Appendix E

Closure Plan

Omaha Public Power District
North Omaha Generating Station
Ash Disposal Area

2023 Permit Modification

September 2023

OPPD North Omaha Station
Closure Plan

Revision Log

This Closure Plan may be revised from time to time when procedures are changed. Because revisions to this document can be made on a periodic basis, document control is necessary. The most recent version of this Closure Plan is required to be posted on the CCR website. The revision log below will be updated every time the plan is amended.

Revision No.	Revision Date	Revised Sections	Originator	Notes
0	October 2016	NA	OPPD	Per CCR Rule – Separated State Closure & Post-Closure Plan
1	September 2019	Section 1.4, 1.5, & 1.6 updated for site life calculations	HDR	State Permit Renewal
2	December 2019	Section 2.1 based on NDEE comments	HDR	State Permit Renewal
3	September 2023	All sections updated for early closure	HDR	State Permit - Major Modification for early landfill closure

Table of Contents

Attachments

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 M Williams
Signature:	
Date:	September 25, 2023
License #:	E-15124

My license renewal date is December 31, 2024.

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 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 Services 444 South 16th 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.

As part of this major permit modification, the total boundary is revised to a total area of 18.503 acres. The previously undeveloped area of 1.363 acres is removed along with 3.974 acres in the

southeast corner of the north end (formerly Phase 5 but never developed). The total area breakdown is shown on Attachment 0-1, Figure 1 in the Permit Summary, and summarized below:

- 9.11 acres: current active area to the north – to be closed in 2024.
- 4.85 acres: capped in 2017 on west, north and east side slopes.
- 4.543 acres: previously closed south area.

- As part of the closure, a portion of the previously closed south area (3.46 acres) will be re-graded to accommodate installation of an access road along the east, preservation of existing trees along the west side, and raised to improve overall drainage. The current topsoil will be stripped to allow installation of an 18" thick infiltration clay layer over the current soil cap. The topsoil will be reused as an erosion layer for vegetation.

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 (9.11 acres) and the formerly closed (4.543 and 4.85 acres) is identified by the ash disposal limit shown on Figure 1 of Attachment 0-1, Permit Closure Comparison. Approximately 1.9 acres are undeveloped and will remain that way. The largest area requiring final cover is 9.11 acres. An additional 3.46 acres of the 4.543 acres previously closed, at the south end, will be stripped of topsoil temporarily (which will be stockpiled) and infiltration layer placed in that area. That area will then be covered with the stockpiled topsoil and seeded for vegetation. No new CCR will be placed in this area, and this will occur during the closure in 2023 and 2024. Permit Drawing 00C101 in Appendix I includes 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 2022 topographic survey, approximately 749,500 cubic yards of air space remained based on the previously permitted final design contours in the 2019 permit Drawings. This included ash disposal only and not the 2 ft thickness of final cover vegetative soil layers. This total permitted volume will not be fully utilized due to the reduction of ash and ash byproduct generation, OPPD's timing of discontinuing combustion of coal at the North Omaha Station, and the decision of closure. It is scheduled for closure by the spring of 2024. The revised final grading is shown in the Permit Drawings (Appendix I). An additional 30,000 cubic yards of CCR will be placed during 2023 and 2024.

The total volume of CCR within the landfill was estimated as part of the 2022 annual inspection dated January 13, 2023. It was determined using the total volume from November 2021 of 883,300 cubic yards and adding 15,900 cubic yards from December 2021 through November 2022, documented by OPPD as material was not sold. Finally, 12,700 cubic yards of ash-like materials had been consolidated from piles located west and south of the coal pile runoff pond placed in the landfill 2022. As such, the total estimated CCR within the landfill was estimated to be 911,900 cubic yards at the end of 2022. With the addition of 30,000 cubic yards planned for disposal during 2023 and 2024, the final CCR volume will be 941,900 cubic yards (1,225,700 tons) at closure.

1.5 Largest Area Requiring Final Cover

The largest area requiring final closure is a combination of the current active area to the north and the south legacy area that is planned for installation of an infiltration layer. The north area (current active area) of 9.11 acres combined with the south area of 3.46 acres provides a total area of 12.57 acres receiving final cover.

