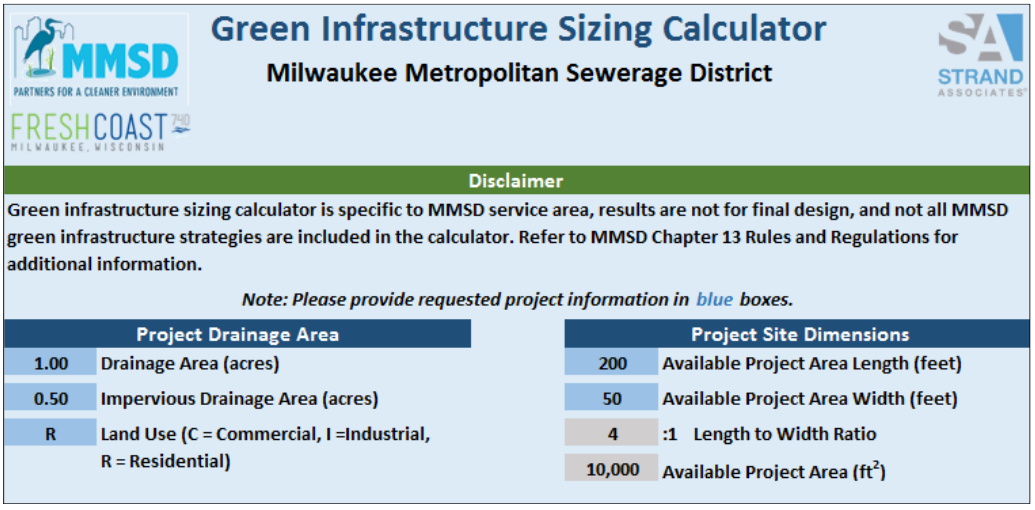
Green Infrastructure Sizing Calculator Detailed Instructions

Make sure the tool is saved to a different folder on the desktop to have full functionality of the tool. If at any point you have a question please contact us at the Green Infrastructure Center of Excellence (414) 225-2222.

Important Terms

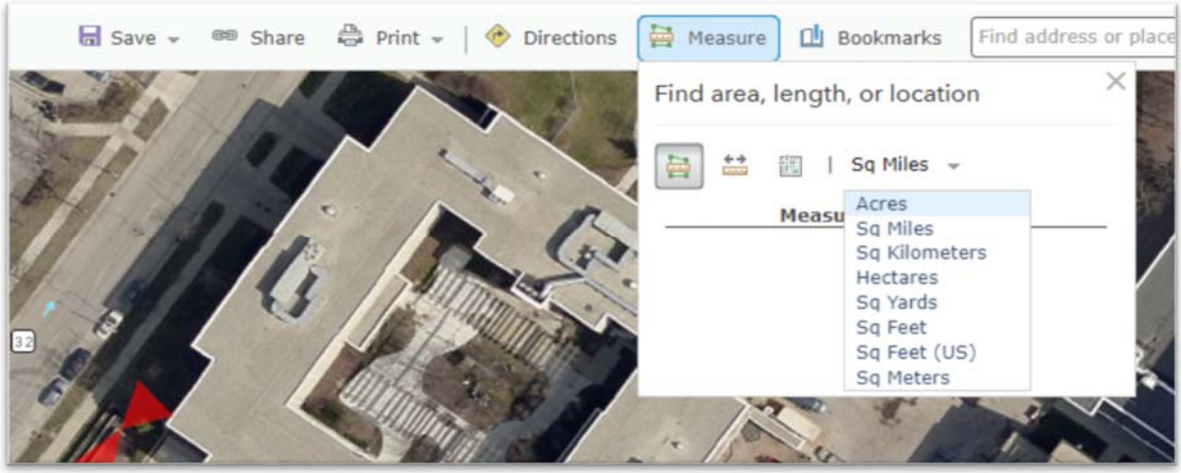
Green infrastructure:	Also refered to as GI is a built system that cleans and captures rain water
Drainage area:	Total area water drains from in a rain storm; also known as tributary area. If you measure in square feet simply divide that number by 43,560 to get the value in acres
Impervious area:	The area that doesn't absorb water within the drainage area
Project site dimensions:	Length and width of the area you have available to place a green infrastructure installation such as a rain garden, bioswale or pervious pavement

1. Begin by selecting the Microsoft Excel File entitled "Green Infrastructure Sizing Calculator."
2. Once the tool opens enter the relevant information into the boxes highlighted in blue (only the blue boxes are editable).



3. To gather some of the information it may be useful to open google maps or the online companion map found on the website. First type in your address in the search bar and hit enter. If you use google maps simply right click to access the measuring tool. The companion map's measuring tool can measure both area and length. To use this tool, click on the

