

**STATEMENT OF WORK**  
**Irrigation System, Microirrigation (441)**  
**North Dakota**  
Contact: Christi Fisher (701) 530-2091

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

## **DESIGN**

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### **Deliverables:**

1. Make an initial site visit with the client for the purpose of collecting design information.
2. Prepare and document the design deliverables under the subsection headings shown below. Documentation shall demonstrate that the practice is compatible with other planned and applied practices at the project site. Identify and engage a qualified person to check the design methodology, technical references, plan drawings, and computations for accuracy.
  - a. Narrative Design Report:
    - i. Executive summary (background, applied practices, parties involved, Federal/State programs, cost, etc.).
    - ii. Design objective(s).
    - iii. Design references.
    - iv. Discussion of assumptions and analyses performed under subsection headings shown below.
    - v. Discussion of estimated quantities, material selections, construction methods, and cost.
    - vi. Discussion of design alternatives that were considered.
  - b. Survey:
    - i. A local benchmark control.
    - ii. Topography survey for contour elevations, horizontal alignments, grades, and locations of critical features (approximate property lines, utilities, roads, pivot point, trees, buildings, etc.).
    - iii. Survey notes, which includes survey points and GPS coordinates.
  - c. Water Quality Test:
    - i. Identification of all physical and chemical properties of the water. Include Biological, organics, Inorganics and metals and their limitations to micro-irrigation emitters.
    - ii. Sodium Absorption rate (SAR) of irrigation water. May limit infiltration of micro sprinklers.
    - iii. Salinity of irrigation water (EC<sub>w</sub>).
    - iv. Leaching requirements depending on crop salt tolerance threshold and EC<sub>w</sub>.
  - d. Soils:
    - i. Identification of all soil map units at and around the site.
    - ii. Soil texture classification, to the vertical limits of the crops root zone. Classification includes available water holding capacity, intake family, slope, etc.
    - iii. Salinity Concerns.
    - iv. Water Table Description. Soil mottling (redoximorphic features), seasonal high water table elevation, apparent water table elevation, and apparent source of water (localized lenses, regional water table, or irrigation-induced water table).
    - v. Geologic investigation. Depth to shale/bedrock or other root limiting feature, connectivity to water tables.
  - e. Crops:
    - i. Crop Peak Consumptive Use.
    - ii. Recommended management depth.
    - iii. Maximum allowable deficit (MAD) for soil moisture.

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- f. Hydraulics:
    - i. Design package which includes emitter or sprinkler flow rate, spacing, diameter of drip tape, lateral lines and sub-mainline. Including appurtenances like filters, flushing valves, pressure gauges, chemical injection, air vents, etc.
    - ii. Measurement of irrigated area under the micro-irrigation system.
    - iii. Application rate based on the peak consumptive use adjusted for system efficiency.
    - iv. Confirmation of depth of tape burial as it relates to the ground surface, and tillage equipment.
    - v. Pipeline capacity and velocity calculations.
    - vi. Calculations and specifications for pressure relief valves, water control valves, and gates.
    - vii. Coefficient of Uniformity (CU) based on manufactures documented values.
  - g. Estimated Quantities and Cost Estimate:
    - i. Calculations, sketches, and computer output to support estimated quantities for all material and construction components.
    - ii. Item, units, unit cost, estimated total cost for all material and construction components.
  - h. Construction and Material Specifications:
    - i. Applicable base specifications.
    - ii. Items of work and construction details (special provisions) specific to the job.
  - i. Construction Inspection Plan:

NOTE: The objective of the Construction Inspection Plan is to identify critical elements of construction, schedule quality control activities, describe the process for change orders, and document "as-built" construction in such a manner that the engineer-of-record can seal and certify the project as meeting NRCS Practice Standard 441.

