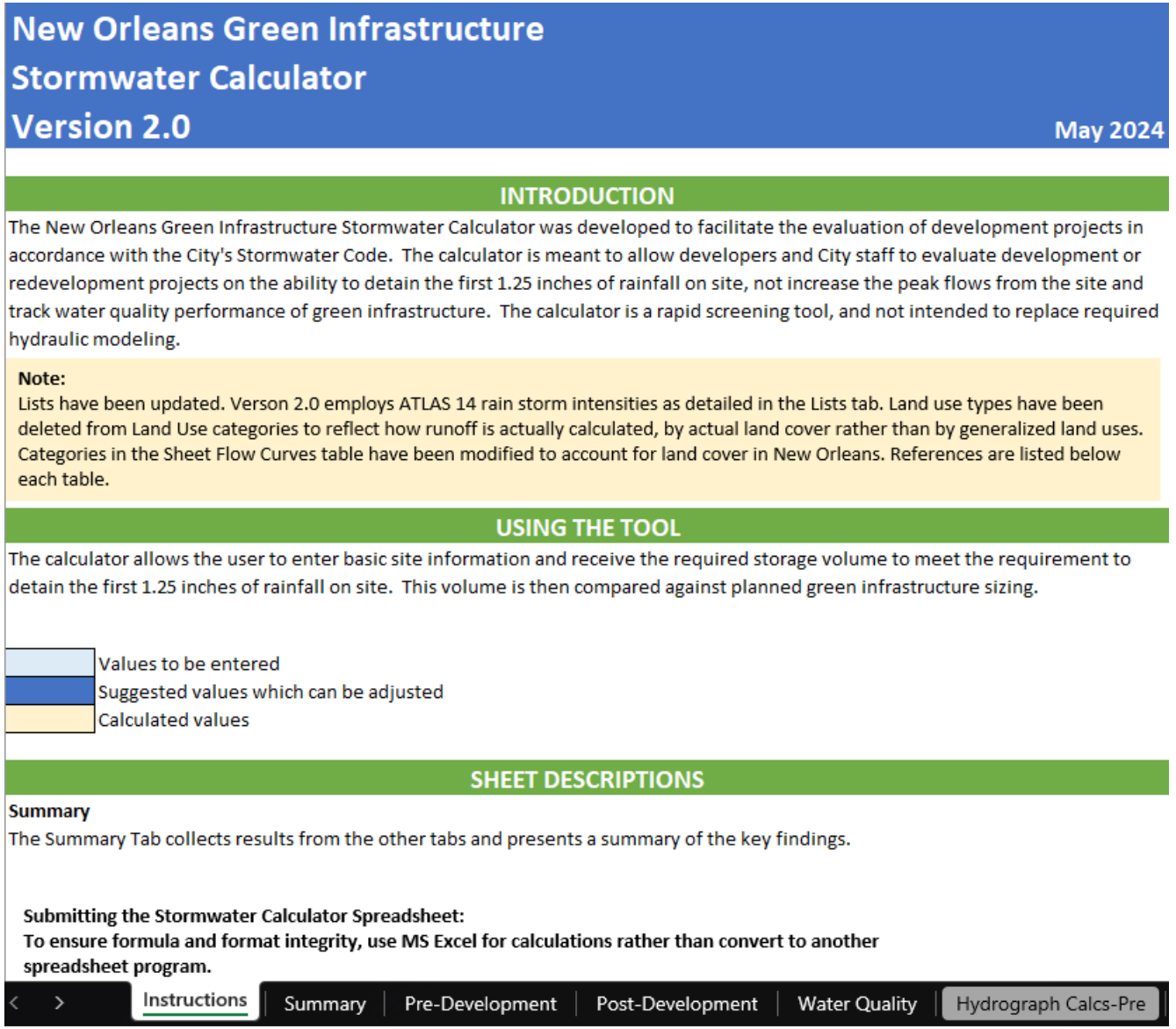
New Orleans Green Infrastructure Toolkit Calculator

User Guidance

Instructions Tab

- Open the calculator where you will find 8 total tabs.
- The first is the instruction tab, which explains each sheet and how the tool is used.
- Of these tabs, user input is required only on the Pre-Development and Post-Development tabs, with the needed results displaying on the Summary tab. The next slides provide a guide on entering the data in these tabs to ensure proper calculations.
- Figures that follow are for tutorial purposes only and values shown do not reflect design criteria.



