HYDROLOGY REPORT

In accordance with the USGS StreamStats (U.S Geological Survey, 2012) website, the watershed at the S.R. 41 Bridge No. 2273 near Farmington Falls, Maine is 425.2 mi^2, including 5.02% comprised of storage areas. There is a gage approximately 13.7 miles downstream of Farmington Falls, in Mercer. The project watershed is 0.822 times the gage watershed area (Ag = 517 mi^2).

The flows for the project were determined using gage data analyzed with USGS program PeakFQ. The design discharges for the S.R. 41 Bridge over Sandy River are summarized below and miscellaneous Hydrology information is included in Appendix E. A max flood of record is included for evaluation. It is noted from USGS Gage #0104800, Sandy River near Mercer, Maine; max of record in 1987.

SUMMARY

Drainage Area	425.2	mi^2
Q1.1	6,700	ft^3/s
Q10	23,400	ft^3/s
Q25	29,500	ft^3/s
Q50	34,250	ft^3/s
Q100	39,200	ft^3/s
Q500	53,300	ft^3/s
Max of Record Flood	44,290	ft^3/s

Reported by: Erdman Anthony
Date: April 17, 2020

Note: All elevations based on North American Vertical Datum (NAVD) of 1988.

HYDRAULIC REPORT

The existing Bridge No. 2273 is 208 ft long between abutment bearings and is on an approximate 0º skew to roadway. The bridge is 29.7 ft wide, and the approach roadway width is 30 ft. The hydraulic opening of the bridge is approximately 3943 ft^2. Sandy River enters the S.R. 41 Bridge from a slight skew upstream. The channel is aligned well with the bridge opening. The existing structure is a four-span reinforced concrete structure that is founded on bedrock.

Bridge 2273 is located within a FEMA Zone AE Detailed Study with floodway area as shown on the Flood Insurance Rate Map for the Town of Farmington, ME, effective July 3, 1995 (included in Appendix E). FEMA will allow no increase in the 100-year water surface elevation without requiring a Conditional Letter of Map Revision.

The U.S. Army Corp of Engineers HEC-RAS Version 5.0.7 was used to model the hydraulics at the S.R. 41 Bridge. The existing conditions were modeled using MDOT's survey data of the channel, floodplain, and existing bridge and the flow data (average estimate) presented in the Hydrology section. Manning's n values were estimated based on photographs and channel bottom descriptions from the HEC-RAS Hydraulic Reference Manual Version 5.0, February 2016, Table 3-1 in conjunction with FEMA Flood Insurance Study (FIS) selected manning's n values for the study reach. A main channel Manning's n of 0.06 was determined as the channel appears to be clean with deep pools, and some sizable stones. The floodplain has a mix of mature trees with short grass and a Manning's n of 0.075 was selected to be in correlation with the FIS.

The survey information provided by MaineDOT includes approximately 400 ft (+/-) of channel and floodplain upstream and 600 ft (+/-) downstream along Sandy River. The slope of the channel is mildly sloped downstream of the structure. For the existing and proposed conditions model, normal depth boundary conditions were selected for all events except 100-yr and 500-yr. FEMA water surface elevations were selected for use. 100-yr storm water surface elevation and 500-yr storm water surface elevations were 340.41' and 343.41', respectively.

The low chord elevation for the existing bridge is 339.25 ft at the upstream and downstream ends of the bridge. The high chord for the existing bridge (elevation of the bridge deck) is 344.53 ft. The existing and proposed conditions analysis was performed using a subcritical flow regime and slope of 0.0006 ft/ft was used for the downstream normal depth boundary conditions in conformance with the energy grade line from FEMA storm (100 year & 500 year) profiles. Energy and Pressure/Weir was selected for the low flow and high flow bridge modeling approach, respectively. Momentum and Yarnell method were also evaluated for low flows. The resulting water surface profiles show that low flows are conveyed through the existing bridge opening. No freeboard is present for 50-year flood events and higher (100-yr, Flood of Record, 500-yr).

According to information provided by MaineDOT, there is history of the bridge being impacted by flood waters. The low chord was impacted and near approach overtopped by flood waters from the April Fool's Flood of 1987. Youtube video of the area following the flood was evaluated for comparison to the existing conditions model. The existing conditions hydraulic model agrees with the flooding video.

The proposed replacement structure will be located to the west of the horizontal alignment of the existing structure. The vertical profile will be raised slightly through the site. The proposed structure will be 230 ft. long, 38.25 ft. wide, have a clear span of 225 ft, and a total hydraulic opening of approximately 4275 ft2. The superstructure will consist of approximately 45 in deep steel girders with a composite concrete deck and 3.25" asphalt wearing surface supported on reinforced concrete abutments.

The low chord elevation for the proposed bridge is 338.44 ft. and 339.56 ft. at the Begin and End abutments, respectively. The proposed hydraulic model was analyzed using the same assumptions for Manning's n values, downstream boundary condition, flow regime, and bridge modeling approach as the existing hydraulic model.

The results from the proposed conditions model show that the water surface elevations for all flow events are lower than existing conditions. The hydraulic analysis summary from the existing and proposed hydraulic models is on the following page.

SUMMARY

	Existing Bridge	Proposed Bridge
	4-Span (50’ - 48’ - 48’ - 51’)	2-Span (112.5’ - 112.5’)
Opening Area, ft^2	3943 (+/-)	4275 (+/-)
Minimum Low Chord Elevation, ft	339.25	338.44
Headwater Elevation @ Q1.1, ft	325.89	325.77
Headwater Elevation @ Q10, ft	335.53	335.30
Headwater Elevation @ Q25, ft	338.06	337.78
Headwater Elevation @ Q50, ft	340.60	340.61
Headwater Elevation @ Q100, ft	342.39	341.99
Headwater Elevation @ Q500, ft	346.67	346.12
Velocity @ Q1.1, ft/s	3.22	3.32
Velocity @ Q10, ft/s	5.25	5.43
Velocity @ Q25, ft/s	5.79	6.00
Velocity @ Q50, ft/s	5.99	6.14
Velocity @ Q100, ft/s	6.34	6.61
Velocity @ Q500, ft/s	7.15	7.35
Maximum Freeboard @ Q50, ft	-1.25’	-2.17’
Maximum Freeboard @ Q100, ft	-3.14’	-3.55’
Flood of Record – April 1, 1987		
Headwater Elevation, ft.	344.58’	344.12’
Velocity, ft/s	6.55	6.84

Reported by: Erdman Anthony
Date: April 17, 2020

Headwater elevation and velocity information was taken from the upstream bounding bridge cross section (Section 992) in the hydraulic models for the existing and proposed bridges. The maximum proposed freeboard for the design 50-year and check 100-year events indicates the difference of the water surface elevation at XS 992 and low chord elevation.

The hydraulic analysis summary shows that the proposed structure will lower headwater elevations upstream of Bridge 2273. However, the downstream effects of the lower upstream water surface elevations are expected to be minimal.

Scour

There appears to be no evidence of significant scour or erosion at the site as the footings are noted to be founded on ledge and the bridge appraisal scour rating (item 113) is 8 – "stable for scour conditions".

The proposed bridge abutments will also be founded on bedrock. Scour protection is not needed for structures on bedrock unless the bedrock is prone to erosion.

A contraction scour analysis was conducted in accordance with FHWA Hydraulic Engineering Circular No. 18 (HEC-18) entitled "Evaluating Scour at Bridges" (Fifth Edition, April 2012). The study bridge is considered to occur under Case 1b contraction scour condition during flood events where overbank flow is completely obstructed by the abutments. Standard contraction scour analysis is applicable to most of the flood event flows which occur with the water surface elevation below the bridge low chord in a non-submergence condition. The submergence of the low chord by 100-year and 500-year flood event dictates a pressure scour analysis for these events only. Local scour calculations for the pier are also developed.

An assumed D_{50} value of 50.88 mm, based on visual inspection, was used for the analysis. Streambed is varied between coarse sand to gravel to small boulders. For this reason, a 2" D50 classification was selected, conservatively. Analysis of the critical velocities indicate clear water scour is anticipated for the overbank (abutment) areas and live-bed scour for the channel area based on the assumed D50 for each flow event. A summary of computed potential scour depth is presented in the following table.

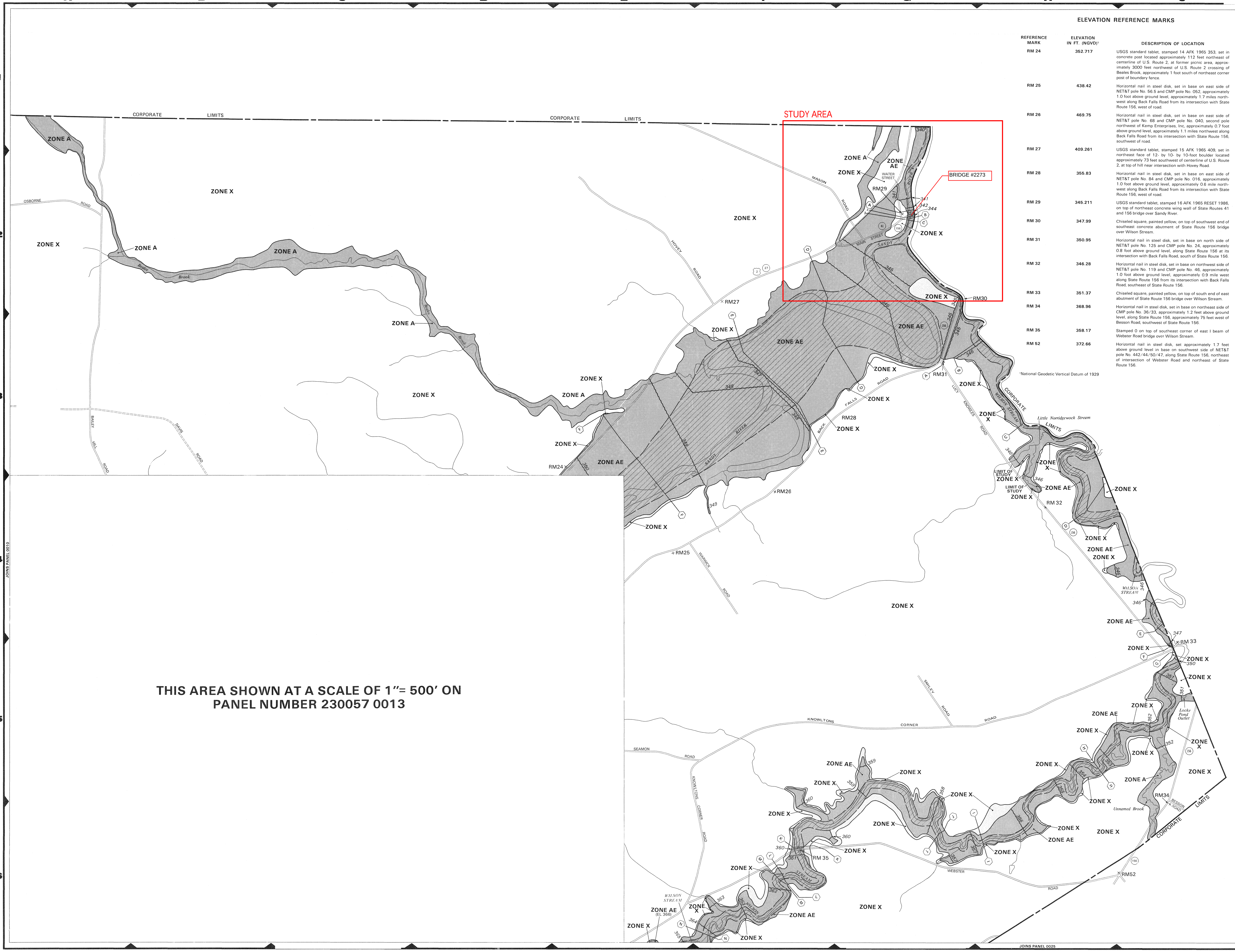
Summary of Contraction/Pressure Scour Potential

Sandy River			
Return Period	Contraction Only (ft.)	Pressure (ft.)	Local Pier Scour (ft.)
10-yr	0	0	7.9
25-yr	0	0	8.4
50-yr	0	2.3	8.6
100-yr	0	4.2	8.9
500-yr	0	8.5	9.5

References: Excerpts from the "Flood of April 1987 in Maine" report prepared by the United States Geological Survey are contained within Appendix E.

Appendix E

Hydraulics Data



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 24	352.717	USGS standard tablet, stamped 14 AFK 1965 353, set in concrete post located approximately 112 feet northeast of centerline of U.S. Route 2, at former picnic area, approximately 3000 feet northwest of U.S. Route 2 crossing of Beales Brook, approximately 1 foot south of northeast corner post of boundary fence.
RM 25	438.42	Horizontal nail in steel disk, set in base on east side of NET&T pole No. 56.5 and CMP pole No. 052, approximately 1.0 foot above ground level, approximately 1.7 miles northwest along Back Falls Road from its intersection with State Route 156, west of road.
RM 26	469.75	Horizontal nail in steel disk, set in base on east side of NET&T pole No. 68 and CMP pole No. 040, second pole northwest of Kemp Enterprises, Inc, approximately 0.7 foot above ground level, approximately 1.1 miles northwest along Back Falls Road from its intersection with State Route 156, southwest of road.
RM 27	409.261	USGS standard tablet, stamped 15 AFK 1965 409, set in northeast face of 12- by 10- by 10-foot boulder located approximately 73 feet southwest of centerline of U.S. Route 2, at top of hill near intersection with Hovey Road.
RM 28	355.83	Horizontal nail in steel disk, set in base on east side of NET&T pole No. 84 and CMP pole No. 016, approximately 1.0 foot above ground level, approximately 0.6 mile northwest along Back Falls Road from its intersection with State Route 156, west of road.
RM 29	345.211	USGS standard tablet, stamped 16 AFK 1965 RESET 1986, on top of northeast concrete wing wall of State Routes 41 and 156 bridge over Sandy River.
RM 30	347.99	Chiseled square, painted yellow, on top of southwest end of southeast concrete abutment of State Route 156 bridge over Wilson Stream.
RM 31	350.95	Horizontal nail in steel disk, set in base on north side of NET&T pole No. 125 and CMP pole No. 24, approximately 0.8 foot above ground level, along State Route 156 at its intersection with Back Falls Road, south of State Route 156.
RM 32	346.28	Horizontal nail in steel disk, set in base on northwest side of NET&T pole No. 119 and CMP pole No. 46, approximately 1.0 foot above ground level, approximately 0.9 mile west along State Route 156 from its intersection with Back Falls Road, southeast of State Route 156.
RM 33	351.37	Chiseled square, painted yellow, on top of south end of east abutment of State Route 156 bridge over Wilson Stream.
RM 34	368.96	Horizontal nail in steel disk, set in base on northeast side of CMP pole No. 36/33, approximately 1.2 feet above ground level, along State Route 156, approximately 75 feet west of Besson Road, southwest of State Route 156.
RM 35	358.17	Stamped 0 on top of southeast corner of east I beam of Webster Road bridge over Wilson Stream.
RM 52	372.66	Horizontal nail in steel disk, set approximately 1.7 feet above ground level in base on southwest side of NET&T pole No. 442/44/50/47, along State Route 156, northeast of intersection of Webster Road and northeast of State Route 156.

[1]National Geodetic Vertical Datum of 1929

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding; velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 — Identified 1990 or later — Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- D—D — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*
- $RM 7_x$ — Elevation Reference Mark
- •M1.5 — River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index.

MAP REPOSITORY
Municipal Building, 147 Lower Main Street, Farmington, Maine 04938
(Maps available for reference only, not for distribution.)

INITIAL IDENTIFICATION:
SEPTEMBER 6, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:
JULY 2, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
MAY 19, 1981

FLOOD INSURANCE RATE MAP REVISIONS:
July 3, 1995 - to change base flood elevations, to add base flood elevations, to change special flood hazard areas, to change zone designations, and to update map format.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE
1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

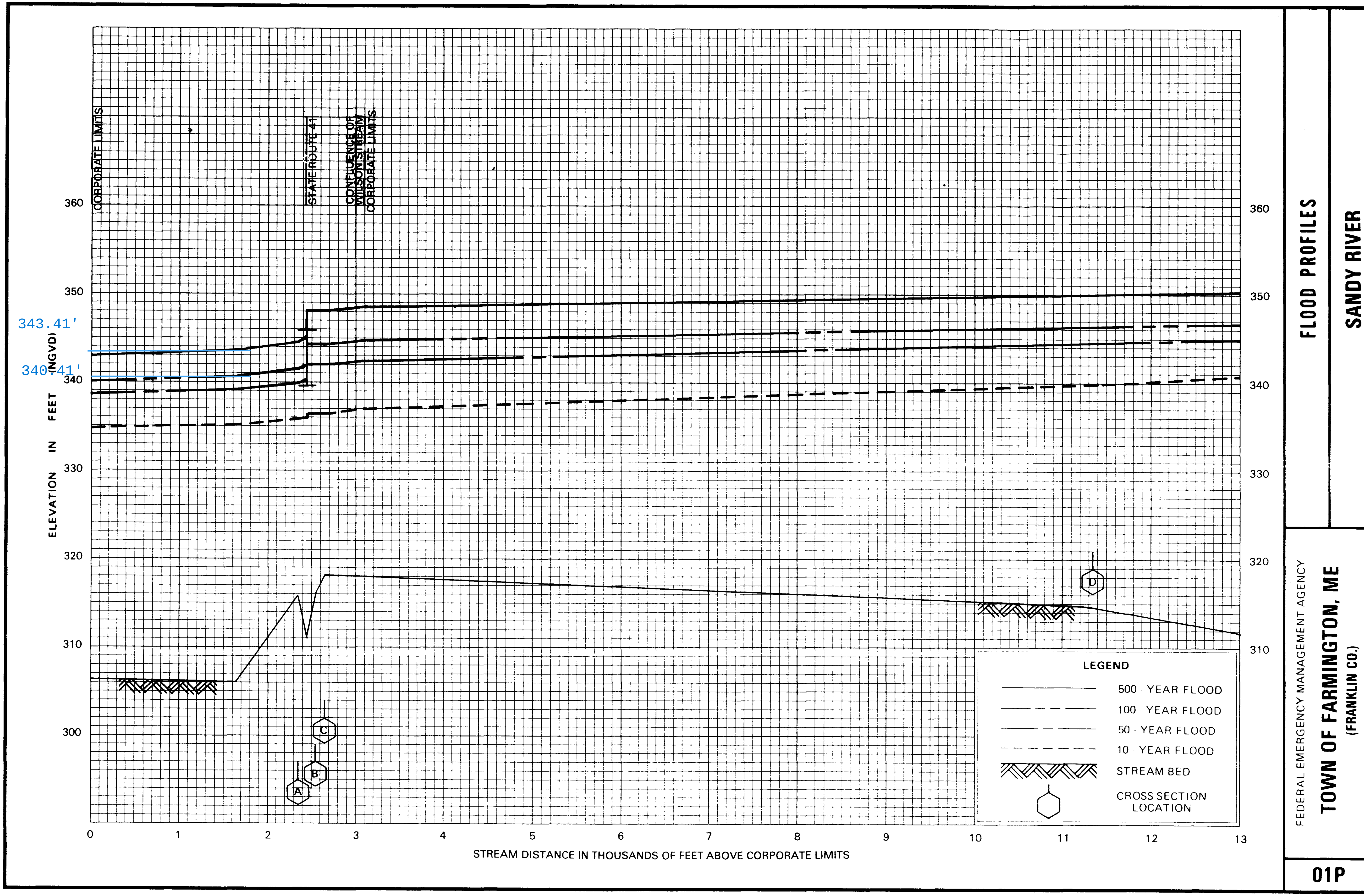
TOWN OF
FARMINGTON, MAINE
FRANKLIN COUNTY

PANEL 15 OF 25
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
230057 0015 C

MAP REVISED:
JULY 3, 1995

Federal Emergency Management Agency



HEC-RAS DOWNSTREAM BOUNDARY CONDITION FOR 100-YR AND 500-YR EVENTS

Environmental Office – Hydrology Section
16 State House Station
Augusta ME 04333-0016
207.557.1052
Charles.Hebson@maine.gov

Maine Department of Transportation

Memo

To: Joe Stilwell

From: Charles Hebson

CC:

Date: 2018 February 13

Re: 22296 Farmington Falls Hydrology

The final recommended design hydrology is summarized in Table 1 and Figure 1 (dotted line) below.

