Problem: *Delineate a Watershed Using a Topographic Map*

Statement:

The topography east of Iowa City 1965 is shown on a USGS 7.5 minute Topo Map (Iowa City East Quadrangle). Note the location of I80 (in red) and Rochester Avenue (red/white dashed line) for orientations.

a. Use this map to delineate the drainage divide (or watershed) of a headwater tributary to the North Branch Ralston Creek. The outlet of the watershed is indicated by the black circle (it is just **upstream** of a confluence).

b. It is common to use a computer tool (e.g., ArcGIS) to delineate watersheds. Use the U.S. Geological Survey's StreamStats 3 for Iowa to delineate this same watershed. Select Interactive Map and then zoom in to Iowa City to find this section of stream. Use the *Watershed Delineation form a Point* tool to select the (same) basin outlet. After the watershed is delineated (it will take a minute or two), select the *Compute Basin Characteristics* tool (under Delineation Results) and print to a PDF file, and then select the *Compute Flow Statistics* tool and print to a PDF file. Finally, capture an image of the delineated watershed (e.g., using *Snipping Tool* or PrtScn on Windows).

In your solution, include your hand drawn watershed (part a) and the StreamStats 3 (part b), and merge with the PDF files for the basin characteristics and flow statistics.

Note: Take a few minutes to compare the two maps. You might see be able to see some parts you missed, but you'll also see some of the limitations of computer-based methods as well.
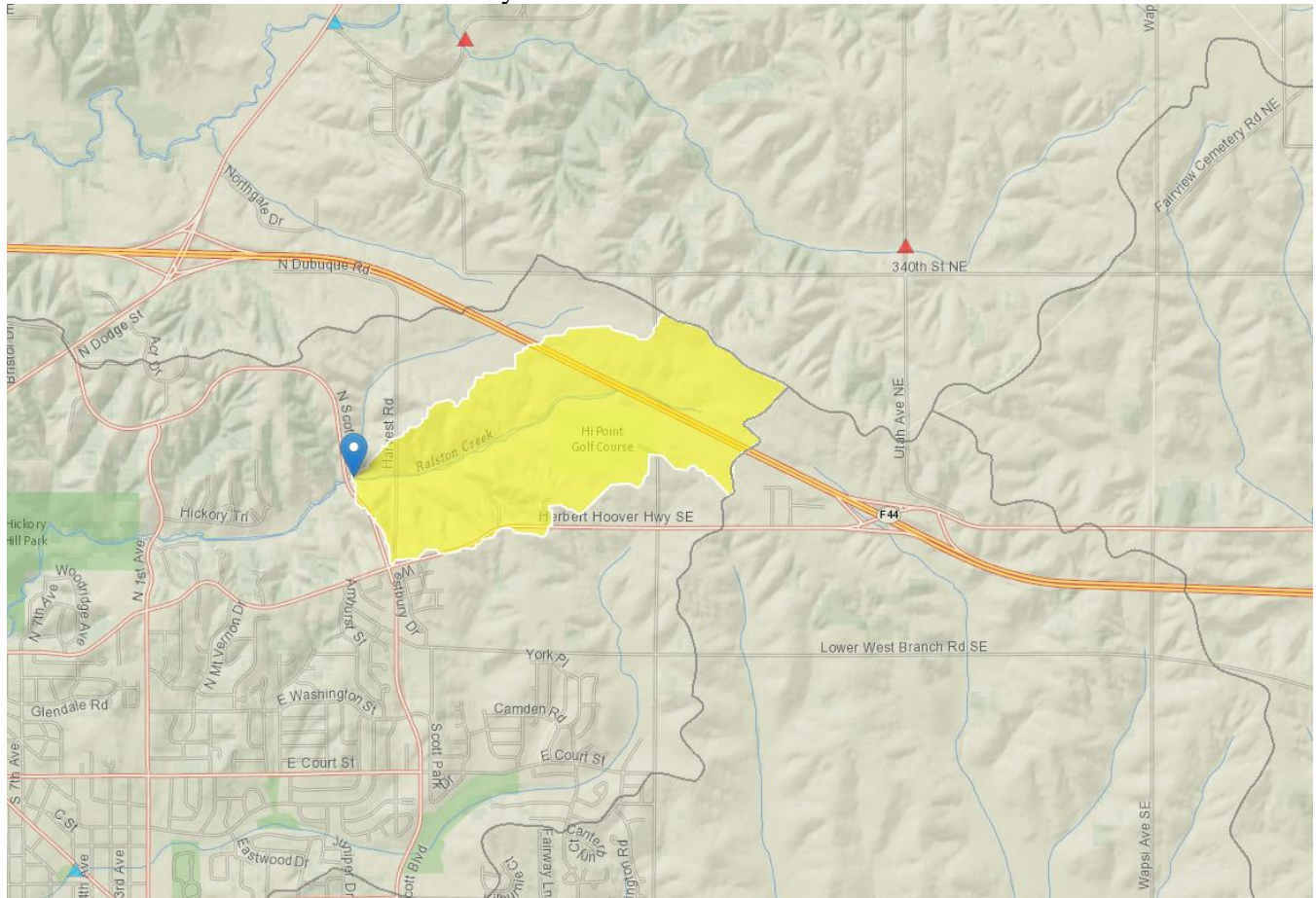
Solution:

