FLORIDA WATERING FACILITY WORKBOOKS

Introduction

Florida NRCS has created three (3) Microsoft Excel® workbooks that aid in the design of watering facilities. The workbooks are: Florida Watering Facility, Solar Watering Facility (Centrifugal), and Solar Watering Facility (Submersible).

The Florida Watering Facility workbook is for the design of watering facilities operated by an electric pump. The Solar Water Facility (Centrifugal) workbook is for the design of a watering facility system when there is one (1) trough that is operated by a solar powered centrifugal pump. The Solar Water Facility (Submersible) workbook is for the design of a watering facility system when there is one (1) trough that is operated by a solar powered submersible pump.

Florida Watering Facility Version 2.1 Users Guide

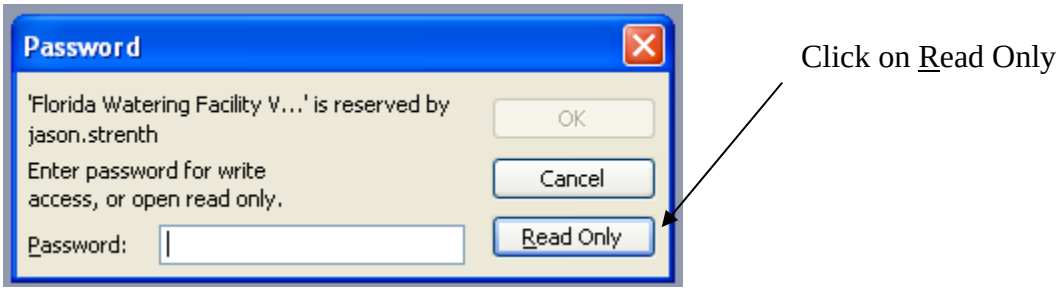
Workbook Purpose and Description

This workbook is intended to aid in the design of a livestock and/or wildlife watering facility connected to a well system. It aids the designer in selecting pipe diameter, pipe pressure class, pump horsepower, pressure tank requirements and other system requirements. The workbook requires a basic knowledge of Microsoft Excel®.

Using the Workbook

To open the workbook, start MS Excel®, and open the file <Florida Watering Facility Version 2.1.xls>. A screen appears asking for a password. The spreadsheet is password protected and the user should click on <Read Only>. See Figure 1.

Figure 1



The cells in the workbook are color coded using the colors: blue and white. The blue cells are input cells either through data entry or via a drop-down menu. The white cells are calculated cells and require no input.

When a required flow rate is known, this workbook can be used to determine the required well pump horsepower and other system requirements for up to four (4) watering facilities. The watering facilities must be in parallel to each other and not in series. Each watering facility can have with up to three (3) sections of pipes. It can be used to determine pipe diameter, pipe pressure class and pressure tank requirements. It is wise to provide the basic layout and system

requirements to the supplier of the pump and pressure tank for verification of the design. Normal industry (plumbing) practice may result in components and settings somewhat different than those determined by this program.

The following instructions explain how to use the workbook to design a watering facility.

1. Enter general information (cooperator, location, and designer, etc.) at the top of the workbook.
2. Enter the **"Well Capacity"**. Well flow capacities can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information or flow rates of similar wells in the area. Be especially cautious in areas where well capacities are typically low.
3. Enter the **"Elevation at Well"**. This can be the actual elevation if known or assumed.
4. Enter the **"Pipe Length in Well"** if known. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information. This is the length of pipe between the pump and pressure tank.
5. Select the nominal **"Pipe Dia. In Well"** from the drop down list. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information.
6. Enter the **"Depth to Water in Well"**. This is the depth measured at the well drawdown level. This may be obtained from the driller's log or from the landowner. If a reliable depth can not be found then estimate the depth based on other wells in the area or measure the static depth with a string and estimate the depth at drawdown.
7. Enter **"Animal Type"**, **"Daily Requirements"**, **"Number of Animals"** and **"Trough Capacity"** to obtain a **"Minimum Flow Rate"**. The minimum daily requirements of various animals can be obtained from the Florida NRCS conservation practice standard Watering Facility, Code 614. Up to two (2) animal types can be entered for each trough. If only one animal type is used for the trough, the **"Daily Requirements"** and/or **"Number of Animals"** for the other animal must be set to zero (0).
8. Enter a **"Selected Flow Rate"** that is equal to or greater than the **"Minimum Flow Rate"**. This is the average flow rate that the pump will be sized for and it can not exceed the well capacity and must be at least 2 gpm.
9. Enter the **"Water Elevation at Trough".** This elevation can be assumed, but must be relative to the other elevations.
10. Enter the desired **"Outlet Pressure"**. A minimum value of at least 10 psi should be used. This is to make sure adequate pressure is available at the trough. Flow rates for float valves are determined based on pressure at the valve. The minimum pressure required to produce the required flow rate for the selected valve should be used if known. Maximum **"Outlet Pressure"** in this workbook is 50 psi.
11. The workbook allows up to three sections of pipelines (A, B, & C) for each trough. The workbook assumes the pipelines to each trough are in series. For each pipeline, enter a