Table 1. Design Hydrology Summary

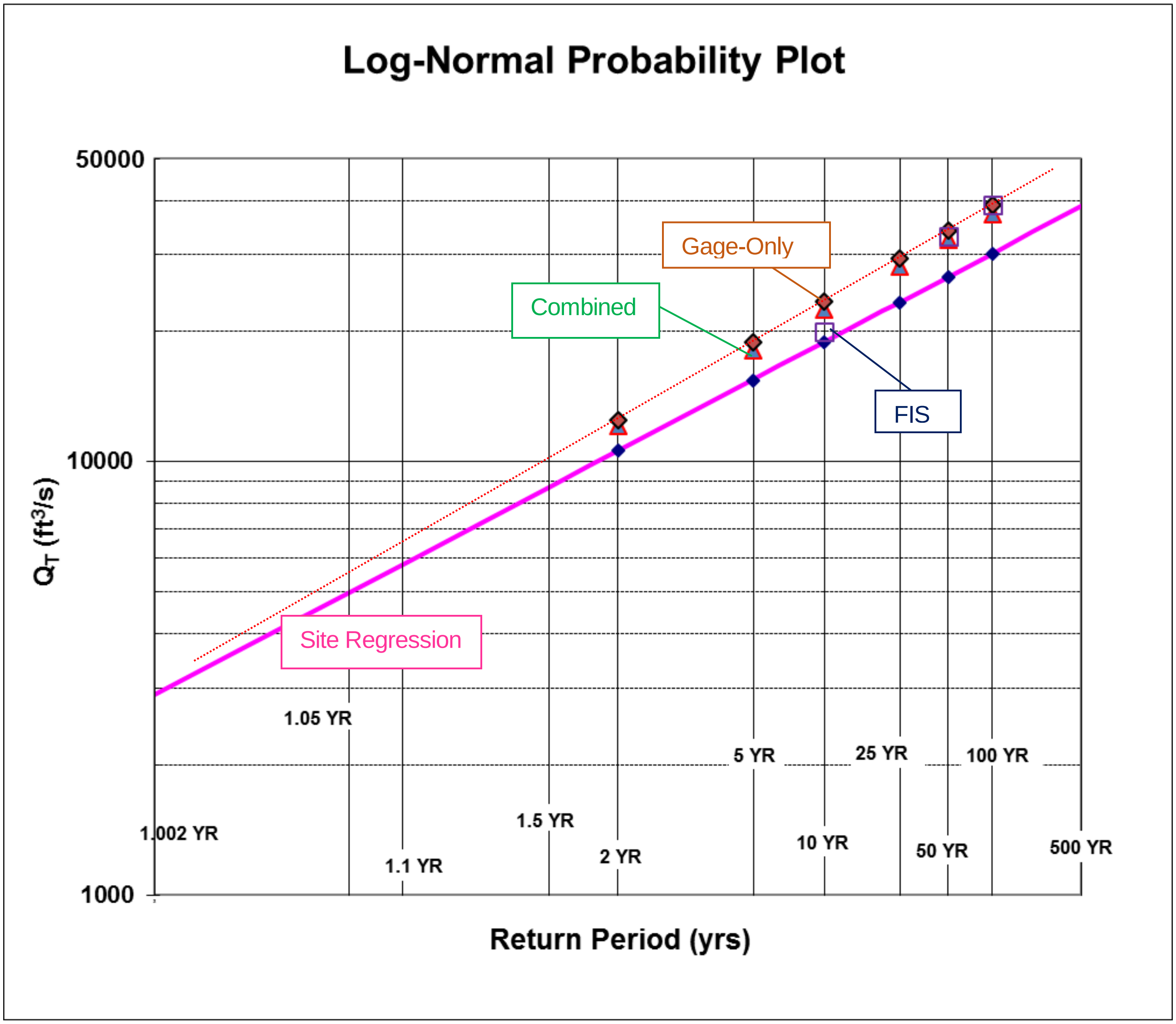
Area			425.2	517.4			418.2	
NWI (%)			5.02	6.73				
Wt / Scale			0.217	0.783	0.822			
Return Period T	**Ex Prob P_{ex}**	**Area exp a***	**Site Regr Q_r**	**USGS gage Q_g 17B Est.**	**Gage – Area-scaled Q_u**	**Gage-Regr Comb Q_{uf}**	**FEMA FIS**	***Final Recommendation***
1.005	0.995	0.860		3646				
1.01	0.990	0.860		4878				***4 150***
1.05	0.952	0.856						
1.1	0.909	0.852	5800					***6 700***
1.5	0.667	0.836						
2	0.500	0.825	10600		12500	12090		***12 500***
5	0.200	0.797	15425	22040	18850	18105		***18 850***
10	0.100	0.783	18890	27270	23385	22410	20000	***23 400***
25	0.040	0.767	23300	34260	29475	28135		
50	0.020	0.757	26680	39720	34235	32600	33100	***34 250***
100	0.010	0.748	30200	45390	39190	37240	39200	***39 200***
500	0.002	0.729	38815	59540	51600	48830	53300	***53 300***
Max of Record				51100	44290			***44 290***

Notes: USGS Gage #01048000, Sandy River near Mercer, Maine; max of record in 1987.

FIS estimates for ME41 at Sandy River

Note: No value recommended for 25-yr. As such, 29,500 cfs was used for evaluation.

Figure 1. Probability Plot showing various estimates.



Discussion

MaineDOT design hydrology for larger structures is ordinarily calculated with statewide peak flow regression equations (Hodgkins, 1999). When the structure is on a gaged river, the regression and gage estimates are combined according to Hodgkins (1999). For long gage record lengths and for gages near the project site, the site regression estimates have relatively little effect on the final site estimates; the final site estimates mostly reflect area-weighted adjustments of the gage values.

Farmington Falls Bridge is located on the Sandy River, connecting Chesterville and Farmington via ME41. The watershed map is shown in Figure 2 as well as in Appendix B. The watershed area at the bridge (A_u) is 425.2 mi^2 with 5.02% wetlands as determined by StreamStats (U.S. Geological Survey, 2012).

For this project, there is a gage (#01048000) on the Sandy River approximately 13.7 miles downstream of Farmington Falls, in Mercer just upstream of Farrand Island. The project watershed is 0.822 times the gage watershed area A_g (517 mi^2). Furthermore, the gage record length is 81 years, 1929 thru 2016. Thus we can expect the project design hydrology to be just a bit smaller than the gage data, with the gage estimates dominating the calculation of the final estimates.

The standard site regression equations Q_r are of the form

$$Q_r = cA^a 10^{wW}$$

where the parameters c, a, and w vary according to return period (Hodgkins, 1999, Table 3); A is watershed area and W is the percentage of watershed area that is mapped as NWI wetlands. The site regression estimates are listed in Table 1 and shown graphically in Figure 1. The regression report is given in Appendix B, along with daily average flow frequency information.

Regression estimates and gage data are combined as an area- weighted average of the regression estimates and area-scaled gage estimates:

$$Q_{uf} = W_r Q_r + (1-W_r) Q_u$$

where $W_r = (A_u/A_g) - 1$ when $A_u > A_g$; $= (A_g/A_u) - 1$ when $A_u < A_g$ (W_r = area weight = 0.053 here)

$$Q_u = Q_g (A_u/A_g)^{a^*}$$

where a^* = exponent similar to “a” above but for simple area-only regression; see Table 1 and Figure 3.

Q_u = estimate at project location, based only on area-scaling of gage data

Q_{uf} = weighted (combined) estimate for return period flow at ungaged project location

The gage data were analyzed using the USGS program PeakFQ (Flynn et al, 2006); results are shown in Figures 4 and 5 and Appendix 1. Strictly speaking, Q_g is calculated as the record-length weighted average of the data Q_g and regression Q_{rg} estimates at the gage. Furthermore, Qg may be calculated as either the simple “systematic record” value by plotting position or the Bulletin 17B LP-III estimate from the gage record (using the statewide skew, Hodgkins, 1999, p. 1). The LP-III estimates were selected for this analysis; both sets are included in Appendix A. For the Mercer gage, the record is so long (81 years) that regression estimates at the gage add little or nothing to estimates based on gage data alone; therefore the gage estimates were from the record alone.

The area-scaled gage values (Q_u) are slightly large than the combined estimate (Q_{uf}). For example, for Q100 the gage-only estimate is 39,190 while the gage-regression combined estimate is 37,240; the regression-only estimate is 30,200, significantly less than the gage-based estimates. There is also a FEMA Flood Insurance Study (FIS) available for Farmington (rev. 1995 July 03), with peak flow estimates at the project location and reported in Table 1 above. The values are close to, and for Q50 and Q100, slightly larger than the gage-only estimates. For consistency with the FIS, it is recommended that the design hydrology be assembled using the larger of the gage-only and FIS values. This set of recommended values is given in Table 1.

Figure 2. Watershed – Sandy River at ME41, Farmington Falls

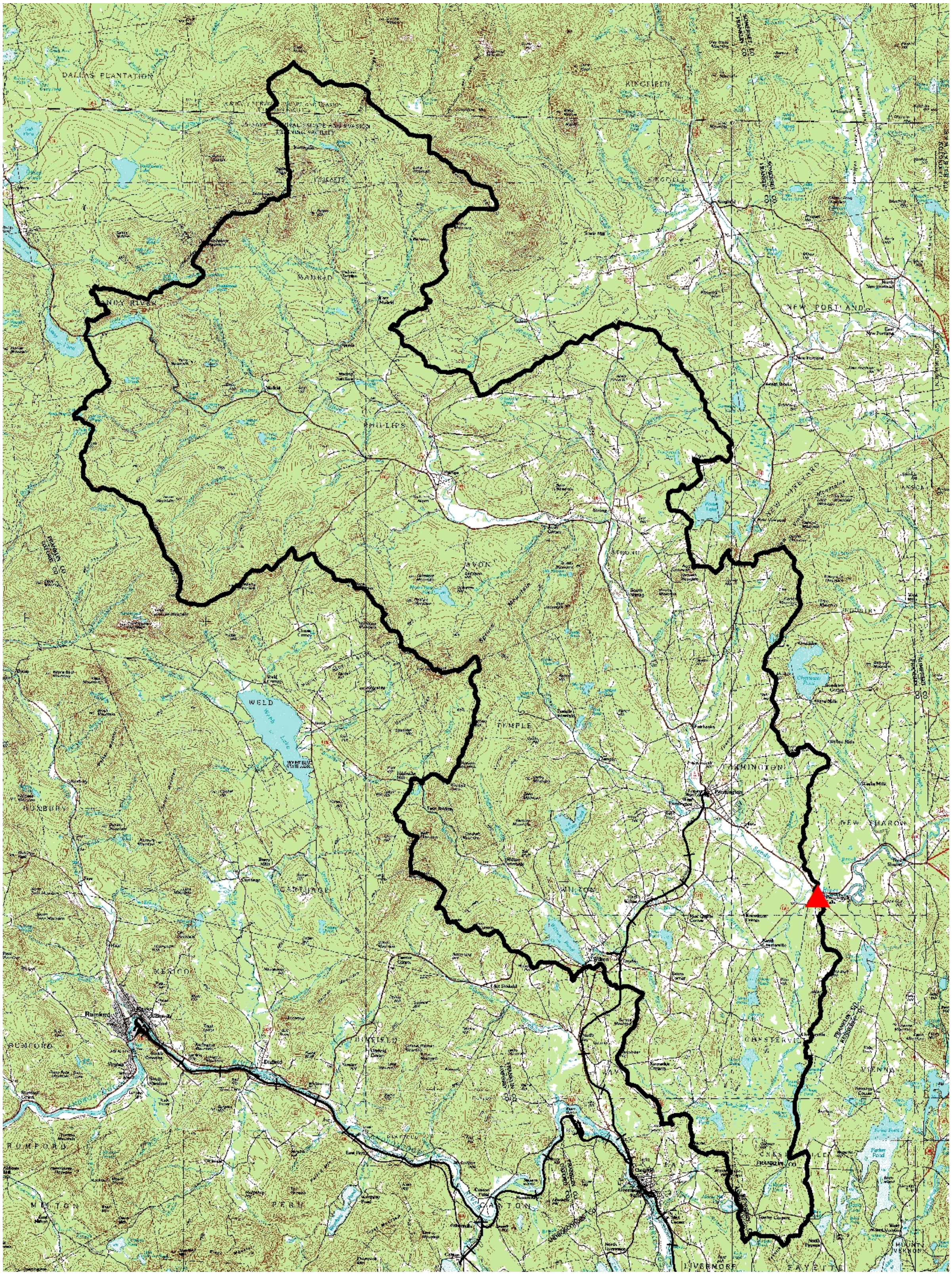


Figure 3. Area Exponent "a" for Watershed Area Scaling of Gage Peak Flow Estimates

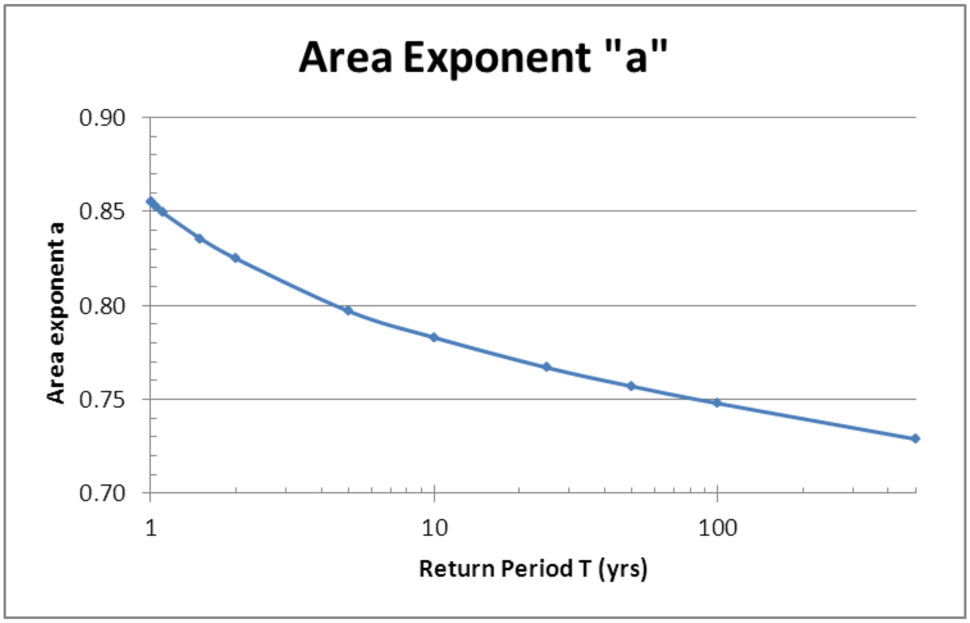


Figure 4. Annual maximum flows at Sandy River (Mercer) gage.

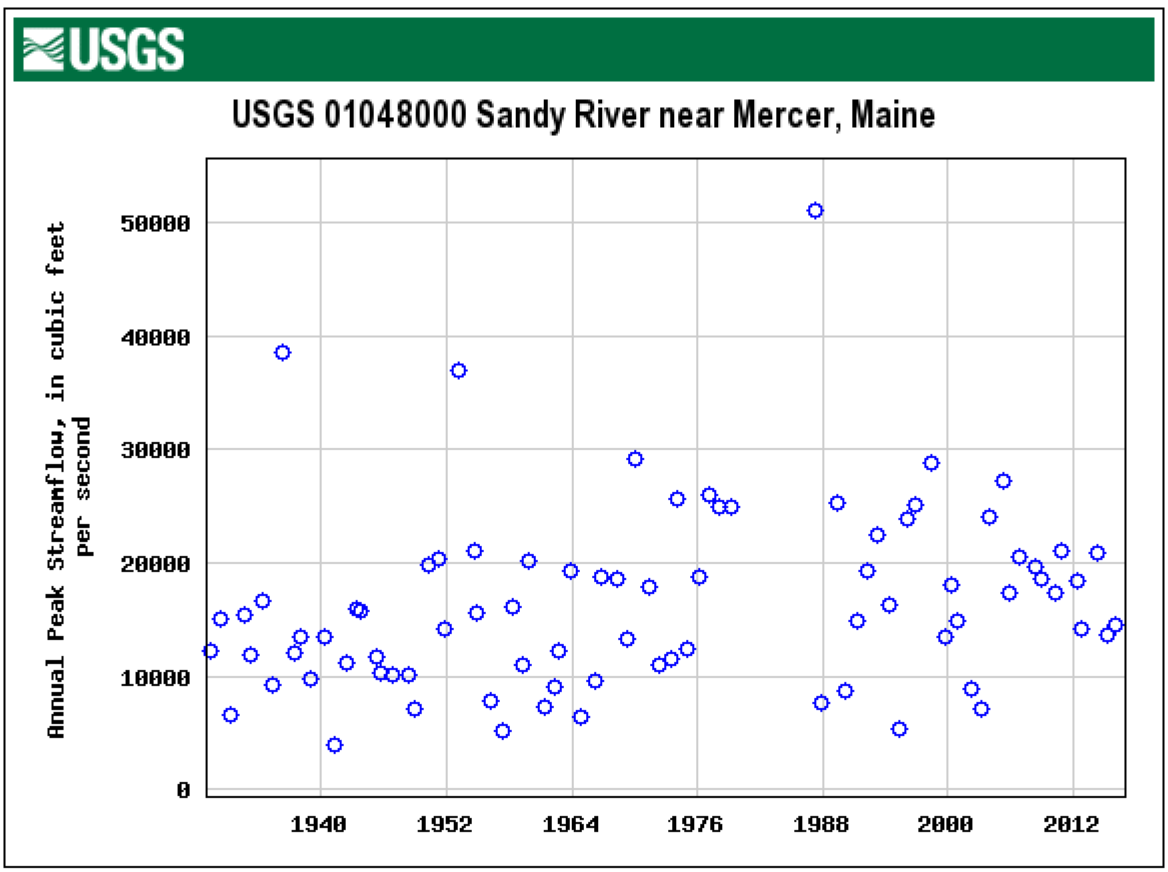
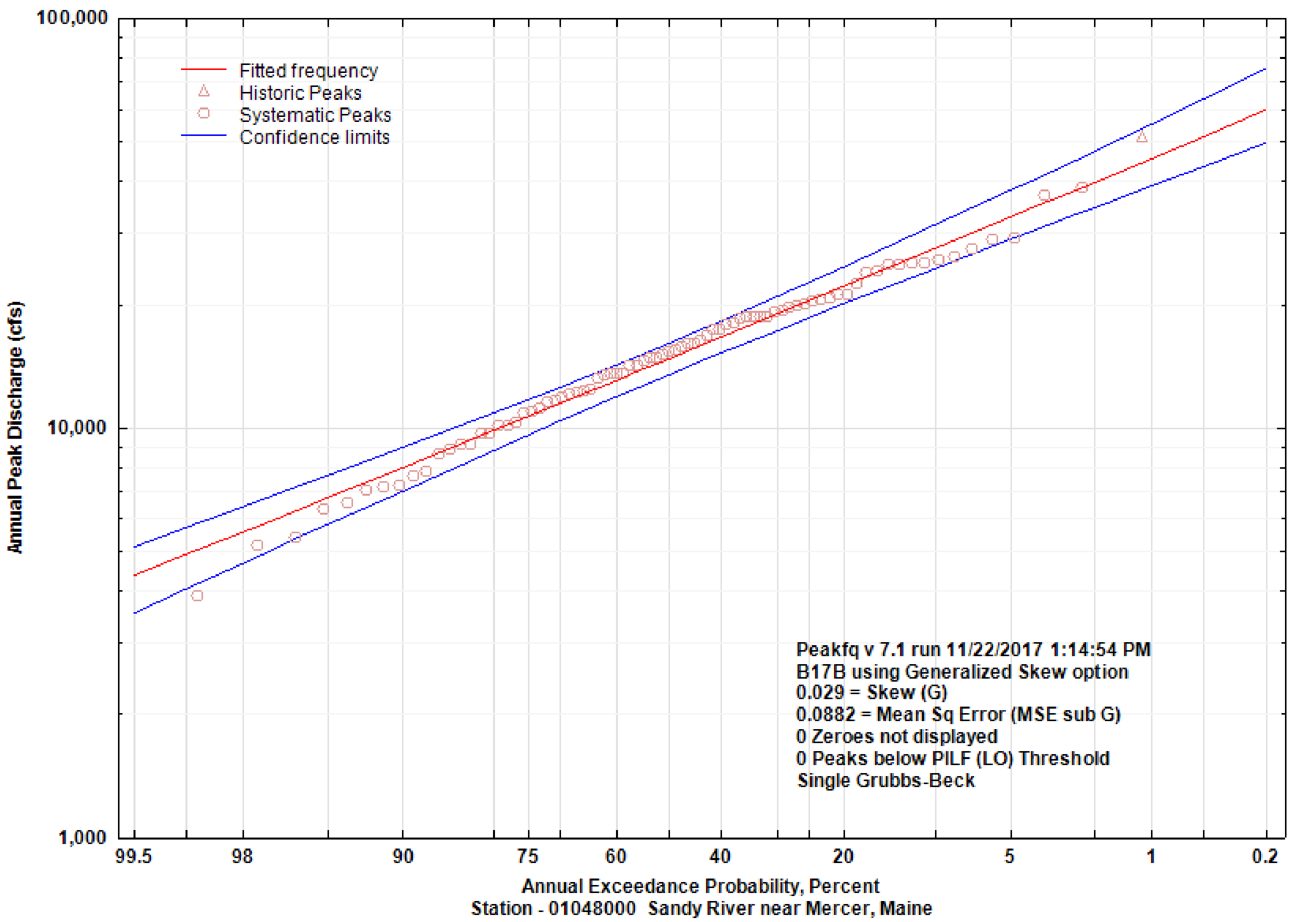


Figure 5. Results of gage peak flow analysis from PeakFQ, Sandy River (Mercer) gage.



