant Work | As needed | Coordinate and review of facility cleanliness. |
| | As needed | Coordinate and contract road repairs and grading as a result of site activities or weather. Maintain safe site access. |
| | As needed | Maintain internal and perimeter erosion control measures to ensure compliance with the project-specific SWPPP. |

Key:
CMMS = computerized maintenance management system
DC = direct current
SWPPP = Stormwater Pollution Prevention Plan
GSU = generator step-up transformers
ISO = independent system operator
NERC = North American Electric Reliability Corporation
OEM = original equipment manufacturer
O&M = operations and maintenance
SCADA = supervisory control and data acquisition

Note:
[1] These items shall be performed according to O&M equipment manuals. Operator shall develop an O&M manual with recurring preventative maintenance activities. The O&M manual frequency of inspections and revisions will be at least as frequent as the O&M equipment manual requirements and include additional supplemental information.

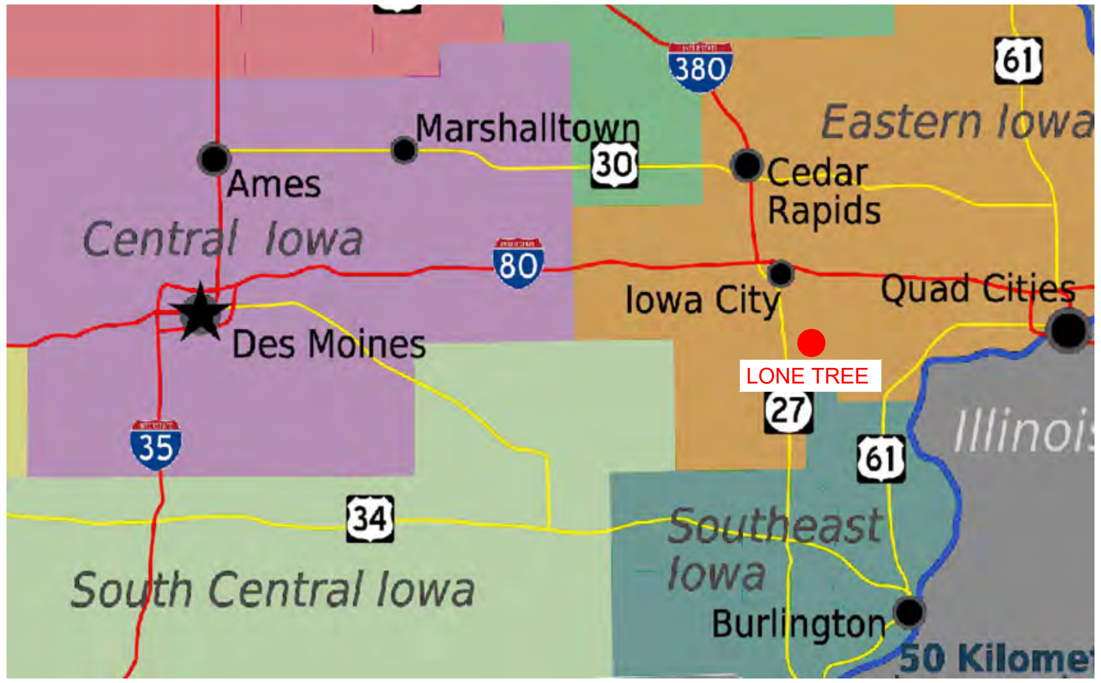
# Appendix A PRELIMINARY SITE LAYOUT

# LONE TREE PROJECT

# Lone Tree, IOWA

# SITE PLAN

| Lone Tree Solar Project | | | | |
|---|---|---|---|---|
| MW ac | MW dc | ratio | MWh/y | Acres |
| 7,50 | 8,97 | 1,20 | 15338 | 50 |




| Contact Information | | | |
|---|---|---|---|
| Mariano Brandi | CEO | mbrandi@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |
| Cynthia Schuchner | Chief Construction and Engineering Officer | cschuchner@pcr.energy | PCR US Houston Office (832) 955 1979 – 1334 Brittmoore Rd, Suit 2407 Houston, TX 77043 – www.pcr.energy/en |

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| 04 | | |
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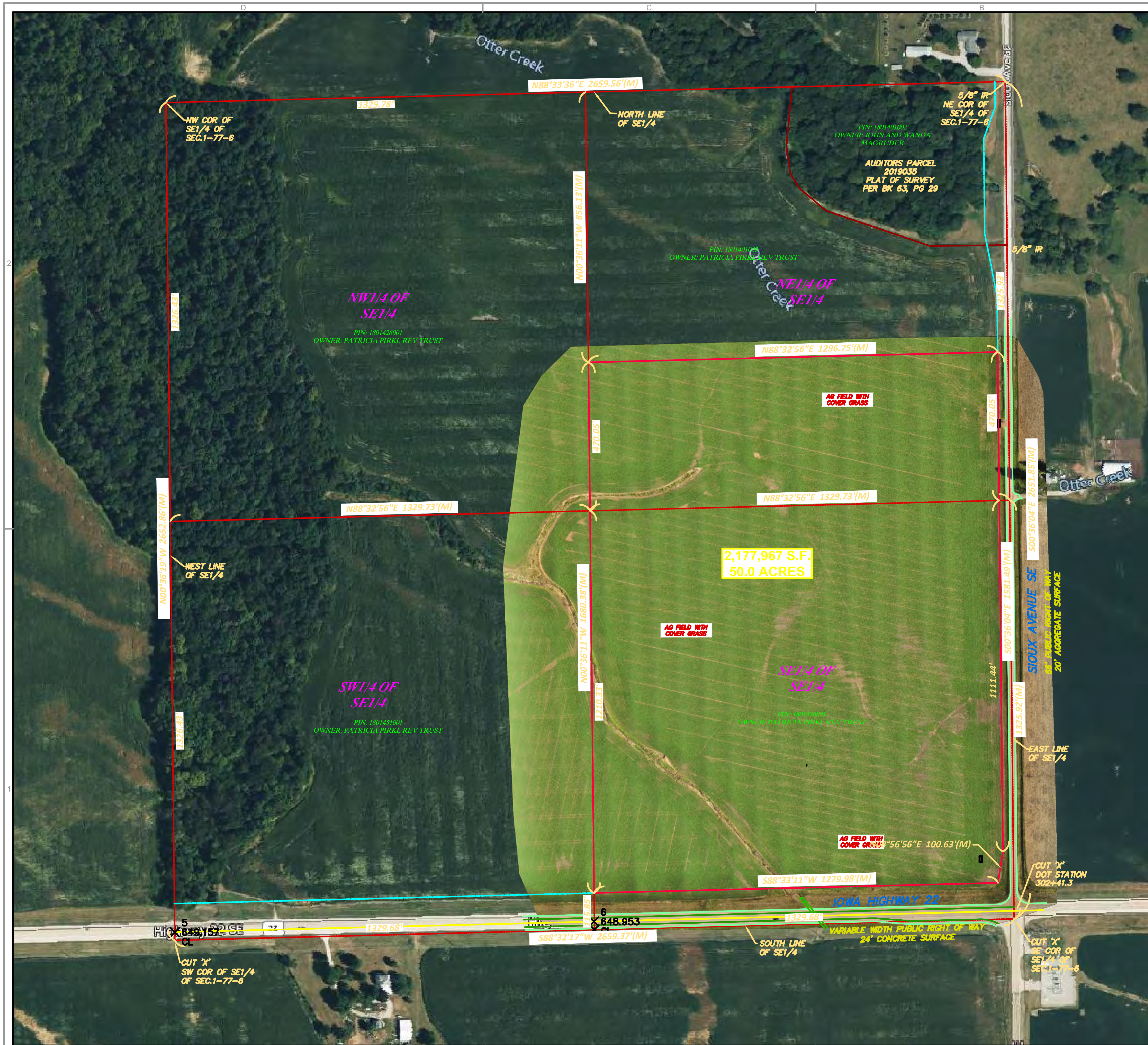
| 00 | 03/09/23 | Preliminary |

REVISIONS

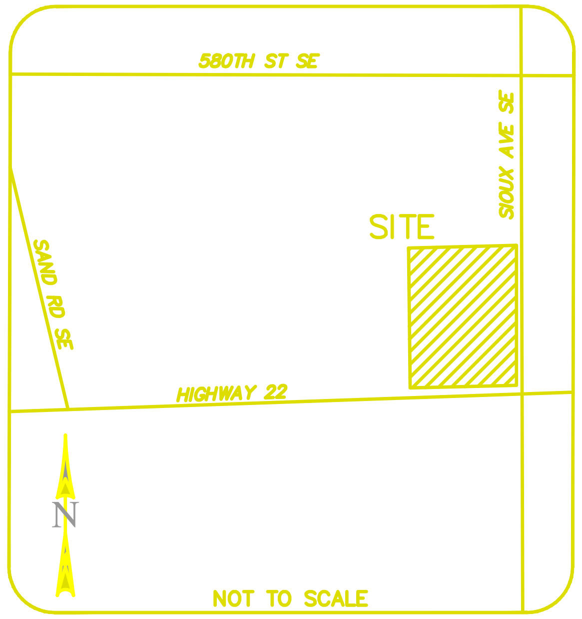
PCR

| | |
|---|---|
| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Sheet: | 01/08 |
| Utility: | CIPCO |
| Scale | |
| Rev: | |
| File: | Site Plan Lone Tree.dwg |




# BOUNDARY SURVEY

PART OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER AND PART OF THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 1, TOWNSHIP 77, RANGE 6 EAST, ALL IN JOHNSON COUNTY, IOWA.




VICINITY MAP

| | |
|---|---|
| | PROPERTY LINE |
| | ADJACENT PROPERTY LINE |
| | RIGHT OF WAY LINE |
| | SURVEY TIE LINE |
| | CONTOURS |
| | STORM DRAIN LINE |
| | FOUND MONUMENT (AS NOTED) |
| | FLARED END SECTION |
| | TELEPHONE PEDESTAL |
| IR | IRON ROD |
| (M&R) | MEASURED & RECORD |
| S.F. | SQUARE FEET |
| BC | BACK OF CURB |

## BASIS OF BEARINGS

THE SOUTH LINE OF THE SOUTHEAST QUARTER; ASSUMED BEARING S88°32'17"W PER STATE PLANE IOWA SOUTH

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REVISIONS

PCR

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|---|---|
| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |
| Sheet: | 02/08 |
| Scale: | |
| Rev: | |


| POINT | LAT | LONG |
|---|---|---|
| A | 41.49670229 | -91.48829677 |
| B | 41.49670967 | -91.48362429 |
| C | 41.49698140 | -91.48355875 |
| D | 41.50132142 | -91.48348547 |
| E | 41.50131371 | -91.48821947 |

Property Boundary (aprox. 50ac)

1V54 Tracker(1)

Fence

MV Underground Cable 12.47 kV

Wetlands

Internal Roads

| | |
|---|---|
| **SOLAR PANEL** | |
| Brand | ZNshine Solar |
| Model | ZXM7-SHLDD-144-550 |
| Power | 550 Wp - Bifacial |
| Dimensions (W x L x D) | 1134 x 2278 x 30 mm |
| **INVERTER** | |
| Brand | SMA |
| Model | Sunny Highpower SHP125-US-20-PEAK3 |
| Power | 125 kW |
| Output Voltage | 480 V |
| **LV Cables (INV - TR)** | |
| Model | EXZHELLENT COMPACT 1000V Prysmian |
| Type | 0,6/1, 1kV Cu 3x2/0AWG XLPE |
| Section | 2/0 AWG |
| Rate Current | 167 A |
| R | 0,16 ohm/km |
| V/A km | 0.34 |
| **MV Cables (TR - SW)** | |
| Type(2) | 12.5 kV Al 3x1x250MCM XLPE |
| Section(2) | 250 MCM |
| Rate Current MVS 1\|2\|3 | 120\|240\|360 A |
| R | 0,568 ohm/km |
| X | 0,194 ohm/km |
| B | 0,156 mF/km |
| Length MV 1\|2\|3 | 267\|596\|950 ft |
| **COMPONENTS** | |
| Total Inverters | 62 |
| Total Trackers 1V54 | 302 |
| Total Modules | 16308 |

NOTES:
1. Tracker configuration is 1 portrait by 54 modules length
2. MV underground cable gauge TBD
3. Dimensions shown are approximate and may change based on final equipment selections
4. TBD if outdoor or indoor solution

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|---|---|---|---|
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 03/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |


Boundaries Lone Tree CIPCO

| MV Cables (Interconnection) | |
|---|---|
| Type(2) | 12.5kV Al 3x2x250MCM XLPE |
| Section(2) | 250 MCM |
| Rate Current | 480 A |
| R | 0,211 ohm/km |
| X | 0,175 ohm/km |
| B | 0,212 mF/km |
| Length | 0.1 miles |
| **Power Factor @POI** | **95%** |

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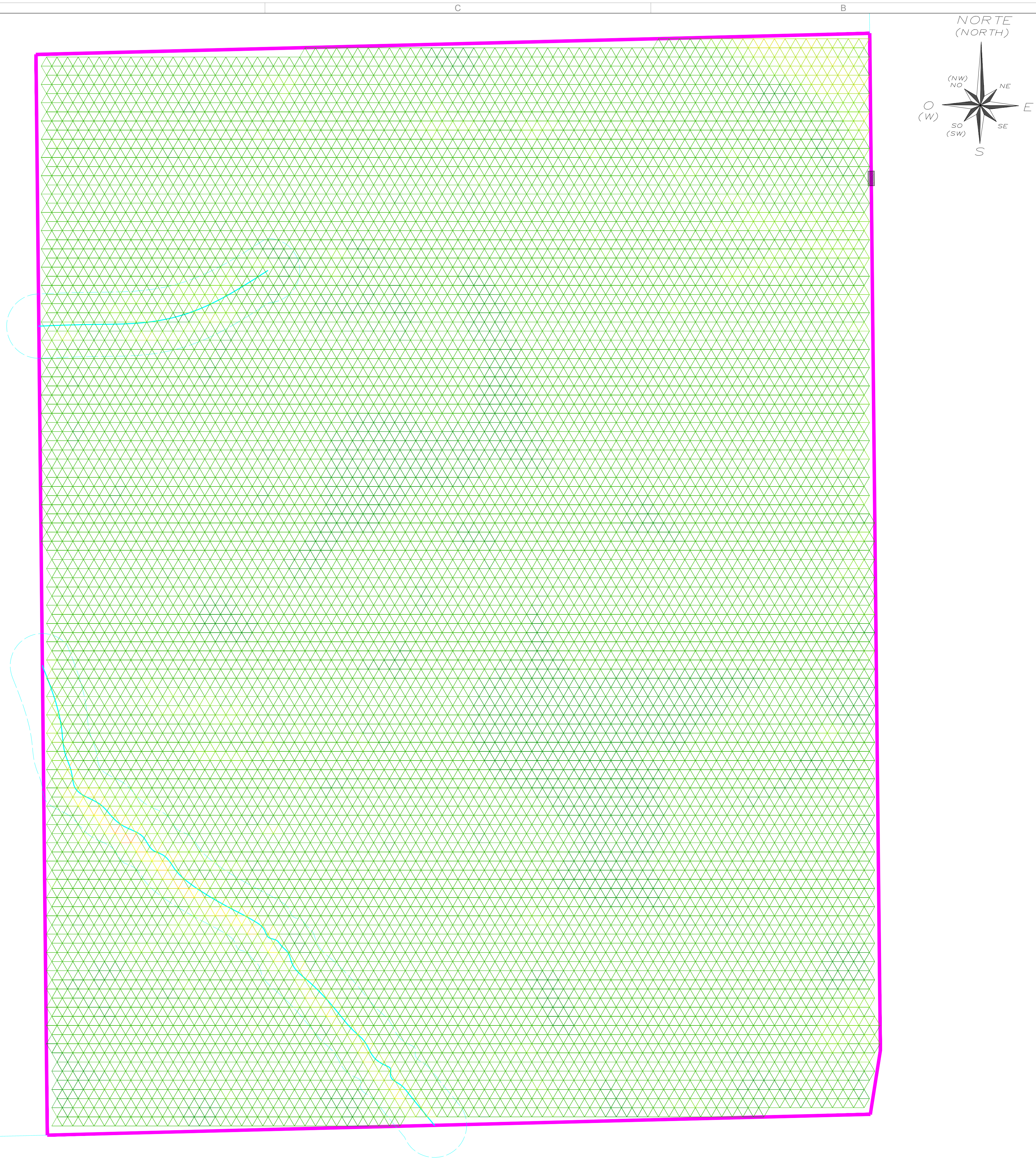
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |
| Sheet: | 04/08 |
| Scale | |
| Rev: | |




| Angle min., ° | Angle max., ° | Distribution, % | Color |
|---|---|---|---|
| 0.00 | 0.00 | 10.31 | |
| 0.00 | 1.75 | 84.08 | |
| 1.75 | 3.50 | 4.14 | |
| 3.50 | 5.25 | 0.99 | |
| 5.25 | 7.00 | 0.30 | |
| 7.00 | 8.75 | 0.11 | |
| 8.75 | 10.50 | 0.06 | |
| 10.50 | 12.25 | 0.02 | |
| 12.25 | 14.00 | 0.00 | |
| 14.00 | 55.00 | 0.00 | |

| | |
|---|---|
| GCR | 21.85% |
| PITCH | 21.5 ft |

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| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |

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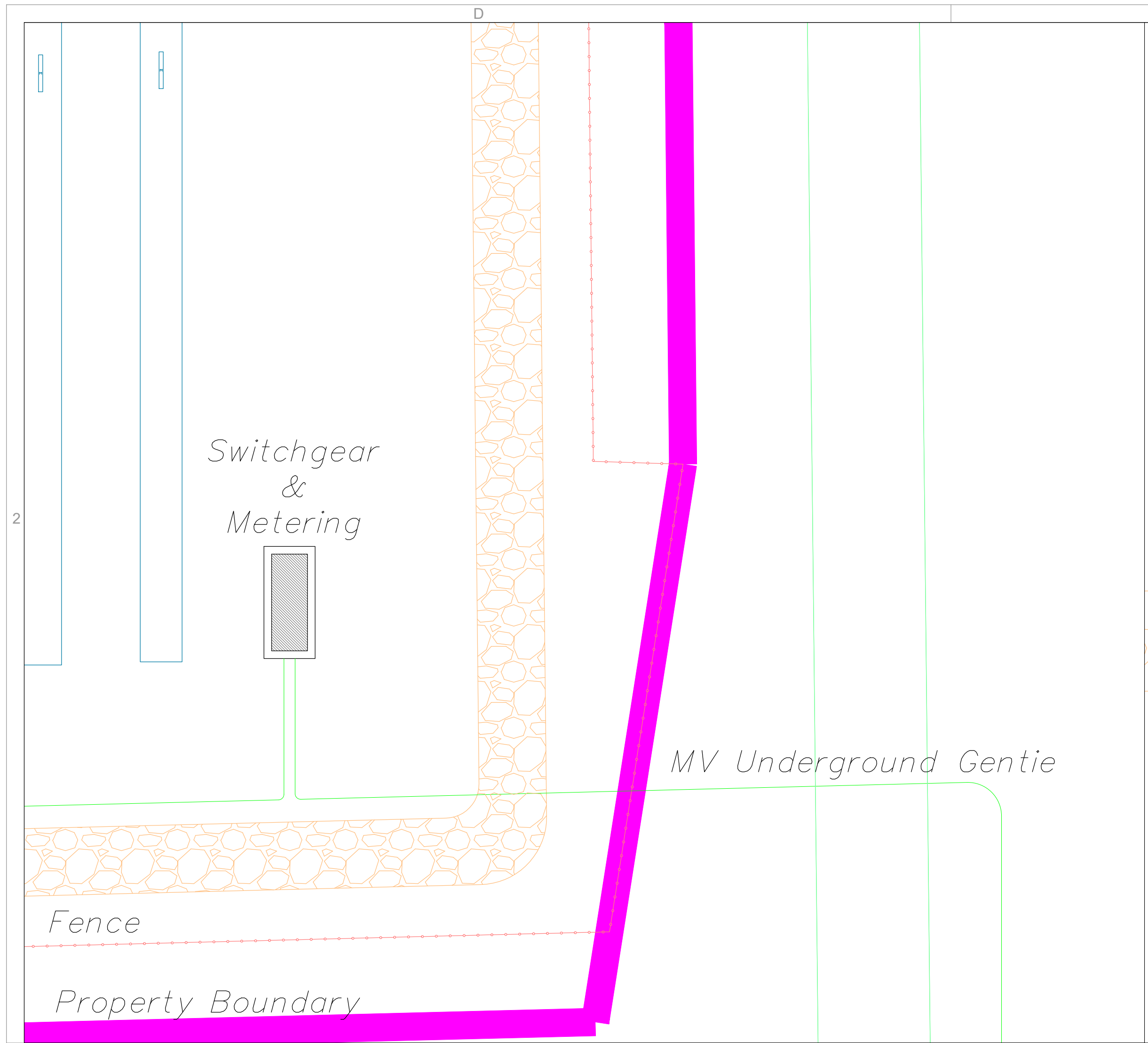
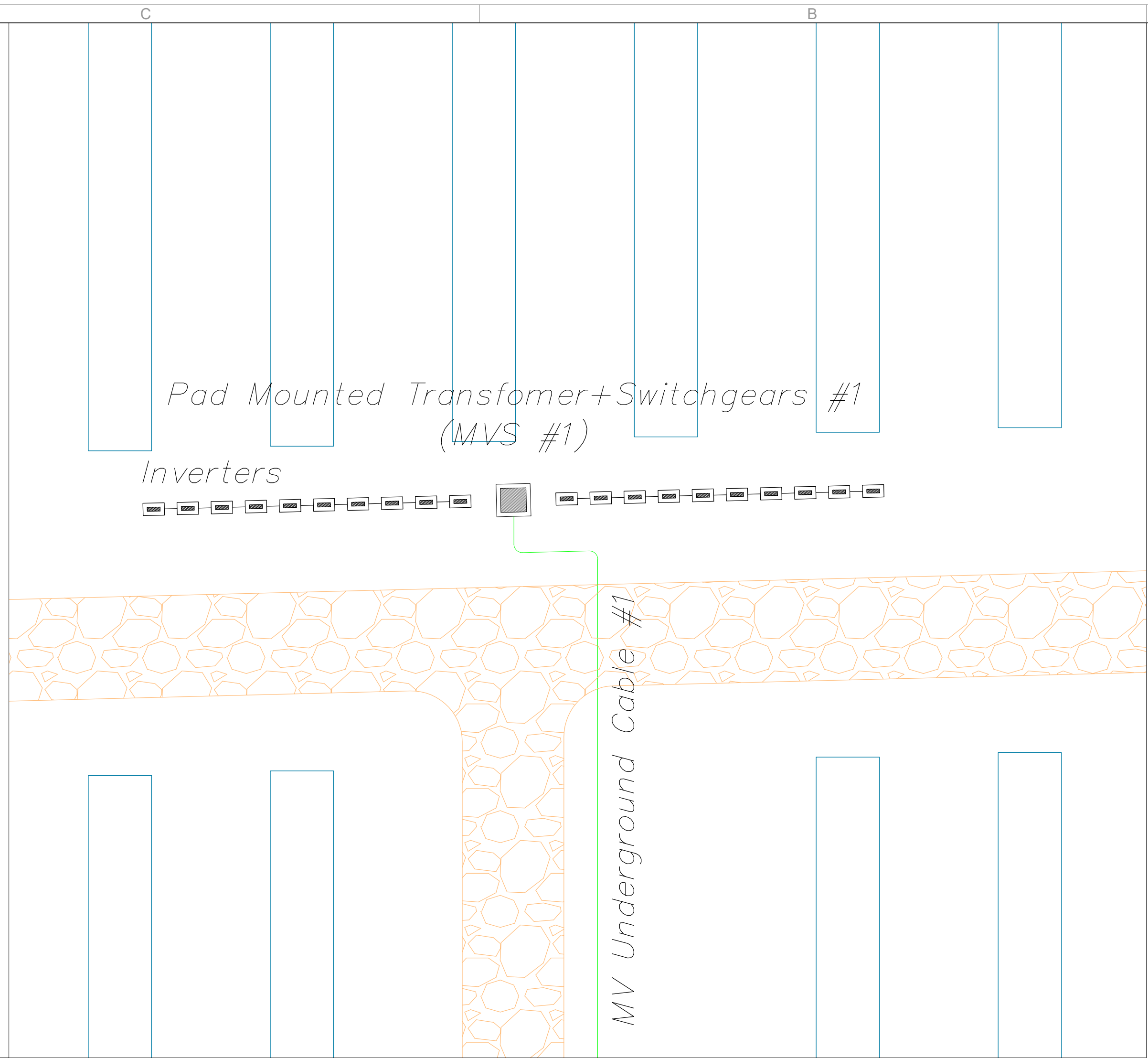
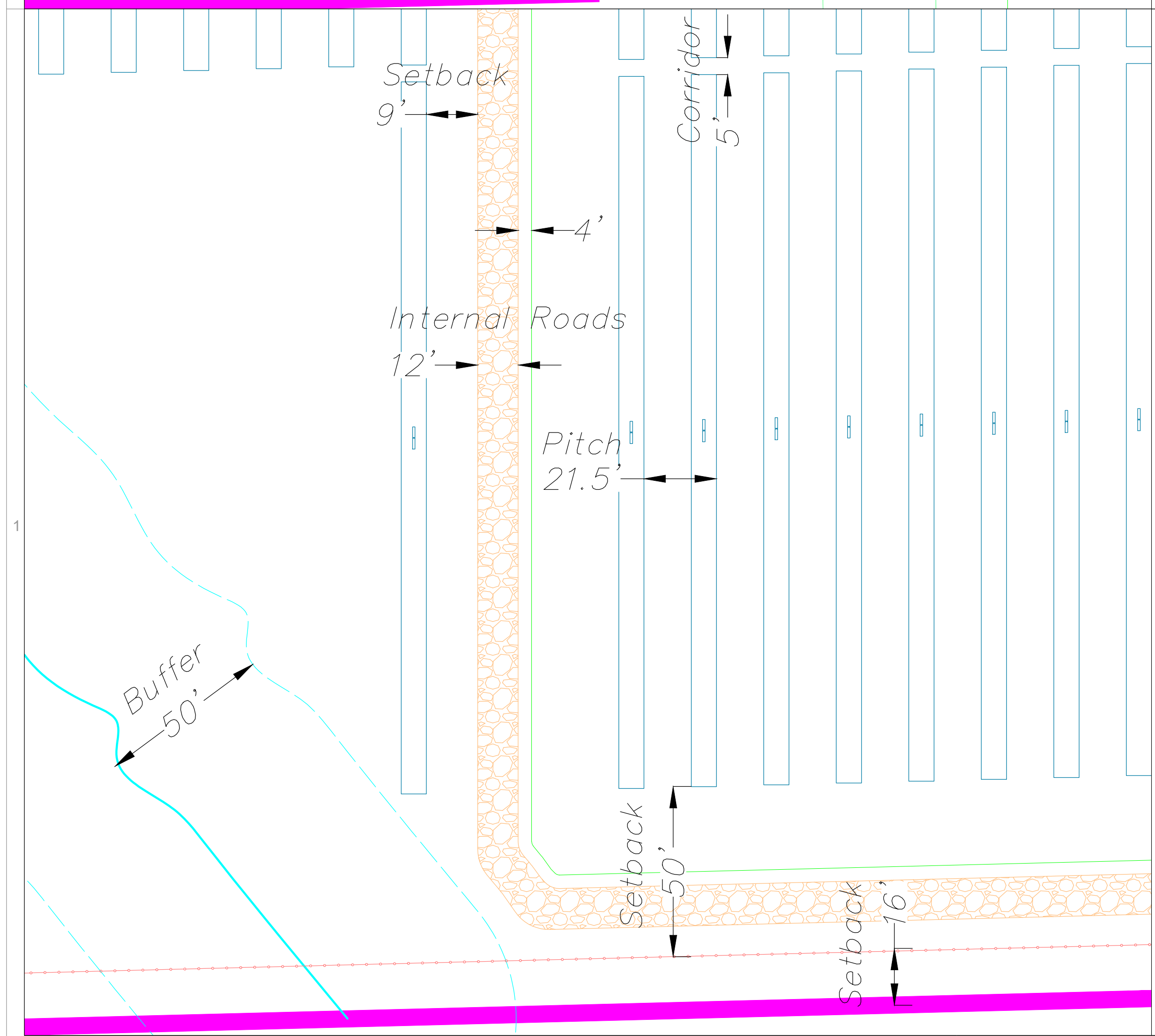
Rev:

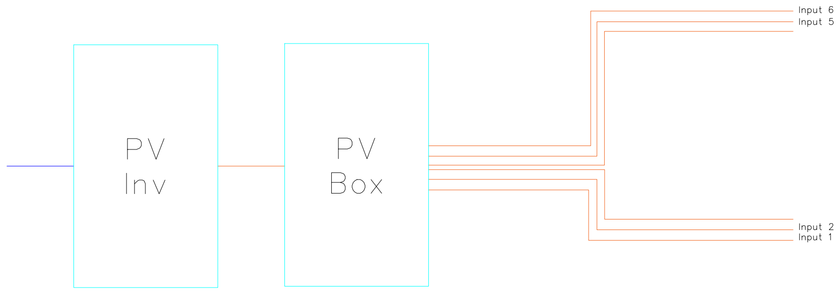



| Voltage | |
|---|---|
| | AC 0,48kV |
| | DC 1500V |

| Inverter | |
|---|---|
| MPPT conected | 1 |
| Strings conected | 10 |
| Modules/String | 27 |
| Strings/Tracker | 2 |




NOTES:

1. A BLA Harness design for the DC cabling may modify the need of installing PV Boxes

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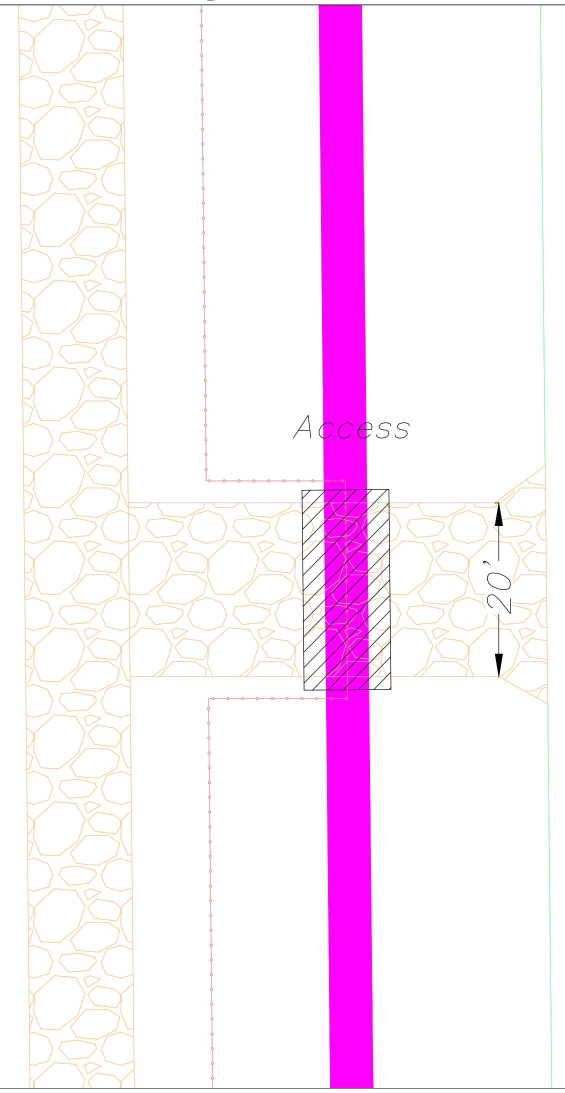
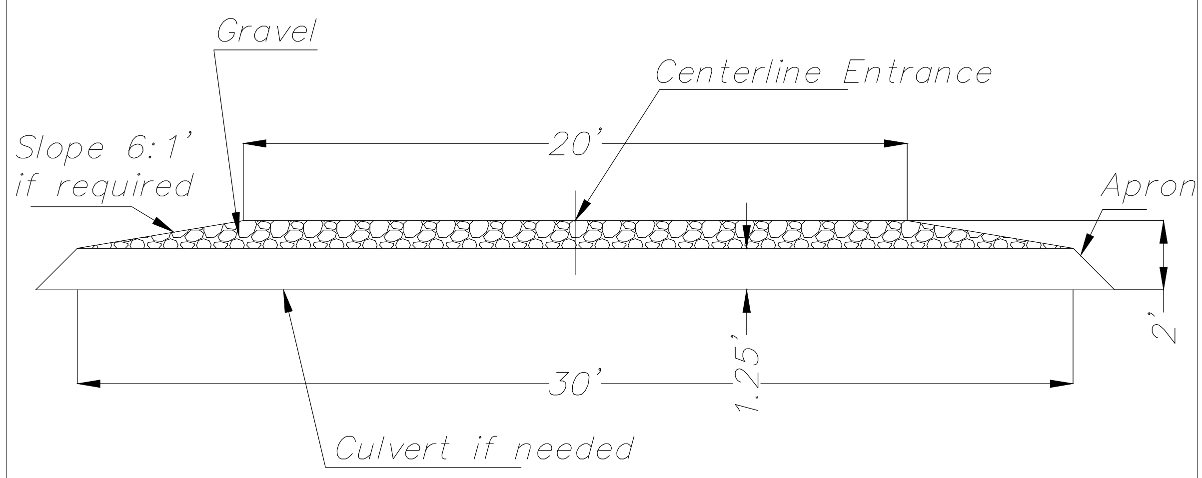
| Project: | LONE TREE | | |
| Sector: | JOHNSON, IOWA, USA | | |
| Owner: | PCR INVESTMENTS SP2 LLC | | |
| Title: | SITE PLAN | Sheet: | 06/08 |
| Utility: | CIPCO | Scale | Rev: |
| File: | Site Plan Lone Tree.dwg | | |




## DETAIL - ACCESS FRONT VIEW




NOTES:

1. Heavy Loads:
   * MVS ~ 10 tn
   * 40 ft PV Container ~ 7 tn

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| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
| Utility: | CIPCO |
| File: | Site Plan Lone Tree.dwg |
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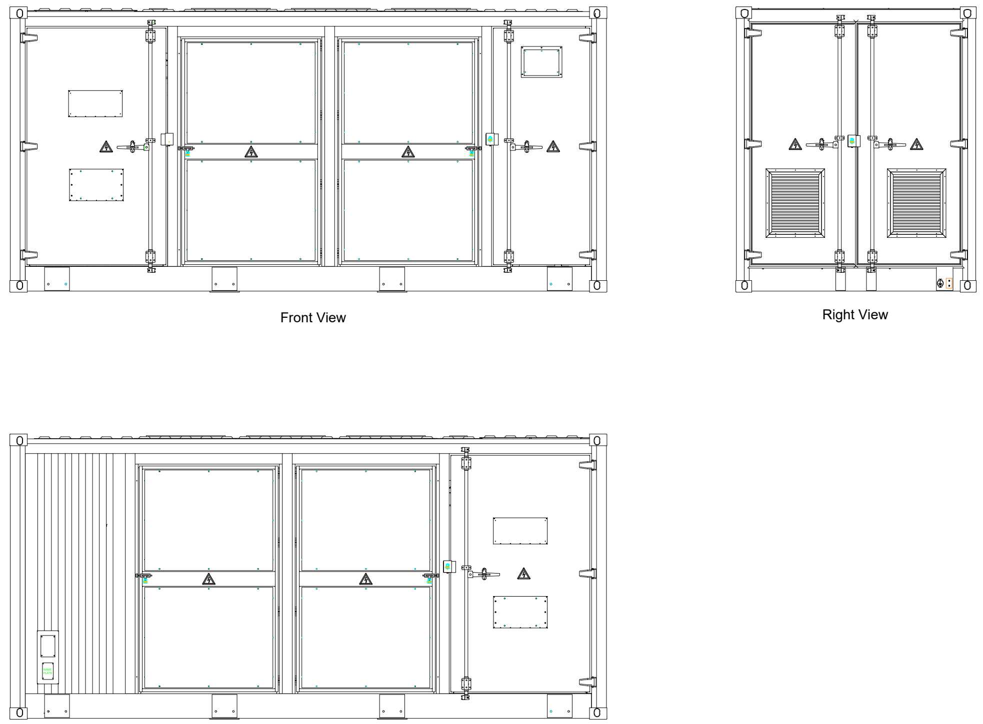
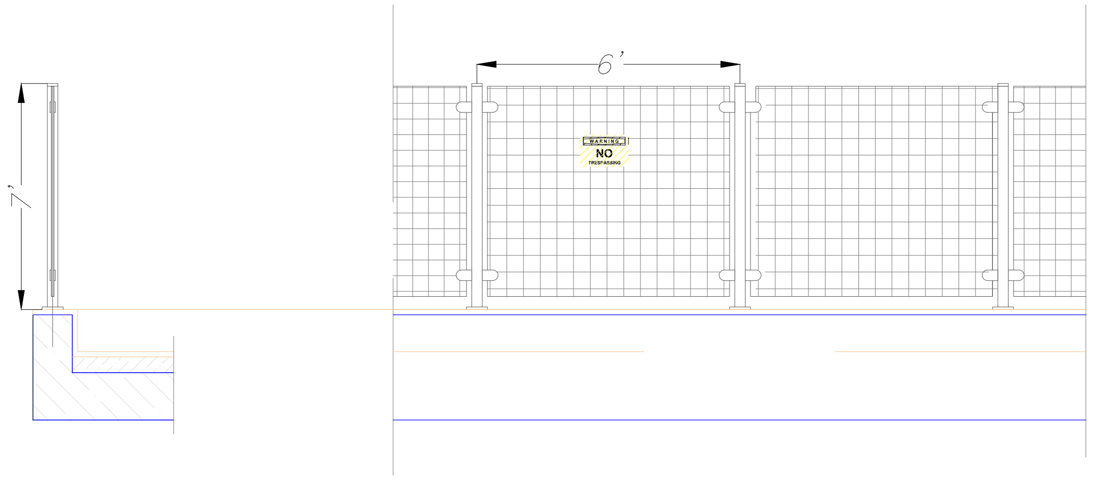
| Scale | |
| Rev: | |

# SW & METERING ROOM[1]

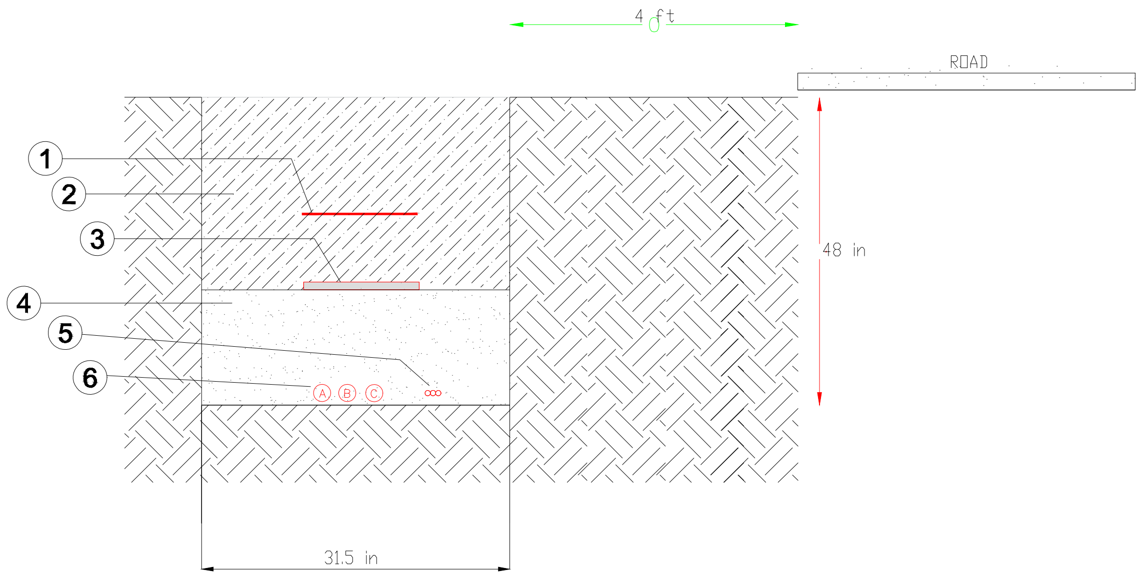



# SITE BOUNDARY FENCE



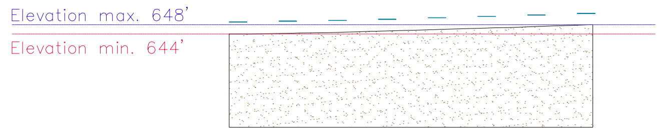

NOTES:
1. 20 ft container solution for indoor option, pad mounted for outdoor alternative
2. Fence warning signs spaced 66 ft
3. Wire opening size TBD
4. All lighting will comply with downcast lighting standards, and all signage will comply with the County's sign standards

DETAIL UNDERGROUND MV CABLE

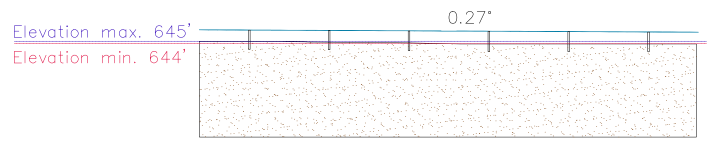



1. Warning sign
2. Filled with excavated land
3. Protection plate
4. Filled with excavated land
5. Tritube (FO)
6. MV 12.47kV Al 3x2x250MCM XLPE

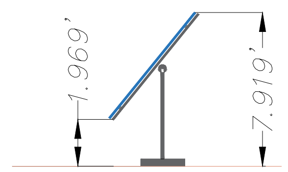
CROSS SECTION VIEW (e.g.)



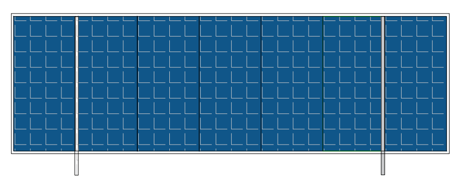

FRONT VIEW (e.g.)




Frame parameters
- Framing type: single-axis trackers
- Module orientation: portrait
- Rows: 1
- Columns: 54
- Turning angle range, °: 52.00
- Horizontal gap between modules, ft: 0.066
- Vertical gap between modules, ft: 0.066
- Motor gap size, ft: 6.562
- Number of joint gaps : 0
- Joint gap size, ft: 1.640
- Overhang left, ft: 0.000
- Overhang right, ft: 0.000
- Pole reveal, ft: 4.914
- Reference height, ft: 1.969
- Frame height at highest point, ft: 7.919
- Frame power, kWp: 29.700




SINGLE AXIS N-S



TRACKER 1-PORTRAIT 54 MODULES

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| Project: | LONE TREE |
| Sector: | JOHNSON, IOWA, USA |
| Owner: | PCR INVESTMENTS SP2 LLC |
| Title: | SITE PLAN |
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Scale

Rev:

# Appendix B STORMWATER POLLUTION PREVENTION PLAN

# Appendix C VEGETATION MANAGEMENT PLAN

# LONE TREE SOLAR

## Emergency Response Plan

Lone Tree Solar
Johnson County, Iowa

**Facility Operator:**
PCR Investments SP2, LLC
1334 Brittmoore Rd, Suite 1327
Houston, TX 77043

## January 2023

## Contents



## Tables



## Figures

## 1.0 Purpose

The Lone Tree Solar (Project) Emergency Response Plan (ERP) describes actions to ensure the safety of Project employees, emergency service members serving the Project, and the surrounding community in the event of an emergency.

## 2.0 General Facility Information

This ERP provides emergency personnel contact information and outlines procedures to prevent, mitigate, and effectively respond to an incident should one arise at the Project.

The Project is a 10-megawatt (MW) ground-mounted solar energy facility located 1.6 miles east of the town of Riverside along Highway 22 in Johnson County, Iowa. The Project is owned and operated by PCR Investments SP 2, LLC (Applicant), a wholly owned subsidiary of PCR Us Investments Corporation (PCR) located in Houston, Texas. PCR is committed to establishing and promoting a safety culture. PCR's historic safety record is a testament to the effectiveness of the safety policy and subsequent standard operational procedures established at each and every facility/project. The Applicant will effectively implement similar practices to ensure that safety and security risks remain minimal during construction and operation.

The Project consists of privately-owned parcels under lease agreement with the Applicant. The Project consists of approximately 20,500 photovoltaic (PV) panels oriented in linear rows spaced approximately 21 feet apart. Panels are connected by electrical cables hung on the underside of the panels or buried underground. "Blocks" of panels are connected to an inverter. There are 64 inverters overall that convert direct current (DC) electricity to alternating current (AC). The AC power is then routed via 12.5-kilovolt (kV) collector lines to the Project collection substation. Gravel roads are constructed throughout the Project to facilitate access for maintenance and repair. A Project overview is provided in Figure 1.

Lone Tree Solar will be monitored remotely via a Supervisory Control and Data Acquisition System (SCADA) that is compliant with the necessary North American Electric Reliability Corporation's (NERC's) Critical Infrastructure Protection (CIP) standards. All servers and firewalls are monitored 24 hours/day, 7 days/week by a Security Operations Center and all employees are required to complete training in information and security awareness. The Project will also have two to three individuals in the local area who will be accessing the site periodically for routine maintenance and to respond to any incidences that arise.

The Project panels are divided across 2 parcels. Panels can be accessed from the access road along Sioux Ave. SE (Figure 1). Each panel array area of the Project is enclosed by woven wire fencing with locking gates to ensure public safety. Gates are outfitted with a “Knox Box” type locking system to allow site access by emergency personnel. All gravel access roads have been designed to facilitate access throughout the Project. Roads are a minimum 14 feet wide and have occasional turnarounds with 35-foot radii to accommodate large truck movement (e.g., pumper or ladder type fire trucks). The 21-foot spacing between each row of panels can also provide access, if needed. In addition, there is a minimum 10-foot-wide clear path between the fence and panels to allow for additional vehicle access (e.g., pickup truck, all-terrain vehicle [ATV], etc.) throughout the site. Project Components, including fencing, inverters, energy storage system, access roads, and gates, are depicted in Figure 1.

## 2.1 Shutoff Procedures and Locations

Entry and shutdown of the Project should only be attempted at the direction of the Operator. In the event of an emergency requiring shutdown, power blocks within the solar arrays can be shut off by local personnel at each inverter. In an emergency, the ON/OFF switch on each inverter should be manually turned to the OFF position, shutting off both the AC and DC switches inside the inverter. After the system has been turned off, the DC Disconnect Switch should be turned off, and a lock should be placed on it to keep it from being re-energized. A schematic of these procedures will be displayed on each inverter.

Figure 1. General Layout of Lone Tree Solar

### 2.2 Operational Contacts

The following people are responsible for the operation, maintenance, and safety at the Lone Tree Solar Facility. The Operator conducts local monitoring of the site on a regular basis. As discussed above, the Operator has 24/7 remote monitoring capabilities from their central control center in Iowa. Should issues arise, central control will dispatch local operations personnel to the site, as necessary. The appropriate PCR Energy Resources/Lone Tree Solar operational contact will be included with final plan. Additional contacts that may require coordination regarding this plan and operation of the Project include the following departments and agencies.

**Table 1. First Responders and Emergency Services Contact Information**

| Department/Agency | Contact | Address |
|---|---|---|
| Lone Tree Volunteer Fire Department | Chief: 319- 629-4617 | 201 West Commercial St.<br>Lone Tree, Iowa 52755<br>319-648-3501 |
| Riverside Fire Department | Chief: 319-653-2107 | 271 River St.<br>Riverside, Iowa 52327<br>319-653-2107 |
| Johnson County Sheriff's Office | Sheriff: 319-356-6020 | 511 S. Capitol St.<br>Iowa City, Iowa 52244<br>319-356-6020, ext 2 |
| Johnson County Emergency Management Department | Coordinator: 319-356-6700 | 4529 Melrose Ave.<br>Iowa City, Iowa 52246<br>319-356-6700 |
| Iowa State Police, District 11, Area D | Public Resource Officer: 319-505-0153 | 5400 16th Ave SW<br>Cedar Rapids, Iowa 52404<br>319-396-1944 |

### 2.3 Emergency Contacts

**In the event of an emergency dial 911**

Emergency "911" calls in Johnson County are routed directly to a dispatch center in the County, where calls are sorted by type of emergency. Police-related calls are dispatched to either the Johnson County Sheriff's Office or the Iowa State Police District 11, Area D.

## 3.0 General Safety and Operational Information

PV panels located throughout the Project convert sunlight to electricity. The process involves solid-state technology that consumes no materials and is completely self-contained. As such, the primary concern for first responders is exposure to electrical components that present a hazard to electric shock. During a response, it should be assumed that:

- All solar equipment on site contains lethal AC and DC voltages;
- Electricity is supplied from multiple sources;
- The site should only be accessed by personnel or emergency responders under the direction of the Operator; and

The following are the most hazardous locations within the Project:

- Inverters and disconnects;
- Vicinity of the solar electric PV system;
- Field wiring and all electrical boxes associated with the system; and
- Collection Substation.

### 3.1 Precautions While in the Vicinity of the Solar Electric System

- Only trained personnel should work near the arrays, modules, electrical boxes, or wiring.
- It is recommended to always have at least two persons present when working on the array or handling modules. Do not attempt to service or respond to an emergency unless another person capable of rendering first aid and cardiopulmonary resuscitation (CPR) is also present.
- Any accidents should be immediately reported to the Operator, as soon as it is safe to do so.
- PV panels are made of glass and may break. If any cracks occur in the modules, touching a crack may expose a person to the full voltage and current of the array. Do not touch the modules without wearing electrical insulating gloves.

## 3.2 Training

Appropriate training of first responders is key to their understanding of the hazards that are present within the Project Area and to mitigate potential risks to their life during a response. As such, first responders that could be dispatched to the Project in the event of an emergency should be trained prior to commencement of operation and on a periodic basis thereafter. The Operator will work with the ____________ Fire Department and _________ Rescue Squad, as well as county and state safety officials, as appropriate, to provide trainings to emergency response leadership and their assigned staff.

# 4.0 Emergency Situations

Emergency situation critical points:

- In the event of an emergency, **dial 911.**
- Entry and shutdown of the Project should only be attempted at the direction of the Operator.
- Solar and substation components are always hot and should always be considered electrically energized (even at night, as there may be battery backup capabilities).

The following personnel will also be contacted in the event of an emergency; the specific contact information for which will be updated for the Final ERP.

**Table 2. Site Personnel Contact Information**

| Title | Name | Office Phone | Cell Phone | Home Phone |
|---|---|---|---|---|
| **Site Leader:** | *NAME To Be Determined (TBD)* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* |
| **Emergency Coordinator:** | *NAME TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* |
| **Operations Center:** | *NAME TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* |
| **Security Operations:** | *NAME TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* | *PHONE NUMBER TBD* |

The public will be notified of all emergency situations, as appropriate, primarily through local emergency responders. In the event of an emergency that requires evacuation of adjacent landowners, local emergency responders and authorities will notify residents through means outlined by their agency or department. The local evacuation procedures are determined by each town and county.

Below is a list of contingencies that could constitute a safety or security emergency:

- Fire;
- Natural emergency, severe weather;
- Physical threat, security breach, crime;
- Cyber security;
- Environmental accident, spill; or
- Injuries and/or serious health conditions.

Below are brief descriptions of emergency response measures by each contingency category listed above. General emergency response measures listed below apply to all contingencies.

- It is the responsibility of the Site Leader to assess a developing emergency situation and initiate the appropriate actions in the ERP to protect personnel, the surrounding environment, and Project equipment from adverse damages.
- In the event of an emergency where personnel should be protected, call 911 immediately, and then contact ____ Operations Center.
- Based upon the type and extent of the emergency, the Site Leader should assess whether an evacuation should be initiated.
- If the Site Leader determines that a facility evacuation is necessary, he/she must determine which type of evacuation to direct (immediate or delayed).

### 4.1 Fire Response

This section describes measures taken at the Project Area to prevent, minimize the severity of, and proactively prepare for the event of a fire emergency.

In the event that a fire should occur at the facility, this section describes the actions that should be taken by Project personnel. Safe and expedient response actions are essential to protect the health and safety of personnel and the surrounding environment, and to minimize damage to Project equipment.

1. Any person who discovers a fire in the facility should immediately make radio contact with the Operator, and provide the following information:

    a. That a fire has been discovered;

    b. The location and source of the fire;

    c. Any injuries that have occurred;

    d. The cause of the fire (if known); and

    e. Actions he/she will be taking to extinguish the fire (if appropriate).

    **Note:** Notifying others of the emergency and getting trained responders on the way is the most important step in minimizing injuries to personnel and damage to equipment. In the event that the person discovering a fire would be significantly delayed in attempting to extinguish it in its incipient stage by first getting to a radio to report it, the priority would be to extinguish the fire in the incipient stage.

2. Any person discovering a fire in its incipient stage should act as quickly as possible to extinguish the fire. In general, a fire should be in its incipient stage if it meets two primary criteria:

    - The fire can be extinguished or controlled with a single portable fire extinguisher; and

    - The person discovering the fire perceives an adequate level of safety in attempting to extinguish the fire.

3. As long as the fire is in its incipient stage, as defined above, the person discovering the fire should utilize all appropriate and readily available fire extinguishing equipment to extinguish the fire.

4. In response to the fire, the Site Leader will need to make the following determinations:

    a. The equipment or activities that need to be shut down and/or ceased.

6. Site Control Room Operator or other person appointed by the person in charge will:

    a. Shutdown equipment as instructed;

    b. Announce the type and location of the emergency over the Public Address (P.A.) system or radio system;

    c. Notify the Site Leader or other Person in Charge; and

    d. Contact local emergency response services and provide the following information:

        - Type of emergency;
        - Magnitude and location;
        - Any immediate danger to people on or off site;
        - Any known injuries;
        - Any other pertinent information;
        - Contact the Operations Center;
        - Contact the System Operator or Transmission Operator if appropriate; and
        - Assign an individual to meet the emergency services at the gate in order to provide directions.

7. Site leader or other Person in Charge will:

    a. Proceed to the fire area;

    b. Determine the extent of the fire;

    c. Determine the area to be isolated;

    d. Determine if evacuation is necessary;

    e. Determine what equipment or activities will need to be shutdown and/or ceased; and

    f. Instruct the control room to notify the local emergency response services of the need for assistance if the fire has progressed or has the potential to progress beyond the incipient level.

8. Site personnel assigned to escort the emergency services:

    a. Shall escort emergency service to the location of the fire. This individual may also be called on to provide emergency services with specific information about the dangers of Project equipment, chemicals nearby, electrical sources, etc.

    b. NOTE: Having routine drills and regular site visits by local emergency services adds value for helping them become familiar with the site layout and the hazards associated at the site.

9. All other site personnel not directly involved with responding:

    a. All other personnel that are not directly involved with responding to the fire shall report to their designated muster stations to ensure all persons are accounted for. These employees will remain at the muster stations until the "all clear" is received.

Upon arrival to the Project, responders shall:

- Evacuate and secure the area and keep people a minimum of 300 feet away, provided there are no immediate threats to people or non-solar property;
- Let the facility burn. Burning electrical equipment is already damaged and must be replaced;
- Manage adjacent areas, such as homes and forested areas, as needed, to limit the potential of the fire spreading; and
- If fire must be suppressed within the array fence line, the Operator will direct local authorities on how to proceed.

The following are the most important considerations when responding to a fire or other emergency at the Project:

- Solar and substation components are always hot and should always be considered electrically energized (even at night, as there may be battery backup capabilities);
- Identify and validate the hazard in order to minimize injury;
- Under the direction of the Operator, isolate or shutdown the electrical power at the site of the fire, if possible; and
- Leave the scene in a safe condition after mitigating hazards.

### 4.2 Natural Emergency, Severe Weather

Severe weather events such as snowstorms are possible at the Project. Although much less common, there is also the potential for minor earthquakes, tornadoes, flooding, hurricanes, or high wind events (e.g., microbursts). These events should have limited impact on the Project Area. The Project is designed and constructed to withstand the extreme weather likely to occur at the Project Area (e.g., high winds, hail, lightning, snowstorms, etc.).

Flooding waters, lightning, high winds and heavy rains may be detrimental to the employees, the environment and/or equipment and structures at the facility. Warnings about developing weather emergencies are issued by local radio stations or tracked by on-site weather systems. These warnings should provide adequate information of the approach of weather-related emergency conditions. The Site Leader at the facility has several means to monitor these weather-related emergencies. These include local radio stations and weather-related websites. After an extreme weather event, the Operator will evaluate all equipment for damages and repair, as necessary, to restore full Project operations. In addition to the general emergency response measures listed above, contingency-specific measures include:

- The Site Leader at the Project should monitor weather-related emergencies. Information and warnings are available via local radio, television, and internet weather and news sites and via OPERATIONS CENTER.
- When information is received that a severe weather watch or warning has been issued, the Site Leader should notify their direct Manager and site employees.

- The Manager will determine if the site should be shut down due to the weather situation. When severe weather is forecast such as high winds associated with a hurricane, or other related conditions such as floods and/or storm surge, considerations for equipment shutdown should be taken consistent with the site's operating practices and plans that ensure safety considerations first.
- Site personnel should seek indoor shelter in a designated secure location, or other reinforced structure. Personnel should remain indoors if the severe weather is affecting the immediate area of the facility.
- The following list represents actions that should be taken at the Site for it to be secured. The listing is not intended to be all inclusive and will vary in applicability pending advance warning of the on-set of the event.
  - Evacuate open areas where solar racking or other conductive materials are located if lightning is in the area, or if there are other unsafe conditions that warrant construction activities to be unsafe;
  - Ensure Site personnel are safe and accounted for;
  - Seek safe shelter. If in your vehicle in winter, ensure survival kit and enough gas is in place;
  - Ensure portable equipment, trash cans, tools, etc. are stored indoors; and
  - Ensure that construction trailers and storage containers are closed and latched.

## 4.3 Physical Security

Physical security incidents can include the following: intrusion, bomb threats, sabotage, vandalism, terrorism, or other similar security events at an electrical generation facility. If a Hostile Intruder enters the Project, each person shall quickly determine the most reasonable way to protect his/her own life. Visitors and contractors are likely to follow the lead of employees and managers during a hostile intruder situation. In addition to the general emergency response measures, each person shall take the following actions, accordingly:

- Evacuate;
- Hide out;
- Take action (as last resort and only when your life is in imminent danger); and

- Call 911 when it is safe to do so.

In the event that the Project receives threatening correspondence either by phone or by other means of communications, the following actions should be performed immediately:

- Gather as much information as possible from the person making the threat;
- If the threat is via written correspondence, place the correspondence in a location in which it will not be touched or otherwise disturbed until police can be contacted; and
- If the threat is being made verbally (phone, or other), communicate and obtain information from the individual making the threat for as long as possible. For phone threats, note the time of the call, do not interrupt the caller and describe the tone of voice as well as any background sounds.

After information on the threat is gathered, inform the Site Leader, contact Security Operations at (____) ____-____, contact local law enforcement, as applicable (e.g., 911), then communicate the Physical Security Event to all on-site personnel.

### 4.4 Cyber Security

Site personnel may become aware of a cyber-incident or the potential for a cyber-incident from any of the following sources:

- A system page/email alert to an administrator/operator;
- OPERATIONS CENTER - will release awareness notification via Operations Center_____;
- An employee or Business Unit (BU) that first recognizes a potential incident that needs to be reported to Corporate Security or the IMSC;
- A BU designated to be contacted by an outside agency such as NERC, Federal Energy Regulatory Commission (FERC), SERC, or other outside source to the First Responder;
- A business partner;
- A manager;
- An outside source; or
- Notification may come as part of PCR's Security Notifications and Event Reporting Policy (NEE-SEC-1764 - Security Notifications and Event Reporting to Corporate Security

or System Operator). Site makes the unit safe or stabilizes the unit as needed, plans the recovery if appropriate.

The following actions shall be taken in the event that a cyber-incident is discovered:

- Site communicates to the appropriate parties:
    - Immediate Supervisor;
    - Corporate Security;
    - OPERATIONS CENTER;
    - Local Emergency Services, if appropriate; and/or
    - Transmission System Operator, if appropriate.
- The team restores the cyber assets affected by the incident to normal operations. This may require reloading data from backup tapes or reinstalling cyber assets from their original distribution media.
- Once the affected cyber assets have been restored, they are tested to make sure they are no longer vulnerable to the vulnerability that caused the incident.
- The impacted system(s) is/are tested to ensure they will function correctly when placed back in production.

### 4.5 Environmental Accident or Spill

The spill or release of any chemical/oil or Heat Transfer Fluid is a potentially serious event, and appropriate response actions must be taken to minimize health hazards to personnel, as well as potential impacts to the environment. It is the policy of the facility that personnel will not respond to spills/releases but will instead call for trained outside responders to perform this function. For the purpose of clarification to personnel, the term “respond” in this context refers to actions taken to perform cleanup operations of spilled substances, and in some cases may even take the meaning of actually stopping the source of a spill. Taking basic response actions to a spill such as setting up barricades, placing containment media and stopping spills in situations such as the Step 1 Example below should not be construed to be acting in the role of a “responder”, as it is defined in Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations.

The basic actions to be taken in response to a chemical or oil/Heat Transfer Fluid (HTF) spill or release are the following:

1. If the spill or release is the direct result of an operational action performed on the system from which the release has originated, the person who performed the action should attempt to stop the release (if possible) if it can be stopped without incurring additional personal exposure to the substance.
2. The person discovering a spill/release should immediately move to a location that is a safe distance from the affected area,
   - If it is safe to do so under prevailing conditions, remain within observation distance; and
   - If safe conditions are in doubt, do not risk exposure – leave the area immediately.
3. The person discovering the spill should look for other personnel in the area and warn them by any means available of the event that has occurred. The Site Leader should be notified immediately over the radio. Information provided should include all of the following that are known:
   - What type of chemical has been spilled/released;
   - The location(s) of the spill/release;
   - If the source of the spill/release has been stopped;
   - If any injuries or chemical exposure has occurred to personnel;
   - Boundaries describing the area of the spill;
   - Whether or not the spill is contained;
   - Quantity released (if it can be estimated); and
   - Environmental impacts (water bodies, streams, ground, roadways).
4. Based upon the report from the person discovering the spill, the Site Leader shall evaluate whether the circumstances pose a threat to the surrounding community or the environment.
5. If a threat is imposed to the community or environment, 911 should be notified immediately.

## 4.6 Personnel Injuries and Serious Health Conditions

The following sections provide basic guidelines for response actions to be taken in the event of emergencies related to personnel health.

Although facility personnel should take the most aggressive response actions that are prudent in an emergency situation, the first and foremost action will be to call 911 to initiate the response of trained outside medical responders. Outside medical responders will not be asked to enter the facility.

To prepare facility personnel for such contingencies, it will be the facility policy that all operating personnel and as many other personnel as possible should be trained in Cardiopulmonary Resuscitation (CPR), bloodborne pathogens, and in the use of an Automated External Defibrillator (AED) if one is available.

Each site will maintain at least one well stocked first aid kit at the control house and one in each site vehicle. These will be inspected at least monthly. Basic guidelines for response actions to be taken in the event of personnel health can be found in the Emergency Action Plan. Each site will determine the locations of their nearest non-emergency Worker's Compensation approved medical facility as well as the Occupational Nurse and post the name, address and phone number. In the event of an emergency, the 911 responders will determine the best location for emergency care.

If present on site, the AED will be maintained at the facility at a designated location known and accessible to all staff.

**AED – PCR sites with AEDs will perform the following:**

- Notify the local Emergency Medical Services (EMS) of the existence, location, and type of AED (California requirement only).
- Test the AED every 6 months and after each use, per the manufacturer's requirements.
- Inspect all AEDs at least every 90 days or per manufacturer's recommendations and document the inspection; including verification the batteries and pads have not expired.
- Maintain records of maintenance and testing.
- Annually notify employees of location(s) of AEDs.

- Provide information on how to take CPR or AED training.
- Annually demonstrate how to use an AED.
- Post instructions (14-point font) next to the unit on how to use the AED.

---

**1. Basic First Response Actions**

a. Check for responsiveness. Responsiveness is when the person is able to respond when you call their name or touch them.

b. If the person is unresponsive, immediately call 911 for outside medical assistance and ask other personnel to bring the AED (if present) to the scene.

  1.) Other personnel should assist with 911 notifications and expediting the delivery of the AED to the scene.

c. Check to see if the victim is breathing normally.

