

Appendix E

Closure Plan

Omaha Public Power District
North Omaha Generating Station
Ash Disposal Area

September 2019





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Attachments

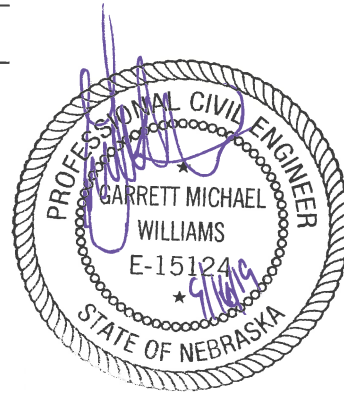
Attachment E-1 NRCS Web Soil Survey

Professional Engineer Certification

"I hereby certify that this Closure Plan for the North Omaha Ash Disposal Area at the Omaha Public Power District North Omaha Generating Station meets the requirements of the Coal Combustion Residual Rule 40 CFR 257.102(b). I am a duly licensed independent Professional Engineer under the laws of the State of Nebraska."

Print Name: Garrett Williams
Signature: 
Date: 9/16/19
License #: E-15124

My license renewal date is December 31st 2020.





1 Site Identification

1.1 Introduction

On April 17, 2015 the U.S. Environmental Protection Agency (EPA) published the final rule for the regulation and management of coal combustion residuals (CCR) under the Resource Conservation and Recovery Act (RCRA). The rule – effective on October 19, 2015 – applies to electric utilities and independent power producers that fall within NAICS code 221112, and the facility produces or stores CCR materials in impoundments or landfills. This regulation applies to Omaha Public Power District's (OPPD's) North Omaha Generating Station.

OPPD has a five-unit fossil fuel-fired generating plant at the North Omaha Power Station. Units #1-3 were converted to burn natural gas in 2016. Units #4-5 continue to burn coal. This Station has an existing landfill permitted under NDEE Title 132 regulations for fossil fuel combustion ash disposal areas. The North Omaha Station Ash Disposal Area is permitted will continue to receive CCR for disposal both before and after October 19, 2015.

This Closure Plan, prepared in accordance with Nebraska Department of Environment and Energy (NDEE) Title 132, Chapter 4 and updated to comply with the federal CCR rule requirements, provides a description of the final cover system, closure activities, schedules, and features incorporated into the closure of the North Omaha Ash Disposal Area. This Closure Plan must be amended whenever there is a change in the operation of the CCR landfill that would substantially affect the written closure plan or before or after closure activities have commenced, unanticipated events necessitate a revision of the written closure plan. OPPD will not implement modifications to the design or operations of the North Omaha Ash Disposal Area that would result in modifications to this Closure Plan without prior approval from NDEE.

1.2 Facility Identification

Facility:	North Omaha Ash Disposal Area
NDEE Permit No.:	NE0054739
Owner Contact Address:	Omaha Public Power District Environmental and Regulatory Affairs 444 South 16 th Street Omaha, Nebraska 68102-2247

1.3 Legal Description

Station property covers NW 1/4 and SW 1/4 of Section 27 and portions of Section 28, Township 16 North, Range 13 East of the 6th Principal Meridian, Douglas County, Nebraska, containing approximately 120 acres more or less. The general legal description of the ash disposal area is as follows:



“A tract of land located in the east ½ of Section 28, Township 16 North, Range 13 East, Douglas County, Nebraska.”

The North Omaha Ash Disposal Area is approximately 23.8 acres with approximately 13.2 acres used for current ash disposal operations, approximately 4.5 acres formerly closed under pre-Subtitle D regulations, approximately 4.2 acres closed in 2017, and approximately 1.94 acres permitted undeveloped area for ash disposal. The Station property is approximately 3.5 miles northwest of Eppley Airfield, along the west shore of the Missouri River at River Mile 625.2.

1.4 Maximum Inventory

A fossil fuel ash disposal area has been operating on the Station property since the 1950s. The active ash disposal area, composed of both the active (17.9 acres) and the formerly closed (4.5 acres) is identified by the ash disposal limit shown on Permit Drawing 2B (Permit – Appendix F). The largest area requiring final cover at any one time over the active life of the North Omaha Ash Landfill is 13.2 acres. Permit drawing 2A is the most recent topographic survey and shows the property/easement lines, closed ash disposal area, active disposal area operations, undeveloped landfill area, and site conditions.

As of the August 15, 2019 topographic survey, approximately 843,600 cubic yards of air space remains based on the final design contours (Appendix I), which includes ash disposal, and final cover vegetative soil layers. The resultant remaining air space available for ash disposal is approximately 796,800 cubic yards. This total permitted volume may not be fully utilized depending upon ash and ash byproducts generation and OPPD’s timing of discontinuing combustion of coal at the North Omaha Station. The North Omaha Ash Disposal Area total life expectancy is projected to be at least five years to the year 2025. Site life calculations and phasing are contained in the Operational Plan (Permit – Appendix A).

Since records of ash disposed and ash sales did not begin until year 1981, the maximum inventory of ash on the Station site can only be estimated based on amount of coal burned, approximate ash content, and available ash use records. The maximum inventory of ash ever to be on-site is estimated to be 1,770,000 tons or 1,360,200 in-place cubic yards, assuming the North Omaha Station ceases coal combustion in 2024. Table 1 summarizes the calculations for this estimate.



Table 1 - Estimate of Maximum Inventory of Ash On-Site

YEARS	COAL BURNED (TONS)	ASH GENERATED (TONS)	ASH STORAGE, SALES & OFFSITE USE (TONS)	ASH DISPOSAL ON STATION SITE (TONS)	ASH DISPOSAL ON STATION SITE ¹² (CY)
HISTORIC ASH DATA & ESTIMATE					
1954 THRU 1969 ¹	3,786,000	416,000	0	416,000	320,000
1970 THRU 1975 ^{2,3}	4,454,000	334,000	0	334,000	257,000
1976 THRU 1980 ^{2,4,5}	6,263,000	501,000	251,000	250,000	192,000
1981 THRU 1989 ^{6,7}	8,580,000	515,000	311,000	204,000	157,000
1990 THRU 1999 ^{7,8,9}	17,335,000	898,000	645,000	253,000	195,000
2000 THRU 2009 ^{7,8}	20,859,000	1,133,000	1,009,000	124,000	95,000
2010 THRU 2014 ^{7,8}	10,903,000	542,000	445,000	97,000	75,000
2015 THRU 2019 ^{7,8,10,13}	6,269,000	327,000	246,000	81,000	56,000
ASH PROJECTIONS					
2019 THRU 2030 ¹¹	6,914,000	364,000	272,000	92,000	69,200
ESTIMATE OF MAXIMUM INVENTORY OF ASH ON-SITE				1,770,000 Tons	1,360,200 CY

Notes & Assumptions:

*All ash quantities rounded to the nearest thousand.