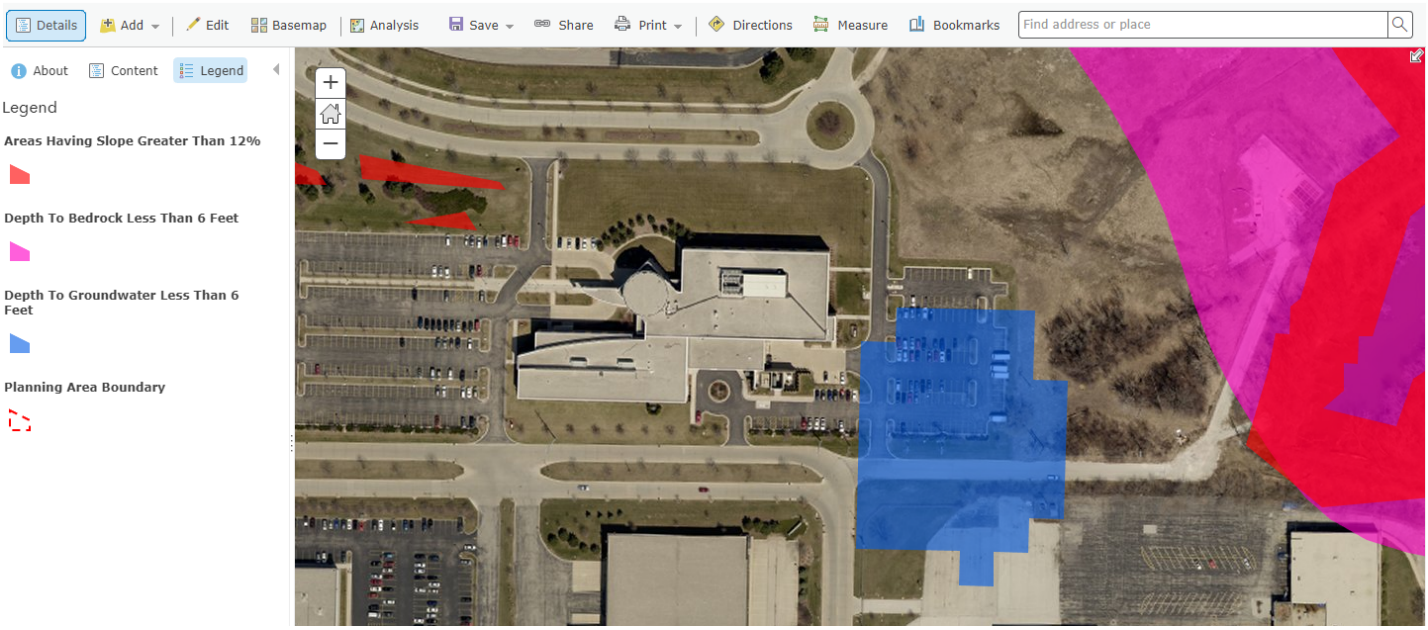
"Measure" button, then the shape button and pick the appropriate measurement unit from the drop-down menu (see picture below). Next draw around the area you are measuring by single clicking at each corner. When done, double-click to view the result.



4. Next answer the Project Specific Questions (see picture below) to the best of your ability.

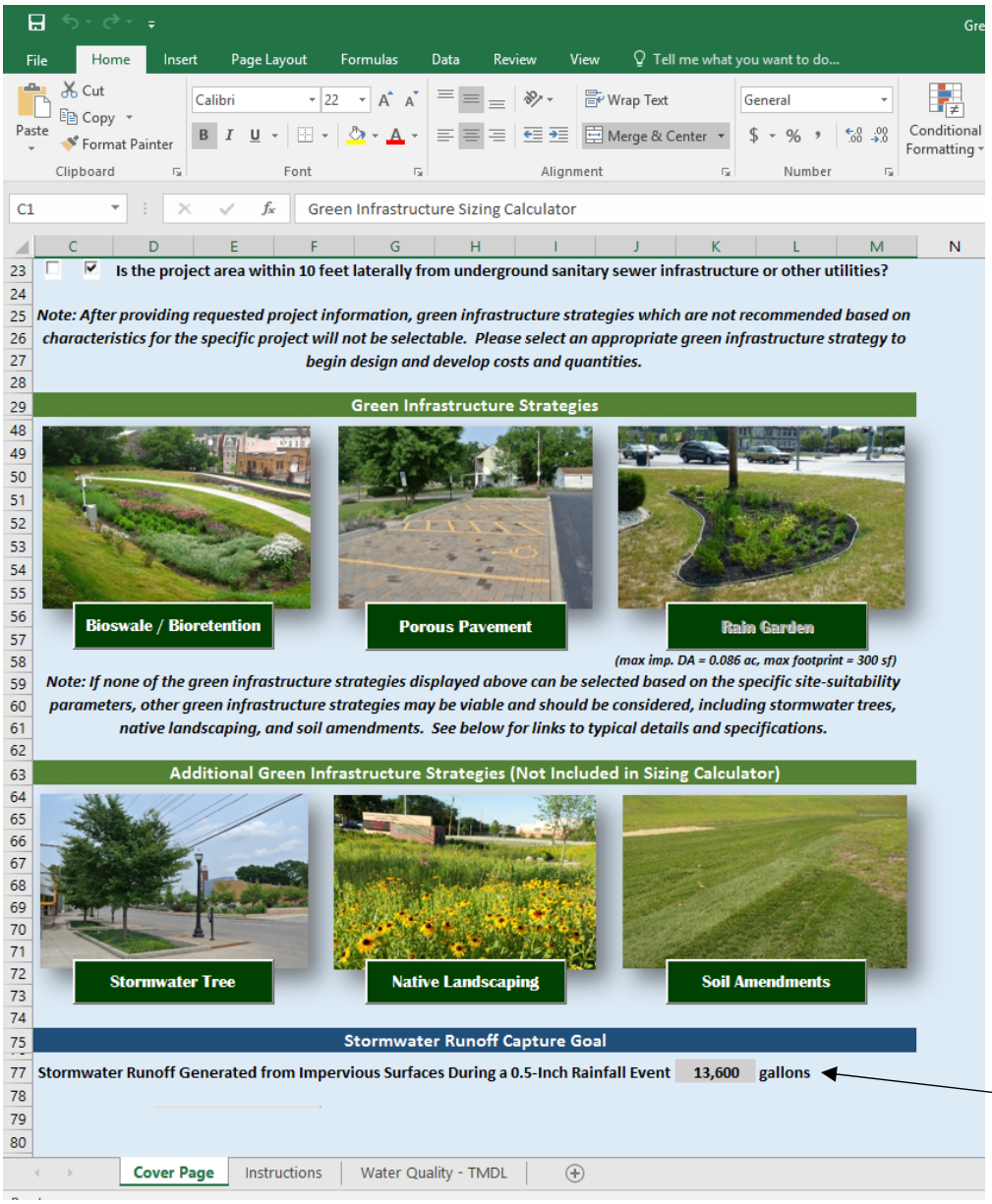
	Project Specific Questions	
Yes	No	
☐	☑	Is the project area for the green infrastructure strategy within the right-of-way?
☐	☑	Are the topographic slopes adjacent to the green infrastructure strategy greater than 12%?
☐	☑	Is the depth to bedrock less than 6 feet?
☐	☑	Is the depth to groundwater less than 6 feet?
☐	☑	Is the project area within 10 feet horizontally of building foundations?
☐	☑	Is the project area within 10 feet laterally from underground sanitary sewer infrastructure or other utilities?