  1.) If no signs of breathing are observed, the responder should check for visible signs of airway blockage.

    i. If obvious signs of airway blockage are noticed, attempt to remove the blockage

  2.) Initiate two rescue breaths into the victim.

  3.) After the rescue breaths, a pulse should be checked for on neck.

    i. If a pulse is present, continue with recovery breathing, but do not initiate chest compressions.

    ii. If no pulse is observed, commence CPR with assisted breathing.

d. If CPR is being performed and the AED arrives to the scene, direct an assistant to begin setting up the AED for operation on the victim.

  1.) CPR should be continued during the time that the AED is being set up.

  2.) If the AED is placed into operation, remain near the victim and follow all AED instructions to ensure safety and proper victim monitoring. Maintain the victim with AED monitoring until trained medical responders arrive at the scene.

e. If the victim is responsive but shows signs of shock or has an obvious severe injury, call 911 immediately and take additional actions as described in the sections below.

f. If the victim has obvious broken bones or is bleeding profusely or may have neck or spine injuries, do not attempt to move the victim unless their immediate safety would be jeopardized by leaving them in that particular location. Make the victim as comfortable as possible and apply pressure to mitigate areas of profuse bleeding until trained medical personnel arrive at the scene.

g. Immobilize all injured parts of the victim.

h. Prepare victim for transportation if the victim can be safely moved.

**2. Physical Shock**

a. Symptoms

1.) Pallid face;

2.) Cool and moist skin;

3.) Shallow and irregular breathing;

4.) Perspiration appearing on the victim's upper lip and forehead;

5.) Increased, but faint pulse rate;

6.) Nausea; and/or

7.) Detached semi-conscious attitude towards what is occurring around him/her.

b. Treatment

1.) Request professional medical aid immediately; and

2.) Remain with and attempt to calm the victim.

**3. Electric Shock**

a. Symptoms

1.) Pale bluish skin that is clammy and mottled in appearance;

2.) Unconsciousness; and/or

3). No indications that the victim is breathing.

b. Treatment

1.) Turn off electricity if possible;

2.) Call for professional medical assistance and an ambulance immediately;

3.) Remove electric contact from victim with non-conducting material; and

4.) Perform CPR and call for the AED, if required.

**4. Burns**

a. Symptoms

1.) Deep red color;

2.) Blisters; and/or

3.) Exposed flesh.

b. Treatment

1.) Cool victim immediately if at all possible;

2.) Free victim of any jewelry or metal if it is safe to remove it;

3.) Do not pull away clothing from burned skin tissue;

4.) Do not apply any ointment to burn area; and/or

5.) Seek professional medical assistance as soon as possible.

**5. Heat Stroke**

a. Symptoms

1.) Face will be red;

2.) Face will be dry to the touch; and/or

3.) The pulse will be extremely strong and fast.

b. Treatment

1.) Rapidly cool victim or death can occur;

2.) Sponge victim with water;

3.) Fan victim to allow evaporation to occur; and

4.) Move victim into a cool environment.

**6. Heat Exhaustion**

a. Symptoms

1.) Increased heart rate;

2.) Fatigue;

3.) Impaired cognitive ability;

4.) Lack of coordination;

5.) Body temperature may be normal;

6.) Clammy skin; and/or

7.) Weakness and dizziness.

b. Treatment

1.) Remove victim from hot environment; and

2.) Lay victim on their back with feet slightly elevated.

## 5.0 Public Safety

Access to the Project is limited to trained staff and maintenance personnel only.

Solar panel arrays and the substation are surrounded by 7-foot woven wire fence per requirements of the National Electric Safety Code (NESC). Additionally, fencing around the substation includes an additional foot of barbed wire (a barbed wire apron on extension arms) along the top of the fence. Access to the Project Area occurs through gates in the chain-link fence that are secured with a padlock, and only Operator personnel have access to the Project (as previously noted, Knox Box type locks are installed at each gate).

In the event of personal injury occurs or if a person should become incapacitated while within the Project site, the following procedures should be followed:

1. Assess the area for hazards and secure the area to protect additional life from injury.

2. Notify the appropriate local authorities by dialing 911, and direct them to the Project access point identified on Figures 1 provided in this plan.

3. Local authorities should contact the Operator at the __________________Operations Center , available 24/7, to determine the appropriate response procedures and methods for shutting down the nearest components to ensure safe access.

# Attachment H:
# Decommissioning Plan and Draft Performance Agreement

# Decommissioning Plan
# Lone Tree Solar Project
# Johnson County, Iowa

Prepared for:
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Project No: 193709077
March 21, 2023

This document entitled Decommissioning Plan – Lone Tree Solar Project, Johnson County, Iowa, was prepared by Stantec Consulting Services Inc. ("Stantec") for the use of PCR Investments SP2, LLC (the "Client"). The material in this document reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in this document are based on conditions and information existing at the time this document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others.

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| | |
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# 1.0 INTRODUCTION

PCR Investments SP2, LLC (PCR) is proposing to construct the Lone Tree Solar Project in Johnson County, Iowa. The proposed Lone Tree Solar Project (Lone Tree or "the Project") is to be located northwest of the city of Lone Tree, Iowa. Major components of the Project include bi-facial solar modules, a tracking system, inverter/transformer stations, access roads, and below ground interconnection cable. The Project will occupy approximately 50 acres of land (within perimeter fencing) and will have a maximum nameplate generating capacity of up to 7.5 megawatts (MW) alternating current (AC).

This Decommissioning Plan (Plan) provides a description of the decommissioning and restoration phase of the Project. Construction is anticipated to begin approximately 12 months after receipt of the required Johnson County permit approval. Construction of the Project is anticipated to take approximately 8 months, with the Commercial Operation Date (COD) to follow. The decommissioning phase is assumed to include the removal of Project facilities as listed in Section 1.1 and shown in Figure 1.

This Plan includes an overview of the primary decommissioning Project activities, including the dismantling and removal of facilities, and subsequent restoration of land. A summary of estimated costs and revenues associated with decommissioning the Project are included in Section 4.0. The summary statistics and estimates provided are based on a 7.5-$MW_{[AC]}$ Project array design.

## 1.1 SOLAR FARM COMPONENTS

The main components of the Project include:

- Solar modules and associated above ground cabling
- Tracking system and steel piles
- In-string inverters
- Transformers stations
- Site access and internal roads
- Perimeter fencing
- Below ground electrical cabling and conduits
- Switchgear structure
- Below ground cabling to point of interconnection (POI)

## 1.2 TRIGGERING EVENTS AND EXPECTED LIFETIME OF PROJECT

Project decommissioning may be triggered by events such as the end of a power purchase agreement or when the Project reaches the end of its operational life. Per Johnson County (County) Zoning Ordinance No. 05-19-22-01 (amendments), Article 8:1.23.BB.10 - following a continuous one-year period in which no electricity is generated, or if substantial action on construction or repairs to the project is discontinued for a period of one year, the permit holder will have one year to complete decommissioning of the utility scale solar installation. At the discretion of the County Zoning Administrator, the continuous one-year period that triggers decommissioning may be extended if the applicant demonstrates ongoing commitment to the project through activities such as but not limited to making lease payments or documentation of ongoing maintenance or repairs. Decommissioning shall be completed in accordance with the approved decommissioning plan. The landowner or tenant must notify the County Zoning Administrator when the project is discontinued and when decommissioning is complete.

If properly maintained, the expected lifetime of a utility-scale solar panel is approximately 30 to 35 years with an opportunity for a project lifetime of 50 years or more with equipment replacement and repowering. Depending on market conditions and project viability, solar arrays may be retrofitted with updated components (e.g., panels, frame, tracking system, etc.) to extend the life of a project. In the event that the modules are not retrofitted, or at the end of the Project's useful life, the panels and associated components will be decommissioned and removed from the Project site.

The value of the individual components of the solar facility will vary with time. In general, the highest component value would be expected at the time of construction with declining value over the life of the Project. Over most of the life of the Project, components such as the solar panels could be sold in the wholesale market for reuse or refurbishment. As efficiency and power production of the panels decrease due to aging and/or weathering, the resale value will decline accordingly. Secondary markets for used solar components include other utility scale solar facilities with similar designs that may require replacement equipment due to damage or normal wear over time; or other buyers (e.g., developers, consumers) that are willing to accept a slightly lower power output in return for a significantly lower price point when compared to new equipment.

Components of the solar facility that have resale value may be sold in the wholesale market. Components with no wholesale value will be salvaged and sold as scrap for recycling or disposed of at an approved offsite licensed solid waste disposal facility (landfill). Decommissioning activities will include removal of the arrays and associated components as listed in Section 1.1 and described in Section 2.

## 1.3 DECOMMISSIONING SEQUENCE

Decommissioning activities will begin within 12 months of the Project ceasing operation and will be completed within approximately 6 to 12 months from the start of decommissioning. Monitoring and site restoration may extend beyond this period to ensure successful revegetation and rehabilitation. The anticipated sequence of decommissioning and removal is described below; however, overlap of activities is expected.

- Reinforce access roads, if needed, and prepare site for component removal
- Install temporary fencing and erosion control best management practices (BMPs) to protect sensitive resources

- De-energize solar arrays
- Dismantle panels and above ground wiring
- Remove module trackers and piles
- Remove inverters
- Remove transformers and skids
- Remove below-ground medium voltage and interconnection electrical cables and conduit (less than 48 inches in depth)
- Remove switchgear structure
- Remove access and internal roads and complete minor grading as required to re-establish overall drainage patterns similar to pre-development conditions
- De-compact subsoils (if required), restore and revegetate disturbed land to allow for pre-construction land use to the extent practicable

# 2.0 PROJECT COMPONENTS AND DECOMMISSIONING ACTIVITIES

The solar facility components and decommissioning activities necessary to restore the Project area, as near as practicable, to pre-construction conditions are described within this section.

## 2.1 OVERVIEW OF SOLAR FACILITY SYSTEM

PCR anticipates utilizing approximately 16,308 solar modules, with a total nameplate generating capacity of up to 8.97 MW direct current (DC) converting to approximately 7.50 $MW_{[AC]}$ on the approximately 50-acre site. Statistics and cost estimates provided in this Plan are based on a bifacial solar module although the final panel manufacturer has not been selected at the time of this report.

Above ground facilities, such as modules, trackers, foundations, steel piles, electrical cabling and conduit will be removed from the site. Electrical cabling greater than 48 inches in depth may be abandoned in place. Access roads may be left in place if requested and/or agreed to by the landowner. Public roads damaged or modified during the decommissioning and reclamation process will be repaired to the pre-decommissioning condition at PCR's expense.

Estimated quantities of materials to be removed and salvaged or disposed of are included in this section. Most of the materials described have salvage value, although there are some components that will likely have none at the time of decommissioning. All recyclable materials, salvaged and non-salvage, will be recycled to the extent possible. All other non-recyclable waste materials will be disposed of in accordance with state and federal law in a licensed solid waste facility. Table 1 presents a summary of the primary components of the Project included in this decommissioning plan.

**Table 1 Primary Components of Solar Farm to be Decommissioned**

| Component | Quantity | Unit of Measure |
|---|---|---|
| Solar Modules (approximate) | 16,308 | Each |
| Tracking System (equivalent trackers – 56 modules) | 302 | Equivalent Trackers |
| Steel Piles | 2,780 | Each |
| Inverters (within arrays) | 62 | Each |
| Transformer Stations (on skids and piles) | 3 | Each |
| Electrical Cables and Conduits (greater than 48-inches below ground abandoned in place) | 1,813 | Lineal Foot (estimated) |
| Perimeter Fencing | 5,909 | Lineal Foot (estimated) |
| Internal Access Roads (approximate) | 7,914 | Lineal Foot (estimated) |

| Component | Quantity | Unit of Measure |
|---|---|---|
| Switchgear Structure | 1 | Each |
| Below Ground Interconnection Cable (greater than 48-inches below ground abandoned in place) | 512 | Lineal Feet (estimated) |

## 2.2 SOLAR MODULES

PCR is considering a 555-watt bi-facial module, such as those manufactured by ZNSHINE Solar or similar type of model for the Project. The ZNSHINE Solar module has been used as a representative module for the calculations in this Plan. Each module assembly (with frame) has a total weight of approximately 71. pounds. The modules are approximately 89.7 inches long and 44.6 inches in width and are mainly comprised of non-metallic materials such as silicon, mono- or poly-crystalline glass, plastic, and epoxies, with an anodized aluminum frame.

At the time of decommissioning, module components in working condition may be refurbished and sold in a secondary market yielding greater revenue than selling as salvage material.

## 2.3 TRACKING SYSTEM AND SUPPORT

The solar modules will be mounted on a one-in-portrait tracking system, such as the Omco Origin tracker manufactured by Omco Solar or a similar manufacturer. Each tracker is approximately 64.3 meters (211 feet) in length and will support 54 solar modules. Smaller trackers may be employed at the edges of the layout to efficiently utilize available space. The tracking system is mainly comprised of galvanized and stainless steel; steel piles that support the system are comprised of structural steel.

The solar arrays will be deactivated from the surrounding electrical system and made safe for disassembly. Electronic components, and internal electrical wiring will be removed and salvaged. The steel piles will be completely removed.

The supports, tracking system, and piles contain salvageable materials which will be sold to provide revenue to offset decommissioning costs.

## 2.4 INVERTERS AND TRANSFORMER STATIONS

PCR is proposing to use the SMA Solar Sunny Highpower PEAK3 or similar inverters, which will be mounted on a racking system located with transformers in two central locations within the solar array. The transformers typically sit on a skid assembly mounted on steel pile foundations within the array. The inverters, transformers, and associated equipment will be deactivated, disassembled, and removed. Depending on condition, the equipment may be sold for refurbishment and re-use. If not re-used, they will be salvaged or disposed of at an approved solid waste management facility. All oils and lubricants will be collected and disposed of at a licensed facility.

## 2.5 ELECTRICAL CABLING AND CONDUITS

The Project's underground electrical collection system will be placed at a minimum depth of approximately four (4) feet (48 inches) unless a greater depth is required by a landowner. Cabling installed below four feet will not interfere with future land use and can be abandoned in place. For purposes of this Plan, it is assumed that all cabling and conduit located at a depth greater than four feet below the surface will be abandoned in place.

## 2.6 PROJECT BELOW GROUND INTERCONNECTION LINE

No project-specific substation will be needed for the Project. The Project will utilize approximately 512 feet (0.1 mile) of 12.5kV below ground cable to connect to the POI. The interconnection cable will be placed at a minimum depth of approximately four (4) feet (48 inches) unless a greater depth is required by a landowner or jurisdiction.

Cabling installed below four feet will not interfere with future land use and can be abandoned in place. For purposes of this Plan, it is assumed that interconnection line located at a depth greater than four feet below the surface will be abandoned in place.

## 2.7 SWITCHGEAR STURCTURE

PCR will utilize one switchgear room to be located in the south-central portion of the Project area. The structure will be in conformance with all local and state building codes and will be removed during the decommissioning process.

## 2.8 PERIMETER FENCING, SITE ACCESS AND INTERNAL ROADS

The Project will include an approximately seven-foot-high woven wire fence surrounding the perimeter of the site.

A network of access roads will allow access to solar facility equipment. The internal access roads will be composed of gravel approximately 12 feet wide and totaling approximately 7,914 feet (1.5 miles) in length. The internal access road lengths may change with final Project design. To be conservative, the decommissioning estimate assumes that all internal access roads will be completely removed.

Access roads located around the perimeter and/or within the array will be comprised of an eight-inch-thick gravel layer placed on compacted native soils. The estimated quantity of the material is provided in Table 2.

**Table 2 Typical Access Road Construction Materials**

| Item | Quantity | Unit |
|---|---|---|
| Gravel or granular fill; eight-inch thick | 2,340 | Cubic Yards |

Decommissioning activities include the removal and stockpiling of aggregate materials on site for salvage preparation. It is conservatively assumed that all aggregate materials will be removed from the Project site and hauled up to five (5) miles from the Project area. Following removal of aggregate, the access road areas will be graded, de-compacted with deep ripper or chisel plow (ripped to 18 inches), backfilled with native subsoil and topsoil, as needed, and graded as required to re-establish overall drainage patterns similar to pre-development conditions.

# 3.0 LAND USE AND ENVIRONMENT

## 3.1 LAND USE

Land use prior to proposed development is primarily agricultural. The areas of the Project that have been disturbed will be restored, as near as practicable, to their pre-construction condition and allow for similar land use. Topsoil, reserved during construction will be used if available and supplemented with comparable soils. Restored areas will be revegetated in compliance with regulations in place at the time of decommissioning.

## 3.2 RESTORATION AND REVEGETATION

Portions of the Project site that have been excavated and backfilled will be restored, as near as practicable, to pre-construction conditions. Soils compacted during de-construction activities will be de-compacted, as necessary, to restore the land to a condition suitable for pre-construction land use. Topsoil will be placed on disturbed areas, as needed, and seeded with appropriate vegetation in coordination with landowners.

## 3.3 SURFACE WATER DRAINAGE AND CONTROL

As previously described, the proposed Project area is predominantly located on agricultural land. The terrain is relatively flat. The Project facilities are being sited to avoid wetlands, waterways, and drainage features to the extent practicable.

Surface water conditions at the Project site will be reassessed prior to the decommissioning phase. PCR will obtain the required water quality permits from the Iowa Department of Natural Resources (IDNR) and the U.S. Army Corps of Engineers (USACE), as needed, prior to decommissioning the Project. Required construction stormwater permits will also be obtained, and a Stormwater Pollution Prevention Plan (SWPPP) prepared describing the protection needed to reflect conditions present at the time of decommissioning. Erosion control best management practices may include: construction entrances, temporary seeding, permanent seeding, mulching (in non-agricultural areas), erosion control matting, silt fence, filter berms, and filter socks.

## 3.4 MAJOR EQUIPMENT REQUIRED FOR DECOMMISSIONING

The activities involved in decommissioning the Project include removal of the Project components: solar modules, tracking system, foundations and piles, inverters, transformers, access roads, and electrical cabling and conduits (unless abandoned below ground). Restoration activities include back-filling of pile and foundation sites; de-compaction of subsoils; grading of surfaces to pre-construction land contours and revegetation of the disturbed areas.

Equipment required for the decommissioning activities is similar to what is needed to construct the solar facility and may include, but is not limited to: small cranes, low ground pressure (LGP) track mounted excavators, backhoes, LGP track bulldozers and dump trucks, front-end loaders, deep rippers, water trucks, disc plows and tractors to restore subgrade conditions, and ancillary equipment. Standard dump trucks may be used to transport material removed from the site to disposal facilities and to import clean fill and topsoil if necessary.

PCR acknowledges that Johnson County Regulations may require the site owner/operator to enter into a Public Roads Damage Avoidance and Mitigation Plan with the County prior to the start of decommissioning activities if decommissioning will utilize County roads.

# 4.0 DECOMMISSIONING COST ESTIMATE SUMMARY

Expenses associated with decommissioning the Project will be dependent on labor costs at the time of decommissioning. For the purposes of this report, 2022 average market values were used to estimate labor expenses. Fluctuation and inflation of the labor costs were not factored into the estimates.

## 4.1 DECOMMISSIONING EXPENSES

During decommissioning, the Project will incur costs associated with disposal of components not sold for salvage, including materials which will be disposed of at a licensed facility, as required. Decommissioning costs also include backfilling, grading, and restoration of the proposed Project site as described in Section 2. Table 3 summarizes the estimated costs for activities associated with the major components of the Project.

**Table 3 Estimated Decommissioning Expenses**

| Activity | Unit | Number | Cost per Unit | Total |
|---|---|---|---|---|
| Overhead and management (includes estimated permitting required) | Lump Sum | 1 | $37,000 | $37,000 |
| Solar modules; disassembly and removal | Each | 16,308 | $4.60 | $75,017 |
| Tracking system disassembly and removal (equivalent tracker) | Each | 302 | $400 | $120,800 |
| Steel pile/post removal | Each | 2,780 | $9.70 | $26,966 |
| Inverters (in-string) | Each | 62 | $300 | $18,600 |
| Transformer stations | Each | 3 | $1,100 | $3,300 |
| Access road excavation and removal | Lump Sum | 1 | $10,350 | $10,350 |
| Perimeter fence removal | Lineal Foot | 5,909 | $2.80 | $16,545 |
| Topsoil replacement and rehabilitation of site | Lump Sum | 1 | 98,050 | $98,050 |
| Switchgear structure | Lump Sum | 1 | $5,000 | $5,000 |
| **Total Estimated Decommissioning Cost** | | | | **$411,628** |

## 4.2 POTENTIAL DECOMMISSIONING REVENUES

A summary of potential revenue to be realized from resale or salvage of the facilities is included in this report. PCR acknowledges that Johnson County does not allow the recognition of revenue due to salvage value to be considered in the final financial security for decommissioning. The estimated resale or salvage value is described in this report to provide information regarding the potential revenue available upon decommissioning.

As previously described, the value of the decommissioned components will be higher in the early stages of the Project and decline over time. Resale of components such as solar panels is expected to be greater than salvage (i.e., scrap) value for most of the life of the Project, as described below. For purposes of this report, only estimated salvage values were considered in net revenue calculations, as this is the more conservative estimate strategy.

Modules and other solar plant components can be sold within a secondary market for re-use. A current sampling of reused solar panels indicates a wide range of pricing depending on age and condition ($0.10 to $0.30 per watt). Future pricing of solar panels is difficult to predict at this time, due to the relatively young age of the market, changes to solar panel technology, and the ever-increasing product demand. A conservative estimation of the value of solar panels at $0.10 per watt would yield approximately $897,000. Increased costs of removal, for resale versus salvage, would be expected in order to preserve the integrity of the panels; however, the net revenue would be substantially higher than the estimated salvage value.

The resale value of components such as trackers, may decline more quickly; however, the salvage value of the steel that makes up a large portion of the trackers is expected to stay at or above the value used in this report.

The market value of steel and other materials fluctuates daily and has varied widely over the past five (5) years. Salvage value estimates were based on an approximate five-year-average price of steel and copper derived from sources including on-line recycling companies and United States Geological Survey (USGS) commodity summaries. The price used to value the steel used in this report is $241 per metric ton; aluminum at $0.40 per pound; silicon at $0.40 per pound and glass at $0.05 per pound.

The main material of the tracking system and piles is assumed to be salvageable steel. The main components of the solar modules are glass and silicon with aluminum framing. A 50 percent recovery rate was assumed for all panel components, due to the processing required to separate the panel components. Alternative and more efficient methods of recycling solar panels are anticipated before this Project is decommissioned, given the large number of solar facilities that are currently being developed. Table 4 summarizes the potential salvage value for the solar array components and construction materials.

**Table 4 Estimated Decommissioning Revenues**

| Item | Unit of Measure-ment | Quantity per Unit | Salvage Price per Unit | Total Salvage Price per Item | Number of Items | Total |
|---|---|---|---|---|---|---|
| Panels – Silicon | Pounds per Panel | 1.8 | $0.40 | $0.72 | 16,308 | $11,742 |
| Panels – Aluminum | Pounds per Panel | 2.9 | $0.40 | $1.16 | 16,308 | $18,917 |
| Panels – Glass | Pounds per Panel | 26.8 | $0.05 | $1.34 | 16,308 | $21,853 |
| Tracking System and Posts | Metric tons per $MW_{[DC]}$ | 32.0 | $241 | $7,712 | 8.97 | $69,177 |
| **Total Potential Revenue** | | | | | | **$121,689** |

* Revenue based on salvage value only. Revenue from used panels at $0.10 per watt could raise $897,000 as resale versus the estimated salvage revenue.

## 4.3 DECOMMISSIONING COST SUMMARY AND FINANCIAL ASSURANCE

Table 5 provides a summary of the estimated net cost to decommission the Project, using the information detailed in Section 4.1. Estimates are based on 2022 prices, with no market fluctuations or inflation considered. Table 5 provides the total estimated decommissioning cost without reductions based on salvage value.

**Table 5 Decommissioning Summary**

| Item | Cost |
|---|---|
| Decommissioning Expenses | $411,628 |
| Gross Decommissioning Cost with 10 Percent Contingency, per Ordinance (i.e., $411,628 X 110%) | $452,791 |

PCR has indicated that, in compliance with the Johnson County Zoning Ordinance, Article 8:1.23.BB.10, they shall provide to the County a Performance Agreement and accompanying financial surety instrument to cover the cost of decommissioning in accordance with the following as stated in the ordinance:

- The applicant shall provide estimates for the total cost for decommissioning the site as determined by a Licensed Engineer. Decommissioning costs shall not take salvage value into account.
- Decommissioning funds shall be an amount equal to the total costs for decommissioning the site, plus a ten percent (10%) contingency.

- Decommissioning funds shall be maintained in the form of cash, certificate of deposit, performance bond, escrow account, surety bond, letter of credit, or other form of financial assurance as agreed to by the approving authority. Any financial document evidencing the maintenance of the decommissioning funds shall include provisions for releasing the funds to the County in the event decommissioning is not completed in a timely manner.
- Prior to any ground disturbance, grading or construction activity on the site, fifty percent (50%) of total estimated decommissioning costs shall be provided by any of the means listed above. An additional twenty five percent (25%) shall be provided within five (5) years of the date of initial approval, and the remaining twenty five percent (25%) of the total re-estimated decommissioning costs shall be provided within eleven (11) years of the date of initial approval. From that point forward, 100% of the total estimated decommissioning costs as determined by the most recent re-estimation shall be maintained in the decommissioning fund until the end of the functional life of the project.
- Financial surety shall be maintained for the life of the project.
- Proof of recertification of the financial surety instrument must be submitted to the County annually.
- Every ten (10) years, the facility owner or operator shall retain an independent Licensed Engineer to re-estimate the total cost of decommissioning and attest that the value of the financial surety instrument is appropriate. This report shall be filed with the County.
    - The required amount of the decommissioning fund shall match the re-estimated cost of decommissioning. Within ninety (90) days of filing the re-estimation report with the County, the facility owner or operator shall cause the fund balance of the financial surety instrument to be adjusted to ensure that it matches the re-estimated decommissioning cost.

PCR will be responsible for decommissioning the Project facilities.

# FIGURES

**Figure 1 Project Layout**

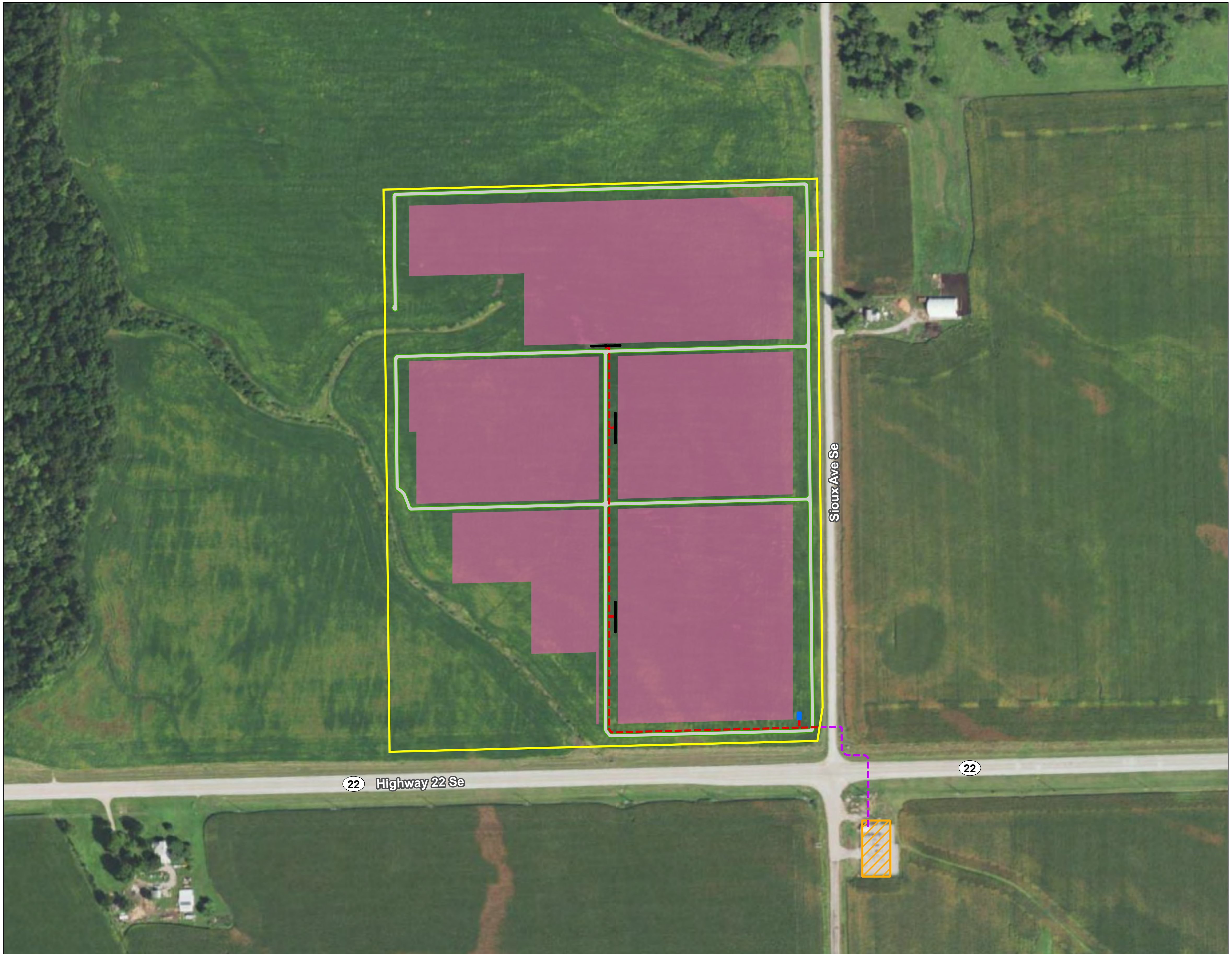



Figure No.
**1**

Title
## Project Location

Client/Project 193709077
PCR Investments LLC
Lone Tree Substation Solar Project

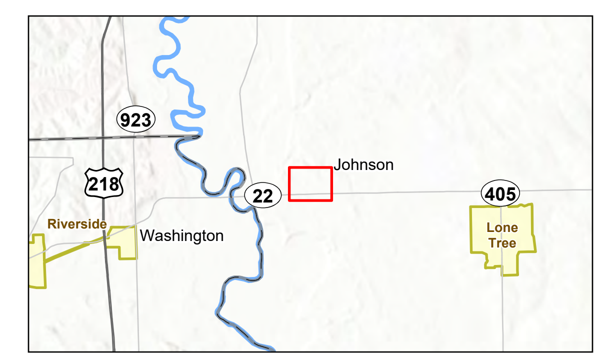
Project Location
Township of Freemont
Johnson County, IA

Prepared by JDS on 2022-08-03
TR by MZ on 2022-08-04
IR by SP on 2022-08-18

N

0 150 300 Feet
(At original document size of 11x17)
1:3,600

Legend
- Project Boundary
- Electrical Collection System
- Generator Tie Line
- Access Roads
- Solar Array
- Transformers, Switchgear, and Power Station
- Switchgear & Metering
- Substation




***Notes***
**1.** Coordinate System: NAD 1983 StatePlane Iowa South FIPS 1402 Feet
**2.** Data Sources: Stantec, PCR Investments LLC, USGS, NADS
**3.** Background: NAIP 2021

Stantec

BANK PERFORMANCE AGREEMENT

Whereas, PCR Investments SP2 LLC, hereinafter referred to as "Applicant", has commenced development pursuant to a previously approved Zoning Amendment Application for Lone Tree Solar (Johnson County Application PZC-TBD), and is now seeking approval for a zoning amendment; and

Whereas, PCR Investments SP2 LLC, has an executed lease agreement on the real property located at <SITE ADDRESS>, in Johnson County, Iowa, which is legally described as:

<FULL LEGAL DESCRIPTION OF PROPERTY>; and

Whereas, Applicant desires to obtain approval from the Johnson County Board of Supervisors for a zoning amendment from Agricultural to Renewable Energy use to site a PV solar farm.); and due to the requirement for financial assurances for decommissioning the facility and restoring the land to agricultural use, as shown on Exhibit A: Decommissioning Cost Estimate, containing an engineer's estimate, and a table showing the equipment to be removed and the responsibilities to restore the land to agricultural use describing the work to be performed, all of which is attached hereto and by this reference is made a part hereof; and

Whereas, as an inducement for Johnson County to approve the zoning amendment for Lone Tree Solar, as requested by Applicant, and as a means of ensuring compliance with the decommissioning of the solar facility and restoration of the land for agricultural use as shown on the attached Exhibit A: Decommissioning Cost Estimate, the Applicant hereby commits to providing financial assurance to ensure the completion of all decommissioning and restoration as shown on the attached Exhibit A: Decommissioning Cost Estimate in a timely manner; and

Whereas, the amount of **$506,951.50** will be necessary to complete the decommissioning of all listed equipment and restoration of the land to agricultural use, which includes a 10% decommissioning contingency, and which amount is supported by the Cost Estimate prepared by a professional engineer, attached hereto as Exhibit A: Decommissioning Cost Estimate; and

Whereas, Applicant offers to guarantee decommissioning of the facility and restoration of the land to agricultural use as specified above and in Exhibit A: Decommissioning Cost Estimate by obtaining and pledging a Standby Letter of Credit ("Letter"), in the amount of $253,475.75 prior to construction from <NAME OF LENDER >, located in <TOWN OF LENDER>, <STATE>, and the amount of $126,737.88 within five (5) years of the date of initial approval and the remaining $126,737.88 within eleven (11) years of the date of initial approval to, and for, the benefit of Johnson County, a copy of which is attached hereto as Exhibit B: Financial Assurances and incorporated in this Agreement by this reference; and

Whereas, the parties agree that after all required improvements as shown in the attached

Exhibit C: Decommissioning Site Plan has been completed and the land restored to agricultural use and certified "completed", the Letter of Credit may then be canceled; and

Whereas, the Johnson County Zoning Administrator and the Johnson County Attorney have been provided the Letter in advance of execution of the Agreement for review, have approved the use of the Letter to satisfy the performance agreement requirement, and have agreed that the terms and conditions of this Agreement and Letter, and Applicant's performance hereunder, will protect the interests of Johnson County herein.

Now, therefore, in consideration of the mutual covenants hereinafter set forth, it is agreed between Johnson County, Iowa, Applicant, and <NAME OF LENDER>, as follows:

1. Applicant agrees to decommission the solar facility and restore the land to agricultural use as shown on and in conformance with the approved Exhibit C: Decommissioning Site Plan and narrative set forth in Exhibit A: Decommissioning Cost Estimate.

2. Coincident with approval of Applicant's Zoning Amendment, Applicant shall deliver the Letter to Johnson County, Iowa. The Letter shall serve as security payment of the specified amounts in the event all required decommissioning and restoration as shown on the attached Exhibit C: Decommissioning Site Plan are not completed by <PERFORMANCE AGREEMENT DEADLINE>, and the parties hereto agree that the Letter shall remain in effect until <NAME OF LENDER> receives a written authorization from the Johnson County Zoning Administrator to cancel said Letter. Said authorization shall be provided within 30 days of Applicant providing the proper documentation to the Johnson County Zoning Administrator that the said improvements have been completed and certified.

3. Johnson County and Applicant agree that the amount specified in the Letter represents approximately one hundred and ten percent (110%) of the cost of completing and installing all required improvements as shown on the attached Exhibit A: Decommissioning Cost Estimate and that the Johnson County Zoning Administration will authorize the cancellation of the Letter upon being satisfied that the improvements have been completed and installed in a timely and satisfactory manner and as shown on Exhibit C: Decommissioning Site Plan.

4. Applicant and <NAME OF LENDER> agree that, if not canceled by <PERFORMANCE AGREEMENT DEADLINE> as a result of Applicant's timely decommissioning and restoration shown on Exhibit C: Decommissioning Site Plan, the Letter shall continue until its cancellation has been authorized by the Johnson County Zoning Administrator.

5. In the event that the decommissioning and restoration as shown on the attached Exhibit A: Decommissioning Cost Estimate have not been completed by <PERFORMANCE AGREEMENT DEADLINE>, Applicant shall be obliged to pay Johnson County in the sum of **$506,951.50**. Failure to fulfill such obligation within ten [10] days of receipt of notice, the County may use the Letter to receive payment and apply such funds towards the decommissioning and restoration shown on Exhibit C: Decommissioning Site Plan <NAME OF LENDER> agrees to pay over the funds to Johnson County upon request in writing to do so by the Johnson County Attorney, who will provide proper documentation of prior notification delivered to Applicant and Applicant's failure to complete the decommissioning and restoration by the agreed date according to [Performance Agreement]. The Johnson County Zoning

Administrator may grant an extension of this deadline, and any forbearance or failure of Johnson County to insist on the performance of any terms or conditions of this Agreement shall not be construed as a waiver of relinquishment of any rights granted hereunder or of the future performance of any such term or condition, and the obligations of the Applicant and <NAME OF LENDER> with respect thereto shall continue in full force and effect for the decommissioning and restoration as shown on the attached Exhibit C: Decommissioning Site Plan.

6. If the cost of the decommissioning and restoration of all required improvements as shown on the attached Exhibit A: Decommissioning Cost Estimate exceeds the amount specified in the Letter, Johnson County shall have a lien and charge against the Project Site for the balance of the cost, in addition to any direct claim against Applicant. In the event Johnson County has proceeded to complete decommissioning and restoration due to Applicant's default, if the amount of payment demanded and received by the County exceeds the cost of construction and installation of the improvements, the County shall refund to Applicant any amount received from the Letter but not used by the County for construction of the same, net of all associated expenses incurred by the County, within [__] days after completion of the decommissioning and restoration works.

7. In the event that a dispute arises as to whether Applicant has completed the decommissioning and restoration as shown on the attached Exhibit C: Decommissioning Site Plan, or as subsequently agreed to by the County and Applicant, in writing, the Letter shall remain in effect until any dispute between the parties is resolved. Applicant agrees that <NAME OF LENDER> is authorized to use the Letter to satisfy any Court Order, binding arbitration award, or mutual settlement between the parties if Applicant does not satisfy such order, award, or settlement. Any remaining amount together with the interest accrued thereon shall be returned to Applicant.

8. The expenses of the Letter, if any, shall be the sole obligation of Applicant. <NAME OF LENDER> shall have no obligation under this Agreement except as set out herein, and Johnson County and Applicant agree that there is no obligation on <NAME OF LENDER> to perform the obligations of the County or of Applicant, except of payment of amounts promised by Applicant to Johnson County in Paragraph 5 above.

9. The Johnson County Zoning Administrator commits to make a determination as to whether all required improvements as shown on the attached Exhibit C: Decommissioning Site Plan have been completed in a satisfactory manner within 30 days of request and documentation from Applicant, and that the Letter should be cancelled, all of it in the same 30 days period of time. Johnson County further agrees that it will immediately after termination of said 30 days period of time, notify <NAME OF LENDER> and Applicant, in writing, when such a determination has been made and that the Letter should be cancelled. Such Notice will <NAME OF LENDER> to cancel the Letter.

Dated this day of <MONTH>, <YEAR> at Iowa City, IA

<LEGAL BUSINESS OR APPLICANT/OWNER NAME >

By:

<NAME OF LENDER>

By:

Johnson County, Iowa

By: Joshua Busard, Director

Planning, Development & Sustainability

<LISTING/DESCRIPTION OF ATTACHMENTS>

Exhibit A: Decommissioning Cost Estimate

Exhibit B: Financial Assurances

Exhibit C: Decommissioning Site Plan

**Attachment I:**
**Sensitive Areas Analysis**

# Sensitive Areas Analysis Report (Revised)

## Conifer Power Lone Tree Sensitive Areas Analysis
## Parcel No. 1801476001
## Highway 22 and Sioux Avenue
## Lone Tree, Johnson County, Iowa

March 22, 2023

Terracon Project No. 06227115RR

**Prepared for:**
PCR US Investments Corp
Houston, Texas

**Prepared by:**
Terracon Consultants, Inc.
Cedar Rapids, Iowa

## TABLE OF CONTENTS



## APPENDICES

# 1.0 SITE LOCATION AND PROJECT DESCRIPTION

Terracon understands that PRC US Investments Corp (the Client) and Conifer Power are preparing preliminary plans to develop the site, located at Highway 22 and Sioux Avenue, with an approximate 7.5-megawatt solar facility. The location of the site is indicated on the attached Exhibits and is further described in Table 1 below.

### Table 1. Site Information

| Site | Parcel No. | County, State | Approximate Size (Acres) | Additional Information |
|---|---|---|---|---|
| Lone Tree | 1801476001 | Johnson, Iowa | 50 | Owner: No Gen-tie route identified by client. |

# 2.0 SCOPE OF SERVICES

## 2.1 Task 1: Critical Wildlife Habitat Review

To determine if critical wildlife habitat exists on-site, Terracon utilized the Iowa Department of Natural Resources (IDNR) PERMT site in addition to the Information for Planning and Consultation (IPaC) websites to obtain updated information pertaining to the site. Terracon had previously obtained information from the IDNR PERMT and IPaC websites for past work completed at the site (Preliminary Threatened and Endangered Species Habitat Assessment Review dated June 17, 2022). However, updated documentation was obtained to reflect current conditions at the site. After review of the updated documentation provided by the IDNR PRMT and IPaC sites, there appears to be no critical wildlife habitat on-site. This includes no suitable bat habitat as the site is void of trees. Also, based on the Johnson County Property Information Viewer, the site is outside of the low and high-potential zones for the Rusty Patched Bumble Bee as shown in Appendix A, Exhibit 6. The prior historical threatened and endangered species report, including the species list as well as agency communication, can be seen as an attachment in Appendix B.

## 2.2 Task 2: Floodplain and Floodway Review

To determine if floodplains and/or floodways are present on-site, Terracon reviewed the Federal Emergency Management Agency (FEMA) Fire Insurance Rate Map (FIRM) panel numbers 19103C0340E and 19103C0405E, both maps have been effective since February 16, 2007. Based on a review of the FEMA FIRM maps, the site does not appear to be within a floodplain or floodway. The site is in Zone X, which is an area of minimal flood hazard. However, areas adjacent west and northeast of the site are in Zone A, which are areas with 1% annual chance of flooding over the life of a 30-year mortgage. A FEMA FIRM map is included in Appendix A, Exhibit 1.

## 2.3 Task 3: Historic Properties Review

To determine if historically significant structures or significant archaeological sites are present in the project area, Terracon reviewed the previously completed Desktop Cultural Resources Assessment dated May 5, 2022. Based on review of the previous report, the area of potential effect is currently undeveloped with agricultural fields, and there were no previously recorded archeological sites identified in the project area.

Terracon engaged the State Historic Preservation Office (SHPO) for recommendations based on the Desktop Cultural Resources Assessment dated May 5, 2022. Based on conversations with SHPO, it was recommended that a pedestrian survey be performed. Terracon, on the behalf of PCR, engaged Bear Creek Environmental to complete the pedestrian survey. Based on the Phase I Archaeological Investigation performed by Bear Creek and dated December, 2022, no cultural materials were observed or collected from the project area during the investigation. Based on those findings, Bear Creek does not recommend further cultural resource investigations for this project at this time. Should cultural materials be discovered during proposed development activities, those activities should cease and the SHPO contacted about the discovery.

The Desktop Cultural Resources Assessment and Bear Creek report are included Appendix B.

## 2.4 Task 4: Prairie and Prairie Remnants Review

Terracon utilized aerial photos to determine the cropping history of the site. Based on review of the aerial images, it appears as though the site has been utilized for agricultural row crop production since at least 1937. Due to the utilization of the site as agricultural row crops, there does not appear to be prairie or prairie remnants located on-site. The referenced aerial images are included in Appendix A, Exhibit 2.

## 2.5 Task 5: Savanna and Savanna Remnants Review

Terracon utilized aerial photos to determine if savannas or savanna remnants are present on-site. Based on review of the aerial images, it appears as though the site has been utilized for agricultural row crop production since at least 1937. There does not appear to be savannas or savanna remnants located on-site. The referenced aerial images are included in Appendix A, Exhibit 2.

## 2.6 Task 6: Significant Slopes Review

Terracon utilized topographic maps to identify landforms that may contain slopes that are at a high risk to erode, slide, or collapse, as well as classify slopes as either a critical or protected slope. A critical slope is a landform with a grade between 25%-35%, and a protected slope is a landform with a grade that exceeds 35%. Based on review of the topographic maps as shown in Appendix A, Exhibit 3, Terracon did not observe slopes that would be classified as either a critical or protected slopes. The maximum slope within the project boundary is approximately 3-5%. Portions of the topographic maps presented in Appendix A, Exhibit 3 are missing coverage, and may not show portions of the site.

## 2.7 Task 7: Stream Corridors, Watercourses, and Surface Water Bodies Review

To determine if an area contains a stream corridor, watercourse and/or surface water body (aquatic features), Terracon utilized the most current topographic maps, as well as the FEMA FIRM map that was obtained for the site. Based on review of the Quadrangle map and the FEMA FIRM map, a stream corridor of Otter Creek was identified on the site, running in a southeast to northwest orientation transecting the southwest corner of the site. The tributary was labeled as an intermittent stream on the Quadrangle map, as depicted by the blue solid and dashed line. Since no floodway was delineated on the FEMA FIRM map, the blue line on the Quadrangle map shall serve as the centerline of a 30-foot wide stream corridor. There is also an apparent grassed-swale in the northwest portion of the site. The apparent swale does not have defining bed and bank characteristics and therefore would not be classified as a stream corridor, waterbody, or surface water body. Based on the classification of the stream, a 30-foot natural buffer shall be established around the stream corridor. The FEMA FIRM map is included in Appendix A, Exhibit 1, and the topographic maps are included in Appendix A, Exhibit 3. Photos of the observed area are included in Appendix C. Portions of the topographic maps presented in Appendix A, Exhibit 3 are missing coverage, and may not show portions of the site.

## 2.8 Task 8: Wetlands Review

To identify areas that would be classified as wetlands, Terracon performed a Waters of the United States (WOUS) and Wetland Delineation Report (the Report) dated June 8, 2022. Furthermore, Johnson County requests that any identified wetlands be classified in one of three classes based on size, makeup, and habitat. Based on the findings of the report, Terracon observed an on-site wetland and an apparent on-site stream corridor. The observed wetland exhibited hydric soil, and wetland hydrology characteristics and totaled approximately 0.43 acres. Based on the Johnson County wetland classification system, this wetland would be classified as a Class 3 wetland, and this wetland would require a 50-foot buffer. The apparent grassed-swale in the northwest portion of the site did not exhibit hydrophytic vegetation or hydric soil. Furthermore, areas exhibiting potential hydric soil, contours, and wet signatures were not identified on the National Wetland Inventory map (NWI) as shown in the Report shown in Appendix B. The wetland determination forms are also included in the Report in Appendix B.

Impact to wetlands is only allowed if it is clearly demonstrated that avoiding and minimizing the impact is unreasonable. Impacts must also consider the class of the wetlands. Class 1 wetlands shall not be impacted for any purpose. Class 2 and 3 wetlands shall not be impacted unless for critical or required infrastructure.

### 2.9 Task 9: Woodlands Review

To identify woodland areas on the site, Terracon utilized aerial images in addition to prior site knowledge collected from Terracon's Waters of the United States and Wetland Delineation Report (the Report) dated June 8, 2022 to determine the presence of woodland areas. Based on past site reconnaissance and the review of aerial images, woodlands were not observed on-site. Aerial images are included in Appendix A, Exhibit 2. Site photographs are included in Appendix C.

## 3.0 CONCLUSIONS

Based on a review of the nine sensitive areas analysis requirements as required by Johnson County, no sensitive area features were identified with the exceptions of a class 3 wetland and an unnamed stream corridor.

The wetland exhibited hydric soil, wetland hydrology characteristics and totaled approximately 0.43 acres. Based on the Johnson County wetland classification system, this wetland would be classified as a Class 3 wetland and would require a 50-foot buffer. The wetland exhibit produced from the Report are included in Appendix A, Exhibit 4. The full wetland report is also included in Appendix B.

The unnamed stream corridor was observed running in a southeast to northwest orientation, transecting the southwest corner of the site The stream corridor was labeled as an intermittent stream on the Quadrangle map, as depicted by the blue solid and dashed line. Since no floodway was delineated on the FEMA FIRM map, the blue line on the Quadrangle map shall serve as the centerline of a 30-foot wide stream corridor. Based on the classification of the stream, a 30-foot natural buffer shall be established around the stream corridor.

At this time, there are no planned impacts to the identified sensitive areas. The preliminary plans show an access road transecting the southwest portion of the site along the apparent wetland and stream corridor. However, at this time, it is planned that this access road (and erosion control measures) is outside of both of the applicable buffers for the wetland and stream. The buffers and limit of disturbance (LOD) can be seen on Exhibits 4,5A, and 5B in Appendix A.

## 4.0 CLOSING

Terracon appreciates the opportunity to provide services on this important project. Please feel free to contact Jordan Smith if you have any questions or require additional information.

Sincerely,
Terracon Consultants, Inc.

Jordan M. Smith
Staff Scientist

Tim V. Capps
Group Manager

# APPENDIX A
## Exhibits

# National Flood Hazard Layer FIRMette

FEMA

91°28'28"W 41°30'7"N


91°28'51"W 41°29'40"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

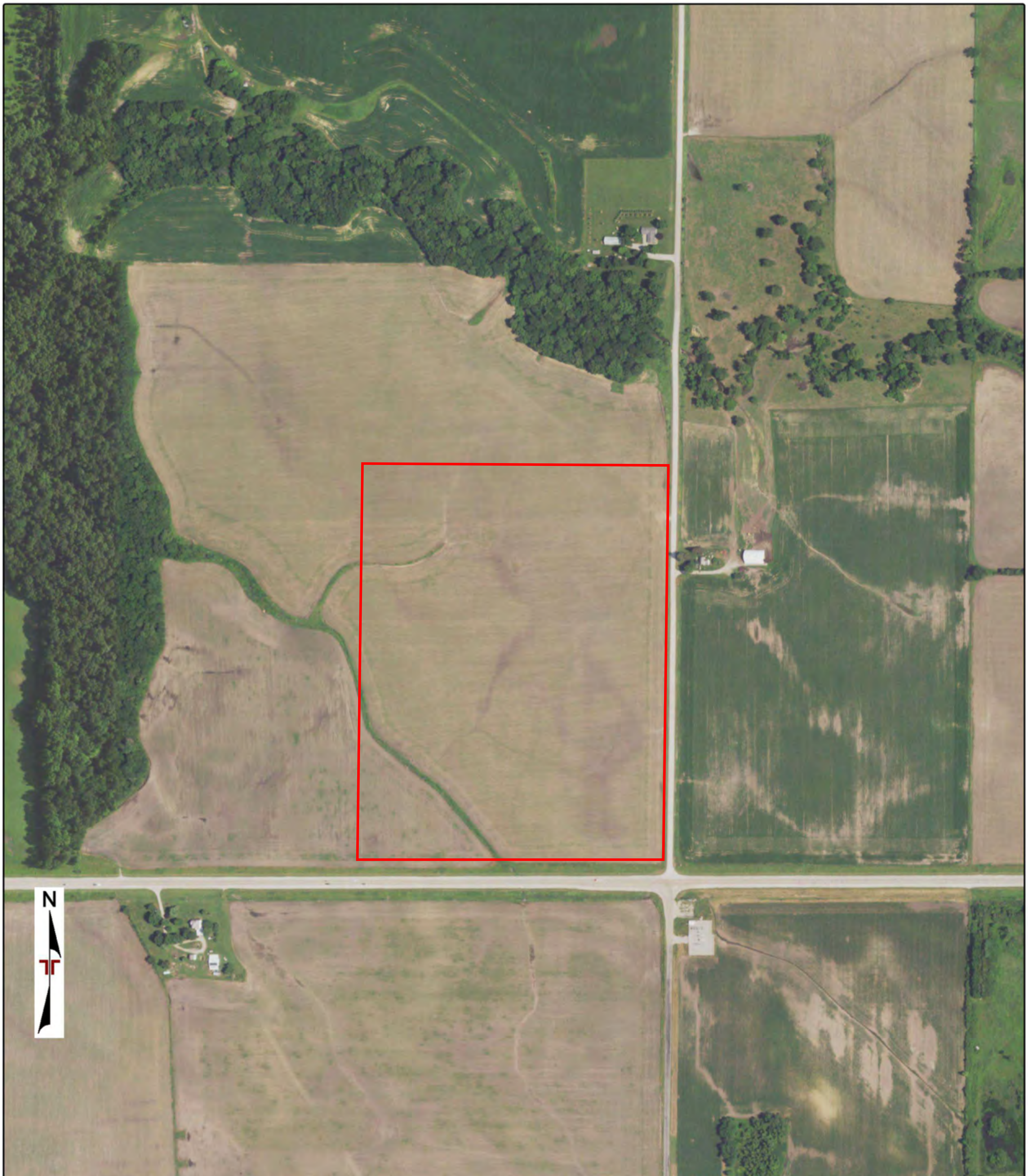
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/25/2022 at 3:50 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

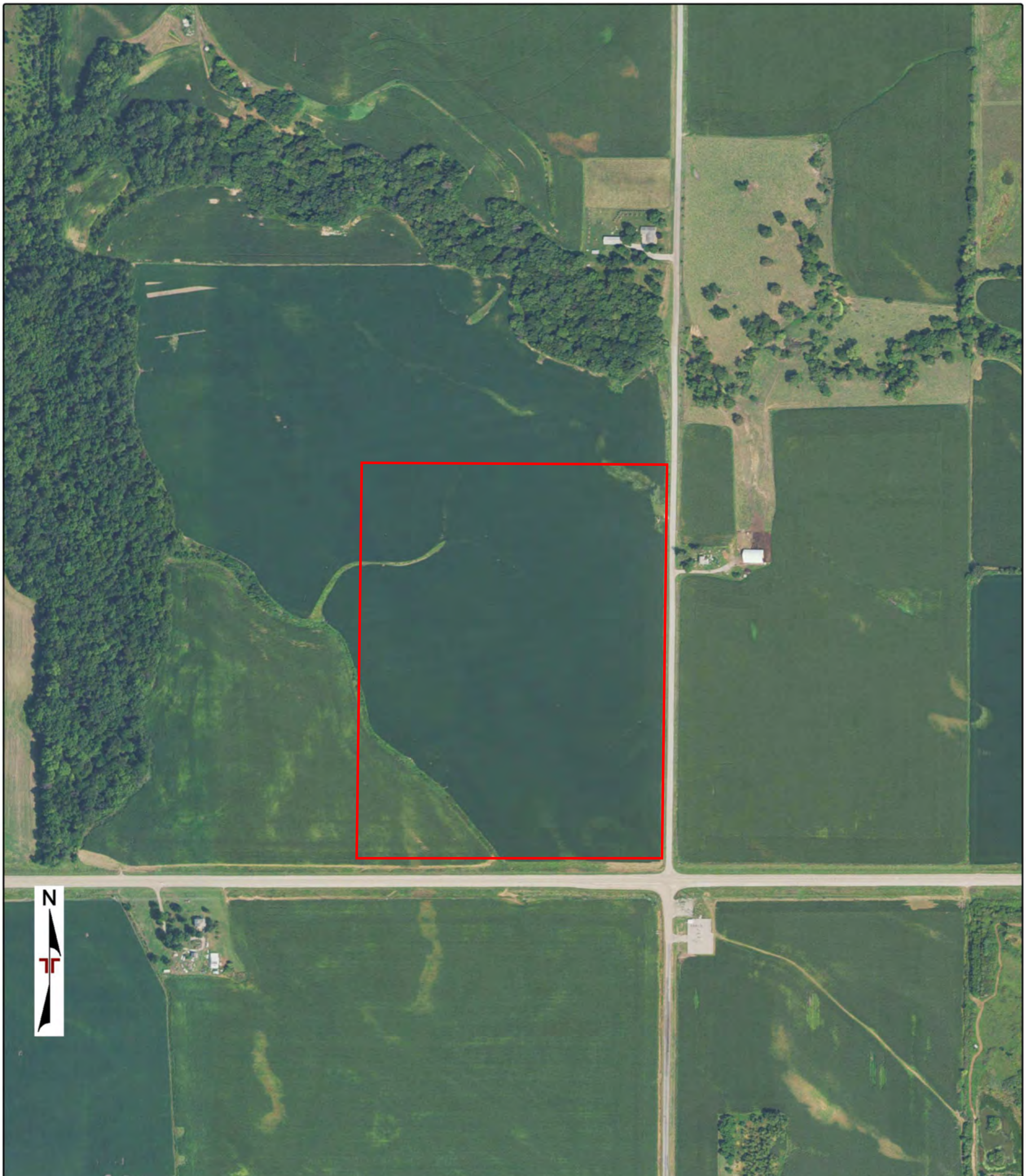
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

N

| | | | | |
|---|---|---|---|---|
| Project Manager: JMS | | Terracon Consulting Engineers & Scientists | FEMA FIRM Map | Exhibit |
| Drawn by: JMS | Scale: NA. | | Conifer Power Sensitive Areas Analysis<br>Highway 22<br>Lone Tree, Iowa | 1 |
| Checked by: TC | File Name: Exhibits | 2640 12th Street SW Cedar Rapids, Iowa 52404 | | |
| Approved by: TC | Date: Sep. 2022 | PH. (319) 366-8321 FAX. (319) 366-0032 | | |




| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2019 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 |
| --- | --- |
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon
2640 12th St SW
Cedar Rapids, Iowa 52404

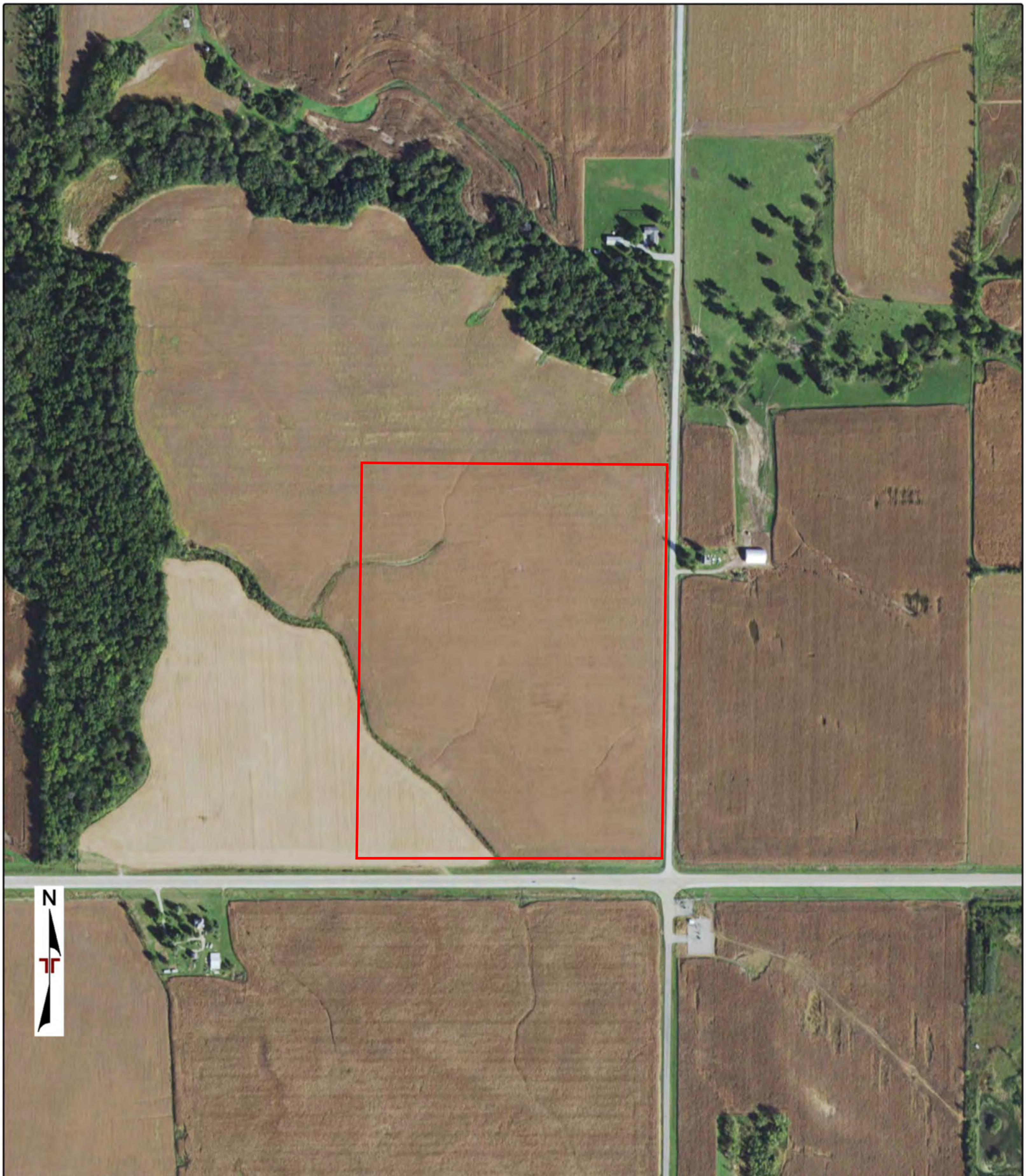
AERIAL PHOTO (2017 - USDA)