New Orleans Green Infrastructure
Stormwater Calculator
Version 2.0
May 2024

INTRODUCTION

The New Orleans Green Infrastructure Stormwater Calculator was developed to facilitate the evaluation of development projects in accordance with the City's Stormwater Code. The calculator is meant to allow developers and City staff to evaluate development or redevelopment projects on the ability to detain the first 1.25 inches of rainfall on site, not increase the peak flows from the site and track water quality performance of green infrastructure. The calculator is a rapid screening tool, and not intended to replace required hydraulic modeling.

Note:
Lists have been updated. Verson 2.0 employs ATLAS 14 rain storm intensities as detailed in the Lists tab. Land use types have been deleted from Land Use categories to reflect how runoff is actually calculated, by actual land cover rather than by generalized land uses. Categories in the Sheet Flow Curves table have been modified to account for land cover in New Orleans. References are listed below each table.

USING THE TOOL

The calculator allows the user to enter basic site information and receive the required storage volume to meet the requirement to detain the first 1.25 inches of rainfall on site. This volume is then compared against planned green infrastructure sizing.

Values to be entered
Suggested values which can be adjusted
Calculated values

SHEET DESCRIPTIONS

Summary
The Summary Tab collects results from the other tabs and presents a summary of the key findings.

Submitting the Stormwater Calculator Spreadsheet:
To ensure formula and format integrity, use MS Excel for calculations rather than convert to another spreadsheet program.

Instructions | Summary | Pre-Development | Post-Development | Water Quality | Hydrograph Calcs-Pre

Pre-Development Tab

Activate the Drainage Area by choosing “Yes”.

These cells require user entry. Cells that do not provide drop down options require designer input. The other cells are locked for calculation purposes.

Drainage Area 4

Drainage Area Used:	Yes

SITE INPUT

Pre-Development

Land Cover/Land Use	Hydrologic Soil Group	% Impervious	CN	Area (sf)	CN*Area	% Area	Impervious Area Disconnected?
Rooftops & Impervious Paving	D	100%	98	10,460	23.5	35.4%	Yes
Lawns	C	3%	74	6,163	10.5	20.9%	Yes
Open Space: grass cover < 50%	C	3%	86	4,817	9.5	16.3%	Yes
Rooftops & Impervious Paving	C	100%	98	8,107	18.2	27.4%	Yes

Total (Acres)	0.68	Any disconnected impervious area?	Yes
% Impervious	64.0%	Impervious area 30% or less?	No
Weighted CN (standard)	91	Use adjusted CN value	No
Weighted CN (adjusted)		CN pervious	79
CN for Use	**91**	Ratio of unconnected	100%

Precipitation for storage volume requirement (in)	1.25
S, max natural retention	1.0
Q, runoff (in)	0.54

TIME OF CONCENTRATION Time needed for water to flow from the most remote point to the outlet

Pre-Development

	Length (ft)	Slope (ft/ft)	Surface Cover	Manning's n	Travel Time (hr)
Sheet Flow	122	0.01	Grass: Bermuda grass	0.41	0.419
Sheet Flow					
Shallow Flow				-	
Shallow Flow				-	

	Length (ft)	Slope (ft/ft)	n-value	Flow Area (sf)	Wetted Perimeter (ft)	Travel Time (hr)
Channel/Pipe Flow	144	0.024	0.009	1.23	3.93	0.003
Channel/Pipe Flow						

Pre-Development Tc (hr)	**0.423**
Pre-Development Tc (min)	**25.371**

Post-Development Tab

Activate the Drainage Area by choosing “Yes”.

These cells require user entry. Cells that do not provide drop down options require designer input. The other cells are locked for calculation purposes.

Drainage Area 1

Drainage Area Used:	Yes

SITE INPUT

Land Cover/Land Use	Hydrologic Soil Group	% Impervious	CN	Area (sf)	CN*Area	% Area	Impervious Area Disconnected?
Rooftops & Impervious Paving	D	100%	98	41,109	92.49	96%	Yes
Green Infrastructure (all types)	A	0%	39	1,733	1.55	4%	No

Total Area (Acres)	0.984	Any disconnected impervious area?	Yes
% Impervious	96.0%	Impervious area 30% or less?	No
Weighted CN (standard)	96	Use adjusted CN value	No
Weighted CN (adjusted)		CN pervious	39
CN for Use	**96**	Ratio of unconnected	100%

Precipitation for storage volume requirement (in)	1.25	GI in Site Input (sf)	1733
S, max natural retention	0.5	GI Individual Input (sf)	11070
Q, runoff (in)	0.83	Match	NO
Require Storage Volume (cf)	**2962**		

Calculator computes required storage based on area and runoff.

