Load Duration Curve

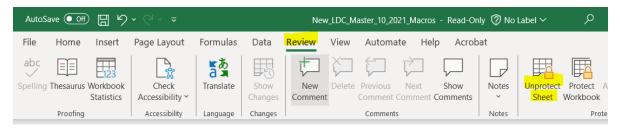
If you experience any problems while navigating through this tool, please reach out to your Watershed Specialist or a TMDL Writer at IDEM.

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Let's Get Started

- 1. Find and save a copy of the NEW Load Duration Curve excel sheet found on the <u>Models/Load</u> <u>Reductions webpage</u> and on the <u>Planning webpage</u>.
- 2. Within the excel sheet, enable content.
- If you have issues updating a tab or cell, be sure to look at the 'Review' tab at the top of the excel sheet and select 'Unprotect Sheet'.



Watershed Names Tab

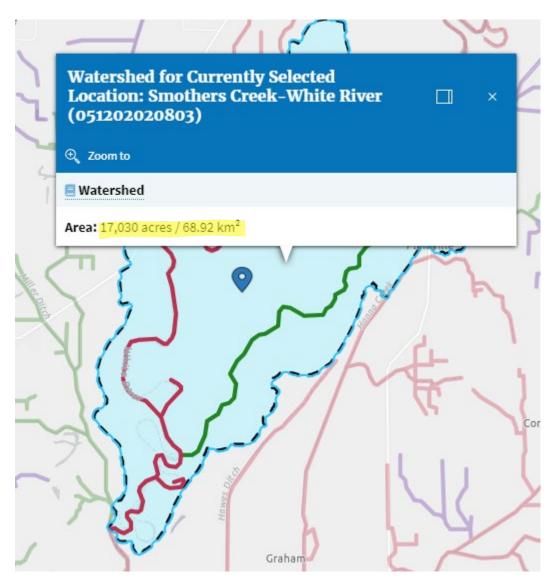
In this tab you will compile all the surface area (SA) and drainage area (DA) values within the watershed of interest. The spreadsheet is broken down by subwatershed (HUC 12) and watershed (HUC 10) boundaries and includes upstream drainage if applicable. In these instructions only public resources will be used to find this information.

	Name	Drainage Area (sq_mi)	Surface Area (sq_mi)		Name	Drainage Area (sq_mi)
HUC10 Watershed Name	HUC10	5077.22	99.36	USGS Gauge	WHITE RIVER NEAR EDWARDSPORT, IN	5015
Upstream Drainage	Upstream Drainage	4977.86	4977.86			
SW1	Bens Creek	5077.22	16.65			
SW2	Pickel Ditch	30.63	30.63			
SW3	Smothers Creek	5030.40	26.6			
SW4	Pollard Ditch	25.48	25.48			

StreamStats and ATTAINS

Find the Surface Area

- 1. Open ATTAINS (HowsMyWaterway) https://mywaterway.epa.gov/
- 2. Search for a HUC 12 in the watershed of interest. Once it populates, right click within the HUC 12 to see the area.

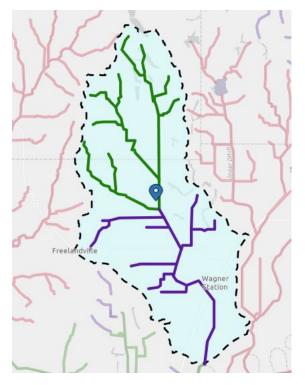


3. This will provide the area of the HUC 12 in km². Use Google, or the conversion chart found in the WatershedNames tab of the LDC tool, to convert km² to mi². Alternatively, divide the km² value by 2.59. Repeat this step to fill in all of the HUC 12 SA cells.

Carrier	ion Chart	
	sq. Miles	
68.92		
	sq. Miles	
	0	

A		D	U	U
		Name	Drainage Area (sq_mi)	Surface Area (sq_mi)
HUC10 Watershe	d Name	HUC10		
Upstream Draina	ge	Upstream Drainage		
Subwatershed 1		SW1		26.6
Subwatershed 2		SW2		
Subwatershed 3		SW3		

- 4. Once all the HUC 12 SA cells are filled in, combine them to get the SA of the entire HUC 10
- The SA and the DA values are the same where there is no upstream drainage.



