



**Scenario Worksheet**

**Practice and Scenario Description:**

<b>Information Type</b>	<b>Data</b>
Region	Appalachian
State	North Carolina
Discipline Group	Water Management Engineering
Practice Code/Name	533 - Pumping Plant
Scenario ID	11
Scenario Name	Photovoltaic-Powered Pump

**Scenario Description**  
 The typical scenario assumes installation of a submersible solar-powered pump in a well or a live stream. The installation includes the pump, wiring, drop pipe, solar panels, mounts, inverter, and all appurtenances. Note: It is generally not advisable to use a storage battery for a number of reasons. A storage tank is generally the most efficient method to store energy. Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Irrigation - energy consumption will be reduced and the increased pressure and flow rates will improve irrigation efficiency. Resource Concerns: Insufficient stockwater. Associated Practices include: 374 - Farmstead Energy Improvement, 382 - Fence, 430 - Irrigation Pipeline, 436 - Irrigation Reservoir, 516 - Livestock Pipeline, 561 - Heavy Use Area Protection, and 614 - Watering Facility.

**Before Practice Situation**  
 Livestock: Inadequate supply or location of water for a prescribed grazing system. Eroded stream banks and degraded water quality due to livestock access to stream. Cattle are not well-distributed because of remote water location. Irrigation: Pressure and flow rate is insufficient for uniform irrigation.

**After Practice Situation**  
 The typical scenario assumes installation of a 230-watt photovoltaic (PV) panel, capable of operating a 1/4 Hp (0.25 Hp) solar-powered submersible pump in a well or other water source (Notes: 1) A PV panel is rated under standard and ideal conditions which will most likely not be replicated in the field; 2) 1 Hp is defined as 746 watts; 3) It is reasonable to expect a 1/4 Hp solar-powered submersible pump to deliver about 1.5 gpm and develop a pressure at the pump outlet of about 60 psi.). The installation includes the pump, wiring, pipeline in the well, solar panels, frame mounts, inverter, and all appurtenances. Water will be pumped to an existing storage tank at a higher elevation from which it will be used to pressurize the Livestock Pipeline (516) or Irrigation Pipeline (430). Grazing - Livestock exclusion from surface water will result in improved surface water quality and reduced erosion. Grazing has potential to be well distributed. Irrigation: Improved pressure and flow rate will improve irrigation efficiency.

Scenario Feature Measure	Number of Pumps
Scenario Unit	Each
Scenario Typical Size	1

**Cost Summary:**

Cost Category	Scenario Cost	Scenario Cost/Unit
Materials	\$3,390.04	\$3,390.04
Equipment/Installation	\$78.93	\$78.93
Labor	\$774.00	\$774.00
Mobilization	\$0.00	\$0.00
Acquisition of Technical Knowledge	\$0.00	\$0.00
Foregone Income	\$0.00	\$0.00
Total	\$4,242.97	\$4,242.97

**Cost Details:** [Select Components](#)

Cost Category	Component ID	Component Name	Component Description	Unit	Price (\$/unit)	Quantity	Cost	Component Justification	Quantity Justification
Materials	1135	Solar Panels, variable cost portion	Variable cost portion of the Solar Panels. This portion IS dependent on the total Kilowatt for the Solar Panels. The total cost of any Solar Panels will include this variable cost plus the fixed cost portion. The completed Solar Panels will include all materials (electrical, controllers, and service drop, etc). This cost will include material, labor and equipment.	Kilowatt	\$3,337.70	0.3	\$1,001.31	1 watt = .001 kilowatts	Required by the situation
Materials	1009	Pump, < 5 HP - Pump and motor, fixed cost portion	Fixed cost portion of the Pump: < 5 HP - Pump and motor. This portion is a base cost for all Pump: < 5 HP and is not dependant on horsepower. The total cost of any Pump: < 5 HP will include this fixed cost plus a variable cost portion. The completed Pump: < 5 HP - Pump and motor will include the motor and controls. This cost will include material, labor and equipment	Each	\$175.60	1	\$175.60	1/4 hp pump	Required by the situation
			Variable cost portion of the Pump: < 5 HP - Pump and motor. This portion IS dependent on the total horsepower for						





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Region	Appalachian
State	North Carolina
Discipline Group	Water Management Engineering
Practice Code/Name	533 - Pumping Plant
Scenario ID	1
Scenario Name	Livestock Water Pump < 2HP

**Scenario Description**

Typical application of a less than 2 HP pump at water source (well or spring) in order to pump water to appropriate locations within the prescribed grazing system. Pump enables the development of new watering sites that are removed from hydrologically sensitive areas and provide for a better distribution of animal wastes and associated nutrients. Cattle exclusion from surface water results in improved surface water quality, reduced erosion. Also used for pressurizing a small irrigation system; or for transferring liquid waste in a waste transfer system. Resource Concerns: Livestock Production Limitation - Inadequate livestock water; Water Quality degradation - Excess nutrients in surface and ground waters; Insufficient water - Inefficient use of irrigation water. Associated Practices include: 374 - Farmstead Energy Improvement; 430 - Irrigation Pipeline; 441 - Irrigation System, Microirrigation; 449 - Irrigation Water Management; 516 - Livestock Pipeline; 313 - Waste Storage Facility; 634 - Waste Transfer; and 614 - Watering Facility.