To help answer questions 2 through 4 you can use the companion map on the website. The characteristics referenced in each question are represented by different colored shapes identified in the legend of the map. In the example below the map contains all 3 characteristics (slope greater than 12% shown in red, depth to bedrock less than 6 feet shown in pink, and depth to groundwater less than 6 feet shown in blue) mentioned in questions 2-4. Check a box as yes if any of the characteristics are present at the project site.

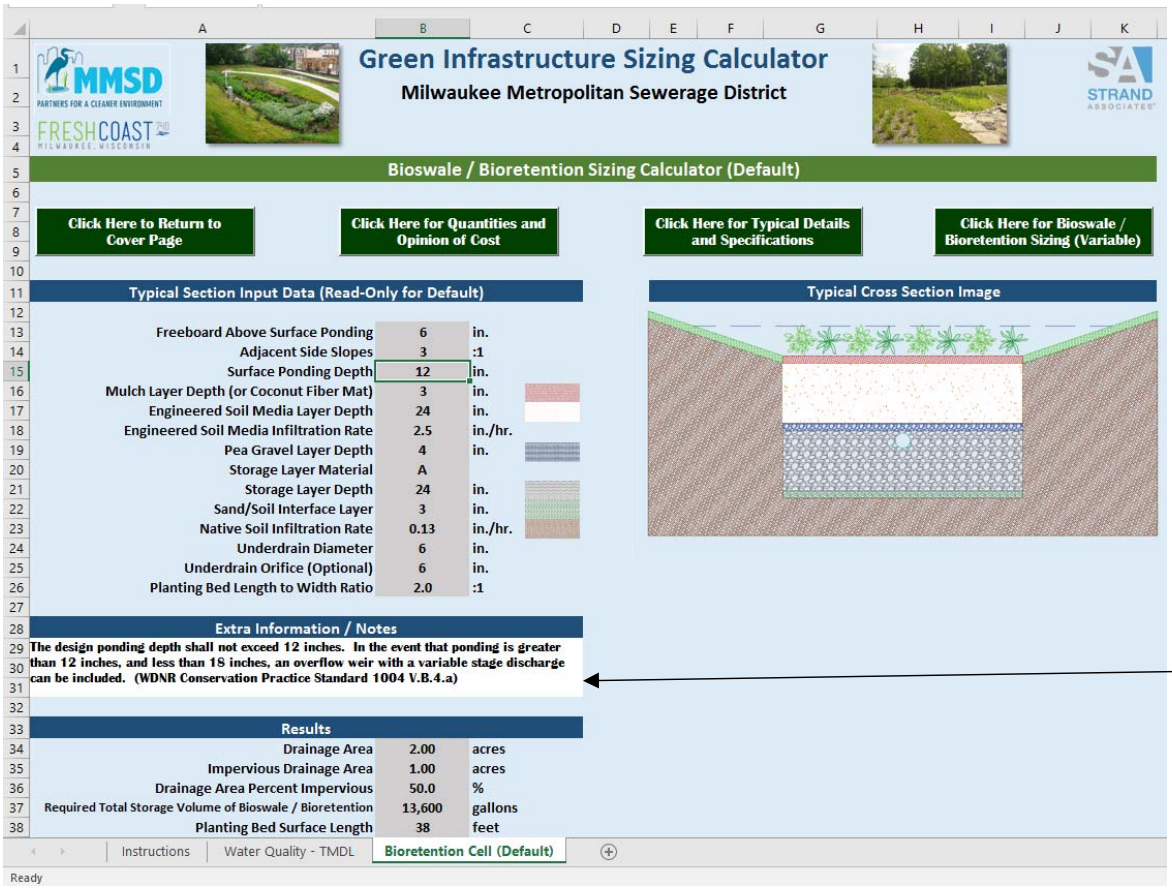


5. Once you have entered the information entered in the blue boxes and answered the project specific questions the tool shows what GI strategies would be the best fit the project site. The GI strategies highlighted in white are the options available to you based on the information you entered. If a GI strategy is grayed out (as seen in the image below) it won't be able to be selected because either the project area is too large, or if "yes" is answered for some of the project specific questions.

