DESIGNS

For

Sisseton-Wahpeton Oyate

Sec25-124N-51W

Irrigation Pipeline (430)
Irrigation System, Micro Irrigation (441)
Irrigation Water Management (449)
Livestock(Irrigation) Pipeline (516)

Prepared by:
USDA-NATURAL RESOURCE CONSERVATION SERVICE

ROBERTS COUNTY
SISSETON FO

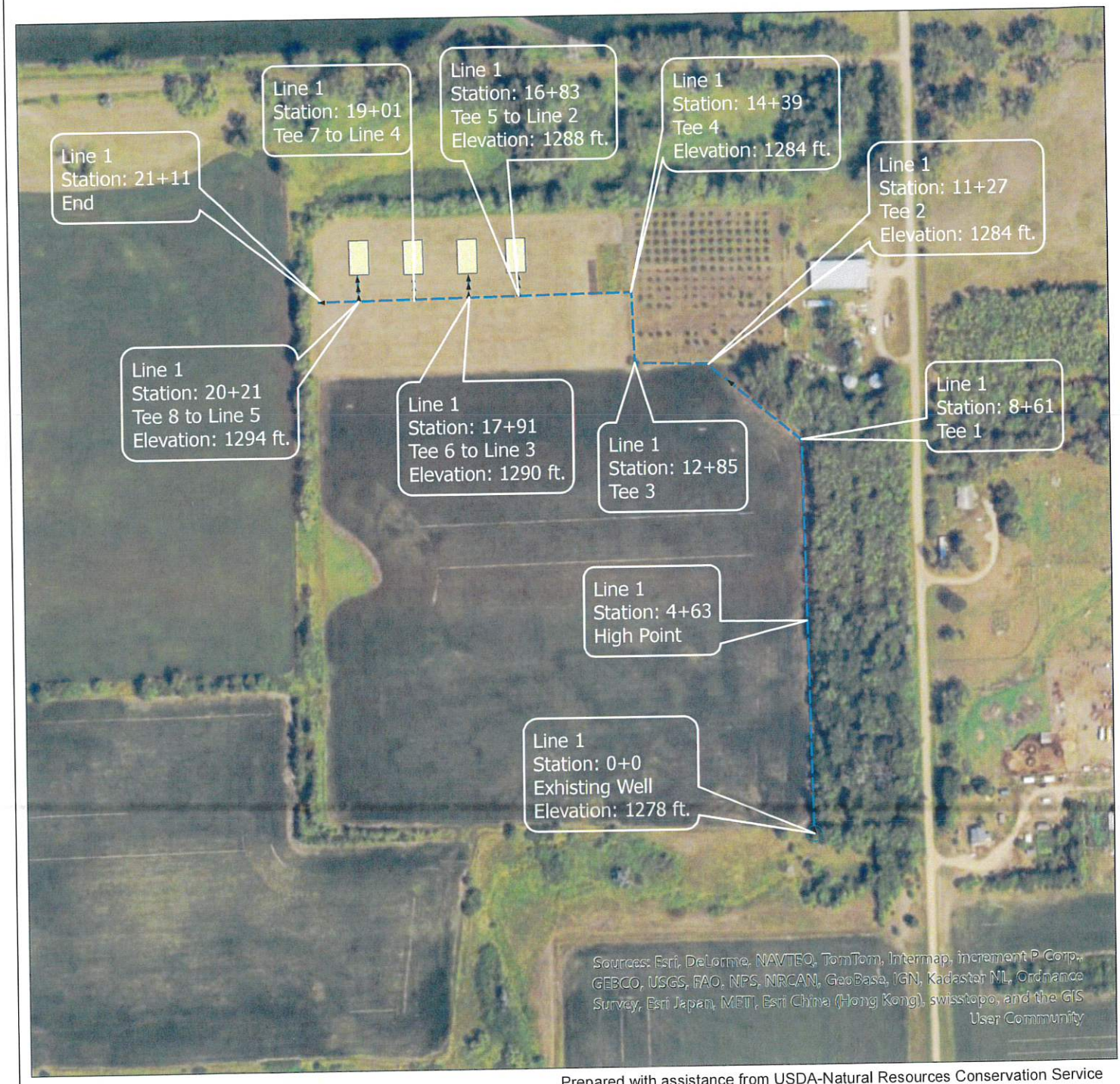
Date: 2/4/2025

Conservation Plan Map

Client(s): Sisseton-Wahpeton Oyate

Approximate Acres:

Assisted By: Patricia.Heermann
USDA-NRCS
SISSETON SERVICE CENTER
ROBERTS COUNTY SOIL & WATER CONSERVATION DISTRICT



Prepared with assistance from USDA-Natural Resources Conservation Service

N
W E
S

- Hydrant
- Well
- Pipeline
- High Tunnel

USDA

0 330 660 1,320 US Feet

USDA is an equal opportunity provider, employer, and lender

PARTICIPANT RESPONSIBILITIES

PARTICIPANT Sisseton-Wahpeton Oyate	**County** Roberts		
PRACTICE(S)			
LEGAL DESCRIPTION	**Sec.** 25	**T** 124N	**R** 51W
GPS			

GENERAL: Policies and regulations of the United States Department of Agriculture (USDA) assistance programs place responsibility on the participant for obtaining necessary local, state, and federal permits, adequate real property rights and interests, applicable water rights, and necessary approvals, easements, and licenses. The participant must also meet requirements for installation, inspection, and operation and maintenance. For copies of South Dakota (SD) laws, please see the Internet at:
https://sdlegislature.gov/Statutes/Codified_Laws

For ALL conservation practices, if the participant elects to install proposed practices in locations **other than where approved by the Natural Resources Conservation Service (NRCS)**, the participant may be in violation of applicable NRCS policy, federal, state, or Tribal laws, and said action may result in the termination of their NRCS contract or withdrawal of financial and technical assistance related to the project.

1. CULTURAL/HISTORICAL RESOURCES

An NRCS approved cultural/historical evaluation **must** be made of all contracted and/or technically assisted practices that have the potential to affect historic properties or culturally significant sites **prior** to construction. If the NRCS approved construction activities expose cultural/historical resources, human remains (bones), or similar objects, the participant and/or contractor **must** immediately stop construction and notify the NRCS. Any further construction without clearance **could jeopardize assistance** (financial/technical) and may be a **violation of state or federal law**.

2. CLEAN WATER ACT

Clean Water Act Section 10 or 404 permits from the **US Army Corps of Engineers** (COE) are required where proposed construction will involve dredging or filling a wetland or stream. Information may be obtained by contacting: **US Army Corps of Engineers, SD Regulatory Office, 28563 Powerhouse Road, Room 120, Pierre, SD 57501, (Phone (605) 224-8531)**. Forms are available on the Internet at:
https://www.nwo.usace.army.mil/Missions/Regulatory-Program/South-Dakota/

National Pollutant Discharge Elimination System permits or approval from the **SD Department of Agriculture and Natural Resources (DANR)** may be needed where discharge of polluted water or wastewater (ag waste, etc.,) to waters of the state (including wetlands) may occur or have occurred. In addition, a **Storm Water Permit** is needed for any **construction** disturbance of over one acre. Information is available by telephone at **(605) 773-3351,** or on the Internet at:
https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/stormwater/default.aspx

3. WATER RIGHTS, CONSTRUCTION PERMIT, AND LOCATION NOTICE

South Dakota Codified Law 46-5 requires securing a permit from the **SD Chief Engineer before construction work begins** for any development involving storage or use of water. Small user exceptions are explained on the Internet. Forms and information are available on the Internet at:
https://danr.sd.gov/OfficeOfWater/WaterRights/default.aspx

Compliance with all requirements of SD water laws is necessary to avoid possible penalties and/or loss of your rights. Forms, signed map, fees, and other pertinent information for filing a **SD Water Right** application should be submitted to: **DANR Water Rights Program, Joe Foss Building, 523 East Capitol, Pierre, SD 57501-3181 (Phone (605) 773-3352).**

South Dakota Codified Law 46-4 requires the filing of a **Location Notice** for small nonnavigable stream and dry draw dams. **South Dakota Codified Law 46A-10A** regulates **drainage**, in SD, generally through **County Drainage Commissions. Administrative Rules (Dam Safety**, etc.,) are located at: https://danr.sd.gov/OfficeOfWater/WaterRights/Wateruse/default.aspx

Other Laws may also apply. The participant is responsible for obtaining all necessary rights and permits, including but not limited to easements, rights-of-way, zoning approval, permits to construct, etc., required by any applicable level of government.

4. PROPERTY RIGHTS (INCLUDING WETLAND EASEMENTS)

The participant is responsible, financially and otherwise, for any costs incurred by the failure to obtain adequate and necessary real property rights and interests, easements, subordination agreements, permits, and/or licenses required for the installation. Participants are cautioned to be sure the area to be affected is either not covered by a **wetland easement** or a written agreement is reached with the easement owner. Property rights documents should be recorded for your future protection.

5. CONSTRUCTION SUPERVISION AND INSPECTION PARTICIPANT RESPONSIBILITIES

(A) South Dakota Codified Law 49-7A, (also known as **SD One-Call)** requires that no **excavator** may **begin** any excavation without first notifying the One-Call Notification Center of the proposed excavation at least two working days prior to starting any excavation. **(Phone 1-800-781-7474 or 811).**

The NRCS makes <u>no representation</u> as to the existence or nonexistence of any utility or buried object and assumes <u>no liability</u> for damage to utilities or buried objects caused by construction of this or other conservation practices.

(B) All conservation practice standards (CPS) require onsite supervision and inspection during construction. The NRCS cannot provide all of the assistance or inspection that may be needed to assure the practice is installed correctly. **Participants must actively lead construction supervision and inspection efforts.** Items requiring **inspection by you** are as follows:

The NRCS must be notified and given the opportunity to inspect the following items **prior to installation**:

(C) If you employ a contractor to do your construction work, it is your responsibility to clearly inform the contractor, **prior** to start of construction, that materials and construction must be in accordance with the plans and specifications.

(D) If necessary, the plans can be modified during construction. However, any changes to project location and/or design such as sizes, grades, elevations, etc., **<u>must</u> be approved by the NRCS** for permits, certifications, and payment to be assured. **Get approvals before construction!**

(E) The completed practice must be checked and/or approved by the NRCS. The NRCS will ask for written certification from you and/or the contractor for those items not inspected by the NRCS and for those items you agreed to inspect. **Certification for practice payment** will be made by the NRCS when it has been determined that the NRCS approved design has been completed. Otherwise, the NRCS will either require construction changes before certification or the practice will not be certified.

(F) The NRCS designed practices, as well as, financially assisted practices designed by contractors (or others), must meet NRCS Conservation Practice Standards (CPS) and must be approved by a NRCS employee with appropriate Job Approval Authority prior to construction.

6. OPERATION AND MAINTENANCE (O&M)

The participant is responsible for the safe O&M of the improvements for the life of the practice. The O&M requirements or special O&M plans are listed below and/or attached.

7. PARTICIPANT RESPONSIBILITIES AND CERTIFICATION

I have reviewed the conservation plan, associated job sheets, and plans and specifications provided to me. I understand my responsibility to follow the conservation plan, job sheets, and plans and specifications for proper installation of the CPSs. I understand the endangered species and cultural/historical resources requirements and certify that I will obtain the necessary land rights, easements, water rights, permits, and other authorizations necessary to complete the planned conservation improvements.

Participant: _____ Date: _____

I have reviewed the requirements as set forth in this document with the participant.

NRCS Employee: _____ Date: _____

Operation & Maintenance Plan
Irrigation Pipeline (Code 430)

Landowner/Operator: Sisseton-Wapeton Oyate

Date:

NRCS Service Center: Sisseton

Conservation District: Roberts

Practice Location: 25-154-51

Tract/Field ID:

(Lat/Long or UTM Coord, or Sec/TS/R)

Expected Lifespan

The minimum expected lifespan of this practice is at least 20 year(s).

Operation and Maintenance

A well-maintained and operated irrigation pipeline is an asset to your farm or ranch. This practice is designed to convey water for storage or application as part of an irrigation water system.

This practice requires you to follow operation and maintenance as outlined in this Operation and Maintenance (O&M) plan. Following the O&M plan helps ensure safety and satisfactory performance through the expected life of the practice. The landowner/operator is responsible for establishing and implementing this plan which includes—

- Check to make sure that all valves and air vents are set at the proper operating condition to provide protection to the pipeline.
- Allow the pipeline to fill gradually when being put into use after shut down or draining. The maximum flow rate during filling should not exceed a velocity of one foot per second.
- Always slowly open, close, or adjust the settings of in-line valves to prevent water hammer.
- Periodically check to make sure all valves, gates, and regulators meet the system requirements. Make adjustments and repairs as necessary following the manufacturer's recommendations.
- Maintain the design depth of cover over the pipeline.
- Avoid travel over the pipeline by heavy equipment, trucks, etc. when the soil is wet.
- Avoid any subsoiling operation that may disturb the pipeline.
- Remove all trash and other debris that could hinder the system's operation.
- Drain the pipeline and components in the fall to eliminate the possibility of water freezing in the system. If parts of the system cannot be drained, they should be pumped out.
- Check exterior pipeline coatings on above ground or on-ground sections of pipe. Repair any damaged coatings.
- Immediately repair any damage to outlets or appurtenances caused by vandalism, vehicular traffic, or livestock.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate actions to alleviate further damage.
- On any permanently seeded areas, maintain a vigorous growth of the vegetative covering. This includes reseeding, fertilization, and application of herbicides when necessary. Periodic mowing may be necessary to control the cover height.
- Mark crossing locations, as needed
- Monitor cathodic protection systems by testing every 2 to 4 years. Special equipment is required for testing.

Operation & Maintenance Plan
Irrigation System, Microirrigation (Code 441)

Landowner/Operator: Sisseton-Wapeton Oyate

Date:

NRCS Service Center: Sisseton

Conservation District: Roberts

Practice Location: 25-154-51

Tract/Field ID:

(Lat/Long or UTM Coord, or Sec/TS/R)

Expected Lifespan

The minimum expected lifespan of this practice is at least 15 year(s).

Operation and Maintenance

A well-maintained and operated mircoirrigation system is an asset to your farm or ranch. This practice is designed to efficiently and uniformly apply irrigation water and maintain soil moisture for plant growth.

This practice requires you to follow operation and maintenance as outlined in this Operation and Maintenance (O&M) plan. Following the O&M plan helps ensure safety and satisfactory performance through the expected life of the practice. The landowner/operator is responsible for establishing and implementing this plan which includes—

- Monitor the crop noting areas of moisture stress and repair or adjust system operation as needed. Periodically examine each outlet (drip emitter, spray head, etc.,) for proper operation. Clean plugged application devices and replace defective parts.
- Operate the system at the design pressure, discharge rate, and irrigation duration and frequency.
- Inspecting flow meter, if applicable, at least monthly during the growing season, and monitor water application.
- Repair all leaks in delivery facilities.
- Cleaning or backflushing filters, as needed.
- Flushing lateral lines at least annually.
- Performing visual inspection of crop performance and emission device flows if visible and replace applicators, as necessary.
- Measuring pressure often on installed gauges or at Schrader valves with a handheld gauge to ensure proper system operation. A pressure drop (or rise) may indicate a problem.
- Checking pressure gauges to ensure proper operation. Repair or replace damaged gauges.
- Following proper maintenance and water treatment to prevent clogging based on emitter and water quality characteristics.
- Injecting chemicals as required to prevent precipitate buildup and algae growth. Conduct proper maintenance and water treatment after chemigation to prevent clogging of emitters.
- Checking chemical or nutrient injection equipment regularly to ensure it is operating properly.
- Checking and assuring proper operation of backflow protection devices.
- If necessary during non-seasonal use, place appurtenances in a secure area where they will not be damaged.
- Drain and protect equipment from freezing, as necessary.
- When draining the microirrigation system, ensure the water drained from pipelines will not cause water quality, soil erosion, or safety problems upon release.
- Remove all rodents and/or burrowing animals that have or may damage any part of the delivery, or application facilities. Repair any damage caused by their activity.
- Repair any vandalism, vehicular, or livestock damage.