**Before Practice Situation**

Livestock: A pump is needed to move water to provide proper flow rate for watering facility which is used as part of a prescribed grazing system.

**After Practice Situation**

A 2 HP pump is installed at water source (well or spring) in order to pump water uphill to appropriate locations within the prescribed grazing system. Pump enables the development of new watering sites that are removed from hydrologically sensitive areas and provide for a better distribution of animal wastes and associated nutrients. Cattle exclusion from surface water results in improved surface water quality, reduced erosion. Associated practices: Fence (382), Prescribed Grazing (528), Water Well (642), Pipeline (516), Spring Development (574), Watering Facility (614)

Scenario Feature Measure	Pump
Scenario Unit	Each
Scenario Typical Size	1

**Cost Summary:**

Cost Category	Scenario Cost	Scenario Cost/Unit
Materials	\$899.06	\$899.06
Equipment/Installation	\$358.44	\$358.44
Labor	\$419.68	\$419.68
Mobilization	\$92.60	\$92.60
Acquisition of Technical Knowledge	\$0.00	\$0.00
Foregone Income	\$0.00	\$0.00
Total	\$1,769.78	\$1,769.78

**Cost Details:**

[Select Components](#)

Cost Category	Component ID	Component Name	Component Description	Unit	Price (\$/unit)	Quantity	Cost	Component Justification	Quantity Justification
Materials	1009	Pump, < 5 HP - Pump and motor, fixed cost portion	Fixed cost portion of the Pump: < 5 HP - Pump and motor. This portion is a base cost for all Pump: < 5 HP and is not dependant on horsepower. The total cost of any Pump: < 5 HP will include this fixed cost plus a variable cost portion. The completed Pump: < 5 HP - Pump and motor will include the motor and controls. This cost will include material, labor and equipment	Each	\$175.60	1	\$175.60	Needed for installation	1 each
Materials	1010	Pump, < 5 HP - Pump and motor, variable cost portion	Variable cost portion of the Pump: < 5 HP - Pump and motor. This portion IS dependent on the total horsepower for the Pump: < 5 HP. The total cost of any Pump: < 5 HP will include this variable cost plus the fixed cost portion. The completed Pump: < 5 HP - Pump and motor will include the motor and controls. This cost will include material, labor and equipment.	Horsepower	\$229.73	2	\$459.46	Needed for installation	2 hp pump
Materials	1038	Pressure Tank, 40 gallon		Each	\$264.00	1	\$264.00	Needed for installation	40 gallon
			Wheel mounted backhoe excavator with						site prep for concrete pad and



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**Practice and Scenario Description:**

<b>Information Type</b>	<b>Data</b>
Region	Appalachian
State	North Carolina
Discipline Group	Water Management Engineering
Practice Code/Name	533 - Pumping Plant
Scenario ID	4
Scenario Name	Small Irrigation or Waste Pump (2 -5 HP)
Scenario Description	The typical scenario supports replacement of a pump in an existing micro irrigation system on cropland using a typical 4 HP pump. Size of pump is determined by required GPM derived from a design for specific irrigation system on cropland. Scenario could also be used for a 4 HP for silage leachate, barmyard runoff, and milkhouse waste (as part of a waste transfer system) at farm headquarters. Irrigation Setting: existing micro- irrigation system employs an inefficient, improperly sized pump that leads to inefficient water delivery resulting in high energy costs; or Waste Transfer Setting: various types of liquid waste at the headquarters is uncollected causing surface and ground water issues. Due to topography, gravity transfer is not possible and a properly sized pump is needed to transfer waste as part of a waste transfer system. Also can be used as Livestock Water Pump for systems requiring 2 HP or greater.
Before Practice Situation	Irrigation Setting: existing micro irrigation system employs an inefficient, improperly sized pump that leads to inefficient water delivery resulting in high energy costs; or Waste Transfer Setting: various types of liquid waste at the headquarters is uncollected causing surface and ground water issues. Due to topography, gravity transfer is not possible and a properly sized pump is needed to transfer waste as part of a waste transfer system.
After Practice Situation	Irrigation Setting: For micro irrigation system, a properly designed pump is installed reducing water and energy usage. Waste Transfer Setting: For liquid waste, wastes that have been collected through a waste transfer system are now efficiently transferred to appropriate treatment or storage facilities. Associated practices: Waste Transfer (634), Irrigation Pipeline (430), Irrigation System, Micro-Irrigation (441), Heavy Use Area Protection (561), Irrigation Water Management (449), Waste Storage Facility (313), Vegetated Treatment Area (635)
Scenario Feature Measure	number of horse power
Scenario Unit	Horse Power
Scenario Typical Size	4