Lone Tree Site

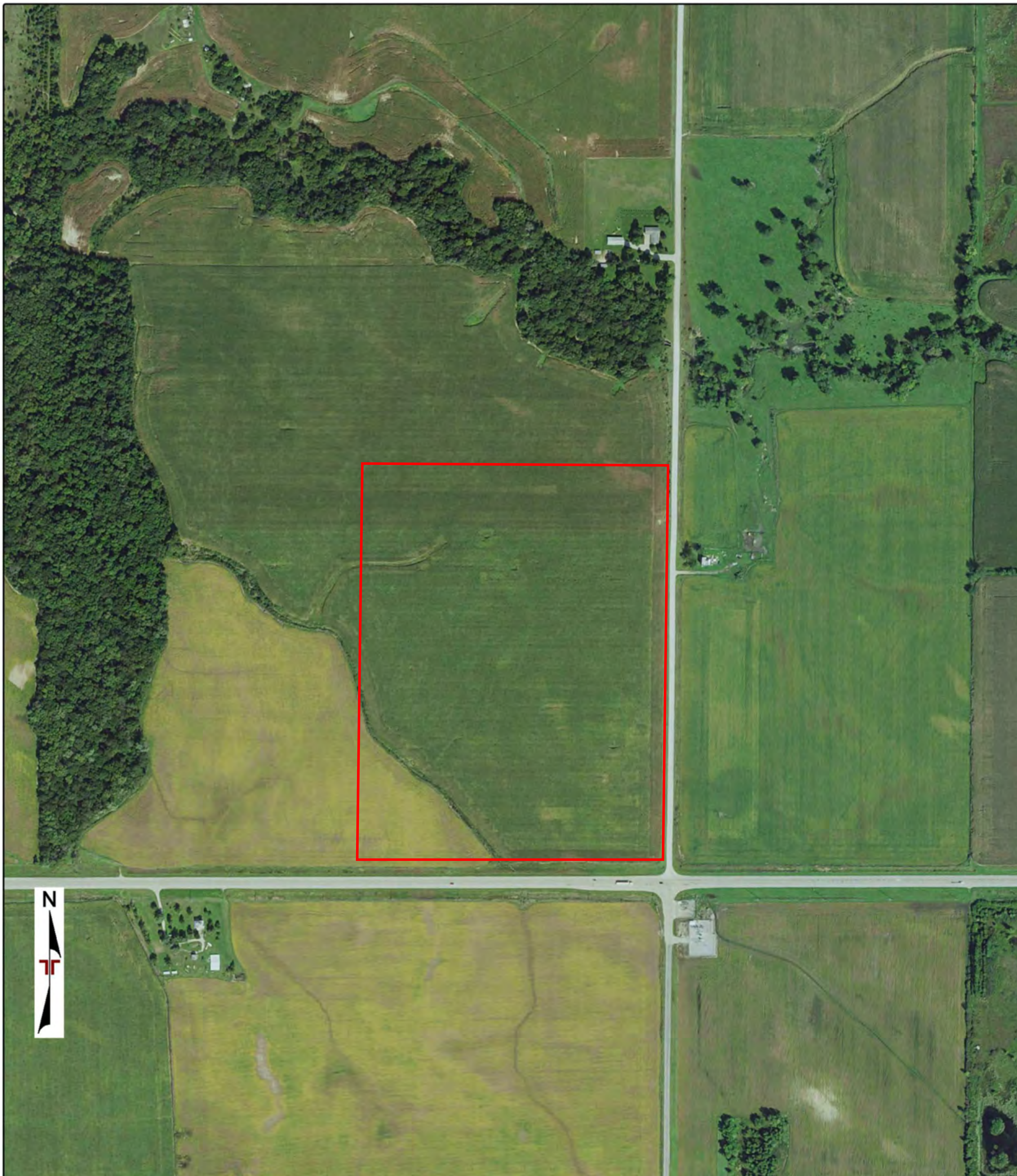
Parcel 1801476001, Iowa

Exhibit

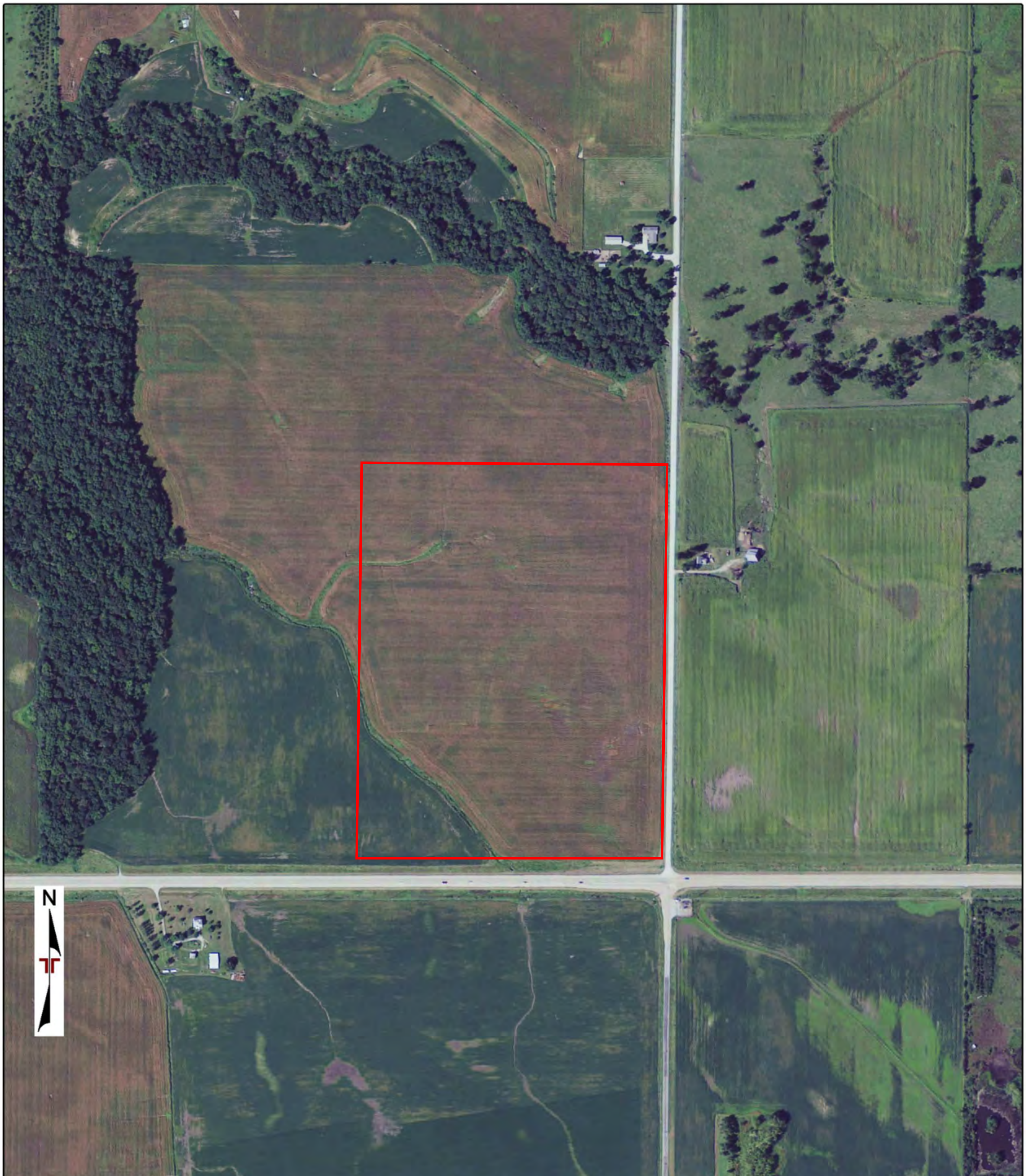
2



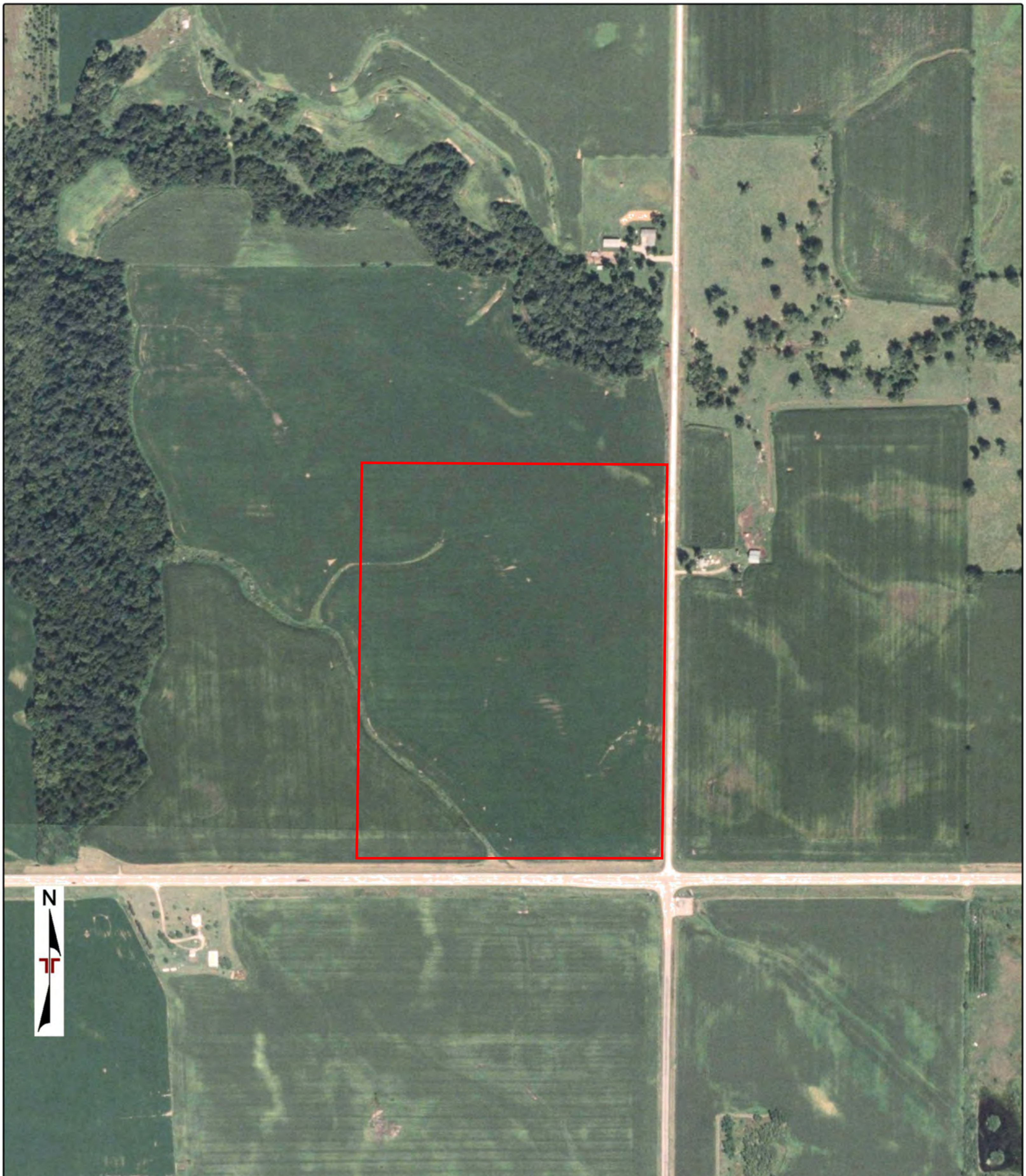

| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2015 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |



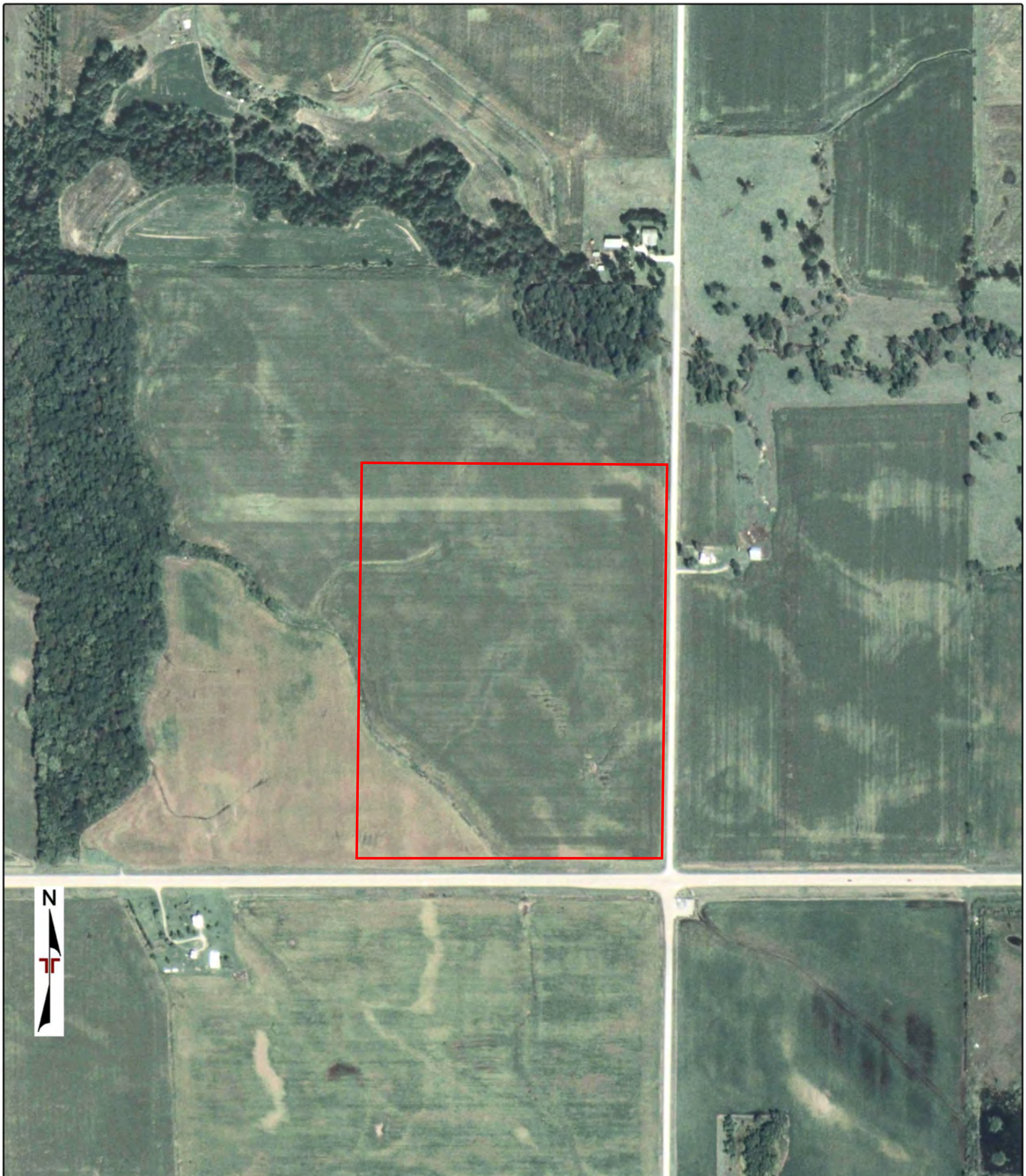

| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (2014 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | | |
| Checked by: | File Name: 22042000035 | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Approved by: | Date: 2022-04-21 | | | |



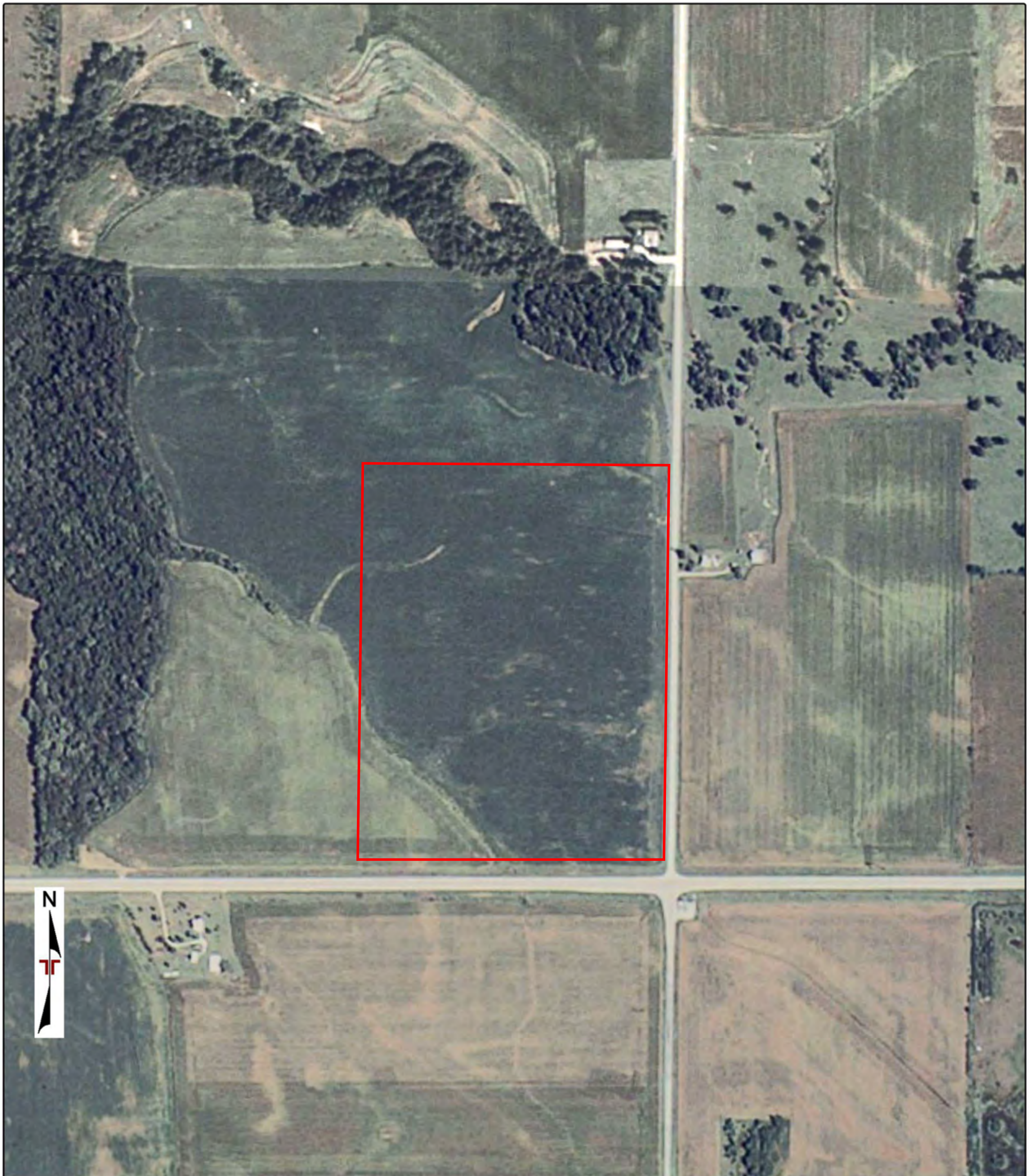

| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2010 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |



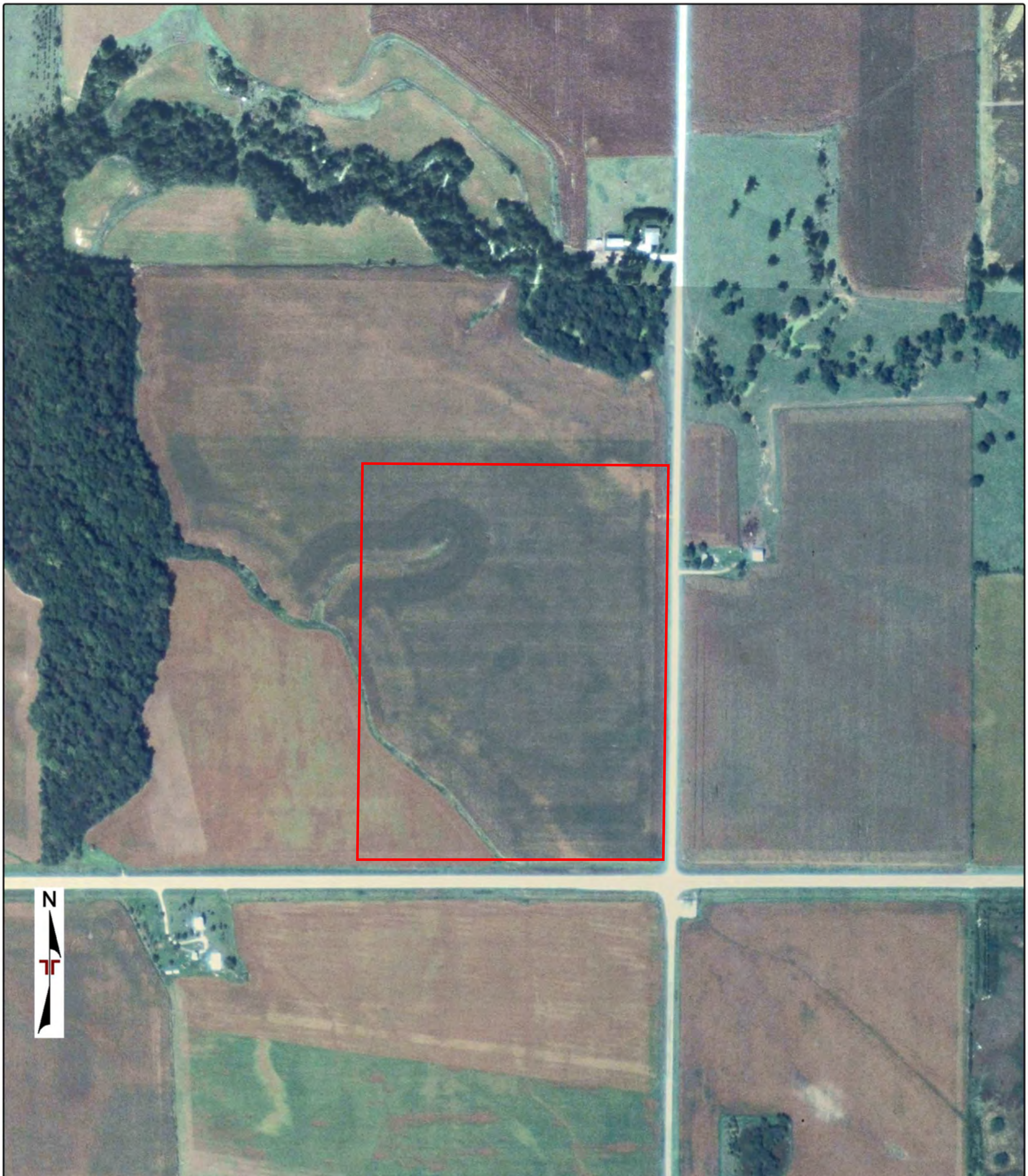

| Project Manager: | Project No. 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2009 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | | 2 |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |




| Project Manager: | Project No. 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2008 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2007 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 |
| --- | --- |
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

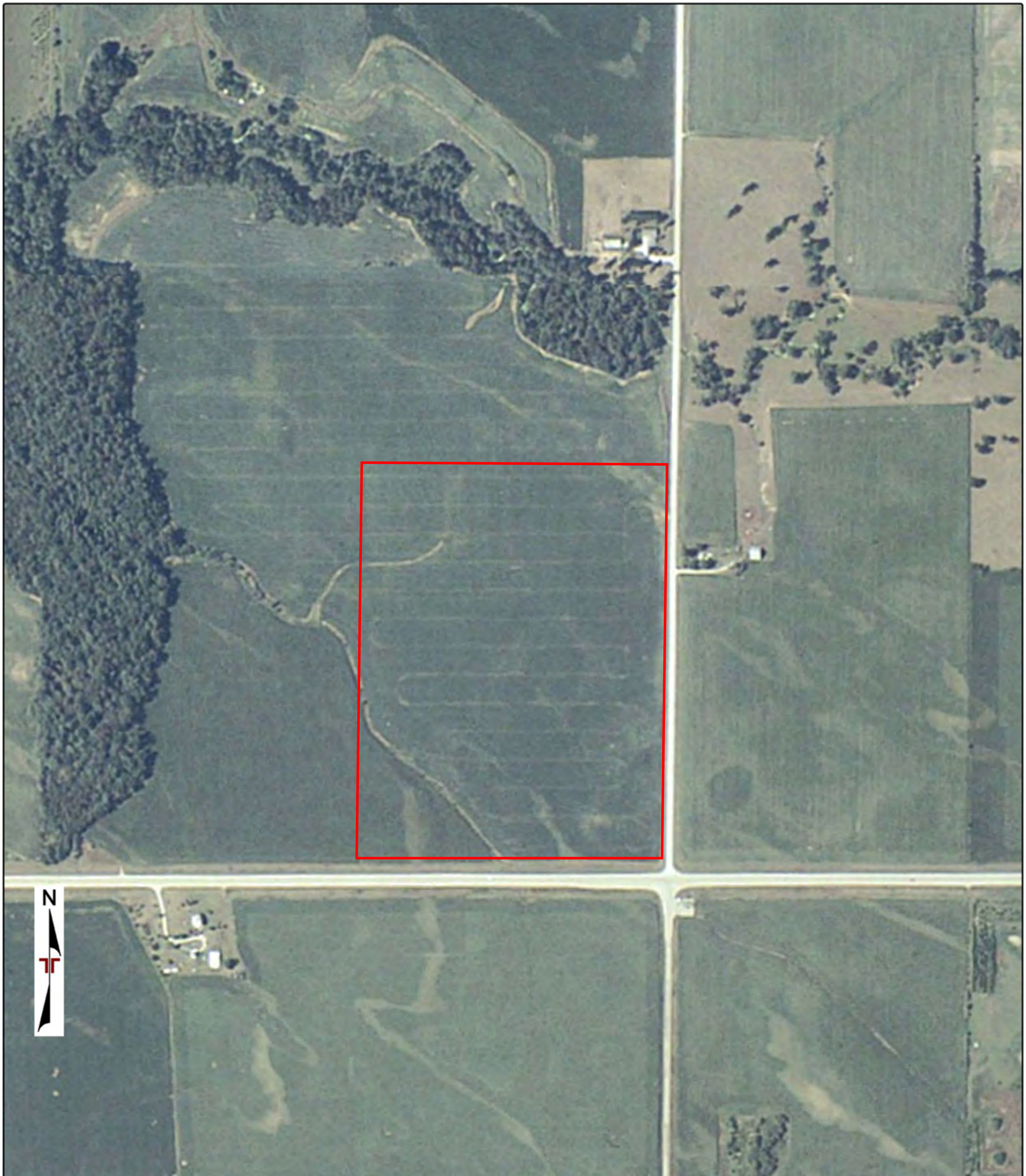
AERIAL PHOTO (2006 - USDA)

Lone Tree Site

Parcel 1801476001, Iowa

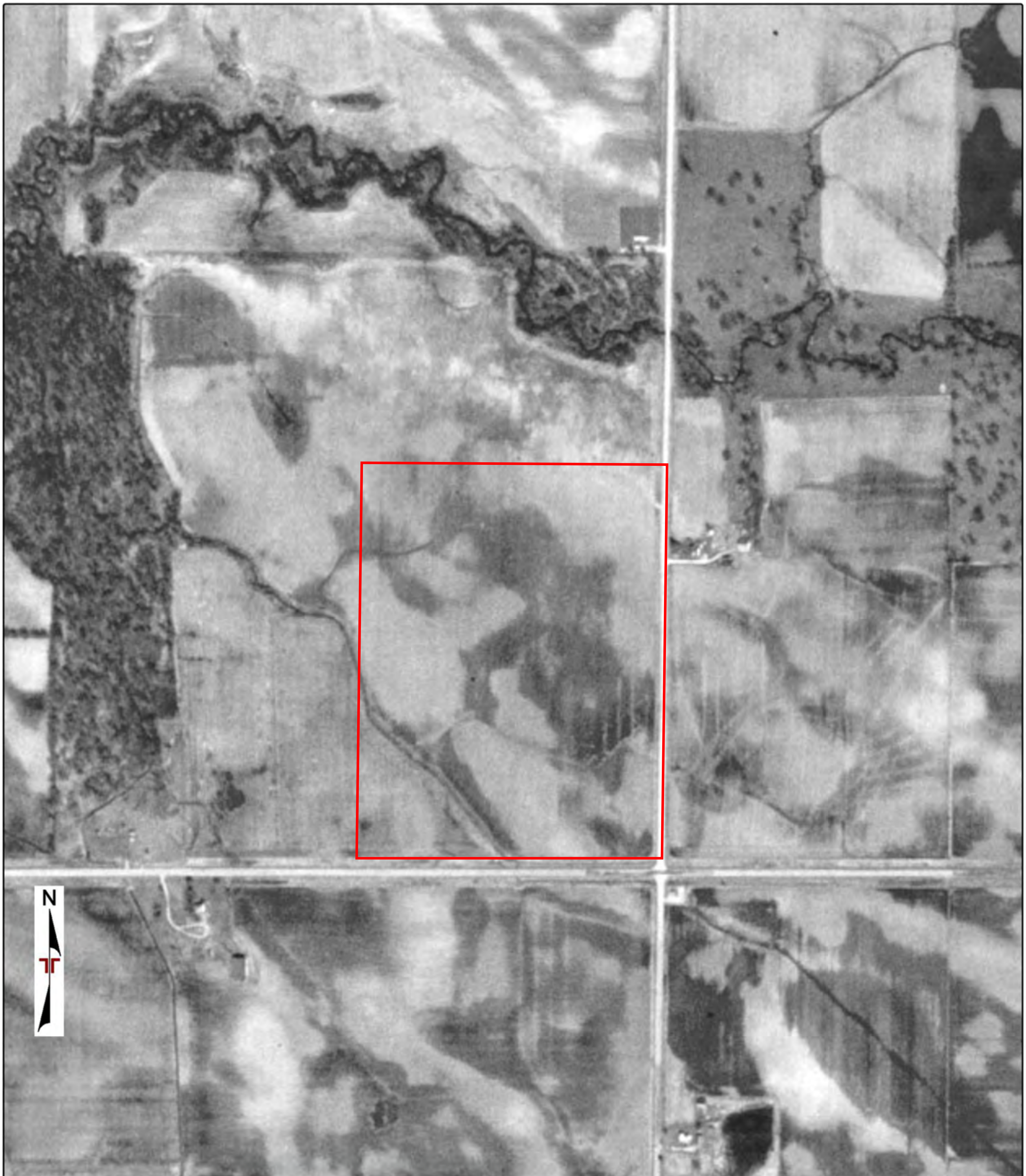
Exhibit

2




| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2005 - USDA) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |


| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (1994 - USGS) | Exhibit |
| Drawn by: | Scale: 1" = 500' | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon
2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (1983 - USGS)

Lone Tree Site
Parcel 1801476001, Iowa

Exhibit 2


| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (1970 - ASCS) | Exhibit |
| Drawn by: | Scale: 1" = 500' | | | |
| Checked by: | File Name: 22042000035 | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Approved by: | Date: 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1963 - ASCS) | Exhibit |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

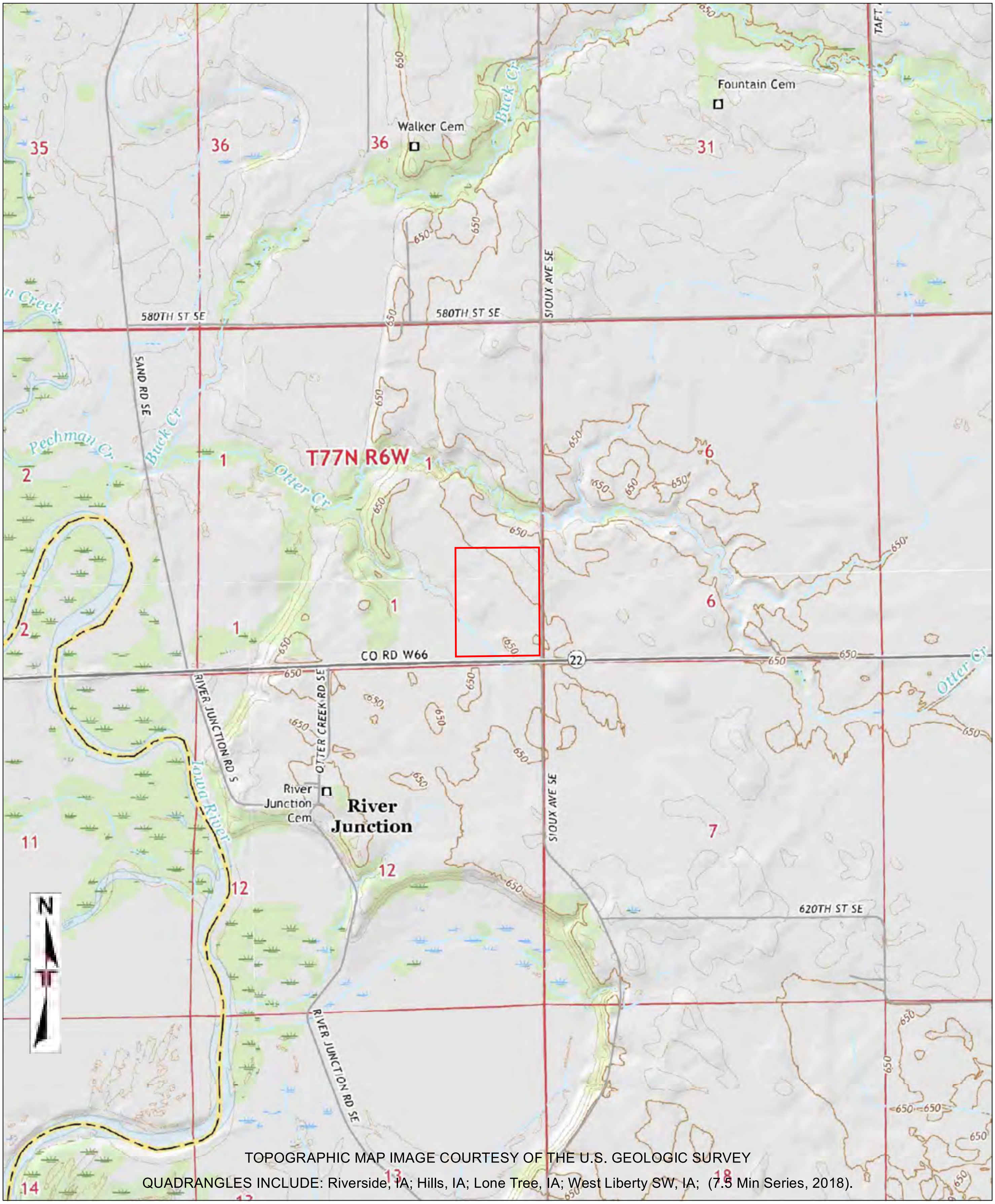
Terracon
2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (1951 - ASCS)

Lone Tree Site
Parcel 1801476001, Iowa

Exhibit 2

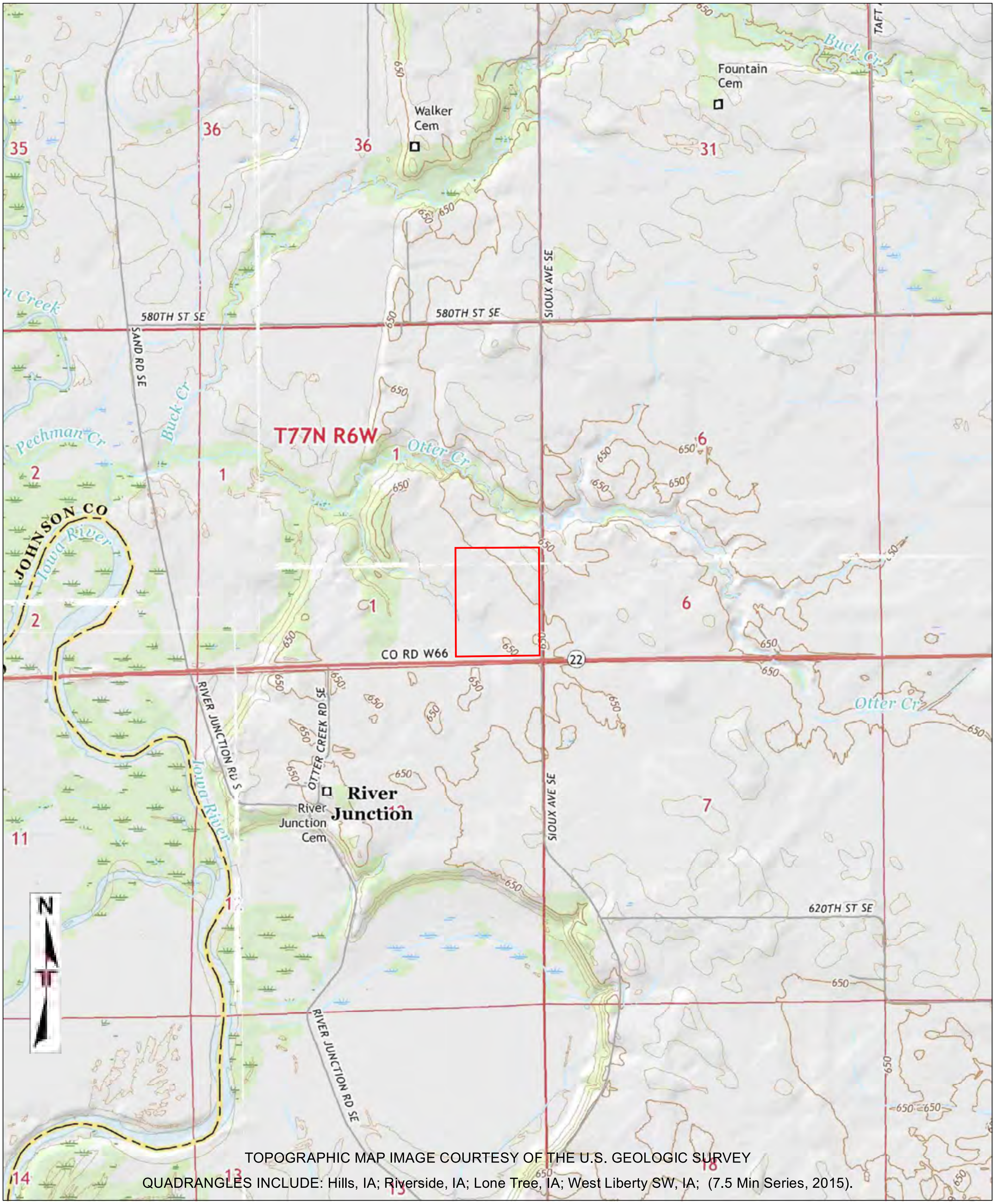

| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (1937 - ASCS) | Exhibit |
| Drawn by: | Scale: 1" = 500' | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Parcel 1801476001, Iowa | 2 |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

QUADRANGLES INCLUDE: Riverside, IA; Hills, IA; Lone Tree, IA; West Liberty SW, IA; (7.5 Min Series, 2018).

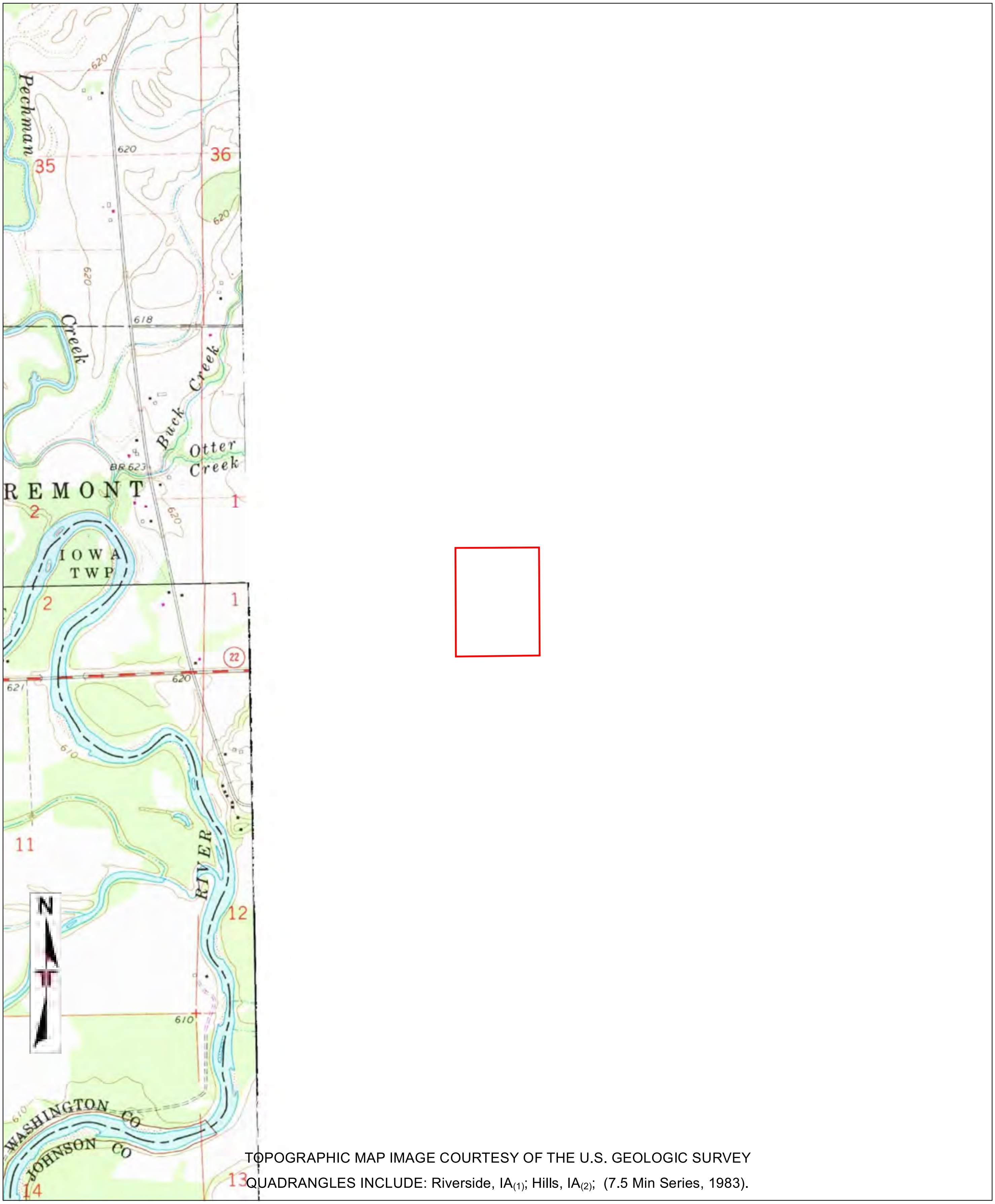
| Project Manager: | Project No: 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (2018) | Exhibit |
|---|---|---|---|---|
| Drawn By: | Scale: 1" = 2000' | | Lone Tree Site Parcel 1801476001, Iowa | 3 |
| Checked By: | File Name: 22042000035 | | | |
| Approved By: | Date: 2022-04-20 | | | |




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

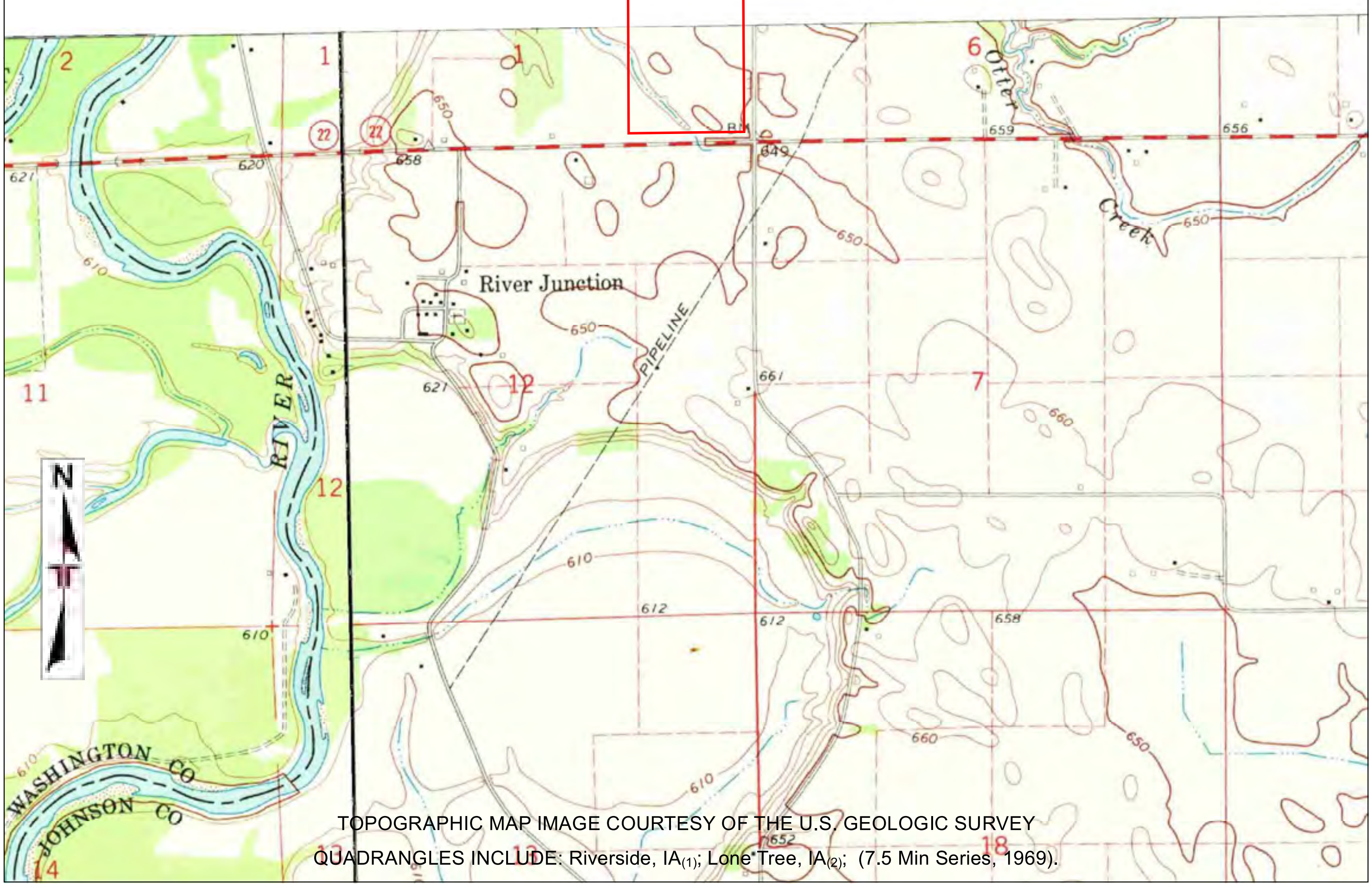
QUADRANGLES INCLUDE: Hills, IA; Riverside, IA; Lone Tree, IA; West Liberty SW, IA; (7.5 Min Series, 2015).

| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No: 06227049 | Terracon | TOPOGRAPHIC MAP (2015) | Exhibit |
| Drawn By: | Scale: 1" = 2000' | | | |
| Checked By: | File Name: 22042000035 | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Parcel 1801476001, Iowa | 3 |
| Approved By: | Date: 2022-04-20 | | | |



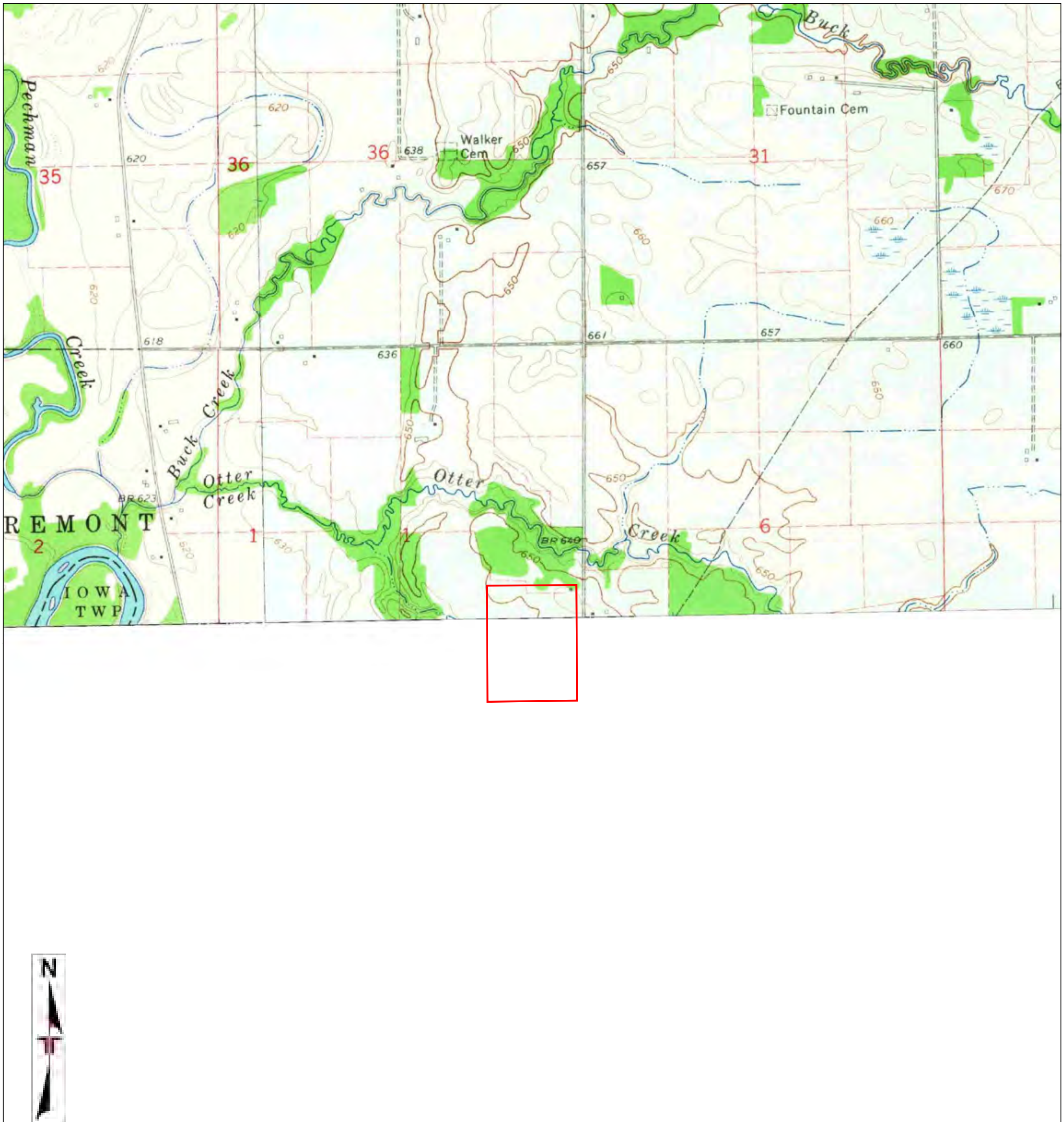

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY
QUADRANGLES INCLUDE: Riverside, IA(1); Hills, IA(2); (7.5 Min Series, 1983).

| Project Manager: | Project No: 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (1983) | Exhibit |
|---|---|---|---|---|
| Drawn By: | Scale: 1" = 2000' | | Lone Tree Site Parcel 1801476001, Iowa | 3 |
| Checked By: | File Name: 22042000035 | | | |
| Approved By: | Date: 2022-04-20 | | | |




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY
QUADRANGLES INCLUDE: Riverside, IA$_{(1)}$; Lone Tree, IA$_{(2)}$; (7.5 Min Series, 1969).

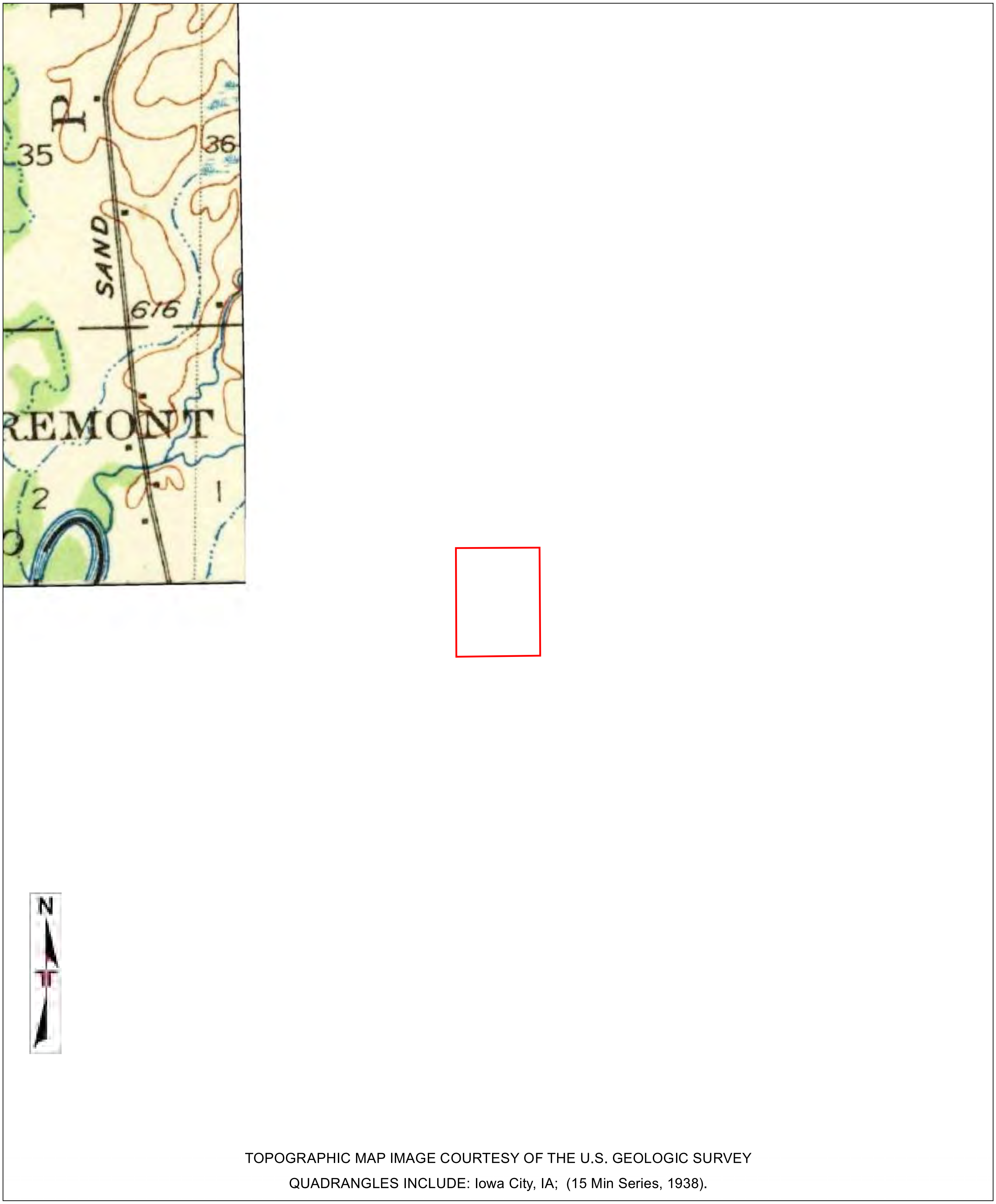
| Project Manager: | Project No: 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (1969) | Exhibit |
|---|---|---|---|---|
| Drawn By: | Scale: 1" = 2000' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 3 |
| Checked By: | File Name: 22042000035 | | | |
| Approved By: | Date: 2022-04-20 | | | |




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

QUADRANGLES INCLUDE: West Liberty SW, IA(1); Hills, IA(2); (7.5 Min Series, 1965).

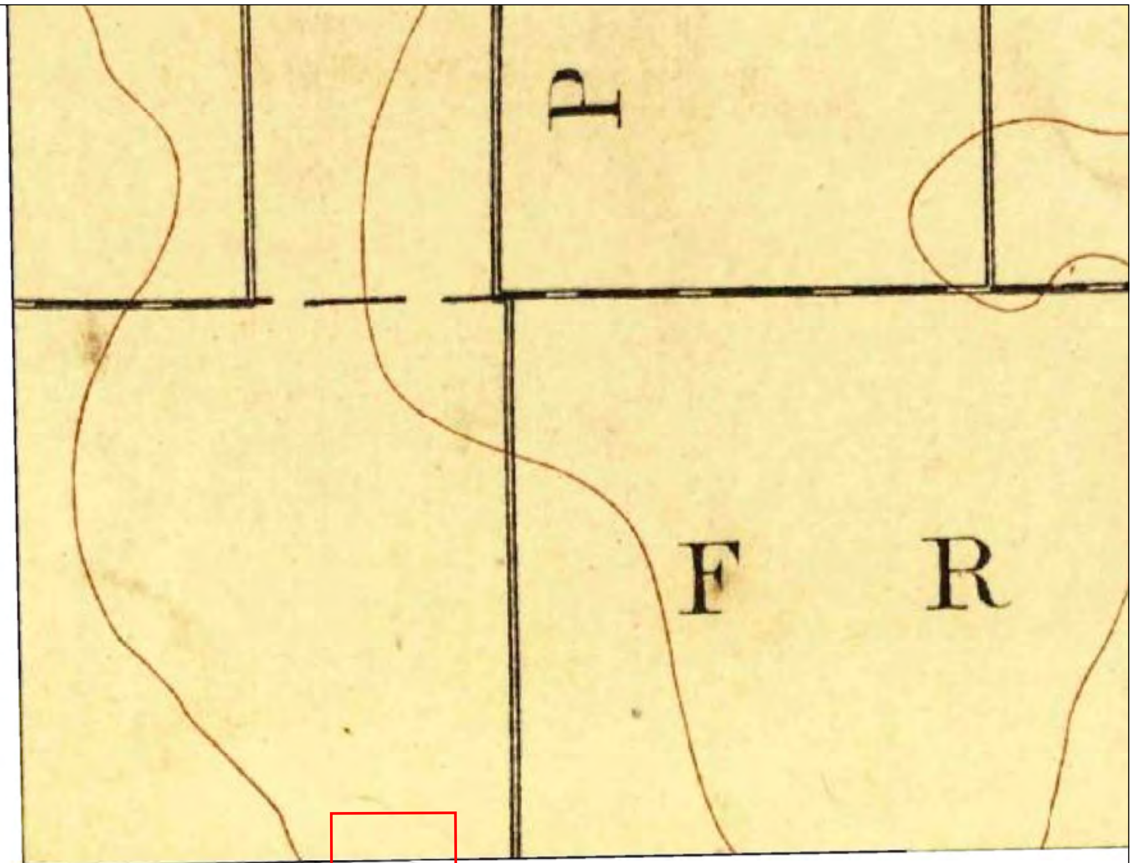
| Project Manager: | Project No: 06227049 | Terracon | TOPOGRAPHIC MAP (1965) | Exhibit |
|---|---|---|---|---|
| Drawn By: | Scale: 1" = 2000' | 2640 12th St SW Cedar Rapids, Iowa 52404 | Lone Tree Site Parcel 1801476001, Iowa | 3 |
| Checked By: | File Name: 22042000035 | | | |
| Approved By: | Date: 2022-04-20 | | | |

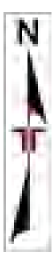



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

QUADRANGLES INCLUDE: Iowa City, IA; (15 Min Series, 1938).

| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No:** 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (1938) | Exhibit |
| **Drawn By:** | **Scale:** 1" = 2000' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 3 |
| **Checked By:** | **File Name:** 22042000035 | | | |
| **Approved By:** | **Date:** 2022-04-20 | | | |

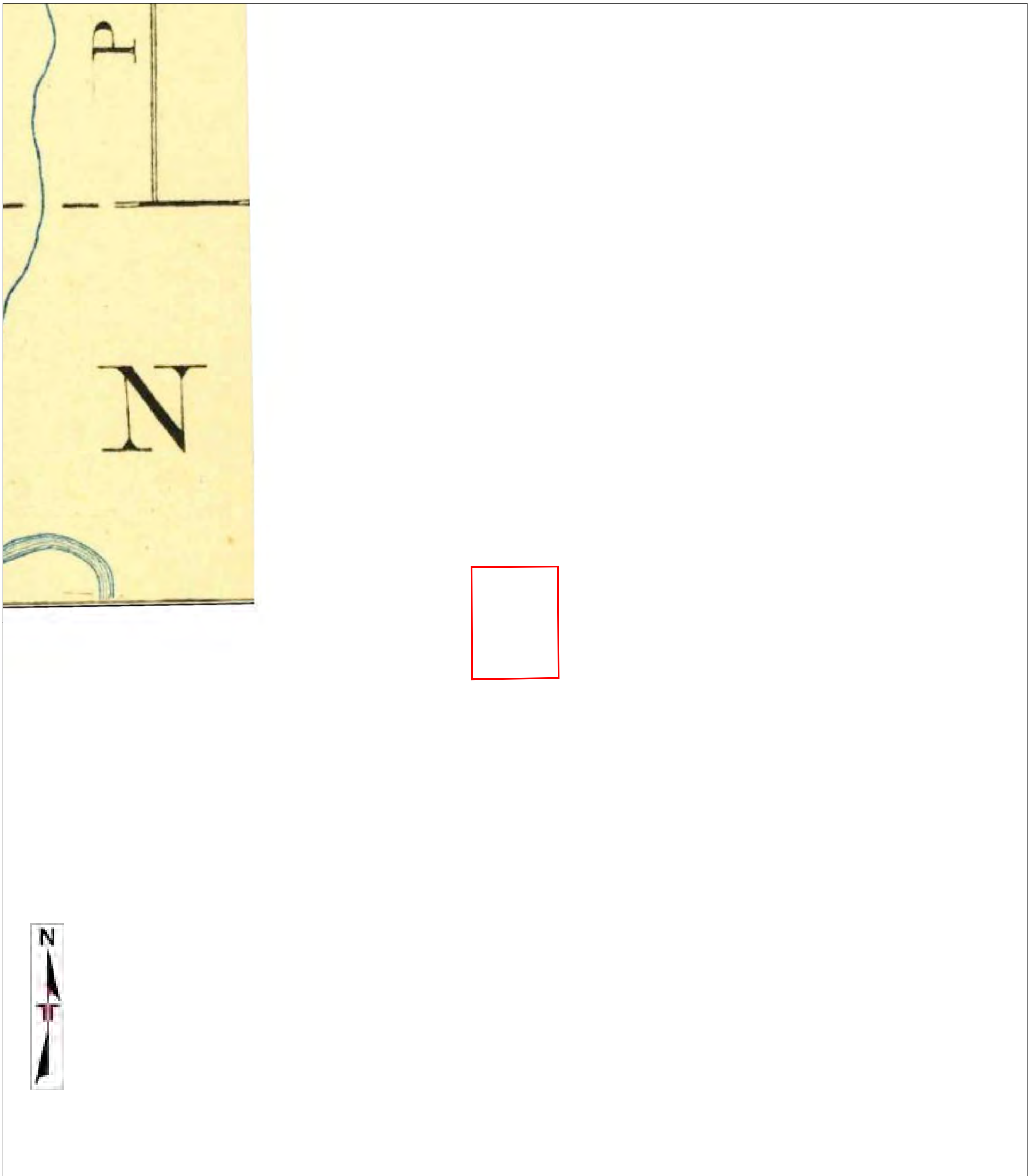



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

QUADRANGLES INCLUDE: West Liberty, IA; (15 Min Series, 1894).

| Project Manager: | Project No: 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (1894) | Exhibit |
|---|---|---|---|---|
| Drawn By: | Scale: 1" = 2000' | | Lone Tree Site Parcel 1801476001, Iowa | 3 |
| Checked By: | File Name: 22042000035 | | | |
| Approved By: | Date: 2022-04-20 | | | |




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGIC SURVEY

QUADRANGLES INCLUDE: Iowa City, IA; (15 Min Series, 1891).

| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No:** 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | TOPOGRAPHIC MAP (1891) | Exhibit |
| **Drawn By:** | **Scale:** 1" = 2000' | | Lone Tree Site<br>Parcel 1801476001, Iowa | 3 |
| **Checked By:** | **File Name:** 22042000035 | | | |
| **Approved By:** | **Date:** 2022-04-20 | | | |


AERIAL PHOTO FROM BING MAPS

NORTH

0 200'

APPROXIMATE DRAWING SCALE

| | |
|---|---|
| Project No. 06227049-2.2 | Date: 12/22/22 |
| Project Mngr: JMS | Drawn By: KEK |
| File Name: 06227049-2.2.dwg | |
| Layout Name: E5 | |

Terracon

2640 12TH STREET SW CEDAR RAPIDS, IOWA 52404
PH. (319) 366-8321 FAX. (319) 366-0032

WETLAND DELINEATION MAP

CONIFER POWER WETLANDS
CONIFER POWER
HIGHWAY 22
LONE TREE, IOWA

EXHIBIT

4


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

| | | | | |
|---|---|---|---|---|
| Project Manager: JMS | Project No. 06227115 | Terracon | SENSITIVE AREAS EXHIBIT FULL VIEW | Exhibit |
| Drawn by: JMS | Scale: AS SHOWN | 2640 12th St SW | Lone Tree Sensitive Areas Analysis | 5A |
| Checked by: TC | File Name: Exh. | Cedar Rapids, IA 52404-3440 | Lone Tree, Iowa | |
| Approved by: TC | Date: March '23 | | | |

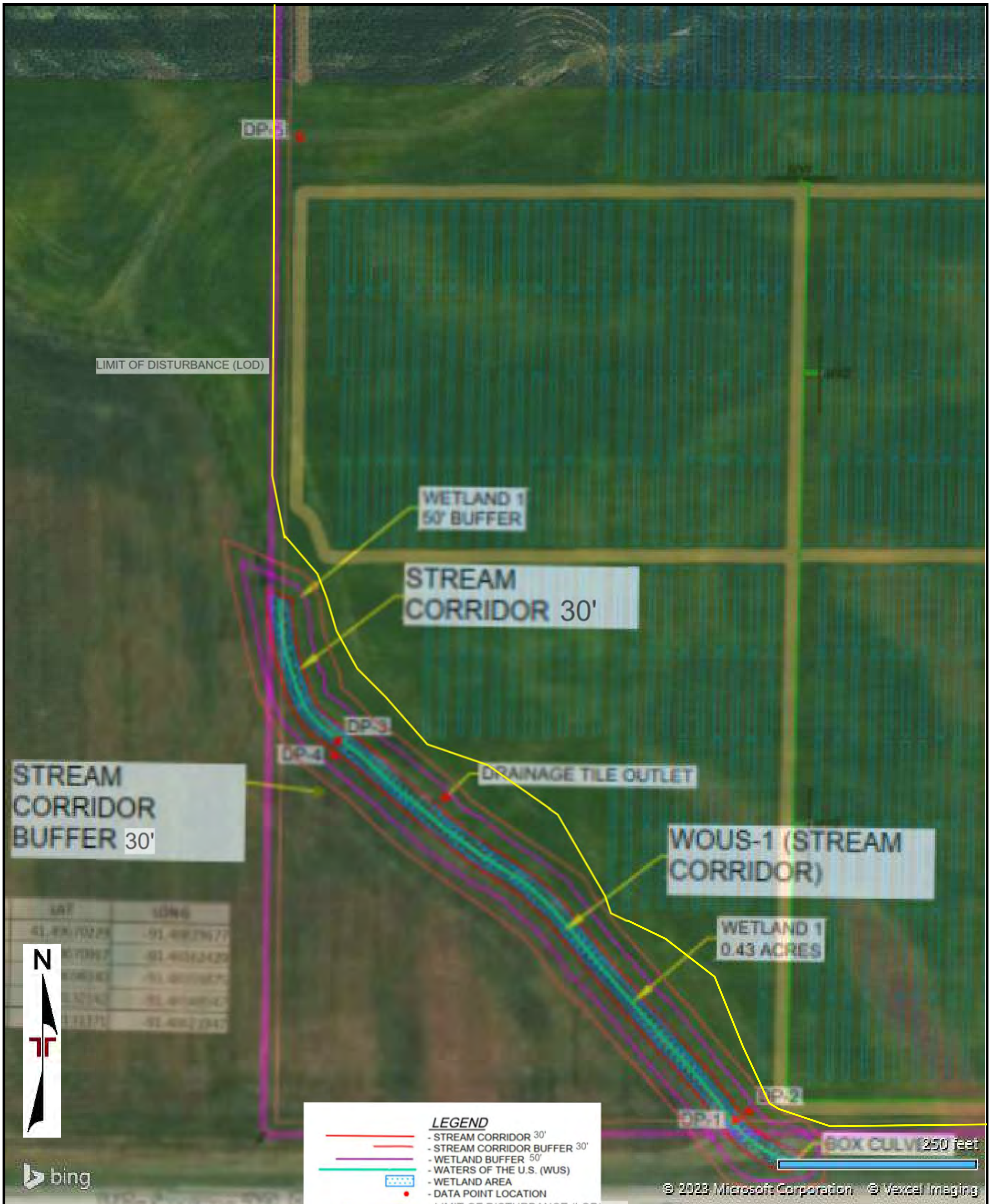
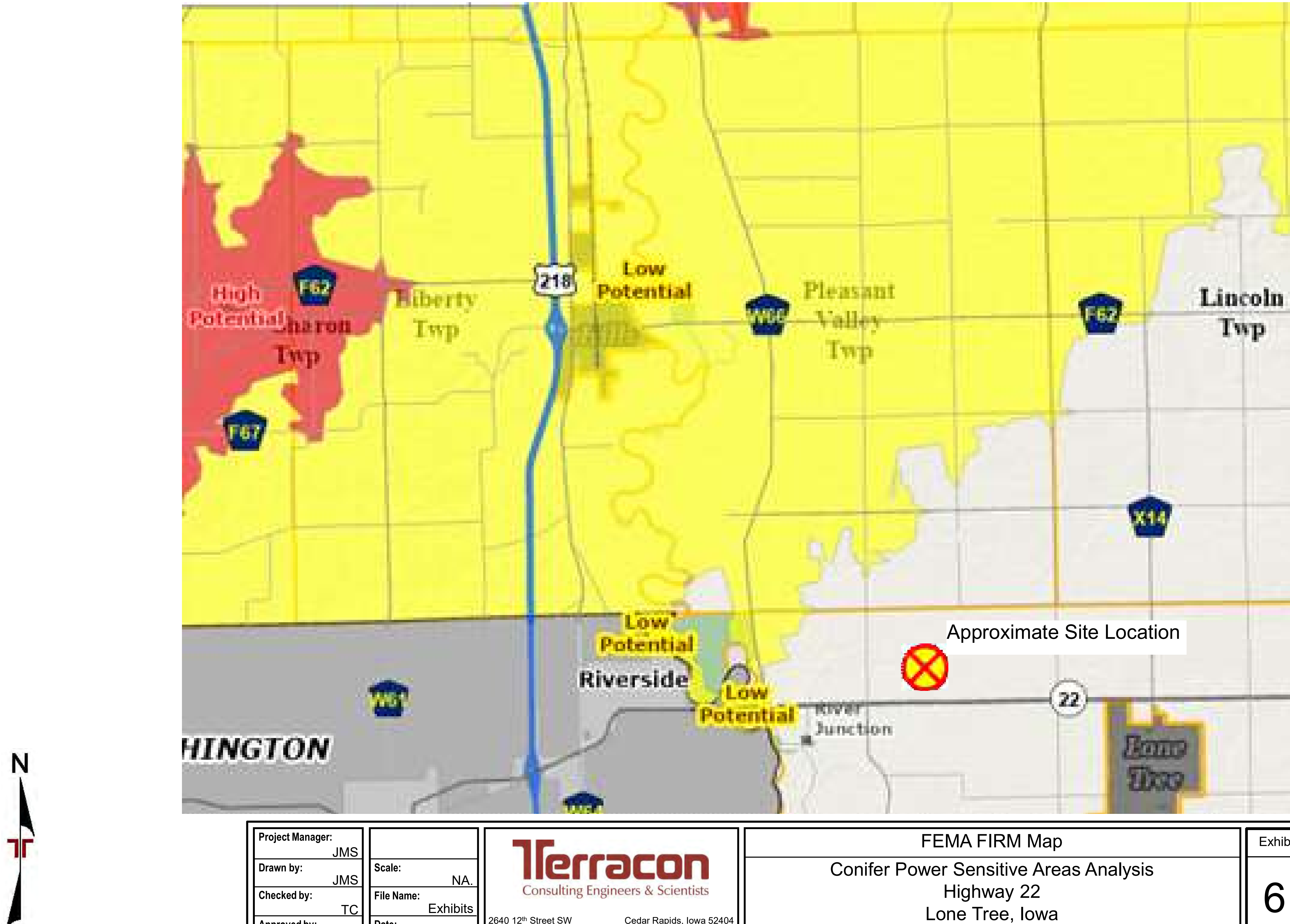



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

| | | | | |
|---|---|---|---|---|
| Project Manager: ? | Project No. 06227115 | Terracon | SENSITIVE AREAS EXHIBIT CLOSEUP | Exhibit |
| Drawn by: ? | Scale: AS SHOWN | 2640 12th St SW | Lone Tree Sensitive Areas Analysis | 5B |
| Checked by: ? | File Name: ? | Cedar Rapids, IA 52404-3440 | Lone Tree, Iowa | |
| Approved by: ? | Date: ? | | | |




| Project Manager: JMS | | Terracon Consulting Engineers & Scientists | FEMA FIRM Map | Exhibit |
|---|---|---|---|---|
| Drawn by: JMS | Scale: NA. | 2640 12th Street SW Cedar Rapids, Iowa 52404 | Conifer Power Sensitive Areas Analysis<br>Highway 22<br>Lone Tree, Iowa | 6 |
| Checked by: TC | File Name: Exhibits | PH. (319) 366-8321 FAX. (319) 366-0032 | | |
| Approved by: TC | Date: Sep. 2022 | | | |

# APPENDIX B
## Historical Reports

# Waters of the United States Delineation Report

**Proposed Solar Location – Lone Tree**

**Parcel 1801476001**
**Lone Tree, Johnson County, Iowa**

June 8, 2022

Terracon Project No. 06227049, Task 2.2

**Prepared for:**
PCR US Investments Corp
Houston, Texas

**Prepared by:**
Terracon Consultants, Inc.
Cedar Rapids, Iowa

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## APPENDICES

# 1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) was retained by PCR US Investments Corp (client) to perform a Waters of the U.S. (WOTUS) delineation on the approximately 36.40 acres site located in rural Lone Tree, Iowa near the intersection of Highway 22 and Sioux Ave. SE, hereafter referred to as the site. The site location is depicted on Site Location Map Location as shown in Exhibits 1 and 2 in Appendix A. The WOTUS Delineation was performed in accordance with Terracon Proposal P06227049, dated March 31, 2022.