a. Delineate the headwater tributary of North Branch Ralston Creek by hand

b. Delineate the headwater tributary of North Branch Ralston Creek with StreamStats 3.

Find attached the streamstats report. The reporting tool allows the basin characteristic report and the flow statistic report to be combined now.
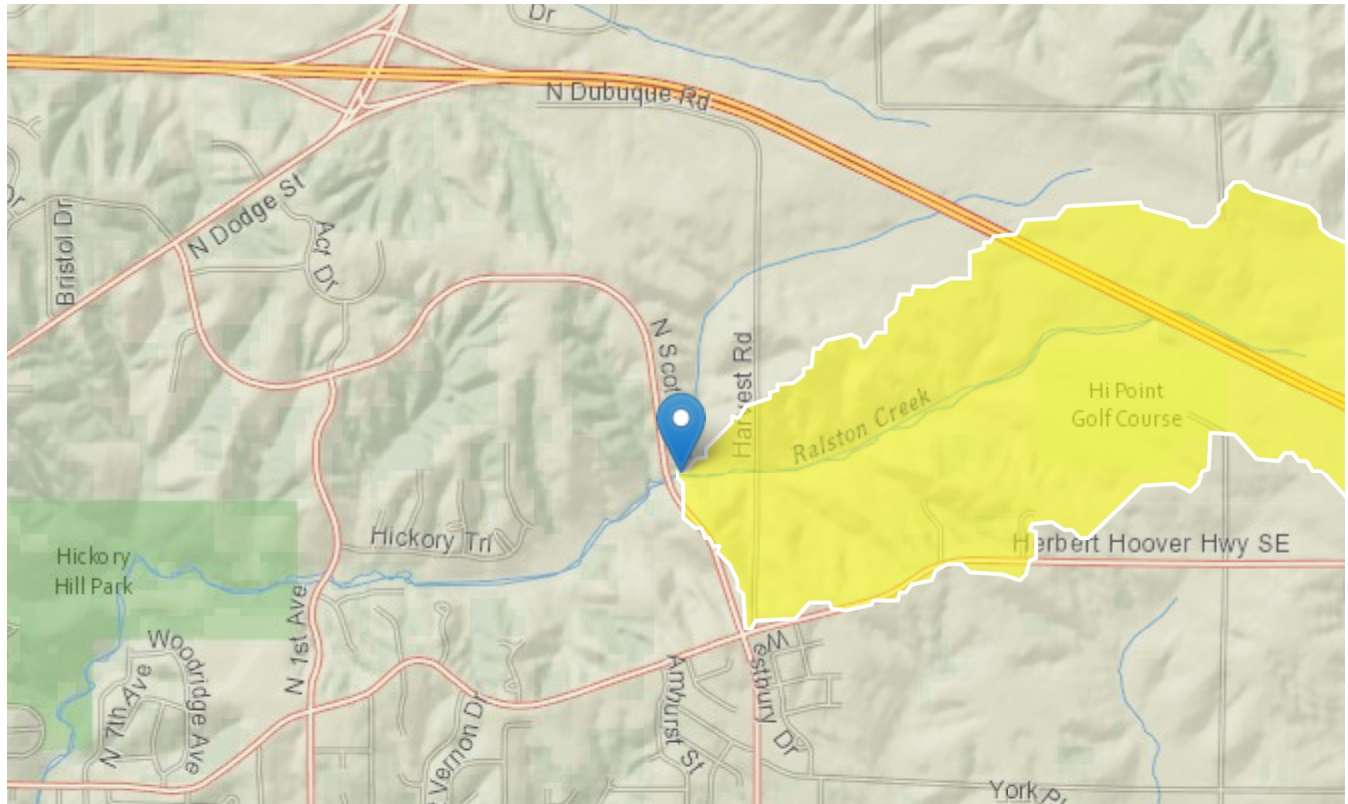
Ralston Creek, WHEP HW-2; Gregory Ewing