6. Select from the GI strategies highlighted in white to access the design parameters.



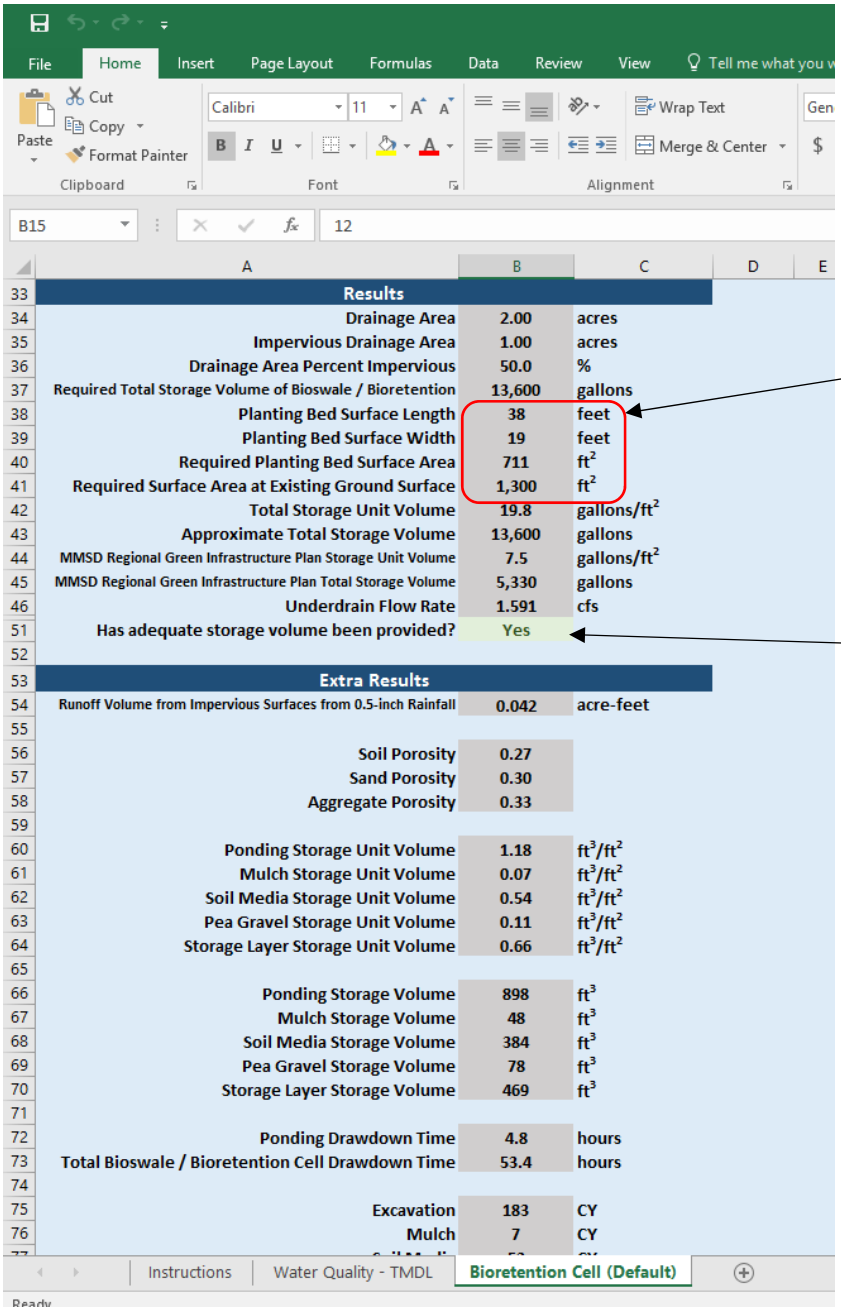
Note the gallons total needed to capture the first half inch of rain over the impervious are inputted.



The notes section will give information about the highlighted section in the typical section area. Most have a reference to a WDNR specification.

7. The default page will size a GI feature to capture the first half inch of rainfall. For example, a half inch of rainfall on a 1-acre impervious area generates 13,600 gallons. The bioretention screenshot above is sized to capture 13,600 gallons based upon the size and this cross section shown above. You will also notice that there are no blue boxes on this screen, and that is because nothing can be edited on the default page. That functionality is reserved for the variable portion of the tool, which can be accessed by clicking the green button on the top right corner.