The purpose of performing the preliminary WOTUS delineation was to characterize the existing site conditions, observe the site for the presence of WOTUS, including wetlands, and provide an opinion regarding whether or not WOTUS (if observed) would be considered jurisdictional by the United States Army Corps of Engineers (USACE).

## 1.1 Site Description

| | |
|---|---|
| **Site Name** | Proposed Solar Location – Lone Tree, Iowa |
| **Site Location/Address** | Parcel 1801476001, Lone Tree, Johnson County, Iowa |
| **Land Area** | Approximately 36.40 acres |
| **Site Improvements** | Unimproved farmland and road rights-of-way |
| **Anticipated Future Site Use** | Development of 10-megawatt solar facility and utility corridor (gen-tie) to nearest substation |

The location of the site is depicted on Exhibit 1 of Appendix A, which was reproduced from a portion of the USGS 7.5-minute series topographic map. The site and adjoining properties are depicted on the Site Diagram, which is included as Exhibit 2 of Appendix A. Aerial photographs of the site are provided in Appendix C and photographs depicting the conditions on-site are provided in Appendix D. Acronyms and terms used in this report are described in Appendix E.

# 2.0 SCOPE OF SERVICES

Terracon performed the following scope of work in accordance with our proposal:

- Preliminary Data Gathering and Analysis of readily available government documentation.
- Mobilized to the site to conduct the Field Delineation.
- Sub-meter Global Positioning Satellite (GPS) surveying of each delineation flag.
- Prepared a map showing approximate locations of delineated WOTUS, including wetland areas observed during the Field Delineation, if any.
- Completed a WOTUS Delineation Report that included site characterization information, a discussion of applicable data, and recommendations for the site.

## 3.0 PRELIMINARY DATA GATHERING AND ANALYSIS

Prior to visiting the site to conduct the field delineation, background research was conducted, consisting of locating and reviewing historic aerial photographs, historic topographic maps, U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, , soil data from the Natural Resources Conservation Service (NRCS), Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), publicly available elevation data such as light detection and ranging (LiDAR) data, and/or other related data based on availability. The preliminary data analysis assisted Terracon in identifying potential aquatic resources and jurisdictional features on the site. The data evaluated is described in the subsections below.

### 3.1 Topographic Maps

The United States Department of the Interior Geologic Survey (USGS) 7.5-Minute Topographic Map of the subject site was reviewed to identify drainages or WOUS within the subject area. A portion of the *Lone Tree*, *Iowa* Quadrangle can be seen as Exhibit 1 in Appendix A.

### 3.2 Aerial Photographs

Readily available aerial photographs (at approximately 10 to 15-year intervals) were reviewed to evaluate the potential presence of aquatic resources that may be considered WOTUS by USACE. Table 1 contains a brief description of applicable features identified during review of the aerial photographs.

- Aerial photograph: ASCS 1937, 1951, 1963, 1970; USGS 1983, 1994; USDA 2005-2010, 2014, 2015, 2017, 2019 (1" = 500')

**Table 1: Summary of Aerial Photographs**

| Direction | Description |
|---|---|
| Site | 1937-2019: The site is an agricultural field with a creek running through the northwestern corner and the southwestern corner. |
| North | 1937: The area directly north of the site appears to be a wooded area. The area further north of the site appears to be agricultural land.<br>1951-1970: A residential dwelling has been constructed further north of the site.<br>1983-2019: Much of the wooded area directly north of the site has been developed into agricultural land. The previous dwelling further north of the site has been razed and a new residential dwelling has been constructed further northeast of the site. |
| East | 1937-2019: Directly east of the site is Sioux Avenue E followed by a residential dwelling and agricultural land. The dwelling appears to be a farming operation. |

| Direction | Description |
|---|---|
| South | 1937: Highway 22 lies directly south of the site followed by agricultural land. A residential dwelling sits further south east of the site.<br>1951-1983: An electrical station has been built directly south east of the intersection of Sioux Avenue and Highway 22, south east of the site.<br>1994-2010: The previously mentioned residential dwelling southeast of the site has been razed.<br>2014-2019: The apparent electrical station has been developed with an additional concrete lot. |
| West | 1937-1994: The area directly west of the site is improved with agricultural land. Further east of the site is a wooded area. Further southwest of the site are two residential properties, one north of Highway 22 and one south of Highway 22. These properties seem to be farming operations.<br>2005-2019: The previously mentioned residential property north of Highway 22 has been razed. |

### 3.3 National Wetlands Inventory

Utilizing the United States Department of the Interior's Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) Mapper website[1], Terracon reviewed areas along the project alignment to identify potential wetland areas. The NWI map and depicts suspect wetland areas and waterbodies based on stereoscopic analysis of high-altitude aerial photographs. It is Terracon's understanding that the published data is not regularly updated and has not been validated in the field. The review of the NWI indicated the following:

**Table 2: Summary National Wetlands Inventory**

| Direction | Description |
|---|---|
| Site | Riverine, intermittent streambed, and seasonally flooded (R4SBC) wetland transecting southwest portion of property in a northwest to southeast direction. |
| North | Riverine, Lower perennial unconsolidated bottom, and semi permanently flooded (R2UBF)(Otter Creek) wetland adjacent north of the site. |
| East | The property adjoining east of Sioux Ave SE with an apparent farmstead shows a Palustrine, emergent persistent, and temporarily flooded (PEM1A) wetland adjoining northeast of the house. |
| South | No observable features within range. |
| West | Riverine, intermittent streambed, and seasonally flooded (R4SBC) wetland connecting to the on-site R4SBC. |

The NWI map obtained the US Fish and Wildlife Service[2] can be seen as Exhibit 3 in Appendix A.

[1] *Posted at www.fws.gov/wetlands/Data/Mapper.html, accessed May 19, 2022*
[2] *https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/, accessed on May 19, 2022*

## 3.4 Soil Data

Data from the USDA NRCS Web Soil Survey was reviewed to identify soil types, including hydric soils for the site. Soils containing hydric soil components are documented on the National List of Hydric Soils. Inclusion on the National List of Hydric Soils indicates that the soil series or one of its components contain characteristics that may be hydric and is not an indication of hydric soil for a specific location.

Table 3 is an excerpt from the NRCS Web Soil Survey Hydric Soil Rating.

**Table 3: Excerpt from the NRCS Web Soil Survey**

| Map Unit Symbol | Map Unit Name | Hydric Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 119 | Muscatine silt loam, 0 to 2 percent slopes | 5 | 0.0 | 0.0% |
| 121B | Tama silt loam, 2 to 5 percent slopes | 0 | 8.1 | 15.0% |
| 122 | Sperry silt loam, depressional, 0 to 1 percent slopes | 100 | 19.1 | 35.6% |
| 160 | Walford silt loam, 0 to 2 percent slopes | 100 | 7.0 | 13.0% |
| 175B | Dickinson fine sandy loam, 2 to 5 percent slopes | 0 | 1.2 | 2.2% |
| 291 | Atterberry silt loam, 1 to 3 percent slopes | 5 | 12.7 | 23.7% |
| M162B | Downs silt loam, till plain, 2 to 5 percent slopes | 0 | 5.3 | 9.9% |
| M162C | Downs silt loam, till plain, 5 to 9 percent slopes | 0 | 0.3 | 0.5% |
| M162C2 | Downs silt loam, till plain, 5 to 9 percent slopes, eroded | 0 | 0.0 | 0.1% |

The NRCS soil data depicts hydric soils on the site. See Soils Map as Exhibit 4 in Appendix A.

## 3.5 FEMA Map

Terracon reviewed the Federal Emergency Management Agency (FEMA) National Flood Hazard Layer Map number 190882. According to the map, the entire project site is not located in a flood zone. As Wetland 1 and Tributary 1 extend off-site, a portion of both features are within a Zone A area. Zone A areas are areas subject to inundation by the 1-percent-annual-chance flood event. A FEMA National Flood Hazard Layer Map is included as Exhibit 5 in Appendix A.

### 3.6 Elevation Data

Terracon reviewed the Hillshade Map of the site obtained from the ISU GIS Support and Research Facility to assist in identifying suspect areas (lowlands, depressions or stream channel). The Hillshade Map uses LIDAR data to depict the approximate topography of the site. The site consists of relatively flat topography. There is an apparent channelized feature transecting the southwest corner of the site in a northwest to southeast direction. A Hillshade Map is included as Exhibit 6 in Appendix A.

## 4.0 FIELD TECHNIQUES

Terracon personnel conducted a reconnaissance of the site on April 27, 2022 to characterize the existing site conditions and identify the presence of potential jurisdictional wetlands and waters. Characteristics of potential jurisdictional wetlands and waters were assessed (when applicable) utilizing the criteria detailed in sections 4.1 and 4.2 of this report. The evaluation methods generally followed the routine on-site determination method referenced in the 1987 USACE Manual and the Midwest Region Version 2.0.

### 4.1 Wetland Observations

Wetlands generally have three essential characteristics: wetland hydrology, hydrophytic vegetation, and hydric soils. Vegetation and hydrology observations were performed throughout the site where access was permitted, and soils were evaluated to determine if wetland characteristics were present. Data regarding the three essential characteristics was gathered within observed suspect wetland areas as applicable to further delineate boundaries.

#### 4.1.1 Plant Community Assessment

Suspect areas were visually observed to determine the species, when possible, and absolute percentage of ground cover for five strata of plant community types within a thirty-foot radius of the observation location. The wetland indicator status for each species of vegetation observed was documented. The indicator status was determined using the USACE National Wetlands Plant List (2016 NWPL v3.5). Indicator status categories for vegetation are presented below:

- **Obligate Wetland (OBL)**: occur almost always (estimated probability greater than 99%) under natural conditions in wetlands.
- **Facultative Wetland (FACW)**: usually occur in wetlands (estimated probability 67%-99%) but occasionally found in non-wetlands.
- **Facultative (FAC)**: equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
- **Facultative Upland (FACU)**: usually occur in non-wetlands (estimated probability 67%-99%) but occasionally found in wetlands.
- **Upland (UPL)**: rarely occur in wetlands, but occur almost always (estimated probability greater than 99%) under natural conditions in non-wetlands.

The percent cover of each stratum was determined and dominance was evaluated. Dominant species were the most abundant species that accounted for more than 20 percent of the absolute percent coverage of the stratum. The number of dominant species with an indicator status of OBL, FACW, and/or FAC was compared to the total number of dominant species across all strata. Typically, when more than 50 percent of the dominant species had an indicator status of OBL, FACW, and/or FAC, hydrophytic vegetation was present.

If the percentage of dominant species with an indicator status of OBL, FACW, and/or FAC was less than 50 percent, prevalence index and morphological adaptations may have been evaluated to confirm if hydrophytic vegetation was present or absent.

### 4.1.2 Hydric Soils Assessment

After Terracon evaluated wetland vegetation, subsurface soil samples were collected. The samples were collected to a depth of approximately 32 inches below ground surface and were visually compared to Munsell Soil Color Charts®, which aided in the evaluation of hydric soil characteristics. The soil samples were further examined for hydric soil indicators including, but not limited to, histosol, thick dark surface, sandy gleyed matrix, sandy redox, loamy gleyed matrix, redox dark surface, and/or redox depressions. If these or other hydric soil indicators were observed in the subsurface soil sample, the observation location was considered to have hydric soil.

### 4.1.3 Wetland Hydrology Assessment

Visual indicators of wetland hydrology were evaluated. Examples of primary wetland hydrology indicators include, but are not limited to, surface water, high water table, soil saturation, water marks, sediment deposits, drift deposits, iron deposits, inundation visible on aerial imagery, and water-stained leaves. Examples of secondary wetland hydrology indicators include, but are not limited to, surface soil cracks, drainage patterns, moss trim lines, and crayfish burrows. If at least one primary wetland hydrology indicator or two secondary wetland hydrology indicators were observed, the observation location was considered to have wetland hydrology.

## 4.2 Classification of Wetlands

Upon completion of the review of the three wetland criteria at each area, a wetland determination was made by a Terracon scientist. Under normal circumstances, if one or more of the wetland criteria were not identified, the area was not considered to be a wetland. The Field Delineation included collection of hydrology, vegetation, and soil assessment data from discrete sample locations (Data Points) necessary to complete required USACE Wetland Determination Data Forms. The number of Data Points evaluated was determined based on professional judgement. The recorded Wetland Determination Data Forms for the project site can be found in Appendix B and Data Point locations are depicted on Wetland Delineation Map (Exhibit 7 in Appendix A).

## 4.3 Surface Water and Drainage Feature Observations

Terracon also made observations of site features that may be considered jurisdictional waterbodies. If a waterbody was identified, observations regarding its characteristics were recorded. Potential jurisdictional waterbodies are typically evaluated based on the observation of the following characteristics:

- **Flow Characteristics:**
  - Perennial: contains water at all times except during extreme drought.
  - Intermittent: carries water a considerable portion of the time, but ceases to flow occasionally or seasonally.
  - Ephemeral: carries water only during and immediately after periods of rainfall or snowmelt.
- **Ordinary High Water Mark (OHWM):** The limit line on the shore established by the fluctuation of the water surface. It is shown by such things as a clear line impressed on the bank, shelving, changes in soil character, destruction of terrestrial vegetation, the presence of litter and debris or other features influenced by the surrounding area.
- **Bank Shape Descriptions:**
  - Undercut: banks that overhang the stream channel
  - Steep: bank slope of approximately greater than 30 degrees
  - Gradual: bank slope of approximately 30 degrees or less
- **Aquatic Habitat Descriptions:**
  - Pool: deeper portion of a stream where water flows slower than in neighboring, shallower portions, smooth surface, and finer substrate
  - Riffle: shallow area in a stream where water flows swiftly over gravel and rock or other coarse substrate resulting in a rough flow and a turbulent surface
  - Run: section of a stream with a low or high velocity and with little or no turbulence on the surface of the water.

During the Field Delineation, linear aquatic resources were evaluated for stream parameters and the approximate locations of the linear features were estimated and displayed on the Wetland Delineation Map (Exhibit 7 in Appendix A).

## 4.4 Depiction of Aquatic Resources

The Wetland Delineation Map (Exhibit 7 in Appendix A) was created by uploading the shapefile points collected using the Trimble Geo7x submeter GPS with Global Navigation Satellite System (GNSS) receiver at each data point location. PathFinder® software was used to conduct differential correction of the GPS point data by combining information in a local base station file from fixed GPS receivers located at various locations throughout the country. The point shapefiles were geoprocessed into polygon shapefiles for each aquatic resource and exported to a map deliverable using ArcMap® software. The GIS data created using the GPS data was evaluated to determine the approximate size of each aquatic resource.

# 5.0 FINDINGS

On April 27, 2022, Terracon performed a Field Delineation on the site using the field techniques described in Section 4.0. The findings of the Field Delineation are illustrated on the Wetland Delineation Map (Exhibit 7 in Appendix A). Site photographs, included in Appendix D, provide an indication of the physical characteristics observed during the Field Delineation. Descriptions of the aquatic resource features observed on site are provided in the following sections:

## 5.1 Wetlands

Terracon observed one potentially jurisdictional wetland on the site totaling 0.43 acres. Hydric soil and hydrology indicators were observed within the wetlands as indicated in the Data Forms included in Appendix B. Table 4 contains a summary of wetlands identified on site during the Field Delineation. The wetland is a fringe emergent wetland directly abutting the tributary along the southwest corner.

**Table 4: Summary of Wetlands**

| Feature | Jurisdictional Opinion | Acreage | Location | Description | Wetland Classification Code |
|---|---|---|---|---|---|
| **Wetland 1** | Yes | 0.43 | Southwest portion of site | Emergent wetland abutting intermittent tributary | PEM1B |

## 5.2 Tributaries

Terracon did not observe jurisdictional tributaries on the site, with the exception of an unnamed intermittent tributary connecting to off-site Otter Creek. Several apparent off-site waterbodies were observed to the north and west as well. Table 5 contains a summary of wetlands identified on site during the Field Delineation.

**Table 5: Summary of Tributaries**

| Tributary | Length (LF) | Name of Water Body | Location | WOTUS | Description | OHWM | Approximate Width Across OHWM |
|---|---|---|---|---|---|---|---|
| **Stream 1** | 950 | Unnamed Tributary | Southwest portion of site | Yes. Connected to Otter Creek | Intermittent tributary to Otter Creek | Yes. Approximately 2-inches to 1-foot | 2-feet |

### 5.3 Other Waters

Terracon did not observe any other apparent waters on-site.

### 5.4 Upland Areas

Terracon sampled and assessed all areas that represented different vegetative communities throughout the project site to thoroughly review if these areas may exhibit the three wetland criteria (hydrophytic vegetation, hydric soils, and hydrology). Some of the sample locations were found to be classified as uplands based on the three wetland criteria not being met in the different vegetative communities. The portions of the site not identified as containing aquatic resources are considered uplands.

## 6.0 CONCLUSIONS

Terracon conducted a WOTUS Delineation of the approximately 36.40 acre site on April 27, 2022. Table 6 contains a summary of the aquatic resources Terracon identified during the Field Delineation and Terracon's opinion regarding the jurisdictional status of each aquatic resource. The aquatic resources identified during the delineation are illustrated on the Depiction of Aquatic Resources Map located in Depiction of Aquatic Resources Map Location. Official authority to make a determination defining applicable jurisdictional limits of aquatic resources has been delegated to the USACE. Jurisdictional Determinations are made by the USACE, upon specific written request, on a case-by-case basis.

**Table 4: Summary of Field Delineation**

| Aquatic Resource | Size | Jurisdictional or Non-Jurisdictional Opinion |
|---|---|---|
| **<u>Wetlands</u>** **Wetland 1** | 0.43 Acres | Yes. Direct tributary to off-site Otter Creek. |
| **<u>Tributaries</u>** **Tributary 1** | 950 Linear feet | Yes. Direct tributary to off-site Otter Creek. |

## 7.0 GENERAL COMMENTS

The preliminary WOTUS delineation was performed in accordance with generally accepted practices of this profession undertaken in similar studies at the same time and in the same geographical area. A preliminary WOTUS delineation, such as the one performed at this site, is of limited scope, is noninvasive, and cannot eliminate the potential that wetlands or WOTUS are present at the site beyond what is identified by the limited scope of this preliminary delineation.

In conducting the limited scope of services described herein, certain sources of information and public records were not reviewed. No biological delineation can wholly eliminate uncertainty regarding the potential for concerns in connection with a project. The limitations of this preliminary delineation should be recognized.

This report has been prepared in accordance with generally accepted scientific and engineering evaluation practices. This report is for the exclusive use of the client and any relying government entities for the project being discussed. No warranties, either expressed or implied, are intended or made.

Conditions within WOTUS naturally change over time and can vary seasonally over short periods. Effects of man-made disturbances and/or temporal variations (e.g. rainfall, season, drought), and/or subjective regulatory interpretation of data and field conditions may preclude assessment in conformance with USACE requirements and sometimes significantly affect findings, conclusions, and recommendations.

## 8.0 CLOSING

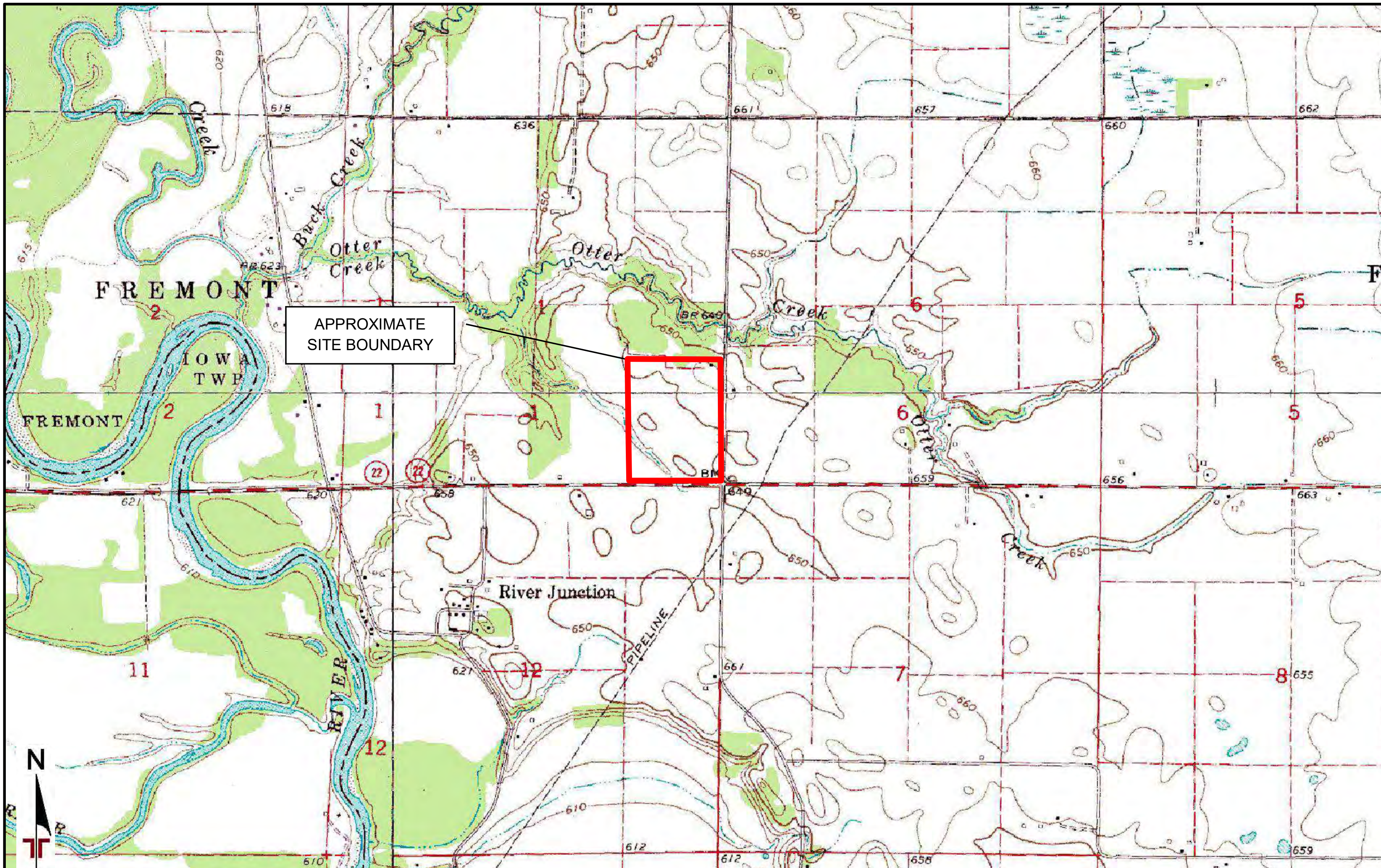
Terracon appreciates the opportunity to provide services on this important project. Please feel free to contact either of the undersigned if you have any questions or require additional information.

Sincerely,
Terracon Consultants, Inc.

Jordan M. Smith
Staff Scientist

Tim V. Capps
Group Manager

# APPENDIX A
## Exhibits




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: HILLS, IA (1/1/1983), WEST LIBERTY SW, IA (1/1/1965), RIVERSIDE, IA (1/1/1983) and LONE TREE, IA (1/1/1969).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: EWH | Project No. 06227049 |
| Drawn by: TLR | Scale: 1"=2,000' |
| Checked by: TC | File Name: Exhibits |
| Approved by: EWH | Date: 4/19/2022 |

Terracon

2640 12th St SW

Cedar Rapids, IA 52404-3440

Topographic Map

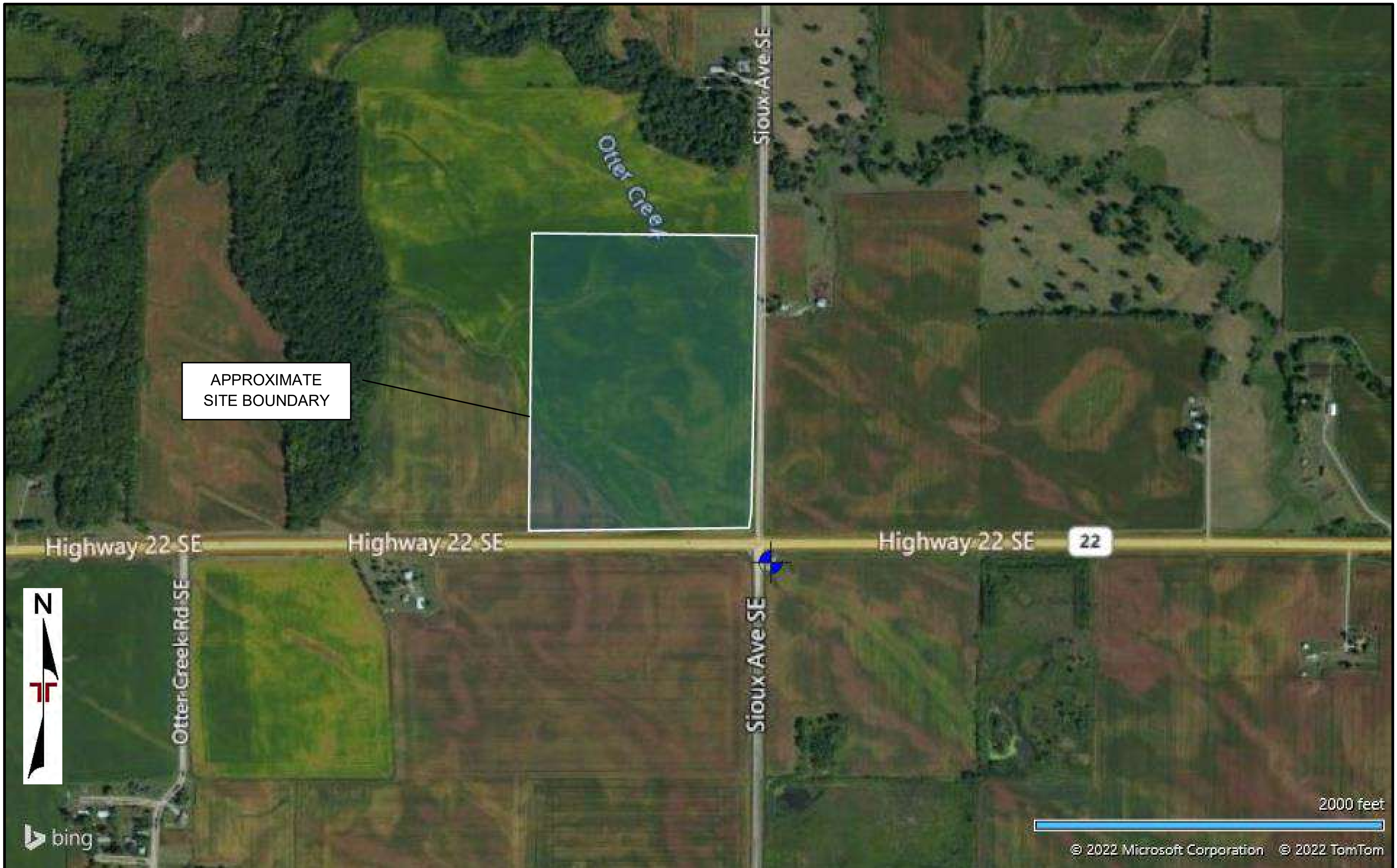
PCR

**Lone Tree**

**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit

1




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

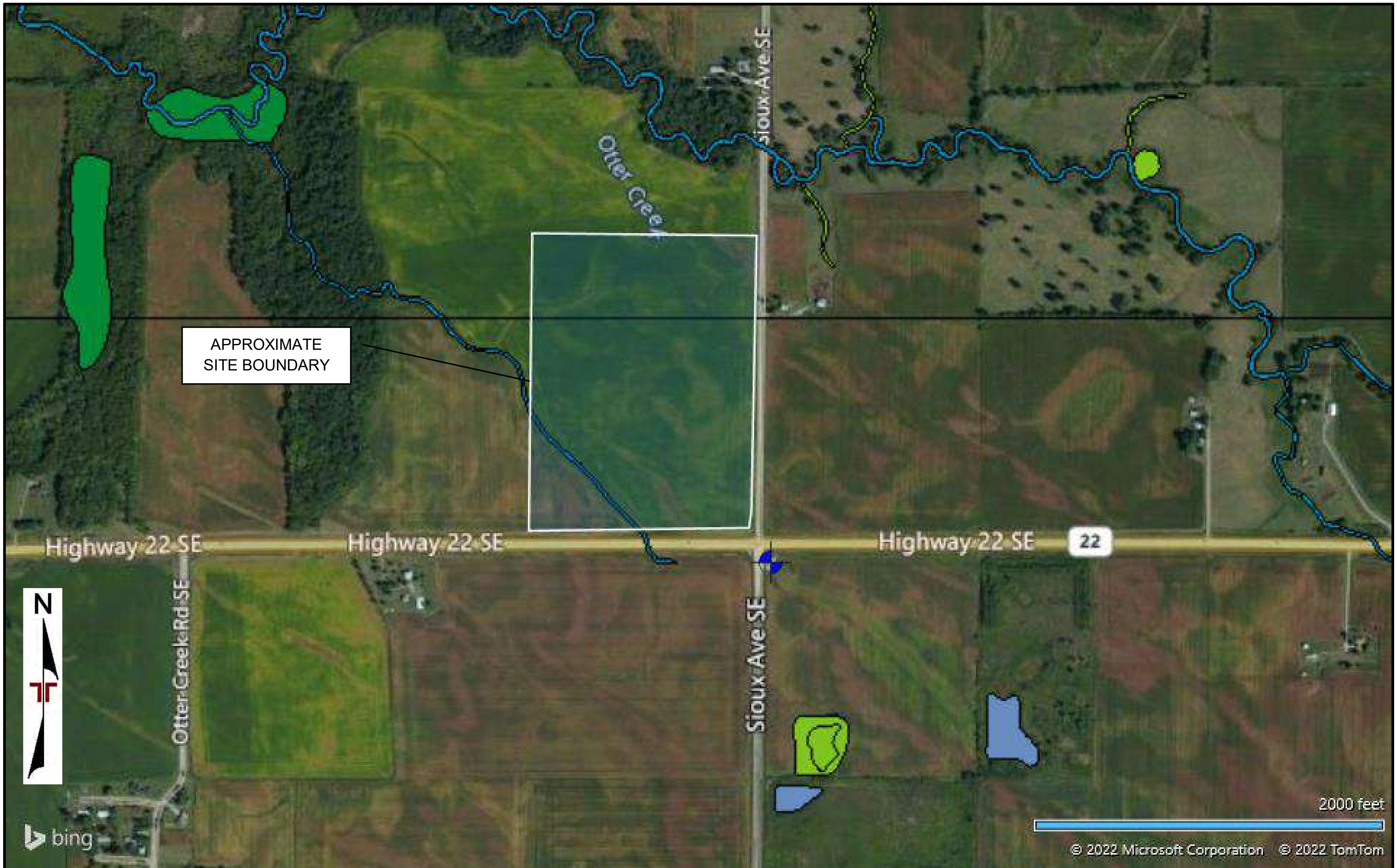
| | |
|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: TLR | Scale: AS SHOWN |
| Checked by: TC | File Name: Exhibits |
| Approved by: EWH | Date: 4/19/2022 |

Terracon
2640 12th St SW
Cedar Rapids, IA 52404-3440

Site Diagram

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
2




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: TLR | Scale: AS SHOWN |
| Checked by: TC | File Name: Exhibits |
| Approved by: EWH | Date: 4/19/2022 |

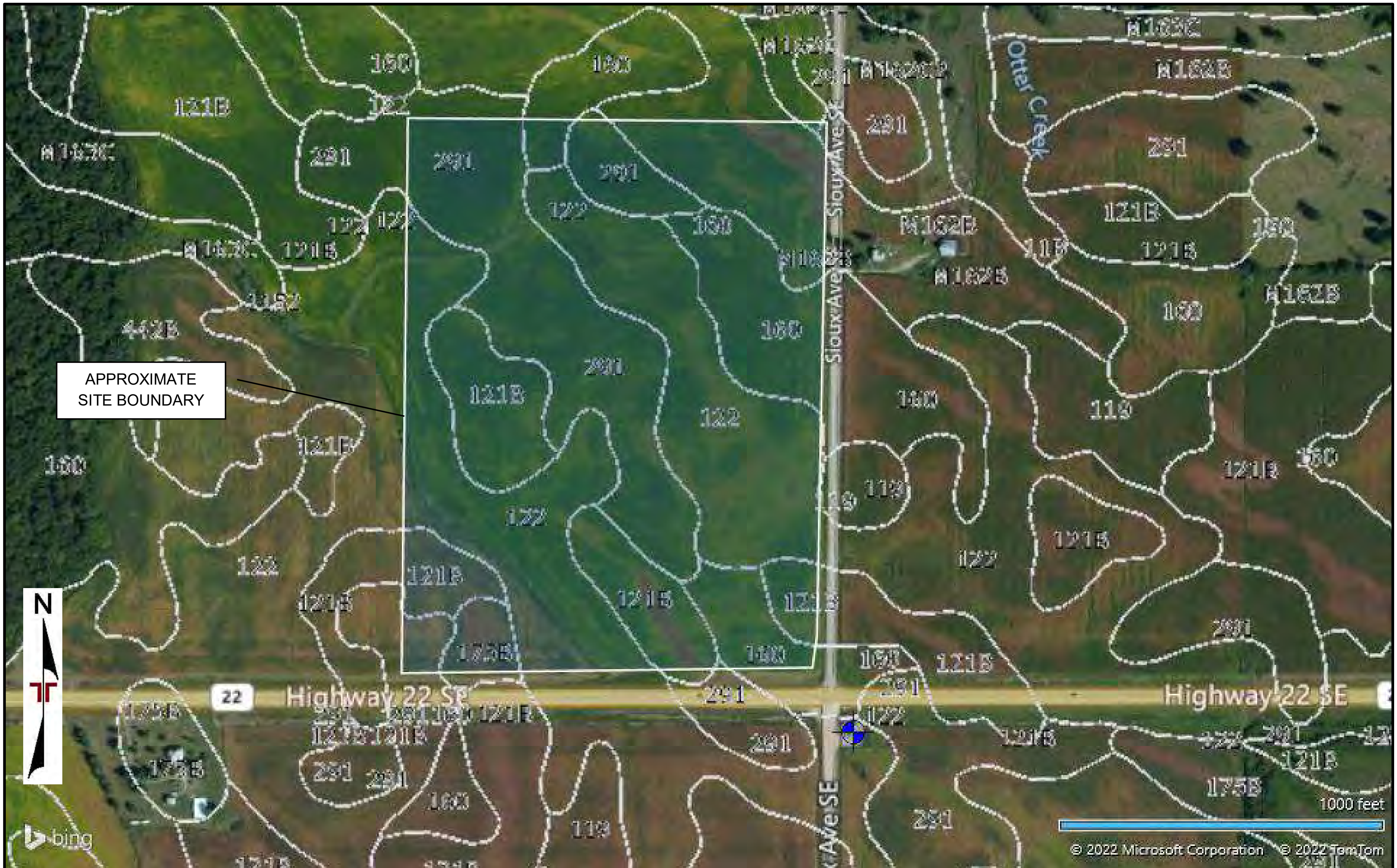
Terracon

2640 12th St SW
Cedar Rapids, IA 52404-3440

National Wetland Inventory Map

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
3




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

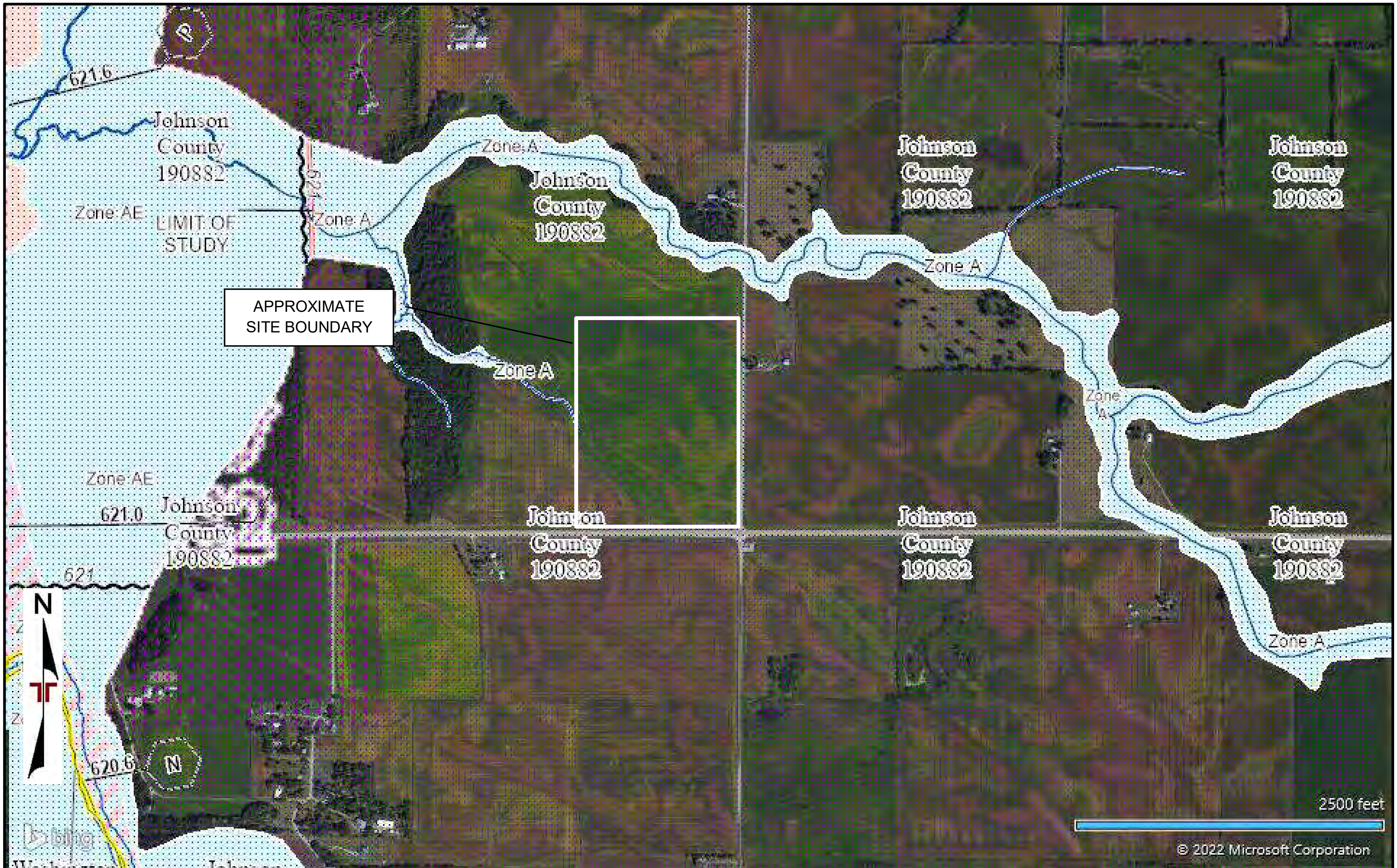
| | |
|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: TLR | Scale: AS SHOWN |
| Checked by: TC | File Name: Exhibits |
| Approved by: EWH | Date: 4/19/2022 |

Terracon
2640 12th St SW
Cedar Rapids, IA 52404-3440

Soil Map

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
4




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

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|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: JMS | Scale: AS SHOWN |
| Checked by: EWH | File Name: Exhibits |
| Approved by: TC | Date: 5/25/22 |

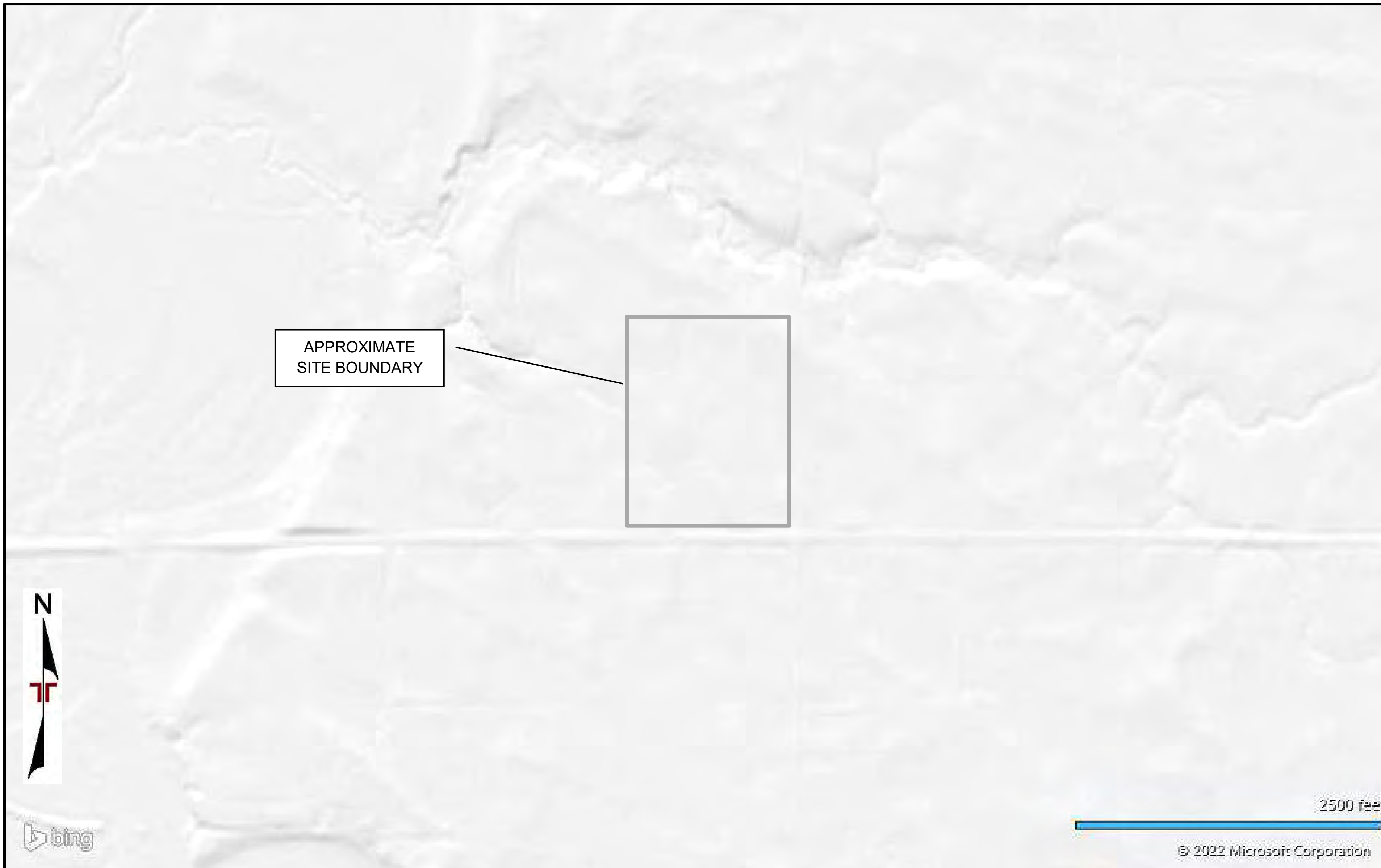
Terracon

2640 12th St SW
Cedar Rapids, IA 52404-3440

FEMA FloodPlain Map

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
5




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

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|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: JMS | Scale: AS SHOWN |
| Checked by: EWH | File Name: Exhibits |
| Approved by: TC | Date: 5/25/22 |

Terracon
2640 12th St SW
Cedar Rapids, IA 52404-3440

Hillshade Map

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
6


*LEGEND*

- BOUNDARY OF ASSESSED AREA
- WATERS OF THE U.S. (WUS)
- WETLAND AREA
- DATA POINT LOCATION

AERIAL PHOTO FROM BING MAPS

NORTH

0 200'

APPROXIMATE DRAWING SCALE

| | |
|---|---|
| Project No. 06227049-2.2 | Date: 03/10/22 |
| Project Mngr: JMS | Drawn By: KEK |
| File Name: 06227049-2.2.dwg | |
| Layout Name: E5 | |

Terracon
2640 12TH STREET SW CEDAR RAPIDS, IOWA 52404
PH. (319) 366-8321 FAX. (319) 366-0032

WETLAND DELINEATION MAP - LONE TREE

CONIFER POWER WETLANDS
CONIFER POWER
HIGHWAY 22
LONE TREE, IOWA

EXHIBIT

7

Terracon

# APPENDIX B

## Wetland Determination Data Forms

| U.S. Army Corps of Engineers<br>**WETLAND DETERMINATION DATA SHEET – Midwest Region**<br>See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R | *OMB Control #: 0710-0024, Exp:11/30/2024*<br>*Requirement Control Symbol EXEMPT:*<br>*(Authority: AR 335-15, paragraph 5-2a)* |
|---|---|

Project/Site: Conifer Power - Lone Tree    City/County: Lone Tree/Johnson    Sampling Date: 4/27/22

Applicant/Owner: Conifer Power    State: IA    Sampling Point: DP-1

Investigator(s): Jordan Smith    Section, Township, Range: S1 T77N R06W

Landform (hillside, terrace, etc.): Drainage    Local relief (concave, convex, none) Concave

Slope (%): 1    Lat: 41°29'48.57"    Long: 91°29'10.54"    Datum: IA State Plane North

Soil Map Unit Name: Sperry silt loam (122)    NWI classification: PEM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ___ | **Is the Sampled Area within a Wetland?** **Yes** X **No** ___ |
| Hydric Soil Present? | Yes X | No ___ | |
| Wetland Hydrology Present? | Yes X | No ___ | |

Remarks:
Data point taken in field.

**VEGETATION** – Use scientific names of plants.

| Tree Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Rhamnus cathartica* | 10 | Yes | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 10 | =Total Cover | |
| **Sapling/Shrub Stratum (Plot size: ___)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | =Total Cover | |
| **Herb Stratum (Plot size: 5)** | | | |
| 1. *Phalaris arundinacea* | 90 | Yes | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| | 90 | =Total Cover | |
| **Woody Vine Stratum (Plot size: ___)** | | | |
| 1. | | | |
| 2. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That Are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of Dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 90 | x 2 = | 180 |
| FAC species | 10 | x 3 = | 30 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 100 (A) | | 210 (B) |
| Prevalence Index = B/A = | | | 2.10 |

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is present. Presented as Photo # 1 in Appendix C.

## SOIL

Sampling Point: DP-1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-16 | 10YR 2/1 | 85 | 5YR 4/6 | 15 | C | M | Loamy/Clayey | Prominent redox concentrations |
| 16-32 | 10YR 2/1 | 100 | | | | | Sandy | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:
Hydric soil present.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | Yes | No | Depth (inches) |
|---|---|---|---|
| Surface Water Present? | | X | |
| Water Table Present? | X | | 12 |
| Saturation Present? (includes capillary fringe) | X | | 6 |

**Wetland Hydrology Present?** **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present.

| U.S. Army Corps of Engineers<br>WETLAND DETERMINATION DATA SHEET – Midwest Region<br>See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R | *OMB Control #: 0710-0024, Exp:11/30/2024*<br>*Requirement Control Symbol EXEMPT:*<br>*(Authority: AR 335-15, paragraph 5-2a)* |
|---|---|

Project/Site: Conifer Power- Lone Tree City/County: Lone Tree/Johnson Sampling Date: 4/27/22

Applicant/Owner: Conifer Power State: IA Sampling Point: DP -2

Investigator(s): Jordan Smith Section, Township, Range: S1 T77N R06W

Landform (hillside, terrace, etc.): Field Local relief (concave, convex, none) None

Slope (%): 1 Lat: 41°29"48.71" Long: 91°29'10.33" Datum: IA State Plane North

Soil Map Unit Name: Sperry silt loam (122) NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ___ | No X | **Is the Sampled Area within a Wetland?** **Yes** ___ **No** X |
| Hydric Soil Present? | Yes ___ | No X | |
| Wetland Hydrology Present? | Yes X | No ___ | |

Remarks:
Taken in field.

**VEGETATION** – Use scientific names of plants.

| Tree Stratum (Plot size: ___ ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | =Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ___ ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | =Total Cover | |
| **Herb Stratum** (Plot size: 5 ) | | | |
| 1. *Digitaria sanguinalis* | 70 | Yes | FACU |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| | 70 | =Total Cover | |
| **Woody Vine Stratum** (Plot size: ___ ) | | | |
| 1. | | | |
| 2. | | | |
| | | =Total Cover | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 70 | x 4 = | 280 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 70 (A) | | 280 (B) |

Prevalence Index = B/A = 4.00

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation not present. Shown as Photo # 2 in Appendix C.

## SOIL

Sampling Point: DP-2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-11 | 10YR 3/2 | 100 | | | | | Loamy/Clayey | |
| 11-32 | 10YR 4/3 | 100 | | | | | Loamy/Clayey | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** **Yes** ___ **No** X

Remarks:
Hydric soil not present.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

**Field Observations:**

| | Yes | No | Depth (inches) |
|---|---|---|---|
| Surface Water Present? | | X | |
| Water Table Present? | | X | |
| Saturation Present? (includes capillary fringe) | X | | 20 |

**Wetland Hydrology Present?** **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present.

| U.S. Army Corps of Engineers<br>**WETLAND DETERMINATION DATA SHEET – Midwest Region**<br>See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R | *OMB Control #: 0710-0024, Exp:11/30/2024*<br>*Requirement Control Symbol EXEMPT:*<br>*(Authority: AR 335-15, paragraph 5-2a)* |
|---|---|

Project/Site: Lone Tree Wetland- WOTUS Delineation City/County: Johnson, Iowa Sampling Date: 4/27/2022

Applicant/Owner: Conifer Power State: IA Sampling Point: DP-3

Investigator(s): Jordan Smith Section, Township, Range: S1 T77N R06W

Landform (hillside, terrace, etc.): Drainage Local relief (concave, convex, none) Concave

Slope (%): 1 Lat: 41°29'53.00" Long: 91°29'16.61" Datum: Iowa State Plane North

Soil Map Unit Name: Sperry silt loam (122) NWI classification: PEM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ___ | **Is the Sampled Area within a Wetland?** **Yes** X **No** ___ |
| Hydric Soil Present? | Yes X | No ___ | |
| Wetland Hydrology Present? | Yes X | No ___ | |

Remarks:
Taken in drainage swale.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 15) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. *Salix interior* | 5 | Yes | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 5 | =Total Cover | |
| **Sapling/Shrub Stratum (Plot size: 10)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | =Total Cover | |
| **Herb Stratum (Plot size: 5)** | | | |
| 1. *Phalaris arundinacea* | 70 | Yes | FACW |
| 2. *Urtica dioica* | 5 | No | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| | 75 | =Total Cover | |
| **Woody Vine Stratum (Plot size: 5)** | | | |
| 1. *Vitis vulpina* | 2 | No | FAC |
| 2. | | | |
| | 2 | =Total Cover | |

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That Are OBL, FACW, or FAC: | 2 | (A) |
| Total Number of Dominant Species Across All Strata: | 2 | (B) |
| Percent of Dominant Species That Are OBL, FACW, or FAC: | 100.0% | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 80 | x 2 = | 160 |
| FAC species | 2 | x 3 = | 6 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 82 (A) | | 166 (B) |

Prevalence Index = B/A = 2.02

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation present. Shown as Photo # 3 in Appendix C.

## SOIL

Sampling Point: DP-3

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-13 | 10YR 2/1 | 93 | 5YR 4/6 | 7 | C | PL | Loamy/Clayey | Prominent redox concentrations |
| 13-32 | 10YR 4/3 | 100 | | | | | Loamy/Clayey | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**
Type: ___
Depth (inches): ___

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:
Hydric soil present.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
X High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
X Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No X | Depth (inches): ___ |
| Water Table Present? | Yes X | No ___ | Depth (inches): 18 |
| Saturation Present? (includes capillary fringe) | Yes X | No ___ | Depth (inches): 1 |

**Wetland Hydrology Present?** **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present.

| U.S. Army Corps of Engineers<br>**WETLAND DETERMINATION DATA SHEET – Midwest Region**<br>See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R | *OMB Control #: 0710-0024, Exp:11/30/2024*<br>*Requirement Control Symbol EXEMPT:*<br>*(Authority: AR 335-15, paragraph 5-2a)* |
|---|---|

Project/Site: Lone Tree Wetland-WOTUS Delineation City/County: Johnson, Iowa Sampling Date: 4/27/2022

Applicant/Owner: Conifer Power State: IA Sampling Point: DP-4

Investigator(s): Jordan Smith Section, Township, Range: S1 T77N R06W

Landform (hillside, terrace, etc.): Field Local relief (concave, convex, none) None

Slope (%): 1 Lat: 41°29'52.76" Long: 91°29'16.71" Datum: Iowa State Plane North

Soil Map Unit Name: Sperry silt loam (122) NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No __ (If no, explain in Remarks.)

Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes X No __

Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes __ | No X | **Is the Sampled Area within a Wetland?** **Yes** __ **No** X |
| Hydric Soil Present? | Yes __ | No X | |
| Wetland Hydrology Present? | Yes X | No __ | |

Remarks:
Taken in Field.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: __) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| =Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: __) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| =Total Cover | | | |
| **Herb Stratum** (Plot size: 5) | | | |
| 1. *Digitaria sanguinalis* | 60 | Yes | FACU |
| 2. *Artemisia annua* | 20 | Yes | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| =Total Cover | 80 | | |
| **Woody Vine Stratum** (Plot size: __) | | | |
| 1. | | | |
| 2. | | | |
| =Total Cover | | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 0 | x 3 = | 0 |
| FACU species | 80 | x 4 = | 320 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 80 (A) | | 320 (B) |

Prevalence Index = B/A = 4.00

**Hydrophytic Vegetation Indicators:**

__ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** __ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation not present. Shown as Photo # 4 in Appendix C.

## SOIL

Sampling Point: DP-4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-7 | 10YR 4/3 | 100 | | | | | Loamy/Clayey | |
| 7-32 | 10YR 3/2 | 100 | | | | | Sandy | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** **Yes** ___ **No** X

Remarks:
No hydric soil present. DP-4 out

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
X Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No X | Depth (inches): ___ |
| Water Table Present? | Yes ___ | No X | Depth (inches): ___ |
| Saturation Present? (includes capillary fringe) | Yes X | No ___ | Depth (inches): 13 |

**Wetland Hydrology Present?** **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present.

| U.S. Army Corps of Engineers<br>**WETLAND DETERMINATION DATA SHEET – Midwest Region**<br>See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R | *OMB Control #: 0710-0024, Exp:11/30/2024*<br>*Requirement Control Symbol EXEMPT:*<br>*(Authority: AR 335-15, paragraph 5-2a)* |
|---|---|

Project/Site: Lone Tree Wetland- WOTUS Delineation City/County: Johnson, Iowa Sampling Date: 4/27/2022

Applicant/Owner: Conifer Power State: IA Sampling Point: DP 5

Investigator(s): Jordan Smith Section, Township, Range: S1 T77N R06W

Landform (hillside, terrace, etc.): Swale Local relief (concave, convex, none) Very slightly convex

Slope (%): 2 Lat: 41°30'00.55" Long: 91°29'17.00" Datum: Iowa State Plane North

Soil Map Unit Name: Sperry silt loam (122) NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___ , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ___ | **Is the Sampled Area within a Wetland?** **Yes** ___ **No** X |
| Hydric Soil Present? | Yes ___ | No X | |
| Wetland Hydrology Present? | Yes X | No ___ | |

Remarks:
Point taken in unfarmed field swale between two fields. DP-5.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___ ) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| =Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ___ ) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| =Total Cover | | | |
| **Herb Stratum** (Plot size: 5 ) | | | |
| 1. *Elymus curvatus* | 100 | Yes | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| =Total Cover | 100 | | |
| **Woody Vine Stratum** (Plot size: ___ ) | | | |
| 1. | | | |
| 2. | | | |
| =Total Cover | | | |

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | 0 | x 1 = | 0 |
| FACW species | 0 | x 2 = | 0 |
| FAC species | 100 | x 3 = | 300 |
| FACU species | 0 | x 4 = | 0 |
| UPL species | 0 | x 5 = | 0 |
| Column Totals: | 100 (A) | | 300 (B) |

Prevalence Index = B/A = 3.00

**Hydrophytic Vegetation Indicators:**

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is present. Presented as Photo # 5 in Appendix C.

