**Agricultural Impact Mitigation Plan**

Lone Tree Substation Solar Project

Johnson County, Iowa

Stantec Project #:193709077

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**AGRICULTURAL IMPACT MITIGATION PLAN**

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# Abbreviations

| | |
|---|---|
| AC | Alternating current |
| AIMP | Agricultural Impact Mitigation Plan |
| BMP | best management practices |
| CIPCO | Central Iowa Power Cooperative |
| DC | direct current |
| EPC | engineering, procurement, and construction contractor |
| GIS | Geographic Information System |
| IADNR | 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 |
| O&M | Operation and Maintenance |
| 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 |
| SWMP | Stormwater Management Plan |
| VMP | Vegetation Management Plan |

# 1.0 PURPOSE AND APLLICABILITY 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 50.1-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 (IADNR) 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 IADNR 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 an 8.03-Megawatt (MW) alternating current ("AC") solar power generating facility sited on approximately 50.11-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 8.03 MW AC (11.38 MW DC). The Project PV modules will be mounted on approximately 366 single-axis, galvanized steel, horizontal tracker mounting systems supported by over 4,758 steel piles. The current design consists of 2 power blocks. The number of single axis trackers varies per block but is anticipated to be approximately 2,379. Each power block includes 33 inverters and is connected to approximately 10,248 PV modules. The dimensions of the single axis trackers are approximately 1,223 feet wide (east-west) and up to 1,582 feet long (north-south). 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 34.5 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 0.28 miles (1,474.2 feet). This includes 0.24 mile (1,298 feet) of AC collection lines within the PV array connecting to the medium voltage (MV) power stations, Switchgear Room and a 175 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 1.34 miles (7,126 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 Marion Road is expected to be approximately 5 feet in total length and is approximately 12-feet wide.

### 2.1.4 O&M Room, Switchgear Room and MV Power Stations

The Project will use driven pier foundations and concrete foundations. The skids for the Switchgear Room and MV Power Stations 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, two MV Power Stations approximately13 feet by 25 feet in size, and one Operation and Maintenance Room approximately 13 feet by 46 feet in size.

### 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 to eight-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 Stormwater Management Plan (SWMP) that will be 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 Stormwater Management 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 Stormwater Management Plan and IDNR requirements.
- Connect Project Switchgear Room 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 9 months, which includes mobilization, construction/installation, and commissioning/testing to achieve the targeted commercial operations date December 31, 2023.

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 Switchgear Room, MV power station, and O&M room; 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, much of the Project Area consists of active agriculture under row crop production. The dominant vegetation within the non-agricultural upland areas are comprised of grassland areas along the perimeter and between agricultural fields and isolated woodland areas. Upland woodlands located within the Project Area are comprised of relatively small, isolated woodlots and perimeter areas within the agricultural landscape.

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 will include the limit of tree clearing, the limit of stump grubbing and in areas where no clearing is required the limit of soil disturbance. Clearing and grubbing will not be conducted within wetlands unless authorized by permit from the IDNR and U.S. Army Corps of Engineers. Woody vegetation (trees, shrubs, etc.) removal will be conducted as described in the Project VMP.

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 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.

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 Stormwater Management 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 public roadways, wetlands, and waterways if crossed as described in Section 4.7.

### 2.2.6 MV Power Station and Switchgear Room

The MV Power Stations and Switchgear Room will be placed on footers with gravel pad foundations that will be designed to specifications necessary to meet the local geotechnical conditions. Each MV power station or Switchgear Room 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 s MV power station/ switchgear to facilitate through-floor cable connections. After the collection system is installed and foundations are poured, the MV power station/switchgear units will be installed into position. MV power station/ switchgear 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 MV power station/switchgear unit. After the MV power station/switchgear unit is properly set and anchored, the Contractor will connect the collection cabling previously installed in the adjacent trenches to the MV power station/switchgear unit.