1.6 Site Life

The remaining life of the North Omaha Station Ash Disposal Area was determined based on the decision of closure by the end of 2023. The site expects to cease burning coal during 2023 and OPPD plans to close the landfill by the end of the year. While the landfill is expected to close prematurely, OPPD is requesting permitted limits remain unchanged for this major permit modification 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 through 2023 and will be under the control of OPPD. At closure, OPPD will notify MUD (Metropolitan Utilities District) 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 (about 6 months) 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 if 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 accordance 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 the contractor's responsibility)
5. Bid the project and select the contractor (3 months)
6. Notification of the date of the receipt of the final volume of waste, the date of the initiation of closure, and the date of the installation of final over system per NDEE 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. (Up to 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 ditches, berms, and letdown structures (1-2 months)
14. Fertilize, Plant, and mulch closure vegetation (<1 month)
15. Complete Closure. The project is expected to 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. The 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 ditches and letdown structures, and if not previously installed, construction of facilities for post-closure monitoring, maintenance, and care. OPPD plans to close the remaining disposal area during the spring of 2024. Closure Drawings are in Appendix I.

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 applicable to various closure alternatives (phased, premature and final).

2.1 Final Cover System Design

The federal CCR rule requires the final cover system to meet either the requirements of 40 CFR 257.102(d)(3)(i), or an alternative final cover system meeting the requirements of 40 CFR 257.102(d)(3)(ii). Both cover systems are required to be less than or equal to the permeability of any liner system or natural subsoils present, or a permeability no greater than $1x10^{-5}$ cm/sec, whichever is less. Previous capping projects for the Ash Disposal Area were built with a capping system with 1x10-7 cm/sec permeability, which will also be done for the rest of the closure. Both cover system designs are described below.

2.1.1 Standard Final Cover System Design {257.102(d)(3)(i)}

Per the CCR Rule, the standard cover system includes an Infiltration Layer 18 inches thick overlain by an Erosion Layer 6 inches thick. The erosion layer provides protection from wind and water erosion and can sustain native plant growth.

INFILTRATION LAYER

40 CFR 257.102(d)(3)(i)(A) requires that 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.

The site has two main types of geologic materials: (1) Quaternary age unconsolidated fill and alluvium, and (2) Pennsylvanian age limestone and shale bedrock. Most 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 site's eastern boundary, fine sand is found, with thicknesses generally between 0.5 and 1.5 feet, occurring at depths 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 $1.30x10^{-6}$ to $9.98x10^{-3}$ cm/sec. The NRCS (Natural Resources Conservation Service) Web Soil Survey indicates that hydraulic conductivity in the vicinity of the North Omaha Station is $9.2x10^{-4}$ cm/sec (Attachment E-1), which is within the range stated in the 1995 Hydrogeological Investigations Report.

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; Plasticity 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. The infiltration layer for the North Omaha Ash Disposal Area will be constructed to a permeability no greater than $1x10^{-7}$ cm/sec, as determined during prior to capping.

EROSION LAYER

The Erosion Layer must be comprised of at least 6 inches of earthen material 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. It may be further amended with compost and/or fertilizer, when necessary, and 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 minimal 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.

2.1.2 Final Cover Erosion Control Features

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 ditches, diversion berms, and letdown structures. Ditches/diversion berms will be placed along the side slopes and at the crest of the side slopes to control erosion and direct stormwater runoff toward the letdown 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 Cover Grading Plan (Permit – Appendix I, Sheet 00C105 and 00C106).

The side slopes of the North Omaha Station Ash Disposal Area will be graded to no steeper than 3 horizontal to 1 vertical (3H:1V). 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 designed to provide sheet flow drainage of storm water.

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

- Letdown structures will convey stormwater runoff collected from the 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 Detail 1, Sheet 00C501 (Appendix I).

- If needed, diversion berms may be constructed near the grade break transition from the shallow slope on top of the CCR landfill to the 3H:1V side slope to terminate sheet flow and direct stormwater to the letdown structures.

The combination of soil types and grasses (in addition to slopes, grades, ditches, 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

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Under established grass conditions, second year and beyond, the previously predicted soil loss

for conservation planning was 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). Revised grades, which are shallower and shorter, will reduce these estimates. Historical cover soil loss (RUSLE2) calculations are included in Appendix Q.

2.1.3 Cover Vegetation

Permanent seeding will be used to provide a long-term, limited 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 U.S. Department of Agriculture, Federal Seed Act standards and bears an official “Certified Seed” label. Legume seed should be inoculated appropriately for the species.

Table 1 – 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 the 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 coulter, 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.