## SOIL

Sampling Point: DP-5

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR 3/2 | 100 | | | | | Loamy/Clayey | |
| 4-20 | 10YR 5/6 | 100 | | | | | Loamy/Clayey | |
| 20-32 | 10YR 4/3 | 100 | | | | | Loamy/Clayey | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

**Indicators for Problematic Hydric Soils[3]:**

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** **Yes** ___ **No** X

Remarks:
Hydric soil not present.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

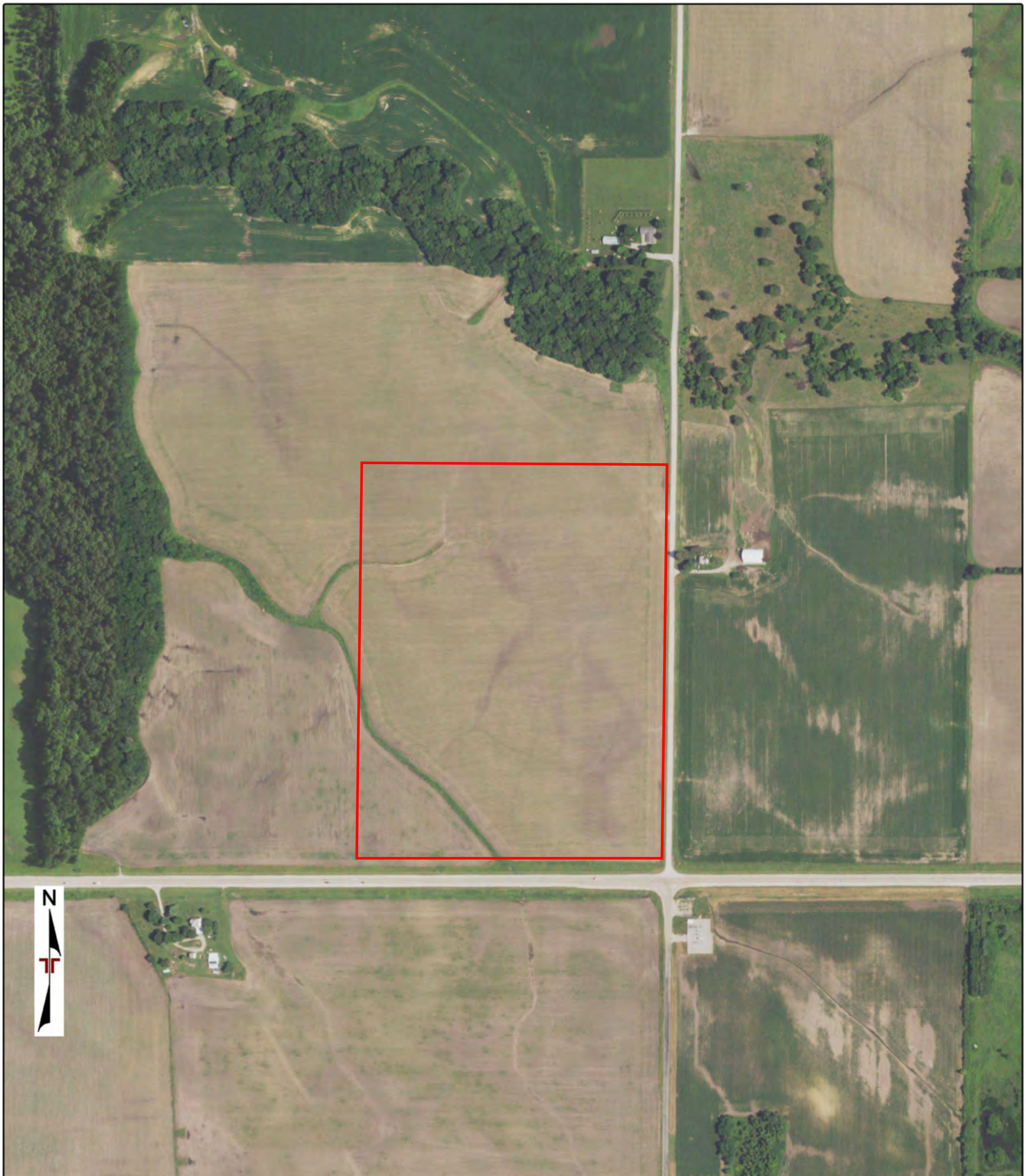
| | Yes | No | Depth (inches) |
|---|---|---|---|
| Surface Water Present? | | X | |
| Water Table Present? | X | | 22 |
| Saturation Present? (includes capillary fringe) | X | | 5 |

**Wetland Hydrology Present?** **Yes** X **No** ___

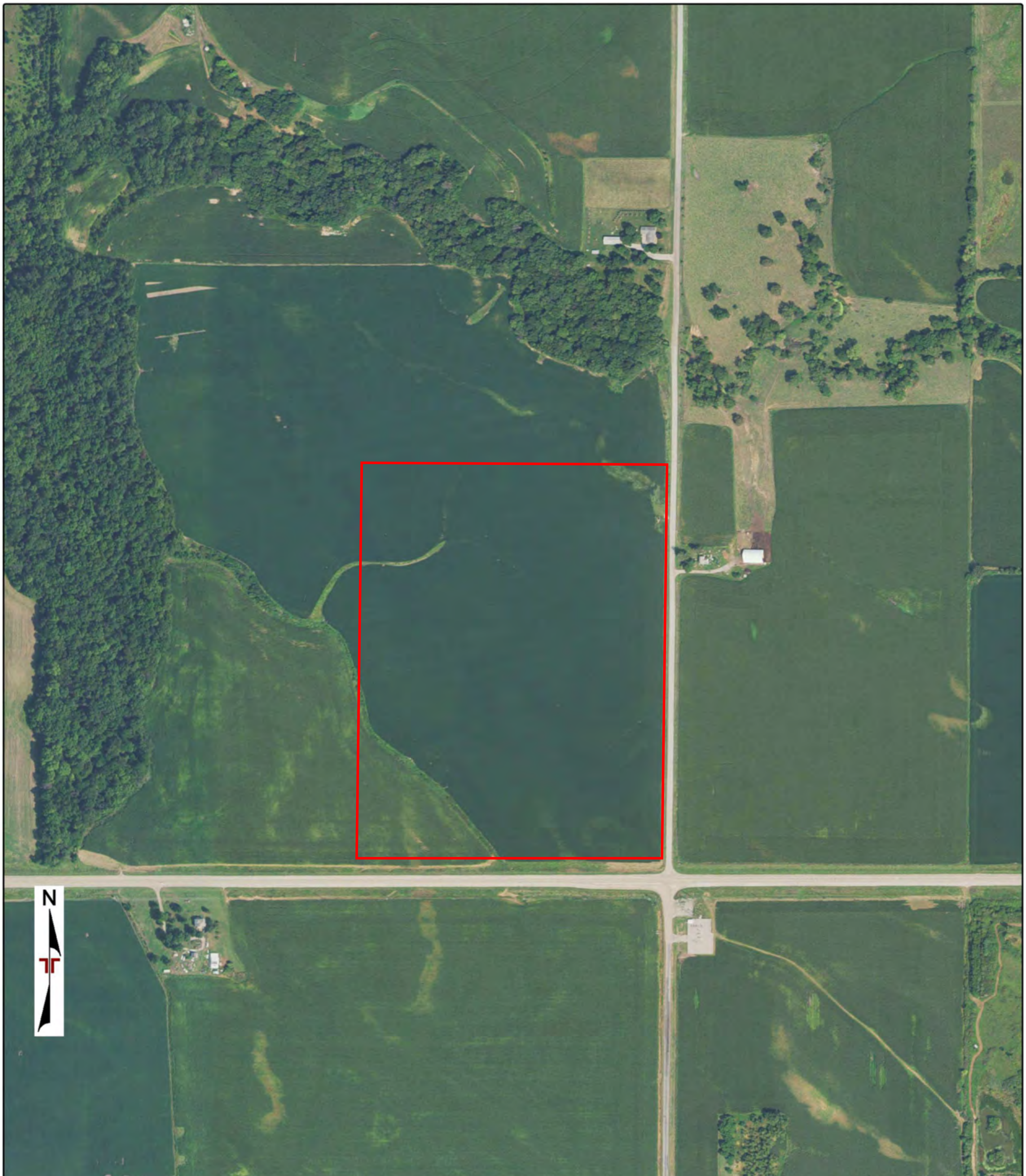
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Wetland hydrology present.

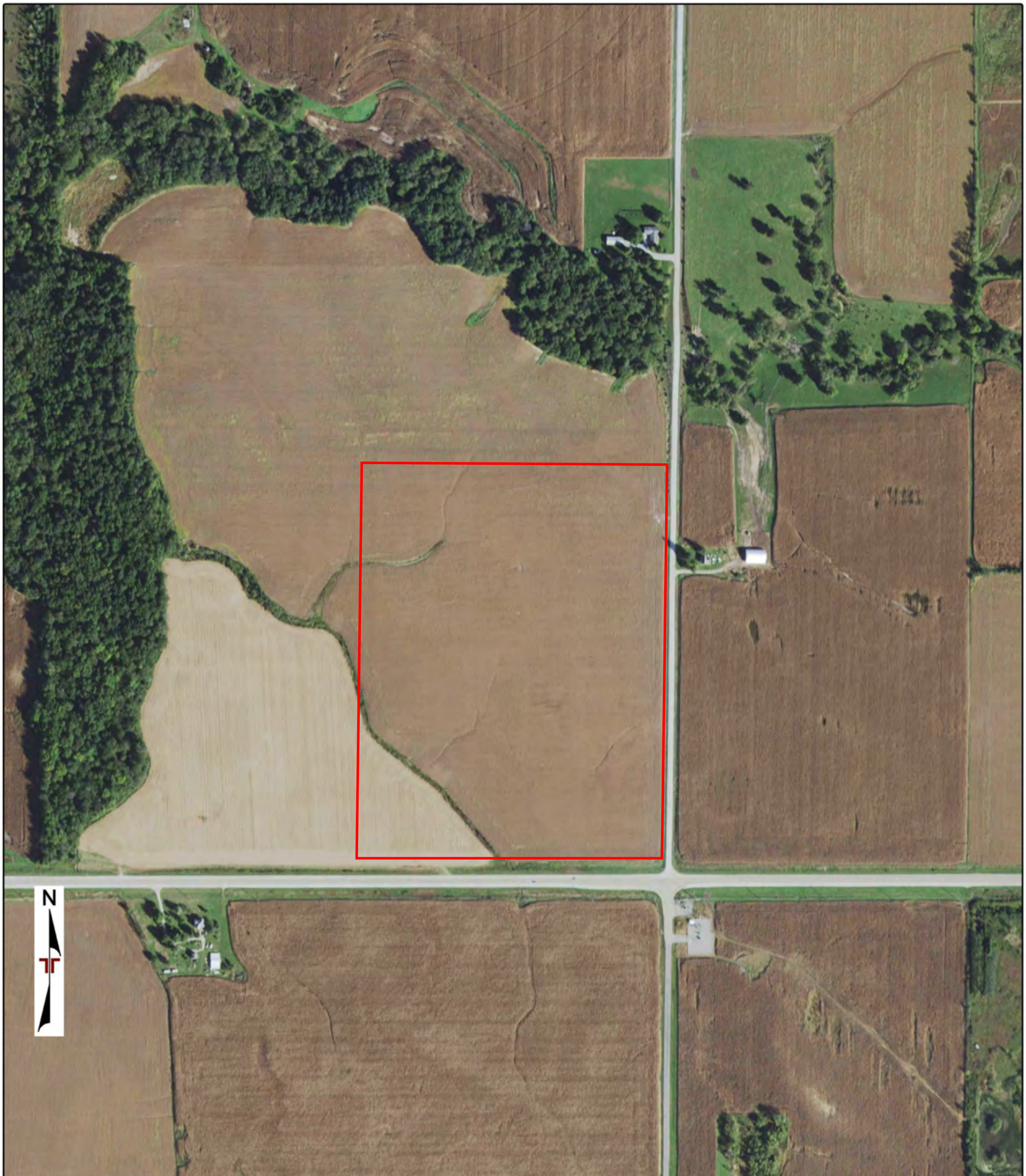
# APPENDIX C
## Aerial Photographs



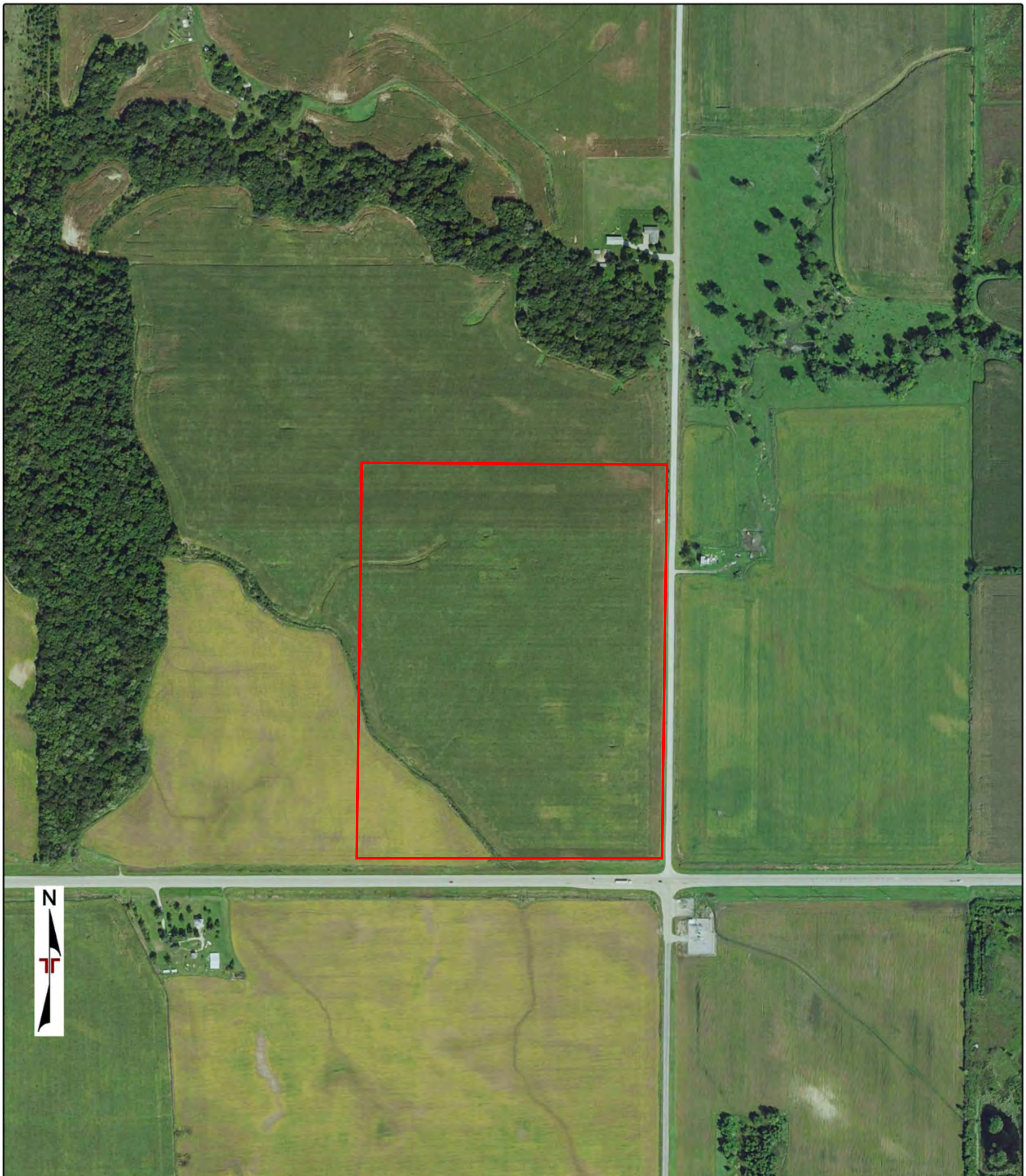

| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (2019 - USDA) | Appendix |
| Drawn by: | Scale: 1" = 500' | 2640 12th St SW Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |



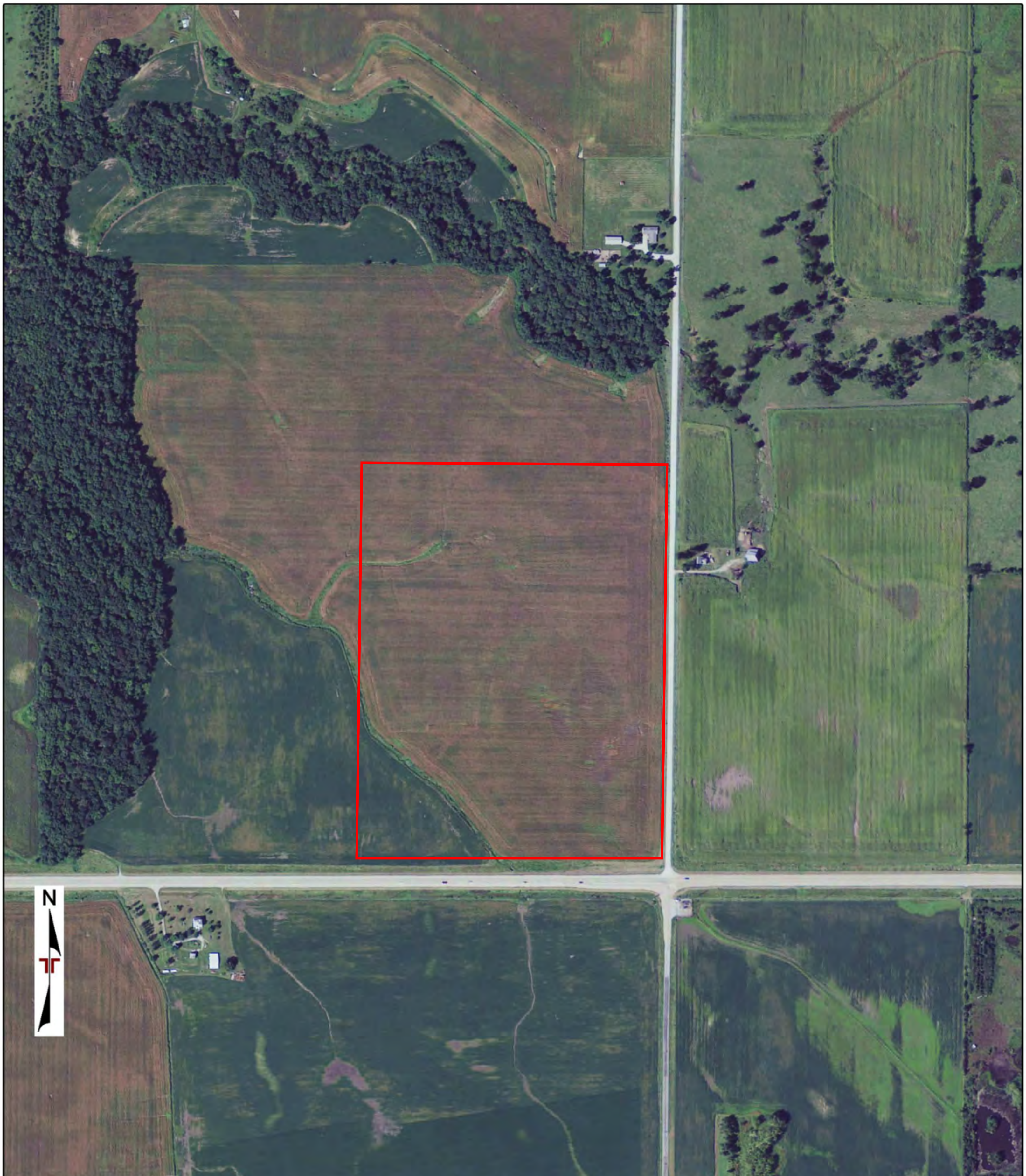

| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2017 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |



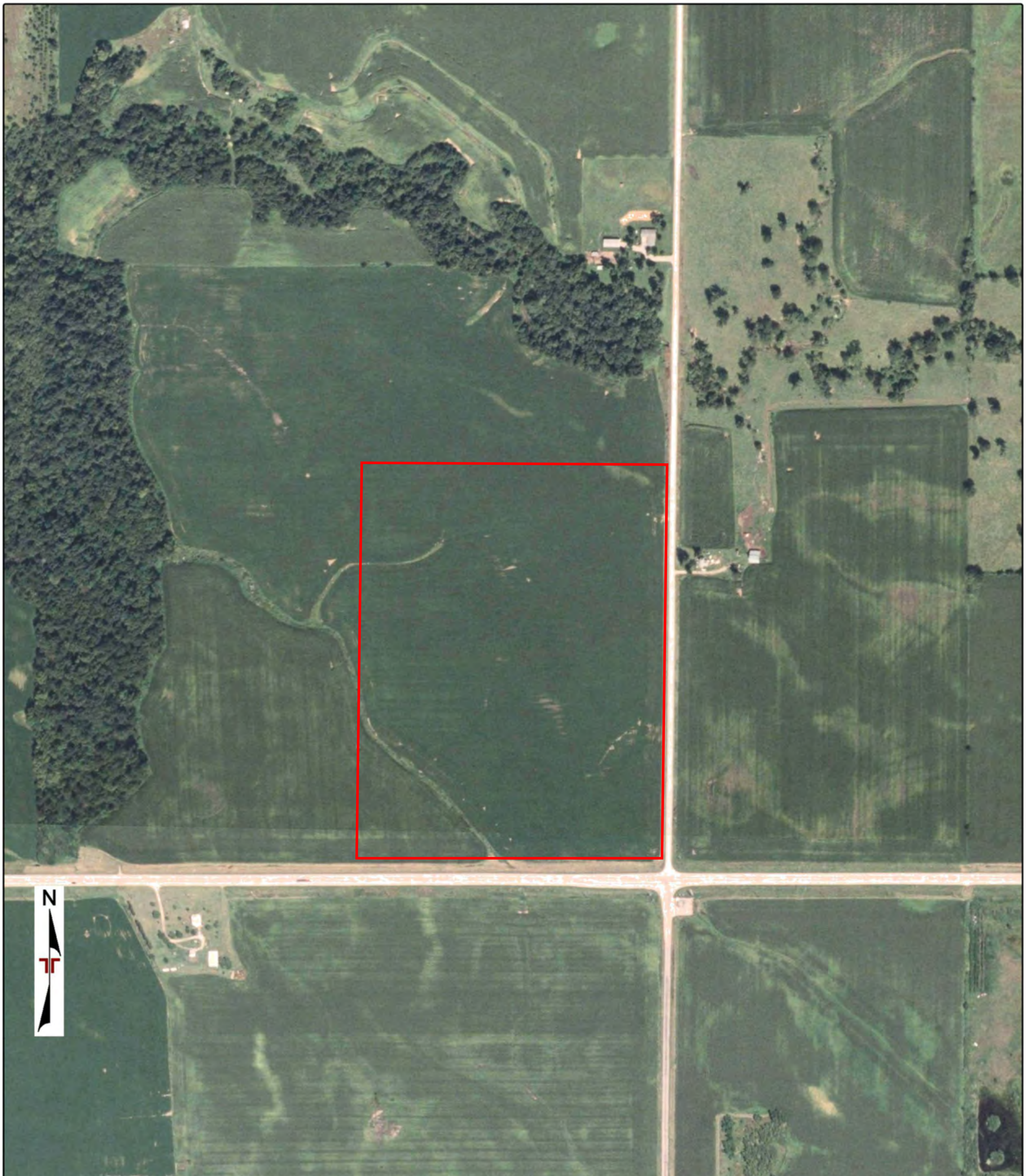

| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2015 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |



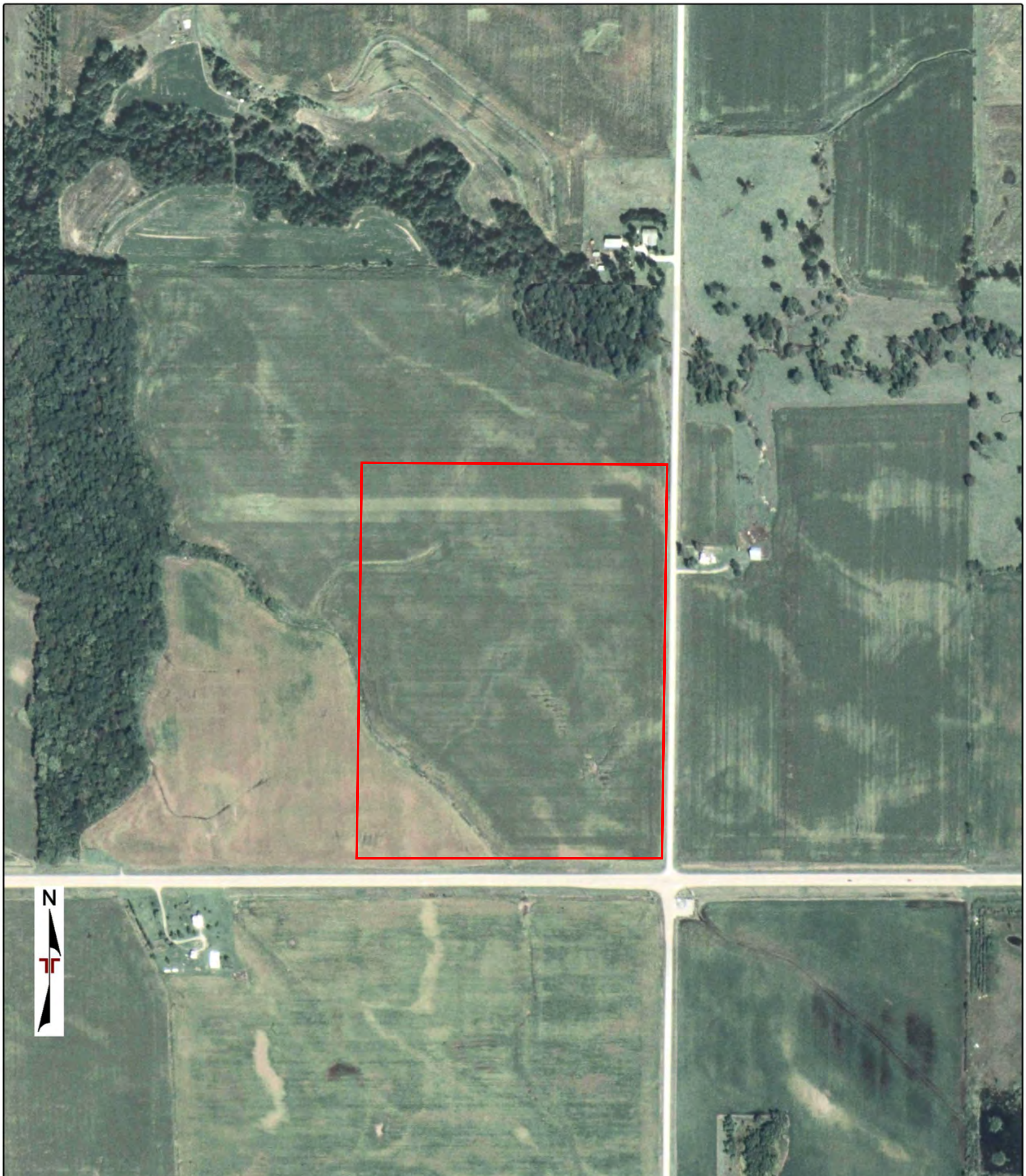

| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2014 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |



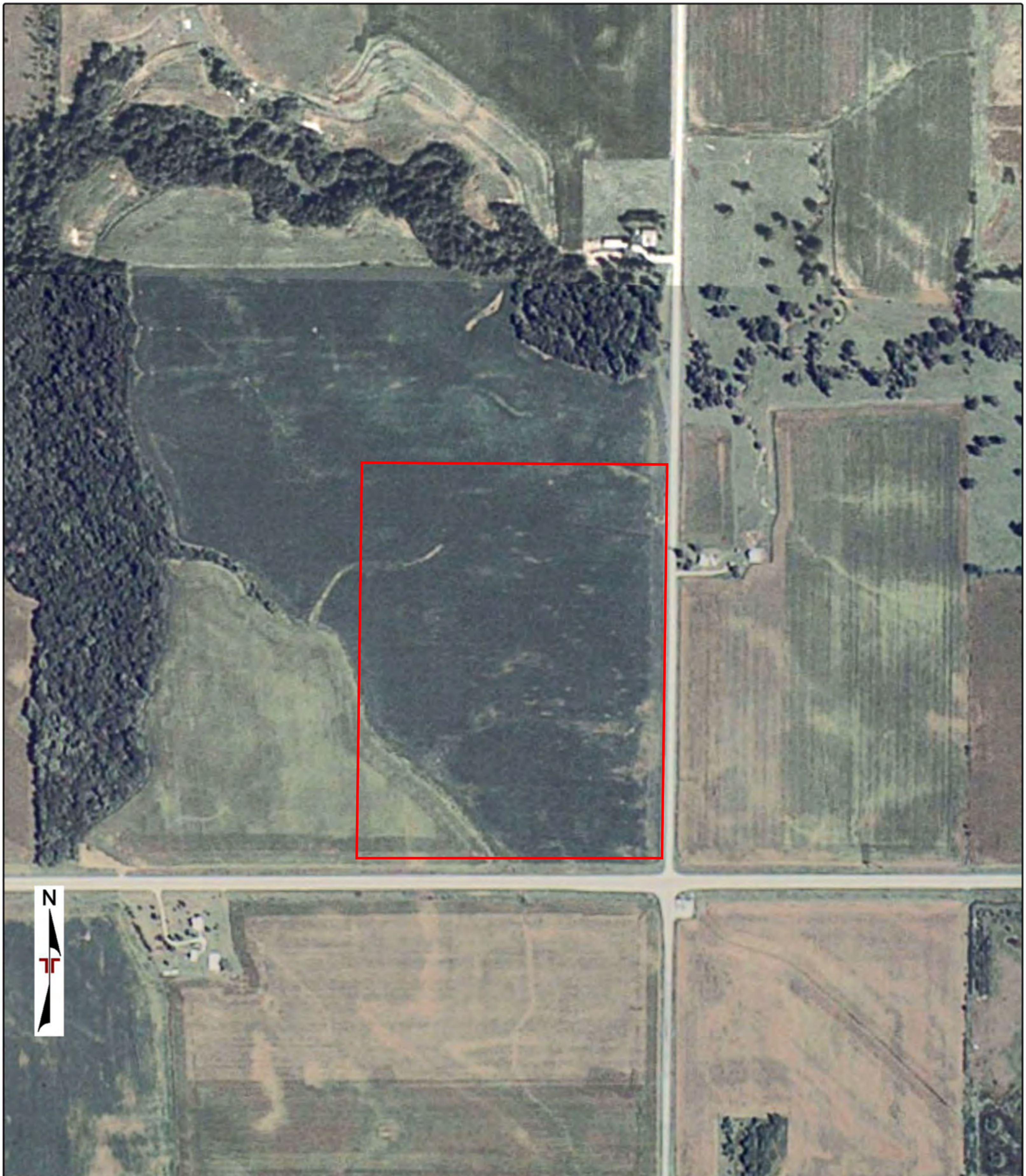

| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No.** 06227049 | Terracon | AERIAL PHOTO (2010 - USDA) | Appendix |
| **Drawn by:** | **Scale:** 1" = 500' | | Lone Tree Site | C |
| **Checked by:** | **File Name:** 22042000035 | 2640 12th St SW | Lone Tree Site | |
| **Approved by:** | **Date:** 2022-04-21 | Cedar Rapids, Iowa 52404 | Parcel 1801476001, Iowa | |




| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No.** 06227049 | Terracon | AERIAL PHOTO (2009 - USDA) | Appendix |
| **Drawn by:** | **Scale:** 1" = 500' | | Lone Tree Site | C |
| **Checked by:** | **File Name:** 22042000035 | 2640 12th St SW | Lone Tree Site | |
| **Approved by:** | **Date:** 2022-04-21 | Cedar Rapids, Iowa 52404 | Parcel 1801476001, Iowa | |




| Project Manager: | Project No.<br>06227049 | Terracon | AERIAL PHOTO (2008 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale:<br>1" = 500' | | | |
| Checked by: | File Name:<br>22042000035 | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Approved by: | Date:<br>2022-04-21 | | | |



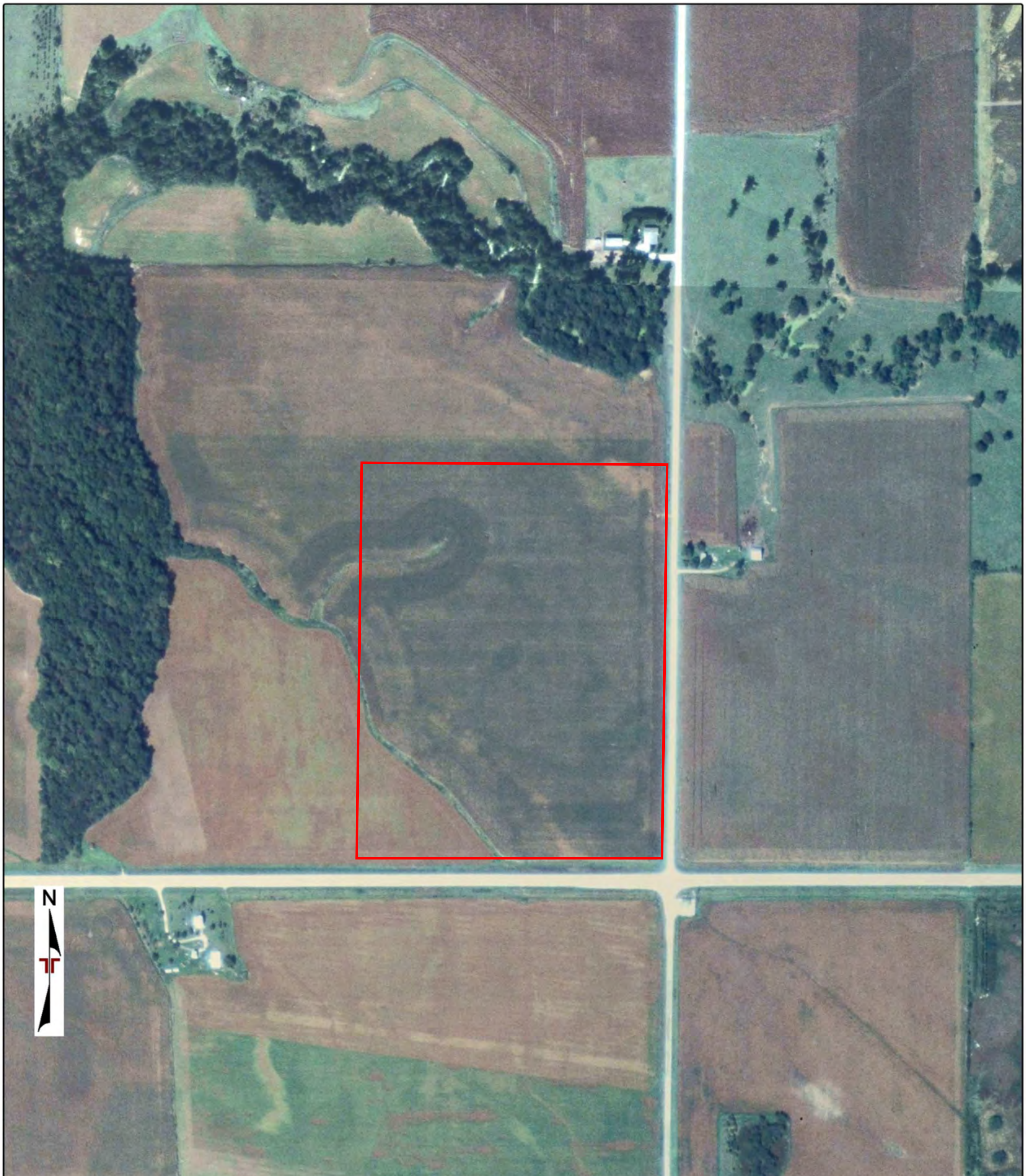

| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon
2640 12th St SW
Cedar Rapids, Iowa 52404

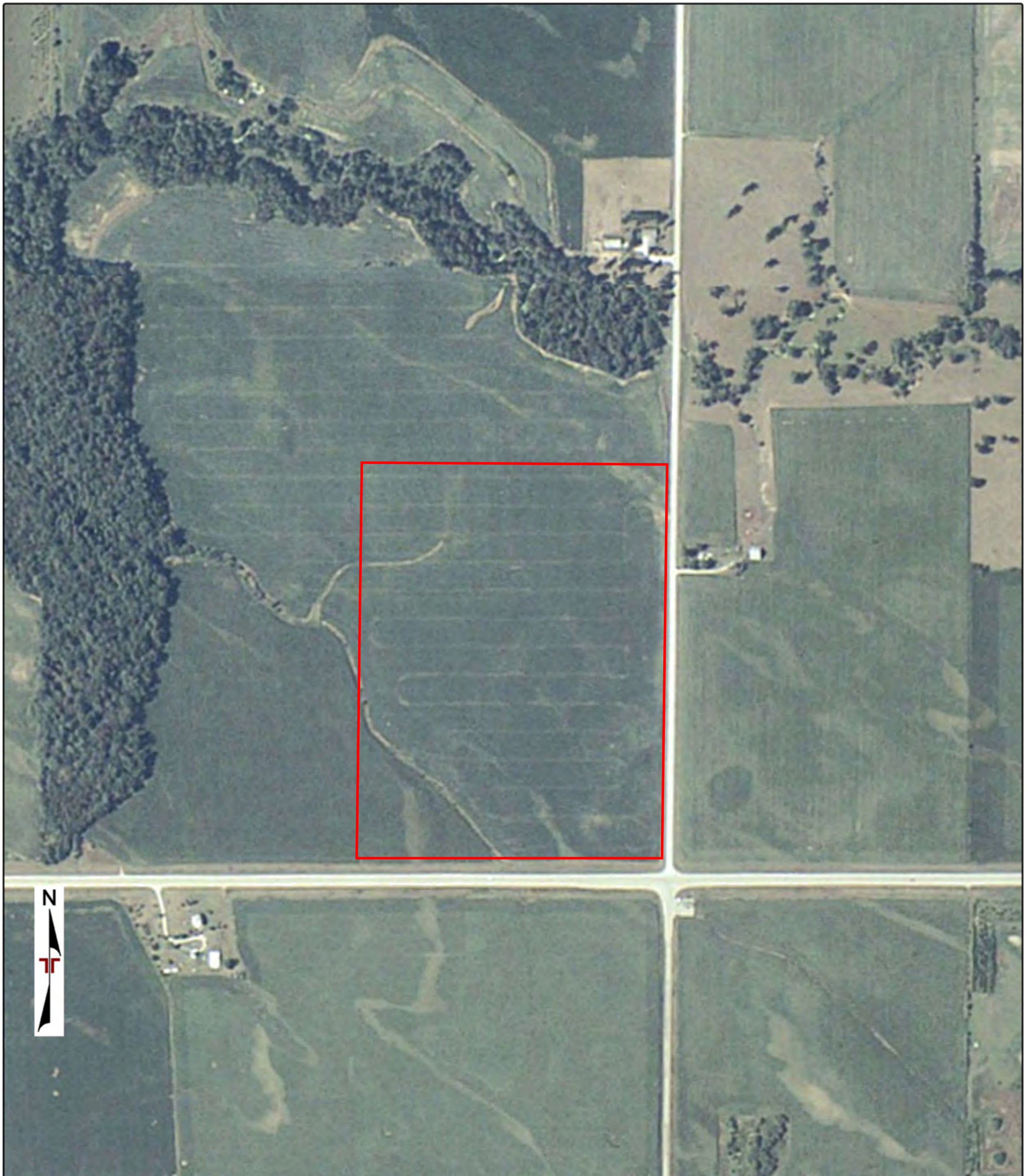
AERIAL PHOTO (2007 - USDA)

Lone Tree Site
Lone Tree Site
Parcel 1801476001, Iowa

Appendix
C

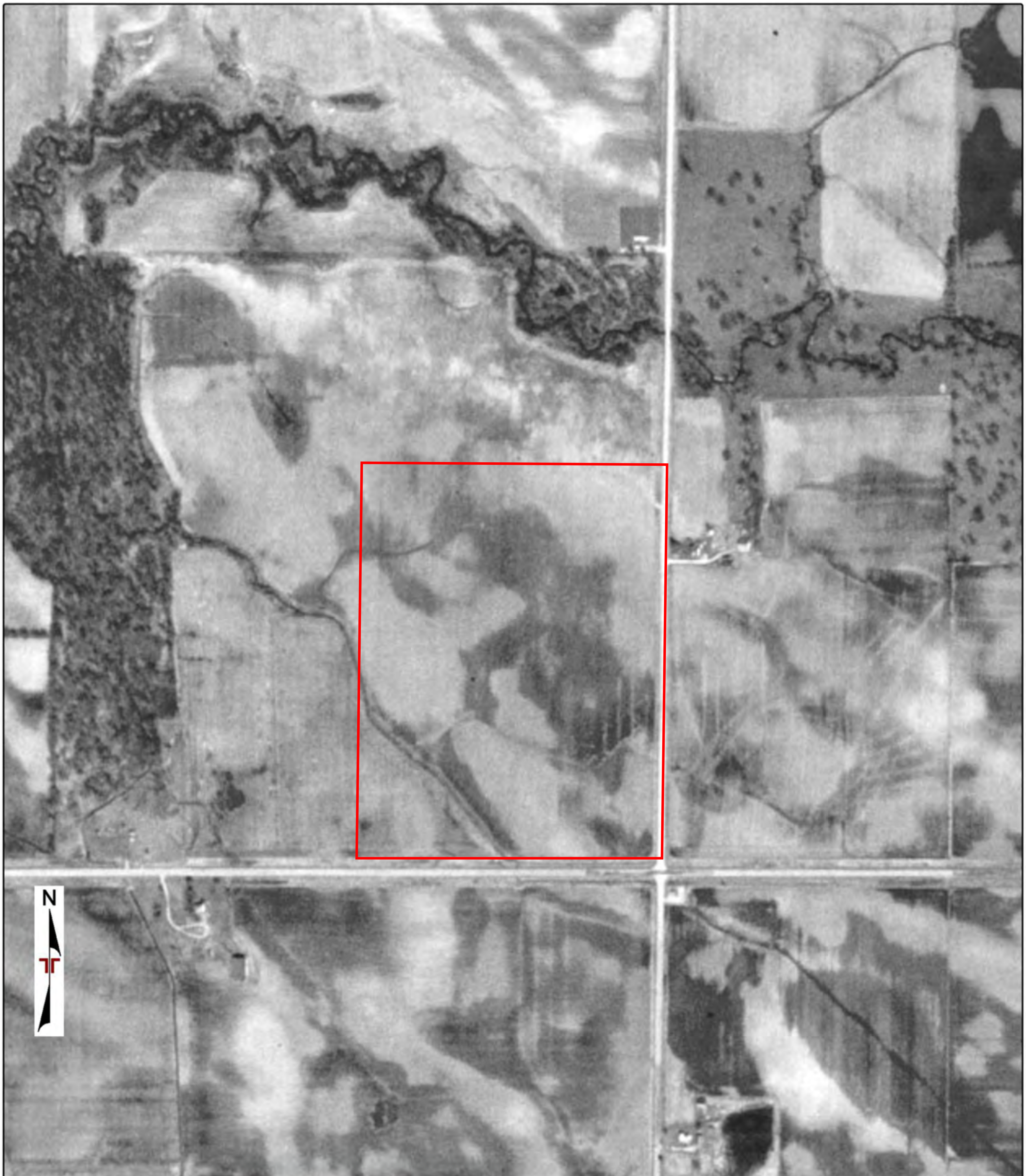



| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2006 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |




| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No.** 06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2005 - USDA) | Appendix |
| **Drawn by:** | **Scale:** 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| **Checked by:** | **File Name:** 22042000035 | | | |
| **Approved by:** | **Date:** 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1994 - USGS) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1983 - USGS) | Appendix |
|---|---|---|---|---|
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| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1970 - ASCS) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |


| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No.<br>06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1963 - ASCS) | Appendix |
| Drawn by: | Scale:<br>1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name:<br>22042000035 | | | |
| Approved by: | Date:<br>2022-04-21 | | | |


| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (1951 - ASCS) | Appendix |
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | 2640 12th St SW | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | Cedar Rapids, Iowa 52404 | Parcel 1801476001, Iowa | |


| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1937 - ASCS) | Appendix |
| --- | --- | --- | --- | --- |
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |

# APPENDIX D
## Photographic Documentation

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 1:** View looking north at data point (DP-1), Wetland 1, and Tributary 1.

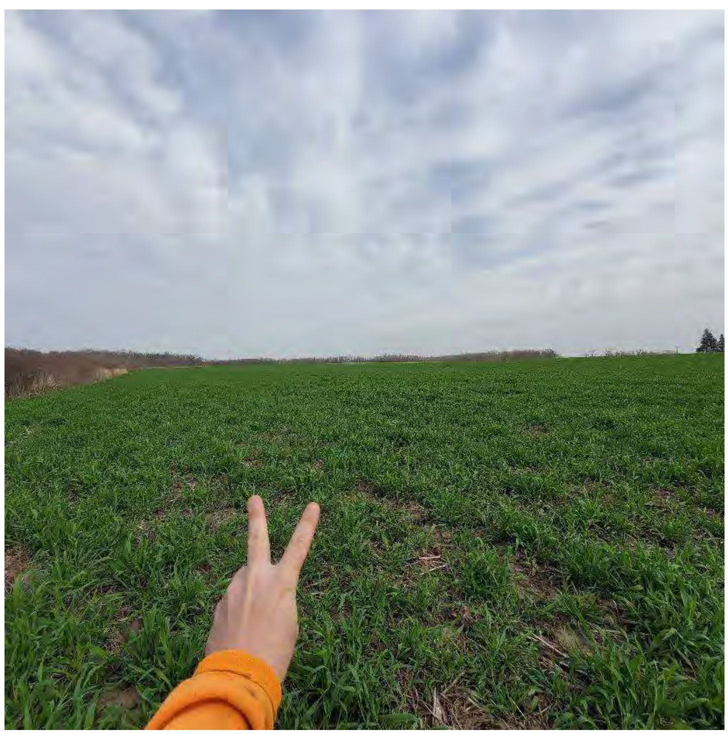

**Photo 2:** View looking north at DP-2, which is an upland point for DP-1 and Wetland 1.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 3:** View looking north at data point (DP-3), Wetland 1, and Tributary 1.

**Photo 4:** View looking north at DP-4, which is an upland point for DP-3 and Wetland 1.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 5:** View of DP-5, which is upland and northeast of Wetland 1 and Tributary 1.

**Photo 6:** View of hydric soil indicator F6 (Redox Dark Surface) observed in Wetland Area 1 soil.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 7:** View looking south-southeast at the south portion of Wetland 1 and Tributary 1.

**Photo 8:** View looking northeast at apparent drainage tile discharging into Tributary 1 and Wetland 1.

# APPENDIX E
## Common Acronyms

**COMMON ACRONMYS**

| | |
|---|---|
| AJD | Approved Jurisdictional Determination |
| CWA | Clean Water Act |
| EPA | Environmental Protection Agency |
| FAC | Facultative |
| FACU | Facultative Upland |
| FACW | Facultative Wetland |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Rate Map |
| GPS | Global Positioning Systems |
| NRCS | Natural Resource Conservation Service |
| NWI | National Wetlands Inventory |
| OBL | Obligate Wetland |
| OHWM | Ordinary High Water Mark |
| PJD | Preliminary Jurisdictional Determination |
| UPL | Obligate Upland |
| USACE | U.S. Army Corps of Engineers |
| USDA | U.S. Department of Agriculture |
| USFWS | U.S. Fish and Wildlife Service |

| | |
|---|---|
| USGS | U.S. Geologic Survey |
| WOTUS | Waters of the U.S. |

# Desktop Cultural Resources Assessment

**Lone Tree Site**
**Iowa Highway 22 and Sioux Avenue SE**
**Johnson County, Iowa**

**April 29, 2022**

**Terracon Project No. 06227049, Task 2.4**


**Prepared for:**
PCR US Investments Corporation
Houston, Texas

**Prepared by:**

Caitlin Gulihur, MA, RPA
Terracon Consultants, Inc.
Austin, Texas

**Desktop Cultural Resources Assessment**
**Lone Tree Site**
**Johnson County, Iowa**
**Terracon Project No. 06227049, Task 2.4**
**April 29, 2022**

## Introduction

Terracon Consultants, Inc. (Terracon) was retained by Conifer Power Company (Conifer) on behalf of PCR US Investments Corporation (client) to perform a desktop cultural resources assessment on an approximate 36.4-acre parcel located in Johnson County, northeast of River Junction, Iowa (Exhibits 1 and 2). This report has been prepared in accordance with our proposal dated March 31, 2022. It is Terracon's understanding that the project area is privately owned, and that the proposed project will be carried out with private funds.

As discussed below, the purpose of Terracon's review is to assist the client in evaluating and complying with requirements relative to Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations (Title 36 Code of Federal Regulations Part 800). This report is a desktop review of the project with regards to potential impacts to recorded historic properties, is based solely on research and was not informed by archaeological fieldwork.

## Project Description and Area of Potential Effect

Terracon understands that the Client and Conifer are preparing preliminary plans to develop the project area with approximate 10-megawatt solar facilities. The proposed project will include a Gen-tie route, which is currently not identified. The project area is located northeast of River Junction, Iowa, in Johnson County, Township 77N, Range 6W, Section 1. For the purposes of the current desktop review, the total area of the potential ground disturbances is considered as the area of potential effect (APE). The total area of the APE is approximately 36.4 acres for the proposed solar facilities (see Exhibits 1 and 2). The project area is currently an undeveloped agricultural field.

## Environmental Context

The project area is located within the Upper Mississippi Alluvial Plain (72d) Level IV ecoregion, characterized by smooth to irregular alluvial plains (Chapman et al. 2002). The vegetation of this ecoregion was historically a mix of oak-hickory forests and tallgrass prairie; however, the majority of the ecoregion is currently used as cropland. In general terms, the project area is located in a rural environment, and consists of an undeveloped tract.

Bedrock geology of the project area is mapped as Famennian Formations (Df), consisting of shale, siltstone, and dolomite (Witzke et al. 2010).

Although agricultural in nature, county soil surveys provide a description of soil characteristics, including depth, color, inclusions, etc., which can be used to elucidate formation processes and environmental characteristics. Eight soils are mapped in the APE (Exhibit 3; USDA NRCS 2022).

**Table 1. Soil Survey Data in APE.**

| Soil or Series Name | Drainage | Soil Depth | Associated Landform |
|---|---|---|---|
| Tama silt loam, 2 to 5 percent slopes (175B) | Well drained | 60 inches to bedrock | Summit, shoulder, and backslope of interfluves |
| Sperry silt loam, depressional, 0 to 1 percent slopes (122) | Poorly drained | 78 inches to bedrock | Summits of interfluves |
| Walford silt loam, 0 to 2 percent slopes (160) | Poorly drained | 80 inches to bedrock | Summits of interfluves |
| Dickinson fine sandy loam, 2 to 5 percent slopes (175B) | Well drained | 60 inches to bedrock | Summit, shoulder, and backslope of dunes |
| Atterberry silt loam, 1 to 3 percent slopes (291) | Somewhat poorly drained | 60 inches to bedrock | Summits of interfluves |
| Downs silt loam, till plain, 2 to 5 percent slopes (M162B) | Well drained | 60 inches to bedrock | Summits and shoulders of interfluves |
| Downs silt loam, till plain, 5 to 9 percent slopes (M162C) | Well drained | 60 inches to bedrock | Summits and shoulders of interfluves |
| Downs silt loam, till plain, 5 to 9 percent slopes, eroded (M162C2) | Well drained | 60 inches to bedrock | Summits and shoulders of interfluves |

## Site Records and Literature Review

The National Register of Historic Places (NRHP) and ISites Public Data Web Map databases informed this records review. In addition, the Office of the State Archaeologist (OSA) was contacted on April 25, 2022, to request a Site File Search. The State Historical Society of Iowa was contacted for information regarding historical resources within one mile of the APE (Berry Bennett, personal communication 2022). Properties and/or districts listed on the NRHP were not located within the APE or within the 1-mile search buffer. Walker Park and Memorial Building located in River Junction was nominated to the NRHP, but the nomination was not completed, and the resource is not listed. The River Junction Cemetery has not been evaluated for NRHP eligibility. In addition to these resources, the OSA had the Old River Junction Bridge from the Notable Locations Database and Abraham Owen Stumptown from the Historic Indian Locations Database mapped within one mile of the APE. These features are not located within or adjacent to the APE, and are not recorded as archaeological sites, but are considered to be locations with potential historical and/or archaeological value.

According to the OSA Site File Search, previously recorded archaeological sites are not located within or adjacent to the APE. One previously recorded archaeological site, 13JH554, is located within the 1-mile search buffer. Site 13JH554 is recorded as a historic-age Euro-American school; the site is approximately 0.15-mile west of the APE. A previous cultural resources survey is located along Iowa Highway 22, immediately south of the APE; portions of that survey may intersect with the current APE.

## Historical Maps and Aerial Review

Historic resources used to inform this review included maps and other resources ordered online. Topographic maps from 1894, 1965, and 1969 were reviewed (ERIS 2022a). Historical aerial photographs from 1937, 1951, 1963, 1970, 1983, 1994, 2005, 2010, and 2019 were also examined (ERIS 2022b). In the topographic map from 1894, structures are not marked in the northern portion of the APE; the southern portion of the APE is not included in the map. The topographic map from 1965 covers the northern portion of the APE; one structure is marked in the northeast corner of the project area. The 1969 map covers the southern portion of the APE and no structures are marked. In the aerial photograph from 1937, structures are not visible in the APE. In the aerial photographs from 1951, 1963, and 1970, a driveway is present in the northeast corner of the APE, and structures associated with that driveway are present within and adjacent to the APE. In the aerials from 1983 and later, the driveway and structures are no longer visible.

## Conclusions and Recommendations

This review relied primarily upon public and nonpublic sources of information, as well as information from the client. Aerial photographs indicate that the APE is currently a vacant agricultural field; evidence of historic-age features was observed in aerial photographs and in topographic maps. Therefore, there is moderate potential to encounter intact, isolable historic-age archaeological deposits. Previously recorded archeological sites are not located within or adjacent to the APE. Based on the topographic setting, the likelihood of the APE to contain intact, isolable prehistoric deposits is low to moderate.

At this time, it is understood that the proposed project will not involve funding or permitting from federal entities, which would provide a nexus for federal oversight. If funding or permitting from a federal entity, such as the US Army Corps of Engineers, is required for this project, a cultural resources survey may be required by the Iowa State Historic Preservation Office (SHPO) in order to comply with Section 106 of the NHPA.

Sincerely,
**Terracon Consultants, Inc.**

Caitlin Gulihur, MA, RPA
Principal Investigator

Ann M. Scott, PhD, RPA
Authorized Project Reviewer

**Attachments**

Exhibit 1: USGS Topographic Map
Exhibit 2: Aerial Photograph
Exhibit 3: Web Soil Survey

## References Cited

Chapman, S.S., J.M. Omernik, G.E. Griffith, W.A. Schroeder, T.A. Nigh, and T.F. Wilton
2002 *Ecoregions of Iowa and Missouri*. Color poster with map, descriptive test, summary tables, and photographs. U.S. Geological Survey, Reston, Virginia.

Environmental Risk Information Services (ERIS)
2022a *Topographic Maps*. Ordered from www.erisinfo.com. Received April 20, 2022.

2022b *Historical Aerials*. Ordered from www.erisinfo.com. Received April 21, 2022.

National Parks Service (NPS)
2022 *National Register of Historic Places*. National Parks Service, U.S. Department of the Interior. https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466. Accessed April 2022.

Office of the State Archaeologist
2022a Iowa Site File Search No. 2022142. Office of the State Archaeologist, University of Iowa. Received April 26, 2022.

2022b I-Sites Public Data Web Map. Office of the State Archaeologist, powered by ESRI. https://isugisf.maps.arcgis.com/apps/Viewer/index.html?appid=3117ad0729b046a697ae5ba82c9b8cfa. Accessed April 2022.

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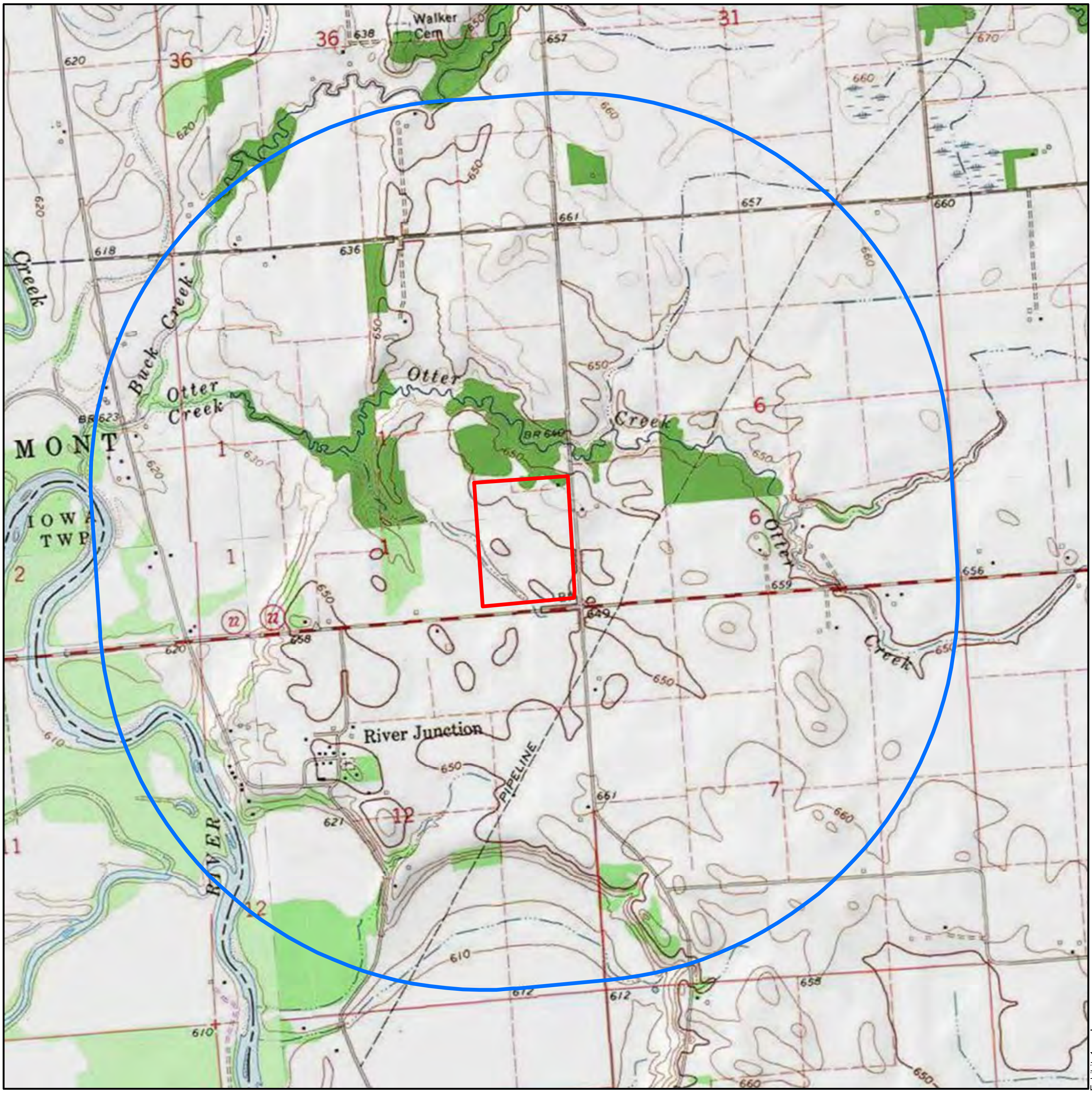
2022 Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed April 2022.

Witzke, Brian J., Raymond R. Anderson, and John P. Pope
2010 *Bedrock Geologic Map of Iowa.* Iowa Geological and Water Survey. https://ngmdb.usgs.gov/ngm-bin/pdp/zui_viewer.pl?id=36869. Accessed April 2022.




**Legend**

- Project Area
- 1-mile Buffer

Miles
0 0.25 0.5

N

DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap USDA WSS, TNRIS, TWDB, USGS, USGS MR OSD, Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

| Project No.: 06227049, 2.4 | Terracon<br>5307 Industrial Oaks Blvd.<br>Suite 160 Austin, TX 78735<br>PH. (512) 442-1122 terracon.com | **USGS Topographic Map** | **Exhibit** |
|---|---|---|---|
| Date: 4/28/2022<br>Drawn By: CG<br>Reviewed By: AS | | USGS Topographic Maps:<br>Lone Tree (1969), West Liberty SW (1965),<br>Hills (1983), and Riverside (1983)<br>Conifer Solar Site - Lone Tree<br>Johnson County, Iowa | **1** |

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**Legend**

Project Area

Feet
0 500 1,000

N

DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap USDA WSS, TNRIS, TWDB, USGS, USGS MR OSD, Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

| | |
|---|---|
| Project No.: | 06227049, 2.4 |
| Date: | 4/28/2022 |
| Drawn By: | CG |
| Reviewed By: | AS |

Terracon
5307 Industrial Oaks Blvd.
Suite 160 Austin, TX 78735
PH. (512) 442-1122 terracon.com

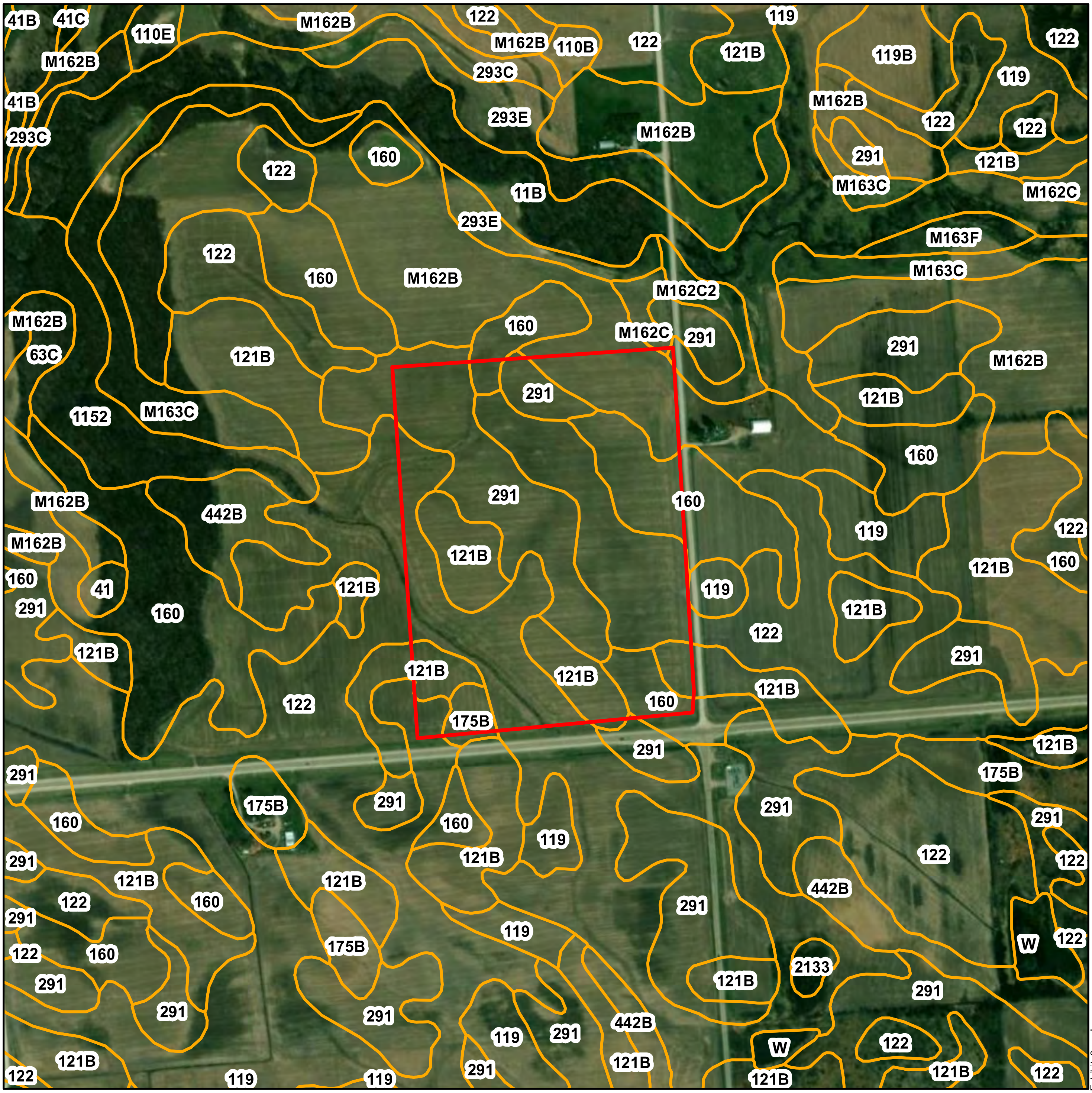
**Aerial Photograph**

Aerial Photograph:
April 2021
Conifer Solar Site - Lone Tree
Johnson County, Iowa

**Exhibit**

**2**

Document Path: N:\GIS\Projects\2022\06227049\Project_Mxds\Task 2.4\06227049_Exhibit_2.mxd




## Legend

- Project Area
- Web Soil Survey

Feet
0 500 1,000

N

DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap USDA WSS, TNRIS, TWDB, USGS, USGS MR OSD, Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

| Project No.: 06227049, 2.4 | Terracon<br>5307 Industrial Oaks Blvd.<br>Suite 160 Austin, TX 78735<br>PH. (512) 442-1122 terracon.com | **Web Soil Survey** | **Exhibit** |
|---|---|---|---|
| Date: 4/28/2022 | | Natural Resource Conservation Service<br>Web Soil Survey<br>Conifer Solar Site - Lone Tree<br>Johnson County, Iowa | **3** |
| Drawn By: CG | | | |
| Reviewed By: AS | | | |

Document Path: N:\GIS\Projects\2022\06227049\Project_Mxds\Task 2.4\06227049_Exhibit_3.mxd

# PHASE I ARCHEOLOGICAL INVESTIGATION FOR A PROPOSED LONE TREE SUBSTATION LOCATION, FREMONT TOWNSHIP, JOHNSON COUNTY, IOWA

Section 1, T77N R06W

BCA 3187-2

**THIS VOLUME MAY CONTAIN SITE LOCATION INFORMATION**
**NOT FOR PUBLIC DISTRIBUTION**

Prepared for
PCR US Investments Corp
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Prepared by
Jeremy L. Skeens
(Principal Investigator)

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December 2022

## MANAGEMENT SUMMARY

This report presents the results of a Phase I archeological investigation conducted for PCR US Investments Corp of Houston, Texas, by Bear Creek Archeology, Inc., of Cresco, Iowa, for a proposed Lone Tree substation location near the Iowa River valley in Johnson County, Iowa. The project area covers an undulating portion of an active agricultural field northwest of the Iowa Highway 22-Sioux Avenue intersection near Otter Creek and the Iowa River valley. Intermittent drainages cross the northwest and southwest corners of the project area. The project area is located in the E½, SE¼ of Section 1, T77N R06W, Fremont Township, Johnson County, Iowa. The total project area covers approximately 20.2 ha (49.9 ac).