This subwatershed has a SA of 25.5 sq mi and does not have any upstream drainage (rivers or streams draining into it). This means that the DA will only include the area of that subwatershed.

А	в	L	U
	Name	Drainage Area (sq_mi)	Surface Area (sq_mi)
HUC10 Watershed Name	HUC10		
Upstream Drainage	Upstream Drainage		
Subwatershed 1	SW1		26.6
Subwatershed 2	SW2	25.5	25.5
	HUC10 Watershed Name Upstream Drainage Subwatershed 1	Name HUC10 Watershed Name HUC10 Watershed Name Upstream Drainage Subwatershed 1	Name Drainage Area (sq_mi) HUC10 Watershed Name HUC10 Upstream Drainage Upstream Drainage Subwatershed 1 SW1

- 5. Once all the SA cells are filled in (and any DA cells for HUC 12s that don't have upstream drainage), open StreamStats: <u>https://streamstats.usgs.gov/ss/</u>
- 6. Navigate to the HUC 10 of interest.



7. Zoom in enough that the option to select a state/region should populate. Select Indiana

Step 2: You have zoomed in sufficiently to select a state or regional study area. Your selection will dictate the data used to perform basin delineation and flow statistics calculation.

Click to select a State or Regional Study Area

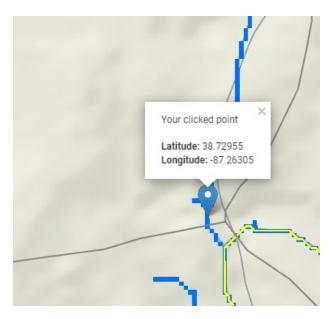


- 8. Zoom in to the most downstream portion of one of the HUC 12s within the HUC 10
- Once zoomed in enough, the option to delineate should appear

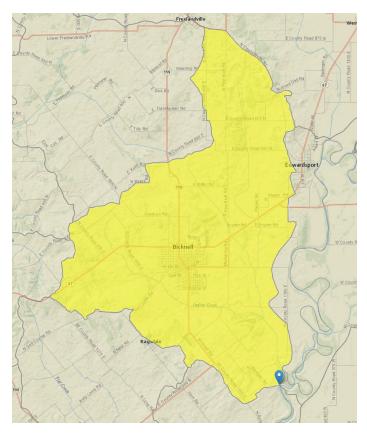
Step 2: Click the 'Delineate' button to activate the delineation tool

P Delineate

- 9. Select delineate
- 10. Make a point as downstream as possible without leaving the HUC 12 boundary
- Make sure you are the main stem of the stream/river as opposed to a tributary. You will know you've selected an adequate point if the entire HUC 12 is highlighted once the delineation is complete. You will know you have not selected an adequate point if only a small area is highlighted within the HUC 12.



11. Wait while the program runs the delineation



12. Once the delineation is complete and the HUC 12 is highlighted, select continue

Step 5: Your delineation is complete. You can now clear, edit, or download your basin, or choose a state or regional study specific function (if available). Click **continue** when you are ready.

🏛 Clear Basin		
	 Clear	Decin
	Clear	Basin

C Edit Basin

State/Region Specific Functions

The following additional functions are available for Indiana.

Check for Coordinated Reach (automatic)

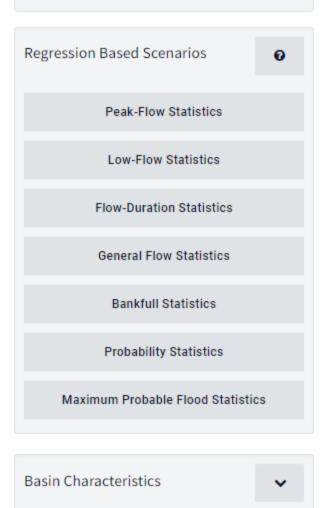
🚣 Download Basin 🗸

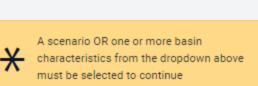
or

Continue

13. Now select 'Basin Characteristics'

Step 1: Select a scenario below, or expand the "Basin Characteristics" panel to select specific basin characteristics.

