

# MaineDOT Culvert Hydrology Summary Sheet

Town: Patten WIN (or Region): 24241.00

Route: ME-11 Local Road Name: Aroostook Scenic Highway

Stream: Weeks Brook

Lat: 46.00869 Long: 68.44642

Asset ID: 46557 Also Known As: \_\_\_\_\_

Existing Structure: 3 x 4'D

\*\*\*\*\*

Watershed Area: 1.7 sq. mi. NWI Wetlands: 4.2 %

Wbf - calculated: 13.3 feet Wbf - measured (if known): 12.5 feet

Q50: 264.7 cfs

Q100: 309.7 cfs

Preliminary Pipe Size\*:  
\_\_\_\_\_

\* Note: this size may NOT meet fish passage regulatory requirements. Consult with ENV staff for guidance.

Comments:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

By: CSH

Date: 7/29/2019

Revised: \_\_\_\_\_

ver: 12/7/2016

WIN: 24241.00  
 Town: Patten  
 Route No. ME-11  
 Asset ID: 46557  
 Lat: 46.00869 Long: 68.44642

Project Name:  
 Stream Name: Weeks Brook  
 Bridge Name:  
 Analysis by: CSH  
 Date: 7/29/2019

### Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

*Enter data in blue cells only!*

	km <sup>2</sup>	mi <sup>2</sup>	ac
A	4.40	1.70	1088.0
W	0.18	0.1	45.7
P <sub>c</sub>	541790	5097303	
County	Aroostook S		
pptA			
A (km <sup>2</sup> )	4.40		
W (%)	4.20		

*Enter data in [mi<sup>2</sup>]*

Watershed Area *DRNAREA*  
 Wetlands area (by NWI)

watershed centroid (E, N; UTM 19N; meters)  
*choose county from drop-down menu*  
 mean annual precipitation (inches; by look-up)

Conf Lvl 0.67

NWI Wetlands % *STORNWI*

*ver. 2018 Jul 09*

**Worksheet prepared by:**

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 Maine Dept. Transportation  
 Augusta, ME 04333-0016  
 207-557-1052

[Charles.Hebson@maine.gov](mailto:Charles.Hebson@maine.gov)

**References:**

Hodgkins, G.A., 1999.  
 Estimating the magnitude of peak flows for streams  
 in Maine for selected recurrence intervals  
*WRIR 99-4008*, USGS Augusta, ME

### Watershed Characteristics for Monthly & Daily Flows

EAVG	841
SLOPE	5.67
EMAX	1112
WATER	0.64
PRECIP	40.6
SG	0.00
HGA	0
DIST	131.00

mean basin elevation (ft)  
 mean basin slope (%)  
 maximum basin elevation (ft)  
 percent of drainage basin land cover classified as open water  
 mean annual precipitation  
 sand & gravel aquifer as decimal fraction of watershed A  
 mean basin percentage of hydrological soil group A  
 distance from the coast (mi)

### Ret Pd Peak Flow Estimate

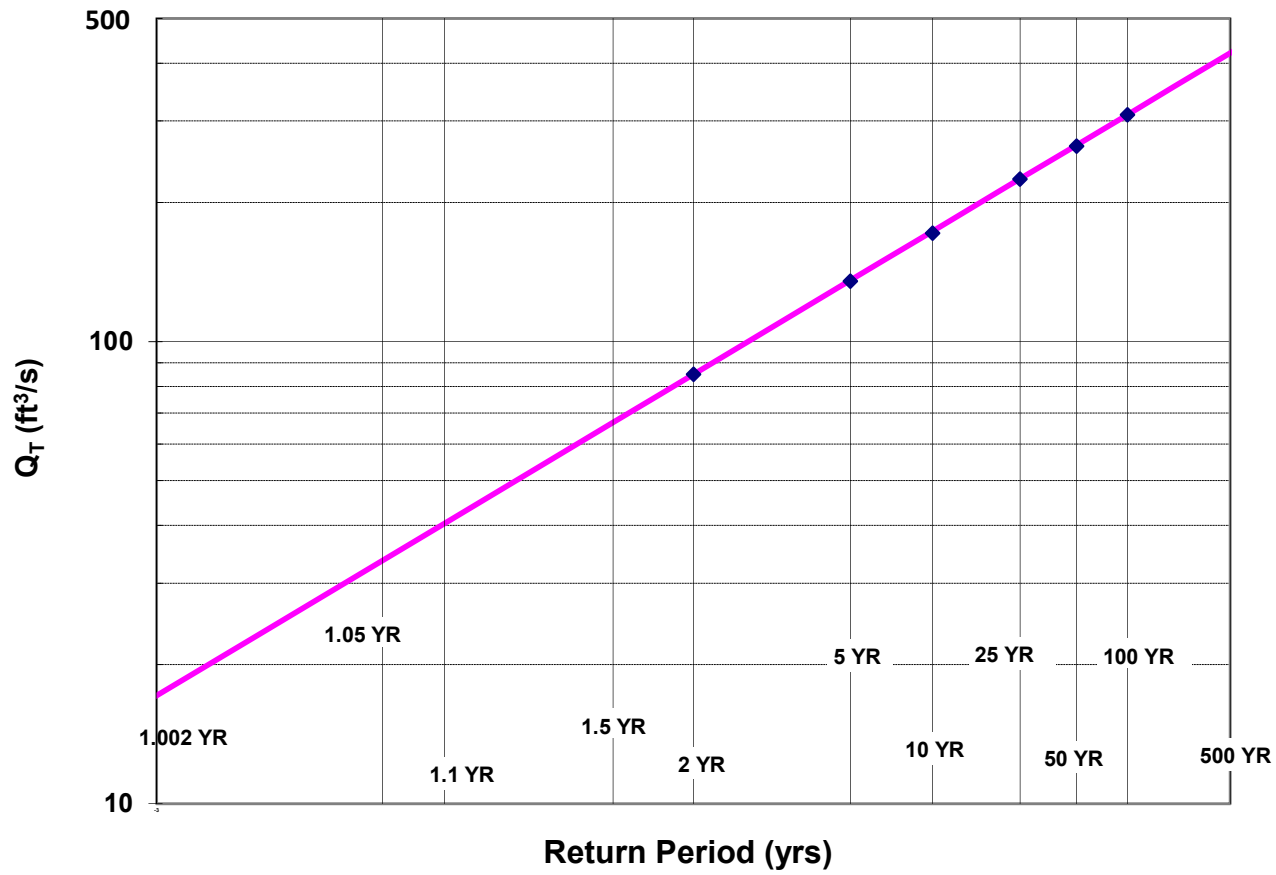
Ret Pd	Lower	Q <sub>T</sub> (m <sup>3</sup> /s)	Upper
T (yr) 1.1		1.15	
2		2.41	
5		3.82	
10		4.86	
25		6.36	
50		7.50	
100		8.77	
500		11.93	