References:

Hodgkins, 1999. Estimating the Magnitude of Peak Flows for Stream in Maine for Selected Recurrence Intervals, US Geological Survey, *WRIR 99-4408*.

Flynn, K., W.H. Kirby, & P.R. Hummel, 2006. User's Manual for Program PeakFQ, Annual Flood Frequency Analysis Using Bulletin 17B Guidelines. US Geological Survey, *Techniques & Methods 4-B4*.

U.S. Geological Survey, 2012. The StreamStats program, online at https://streamstatsags.cr.usgs.gov/streamstats/

Appendix A:

Edited Output for Sandy River (Mercer) Gage

**edited for formatting purposes*

[this page intentionally left blank]

```
  Program PeakFq          U. S. GEOLOGICAL SURVEY          Seq.002.000
Version 7.1        Annual peak flow frequency analysis      Run Date / Time
  3/14/2014                                                  11/22/2017 13:14

                         --- PROCESSING OPTIONS ---

                      Plot option         = Graphics device
                      Basin char output   = None
                      Print option        = Yes
                      Debug print         = No
                      Input peaks listing = Long
                      Input peaks format  = WATSTORE peak file

                      Input files used:
                         peaks (ascii)  -
C:\ProgFils\PeakFQ\data\SANDY_R_ANN_MAX.TXT
                         specifications - C:\ProgFils\PeakFQ\data\PKFQWPSF.TMP
                      Output file(s):
                         main - C:\ProgFils\PeakFQ\data\SANDY_R_ANN_MAX.PRT


               Station - 01048000  Sandy River near Mercer, Maine


                     I N P U T   D A T A   S U M M A R Y

                Number of peaks in record            =       81
                Peaks not used in analysis           =        0
                Systematic peaks in analysis         =       80
                Historic peaks in analysis           =        1
                Beginning Year                       =     1929
                Ending Year                          =     2016
                Historical Period Length             =       88
                Generalized skew                     =    0.029
                     Standard error                  =    0.297
                     Mean Square error               =    0.088
                Skew option                          =  GENERALIZED
                Gage base discharge                  =      0.0
                User supplied high outlier threshold =   --
                User supplied PILF (LO) criterion    =   --
                Plotting position parameter          =     0.00
                Type of analysis                       BULL.17B
                PILF (LO) Test Method                      GBT
                Perception Thresholds            =   Not Applicable
                Interval Data                    =   Not Applicable
                Watershed Area                   =   517.4 mi²


  *********  NOTICE  --  Preliminary machine computations.        *********
  *********  User responsible for assessment and interpretation.  *********

    WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.                   0.0
    WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.           3720.1
    WCF156I-17B HI-OUTLIER TEST SUPERSEDED BY MIN HIST PK           56673.9
    WCF165I-HIGH OUTLIERS AND HISTORIC PEAKS ABOVE HHBASE.  0  1    51100.0
   *WCF151I-17B WEIGHTED SKEW REPLACED BY USER OPTION.    -0.132     0.029
```

Kendall's Tau Parameters

	TAU	P-VALUE	MEDIAN SLOPE	No. of PEAKS
SYSTEMATIC RECORD	0.199	0.009	82.762	80

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	4.1620	0.2012	-0.437
BULL.17B ESTIMATE	0.0	1.0000	4.1682	0.2082	0.029

BULL.17B ESTIMATE OF MSE OF AT-SITE SKEW 0.0740

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

			<-- FOR BULLETIN 17B ESTIMATES -->		
ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	VARIANCE OF EST.	95% CONFIDENCE INTERVALS LOWER	UPPER
0.9950	4340.	3646.	----	3530.0	5115.0
0.9900	4878.	4271.	----	4029.0	5683.0
0.9500	6721.	6427.	----	5779.0	7605.0
0.9000	7980.	7881.	----	6997.0	8908.0
0.8000	9832.	9962.	----	8799.0	10830.0
0.6667	11960.	12250.	----	10850.0	13080.0
0.5000	14700.	15020.	----	13440.0	16060.0
0.4292	16010.	16280.	----	14660.0	17540.0
0.2000	22040.	21580.	----	20000.0	24620.0
0.1000	27270.	25620.	----	24420.0	31110.0
0.0400	34260.	30350.	----	30120.0	40120.0
0.0200	39720.	33620.	----	34460.0	47390.0
0.0100	45390.	36690.	----	38890.0	55110.0
0.0050	51310.	39600.	----	43430.0	63310.0
0.0020	59540.	43240.	----	49640.0	74970.0

Program PeakFq
Version 7.1
3/14/2014

U. S. GEOLOGICAL SURVEY
Annual peak flow frequency analysis

Seq.001.003
Run Date / Time
11/22/2017 13:14

Station - 01048000 Sandy River near Mercer, Maine

I N P U T D A T A L I S T I N G

Water Yr	**Peak Val**	**Water Yr**	**Peak Val**	**Water Yr**	**Peak Val**	**Water Yr**	**Peak Val**
1929	12200	1949	7160	1969	13200	1996	23900
1930	15100	1950	19900	1970	29100	1997	25200
1931	6550	1951	20400	1971	17900	1998	28800
1932	15400	1952	14200	1972	11000	1999	13500
1933	11900	1953	36900	1973	11600	2000	18000
1934	16700	1954	21100	1974	25600	2001	14800
1935	9130	1955	15500	1975	12400	2002	8820
1936	38600	1956	7840	1976	18700	2003	7050
1937	12100	1957	5180	1977	26000	2004	24100
1938	13400	1958	16100	1978	25000	2005	27300
1939	9710	1959	10900	1979	24900	2006	17300
1940	13500	1960	20100	**1987**	**51100**	2007	20600
1941	3880	1961	7240	1988	7590	2008	19600
1942	11200	1962	9070	1989	25300	2009	18600
1943	16000	1963	12300	1990	8630	2010	17400
1944	15700	1964	19200	1991	14800	2011	21100
1945	11700	1965	6330	1992	19300	2012	18400
1946	10300	1966	9640	1993	22500	2013	14200
1947	10100	1967	18700	1994	16300	2014	20800
1948	10100	1968	18600	1995	5410	2015	13600
						2016	14600

End PeakFQ analysis.
Stations processed : 1
Number of errors : 0
Stations skipped : 0
Station years : 81

For the station below, the following records were ignored:

FINISHED PROCESSING STATION: 01048000 USGS Sandy River near Mercer, Maine

For the station below, the following records were ignored: *none*

FINISHED PROCESSING STATION:

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YR	Ranked Discharge	Systematic Record	17B Est	WATER YR	Ranked Discharge	Systematic Record	17B Est
1987	51100	--	0.0112	1932	15400	0.4938	0.4995
1936	38600	0.0123	0.023	1930	15100	0.5062	0.5117
1953	36900	0.0247	0.0352	1991	14800	0.5185	0.5239
1970	29100	0.037	0.0474	2001	14800	0.5309	0.5362
1998	28800	0.0494	0.0596	2016	14600	0.5432	0.5484
2005	27300	0.0617	0.0718	1952	14200	0.5556	0.5606
1977	26000	0.0741	0.0841	2013	14200	0.5679	0.5728
1974	25600	0.0864	0.0963	2015	13600	0.5802	0.585
1989	25300	0.0988	0.1085	1940	13500	0.5926	0.5973
1997	25200	0.1111	0.1207	1999	13500	0.6049	0.6095
1978	25000	0.1235	0.1329	1938	13400	0.6173	0.6217
1979	24900	0.1358	0.1452	1969	13200	0.6296	0.6339
2004	24100	0.1481	0.1574	1975	12400	0.642	0.6461
1996	23900	0.1605	0.1696	1963	12300	0.6543	0.6584
1993	22500	0.1728	0.1818	1929	12200	0.6667	0.6706
1954	21100	0.1852	0.194	1937	12100	0.679	0.6828
2011	21100	0.1975	0.2062	1933	11900	0.6914	0.695
2014	20800	0.2099	0.2185	1945	11700	0.7037	0.7072
2007	20600	0.2222	0.2307	1973	11600	0.716	0.7195
1951	20400	0.2346	0.2429	1942	11200	0.7284	0.7317
1960	20100	0.2469	0.2551	1972	11000	0.7407	0.7439
1950	19900	0.2593	0.2673	1959	10900	0.7531	0.7561
2008	19600	0.2716	0.2796	1946	10300	0.7654	0.7683
1992	19300	0.284	0.2918	1947	10100	0.7778	0.7805
1964	19200	0.2963	0.304	1948	10100	0.7901	0.7928
1967	18700	0.3086	0.3162	1939	9710	0.8025	0.805
1976	18700	0.321	0.3284	1966	9640	0.8148	0.8172
1968	18600	0.3333	0.3407	1935	9130	0.8272	0.8294
2009	18600	0.3457	0.3529	1962	9070	0.8395	0.8416
2012	18400	0.358	0.3651	2002	8820	0.8519	0.8539
2000	18000	0.3704	0.3773	1990	8630	0.8642	0.8661
1971	17900	0.3827	0.3895	1956	7840	0.8765	0.8783
2010	17400	0.3951	0.4018	1988	7590	0.8889	0.8905
2006	17300	0.4074	0.414	1961	7240	0.9012	0.9027
1934	16700	0.4198	0.4262	1949	7160	0.9136	0.915
1994	16300	0.4321	0.4384	2003	7050	0.9259	0.9272
1958	16100	0.4444	0.4506	1931	6550	0.9383	0.9394
1943	16000	0.4568	0.4629	1965	6330	0.9506	0.9516
1944	15700	0.4691	0.4751	1995	5410	0.963	0.9638
1955	15500	0.4815	0.4873	1957	5180	0.9753	0.9761
				1941	3880	0.9877	0.9883

Appendix B:

Regression Hydrology Report for Farmington Falls Bridge

[this page intentionally left blank]

WIN:	22296.00		**Project Name:**	Farmington 22296 Farmington Falls
Town:	Farmington		**Stream Name:**	Sandy River
Route No.	Rt 41		**Bridge Name:**	Farmington Falls
Asset ID:	2273		**Analysis by:**	DFB
Lat:	44.6200	**Long:** -70.07477	**Date:**	10/13/2017

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

Enter data in blue cells only!

	km^2	mi^2	ac	*Enter data in [mi^2]*
A	1101.27	425.20	272128.0	Watershed Area *DRNAREA*
W	55.28	21.3	13660.8	Wetlands area (by NWI)
P_c	421949	4978262		watershed centroid (E, N; UTM 19N; meters)
County	Franklin			*choose county from drop-down menu*
pptA	45.6			mean annual precipitation (inches; by look-up)
SG	0.05			sand & gravel aquifer as decimal fraction of watershed A

Worksheet prepared by:
Charles S. Hebson, PE
Environmental Office
Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052
Charles.Hebson@maine.gov

ver. 2017 Jun. 09

A (km^2)	1101.27	**Conf Lvl**	0.67
W (%)	5.02		NWI Wetlands % *STORNWI*

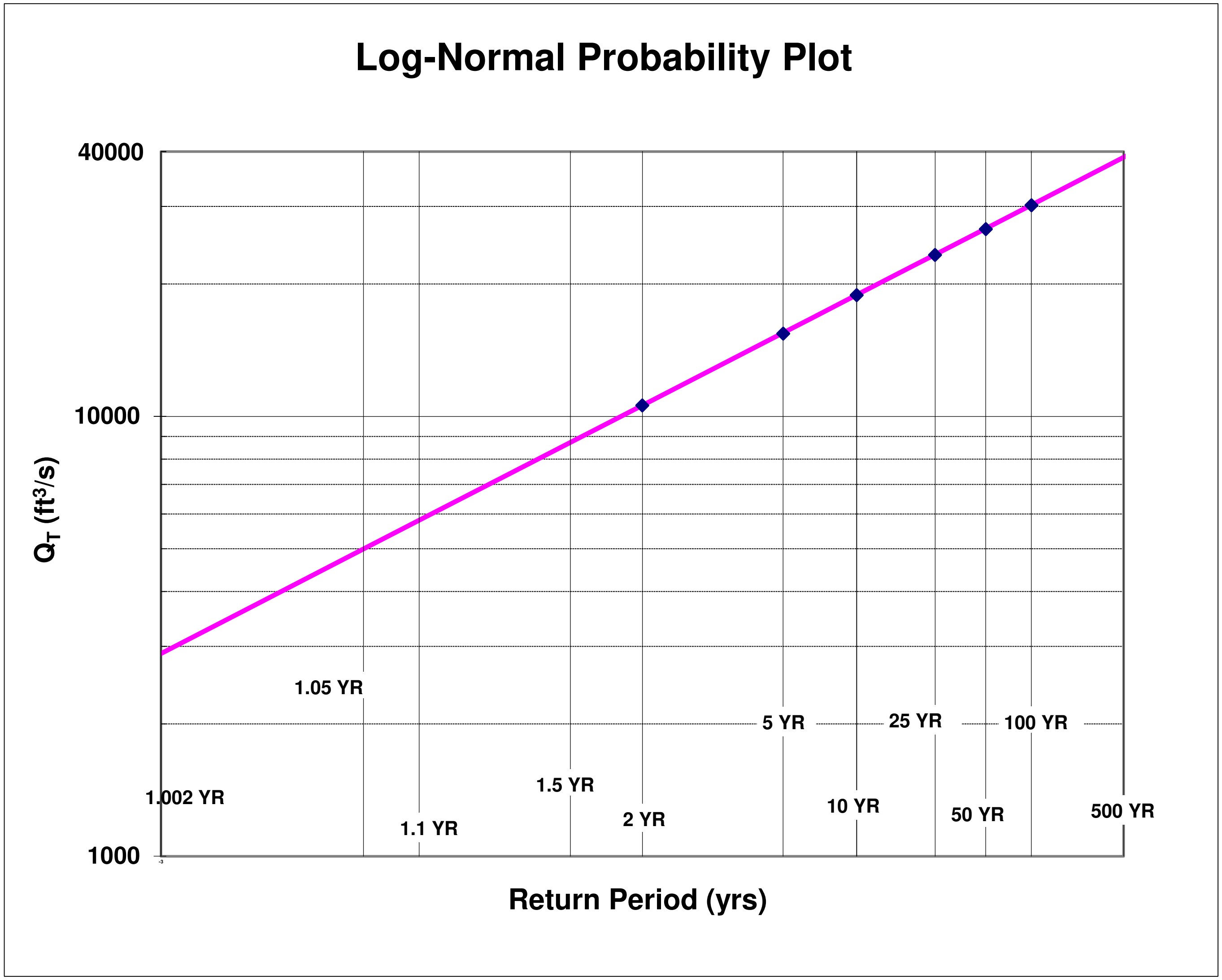
Ret Pd T (yr)	Lower	Peak Flow Estimate Q_T (m^3/s)	Upper	Q_T (ft^3/s)
1.1		164.40		5804.8
2		300.19		10599.8
5		436.77		15422.5
10		534.97		18889.7
25		659.69		23293.8
50		755.57		26679.1
100		855.22		30197.9
500		1099.25		38814.4

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

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
40000
10000
1000
QT (ft3/s)
1.05 YR
5 YR
25 YR
100 YR
1.002 YR
1.5 YR
10 YR
50 YR
500 YR
1.1 YR
2 YR
Return Period (yrs)

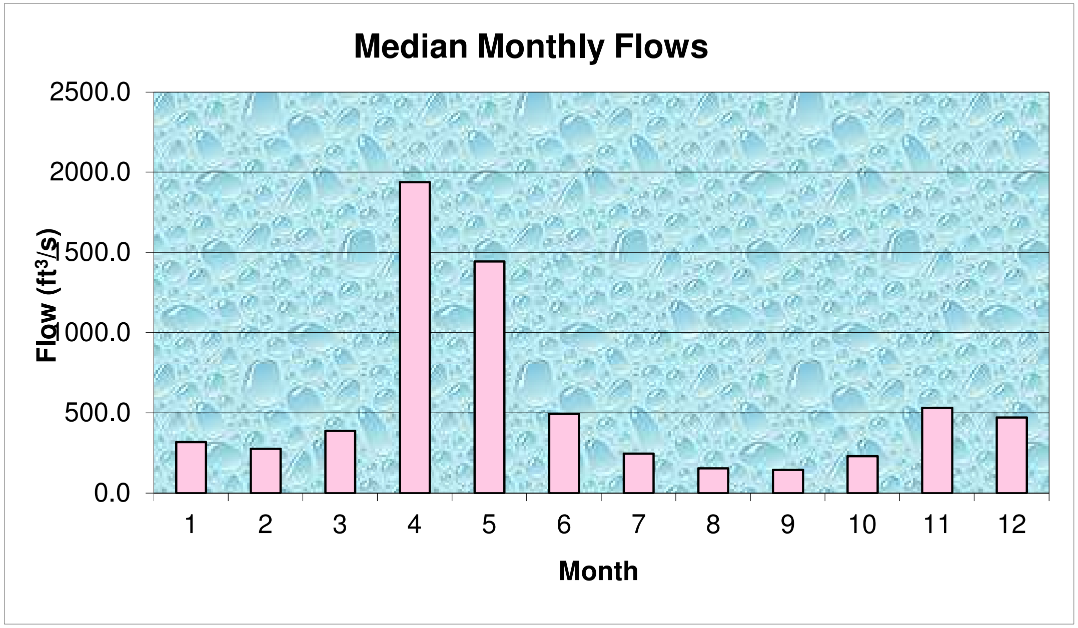
WIN:	22296.00	**Project Name:**	Farmington 22296 Farmington Falls
Town:	Farmington	**Stream Name:**	Sandy River
Route No.	Rt 41	**Bridge Name:**	Farmington Falls
Asset ID:	2273	**Analysis by:**	DFB
Lat:	44.61998 **Long:** -70.07477	**Date:**	10/13/2017

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

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

	Value	**Variable**	**Explanation**
	425.20	*A*	Area (mi^2)
421948.5	4978262	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
	103.59	*DIST*	Distance from Coastal reference line (mi)
	45.6	*pptA*	Mean Annual Precipitation (inches)
	0.05	*SG*	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q_{median} (ft3/s)	(m^3/s)
Jan	**318.96**	9.0389
Feb	**276.96**	7.8488
Mar	**387.79**	10.9893
Apr	**1939.57**	54.9647
May	**1445.28**	40.9573
Jun	**494.38**	14.0101
Jul	**246.28**	6.9793
Aug	**154.44**	4.3765
Sep	**144.86**	4.1050
Oct	**230.96**	6.5449
Nov	**532.33**	15.0854
Dec	**471.98**	13.3752