"Selected Flow Rate" then, select a **"Pipe Material"**, **"Pipe Wall Designation",** and **"Nominal Pipe Diameter"** from the drop-down lists for each pipeline. For pipelines that are not being utilized, enter zero (0) for the **"Selected Flow Rate".** If the velocity is greater than 5 feet per second, select a larger pipe diameter.

12. Enter the pipe components, lengths and fittings for the pipelines.
13. Check **"Pipe/Fittings Friction Loss"** and **"Total Head Required".** Adjust pipe diameter if necessary.

If designing less than four troughs, set the **"Daily Requirements", "Number of Animals"** and **"Selected Flow Rate"** for the troughs not being designed to zero (0) so the workbook does not use these troughs in the calculation and proceed to step 14. If designing more than one trough, repeat steps 7-13 for the other troughs. A mainline should be used even if only one trough is being designed. When designing multiple troughs, the workbook uses the trough and pipeline series with the highest head requirement to size the pump.

14. Enter the **"Selected Flow Rate"** for the mainline. This value must be at least equal to the **"Minimum Flow Rate"** for the mainline, be not greater than the well capacity and must be at least 2 gpm. The **"Minimum Flow Rate"** for the mainline is calculated as the maximum of the 12 sections of pipelines. Depending on how many troughs are being operated at one time, the **"Selected Flow Rate"** may need to be greater than the **"Minimum Flow Rate"**.
15. Select a **"Pipe Material"**, **"Pipe Wall Designation",** and **"Nominal Pipe Diameter"** from the drop-down lists for the mainline. If the velocity is greater than 5 feet per second, select a larger pipe diameter.
16. Enter the pipe components, lengths and fittings for the mainline.
17. Check **"Pipe/Fittings Friction Loss"** and **"Total System Loss".** Adjust pipe diameter if necessary.
18. Two different values for **"Pumping Head"** are displayed. One is the head required from the pump to the trough and the other is the head required from the pump to the pressure tank. *The pump horsepower is based on the greater of these values.*
19. Enter the **"Pump Efficiency"** and **"Motor Efficiency"** values. If these values are unknown, use 0.65 for pump efficiency and 0.90 for motor efficiency.
20. The **"Calculated Pump Size"** will be displayed as the minimum horsepower needed. Select a standard pump size from the dropdown list that has a horsepower rating equal to or greater than the minimum. There is generally no advantage to greatly oversizing the pump. An oversized pump will refill the storage tank more quickly and shut off sooner.
21. Check the **"Pipe Pressure Rating"** for each pipe. Go to the Pipe Pressure Tables worksheet to verify that the selected **"Wall Designation"** and **"Pipe Material"** is available in a pressure rating that exceeds the minimum. If the selected wall designation and pipe material is not available in a pressure rating that exceeds the minimum pressure rating, choose a thicker wall pipe and revise the design. This will usually not be a

concern for PVC pipe and systems having small elevation changes. ABS and PE materials generally have lower pressure ratings for the same pipe sizes.

22. Check **"Max pressure @ Trough"** for each trough designed to ensure the float valve can handle the maximum pressure.