No previously recorded archeological sites or historic properties/structures are located within the project area. A previous Phase I survey of the Iowa Highway 22 corridor included the south perimeter of the project area and recorded a nearby historic schoolhouse (13JH554). The archival search indicated four additional previous cultural resource investigations within 1.6 km (1 mi) of the project area. The River Junction Cemetery (52-05201) is the only inventoried historic property mapped within .8 km (.5 mi) of the project area.

Surface cover for the project area consisted of harvested corn residue with grass and trees along the drainages. Gentle to moderate slopes were common along the rolling landscape. The geomorphic evaluation identified a project area comprised mainly of eroded and/or disturbed uplands with evidence of prolonged saturation along the drainages. Relative intact soil was recorded beneath the plowzone along the drainage channel in the southwest corner. A linear rise at the south-central perimeter was comprised of deep, eolian deposits.

During the field investigation, a visual surface examination was conducted throughout the entire project area. A total of 30 shovel tests were excavated along each side of the southwest drainage channel. Nine auger tests were used to investigate the windblown deposits along the linear rise. No cultural materials were observed or collected from the project area during the investigation. No further cultural resource investigations are recommended for the identified project area.

Information contained in this report relating to the nature and location of archeological sites is considered private and confidential and nor for public disclosure in accordance with Section 304 of the National Historic Preservation Act (54 U.S.C § 307103); 36 CFR Part 800.6(a)(5) of the Advisory Council on Historic Preservation's rules implementing Sections 106 and 110 of the National Historic Preservation Act; Section 9(a) of the Archaeological Resource Protection Act (54 U.S.C. § 100707), and Chapter 22.7, subsection 20 of the Iowa Code.

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# INTRODUCTION

The following report presents the results of a Phase I archeological investigation conducted for PCR US Investments Corp of Houston, Texas, by Bear Creek Archeology, Inc. (BCA) of Cresco, Iowa, for a proposed Lone Tree substation location near the Iowa River valley in Johnson County, Iowa. The Phase I archeological survey was conducted in accordance with the National Historic Preservation Act (Advisory Council on Historic Preservation 2004, 2016) and the Secretary of the Interior's standards for the identification of historic properties (National Park Service [NPS] 1983). The investigation meets or exceeds the guidelines for Iowa archeological investigations offered by the Association of Iowa Archaeologists (AIA; 2021). The fieldwork for this investigation was conducted by BCA personnel in November 2022. The fieldwork, data analyses, and report production were completed by BCA personnel under the supervision of the Principal Investigator. The resulting field notes and other records generated by BCA during this project are housed at BCA's office in Cresco, Iowa.

# PROJECT LOCATION AND DESCRIPTION

Positioned in the Southern Iowa Drift Plain physiographic region (Prior 1991; Figure 1), the project area encompasses an undulating portion of an active agricultural field northwest of the Iowa Highway 22-Sioux Avenue intersection. Intermittent drainages cross the northwest and southwest corners of the project area The project area occurs approximately .6 km (.4 mi) east of the Iowa River valley and 125 m (410 ft) south of Otter Creek. The project area is located in the E½ SE¼ of Section 1, T77N R06W, Fremont Township, Johnson County, Iowa (Figures 2 and 3). The total project area covers approximately 20.2 ha (49.9 ac).

# INVESTIGATION PREMISES

The purpose of this investigation is to document the cultural resources within the project area at the Phase I level of investigation. The goals of the Phase I survey are based on the Secretary of the Interior's Standards and Guidelines for the Identification of Archeological Properties (NPS 1983:44716–44728). These standards are summarized and annotated within the archeological guidelines for Iowa (AIA 2021). Phase I surveys are intended to provide basic data on the occurrence, location, and identification of cultural resources within a given area.

The survey strategy of this Phase I investigation was based on an analysis of the project area and the landforms that exist within it. Archeological sites are integrated into the environment by natural processes and may be viewed not only as cultural remains, but also as geological deposits. The geographic and pedologic character of a region is conditioned by geological processes, and an awareness of these processes is fundamental to any evaluation of the archeological record. Landform and soil attributes have a strong influence on the presence, absence, and distribution of the plant and animal populations utilized by human groups. Geological processes affect not only the patterns of human habitation and environmental exploitation, but they are also largely responsible for the preservation, destruction, and manipulation of the archeological record. Therefore, archeological sites should be viewed as a product of both cultural and geological processes (Bettis and Green 1991).

This perspective on site location takes into account both the geological processes and cultural interactions of an area, allowing archeologists to use landform modeling to predict site occurrence and patterned distributions within a given region (Bettis and Benn 1984; Bettis and Thompson 1981). Such an approach also proves useful in investigator recognition of post-settlement alluvium (PSA), made land, plowzones, and other disturbances that may have modified the area under investigation.

As a tool of cultural resource management, this type of landform modeling is critical to the development and implementation of survey strategies. More sensitive strategies toward geomorphological context allow the investigator to focus on those areas where the probabilities of site occurrence are highest. This reduces or eliminates the cost of surveying areas where sites should not sensibly occur in situ (e.g., made land, heavily disturbed areas, and landforms consisting entirely of recent alluvium, etc.). Informed survey strategies such as the one outlined above allow for the determination of the depth and distribution of subsurface tests necessary for the detection of buried cultural resource deposits. Additionally, the nature of the proposed impacts can be assessed in terms of the landforms present.

## GENERAL INVESTIGATION METHODOLOGY

Prior to beginning the fieldwork, on-line site and previous survey records at the Office of the State Archaeologist (OSA) in Iowa City were examined to determine if previously reported properties are recorded within or near the project area. To check for non-extant structures, digital copies of the nineteenth century General Land Office (GLO) map, historic plat maps, and aerial photographs stored on the BCA server were also consulted.

Also preceding the fieldwork, a brief geomorphic review was conducted to assess the general landform context of the survey area. A ¾" cm hand probe was used to inspect subsurface deposits and monitor the depth of the plowzone and other modern impacts. Representative soil profiles were recorded for various landscape positions, supplemented by visual assessments of the project area. Upon completion of this assessment, the site discovery stage utilized the excavation of subsurface shovel and auger tests on those landforms determined by the geomorphic evaluation to have suitable potential for cultural materials coupled with either low surface visibility and/or the presence of an intact soil stratigraphy. When undertaken, subsurface tests were advanced at 10–15 m (32.8–49.2 ft) intervals, with the removed matrix screened through one-quarter inch hardware mesh. Each shovel test was a minimum of 35 cm in diameter, while bucket auger tests had a minimum diameter of 20 cm. Subsurface tests were advanced to a maximum depth of 140 cm below surface, or well into the subsoil (i.e., Bt or E/Bt horizon). All tests were backfilled.

## ENVIRONMENTAL CONTEXT AND LANDFORM MODELS

### *Physiographic Region*

The project area is located in east-central Iowa within the Southern Iowa Drift Plain physiographic region (Prior 1991; Figure 1). Although the Southern Iowa Drift Plain was not glaciated during the Wisconsinan glacial stage, this region saw repeated earlier glacial events broadly identified as the Illinoian (confined to the eastern margins of the region) and Pre-Illinoian (comprised of multiple glacial and interglacial stages covering the entire region) epochs that deposited thick glacial drift (till) across the entire landscape (Prior 1991). In most places the till is blanketed by Wisconsinan-age loess (Prior 1991) although, as noted in soil surveys from the region, heavy erosion on steeper sideslopes sometimes expose remnants of a paleosol formed on the glacial drift. Exposed sporadically in larger stream valleys and deeper ravines, Mississippian bedrock is present below the till in the southeastern part of the state with isolated outcrops of Pennsylvanian-age coal also reported. Since the end of the Illinoian glacial stage in southern Iowa, approximately 500,000 years ago, the Southern Iowa Drift Plain has been exposed to stream erosion, weathering processes, soil development, loess deposition, and hillslope evolution resulting in a well-integrated drainage network and multi-stepped erosional surfaces. Topographic features include mostly level upland divides and plateaus, steeply rolling hills, narrow interfluves, and alluvial lowlands (Bettis and Littke 1987; Prior 1991). Due to the age of the sediments (Bettis and Littke 1987), archeological sites in the uplands are limited to the near surface and are commonly incorporated into the plowzone in agricultural fields.

### *Upland Landform Model*

The upland landform model (Figure 4) used in this report is based on Ruhe's (1969) analysis of hillslope evolution detailing the erosional and depositional sequences of upland components. Hillslopes are divided into five components (listed in descending order): summit, shoulder, sideslope, footslope, and toeslope. Not all components, however, may be present on a given hillslope.

Summits comprise the upper portion of the uplands and tend to be stable but are subjected to minor deposition and erosion by eolian processes. Shoulders form by the gradual back cutting of hillslopes at summit margins and are generally convex in cross-section with a low degree of slope. Comprised of backslope, headslope, and noseslope subcomponents, sideslopes are erosional features formed by the back cutting of valley walls. Footslopes, the lower remnants of hillslopes, are eroded and often covered by colluvial deposits derived from the shoulder and backslope. Toeslopes are found at the base of the upland landform and consist almost entirely of colluvial deposits.

Due to their low degree of erosion and relative flatness, summits and shoulders have high potential for containing prehistoric sites that, at times, may be intact and shallowly buried. Footslope and toeslope areas also have good prehistoric site potential because they represent depositional features (i.e., they are time transgressive in terms of stability), generally have a low degree of slope (Van Nest 1993) and may be relatively close to water. Sideslopes, because of their steeper inclines and higher rates of erosion, rarely contain intact prehistoric materials. Finally, historic archeological sites can be found on any upland landform component.

When using this model, it is important to account for agriculturally induced wind and water erosion. All cultivated upland components have been subjected to erosional pressures. Consequently, summit, shoulder, footslope, and toeslope positions that have undergone decades of cultivation typically possess lower potential for intact sites.

*Project Area Soil and Landscape Analysis*

The project area covers an undulating, loess-mantled outwash terrace near the Iowa River valley. Intermittent, upland drainages within the project area ultimately flow northwest into Otter Creek along the Iowa River valley margin. The Soil Surveys of Johnson County, Iowa (Schermerhorn 1983) and the Natural Resources Conservation Service (NRCS; 2021) map seven soil series (divided into nine soil units) within the project area (Table 1; Figure 5).

Table 1. Soil information for the project area (NRCS 2021; Schermerhorn 1983; Web Soil Survey 2022)

| Symbol/Soil Name | % of Project Area | Landscape Position | Drainage Class | Parent Material | Native Vegetation |
|---|---|---|---|---|---|
| (119) Muscatine silt loam, 0–2% slopes | <.1 | interfluves | somewhat poor | fine-silty loess | tall prairie grass |
| (121B) Tama silt loam, 2–5% slopes | 15.9 | interfluves | well | fine-silty loess | tall prairie grass |
| (122) Sperry silt loam, depressional, 0–1% slopes | 37.5 | interfluves | very poor | loess | herbaceous wetland plants |
| (160) Walford silt loam, 0–2% slopes | 12.3 | interfluves | poor | fine-silty loess | herbaceous/woody plants |
| (175B) Dickinson fine sandy loam, 2–5% slopes | 2 | stream terraces, dunes | well | sandy eolian deposits | tall prairie grass |

Table 1, continued. Soil information for the project area (Schermerhorn 1983; NRCS 2021; Web Soil Survey 2022)

| Symbol/Soil Name | % of Project Area | Landscape Position | Drainage Class | Parent Material | Native Vegetation |
|---|---|---|---|---|---|
| (291) Atterberry silt loam, 1–3% slopes | 23.8 | interfluves | somewhat poor | fine-silty loess | tall prairie grass and trees |
| (M162B) Downs silt loam, till plain, 2–5% slopes | 8.3 | interfluves | well | fine-silty loess | tall prairie grass and scattered trees |
| (M162C) Downs silt loam, till plain, 5–9% slopes | .1 | interfluves | well | fine-silty loess | tall prairie grass and scattered trees |
| (M162C2) Downs silt loam, till plain, 5–9% slopes, eroded | .1 | interfluves | well | fine-silty loess | tall prairie grass and scattered trees |

The upland summit in the northeast corner of the project area is mapped as gently to moderately (2–9%) sloped Downs silt loam (map symbols M162B, M162C, and M162C2), a small portion of which is eroded. As it occurs within the project area, the Downs soil series consists of well drained soil formed in fine-silty loess along interfluves on till plains. Approximately 38% of the project area, including the area directly adjacent the intermittent drainages, is mapped as Sperry silt loam (122), a very poorly drained soil formed in depressions along interfluves in loess. A small portion (approximately 2%) of the project area near the south perimeter is mapped as Dickinson fine sandy loam, which consists of well drained soil formed in sandy windblown deposits on stream terraces or dunes. Just over half (approximately 52%) of the project area is mapped as Muscatine (119), Tama (121B), Walford (160), and Atterberry (291) silt loams. These soil series range in drainage class from poor to well drained and are all formed in fine-silty loess along interfluves.

A review of the topographic map (Figure 2) and lidar imagery (Figure 6) indicates the project area covers a rolling outwash terrace situated above Otter Creek and the Iowa River valley. The highest elevation occurs along an upland summit along Sioux Avenue in the northeast corner of the project area. Intermittent drainages that cross the project area feed into Otter Creek at the Iowa River valley margin. The entire project area has likely been affected by prolonged use of the land for cultivation. Given the likelihood of disturbance at the surface of the agricultural field and the position of the project area along uplands near perennial waterways, the archeological potential for the project area is considered low to moderate.

While soil survey and topographic map analyses are essential at the prefield level, field investigation is necessary to determine if the reported information from these sources is accurate. Because much of the soil survey information is documented without localized field inspection and landforms are constantly evolving, one must accurately document the current landscape to determine a given project area's archeological potential.

# ARCHIVAL REVIEW RESULTS

## *Previously Recorded Sites, Properties/Structures, and Surveys*

Prior to fieldwork, information regarding previously documented archeological sites, historic properties/structures, and former surveys within or near the project area was obtained from the on-line resource managed by OSA. The archival search indicated no previously recorded archeological sites or inventoried historic properties/structures in or directly adjacent the project area. A 1986 (Jacobs) Phase I-level survey conducted prior to improvements along Iowa Highway 22 overlaps the south perimeter of the project area. The remains of a nearby historic schoolhouse (13JH554) were collected from the surface approximately .3 km (.2 mi) west of the current project area. The site was recommended for no further work. No recommendation for National Register of Historic Places (NRHP) eligibility was given at the time of the survey. This is the only archeological site on record within a 1.6 km (1 mi) radius of the project area.

River Junction Cemetery (a.k.a. Stumptown Cemetery [Site Inventory Number 52-05201]) is the only inventoried historic property mapped within .8 km (.5 mi) of the project area. The cemetery is located southwest of the project area along the east side of Otter Creek Road in Section 12, T77N R06W, Fremont Township, Johnson County. The cemetery is still in use and will not be affected by the proposed project.

Four additional previous cultural resource surveys have been conducted within a 1.6 km (1 mi) radius of the project area (Table 2). A Phase I archeological survey for a Lone Tree substation expansion project was conducted immediately southeast of the Iowa Highway 22-Sioux Avenue intersection (Butler 2011). A portion of River Junction Road was included in Phase IA investigations conducted southwest of the project area by BCA (Scott 2011a, 2011b). A Phase I survey for a small development project was also conducted southwest of the current project area (Anderson 2019). No new sites were recorded as a result of the nearby investigations.

Table 2. Previously conducted archeological surveys within 1.6 km (1 mi) of the project area.

| R&C/Report # | Investigation Type | Results | Reference |
|---|---|---|---|
| 19860700024* | Phase I | two new sites, including nearby 13JH554 | Jacobs 1986 |
| 20040500153 | Phase I | no sites | Butler 2011 |
| BCA 1790a | Phase IA | no new sites | Scott 2011a |
| BCA 1820a | Phase IA | no new sites | Scott 2011b |
| TR 1065 | Phase I | no sites | Anderson 2019 |

*overlaps the project area

## *Historic Maps and Aerial Photographs*

An 1841 GLO map, 1875 statewide atlas, and four additional late nineteenth to early twentieth century historic plat maps were used to determine if documented historic buildings or structures once existed within the project area (Andreas 1875; GLO 1841;

Geographic Publishing Company 1917; Huebinger 1900; Novak 1889; Thompson and Everts 1870; Figures 7–12). Historic and modern aerial photographs were reviewed to determine if any potential historic buildings or structures were located in the project area and to gain a better understanding of the land use practices within the project area since 1937 (Figures 13–16).

The 1841 GLO map does not indicate the presence of any historic buildings or structures (Figure 7). Though no potential structures occur within the project boundaries, a schoolhouse (13JH554) is illustrated west of the project area on all of the subsequent historic maps (Andreas 1875; GLO 1841; Geographic Publishing Company 1917; Huebinger 1900; Novak 1889; Thompson and Everts 1870; Figures 8–12). The early aerial photographs show most of the project area utilized as agricultural land, with a minimal amount of timber along the northeast perimeter. The drainage channel is visible along the southwest corner (Figures 13 and 14). Instances of channelization along the southwest drainage channel can be seen in the 1963 and 1983 aerial photographs. By 1983, the wooded northeast perimeter was converted to agricultural land (Figures 15 and 16).

While historic plat maps and aerial images can provide a wealth of information regarding historic properties, structures may exist that were not recorded and those that are recorded can occur in a different location than that depicted. It is for these reasons that historic plat maps must be substantiated through field investigation.

## SURVEY RESULTS

### *Geomorphic Evaluation*

To begin the investigation, a geomorphic evaluation was conducted across the project area. Based on the landscape evaluation, the project area generally includes a portion of a level to moderately (0–9%) sloped outwash terrace near Otter Creek and the Iowa River valley. Intermittent drainages associated with Otter Creek occur in the west half of the project area. Based on the soil data, there is the potential for eolian deposits near the south perimeter. The uplands throughout the project area are expected to be eroded and/or disturbed by long-term agricultural use and alteration of the drainage channel in the southwest corner. The geomorphic evaluation utilized visual assessments and the extraction of seven hand probes, resulting in six representative profiles. Landforms and soil profile locations are reproduced in Figure 3. Soil profiles (SPs) are presented in Appendix A.

The project area is situated in an active agricultural field along an undulating outwash terrace. The steepest slopes (5–9%) occur along a rise in the northeast corner near Sioux Avenue and a linear rise at the south-central perimeter. Intermittent drainages cross the northwest and southwest corners (Figures 17–23). Soil along the northwest drainageway floor was found to be disturbed/eroded and poorly drained, with a shallow plowzone directly overlaying gleyed Bt horizons (Figures 24 and 25; SP 1). The partially intact remnant of an A horizon was recorded below the disturbed plowzone near the southwest drainage channel. The relatively intact silt loam quickly transitioned to the moderately well developed and poorly drained subsoil at this location (Figures 26–28; SP 2). Near level positions across most of the outwash terrace consisted of a disturbed plowzone extending to approximately 25 cm. The underlying silty clay loam became more well developed with depth (Figures 29–32; SPs 3 and 4). The higher summit in the northeast corner was heavily eroded and disturbed at the surface (Figure 33; SP 5). A soil probe utilized along the linear rise extending from the south-central perimeter revealed deep, fine sand horizons deposited by wind. Disturbance from long-term agricultural use was noted at the surface (Figures 34–36; SP 6).

Many of the upland landforms possess low potential of containing in situ archeological deposits due to disturbance caused by ongoing cultivational use and erosion, as well as evidence of prolonged saturation. There is low to moderate potential for archeological deposits along the southwest drainage channel based on the relatively intact surficial deposits observed beneath the plowzone during the geomorphic evaluation. Intact cultural deposits could also be encountered along the south-central linear rise due to the depositional nature of the eolian deposits that occur along the landform. Based on the results of this evaluation, subsurface testing will focus on these positions in the south portion of the project area. Cultural material should be expressed at or near the surface of the active agricultural field throughout the remainder of the project area and a visual surface inspection will be conducted.

*Archeological Survey*

The survey strategy utilized for this investigation was determined by the results of the archival review, conditions observed in the field, geomorphic investigation, and the potential of a given landform to contain cultural resources. For the purposes of site discovery and evaluation, a visual surface inspection was implemented throughout the project area. Systematic subsurface testing was employed along the drainage channel in the southwest corner, as well as the near level summit of a linear rise in the south-central portion of the project area, based on soil observed during the geomorphic evaluation. During the initial site discovery stage, a total of 30 shovel tests and nine bucket auger tests were excavated.

At the time of the investigation, nearly all of the project area was covered in harvested corn residue (50–90% ground surface visibility [GSV]; Figures 37 and 38). A minimal amount of grass and small trees (<10% GSV) were present along the drainages in the northwest and southwest corners. Based on the adequate surface visibility and the disturbed plowzone recorded during the geomorphic evaluation (Appendix A: SPs 3–5), the investigation began with a pedestrian survey initiated at 5 m intervals throughout the entire project area (Figure 39). No cultural material was present along the surface of the harvested field.

Subsurface testing began with a series of auger tests ($n = 9$) placed at 15 m intervals along the summit of the linear rise in the south-central portion of the project area (Figure 40). Due to the depositional nature of eolian deposits, cultural material could be encountered within the weakly structured, sandy B horizons found along the landform. Therefore, the auger tests placed on the rise were excavated through the Bw horizons and into the underlying E/Bt horizon to approximate depths of 100–140 cm. The three northernmost test locations consisted of disturbed soil with an Ap-Bw-Bt profile that was typical for most of the outwash terrace within the project area (Appendix A: SPs 3–5). These three tests ended at approximate depths of 40–55 cm, or 20 cm into the sterile subsoil. Two parallel transects of shovel tests were placed at 10–15 m intervals along the edges of the drainage channel in the southwest corner (Figure 41). The intact A horizon remnant was found at many of the test locations along the channel, excluding only the northwest and southeast ends of the transects where the typical Ap-Bw-Bt profile was observed. The Btg horizon was encountered at 30–55 cm during shovel testing and tests concluded at approximately 50–75 cm in depth. No cultural material was observed or collected from any of the subsurface test locations in the project area.

## SUMMARY AND RECOMMENDATIONS

The preceding report presents the results of a Phase I archeological investigation conducted across the project area for a proposed Lone Tree substation location in Johnson County. The project area exists within an active agricultural field along a loess-mantled outwash terrace near Otter Creek and the Iowa River valley . No previously recorded archeological sites or historic properties/structures are located within the project area. A previous Phase I survey of the Iowa Highway 22 corridor included the south perimeter of the project area and recorded a nearby historic schoolhouse (13JH554). The archival search indicated four additional previous cultural resource investigations within 1.6 km (1 mi) of the project area. The River Junction Cemetery (52-05201) is the only inventoried historic property mapped within .8 km (.5 mi) of the project area.

Surface cover for the project area consisted of harvested corn residue (30–50% GSV) with grass and trees (<10% GSV) along the drainages. Gentle to moderate slopes were common along the rolling landscape. The geomorphic evaluation identified a project area comprised mainly of eroded and/or disturbed uplands with evidence of prolonged saturation along the drainages. Relative intact soil was recorded beneath the plowzone along the drainage channel in the southwest corner. A linear rise at the south-central perimeter was comprised of deep, eolian deposits.

During the field investigation, a visual surface examination was conducted throughout the entire project area. A total of 30 shovel tests were excavated along each side of the southwest drainage channel. Nine auger tests were used to investigate the windblown deposits along the linear rise. No cultural materials were observed or collected from the project area during the investigation. No further cultural resource investigations are recommended for the identified project area.

No technique of modern archeological research is adequate to identify all archeological sites or cultural deposits within a given area. In the event that any cultural materials not recorded by this investigation are discovered in the course of the proposed development activities, the State Historic Preservation Office should be contacted immediately. It is the responsibility of the developer to protect cultural resources from disturbance until a professional examination can be made or authorization to proceed is granted by the State Historic Preservation Office or a designated representative.

**Information contained in this report relating to the nature and location of archeological sites is considered private and confidential and not for public disclosure in accordance with Section 304 of the National Historic Preservation Act (54 U.S.C § 307103); 36 CFR Part 800.6(a)(5) of the Advisory Council on Historic Preservation's rules implementing Sections 106 and 110 of the National Historic Preservation Act; Section 9(a) of the Archaeological Resource Protection Act (54 U.S.C. § 100707), and Chapter 22.7, subsection 20 of the Iowa Code.**

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FIGURES

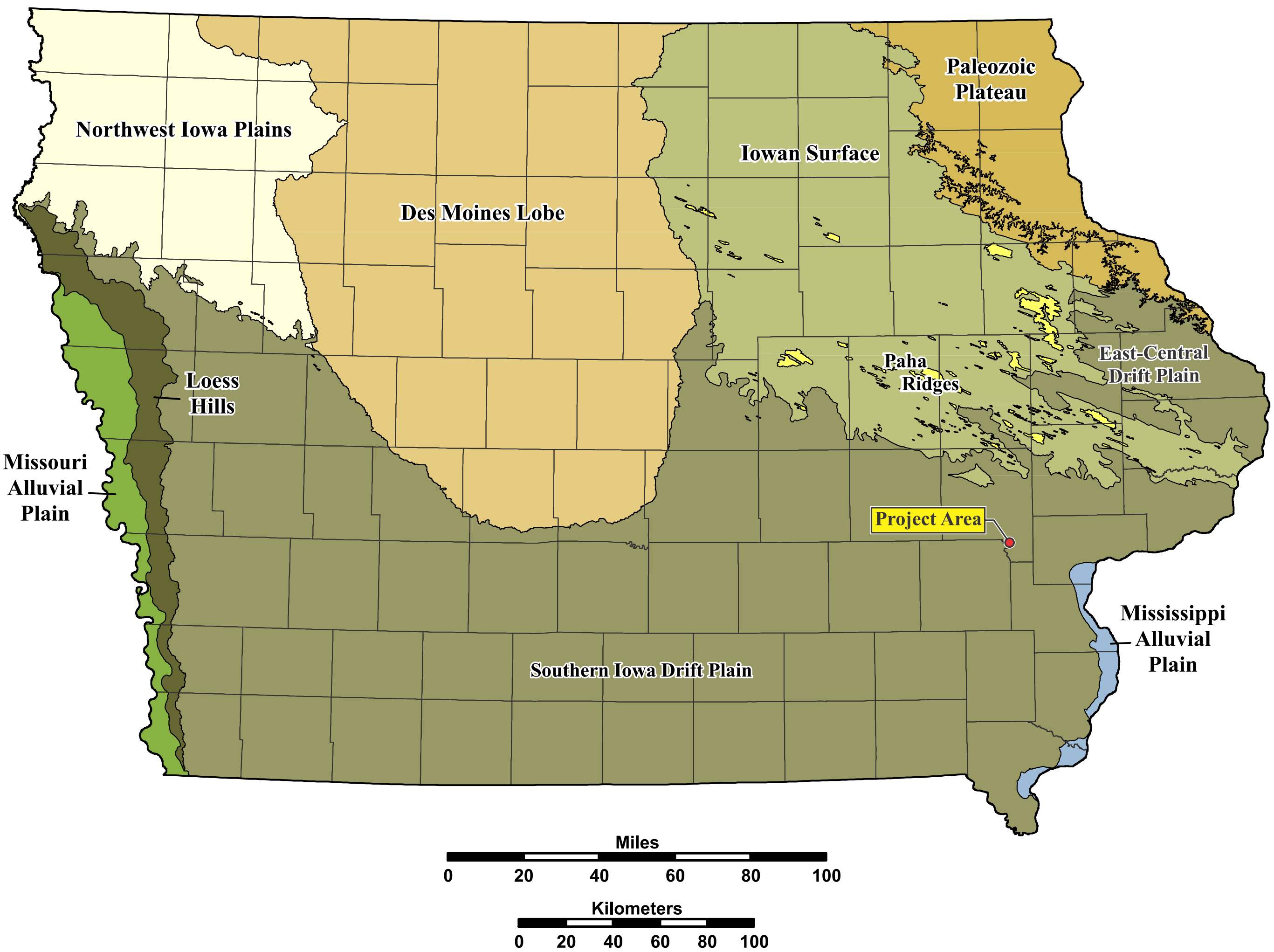


**Figure 1. Physiographic location of the project area (adapted from Prior [1991:31]).**

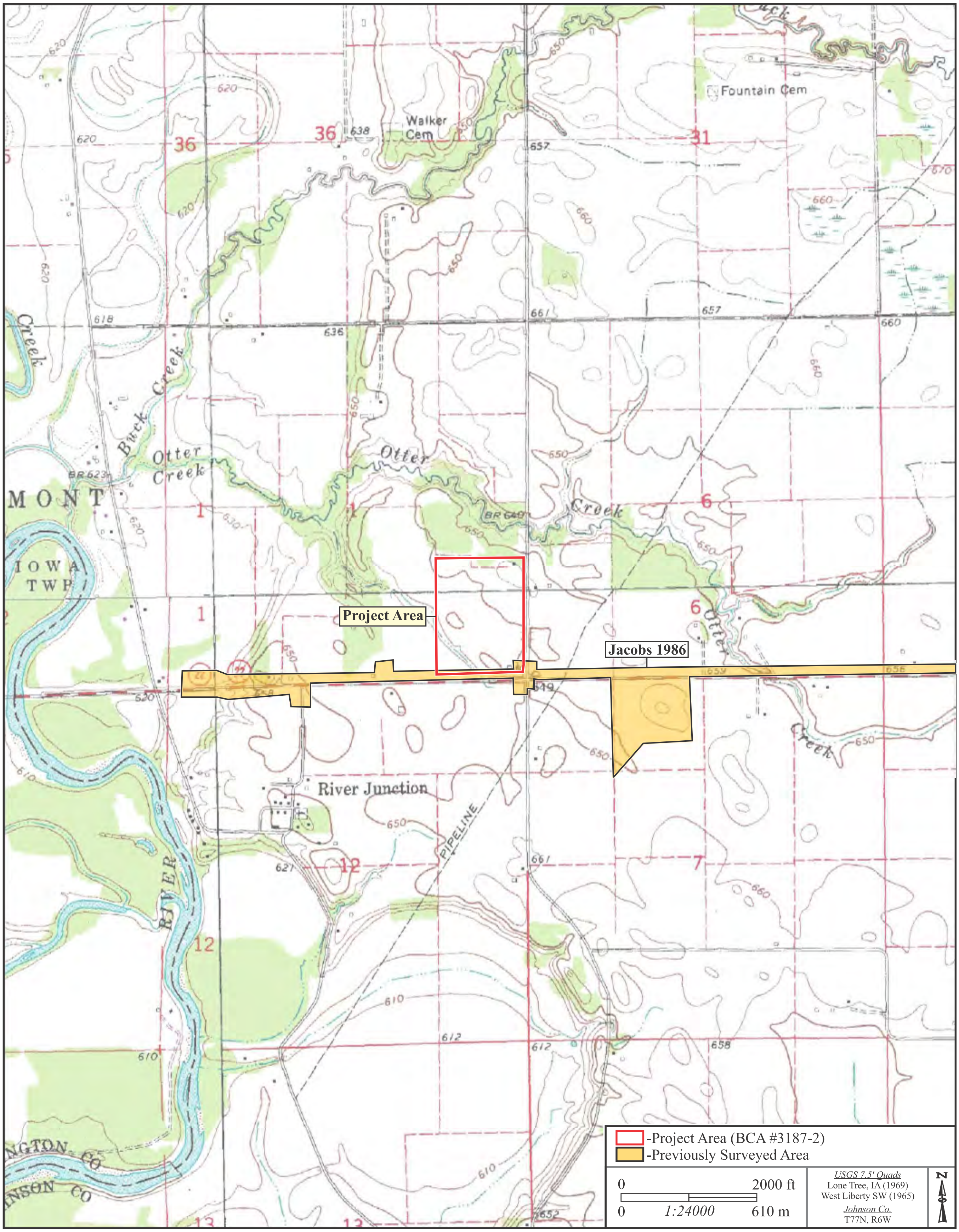


**Figure 2. Topographic coverage of the project area.**


**Figure 3. Scale map of the project area.**

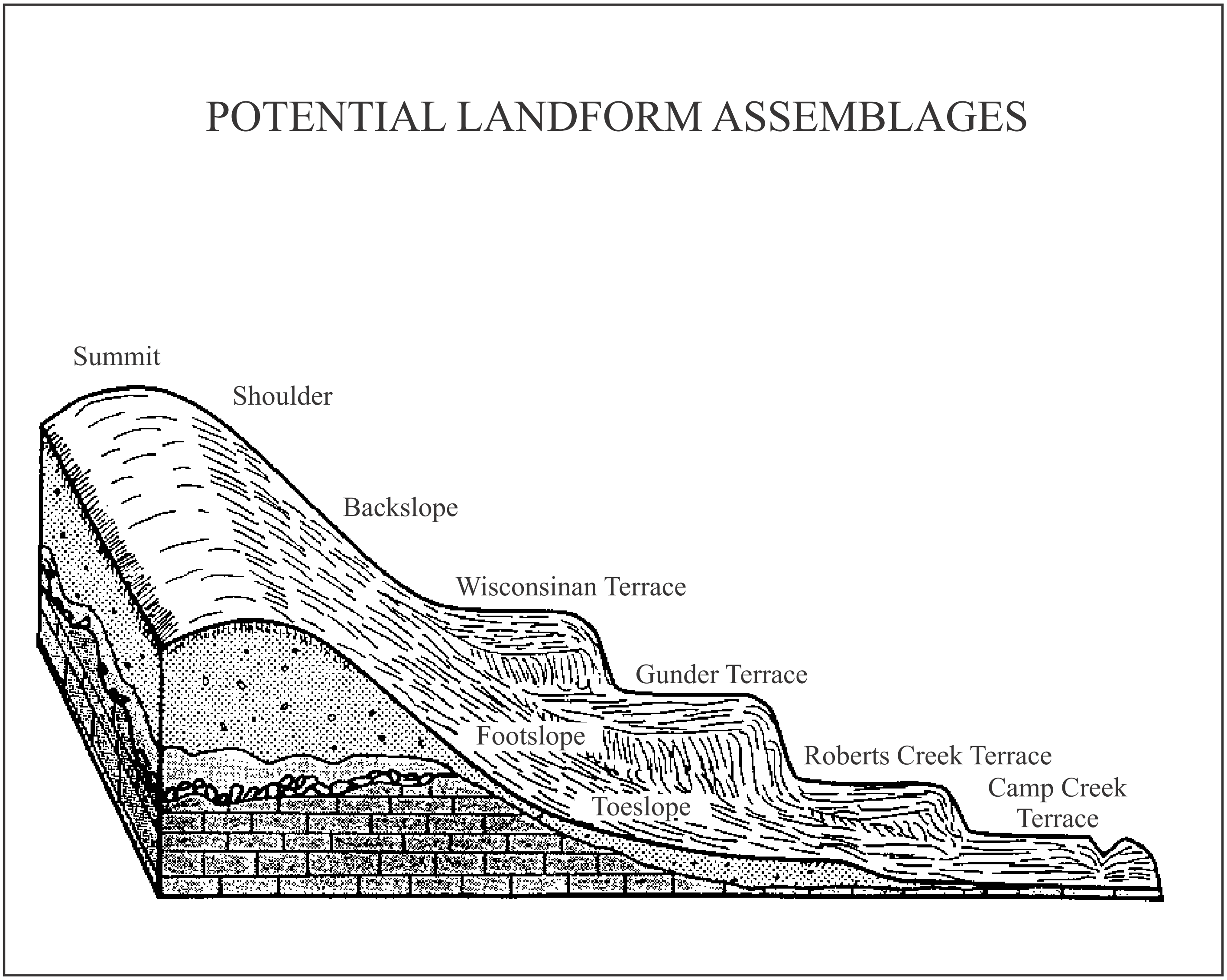


**Figure 4. Diagram of potential landform components (adapted from Ruhe [1969]).**

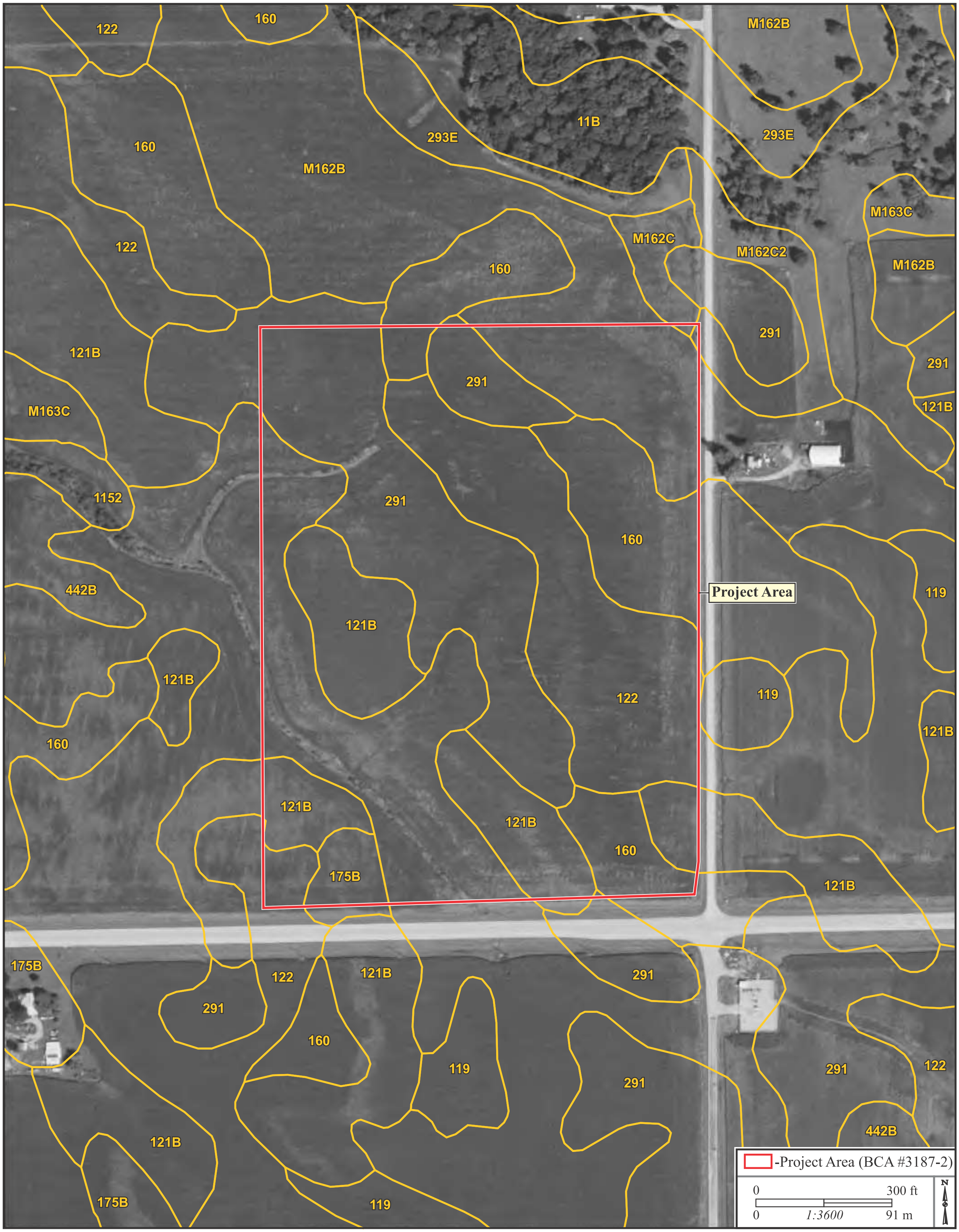


Figure 5. Soil map of the project area (NRCS 2021).

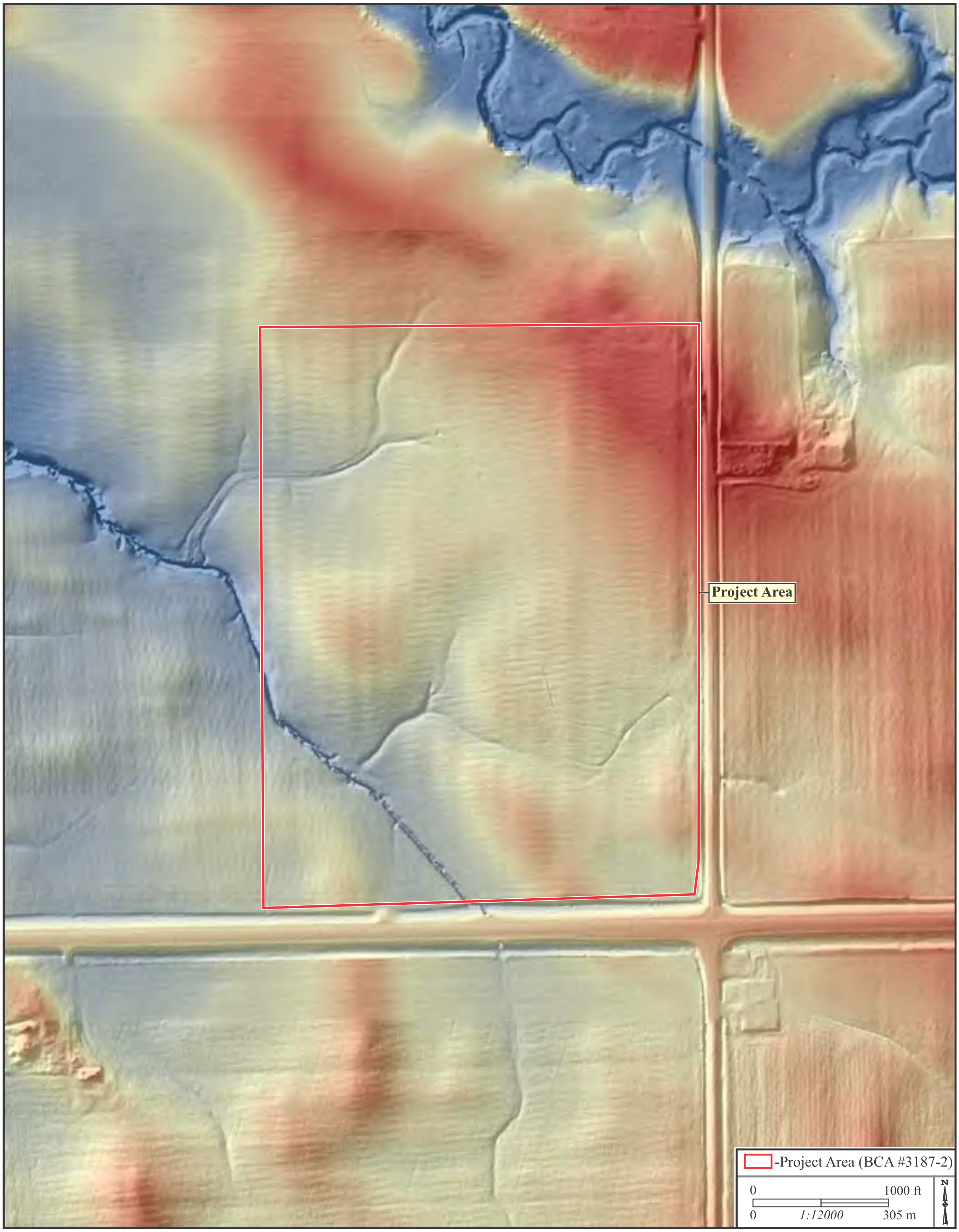


**Figure 6. Lidar image of the project area.**

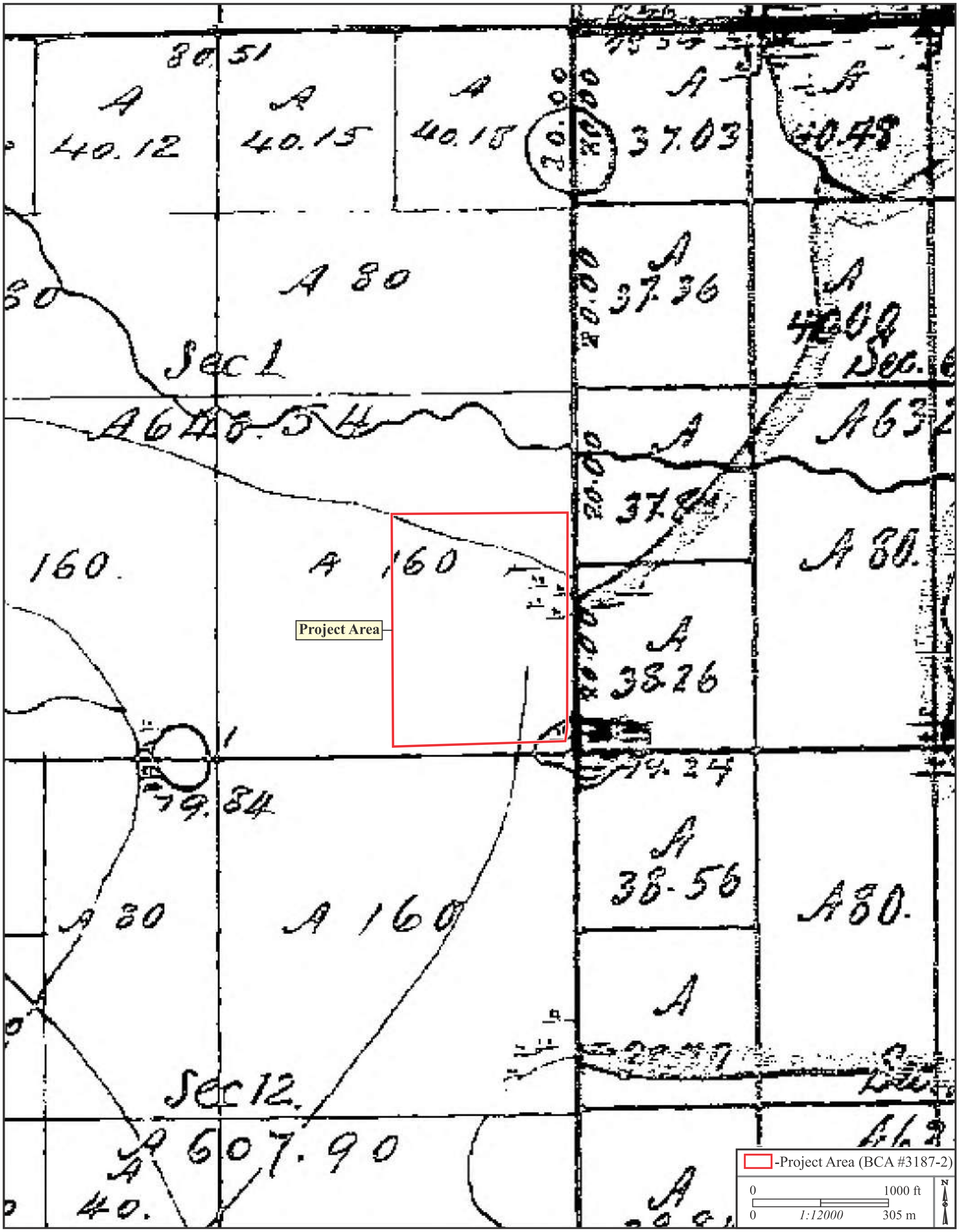


**Figure 7. 1841 map of the project area (GLO).**

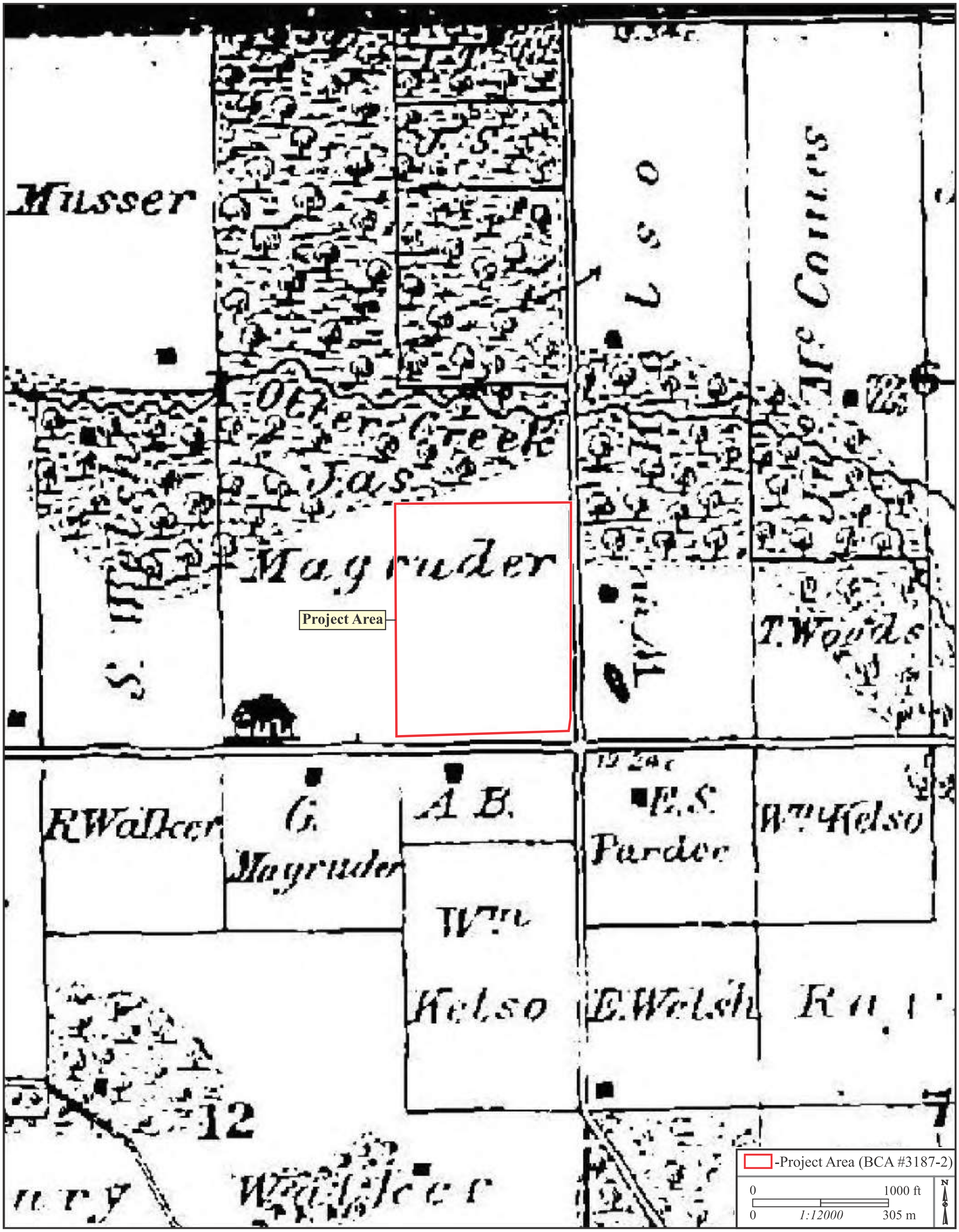


Figure 8. 1870 map of the project area (Thompson and Everts).


**Figure 9. 1875 map of the project area (Andreas).**


Figure 10. 1889 map of the project area (Novak).


**Figure 11. 1900 map of the project area (Huebinger).**


Figure 12. 1917 map of the project area (Geographic Publishing Company).


**Figure 13. 1937 aerial photograph of the project area.**


**Figure 14. 1951 aerial photograph of the project area.**


Figure 15. 1963 aerial photograph of the project area.


**Figure 16. 1983 aerial photograph of the project area.**

**Figure 17. Project area from the northwest corner. View to the east (11/22/22).**

**Figure 18. Project area from the northeast corner. View to the south (11/22/22).**

**Figure 19. Project area from the southeast corner. View to the north (11/22/22).**

**Figure 20. Project area from the southwest corner. View to the northeast (11/22/22).**

**Figure 21. Linear rise along the south-central perimeter of the project area. View to the north-northeast (11/22/22).**

**Figure 22. Intermittent drainage in the northwest corner of the project area. View to the east (11/22/22).**

**Figure 23. Intermittent drainage in the southwest corner of the project area. View to the northwest (11/22/22).**

**Figure 24. Soil Profile 1, 0-34 cm (11/22/22).**

**Figure 25. Soil Profile 1, 34-61 cm (11/22/22).**

**Figure 26.  Soil Profile 2, 0-34 cm (11/22/22).**

**Figure 27.  Soil Profile 2, 34-65 cm (11/22/22).**


**Figure 28. Soil Profile 2, 65-99 cm (11/22/22).**

**Figure 29. Soil Profile 3, 0-34 cm (11/22/22).**

**Figure 30. Soil Profile 3, 34-62 cm (11/22/22).**

**Figure 31. Soil Profile 4, 0-34 cm (11/22/22).**

**Figure 32. Soil Profile 4, 34-65 cm (11/22/22).**


**Figure 33. Soil Profile 5, 0-33 cm (11/22/22).**

**Figure 34. Soil Profile 6, 0-34 cm (11/22/22).**

**Figure 35. Soil Profile 6, 34-69 cm (11/22/22).**


**Figure 36. Soil Profile 6, 102-130 cm (11/22/22).**

**Figure 37. Typical ground surface visibility (50-70%) in the project area (11/22/22).**

**Figure 38. Typical ground surface visibility (70-90%) in the project area (11/22/22).**

**Figure 39. Pedestrian survey of the project area. View to the east (11/22/22).**

**Figure 40. Auger testing near the south-central perimeter of the project area. View to the northwest (11/22/22).**

**Figure 41. Shovel testing along the drainage channel in the southwest corner of the project area. View to the northwest (11/22/22).**

APPENDIX A
Soil Profiles

DESIGNATION: SP 1
LANDSCAPE POSITION: drainageway floor
PARENT MATERIAL: loess
VEGETATION: harvested corn residue, 50–70% ground surface visibility (GSV)
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded along the floor of an intermittent drainageway in the northwest corner of the project area.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–19 | Ap | Very dark grayish brown (2.5Y 3/2) silt loam; weak medium granular structure parting to massive; friable; few very fine strong brown (7.5YR 4/6) redoximorphic concentrations; abrupt boundary. |
| 19–47 | Btg1 | Light olive brown (2.5Y 5/3) silty clay loam; weak fine and medium subangular blocky structure; firm; abundant very fine and fine strong brown (7.5YR 4/6) redoximorphic concentrations; few fine manganese concretions; discontinuous clay skins on ped faces; clear boundary. |
| 47–85 | Btg2 | Light olive gray (5Y 6/2) silty clay loam; moderate medium subangular blocky structure; plastic; abundant fine strong brown (7.5Yr 5/8) redoximorphic concentrations; common fine very dark gray (5Y 3/1) concentrations; discontinuous clay skins on ped faces; gradual boundary. |
| 85–102 | Btg3 | Greenish gray (10Y 6/1) silty clay loam; moderate fine to medium subangular blocky structure; plastic; abundant fine reddish yellow (7.5YR 6/8) redoximorphic concentrations; common dark gray (5Y 4/1) clay skins on ped faces. End. |

DESIGNATION: SP 2
LANDSCAPE POSITION: drainageway floor
PARENT MATERIAL: loess
VEGETATION: tall prairie grass, <10% GSV
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded from a low-lying portion of the drainageway floor in the southwest corner of the project area.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–19 | Ap | Very dark gray (2.5Y 3/1) silt loam; massive; friable; few very fine roots; abrupt boundary. |
| 19–40 | A/AB | Very dark gray to dark gray (2.5Y 3/1–2.5Y 4/1) silt loam; weak fine and medium subangular blocky structure; friable; higher clay fraction with depth; common very fine strong brown (7.5YR 4/6) redoximorphic concentrations; gradual boundary. |
| 40–73 | Btg1 | Light brownish gray (2.5Y 6/2) silty clay loam; moderate fine subangular blocky structure; firm; abundant fine strong brown (7.5YR 5/8) redoximorphic concentrations; very few very fine roots; gradual boundary. |
| 73–120 | Btg2 | Gray (5Y 6/1) silty clay loam; moderate medium subangular blocky parting to fine prismatic structure; plastic; abundant fine strong brown to reddish yellow (7.5YR 5/8–7.5YR 6/8) redoximorphic concentrations; common fine light gray (5Y 7/1) depletions; clear boundary. |

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 120–140 | BCg | Light gray (10Y 7/1) silty clay loam; moderate medium subangular blocky structure; firm; common very fine and fine strong brown (7.5YR 4/6) redoximorphic concentrations; clear boundary. |
| 140–159 | Cg | Light gray (10YR 7/1) clay loam; massive; firm; abundant very fine and fine strong brown (7.5YR 5/8) redoximorphic concentrations. End. |

DESIGNATION: SP 3
LANDSCAPE POSITION: summit
PARENT MATERIAL: loess
VEGETATION: harvested corn residue, 70–90% GSV
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded from an isolated rise near the west-central perimeter of the project area.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–23 | Ap | Very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) silt loam; massive; friable; few very fine roots; abrupt boundary. |
| 23–43 | Bw | Yellowish brown (10YR 5/4) silty clay loam; weak fine subangular blocky structure; friable to firm; few fine very dark grayish brown (10YR 3/2) concentrations; clear boundary. |
| 43–80 | Bt1 | Yellowish brown to light yellowish brown (10YR 5/4–10YR 6/4) silty clay loam; weak fine and medium subangular blocky structure; firm; gradual boundary. |
| 80–93 | Bt2 | Light yellowish brown to brownish yellow (10YR 6/4–10YR 6/6) silty clay loam; moderate medium subangular blocky structure; plastic; common very fine and fine strong brown (7.5YR 4/6) redoximorphic concentrations. End. |

DESIGNATION: SP 4
LANDSCAPE POSITION: outwash terrace
PARENT MATERIAL: loess
VEGETATION: harvested corn residue, 50–70% GSV
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded from a level position near the center of the project area.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–25 | Ap | Very dark gray (2.5Y 3/1) silt loam; massive; friable; very few very fine roots; abrupt boundary. |
| 25–50 | Bw | Light olive brown (2.5Y 5/3) silty clay loam; weak fine subangular blocky structure; firm; common very fine yellowish brown (10YR 5/6) redoximorphic concentrations; few fine manganese concretions; gradual boundary. |
| 50–75 | Bt1 | Light yellowish brown (2.5Y 6/3) and dark gray (2.5Y 4/1) silty clay loam; moderate fine and medium subangular blocky structure; plastic; abundant fine strong brown (7.5Yr 5/8) redoximorphic concentrations; gradual boundary. |
| 75–98 | Bt2 | Pale brown (2.5Y 7/3) clay loam; strong fine prismatic structure; plastic; abundant fine yellowish red (5YR 5/8) redoximorphic concentrations. End. |

DESIGNATION: SP 5
LANDSCAPE POSITION: summit
PARENT MATERIAL: loess
VEGETATION: harvested corn residue, 70–90% GSV
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded from the highest elevation in the project area at the northeast corner.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–15 | Ap | Very dark gray (10YR 3/1) and olive brown (10YR 4/3) loam; massive; firm; abrupt boundary. |
| 15–33 | Bt | Light yellowish brown (10YR 6/4) and light olive brown (10YR 5/3) silty clay loam; moderate fine and medium subangular blocky structure; plastic; very few very fine roots. End. |

DESIGNATION: SP 6
LANDSCAPE POSITION: summit
PARENT MATERIAL: eolian deposits
VEGETATION: harvested corn residue, 70–90% GSV
METHOD: hand probe
DATE DESCRIBED: 11/22/2022
DESCRIBED BY: J. Skeens
COMMENTS: This profile was recorded from a linear rise extending northwest from Iowa Highway 22 along the south-central perimeter.

| Depth (cm) | Soil Horizon | Description |
|---|---|---|
| 0–24 | Ap | Very dark gray (10YR 3/1) loam; massive; friable; abrupt boundary. |
| 24–55 | Bw1 | Yellowish brown (10YR 5/4) and dark grayish brown (10YR 4/2) fine sandy loam; weak fine subangular blocky structure; friable to firm; clear boundary. |
| 55–85 | Bw2 | Brownish yellow (10YR 6/6) fine loamy sand; very weak medium subangular blocky structure; very friable; few very fine roots; unknown boundary. |
| 85–129 | E/Bt | Brownish yellow (10YR 6/6–10YR 6/8) fine sand; very weak medium to coarse subangular blocky structure; very friable; common fine dark gray (10YR 4/1) clay loam ribbons. End. |

APPENDIX B
National Archaeological Database Form

Database Doc Number:________________

NATIONAL ARCHAEOLOGICAL DATABASE – REPORTS; DATA ENTRY FORM

1. R and C #:________________
2. Authors: Skeens, Jeremy L.

Year of Publication 2022

3. Title Phase I Archeological Investigation for a Proposed Lone Tree Substation Location, Fremont Township, Johnson County, Iowa

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4. Report Title: BCA Reports

Volume #: ________ Report #: 3187-2 NTIS: ________

Publisher: Bear Creek Archeology, Inc.

Place: Cresco, Iowa 52136

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5. Unpublished

Sent From: ____________

Sent To: ____________

Contract #: ____________

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6. Federal Agency: ____________

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7. State: Iowa

County: Johnson

Town: ____________

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8. Work Type: ____________

9. Keyword:

0 - Types of Resources / Features
1 - Generic terms / Research Questions
2 - Taxonomic Names
3 - Artifact Types / Material Classes
4 - Geographic Names / Locations
5 - Time Periods
6 - Project Names / Study Unit
7 - Other Key Words

| | | | |
|---|---|---|---|
| Southern Iowa Drift Plain | [ 4 ] | | [ ] |
| 20.2 ha (49.9 ac) | [ 7 ] | | [ ] |
| No sites | [ 7 ] | | [ ] |
| | [ ] | | [ ] |
| | [ ] | | [ ] |
| | [ ] | | [ ] |
| | [ ] | | [ ] |

-------------------------

10. UTM Zone:

| Zone | Easting | Northing |
|---|---|---|
| 15 | | |
| 15 | | |
| 15 | | |
| 15 | | |

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11. Township: 77N

Range: 06W

Other Publication Types:

12. Monographs:

Name: ____________________

Place: ____________________

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13. Chapter: In: ________ First: ________ Last: ________

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14. Journal: Volume: ________ Issue: ________ First: ________ Last: ________

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15. Dissertation:

Degree: Ph.D. LL.D. M.A. M.S. B.A. B.S. Institute ________

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16. Paper: Meeting: ____________________

Place: ____________________ Date: ________

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17. Other:

Reference Line: ____________________

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18. Site #:

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19. Quad Map: Name West Liberty SW, Iowa Date 1965

Lone Tree, Iowa 1969

June 17, 2022

PCR US Investments Corp
1334 Brittmoore Rd Ste 2407
Houston, TX 77043

C/O: Conifer Power Company
301 West Bay Street, Suite 1404
Jacksonville, Florida 32202

Attn: Steven Link
E: sl@coniferpower.com

**Re: Preliminary Threatened and Endangered Species Habitat Assessment Review**
Proposed Solar Location – Lone Tree
Parcel no. 1801476001
Lone Tree, Johnson County, Iowa
Terracon Project No. 06227049; Task 2.3

Dear Mr. Link:

Terracon Consultants, Inc. (Terracon is pleased to submit this preliminary threatened and endangered species (T&E) habitat assessment review to Conifer Power Company (Conifer), on behalf of PCR US Investments Corporation (the Client). These Services were conducted in general accordance with Terracon Proposal No. P06227049 dated March 31, 2022, and the updated KMZ file provided on April 14, 2022 by Conifer.