- 1 North Omaha Station burned bituminous Kansas coal from 1954 to 1969 with an approximate ash content of 12%. An estimated 11% of the coal was collected as ash and 100% of this collected ash was disposed of on site.
- 2 North Omaha Station burned Hanna Basin, Wyoming coal from 1970 to 1985 with an approximate ash content of 8%.
- 3 From 1970 to 1975, estimated 7.5% of the coal was collected as ash and 100% of this ash was disposed of on site.
- 4 Off site use of the fly ash from the North Omaha Station started in 1976. This coincides with the installation of a new precipitator and the contract with Nebraska Ash Company.
- 5 From 1976 to 1980, estimated 8% of the coal was collected as ash due to a new precipitator and assumed 50% of this ash was disposed of on site.
- 6 Records of average ash percentage content, off-site ash use and sale quantities began in 1981. From 1981 to 1985, both Hanna Basin and Powder River Basin (PRB) coal were burned with Hanna Basin coal slowly being phased out.
- 7 North Omaha Station burned PRB coal from 1986 to 2019.
- 8 From 1993 to 2019, some fly ash is stored in the on-site ash storage building prior to future sales.
- 9 In 1993, 21,100 tons of fly ash was reclaimed from the landfill and taken off-site.
- 10 Coal burned listed in the period from 2015 through 2019 includes actual coal burn through December 2018, plus an estimated coal burn for Jan-July of 2019. The amount of ash that was generated is based on the actual average monthly ash percentage.
- 11 Ash projections from Table 4-2 in Operations Plan (Permit - Appendix A) start September 2019 through calculated site life. Ash generated includes estimated ash byproducts from future air pollution controls.
- 12 Cubic yards based on average fly ash density of 86.6 lbs per cubic foot through 2014, ash density of 96 lbs per cubic foot for 2015-2019 as a calculated value, and in-place compaction to 90% for historic and 97% for projections.
- 13 Units 1-3 removed from service in 2016 and converted to natural gas; 2 coal-fired units remaining



1.5 Largest Area Requiring Final Cover

The Phase 1 and 2 Side Slope Closure project in 2015 installed final cover over approximately 4.2 acres of the North Omaha Ash Disposal Area. Therefore, the largest area requiring final cover is approximately 13.2 acres, which is 23.84 acres, less areas that have received final cover (8.7 acres), less undeveloped areas (1.94 acres).

1.6 Site Life

The remaining life of the North Omaha Station Ash Disposal Area was determined based on the design volume (available disposal capacity) and the projected ash generation rates determined at the time of the 2019 permit renewal. Based on recent historical data, it was assumed that 25% of ash generated at the North Omaha Station would be landfilled. The site expects to cease burning coal by 2025. OPPD plans to close the landfill at that point, which is projected to occur at the end of Phase 3. While the landfill is expected to close prematurely, OPPD is requesting permitted limits remain unchanged for this permit renewal to allow flexibility for movement of ash within permitted limits.

1.7 Notifications

The facility will be used for the disposal of fossil fuel combustion ash from the North Omaha Station and for the landfilling of any ash pond solids generated on-site. The operation of the disposal area will continue for the life of the generating station (with combustion of coal) and will be under the control of OPPD. At closure of the North Omaha Ash Disposal Area, OPPD will notify MUD and the City of Omaha that a notation on the deed will be filed against their property documenting the existence of a closed fossil fuel combustion ash disposal area.

OPPD will provide NDEE formal written notice of its intent to close the North Omaha Ash Disposal Area at least 180 days prior to date of final receipt of ash. OPPD will also provide NDEE notice of phased closure construction activities at least 30 days prior, including projected date of initiation of phased or final closure, a construction schedule, and date of installation of the final cover system. Copies of the written notice and notifications will be placed in the landfill operating record.

1.8 Schedule of Activities

Within 30 days after the closure date, the closure plan shall be implemented. Closure activities will be completed in accordance with the closure plan within 6 months after closure date, depending on timing of the construction season or an extension has been received from NDEE. OPPD will notify NDEE of the date of the initiation of final closure and the date of installation of the final cover system. The schedule is set up to satisfy Nebraska Title 132 and 40 CFR 102. The milestones for closure get updated once the closure contractor is selected. A tentative closure plan might include the following items:

1. Notification to the NDEE 180 days prior to closure in accordant with Title 132.
2. Hire a surveyor to obtain current information on the site. (1 month)



3. Hire a consultant or design engineer to identify how the plan must be modified for the current conditions and develop bid documents.(4-5 months)
4. Acquire off-site location for borrow material. (2-3 months; may become contractors responsibility)
5. Bid the project and select the contractor (3 months)
6. Notification of closure activities 30 days prior to commencing construction per Title 132
7. Notification of intent to close, including the final design certification no later than start date per the CCR rule.
8. Commence closure no later than 30 days after final ash receipt, this may be dependent on the time of year and weather conditions.
9. Establish temporary erosion controls (1 week)
10. Reshape final ash grades in preparation for cover system. (could take 2 months if ash generation volume was low in the final 180 days)
11. Install the final cover infiltration layer. (estimate 3 month)
12. Install the vegetation layer unless using an alternative closure system. (1 month)
13. Construct terraces, berms and letdown structures (1-2 months)
14. Fertilize, Plant, and mulch closure vegetation (<1 month)
15. Complete Closure. It is anticipated that the project will take longer than six months. Factors that will extend the time frame are:
 - A. Weather, as work will be limited by freezing conditions in the winter and possibly rainfall could limit working days.
 - B. The landfill may need significant reshaping. This site is projected to reach capacity in 2030, but the closure date is expected to be closer to 2023. Since the landfill is not anticipated to be full, design adjustments and profile contouring may be extensive to achieve optimal conditions.
 - C. Timing of the planting of final cover vegetation may be an issue due to growing seasons.
16. Notification of Completion of Closure with 30 days (CCR Rule)
17. Submit final CQA Report to the NDEE
18. Deed Notifications
19. Demonstration deed was correctly recorded. (Sent to NDEE, and placed in the North Omaha Ash Disposal Area records).