Q <sub>T</sub> (ft <sup>3</sup> /s)
40.4
85.0
135.1
171.7
224.6
264.7
309.7
421.1

Lombard, P.J. & G.A. Hodgkins, 2015.  
 Peak flow regression equations for small, ungaged streams in  
 Maine - Comparing map-based to field-based variables  
*SIR 2015-4059*, USGS, Augusta, ME

$$Q_T = b \times A^a \times 10^{-WW}$$

# Log-Normal Probability Plot



**WIN:** 24241.00  
**Town:** Patten  
**Route No.:** ME-11  
**Asset ID:** 46557  
**Lat:** 46.00869 **Long:** 68.44642

**Project Name:** 0  
**Stream Name:** Weeks Brook  
**Bridge Name:** 0  
**Analysis by:** CSH  
**Date:** 7/29/2019

**DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED**

**MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013, 2015)**

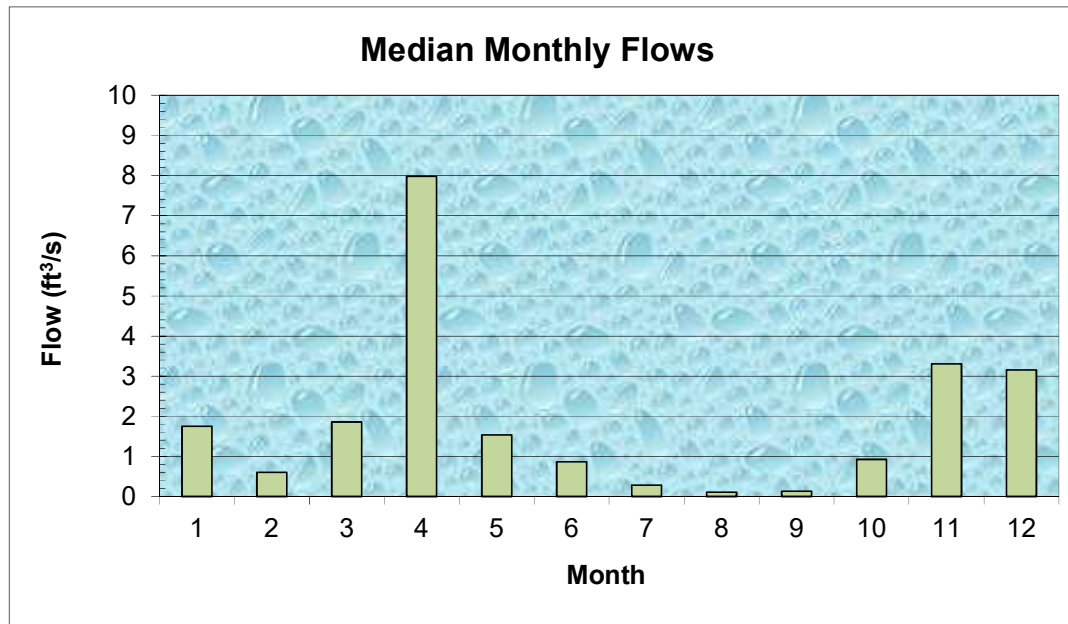
Value	Variable	Explanation
1.70	A	Area (mi <sup>2</sup> )
541790	5097303	$P_c$ Watershed centroid (E,N; UTM; Zone 19; meters)
130.21	DIST	Distance from Coastal reference line (mi)
40.6	pptA	Mean Annual Precipitation (inches)
0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	$Q_{median}$ (ft <sup>3</sup> /s)	(m <sup>3</sup> /s)
Jan	1.75	0.0496
Feb	0.60	0.0171
Mar	1.86	0.0527
Apr	7.98	0.2262
May	1.54	0.0435
Jun	0.87	0.0246
Jul	0.28	0.0079
Aug	0.11	0.0031
Sep	0.13	0.0037
Oct	0.93	0.0263
Nov	3.31	0.0937
Dec	3.16	0.0894

$Q_{bf}$	9.1
ann avg	4.2
ann med	1.7
$Q_{1.002}$	17.1
$Q_{1.01}$	23.2
$Q_{1.05}$	33.6
$Q_{bf}$	37.8

assume v = 4ft/s

$W_{bf}$	13.3	estimated bankfull width (ft)
$d_{bf}$	0.7	estimated bankfull depth (ft)
$A_{bf}$	7.2	estimated bankfull flow area (ft <sup>2</sup> )