Operation & Maintenance Plan
Irrigation Water Management (Code 449)

Landowner/Operator: Sisseton-Wapeton Oyate

Date:

NRCS Service Center: Sisseton

Conservation District: Roberts

Practice Location: 25-154-51

Tract/Field ID:

(Lat/Long or UTM Coord, or Sec/TS/R)

Expected Lifespan

The minimum expected lifespan of this practice is at least 1 year(s).

Operation and Mantienance

A properly operated, maintained, and managed sprinkle irrigation system is an asset to your farm. Your system was designed and installed to apply irrigation water to meet the needs of the crop without causing erosion, runoff, and losses to deep percolation. The estimated life span of your irrigation system is 15 years. The life of the system can be assured and usually increased by developing and carrying out a good operation and maintenance program.

Pollution hazards to ground and surface water can be minimized when good irrigation water management practices are followed. Losses of irrigation water to deep percolation and runoff should be minimized. Deep percolation and runoff from irrigation can carry nutrients and pesticides into ground and surface water. Avoiding spills from agriculture chemicals, fuels, and lubricants, will also minimize potential pollution hazards to ground and surface water.

Leaching for salinity control may be required if electrical conductivity of the irrigation water or soil water exceeds plant tolerance for your yield and quality objectives. If this condition exists on your field(s), a salinity management plan should be developed.

Make sure that all measuring devices, valves, sprinkler heads, surface pipeline, and other mechanical parts of the system are checked periodically and worn or damaged parts are replaced as needed. Always replace a worn or improperly functioning nozzle with a new nozzle of the same design size and type. Sprinkler heads operate efficiently and provide uniform application when they are plumb, in good operating condition, and operate at planned pressure. Maintain all pumps, piping, valves, electrical, and mechanical equipment in accordance with manufacturer recommendations. Check and clean screens and filters as necessary to prevent unnecessary hydraulic friction loss and to maintain water flow necessary for efficient pump operation.

Protect pumping plant and all associated electrical and mechanical controls from damage by livestock, rodents, insects, heat, water, lightning, sudden power failure, and sudden water source loss. Provide and maintain good surface drainage to prevent water pounding around pump and electrical equipment. Assure all electrical/gas fittings are secure and safe. Always replace worn or excessively weathered electric cables and wires and gas tubing and fittings when first noticed. Check periodically for undesirable stray currents and leaks. Display appropriate bilingual operating instructions and warning signs as necessary. During non-seasonal use, drain pipelines and valves, and secure and protect all movable equipment (i.e., wheel lines).

Irrigation scheduling is a critical part of an irrigation water management system. Scheduling is based on a soil-water balance or crop-water balance for one or more points in a field. By measuring existing and estimating future soil-water content or monitoring crop water-water stress level, irrigation water may be applied before damaging crop stress occurs.

Scheduling irrigation involves forecasting of crop water use rates to anticipate future water needs. Several scheduling techniques and levels of sophistication can be applied to track the amount of soil water in the crop root zone and crop water use. The Natural Resources Conservation Service (NRCS) can assist in the selection of an irrigation scheduling program.

Ensure that irrigation rules are followed as noted in South Dakota Codified State Law 45-5-6, which refers to maximum application rates of irrigation. This law can be found here: https://sdlegislature.gov/Statutes/Codified_Laws/2066746.

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION PLANS AND SPECIFICATIONS

LIVESTOCK WATER SYSTEM

for

Sisseton-Wahpeton Oyate

Section: 25 County: Roberts

Township: 124N Range: 51W

Prepared By:

Hayti Field Support Office

Designed By: P. Heermann

Date: 1/31/2025

Prepared For:

Roberts Conservation District, South Dakota

Sisseton NRCS Field Office

PIPELINE DESIGN SPREADSHEET
APRIL 2024
VERSION 4.05

Livestock Watering System Documentation Requirements

ITEM	FORM NUMBER

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

_____ Environmental Effects for Conservation Planning	NRCS-CPA-52
_____ Cultural Resources	Cultural Resource Tool
_____ Minimal Effect (if pipeline crosses wetland; use Expedited ME #10)	SD-CPA-10

PERMITS & CERTIFICATIONS (landowner responsible)

516 Livestock Pipeline

_____ SD DANR Stormwater Permit for Construction Activities (Needed for Pipelines greater than 3 miles long)	https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/stormwater/StormWaterConstruction.aspx
_____ Water Rights Permit from DANR (more than 15 gpm flow rate)	https://danr.sd.gov/OfficeOfWater/WaterRights/Wateruse/default.aspx

533 Pumping Plant

_____ Installation by licensed well driller or pump installer	https://apps.sd.gov/nr68welllogs/driller
_____ Homeowner Wiring Permit or wiring completed by licensed electrician.	https://dlr.sd.gov/electrical/homeowner_wiring.aspx

DESIGN

516 Livestock Pipeline

_____ Design Data	JP 12.1 or JP 12.1B
_____ Pipeline Hydraulics and Profile	SD-ENG-5D or Simplified Method
_____ Material Estimates	JP 12.1

533 Pumping Plant

_____ Daily Water Requirement	SD-ENG-47
_____ Total Dynamic Head	JP 12.1 or JP 22.0 or JP 22.1
_____ Pump Technical Data	JP 12.1 or JP 22.0 or JP 22.1
_____ Pressure Tank Size	JP 12.1 or JP 22.0 or JP 22.1
_____ Pressure Switch Setting	JP 12.1 or JP 22.0 or JP 22.1
_____ Pump Curve	JP 12.1 or JP 22.0 or JP 22.1

561 Heavy Use Area Protection Watering Facility

_____ Apron Dimensions and Quantities	Apron Spreadsheet

614 Watering Facility

_____ Water Requirements and Tank Capacity	SD-ENG-47 or SD-ENG-47B

642 Water Well

_____ Record of Installation	JP 26.0
_____ Well Driller's Log	Provided by Driller
_____ Water Analysis (If well is for Domestic Use)	Provided by Driller / Owner

ITEM	FORM NUMBER

PLANS AND SPECIFICATIONS

All Practices

_____ Participant Responsibilities	SD-ENG-11P
_____ Cost Estimate (not needed for Job Class III and under; contract documents are adequate)	SD Cost Estimate Worksheet

516 Livestock Pipeline

_____ Plan View Map	JP 12.1 / GIS Map / AutoCAD Map
_____ Appurtenances (protection of above ground components)	JP 12B
_____ Construction notes (with SD One-Call statement)	JP 12.1
_____ Signature for designer, checker, job approval	JP 12.1
_____ Construction and Material Specifications - Wood Fabrication and Installation	SD-16
_____ Construction and Material Specifications - Plastic Pipeline (Livestock/Domestic)	SD-20A
_____ Construction and Material Specifications - Plastic Pipe	SD-55
_____ Operation and Maintenance Plan (O&M)	516 O&M

533 Pumping Plant

_____ Plan View Map	JP 12.1 / GIS Map / AutoCAD Map
_____ Appurtenances (protection of above ground components)	JP 12B
_____ Construction notes (with SD One-Call statement)	JP 12.1 or JP 22.0 or JP 22.1
_____ Construction and Material Specifications	
_____ Signature for designer, checker, job approval	JP 12.1 or JP 22.0 or JP 22.1
_____ Operation and Maintenance Plan (O&M)	533 O&M

561 Heavy Use Area Protection Watering Facility

_____ Construction notes	JP 14.5 or JP 14.5A
_____ Signature for designer, checker, job approval	JP 14.5 or JP 14.5A
_____ Construction and Material Specifications - Drainfill and Filter	SD-9
_____ Construction and Material Specifications - Concrete (Class 3500)	SD-12A
_____ Construction and Material Specifications - Steel Reinforcement	SD-13
_____ Operation and Maintenance Plan (O&M)	561 O&M

614 Watering Facility

_____ Plan View and Side View	JP 14X
_____ Guard post assembly	JP 14X
_____ Table of Quantities	JP 14X
_____ Construction Notes (with SD One-Call statement)	
_____ Signature for designer, checker, job approval	JP 14X
_____ Wildlife Escape Ramp	JP 13.1
_____ Construction and Material Specifications - Wood Fabrication and Installation	SD-16

ITEM	FORM NUMBER
_____ Operation and Maintenance Plan (O&M)	614 O&M
642 Water Well	
_____ Signature for Job Approval	JP 26.0
_____ Construction and Material Specifications - Well	SD-32
_____ Operation and Maintenance Plan (O&M)	642 O&M

CONSTRUCTION

516 Livestock Pipeline	
_____ Construction Check Survey	JP 12.1
_____ As-built drawings and quantities with compliance statement	JP 12.1, JP 12.1B, or SD-ENG-5D
_____ Certification Statement (contractor)	JP 12.1 or JP 12.1B
_____ Construction Inspection Report	SD-ENG-19
533 Pumping Plant	
_____ Final Inspection of Homeowner Wiring	Sticker will be placed in well service panel by electrical inspector
_____ Construction check survey (Pump Curve, Brand, Model, Horsepower) SCS-ENG-28&29	JP 12.1 or JP 22.0 or JP 22.1
_____ As-built drawings & quantities with compliance statement	JP 12.1 or JP 22.0 or JP 22.1
_____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
_____ Construction Inspection Report	SD-ENG-19
561 Heavy Use Area Protection Watering Facility	
_____ Construction Check Survey	JP 14.5
_____ As-built drawings and quantities with compliance statement	JP 14.5
_____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
_____ Construction Inspection Report	SD-ENG-19
614 Watering Facility	
_____ Construction Check Survey	JP 14X
_____ As-built drawings and quantities with compliance statement	JP 14X
_____ Certification Statement (use if NRCS did not inspect)	SD-ENG-2
_____ Construction Inspection Report	SD-ENG-19
642 Water Well	
_____ Construction Check Survey	JP 26.0
_____ Certification Statement (well driller)	JP 26.0
_____ Construction Inspection Report	SD-ENG-19

PARTICIPANT RESPONSIBILITIES

PARTICIPANT	**Sisseton-Wahpeton Oyate**				**County**	**Roberts**	
PRACTICE	Livestock Pipeline, Pumping Plant,						
LEGAL DESCRIPTION		**Sec.**	**25**	**T**	**124N**	**R**	**51W**
GPS Coords.							

GENERAL: Policies and regulations of USDA assistance programs place responsibility on the participant for obtaining necessary local, state, and federal permits, adequate real property rights and interests, applicable water rights, and necessary approvals, easements, and licenses. The participant must also meet requirements for installation, inspection, and operation and maintenance. For copies of South Dakota Laws, see Internet at: http://sdlegislature.gov/statutes/Codified_Laws/

For ALL conservation practices, if the participant elects to install proposed practices in locations **other than where approved by NRCS**, the participant may be in violation of applicable NRCS policy, federal, state or Tribal laws and said action may result in the termination of their NRCS contract or withdraw of financial and technical assistance related to the project.

1. CULTURAL/HISTORICAL RESOURCES

An NRCS approved cultural/historical evaluation **must** be made of all contracted and/or technically assisted practices that have the potential to affect historic properties or culturally significant sites **prior** to construction. If NRCS approved construction activities expose cultural/historical resources, human remains (bones), or similar objects, the participant and/or contractor **must** immediately stop construction and notify NRCS. Any further construction without clearance **could jeopardize assistance** (practice payments/technical) and may be a **violation of state or federal law**.

2. CLEAN WATER ACT

Clean Water Act Section 404 or Rivers and Harbors Act Section 10 permits from the **US Army Corps of Engineers** are required where proposed construction will involve dredging or filling a wetland, or stream. Information may be obtained by contacting: **US Army Corps of Engineers, South Dakota Regulatory Office, 28563 Powerhouse Road, Room 120, Pierre SD 57501, (Phone 605 224 8531)**. Forms are available on the internet at: http://www.nwo.usace.army.mil/Missions/Regulatory-Program/

National Pollutant Discharge Elimination System (NPDES) permits or approval from the **South Dakota Department of Agriculture and Natural Resources (DANR)** may be needed where discharge of polluted water or wastewater (ag waste etc.) to waters of the state (including wetlands) may occur or have occurred. In addition, a **Storm Water Permit** is needed for any **construction** disturbance of over one acre. Information is available by telephone at **605 773 3351** or on the Internet at: https://danr.sd.gov/OfficeOfWater/SurfaceWaterQuality/stormwater/default.aspx

3. PROPERTY RIGHTS (INCLUDING WETLAND EASEMENTS)

The participant is responsible, financially and otherwise, for any costs incurred by the failure to obtain adequate and necessary real property rights and interests, easements, subordination agreements, permits, and/or licenses required for the installation. Participants are cautioned to ensure the area to be affected is not covered by a **wetland easement** or a written agreement is reached with the easement owner. Property rights documents should be recorded for your future protection.

4. PARTICIPANT RESPONSIBILITIES IN CONSTRUCTION SUPERVISION AND INSPECTION

(A) South Dakota Codified Law 49-7A, (also known as **South Dakota One-Call)** requires that no **excavator** may **begin** any excavation without first notifying the One-Call Notification Center of the proposed excavation **(Phone 1-800-781-7474). NRCS makes no representation as to the existence or non-existence of any utility or buried object, and assumes no liability for damage to utilities or buried objects caused by construction of this or other conservation practices.**

(B) All conservation practices require on-site supervision and inspection during construction. The NRCS cannot provide all of the assistance or inspection that may be needed to assure the practice is installed correctly. **Participants must actively lead construction supervision and inspection efforts.** Items requiring **inspection by the participant** are as follows:

Pipeline bury depth, pipeline size and type, gravel backfill around frost-free hydrants, and stop and drain valves.
NRCS must be notified and given the opportunity to inspect the following items prior to installation: Any artifacts or other cultural resources uncovered during trenching.

(C) If you employ a contractor to do your construction work, it is your responsibility to clearly inform the contractor, **prior** to start of construction, that materials and construction must be in accordance with the plans and specifications.

(D) If necessary, the plans can be modified during construction. However, changes to pipe sizes, pipe materials, routes, etc., **must be approved by NRCS** for financial assistance to be assured. **Get approvals before construction!**

(E) The completed practice must be checked by NRCS. NRCS will ask for written certification from you and/or the contractor for those items not inspected by NRCS and for those items you agreed to inspect. **Certification for financial assistance** will be made by NRCS when it has been determined that the NRCS approved design has been completed.

(F) NRCS designed practices as well as financially assisted practices designed by contractors (or others) must meet NRCS Practice Standards and must be approved by an NRCS employee with appropriate Job Approval Authority.

5. OPERATION AND MAINTENANCE (O&M)

The participant is responsible for the safe operation and maintenance of the improvements for the life of the practice. O&M requirements or special O&M plans are listed below:

1. Maintain the design depth of cover over pipelines and the backfill around structures.
2. Valves such as pressure regulators, flow control valves, and check valves may need regular service if pressures, flow rates and backflow prevention are to be maintained.
3. Repair or replace guard posts which provide protection for system appurtenances.
4. Install additional air release valves at summits along the pipeline route if design flow is not being delivered to outlets.
5. Inspect connections, valves, floats, etc., to make sure they are functioning properly. Check tanks for leaks. Make needed repairs.
6. Replace compacted earth or gravel around perimeter of tank as needed to provide adequate footing and drainage.
7. Remove debris, algae, rodents, etc., from the tank to maintain water quality. Copper sulfate or chlorine may be used to prevent algae growth.
8. Check Tank regularly for functionality of animal escape mechanisms.
9. Drain the system and components that are subject to damage by freezing.

6. PARTICIPANT RESPONSIBILITIES AND CERTIFICATION

I have reviewed the conservation plan, associated job sheets, and plans and specifications provided to me. I understand my responsibility to follow the conservation plan, job sheets, and plans and specifications for proper installation of the conservation practices. I understand the endangered species and cultural/historical resources requirements and certify that I will obtain the necessary landrights, easements, water rights, permits, and other authorizations necessary to complete the planned conservation improvements.

Participant Signature: _____ Date: _____

I have reviewed the requirements as set forth in this document with the participant.

NRCS Employee: _____ Date: _____

OPERATION AND MAINTENANCE PLAN - LIVESTOCK WATER SYSTEM
CPS 516 LIVESTOCK PIPELINE
CPS 533 PUMPING PLANT

Producer / Operator: Sisseton-Wahpeton Oyate Date: 1/31/2025

NRCS Service Center: Sisseton Conservation District: Roberts

Location: Sect. 25, T 124N, R 51W, Roberts County, SD Tract / Field ID:

Expected Lifespan

The minimum expected lifespan for Heavy Use Area Protection and Watering Facility is at least 10 years. The minimum expected lifespan for Pumping Plant is at least 15 years. The minimum expected lifespan for Livestock Pipeline and Water Well is at least 20 years.