Region ID: IA
Workspace ID: IA20190124204902515000
Clicked Point (Latitude, Longitude):   41.67386, -91.48620
Time: 2019-01-24 14:49:18 -0600

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.91	square miles
DESMOIN	Area underlain by Des Moines Lobe	0	percent
BSHAPE	Basin Shape Factor for Area	3.31	dimensionless
BFI	Proportion of mean annual flow that is from ground water (base flow)	0.50654	dimensionless

Parameter Code	Parameter Description	Value	Unit
STREAM_VARG	Streamflow variability index as defined in WRIR 02-4068, computed from regional grid	0.586	dimensionless
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	100	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	0	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	6.31	percent
PRECIP	Mean Annual Precipitation	36.66	inches
RSD	Relative stream density first defined in SIR 2012_5171	0.38	dimensionless
HYSEP	Median percentage of baseflow to annual streamflow	50.3	percent
BASLENAH	Basin length from outlet to basin divide determined using the method in the ArcHydro Toolset	1.74	miles
CCM	Constant of channel maintenance computed as drainage area divided by total stream length	0.59	square mile per mile
CSL100	Longest flow path slope in feet per miles, using DEM	56	feet per mi
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	46	feet per mi
DRNFREQ	Number of first order streams per square mile of drainage area	1.09	1st-order streams per square mile
FOSTREAM	Number of First Order Streams	1	dimensionless
HIGHREG	HIGHREG	2	dimensionless
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	4.54	inches
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	84	percent

Parameter Code	Parameter Description	Value	Unit
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	14.9	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	3.19	percent
PRJULDEC10	Basin average mean precipitation for July to December from PRISM 1981-2010	3.22	inches
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOKSAT	Saturated hydraulic conductivity in micrometers per second from NRCS SSURGO database	8.94	micrometers per second
STRMTOT	total length of all mapped streams (1:24,000-scale) in the basin	1.543	miles
TAU_ANN_G	Tau, Average annual base-flow recession time constant as defined in SIR 2008-5065	24.13	days

Peak-Flow Statistics Parameters [Peak Region 2 2013 5086]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	0.08	7783
DESMOIN	Des Moines Lobe	0	percent	0	100
BSHAPE	Basin Shape Factor	3.31	dimensionless	0.806	13.94

Peak-Flow Statistics Parameters [Peak Region 2 DA only 2015 5055]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	0.08	7783

Peak-Flow Statistics Flow Report [Peak Region 2 2013 5086]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp
2 Year Peak Flood	150	ft^3/s	71.2	316	46.8

Statistic	Value	Unit	PIl	PIu	SEp
5 Year Peak Flood	334	ft^3/s	218	512	25.7
10 Year Peak Flood	517	ft^3/s	363	737	20.8
25 Year Peak Flood	802	ft^3/s	574	1120	19.4
50 Year Peak Flood	994	ft^3/s	700	1410	20.4
100 Year Peak Flood	1190	ft^3/s	810	1740	22.3
200 Year Peak Flood	1550	ft^3/s	1020	2370	24.9
500 Year Peak Flood	1710	ft^3/s	1070	2760	28.2