**Cost Summary:**

Cost Category	Scenario Cost	Scenario Cost/Unit
Materials	\$3,053.44	\$763.36
Equipment/Installation	\$215.04	\$53.76
Labor	\$556.50	\$139.13
Mobilization	\$92.60	\$23.15
Acquisition of Technical Knowledge	\$0.00	\$0.00
Foregone Income	\$0.00	\$0.00
Total	\$3,917.58	\$979.40

**Cost Details:**

[Select Components](#)

Cost Category	Component ID	Component Name	Component Description	Unit	Price (\$/unit)	Quantity	Cost	Component Justification	Quantity Justification
Materials	1009	Pump, < 5 HP - Pump and motor, fixed cost portion	Fixed cost portion of the Pump: < 5 HP - Pump and motor. This portion is a base cost for all Pump: < 5 HP and is not dependant on horsepower. The total cost of any Pump: < 5 HP will include this fixed cost plus a variable cost portion. The completed Pump: < 5 HP - Pump and motor will include the motor and controls. This cost will include material, labor and equipment	Each	\$175.60	1	\$175.60	required for installation	
Materials	1010	Pump, < 5 HP - Pump and motor, variable cost portion	Variable cost portion of the Pump: < 5 HP - Pump and motor. This portion IS dependent on the total horsepower for the Pump: < 5 HP. The total cost of any Pump: < 5 HP will include this variable cost plus the fixed cost portion. The completed Pump: < 5 HP - Pump and motor will include the motor and controls. This cost will include material, labor and equipment.	Horsepower	\$229.73	4	\$918.92	pump installation	3 hp pump required for installation
Materials	1038	Pressure Tank, 40 gallon	0	Each	\$264.00	1	\$264.00	needed for installation	40 gallon pressure tank



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Information Type	Data
Region	Appalachian
State	North Carolina
Discipline Group	Water Management Engineering
Practice Code/Name	533 - Pumping Plant
Scenario ID	5
Scenario Name	Irrigation or Waste Pump (>5 - 10 HP)
Scenario Description	The typical scenario supports replacement of a pump in an existing irrigation system (includes backflow prevention device or water meter as appropriate) on cropland with a typical 8 HP permanent pump. Size of pump is determined by required GPM derived from a design for specific irrigation system on cropland. Scenario could also be used for a 8 HP pump for silage leachate, barnyard runoff, and milkhouse waste (as part of a waste transfer system) at farm headquarters. The combination of higher solids content and volume require a larger horse power pump. This liquid manure pump is used to transfer semi-solid manure from a small reception pit located either below a barnyard or at the end of a free-stall barn or scrape alley.
Before Practice Situation	Irrigation Setting: Either an existing irrigation system employs an inefficient, improperly sized pump that leads to inefficient water delivery resulting in high energy costs; or Waste Transfer Setting: various types of semi-solid or liquid waste at the headquarters is uncollected causing surface and ground water issues.
After Practice Situation	Irrigation Setting: For irrigation system, a properly designed pump is installed reducing water and energy usage. Waste Transfer Setting: For semi-solid or liquid waste, wastes that have been collected through a waste transfer system are now efficiently transferred to appropriate treatment or storage facilities or crop application. Due to topography, gravity transfer is not possible and a properly sized pump is needed to transfer waste as part of a waste transfer system. Associated practices: Waste Transfer (634), Irrigation Pipeline (430), Irrigation System, Micro-Irrigation (441), Heavy Use Area Protection (561), Irrigation Water Management (449), Waste Storage Facility (313), Vegetated Treatment Area (635)
Scenario Feature Measure	number of horse power
Scenario Unit	Horse Power
Scenario Typical Size	8

**Cost Summary:**

Cost Category	Scenario Cost	Scenario Cost/Unit
Materials	\$4,785.92	\$598.24
Equipment/Installation	\$215.04	\$26.88
Labor	\$549.42	\$68.68
Mobilization	\$92.60	\$11.58
Acquisition of Technical Knowledge	\$0.00	\$0.00
Foregone Income	\$0.00	\$0.00
Total	\$5,642.98	\$705.37

**Cost Details:**

[Select Components](#)

Cost Category	Component ID	Component Name	Component Description	Unit	Price (\$/unit)	Quantity	Cost	Component Justification	Quantity Justification
Materials	1012	Pump, > 5 HP - Pump and motor, variable cost portion	Variable cost portion of the Pump: > 5 HP - Pump and motor, 2.5" through 10" discharge size, flows to 7000 gpm and heads to 325 ft. This portion is dependent on the total horsepower for the Pump: > 5 HP. The total cost of any Pump: > 5 HP will include this variable cost plus the fixed cost portion. The completed Pump: > 5 HP - Pump and motor will include the motor and controls. This cost will include materials only.	Horsepower	\$105.45	8	\$843.60	needed for installation	7.5 hp pump
		Pump, > 5 HP - Pump and motor,	Fixed cost portion of the Pump: > 5 HP - Pump and motor, 2.5" through 10" discharge size, flows to 7000 gpm and heads to 325 ft. This portion is a base cost for all Pump: > 5 HP and is not dependant on horsepower. The total cost of any Pump: > 5 HP will include this fixed cost plus a variable cost portion. The completed Pump: > 5 HP - Pump and motor will include the motor and controls.						