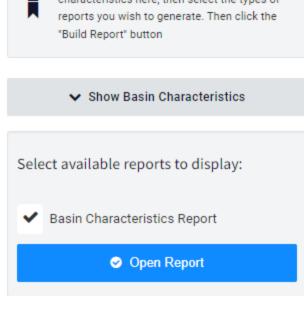




14. Scroll down to and select 'DRNAREA' then select continue

Basin Characteristics		
s	elect All Basin Cl	haracteristics
Select	Parameter	Description
	BFREGNO	BFREGNO
	BSLDEM10M	Mean basin slope computed from 10 m DEM
	CONTDA	Area that contributes flow to a point on a stream
	CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known
~	DRNAREA	Area that drains to a point on a stream

15. Next select 'Show Basin Characteristics'



Step 1: You can modify computed basin characteristics here, then select the types of

- The DA should now be visible
 - ∧ Hide Basin Characteristics

Basin Characteristics can be edited here		
Parameter	Value	
DRNAREA	30.618	

- 16. If interested, select 'Open Report' and download the delineation report.
- 17. Repeat these steps for each HUC 12.

Find the Upstream Drainage

1. Subtract the HUC 10 SA from the HUC 10 DA to get the upstream drainage values.

HUC 10 DA - HUC 10 SA = Upstream drainage

	Name	Drainage Area (sq_mi)	Surface Area (sq_mi)
HUC10 Watershed Name	HUC10	5077.22	99.36
Upstream Drainage	Upstream Drainage		
SW1	Bens Creek	5077.22	16.65
SW2	Pickel Ditch	30.63	30.63
SW3	Smothers Creek	5030.40	26.6
SW4	Pollard Ditch	25.48	25.48

5077.22 - 99.36 = 4,977.86

	Name	Drainage Area (sq_mi)	Surface Area (sq_mi)
HUC10 Watershed Name	HUC10	5077.22	99.36
Upstream Drainage	Upstream Drainage	4977.86	4977.86
SW1	Bens Creek	5077.22	16.65
SW2	Pickel Ditch	30.63	30.63
SW3	Smothers Creek	5030.40	26.6
SW4	Pollard Ditch	25.48	25.48

The upstream drainage is looking at the flow that is coming in from outside the watershed. The DA combines the upstream drainage and the drainage within the watershed. If there were no upstream drainage, the SA and the DA would be the same. Therefore, subtracting the SA of the watershed from the DA of the watershed isolates the drainage that is coming from outside the watershed.

Rainflow_Raw Tab

- 1. Open <u>Cli-MATE</u>
- 2. If you do not have an account, register for free.



- This option can be found on the Cli-MATE home page
- 3. Once registered, login
- 4. Change the location by clicking 'Select Daily Station'

CURRENT DAILY STATION INFORMATION:	CURRENT HOURLY STATION INFORMATION
Station Name: CHAMPAIGN 3S	Station Name: CHICAGO MIDWAY AP
County: CHAMPAIGN	County: COOK
State: IL Syn	chronize State: IL
More Info St	ations More Info
Select Daily Station <	Select Hourly Station

- 5. Do one of the following to select a station:
 - a. Enter station ID
 - b. Find a station
 - c. Go to Map Selector

USING TEXT SELECTION	
Enter the station ID:	DALOTA PARTICIPACITA
Next	The second secon
	SOUTH IN THE PARTY AND
OR	UNITED STATES
Find a Station	The second secon
Next	Go to Map Selector

USING MAP SELECTION:

- If you don't know the station ID, the 'Map Selector' tool is likely going to be easier to use than the 'Find a Station' tool. Using the 'Map Selector' tool you can navigate to your watershed by entering a nearby town name or address. Try to find a station within or near your watershed for the most accurate data. Additionally, choose a site that is still currently in use. You will want data from the same period of time are your sampling data was collected.
- 6. Once a station has been selected, select 'Daily-Observed Data'- 'Daily'- 'Between Two Dates'