**References**

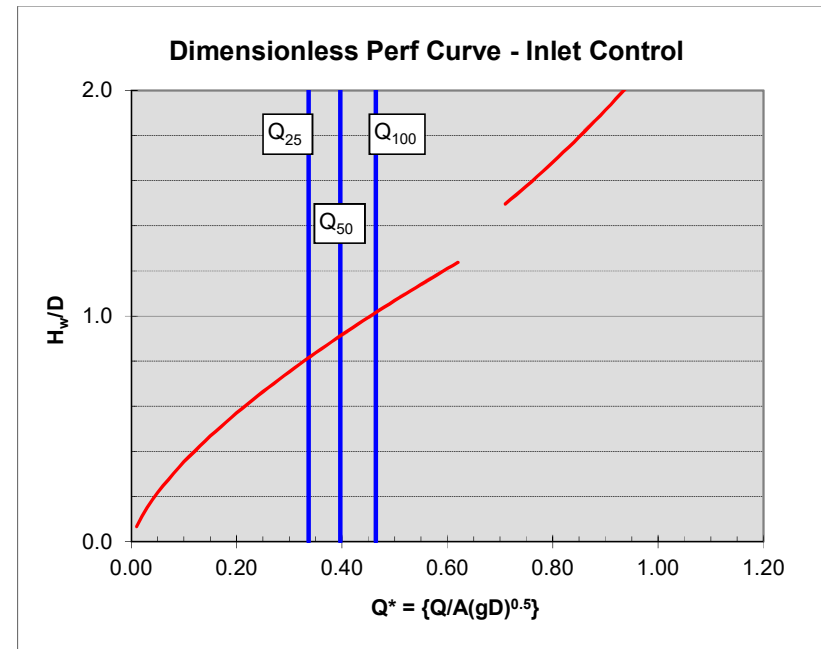
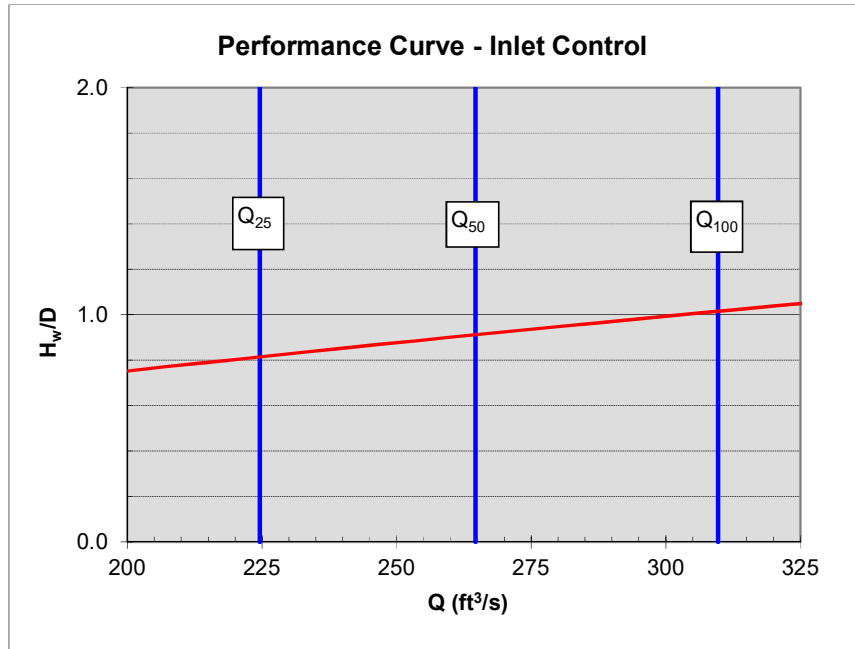
- Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 ..., USFWS QRP Project
- Dudley, R.W., 2004. Estimating Monthly Streamflows ... , SIR 2004-5026
- Dudley, R.W., 2015. Regression Equations for Monthly and Annual Mean..., USGS SIR 2015-5151

**NOTE:** This page is for preliminary sizing only.  
Final design should be done with HY8 or HDS-5

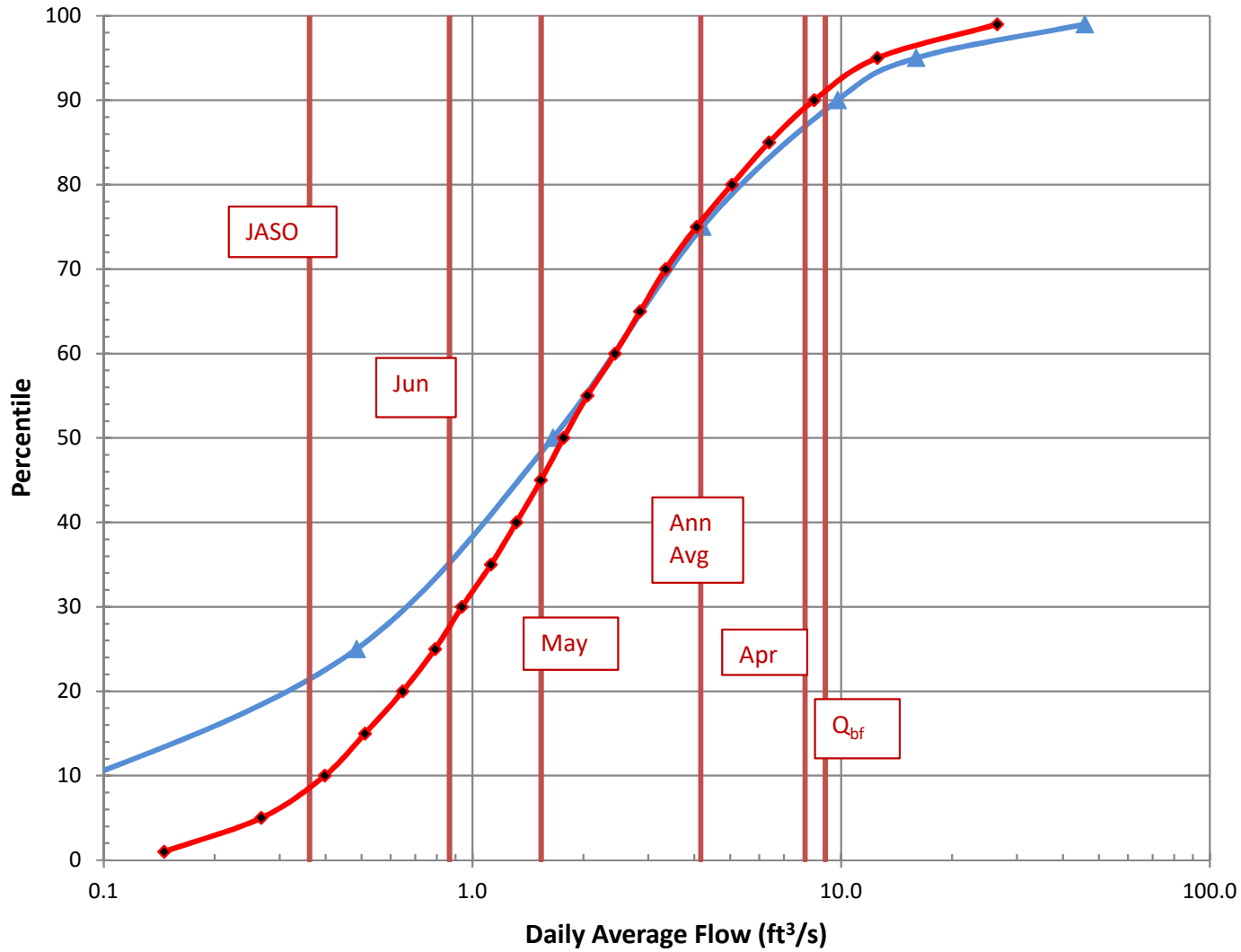
**Preliminary Culvert Sizing - Round & Box Culverts**

