United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

IRRIGATION AND DRAINAGE TAILWATER RECOVERY

CODE 447

(no)

DEFINITION

A system designed to collect, store, and convey irrigation tailwater, rainfall runoff, field drain water, or combination thereof for reuse in water distribution to the crop.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Improve irrigation water use efficiency
- Improve offsite water quality
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

A tailwater recovery system is suitable for use on lands that have a properly designed and installed irrigation or subsurface drainage system where recoverable irrigation runoff, subsurface drainage outflows, or rainfall runoff are expected under current or planned management practices.

This practice does not apply to detailed design criteria or construction specifications for individual structures or components of the recovery system.

CRITERIA

General Criteria Applicable to All Purposes

Where criteria for individual components of the tailwater recovery system are described in existing NRCS conservation practice standards, use those practice standards and their specific criteria for planning, designing, and installation of that component. Use sound engineering principles for the design of components not addressed in NRCS conservation practice standards.

Laws and regulations

Ensure that the tailwater recovery system is planned, designed, and constructed to meet all Federal, State, and local laws and regulations. The landowner must obtain all necessary permissions from regulatory agencies, or document that no permits are required.

Utilities

The landowner and/or contractor is responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Collection

Provide a means of collecting the water to be recovered. Ensure that the collection system is protected from erosion damage. Collection components may include, but are not limited to, ditches, culverts, pipelines, pumps and sumps, and water control structures, as needed. Size the capacity of the collection

components to safely handle the expected rate of flow from the irrigation runoff, rainfall runoff, and/or drainage system, as applicable.

Storage
Provide a means of storing the recovered water until it can be redistributed in the irrigation or distribution system. Include the inflow volume, inflow rate, and the required water elevation at the control point where the tailwater is returned to the distribution system in the storage capacity design calculations.

For irrigation tailwater design the tailwater recovery storage component to store, at a minimum, the complete runoff from a single irrigation set, if one or more of the following conditions apply:

- The energy sources for tailwater pump back systems are subject to interruption,
- Safe emergency bypass areas cannot be provided, or
- Tailwater discharge violates local or State regulations.

Where a tailwater recovery system is used to collect irrigation tailwater, drainage tailwater, or rainfall runoff for storage and use as irrigation reservoir replenishment, base the size and capacity of collection and storage components on expected drainages and runoff volumes and rates. Provide an adequate outlet for inflow that exceeds the expected storage volume. Use criteria found in NRCS Conservation Practice Standard (CPS) Pond (Code 378).

Protect system components from storm events and excessive sedimentation. Design sumps and collecting basins with inlets that protect the side slopes and the collection components from erosion. Where required by State law, provide a diversion, dike, or water control structure to limit entrance of rainfall runoff into the designed inlet structure.

Install sediment traps as needed.

Conveyance
Provide a means to convey water from the storage component to a point of entry in the irrigation or distribution system. Conveyance components may consist of a pumping plant and pipeline to return the water to the upper end of the field, or a gravity outlet having a ditch or pipeline to convey the water to a lower elevation in the irrigation system. Other components or combinations of components may be necessary as determined on a site-specific basis.

For systems where tailwater is discharged into a collecting basin, irrigation reservoir, or pipeline that has components for regulating fluctuating flows (e.g., a float valve), small sumps with frequently cycling pumping plants may be used. If the storage component is not designed to regulate flows, ensure the capacity of the tailwater sumps or collection basins is large enough to provide the regulation needed.

Determine the capacity of conveyance components by an analysis of the expected rate of tailwater supplied to the storage component, the planned tailwater storage capacity, and the anticipated irrigation application or other water distribution. If the tailwater capture is used as an independent irrigation supply rather than as a supplement to a primary irrigation water supply, ensure the rate and volume of flow is adequate for the irrigation system supplied.

Additional Criteria Applicable to Improving Offsite Water Quality

Storage components
Where additional storage is required to provide adequate retention time for the breakdown of chemicals in runoff water, size the storage components accordingly. Use site-specific information about the chemical of concern to determine allowable retention times.

Where additional storage is required to provide for sediment deposition, base additional storage volumes on site-specific information of the contributing watershed.

Additional Citeria Applicable to Reducing Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Calculate the reduction of energy use as the average annual or seasonal energy reduction compared to previous operating conditions.

CONSIDERATIONS

Additional Considerations to Improve Irrigation Water Use Efficiency

Good irrigation system design and management will limit tailwater volume to that needed for effective operation. This may reduce the capacity of the collection, storage, and conveyance components.

Changes in irrigation water management may be necessary to optimize the use of return flows.

Downstream flows and aquifer recharge dependent on tailwater and rainfall runoff will be reduced and may cause undesirable environmental, social, or economic effects.

Additional Considerations to Improve Offsite Water Quality

Effects on surface and ground water quality by the movement of sediment and soluble and sediment-attached substances should be considered.

Chemical-laden water can create a potential hazard to wildlife, especially waterfowl that are drawn to ponded water. Consider installing measures that will deter waterfowl use if the water will be hazardous to them.

Treatment of tailwater to eliminate pathogens that cause foodborne illnesses may be necessary if it is used to irrigate fruits and vegetables.

Plan nutrient and pest management measures to limit chemical-laden tailwater when practical.

Protect system components from storm events and excessive sedimentation.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for irrigation tailwater recovery systems in accordance with this standard and describe the requirements for applying the practice to achieve its intended purpose.

At a minimum, include the following in the plans and specifications:

- Site plan layout of the tailwater recovery system and associated components
- Cross sections and profiles
- Type, quality, and quantity of the various system components
- Location of utilities and notification requirements

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan specific to the components installed for use by the landowner or operator responsible for operation and maintenance. Provide specific instructions for operating and maintaining components to ensure they function properly.

The plan will include provisions to address, at a minimum,—

- Periodic cleaning and regrading of collection components to maintain proper flow lines and functionality.
- Periodic checks and removal of debris as necessary from trash racks and structures to assure proper operation.

- Periodic removal of sediment from traps and storage components to maintain design capacity and efficiency.
- Inspection or testing of all pipeline and pumping plant components and appurtenances, as applicable.
- Routine maintenance of all mechanical components in accordance with the manufacturer's recommendations.

REFERENCES

USDA NRCS. 1993. National Engineering Handbook (Title 210), Part 623, Chapter 2, Irrigation Water Requirements. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. 2012. National Engineering Handbook (Title 210), Part 623, Chapter 4, Surface Irrigation. Washington, D.C.

USDA NRCS. 2016. National Engineering Handbook (Title 210), Part 623, Chapter 8, Irrigation Pumping Plants. Washington, D.C.

USDA NRCS. 1983. National Engineering Handbook (Title 210), Part 650, Engineering Field Handbook, Chapter 15, Irrigation. Washington, D.C.

USDA NRCS. 1997. National Engineering Handbook (Title 210), Part 652, Irrigation Guide. Washington, D.C.