Peak-Flow Statistics Flow Report [Peak Region 2 DA only 2015 5055]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp
2 Year Peak Flood	135	ft^3/s	63.6	288	47.4
5 Year Peak Flood	358	ft^3/s	224	572	28.2
10 Year Peak Flood	571	ft^3/s	382	851	23.6
25 Year Peak Flood	890	ft^3/s	592	1340	24
50 Year Peak Flood	1160	ft^3/s	752	1780	25.4
100 Year Peak Flood	1450	ft^3/s	916	2280	26.9
200 Year Peak Flood	1750	ft^3/s	1070	2850	29.1
500 Year Peak Flood	2160	ft^3/s	1250	3730	32.6

Peak-Flow Statistics Citations

Eash, D.A., Barnes, K.K., and Veilleux, A.G.,2013, Methods for estimating annual exceedance-probability discharges for streams in Iowa, based on data through water year 2010: U.S. Geological Survey Scientific Investigations Report 2013-5086, 63 p. with a (http://pubs.usgs.gov/sir/2013/5086/)
Eash, D.A.,2015, Comparisons of estimates of annual exceedance-probability discharges for small drainage basins in Iowa, based on data through water year 2013: U.S. Geological Survey Scientific Investigations Report 2015−5055, 37 p. (http://dx.doi.org/10.3133 /sir20155055.)

Probability Statistics Parameters [Southern Region Zero Probability 2012 5171]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	2.54	7783
BFI	Base Flow Index	0.50654	dimensionless	0.185	0.617

Probability Statistics Disclaimers [Southern Region Zero Probability 2012 5171]

> One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Probability Statistics Flow Report [Southern Region Zero Probability 2012 5171]

Statistic	Value	Unit
Probability zero flow 1 day 10 year	0.991	dim
Probability zero flow 7 day 10 year	0.942	dim
Probability zero flow 30 day 10 year	0.775	dim
Probability zero flow 30 day 5 year	0.476	dim
Prob zero flow 1 day 10 yr Oct to Dec	0.981	dim
Prob zero flow 7 day 10 yr Oct to Dec	0.86	dim

Probability Statistics Citations

Eash, D.A., and Barnes, K.K.,2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific Investigations Report 2012-5171, 99 p. (http://pubs.usgs.gov/sir/2012/5171/)

Low-Flow Statistics Parameters [Low Flow Southern annual 2012 5171]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	2.94	7783
STREAM_VARG	Streamflow Variability Index from Grid	0.586	dimensionless	0.361	0.76
SSURGOB	SSURGO Percent Hydrologic Soil Type B	100	percent	2.79	99.8

Low-Flow Statistics Disclaimers [Low Flow Southern annual 2012 5171]

> One or more of the parameters is outside the suggested range. Estimates were extrapolated with

unknown errors

Low-Flow Statistics Flow Report [Low Flow Southern annual 2012 5171]

Statistic	Value	Unit
1 Day 10 Year Low Flow	0.0014	ft^3/s
7 Day 10 Year Low Flow	0.00165	ft^3/s
30 Day 10 Year Low Flow	0.00138	ft^3/s
30 Day 5 Year Low Flow	0.00238	ft^3/s

Low-Flow Statistics Citations

Eash, D.A., and Barnes, K.K.,2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific Investigations Report 2012-5171, 99 p. (http://pubs.usgs.gov/sir/2012/5171/)

General Flow Statistics Parameters [Low Flow Southern annual 2012 5171]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	2.94	7783
STREAM_VARG	Streamflow Variability Index from Grid	0.586	dimensionless	0.361	0.76
SSURGOC	SSURGO Percent Hydrologic Soil Type C	0	percent	0	91.9

General Flow Statistics Disclaimers [Low Flow Southern annual 2012 5171]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

General Flow Statistics Flow Report [Low Flow Southern annual 2012 5171]

Statistic	Value	Unit
Harmonic Mean Streamflow	0.145	ft^3/s

General Flow Statistics Citations

Eash, D.A., and Barnes, K.K.,2012, Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa: U.S. Geological Survey Scientific

Investigations Report 2012-5171, 99 p. (http://pubs.usgs.gov/sir/2012/5171/)