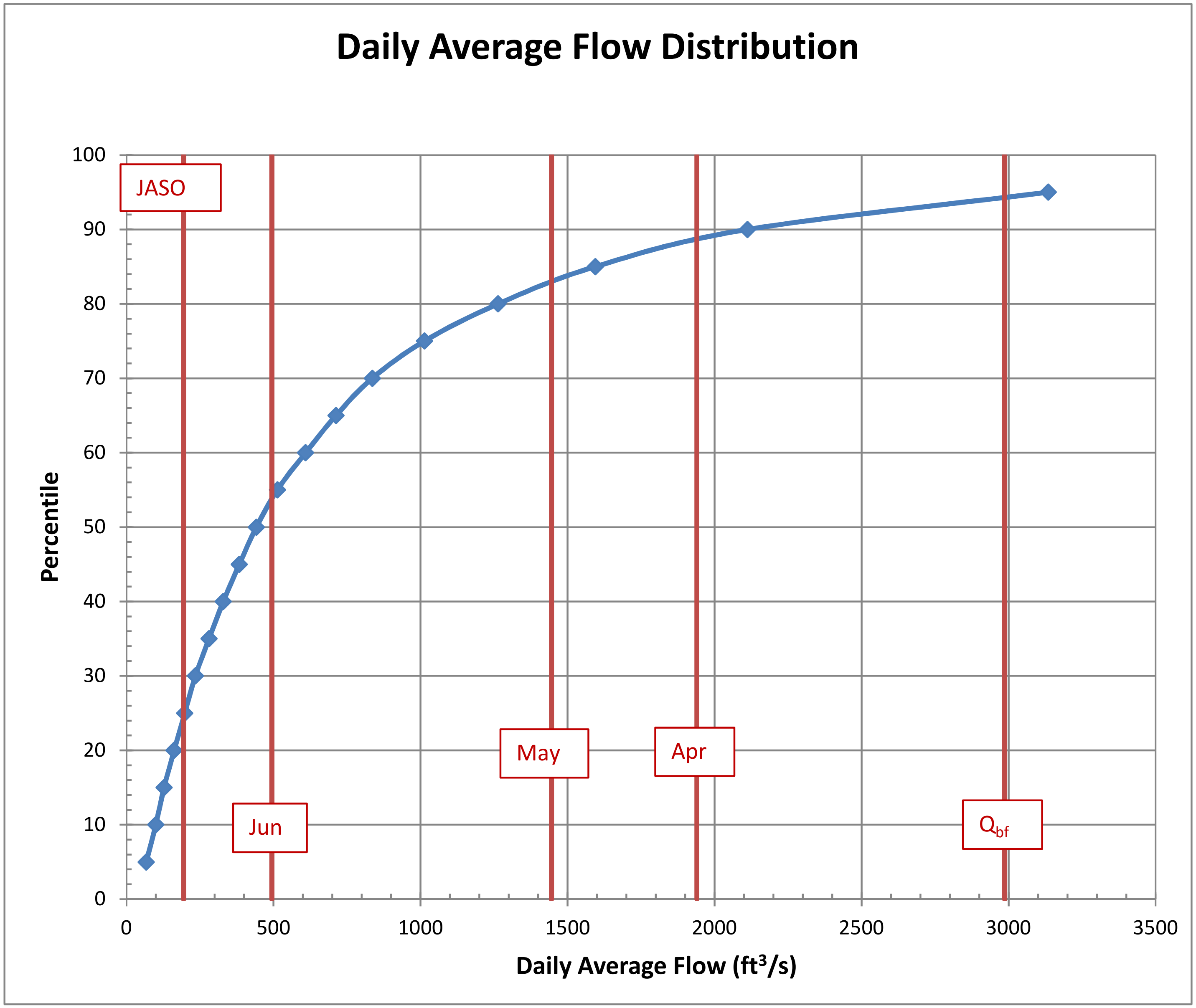
Q_{bf}	**2986.7**	
ann avg	**847.6**	
ann med	**470.5**	
$Q_{1.002}$	**2891.8**	
$Q_{1.01}$	**3703.8**	
$Q_{1.05}$	**4991.7**	
Q_{bf}	**2656.7**	assume v = 4ft/s

W_{bf}	**142.8**	estimated bankfull width (ft)
d_{bf}	**4.7**	estimated bankfull depth (ft)
A_{bf}	**829.1**	estimated bankfull flow area (ft^2)

References

Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 …, USFWS QRP Project

Dudley, R.W., 2004. Estimating Monthly Streamflows … , SIR 2004-5026



Daily Avg Flow Dist

A_{ws} = (mi^2) 425.2

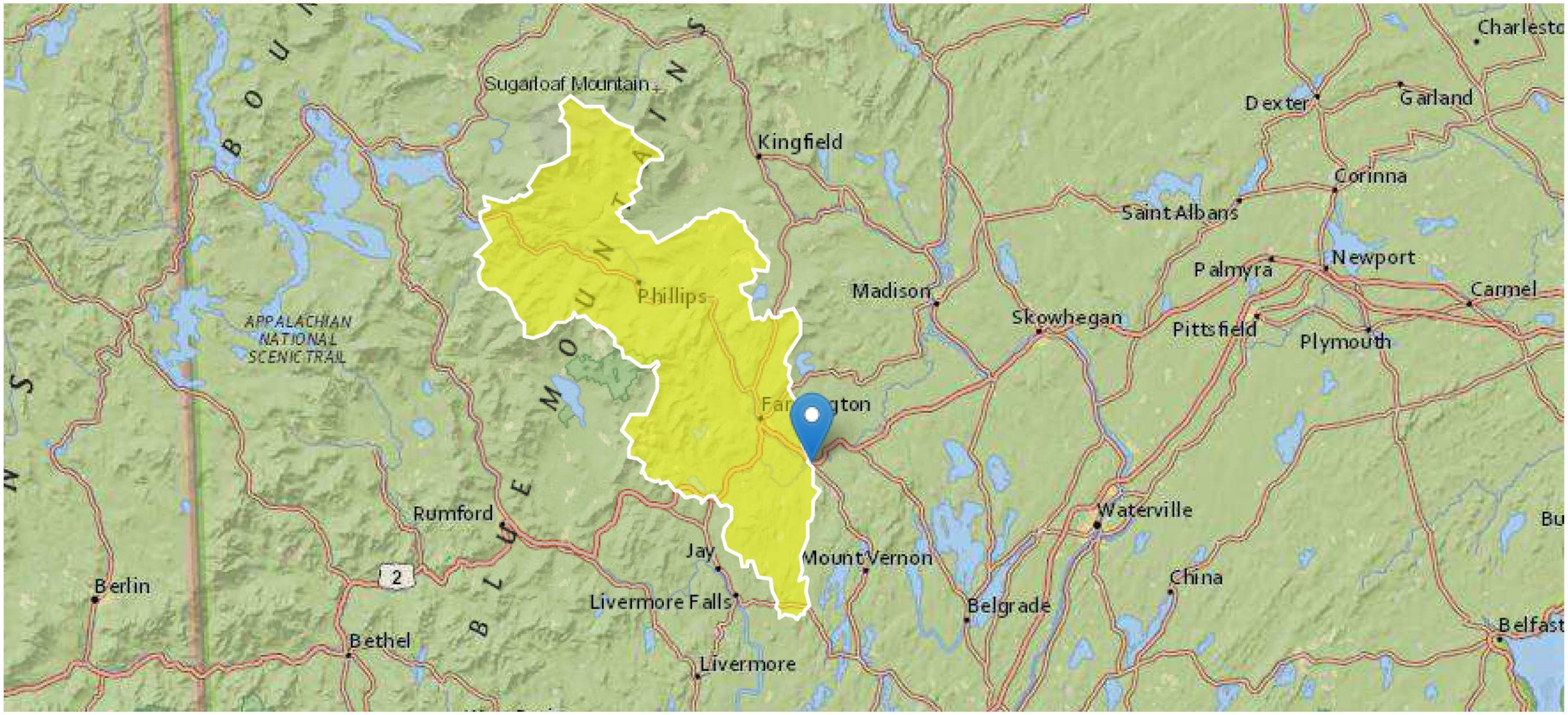
Q (ft^3/s)

Pctl	Median	84th pctl
5	66.93	107.71
10	99.41	149.48
15	127.78	186.65
20	161.83	226.35
25	197.97	265.33
30	234.27	302.19
35	280.66	345.38
40	329.13	397.18
45	383.64	449.09
50	441.68	530.19
55	512.92	617.09
60	609.16	724.38
65	712.66	843.92
70	835.92	984.60
75	1013.36	1184.02
80	1263.78	1413.66
85	1594.61	1811.59
90	2112.31	2432.57
95	3134.88	3782.85

Q_{bf}	2986.7
$Q_{1.002}$	2891.8
$Q_{1.1}$	5804.8
Q_2	10599.8

Farmington 22296 Farmington Falls 2273

Region ID: ME
Workspace ID: ME20171013153748570000
Clicked Point (Latitude, Longitude): 44.61998, -70.07477
Time: 2017-10-13 11:38:08 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	425.2	square miles
STORNWI	Percentage of strorage (combined water bodies and wetlands) from the Nationa Wetlands Inventory	5.02	percent

Parameter Code	Parameter Description	Value	Unit
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0.048	dimensionless
ELEV	Mean Basin Elevation	1103.1	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	13.2	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	397676.2	
CENTROIDY	Basin centroid vertical (y) location in state plane units	4956997.26	
COASTDIST	Shortest distance from the coastline to the basin centroid	101	miles
ELEVMAX	Maximum basin elevation	4131.1	feet
LC06WATER	Percent of open water, class 11, from NLCD 2006	0.98	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	3.96	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.78	percent
PRECIP	Mean Annual Precipitation	47.4	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	4.82	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	6.73	percent

General Disclaimers

The delineation point is in an exclusion area.

Bankfull Statistics Parameters [100 Percent (425 square miles) Central and Coastal Bankfull 2004 5042]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	425.2	square miles	2.92	298

Bankfull Statistics Disclaimers [100 Percent (425 square miles) Central and Coastal Bankfull 2004 5042]

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

Bankfull Statistics Flow Report [100 Percent (425 square miles) Central and Coastal Bankfull 2004 5042]

Statistic	Value	Unit
Bankfull Streamflow	2990	ft^3/s
Bankfull Width	179	ft
Bankfull Depth	4.65	ft
Bankfull Area	829	ft^2

Bankfull Statistics Citations

Dudley, R.W.,2004, Hydraulic-Geometry Relations for Rivers in Coastal and Central Maine: U.S. Geological Survey Scientific Investigations Report 2004-5042, 30 p (http://pubs.usgs.gov/sir/2004/5042/pdf/sir2004-5042.pdf)

Peak-Flow Statistics Parameters [Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	425.2	square miles	0.93	1653
STORNWI	Percentage of Storage from NWI	5.02	percent	0.7	26.7

Peak-Flow Statistics Flow Report [Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

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

Statistic	Value	Unit	PII	Plu	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	10600	ft^3/s	5920	19000	35.1	35.1	1.8
5 Year Peak Flood	15400	ft^3/s	8540	27800	36.1	36.1	2.5
10 Year Peak Flood	18900	ft^3/s	10300	34600	36.8	36.8	3.2
25 Year Peak Flood	23300	ft^3/s	12400	43700	38.6	38.6	4.1
50 Year Peak Flood	26700	ft^3/s	14000	51000	39.9	39.9	4.8
100 Year Peak Flood	30200	ft^3/s	15500	58900	41.2	41.2	5.4
500 Year Peak Flood	38800	ft^3/s	18800	80000	44.9	44.9	6.4

Peak-Flow Statistics Citations

Hodgkins, G. A.,1999, Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals: U.S. Geological Survey Water-Resources Investigations Report 99-4008, 45 p. (http://me.water.usgs.gov/99-4008.pdf)

Low-Flow Statistics Parameters [Statewide LowFlow SIR 2004 5026]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	425.2	square miles	9.79	1418
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.048	dimensionless	0	0.455

Low-Flow Statistics Flow Report [Statewide LowFlow SIR 2004 5026]

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

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
7 Day 10 Year Low Flow	36.9	ft^3/s	44.3	44.3	2.9

Low-Flow Statistics Citations

Dudley, R.W.,2004, Estimating Monthly, Annual, and Low 7-Day, 10-Year Streamflows for Ungaged Rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2004-5026, 22 p. (http://water.usgs.gov/pubs/sir/2004/5026/pdf/sir2004-5026.pdf)

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	425.2	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.048	dimensionless	0	0.212
ELEV	Mean Basin Elevation	1103.1	feet	239	2120

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

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

Statistic	Value	Unit	SEp
1 Percent Duration	54.3	ft^3/s	144
5 Percent Duration	95.6	ft^3/s	62
10 Percent Duration	130	ft^3/s	41

Statistic	Value	Unit	SEp
25 Percent Duration	220	ft^3/s	22
50 Percent Duration	447	ft^3/s	20
75 Percent Duration	1020	ft^3/s	17
90 Percent Duration	2120	ft^3/s	17
95 Percent Duration	3220	ft^3/s	18
99 Percent Duration	6230	ft^3/s	29

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 [Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	425.2	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.048	dimensionless	0	0.212
ELEV	Mean Basin Elevation	1103.1	feet	239	2120

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

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

Statistic	Value	Unit	SEp
Mean Annual Flow	893	ft^3/s	16

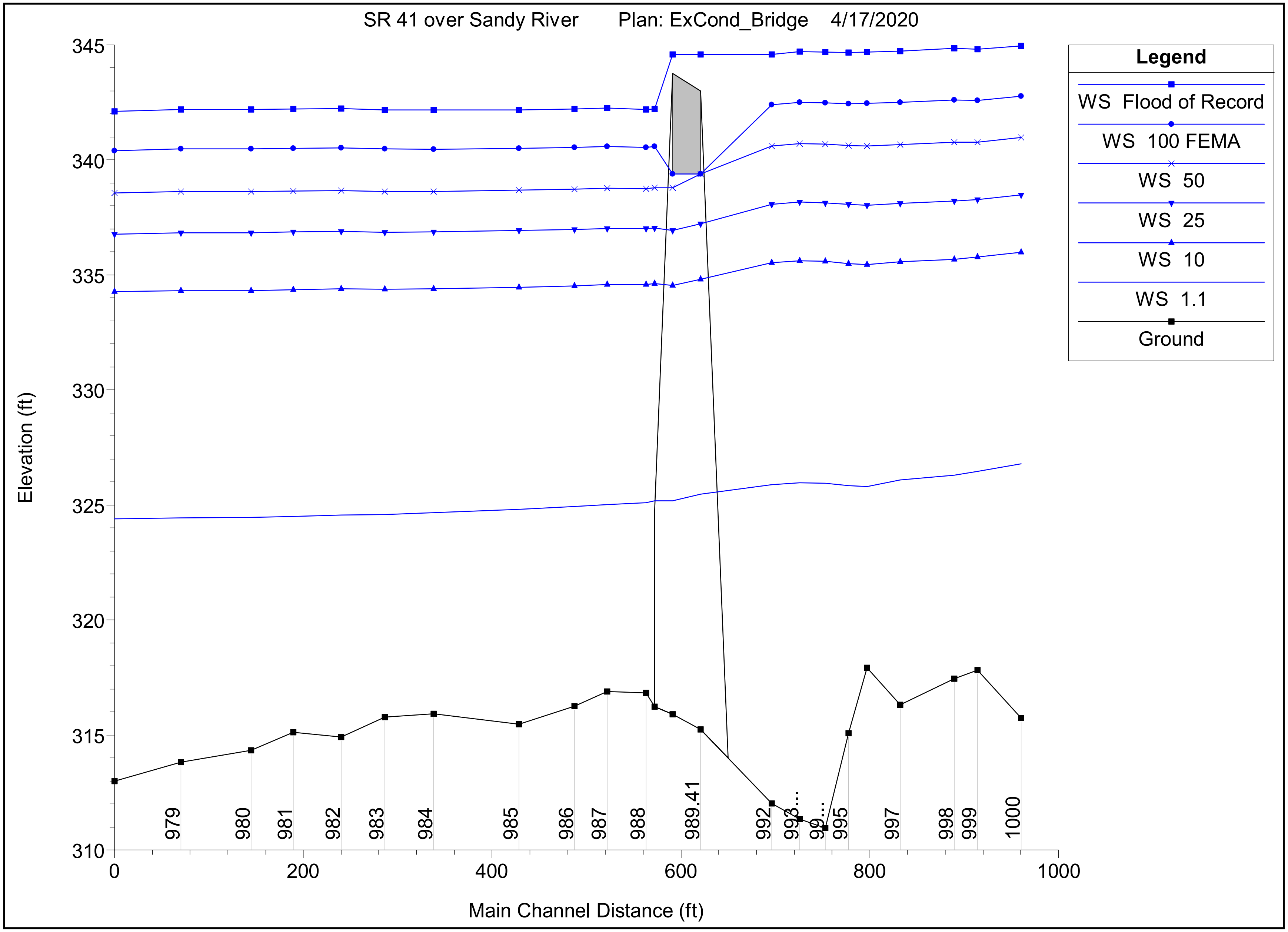
Annual Flow Statistics Citations

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)

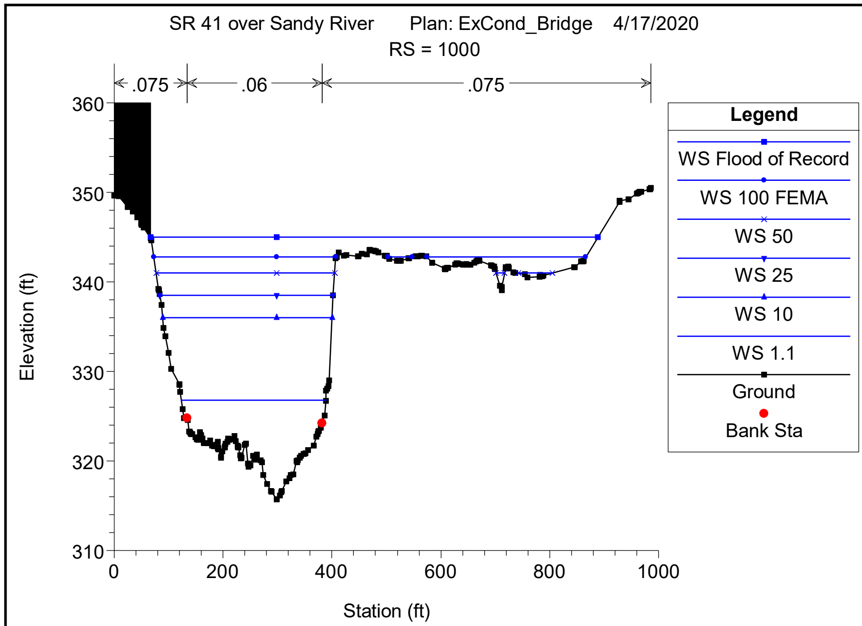
NOTES:
- CROSS SECTION GEOMETRY BEYOND THE LIMIT OF THE FIELD SURVEY WAS OBTAINED FROM MAINE GEOLIBRARY ELEVATION DATA.
- THERE IS MINIMAL TO NO DIFFERENCE IN FLOODPLAIN BOUNDARY BETWEEN EXISTING AND PROPOSED CONDTIONS.

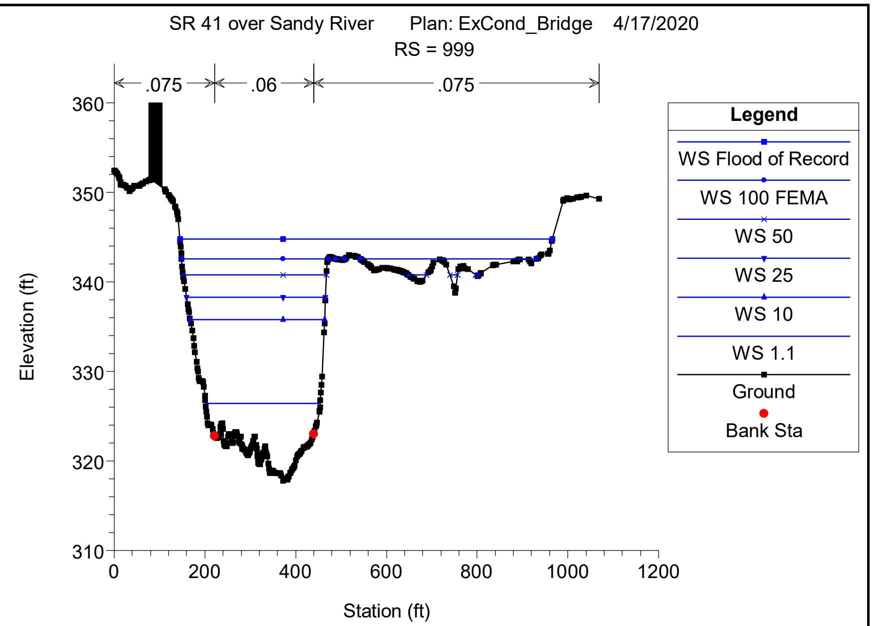
50 YEAR FLOOD MAP

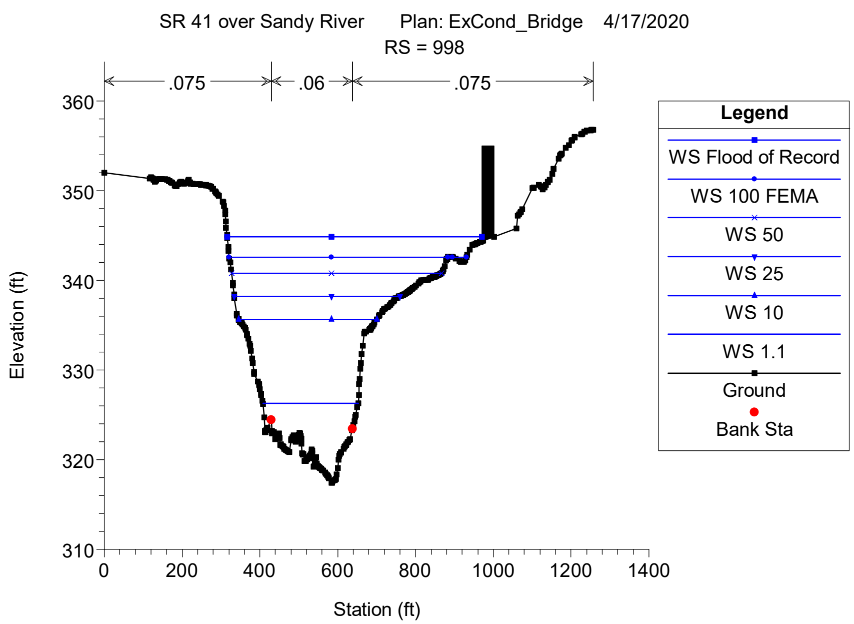
FARMINGTON FALLS BRIDGE NO. 2273
EXISTING AND PROPOSED CONDITION