23. Select an appropriate pressure tank and pressure switch settings. Note the **"Minimum Operating Pressure"** required to produce the average flow rate. This value should be at or below the midpoint between the switch-on/switch-off settings to provide the average flow rate in the desired delivery time.

24. The **"Minimum Tank Drawdown Capacity"** and **"Minimum Tank Capacity"** are shown. Select a tank with at least the minimum drawdown capacity to prevent frequent cycling of the pump. The minimum tank capacity is based on a pre-charge of 2 psi lower than the **"Switch-on"** pressure setting. Actual tank capacity may vary and shall be selected by the tank manufacturer.

25. Select **"Switch-on"** and **"Switch-off"** settings as low as possible. However, these may have to be adjusted to provide adequate pressure or to minimize high velocities. The **"Minimum Operating Pressure"** should fall in the middle to lower end of this range.

26. Click on the **"Summary"** worksheet tab. Enter **"Trough Size"**, **"Trough Perimeter"** and **"No. of Troughs"** to meet the minimum storage capacity. Also, enter any **"Other Pipe and Items"** needed.

27. Click on the **"Construction Specifications"** worksheet tab. Enter any material or construction requirements for the pipeline, pump, pressure tank or water trough.

28. Click on the **"O & M Plan"** worksheet tab. Enter any additional items the landowner will need to be aware of to properly operate and maintain the watering facility.

GENERAL COMMENTS - In systems having valves that close slowly, friction losses and velocities that exceed the recommended values by a small amount should generally not be a problem and surge protection will most likely not be required unless the recommended values are greatly exceeded. **However, an engineer should be consulted** to determine if this is the case. Also systems having large elevation changes at intermediate points between the well and trough (even though the difference between the well and trough is small) should be checked by an engineer to determine if air release valves are necessary.

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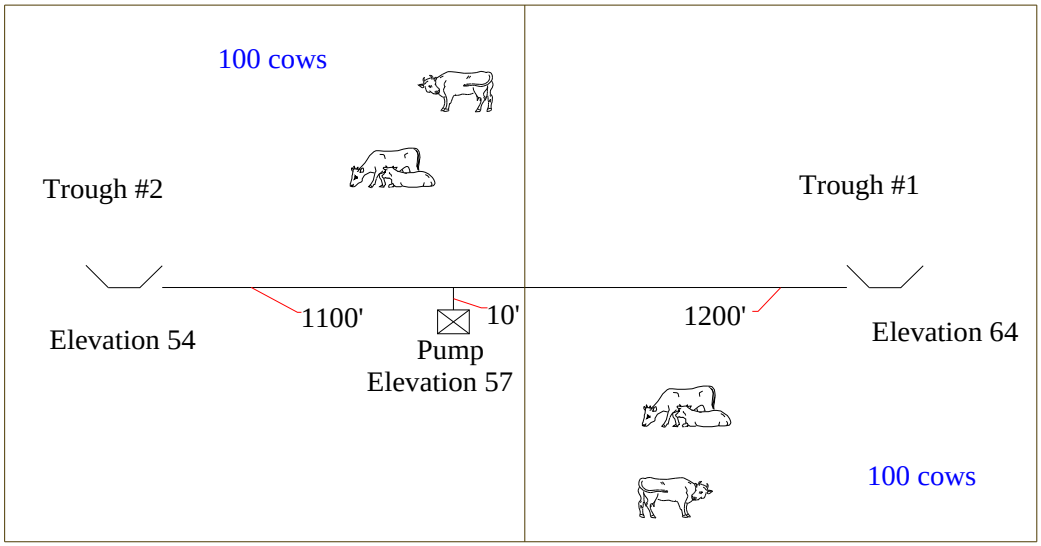
Example

A landowner has two pastures with 100 beef cows in each pasture as shown below. The landowner wants a watering facility in each pasture. The ground elevation is as shown. Assume the water elevation in the watering facility is 2 feet above ground. The landowner would like to use 100 gallon watering facilities, Schedule 40 PVC pipe and at least 5 gpm to each watering facility.