2.1.4 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 like ditches, culverts, and discharge structures will be built before final closure of all phases. The final closure includes slopes, grades, ditches, 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 contact water. 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 to 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 always staffed. 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

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Douglas County, Nebraska, and Pottawattamie County, Iowa

OPPD North Omaha Station

August 28, 2019

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.

Custom Soil Resource Report
Soil Map

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

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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 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.

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

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

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

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

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

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

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

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

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

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.

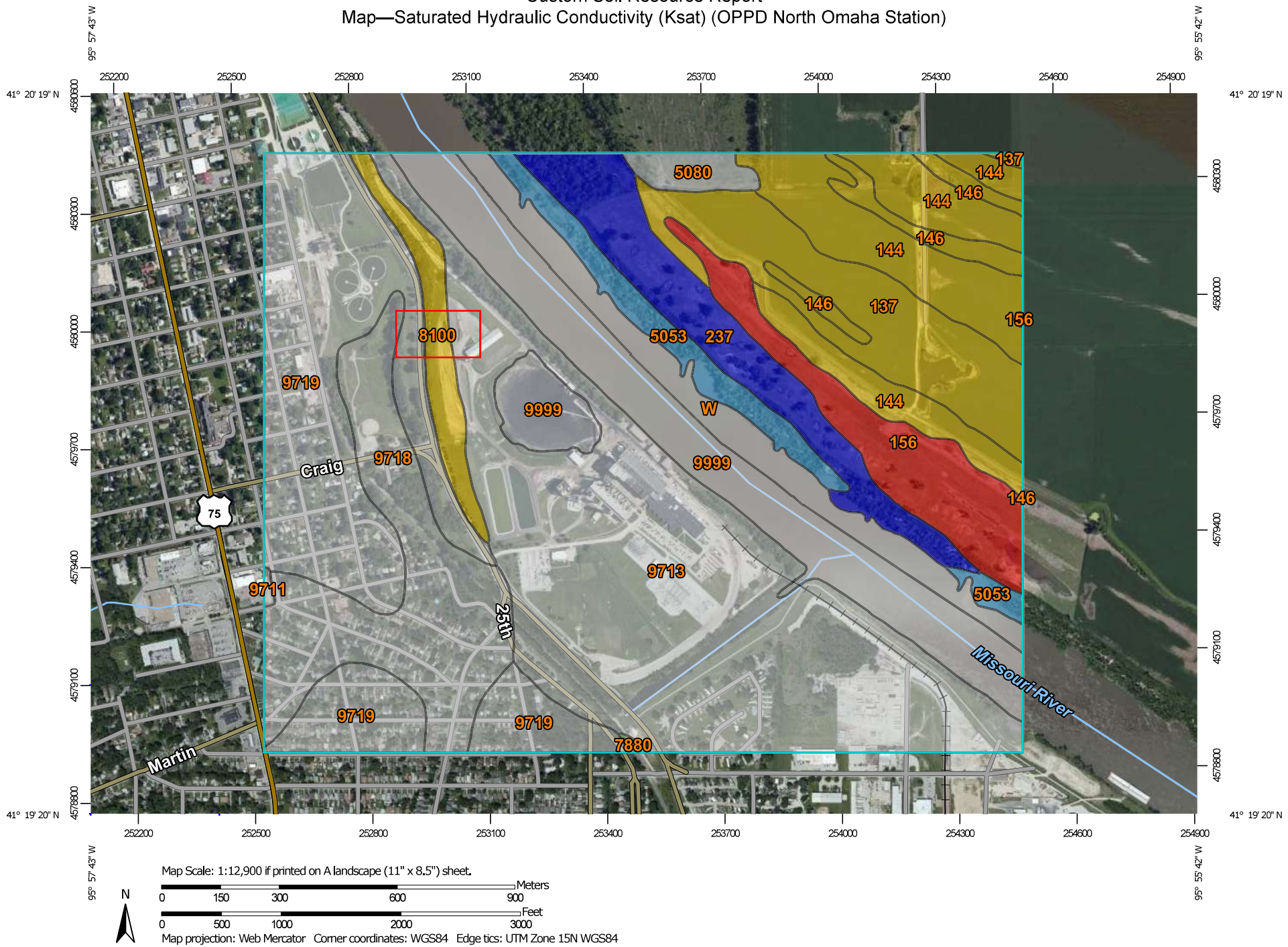
Saturated Hydraulic Conductivity (Ksat) (OPPD North Omaha Station)

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.

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



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

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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 Rating Polygons

- <= 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 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

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 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.

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-Ida 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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