NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

PUMPING PLANT

(No.)
Code 533

DEFINITION

A facility that delivers water at a designed pressure and flow rate. Includes the required pump(s), associated power unit(s), plumbing, appurtenances, and may include on-site fuel or energy source(s), and protective structures.

PURPOSE

This practice is applied as part of a conservation system to support one or more of the following:

- Deliver water for irrigation, watering facilities, ponds, wetlands, or fire protection.
- Removal of excessive subsurface or surface water.
- Provide efficient wate use on irrigated land.
- Transfer of animal waste as a part of a manure transfer system,
- Improvement air quality.
- Reduce energy.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where conservation objectives require the one of the following;

- Addition of energy to pressurize and transfer water to maintain critical levels soils, wetlands,or reservoirs .
- Transfer wastewater.
- Remove of surface water or groundwater.
- To provide a water supply for such purposes as irrigation, recreation, livestock, or wildlife.

CRITERIA

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

Design, installation, and operation of a pumping plant 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 6001 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), national Food Security Act Manual (NFSAM), and the National Environmental compliance Handbook (NECH).

The efficiency of units, type of power, quality of building, automation features, and other accessories installed shall be in keeping with the economic and environmental value of the system to accomplish the conservation objectives.

Criteria for the design of components not addressed in Florida NRCS conservation practice standards shall be consistent with sound engineering principles.

Pump requirements. Design flow rate, range of operating heads and pump type shall meet the requirements of the application.

Base selection of pump materials on the physical and chemical qualities of the material being pumped and manufacturers recommendations.

Size pumps utilized for the transfer of wastewater or manure to transfer material at the required system head and flow rate determined by the waste management plan.

Power units. Select power units on the basis of availability and cost of fuel and/or power, operating conditions, conservation needs, the need for automation, and other site specific objectives. Match the power unit to the pump. Choose a power unit to match the pump and be capable of operating the pump efficiently and effectively within the planned range of operating conditions. Size the power unit to meet the horsepower requirements of the pump, including pump efficiency, service factor and environmental conditions.

Electrical power units may include line power, photovoltaic, and wind or water powered turbines.

Electrical wiring shall meet the requirements of the National Electrical Code (NEC).

Variable Frequency Drives. The owner shall inform the electric power provider that a Variable Frequency Drive will be installed prior to installation, and be responsible for following requirements of the electric power provider.

The Variable Frequency Drive shall be protected against overheating.

The Variable Frequency Drive control panel shall provide the read out display of flow rate or pressure.

Photovoltaic panels. The photovoltaic array shall be sized based on average data for the location and the time of year pumping occurs, according to manufacturer's recommendations. The photovoltaic array shall provide the power necessary to operate the pump at the design flow rate, with the appropriate service factor considering a minimum panel degradation of 10 years. Fixed arrays shall be oriented to receive maximum sunlight. Panel tilt angle shall be based on the location latitude and time of year for power requirements. Panels shall be mounted securely to resist movement by environmental factors.

Windmills. Pumping units shall be sized according to pumping lifts and capacities, as specified by the manufacturer. The diameter of the mill shall be based on the stroke length and the average wind speed. Towers shall be proportioned to the mill diameter, with adequate height for efficient and safe operation.

Water powered pumps (hydraulic rams). Pumping units shall be sized according to flow rate, lift, fall, and efficiency. Bypass water shall be returned to the stream or storage facility, without erosion or impairment to water quality.

Suction and discharge pipes. To prevent cavitation, design the suction and discharge pipes to account for suction lift, net positive suction head, pipe diameter and length, minor losses, temperature, and altitude. Base the size of suction and discharge pipes on a hydraulic analysis, operating costs, and compatibility with other system components.

Appurtenances such as gate valves, check valves, pressure reducing valves, pressure gages, pipe connections, and other protective devices, shall be included to meet the requirements of the application.

Screens, filters, trash racks, or other devices shall be installed as needed to prevent the intake of sand, gravel, debris, or other objectionable material into the pump. Intake screens shall be designed according to applicable Federal and State guidelines, to avoid entrainment or trapping of aquatic organisms.

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Design the discharge bay or connection with the distribution system to meet hydraulic and structural requirements.

Base the arrangement and length of the discharge pipe on the need for recovery of head through siphoning action, and for delivery of water in keeping with conservation and environmental objectives. Install gates, valves, pipe connections, discharge bays, and other

protective devices, as needed, for satisfactory pumping plant operation.

Back flow prevention. Follow Federal, state, and local laws, rules, and regulations concerning back flow prevention when pumping from wells, or chemigating. Florida state laws applicable for back flow prevention where chemicals are applied, include Florida Statute (FS) - 487.064 and Florida Administrative Code (FAC) 5E-2.30.

Building and accessories. Pumps shall be securely mounted on a solid foundation such as pilings or concrete.

Where buildings are necessary to protect the pumping plant, provisions shall be included for adequate ventilation and accessibility for equipment maintenance, repairs, or removal.

Suction bays or sumps shall be designed to prevent the introduction of air at the intake.