Example Solution

United States Department of Agriculture
NRCS Natural Resources Conservation Service

WATERING FACILITY DESIGN FOR WELL SYSTEMS

Cooperator	E. Sadler	Location	S29,T1N,R11E
Conservation District	Madison	Field Office	Madison
Identification No.	1	Field No.	P1, P2
Operation Type	Beef Cattle		
Designed By	D. Conservationist	Date	5/8/2010
Checked By	A. Engineer	Date	5/16/2010

PLEASE READ INSTRUCTIONS ON "INSTRUCTIONS" WORKSHEET BEFORE BEGINNING

Input cell
Calculated cell, requires no input

Well Information		
Distance to Power	1500	feet
Well Capacity	20.0	gpm
Elevation at Well	57.00	ft
Pipe Length in Well	50.0	ft
Pipe Dia. in Well	1.25	in
Actual Well Pipe Dia.	1.38	in
Depth to Water in Well	40.0	ft
Well Pipe Friction Loss	0.73	ft.

Trough #1 Information			
Animal Type	beef		
Daily Requirements	12.0	0.0	gpd/animal
Number of Animals	100	0	
Total Daily Requirement	1200	0	gallons
Trough Capacity	100	gallons	
Min. required trough perimeter			
◊Circular trough	8.3	ft	
◊Straight side trough	12.5	ft	
Minimum Flow Rate	4.17	gpm	
Selected Flow Rate	5.0	gpm	
Water Elevation at Trough	66.00	ft	
Elevation Difference From Well to Trough	9.00	ft	
Outlet Pressure	10	psi	
Pipeline #1A Informatior			
Selected Flow Rate	5.0	gpm	
Pipe Material	PVC		
Pipe Wall Designation	Schedule 40		
Nominal Pipe Diameter	1	in	
Actual Pipe Diameter	1.049	in	
Flow Coefficient	150		
Velocity	1.86	fps	
Pipe Low Point Elevation	55.50	ft	
Pipe Length	1200.0	ft	
Adapters	0	no.	
Couplers	0	no.	
45 Degree Elbows	0	no.	
90 Degree Elbows	3	no.	
Straight Flow Tees	2	no.	
Angle flow tees	1	no.	
Gate Valves	1	no.	
Globe Valves	0	no.	
Check Valves	0	no.	
Pipe/Fittings Friction Loss	18.58	ft.	
Pipe Pressure Rating	70	psi	

Trough #2 Information			
Animal Type	beef		
Daily Requirements	12.0	0.0	gpd/animal
Number of Animals	100	0	
Total Daily Requirement	1200	0	gallons
Trough Capacity	100	gallons	
Min. required trough perimeter			
◊Circular trough	8.3	ft	
◊Straight side trough	12.5	ft	
Minimum Flow Rate	4.17	gpm	
Selected Flow Rate	5.0	gpm	
Water Elevation at Trough	56.00	ft	
Elevation Difference From Well to Trough	-1.00	ft	
Outlet Pressure	10	psi	
Pipeline #2A Informatior			
Selected Flow Rate	5.0	gpm	
Pipe Material	PVC		
Pipe Wall Designation	Schedule 40		
Nominal Pipe Diameter	0.75	in	
Actual Pipe Diameter	0.824	in	
Flow Coefficient	150		
Velocity	3.01	fps	
Pipe Low Point Elevation	52.50	ft	
Pipe Length	1100.0	ft	
Adapters	0	no.	
Couplers	0	no.	
45 Degree Elbows	0	no.	
90 Degree Elbows	3	no.	
Straight Flow Tees	2	no.	
Angle flow tees	1	no.	
Gate Valves	1	no.	
Globe Valves	0	no.	
Check Valves	0	no.	
Pipe/Fittings Friction Loss	55.10	ft.	
Pipe Pressure Rating	72	psi	

Pipeline #1B Information		
Selected Flow Rate	0.0	gpm
Pipe Material	PVC	
Pipe Wall Designation	Schedule 40	
Nominal Pipe Diameter	1	in
Actual Pipe Diameter	1.049	in
Flow Coefficient	150	
Velocity	0.00	fps
Pipe Low Point Elevation	93.50	ft
Pipe Length	0.0	ft
Adapters	0	no.
Couplers	0	no.
45 Degree Elbows	0	no.
90 Degree Elbows	0	no.
Straight Flow Tees	0	no.
Angle flow tees	0	no.
Gate Valves	0	no.
Globe Valves	0	no.
Check Valves	0	no.
Pipe/Fittings Friction Loss	0.00	ft.
Pipe Pressure Rating	69	psi