### 2.2.7 Project Security Fencing

Array fencing will consist of seven to eight-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 Room
- MV Power Station
- Operation and Maintenance Room

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 50.11-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 (49.21 acres, 98.2 percent) are in the coarse loamy family (i.e. sandy loam, loam, and silt loam, indicating fine textured soils dominated by soil particles in the fine sand fraction (particle sizes between 0.25 and 0.1 mm in diameter).

Slope affects constructability, water erosion, revegetation, compaction and rutting, among other properties. Approximately 50.05-acres, (99.7 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 (0.06-acres, 0.03 percent) have representative slopes in the >5 to 8 percent class. No soils within the Project Area have representative slopes in excess of 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 37.04-acres (73.9 percent) of the soils within the Project Area are either somewhat poorly drained, poorly drained, or very poorly drained, indicating wet, clayey soils with very low infiltration rates. The remaining 13.07-acres (26.1 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, MV Stations, The Switchgear Room and the O&M Room. Most of the soils within the Project Area are Alfisols and are characterized by moderately leached soils that have relatively high native fertility (47.99 acres, 98.3 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 Family[2] | Slope Range[3] | | Drainage Class[4] | | | | Topsoil Thickness[5] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Coarse Loamy | 0-5 | >5-8 | W | SP | P | VP | >6-12 | >12-18 |
| | Acres | | | | | | | | | |
| Solar Array Area | 34.81 | 34.81 | 34.80 | <0.01 | 9.11 | 8.40 | 5.56 | 11.73 | 26.41 | 8.40 |
| Access Roads | 1.89 | 1.89 | 1.86 | 0.02 | 0.59 | 0.35 | 0.27 | 0.67 | 1.42 | 0.47 |
| Collection Line | 0.03 | 0.03 | 0.03 | 0 | <0.01 | <0.01 | <0.01 | <0.01 | 0 | 0.03 |
| MV Power Stations | 0.02 | 0.02 | 0.01 | 0 | <0.01 | 0 | 0 | <0.01 | 0.02 | 0 |
| Switchgear Room | 0.01 | 0.01 | 0.01 | 0 | 0.01 | 0 | 0 | 0 | 0.01 | 0 |
| O&M Room | 0.01 | 0.01 | 0.01 | 0 | 0.01 | 0 | 0 | 0 | 0.01 | 0 |
| Perimeter Area Outside the Solar Array Area | 13.14 | 13.14 | 13.10 | 0.03 | 3.32 | 3.15 | 0.42 | 6.23 | 4.51 | 8.63 |
| Generator Tie Line | 0.19 | 0.19 | 0.20 | 0 | 0 | 0 | 0.19 | 0 | 0.20 | 0 |
| **Total** | **50.11** | **50.11** | **50.05** | **0.06** | **13.08** | **11.91** | **6.47** | **18.65** | **32.58** | **17.53** |

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; "P" Poorly drained; "SP" Somewhat poorly drained. No soils within the Project Area are Very 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 are broken down by acreage with the 50.11-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. 24.93-acres, (49.75 percent) of the soils in the Project Area are classified as Prime Farmland.

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. 0.06-acres (0.12 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 20.26-acres (40.4 percent) are in LCC 3e and have severe limitations due to parent material and susceptibility to wind erosion.

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 (24.99acres, 49.88 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 | | | | | | | | |
| Solar Array Area | 34.81 | 17.51 | <0.01 | 0 | 0 | 0 | 14.56 | 20.26 | 17.30 |
| Access Roads | 1.89 | 0.92 | 0.02 | 1.62 | 0 | 0.27 | 0 | 0 | 0.95 |
| Collection Line | 0.03 | 0.02 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0.01 |
| MV Power Stations | 0.02 | 0.01 | 0 | 0 | 0 | 0.02 | 0 | 0 | <0.01 |
| Switchgear Room | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 |
| O&M Room | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 |
| Perimeter Area Outside the Solar Array Area | 13.14 | 6.45 | 0.03 | 0 | 8.61 | 4.53 | 0 | 0 | 6.65 |
| Generator Tie Line | 0.19 | 0.19 | 0 | 0 | 0 | 0.19 | 0 | 0 | 0.19 |
| **Total** | **50.11** | **25.12** | **0.05** | **1.62** | **8.61** | **5.04** | **14.58** | **20.26** | **25.10** |