Daily-Observed Data	Þ	Daily	•	Between Two Dates
Iourly-Observed Data	►	Monthly	Þ	Degree Days
Climate Division Data	►	Seasonal	Þ	This Date in History
State Data	►	Annual	Þ	Almanac for a Day
Gridded Data	►	Multi-Station	Þ	Threshold Search
Maps of Data	►	County Data	►	Multi-Day Extremes
Charts and Graphs	►			Ranking
Help	►			Single Variable Data
				Keetch-Byram Index
				the second second

7. Select 'Custom'

n	Э	t	0
υ	u	Ľ	C

Custom O Last Month Clast 7 Days ○ This Year O Period of Record

Clast 30 Days

○ This Month

8. Set the dates to the start and end dates of sampling for the project

Number of Days: 30	
Beginning Date:	
September 🗸 1 🖌 2024 🗸	Autocompute End Date
Ending Date:	
September 🗸 30 🗸 2024 🗸	Autocompute Start Date

- 9. Under variables, select only 'Precipitation'
- 10. Select 'Get Tabular Data'
- 11. Select 'CSV Version' to download the data and format that can be copied into the RainfallRaw tab

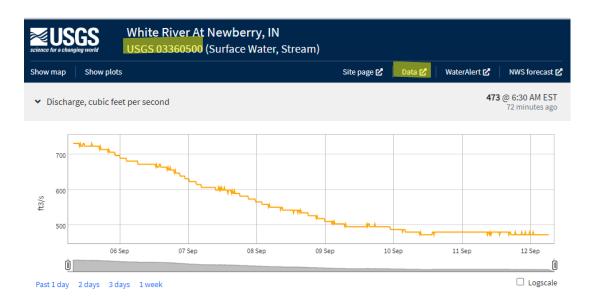
Data Selector	Daily Data B	Between Two Dates
Printer Version	WASHINGTO	
CSV Version	Date	Precipitation (in)
	2023-11-01	0.00
Send Feedback	2023-11-02	0.00
	2023-11-03	0.00
	2023-11-04	0.00
	2023-11-05	0.00
	2023-11-06	0.00
	2023-11-07	0.00
	2023-11-08	0.00
	2023-11-09	0.00
	2023-11-10	0.00
	2023-11-11	0.00
	2023-11-12	0.00
	2023-11-13	0.00
	2023-11-14	0.00
	2023-11-15	0.00
	2023-11-16	0.00
	2023-11-17	0.06

You should end up with something like this once you've pasted the data into the Rainfall_Raw tab:

Daily Data Between Two Dates		
WASHINGTON 1 W (IN)		
USC00129253		
Date		PRCP
	11/1/2023	0
	11/2/2023	0
	11/3/2023	0
	11/4/2023	0
	11/5/2023	0
	11/6/2023	0
	11/7/2023	0
	11/8/2023	0
	11/9/2023	0
	11/10/2023	0
	11/11/2023	0
	11/12/2023	0
	11/13/2023	0
	11/14/2023	C
	11/15/2023	0
	11/16/2023	C
	11/17/2023	0.06
	11/18/2023	0

RawFlowData Tab

- 1. Open USGS | National Water Dashboard
- 2. Zoom-in to the area of interest and select a site that is located as close as possible to that the HUC 10. Ideally this site will be at the most downstream point of the HUC 10.
- 3. Once selected, a window should open that provides the gauge name and site number



- 4. Open the 'Data' tab (highlighted in the screenshot example above).
- 5. Ensure that the site offers daily data over a 10-yr period. Under 'Available Data' look for 'Daily Data' and make sure the 'Begin Date' is at least 10 years before the end of sampling and the 'End Date' is current.
- You will need 10 years worth of daily data from the point sampling ended for your project for best results. For example, if sampling for your project ended in September 2024, you will need daily data starting from September 2014. If there is a gauge within your watershed, but it does not have the correct daily data, choose a different gauge. A gauge that is used in place of a gauge within the watershed is called a surrogate gauge. Try to find a surrogate gauge that has a similar DA to the total DA for your watershed.
- 6. If the correct data is available, find the DA and plug it into excel.