Seasonal Flow Statistics Parameters [Low Flow Southern Apr Jun 2016 5111]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	2.59	7790
SSURGOD	SSURGO Percent Hydrologic Soil Type D	0	percent	0	61.8
SSURGOC	SSURGO Percent Hydrologic Soil Type C	0	percent	0	92

Seasonal Flow Statistics Parameters [Low Flow Southern Oct Dec 2016 5111]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	2.59	7790
SSURGOC	SSURGO Percent Hydrologic Soil Type C	0	percent	0	92
BSLDEM10M	Mean Basin Slope from 10m DEM	6.31	percent	1.1	12.3

Seasonal Flow Statistics Disclaimers [Low Flow Southern Apr Jun 2016 5111]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Seasonal Flow Statistics Flow Report [Low Flow Southern Apr Jun 2016 5111]

Statistic	Value	Unit
Apr to Jun 1 Day 10 Year Low Flow	0.0115	ft^3/s
Apr to Jun 7 Day 10 Year Low Flow	0.0165	ft^3/s
Apr to Jun 30 Day 10 Year Low Flow	0.0473	ft^3/s

Seasonal Flow Statistics Disclaimers [Low Flow Southern Oct Dec 2016 5111]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Seasonal Flow Statistics Flow Report [Low Flow Southern Oct Dec 2016 5111]

Statistic	Value	Unit
1 Day 10 Year lowflow Oct to Dec	0.000725	ft^3/s
7 Day 10 Year lowflow Oct to Dec	0.00106	ft^3/s
Oct_to_Dec_30_Day_10_Year_Low_Flow	0.0032	ft^3/s

Seasonal Flow Statistics Citations

Eash, D.A., Barnes, K.K., and O'Shea, P.S.,2016, Methods for estimating selected spring and fall low-flow frequency statistics for ungaged stream sites in Iowa, based on data through June 2014: U.S. Geological Survey Scientific Investigations Report 2016-5111, 32 p. (http://dx.doi.org/10.3133/sir20165111)

Flow-Duration Statistics Parameters [Statewide Flow Duration 2012 5232]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.91	square miles	15.5	7782
SSURGOC	SSURGO Percent Hydrologic Soil Type C	0	percent	0.09	83.5
PRECIP	Mean Annual Precipitation	36.66	inches	27.7	38
RSD	Relative Stream Density	0.38	dimensionless	0.22	0.49
HYSEP	Hydrograph separation percent	50.3	percent	20.3	78
STREAM_VARG	Streamflow Variability Index from Grid	0.586	dimensionless	0.21	0.76
SSURGOB	SSURGO Percent Hydrologic Soil Type B	100	percent	5.7	99.4
SSURGOD	SSURGO Percent Hydrologic Soil Type D	0	percent	0	57

Flow-Duration Statistics Disclaimers [Statewide Flow Duration 2012 5232]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Flow-Duration Statistics Flow Report [Statewide Flow Duration 2012 5232]

Statistic	Value	Unit
1 Percent Duration	7.81	ft^3/s
5 Percent Duration	1.66	ft^3/s
10 Percent Duration	0.771	ft^3/s
15 Percent Duration	0.661	ft^3/s
20 Percent Duration	0.531	ft^3/s
30 Percent Duration	0.397	ft^3/s
40 Percent Duration	0.286	ft^3/s
50 Percent Duration	0.222	ft^3/s
60 Percent Duration	0.155	ft^3/s
70 Percent Duration	0.0899	ft^3/s
80 Percent Duration	0.0293	ft^3/s
85 Percent Duration	0.0189	ft^3/s
90 Percent Duration	0.0122	ft^3/s
95 Percent Duration	0.00461	ft^3/s
99 Percent Duration	0.00116	ft^3/s

Flow-Duration Statistics Citations

Linhart, S.M., Nania, J.F., Sanders, C.L., Jr., and Archfield, S.A.,2012, Computing daily mean streamflow at ungaged locations in Iowa by using the Flow Anywhere and Flow Duration Curve Transfer statistical methods: U.S. Geological Survey Scientific Investigations Report 2012−5232, 50 p. (http://pubs.usgs.gov/sir/2012/5232/)

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Application Version: 4.3.0