The discharge bay or the connection to the distribution system shall meet all hydraulic and structural requirements.

Structures and equipment shall be designed to provide adequate safety features to protect operators, workers, and the public from potential injury. Drive shaft covers shall be required on all exposed rotating shafts.

Foundation. Design foundations to safely support the loads imposed by the pumping plant and appurtenances. Use sheet piling or other measures, as required, to prevent piping beneath the foundation.

Mount pumps in the open, on piling, concrete foundations, in a well or pit, floating platform, or by other appropriate means.

Safety. Structures and equipment shall be designed to provide adequate safety features to protect operators, workers, and the public from potential injury. Drive shaft covers shall be required on all exposed rotating shafts.

Protection. Provide screens, filters, trash racks, or other devices shall be installed as needed, to prevent the intake of sand, gravel, debris or other objectable material into the pump. Intake screens shall be designed according to applicable Federal and State guidelines, to avoid entrainment or trapping of aquatic organisms.

Vegetate all areas disturbed during construction in accordance with Florida NRCS conservation practice standard Critical Area Planting, Code 342.

Additional Criteria Applicable to Providing the Efficient Use of Water on Irrigated Land

Provisions for the connection of flow and pressure measurement devices shall be included in power plant system design.

Additional Criteria Applicable to the Improvement of Energy Use Efficiency

For fossil fuel or electrical grid power sources, pumping plant installations shall meet or exceed the Nebraska Pumping Plant Performance Criteria. Refer to the NRCS National Engineering Handbook, Part 652, National Irrigation Guide, Table 12-2.

Additional Criteria Applicable to the Improvement of Air Quality

Replacement pumping plants shall have lower total emissions of oxides of nitrogen and fine particulate matter, compared to the unit being replaced.

New, replacement, or retrofitted pumping equipment shall utilize a non-combustion power source, or cleaner-burning technologies or fuels.

CONSIDERATIONS

When planning this practice consider the following items, as applicable:

- The removal of surface water by a pumping plant can affect downstream flows or aquifer recharge volumes. Consider potential the long term impacts downstream of the pumping plant.
- If using a pumping plant to remove surface water or ground water flowing into a wetland, consider the potential impacts on existing wetland hydrology.
- The operation and maintenance of a pumping plant can involve the use of fuels and lubricants that when spilled may adversely affect surface or ground water quality. Consider measures to protect the environment from potential spills. In some cases, secondary containment of spilled fuel may be required by Federal and State laws or regulations.

- Pumping plants are often constructed in flood-prone areas or can be subject to other unexpected natural events. Consider how the pumping plant may be protected from extreme natural events and the consequences of damage or failure.
- Include protective sensors to detect low or stopped flow, or pressures that are too high or too low.
- The visual appearance of buildings or structures associated with the pumping plant should be compatible with the surrounding environment.
- When installing new or replacing existing combustion equipment, non-combustion and renewable energy sources, such as solar, wind, and water, should be considered.

PLANS AND SPECIFICATIONS

Prepare the plans and specifications for installing pumping plants in compliance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose.

As a minimum, include, as applicable, the following items in the plans and specifications.

- Pump location
- Size and type of pump and power unit
- Pump discharge capacity (gpm) and required head at pump discharge
- Details for mounting pump (may be left up to the manufacturer)
- Details for pump pad including dimensions, type of material, etc.
- Details of appurtenances
- Location of utilities and notification requirements.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for use by the landowner or operator responsible for PAM application. The plan shall document needed actions to ensure that practices perform adequately throughout their expected life.

O&M requirements shall be included as an identifiable part of the design. Depending on the scope of the project, this may be accomplished by brief statements in the plans and specifications, the conservation plan narrative, or as a separate O&M plan.

The O&M Plan shall provide specific instructions for PAM applications to ensure it is used properly.

The O&M plan shall include the, but not limited to the following provisions:

- Inspection or testing of all pumping plant components and appurtenances,.
- Proper start-up procedures for the operation of the pumping plant.
- The rpm range for normal operation and associated operating pressures.
- Routine maintenance of all mechanical components (power unit, pump, drive train, etc.) in accordance with the manufacturer's recommendations.
- When applicable, the power unit, fuel storage facilities and fuel lines should be frequently checked for fuel or lubricant leaks and repaired as needed.
- Periodic checks and removal of debris as necessary from trash racks and structures to assure adequate capacity reaches the pumping plant intake.
- Periodic removal of sediment in suction bays to maintain design capacity and efficiency.
- Inspection and maintenance of anti-siphon devices, if applicable.
- Routine test and inspection of all automated components of the pumping plant to assure they are functioning as designed.
- Inspect and maintain secondary containment facilities, if applicable.
- Periodic inspection of all safety features to ensure they are in place and functional.
- Prior to retrofitting any electrically powered equipment, electrical service must be disconnected and the absence of stray electrical current verified.

REFERENCES

Florida Administrative Code 5E-2.30
Florida NRCS Conservation Practice Standard
Critical Area planting, Code 342
Florida Statute 487.064

General Manual
- 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