Shape:	Box			
Type:	Box 0 ww	Q <sub>25</sub>	224.6	
D or R (ft)	6	Q <sub>50</sub>	264.7	trial D / R = 7.7
w (ft)	8 box width	Q <sub>100</sub>	309.7	trial w: BFW = 13.3
Slope (ft/ft)	0.02			
A (ft <sup>2</sup> )	48.00			
g (ft/s <sup>2</sup> )	32.2			

**Note:**  
culvert dimensions are for open flow area; adjust for lost capacity due to embedding / backfilling (min {2' / 25% rise} embedment)



# Daily Average Flow Distribution



## Daily Avg Flow Dist

$A_{ws} = (mi^2)$  1.7

Q (ft<sup>3</sup>/s)

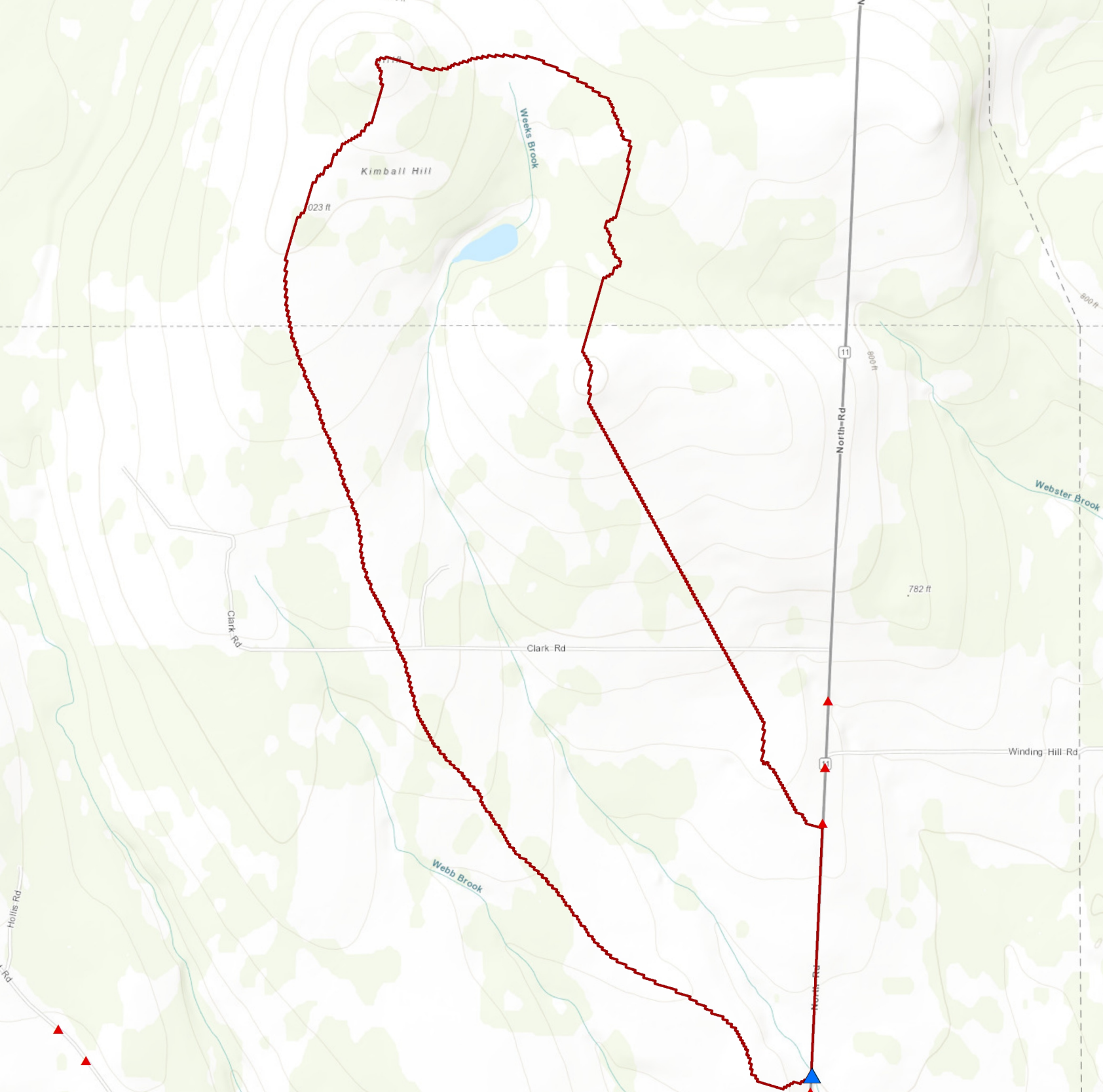
Pctl	Median	84 <sup>th</sup> pctl
1	0.15	0.26
5	0.27	0.43
10	0.40	0.60
15	0.51	0.75
20	0.65	0.90
25	0.79	1.06
30	0.94	1.21
35	1.12	1.38
40	1.32	1.59
45	1.53	1.80
50	1.77	2.12
55	2.05	2.47
60	2.44	2.90
65	2.85	3.37
70	3.34	3.94
75	4.05	4.73
80	5.05	5.65
85	6.38	7.24
90	8.45	9.73
95	12.53	15.12
99	26.50	34.89