The post-closure plan will be implemented immediately after final closure is complete.

1.9 Final Closure Certifications and Reports

OPPD will prepare, directly or through a contract, the documentation of closure in accordance with NDEE Title 132, Chapter 4. Documentation of closure will include certification by an independent professional engineer registered in the State of Nebraska verifying that closure has been completed in accordance with this or any subsequently updated Closure Plan. Documentation of closure will also include construction quality assurance documentation for each phased closure submitted to NDEE.

Certifications required by the federal CCR rule are included with the notifications described under Section 1.7 above.

When the North Omaha Ash Disposal Area completes final closure, a survey and plat (prepared by a licensed surveyor in the State of Nebraska and meeting the minimum standards of property boundary surveys) will be submitted to NDEE. The survey plat will include the name of the property owner as it appears on the property deed, a legal description of the site, description of the CCR accepted, location of the CCR, approximate depth of fill, and location and description of groundwater management systems, which are to be maintained.

1.10 Registration on Deed

Pursuant to NDEE, within 90 days following the North Omaha Ash Disposal Area completion of installation of the final cover system for final closure, a notation will be recorded on the deed to the Station property or other instrument that is normally examined during a title search with the Otoe County Registrar of Deeds. A final plat will be filed with the Douglas County Registrar prepared by a registered land surveyor licensed in the State of Nebraska. OPPD will provide documentation of the deed notation to NDEE to show that such notation has been recorded, and a copy of this record and documentation will be placed in the operating record.

The notation on the deed will in perpetuity notify any potential purchaser of the property that:

1. A closed fossil fuel combustion ash disposal area exists on the property (the land has been used as a CCR landfill);
2. The type, depth, and location of CCR on the property is identified (as necessary) as well as the existence of any monitoring systems; and
3. Its use is restricted under the CCR rule post-closure care requirements of 40 CFR 257.104(d)(1)(iii) and may be restricted under NDEE Title 132, Chapter 4 to protect the monitoring system or any other components of the containment system.

2 Closure Plan

The purpose of this Closure Plan is to describe the steps necessary to close the North Omaha Ash Disposal Area in a manner that will properly stabilize the ash disposal area, minimize potential for adverse environmental impact, and minimize the need for corrective work. The closure of the North Omaha Ash Disposal Area involves site preparation and grading as needed, construction of the final cover system including terraces and downchute structures, and if not previously installed, construction of facilities for post-closure monitoring, maintenance, and care. OPPD plans to close the remaining disposal area in phases after areas are filled to final grades and as funds are budgeted. Phase Development Drawings are located in Attachment A-5 to the Operational Plan (Appendix A).

This Closure Plan provides a basis for estimating closure costs and ensures that funds are available to properly close the ash disposal area at any time during the operating life. Closure cost estimates are included in the Financial Assurance (Appendix G).

Installation of final cover can begin when a phase reaches final elevation. Phase 1 and 2 Side Slopes have had a 2-foot final soil cover installed in 2017 in accordance with the NDEE Title 132 regulations. Current active cells will be closed in accordance with this updated Closure Plan and the requirements of the federal CCR rule. The discussion below applies to both phased closure and final closure. Closure activities at the North Omaha Ash Disposal Area can include the following components:

- Final cover construction
- Storm water/drainage system
- Leachate management system
- Groundwater monitoring system
- Access controls
- On-site structures and roadways

The following description of activities is generally applicable to various closure alternatives (phased, premature and final).

2.1 Final Cover System Design

The final cover system design for the North Omaha Ash Disposal Area includes an infiltration layer 18 inches thick and an erosion layer 8 inches thick. The federal CCR rule requires the final cover system to meet either the requirements of 40 CFR 257.102(d)(3)(i) or the requirements of 40 CFR 257.102(d)(3)(ii). The proposed final cover design for the North Omaha Ash Disposal Area meets the requirements of 40 CFR 257.102(d)(3)(i). Under this rule, the permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less. Additionally, the final cover system must include an erosion layer that provides protection from wind or water erosion that is equivalent to the erosion protection of a minimum of six inches of earthen material capable of sustaining native plant growth. Finally, the disruption of the integrity

of the final cover system must be minimized through a design that accommodates settling and subsidence.

The closure system is designed to minimize erosion. The disposal area will be constructed with an average 2 percent top grade and a 3:1 (horizontal: vertical) maximum side slope grade. Stormwater discharge will be directed and controlled by terraces and downchutes. Terraces will be placed along the sideslopes and at the crest of the sideslopes to control erosion and direct stormwater runoff toward the downchute structures to perimeter channels for discharge into the coal pile runoff pond or off-site through a north drainage channel. Final grading and side slopes will minimize infiltration, ponding of precipitation and erosion. The proposed final grades are shown on the Final Grading Plan (Permit – Appendix I, Sheet 01C103).

OPPD will continue to evaluate the alternate cover design options allowed under the CCR rule. The landfill location in the city of Omaha makes the procurement of adequate and appropriate clay liner material and topsoil challenging. OPPD will submit any change to the final cover system design to the NDEE prior to implementing the change.

The sideslopes of the North Omaha Station Ash Disposal Area will be graded to no steeper than 3 horizontal to 1 vertical (3:1). The top surface of the disposal area will be graded and maintained at a minimum 2 percent and maximum 10 percent slope. The slopes and grades are generally designed to provide sheet flow drainage of storm water.