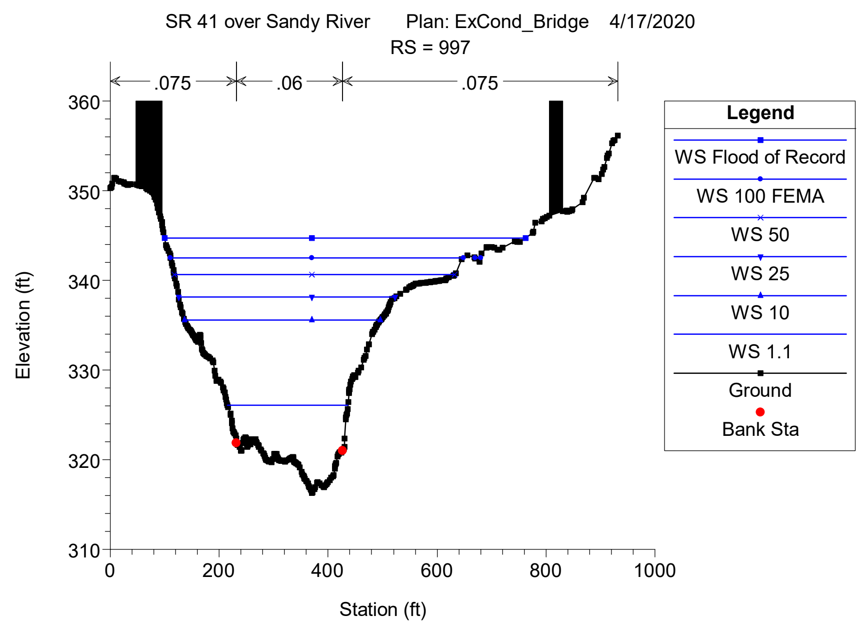


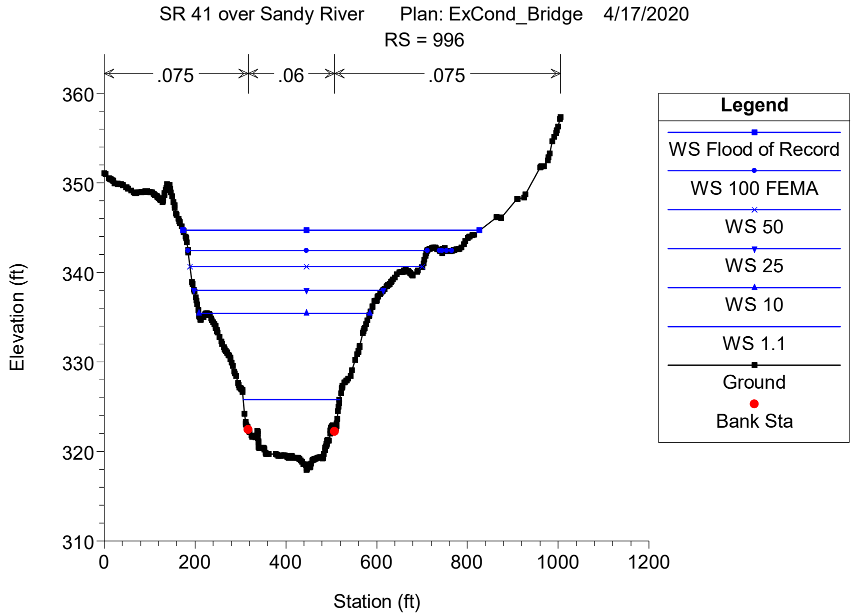
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Elevation (ft)
Main Channel Distance (ft)
345
340
335
330
325
320
315
310
0
200
400
600
800
1000
979
980
981
982
983
984
985
986
987
988
989.41
992
993...
99...
995
997
998
999
1000

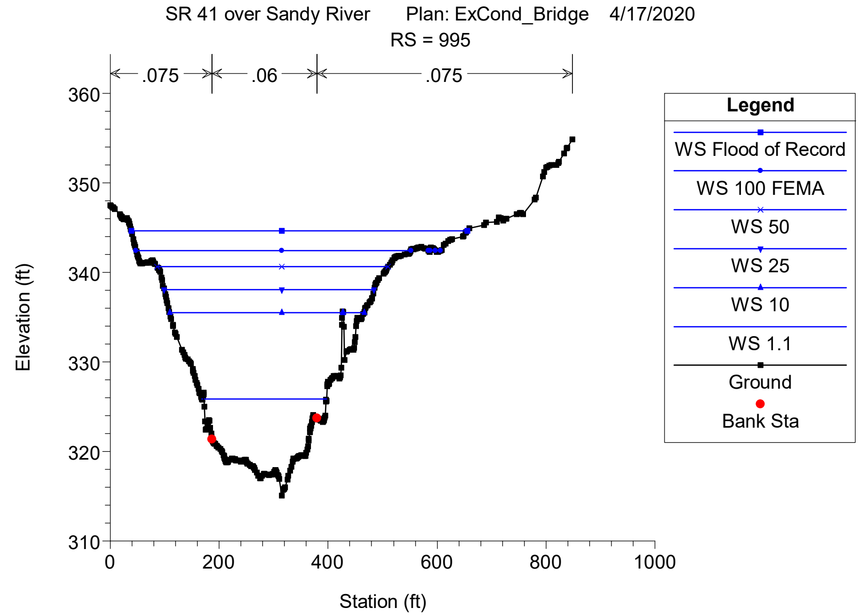

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 1000
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

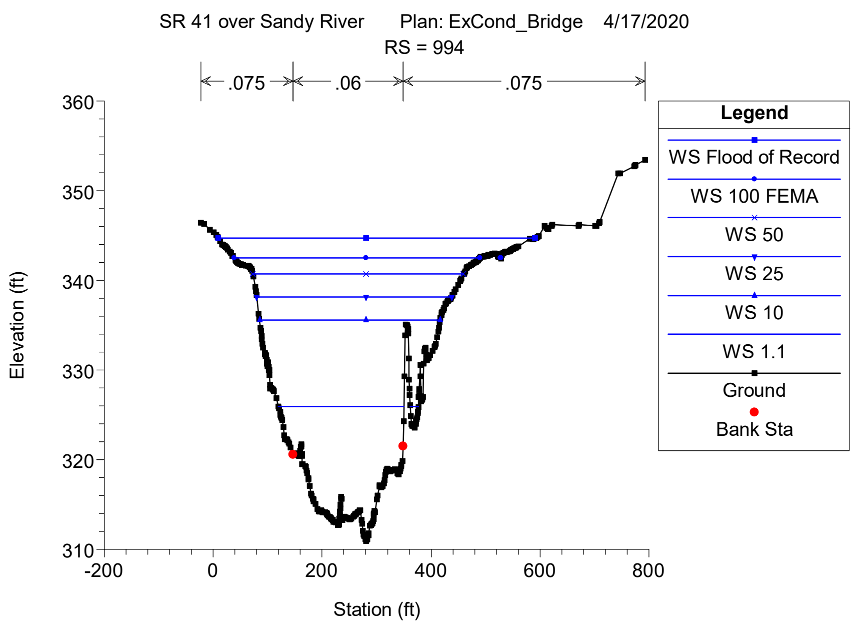

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 999
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
1200
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

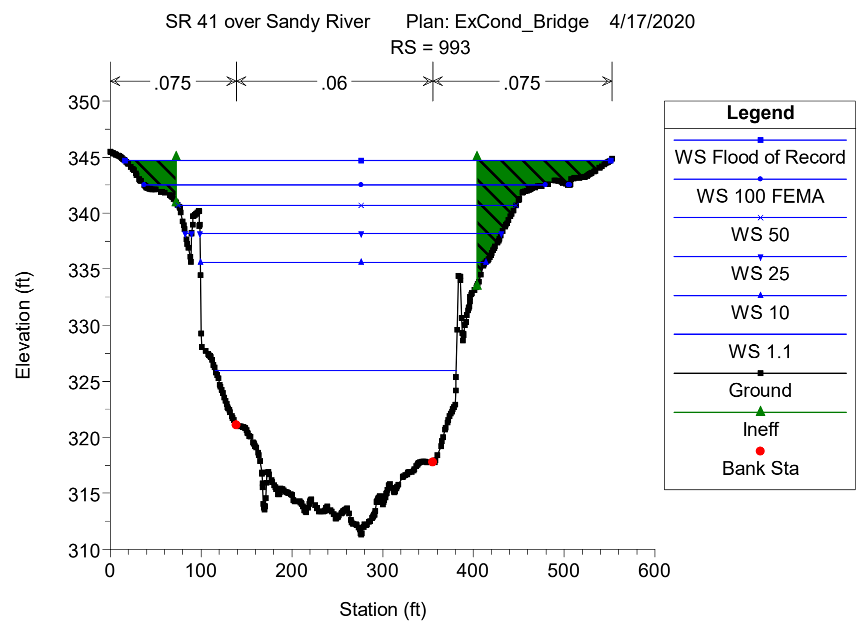

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 998
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
1200
1400
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

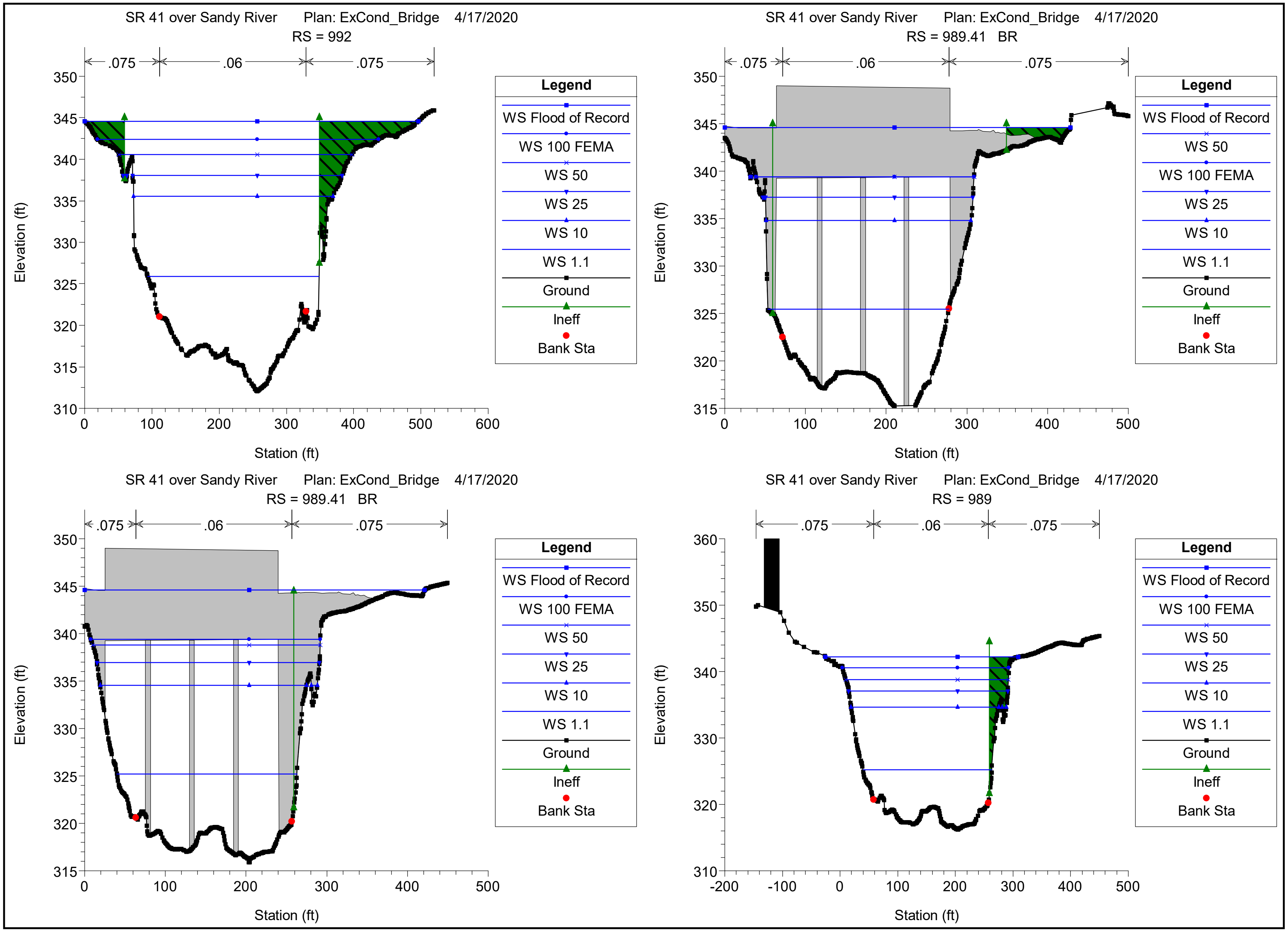

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 997
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 996
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

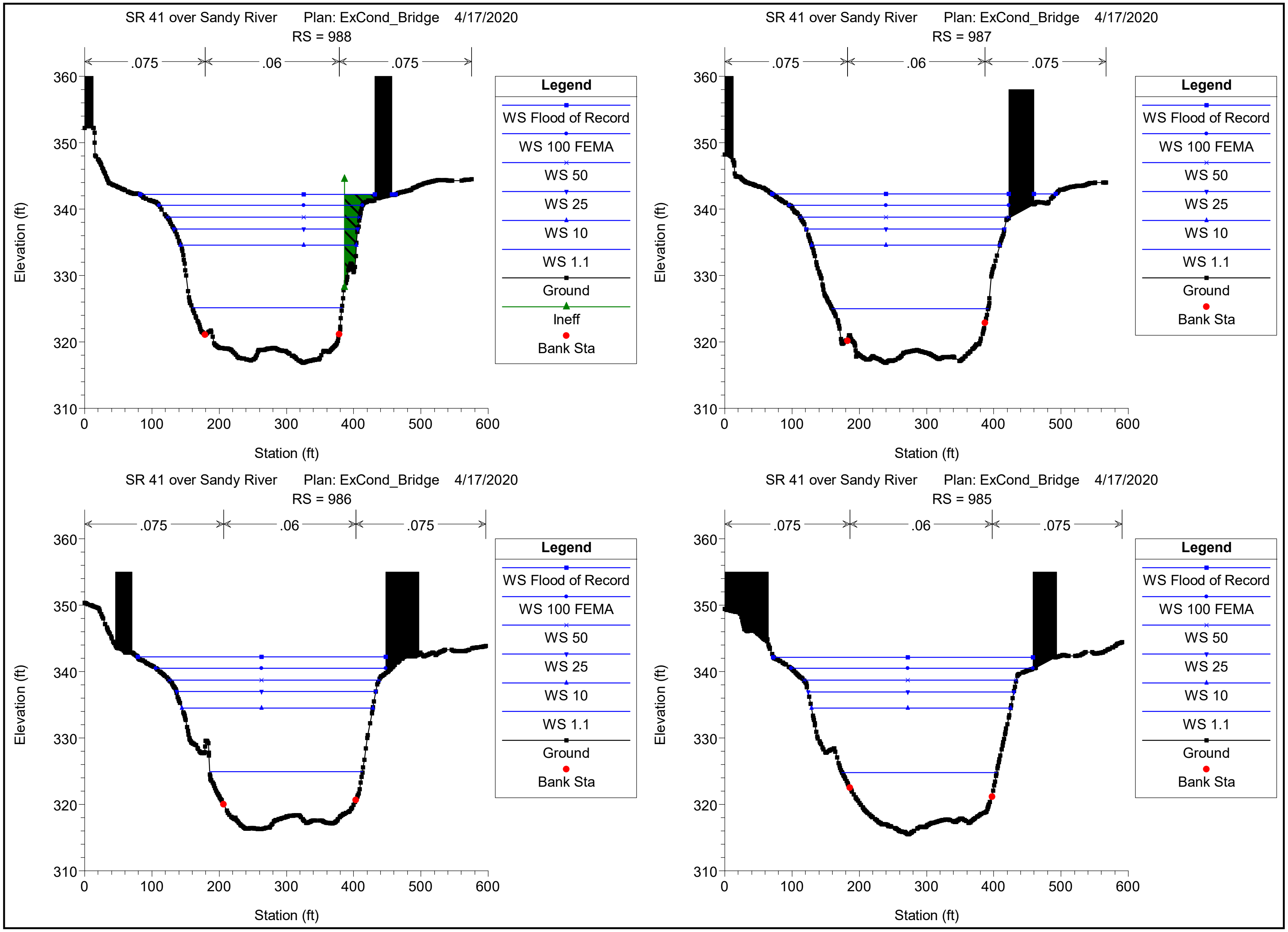

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 995
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

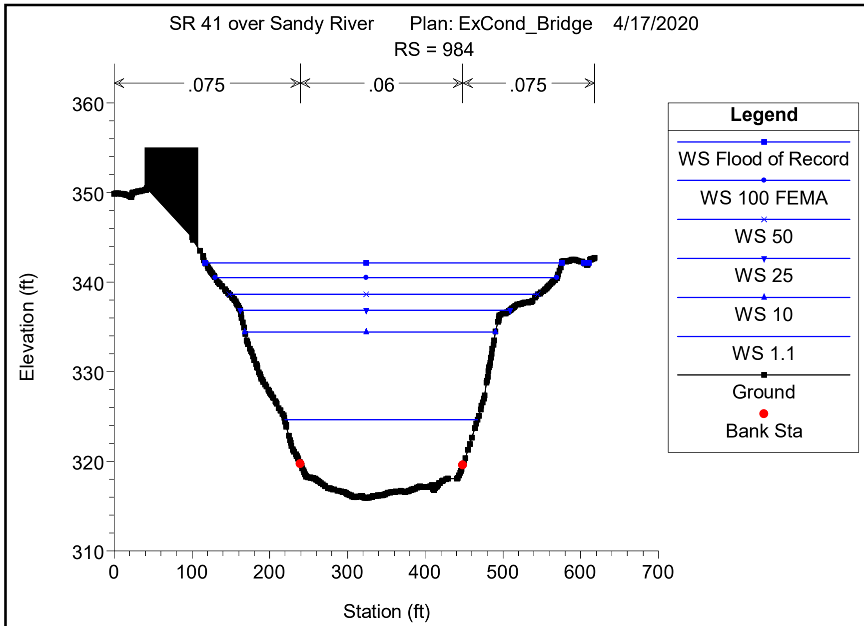

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 994
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

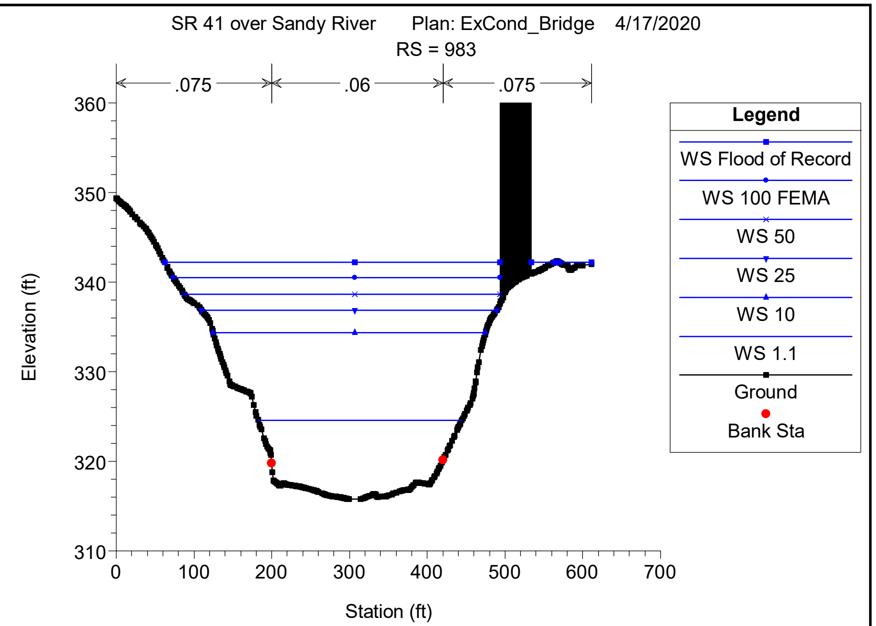

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 993
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta

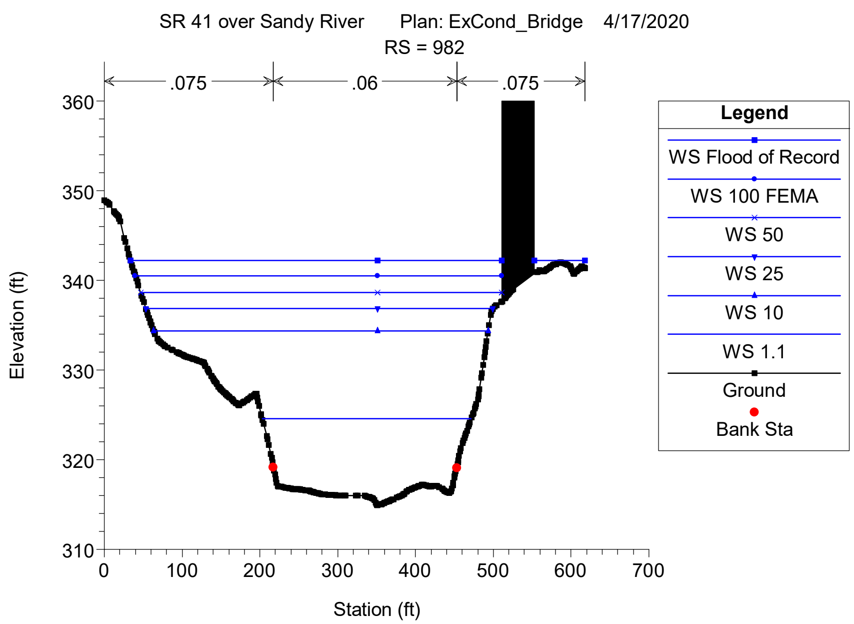


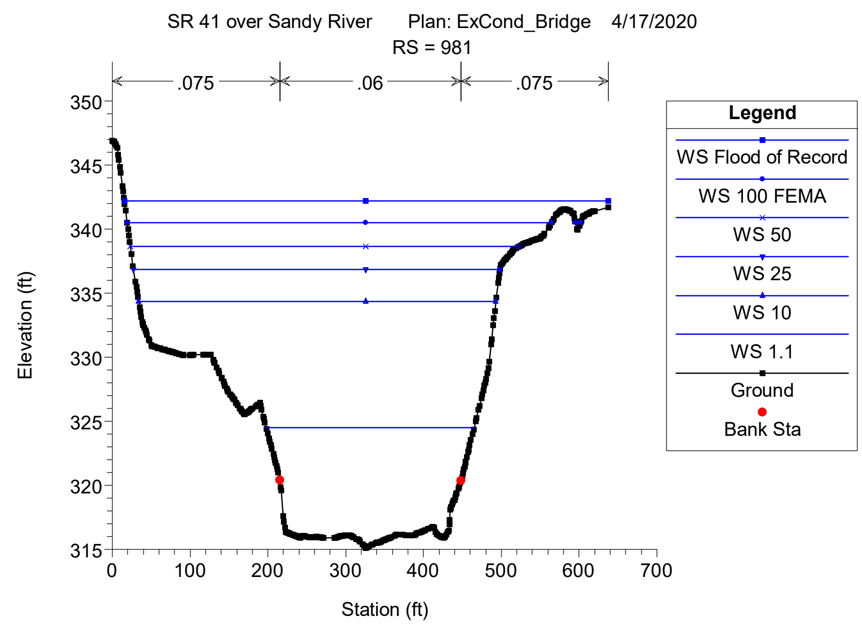
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 992
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 989.41 BR
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 50
WS 100 FEMA
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 989.41 BR
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 989
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta

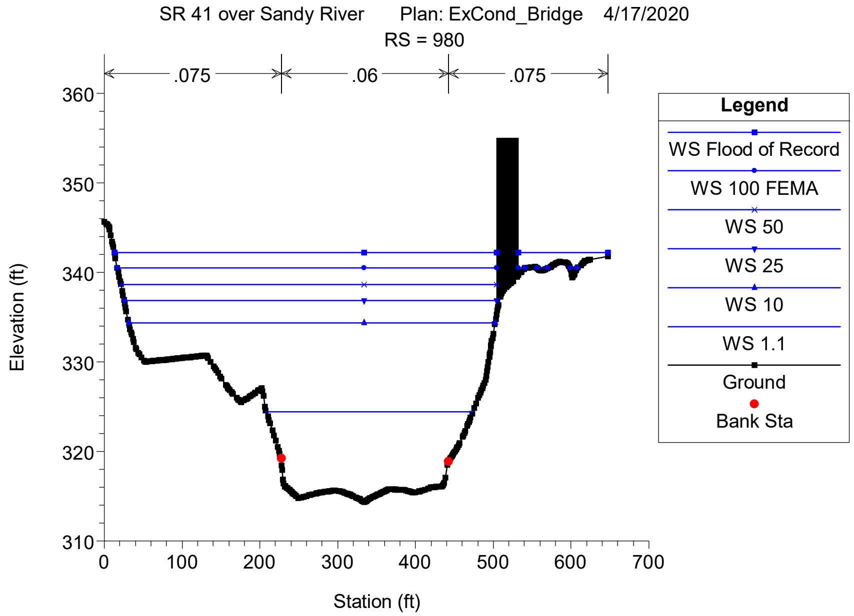

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 988
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 987
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 986
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 985
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)

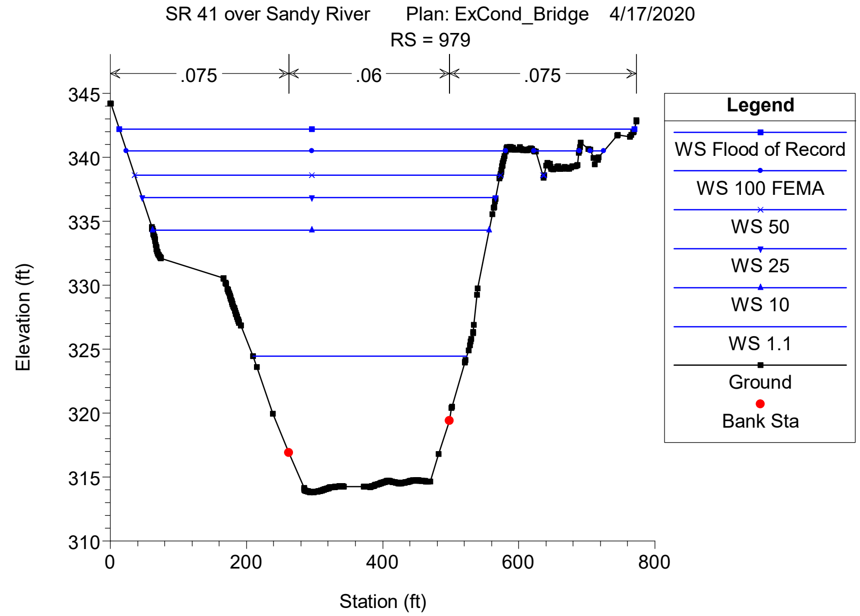

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 984
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

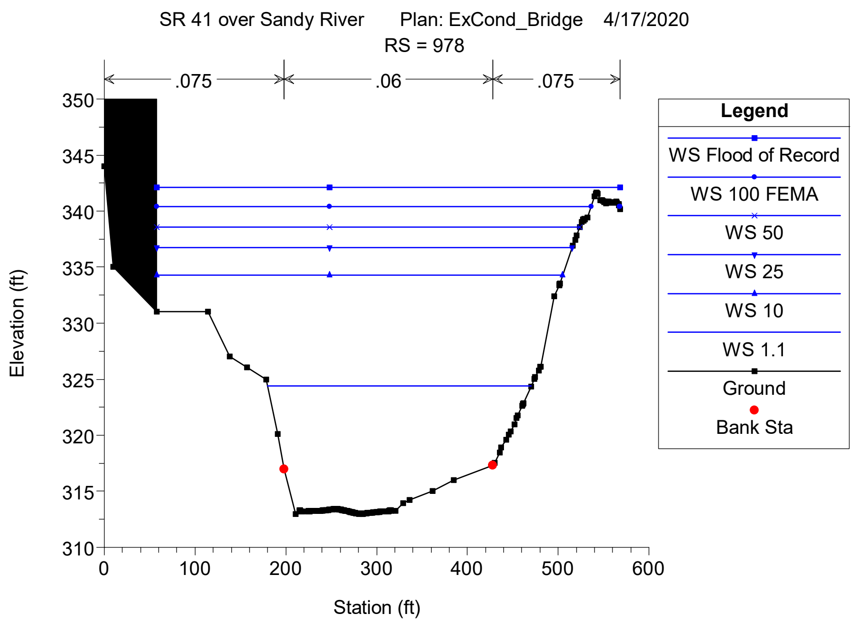

SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 983
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 982
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 981
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 980
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
100
200
300
400
500
600
700
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 979
.075
.06
.075
Elevation (ft)
Station (ft)
345
340
335
330
325
320
315
310
0
200
400
600
800
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: ExCond_Bridge 4/17/2020
RS = 978
.075
.06
.075
Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
315
310
0
100
200
300
400
500
600
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

HEC-RAS Plan: ExCond_Bridge River: Sandy River Reach: Reach 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1000	1.1	6700.00	315.73	326.79	323.31	327.08	0.002712	4.32	1571.87	265.46	0.30
Reach 1	1000	10	23400.00	315.73	335.98	327.08	336.49	0.001480	5.84	4250.03	311.08	0.26
Reach 1	1000	25	29500.00	315.73	338.48	328.13	339.06	0.001394	6.26	5036.29	318.82	0.26
Reach 1	1000	50	34250.00	315.73	340.97	328.95	341.56	0.001194	6.32	5870.86	405.30	0.25
Reach 1	1000	Flood of Record	44290.00	315.73	344.97	330.58	345.56	0.000999	6.51	8570.96	821.54	0.23
Reach 1	1000	100 FEMA	39200.00	315.73	342.76	329.74	343.39	0.001148	6.56	6826.81	672.41	0.25
Reach 1	999	1.1	6700.00	317.82	326.46	323.93	326.90	0.004871	5.37	1292.23	253.16	0.40
Reach 1	999	10	23400.00	317.82	335.77	327.90	336.40	0.001973	6.58	3861.72	296.16	0.30
Reach 1	999	25	29500.00	317.82	338.27	328.78	338.98	0.001822	7.01	4614.13	306.46	0.30
Reach 1	999	50	34250.00	317.82	340.78	329.89	341.48	0.001527	7.03	5430.54	380.74	0.28
Reach 1	999	Flood of Record	44290.00	317.82	344.82	331.43	345.50	0.001231	7.14	8191.30	820.91	0.26
Reach 1	999	100 FEMA	39200.00	317.82	342.58	330.68	343.32	0.001452	7.26	6389.00	732.98	0.27
Reach 1	998	1.1	6700.00	317.44	326.29	323.87	326.77	0.005283	5.60	1238.16	244.79	0.42
Reach 1	998	10	23400.00	317.44	335.68	327.91	336.35	0.002106	6.82	3888.47	355.16	0.31
Reach 1	998	25	29500.00	317.44	338.22	329.06	338.93	0.001867	7.13	4873.94	425.76	0.30
Reach 1	998	50	34250.00	317.44	340.77	330.01	341.43	0.001484	6.96	6093.65	539.72	0.27
Reach 1	998	Flood of Record	44290.00	317.44	344.85	331.61	345.45	0.001132	6.88	8528.03	654.76	0.25
Reach 1	998	100 FEMA	39200.00	317.44	342.61	330.78	343.26	0.001339	7.01	7115.83	598.91	0.26
Reach 1	997	1.1	6700.00	316.31	326.08	322.93	326.50	0.003770	5.24	1316.37	221.63	0.36
Reach 1	997	10	23400.00	316.31	335.57	327.20	336.23	0.001914	6.82	3972.19	359.88	0.30
Reach 1	997	25	29500.00	316.31	338.12	328.49	338.83	0.001715	7.13	4941.49	397.82	0.29
Reach 1	997	50	34250.00	316.31	340.67	329.53	341.35	0.001420	7.07	6082.54	515.16	0.27
Reach 1	997	Flood of Record	44290.00	316.31	344.73	331.07	345.38	0.001137	7.12	8399.55	661.96	0.25
Reach 1	997	100 FEMA	39200.00	316.31	342.51	330.48	343.18	0.001299	7.15	7050.02	548.19	0.26
Reach 1	996	1.1	6700.00	317.91	325.79	323.32	326.33	0.005482	5.91	1160.25	211.73	0.43
Reach 1	996	10	23400.00	317.91	335.45	327.61	336.15	0.002141	7.08	3880.77	377.61	0.32
Reach 1	996	25	29500.00	317.91	338.03	329.12	338.76	0.001866	7.32	4898.72	417.00	0.30
Reach 1	996	50	34250.00	317.91	340.61	330.00	341.30	0.001507	7.19	6071.19	511.14	0.28
Reach 1	996	Flood of Record	44290.00	317.91	344.69	331.89	345.34	0.001182	7.18	8409.59	653.14	0.25
Reach 1	996	100 FEMA	39200.00	317.91	342.46	330.77	343.13	0.001358	7.23	7032.59	543.71	0.27
Reach 1	995	1.1	6700.00	315.07	325.83	322.07	326.20	0.003011	4.90	1415.52	225.77	0.33
Reach 1	995	10	23400.00	315.07	335.50	326.51	336.08	0.001621	6.44	4222.33	355.63	0.28
Reach 1	995	25	29500.00	315.07	338.06	327.73	338.70	0.001511	6.84	5174.12	384.73	0.28
Reach 1	995	50	34250.00	315.07	340.63	329.00	341.25	0.001262	6.80	6206.12	424.61	0.26

HEC-RAS Plan: ExCond_Bridge   River: Sandy River   Reach: Reach 1 (Continued)

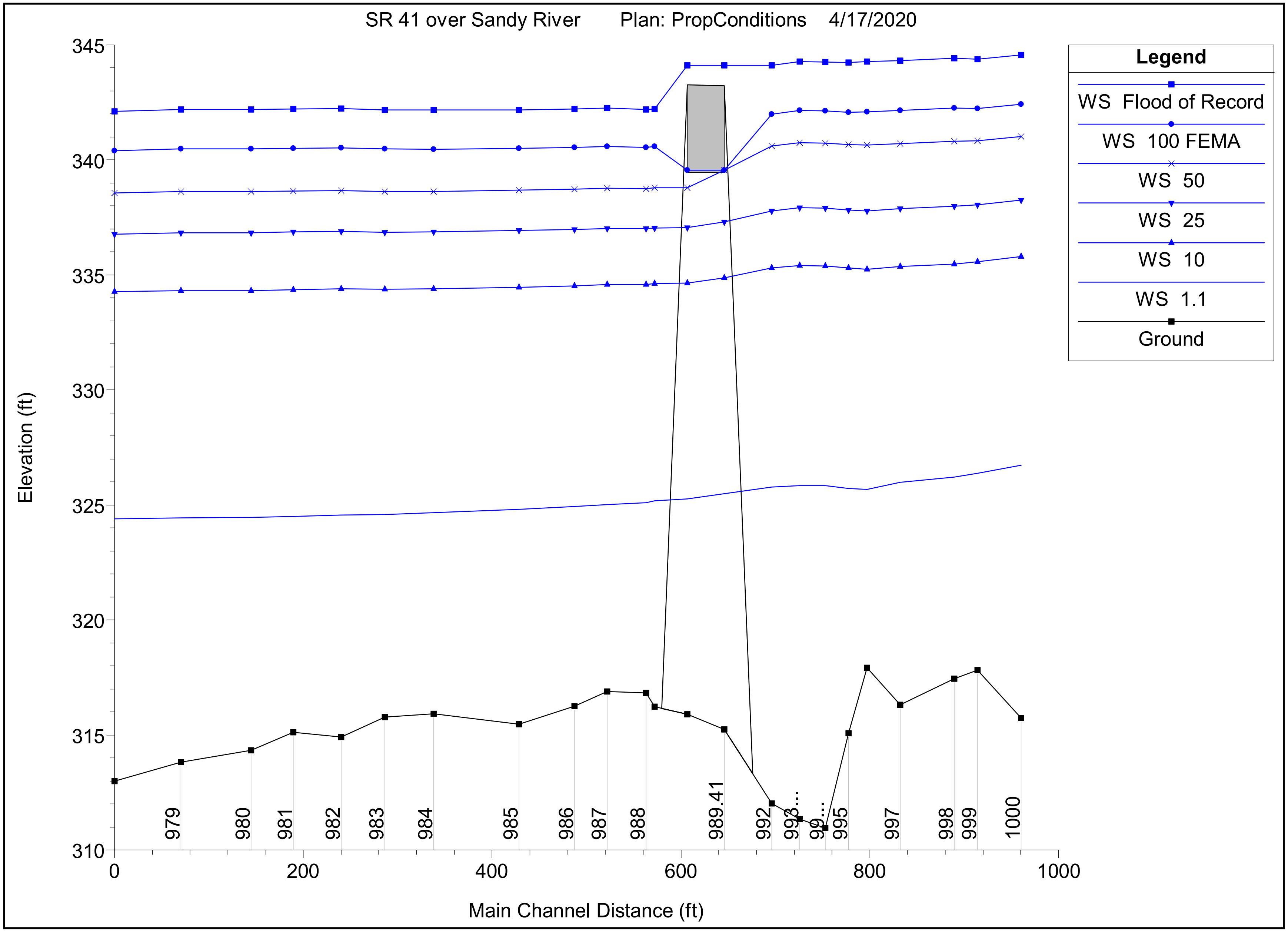
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	995	Flood of Record	44290.00	315.07	344.66	330.71	345.32	0.001108	7.14	8345.68	617.25	0.25
Reach 1	995	100 FEMA	39200.00	315.07	342.43	329.82	343.11	0.001249	7.13	7050.01	516.22	0.26
Reach 1	994	1.1	6700.00	310.95	325.95	318.21	326.10	0.000781	3.18	2181.15	245.32	0.18
Reach 1	994	10	23400.00	310.95	335.59	323.22	336.00	0.000910	5.34	4949.36	331.89	0.21
Reach 1	994	25	29500.00	310.95	338.14	324.47	338.63	0.000926	5.85	5821.87	357.69	0.22
Reach 1	994	50	34250.00	310.95	340.69	325.42	341.19	0.000835	5.96	6770.43	386.99	0.21
Reach 1	994	Flood of Record	44290.00	310.95	344.69	327.20	345.27	0.000825	6.54	8666.83	581.06	0.21
Reach 1	994	100 FEMA	39200.00	310.95	342.48	326.34	343.05	0.000866	6.36	7513.80	452.23	0.22
Reach 1	993	1.1	6700.00	311.34	325.95	318.06	326.07	0.000568	2.80	2505.21	265.29	0.15
Reach 1	993	10	23400.00	311.34	335.61	322.48	335.96	0.000729	4.88	5289.90	314.37	0.19
Reach 1	993	25	29500.00	311.34	338.16	323.69	338.58	0.000758	5.39	6076.63	339.16	0.20
Reach 1	993	50	34250.00	311.34	340.70	324.54	341.15	0.000714	5.61	6886.14	372.10	0.20
Reach 1	993	Flood of Record	44290.00	311.34	344.71	326.18	345.23	0.000698	6.12	8212.93	535.12	0.20
Reach 1	993	100 FEMA	39200.00	311.34	342.51	325.34	343.01	0.000727	5.93	7484.26	442.64	0.20
Reach 1	992	1.1	6700.00	312.03	325.89	319.40	326.05	0.000895	3.22	2158.43	254.74	0.19
Reach 1	992	10	23400.00	312.03	335.53	323.73	335.93	0.000915	5.25	4781.95	296.75	0.21
Reach 1	992	25	29500.00	312.03	338.06	324.86	338.55	0.000941	5.79	5484.80	317.21	0.22
Reach 1	992	50	34250.00	312.03	340.60	325.72	341.12	0.000869	5.99	6207.52	346.56	0.22
Reach 1	992	Flood of Record	44290.00	312.03	344.58	327.42	345.20	0.000846	6.55	7361.41	496.06	0.22
Reach 1	992	100 FEMA	39200.00	312.03	342.39	326.57	342.98	0.000883	6.34	6727.04	418.08	0.22
Reach 1	989.41		Bridge									
Reach 1	989	1.1	6700.00	316.22	325.18	321.47	325.53	0.002795	4.75	1440.40	223.15	0.32
Reach 1	989	10	23400.00	316.22	334.62	325.73	335.31	0.001829	6.80	3619.58	263.68	0.30
Reach 1	989	25	29500.00	316.22	337.05	326.98	337.87	0.001808	7.41	4207.70	276.04	0.30
Reach 1	989	50	34250.00	316.22	338.78	327.86	339.70	0.001805	7.85	4634.92	281.97	0.30
Reach 1	989	Flood of Record	44290.00	316.22	342.21	329.63	343.33	0.001812	8.72	5530.34	334.50	0.31
Reach 1	989	100 FEMA	39200.00	316.22	340.58	328.75	341.58	0.001774	8.23	5088.65	288.80	0.31
Reach 1	988	1.1	6700.00	316.83	325.11	321.75	325.49	0.003277	4.99	1376.23	222.73	0.34
Reach 1	988	10	23400.00	316.83	334.59	326.01	335.29	0.001909	6.88	3601.74	261.44	0.30
Reach 1	988	25	29500.00	316.83	337.01	327.23	337.85	0.001880	7.49	4205.19	273.08	0.31
Reach 1	988	50	34250.00	316.83	338.75	328.11	339.68	0.001867	7.93	4654.22	286.22	0.31
Reach 1	988	Flood of Record	44290.00	316.83	342.20	329.85	343.31	0.001832	8.72	5618.07	355.02	0.32
Reach 1	988	100 FEMA	39200.00	316.83	340.56	329.00	341.56	0.001824	8.29	5141.37	302.63	0.31