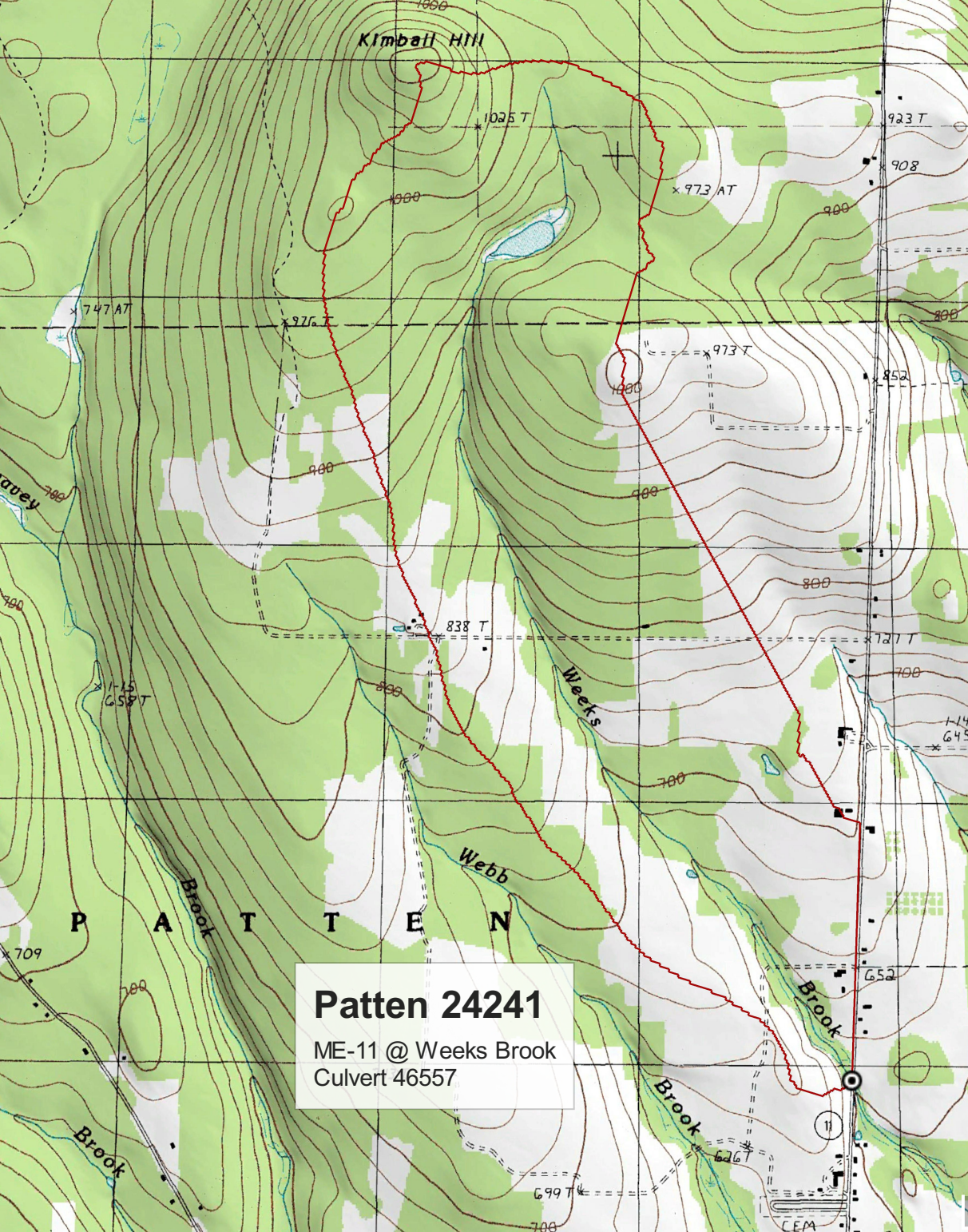
$Q_{bf}$  9.1

$Q_{1.002}$  17.1

$Q_{1.1}$  40.4

$Q_2$  85.0

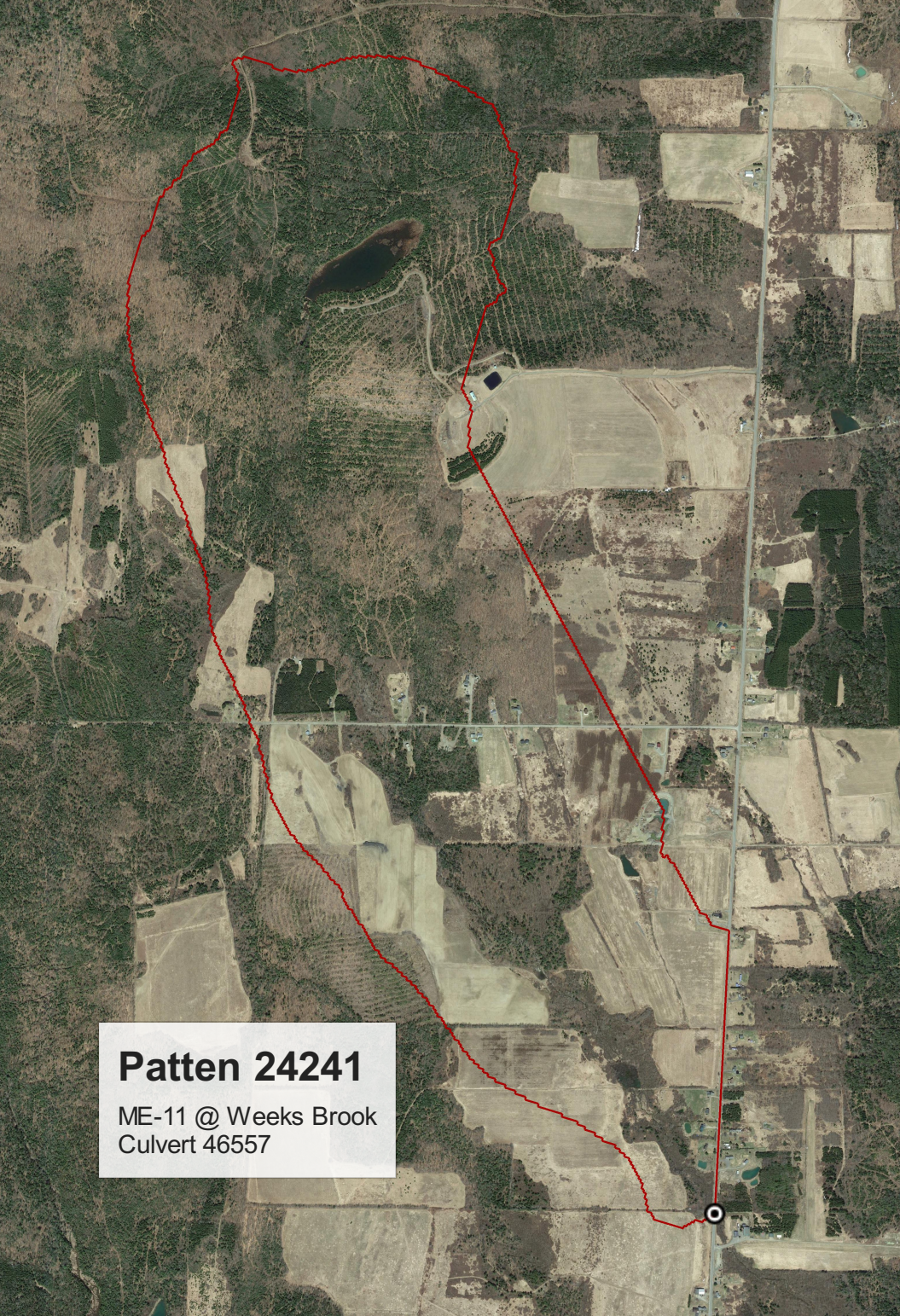




Kimball Hill

**Patten 24241**

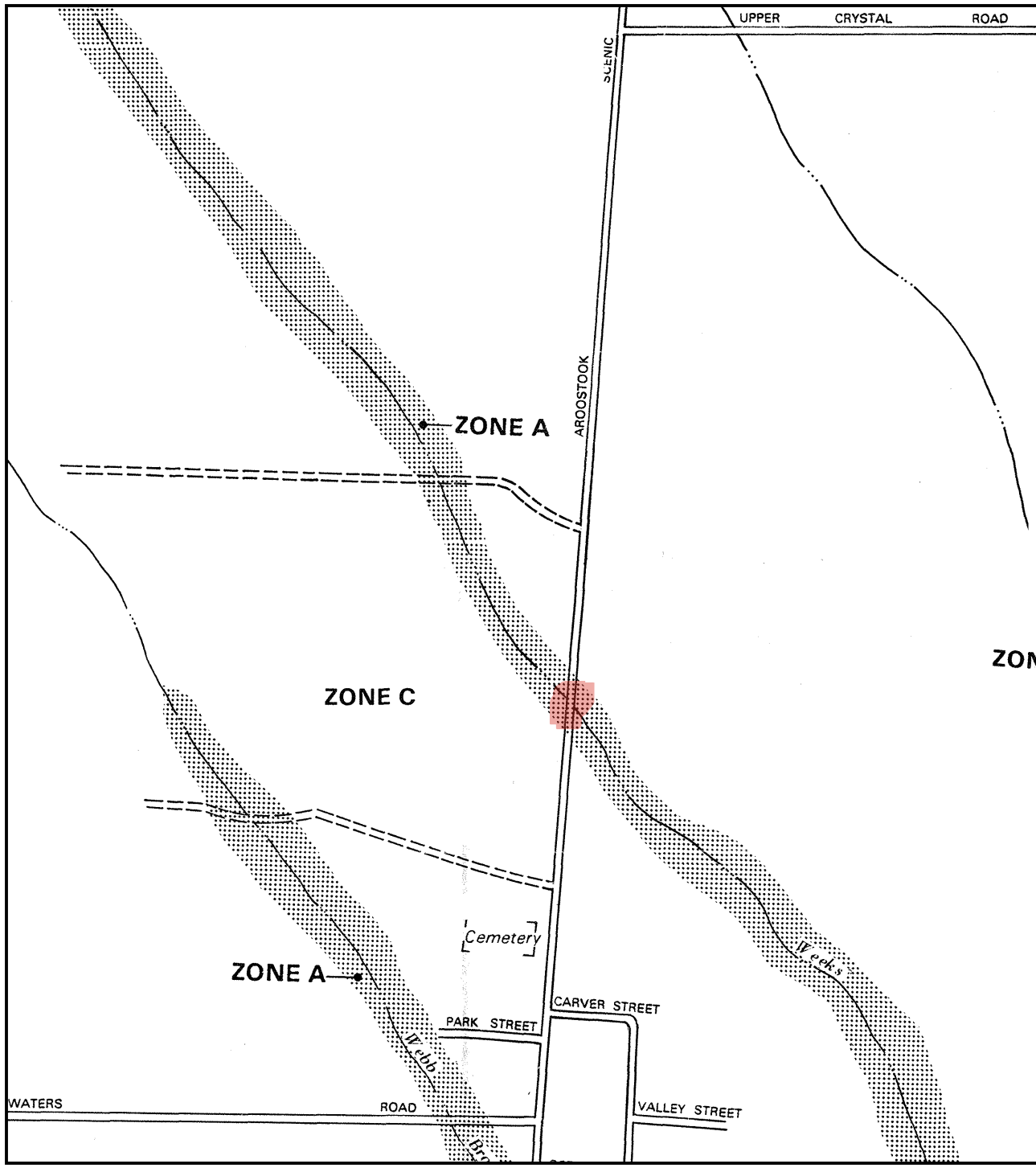
ME-11 @ Weeks Brook  
Culvert 46557



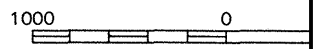
**Patten 24241**

ME-11 @ Weeks Brook  
Culvert 46557





APPROXIMATE SCALE



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP

TOWN OF  
PATTEN, MAINE  
PENOBSCOT COUNTY

PANEL 10 OF 20  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER  
230115 0010 C

EFFECTIVE DATE:  
SEPTEMBER 18, 1985



Federal Emergency Management Agency

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at <https://msc.fema.gov>.