2.1.1 Infiltration Layer

40 CFR 257.102(d)(3)(ii)(A) requires that the final cover system include an infiltration layer that has a permeability less than or equal to the permeability of any bottom liner system present. The North Omaha Ash Disposal Area does not include a bottom liner system. The site is comprised of two primary type of geologic materials: (1) Quaternary age unconsolidated fill and alluvium, and (2) Pennsylvanian age limestone and shale bedrock. The majority of the site is underlain by approximately 15 to 18 feet of clayey and silty soils and a mixture of fly and bottom ash (SCS Engineers, 1995 found in Appendix N). The texture of the soil ranges from silty to silty sand. Near the eastern boundary of the site fine sand is found, with thicknesses generally between 0.5 and 1.5 feet, occurring at depth of 6.5 to 14 feet. Directly under the fill material, unconsolidated alluvium occurs, comprised of laterally and vertically discontinuous fine grained, cohesive clayey sand and sandy clays, and non-cohesive silt and fine sands. The coefficient of permeability found in the 1995 Hydrogeological Investigations Report (Appendix N) ranged from 1.30×10^{-6} to 9.98×10^{-3} cm/sec. The NRCS Web Soil Survey indicates that hydraulic conductivity in the vicinity of the North Omaha Station is 9.2×10^{-4} cm/sec (Attachment E-1), which is within the range stated in the 1995 Hydrogeological Investigations Report. In addition to this historical information, Soil samples from below the ash disposal area were evaluated for permeability. The results of these tests ranged from 1.7×10^{-6} cm/sec to 2.2×10^{-7} cm/sec and are included at the end of the Closure Plan. Due to the variable nature and previous pump test via 1995 work, the infiltration layer for the North Omaha Ash Disposal Area is anticipated to be constructed to a permeability less than or equal to 1×10^{-5} cm/sec. As part the groundwater monitoring investigation, OPPD will drill new boreholes to confirm that base permeability is as anticipated. If investigation determines that base

permeability is less than 1×10^{-5} cm/sec, the infiltration layer will be constructed to a permeability no greater than the base permeability.

The primary purpose of the infiltration layer is to prevent downward movement of moisture into the CCR. Soils for final cover infiltration layer will be obtained from either on or off-site borrow sources. Factors considered in soil selection include: percentage of fines; Plastic Index (based on Atterberg Limits-ASTM D4318); and percent gravel and stones. The infiltration layer construction will include successive horizontal lifts of suitable soils compacted to a minimum percent of Standard Proctor density to be determined with the source testing of soils. Horizontal lifts will not exceed six inches in compacted thickness. The final construction specification will reflect these considerations of soil properties, preparation and compaction.

2.1.2 Erosion Layer

Federal CCR regulations require the erosion layer to be comprised of a minimum of 6 inches of earthen material that is capable of sustaining native plant growth. Soils for the final cover erosion layer will be obtained from either an onsite borrow source or an offsite borrow source.

The erosion layer may be further amended with compost and/or fertilizer, when necessary. This erosion layer serves several purposes including: 1) to allow run-off of major storm events while inhibiting erosion; 2) to support vegetation which will not extend into the infiltration layer; 3) to reduce long-term maintenance by supporting diverse species of grasses, which reproduce voluntarily, and are low maintenance; and 4) to encourage evapo-transpiration as a means of controlling liquid migration to the infiltration layer.

Factors to be considered in erosion layer soil selection include agricultural properties (e.g., pH, sodium absorption ratio, nutrient levels [nitrogen, potassium, and phosphate]). The final construction specification will reflect these considerations of soil agricultural properties, discing, treatment, and methods of installation of grasses.

2.1.3 Final Cover Erosion Control Features

The final cover includes slopes, grades, terraces, letdown structures, and diversion berms designed to promote surface water run-off (to minimize infiltration) without creating excessive erosion.

- Terraces will be constructed of compacted soils during final closure as depicted in Permit Drawings (Appendix I). Terraces will be constructed approximately every 20 to 30 vertical feet to minimize erosion rills and soil loss. A typical series of terraces is shown on Sheets 01C102 and 01C103 (Appendix I). Terraces will typically discharge into letdown structures.
- Letdown structures will convey stormwater runoff collected from the terraces and diversion berm to the perimeter drainage channels. Each letdown structure will be constructed of materials which will prevent erosion due to anticipated velocities of runoff during a storm event. A typical letdown structure is depicted on Sheet 01C104 (Appendix I).

- Diversion berms will be constructed near the grade break transition from the shallow slope on top of the CCR landfill to the 3:1 side slope to terminate sheet flow and direct stormwater to the letdown structures. The diversion berm detail is depicted on Sheet 01C104 (Appendix I).

The combination of soil types and grasses (in addition to slopes, grades, terraces and berms) have been selected to control the rate of erosion such that maximum soil loss does not exceed the excessive erosion rate of 5 tons per acre per year as required by NDEE. Based on the final closure elevations, contours and structures shown in the Permit Drawings (Appendix I), the Revised Universal Soil Loss Equation (RUSLE2) predicts first year soil loss for conservation planning under new vegetative growth conditions at 2.9 tons per acre for the North Omaha Ash Disposal Area.

Under established grass conditions, second year and beyond, the predicted soil loss for conservation planning is 0.36 tons per acre per year (see calculations in Permit – Appendix Q). This is equivalent to a loss of cover thickness of approximately 0.016 inches in the first year and 0.002 inches per year over the remaining post-closure period, using a soil density of 100 pounds per cubic foot and soil loss for conservation planning. This equates to approximately 0.074 inches of total soil loss over a 30-year post-closure period (post-closure period of 30 years required by federal CCR rule). Final cover soil loss (RUSLE2) calculations are included in Appendix Q.

2.1.4 Cover Vegetation

Permanent seeding will be used to provide a long-term, low maintenance vegetative cover. Based on the Phase 1 cap construction, grassing is anticipated to include a mixture of wheat grass, switchgrass, bluestem, and grama. Seed mixtures historically used and anticipated in the future are included in Table 1, below. Final seed mixture and application rates will be confirmed, and if appropriate, modified for each specific phase of capping.

All permanent seed shall be certified seed that meets published US Department of Agriculture, Federal Seed Act standards and bears an official “Certified Seed” label. Legume seed should be inoculated appropriately for the species.