Operation and Maintenance Items

Operation and maintenance (O&M) is necessary for all conservation practices and is required for all practices installed with the Natural Resources Conservation Service assistance. The land user is responsible for proper O&M throughout the life of the practice and as may be required by federal, state, or local laws or regulations.

Operation refers to operation of the practice in compliance with all laws, regulations, ordinances, and easements; and in such a manner that will result in the least adverse impact on the environment and will permit the practice to serve the purpose for which it was installed. Maintenance includes work to prevent deterioration of the practice, repairing damage, or replacing components which fail.

Necessary operation and maintenance items for CPS 516 Livestock Pipeline include:

- Install additional air release valves at summits along the pipeline route if design flow is not being delivered to outlets.
- Allow the pipeline to fill gradually when being put into use after shut down or draining. The maximum flow rate during filling should not exceed a velocity of one foot per second.
- Always slowly open, close, or adjust the settings of in-line valves to prevent water hammer.
- Periodically check to make sure all valves such as pressure regulators, flow control valves, and check valves meet the system requirements. Make adjustments and repairs as necessary following the manufacturer's recommendations.
- Maintain the design depth of cover over the pipelines and the backfill around structures.
- Repair or replace guard posts which provide protection for system appurtenances.
- Inspect connections, valves, floats, etc., to make sure they are functioning properly. Check tanks for leaks. Make needed repairs.
- Drain the pipeline and components in the fall to eliminate the possibility of water freezing in the system. If parts of the system cannot be drained, they should be pumped out.
- Check exterior pipeline coatings on above ground or on-ground sections of pipe. Repair any damaged coatings.

- Immediately repair any damage to outlets or appurtenances caused by vandalism, vehicular traffic, or livestock.
- Mark crossing locations, as needed.

Necessary operation and maintenance items for CPS 533 Pumping Plant include:

- Develop and follow proper startup and shutdown procedures for the operation of the pumping plant.
- Keep records, including manufacturer installation and operation and maintenance guide along with records of when equipment is serviced, work performed, and by whom.

- Inspect and test all pumping plant components and appurtenances annually to identify repair and maintenance needs.
- Periodically inspect of all safety features to ensure proper placement and function.
- Perform routine maintenance of all mechanical components (power unit, pump, drive train, etc.) in accordance with the manufacturer's recommendations, including lubrication of parts.

- Protect the system from damage due to freezing temperatures. If parts of the system cannot be drained, a non-toxic antifreeze solution may be added.
- Inspect metal surfaces for rust and other damage. Especially inspect sections in contact with earthfill and/or other materials. Repair or replace damaged sections and apply a protective covering.
- Disconnect electrical service and verify the absence of stray electrical current prior to retrofitting any electrically powered equipment.
- For photovoltaic panels, change the tilt angle seasonally if used year-round.
- When applicable, periodically clean the solar array of snow, ice, dust, and film to maintain efficiency.
- Remove rodents and/or burrowing animals that damage any part of the facility. Repair any damage caused by their activity. Repair any vandalism, vehicular, or livestock damage.

Other: _____

Other: _____

Other: _____

Other: _____

Rev. April 2022

U. S. Department of Agriculture
Natural Resources Conservation Service

South Dakota
Rev. 12/2021

Pipeline Construction Checkout Worksheet

Owner / Operator: _____ *Date:* _____

Pipeline Water Source:

Take photos of the start and mark the location on the GPS. Include well log for design and certification purposes.

Circle one of the Following: *New Well* *Tee from existing pipeline*
Existing well *Rural Water*

Pits, Pumps and, Tees:

Can you get in the pit? Take photos of the plumbing, the pressure tank, switch, control box and plaques with model number, and other information. Mark the location on the GPS.

New & Existing Wells:

Pump brand and model _____

Horse power _____ GPM _____

Control box for the pump _____

Pressure tank brand _____

Size (gallons) _____

Pressure switch setting _____

Rural Water & Tees from Existing Lines

Pressures at tee to new line/ from meter pit _____

RW Meter pit, PRVs, flow controls etc. _____

Pressure gage reading in RW meter pit _____

Pipe :

If possible, take photos of pipe used and the pipe markings.

Pipe Material and Size _____

Pipeline :

1. The first thing you should do when checking out a pipeline is bring the design with you. Next look at it before you start to measure the pipeline. Make a note of the appurtenances and their locations
2. Try not to use the tracking function on the GPS all the time. It works best when in a moving vehicle Stop the tracking function when walking or taking a point.
3. Measure the pipeline in small chunks. Measure from start to first tee or tank. Then start a new line from that point to the next tee or tank.
4. Document where the pipeline changes from 1.5" to 2" or changes material, etc.
5. Take photos of the tees, tanks, PRVs, shutoffs etc.
6. Measure points at tees, tanks, hydrants, shutoffs, PRVs, booster pump pits, meter/well pits, etc.
7. Use simple naming conventions like tank, hydrant, PRV, etc. Use the comments field for more detail. Items to include in comments: tank Dia, pressure switch setting, pump model #s, etc.
8. The GPS can be used to keep your notes. That does not mean you can't make a paper copy in the field using survey pages or the SD-ENG-19.
9. Back at the office download your project from the GPS. Make sure that all the points and lines are imported into ArcMap before you delete the project off the GPS unit.
10. Be in contact with your producers and contractors.

U. S. Department of Agriculture
Natural Resources Conservation Service

South Dakota
Rev. 12/2021

CONSTRUCTION INSPECTION REPORT

Owner/Operator _____ Date: _____

Structure _____ Weather _____

Location _____ Farm ID _____

Inspector _____

Narrative _____

U. S. Department of Agriculture
Natural Resources Conservation Service

South Dakota
Rev. 12/2021

CONSTRUCTION INSPECTION / AS-BUILT DATA

Station	Appurtenances	Pipe Size	Material & SDR #	Length	Buried Depth

Design Data

Water source	Electric Well
Number of livestock	100
Pipeline design flow (gpm)	10
No. days storage required	0
Minimum capacity required (Gal.)	2880
Average Pressure Head (PSI)	50
Well Static Water Level (Feet)	10
Estimated Drawdown in Well (Feet)	10

Pipe Materials and Appurtenance Locations

Line Number	Station	Pipe Size and Pressure	Hydrants, Valves or other items required

Pump Recommendations

Pump Type	Pump Rate (GPM)	Head (TDH)	Brand & Model No. (or equal)
	10	136	1/2 HP 10 GPM Pump

Pressure Tank Recommendations

Minimum Size (Gal.)	Min Press. Rating	Pressure Switch Setting On/Off (PSI)		Selected Tank Size	Brand & Model No. (or equal)
63	100 PSI	35	55	85 Gal.	Pentair PS85

Construction Notes

1. SD STATE LAW requires that no excavator may begin any excavation without first notifying the ONE-CALL notification center of the proposed excavation at **811** or **1-800-781-7474** at least two working days prior to starting any excavation.
2. Pipelines designed for potable water shall use pipe carrying the NSF label, and the lines shall be shock chlorinated.
3. Guard posts are required at all above ground appurtenances.
4. Pipeline is to be buried deep enough to obtain a minimum depth of cover of 6.5 feet, measured from original ground.
5. Water bars are to be installed at locations selected by the NRCS technician.

Attachments to this Plan

JOB PLAN 12B (Appurtenances for Pipelines)
JOB PLAN _____ (Stockwater Tank)

Table of Quantities

ITEM OR MATERIAL	UNIT	QUANTITY	AS-BUILT
2 In. HDPE 4710 DR 11	Lin.Ft.	2,511	
6.5 ft trenching depth	Lin.Ft.	2,000	
Above Ground Pipe	Lin.Ft.	500	
Pumping Plant	Each	1	

Notes:

Section 25 Town. 124N Range 51W

SEE ATTACHED PLAN MAP

N

Plan View & Location Map

Scale 1 inch = _____ Ft.

Rev. 02/2022

Job Class III (Less than: 3.0 Miles, 2" Dia., 130 PSI)

Plastic Pipe Specifications:

1. The work shall consist of furnishing and installing plastic pipe, fittings and appurtenances.
2. The pipe shall be free of all defects and conform to all applicable ASTM specifications for the type of plastic specified.
3. All joints and connections shall carry the design flow without leakage. Manufacturers recommendations must be followed.
4. Dissimilar metals must not be in contact with each other. Steel or other corrosive metals must be protected from corrosion.
5. Trenches containing rocks which could damage the pipe shall be over excavated and backfilled with suitable material. Pipelines may be "plowed-in" where soils are suitable.
6. All backfill recommendations of the manufacturer shall be met with the initial 6" being free of rocks. Mound soil over trench to allow for settlement.
7. Pipe not connected with gasketed couplers must be "snaked" in the trench. The pipe shall be allowed to come within a few degrees of subsoil temperature before backfilling.

Wood Fabrication Specifications:

1. The work shall consist of furnishing wood guard posts and protective structures.
2. All wood plywood, OSB, and lumber shall be pressure treated or exterior grade.
3. All wood material shall be new or like new, and free of major defects.
4. All timber structures shall be installed in a workmanlike manner.

Constr. Spec. SD-20A Plastic Pipeline, SD-16 Wood Fabrication and SD-55 Plastic Pipe are incorporated by reference. For a full text version see https://www.nrcs.usda.gov/wps/portal/nrcs/main/sd/technical/engineering/

CONTRACTOR/PRODUCER CERTIFICATION

I certify that this pipeline and related appurtenances were installed in accordance with these approved/"as-built" NRCS plans and specifications. The information included on this form is a true and factual record of the job performed by me.

Contractor/Producer Signature _____ Date _____

The contractor shall furnish the owner a one-year guarantee covering materials and construction.

STATEMENT OF COMPLIANCE

Construction (was) (was not) completed in accordance with approved construction plans and specifications.

NRCS JAA _____ Date _____

Designed: P. Heermann Date: 1/31/2025
Drawn: P. Heermann Date: 1/31/2025
Checked: B. Pettigrew Date: 2/2025
Approved: B. Pettigrew Date: 2/2025

Sisseton-Wahpeton Oyate
CPS 430 - IRRIGATION PIPELINE
Sect. 25 Township 124N Range 51W
Roberts County, South Dakota

United States Department of Agriculture
Natural Resources Conservation Service

File Name

Drawing Name
JOB PLAN 12.1

Sheet 1 of 2

Pipe Materials and Appurtenance Locations

Line Number	Station	Pipe Size and Pressure	Hydrants, Valves or other items required
1	0+00	2 In. HDPE 4710 DR 11	Well
1	4+63	2 In. HDPE 4710 DR 11	High Point
1	8+61	2 In. HDPE 4710 DR 11	Tee 1
1	11+27	2 In. HDPE 4710 DR 11	Tee 2
1	12+85	2 In. HDPE 4710 DR 11	Tee 3
1	14+39	2 In. HDPE 4710 DR 11	Tee 4
1	16+83	2 In. HDPE 4710 DR 11	Tee 5 to Line 2
1	17+91	2 In. HDPE 4710 DR 11	Tee 6 to Line 3
1	19+01	2 In. HDPE 4710 DR 11	Tee 7 to Line 4
1	20+21	2 In. HDPE 4710 DR 11	Tee 8 to Line 5
1	21+11	2 In. HDPE 4710 DR 11	End
2	0+00	2 In. HDPE 4710 DR 11	Tee
2	1+00	2 In. HDPE 4710 DR 11	Line 2 End Hydrant
3	0+00	2 In. HDPE 4710 DR 11	Tee from Line 1
3	1+00	2 In. HDPE 4710 DR 11	End
4	0+00	2 In. HDPE 4710 DR 11	Tee from Line 1
4	1+00	2 In. HDPE 4710 DR 11	End
5	0+00	2 In. HDPE 4710 DR 11	Tee From Line 1
5	1+00	2 In. HDPE 4710 DR 11	End

Rev. 02/2022

File Name

Drawing Name JOB PLAN 12.1

Sheet 2 of 2

USDA United States Department of Agriculture

Natural Resources Conservation Service

Sisseton-Wahpeton Oyate

CPS 430 - IRRIGATION PIPELINE

Sect. 25 Township 124N Range 51W

Roberts County, South Dakota

Designed:	P. Heermann	Date: 1/31/2025
Drawn:	P. Heermann	Date: 1/31/2025
Checked:	B. Pettigrew	Date: 2/2025
Approved:	B. Pettigrew	Date: 2/2025

United States Department of Agriculture
Natural Resources Conservation Service

SD-ENG-5D
REV. 12/2021

Pipeline Design Calculations

Project:	Sisseton-Wahpeton Oyate						Sec.	25	T.	124N	R.	51W	Roberts		County
Designer:	P. Heermann			Date:	1/31/2025		Checker:	B. Pettigrew			Date:	2/2025		Sheet	1

Line No.	Station	Appurtenances	Ground Elev.	Flow gpm	Pipe Size	Material & SDR #	H_F/100 ft	Length	H_F	HGL Elev.	Hydr. Press. psi	SGL Elev.	Static Press. psi	Water Temp (°F)	Max Press. Allowed for Pipe (psi)
1	0+00	Well	1278							1359	35	1405	55	60	144
				10	2	HDPE 4710 DR 11	0.272	463	1.26						
1	4+63	High Point	1290							1358	29	1405	50	60	144
				10	2	HDPE 4710 DR 11	0.272	398	1.08						
1	8+61	Tee 1	1284							1357	31	1405	52	60	144
				10	2	HDPE 4710 DR 11	0.272	266	0.72						
1	11+27	Tee 2	1284							1356	31	1405	52	60	144
				10	2	HDPE 4710 DR 11	0.272	158	0.43						
1	12+85	Tee 3	1286							1355	30	1405	52	60	144
				10	2	HDPE 4710 DR 11	0.272	154	0.42						
1	14+39	Tee 4	1284							1355	31	1405	52	60	144
				10	2	HDPE 4710 DR 11	0.272	244	0.66						
1	16+83	Tee 5 to Line 2	1288							1354	29	1405	51	60	144
				10	2	HDPE 4710 DR 11	0.272	108	0.29						
1	17+91	Tee 6 to Line 3	1290							1354	28	1405	50	60	144
				10	2	HDPE 4710 DR 11	0.272	110	0.30						
1	19+01	Tee 7 to Line 4	1293							1354	26	1405	49	60	144
				10	2	HDPE 4710 DR 11	0.272	120	0.33						
1	20+21	Tee 8 to Line 5	1294							1353	26	1405	48	60	144
				10	2	HDPE 4710 DR 11	0.272	90	0.24						
1	21+11	End	1294							1353	26	1405	48	60	144

☐ Add a Pressure Reducer STA _____ Pressure Setting _____ PSI PRV Size _____ Inch

☐ Add a Booster Pump STA _____ Hydraulic Pressure _____ PSI Static Pressure _____ PSI

☐ Add Pipeline Appurtenances Pressure Losses STA _____

United States Department of Agriculture
Natural Resources Conservation Service

SD-ENG-5D
REV. 12/2021

Pipeline Design Calculations

Project:	Sisseton-Wahpeton Oyate					Sec.	25	T.	124N	R.	51W	Roberts	County
Designer:	P. Heermann			Date:	1/31/2025	Checker:	B. Pettigrew			Date:	2/2025	Sheet	2

Line No.	Station	Appurtenances	Ground Elev.	Flow gpm	Pipe Size	Material & SDR #	H_F/100 ft	Length	H_F	HGL Elev.	Hydr. Press. psi	SGL Elev.	Static Press. psi	Water Temp (F)	Max Press. Allowed for Pipe (psi)
2	0+00	Tee	1288							1354	29	1405	51	60	144
				10	2	HDPE 4710 DR 11	0.272	100	0.27						
2	1+00	Line 2 End Hydrant	1287							1354	29	1405	51	60	144

☐ Add a Pressure Reducer STA _____ Pressure Setting _____ PSI PRV Size _____ Inch

☐ Add a Booster Pump STA _____ Hydraulic Pressure _____ PSI Static Pressure _____ PSI