Terracon was retained to perform a preliminary habitat assessment for threatened and endangered species for the proposed 10 mega-watt solar project, hereafter referred to as the subject site. Terracon understands that Conifer is assisting the Client with preparing plans for the development of the site as a solar array and gen-tie connection to the substation in proximity to the site.

We appreciate the opportunity to provide services to Conifer and PCR. If you have questions concerning this report, or if we can assist you in any other matter, contact us at 319-366-8321.

Sincerely,
**Terracon Consultants, Inc.**

Jordan M. Smith
Staff Scientist

Tim Capps
Authorized Project Reviewer

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## Appendices:

# PRELIMINARY THREATENED AND ENDANGERED SPECIES HABITAT ASSESSMENT REVIEW
# Lone Tree
# Parcel 1801476001
# Highway 22 and Sioux Avenue
# Lone Tree, Johnson County, Iowa

**Terracon Project No. 06227049**
**June 17, 2022**

## 1.0 SITE LOCATION AND PROJECT INFORMATION

Terracon understands that the Client and Conifer are preparing preliminary plans to develop the site with an approximate 10-megawatt solar facility. The location of the site is indicated in Table 1 and the Exhibit A, below.

**Table 1. Site Information**

| Site | Parcel No. | County, State | Approximate Size (Acres) | Additional Information |
|---|---|---|---|---|
| Lone Tree | 1801476001 | Johnson, Iowa | 36.40 | Owner: No Gen-tie route identified by client. |

### 1.1 Background

The Endangered Species Preservation Act (Act) serves to protect plant and animal species listed by the U.S. Fish and Wildlife Service (USFWS) as threatened or endangered of extinction. The Act allows listing of native animal species as endangered and provided means for the protection of species so listed. The Departments of Interior, Agriculture, and Defense were to seek to protect listed species and preserve the habitats of such species.

Iowa laws and regulations prohibit harm to animal species and the commerce of plant species listed by the is Chapter 481B of the Code of Iowa Endangered Plants and Wildlife and the Iowa Department of Natural Resources (IDNR) as threatened or endangered of extinction (without a permit). In Illinois, Section 17 of the Illinois Natural Areas Preservation Act (525ILCS 30/17) and the Illinois Endangered Species Protection Act (520 ILCS 10/11) cover threatened, and endangered species impacts.

### 1.2 Scope of Services

This scope of services is intended to provide preliminary information that will assist the client in evaluating and complying with federal and state endangered species requirements regulated by the USFWS and the Department of Natural Resources, respectively. Absence of documented sightings on-site or in the immediate vicinity does not ensure that listed species are not present. The lack of documented sightings may indicate that the area has not been surveyed or did not previously contain habitat. This level of investigation does not provide a habitat suitability analysis for all species with the potential to be present.

Terracon assessed the potential for listed species to be impacted by eventual development of the site as follows:

- A compilation and review of published and readily available resources is initially performed to preliminarily identify potential areas of interest on-site. The resources generally included aerial photographs, topographic maps, applicable federal and state threatened, and endangered species lists, designated critical habitats, other current species information, soil survey maps, and, the National Wetlands Inventory.

  Terracon requested an Official Species List (List) through the USFWS Information for Planning and Consultation (IPAC) system for the project area. Terracon also utilized the Iowa Department of Natural Resources (IDNR) Threatened and Endangered webpage / Iowa Natural Areas Inventory (INAI) to evaluate the potential effect of threatened and endangered species for the site. Utilizing the Iowa DNR Permit and Environmental Review Management Tool (PERMIT) site, Terracon requested an Environmental Review for Natural Resources for the site.

- Preparation of this letter report.

## 2.0 THREATENED AND ENDANGERED SPECIES HABITAT REVIEW

### 2.1 UFSWS Official Species List

Terracon requested an official species lists (the List) from the IPAC system. A copy of the List is included in Appendix B. The List identified a total of 6 of threatened, endangered, candidate species, or species of concern for the project site(s). Table 2 includes the species identified on the List and their suitable habitat.

**Table 2. IPAC Listed Species**

| Group | Name | Status | Habitat[1] |
|---|---|---|---|
| Mammals | Northern Long-Eared Bat (*Myotis septentrionalis*) | Threatened | Hibernates in caves and mines – swarming in surrounding wooded areas in autumn, Roots and forages in upland forests during late spring and summer. |
| Mammals | Indiana Bat (*Myotis sodalist)* | Endangered | Hibernates in caves and mines – swarming in surrounding wooded areas in autumn, Roots and forages in upland forests during late spring and summer. |
| Clams | Higgins Eye (pearlymussel) *Lampsilis higginsii* | Endangered | Larger rivers where it is usually found in areas with deep water and moderate currents. |
| Insects | Monarch Butterfly (*Danaus plexippus*) | Candidate | Open fields and meadows with milkweed |
| Flowering Plants | Eastern Prairie Fringed Orchid (*Platanthera leucophaea)* | Threatened | Wet prairies and sedge meadows |
| Flowering Plants | Western Prairie Fringed Orchid (*Platanthera praeclara*) | Threatened | Wet prairies and sedge meadows |

Critical habitat are specific geographic areas that contain features essential for the conservation of a T&E Species. The list did not identify critical habitats within the project area that would be under the USFWS office's jurisdiction that need to be protected.

## 2.2 State Listed Species Review

Based on review of the Iowa Natural Areas Inventory (INAI) interactive webpage,[2] there are 88 listed unique species in Johnson County, Iowa. Table 3 summarizes the state listed species:

[1] *As indicated in the IPAC return*
[2] *Posted at: https://programs.iowadnr.gov/naturalareasinventory/pages/RepDistinctSpeciesByCounty.aspx?CountyID=52*

**Table 3. State Listed Species**

| Group | No. of Threatened State Status Species | No. of Endangered State Status Species | No. Special Concern State Status Species | No. of Threatened Federal Status Species | No. of Endangered Federal Status Species |
|---|---|---|---|---|---|
| Amphibians | 1 | 0 | 0 | 0 | 0 |
| Birds | 0 | 3 | 1 | 0 | 0 |
| Fish | 1 | 1 | 0 | 0 | 0 |
| Freshwater Mussels | 3 | 5 | 0 | 0 | 3 |
| Insects | 1 | 0 | 3 | 0 | 0 |
| Mammals | 1 | 1 | 0 | 0 | 0 |
| Plants (Dicots) | 4 | 2 | 23 | 0 | 0 |
| Plants (Monocots) | 4 | 2 | 16 | 1 | 0 |
| Plants (Pteriodophytes) | 1 | 1 | 4 | 0 | 0 |
| Reptiles | 3 | 1 | 2 | 0 | 0 |
| **Totals:** | 19 | 16 | 49 | 1 | 3 |

Please note that some species are classified under both state and federal status' or only listed by one agency and classifications may differ between federal and state classifications. A copy of the information obtained from the INAI is presented in Appendix B

Utilizing the Iowa DNR Permit and Environmental Review Management Tool (PERMIT) site, Terracon requested an Environmental Review for Natural Resources for the project. The IDNR searched records for state and federal listed endangered or threatened species, rare natural communities, sensitive habitat and state lands and water in the proposed project area. The tracking number provided for the inquiry is 20220809. A copy of the IDNR response is presented in Appendix B and is discussed in Section 5.

## 2.3 Soil Survey Information

Terracon utilized the U.S. Department of Agriculture Soil Conservation Service, now known as the Natural Resource Conservation Service (NRCS) on-line Web Soil survey (WSS) to identify soil types and hydric soils. The following soil types were identified at subject site(s), based on an area of inquiry search utilizing the WSS:

**Table 4. Soil Types**

| Map Unit Symbol | Map Unit Name | National Hydric Soil List | County Hydric Soil List |
|---|---|---|---|
| 119 | Muscatine Silt loam | Yes | Yes |
| 121B | Tama Silt loam | No | No |
| 175B | Dickinson Fine Sandy loam | No | No |
| 122 | Sperry Silt loam, depressional | Yes | Yes |
| 160 | Walford Silt loam | Yes | Yes |
| 291 | Atterberry Silt loam | Yes | Yes |
| M162B | Downs Silt Loam, Till Plain | No | No |
| M162C | Downs Silt Loam, Till Plain | No | No |
| M162C2 | Downs Silt Loam, Till Plain | No | No |

- The Muscatine Silt loam soils are generally found on interfluves and summits. Soils generally consist of somewhat poorly drained soils and has a hydric soil rating.
- The Tama Silt loam soils are generally found on interfulves. Soils generally consist of well drained soils and has a non-hydric soil rating.
- The Dickinson Fine Sandy loam soils are generally found on stream terraces and dunes. Soils generally consist of well drained soils and has a non-hydric soil rating.
- The Sperry Silt loam, depressional soils are generally found on interfluves and summits. Soils generally consist of very poorly drained soils and has a hydric soil rating.
- The Walford Silt loam soils are generally found interfluves and summits. Soils generally consist of poorly drained soils and has a hydric soil rating.
- The Atterberry Silt loam soils are generally found on interfluves and summits. Soils generally consist of somewhat poorly drained soils and has a hydric soil rating.
- The Downs Silt loam, Till Plain soils are generally found on interfluves and summit shoulders. Soils generally consist of well drained soils and has a non-hydric soil rating.

## 2.4 Aerial Photographs

Terracon reviewed aerial photographs obtained from ERIS to identify suspected wetland and sensitive areas on the subject site. Aerial photographs from 1937, 1951, 1963, 1970, 1983, 1994, 2005-2010, 2014, 2015, 2017, 2019 were reviewed and have been included in Appendix B. A summary of the aerial photography is provided in the following table.

**Historical Aerial Photographs – Lone Tree**

| Year | Description |
|---|---|
| 1937-2019 | The site is an agricultural field with apparent aquatic features running through the northwestern corner and the southwestern corner. |

# 3.0 PRELIMINARY HABITAT INVESTIGATION FIELD SERVICES

## 3.1 Field Services

On April 27, 2022 the preliminary habitat survey was performed by Mr. Jordan Smith, Staff Scientist, who holds a BA in Environmental Science and is an experienced wetland delineator for the Terracon Cedar Rapids, Iowa office.

## 3.2 Methods

These services are intended to provide preliminary information that will assist the client in evaluating and complying with federal and state endangered species requirements regulated by the USFWS and IDNR, respectively. To meet this objective, Terracon investigated and assessed the potential for listed species to be impacted by eventual development of the site as generally follows:

- An assessment of the potential effect on listed species was made in consideration of the presence of suitable habitat, the likelihood for listed species to make use of suitable habitat, the likelihood for listed species to be present on the site as evidenced by indicators that are visible at the time of the site reconnaissance, and/or the likelihood for potential project effects on listed species. Suitable avoidance and minimization measures to minimize adverse effects may be taken into account, as appropriate and in coordination with the client, but only on a preliminary, conceptual basis.
- The habitat survey for the Northern Long Eared Bat was performed in general accordance with guidance published by the USFWS. The guidelines define suitable summer habitat as a wide variety of forested/wooded habitats where roosting and foraging may take place. Non-forested habitat such as wetland areas, wood lines, fence lines, and edges of agricultural fields may also qualify as travel corridors. Preferred tree species characteristics include exfoliating bark, crevices, cracks, etc. with a diameter breast height (dbh) of three inches or greater. Wooded areas may be somewhat dense; however, open corridors that provide access to feeding in riparian and floodplain areas are necessary for travel purposes.

# 4.0 FINDINGS AND RECOMMENDATIONS

## 4.1 Findings

The site is currently agricultural in use and is located within the drainage corridor of Otter Creek. Properties to the north and east are of mixed (residential and agricultural) use, properties to the south and west are agricultural in use.

Select photos of the subject site and site conditions are included in Appendix D. The following is a general summary of the site conditions relative to the reference documents for federally listed T&E species:

- Terracon performed a limited tree habitat assessment within the project alignment. Terracon evaluated the tree suitability generally based on FWS guidelines. Upon assessment, Terracon did not observe trees that presented suitable habitat for Northern Long-Eared Bats.
- The site consists of agricultural land and an apparent drainage feature that flows through the southeastern corner of the site. The site consists of, but is not limited to, herbaceous vegetation including reed canary grass, hairy crabgrass, stinging nettle, annual wormwood, and nodding wildrye; woody vegetation including rock grape; and trees including blackthorn, and sandbar willow.
- Based on the FWS habitat description and our observations, suitable habitat for the Higgins Eye Mussel was not observed in the project site.
- Based on the FWS habitat description and our observations, suitable habitat for the Eastern and Western Prairie Fringed Orchid was not observed in the project site.
- Based on the FWS habitat description and our observations, suitable habitat for the Monarch Butterfly was not observed in the project site.

On April 19, 2022, Terracon utilized the IPaC system and input the project information based on our knowledge of the project to date. An automated letter dated April 19, 2022 from USFWS for the project was downloaded from the IPaC site. A copy of the USFWS verification letter is appended to this document and indicates the following:

*"Based upon your IPaC submission, any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the Action is not likely to result in unauthorized take of the northern long-eared bat. If your Action proceeds as described and no additional information about the Action's effects on species protected under the ESA becomes available, no further coordination with the Service is required with respect to the northern long-eared bat."*

*"Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) and Migratory Bird Treaty Act (16 U.S.C. 703 et seq), as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at http://www.fws.gov/midwest/ midwestbird/EaglePermits/index.html to help you determine if you can avoid impacting eagles or if a permit may be necessary."*

*The following species may occur in your project area and are not covered by this determination:*

- Eastern Prairie Fringed Orchid *Platanthera leucophaea (Threatened)*
- Higgins Eye *(pearlymussel) Lampsilis higginsii (Endangered)*
- Indiana Bat *Myotis sodalis (Endangered)*
- Monarch Butterfly *Danaus plexippus (Candidate)*
- Western Prairie Fringed Orchid *Platanthera praeclara (Threatened)*

On April 21, 2022, Mr. Seth Moore, IDNR Environmental Specialist responded to the records request for the Lone Tree site, indicating the IDNR searched for records of rare species and significant natural communities in the project area and found no site-specific records that would be impacted by this project.

In response to the records request for the Lone Tree site, the IDNR responded with the following as seen in Appendix C:

"*These records and data are not the result of thorough field surveys. If listed species or rare communities are found during the planning or construction phases, additional studies and/or mitigation may be required. This letter is a record of review for protected species, rare natural communities, state lands and waters in the project area, including review by personnel representing state parks, preserves, recreation areas, fisheries and wildlife but does not include comment from the Environmental Services Division of this Department. This letter does not constitute a permit. Other permits may be required from the Department or other state or federal agencies before work begins on this project."*

Copies of the Agency Correspondence are provided in Appendix C.

## 4.2 Recommendations

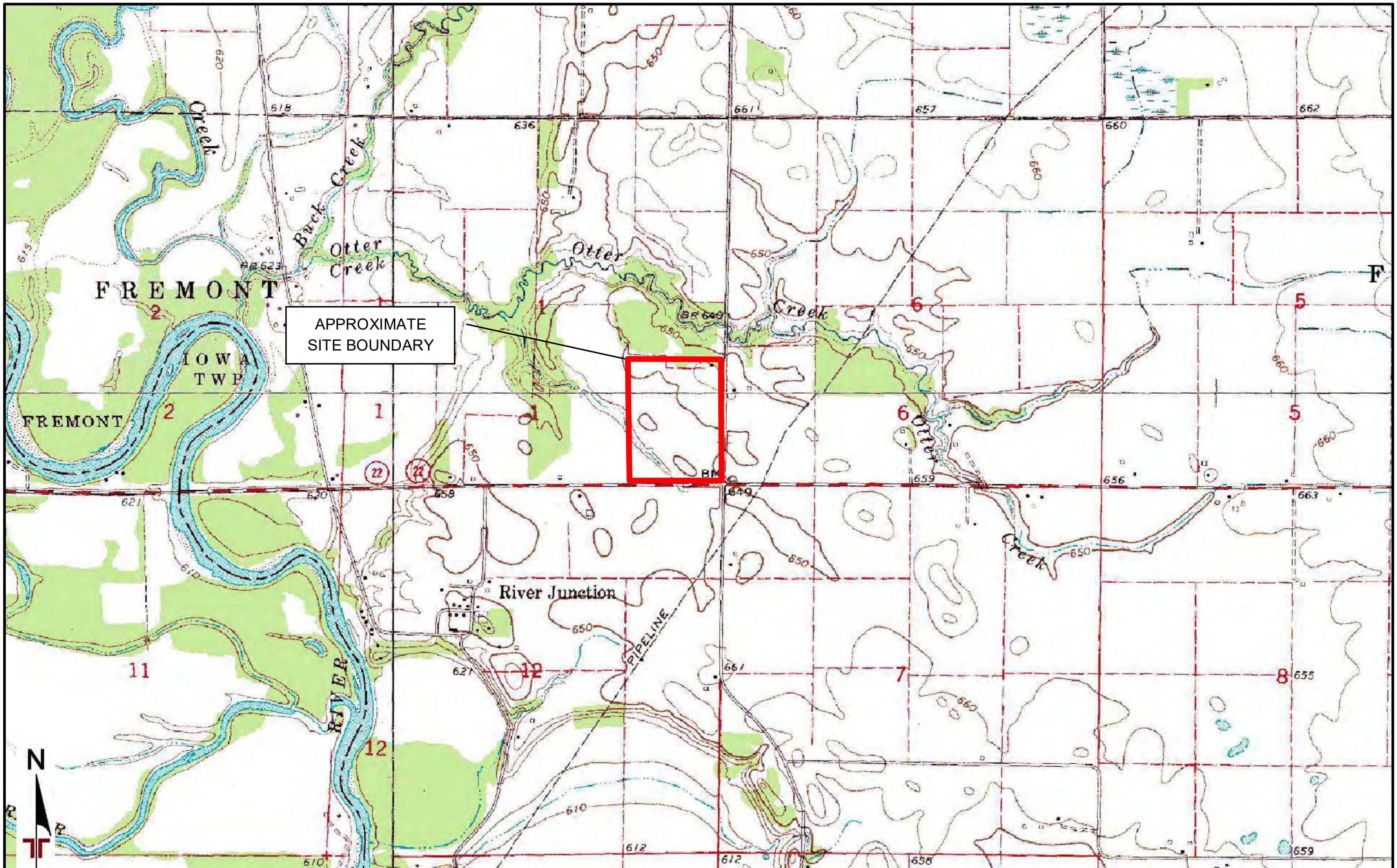
Terracon did not observe suitable habitat for the Northern Long-Eared Bat or other federally listed species at the site, therefore no actions are recommended at this time.

## 5.0 GENERAL COMMENTS

The findings of this Preliminary T&E Habitat Evaluation are based on the project location, project type, and property boundaries provided by the client. The findings and opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at a later date. The opinions included herein are based on information obtained during this Preliminary T&E Habitat Evaluation and our experience. Due to the preliminary attributes of this project, additional regulatory consultation and investigations may be warranted before the project can commence. Additionally, the client should understand that the responses to the IPAC qualification interview based on our understanding of the project, readily available information, and our knowledge of similar projects and may not reflect any and all project activities. Additional agency coordination is likely.

This report has been prepared in accordance with generally accepted scientific and engineering evaluation practices. This report is for the exclusive use of the client for the project being discussed. No warranties, either express or implied, are intended or made.

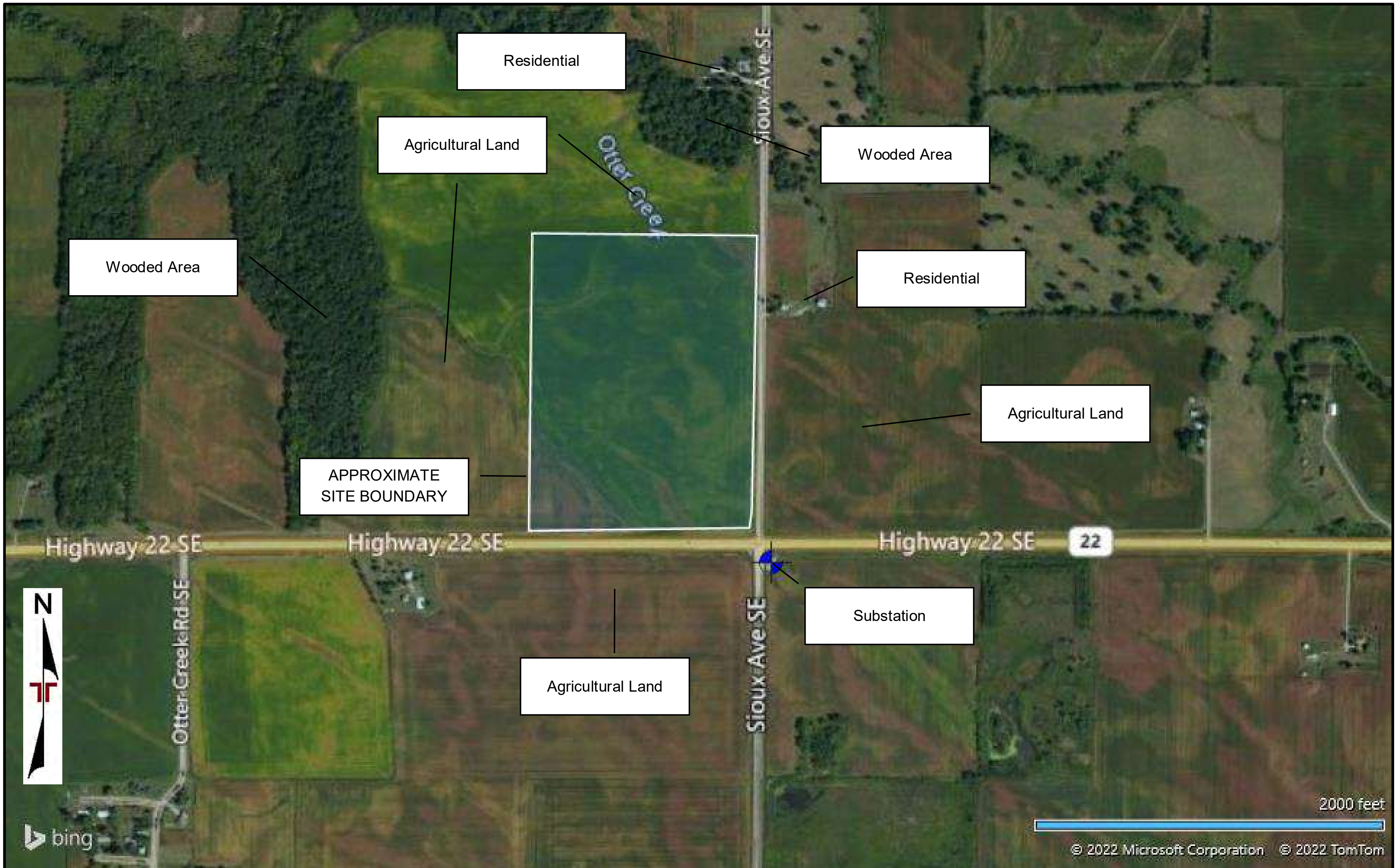
# APPENDIX A
## EXHIBITS




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: HILLS, IA (1/1/1983), WEST LIBERTY SW, IA (1/1/1965), RIVERSIDE, IA (1/1/1983) and LONE TREE, IA (1/1/1969).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | | | |
|---|---|---|---|
| Project Manager: EWH | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, IA 52404-3440 | Topographic Map |
| Drawn by: TLR | Scale: 1"=2,000' | | PCR **Lone Tree** **Johnson County, Iowa, Parcel ID: 1801476001** |
| Checked by: TC | File Name: Exhibits | | Exhibit 1 |
| Approved by: EWH | Date: 4/19/2022 | | |




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: FWH | Project No. 06227049 |
| Drawn by: TLR | Scale: AS SHOWN |
| Checked by: TC | File Name: Exhibits |
| Approved by: EWH | Date: 4/19/2022 |

Terracon
2640 12th St SW
Cedar Rapids, IA 52404-3440

Site Diagram

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
2

# APPENDIX B
# AGENCY CORRESPONDANCE and SPECIES LISTS

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Illinois-Iowa Ecological Services Field Office
Illinois & Iowa Ecological Services Field Office
1511 47th Ave
Moline, IL 61265-7022
Phone: (309) 757-5800 Fax: (309) 757-5807

In Reply Refer To:
Project Code: 2022-0033218
Project Name: Lone Tree Site

April 19, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

**Migratory Birds**: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Wetlands

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Illinois-Iowa Ecological Services Field Office**
Illinois & Iowa Ecological Services Field Office
1511 47th Ave
Moline, IL 61265-7022
(309) 757-5800

# Project Summary

Project Code: 2022-0033218
Event Code: None
Project Name: Lone Tree Site
Project Type: Acquisition of Lands
Project Description: Lone Tree Site, 1801476001, 36.40 acres
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.498983499999994,-91.4858634315035,14z


Counties: Johnson County, Iowa

# Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Mammals

| NAME | STATUS |
|---|---|
| Indiana Bat *Myotis sodalis*<br>There is **final** critical habitat for this species. The location of the critical habitat is not available.<br>Species profile: https://ecos.fws.gov/ecp/species/5949 | Endangered |
| Northern Long-eared Bat *Myotis septentrionalis*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/9045 | Threatened |

## Clams

| NAME | STATUS |
|---|---|
| Higgins Eye (pearlymussel) *Lampsilis higginsii*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/5428 | Endangered |

## Insects

| NAME | STATUS |
|---|---|
| Monarch Butterfly *Danaus plexippus*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/9743 | Candidate |

## Flowering Plants

| NAME | STATUS |
| --- | --- |
| Eastern Prairie Fringed Orchid *Platanthera leucophaea*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/601 | Threatened |
| Western Prairie Fringed Orchid *Platanthera praeclara*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/1669 | Threatened |

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

# USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

# Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

# IPaC User Contact Information

| | |
|---|---|
| Agency: | Terracon |
| Name: | Ian Bootsmiller |
| Address: | 2640 12th Street |
| City: | Cedar Rapids |
| State: | IA |
| Zip: | 52404 |
| Email | ian.bootsmiller@terracon.com |
| Phone: | 3195418757 |

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Illinois-Iowa Ecological Services Field Office
Illinois & Iowa Ecological Services Field Office
1511 47th Ave
Moline, IL 61265-7022
Phone: (309) 757-5800 Fax: (309) 757-5807


In Reply Refer To: May 18, 2022
Project code: 2022-0033218
Project Name: Lone Tree Site

Subject: Consistency letter for the 'Lone Tree Site' project indicating that any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o).

Dear Ian Bootsmiller:

The U.S. Fish and Wildlife Service (Service) received on May 18, 2022 your effects determination for the 'Lone Tree Site' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. You indicated that no Federal agencies are involved in funding or authorizing this Action. This IPaC key assists users in determining whether a non-Federal action may cause "take"[1] of the northern long-eared bat that is prohibited under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the Action is not likely to result in unauthorized take of the northern long-eared bat.

Please report to our office any changes to the information about the Action that you entered into IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation.

If your Action proceeds as described and no additional information about the Action's effects on species protected under the ESA becomes available, no further coordination with the Service is required with respect to the northern long-eared bat.

The IPaC-assisted determination for the northern long-eared bat **does not** apply to the following ESA-protected species that also may occur in your Action area:

- Eastern Prairie Fringed Orchid *Platanthera leucophaea* Threatened

- Higgins Eye (pearlymussel) *Lampsilis higginsii* Endangered
- Indiana Bat *Myotis sodalis* Endangered
- Monarch Butterfly *Danaus plexippus* Candidate
- Western Prairie Fringed Orchid *Platanthera praeclara* Threatened

You may coordinate with our Office to determine whether the Action may cause prohibited take of the animal species listed above.

---

[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

**Action Description**
You provided to IPaC the following name and description for the subject Action.

**1. Name**

Lone Tree Site

**2. Description**

The following description was provided for the project 'Lone Tree Site':

Lone Tree Site, 1801476001, 36.40 acres

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.498983499999994,-91.4858634315035,14z


**Determination Key Result**

This non-Federal Action may affect the northern long-eared bat; however, any take of this species that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o).

**Determination Key Description: Northern Long-eared Bat 4(d) Rule**
This key was last updated in IPaC on **May 15, 2017**. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for non-Federal actions is to assist determinations as to whether proposed actions are excepted from take prohibitions under the northern long-eared bat 4(d) rule.

If a non-Federal action may cause prohibited take of northern long-eared bats or other ESA-listed animal species, we recommend that you coordinate with the Service.

# Determination Key Result

Based upon your IPaC submission, any take of the northern long-eared bat that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o).

## Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?

   *No*

2. Will your activity purposefully **Take** northern long-eared bats?

   *No*

3. [Semantic] Is the project action area located wholly outside the White-nose Syndrome Zone?

   **Automatically answered**
   *No*

4. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

   Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases and other sources of information on the locations of northern long-eared bat roost trees and hibernacula is available at www.fws.gov/media/nleb-roost-tree-and-hibernacula-state-specific-data-links-0.

   *Yes*

5. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?

   *No*

6. Will the action involve Tree Removal?

   *No*

# Project Questionnaire

**If the project includes forest conversion, report the appropriate acreages below. Otherwise, type ‘0’ in questions 1-3.**

1. Estimated total acres of forest conversion:

*0*

2. If known, estimated acres of forest conversion from April 1 to October 31

*0*

3. If known, estimated acres of forest conversion from June 1 to July 31

*0*

**If the project includes timber harvest, report the appropriate acreages below. Otherwise, type ‘0’ in questions 4-6.**

4. Estimated total acres of timber harvest

*0*

5. If known, estimated acres of timber harvest from April 1 to October 31

*0*

6. If known, estimated acres of timber harvest from June 1 to July 31

*0*

**If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type ‘0’ in questions 7-9.**

7. Estimated total acres of prescribed fire

*0*

8. If known, estimated acres of prescribed fire from April 1 to October 31

*0*

9. If known, estimated acres of prescribed fire from June 1 to July 31

*0*

**If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type ‘0’ in question 10.**

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

*0*

# IPaC User Contact Information

Agency: Terracon
Name: Ian Bootsmiller
Address: 2640 12th Street
City: Cedar Rapids
State: IA
Zip: 52404
Email ian.bootsmiller@terracon.com
Phone: 3195418757

## Smith, Jordan M

| | |
|---|---|
| **From:** | seth.moore@dnr.iowa.gov |
| **Sent:** | Thursday, April 21, 2022 3:42 PM |
| **To:** | Bootsmiller, Ian |
| **Subject:** | 2022-0809 Environmental Review Request - Lone Tree |

41.4990/-91.4859; Johnson County
Sec. 6/T77N/R05W

Thank you for inviting Department comment on the impact of this project. The Department has searched for records of rare species and significant natural communities in the project area and found no site-specific records that would be impacted by this project. However, these records and data are not the result of thorough field surveys. If listed species or rare communities are found during the planning or construction phases, additional studies and/or mitigation may be required.

This letter is a record of review for protected species, rare natural communities, state lands and waters in the project area, including review by personnel representing state parks, preserves, recreation areas, fisheries and wildlife but does not include comment from the Environmental Services Division of this Department. This letter does not constitute a permit. Other permits may be required from the Department or other state or federal agencies before work begins on this project.

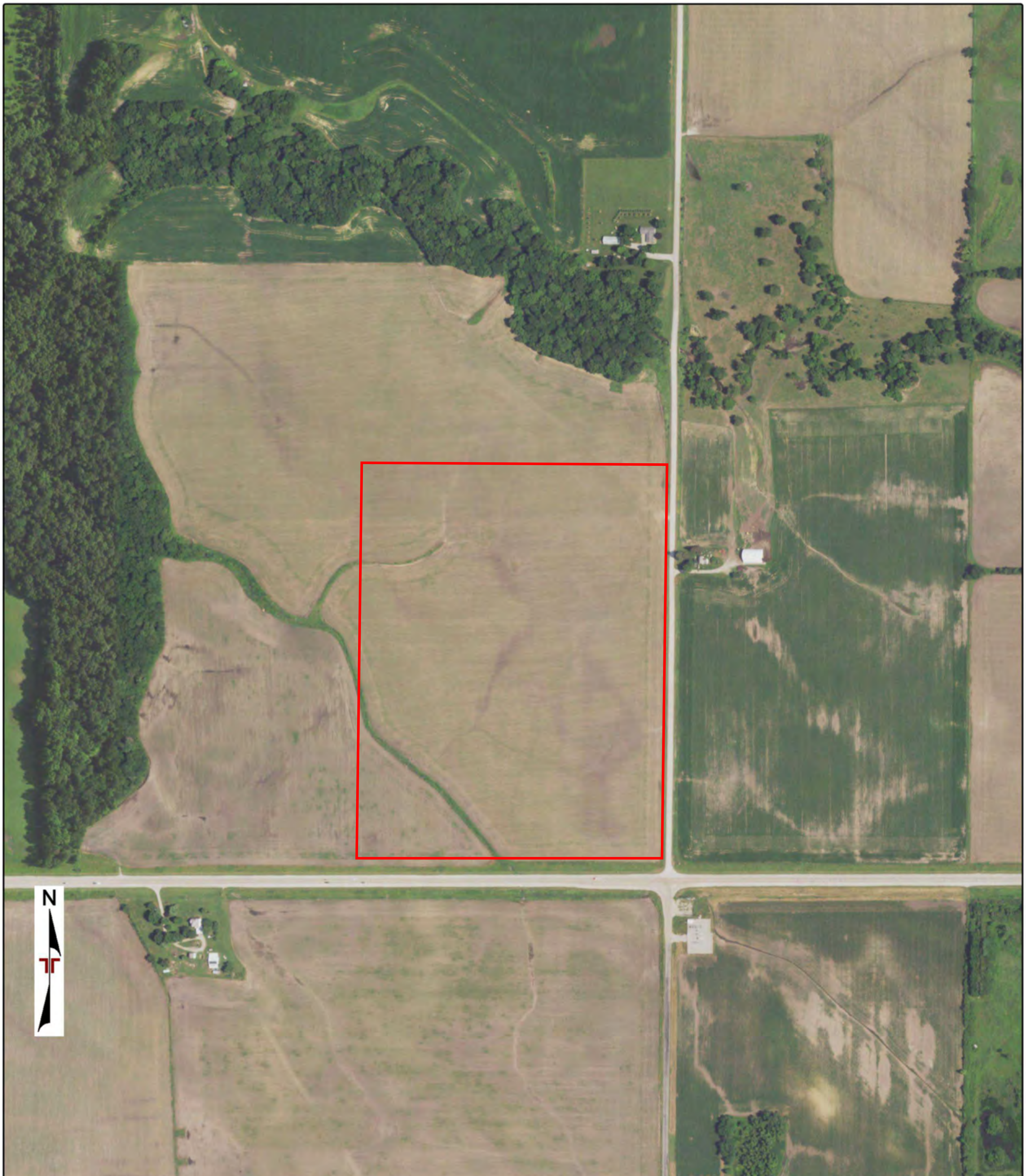
If you have questions about this letter or require further information, please contact me at (515) 330-6432.

Environmental Review requests can be submitted electronically to: SLER@dnr.iowa.gov.

Sincerely,

**Seth Moore** | Environmental Specialist
Iowa Department of Natural Resources
P 515-330-6432 | F 515-725-8202 | 502 E. 9th St., Des Moines, IA 50319
www.iowadnr.gov

# APPENDIX C
# AERIAL PHOTOGRAPHS




| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (2019 - USDA)

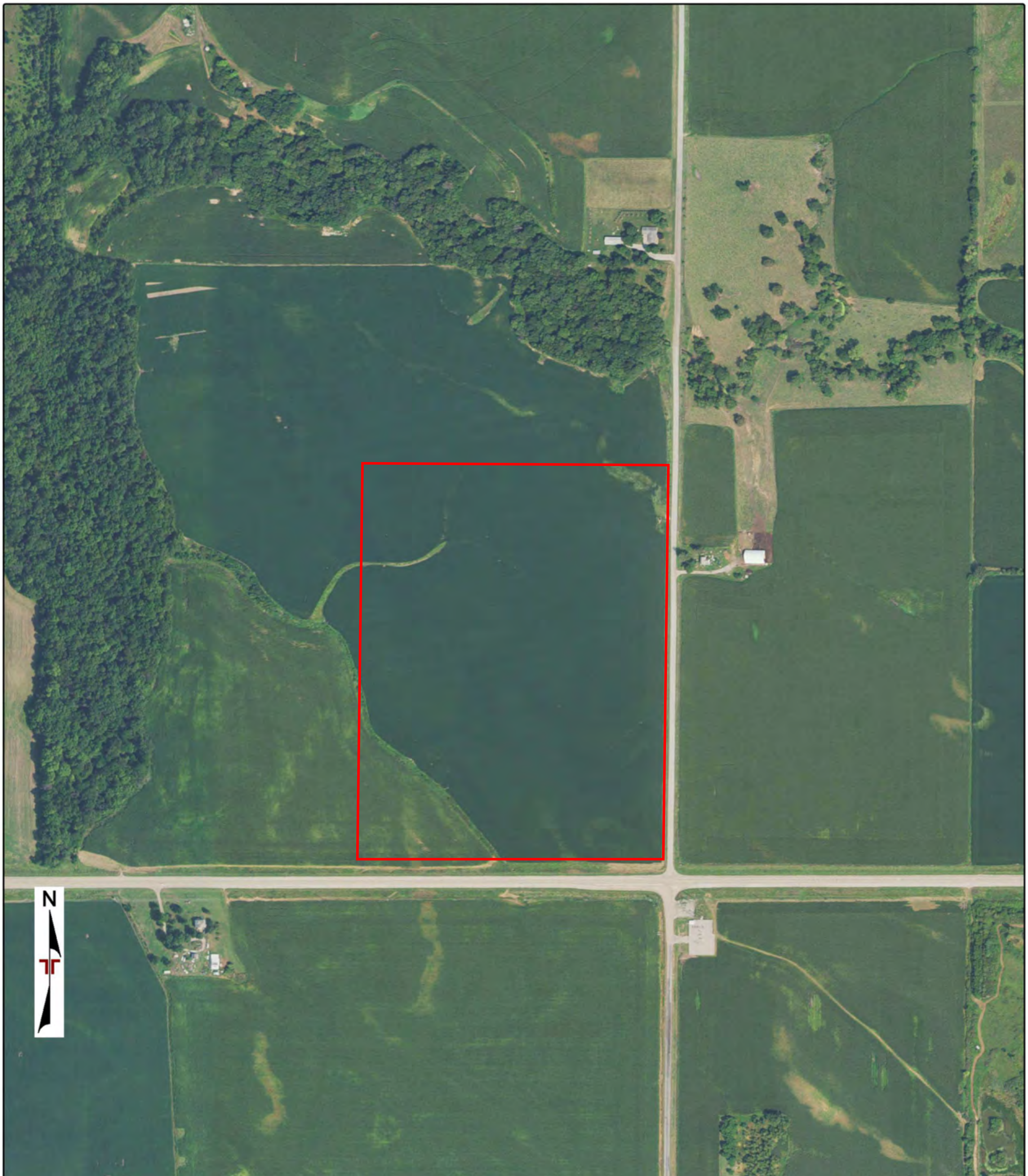
Lone Tree Site

Lone Tree Site

Parcel 1801476001, Iowa

Appendix

C




| Project Manager: | Project No. 06227049 | Terracon | AERIAL PHOTO (2017 - USDA) | Appendix |
|---|---|---|---|---|
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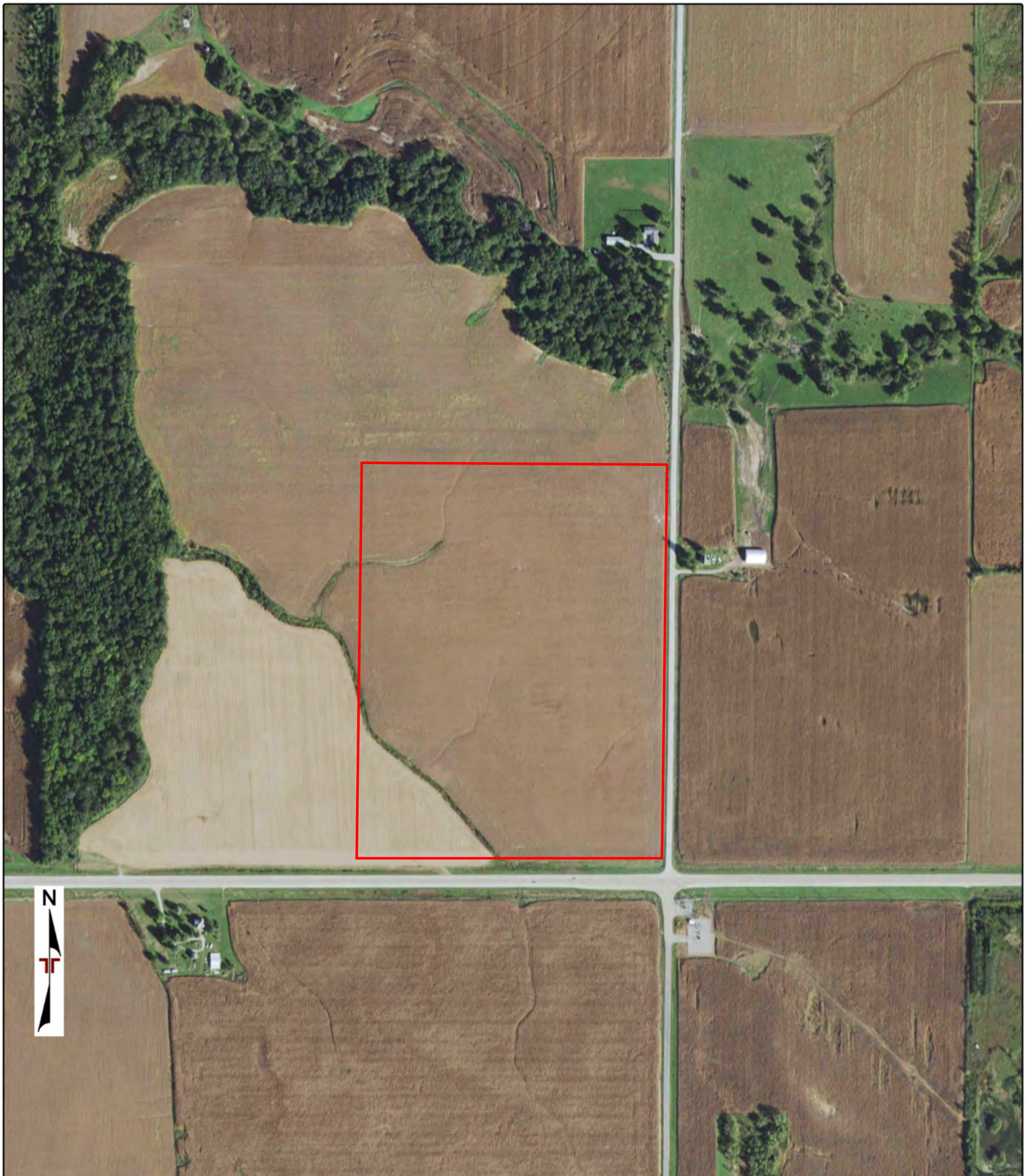
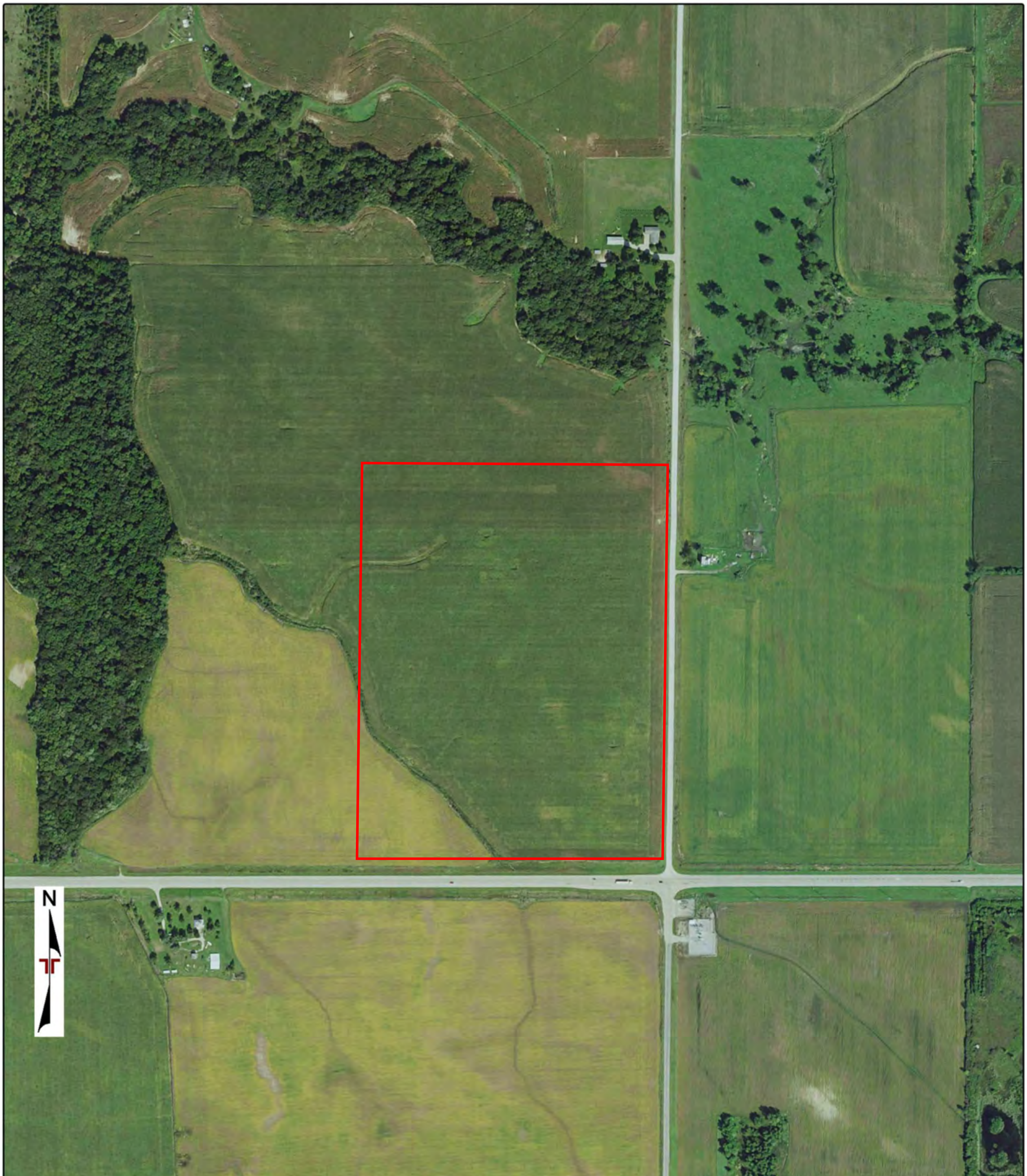
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No.<br>06227049 | Terracon | AERIAL PHOTO (2015 - USDA) | Appendix |
| Drawn by: | Scale:<br>1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name:<br>22042000035 | 2640 12th St SW<br>Cedar Rapids, Iowa 52404 | | |
| Approved by: | Date:<br>2022-04-21 | | | |




| | | | | |
|---|---|---|---|---|
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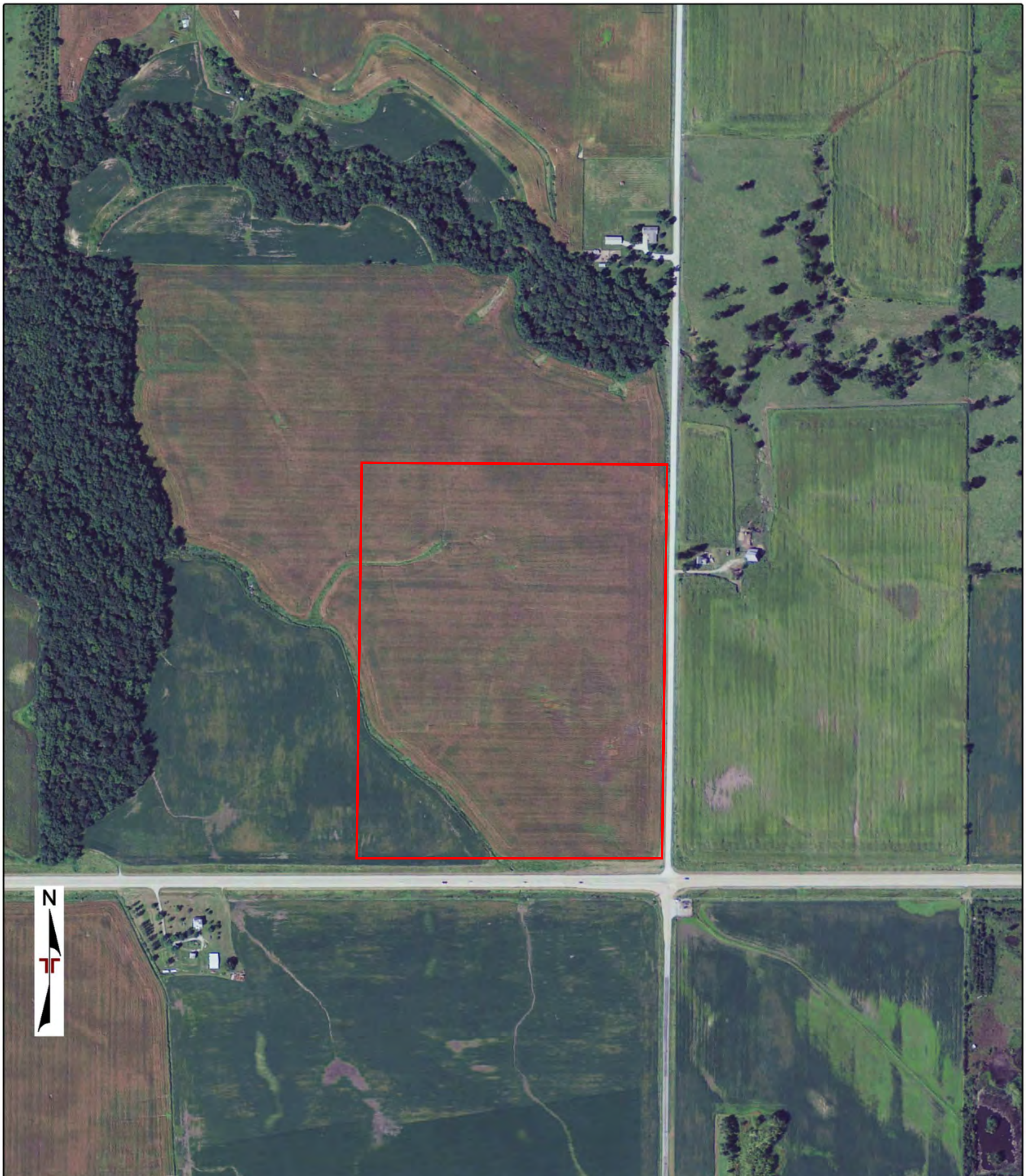
| **Checked by:** | **File Name:** 22042000035 | | | |
| **Approved by:** | **Date:** 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 |
| --- | --- |
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (2010 - USDA)

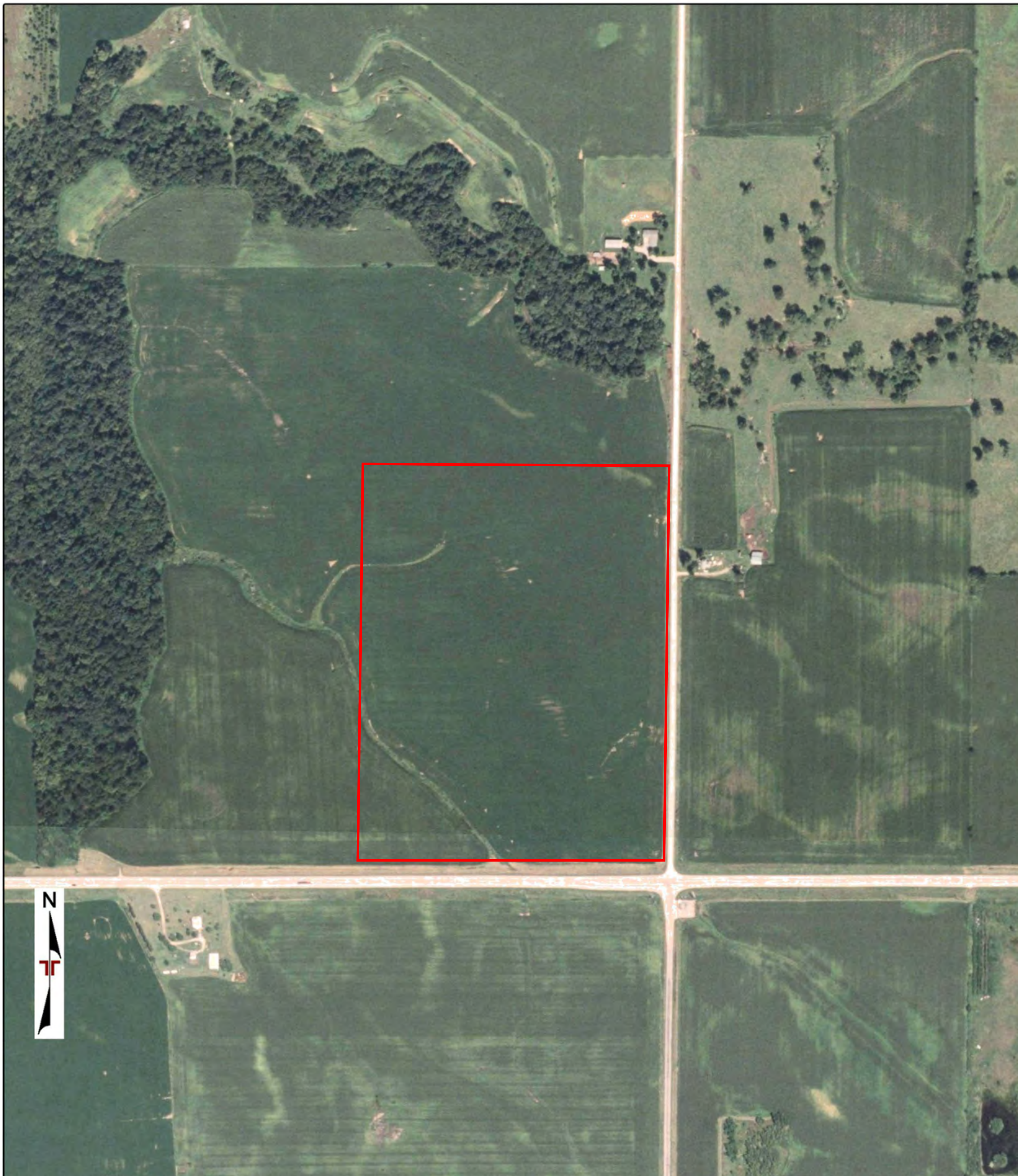
Lone Tree Site

Lone Tree Site

Parcel 1801476001, Iowa

Appendix

C

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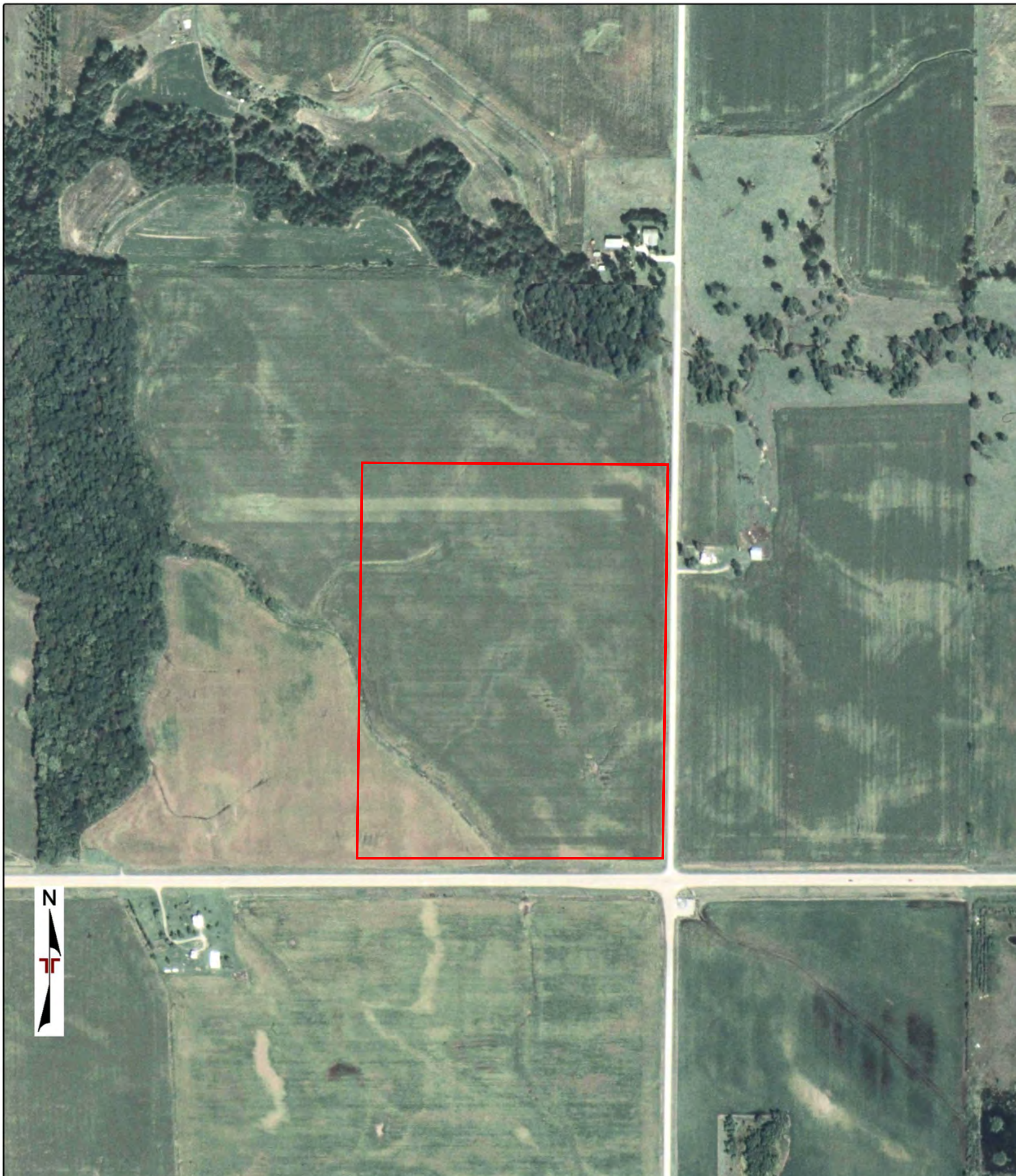
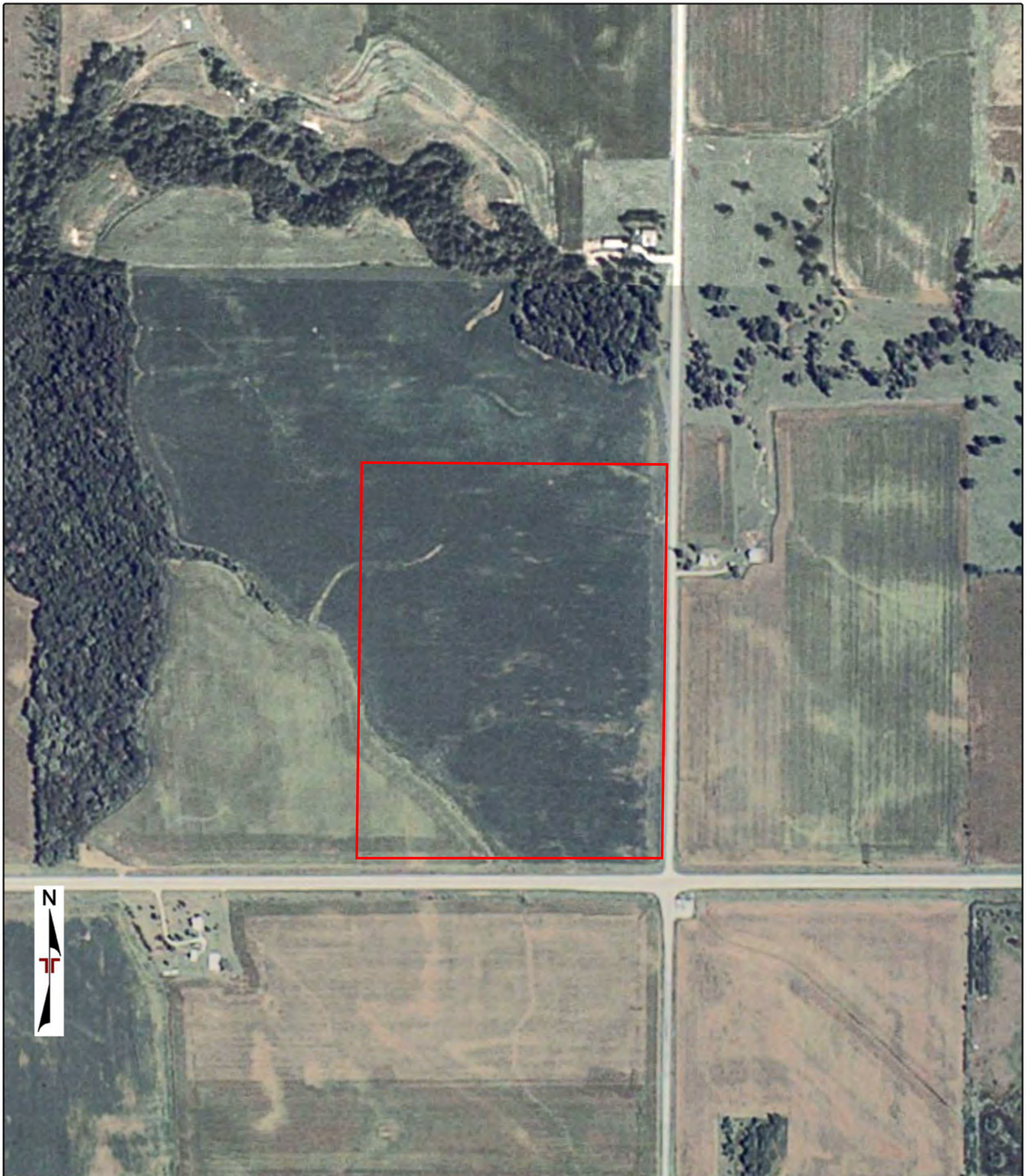
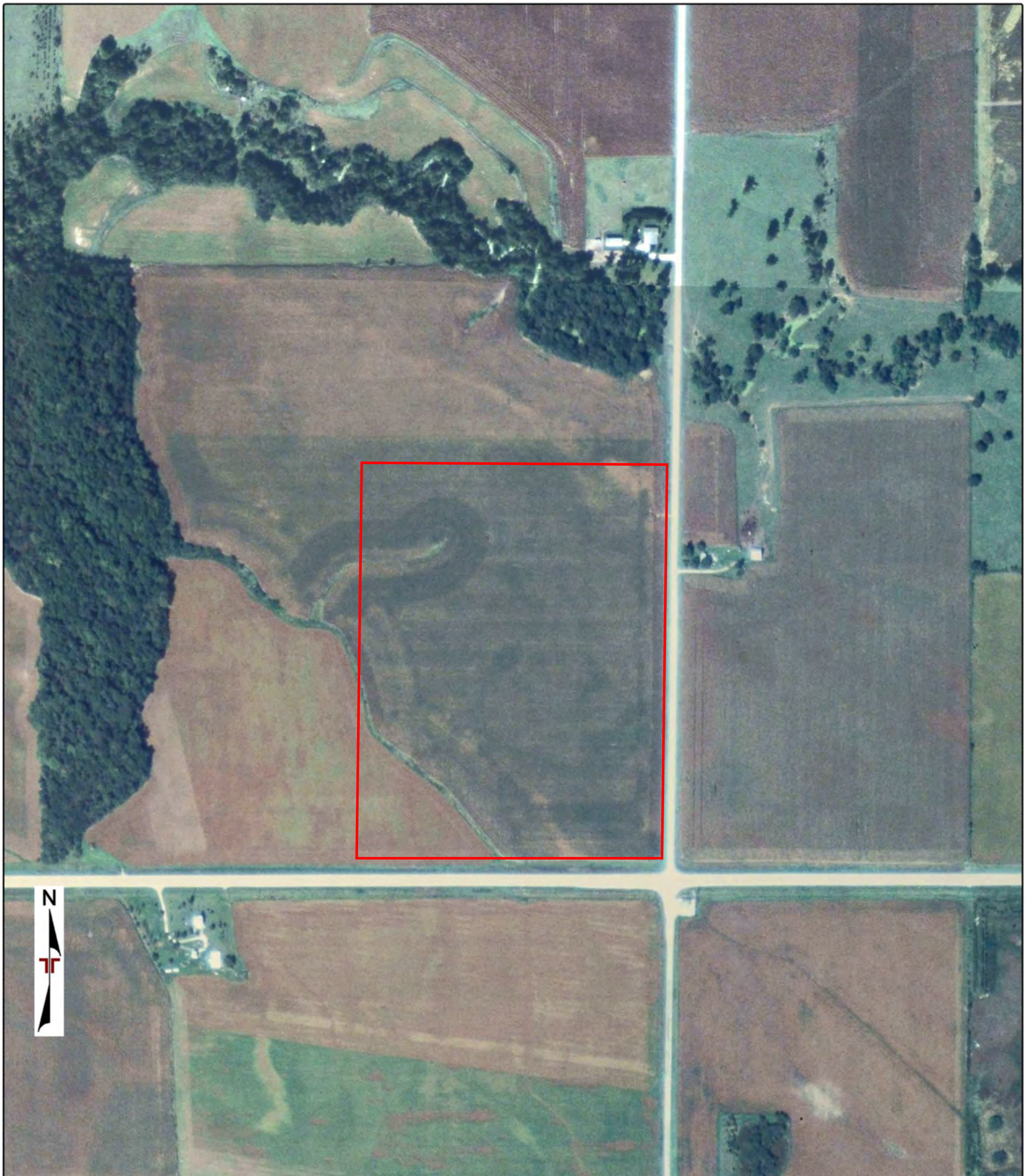
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No.<br>06227049 | Terracon<br>2640 12th St SW<br>Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2008 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale:<br>1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name:<br>22042000035 | | | |
| Approved by: | Date:<br>2022-04-21 | | | |




| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (2007 - USDA) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |




| Project Manager: | Project No. 06227049 |
| --- | --- |
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (2006 - USDA)