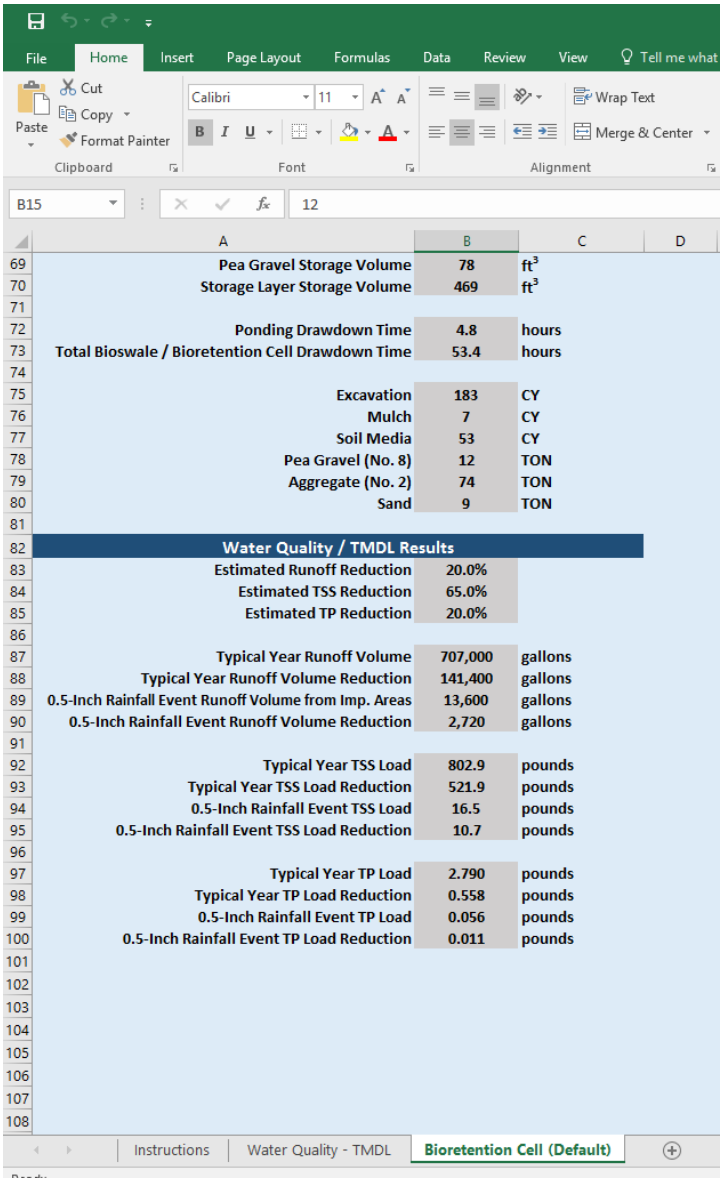
8. The GI strategy surface area is the red/orange section-need to account for area that slopes into the strategy. Calculated as “required surface area at existing ground surface”.



	A	B	C
33	**Results**		
34	Drainage Area	2.00	acres
35	Impervious Drainage Area	1.00	acres
36	Drainage Area Percent Impervious	50.0	%
37	Required Total Storage Volume of Bioswale / Bioretention	13,600	gallons
38	Planting Bed Surface Length	38	feet
39	Planting Bed Surface Width	19	feet
40	Required Planting Bed Surface Area	711	ft^2
41	Required Surface Area at Existing Ground Surface	1,300	ft^2
42	Total Storage Unit Volume	19.8	$gallons/ft^2$
43	Approximate Total Storage Volume	13,600	gallons
44	MMSD Regional Green Infrastructure Plan Storage Unit Volume	7.5	$gallons/ft^2$
45	MMSD Regional Green Infrastructure Plan Total Storage Volume	5,330	gallons
46	Underdrain Flow Rate	1.591	cfs
51	Has adequate storage volume been provided?	Yes	
52			
53	**Extra Results**		
54	Runoff Volume from Impervious Surfaces from 0.5-inch Rainfall	0.042	acre-feet
55			
56	Soil Porosity	0.27	
57	Sand Porosity	0.30	
58	Aggregate Porosity	0.33	
59			
60	Ponding Storage Unit Volume	1.18	ft^3/ft^2
61	Mulch Storage Unit Volume	0.07	ft^3/ft^2
62	Soil Media Storage Unit Volume	0.54	ft^3/ft^2
63	Pea Gravel Storage Unit Volume	0.11	ft^3/ft^2
64	Storage Layer Storage Unit Volume	0.66	ft^3/ft^2
65			
66	Ponding Storage Volume	898	ft^3
67	Mulch Storage Volume	48	ft^3
68	Soil Media Storage Volume	384	ft^3
69	Pea Gravel Storage Volume	78	ft^3
70	Storage Layer Storage Volume	469	ft^3
71			
72	Ponding Drawdown Time	4.8	hours
73	Total Bioswale / Bioretention Cell Drawdown Time	53.4	hours
74			
75	Excavation	183	CY
76	Mulch	7	CY

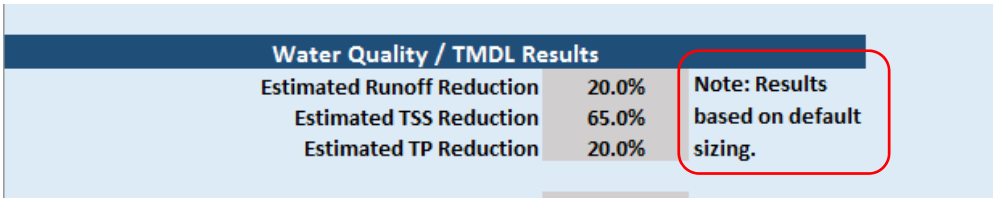
9. The Extra Results section primarily presents the quantities required to build the GI feature. These are used to help calculate the quantities and opinions of cost.