[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 a NRCS rating of high for the NRCS Soil Erodibility Factor (Kw). 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. 48.73 acres (97.24 percent) of the project area contains soil moderate Kw, with 0.90 acres (1.80 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. 50.11-acres, (100 percent) of wet soils may have issues with rutting.

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. Only 0.9-acres (0.01 percent) of the soils within the Project Area are moderately susceptible to drought. 49.21-acres (99.9 percent) of the soils within the Project Area are either slightly or somewhat susceptible to drought.

Two basic methods are used to hold solar array systems to the ground, based on site conditions and cost. One method employs driven piles, screw augers, or concrete piers that penetrate into the soil to provide a stable foundation. The ease of installation and general site suitability of soil-penetrating anchoring systems depends on soil characteristics such as rock fragment content, soil depth, soil strength, soil corrosivity, shrink-swell tendencies, and drainage. The other basic anchoring system utilizes precast ballasted footings or ballasted trays on the soil surface to make the arrays too heavy to move. The site considerations that impact both basic systems are slope, slope aspect, wind speed, land surface shape, flooding, and ponding. Soil-penetrating anchoring systems can be used where the soil conditions are not limited. 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.

For Ground-based Solar Panel Arrays, soils are placed into interpretive rating classes of not limited, somewhat limited, or very limited. 50.11-acres, (100 percent) of the soils within the Project Area are very limited.

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## 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 | | | | | | | | | |
| Solar Array Area | 34.81 | 34.81 | 0 | 34.81 | 0 | 34.81 | 34.81 | 25.70 | 9.11 | 0 |
| Access Roads | 1.89 | 1.89 | 0 | 1.89 | 0 | 1.89 | 1.89 | 1.29 | 0.59 | 0 |
| Collection Line | 0.03 | 0.03 | 0 | 0.03 | 0 | 0.03 | 0.03 | 0.02 | 0.01 | 0 |
| MV Power Stations | 0.02 | 0.02 | 0 | 0.02 | 0 | 0.02 | 0.02 | 0.01 | 0.01 | 0 |
| Switchgear Room | 0.01 | 0.01 | 0 | 0.01 | 0 | 0.01 | 0.01 | 0 | 0.01 | 0 |
| O&M Room | 0.01 | 0.01 | 0 | 0.01 | 0 | 0.01 | 0.01 | 0 | 0.01 | 0 |
| Perimeter Area Outside the Solar Array Area | 13.14 | 11.77 | 0 | 13.14 | 0.9 | 12.24 | 13.14 | 9.81 | 2.42 | 0.9 |
| Generator Tie | 0.19 | 0.19 | 0 | 0.19 | 0 | 0.19 | 0.19 | 0.19 | 0 | 0 |
| **Total** | **50.11** | **48.73** | **0** | **50.11** | **0.9** | **49.21** | **50.11** | **37.04** | **12.17** | **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). 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 coarse-loamy composition in the Project Area's soils. Coarse soils have 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 SWPPP. 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 3e, suggesting severe limitations to land use and conservation practices and an added susceptibility to erosion, 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.

# 4.0 BMPS DURING CONSTRUCTION AND OPERATION

The Project will be constructed and operated on property owned 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 Wapsipinicon River in northeastern Iowa. 24.93-acres, (49.7 percent) of the farmland within the Project Area is considered prime farmland and 0.06-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 MV power station, Switchgear Room, and O&M room. 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 activites 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 SWPPP compliance.

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. Upon request from the landowner, PCR Investments will measure topsoil depth at selected locations before and after construction.

