# Baseflow Separation: A step-by-step guide for streamflow divorce

1. Extract the streamflow data from February 12th, 2025. Streamflow data can be accessed here: https://waterdata.usgs.gov/monitoring-location/02465000/?agency_cd=USGS#dataTypeId=continuous-00060-0&period=P7D&showMedian=true

2. Scroll down and select 'Change time span'

| Change time span | Subscribe to WaterAlert | View related graphs | Download data | View data records |
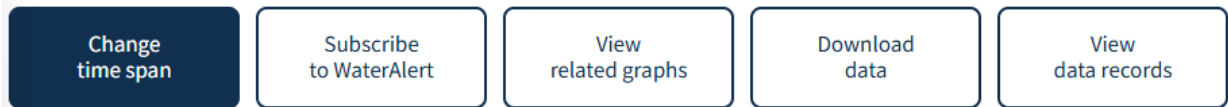
3. Select date range: February 12th, 2025 12:00 AM to February 12th, 2025

Select a date range:

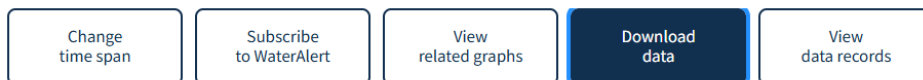mm/dd/yyyy

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02/12/2025
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mm/dd/yyyy

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02/12/2025
```

4. Select 'Change time span' button below the date range.

Change time span

5. Select 'Download Data' button and check 'Continuous Data' before hitting 'Retrieve' button

| Change time span | Subscribe to WaterAlert | View related graphs | Download data | View data records |

Select data to retrieve
- ◯ Continuous data
- ◯ Daily statistics - median
- ◯ Daily statistics - all
- ◯ About this location

A separate tab will open with the requested data.
All data are in RDB format.
Data are retrieved from USGS Water Data Services.
If you are an R user, use the USGS dataRetrieval package to
download, analyze and plot your data

**⬇ Retrieve**

6. You should see a table in a separate tab that looks like this:

```
# ---------------------------------- WARNING ----------------------------------------
# Some of the data that you have obtained from this U.S. Geological Survey database may not
# have received Director's approval.  Any such data values are qualified as provisional and
# are subject to revision.  Provisional data are released on the condition that neither the
# USGS nor the United States Government may be held liable for any damages resulting from its use.
#  Go to http://help.waterdata.usgs.gov/policies/provisional-data-statement for more information.
#
# File-format description:  http://help.waterdata.usgs.gov/faq/about-tab-delimited-output
# Automated-retrieval info: http://help.waterdata.usgs.gov/faq/automated-retrievals
#
# Contact:    gs-w_support_nwisweb@usgs.gov
# retrieved: 2025-03-19 16:12:24 -04:00 (natwebcaas01)
#
# Data for the following 1 site(s) are contained in this file
#    USGS 02465000 BLACK WARRIOR RIVER AT NORTHPORT AL
# ---------------------------------------------------------------------------------
#
# TS_ID - An internal number representing a time series.
#
# Data provided for site 02465000
#    TS_ID        Parameter Description
#    309819       00060     Discharge, cubic feet per second
#
# Data-value qualification codes included in this output:
#     P  Provisional data subject to revision.
#
agency_cd       site_no datetime        tz_cd   309819_00060    309819_00060_cd
5s      15s     20d     6s      14n     10s
USGS    02465000        2025-02-12 01:00        CST     13100   P
USGS    02465000        2025-02-12 01:15        CST     12900   P
USGS    02465000        2025-02-12 01:30        CST     12700   P
USGS    02465000        2025-02-12 01:45        CST     12700   P
USGS    02465000        2025-02-12 02:00        CST     11100   P
```

7. Select the three dots in the top right corner to open up the drop down menu. Select 'More Tools' and 'Save page as'
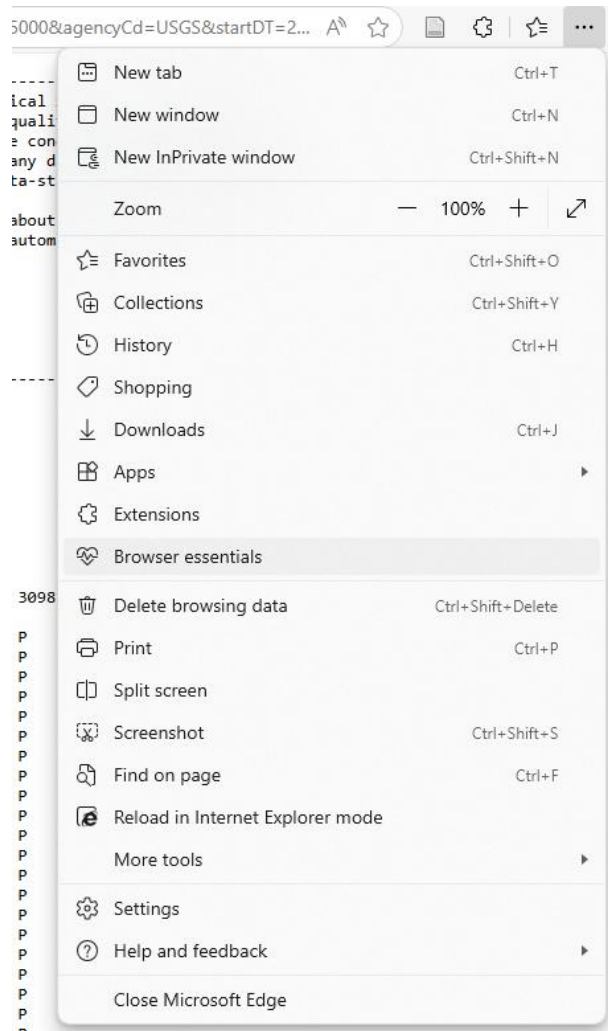
8. You should get this as a result. Please save it in a folder most convenient for you.
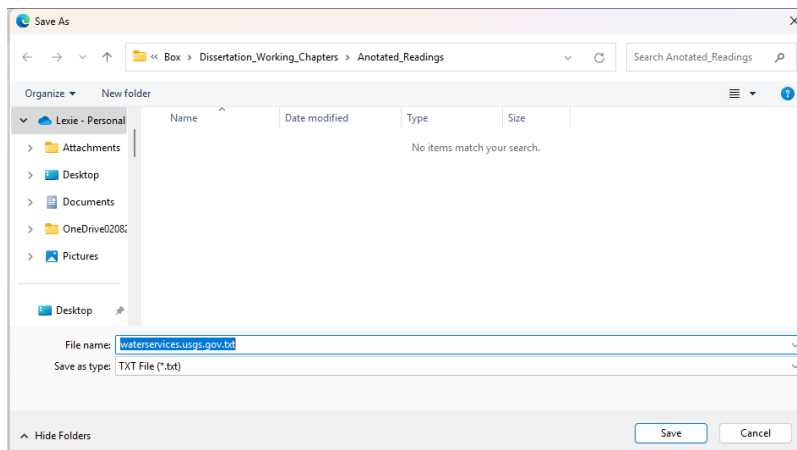
9. CONGRATULATIONS! You just learned how to extract and save data properly!
10. Please open the Excel spreadsheet that has been provided for you. We will now begin to learn how to apply the Eckhardt Filter to our collected data!
11. When you open the file, you should see the following (with different numbers). To the side of the provided chart, create two cells for the variables BFImax and alpha.

First spreadsheet (cell J9 selected):

Time	Discharge (ft₃/sec)	b-1	b
0:00	12000		0
0:15	12100	0	0
0:30	12200	0	0
0:45	12300	0	0
1:00	12400	0	0
1:15	12500	0	0
1:30	12600	0	0
1:45	12700	0	0
2:00	12800	0	0
2:15	12900	0	0
2:30	13000	0	0
2:45	13100	0	0
3:00	13200	0	0
3:15	13300	0	0
3:30	13400	0	0
3:45	13500	0	0
4:00	13600	0	0
4:15	13700	0	0
4:30	13800	0	0
4:45	13900	0	0
5:00	14000	0	0
5:15	14100	0	0
5:30	14200	0	0
5:45	14300	0	0
6:00	14400	0	0
6:15	14500	0	0

Second spreadsheet (cell H14 selected):

Time	Discharge (ft₃/sec)	b-1	b		F	G	H
0:00	12000		0		alpha		
0:15	12100	0	0		BFImax		
0:30	12200	0	0				
0:45	12300	0	0				
1:00	12400	0	0				
1:15	12500	0	0				
1:30	12600	0	0				
1:45	12700	0	0				
2:00	12800	0	0				
2:15	12900	0	0				
2:30	13000	0	0				
2:45	13100	0	0				
3:00	13200	0	0				
3:15	13300	0	0				
3:30	13400	0	0				
3:45	13500	0	0				
4:00	13600	0	0				
4:15	13700	0	0				
4:30	13800	0	0				
4:45	13900	0	0				
5:00	14000	0	0				
5:15	14100	0	0				
5:30	14200	0	0				

12. Enter in the Eckhardt formula into cell D2

$$b_1 = \frac{(1-BFI_{max})\alpha b_{t-1} + (1-\alpha)BFI_{max}Q_t}{1-\alpha BFI_{max}}$$

In the formula bar:
`=((1-$G$2)*$G$1*C2)+((1-$G$1)*$G$2*B2)/(1-($G$1*$G$2))`

	A	B	C	D	E	F	G	H
1	Time	Discharge (ft₃/sec)	b-1	b			alpha	
2	0:00	12000		=((1-G2)*G1*C2)+((1-G1)*G2*B2)/(1-(G1*G2))				
3	0:15	12100						
4	0:30	12200						
5	0:45	12300						
6	1:00	12400						
7	1:15	12500						
8	1:30	12600						
9	1:45	12700						
10	2:00	12800						
11	2:15	12900						
12	2:30	13000						
13	2:45	13100						
14	3:00	13200						
15	3:15	13300						
16	3:30	13400						
17	3:45	13500						
18	4:00	13600						
19	4:15	13700						

13. Drag cell D2 to the bottom of the chart to apply the cell to all the time steps.

14. In cell C3, type =D2. Drag this down to apply to all time steps.

	A	B	C	D	E	F	G	H
1	Time	Discharge (ft$_3$/sec)	b-1	b		alpha		
2	0:00	12000		0		BFImax		
3	0:15	12100	=D2	0				
4	0:30	12200		0				
5	0:45	12300		0				
6	1:00	12400		0				
7	1:15	12500		0				
8	1:30	12600		0				
9	1:45	12700		0				
10	2:00	12800		0				
11	2:15	12900		0				
12	2:30	13000		0				
13	2:45	13100		0				
14	3:00	13200		0				
15	3:15	13300		0				
16	3:30	13400		0				
17	3:45	13500		0				
18	4:00	13600		0				
19	4:15	13700		0				

15. Input values into cells G2 and G3 with your estimates for the variables alpha and BFImax.

16. Because there is not a known value of baseflow for the first time-step, we will estimate a reasonable value for the first b-1 (cell C2). A reasonable estimate is the BFImax times the discharge.

17. You should now have a completed series of baseflow values. These can be plotted for easier understanding if desired. A good check is to make sure the baseflow values are all less than the total streamflow.