DESCRIPTION:

Latitude 38°55'41.2", Longitude 87°01'09.4" NAD83 Greene County, Indiana, Hydrologic Unit 05120202 Drainage area: 4,688 square miles Datum of gage: 465.08 feet above NAVD88.

AVAILABLE DATA:

Data Type		Begin Date	End Date	Count
Current / Historical Observations	(availability statement)	1987-11-02	2024-09-12	
Daily Data				
Discharge, cubic feet per second		1928-10-01	2024-09-11	35045
Daily Statistics				
Discharge, cubic feet per second		1928-10-01	2024-05-28	34939
Monthly Statistics				
Discharge, cubic feet per second		1928-10	2024-05	
Annual Statistics				
Discharge, cubic feet per second		1929	2024	
Peak streamflow		1897-03-05	2022-02-22	116
Field measurements		1939-04-19	2024-08-20	288
Water-Year Summary		2006	2023	18
Revisions		Available (sit	e:1) (timeser	ies:0)

F	G	Н	
	Name	Drainage Area (sq_mi)	
USGS Gauge	WHITE RIVER AT NEWBERRY, IN	4688	

- Next, download flow data
- 7. Open USGS Water Data for the Nation
- 8. Select 'Surface Water'
- 9. Select 'Daily Data'
- 10. On the 'Choose Site Selection Criteria' page, select the following:
 - 1. Site Location: State/Territory
 - 2. Site Identifier: Site Number
 - 3. Site Attribute: Blank
 - 4. Data Attribute: Blank
- 11. Submit
- 12. Enter the USGS Gauge site number acquired in step 3 and select Indiana

Select sites which meet all of the following criteria:

Define one or more values for each of the following site-selection criteria: --- or select new criteria

2 Site Number en 03360730		site ID (<i>optional</i>) O match from the start	\odot match any part
2 State/Territory Nawaii Idaho Illinois Indiana Iowa Johnston Atoll	select one or more	e	

- 13. Scroll to the bottom of the page. Under 'Retrieve USGS Surface-Water Daily Data for Selected Sites' change the 'Retrieve Data for:' to 'for the date range:' and enter a 10-yr span that ends at the same time sampling ended for the project.
- 14. Change the Output Options Format to 'Tab-separated'

Retrieve USGS Surface-Water Daily Data for Selected Sites

Choose one of the following options for displaying data for the sites meeting the criteria above

 Retrieve data for: the previousdays (1 - 365) **OR** for the date range: First date: 2014-09-11 Last date: 2024-09-11 (1838-01-01 through 2024-09-11)
Output Options:
🛇 🛿 Graphs of data 🛛 🛛 use arithmetic Y-axis for streamflow
🔾 🛿 Graphs of data with long-term statistics 🛛 🛛 use arithmetic Y-axis for streamflow
🔾 🛿 Graphs of data without long-term statistics 🛛 🔲 use arithmetic Y-axis for streamflow
○ 🛿 Graphs of data with field measurements 🗆 use arithmetic Y-axis for streamflow
○ 🛿 Table of data
15. Submit

16. Go to downloads and open the downloaded data in a web browser. Copy data

				- WARNING -			
Some o	of the da	ta that	you have obt	tained from	this U.S. Ge	ological Survey database	
may no	ot have r	received	Director's a	approval. A	ny such data	values are qualified	
as pro	ovisional	and are	subject to	revision. I	Provisional d	ata are released on the	
condit	tion that	: neither	the USGS no	or the Unite	ed States Gov	ernment may be held liable	
for ar	ny damage	es result	ing from it:	s use.			
Additi	ional inf	o: https	://waterdata	a.usgs.gov/	provisional-d	ata-statement/	
				_			
retrie	eved: 202	4-09-12	09:34:20 ED	r (va	ww02)		
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				Histic I	Description		
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	51815	00	0060 0000	03 Disc	harge, cubic	feet per second (Mean)	
	51815	00	0060 0000	03 Discl	harge, cubic	feet per second (Mean)	
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Try opening the data in Internet Explorer. This web browser seems to offer the most consistent formatting when copy/pasting the data into excel.