10. This component of the page is geared more for municipal partners and developers.

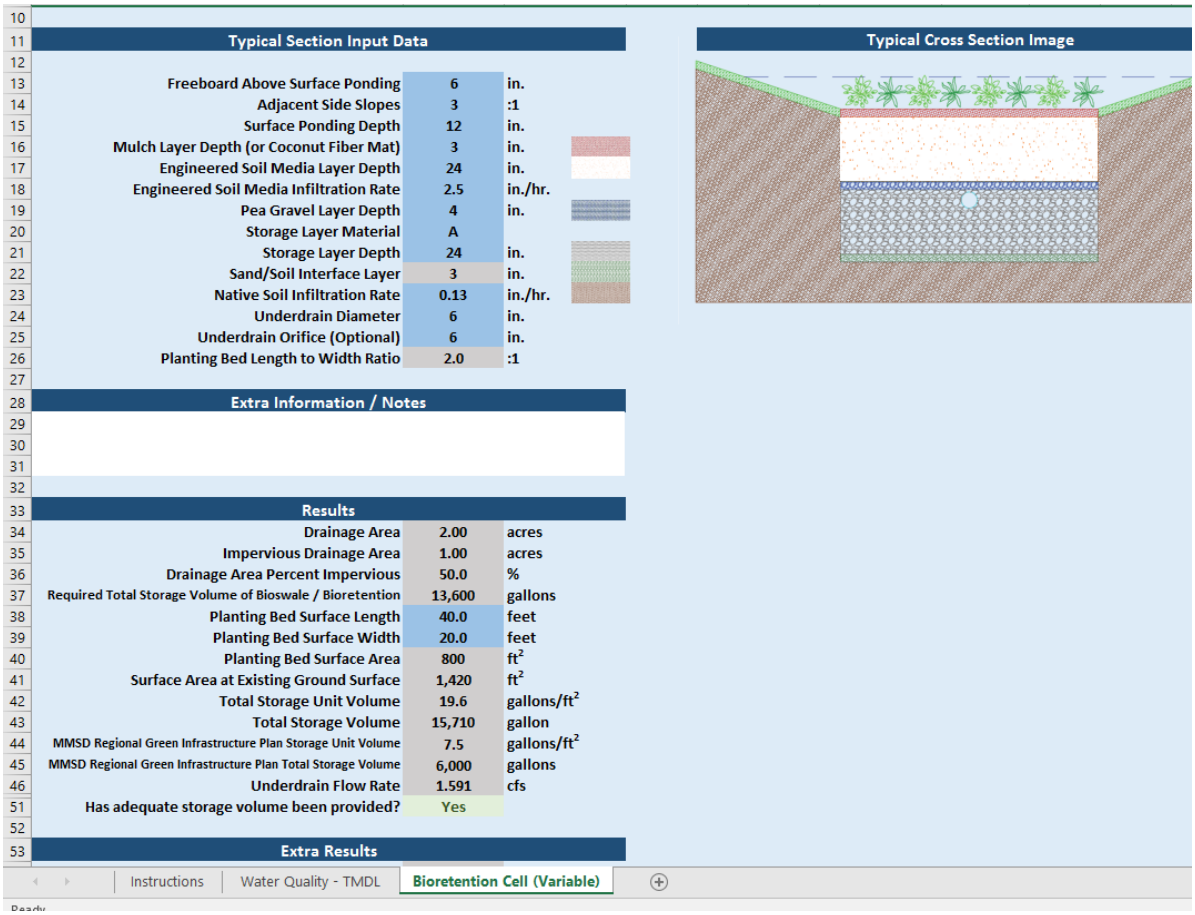


	A	B	C	D
69	Pea Gravel Storage Volume	78	ft^3	
70	Storage Layer Storage Volume	469	ft^3	
71				
72	Ponding Drawdown Time	4.8	hours	
73	Total Bioswale / Bioretention Cell Drawdown Time	53.4	hours	
74				
75	Excavation	183	CY	
76	Mulch	7	CY	
77	Soil Media	53	CY	
78	Pea Gravel (No. 8)	12	TON	
79	Aggregate (No. 2)	74	TON	
80	Sand	9	TON	
81				
82	**Water Quality / TMDL Results**			
83	Estimated Runoff Reduction	20.0%		
84	Estimated TSS Reduction	65.0%		
85	Estimated TP Reduction	20.0%		
86				
87	Typical Year Runoff Volume	707,000	gallons	
88	Typical Year Runoff Volume Reduction	141,400	gallons	
89	0.5-Inch Rainfall Event Runoff Volume from Imp. Areas	13,600	gallons	
90	0.5-Inch Rainfall Event Runoff Volume Reduction	2,720	gallons	
91				
92	Typical Year TSS Load	802.9	pounds	
93	Typical Year TSS Load Reduction	521.9	pounds	
94	0.5-Inch Rainfall Event TSS Load	16.5	pounds	
95	0.5-Inch Rainfall Event TSS Load Reduction	10.7	pounds	
96				
97	Typical Year TP Load	2.790	pounds	
98	Typical Year TP Load Reduction	0.558	pounds	
99	0.5-Inch Rainfall Event TP Load	0.056	pounds	
100	0.5-Inch Rainfall Event TP Load Reduction	0.011	pounds	

11. The water quality/TMDL results section takes you through the estimated reductions for volume, TSS, and TP. These are estimates made through the assumptions that are found on the TMDL tab. This is just a planning level estimate though and the results do not change when you enter the variable portion of the tool. This is even noted as seen in the image below in the variable section.



Water Quality / TMDL Results		
Estimated Runoff Reduction	20.0%	Note: Results
Estimated TSS Reduction	65.0%	based on default
Estimated TP Reduction	20.0%	sizing.