HEC-RAS Plan: ExCond_Bridge River: Sandy River Reach: Reach 1 (Continued)

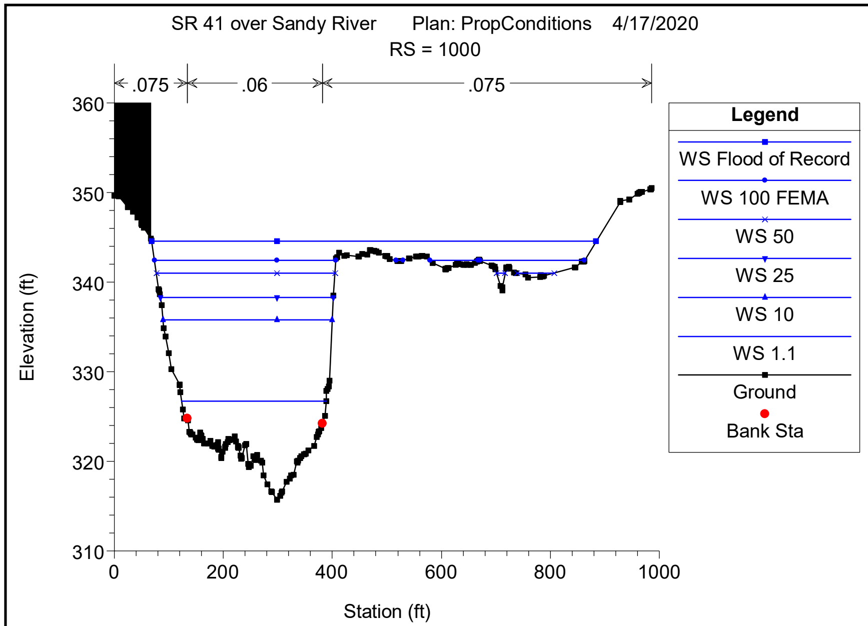
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	987	1.1	6700.00	316.88	325.02	321.37	325.35	0.002786	4.68	1474.95	232.29	0.32
Reach 1	987	10	23400.00	316.88	334.58	325.53	335.19	0.001656	6.46	3921.26	279.61	0.28
Reach 1	987	25	29500.00	316.88	337.03	326.72	337.74	0.001615	7.00	4625.39	295.10	0.28
Reach 1	987	50	34250.00	316.88	338.78	327.65	339.57	0.001595	7.39	5153.16	310.04	0.29
Reach 1	987	Flood of Record	44290.00	316.88	342.26	329.33	343.19	0.001547	8.07	6329.44	383.76	0.29
Reach 1	987	100 FEMA	39200.00	316.88	340.60	328.50	341.45	0.001556	7.72	5730.17	326.29	0.29
Reach 1	986	1.1	6700.00	316.25	324.94	320.91	325.25	0.002385	4.55	1524.68	227.45	0.30
Reach 1	986	10	23400.00	316.25	334.52	325.22	335.13	0.001596	6.50	3970.51	284.11	0.28
Reach 1	986	25	29500.00	316.25	336.97	326.39	337.68	0.001561	7.04	4683.76	296.61	0.28
Reach 1	986	50	34250.00	316.25	338.72	327.28	339.51	0.001551	7.43	5215.15	312.40	0.29
Reach 1	986	Flood of Record	44290.00	316.25	342.21	329.04	343.13	0.001514	8.13	6406.64	369.27	0.29
Reach 1	986	100 FEMA	39200.00	316.25	340.53	328.20	341.39	0.001526	7.79	5809.74	341.94	0.29
Reach 1	985	1.1	6700.00	315.47	324.81	320.74	325.11	0.002358	4.43	1530.00	230.30	0.29
Reach 1	985	10	23400.00	315.47	334.46	324.99	335.03	0.001463	6.19	4110.25	296.11	0.27
Reach 1	985	25	29500.00	315.47	336.93	326.17	337.58	0.001423	6.69	4851.96	306.30	0.27
Reach 1	985	50	34250.00	315.47	338.69	327.08	339.40	0.001404	7.04	5398.37	316.25	0.27
Reach 1	985	Flood of Record	44290.00	315.47	342.17	328.95	343.03	0.001382	7.74	6626.00	386.01	0.28
Reach 1	985	100 FEMA	39200.00	315.47	340.50	327.94	341.29	0.001396	7.42	6001.59	359.48	0.27
Reach 1	984	1.1	6700.00	315.91	324.65	320.22	324.91	0.001852	4.11	1694.12	247.86	0.26
Reach 1	984	10	23400.00	315.91	334.40	324.36	334.88	0.001227	5.80	4513.12	322.15	0.25
Reach 1	984	25	29500.00	315.91	336.87	325.52	337.43	0.001216	6.31	5328.16	347.40	0.25
Reach 1	984	50	34250.00	315.91	338.63	326.39	339.26	0.001223	6.70	5983.53	396.31	0.25
Reach 1	984	Flood of Record	44290.00	315.91	342.17	328.14	342.87	0.001149	7.19	7518.88	465.03	0.25
Reach 1	984	100 FEMA	39200.00	315.91	340.46	327.27	341.14	0.001186	6.97	6753.34	439.30	0.25
Reach 1	983	1.1	6700.00	315.78	324.59	319.85	324.81	0.001574	3.84	1803.90	261.96	0.24
Reach 1	983	10	23400.00	315.78	334.39	323.89	334.81	0.001056	5.42	4858.03	350.62	0.23
Reach 1	983	25	29500.00	315.78	336.86	325.10	337.35	0.001046	5.89	5755.26	379.91	0.23
Reach 1	983	50	34250.00	315.78	338.64	325.92	339.17	0.001035	6.20	6454.90	406.24	0.23
Reach 1	983	Flood of Record	44290.00	315.78	342.18	327.48	342.78	0.000973	6.65	7976.84	501.58	0.23
Reach 1	983	100 FEMA	39200.00	315.78	340.48	326.81	341.05	0.000995	6.42	7217.37	420.15	0.23
Reach 1	982	1.1	6700.00	314.91	324.56	319.31	324.74	0.001171	3.43	2006.61	268.74	0.21
Reach 1	982	10	23400.00	314.91	334.39	323.15	334.74	0.000855	4.96	5449.37	430.11	0.21
Reach 1	982	25	29500.00	314.91	336.89	324.28	337.28	0.000822	5.31	6541.92	446.17	0.21

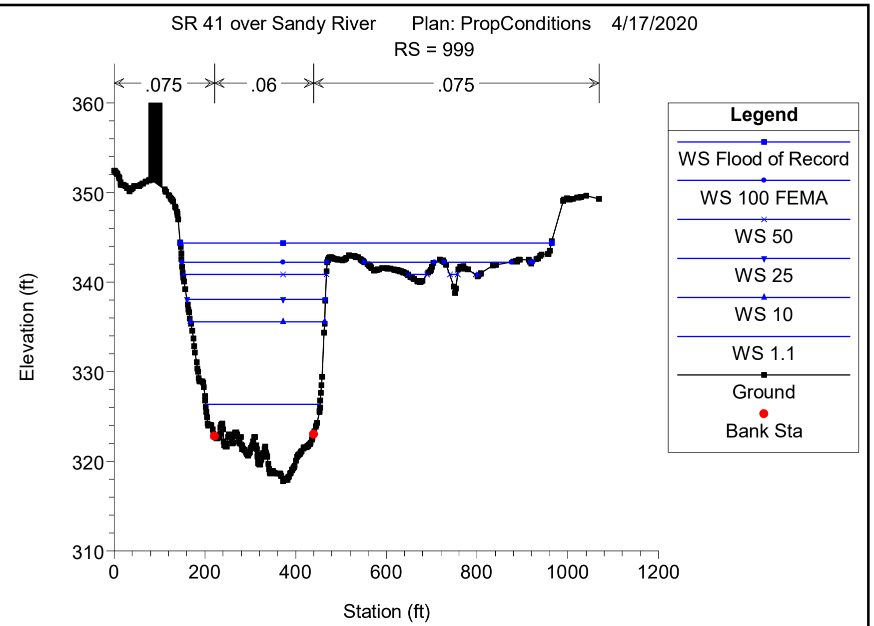
HEC-RAS Plan: ExCond_Bridge River: Sandy River Reach: Reach 1 (Continued)

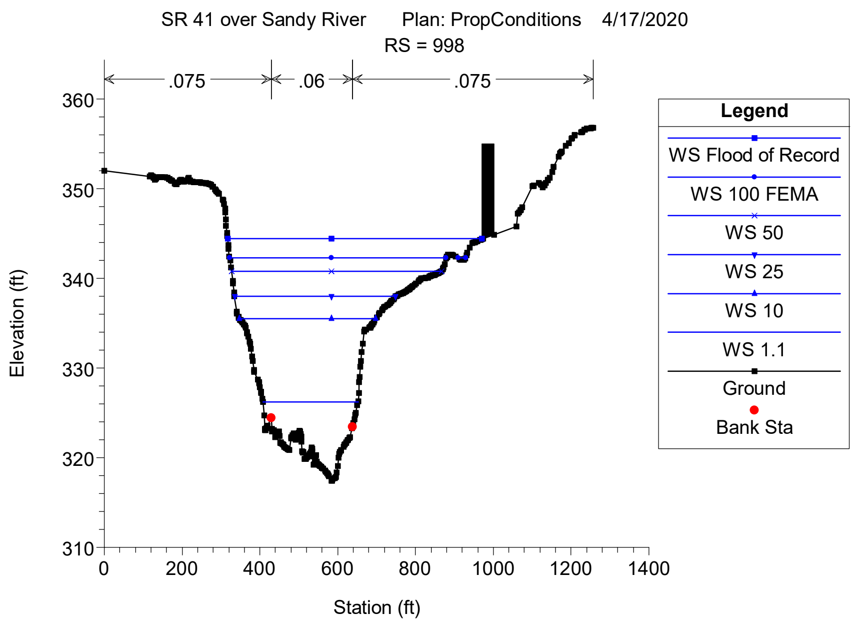
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	982	50	34250.00	314.91	338.68	325.08	339.10	0.000805	5.55	7360.92	464.26	0.21
Reach 1	982	Flood of Record	44290.00	314.91	342.24	326.78	342.70	0.000751	5.92	9092.31	542.29	0.21
Reach 1	982	100 FEMA	39200.00	314.91	340.53	325.89	340.97	0.000770	5.73	8228.14	471.12	0.21
Reach 1	981	1.1	6700.00	315.12	324.49	319.14	324.68	0.001183	3.45	1987.91	267.20	0.21
Reach 1	981	10	23400.00	315.12	334.36	323.07	334.69	0.000827	4.88	5656.72	459.08	0.20
Reach 1	981	25	29500.00	315.12	336.87	324.25	337.23	0.000785	5.18	6822.03	471.36	0.20
Reach 1	981	50	34250.00	315.12	338.65	325.09	339.05	0.000769	5.43	7684.79	499.73	0.20
Reach 1	981	Flood of Record	44290.00	315.12	342.22	326.86	342.66	0.000722	5.80	9676.24	621.90	0.20
Reach 1	981	100 FEMA	39200.00	315.12	340.51	325.94	340.92	0.000739	5.61	8668.47	551.93	0.20
Reach 1	980	1.1	6700.00	314.33	324.45	318.59	324.63	0.001018	3.39	2070.38	265.56	0.20
Reach 1	980	10	23400.00	314.33	334.33	322.72	334.66	0.000796	4.92	5779.67	470.63	0.20
Reach 1	980	25	29500.00	314.33	336.84	323.91	337.19	0.000757	5.21	6972.49	478.66	0.20
Reach 1	980	50	34250.00	314.33	338.63	324.75	339.01	0.000734	5.41	7835.01	482.85	0.20
Reach 1	980	Flood of Record	44290.00	314.33	342.20	326.49	342.62	0.000685	5.76	9735.07	606.34	0.20
Reach 1	980	100 FEMA	39200.00	314.33	340.49	325.62	340.89	0.000703	5.58	8747.85	518.94	0.20
Reach 1	979	1.1	6700.00	313.81	324.43	317.62	324.55	0.000630	2.81	2539.71	314.30	0.16
Reach 1	979	10	23400.00	313.81	334.32	321.51	334.59	0.000601	4.39	6398.16	494.42	0.18
Reach 1	979	25	29500.00	313.81	336.83	322.65	337.13	0.000588	4.71	7670.86	519.23	0.18
Reach 1	979	50	34250.00	313.81	338.62	323.46	338.94	0.000579	4.93	8619.63	539.72	0.18
Reach 1	979	Flood of Record	44290.00	313.81	342.19	325.02	342.56	0.000566	5.35	10951.81	756.47	0.18
Reach 1	979	100 FEMA	39200.00	313.81	340.49	324.22	340.82	0.000559	5.09	9724.90	643.50	0.18
Reach 1	978	1.1	6700.00	313.00	324.39	317.36	324.51	0.000600	2.81	2517.33	290.74	0.16
Reach 1	978	10	23400.00	313.00	334.27	321.28	334.54	0.000600	4.44	6221.53	446.84	0.18
Reach 1	978	25	29500.00	313.00	336.77	322.41	337.08	0.000601	4.81	7352.73	457.66	0.18
Reach 1	978	50	34250.00	313.00	338.56	323.20	338.90	0.000600	5.06	8178.08	465.69	0.18
Reach 1	978	Flood of Record	44290.00	313.00	342.11	324.81	342.51	0.000600	5.55	9906.35	510.32	0.19
Reach 1	978	100 FEMA	39200.00	313.00	340.41	324.03	340.78	0.000592	5.28	9053.60	479.50	0.18

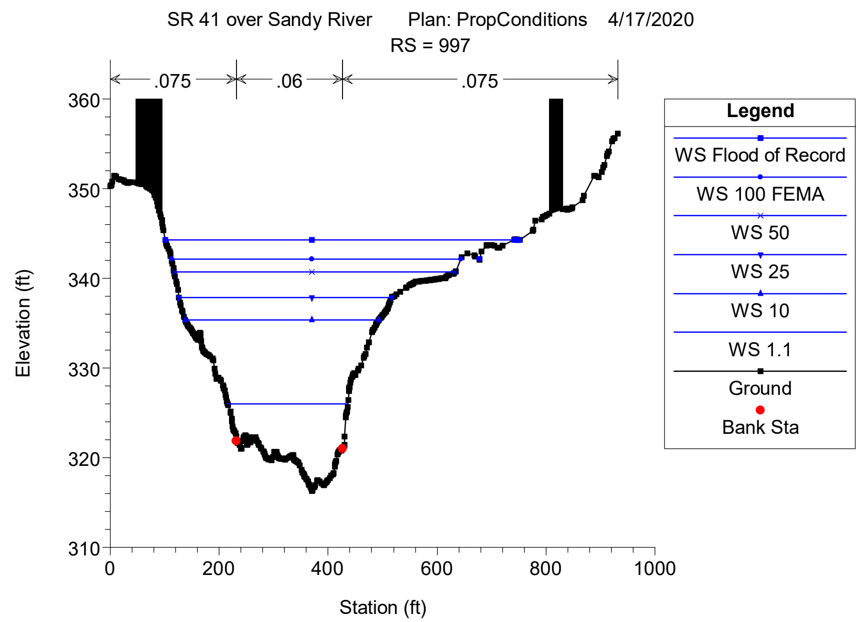


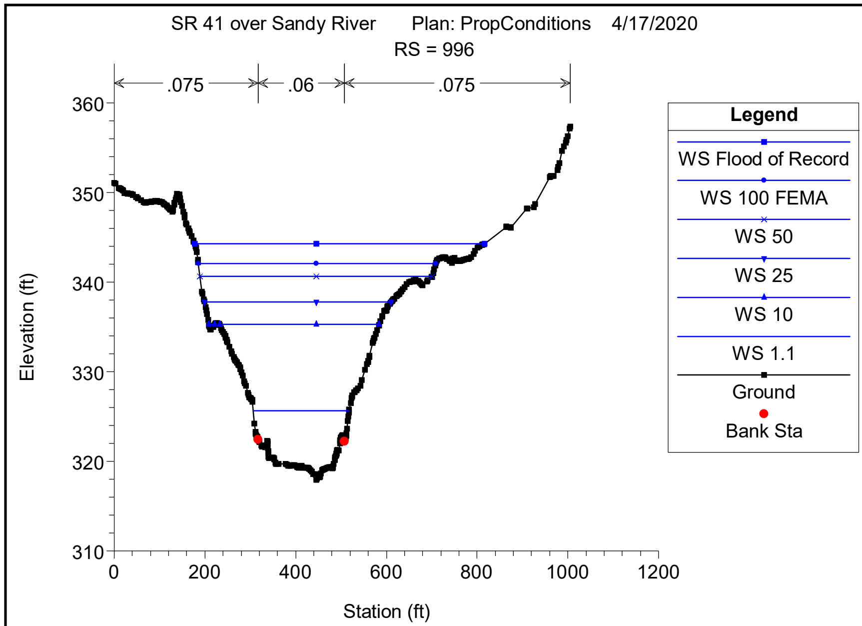
SR 41 over Sandy River Plan: PropConditions 4/17/2020
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Elevation (ft)
Main Channel Distance (ft)
345
340
335
330
325
320
315
310
0
200
400
600
800
1000
979
980
981
982
983
984
985
986
987
988
989.41
992
993...
99...
995
997
998
999
1000

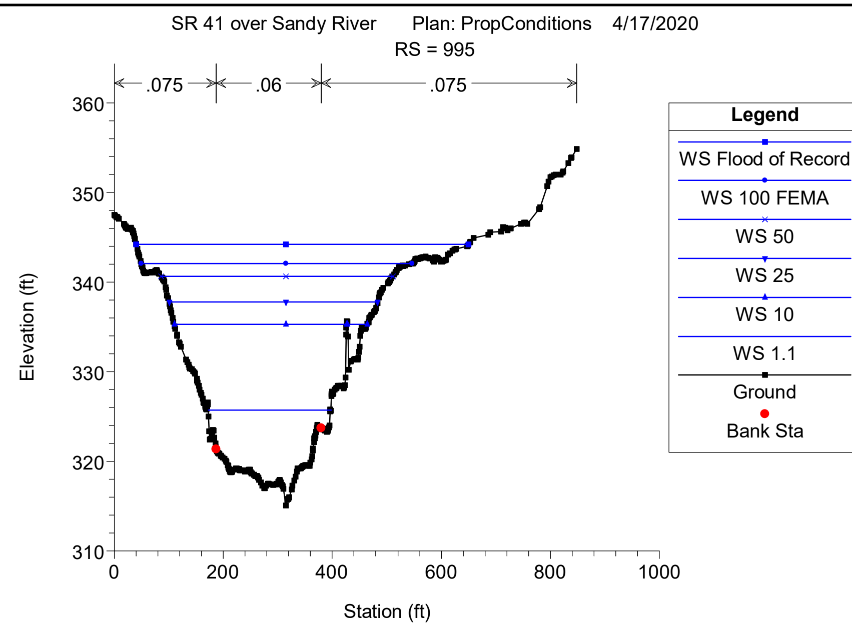

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 1000
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

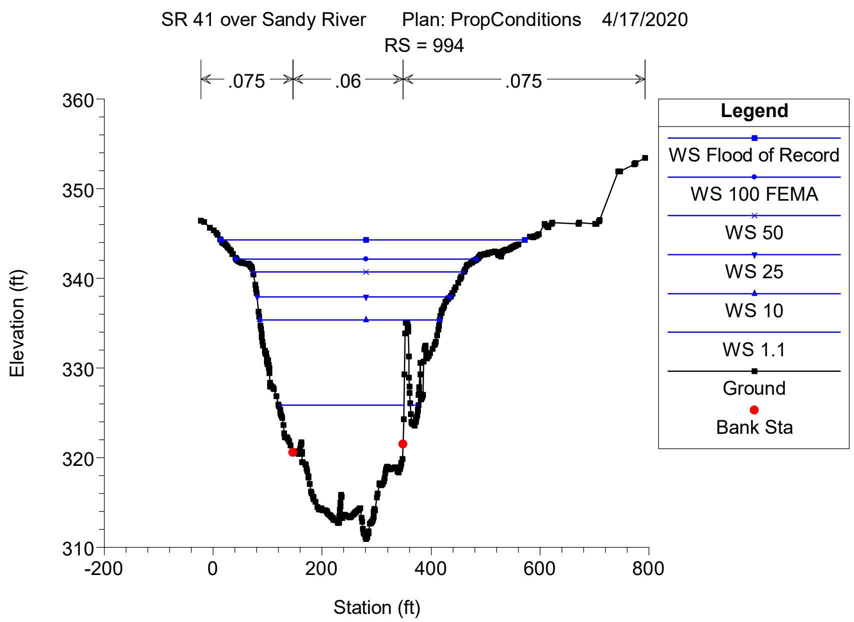

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 999
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