17. Navigate to cell A1 in the RawFlowData tab and right-click. Select 'Paste Special'-'Text'-'OK'

📋 Past	e Options:			
Ŵ	Ê			
Paste	e <u>S</u> pecial			
Paste Special			?	×
Source:				
Paste link:	Ls: HTML Unicode Text Text	Display	as icon	
Result	erts the contents of the Clinhoard as UTA	41 Format		
	erts the contents of the Clipboard as HTN	OK	Car	ncel

Solution Solution Control Cont

	A	В	С	D	E			
1	# WARNING							
2	# Some of the data that you have obtained from this U.S. Geo							
3	# may not have received Director's approval. Any such data v							
4	# as provisional and are subject to revision. Provisional data							
5	# condition that neither the USGS nor the United States Gove	condition that neither the USGS nor the United States Government may be held liable						
6	# for any damages resulting from its use.							
7	#							
8	# Additional info: https://waterdata.usgs.gov/provisional-da	ita-statem	ent/					
9	#							
10	# Contact: gs-w_waterdata_support@usgs.gov							
11	# retrieved: 2024-09-12 09:34:20 EDT (vaww02)							
12	#							
13	# Data for the following 1 site(s) are contained in this file							
14	# USGS 03360500 WHITE RIVER AT NEWBERRY, IN							
15	#							
16	#							
17	# Data provided for site 03360500							
18	# TS parameter statistic Description							
19	# 51815 00060 00003 Discharge, cubic feet per seco	nd (Mean)						
20	#							
21	# Data-value qualification codes included in this output:							
22	# A Approved for publication Processing and review com	pleted.						
23	# P Provisional data subject to revision.							
24	# e Value has been estimated.							
25	#							
26	agency_cd	site_no	datetime	51815_00060_00003	51815_00060_00003_cd			
27	5s	15s	20d	14n	10s			
28	USGS	3360500	9/11/2014	1970	Α			
29	USGS	3360500	9/12/2014	3870	A			
30	USGS	3360500	9/13/2014	5140	A			
31	USGS	3360500	9/14/2014	4770	A			
32	USGS	3360500	9/15/2014	4030	A			
33	USGS	3360500	9/16/2014	3470	Α			
34	USGS	3360500	9/17/2014	3190	A			

FlowPrep and Flow Data Tabs

These tabs should automatically populate with data from the RawFlowData tab. Double check that the data is being pulled from the correct rows. The FlowPrep tab and Flow Data tab both assume that the first date is in cell C31 in the RawFlowData tab. If the first date displayed in column A of the FlowPrep tab and column B of the Flow Data tab is not the first date in the RawFlowData tab, do one of the following:

If the data looks correct you can skip to the LDC section

Update formula

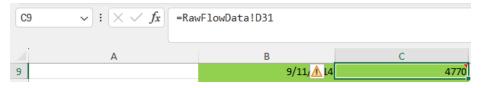
1. Go to the formula bar for cell A2 in the FlowPrep tab

$\begin{array}{ c c c c c } A2 & \checkmark & \vdots & \swarrow & f_x \\ \hline \end{array}$		=RawFlowData!C31			
	А	В	С	D	E
1	Date	Year	Month	Day	Flow
2	9/14/2014	1 2014	9	14	#DIV/0!

2. Delete 'C31' in the formula bar and replace it with the top-most cell in the date column (column C) of the RawFlowData tab

A	2 ~	$\times \checkmark f_x$	=RawFlowData!C28		
	А	В	С	D	E
1	Date	Year	Month	Day	Flow
2	9/11/2014	<u>A</u> 2014	9	11	#DIV/0!