Table 2 - Capping System Vegetative Cover

GRASSES	Pounds of PLS PER ACRE
Canada wildrye-Mandan, Nebraska native	24
Western Wheatgrass-Flintlock, Barton	24
Slender Wheatgrass	18
Indiangrass-Oto, NE-54, Holt	18
Switchgrass-Pathfinder, Blackwell, Trailblazer	10
Big Bluestem-Pawnee, Roundtree, Bonanza	18
Little Bluestem – Aldous, Blaze, Camper, Nebraska native	15
Sideoats grama-Butte, El Reno, Trailway	24
Oats/Wheat (wheat in the fall)	24
Cover Crop (oats or wheat), when used in temporary grassing; 100 PLS rates will be used when used as an exclusive stabilization method.	

PLS = Pure Live Seed

The final construction specifications will require the contractor to sample and analyze the soils used for final cover erosion layer to obtain recommendations on the type and amount of nutrients to add to the cover soil and for the seed application rates. Fertilizer and other soil amendments will be applied at the rate defined by the test recommendations. Fertilizer and other soil amendments shall be incorporated into the top 4 to 6 inches for permanent closure. Mulch products may include Hydro-mulch, peat moss, hay, or straw. Other materials may also be considered. Hydro-mulch shall be applied in accordance with manufacturer’s recommendations. Where hay or straw are utilized they shall be applied at a minimum rate of 4,000 pounds per acre. Hay and straw mulching shall be placed loose and immediately following spreading it will be anchored using a rolling couler, wheatland packer or similar mulch crimper having wheels with V-shaped edges to force the mulch into the soil surface. Other methods of installation or anchoring may be considered if they can assure that the mulch is applied and anchored in a manner as to remain in place.

2.1.5 Construction Quality Assurance

Construction of the final cover shall be in accordance with requirements of the Construction Quality Assurance (CQA) Plan (Permit – Appendix H). OPPD will submit CQA documentation including a topographical survey showing final contours and a certification signed by an independent professional engineer registered in the State of Nebraska verifying that closure was completed in accordance with the approved closure plan and in accordance with the CQA Plan.

2.2 Erosion Controls

Permanent erosion control features are described under the final cover system. Run-off will be returned to natural drainage. For disturbances of more than 1 acre, silt fences or other erosion control measures will be installed, as necessary. Temporary erosion controls will consist of silt fence, filter socks, staked hay bales or other erosion control measures. These will only be utilized

during construction of the final cover system on the landfill area or where stormwater is likely to discharge from the disposal area.

2.2.1 Storm Water/Drainage System

Drainage structures such as ditches, culverts, and discharge structures will be constructed prior to final closure of all phases. The final closure includes slopes, grades, terraces, and letdown structures designed to promote surface water run-off (to minimize infiltration) without creating excessive erosion. Permanent drainage structures and ditches are designed to accommodate a 25-year, 24-hour storm event, as identified in the site drainage calculations (Appendix Q) and the Run-on and Run-off System Control Plan (Appendix C).

2.3 Leachate Management System

This is an existing facility that has been operating since the 1950s. Compacted ash provides a very low permeability barrier to leachate. The in-place ash, compacted fly ash low permeability layer, and overall capping system significantly reduces infiltration (Appendices P and Q).

2.4 Groundwater Monitoring System

No new monitoring wells are proposed to be installed at the time of final closure. All installed monitoring wells are protected with bollards or other protection features from potential vehicular damage. The groundwater monitoring system is described in the Groundwater Sampling and Analysis Plan (Appendix D).

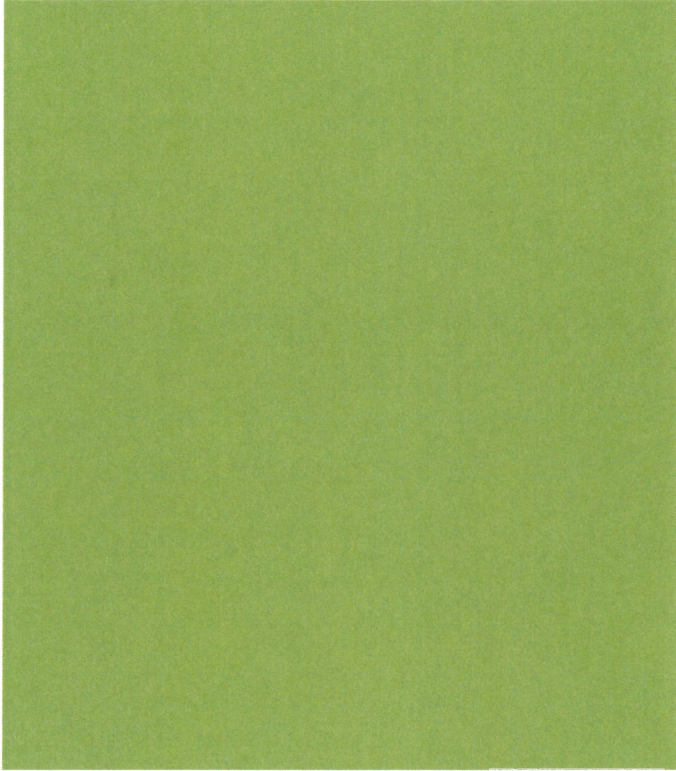
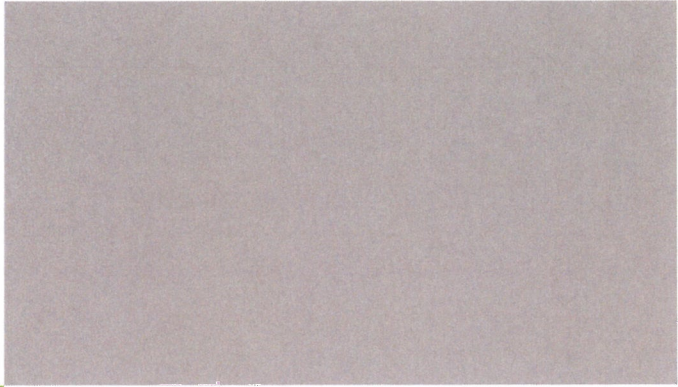
2.5 Access Control

The Station facilities are surrounded by a chain link fence with a security gate at the entrance. Access onto the Station site is through the gate with security personnel either during administrative office hours or by key card after hours. The power plant is staffed at all times. Unauthorized personnel will not be allowed on-site.

