**Title of the Practice: Pumping Plant (NRCS Conservation Practice 533)**

Definition: This practice envisions a facility that delivers water at a designed pressure and flow rate. This may be for purposes of irrigation, watering facilities, wetlands or fire protection. The plant will include the required pump(s), associated power unit(s), plumbing and accessories. Importantly for organic producers who value renewable energy technologies, it may include on-site fuel or energy source(s).

**PURPOSE**

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

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

**General Expectations**

The pump will be selected to meet the required flow rate, expected operating head range and material being pumped. Pump power units shall be selected based on the availability and cost of power, operating conditions, need for automation, and other site specific objectives. Power units shall match the pump requirements and be capable of operating efficiently and effectively within the planned range of conditions. The power unit shall be sized to meet the horsepower requirements of the pump, including efficiency, service factor, and environmental conditions. Design of the system will accommodate manufacturers’ recommendations for any and all components.

**Renewable Energy Opportunities for Organic Producers**

Electric power units may include line power, photovoltaic panels, and wind or water powered turbines:

* A photovoltaic array shall be sized based on average data for the location and the time of year pumping occurs. 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.
* A windmill pumping unit shall be sized according to pumping lifts and capacities. 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.
* A water powered pump (hydraulic ram) unit 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.

**Design considerations:**

* To prevent cavitation, suction and discharge pipes shall be designed to account for suction lift, net positive suction head, pipe diameter and length, minor losses, temperature, and altitude.
* 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 to avoid entrainment or trapping of aquatic organisms.
* Backflow prevention devices shall be included to prevent contamination of water sources connected to the pumping plant.
* Pumps shall be securely mounted on a solid foundation such as pilings or concrete. Foundations shall be designed to safely support the loads imposed by the pumping plant and appurtenances.
* 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.

**Environmental Considerations**

* Provisions for the connection of flow and pressure measurement devices shall be included in power plant system design.
* 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.
* 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.
* 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.
* 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.
* 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/ OPERATION AND MAINTENANCE**

* Plans and specifications for constructing pumping plants shall be in accordance with this standard. An Operation and Maintenance plan specific to the pumping plant being installed shall be prepared for use by the owner and responsible operator. 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. Include protective sensors to detect low or stopped flow, or pressures that are too high or too low. Include protective sensors to detect low or stopped flow, or pressures that are too high or too low.

**Practice financing (2014):**

**North Carolina**

|  |  |  |  |
| --- | --- | --- | --- |
| **Practice** | **Component** | **Unit** | **Practice Rate** |
| Pumping Plant |  Pump <= 1.5 HP | Each | $1,789.37 |
| Pumping Plant | Pump <= 1.5 HP HU\* | Each | $2,147.24 |
| Pumping Plant | Water Ram | Each | $1,120.35 |
| Pumping Plant | Water Ram HU | Each | $1,344.42 |
| Pumping Plant | Pump > 1.5 HP and <= 5 HP | BHP | $889.91 |
| Pumping Plant | Pump > 1.5 HP and <= 5 HP HU | BHP | $1,066.82 |
| Pumping Plant | Pump > 5 HP and <= 10 HP | BHP | $512.31 |
| Pumping Plant | Pump > 5 HP and <= 10 HP HU | BHP | $614.77 |

\*HU = Historically Underserved or Beginning Farmer rates

**South Carolina**

|  |  |  |  |
| --- | --- | --- | --- |
| Pumping Plant | Electric Powered Pump <= 3 HP | HP | $1003 |
| Pumping Plant | HU\*-Electric Powered Pump <= 3 HP | HP | $1203 |
| Pumping Plant | Electric Powered Pump <= 3 HP with Pressure Tank | HP | $1327 |
| Pumping Plant | HU-Electric Powered Pump <= 3 HP with Pressure Tank | HP | $1592 |
| Pumping Plant | Electric Powered Pump >3 to 10 HP | HP | $500 |
| Pumping Plant | HU-Electric Powered Pump >3 to 10 HP | HP | $600 |
| Pumping Plant | Photovoltaic Powered Pump (Solar) | HP | $5939 |
| Pumping Plant | HU-Photovoltaic Powered Pump (Solar) | HP | $7127 |
| Pumping Plant | Water Ram Pump | IN | $559 |
| Pumping Plant | HU-Water Ram Pump | IN | $671 |
| Pumping Plant | Livestock Nose Pump | Each | $499 |
| Pumping Plant | HU-Livestock Nose Pump | Each | $599 |
| Pumping Plant | Pumping Plant - Small | HP | $1916 |
| Pumping Plant | HU-Pumping Plant - Small | HP | $2300 |
| Pumping Plant | Pumping Plant - Large | HP | $1308 |
| Pumping Plant | HU-Pumping Plant - Large | HP | $1570 |

\*HU = Historically Underserved or Beginning Farmer rates