Pipeline #2B Information		
Selected Flow Rate	0.0	gpm
Pipe Material	PVC	
Pipe Wall Designation	Schedule 40	
Nominal Pipe Diameter	0.75	in
Actual Pipe Diameter	0.824	in
Flow Coefficient	150	
Velocity	0.00	fps
Pipe Low Point Elevation	93.50	ft
Pipe Length	300.0	ft
Adapters	0	no.
Couplers	0	no.
45 Degree Elbows	0	no.
90 Degree Elbows	3	no.
Straight Flow Tees	2	no.
Angle flow tees	1	no.
Gate Valves	1	no.
Globe Valves	0	no.
Check Valves	0	no.
Pipe/Fittings Friction Loss	0.00	ft.
Pipe Pressure Rating	69	psi

Pipeline #1C Information		
Selected Flow Rate	0.0	gpm
Pipe Material	PVC	
Pipe Wall Designation	Schedule 40	
Nominal Pipe Diameter	0.75	in
Actual Pipe Diameter	0.824	in
Flow Coefficient	150	
Velocity	0.00	fps
Pipe Low Point Elevation	93.50	ft
Pipe Length	0.0	ft
Adapters	0	no.
Couplers	0	no.
45 Degree Elbows	0	no.
90 Degree Elbows	0	no.
Straight Flow Tees	0	no.
Angle flow tees	0	no.
Gate Valves	0	no.
Globe Valves	0	no.
Check Valves	0	no.
Pipe/Fittings Friction Loss	0.00	ft.
Pipe Pressure Rating	69	psi

Pipeline #2C Information		
Selected Flow Rate	0.0	gpm
Pipe Material	PVC	
Pipe Wall Designation	Schedule 40	
Nominal Pipe Diameter	0.75	in
Actual Pipe Diameter	0.824	in
Flow Coefficient	150	
Velocity	0.00	fps
Pipe Low Point Elevation	93.50	ft
Pipe Length	100.0	ft
Adapters	0	no.
Couplers	0	no.
45 Degree Elbows	0	no.
90 Degree Elbows	3	no.
Straight Flow Tees	2	no.
Angle flow tees	1	no.
Gate Valves	1	no.
Globe Valves	0	no.
Check Valves	0	no.
Pipe/Fittings Friction Loss	0.00	ft.
Pipe Pressure Rating	69	psi

Total Pipeline #1 Head Required	50.68	ft.
Max pressure @Trough	46.1	psi

Total Pipeline #2 Head Required	77.20	ft.
Max pressure @Trough	50.4	psi

Example Solution (cont.)

Mainline Information		
Minimum Flow Rate	5.00	gpm
Selected Flow Rate	10.0	gpm
Pipe Material	PVC	
Pipe Wall Designation	Schedule 40	
Nominal Pipe Diameter	1	in
Actual Pipe Diameter	1.049	in
Flow Coefficient	150	
Velocity	3.72	fps
Pipe Low Point Elevation	55.50	ft
Pipe Length	10.0	ft
Adapters	0	no.
Couplers	0	no.
45 Degree Elbows	0	no.
90 Degree Elbows	3	no.
Straight Flow Tees	2	no.
Angle flow tees	1	no.
Gate Valves	1	no.
Globe Valves	0	no.
Check Valves	1	no.
Pipe/Fittings Friction Loss	2.67	ft.
Pipe Pressure Rating	70	psi

Pressure Tank Selection Guidelines:		
Minimum Operating Pressure	35	psi
Minimum Tank Drawdown	10.0	gal
Minimum Tank Capacity	33.9	gal

Pressure Tank Settings		
Switch-on Setting	30	psi
Switch-off Setting	50	psi

Pump Selection					
Total System Loss	79.88	ft.			
Total Pumping Head (Pump to Trough)	120.6	ft	Total Pumping Head (Pump to Pressure Tank)	156.2	ft
Pump Efficiency	0.80				
Motor Efficiency	0.80				
Calculated Pump Size	0.62	HP	Selected Pump Size	0.75	HP

Solar Watering Facility (Centrifugal) Version 1.0 Users Guide

Workbook Purpose and Description

This workbook is intended to aid in the design of a livestock and/or wildlife solar watering facility connected to a well system with a centrifugal pump. It aids the designer in selecting pipe diameter, pipe pressure class, pump requirements and other system requirements. The workbook requires a basic knowledge of Microsoft Excel®.