☐ Add Pipeline Appurtenances Pressure Losses STA _____

United States Department of Agriculture
Natural Resources Conservation Service

SD-ENG-5D
REV. 12/2021

Pipeline Design Calculations

Project:	Sisseton-Wahpeton Oyate						Sec.	25	T.	124N	R.	51W	Roberts	County
Designer:	P. Heermann			Date:	1/31/2025		Checker:	B. Pettigrew			Date:	2/2025	Sheet	3
Line No.	Station	Appurtenances	Ground Elev.	Flow gpm	Pipe Size	Material & SDR #	H_F/100 ft	Length	H_F	HGL Elev.	Hydr. Press. psi	SGL Elev.	Static Press. psi	Water Temp (F)	Max Press. Allowed for Pipe (psi)
3	0+00	Tee from Line 1	1290							1354	28	1405	50	60	144
				10	2	HDPE 4710 DR 11	0.272	100	0.27						
3	1+00	End	1290							1354	28	1405	50	60	144

☐ Add a Pressure Reducer STA _____ Pressure Setting _____ PSI PRV Size _____ Inch

☐ Add a Booster Pump STA _____ Hydraulic Pressure _____ PSI Static Pressure _____ PSI

☐ Add Pipeline Appurtenances Pressure Losses STA _____

United States Department of Agriculture
Natural Resources Conservation Service

SD-ENG-5D
REV. 12/2021

Pipeline Design Calculations

Project:	Sisseton-Wahpeton Oyate					Sec.	25	T.	124N	R.	51W	Roberts		County
Designer:	P. Heermann			Date:	1/31/2025	Checker:	B. Pettigrew			Date:	2/2025		Sheet	4

Line No.	Station	Appurtenances	Ground Elev.	Flow gpm	Pipe Size	Material & SDR #	H_F/100 ft	Length	H_F	HGL Elev.	Hydr. Press. psi	SGL Elev.	Static Press. psi	Water Temp (F)	Max Press. Allowed for Pipe (psi)
4	0+00	Tee from Line 1	1293							1354	26	1405	49	60	144
				10	2	HDPE 4710 DR 11	0.272	100	0.27						
4	1+00	End	1292							1353	27	1405	49	60	144

☐ Add a Pressure Reducer STA _____ Pressure Setting _____ PSI PRV Size _____ Inch

☐ Add a Booster Pump STA _____ Hydraulic Pressure _____ PSI Static Pressure _____ PSI

☐ Add Pipeline Appurtenances Pressure Losses STA _____

United States Department of Agriculture
Natural Resources Conservation Service

SD-ENG-5D
REV. 12/2021

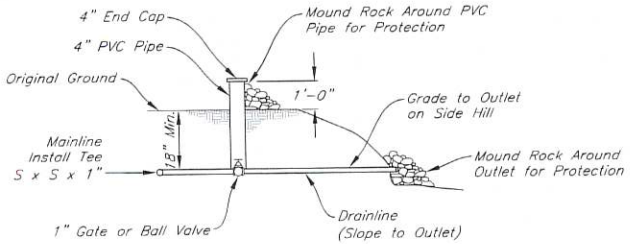
Pipeline Design Calculations

Project:	Sisseton-Wahpeton Oyate						Sec.	25	T.	124N	R.	51W	Roberts		County
Designer:	P. Heermann			Date:	1/31/2025		Checker:	B. Pettigrew			Date:	2/2025		Sheet	5
Line No.	Station	Appurtenances	Ground Elev.	Flow gpm	Pipe Size	Material & SDR #	H_F/100 ft	Length	H_F	HGL Elev.	Hydr. Press. psi	SGL Elev.	Static Press. psi	Water Temp (F)	Max Press. Allowed for Pipe (psi)
5	0+00	Tee From Line 1	1294							1353	26	1405	48	60	144
				6	2	HDPE 4710 DR 11	0.106	100	0.11						
5	1+00	End	1293							1353	26	1405	49	60	144

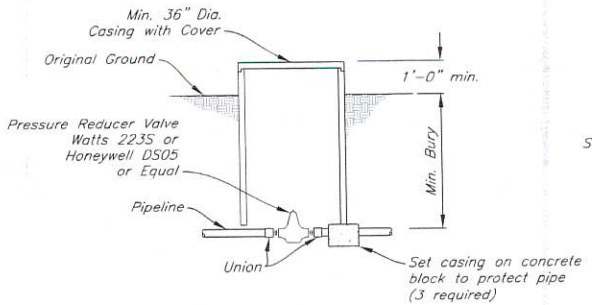
☐ Add a Pressure Reducer STA _____ Pressure Setting _____ PSI PRV Size _____ Inch

☐ Add a Booster Pump STA _____ Hydraulic Pressure _____ PSI Static Pressure _____ PSI

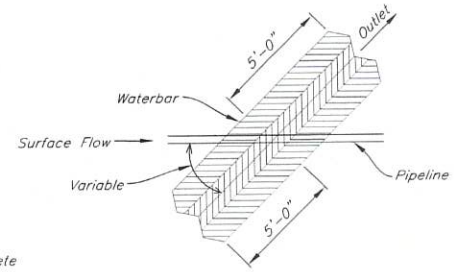
☐ Add Pipeline Appurtenances Pressure Losses STA _____



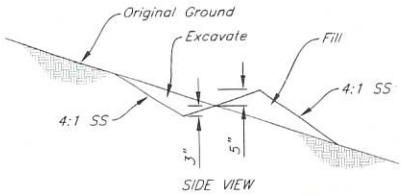
TYPICAL DRAIN INSTALLATION
FOR SHALLOW BURY PIPELINES



TYPICAL PRESSURE REDUCER
INSTALLATION

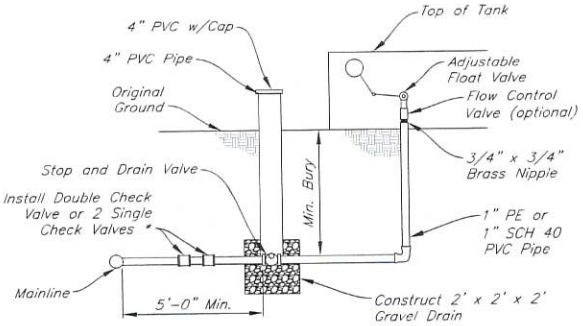


PLAN VIEW

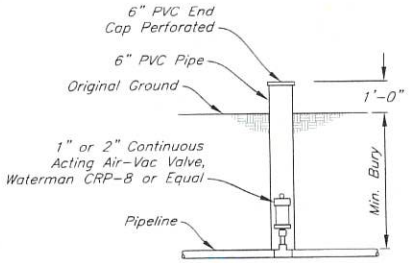


SIDE VIEW

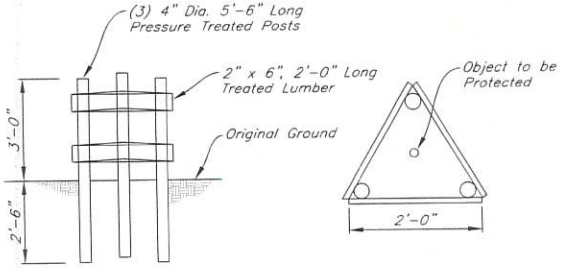
TYPICAL WATERBAR
INSTALLATION



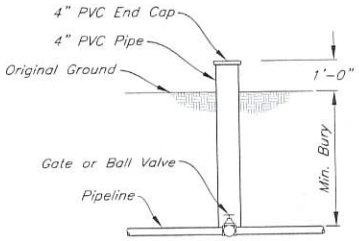
TYPICAL STOP AND DRAIN INSTALLATION



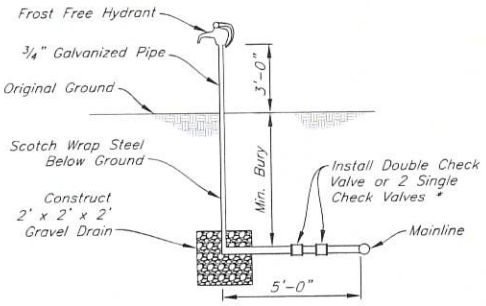
TYPICAL AIR-VAC VALVE
INSTALLATION
(IN RISER)



TYPICAL GUARD POST INSTALLATION
(Use to Protect Above Ground Appurtenances from Livestock)



TYPICAL GATE OR BALL
VALVE INSTALLATION
(IN RISER)



TYPICAL HYDRANT INSTALLATION

* Required if Mainline Serves Household or Other Potable Use.

MATERIAL LIST	
ITEM	*QUANTITY*
4" Dia. 5'-6" Long Pressure Treated Posts	3
2" x 6" x 2'-0" Pressure Treated Lumber	6
3/8" Dia. 4" Long Lag Screws or #16 Ring Shank Nails	24

STOCKWATER PIPELINE APPURTENANCES
JOB PLAN 12B 12/2021

TANK SELECTION		
DATE	APPROVED	TITLE
04/01/2008	Jay B. Cobb	SCE-SD
05/07/2012	Jay B. Cobb	SCE-SD
12/15/2021	Jay B. Cobb	SCE-SD

Date 2/4/2025
Designed P. Heermann 2/4/2025
Drawn P. Heermann
Checked B. Pettigrew 12/2025
Approved B. Pettigrew 12/2025

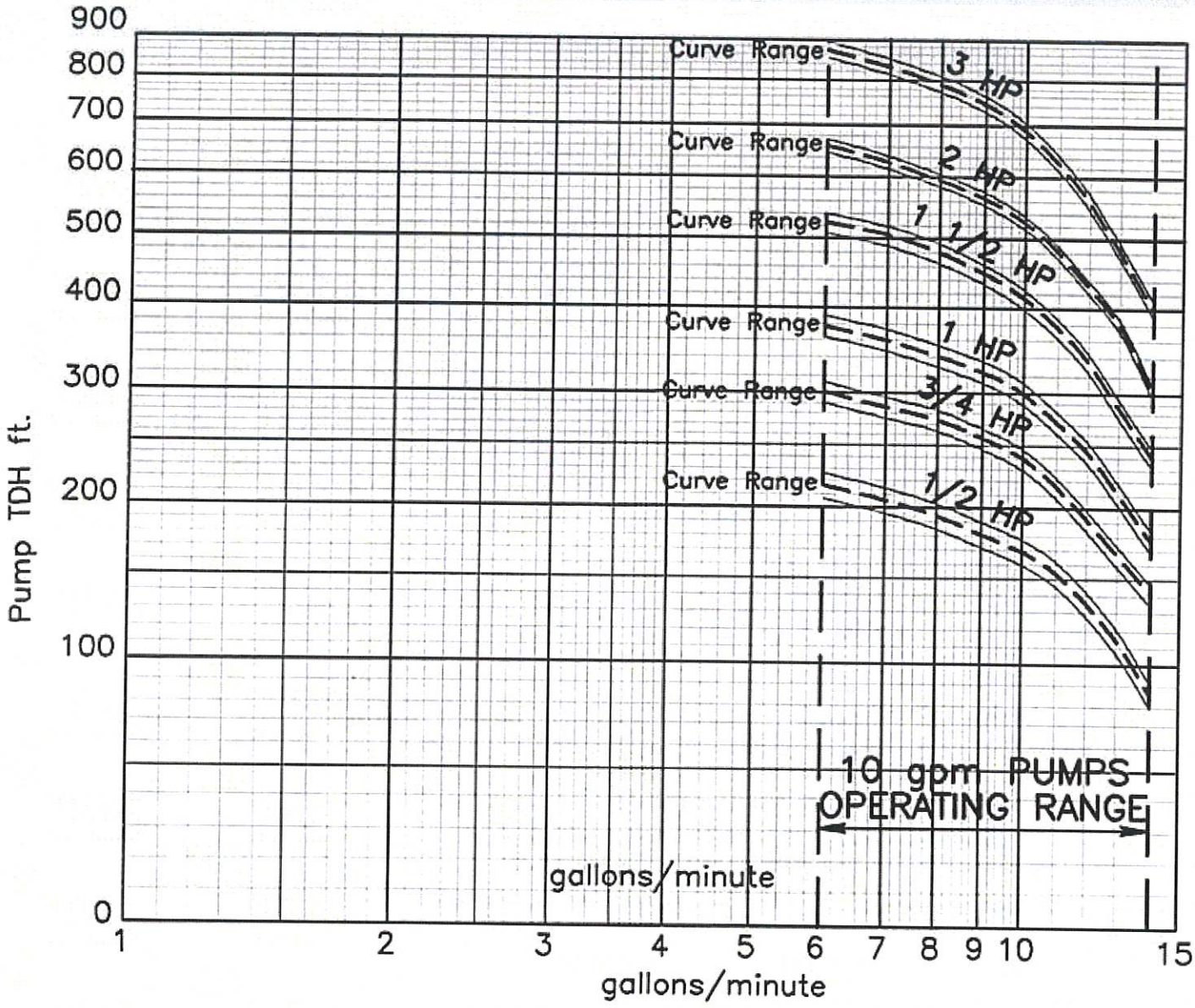
NAME: Sisseton-Wahpeton Oyate
516 – LIVESTOCK PIPELINE
Stockwater Pipeline Appurtenances
Sect. 25, T. 124N, R. 51W Roberts County, South Dakota

USDA United States Department of Agriculture
Natural Resources Conservation Service

File No. Job. Plan 12B.dwg
Drawing No. – – –
12/22/2021 3:07 PM
Sheet of

These are generic pump curves and do not necessarily correspond to a particular manufacturer's model of submersible pumps. These curves may not work in all situations and with all pumps. Use pump curves available from the manufacturer if you know which brand of pump is going to be installed.

5 GPM Pump | 7 GPM Pump | 10 GPM Pump | 15 GPM Pump | 20 GPM Pump



Selected Pump Type:
(Example: 3/4 HP 7 GPM Pump)

1/2 HP 10 GPM Pump

Print | Close

Total Dynamic Head TDH (Feet)

135.5

Minimum Pump Flow Rate (GPM)

10

Irrigation Water Management Plan — Small Farms and Gardens

Description

Irrigation Water Management (IWM) is the process of determining and controlling the volume, frequency, and application rate of irrigation water. IWM helps the irrigator to properly manage irrigation water application, while implementing an environmentally friendly and economically viable conservation practice.

Drip tape irrigation on crop growing beds

Purpose

IWM accomplishes one or more of the following purposes:

- Improve irrigation water use efficiency (save water).
- Minimize irrigation-induced soil erosion.
- Protect surface and ground water quality.
- Manage salts in the crop root zone.
- Manage air, soil, or plant microclimate.
- Improve poor plant productivity and health.
- Reduce energy use.

Flow Rate and Volume Measurement

To properly apply IWM an irrigator must possess the ability to measure the flow rate and volume of irrigation applications. There are various methods available to help producers accomplish this. Available upstream and downstream distances, cost, telemetry capability, pipe size, and water quality may all be factors in the type of device used and location of installation.

A flowmeter is the most used device. It is typically installed near the water source or pump discharge point but is sometimes installed at other locations.

Flow meter examples

Irrigation Scheduling

Irrigation Scheduling determines when to irrigate and how much water to apply during each application. Application amount, rate, and timing are scheduled to replace soil moisture used by the crop, while still allowing sufficient capacity for storage of additional moisture from effective precipitation in the soil profile. Base the timing of irrigation on one or more of the following methods:

- Soil moisture monitoring techniques
  - Soil moisture sensors
  - Feel and appearance
- Plant monitoring (critical growth stage)

Base the volume (depth) of water needed for each irrigation event on the following, depending on each crop or field:

- Available water-holding capacity of the soil for the crop rooting depth
- Management allowable soil water depletion
- Current soil moisture status
- Current crop/forage growth stage
- Distribution uniformity of the irrigation event

Estimating Soil Moisture with Sensors

Electronic sensors, either stationary or portable, can be used to measure or estimate the amount of water in the soil. Stationary sensors can be placed at selected locations and predetermined depths throughout the field. Portable probes can be used in multiple locations.

Estimating Soil Moisture by Feel and Appearance

Soil moisture is typically sampled at 6 inches and then every 12 inches to the rooting depth of the crop (Table 1). Use the Estimating Soil Moisture by Feel and Appearance publication (Estimating Soil Moisture) to determine the soil moisture deficit for the crop root zone. Apply the amount of water required to raise the soil-water content to field capacity. The soil texture at each depth must be known to use this method. Soil texture can be determined by the feel method (https://www.nrcs.usda.gov/ sites/default/files/2022-11/texture-by-feel.pdf) or by referencing the NRCS Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

Example: Net irrigation event of 3.1" will refill the root zone (48").