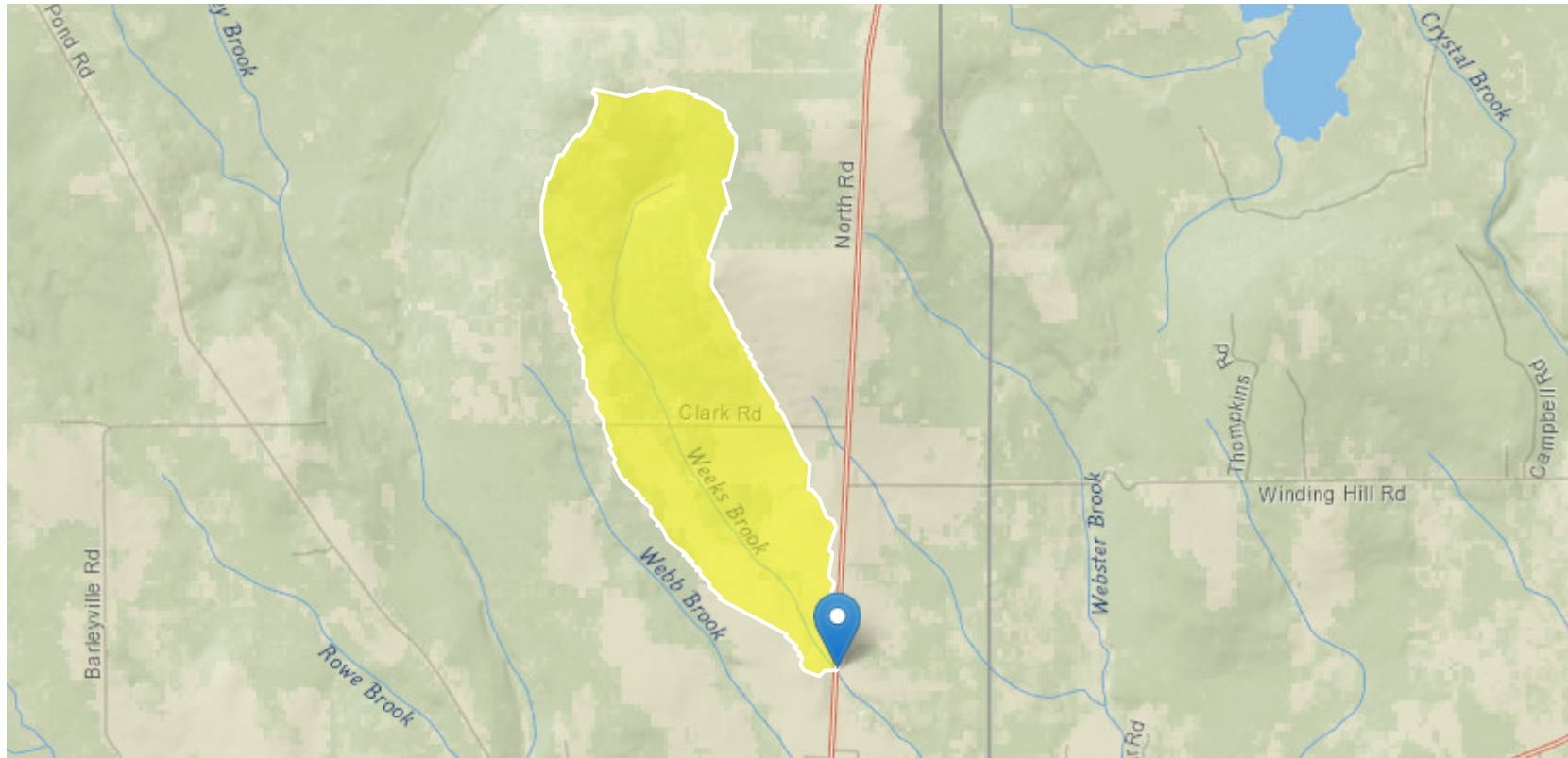
# Patten 24241 ME-11 46557

Region ID: ME

Workspace ID: ME20190730001257520000

Clicked Point (Latitude, Longitude): 46.00869, -68.44639

Time: 2019-07-29 20:13:19 -0400



Basin Characteristics

<b>Parameter Code</b>	<b>Parameter Description</b>	<b>Value</b>	<b>Unit</b>
DRNAREA	Area that drains to a point on a stream	1.7	square miles
STORNWI	Percentage of storage (combined water bodies and wetlands) from the National Wetlands Inventory	4.19	percent
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0	dimensionless
ELEV	Mean Basin Elevation	840.8	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.67	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	541789.98	feet
CENTROIDY	Basin centroid vertical (y) location in state plane units	5097302.6	feet
COASTDIST	Shortest distance from the coastline to the basin centroid	131	miles
ELEVMAX	Maximum basin elevation	1111.5	feet
LC06WATER	Percent of open water, class 11, from NLCD 2006	0.64	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.72	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.26	percent
PRECIP	Mean Annual Precipitation	40.6	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	0	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	0	percent

Peak-Flow Statistics Parameters<sup>[Statewide Peak Flow DA LT 12sqmi 2015 5049]</sup>

<b>Parameter Code</b>	<b>Parameter Name</b>	<b>Value</b>	<b>Units</b>	<b>Min Limit</b>	<b>Max Limit</b>
DRNAREA	Drainage Area	1.7	square miles	0.31	12

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
STORNWI	Percentage of Storage from NWI	4.19	percent	0	22.2

Peak-Flow Statistics Flow Report[Statewide Peak Flow DA LT 12sqmi 2015 5049]

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

Statistic	Value	Unit	SEp
1.01 Year Peak Flood	25	ft <sup>3</sup> /s	38
2 Year Peak Flood	84.9	ft <sup>3</sup> /s	34
5 Year Peak Flood	135	ft <sup>3</sup> /s	35
10 Year Peak Flood	172	ft <sup>3</sup> /s	37
25 Year Peak Flood	225	ft <sup>3</sup> /s	39
50 Year Peak Flood	265	ft <sup>3</sup> /s	41
100 Year Peak Flood	310	ft <sup>3</sup> /s	42
250 Year Peak Flood	354	ft <sup>3</sup> /s	44
500 Year Peak Flood	421	ft <sup>3</sup> /s	47