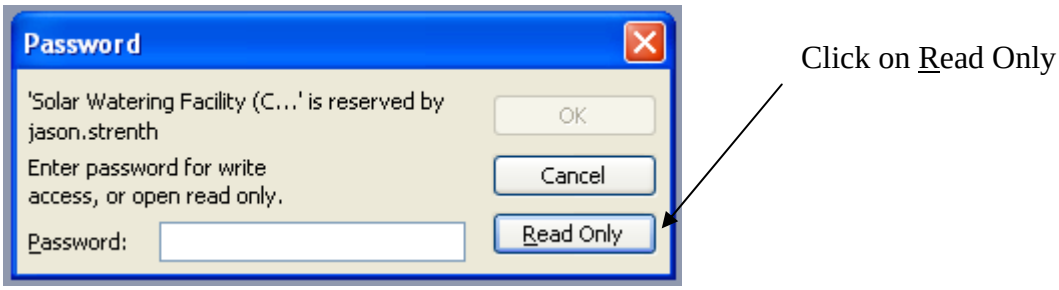
Where Workbook Applies

This workbook should only be used when designing solar watering facilities where there is one trough and one pump.

Using the Workbook

To open the workbook, start MS Excel®, and open the file <Solar Watering Facility (Centrifugal) Version 1.0.xls>. A screen appears asking for a password. The spreadsheet is password protected and the user should click on <Read Only>. See Figure 1.

Figure 1



The cells in the workbook are color coded using the colors: blue and white. The blue cells are input cells either through data entry or via a drop-down menu. The white cells are calculated cells and require no input.

This workbook can be used to determine the required pump flow rate and discharge pressure and other system requirements for a solar watering facility with or without a backup battery. It can be used to determine pipe diameter and pipe pressure class. It is wise to provide the basic layout and system requirements to the supplier of the pump and solar panels for verification of the design. Normal industry (plumbing) practice may result in components and settings somewhat different than those determined by this program.

The following instructions explain how to use the workbook to design a solar watering facility.

29. Enter general information (cooperator, location, and designer, etc.) at the top of the workbook.

30. Enter the **"Well Capacity"**. Well flow capacities can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information or flow rates of similar wells in the area. Be especially cautious in areas where well capacities are typically low.
31. Enter the "**Well Diameter**".
32. Enter the **"Elevation of Pump"**. This can be the actual elevation if known or assumed.
33. Enter the **"Pipe Length in Well"** if known. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information. This is the length of pipe on the suction side of the pump.
34. Select the nominal **"Pipe Dia. In Well"** from the drop down list. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information.
35. Enter the **"Depth to Water in Well From Pump Inlet"**. This value includes the depth measured in the well at drawdown from the ground surface plus the distance the pump is above ground. This may be obtained from the driller's log or from the landowner. If a reliable depth can not be found then estimate the depth based on other wells in the area or measure the static depth with a string, estimate the depth at drawdown, and add the distance the pump sits above ground.
36. Enter **"Animal Type"**, **"Daily Requirements"**, and **"Number of Animals"** to obtain a "**Total Daily Requirement per Animal Type**" and "**Total Daily Requirement All Animals**". The minimum daily requirements of various animals can be obtained from the Florida NRCS conservation practice standard Watering Facility, Code 614. Up to four (4) animal types can be entered. Set the **"Daily Requirements"** and/or **"Number of Animals"** to zero (0) for animal types not used.
37. Answer the question "**Is There A Reliable 3 Day Water Source?**". The 3 day water source could be a pond, stream, or other troughs that are available to the animals. If yes is answered, the location and quantity of the 3 day water source must be documented.
38. Enter a "**Selected Trough Capacity**" that is equal to or greater than the minimum trough capacity.
39. Enter a "**Selected Flow Rate**" that is equal to or greater than the "**Calculated Flow Rate**". This is the average flow rate that the system will be sized for and it can not exceed the well capacity and must be at least 2 gpm.
40. Enter the **"Maximum Water Elevation at Trough".** This elevation can be assumed, but must be relative to the other elevations.
41. Enter the desired **"Outlet Pressure at Trough"**. A minimum value of at least 10 psi should be used. This is to make sure adequate pressure is available at the trough. Flow rates for float valves are determined based on pressure at the valve. The minimum pressure required to produce the required flow rate for the selected valve should be used if known. Maximum **"Outlet Pressure at Trough"** in this workbook is 50 psi.