Sample Depth	Zone	USDA Texture	AWC* for Zone	Soil Moisture Depletion**	Percent Depletion
6"	0-12"	sandy loam	1.4"	1.0"	70
18"	12-24"	sandy loam	1.4"	0.8"	55
30"	24-36"	loam	2.0"	0.8"	40
42"	36-48"	silty clay loam	2.0"	0.5"	25
TOTALS	--	--	6.8"	3.1"	

Available Water Holding Capacity

**Determined by "feel and appearance method"*

Crop Rooting Depth

Rooting depths vary with crop species and may be affected by compaction or hardpans. Rooting depth determines the volume of soil from which the crop can draw water and is important to determine the depth to which the soil must be wetted when irrigating.[2,3]

Table 1. Rooting depth of common crops

Shallow (6-12 inches)	Moderate (18-24 inches)	Deep (> 36 inches)
Beet	Brussels sprouts	Asparagus
Broccoli	Cabbage	Lima bean
Carrot	Cantaloupe	Pumpkin
Cauliflower	Cucumber	Sweet potato
Celery	Eggplant	Watermelon
Greens	Pea	Winter squash
Herbs	Potato	
Onion	Snap bean	
Pepper	Summer squash	
Radish	Sweet corn	
Spinach	Sweet potato	
	Tomato	

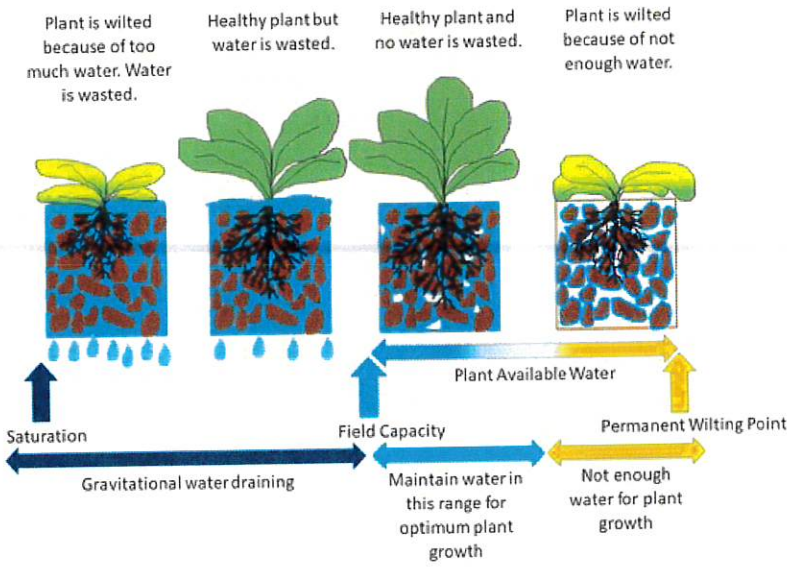
University of Nebraska-Lincoln Extension NebGuide G2189 and Midwest Vegetable Production Guide

Available Water Holding Capacity

Available water holding capacity (AWC) is the maximum amount of water the soil can hold that can be absorbed by plants. The plant available water is between field capacity and the permanent wilting point.

The total available water holding capacity for a given location depends on soil texture, organic matter, and rooting depth.[2,3] Compaction will reduce irrigation infiltration and affect plant available water.

Different soil types have different AWCs. Coarse soils, such as sands, have relatively larger pore space and do not hold as much water as fine textured soils, such as clays. Refer to the Estimating Soil Moisture by Feel and Appearance publication (Estimating Soil Moisture) for AWC by soil type.



For each percent increase of organic matter in the top 12" of soil, the moisture-holding capacity is estimated to increase by thousands of gallons per acre (~380 gallons per 1,000 square feet). Soils with high water-holding capacities require less frequent irrigation than those with low water- holding capacities. However, when soils are irrigated less frequently, a greater amount of water must be applied per application to meet crop needs.[2,3] Monitor soil moisture to ensure that crops receive adequate water – in the range between field capacity and before reaching the crop's wilting point.

Plant Monitoring (Critical Growth Stage)

Crops require an adequate supply of moisture throughout their entire growth for production and the most efficient use of water.

While the frequency and amount of water varies according to individual crop, growth stage, current soil moisture, soil type, and weather conditions, generally 1 to 2 acre-inches of water are required each week.[4] One acre-inch is 27,156 gallons of water (623 gallons per 1,000 square ft).

Most crops are sensitive to water stress during one or more critical growth periods in their growing season. Moisture stress during a critical period can cause an irreversible loss of yield or product quality. Nearly all vegetable crops are sensitive to drought during two periods: two to three weeks before harvest and during harvest.

Critical periods must be considered with caution because they depend on plant species as well as variety. Some crops can be moderately stressed during noncritical periods with no adverse effect on yields. Other plants require mild stress to set and develop fruit for optimum harvest time (weather or market). Table 2 lists several crops and critical growth stages.

Management Allowable Depletion

Management Allowable Depletion (MAD) is the percentage of the soil available water holding content that can be depleted between irrigation events without serious plant moisture stress. Only a portion of the AWC of a soil is easily used by a crop before water stress develops.[5]

The average MAD for high value vegetable crops grown in the Midwest is 25% for shallow rooted crops, 30% for moderately rooted crops, and 40% for deep rooted crops.[5]

The amount and frequency of irrigation water to apply to crops can be calculated by knowing the MAD, soil texture and associated AWC, crop rooting depth, and the crop water needs for the current growth stage.

Refer to the datasheet on page 9 of this plan for an example irrigation schedule.

Table 2. Critical growth stage of common crops

Crop*	Critical Stage
Broccoli, Cabbage, Cauliflower, Lettuce	Head Development
Carrot, Radish, Beet, Turnip, Sweet Potato	Root Enlargement
Sweet Corn	Silking, Tasseling, and Ear Development
Cucumber, Eggplant, Pepper, Melon, Tomato	Flowering, Fruit Set, and Maturation
Bean, Pea	Flowering, Fruit Set, and Development
Onion	Bulb Development
Potato	Tuber Set and Enlargement
Summer Squash	Bud Development and Flowering
Greens, Spinach	Continuous

** Planting and stand establishment represent a most critical period for adequate water when transplanting*

Transplants and Direct Seeded Crops

Plant growth stage influences the susceptibility of crops to drought stress. Irrigation is especially useful when establishing newly seeded or transplanted crops. Irrigation after transplanting can significantly increase the plant survival rate, especially when soil moisture is marginal, and the evapotranspiration rate is high. Irrigation can also increase the uniformity of emergence and final stand of seeded crops.[3]

For seeded crops, reduce the rate of application and the total amount of water applied to avoid crusting. If crusting is present, use low application rates and small amounts of irrigation water to soften the crust while seedlings are emerging.[3]

Drip irrigation on transplanted crops

Application System Distribution Uniformity

How much water is being put on? In addition to irrigation water, it is also important to track the amount of precipitation at your farm with rain gauge(s). Depending on the size of your operation, multiple gauges might be needed.

Determining the amount of irrigation water that was applied depends on the method of application:

- Sprinkler / mini-wobbler – place multiple collection devices (tuna cans or rain gauges) where you plan to apply. Apply water for a determined amount of time but less than what will be needed to see how much water is collected in each device. Multiply appropriately to determine the amount of water planned (i.e., water was on for 15 minutes and 0.25 inches was collected equals running it for about an hour to get 1.0 inch).
- Drip Tape – collect water from 2 holes each at the start, middle and end of the bed. Run for a determined amount of time to figure out how much was applied and adjust up or down to meet needs.
- Flow meter – use flow meter to determine amount of water being applied.

Continue to monitor if water is being applied uniformly and at planned rates across all areas. If not using flow meters, pay attention to water pressure as it can vary through the day.

Drip irrigation under beans

Drip irrigation and cilantro transplants

Water Infiltration and Irrigation-Induced Erosion

Water - as rainfall or irrigation - that is unable to infiltrate the soil will likely result in runoff. Soil lacking adequate structure (e.g., compacted), especially on a slope, will likely result in runoff.

Excessive amounts of runoff cause erosion. Indicators of erosion are little rills or gullies in fields. Sedimentation at the base of slopes is also a sign of erosion.

Water moves much quicker through a sandy soil compared to a clay soil due to the number and size of air pore space between the particles.[2]

If the amount of water being applied causes erosion, reduce the rate of water being applied at any one time by half and then apply the other half 12-24 hours later. Improving aggregate stability and infiltration or adding mulch will also reduce erosion.

Water Quality

Irrigation water quality directly affects crops, soils, and the environment. Testing irrigation water can help prevent potential adverse impacts by properly treating the water prior to application.

This is especially true in high tunnel systems where irrigation is the only source of water. Crops grown outside are less affected by irrigation water sources since they experience dilution from precipitation.

A water sample should be sent to a laboratory that is equipped to test water for agricultural irrigation purposes. At a minimum, the analysis should include alkalinity, pH, soluble salts, hardness, and heavy metals.

Based on the water test results, apply filters to the irrigation system and/or amendments to the water prior to application, as needed.

Clogged drip tape from unfiltered water

Irrigation and Mulching

Mulches used on many farms are either synthetic or natural. Consider mulch product and type when planning for crop irrigation.

Synthetic: Plastic mulch

Lay plastic mulches over moist soil. Irrigate the field if soil moisture is not adequate prior to laying the mulch.[1] Plastic mulch is not permeable. If irrigating mulched crops throughout the season, lay drip tape under plastic mulch to apply water directly to soil surface. If irrigating with overhead sprinklers, monitor soil moisture to check that crops receive adequate water.

Synthetic: Landscaping fabric

Commercial landscaping fabric is often used on farms for weed control. It is permeable yet can partially obstruct rain or irrigation water. Lay landscaping fabric over moist soil. Lay drip tape under the fabric for the best direct application of water to the soil surface.

Drip irrigation tape under landscaping fabric

Natural: Straw, hay, compost, wood chips, wool, and other biodegradable natural materials

Natural materials can improve soil moisture and irrigation efficiency by moderating soil temperatures and reducing evaporation from soil surfaces.

When using synthetic and natural mulches, it can be hard to visually see soil moisture. Drip tape can become clogged by soil or minerals in the source water or cut by equipment. It is important to monitor soil moisture regularly to ensure water is adequately meeting crop needs.

Water Table Contribution

The depth to the water table can change depending on the time of year. If the water table is within 6 ft of the surface during the growing period, then the amount of irrigation water needed may be less than anticipated due to capillary action.

Determine water table depth by measuring the water level in a nearby shallow well or dig a representative hole. If a shallow water table exists, closely monitor the soil moisture at the lower depths of a crop's root zone to avoid over-watering.

Other Considerations

Increased crop residue left on the field will reduce the potential for irrigation-induced erosion, increase the infiltration of water into the soil, and reduce evaporation from the soil surface.

Avoid operating heavy equipment on wet soils to minimize soil compaction.

Adequate crop rotation is important to prevent disease and pest pressure.

Consider crop species selection in situations where drought or water deficits are recurrent.

Consider irrigation water management to maintain or improve soil health by following a soil management system that creates a favorable habitat for soil microbes:

- Minimize soil disturbance - physical, chemical, and biological
- Use plant diversity in the rotation to increase diversity below ground
- Keep a living root growing year-round as much as possible
- Keep the soil covered with residue and growing plants year-round

Manage water so it does not drift or come in direct contact with surrounding electrical lines, supplies, devices, controls, or components that could cause loss of electrical power or the creation of an electrical safety hazard to humans or animals.

Fertigation and chemigation are the application of water-soluble fertilizers and chemicals to crops by injecting them into the irrigation system. These liquid applications should not be considered in the amount or frequency of irrigation water applied as they fall under nutrient management and pest management considerations. It is important to note, however, that irrigation systems can be used in this manner.

Drip irrigation tape under landscaping fabric

Consider how the interruption of power to irrigation systems from load control, interruptible power schedules, repair and maintenance downtime, and harvest downtime may change the plans for irrigation water management.

The use of new technologies for data collection such as drones, advanced imaging technology, remote sensing technology, yield monitoring, and data logging to calculate water use can lead to more efficient water application.

The use of energy saving technologies, such as low energy precision application irrigation, and the use of alternative energy sources can result in significant energy saving versus conventional methods.

It is the responsibility of organic producers to ensure that all permissible activities, design, materials used, and material specifications are consistent with the USDA National Organic Program.

Record Keeping

The remaining pages of this document must be completed to customize the Irrigation Water Management Plan to an operation.

Good record keeping is a best management practice for all farming operations and can help improve yields and profits.

If a NRCS program payment is scheduled for Irrigation Water Management (449), then record keeping is required. Documentation must include this Irrigation Water Management Plan and a record of the items listed below for each irrigation event.

- Location
- Date
- Crop
- Method to determine soil moisture
- Plant growth stage
- Available water capacity
- Soil moisture depletion
- Amount of water applied
- Rainfall/climate considerations

References

- [1]South Dakota Field Office Technical Guide (FOTG) Practice Standard 449 - Irrigation Water Management.
- Midwest Vegetable Production Guide for Commercial Growers, 2022.
- [2]Water Wise Vegetable and Fruit Production, UNL Extension NebGuide G2189, June 2013
- Estimating Soil Moisture by Feel and Appearance, USDA-NRCS, April 1998.
- Indiana High Tunnel Handbook, Purdue Extension Service, HO-296, August 2018.
- [3] Irrigating Vegetable Crops, University of Massachusetts Vegetable Program, 2013
- [4]Vegetable Gardening in South Dakota, SDSU Extension, July 2019
- [5] Basics of Irrigation Scheduling, University of Minnesota, 2019
- [6] National Engineering Handbook. Part 652, Irrigation Guide. USDA-NRCS, 1997
- Irrigation Scheduling: Checkbook Method, UNL Extension Circular EC 709

Additional Resources

- High Tunnel Micro-Irrigation Guide, Carolina Farm Stewardship Association, 2017 https://www.carolinafarmstewards.org/wp-content/uploads/2017/01/High-Tunnel-Micro-Irrigation-Guide.pdf
- Crops - Greenhouse and Indoor Production Resources, Purdue Extension Service https://mdc.itap.purdue.edu/newsearch.asp?subCatID=425%20&CatID=10
- Fruit Growers News – Specialty Crop Irrigation: A Video Alternative to Educational Meetings, Purdue University and Michigan State University, May 2020 https://fruitgrowersnews.com/news/specialty-crop-irigation-a-video-alternative-to-educational-meetings/
- Best Management Practices for Irrigating Vegetables, Rutgers Cooperative Extension, 2002 https://njaes.rutgers.edu/drought/pdfs/BMP-Irrigating-Vegetables.pdf

United States Department of Agriculture

Office: Hayti Planner: P. Heermann

Address: 301 Marsh St Hayti, SD 57241

Contact Information: 605-659-4787

IRRIGATION WATER MANAGEMENT PLAN DATASHEET - SMALL FARMS & GARDENS

GENERAL INFORMATION

Participant: Sisseton-Wahpeton Oyate County: Roberts

Farm: Tract: Contract #:

IRRIGATION HISTORY & EXISTING COMPONENTS

Existing Garden/Fields: # Fields/Plots # Systems Total Area Sq. Ft.