    - i. Critical construction and material items that require inspection.
    - ii. Required submission of shop drawings, material specifications, bills of lading, load tickets, etc.
    - iii. Names, titles, and basic qualifications of inspectors who must supervise critical elements of construction.
    - iv. Schedule of critical construction items.
    - v. Safety details and protocol for hazardous operations e.g., electrical safety.
    - vi. Establishment of local benchmark control and horizontal and vertical alignments.
    - vii. Construction tolerances for lines, grades, compaction, concrete air/slump/compression, gradations, soundness, etc.
    - viii. Locations and features that require as-built survey shots and photograph documentation.
    - ix. Procedure for authorizing and documenting change orders. All change orders from the plans and specifications must be authorized and documented by the landowner, designer, and NRCS.
    - x. List of items that must be recorded on "as-built" drawings.
  - j. Operation and Maintenance:
    - i. Critical elements of operation and maintenance.
    - ii. Frequency of inspection.
    - iii. Normal operating range or conditions.
    - iv. Typical problems that may occur.
    - v. Minor maintenance procedures.
    - vi. Contact information for persons or entities that can assist with problems.
3. Plan Drawings:
- a. Cover Sheet:
    - i. Location Map.
    - ii. Estimated Quantities Schedule for all construction and material items.
    - iii. Required permits and easements.
    - iv. Utility notification statement.
    - v. Job Approval Class for all conservation practices.
  - b. Plan View Sheet:
    - i. Location and description of local benchmark control.
    - ii. Horizontal alignments (stationing, deflection angles, horizontal curve data).

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- iii. Location and description of critical land features (buildings, roads, trees, utilities, approximate property lines).
- iv. Location and description of appurtenances used in the design.
- v. Area of coverage in acres or square feet (as appropriate).
- vi. Zones irrigated at one time, length, spacing and diameter of micro tape or sprinkler. Manufactures name if specific to design criteria.
- vii. Show critical hydraulic information.
- c. Profile View Sheets:
  - i. Existing ground profiles with planned lines and grades of the improvement.
  - ii. Station and elevation flags for all grade breaks.
  - iii. Label pipe diameters and classifications.
  - iv. Station and elevation and description flags for all appurtenances.
- d. Detail Sheets for Appurtenances:
  - i. Detail sections.
  - ii. Locations and elevation labels.
  - iii. Details of micro irrigation appurtenances, which include but are not limited to filtering system, control valves, concrete works, dogleg details, sprinkler nozzle type and height, etc.
  - iv. Make/model of parts, suppliers, performance ratings, gradations, or other critical information not shown in the specifications.
  - v. Safety details and considerations.

## **INSTALLATION**

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### **Deliverables:**

1. Pre-construction conference with the landowner and contractor.
2. Sufficient on-site inspection to ensure that the project is installed according to the plans and specifications--in such a manner that the designer can technically certify construction as meeting the plans, specifications, and Practice Standard 441.
3. Ensure that the landowner understands the plans and specifications, and has obtained the required permits and permissions to construct the project.
4. Establish or verify local benchmark control and stake horizontal and vertical alignments--in such a manner that the NRCS can use this control during Quality Assurance Reviews.
5. Confirm that the assumptions used in the design are valid.
6. Inspect and document critical elements of construction as described in the Construction Inspection Plan which includes, but is not limited to:
  - a. Verification and approval of shop drawings and material specifications.
  - b. Verification that installed tape or sprinkler nozzles and appurtenances.
  - c. As-built survey of critical grades and elevations, as-built measurements of appurtenances.
  - d. Tests for earthfill compaction, concrete, etc.
  - e. Collection of bills of lading, load tickets, etc.
  - f. As-built photographs of staged construction.
7. Document change orders approved by the landowner and the NRCS.
8. Ensure that proper safety protocols are followed for hazardous operations e.g., electrical and trench safety.

## **CHECK OUT**

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### **Deliverables:**

1. Conduct a final site inspection to technically certify that the completed construction meets the plans, specifications, and NRCS Practice Standard 441.
2. Prepare an "as-built" set of plans which document construction changes in red-line ink which includes, but is not limited to:
  - a. Actual installed quantities and materials (manufacturer/model/size/schedule/grade/strength) for all material and construction items.

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- b. Final elevations, lines, and grades of Microirrigation features.
3. Assemble shop drawings, material specifications, bills of lading, load tickets.
4. Assemble test results for earthfill compaction, concrete, etc.
5. Place a certification statement on the as-built plan which states, "To the best of my knowledge, judgment, and belief, this practice was installed in accordance with the plans and specifications and meets NRCS Practice Standard 441 – Irrigation System, Microirrigation."

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – Irrigation System, Microirrigation, 441
- NRCS National Engineering Handbook Parts 600-659
- NRCS Web Soil Survey