42. Select a **"Pipe Material"**, **"Pipe Wall Designation",** and **"Nominal Pipe Diameter"** from the drop-down lists for the pipeline. If the velocity is greater than 5 feet per second, select a larger pipe diameter.
43. Enter the pipe components, lengths and fittings for the pipeline.
44. Check **"Pipe/Fittings Friction Loss"** and **"Pipe Pressure Rating"** for each pipe.
45. Review the "**Pressure Required at Pump Discharge**" and "**Pump Total Dynamic Head (TDH)**"to determine if reasonable. If not, adjust pipe diameter.
46. Click on and print either the **"Direct Drive Schematic"** or "**Battery Backup Schematic**" worksheet tab depending on which system will be used.
47. Click on the "**O&M Plan**" worksheet tab. Enter any additional items on the O&M Plan and print.
48. Click on the "**Construction Specs**" worksheet tab. Enter any additional items on the construction specifications and print.

GENERAL COMMENTS - In systems having valves that close slowly, friction losses and velocities that exceed the recommended values by a small amount should generally not be a problem and surge protection will most likely not be required unless the recommended values are greatly exceeded. **However, an engineer should be consulted** to determine if this is the case. Also systems having large elevation changes at intermediate points between the well and trough (even though the difference between the well and trough is small) should be checked by an engineer to determine if air release valves are necessary.

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Solar Watering Facility (Submersible) Version 1.0 Users Guide

Workbook Purpose and Description

This workbook is intended to aid in the design of a livestock and/or wildlife solar watering facility connected to a well system with a submersible pump. It aids the designer in selecting pipe diameter, pipe pressure class, pump requirements and other system requirements. The workbook requires a basic knowledge of Microsoft Excel®.

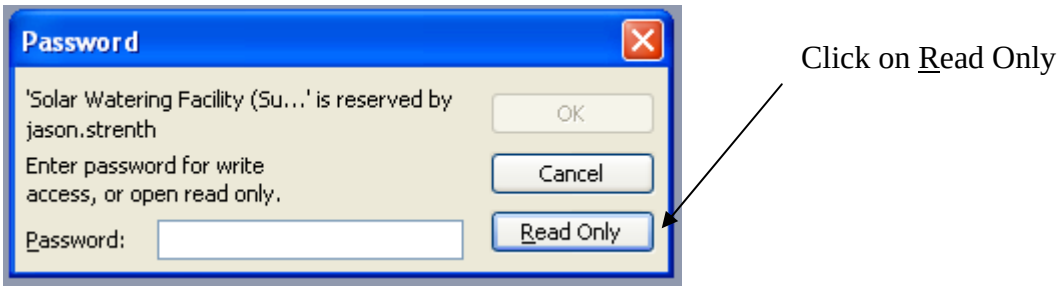
Where Workbook Applies

This workbook should only be used when designing solar watering facilities where there is one trough and one pump.

Using the Workbook

To open the workbook, start MS Excel®, and open the file <Solar Watering Facility (Submersible) Version 1.0.xls>. A screen appears asking for a password. The spreadsheet is password protected and the user should click on <Read Only>. See Figure 1.

Figure 1



The cells in the workbook are color coded using the colors: blue and white. The blue cells are input cells either through data entry or via a drop-down menu. The white cells are calculated cells and require no input.