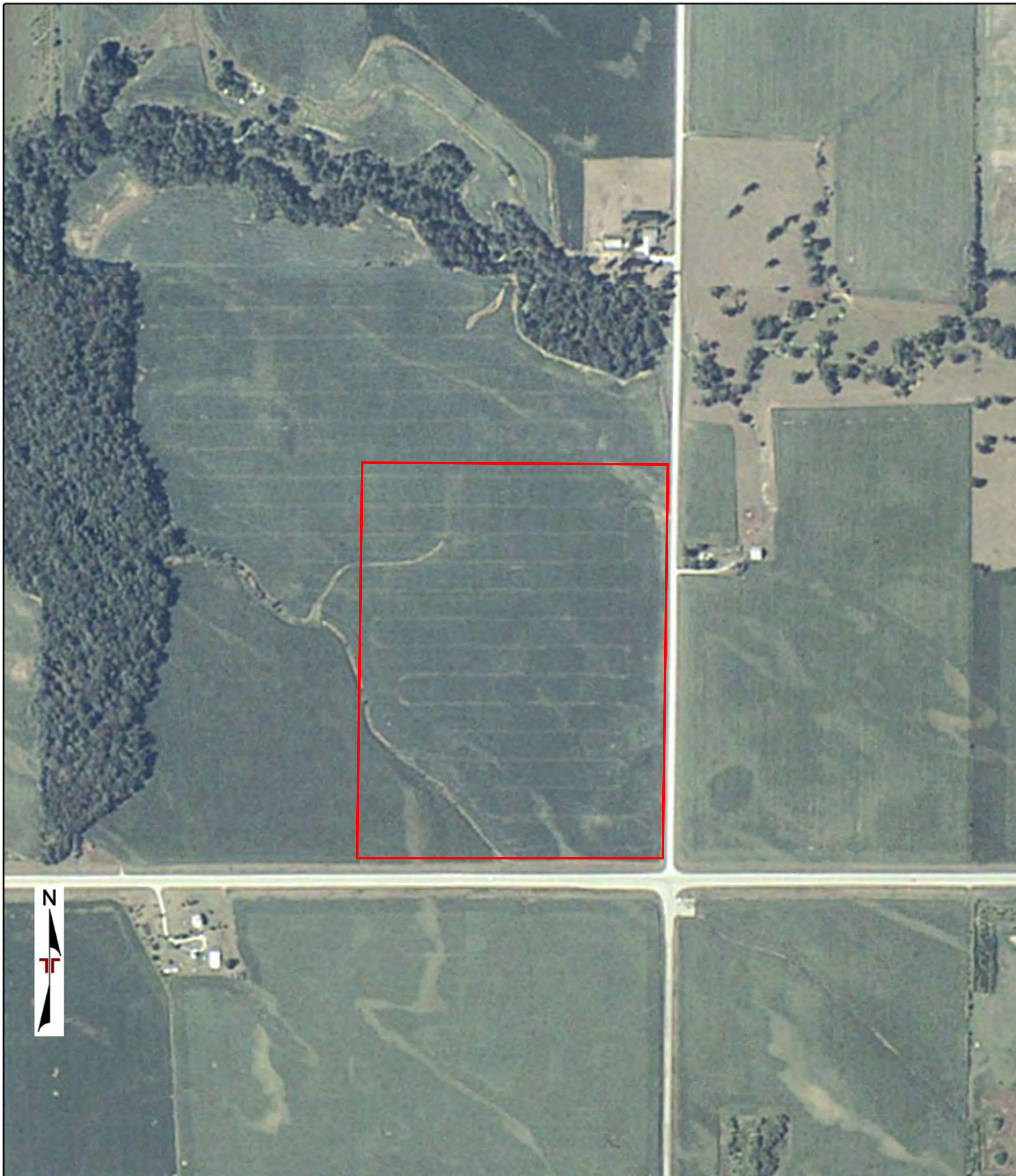
Lone Tree Site

Lone Tree Site

Parcel 1801476001, Iowa

Appendix

C




| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (2005 - USDA)

Lone Tree Site

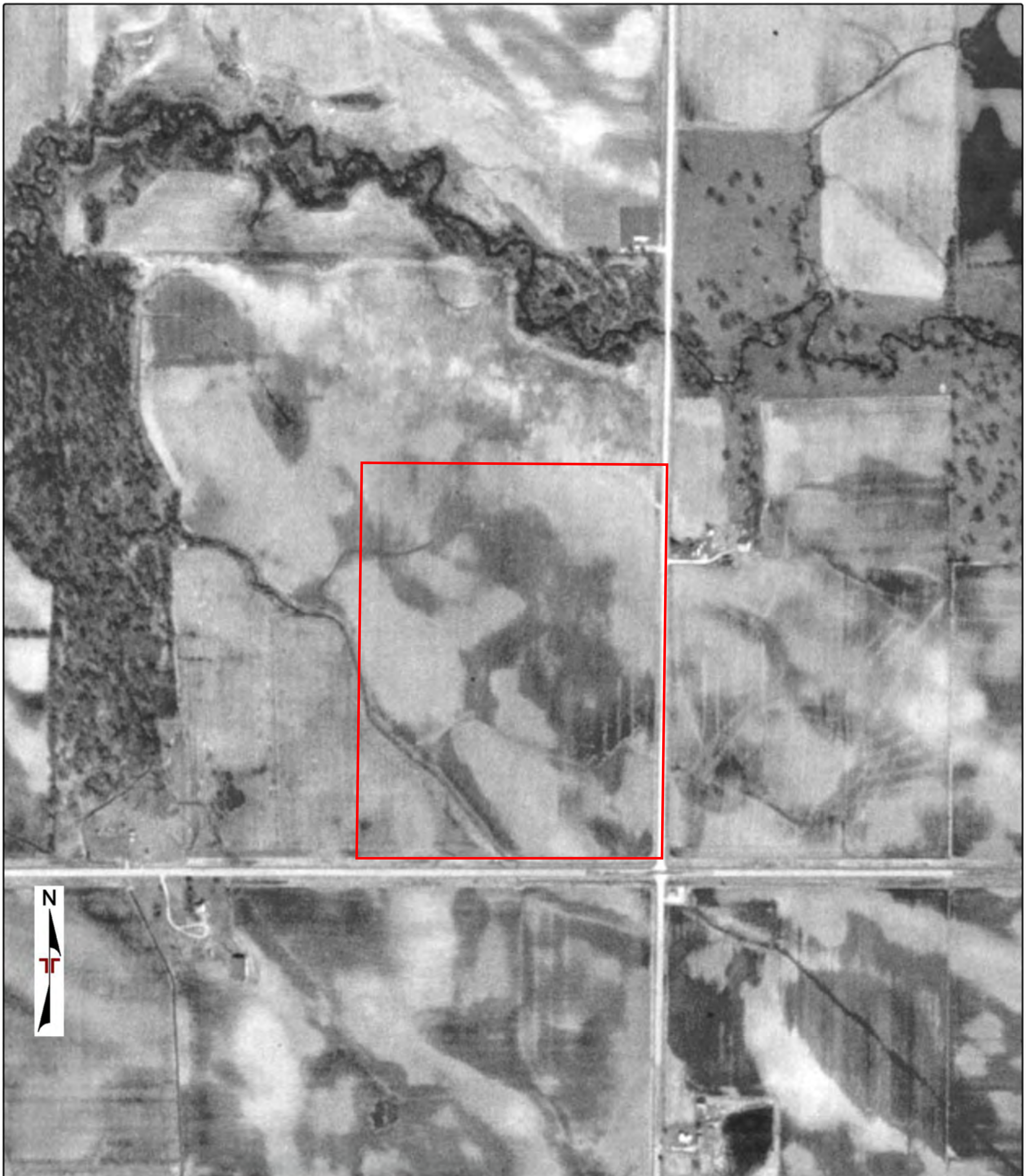
Lone Tree Site

Parcel 1801476001, Iowa

Appendix

C


| | | | | |
|---|---|---|---|---|
| **Project Manager:** | **Project No.** 06227049 | Terracon | AERIAL PHOTO (1994 - USGS) | Appendix |
| **Drawn by:** | **Scale:** 1" = 500' | | Lone Tree Site | C |
| **Checked by:** | **File Name:** 22042000035 | 2640 12th St SW | Lone Tree Site | |
| **Approved by:** | **Date:** 2022-04-21 | Cedar Rapids, Iowa 52404 | Parcel 1801476001, Iowa | |




| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1983 - USGS) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1970 - ASCS) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site | C |
| Checked by: | File Name: 22042000035 | | Lone Tree Site | |
| Approved by: | Date: 2022-04-21 | | Parcel 1801476001, Iowa | |


| | | | | |
|---|---|---|---|---|
| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1963 - ASCS) | Appendix |
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site Lone Tree Site Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |


| Project Manager: | Project No. 06227049 |
|---|---|
| Drawn by: | Scale: 1" = 500' |
| Checked by: | File Name: 22042000035 |
| Approved by: | Date: 2022-04-21 |

Terracon

2640 12th St SW
Cedar Rapids, Iowa 52404

AERIAL PHOTO (1951 - ASCS)

Lone Tree Site

Lone Tree Site

Parcel 1801476001, Iowa

Appendix

C


| Project Manager: | Project No. 06227049 | Terracon 2640 12th St SW Cedar Rapids, Iowa 52404 | AERIAL PHOTO (1937 - ASCS) | Appendix |
|---|---|---|---|---|
| Drawn by: | Scale: 1" = 500' | | Lone Tree Site<br>Lone Tree Site<br>Parcel 1801476001, Iowa | C |
| Checked by: | File Name: 22042000035 | | | |
| Approved by: | Date: 2022-04-21 | | | |

# APPENDIX D
# PHOTOGRAPHIC DOCUMENTATION

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 1:** View of the site looking northeast at the east adjoining residential property.

**Photo 2:** View of the site looking east at the east adjoining residential property.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 3:** View of site looking south.

**Photo 4:** View of south adjoining agricultural field.

**Photo 5:** View of the site looking west at the west adjoining wooded area.

**Photo 6:** View of creek running through the site.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 7:** View of north adjoining agricultural land and wooded area.

**Photo 8:** View of creek running through the site, near the Highway 22.

# APPENDIX C
## Photographic Documentation

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 1:** View of the site looking northeast at the east adjoining residential property.

**Photo 2:** View of the site looking east at the east adjoining residential property.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 3:** View of site looking south.

**Photo 4:** View of south adjoining agricultural field.

**PHOTOGRAPHIC DOCUMENTATION**
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 5:** View of the site looking west at the west adjoining wooded area.

**Photo 6:** View of tributary running through the site.

Terracon

# PHOTOGRAPHIC DOCUMENTATION
**Lone Tree**
**Photos Taken: 04/27/2022**

**Photo 7:** View of north adjoining agricultural land and wooded area.

**Photo 8:** View of tributary running through the site, near the Highway 22.

**Attachment J:**
**Stormwater Management Plan**

**STORMWATER MANAGEMENT REPORT**

# Lone Tree Project

**March 20, 2023**

Prepared for:

**PCR Energy**
**1334 Brittmoore Rd.**
**Suite 1327**
**Houston, TX 77043**

Prepared by:

**Stantec**
**11311 Aurora Ave.**
**Des Moines, IA 50322**

## Table of Contents



## List of Appendices

# 1.0 PROJECT INTRODUCTION

## 1.1 PROJECT BACKGROUND

The proposed Lone Tree Project is located at the northwest quadrant of the intersection of Highway 22 and Sioux Ave. in Johnson County, Iowa, west of Lone Tree. The project includes construction of approximately 16,308 photovoltaic (PV) solar modules with associated equipment and infrastructure. The 50-acre site is entirely planted row crops with the exception of two drainageways that cross portions of the site along the western border. The areas surrounding the project are also planted row crops. The site primarily sheet flows east to west into the two drainageways and then west Otter Creek, a tributary of the Iowa River. This report will detail the existing and proposed development conditions and summarize the proposed water quality treatment volumes to be provided.

## 1.2 EXISTING CONDITIONS

The entire parcel area is 50 acres located within the Iowa River Watershed. The site generally drains from east to west by sheet flow to the identified drainageways; off-site areas to the north sheet flow across the site, and a portion of the rights-of-way or Highway 22 and Sioux Avenue are conveyed by roadside swales to the southernmost drainageway. The two drainageways converge off-site before continuing west into Otter Creek approximately 1 mile upstream of the Iowa River. Per the Iowa Department of Natural Resources 2018 Impaired Waters Map, Otter Creek is not identified as a Total Max Daily Load (TMDL) Impaired Waterbody, the Iowa River is identified as a Total Max Daily Load (TMDL) Impaired Waterbody.

According to the USDA Natural Resource Conservation Service Soils Survey, existing soil types are:

| Map Symbol | Soil Type | Hydrologic Soil Group | Percentage of Site |
|---|---|---|---|
| M162B | Downs silt loam | C | 9% |
| M162C | Downs silt loam | C | 1% |
| 291 | Atterberry silt loam | C/D | 24% |
| 160 | Walford silt loam | C/D | 12% |
| 122 | Sperry silt loam | D | 37% |
| 121B | Tama silt loam | C | 15% |
| 175B | Dickinson fine sandy loam | A | 2% |

The majority of the site consists of soils with a hydrologic soil group of D or C/D (73%), with small areas of group C (25%) soils and one single area of group A soils (2%); given the abundance of D or C/D soils throughout the site, a hydrologic soil group of D was utilized to calculate curve numbers for both pre and post developed conditions.

The area is currently cultivated agriculture with a cover type identified "Row crops, straight row, poor condition". Existing overall site drainage is shown on the enclosed Pre-developed Drainage Exhibit (Appendix B).

## 1.3 PROPOSED CONDITIONS

The proposed development will include approximately 16,308 PV solar modules, and 62 power inverters, underground infrastructure, and 12' wide service roads. The site does not currently have stormwater controls. The existing drainage pattern will be preserved after development. The proposed development will improve the existing cultivated land into a vegetated meadow condition and therefore will reduce post-developed runoff rates to less than pre-developed rates as well as reduce pollutant loads to downstream waterways. Per industry standards, solar array areas were considered pervious surface due to panels being elevated off the ground allowing for runoff beneath them.

# 2.0 HYDROLOGIC ANALYSIS

## 2.1 RUNOFF COEFFICIENTS

A pre-developed curve number (CN) of 91 was used to represent the existing agricultural site and is classified as "Row crops, straight row, poor condition" with Hydrologic Soil Group (HSG) D. For post-developed conditions, a composite CN of 81 was utilized based on a combination of service roads and good condition grass cover with HSG D.

| Pre-Developed | | | |
|---|---|---|---|
| **Cover Type** | **CN (HSG D)** | **Area (ac.)** | **Weighted CN** |
| Row crops, Straignt row (SR), Poor | 91 | 50 | **91** |

| Post-Developed | | | |
|---|---|---|---|
| **Cover Type** | **CN (HSG D)** | **Area (ac.)** | **Weighted CN** |
| Impervious | 98 | 2.19 | 4 |
| Open space, Good condidtion | 80 | 47.81 | 76 |
| **Composite CN** | | | **81** |

## 2.2 TIME OF CONCENTRATION

Travel time for existing conditions was calculated using the NRCS TR-55 method with a combination of sheet, shallow concentrated flow, and channelized flow as observed in the aerial topography. A maximum length of 100 feet of sheet flow was used before transitioning to shallow concentrated flow. The total time of concentration was calculated at 18.1 minutes. The total travel path is shown on the Pre-Developed Drainage exhibit found in Appendix B.

The proposed development will have minimal grading and will maintain the existing drainage patterns and improved ground cover. The time of concentration for post-developed conditions was calculated at 27.6. The travel paths are detailed on the pre- and post-developed drainage exhibits.

### 2.3 PRE-DEVELOPED VS. POST-DEVELOPED RUNOFF RATES

Peak runoff rates were calculated Using the input criteria listed in the sections above for both pre-developed and post-developed conditions for the 5-, 25-, and 100-yr storm events. The reduction in peak runoff rate from pre to post developed conditions is shown below:

| | 5-Year | 25-Year | 100-Year |
|---|---|---|---|
| Pre-Developed Peak Runoff Rate (cfs) | 116.48 | 180.24 | 246.32 |
| Post-Developed Peak Runoff Rate (cfs) | 87.94 | 155.36 | 228.04 |
| **Runoff Rate Reduction (cfs)** | **28.54** | **24.88** | **18.28** |

## 3.0 HYDRAULIC ANALYSIS

### 3.1 MODELING PARAMETERS

Hydrologic modeling was performed using the Hydraflow Hydrographs Extension version 2021 software.. This model uses the Soil Conservation Service (SCS) TR-20 methodology to determine peak flows and runoff volumes.

A Type II 24-hour storm type was selected to model the rainfall distribution across each rainfall event as per the Iowa Stormwater Management Manual. Precipitation data was taken from NRCS rainfall distribution data.

### 3.2 DETENTION REQUIREMENTS

Post-developed peak runoff rates for all storm events have decreased from existing peak rates; peak rate control detention is unwarranted.

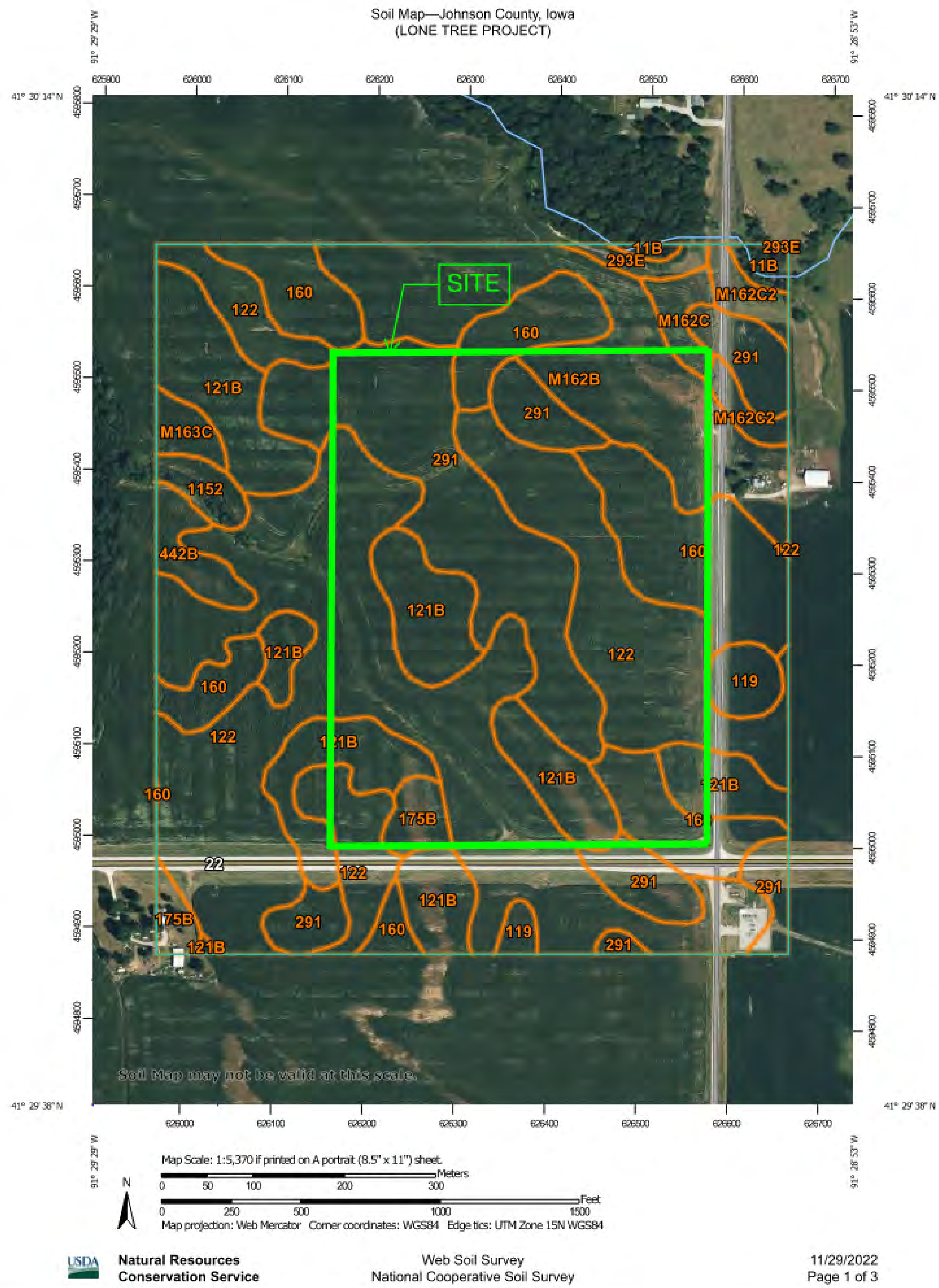
### 3.3 WATER QUALITY SUMMARY

The conversion of cultivated agricultural use to a more densely vegetated meadow-like condition will cause a significant reduction in overall pollution to downstream areas, including a decrease in TSS, nitrogen, and phosphorus loading rates. The D and C/D soil groups encountered on site do not allow for infiltration of retained runoff; group C soils allow for very little to negligible infiltration. Due to the soil types encountered on this site, infiltration of runoff is impractical or ineffective. With the reduction in pollutant load, and the site soil conditions, a waiver for water quality retention requirements is requested.

## 4.0 CONCLUSIONS

The proposed development is designed to maintain existing drainage patterns while improving the site by establishing permanent, good quality, vegetated cover. The improvements will significantly reduce post-developed peak runoff rates and pollutant loads from the existing conditions. in summary, these improvement help contribute to an environmentally sound development.

# APPENDIX A SOILS MAP



# APPENDIX B PRE-DEVELOPED DRAINAGE

# APPENDIX C POST-DEVELOPED DRAINAGE

# APPENDIX D HYDROGRAPH REPORTS

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 116.48 | 10 | 730 | 479,278 | ------ | ------ | ------ | Pre-Developed Site |
| 2 | SCS Runoff | 87.94 | 2 | 730 | 353,233 | ------ | ------ | ------ | Post-Developed Site |

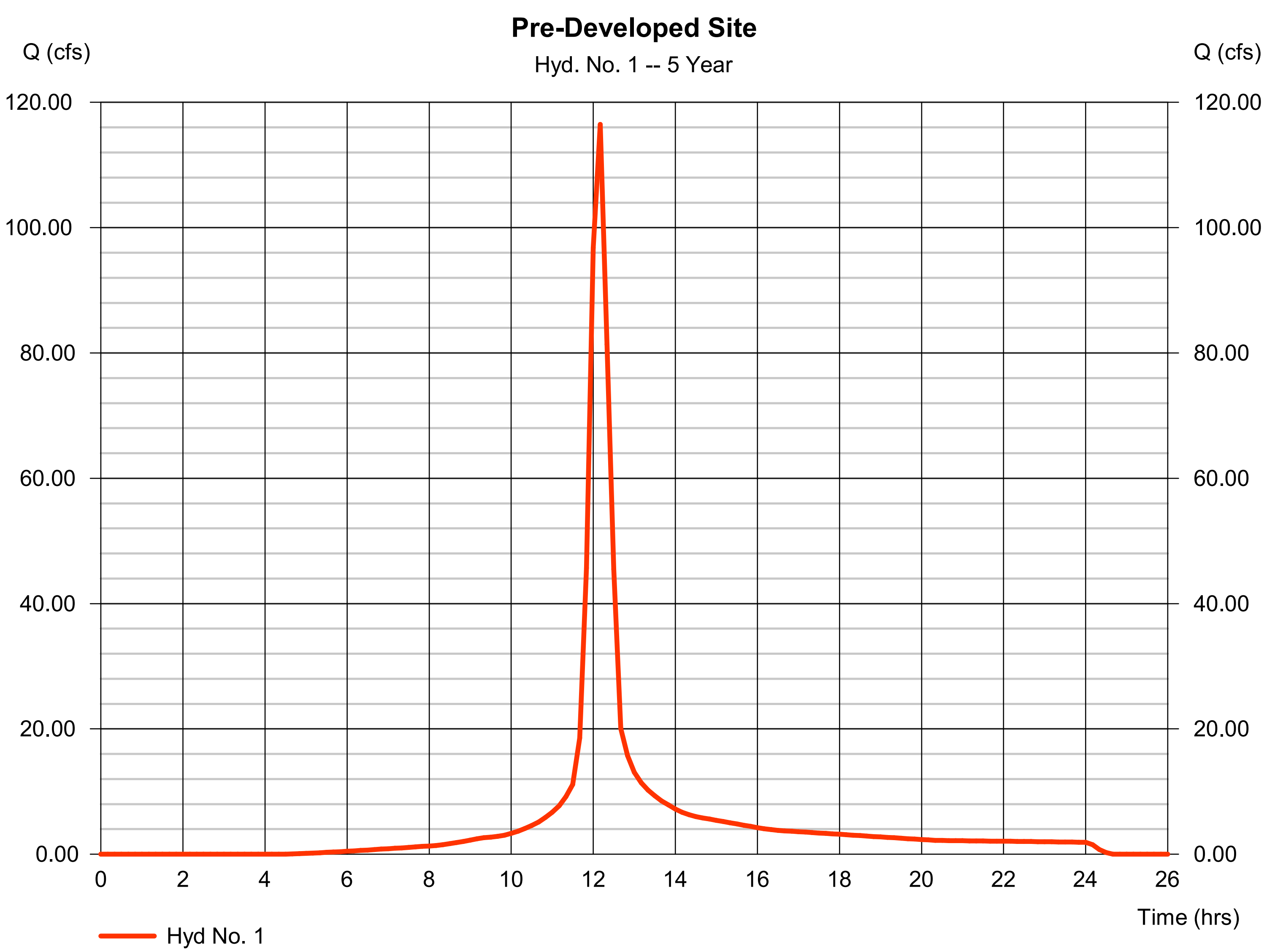
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 — Wednesday, 11 / 30 / 2022

## Hyd. No. 1

Pre-Developed Site

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 116.48 cfs |
| Storm frequency | = 5 yrs | Time to peak | = 12.17 hrs |
| Time interval | = 10 min | Hyd. volume | = 479,278 cuft |
| Drainage area | = 50.000 ac | Curve number | = 91 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 18.10 min |
| Total precip. | = 3.79 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



# TR55 Tc Worksheet



## Hyd. No. 1

Pre-Developed Site

| Description | | A | | B | | C | | Totals |
|---|---|---|---|---|---|---|---|---|
| **Sheet Flow** | | | | | | | | |
| Manning's n-value | = | 0.060 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = | 100.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = | 2.61 | | 0.00 | | 0.00 | | |
| Land slope (%) | = | 2.61 | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **=** | **4.69** | **+** | **0.00** | **+** | **0.00** | **=** | **4.69** |
| **Shallow Concentrated Flow** | | | | | | | | |
| Flow length (ft) | = | 1435.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = | 1.53 | | 0.00 | | 0.00 | | |
| Surface description | = | Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =2.00 | | | 0.00 | | 0.00 | | |
| **Travel Time (min)** | **=** | **11.98** | **+** | **0.00** | **+** | **0.00** | **=** | **11.98** |
| **Channel Flow** | | | | | | | | |
| X sectional flow area (sqft) | = | 12.00 | | 0.00 | | 0.00 | | |
| Wetted perimeter (ft) | = | 11.00 | | 0.00 | | 0.00 | | |
| Channel slope (%) | = | 0.74 | | 0.00 | | 0.00 | | |
| Manning's n-value | = | 0.025 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =5.43 | | | 0.00 | | 0.00 | | |
| Flow length (ft) | ({0})462.0 | | | 0.0 | | 0.0 | | |
| **Travel Time (min)** | **=** | **1.42** | **+** | **0.00** | **+** | **0.00** | **=** | **1.42** |

**Total Travel Time, Tc .............................................................................. 18.10 min**

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 180.24 | 10 | 730 | 758,710 | ------ | ------ | ------ | Pre-Developed Site |
| 2 | SCS Runoff | 155.36 | 2 | 730 | 621,112 | ------ | ------ | ------ | Post-Developed Site |

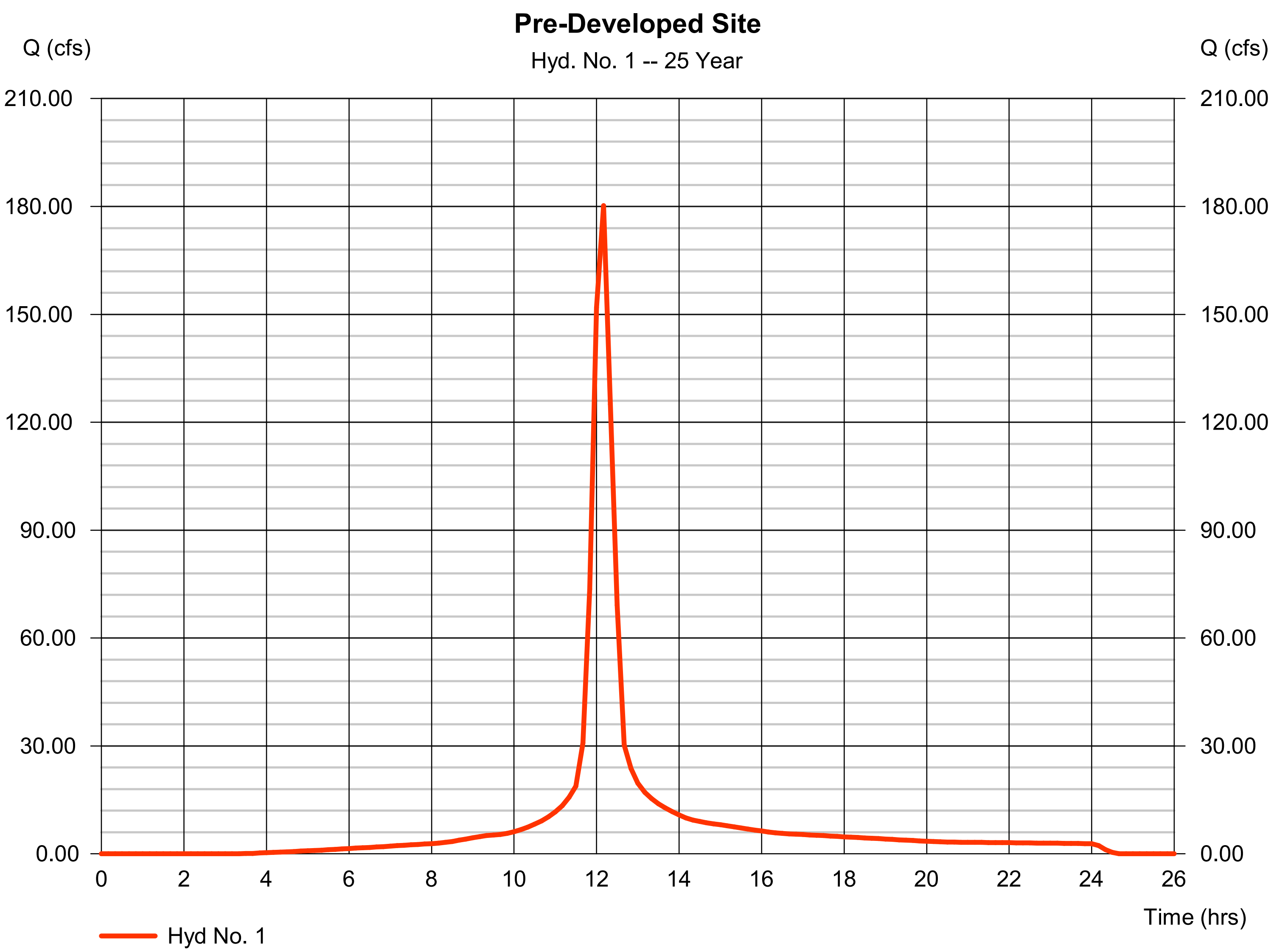
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 11 / 30 / 2022

## Hyd. No. 1

Pre-Developed Site

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 180.24 cfs |
| Storm frequency | = 25 yrs | Time to peak | = 12.17 hrs |
| Time interval | = 10 min | Hyd. volume | = 758,710 cuft |
| Drainage area | = 50.000 ac | Curve number | = 91 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 18.10 min |
| Total precip. | = 5.49 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 246.32 | 10 | 730 | 1,055,732 | ------ | ------ | ------ | Pre-Developed Site |
| 2 | SCS Runoff | 228.04 | 2 | 730 | 917,800 | ------ | ------ | ------ | Post-Developed Site |

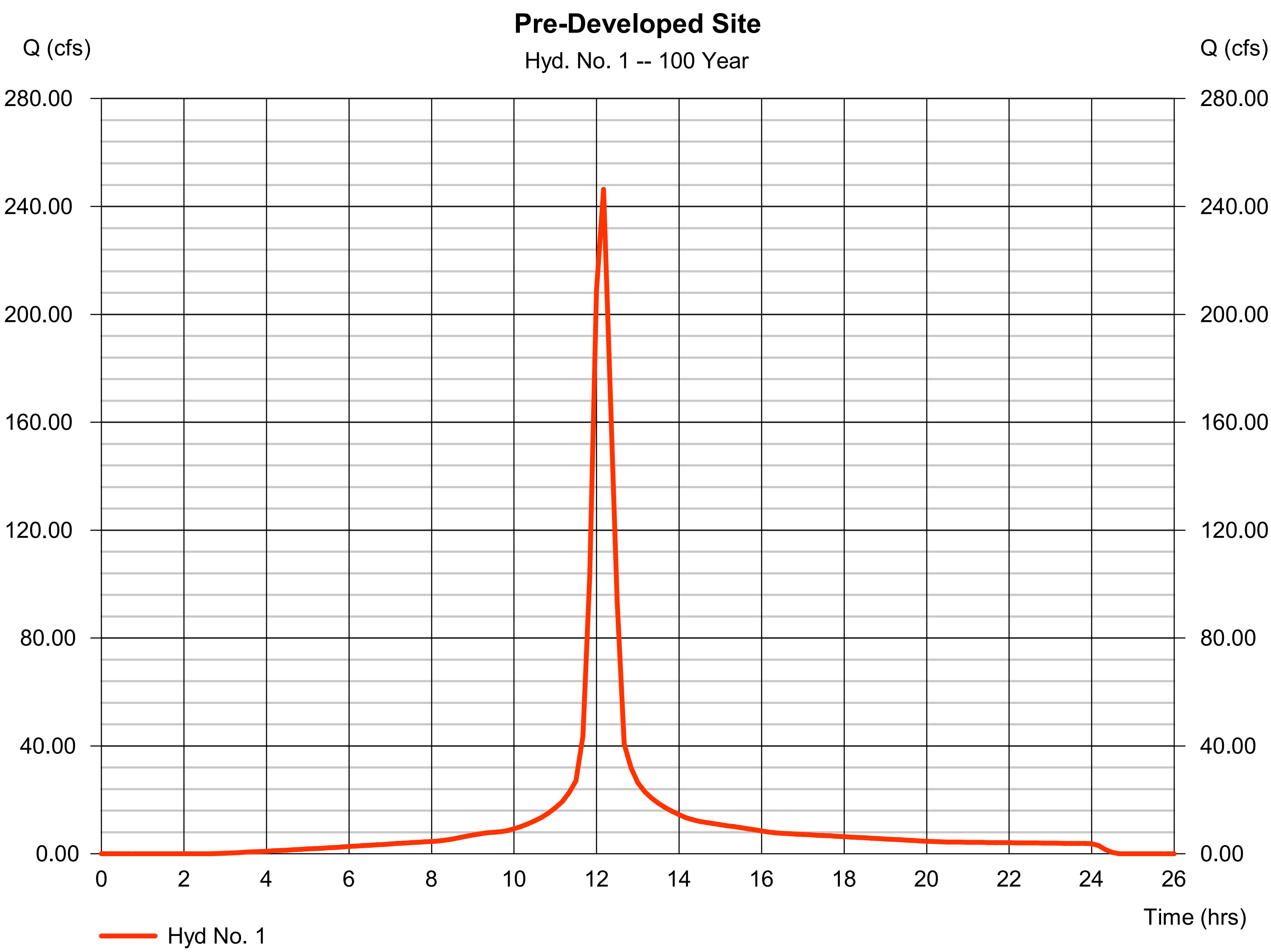
# Hydrograph Report



## Hyd. No. 1

Pre-Developed Site

| | | | |
|---|---|---|---|
| Hydrograph type | = SCS Runoff | Peak discharge | = 246.32 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 12.17 hrs |
| Time interval | = 10 min | Hyd. volume | = 1,055,732 cuft |
| Drainage area | = 50.000 ac | Curve number | = 91 |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 18.10 min |
| Total precip. | = 7.27 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |



**Attachment K:**
**Erosion Control Plan**

March 23, 2023

Cynthia Schuchner
PCR US Investments Corp
1334 Brittmoore Rd Ste 2407
Houston, TX 77043

Telephone: (832) 955 1979
Email: cschuchner@pcr.energy

RE: Erosion Control Plan
Conifer Power Lone Tree
Parcel No. 1801476001
Highway 22 and Sioux Avenue SE
Lone Tree, Johnson County, Iowa
Terracon Project No. 06227115

Dear Ms. Schuchner:

Terracon is pleased to submit the enclosed Erosion Control Plan (ECP) in accordance with our proposal (Terracon Proposal No. P06227135) dated August 23, 2022. Terracon appreciates the opportunity to provide services on this important project. Please feel free to contact either of the undersigned if you have any questions or require additional information.

Sincerely,
**Terracon Consultants, Inc.**

Jordan M. Smith
Staff Scientist

David C. McCormick, P.E. (AR, TX, LA, NM, KS, MO, IA, FL)
Department. Manager

Enclosure: Erosion Control Plan – Lone Tree

# Erosion Control Plan

## Conifer Power Lone Tree Erosion Control Plan
## Parcel No. 1801476001
## Highway 22 and Sioux Avenue
## Lone Tree, Johnson County, Iowa

March 23, 2023
Terracon Project No. 06227135


**Prepared for:**
PCR US Investments Corp
Houston, Texas

**Prepared by:**
Terracon Consultants, Inc.
Cedar Rapids, Iowa

## TABLE OF CONTENTS



## APPENDICES

# 1.0 SITE LOCATION AND PROJECT DESCRIPTION

Terracon understands that PRC US Investments Corp (the Client) and Conifer Power are preparing preliminary plans to develop the site, located at Highway 22 and Sioux Avenue, with an approximate 7.5-megawatt solar facility. The location of the site is indicated on the attached Exhibits and is further described in Table 1 below.

### Table 1. Site Information

| Site | Parcel No. | County, State | Approximate Size (Acres) | Additional Information |
|---|---|---|---|---|
| Lone Tree | 1801476001 | Johnson, Iowa | 50 | Owner: No Gen-tie route identified by client. |

# 2.0 SCOPE OF SERVICES

## 2.1 Erosion Control Plan

The Erosion Control Plan (ECP) will help to address areas that may affect erosion and sediment disposition at the site. The Site will include all construction areas, areas where equipment may travel, staging areas, hauling roads, areas of access, areas of erosion control measures, tree clearing areas, landscaping areas, as well as borrow and fill areas. The ECP will help to identify critical areas, limit exposed areas, limit time of exposure, control surface water, control sedimentation, and manage stormwater runoff by addressing the following:

- Initial grading, site roadwork, and trenching
- Temporary erosion and sediment controls
- Wet weather conditions
- Drain tile identification
- Permanent vegetative cover

### 2.1.1 Initial Grading, Site Roadwork, and Trenching

Site grading activities will only occur in select areas where elevations need to be modified to accommodate tracker/racking system slope tolerances, site drainage, access roads, laydown areas, foundations for the MV power station, Switchgear Room and O&M Room. This approach to grading minimizes impacts and/or preserves existing soil and root structures, topsoil nutrients, seed base, and pre-construction site hydrology.

**Stockpile & Mining Areas**

During construction activities (grading and trenching), it may be necessary to stockpile and segregate soils on a temporary basis. The stockpiles should be covered when possible, and silt-fences should be placed on the downward side to prevent erosion and sedimentation from the piles. At this time, it is unknown where the stockpiles (if any) will be located on-site.

**Roadwork**

During construction activities, there will be machinery on-site that will utilize access roads. Due to the potential for erosion and sedimentation resulting from vehicular traffic, traffic should be limited to designated roadways within the site when possible.

### 2.1.2 Temporary Erosion and Sediment Controls

To provide adequate site drainage, Terracon recommends the use of gradient treatments. These gradient treatments are used to decrease runoff velocities, trap sediments locally and increase filtration of water into the soil thus limiting erosion and supporting vegetation growth. Graded surfaces will be roughened prior to seeding to decrease runoff velocity, thereby reducing erosion and aid in establishment of vegetation. If necessary, at periodic intervals not to exceed 200 feet silt fences or rock check dams shall be provided in all collection ditches until vegetation has been established. Actual spacing of silt fences/rock check dams will be adjusted for the steepness of the ditch slope. Silt fences/rock check dams will be maintained in order to assure minimization of silt transportation and cleaned when sediment exceeds one-half the height of the fence. Once vegetation is established, the use of silt fences/rock check damns will not be required. Surface water run-off from stockpile areas will be routed through silt fences/rock check dams to aid in prevention erosion.

A site Drainage Map has been developed to identify the drainage systems associated with the Facility (See **Exhibit 3**). The maps incorporate Facility structures, roads, and drainage. The maps provide the basis for the erosion control plan measures and should be updated as needed to keep the plan current. **Exhibit 3** depicts the surface drainage patterns for the property. A thorough understanding of the area's surface drainage patterns is essential for developing an ECP. **Exhibit 4** shows that the solar farm drains to the southwest. This area will utilize silt fencing, and rock check dams to minimize sediment leaving the facility. Rock check-dams will be installed along the apparent drainage on the northwest portion of the site. Spacing and design will be based off of the Statewide Urban Design and Specifications (SUDAS) standard specifications, and actual field conditions. Per the SUDAS standard specifications, the rock check-dams shall not be placed closer than 20-feet apart.

### 2.1.3 Wet Weather Conditions

Site work in wet soil conditions will not begin or continue at times when or locations where the passage of heavy equipment may cause rutting to the point where topsoil and subsoil are mixed, or underground drainage structures could be damaged.

Some activities may be suspended due to the following factors:

- Extent of ponding;
- Extent and depth of soil erosion (rutting, compaction, mixing of soil);
- If unable to reroute site traffic temporarily;
- Type of equipment operating on-site during that time period; and
- Drainage tile avoidance as explained below in section 2.1.4.

If adverse wet weather construction impacts cannot be minimized or managed, work will stop in that applicable area until site conditions improve.

### 2.1.4 Drain Tile Identification, Avoidance, and Repair

Due to the location of the proposed solar facility in an agricultural area, it is anticipated that drain-tiles will be encountered during construction activities. The drain tile system aids the site in draining properly, which helps prevent excessive surface runoff. If the drainage tile system is impacted and/or destroyed, it could limit the site's ability to properly drain, resulting in excessive runoff and potential erosion and sedimentation issues. Drain tiles will be identified (to the best extent possible) to assist in avoidance and repairs by field observations. The field observations should be documented and updated as needed.

### 2.1.5 Permanent Vegetative Cover

Following the completion of construction activities, the Client shall stabilize exposed areas and control runoff using structural or non-structural control measures to minimize onsite erosion and sedimentation and the resulting discharge of pollutants. Terracon recommends that the vegetative cover follow the seeding mixes as shown in the VMP, and as shown below:

| SEASON | Scientific Name | Common Name |
|---|---|---|
| Temporary Spring-Summer<br>(Mid-April to Mid-August) without permanent seed | *Avena sativa*<br>*Lolium multiflorum* | Seed Oats<br>Annual Rye |
| Spring-Summer and Early Fall (Mid-April to Mid-August) with permanent seed | *Avena sativa*<br>*Lolium multiflorum* | Seed Oats<br>Annual Rye |
| Temporary Fall<br>(Late August – Early | *Triticum aestivum*<br>*Lolium multiflorum* | Winter Wheat<br>Annual Rye |

| | | |
|---|---|---|
| November) without permanent seed | | |
| Temporary Fall<br>(Late August – Early November) with permanent seed | *Triticum aestivum*<br>*Lolium multiflorum* | Winter Wheat<br>Annual Rye |

Furthermore, the seeding mix should be overlain with a natural mulch. Materials used as mulch may consist of, but are not limited to: dry cereal straw, prairie hay, or wood excelsior made of wood fibers cut from green wood. Materials used as mulch should be free of noxious weeds and seed bearing or root portions of plants.

## 3.0 CLOSING

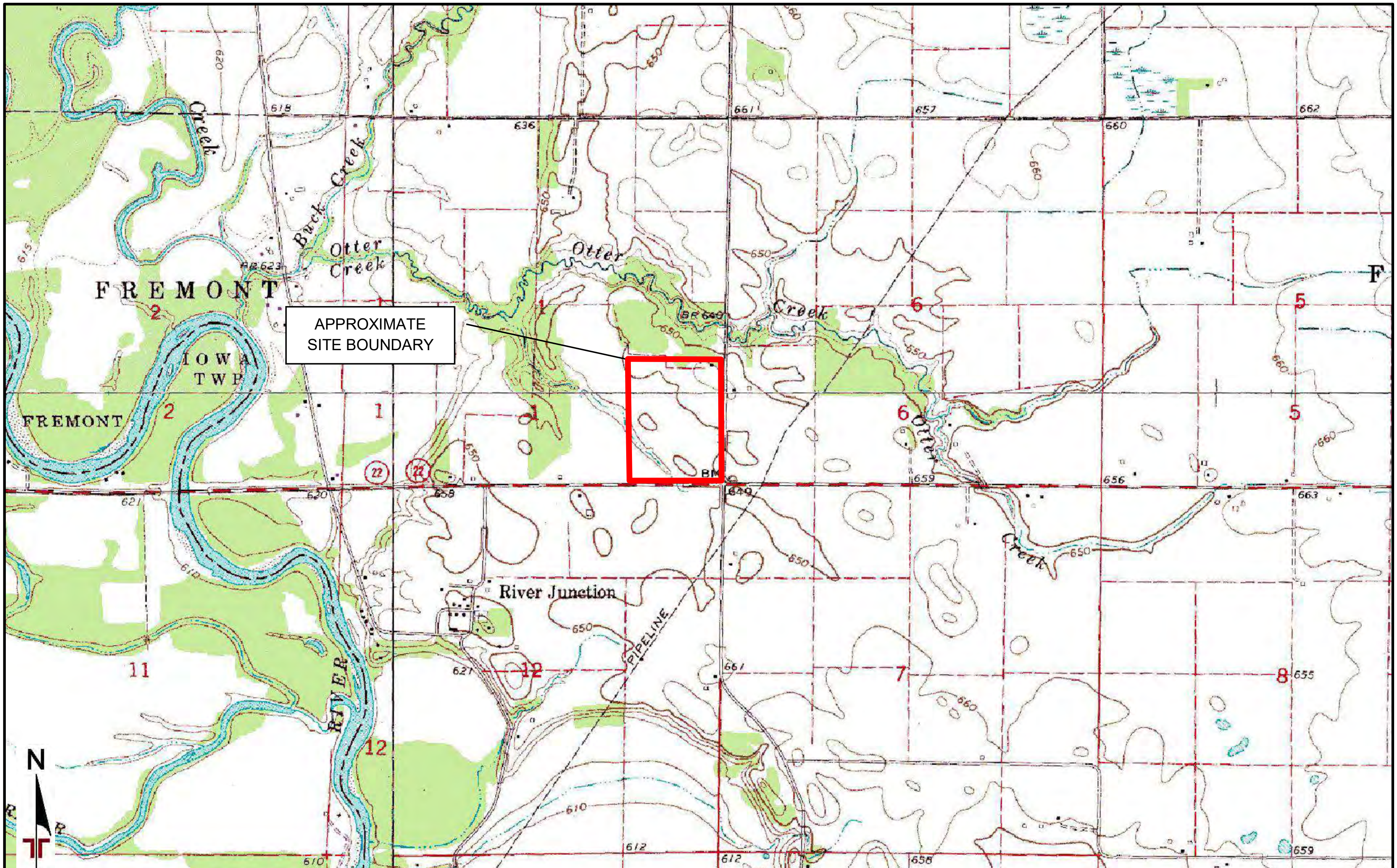
Terracon appreciates the opportunity to provide services on this project. Please feel free to contact either of the undersigned if you have any questions or require additional information.

Sincerely,
Terracon Consultants, Inc.

Jordan M. Smith
Staff Scientist

David C. McCormick, P.E. (AR, TX, LA, NM, KS, MO, IA, FL)
Department. Manager

# APPENDIX A
## Exhibits




TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: HILLS, IA (1/1/1983), WEST LIBERTY SW, IA (1/1/1965), RIVERSIDE, IA (1/1/1983) and LONE TREE, IA (1/1/1969).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: JMS | Project No. 06227135 |
| Drawn by: JMS | Scale: 1"=2,000' |
| Checked by: DM | File Name: Exhibits |
| Approved by: DM | Date: Sep. 2022 |

Terracon

2640 12th St SW
Cedar Rapids, IA 52404-3440

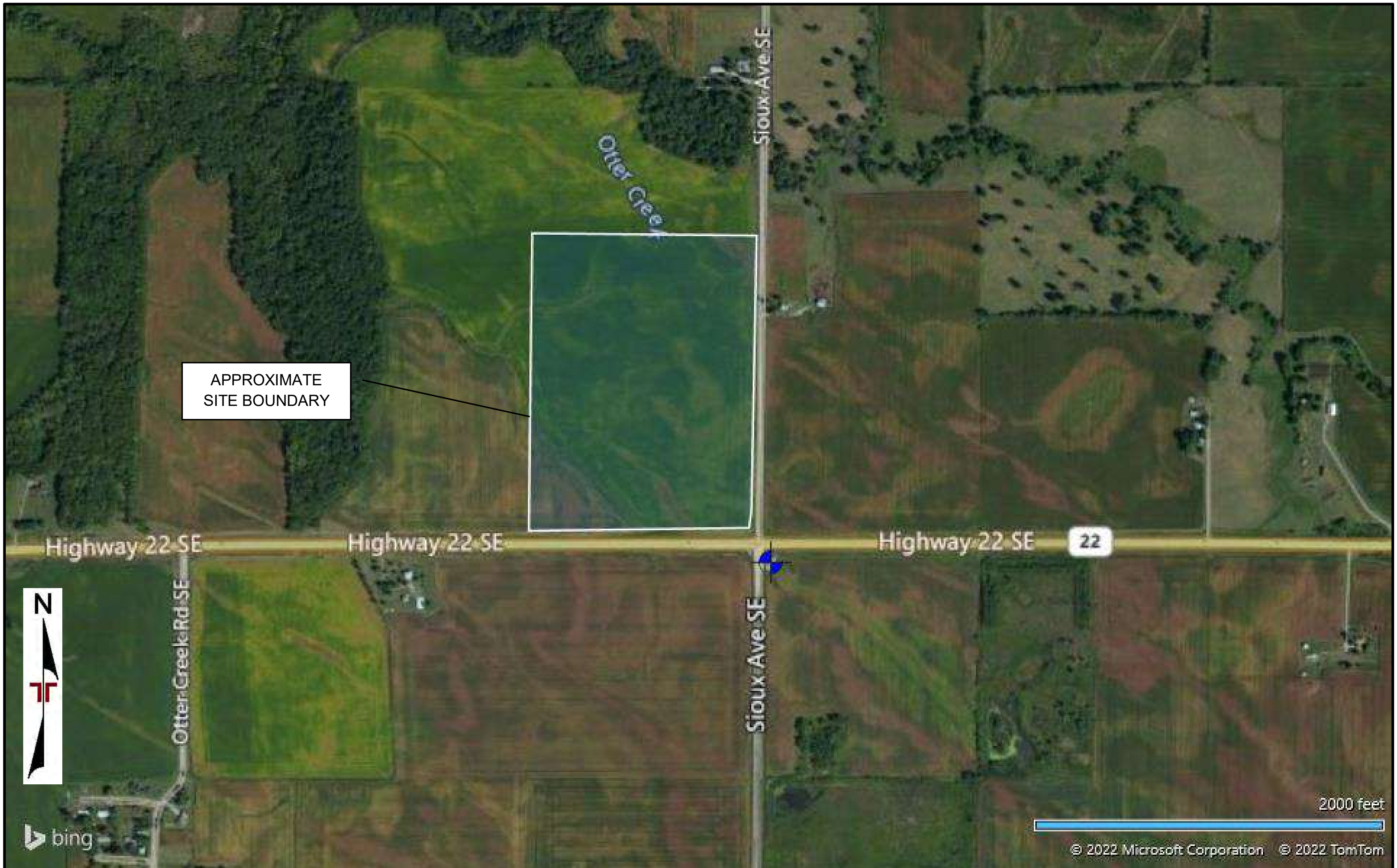
## Site Location Map

PCR

**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit

1




AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: JMS | Project No. 06227049 |
| Drawn by: JMS | Scale: AS SHOWN |
| Checked by: DM | File Name: Exhibits |
| Approved by: DM | Date: Sep. 2022 |

Terracon
2640 12th St SW
Cedar Rapids, IA 52404-3440

Site Diagram

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
2


AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: JMS | Project No. 06227049 |
| Drawn by: JMS | Scale: AS SHOWN |
| Checked by: DM | File Name: Exhibits |
| Approved by: DM | Date: Sep. 2022 |

Terracon

2640 12th St SW
Cedar Rapids, IA 52404-3440

# Drainage Map

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
3


| POINT | LAT | LONG |
|---|---|---|
| A | 41.49670229 | -91.48829677 |
| B | 41.49670967 | -91.48362429 |
| C | 41.49698140 | -91.48355875 |
| D | 41.50132142 | -91.48348547 |
| E | 41.50131371 | -91.48821947 |

Property Boundary (aprox. 50ac)
1V54 Tracker(1)
Fence
MV Underground Cable 12.47 kV
Wetlands
Internal Roads

| SOLAR PANEL | |
|---|---|
| Brand | ZNshine Solar |
| Model | ZXM7-SHLDD-144-550 |
| Power | 550 Wp - Bifacial |
| Dimensions (W x L x D) | 1134 x 2278 x 30 mm |
| **INVERTER** | |
| Brand | SMA |
| Model | Sunny Highpower SHP125-US-20-PEAK3 |
| Power | 125 kW |
| Output Voltage | 480 V |
| **LV Cables (INV - TR)** | |
| Model | EXZHELLENT COMPACT 1000V Prysmian |
| Type | 0,6/1,1kV Cu 3x2/0AWG XLPE |
| Section | 2/0 AWG |
| Rate Current | 167 A |
| R | 0,16 ohm/km |
| V/A km | 0.34 |
| **MV Cables (TR - SW)** | |
| Type(3) | 12.5 kV Al 3x1x250MCM XLPE |
| Section(3) | 250 MCM |
| Rate Current MVS 1\|2\|3 | 120\|240\|360 A |
| R | 0,568 ohm/km |
| X | 0,194 ohm/km |
| B | 0,136 mF/km |
| Length MV 1\|2\|3 | 267\|596\|950 ft |
| **COMPONENTS** | |
| Total Inverters | 62 |
| Total Trackers 1V54 | 302 |
| Total Modules | 16308 |

NOTES:
1. Tracker configuration is 1 portrait by 54 modules length
2. MV underground cable gauge TBD
3. Dimensions shown are approximate and may change based on final equipment selections
4. TBD if outdoor or indoor solution

REVISIONS

PCR

| | |
|---|---|
| Project | LONE TREE |
| Location | JOHNSON, IOWA, USA |
| Owner | PCR INVESTMENTS SPS LLC |
| Title | SITE PLAN |
| Utility | CIPCO |
| File | Site Plan Lone Tree.dwg |

N

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

| | |
|---|---|
| Project Manager: JMS | Project No. 06227049 |
| Drawn by: JMS | Scale: AS SHOWN |
| Checked by: DM | File Name: Exhibits |
| Approved by: DM | Date: Sep. 2022 |

Terracon

2640 12th St SW
Cedar Rapids, IA 52404-3440

Site Plan

PCR
**Lone Tree**
**Johnson County, Iowa, Parcel ID: 1801476001**

Exhibit
4

# APPENDIX B
## Inspection Forms

# INSPECTION AND MONITORING RECORDS
# AND SELF-INSPECTION RECORDS

| **Project Name** | |
|---|---|

**PART 1A: Rainfall Data**

| | **Rain Amount (inches)**<br>**Daily Rainfall Required. If no rain, indicate with a "zero"** |
|---|---|
| **M** | |
| **T** | |
| **W** | |
| **Th** | |
| **F** | |
| **Sat (Inspection Optional)** | |
| **Sun (Inspection Optional)** | |

**PART 1B: Phase(s) of the Plan**

| **Check ALL applicable box(es) that apply to completed & current phases** | **X** |
|---|---|
| Initial installation of erosion and sediment control measures | |
| Clearing and grubbing of existing ground cover | |
| Completion of any grading that requires ground cover | |
| Completion of all land-disturbing activity, construction or development | |
| Permanent ground cover sufficient to restrain erosion has been established | |

| | |
|---|---|
| **Are there any site or project conditions that limit completion of inspection?**<br>If yes, explain conditions and areas of site that were inaccessible. | |

**PART 2: STORMWATER PLANS AND CONTROLS:** For each question below, mark the corresponding box as Yes, No or N/A. For all items marked "No", note in Part 3A the Reference letter and provide the Corrective Action and location of the deficiency, the original date noted, and the date it was noted as being corrected. NOTE: Reference letters may be used multiple times.

| Reference | Part 2A: Stormwater Pollutant Controls | Yes | No | N/A |
|---|---|---|---|---|
| C | Are erosion and sediment controls that are shown on the approved plan installed and operating properly with no repairs needed? | | | |
| D | Are stormwater controls that are shown on the approved plan installed and operating properly with no repairs needed? | | | |
| E | Vehicle Tracking: Are construction entrances operating properly with no repairs needed? | | | |
| F | Soil Stabilization: Are areas of the site where construction activities have ceased been properly stabilized within the required timeframes? | | | |
| G | Are earthen stockpiles stabilized or otherwise protected from sediment loss, and located at least 50 feet away or downhill from drain inlets and surface waters? | | | |
| **Reference** | **Part 2B: Non-Storm Water Pollutant Controls** | **Yes** | **No** | **N/A** |
| H | Concrete, stucco, paint, etc. washouts: Are washouts installed, properly located, posted and operating with no repairs needed? | | | |
| I | Solid & hazardous wastes: Are trash, debris, and hazardous materials properly managed? | | | |
| J | Sanitary waste: Are portable toilets properly located and operating with no visible repairs needed? | | | |
| K | Equipment and stored fluids: Are fuels, lubricants, hydraulic fluids, etc. contained so as not to enter surface and ground waters? | | | |

For any items listed in the section below, a full description of sedimentation is required in Part 3A. This includes, but may not be limited to: location, estimated amount of sediment that has left the site and/or entered waters, apparent causes of the sediment loss, and what corrective actions need to be taken to prevent this from recurring.

| Reference | Part 2C: Sedimentation | Yes | No | N/A |
|---|---|---|---|---|
| L | Are sediment or other pollutants noted beyond the approved or permitted limits of disturbance? | | | |
| M | Are BMPs detected as releasing sediment or other pollutants into receiving waters? | | | |

**PART 3A: EROSION AND SEDIMENTATION CONTROL MEASURES:** Measures **should** be inspected at least ONCE PER 7 CALENDAR DAYS AND WITHIN 24 HOURS OF A RAINFALL EVENT EQUAL TO OR GREATER THAN 1.0 INCH PER 24 HOUR PERIOD. *Add rows as needed.*

| **Erosion and Sedimentation Control Measures Inspected** | | | **Inspection Date** | **Describe Actions Needed**<br>**Corrective actions should be performed as soon as possible and before the next storm event** | **Date Previous Action(s) Observed as Corrected** |
|---|---|---|---|---|---|
| Measure ID **or** Location and Description | Reference(s) | Operating Properly? (Y/N) | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **Report unanticipated bypasses, or non-compliance conditions that may endanger health or the environment, to the appropriate DEQ Regional Office via phone call or email within 24 hours of discovery.** | | | | | |

**PART 3C: GROUND STABILIZATION**: Must be recorded, at a minimum, after each phase. *Add rows as needed.*

| Site area description and location where construction activities have temporarily or permanently ceased | Time Limit for Ground Cover (see table below) | Have stabilization measures been installed? (Y/N) | Temporary or Permanent Stabilization (T/P) | Is Ground Cover Sufficient to Restrain Erosion? (Y/N) | **Original Inspection Date** | **Describe Actions Needed**<br>**Corrective actions should be performed as soon as possible and before the next storm event** | **Date Previous Action(s) Observed as Corrected** |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| **GROUND STABILIZATION TIMEFRAMES (RECOMMENDED)** | | |
|---|---|---|
| **Site Area Description** | **Stabilization** | **Timeframe Variations** |
| Perimeter dikes, swales and slopes | 7 Days | None |
| High Quality Water (HQW) Zones | 7 Days | None |
| Slopes Steeper than 3:1 | 7 Days | 7 days for perimeter dikes, swales, slopes and HWQ zones<br>14 days for slopes 10 ft or less in length and not steeper than 2:1 |
| Slopes 3:1 to 4:1 | 14 Days | 7 days for perimeter dikes, swales, slopes and HWQ zones<br>7 days for slopes greater than 50 ft in length |
| All other areas with slopes flatter than 4:1 | 14 Days | 7 days for perimeter dikes, swales, slopes and HWQ zones |

**PART 3D: NEW OR REVISED MEASURES:** Erosion and sedimentation control measures omitted or installed, at a minimum since the last inspection, shall be documented here or by initialing and dating each measure or practice shown on a copy of the approved erosion and sedimentation control plan. Alterations and relocations of measures shall also be documented if they significantly deviate from the approved plan. The removal of measures should also be documented. List dimensions of measures such as Sediment Basins and Dissipator Pads. Add rows as needed. Corrective actions should be included in Part 3A.

| Measure ID **or** Location and Description | Proposed Dimensions (ft.) | Actual Dimensions (ft.) | Significant Deviation* from Plan? (Y/N) | Date measure observed as installed, altered, relocated or removed | Installed (I) Altered (A) Relocated (R) Removed (X) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

*Significant deviation means any omission, alteration or relocation of an erosion or sedimentation control measure that prevents it from performing as intended.

**PART 4: Signature of Inspector**

| **Financially Responsible Party (FRP) / Permittee** | | | | **County** | |
|---|---|---|---|---|---|
| **INSPECTOR** | | Name | Employer | | |
| **Inspector Type (Mark)** | **X** | Address | | | |
| **FRP/Permittee** | | | | | |
| **Agent/Designee** | | Phone Number | Email Address | | |

| **By this signature, I certify that this report is accurate and complete to the best of my knowledge.** | |
|---|---|
| Financially Responsible Party / Permittee or Agent / Designee | Date & Time of Inspection |