2.6 On-Site Structures and Roadways

Ash silos, ash storage building, and other structures may remain at the closure of the North Omaha Ash Disposal Area for future ash sales and disposal operations at an alternative disposal area. Maintenance equipment required during the post-closure period may remain on site. Plant facility buildings may continue to function for ongoing Station operations.

The final site configuration will incorporate roadways to access the groundwater monitoring wells, surface water facilities and other appropriate areas.



Attachment E-1
NRCS Web Soil Survey





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 Douglas County, Nebraska, and Pottawattamie County, Iowa

OPPD North Omaha Station



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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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

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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

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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.

Custom Soil Force Report Soil wrap












































Map Scale: 1:12,900 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
 Special Point Features	 Special Line Features
 Blowout	 Water Features
 Borrow Pit	 Streams and Canals
 Clay Spot	 Transportation
 Closed Depression	 Rails
 Gravel Pit	 Interstate Highways
 Gravelly Spot	 US Routes
 Landfill	 Major Roads
 Lava Flow	 Local Roads
 Marsh or swamp	 Background
 Mine or Quarry	 Aerial Photography
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:15,800.

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: Douglas County, Nebraska
 Survey Area Data: Version 13, Sep 12, 2018

Soil Survey Area: Pottawattamie County, Iowa
 Survey Area Data: Version 23, Sep 11, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jul 1, 2018—Sep 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7880	Onawa silty clay, occasionally flooded	0.5	0.1%
8100	Monona-Pohocco-Ida silt loams, 17 to 33 percent slopes	15.9	2.2%
9711	Urban land-Udarents complex, 0 to 16 percent slopes	0.5	0.1%
9713	Urban land-Udorthents complex, 0 to 10 percent slopes, occasionally flooded	191.5	26.1%
9718	Urban land-Udorthents-Judson complex, 0 to 11 percent slopes	69.5	9.5%
9719	Urban land-Udorthents-Marshall complex, 0 to 9 percent slopes	120.7	16.4%
9999	Water	77.5	10.6%
Subtotals for Soil Survey Area		476.0	64.8%
Totals for Area of Interest		734.3	100.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
137	Haynie silt loam, 0 to 2 percent slopes, occasionally flooded	49.7	6.8%
144	Blake silty clay loam, 0 to 2 percent slopes	60.7	8.3%
146	Onawa silty clay, 0 to 2 percent slopes	12.2	1.7%
156	Albaton silty clay, 0 to 2 percent slopes, occasionally flooded	35.7	4.9%
237	Sarpy loamy fine sand, 0 to 3 percent slopes	41.0	5.6%
5053	Psammaquents, frequently flooded	21.1	2.9%
5080	Udorthents, sanitary landfill	6.9	0.9%
W	Water	31.0	4.2%
Subtotals for Soil Survey Area		258.3	35.2%
Totals for Area of Interest		734.3	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

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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.

Douglas County, Nebraska

7880—Onawa silty clay, occasionally flooded

Map Unit Setting

National map unit symbol: 1vfdb
Elevation: 800 to 1,300 feet
Mean annual precipitation: 24 to 36 inches
Mean annual air temperature: 39 to 61 degrees F
Frost-free period: 155 to 175 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Onawa, occasionally flooded, and similar soils: 63 percent
Minor components: 37 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Onawa, Occasionally Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium over loamy alluvium

Typical profile

A - 0 to 7 inches: silty clay loam
Cg1 - 7 to 22 inches: silty clay
2Cg2 - 22 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: Clayey Floodplain Forest (F107BY017MO), Clayey Overflow - Veg. zone 4 (R107XY069NE)
Hydric soil rating: No

Minor Components

Fluvaquents, silty, frequently flooded

Percent of map unit: 13 percent
Landform: Flood plains

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Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Wet Floodplain Prairie (R107BY019MO)
Hydric soil rating: Yes

Lossing, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Floodplain Forest (F107BY016MO)
Hydric soil rating: No

Albaton, occasionally flooded

Percent of map unit: 7 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Floodplain Forest (F107BY017MO), Clayey Overflow -
Veg. zone 4 (R107XY069NE)
Hydric soil rating: Yes

Modale, occasionally flooded

Percent of map unit: 7 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Wet Floodplain Woodland (F107BY026MO)
Hydric soil rating: No

8100—Monona-Pohocco-Ida silt loams, 17 to 33 percent slopes

Map Unit Setting

National map unit symbol: 1vfd6
Elevation: 800 to 1,300 feet
Mean annual precipitation: 24 to 36 inches
Mean annual air temperature: 39 to 61 degrees F
Frost-free period: 155 to 175 days
Farmland classification: Not prime farmland

Map Unit Composition

Monona and similar soils: 41 percent
Pohocco and similar soils: 38 percent
Ida and similar soils: 21 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Monona

Setting

Landform: Loess hills
Landform position (two-dimensional): Backslope

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Landform position (three-dimensional): Side slope, nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Fine-silty loess

Typical profile

Ap - 0 to 7 inches: silt loam
A - 7 to 15 inches: silt loam
Bw - 15 to 30 inches: silt loam
C - 30 to 80 inches: silt loam

Properties and qualities

Slope: 14 to 33 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Deep Loess Exposed Backslope Savanna (R107BY003MO), Silty
- Veg. zone 4 (R107XY075NE)
Hydric soil rating: No

Description of Pohocco

Setting

Landform: Loess hills
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope, nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Fine-silty loess

Typical profile

Ap - 0 to 6 inches: silt loam
Bw - 6 to 15 inches: silt loam
Bk - 15 to 28 inches: silt loam
C - 28 to 80 inches: silt loam

Properties and qualities

Slope: 14 to 33 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

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Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Calcareous Loess Exposed Backslope Woodland (F107BY011MO), Calcareous Loess Protected Backslope Forest (F107BY010MO), Silty - Veg. zone 4 (R107XY075NE)
Forage suitability group: Loam (G107BY100NE)
Hydric soil rating: No

Description of Ida

Setting

Landform: Loess hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex, linear
Parent material: Calcareous loess

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C - 12 to 80 inches: silt loam

