NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION SYSTEM, TAILWATER RECOVERY

(No.)

Code 447

DEFINITION

An irrigation system designed to collect, store, and convey irrigation tailwater and/or rainfall runoff for reuse in irrigation.

PURPOSE

- 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 and facilities served by a properly designed and installed irrigation system where recoverable irrigation runoff and/or rainfall runoff flows can be anticipated under current or expected management practices.

The components of the system may include but are not limited to, ditches, sumps, collecting basins or reservoirs, culverts, pumping plants, water control and/or grade stabilization structures, and pipelines. It 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

The installation and operation of a tailwater recovery system shall comply with all Federal, state and local laws, rules and regulations.

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Use appropriate Florida NRCS conservation practice standards and specifications in the design and construction of components needed for a tailwater recovery system. Use sound engineering principles for the design of components not addressed in Florida NRCS conservation practice standards.

Collection. Facilities for the collection of irrigation tailwater and rainfall can be an integral part of irrigation systems covered by Florida NRCS conservation practice standards Sprinkler System, Code 442 and Irrigation System, Surface and Subsurface, Code 443. Tailwater and/or rainfall collection components may include, but are not limited to, ditches, sumps, collecting basins or reservoirs, pumping plants, culverts, pipelines, water control and/or grade stabilization structures or other erosion control measures, as needed.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Storage. Storage components are needed to store the collected water until it is redistributed in the irrigation system. Include runoff volume, runoff rate and the required level of water control at the point where the tailwater is returned to the irrigation system in the storage capacity design calculations.

For systems where tailwater is discharged into a collecting basin, irrigation reservoir (Florida NRCS conservation practice standard Irrigation Reservoir, Code 436), or into a pipeline having facilities for regulating fluctuating flows (i.e. 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 or reservoirs is large enough to provide the regulation needed to permit efficient use of the water.

Design the tailwater recovery system to store, at a minimum, the complete runoff from a single irrigation set, if any 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.

Equip sumps, collecting basins, and reservoirs with inlets designed to protect the side slopes and the collection facilities from erosion. Where required by state law, provide a diversion, dike, or water control structure or other structure to limit the entrance of rainfall runoff into the designed inlet structure.

Install sediment traps as needed.

The USDA ARS computer program SPAW (Soil-Plant-Air-Water) or other Florida NRCS approved method will be used to size the storage facility (collection basins and irrigation reservoirs) based on the water budget (expected runoff volumes and rates, expected crops water needs, precipitation, evapotranspiration and seepage losses). Provide a stable non-erosive outlet. Size the outlet to convey, at a minimum, the excess flow from the design storm taking into account the flow from the inlet structure(s) and storage in the tailwater recovery system for rainfall runoff that exceeds the expected runoff volume.

Document the adequacy of excavated type ponds based on water budgets, long term water table depths, soil survey data, geologic investigations, reports, similar systems in the geographical area, and experience.

Conveyance. All tailwater recovery systems require components that convey water from the storage component to a point of entry into the irrigation system. These 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.

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

Foundation, embankment, and spillway. Design earthen dams, embankments, pits and appurtenant structures to meet the appropriate criteria in Florida NRCS conservation practice standard for Dam, Code 402, or Pond, Code 378.

Seepage. Porous or highly permeable soils are often exposed when clayey or impermeable soils are removed from the impoundment area for use as fill material in the embankment. The resulting seepage creates an unsatisfactory irrigation reservoir (embankment or pit).

Adequate soils, foundation, and borrow area geologic investigations and design precautions shall be taken to prevent exposure of permeable soils, excessive seepage, water loss from the impoundment area, and/or through the embankment foundation. If necessary use of an appropriate method of sealing or lining to prevent excessive seepage losses.

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 the runoff water, size 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.

When the storage component is expected to receive chemical-laden waters, control seepage from a storage facility to the extent possible. Control may be in the form of natural soil liners, soil additives, commercial liners, or other approved methods.

Additional Criteria Applicable to Reduce Energy Use

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

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

CONSIDERATIONS

Water Quantity

- Good irrigation system design and management will limit tailwater volume to that needed for effective operation. This may reduce the capacity of collection, storage, and conveyance components.
- Changes in irrigation water management activities may be necessary to optimize the use of return flows.
- Downstream flows or aquifer recharge dependent on tailwater and rainfall runoff will be reduced and could cause undesirable environmental, social, or economic benefits. Existing wetland hydrology could be impacted by this practice.

Water Quality

- Effects on surface and groundwater quality by the movement of sediment and soluble and sediment – attached substances should be considered.
- Nutrient or chemical-laden water can create a potential hazard to wildlife, especially waterfowl that are drawn to ponded water.
- Treatment of tailwater to eliminate pathogens that cause food-borne illnesses may be necessary if it is used to irrigate fruits and vegetables.
- Plan nutrient and pest management measures to limit nutrient or chemical-laden tailwater when practical.
- Give consideration to monitoring of irrigation reuse water for weed seed, harmful bacteria, salinity, and disease. Take necessary steps to prevent spreading of these problems
- Protect system components from storm events and excessive sedimentation.

Other Considerations

- Effects on the visual quality of water resources should also be considered.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for irrigation tailwater recovery systems for specific field sites in accordance with this standard and describe the requirements for applying the practice to achieve its intended purpose. As a minimum, the plans and specifications shall include, but not limited to, the following items:

- Site plan layout of the tailwater recovery pond and associated structures.
- Cross sections and profiles of sumps, storage basin, culverts, reservoir, and other components.
- Type, quality, and quantity of the various system components.
- Location of utilities and notification requirements.
- Methods of seepage control, if necessary.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan specific to the irrigation tailwater recovery facilities and components planned. The O&M plan shall provide specific instructions for operating and maintaining facilities to ensure they function properly. Copies of the O&M plan shall be provided to the landowner or operator responsible for the O&M. The O&M plan shall include, but not limited to, the following items and others as appropriate.

- Periodic cleaning and re-grading 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/or storage components to maintain design capacity and operating efficiency.
- Prevent and if necessary remove all crop residue and foreign debris from entering the system.
- Inspection of components (pumps, culverts, pipelines, structures, ponds, etc.) to ensure they are in operating as planned and maintained in accordance with manufacturer's recommendations.
- 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.
- Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity. If threatened species are involved, follow policy on endangered or threatened species.

REFERENCES

Florida NRCS Conservation Practice Standards
Dam, Code 402
Irrigation Reservoir, Code 436
Irrigation System, Surface and Subsurface, Code 443
Pond, Code 378
Pumping Plant, Code 533
Sprinkler System, Code 442

General Manual Title 420-Part 401
Title 450-Part 401
Title 190-Parts 410.22 and 410.26
Title 420-Part 401
Title 450-Part 401
Title 190-Parts 410.22 and 410.26

National Cultural Resources Procedures Handbook
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook Florida Supplements to Parts 600.1 and 600.6

NEH, Part 652, Irrigation Guide
NEH, Section 15 Chapter 8. Irrigation Pumping Plants
National Engineering Handbook. Part 623 Chapter 2, Irrigation Water Requirements