This workbook can be used to determine the required pump flow rate and discharge pressure and other system requirements for a solar watering facility with or without a backup battery. It can be used to determine pipe diameter and pipe pressure class. It is wise to provide the basic layout and system requirements to the supplier of the pump and solar panels for verification of the design. Normal industry (plumbing) practice may result in components and settings somewhat different than those determined by this program.

The following instructions explain how to use the workbook to design a solar watering facility.

49. Enter general information (cooperator, location, and designer, etc.) at the top of the workbook.
50. Enter the **"Well Capacity"**. Well flow capacities can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's

information or flow rates of similar wells in the area. Be especially cautious in areas where well capacities are typically low.

51. Enter the "**Well Diameter**".
52. Enter the **"Ground Elevation at Well"**. This can be the actual elevation if known or assumed.
53. Enter the **"Pipe Length in Well"** if known. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information. This is the length of pipe between the pump and top of well casing.
54. Select the nominal **"Pipe Dia. In Well"** from the drop down list. This can be obtained from driller's log if available. If logs are not available then make best estimate based on landowner's information.
55. Enter the **"Depth to Water in Well"**. This is the depth measured at the well drawdown level. This may be obtained from the driller's log or from the landowner. If a reliable depth can not be found then estimate the depth based on other wells in the area or measure the static depth with a string and estimate the depth at drawdown.
56. Enter **"Animal Type"**, **"Daily Requirements"**, and **"Number of Animals"** to obtain a "**Total Daily Requirement per Animal Type**" and "**Total Daily Requirement All Animals**". The minimum daily requirements of various animals can be obtained from the Florida NRCS conservation practice standard Watering Facility, Code 614. Up to four (4) animal types can be entered. Set the **"Daily Requirements"** and/or **"Number of Animals"** to zero (0) for animal types not used.
57. Answer the question "**Is There A Reliable 3 Day Water Source?**". The 3 day water source could be a pond, stream, or other troughs that are available to the animals. If yes is answered, the location and quantity of the 3 day water source must be documented.
58. Enter a "**Selected Trough Capacity**" that is equal to or greater than the minimum trough capacity.
59. Enter a "**Selected Flow Rate**" that is equal to or greater than the "**Calculated Flow Rate**". This is the average flow rate that the system will be sized for and it can not exceed the well capacity and must be at least 2 gpm.
60. Enter the **"Maximum Water Elevation at Trough".** This elevation can be assumed, but must be relative to the other elevations.
61. Enter the desired **"Outlet Pressure at Trough"**. A minimum value of at least 10 psi should be used. This is to make sure adequate pressure is available at the trough. Flow rates for float valves are determined based on pressure at the valve. The minimum pressure required to produce the required flow rate for the selected valve should be used if known. Maximum **"Outlet Pressure at Trough"** in this workbook is 50 psi.
62. Select a **"Pipe Material"**, **"Pipe Wall Designation",** and **"Nominal Pipe Diameter"** from the drop-down lists for the pipeline. If the velocity is greater than 5 feet per second, select a larger pipe diameter.
63. Enter the pipe components, lengths and fittings for the pipeline.

64. Check **"Pipe/Fittings Friction Loss"** and **"Pipe Pressure Rating"** for each pipe.
65. Review the "**Pressure Required at Pump Discharge**" to determine if reasonable. If not, adjust pipe diameter.
66. Click on and print either the **"Direct Drive Schematic"** or "**Battery Backup Schematic**" worksheet tab depending on which system will be used.
67. Click on the "**O&M Plan**" worksheet tab. Enter any additional items on the O&M Plan and print.
68. Click on the "**Construction Specs**" worksheet tab. Enter any additional items on the construction specifications and print.

GENERAL COMMENTS - In systems having valves that close slowly, friction losses and velocities that exceed the recommended values by a small amount should generally not be a problem and surge protection will most likely not be required unless the recommended values are greatly exceeded. **However, an engineer should be consulted** to determine if this is the case. Also systems having large elevation changes at intermediate points between the well and trough (even though the difference between the well and trough is small) should be checked by an engineer to determine if air release valves are necessary.

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