TIME OF CONCENTRATION

	Length (ft)	Slope (ft/ft)	Surface Cover	Manning's n	Travel Time (hr)
Sheet Flow	60	0.010	Asphalt	0.011	0.01
Sheet Flow					
Shallow Flow				-	
Shallow Flow				-	

	Length (ft)	Slope (ft/ft)	n-value	Flow Area (sf)	Wetted Perimeter (ft)	Travel Time (hr)
Channel/Pipe Flow	249	0.01	0.009	0.79	3.14	0.010
Channel/Pipe Flow	10	0.01	0.009	0.2	1.57	0.001

Post-Development Tab: Green Infrastructure Inputs

Bioretention/Bioswale/Planter	Bio1A	Bio1B	Bio1C	Bio1D
Length (ft)	38	23.4	8	
Width (ft)	38	23.4	8	
Side Slope Ratio (X:1)	12	12	12	
Area (sf)	1444	547.56	64	
Contributing Drainage Area (sf)	1677	587	73	
Ponding Depth (in)	0	0	0	
Biorentention Soil Depth (in)	20	20	20	
Biorentention Soil Void Space	0.33	0.33	0.33	
Bridging Stone Layer Depth (in)	0	0	0	
Bridging Stone Void Space	0.3	0.3	0.3	
Aggregate Layer Depth (in)	0	0	0	
Aggregate Layer Void Space	0.33	0.33	0.33	
Subsurface Storage Volume (cf)	794	301	35	
Surface Storage Volume (cf)	0	0	0	
Total Storage Volume (cf)	794	301	35	
Total Bioretention Storage Volume (cf)	**1130.6**			

Pervious Pavement	PP1A	PP1B	PP1C	PP1D
Area (sf)	1200			
Contributing Drainage Area (sf)	7200			
Pavement Depth (in)	4			
Pavement Void Space	0.25			
Aggregate Layer Depth (in)	8			
Aggregate Layer Void Space	0.33			
Storage Volume (cf)	364			
Total PP Storage Volume (cf)	**364**			

Total Trench Storage Volume (cf)	**0.0**

Tree Cell	TC1A	TC1B	TC1C	TC1D
Length (ft)	20			
Width (ft)	4			
Area(sf)	80	0	0	0
Contributing Drainage Area (sf)				
Depth of Amended Soil (in)	6			
Depth of Open Space (if any) (in)	0			
Amended Soil Void Space	0.33			
Subsurface Storage (cf)	13.2	0	0	0
Total Tree Cell Storage Volume (cf)	**13.2**			

Infiltration Trench	IT1A	IT1B	IT1C	IT1D
Length (ft)	54.8	30.7	54.8	
Width (ft)	54.8	30.7	54.8	
Area(sf)	3003.04	942.49	3003.04	0
Side Slope Ratio (X:1)	0			
Contributing Drainage Area (sf)	0			
Ponding Depth (in)	0	0	0	0
Aggregate Layer Depth (in)	12	27	2	24
Aggregate Layer Void Space	0.3	0.3	0.3	0.3
Subsurface Storage Volume (cf)	900.912	636.18075	150.152	0
Surface Storage Volume (cf)	0	0	0	0
Total Storage Volume (cf)	900.912	636.18075	150.152	0
Total Trench Storage Volume (cf)	**1687.24475**			

Designer input cells. Void space cells should be entered as a fraction to represent a percentage.

Detention/Retention Basins

Basin Used?	Yes
Detention or Retention?	Detention
Contributing Drainage Area (sf)	34,724

Stage (ft)	Surface Area (sf)	Volume (cf)
0	2066	0
1	2066	2066
2	2066	2066
2.25	2066	516.5

Orifice Information

Centerline Depth (ft)	Area (sf)	Coefficient of Discharge
0.25	0.022	0.62

Total Basin Storage Volume (cf)	**4649**
Total Surface Area (sf)	**2066**
Total Provided Storage Non-Detention (cf)	**2818**
Total Provided Storage with Detention (cf)	**7466**
SubArea Requirement Met	YES
Total Contributing Area to GI (sf)	**37,061**
Total Drainage Area(sf)	**42,841**
Contributing Area Equal or Less than Drainage Area	YES

Computed sum of storage provided should meet or exceed required storage volume. The sum of the contributing areas associated with each G.I. feature should not exceed the drainage area.