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, without the written consent of the landowner.

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 Switchgear Room, MV Power Stations, and O&M Room 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. It is estimated that micro-grading or site leveling will occur on roughly 40-60 acres at one time, with the use of construction blocks, minimizing the acreage of exposed soils at any given time, to the extent practicable. 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 Stormwater Management 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 and 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 Switchgear Room, MV Power Stations, and O&M Room 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 public roadways, wetlands, and waterways if crossed. Bore pits will be setback at least 10 feet from wetland boundaries or ordinary highwater mark of waterways. 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 feature 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 CONSTRUCTION MAT SEQUENCE AND TIMING

Construction mats may be used to reduce impacts to farmed wetlands. The use of the construction mats in farmed wetlands will be determined by an examination of site-specific soil stability and moisture content at the time of construction. If this examination determines that there is a potential for rutting, then construction mats will be placed prior to construction activities to prevent rutting. Low ground pressure tracked equipment, or work during frozen soil conditions may be used to minimize surficial wetland impacts, in lieu of construction mats.

### 4.9.1 Construction Mat Installation and Maintenance

The following practices will be used to minimize impacts to farmed wetland areas during installation and use of construction mats.

- Mats should be in good condition to ensure proper installation, use and removal.
- Construction mats shall not be dragged into position in wetlands.
- Woody vegetation (trees, shrubs, etc.) should be cut at or above ground level and not uprooted in order to prevent disruption to the wetland soil structure and to allow stump sprouts to revegetate the work area.
- Where feasible, mats shall be placed in a location that would minimize the amount needed for the wetlands crossing.
- Erosion and sediment controls shall be installed at approaches to mats to promote a smooth transition to, and minimize sediment tracking onto mats.
- In most cases, construction mats should be placed along the travel area so that the individual boards are resting perpendicular to the direction of traffic. No gaps should exist between mats. Mats should be placed far enough on the entrance and exit of the resource area to rest on non-wetland soils.
- Standard construction mat BMP details shall be provided to work crews.

- Mats shall be monitored to assure correct functioning of the mats. Mats shall be inspected during use for any defects or structural problems.
- Mats which become covered with soils or construction debris should be cleaned and the materials removed and disposed of in an upland location. The material should not be scraped and shoveled into the resource area. Mats which become imbedded shall be reset or layered to prevent mud from covering them or water passing over them.
- Operating heavy equipment in wetlands shall be minimized, and equipment shall not be stored, maintained, fueled, or repaired in wetlands unless the equipment is broken down and cannot be easily removed.
- An adequate supply of spill containment equipment shall be maintained on site.

### 4.9.2 Construction Mat Removal

The following practices will be used to minimize impacts to wetland areas during removal of construction mats.

- Restoration within wetland areas will include removal of all construction mats and construction-related materials.
- Matting should be removed by "backing" out of the site, removing mats one at a time.
- Mats should be cleaned before transport to another wetland location to remove soil and any invasive plant species seed stock or plant material.
- Cleaning methods may include but are not limited to shaking or dropping mats in a controlled manner with a piece of machinery to knock off attached soil and debris, spraying with water or air, and sweeping.

### 4.9.3 Construction Mat Area Specific Monitoring And Restoration

Matted wetlands will be inspected after mat removal to document site conditions and then regularly, as necessary. Proposed restoration objectives, along with remedial restoration options, are outlined below.

- Once construction mats are removed, the matted area will be restored to pre-existing topography. Areas with ground surface disturbance in wetlands will be repaired using hand tools, back dragging, or other appropriate means to restore topography while minimizing additional disturbance or soil compaction.
- If soil compaction is observed in farmed wetlands, soils may be disked to alleviate compaction. Care will be taken prevent negatively affecting the soil bearing strength and natural channels in the soil such that the soil becomes recompacted.
- Erosion controls will be maintained, and bare soils stabilized to be compliant with the Project's SWMP. A temporary cover crop may be installed over disturbed soils following ground disturbance as described above.
- Farmed wetlands will be seeded as described above
- Wetlands will be monitored to document revegetation success and community composition. Sites will be revisited regularly to note vegetative cover response. Corrective actions described in the VMP and reseeding if necessary, shall be

conducted to control negative influences that may deter the establishment of permanent planned vegetation.