Garden/Field Type: ☐ Rows ☐ Beds ☐ High Tunnel ☐ Other:

Water Source:

- ☐ City / Municipal
- ☒ Domestic Well
- ☐ Shared Well
- ☐ Irrigation Well
- ☐ Irrigation Reservoir
- ☐ Pond
- ☐ Other:

Pressure Source:

- ☐ City / Municipal
- ☐ Pressure Tank
- ☐ Direct Pump
- ☐ Gravity

Operating Pressures If Known:

Minimum PSI

Typical PSI

Maximum PSI

Avg Source Flow Rate: 10.0 GPM *(If Known)*

Is Electricity Available on Site? ☒ Yes ☐ No

Past Irrigation History *(type/frequency/amount or rate/crops/production/issues/challenges/other information)*

SOILS & CROP INFORMATION

Data from Web Soil Survey

Map Unit Symbol: PeA

Map Unit Name: Peever clay-loam

Representative Soil Profile

Crop Roots	Depth	Texture	AWC
Shallow	6"	Clay Loam	1.00 "
Moderate	18"	Clay	2.62 "
Deep	36"	Clay	5.05 "

AWC - Total Available Water Holding Capacity
MAD - Management Allowable Depletion

Potential Crops & Growing Season

Spring

Summer

Fall

Winter

Example Irrigation Schedule - No Rainfall

Crop Needs	Crop Roots	MAD, %	Amount	Frequency
1.50 in/wk	Shallow	25.0	0.21 "	every 1 days
	Moderate	30.0	0.64 "	every 3 days
	Deep	40.0	1.93 "	every 9 days

PLANNED SYSTEM INFORMATION

REQUIRED: Attach Irrigation Site Plan Map

Planned System Components (Optional/If Known):

- ☒ *441 / 442 Irrigation System*
  - ☐ Emitter
  - ☒ Drip Tape
  - ☐ Micro Sprinkler
  - ☐ Other:
- ☒ *533 Pumping Plant*
  - ☒ Electric
  - ☐ Solar
- ☒ *430 Irrigation Pipeline*
  - Diameter: 2.00 "
  - Material: HDPE 4710
- ☐ *436 Irrigation Reservoir or 636 Water Harvesting Catchment*
  - ☐ Storage Tank
  - ☐ Constructed Dam/Pit
- ☐ *558 Roof Runoff Management*
  - ☐ Roof Gutters
  - ☐ Trench Gutters

In-season water needs determined by:

- ☐ Soil Moisture Sensors
- ☒ Soil Appearance & Feel Method
- ☐ Plant Monitoring
- ☐ Computerized Irrigation Scheduling

Applied water volume/rate determined by:

- ☒ In-Line Flowmeter w/Totalizer
- ☒ Duration of Irrigation
  - Application Rate: 0.38 in/hr
  - System Efficiency: 90.0 %
  - Time to Apply 1.50 ": 4.4 hr

Other Planned Conservation Components (Optional):

- ☐ Cover Crop
- ☐ Mulching Residue
- ☐ Mgmt Crop
- ☐ Rotation
- ☐ Pollinator Habitat
- ☐ Other :
- ☐ Nutrient Mgmt
- ☐ Integrated Pest Mgmt
- ☐ High Tunnel System
- ☐ Low Tunnel System
- ☐ Raised Beds

Fertigation/Chemigation planned on system?

☐ Yes ☒ No

Backflow Prevention Type:

*Backflow prevention measures (sufficient air gap or an appropriately rated valve) are **required** for systems utilizing in-line chemigation or fertigation.*

CERTIFICATION

This plan was developed with best available information but may require operator adaptability to changing conditions. I have read and understand the operation and maintenance requirements associated with this management plan

Operator/Landowner: Date:

IRRIGATION WATER MANAGEMENT - 449

U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

Producer:	SWO	Location:	Section 25 Township 124N Range 51W
Irrigation System Type:	Center Pivot - Mid Elevation Spray application(MESA)		

Cropping System:

Crop	Corn
Root Depth (ft)	4
Irrigated Area (acres)	1

Climate:

Area	5
Annual Rainfall	21.78
Average Annual Net Irrigation	9.6 in.
Design Consumptive Use	0.26

Soils:

	Name	Peever
	Texture	Clay Loam
AWC	Intake Family (Group)	0.3 (7)
AWC	1 ft	2.3 in.
AWC	2 ft	4.1 in.
AWC	3 ft	5.6 in.
AWC	4 ft	7.1 in.
AWC	5 ft	8.6 in.
	Estimated Max Soil Infiltiration	0.65 in/hr

For soils in intake family 0.1 or irrigation Group 9, complete onsite soil investigation to avoid runoff and high water table issues.

Water Considerations:

Source	Well
Name on Permit	0
Capacity (GPM)	6
Known Water Quality Issues:	
No Concern	

IWM CHECKLIST

- ☐ Plan Map (with sensor locations)
- ☐ Soils Map
- ☐ FIRI Run
- ☐ IWM Record of Management
- ☐ CPED Run
- ☐ ENG-9C
- ☐ O and M
- ☐ Feel and Appearance
- ☐ CP Nozzle

Online access for software: HERE

Job Class: Job Class 1 (160 acres)

Power Source:

Drive Type	0
Energy Source	0
Pump	
Cost to irrigate ($/inch)	

Method of water measurement: Flow Meter

Method of Irrigation Scheduling: Soil Moisture

Use this form each irrigation season to document and certify that IWM was completed on the field.

This IWM Plan has been operated in accordance with standard 449 and the seasonal water management documentation has been turned into NRCS for certification:

YEAR 1 Certification

NRCS JAA Signature for annual IWM

Producer Signature

NRCS

CPS 449 - IRRIGATION WATER MANAGEMENT

Sprinkler Irrigation

USDA	*Section 25 Township 124N Range 51W*
NRCS	*Roberts County, South Dakota*

	Date
Planned:	1/31/2025
Drawn:	P. Heermann
Checked:	B. Pettigrew
Approved:	B. Pettigrew 2/2025

MAINE IRRIGATION WATER MANAGEMENT PLAN WORKSHEET FOR DRIP IRRIGATION

OWNER	Sisseton-Wahpeton Oyate	PLANNED BY	P. Heermann
SERVICE CENTER	Sisseton-Wahpeton Oyate	DATE	1/31/2025
FARM NAME		SCENARIO	Proposed
		CHECKED BY	

Field information

Input in yellow cells
Output in blue cells

Zone name	High Tunnel Zone 1 (Proposed)	
width of field	48	ft
row spacing	2.5	ft
width divided by rows +1	20	
number of drip lines	20	each
length of field	72	feet
length of drip tape per row	72	feet
Total length of tape needed	1454	feet

Proposed Drip tape to be used by producer

NetaFim Drip tape 0.638 inch diameter, 15 mil, operation pressure+10 psi, 0.22 gph emitter

gpm/100 feet of drip tape	0.367	gallons/min. per 100 feet of tape
gph per emitter	0.22	gallons per hour per emitter
emitter spacing	12	inches
width of area to be irrigated	13	inches

Assumed circular wetted area from each emitter

Area	0.921	square feet
System efficiency	90.00%	
Application rate	0.38	inches per hour

Soil name	Pever Clay Loam	
Maximum application rate for soil	0.65	inches per hour
Available Water Capacity	2.62	inch
Maximum allowable depletion	1.31	
application rate does not exceed soil uptake	OK	

Plant uptake	0.2	inches/day
Days between irrigation events	2	days
Application amount per irrigation	0.44	inches
Time needed to apply	69.6	minutes
Wilt Check	OK	

Flow required by zone	5.337648	gallons per minute
Volume of Water Applied per Event	372	gallons
Actual flow available	10	gallons per minute
Amount of tape that can be irrigated with actual flow	2452.316	feet
Actual flow can support zone	YES	

Run zone 69.6 minutes every 2 days

MAINE IRRIGATION WATER MANAGEMENT PLAN WORKSHEET FOR DRIP IRRIGATION

OWNER	Sisseton-Wahpeton Oyate	PLANNED BY	P. Heermann
SERVICE CENTER	Sisseton-Wahpeton Oyate	DATE	1/31/2025
FARM NAME		SCENARIO	Proposed
		CHECKED BY	

Field information

Zone name	High Tunnel Zone 2 (Proposed)		Input in yellow cells
width of field	48	ft	Output in blue cells
row spacing	2.5	ft	
width divided by rows +1	20		
number of drip lines	20	each	
length of field	72	feet	
length of drip tape per row	72	feet	
Total length of tape needed	1454	feet	

Proposed Drip tape to be used by producer

NetaFim Drip tape 0.638 inch diameter, 15 mil, operation pressure+10 psi, 0.22 gph emitter

gpm/100 feet of drip tape	0.367	gallons/min. per 100 feet of tape
gph per emitter	0.22	gallons per hour per emitter
emitter spacing	12	inches
width of area to be irrigated	13	inches

Assumed circular wetted area from each emitter

Area	0.921	square feet
System efficiency	90.00%	
Application rate	0.38	inches per hour

Soil name	Pever Clay Loam	
Maximum application rate for soil	0.65	inches per hour
Available Water Capacity	2.62	inch
Maximum allowable depletion	1.31	
application rate does not exceed soil uptake	OK	

Plant uptake	0.2	inches/day
Days between irrigation events	2	days
Application amount per irrigation	0.44	inches
Time needed to apply	69.6	minutes
Wilt Check	OK	

Flow required by zone	5.337648	gallons per minute
Volume of Water Applied per Event	372	gallons
Actual flow available	10	gallons per minute
Amount of tape that can be irrigated with actual flow	2452.316	feet
Actual flow can support zone	YES	

Run zone 69.6 minutes every 2 days

MAINE IRRIGATION WATER MANAGEMENT PLAN WORKSHEET FOR DRIP IRRIGATION

OWNER	Sisseton-Wahpeton Oyate	PLANNED BY	P. Heermann
SERVICE CENTER	Sisseton-Wahpeton Oyate	DATE	1/31/2025
FARM NAME		SCENARIO	Proposed
		CHECKED BY	

Field information

Input in yellow cells
Output in blue cells

Zone name	High Tunnel Zone 3 (Proposed)	
width of field	48	ft
row spacing	2.5	ft
width divided by rows +1	20	
number of drip lines	20	each
length of field	72	feet
length of drip tape per row	72	feet
Total length of tape needed	1454	feet

Proposed Drip tape to be used by producer

NetaFim Drip tape 0.638 inch diameter, 15 mil, operation pressure+10 psi, 0.22 gph emitter

gpm/100 feet of drip tape	0.367	gallons/min. per 100 feet of tape
gph per emitter	0.22	gallons per hour per emitter
emitter spacing	12	inches
width of area to be irrigated	13	inches

Assumed circular wetted area from each emitter

Area	0.921	square feet
System efficiency	90.00%	
Application rate	0.38	inches per hour

Soil name	Pever Clay Loam	
Maximum application rate for soil	0.65	inches per hour
Available Water Capacity	2.62	inch
Maximum allowable depletion	1.31	
application rate does not exceed soil uptake	OK	

Plant uptake	0.2	inches/day
Days between irrigation events	2	days
Application amount per irrigation	0.44	inches
Time needed to apply	69.6	minutes
Wilt Check	OK	

Flow required by zone	5.337648	gallons per minute
Volume of Water Applied per Event	372	gallons
Actual flow available	10	gallons per minute
Amount of tape that can be irrigated with actual flow	2452.316	feet
Actual flow can support zone	YES	

Run zone 69.6 minutes every 2 days

MAINE IRRIGATION WATER MANAGEMENT PLAN WORKSHEET FOR DRIP IRRIGATION

OWNER	Sisseton-Wahpeton Oyate	PLANNED BY	P. Heermann
SERVICE CENTER	Sisseton-Wahpeton Oyate	DATE	1/31/2025
FARM NAME		SCENARIO	Proposed
		CHECKED BY	

Field information

Zone name	High Tunnel Zone 4 (Proposed)		Input in yellow cells
width of field	48	ft	Output in blue cells
row spacing	2.5	ft	
width divided by rows +1	20		
number of drip lines	20	each	
length of field	72	feet	
length of drip tape per row	72	feet	
Total length of tape needed	1454	feet	

Proposed Drip tape to be used by producer

NetaFim Drip tape 0.638 inch diameter, 15 mil, operation pressure+10 psi, 0.22 gph emitter

gpm/100 feet of drip tape	0.367	gallons/min. per 100 feet of tape
gph per emitter	0.22	gallons per hour per emitter
emitter spacing	12	inches
width of area to be irrigated	13	inches

Assumed circular wetted area from each emitter

Area	0.921	square feet
System efficiency	90.00%	
Application rate	0.38	inches per hour

Soil name	Pever Clay Loam	
Maximum application rate for soil	0.65	inches per hour
Available Water Capacity	2.62	inch
Maximum allowable depletion	1.31	
application rate does not exceed soil uptake	OK	

Plant uptake	0.2	inches/day
Days between irrigation events	2	days
Application amount per irrigation	0.44	inches
Time needed to apply	69.6	minutes
Wilt Check	OK	

Flow required by zone	5.337648	gallons per minute
Volume of Water Applied per Event	372	gallons
Actual flow available	10	gallons per minute
Amount of tape that can be irrigated with actual flow	2452.316	feet
Actual flow can support zone	YES	

Run zone 69.6 minutes every 2 days

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SD-ENG-9C
REV. 12/05

DOCUMENTATION OF APPLIED IRRIGATION WATER MANAGEMENT

NAME SWO Date 1/31/2025 PREPARED BY: P. Heermann

TRACT(s) FIELD # (s)

Introduction: All cooperators receiving USDA Program funds for irrigation water management must have land that has been irrigated two out of the last five years and have an irrigation system design, irrigation water management plan, operation and maintenance plan and an identified irrigation scheduling method. The design and supporting documentation must be submitted for approval prior to implementation. The following information will be provided to NRCS if the system is designed by a private vendor:

System Design Information and Irrigation Water Management Plan

Design information may include but not be limited to the following: computations and analyses to develop the plan, system capacity, depth of application, uniformity, rate, frequency, pressure, hydraulics, and plans and specifications. An Irrigation Water Management Plan is also needed that describes the crops to be irrigated, crop water use, crop water source etc., and how the system will be operated (set time or time per revolution, typical time between irrigations, source and skill of irrigation labor etc.).

Operation and Maintenance Plan

This plan should include, as a minimum, a general description of the system maintenance required including some mention of frequency and maintenance of the pump. This may be provided by NRCS if not supplied by the vendor.

Irrigation Scheduling

Method of irrigation scheduling (soil moisture, checkbook, or other approved method):

A sample soil moisture balance worksheet is attached as an example of an approved method for scheduling irrigations. NRCS may request to review irrigation scheduling sheets at any time for the life of the contract.

Certification

I certify that I have physically irrigated the acres identified in the Irrigation Water Management Plan and EQIP contract at least two of the last five years. I understand that it is my responsibility to provide irrigation documentation to support this claim if requested by the NRCS.

If I am awarded an EQIP contract I agree to properly operate and maintain the irrigation system for the life of the practice and will follow an approved (by NRCS) irrigation scheduling method. I recognize that NRCS may review my irrigation system and records at any time to assure program compliance within the life of the contract.

Producer Signature:

Microirrigation

N

PLAN VIEW
NO SCALE

LOCATION MAP

LOCATION
2 Miles South, 1 Mile West, 1 Mile South of Peever, SD

Table of Quantities

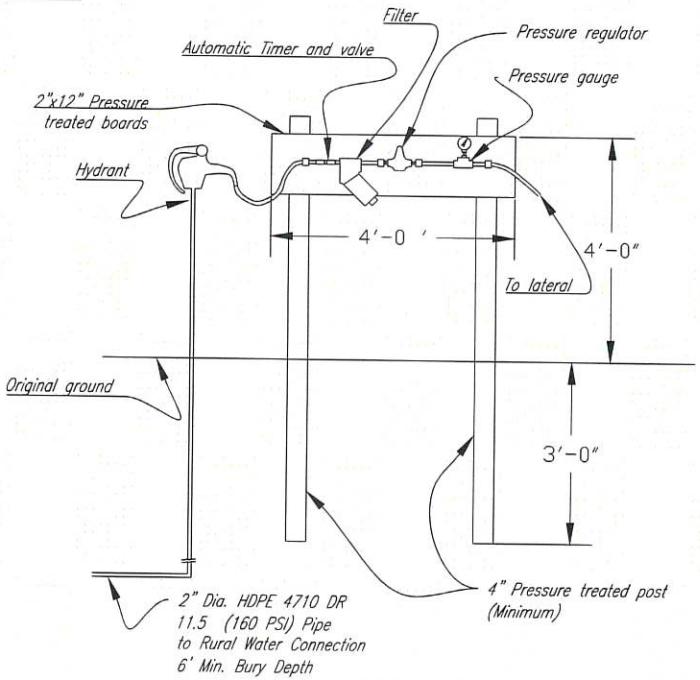
Item or Material	Unit	Quantity	ASBUILT
2" HDPE 4710 DR 11 (160 psi)	LF	2511	
Filter	EA.	4	
Pressure regulator, 10 PSI	EA.	4	
Pressure gauge	EA.	4	
Flow Meter	EA.	4	
Drip Tape	ACRE	0.320	

PIPELINE CONSTRUCTION NOTES:

1. SD STATE LAW REQUIRES TAHT NO EXCAVATOR MAY BEGIN ANY EXCAVATION WITHOUT FIRST NOTIFYING THE ONE-CALL NOTIFICATION CENTER OF THE PROPOSED EXCAVATION AT 811 OR 1-800-781-7474 AT LEAST TWO WORKING DAYS PRIOR TO STARTING ANY EXCAVATION.
2. THE PIPE SHALL BE FREE OF ALL DEFECTS AND CONFORM TO ALL APPLICABLE ASTM SPECIFICATIONS FOR THE TYPE OF PLASTIC SPECIFIED.
3. ALL JOINTS AND CONNECTIONS SHALL CARRY THE DESIGN FLOW WITHOUT LEAKAGE. MANUFACTURERS RECOMMENDATIONS MUST BE FOLLOWED.
4. TRENCHES CONTAINING ROCKS WHICH COULD DAMAGE THE PIPE SHALL BE OVER EXCAVATED AND BACKFILLED WITH SUITABLE MATERIAL PIPELINES MAY BE "PLOWED IN" WHERE SOILS ARE SUITABLE.
5. ALL BACKFILL RECOMMENDATIONS OF THE MANUFACTURER SHALL BE MET WITH THE INITIAL 6" BEING FREE OF ROCKS. MOUND SOIL OVER TRENCH TO ALLOW FOR SETTLEMENT.
6. PIPE NOT CONNECTED WITH GASKETED COUPLERS MUST BE "SNAKED" IN THE TRENCH. THE PIPE SHALL BE ALLOWED TO COME WITHIN A DEGREES OF SUBSOIL TEMPERATURE BEFORE BACKFILLING.