- 3. Double click in the bottom right-hand corner of the updated cell to update the rest of the cells in that column
- 4. Make the same update to column B in the Flow Data tab.
- 5. Go to the formula bar for cell C9 in the Flow Data tab



Delete 'D31' in the formula bar and replace it with the top-most cell in the flow column (column D) of the RawFlowData tab

C9	\checkmark : $\times \checkmark f_x$	=RawFlowData!D28		
	А	В	С	
9		9/11, <u>A</u> l4	1970	

7. Double click in the bottom right-hand corner of the updated cell to update the rest of the cells in that column

Copy and paste

1. Select the top-most cell in the date column (column C) of the RawFlowData tab

	А	В	С	D
25	#			
26	agency_cd	site_no	datetime	51815_00060_00003
27	5s	15s	20d	14n
28	USGS	3360500	9/11/2014	1970 .

- 2. Hold the CTRL+Shift+Down keys. This will select the entire column. Copy
- 3. Paste the date column to column A in the FlowPrep tab and column B in the Flow Data tab.
- 4. Select the top-most cell in the flow column (column D) of the RawFlowData tab

	А	В	С	D
25	#			
26	agency_cd	site_no	datetime	51815_00060_00003
27	55	15s	20d	14n
28	USGS	3360500	9/11/2014	1970 .

- 5. Hold ctrl+shift+down key. This will select the entire column. Copy
- 6. Paste the flow column to column C in the Flow Data tab
- Double check that all the data in each of the columns from this section is correctly formatted before moving on.

LDC

The top of this tab should show the HUC 12, drainage, and flow data separated out by the following parameters: E. coli, Total Phosphorus, Total Suspended Solids, and Nitrogen, N+N, as well as various permit types. Graphs to the right will visually show the data for each table on the left. There are formulas that pull data from other tabs. You should not have to add anything in this tab.

90th Percentile

There are four 90th percentile tabs; each covers one of the following parameters: E. coli, TSS, TP, TN. These are optional Tabs that help calculate the 90th percentile concentration value based on flow.

Use the tabs with parameters relevant to your project

- 1. Use the Watershed Data_Pivot tab or raw sampling results to fill out columns A-F.
- 2. Once the data is entered, the pivot table on the right-hand side of the tab should populate. Right click the pivot table and select "Refresh" if it does not update automatically.

If Refresh does not work:

- 3. Right click the pivot table and select 'Show Field List'
- 4. In the 'Show Field List' pane, make sure the following is true:
 - Rows- Subwatershed Name Columns- Flow Regime
 - Values- Reduction

- 5. Select the drop-down option next to 'Reduction' and select 'Value Field Settings'
- 6. In the 'Summarize Values By' tab, select 'Max'
- 7. Click 'Ok'

PivotTable Fields \sim \times					
Choose fields to add to report:					
Search		Q			
Subwatershed Name PROTOCOL LAB_RESULT Drib Flam					
Daily Flow Flow Percentile Measured Load Flow Regime 90th Percentile					
Reduction More Tables					
Drag fields between areas belo	w:				
▼ Filters	III Columns				
	Flow Regime	~			
Rows	Σ Values				
Subwatershed Name 🔻	Max of Reduction	-			

SW1-12

These tabs are used to separate data by subwatershed in order to highlight impairments and create automatic graphs to display collected observed data.

1. Copy and paste each site's sample dates, E. coli results, TP results, TSS results, and Nitrogen + results into the appropriate subwatershed tab.

Site #1					
<u>Date</u>	<u>E. coli</u>	Phosphorus, Total	Solids, Suspended Total, (TSS)	Nitrogen, Nitrate+Nitrite	
#N/A	#N/A	#N/A	#N/A	#N/A	
#N/A	#N/A	#N/A	#N/A	#N/A	
#N/A	#N/A	#N/A	#N/A	#N/A	
#N/A	#N/A	#N/A	#N/A	#N/A	
#N/A	#N/A	#N/A	#N/A	#N/A	

- The red columns should update once this data has been plugged in.
- 2. Once the data has been entered you should see graphs with a flow regime and acceptable load bar to indicate what reductions are still needed.