*Peak-Flow Statistics Citations*

**Lombard, P.J., and Hodgkins, G.A.,2015, Peak flow regression equations for small, ungaged streams in Maine– Comparing map-based to field-based variables: U.S. Geological Survey Scientific Investigations Report 2015–5049, 12 p. (<http://dx.doi.org/10.3133/sir20155049>)**

Flow-Duration Statistics Parameters[Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.7	square miles	14.9	1419

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	840.8	feet	239	2120

Flow-Duration Statistics Disclaimers[Statewide Annual SIR 2015 5151]

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

Flow-Duration Statistics Flow Report[Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
1 Percent Duration	0.00478	ft <sup>3</sup> /s
5 Percent Duration	0.0319	ft <sup>3</sup> /s
10 Percent Duration	0.0918	ft <sup>3</sup> /s
25 Percent Duration	0.485	ft <sup>3</sup> /s
50 Percent Duration	1.65	ft <sup>3</sup> /s
75 Percent Duration	4.2	ft <sup>3</sup> /s
90 Percent Duration	9.78	ft <sup>3</sup> /s
95 Percent Duration	16	ft <sup>3</sup> /s
99 Percent Duration	45.8	ft <sup>3</sup> /s

*Flow-Duration Statistics Citations*

**Dudley, R.W., 2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (<http://dx.doi.org/10.3133/sir20155151>)**

Annual Flow Statistics Parameters<sup>[Statewide Annual SIR 2015 5151]</sup>

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.7	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	840.8	feet	239	2120

Annual Flow Statistics Disclaimers<sup>[Statewide Annual SIR 2015 5151]</sup>

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

Annual Flow Statistics Flow Report<sup>[Statewide Annual SIR 2015 5151]</sup>

Statistic	Value	Unit
Mean Annual Flow	4.16	ft <sup>3</sup> /s

*Annual Flow Statistics Citations*

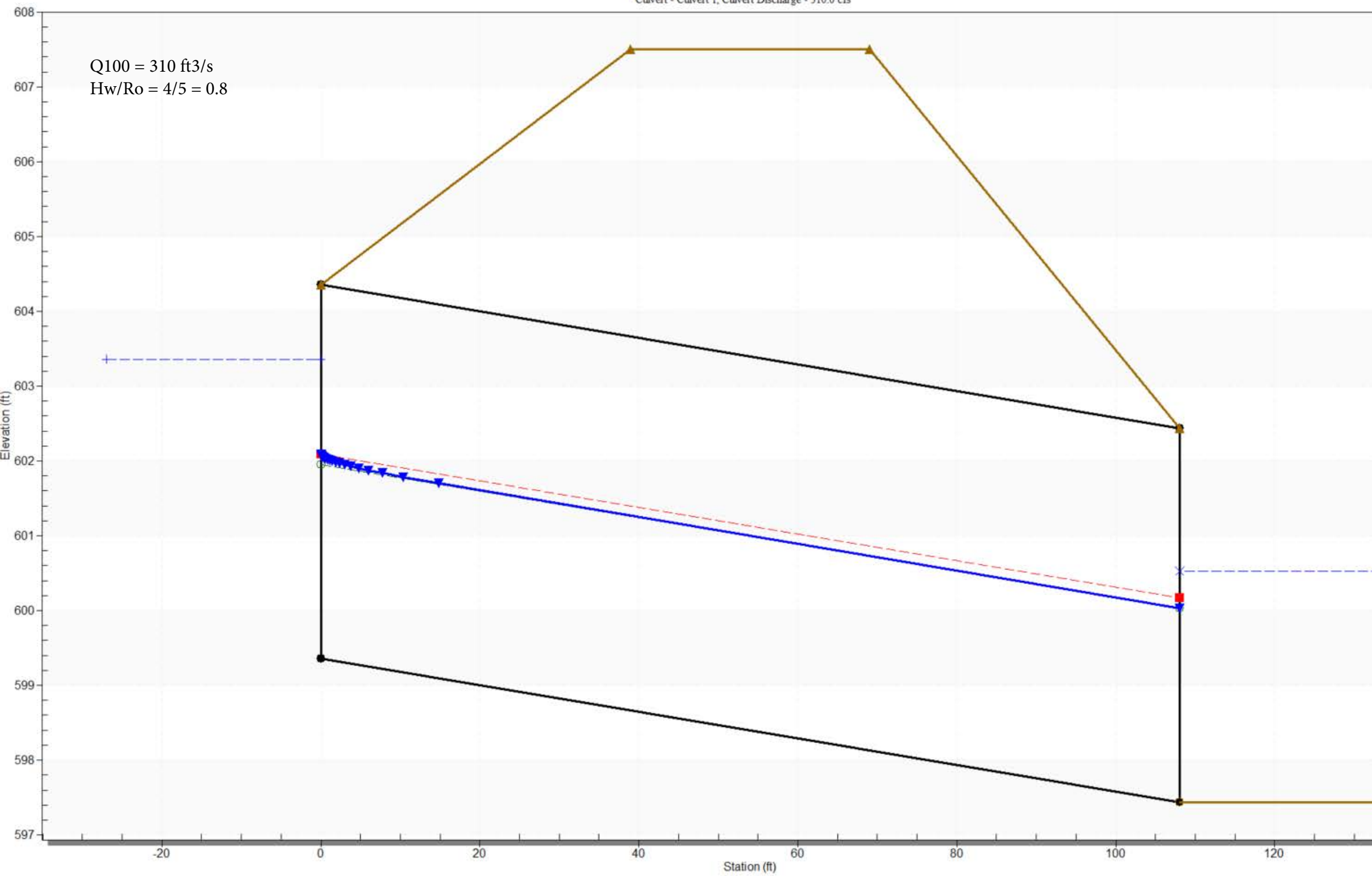
**Dudley, R.W., 2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (<http://dx.doi.org/10.3133/sir20155151>)**

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Crossing - 15Sx7 (Copy), Design Discharge - 310.0 cfs  
Culvert - Culvert 1, Culvert Discharge - 310.0 cfs

Q100 = 310 ft<sup>3</sup>/s  
Hw/Ro = 4/5 = 0.8



# Crossing: 15Sx7 (Copy)

Front View (Not to scale)

Roadway

Design Headwater

Culvert 1: Y-Top

Culvert 1: Y-Bottom