Typical Section Input Data		
Freeboard Above Surface Ponding	6	in.
Adjacent Side Slopes	3	:1
Surface Ponding Depth	12	in.
Mulch Layer Depth (or Coconut Fiber Mat)	3	in.
Engineered Soil Media Layer Depth	24	in.
Engineered Soil Media Infiltration Rate	2.5	in./hr.
Pea Gravel Layer Depth	4	in.
Storage Layer Material	A	
Storage Layer Depth	24	in.
Sand/Soil Interface Layer	3	in.
Native Soil Infiltration Rate	0.13	in./hr.
Underdrain Diameter	6	in.
Underdrain Orifice (Optional)	6	in.
Planting Bed Length to Width Ratio	2.0	:1

Typical Cross Section Image

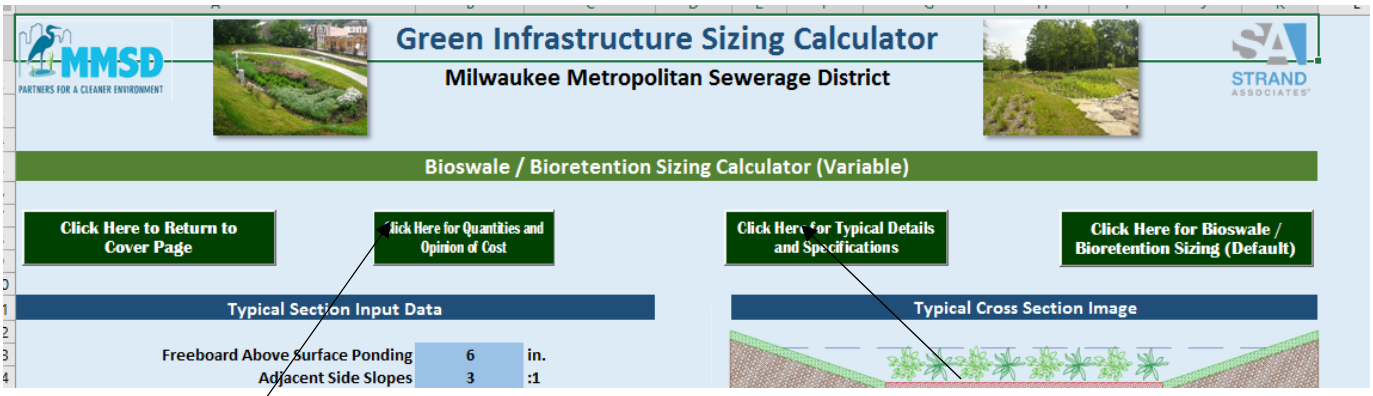
Extra Information / Notes

Results		
Drainage Area	2.00	acres
Impervious Drainage Area	1.00	acres
Drainage Area Percent Impervious	50.0	%
Required Total Storage Volume of Bioswale / Bioretention	13,600	gallons
Planting Bed Surface Length	40.0	feet
Planting Bed Surface Width	20.0	feet
Planting Bed Surface Area	800	ft^2
Surface Area at Existing Ground Surface	1,420	ft^2
Total Storage Unit Volume	19.6	gallons/ft^2
Total Storage Volume	15,710	gallon
MMSD Regional Green Infrastructure Plan Storage Unit Volume	7.5	gallons/ft^2
MMSD Regional Green Infrastructure Plan Total Storage Volume	6,000	gallons
Underdrain Flow Rate	1.591	cfs
Has adequate storage volume been provided?	Yes	

Extra Results

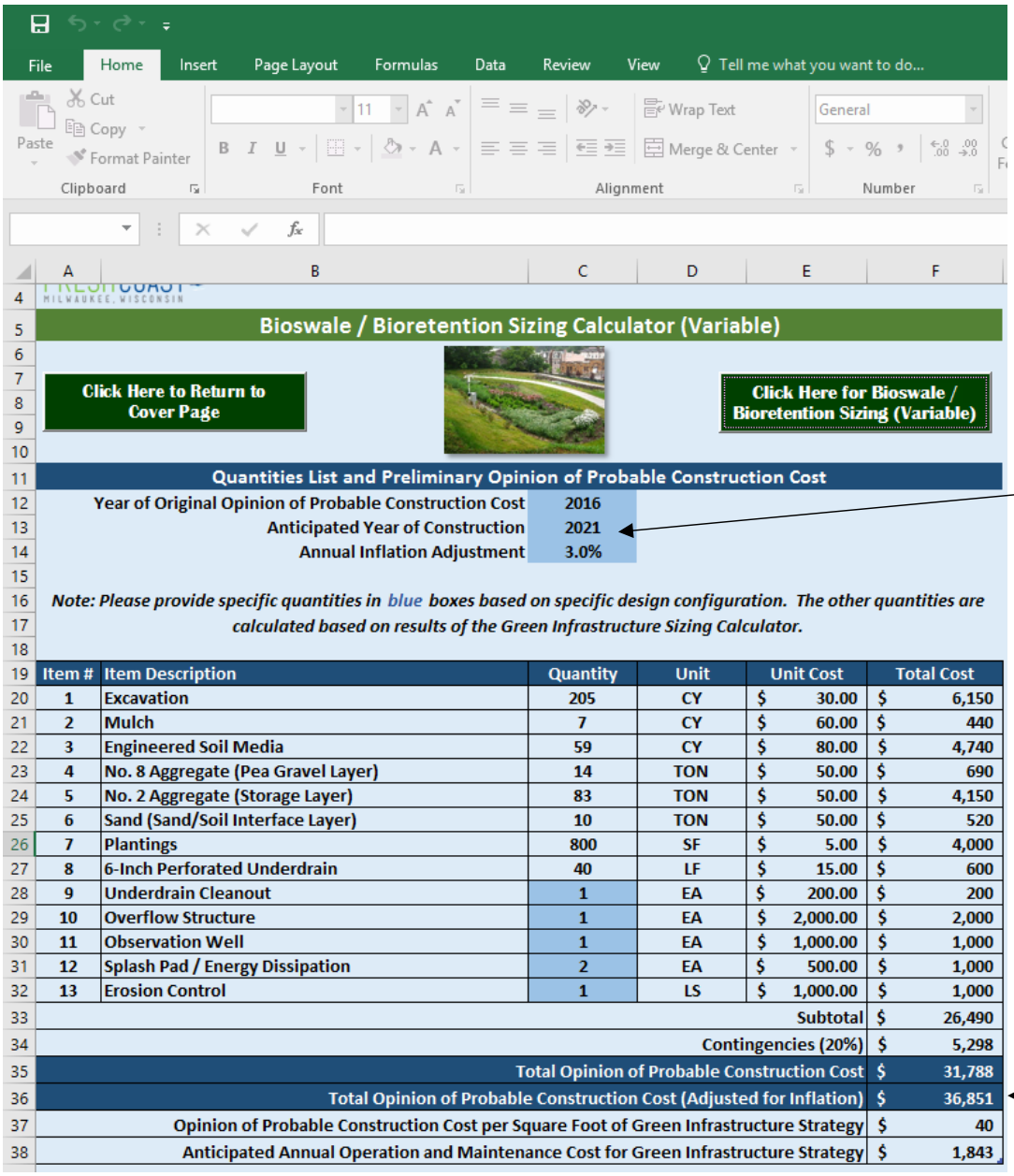
Instructions | Water Quality - TMDL | Bioretention Cell (Variable)