CONSTRUCTION SPECIFICATIONS

CONSTR. SPEC. SD-14 WOOD AND STEEL STRUCTURES, SD-20A PLASTIC PIPELINE, AND SD-55 PLASTIC PIPE ARE INCORPORATED BY REFERENCE. FOR A FULL TEXT VERSION, SEE:
https://www.nrcs.usda.gov/wps/portal/nrcs/main/sd/technical/engineering/



DRIP IRRIGATION SPECIFICATIONS

1. THE LINE SHALL BE POLYETHYLENE PIPE APPROVED FOR ABOVE GROUND DRIP WATERING SYSTEMS. THE ABOVE GROUND LIFE MUST BE A MINIMUM OF THREE YEARS.
2. THE EMITTER SHALL BE ABLE TO DELIVER THE DESIGNED GPH AT THE REQUIRED PRESSURE RANGE. THE EMITTER SHOULD BE THE TYPE THAT CAN BE TAKEN APART TO MONITER THE STATE OF THE SYSTEM.
3. THE EMITTER SHALL BE PLACED WITHIN 6" OF PLANT
4. ALL PIPELINES SHALL BE DESIGNED TO PERMIT DRAINING AND FLUSING.
5. THE LATERAL LINES SHALL BE SNAKED DURING INSTALLATION NOT LESS THAN ONE FOOT PER 100 FT. NOR MORE THAN 5 FEET PER 100 FT., TO ALLOW FOR CONTRACTION AND EXPANSION. LATERAL LINES SHOULD BE EXTENDED APPROX-IMATELY FIVE FT. PAST THE LAST EMITTER IN THE ROW TO PROVIDE A SEDIMENT TRAP.
6. ALL FITTINGS SHALL BE COMPATIBLE TO THE PIPELINE USED AND SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PIPE MANUFACTURER.

CONTRACTOR/PRODUCER CERTIFICATION
I certify that this pipeline and related appurtances were installed in accordance with these approved/"as-built" NRCS construction plans and specifications.
the information included on this form is a true and factual record of the job performed by me.

Contractor/Producer Signature Date

"STATEMENT OF COMPLIANCE"
Construction (was) (was not) completed in accordance with approved construction plans and specifications.

NRCS JAA Date

Date
Designed P. Heermann 2/4/25
Drawn P. Heermann 2/4/25
Checked B. Pettigrew 2/2025
Approved B. Pettigrew 2/2025

PRODUCER SWO
17 SECT. 25 T. 124 R. 51
Hamlin COUNTY
Roberts CONSERVATION DISTRICT

USDA - NRCS
SISSETON
ROBERTS COUNTY, SD

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

File Name: Romerth_DRIP_IRRIGATION
Drawing No.
Sheet of

Soil Map—Roberts County, South Dakota

Map Scale: 1:5,510 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Roberts County, South Dakota
Survey Area Data: Version 25, Sep 3, 2024

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

Date(s) aerial images were photographed: Jun 17, 2022—Jul 21, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Dm	Divide-Marysland loams	6.4	4.7%
FdA	Fordville loam, 0 to 2 percent slopes	7.5	5.5%
J209C	Forman-Buse complex, 6 to 12 percent slopes, moderately eroded	4.4	3.2%
J225B	Forman-Aastad complex, 1 to 4 percent slopes	10.4	7.7%
La	LaDelle silt loam	7.8	5.8%
Lt	Lamoure silty clay loam, 0 to 2 percent slopes, frequently flooded	19.0	14.1%
PeA	Peever clay loam, 0 to 2 percent slopes	36.9	27.3%
PeB	Peever clay loam, 2 to 6 percent slopes	37.1	27.4%
PeC	Peever clay loam, 6 to 9 percent slopes	5.7	4.2%
Totals for Area of Interest		**135.3**	**100.0%**

Roberts County, South Dakota

PeA—Peever clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2w8f6
Elevation: 920 to 2,130 feet
Mean annual precipitation: 22 to 31 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 120 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Peever

Setting

Landform: Moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Ap - 0 to 7 inches: clay loam
Bt - 7 to 20 inches: clay
Bk - 20 to 49 inches: clay
C - 49 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
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 47 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Gypsum, maximum content: 10 percent
Maximum salinity: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: R102DY011SD - Clayey
Forage suitability group: Clayey Subsoil (G102AY210SD)
Other vegetative classification: Clayey Subsoil (G102AY210SD)
Hydric soil rating: No

Minor Components

Cavour

Percent of map unit: 5 percent
Landform: Moraines
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R102AY013SD - Claypan
Other vegetative classification: Claypan (G102AY800SD)
Hydric soil rating: No

Rentill

Percent of map unit: 3 percent
Landform: Moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R102AY010SD - Loamy
Other vegetative classification: Droughty Loam (G102AY120SD)
Hydric soil rating: No

Tonka, occasionally ponded

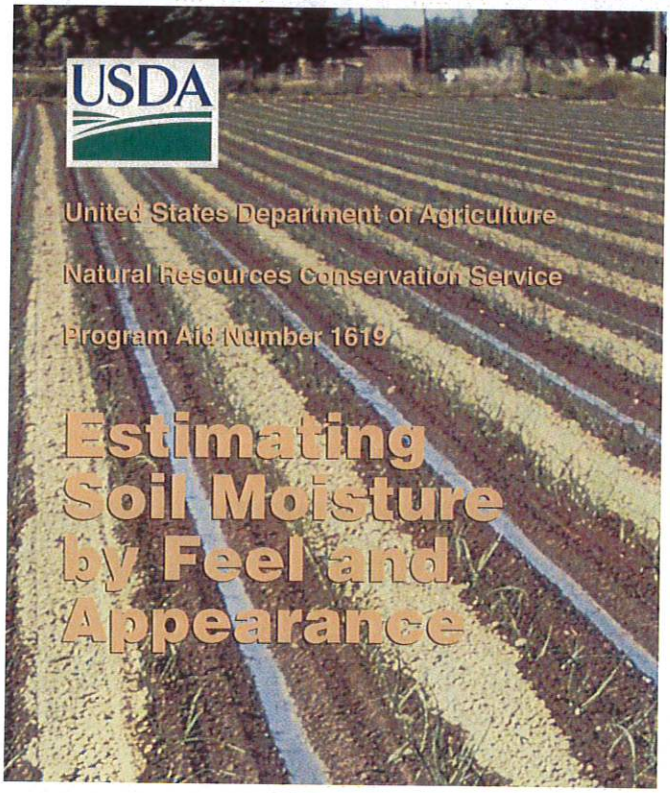
Percent of map unit: 2 percent
Landform: Moraines
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R102AY004SD - Wet Meadow
Other vegetative classification: Wet (G102AY900SD)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Roberts County, South Dakota
Survey Area Data: Version 25, Sep 3, 2024

Estimating Soil Moisture by Feel and Appearance

Irrigation Water Management (IWM) is applying water according to crop needs in an amount that can be stored in the plant root zone of the soil.



The "feel and appearance method" is one of several irrigation scheduling methods used in IWM. It is a way of monitoring soil moisture to determine when to irrigate and how much water to apply. Applying too much water causes excessive runoff and/or deep percolation. As a result, valuable water is lost along with nutrients and chemicals, which may leach into the ground water.

The feel and appearance of soil vary with texture and moisture content. Soil moisture conditions can be estimated, with experience, to an accuracy of about 5 percent. Soil moisture is typically sampled in I-foot increments to the root depth of the crop at three or more sites per field. It is best to vary the number of sample sites and depths according to crop, field size, soil texture, and soil stratification. For each sample the "feel and appearance method" involves:

1. Obtaining a soil sample at the selected depth using a probe, auger, or shovel;
2. Squeezing the soil sample firmly in your hand several times to form an irregularly shaped "ball";
3. Squeezing the soil sample out of your hand between thumb and forefinger to form a ribbon;
4. Observing soil texture, ability to ribbon, firmness and surface roughness of ball, water glistening, loose soil particles, soil/water staining on fingers, and soil color. [Note: A very weak ball will disintegrate with one bounce of the hand. A weak ball disintegrates with two to three bounces;
5. Comparing observations with photographs and/or charts to estimate percent water available and the inches depleted below field capacity.

Example:

Sample Depth	Zone	USDA Texture	AWC*for Zone	Soil Moisture Delpetion**	Percent Depletion
6"	0-12"	sandy loam	1.4"	1.0"	70
18"	12-24"	sandy loam	1.4"	.8"	55
30"	24-36"	loam	2.0"	.8"	40
42"	36-48"	loam	2.0" / 6.8"	.5" / 3.1"	25

Result: A 3.1" net irrigation will refill the root zone.
** Available Water Capacity*
*** Determined by "feel and appearance method"*

Available Water Capacity (AWC) is the portion of water in a soil that can be readily absorbed by plant roots of most crops.

Soil Moisture Deficit (SMD) or Depletion is the amount of water required to raise the soil-water content of the crop root zone to field capacity.

Appearance of fine sand and loamy fine sand soils at various soil moisture conditions.

Available Water Capacity 0.6-1.2 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

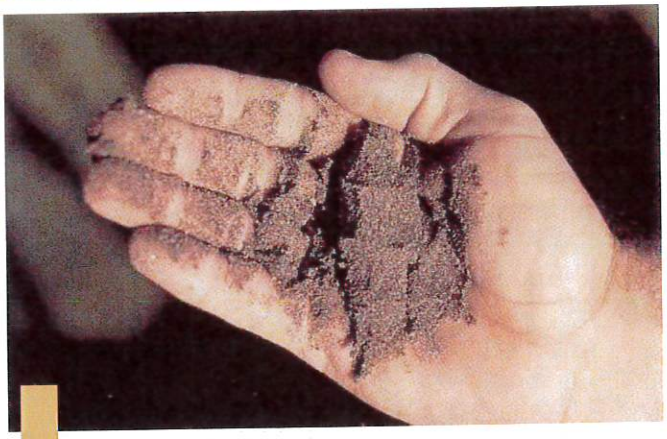
In/ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available
1.2-0.5 in./ft. depleted

Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure. (Not pictured)

25-50 percent available
0.9-0.3 in./ft. depleted

Slightly moist, forms a very weak ball with well-defined finger mark



50-75 percent available
0.6-0.2 in./ft. depleted

Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon.

75-100 percent available
0.3-0.0 in./ft. depleted

Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon

100 percent available
0.0 in./ft. depleted (field capacity)

Wet, forms a weak ball, moderate to heavy soil/water coating on fingers, wet outline of soft ball remains on hand. (Not pictured)

Appearance of sandy loam and fine sandy loam soils at various soil moisture conditions.

Available WaterCapacity 1.3-1.7 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

In/ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available 1 7-1.0 in/ft. depleted

Dry, forms a very weak ball, aggregated soil grains break away easily from ball. (Not pictured)

25-50 percent available 1.3-0.7 in/ft. depleted

Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away.

50-75 percent available 0.9-0.3 in./ft. depleted

Moist, forms a ball with defined finger marks, very light soil/water staining on fmgers, darkened color, will not slick.

75-100 percent available 0.4-0.0 in./ft. depleted

Wet, forms a ball with wet outline left on hand, light to medium staining on fingers, makes a weak ribbon between the thumb and forefinger.

100 percent available 0.0 in./ft. depleted (field capacity)

Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. (Not pictured)

Appearance of sandy clay loam, loam, and silt loam soils at various soil moisture conditions.

Available WaterCapacity 1.5-2.1 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

In/ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available
2.1-1.1 in./ft. depleted

Dry, soil aggregations break away easily, no staining on fingers, clods crumble with applied pressure. (Not pictured)

25-50 percent available
1.6-0.8 in./ft. depleted

Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away.

50-75 percent available
1.1-0.4 in./ft. depleted

Moist, forms a ball, very light staining on fingers, darkened color, pliable, forms a weak ribbon between the thumb and forefinger.

75-100 percent available
0.5-0.0 in/ft. depleted

Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger.

100 percent available
0.0 in/ft. depleted (field capacity)

Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. (Not pictured)

Appearance of clay, clay loam, and silt clay loam soils at various soil moisture conditions.

Available WaterCapacity 1.6-2.4 inches/foot

Percent Available: Currently available soil moisture as a percent of available water capacity.

In/ft. Depleted: Inches of water currently needed to refill a foot of soil to field capacity.

0-25 percent available
2.4-1.2 in/ft. depleted

Dry, soil aggregations separate easily, clods are hard to crumble with applied pressure. (Not pictured)

25-50 percent available
1.8-0.8 in/ft. depleted

Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure.

50 - 75 percent available
1.2-0.4 in./ft. depleted

Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.

75-100 percent available
0.6-0.0 in./ft. depleted

Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger.