GENERAL INFORMATION

Site Location	#### Address Street New Orleans, LA #####		
Name of Developer	John Doe Developer	Developer Contact	###.###.####
Name of Engineer	Jane Doe Engineering	Engineer Contact	###.###.####

SUMMARY - STORAGE VOLUME

	Drainage Area 1	Drainage Area 2	Drainage Area 3	Drainage Area 4	Drainage Area 5	Drainage Area 6	Drainage Area 7	Drainage Area 8	Total
Total Area (acres)	1.0	0.8	0.2						1.9
Required Storage Volume (cf)	2961.8	1143.7	264.7						4370.2
Provided Storage Volume (cf)	5792.3	2980.0	0.0						8772.2
Bypass Volume (cf)	0.0	0.0	264.7						264.7
Storage Requirement Met									YES
Bypass Volume <=10%									YES

SUMMARY - WATER QUALITY

Average Annual Rainfall Total (in): 63

New Development or Substantial Improvement? Substantial Improvement

Average Annual Loadings

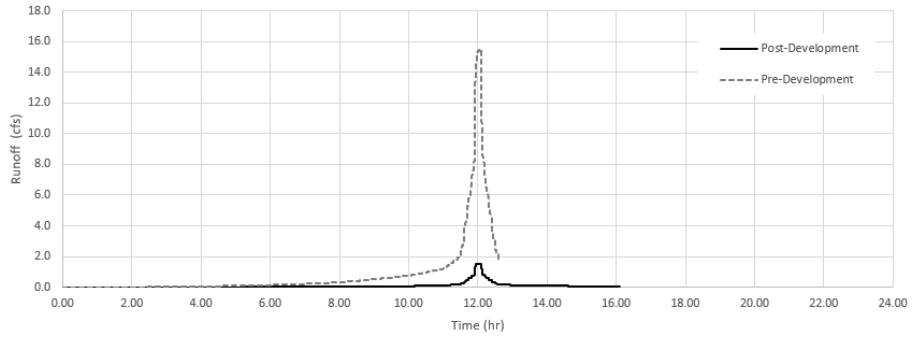
	Units	Pre-Development	Post-Development w/o GI	Post-Development w/ GI	Annual Reduction via GI	Reduction %
TSS	lbs	5574	9366	4225	5141	55%
BOD	lbs	63.8	129.9	95.4	34.5	27%
TP	lbs	11.88	12.71	9.99	2.72	21%
TN	lbs	44.38	36.62	30.40	6.22	17%
Pb	lbs	1.14	3.02	1.58	1.44	48%
Zn	lbs	3.08	8.04	4.39	3.66	45%
E.Coli	Billion Colonies	209.2	292.3	187.2	105.2	36%

TSS Reduction Target Met: Yes

SUMMARY - RUNOFF

Storm for Analysis: 10-yr Rainfall Depth (in): 9.84

	Pre-Development	Post-Development	Requirement Met
Total Site (acres)	1.94	1.94	YES
Peak Runoff Rate (cfs)	15.50	1.54	YES
Total Runoff (MG)	0.30	0.04	YES



Summary Tab

Summary Tab shows that the following requirements are met:

- Adequate storage for runoff is provided.
- 10% or less of runoff volume is bypassed.
- Total area of Pre-development and Post Development are the same.
- Post Development peak runoff rate is less than the Pre-Development runoff rate.
- Post Development total runoff is less than the Pre-Development runoff rate.
- Water Quality TSS reduction is accomplished.

Water Quality Tab

This tab calculates pollutant data based on values entered in Pre-Development and Post-Development tabs. User entry is not required. All cells are locked.

WATER QUALITY DATA & CALCULATIONS

Removal Efficiencies

	TSS	TDS	BOD	COD	TP	TN	Pb	Zn	E.Coli
Bioretention/Bioswale/Planter/Tree Cell	75%	74%	80%	80%	34%	21%	91%	85%	80%
Infiltration Trench	70%	10%	20%	20%	30%	10%	60%	40%	
Pervious Pavement	72%				43%	38%	82%	79%	
Retention Basin	75%	30%	30%	30%	45%	60%	75%	45%	95%
Detention Basin	65%	0%	25%	25%	22%	28%	48%	57%	60%

Based on data collected from the International Stormwater BMP Database: Pollutant Category Statistical Summary Report Solids, Bacteria, Nutrients, and Metals December 2014

Water Environment & Reuse Foundation. 2017. International Stormwater BMP Database. 2016 Summary Statistics.