Properties and qualities

Slope: 14 to 33 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Available water storage in profile: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Calcareous Loess Exposed Backslope Prairie (R107BY006MO), Calcareous Loess Protected Backslope Savanna (R107BY013MO), Limy Upland (R102CY059NE)
Hydric soil rating: No

9711—Urban land-Udarents complex, 0 to 16 percent slopes

Map Unit Setting

National map unit symbol: 1vfdz
Elevation: 800 to 1,300 feet
Mean annual precipitation: 24 to 36 inches
Mean annual air temperature: 39 to 61 degrees F
Frost-free period: 155 to 175 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 71 percent
Udarents and similar soils: 29 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, interfluve, side slope, nose slope
Down-slope shape: Convex, concave
Across-slope shape: Linear

Description of Udarents

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, interfluve, side slope, nose slope
Down-slope shape: Convex, concave
Across-slope shape: Linear
Parent material: Disturbed fine-silty loess

Typical profile

H1 - 0 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 27 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 8 percent

Interpretive groups

Land capability classification (irrigated): None specified

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Ecological site: Deep Loess Upland Prairie (R107BY002MO)
Hydric soil rating: Unranked

9713—Urban land-Udorthents complex, 0 to 10 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 1vfdt
Elevation: 800 to 1,300 feet
Mean annual precipitation: 24 to 36 inches
Mean annual air temperature: 39 to 61 degrees F
Frost-free period: 155 to 175 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 59 percent
Udorthents and similar soils: 31 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear

Description of Udorthents

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Disturbed silty alluvium

Typical profile

H1 - 0 to 12 inches: silty clay loam
H2 - 12 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Medium
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 8 percent

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: Wet Floodplain Prairie (R107BY019MO)
Hydric soil rating: Unranked

Minor Components

Albaton, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Floodplain Forest (F107BY017MO), Clayey Overflow - Veg. zone 4 (R107XY069NE)
Hydric soil rating: Yes

Haynie, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Floodplain Forest (F107BY016MO), Silty Lowland - Veg. zone 4 (R107XY070NE)
Hydric soil rating: No

9718—Urban land-Udorthents-Judson complex, 0 to 11 percent slopes

Map Unit Setting

National map unit symbol: 2sy75
Elevation: 960 to 1,270 feet
Mean annual precipitation: 31 to 32 inches
Mean annual air temperature: 51 to 51 degrees F
Frost-free period: 155 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 49 percent
Udorthents and similar soils: 31 percent
Judson and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, interfluve, side slope, nose slope
Down-slope shape: Convex, concave

Custom Soil Resource Report

Across-slope shape: Linear
Parent material: Disturbed fine-silty loess

Typical profile

A - 0 to 12 inches: silty clay loam
C - 12 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 11 percent
Depth to restrictive feature: More than 80 inches
Natural 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
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 12.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Footslope Savanna (R107BY008MO)
Hydric soil rating: Unranked

Description of Judson

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Silty colluvium

Typical profile

Ap - 0 to 9 inches: silty clay loam
A - 9 to 22 inches: silty clay loam
AB - 22 to 28 inches: silty clay loam
Bt - 28 to 35 inches: silty clay loam
BC - 35 to 52 inches: silty clay loam
C - 52 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 11 percent
Depth to restrictive feature: More than 80 inches
Natural 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

Custom Soil Resource Report

Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: Loamy Footslope Savanna (R107BY008MO), Silty - Veg. zone 4 (R107XY075NE)

Hydric soil rating: No

9719—Urban land-Udorthents-Marshall complex, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: 1vfdy

Elevation: 800 to 1,300 feet

Mean annual precipitation: 24 to 36 inches

Mean annual air temperature: 39 to 61 degrees F

Frost-free period: 155 to 175 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 57 percent

Udorthents and similar soils: 23 percent

Marshall and similar soils: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Head slope, interfluve, side slope, nose slope

Down-slope shape: Convex, concave

Across-slope shape: Linear

Description of Udorthents

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Head slope, interfluve, side slope, nose slope

Down-slope shape: Convex, concave

Across-slope shape: Linear

Parent material: Disturbed fine-silty loess

Custom Soil Resource Report

Typical profile

H1 - 0 to 12 inches: silty clay loam

H2 - 12 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 9 percent

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 8 percent

Interpretive groups

Land capability classification (irrigated): None specified

Ecological site: Deep Loess Upland Prairie (R107BY002MO)

Hydric soil rating: Unranked

Description of Marshall

Setting

Landform: Loess hills

Landform position (two-dimensional): Summit

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Fine-silty noncalcareous loess

Typical profile

Ap - 0 to 7 inches: silty clay loam

A - 7 to 18 inches: silty clay loam

Bw - 18 to 47 inches: silty clay loam

C - 47 to 68 inches: silty clay loam

Properties and qualities

Slope: 0 to 9 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: Loess Upland Prairie (R107BY007MO)

Hydric soil rating: No

9999—Water

Map Unit Setting

National map unit symbol: 1vffb

Elevation: 3,500 to 5,250 feet

Mean annual precipitation: 22 to 24 inches

Mean annual air temperature: 47 to 50 degrees F

Frost-free period: 120 to 150 days

Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat) (OPPD North Omaha Station)