## 4.10 TEMPORARY EROSION AND SEDIMENT CONTROL

PCR Investments will prevent excessive soil erosion on lands disturbed by construction by adhering to a SWPPP required under the NPDES permitting requirement that will be administered by the IADNR. Prior to construction, the Project's Engineer of Record will outline the reasonable methods for erosion control and prepare the SWPPP.

These measures would primarily include silt fencing on the downside of all hills and near waterways. 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 SWPPP will designate onsite SWPPP inspectors to be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the SWPPP. The SWPPP 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 SWPPP plans will be submitted to the IADNR prior to construction start and designated onsite SWPPP inspectors will be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the SWPPP.

## 4.11 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.

## 4.12 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. Additionally, any equipment working below the OHWM of waterways will be cleaned using the appropriate BMPs before moving to another location to work below the OHWM.

Project Plan details can be found in the project specific Vegetation Management Plan developed for the Project.

# 7.0 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.

## 7.1 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

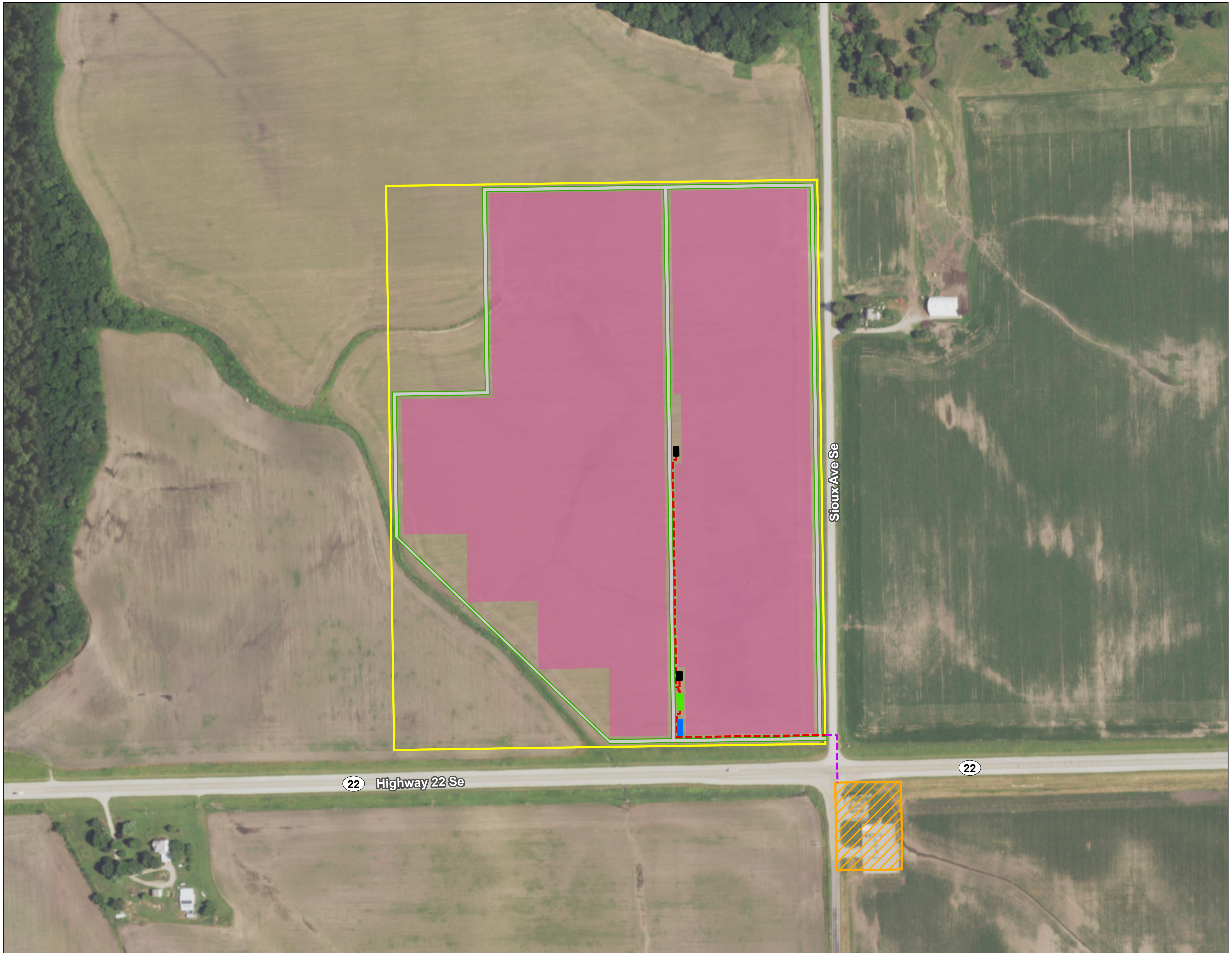



*Figure No.*
**1**

*Title*
## Project Location

*Client/Project* 193709077
PCR Investments LLC
Lone Tree Substation Solar Project

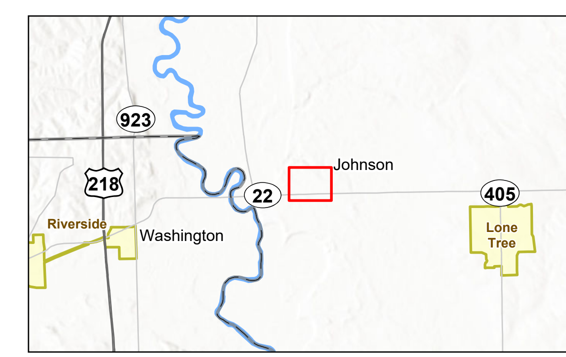
*Project Location*
Township of Freemont
Johnson County, IA

Prepared by JDS on 2022-08-03
TR by MZ on 2022-08-04
IR by XXX on 2022-XX-XX

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
- O&M Room
- MV Power Station
- Switchgear Room
- 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 2019