100 percent available
0.0 in./ft. depleted (field capacity)

Wet, forms a soft ball, free water appears on soil surface after squeezing or shaking, thick soil/water coating on fingers, slick and sticky. (Not pictured)

Guidelines for Estimating Soil Moisture Conditions

	Coarse Texture- Fine Sand and Loamy Fine Sand	Moderately Coarse Texture Sandy Loam and Fine Sandy Loam	Medium Texture - Sandy Clay Loam, Loam, and Silt Loam	Fine Texture- Clay, Clay Loam, or Silty Clay Loam
	Available Water Capacity (Inches/Foot)			
	0.6-1.2	1.3-1.7	1.5-2.1	1.6-2.4
Available Soil Moisturre Percent	Soil Moisture Deficit (SMD) in inches per foot when the feel and appearance of the soil are as described.			
0-25	Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure. SMD 1.2-0.5	Dry, forms a very weak ball, aggregated soil grains break away easily from ball. SMD 1.7 -1.0	Dry. Soil aggregations break away easily. no moisture staining on fingers, clods crumble with applied pressure. SMD 2.1-1.1	Dry, soil aggregations easily separate, clods are hard to crumble with applied pressure SMD 2.4-1.2
25-50	Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remain on fingers. SMD O.9-0.3	Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away. SMD 1.3-0.7	Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away. SMD1.6-0.8	Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure SMD 1.8-0.8
50-75	Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon. SMD O.6-0.2	Moist, forms a ball with defined finger marks. very light soil/water staining on fingers. darkened color, will not slick. SMD O.9-0.3	Moist, forms a ball, very light water staining on fingers, darkened color, pliable, forms a weak ribbon between thumb and forefinger. SMD 1.1- 0.4	Moist. forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger. SMD I.2-0.4
75-100	Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon. SMD O.3-0.0	Wet, forms a ball with wet outline left on hand, light to medium water staining on fingers, makes a weak ribbon between thumb and forefinger. SMD O.4-0.0	Wet, forms a ball with well defined finger marks, light to heavy soil/water coating on fingers, ribbons between , thumb and forefinger. SMD O.5 -0.0	Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger. SMD O.6-0.0
Field Capacity (100 %)	Wet, forms a weak ball, moderate to heavy soil/ water coating on fingers, wet outline of soft ball remains on hand. SMD 0.0	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking,medium to heavy soil/water coating on fingers. SMD 0.0	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. SMD 0.0	Wet, forms a soft ball, free water appears on soil surface after squeezing or shaking, thick soil/water coating on fingers, slick and sticky. SMD 0.0

April 1998

TABLE 1 - ROOTING DEPTH AND PEAK CONSUMPTIVE USE RATE FOR VARIOUS CROPS (Maine)					
Truck Crops	Rooting Depth Inches	Peak Consumptive Use In/Day	Truck Crops	Rooting Depth Inches	Peak Consumptive Use In/Day
Asparagus	24	0.17	Lima Beans	24	0.17
Beets	12	0.17	Muskmelons	24	0.17
Broccoli	12	0.2	Okra	18	0.17
Cabbage	18	0.2	Onions-bunch	6	0.2
Carrots	12	0.17	Onions-dry	12	0.2
Cauliflower	12	0.17	Parsnips	12	0.17
Celery	6	0.17	Peas	18	0.15
Chives	6	0.18	Peppers	18	0.17
Collards	18	0.17	Potatoes	18	0.17
Corn (sweet)	24	0.2	Pumpkin	24	0.17
Cucumbers	18	0.17	Radish	6	0.15
Dandelion	6	0.15	Rutabagas	12	0.17
Egg Plant	18	0.2	Shallots	12	0.17
Endive	6	0.17	Snap beans	18	0.15
Escarole	6	0.17	Spinach	6	0.17
Fennel	6	0.17	Squash	24	0.17
Horseradish	18	0.17	Sweet Potatoes	24	0.17
Kale	18	0.17	Swiss Chard	12	0.17
Kohlrabi	18	0.17	Tomatoes	24	0.2
Lettuce	6	0.17	Turnips	24	0.17
Field Crops And Grain	Rooting Depth Inches	Peak Consumptive Use In/Day	Fruits, Berries And Orchards	Rooting Depth Inches	Peak Consumptive Use In/Day
Barley	24	0.15	Apples	24	0.2
Corn (field)	24	0.15	Blueberries	18	0.15
Millet	24	0.15	Cane fruit and		
Oats	24	0.15	Grapes	24	0.15
Rye	24	0.15	Cranberries	6	0.15
Sorghum	24	0.17	Peaches	24	0.2
Soybeans	24	0.17	Pears	24	0.2
Wheat	24	0.15	Strawberries	6	0.17
Grasses and	Rooting Depth	Peak Consumptive Use	Grasses and	Rooting Depth	Peak Consumptive Use

Legumes	Inches	In/Day	Legumes	Inches	In/Day
Alfalfa	24	0.2	Reed canary Grass	24	0.17
Bluegrass Pasture	18	0.17	Red clover	18	0.17
Bromegrass	24	0.17	Sudan grass	24	0.17
Ladino clover	18	0.2	Sweet clover	24	0.17
Orchardgrass	24	0.17			

Flowers	Rooting Depth Inches	Peak Consumptive Use In/Day
Annual flowers	6	0.17
Ericaceous ornamental plants (azalea, etc.)	12	0.17
Gladioli, peonies, iris	12	0.17
Other bulb or corm plants	12	0.17
Nursery Plants		
Bedded plants after propagation	6	0.17
Finished landscape plants, ready for sale	18 to 24	0.17
Ground cover plants (vinca, ivy)	6	0.17
Lining-out plants	12	0.17
Perennial ornamentals – trees and shrubs		
(conifers and flowering shrubs)	24	0.17
Turf		
Athletic fields – in active use	6	0.17
Athletic Fields – not in active use	12	0.17
Golf greens (bentgrass)	6	0.17
Golf fairways (bluegrass, fescue, zoysia, Bermuda grass)	6	0.17
Grass sod – being established or being prepared for immediate sale	6	0.17
Grass sod (lawns, sod being held for sale)	12	0.17

Notes:

1. Rooting depths shown are the depth of soil in which the larger portion of the total root system would be when the marketable part of the crop was being produced or when the loss of water from turf and ornamental plants was greatest.

2. Depth of irrigation while the crop is developing its root system should be determined by the actual depth to which roots have grown.

Construction Specification
SD-14 Wood and Steel Structures

1. Scope

The work shall consist of furnishing and constructing wood and/or steel structures.

2. Materials

Plywood

Plywood and Oriented Strand Board (OSB) for use in above ground sheltered construction (buildings etc.,) shall meet Product Standard PS-1 and shall conform to the requirements shown on the drawings.

Plywood for use in exposed above ground construction shall be exterior grade, meet Product Standard PS-1 and shall conform to the requirements shown on the drawings.

Treated plywood for use above ground shall meet Product Standard PS-1 and be pressure treated with waterborne preservatives (Arsenicals) to a retention level of at least 0.4 pounds per cubic foot except as shown on the drawings.

Treated plywood that is to be in permanent contact with water or the earth must meet Product Standard PS-1 and be pressure treated with waterborne preservatives (Arsenicals) to a retention level of 0.6 pounds per cubic foot, except as shown on the drawings.

Structural poles, posts, and lumber

All wood material shall be sound, new wood free from decay and disease damage, shall be straight, not cracked, and shall meet the requirements shown on the drawings. Structural timber and lumber shall be structural grade or better.

Unless otherwise specified, all poles, posts, and all nominal lumber sizes 2X10 or larger shall be pressure treated by one of the following preservatives:

- Creosote
- Pentachlorophenol
- Waterborne Preservatives (Arsenicals) treated to 0.4 pounds per cubic foot retention

Unless otherwise specified, all nominal lumber sizes 2X8 or smaller shall be pressure treated using waterborne preservatives (Arsenicals). Wood for use above ground shall be treated to a retention level of at least 0.4 pounds per cubic foot. Wood for use in permanent contact with water or earth shall be treated to a retention level of at least 0.6 pounds per cubic foot.

Hardware

Bolts, rods, nuts, washers, and other hardware shall be an appropriate grade of steel and shall be galvanized except as shown otherwise on the drawings.

Structural Steel

Except as shown on the drawings, steel shall be malleable, weldable, carbon steel.

Galvanizing of Steel

Except as otherwise specified, items shown on the drawings to be galvanized, shall be galvanized according to ASTM A123, except bolts, screws, and other fasteners 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating following ASTM B766 or B633.

Zinc Painting of Steel

For items specified to be painted with zinc paint, the surfaces shall be cleaned and painted as follows.

Cleaning

Surfaces to be painted must be clean and dry. Remove oil and grease using a solvent. Clean surfaces to be painted using sand blasting, power disk sanding, or wire brushing.

Painting

Apply 2 coats of zinc-rich cold galvanized compound using brush, or aerosol application (example: Rust-Oleum Professional Galvanizing Compound) or zinc dust - zinc oxide primer ASTM D79, D520, or D4146.

Epoxy Polyamide and Acrylic Polyurethane Coating

For items specified to be painted with a combination of epoxy paint and acrylic polyurethane, the surfaces shall be cleaned and painted as follows:

Cleaning

Surfaces to be coated shall be prepared by removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from surfaces with solvents or commercial cleaners using various methods of cleaning, such as wiping, dipping, steam cleaning, or vapor degreasing. After degreasing is completed, sand blasting, power disk sanding, or wire brushing shall be used to remove loose, detrimental foreign material. Adherent mill scale, rust, and paint need not be removed.

Painting

Apply one coat of epoxy polyamide primer, one coat of epoxy polyamide, and one coat of acrylic polyurethane (gloss or semigloss) to provide a minimum dry-film thickness of 11 mils.

Epoxy Polyamide Coating

For items specified to be painted with epoxy paint, the surfaces shall be cleaned and painted as follows:

Cleaning

Surfaces to be coated shall be prepared by removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from surfaces with solvents or commercial cleaners using various methods of cleaning, such as wiping, dipping, steam cleaning, or vapor degreasing. After degreasing is completed, sand blasting, power disk sanding, or wire brushing shall be used to remove loose, detrimental foreign material. Adherent mill scale, rust, and paint need not be removed.

Painting

Apply one coat of epoxy polyamide primer and one or more coats of epoxy polyamide, and one coat of acrylic polyurethane (gloss) or acrylic polyurethane (semigloss) to provide a minimum dry-film thickness of 8 mils.

3. Installation

Structures shall be installed accurately to the dimensions shown on the drawings.

Nails and spikes shall be driven in wood with just sufficient force to set the heads flush with the surface of the wood.

Bolt holes shall be drilled for snug fit. Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.

Washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with wood.

Steel welds shall be heavy duty with obvious strength equal to the strength of the structural steel.

Construction Specification
SD-20A Plastic Pipeline (Livestock Water and/or Domestic)

1. Scope

The work consists of furnishing and installing Poly-vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadine-Styrene (ABS) plastic pipe complete with fittings and appurtenances, as shown on the drawings.

2. Materials

Plastic pipe and fittings shall conform to Material Specification SD-55.

3. Handling and Storage

Pipe shall be delivered to the site and handled by means that provide adequate support to the pipe. Plastic pipe shall be protected from bending, impact, abrasion, and cutting damage. Manufacturer's recommendations must be followed. Special care shall be taken to avoid impact damage below 40°F temperature.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for 15 days or longer.

4. Joints and Connections

Unless otherwise specified on the construction drawings, joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious effect on the gasket or pipe material.

All joints and connections shall be made to carry design flows without significant pressure loss and to withstand the maximum design working pressure without leakage. Manufacturer's recommendations must be followed.

Dissimilar metals must not be in contact with each other. Steel or other metals subject to corrosion must be protected from corrosion using high quality materials.

Pipe ends shall be cut square and be deburred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

5. Trench Construction

Except as shown on the drawings, pipe trenches shall be not wider than 30 inches.

Where trench bottoms contain rocks or other material that may contact and damage the pipe, the trench bottom shall be excavated at least four inches below pipe grade and backfilled with bedding material consisting of sand or fine-grained soil.

Pipelines may be installed by "plow-in" where soils are suitable and rocks will not damage the pipe system.

6. Road Crossings

All pipelines installed that cross roads (township or county) shall be sleeved. The preferred sleeve installation method is by directional drilling, boring or jacking. Conventional open-trench crossings shall not be allowed. If sleeves are installed by narrow trenching, the trench shall be cut at an angle of at least 15 degrees from perpendicular to the road centerline. The narrow trench within the roadway embankment shall be filled with clean ½" maximum size aggregate to within 6" of the top of the trench then finished with 6" of materials matching the existing road surface.

Sleeve material shall be ¼" thick wall steel, DR-7 HDPE or Schedule 40 (equivalent wall thickness).

7. Placement

Pipe that is not connected with flexible "slip-joint" connections must be installed in a "snake-like" position. The pipe shall be allowed to come to within a few degrees of subsoil temperature before backfilling or being connected to other facilities.

For pipe over four inches diameter, small holes shall be excavated in bedding material under pipe bells, fittings, and appurtenances as needed to assure the pipeline is uniformly supported on bedding at line and grade throughout its entire length. Blocking or mounding beneath the pipeline to bring it to design grade is not permitted. Care shall be taken to prevent distortion or damage and to exclude foreign material from entering the pipeline.

8. Thrust Blocks

Except as otherwise specified, for pipelines greater than 1 1/2 inch diameter, thrust control shall be provided at all elbows greater than 45°, all tee connections, and at any location of potential thrust damage.

Thrust blocks must be formed against solid, compact earth. Except as otherwise shown on the drawings, thrust blocks shall consist of filling the space between the pipe and trench wall with concrete to the top of the pipe and for a distance of one foot along the pipe in each direction from center of the thrust.

9. Backfill

All backfill recommendations of the pipe manufacturer shall be met. Vehicles or construction equipment shall not cross the pipe until earth cover over the pipe exceeds two feet.

Initial backfill to six inches above top of pipe is required. Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe. Except as otherwise specified, earth haunching and initial backfill shall consist of soil that is free of rocks, hard clods, or other objects more than one inch in diameter. Except where the pipe trench is precision excavated with pipe fitting bottom and with trench width not more than 110 percent of the pipe diameter, earth fill shall be worked and compacted under the haunches of the pipe to provide continuous support in layers not more than 6 in. thick. Care shall be taken to insure the pipe is not deformed, damaged, or displaced.

Final backfill shall consist of remaining backfill from top of initial backfill to ground surface, including mounding for settlement. Final backfill within two feet of the pipe shall be free of debris, rocks, or other objects three inches nominal diameter or larger. Final backfill shall be placed in approximately uniform, void free, compacted layers.

10. Testing

The pipeline shall be completely tested for 2 hours at design pressure (but not less than 10 feet of head) for pressure, leakage, and proper functioning. Lines must be slowly filled (to avoid damage) and flushed clean.

Conditions requiring repair and retest include excessive water hammer, continuing unsteady delivery of water, damage to the pipe, detrimental discharge from control valves, visible leaks, and/or loss of more than one-half gallon of water per hour per inch diameter per mile of pipe.

11. Potable Water Pipelines

All equipment and pipelines used for water for human consumption shall meet all requirements (including shock chlorinating) of the South Dakota Department of Health. Manufacturer's recommendations must be followed.

12. Certification and Guarantee

The installing contractor shall certify that his or her installation complies with this specification. The contractor shall furnish the installation owner a one-year written guarantee protecting the installation from defective materials and construction. Material manufacturers and pipe markings must also be supplied to the owner in writing.

Material Specification
SD-55 Plastic Pipe

1. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. Materials

Pipe

The pipe must be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It must be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe must be measured as prescribed in ASTM D2122. Unless otherwise specified in the construction drawings, the pipe must conform to the requirements listed in this specification and the applicable reference specifications listed below.

Poly vinyl chloride (PVC) Pipe	Specification
Plastic pipe - Schedule 40, 80, or 120	ASTM D1785 ASTM D2466
Pressure rated pipe - SDR Series	AWWA C900 ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Joints for IPS PVC pipe using solvent weld cement	ASTM D2672
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings A	ASTM F3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F949
Pressure pipe, 4-inch through 60-inch for water distribution	AWWA C900

Polyethylene (PE) pipe	Specification
12- to 60-inch annular corrugated profile-wall polyethylene (PE) pipe and fittings	ASTM F2306
SIDR-PR based on controlled inside diameter	ASTM D2239
SDR-PR based on controlled outside diameter	ASTM D3035

High density polyethylene (HDPE) pipe	Specification
Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Heat joining polyolefin pipe and fittings	ASTM D2657

Acrylonitrile-butadine-styrene (ABS) pipe	Specification
Composite sewer pipe	ASTM D2680

Fittings and Joints

Fittings and joints must be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints must be compatible with the pipe and measured in accordance with ASTM D2122. Joint and fitting

material must be compatible with the pipe material. The joints and fittings must be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It must be free from visible cracks, holes, foreign inclusions, or other defects. Fittings and joints must conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, and the requirements shown on the drawings.

Solvents

Solvents for solvent-welded pipe joints must be compatible with the plastic pipe used and must conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

Gaskets

Rubber gaskets for pipe joints must conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

3. Perforations

Except as otherwise specified, perforations of perforated pipe shall meet the following requirements:

a. Perforations may be circular or slots, but must be free of materials that reduce effective openings.

b. Circular perforations shall be 3/16 to 5/16 inch diameter holes arranged in rows parallel to the axis of the pipe. Center-to-center perforation spacing along rows shall not exceed 2.5 inches. Perforations may appear at the ends of short and random lengths. Rows shall be arranged in equal groups at equal distance from pipe bottom vertical centerline. Lowermost rows shall be separated by 60 to 125 degrees. Uppermost rows shall be separated by an arc of 166 degrees or less. Other rows shall be uniformly spaced.

c. Slot perforations shall be located within two rows, with one row in each of the lower quadrants of the pipe. Slots shall be no wider than 1/8 inch and spaced no more than 1.5 inches apart.

d. Row numbers and minimum openings must be as follows.

Perforations			
Nominal pipe size	**Minimum Number of Rows (Circular)**	**Minimum Number of Rows (Slot)**	**Minimum Opening/foot (Square Inches)**
3 to 4	2	2	0.22
6 to 10	4	2	0.44
12 or Larger	6	2	0.66

4. Potable Water Pipeline

Pipelines specified for use to carry potable water shall meet requirements of the ANSI / NSF Standard 61, Drinking Water System Components – Health Effects.