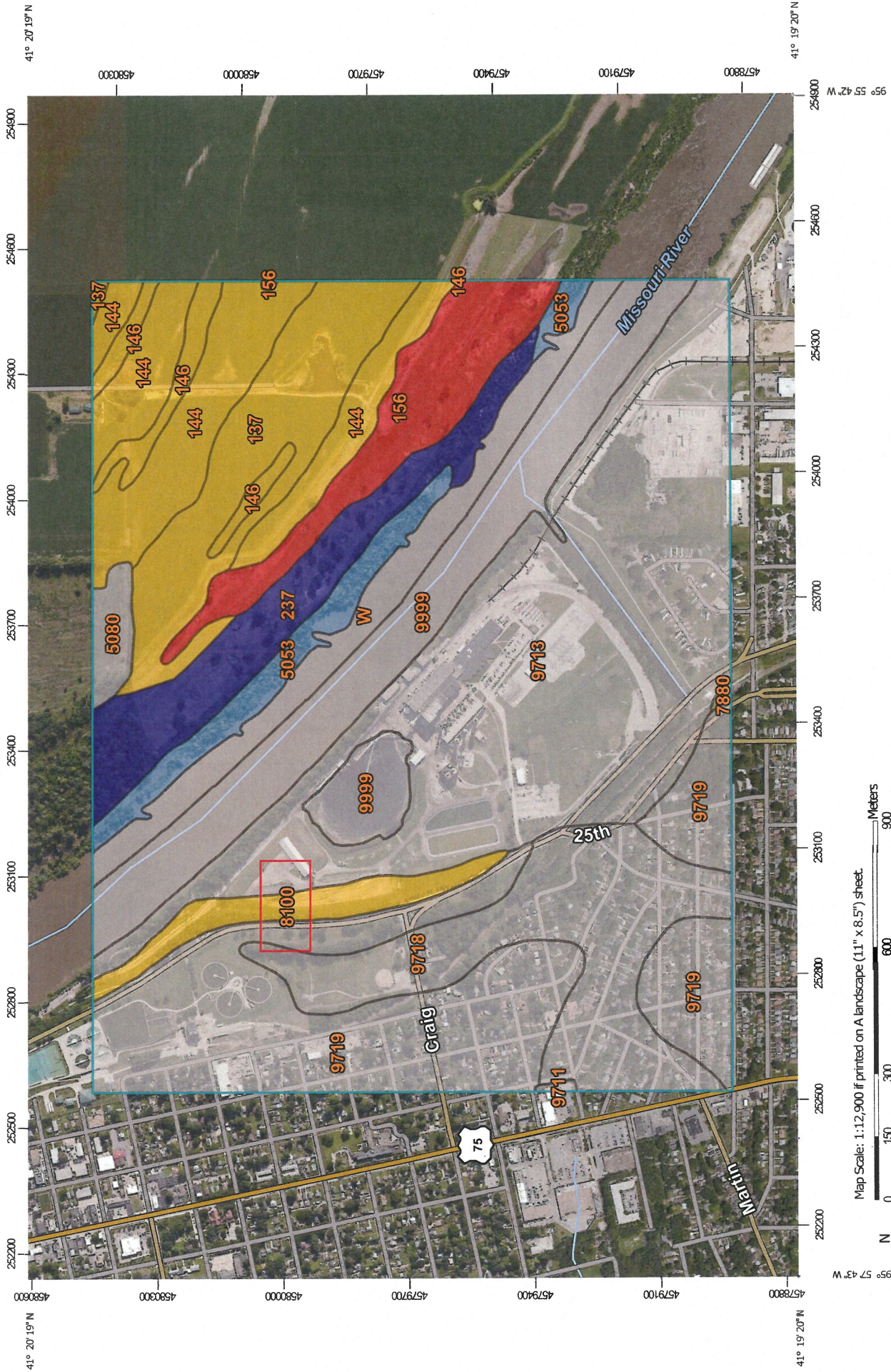
Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

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Custom Soil Force Report
 Map—Saturated Hydraulic Conductivity, (Ksat) (OPPD North Omaha Station)



Map Scale: 1:12,900 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

Area of Interest (AOI)	Transportation
Area of Interest (AOI)	+++ Rails
Soils	Interstate Highways
Soil Rating Polygons	US Routes
<= 0.0400	Major Roads
> 0.0400 and <= 9.2000	Local Roads
> 9.2000 and <= 13.9484	Background
> 13.9484 and <= 183.6579	Aerial Photography
> 183.6579 and <= 189.3421	
Not rated or not available	
Soil Rating Lines	
<= 0.0400	
> 0.0400 and <= 9.2000	
> 9.2000 and <= 13.9484	
> 13.9484 and <= 183.6579	
> 183.6579 and <= 189.3421	
Not rated or not available	
Soil Rating Points	
<= 0.0400	
> 0.0400 and <= 9.2000	
> 9.2000 and <= 13.9484	
> 13.9484 and <= 183.6579	
> 183.6579 and <= 189.3421	
Not rated or not available	
Water Features	
Streams and Canals	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:15,800.

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: Douglas County, Nebraska
 Survey Area Data: Version 13, Sep 12, 2018

Soil Survey Area: Pottawattamie County, Iowa
 Survey Area Data: Version 23, Sep 11, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jul 1, 2018—Sep 30, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

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Custom Soil Resource Report

Table—Saturated Hydraulic Conductivity (Ksat) (OPPD North Omaha Station)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
7880	Onawa silty clay, occasionally flooded	13.9484	0.5	0.1%
8100	Monona-Pohocco-Ilda silt loams, 17 to 33 percent slopes	9.2000	15.9	2.2%
9711	Urban land-Udarents complex, 0 to 16 percent slopes		0.5	0.1%
9713	Urban land-Udorthents complex, 0 to 10 percent slopes, occasionally flooded		191.5	26.1%
9718	Urban land-Udorthents-Judson complex, 0 to 11 percent slopes		69.5	9.5%
9719	Urban land-Udorthents-Marshall complex, 0 to 9 percent slopes		120.7	16.4%
9999	Water		77.5	10.6%
Subtotals for Soil Survey Area			476.0	64.8%
Totals for Area of Interest			734.3	100.0%

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
137	Haynie silt loam, 0 to 2 percent slopes, occasionally flooded	9.0000	49.7	6.8%
144	Blake silty clay loam, 0 to 2 percent slopes	6.5921	60.7	8.3%
146	Onawa silty clay, 0 to 2 percent slopes	5.1095	12.2	1.7%
156	Albaton silty clay, 0 to 2 percent slopes, occasionally flooded	0.0400	35.7	4.9%
237	Sarpy loamy fine sand, 0 to 3 percent slopes	189.3421	41.0	5.6%
5053	Psammaquents, frequently flooded	183.6579	21.1	2.9%
5080	Udorthents, sanitary landfill		6.9	0.9%
W	Water		31.0	4.2%
Subtotals for Soil Survey Area			258.3	35.2%
Totals for Area of Interest			734.3	100.0%

**Rating Options—Saturated Hydraulic Conductivity (Ksat) (OPPD
North Omaha Station)**

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 0

Bottom Depth: 60

Units of Measure: Inches

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