Stantec



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

United States Department of Agriculture

NRCS

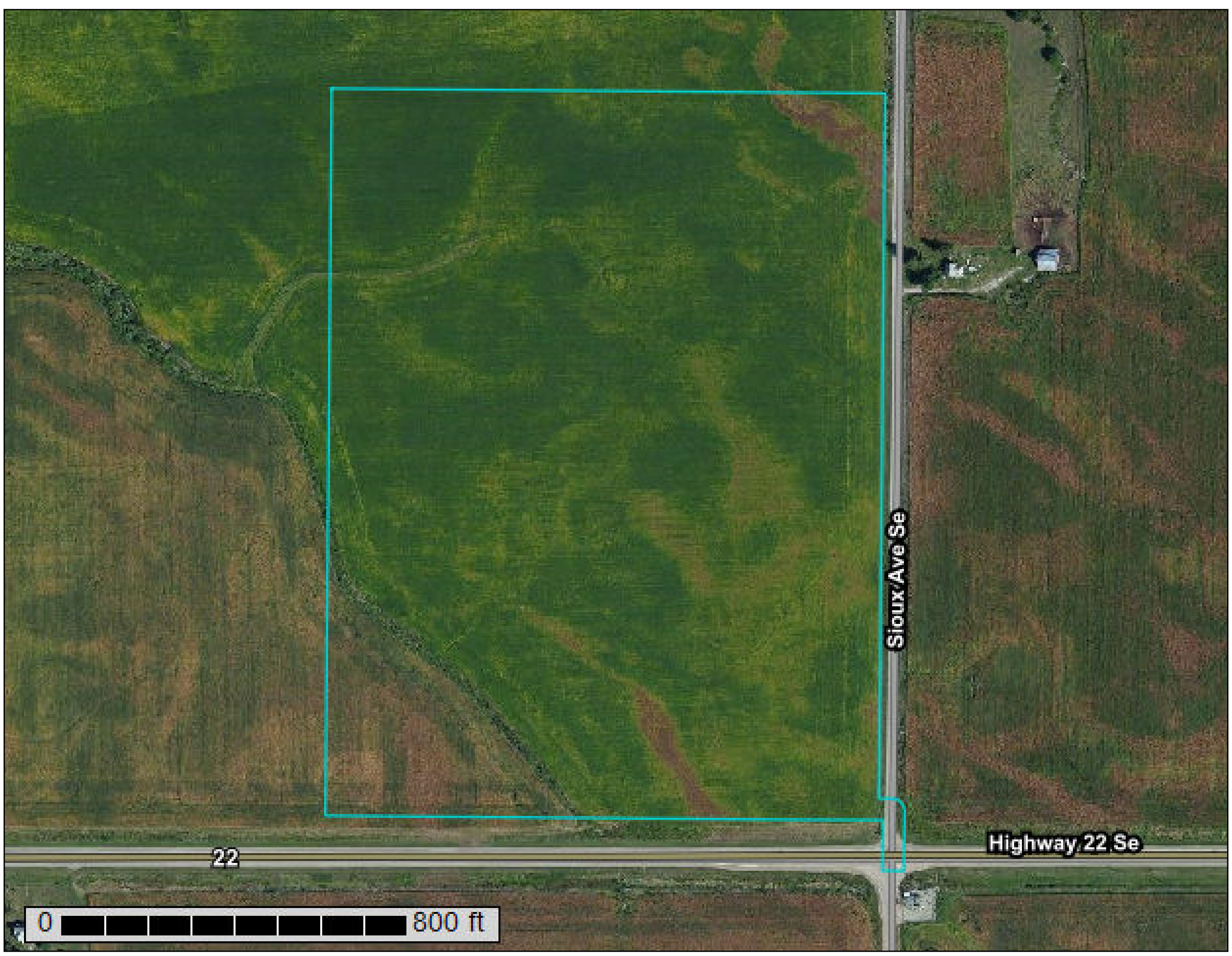
Natural Resources Conservation Service

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




July 14, 2022

# 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.

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# 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.