Event Mean Concentrations of Pollutants by Land Use (mg/L except E.Coli in colonies/mL)

Land Use	TP	TN	TSS	Pb	Cu	Zn	BOD	COD	E.Coli
General Commerical	0.314	0.7	119	0.0277	0.0278	0.202	6.7	87	45
General Institutional	0.198	0.7	144	0.0077	0.0109	0.102	6.7	54	45
General Industrial	0.403	1.6	160	0.039	0.0317	0.229	6.4	91	25
General Residential	0.441	1.6	125	0.0152	0.0252	0.126	5.3	72	78
Urban Residential	0.3775	1.15	122	0.02145	0.0265	0.164	6	79.5	61
Open Space: grass cover > 75%	0.313	0.67	249	0.0066	0.0148	0.046	4.2	25	31
Open Space: grass cover 50 - 75%	0.313	0.67	249	0.0066	0.0148	0.046	4.2	25	31
Open Space: grass cover < 50%	0.313	0.67	249	0.0066	0.0148	0.046	4.2	25	31
Heavy Industrial	0.3	1.6	124	0.29	0.148	1.6	6.4	67	25.0
Residential Roof	0.11	1.5	19	0.021	0.02	0.312	5.3	49	0.3
Commercial Roof	0.14	2.1	9	0.017	0.007	0.256	6.7	27	1.1
Industrial Roof	0.14	2.1	17	0.043	0.062	1.39	6.4	67	5.8
Commercial/Residential Parking	0.15	1.9	122	0.028	0.051	0.139	6.0	80	1.8
Industrial Parking	0.15	1.9	228	0.085	0.034	0.224	6.4	67	2.7
Gravel Roadway	0.56	2.1	173	0.028	0.017	0.107	5.3	49	17.0
Residential Street	0.55	1.4	172	0.051	0.025	0.173	5.3	49	37.0
Rooftops & Impervious Paving	0.55	1.4	468	0.17	0.073	0.45	6.7	27	12.0
Rural Highway	0.32	22	51	0.08	0.022	0.08	4.2	21	31.0
Urban Highway	0.394	3	140	0.0636	0.0437	0.22	6.7	102	31.0
Lawns	2.1	9.1	602	0.017	0.017	0.05	4.2	21	24.0
Landscaping	2.1	9.1	37	0.029	0.094	0.263	4.2	21	94.0
Other Impervious	0.32	2.0	106	0.03	0.03	0.20	5.9	59	14.7
Green Infrastructure (all types)	0.313	0.67	249	0.0066	0.0148	0.046	4.2	25	31

Pitt R., et al., 2018, National Stormwater Quality Database (NSQD), Version 4.02.

Frederick, C.P., 2011, Water-quality characteristics of urban storm runoff at selected sites in East Baton Rouge Parish, Louisisana, February 2006 through November 2009: U.S. Geological Survey Scientific Investigation Report 2011-5199, 17 p. Revised December 2011.

Shaver, Earl, et al., 2007, Fundamental of Urban Runoff Management: Technical and Institutional Issues, North American Lake Management Society (NALMS) and U.S. Environmental Protection Agency. 2nd edition.

New York State Stormwater Management Design Manual, Appendix A. "The Simple Method to Calculate Urban Stormwater Loads"

Percent reduction in pollutant load by each green infrastructure type.

Absolute values of individual pollutant loads for each given land use type. Source of data indicated by cell color according to legend below.

Concentrations and loads for each drainage area calculated from data entered in the Pre-Development and Post-Development tabs. Reduction in pollutant loads shown for Post-Development with green infrastructure.

Pre-Development 1

Land Cover/Land Use	%	TSS	BOD	TP	TN	Pb	Zn	E.Coli
Rooftops & Impervious Paving	37.7%	468.0	6.7	0.6	1.4	0.2	0.5	12.0
Lawns	50.1%	602.0	4.2	2.1	9.1	0.0	0.1	24.0
Rooftops & Impervious Paving	12.2%	468.0	6.7	0.6	1.4	0.2	0.5	12.0
Total	0.40	535.1	5.4	1.3	5.3	0.1	0.2	18.0