12. In the variable part of the tool, you will see that some of the boxes are blue. These can now be edited, so the tool can more accurately calculate what you are building. If you need to change either the length or width of your project or the typical section layers, this would be the area of the tool where you can modify these numbers. This part of the tool can also more accurately calculate the gallons of capture from a GI feature that is already built if all the layers and size are put in accurately.



Clicking here will take you to a cost estimate with an inflation adjustment factor as seen in the image below.

Clicking here will open the details and specification pdfs related to the specific GI feature being viewed.



Bioswale / Bioretention Sizing Calculator (Variable)

Click Here to Return to Cover Page

Click Here for Bioswale / Bioretention Sizing (Variable)

Quantities List and Preliminary Opinion of Probable Construction Cost

Year of Original Opinion of Probable Construction Cost	2016
Anticipated Year of Construction	2021
Annual Inflation Adjustment	3.0%

Note: Please provide specific quantities in blue boxes based on specific design configuration. The other quantities are calculated based on results of the Green Infrastructure Sizing Calculator.

Item #	Item Description	Quantity	Unit	Unit Cost	Total Cost
1	Excavation	205	CY	$ 30.00	$ 6,150
2	Mulch	7	CY	$ 60.00	$ 440
3	Engineered Soil Media	59	CY	$ 80.00	$ 4,740
4	No. 8 Aggregate (Pea Gravel Layer)	14	TON	$ 50.00	$ 690
5	No. 2 Aggregate (Storage Layer)	83	TON	$ 50.00	$ 4,150
6	Sand (Sand/Soil Interface Layer)	10	TON	$ 50.00	$ 520
7	Plantings	800	SF	$ 5.00	$ 4,000
8	6-Inch Perforated Underdrain	40	LF	$ 15.00	$ 600
9	Underdrain Cleanout	1	EA	$ 200.00	$ 200
10	Overflow Structure	1	EA	$ 2,000.00	$ 2,000
11	Observation Well	1	EA	$ 1,000.00	$ 1,000
12	Splash Pad / Energy Dissipation	2	EA	$ 500.00	$ 1,000
13	Erosion Control	1	LS	$ 1,000.00	$ 1,000
				Subtotal	$ 26,490
				Contingencies (20%)	$ 5,298
				Total Opinion of Probable Construction Cost	$ 31,788
				Total Opinion of Probable Construction Cost (Adjusted for Inflation)	$ 36,851
				Opinion of Probable Construction Cost per Square Foot of Green Infrastructure Strategy	$ 40
				Anticipated Annual Operation and Maintenance Cost for Green Infrastructure Strategy	$ 1,843

Inflation adjustment factor. Everything can be edited to more accurately depict the price for a possible future project.

13. The blue boxes are again what is editable. Any of the quantity and unit costs can be changed if you have more accurate numbers. However, quantities in rows 1 through 8 (in the above example) are based upon the results of the calculator sizing the GI feature as noted above.

Advanced Instructions

The following information is geared towards municipalities, developers, and more advanced users.

- Below are some conversions that can be used in the tool to size GI strategies differently in the variable part of the tool. To calculate for say a 5 year event you could convert the runoff total. Since this total is initally sized based on a half inch event, to calculate a 5 year event you could multiply the gallons total by 6.28 (3.14 inches / 0.5 inches) and come up with a gallons total for the 5 year event. You can then play with the blue boxes in the variable section to come up with a GI feature sized for the 5 year event.

- Note the 3 tabs at the bottom of the excel document. The instructions tab can help you go through the tool. The water quality-TMDL tab, for municipal based projects, will take you through the TMDL goals for each municipality by watershed and reach. It will also take you through the assumptions that went in to achieve the estimated WinSLAMM results found on the default page of the 3 green infrastructure strategies.

- The area constraint can be overcome if the site (drainage area) is broken up into parts. For example, instead of one rain garden for an entire house (one drainage area) you could separate into two drainage areas (each half of the roof) leading to 2 separate rain gardens.