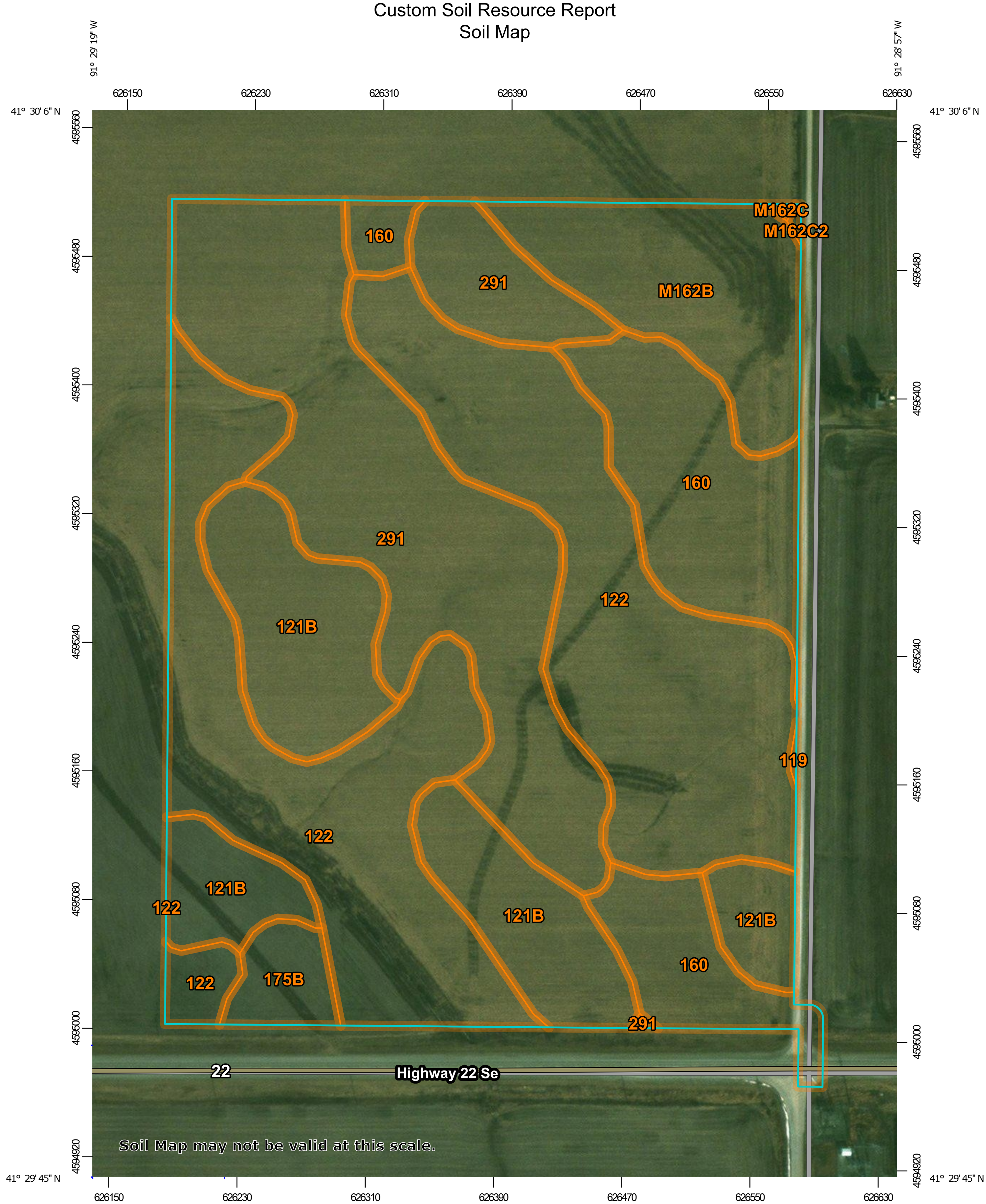
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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: 1:3,230 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 45, 90, 180, 270

Feet: 0, 150, 300, 600, 900

N

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 24, Sep 14, 2021

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

Date(s) aerial images were photographed: Apr 18, 2010—Feb 9, 2017

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 | 15.9% |
| 122 | Sperry silt loam, depressional, 0 to 1 percent slopes | 18.7 | 37.2% |
| 160 | Walford silt loam, 0 to 2 percent slopes | 6.5 | 13.0% |
| 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 | 23.7% |
| M162B | Downs silt loam, till plain, 2 to 5 percent slopes | 4.1 | 8.2% |
| 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** | | **50.1** | **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:* R108CY516IA - 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:* R108CY516IA - 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:* R108CY503IA - 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:* R108CY516IA - 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:* R108CY515IA - 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:* R108CY516IA - 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:* R108CY516IA - 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:* R108CY517IA - 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:* R108CY515IA - 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:* R108CY506IA - 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:* R108CY506IA - 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:* R108CY517IA - 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:* R108CY517IA - 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:* R108CY504IA - 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:* R108CY504IA - 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:* R108CY517IA - 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:* R108CY504IA - 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:* R108CY504IA - 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:* R108CY504IA - 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:* R108CY504IA - 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:* R108CY504IA - Loess Upland Savanna
*Hydric soil rating:* No