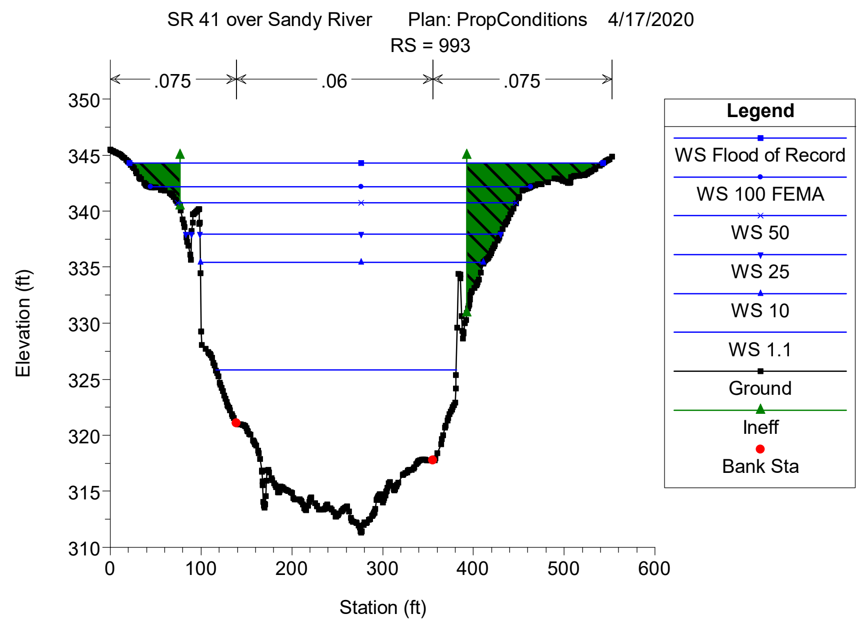

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 998
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

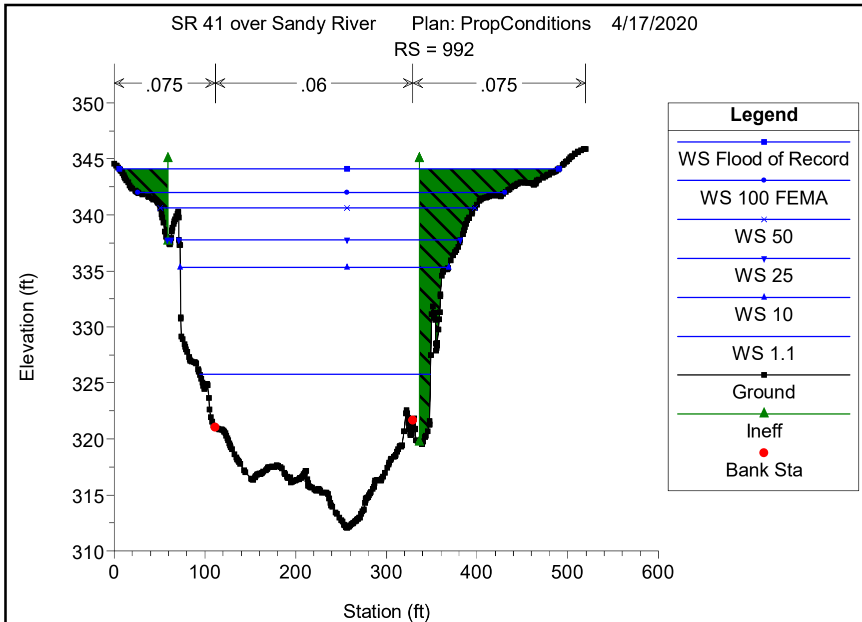

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 997
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

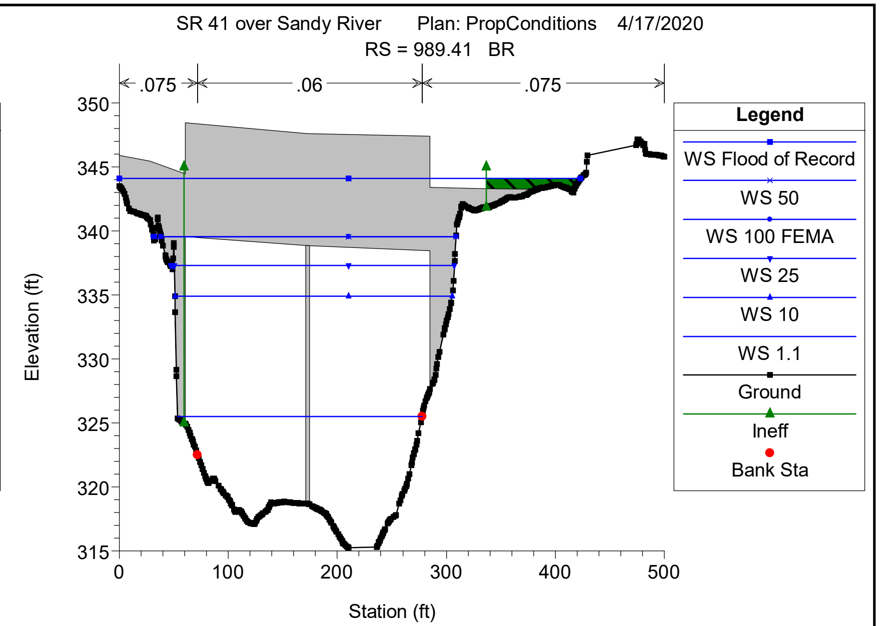

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 996
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
1200
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

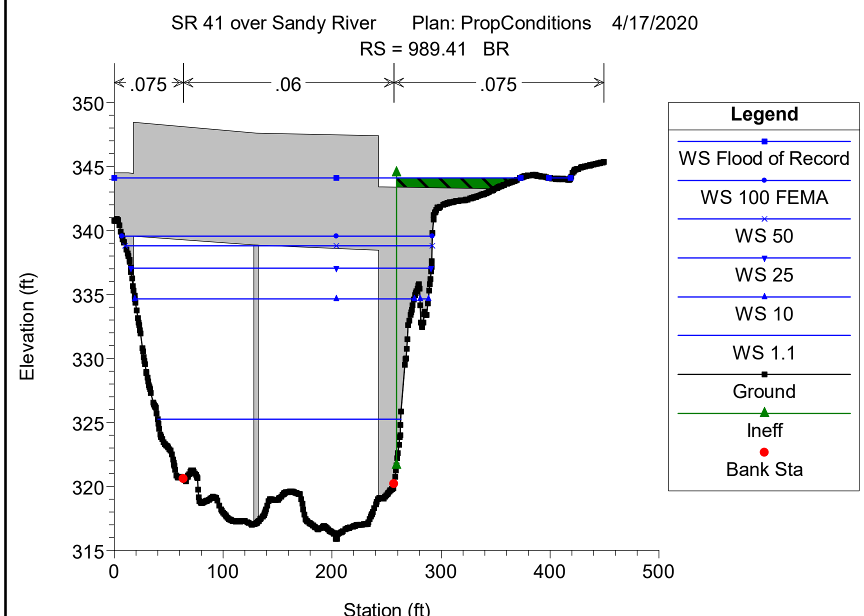

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 995
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
0
200
400
600
800
1000
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

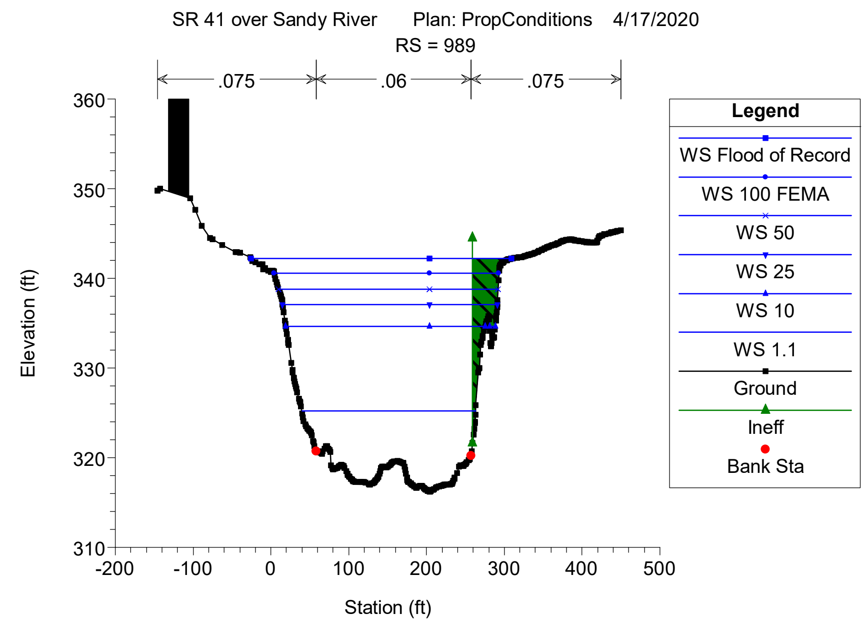

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 994
.075
.06
.075
Elevation (ft)
Station (ft)
360
350
340
330
320
310
-200
0
200
400
600
800
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

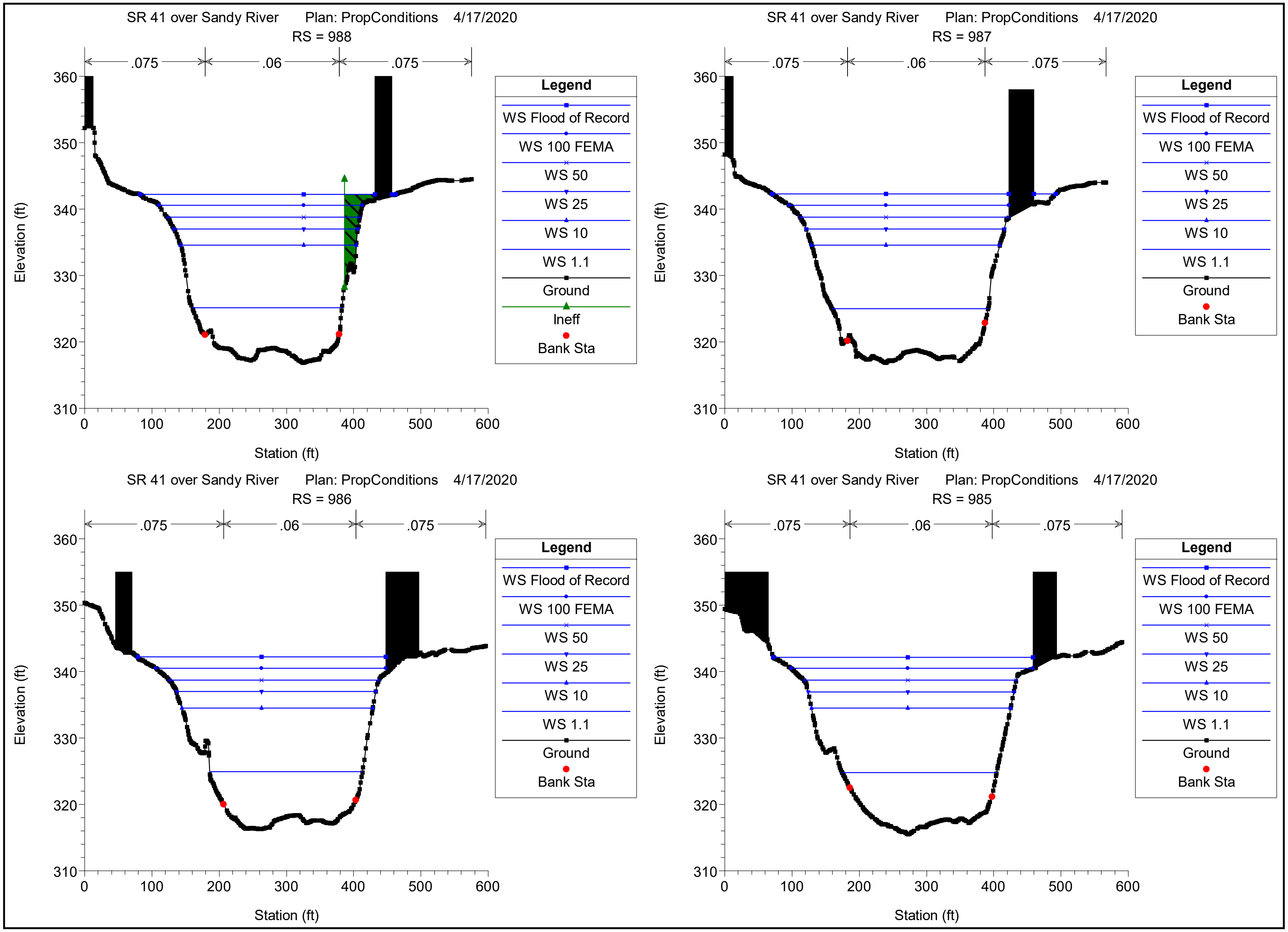

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 993
.075
.06
.075
Elevation (ft)
Station (ft)
350
345
340
335
330
325
320
315
310
0
100
200
300
400
500
600
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta

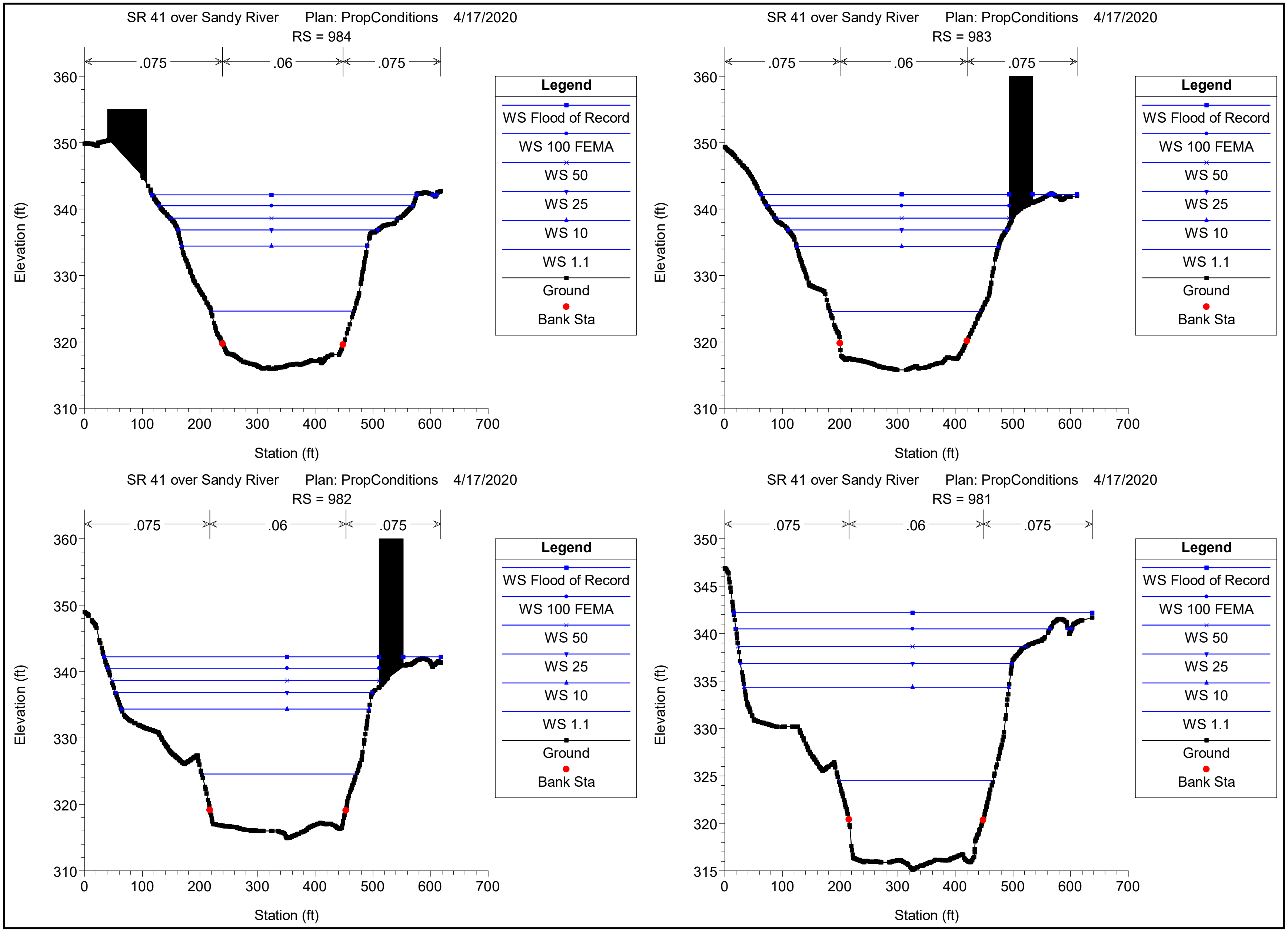

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 992
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 989.41 BR
.075
.06
.075
Legend
WS Flood of Record
WS 50
WS 100 FEMA
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

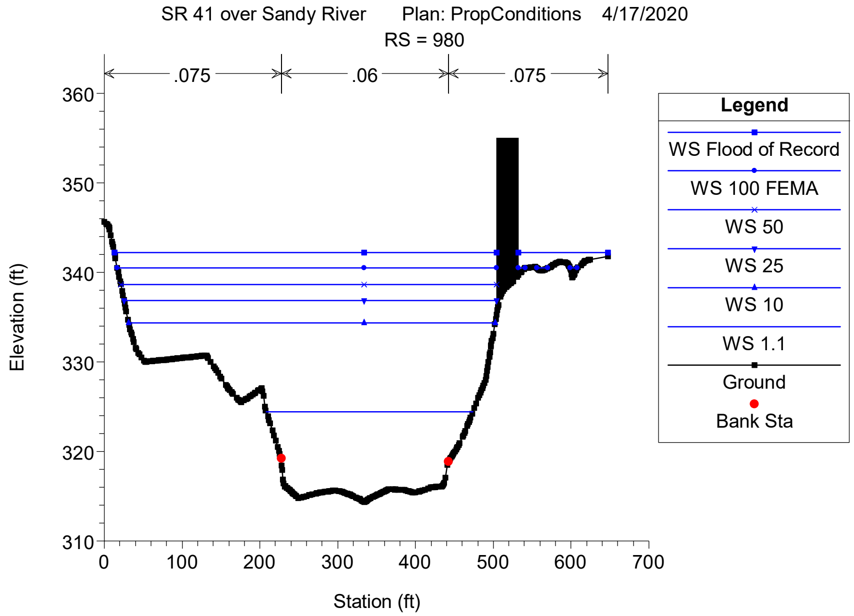

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 989.41 BR
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

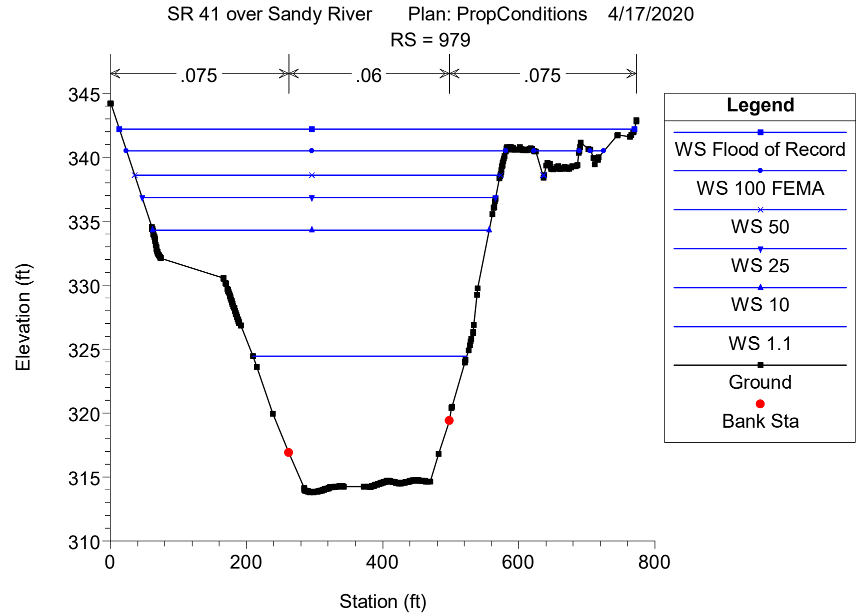

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 989
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

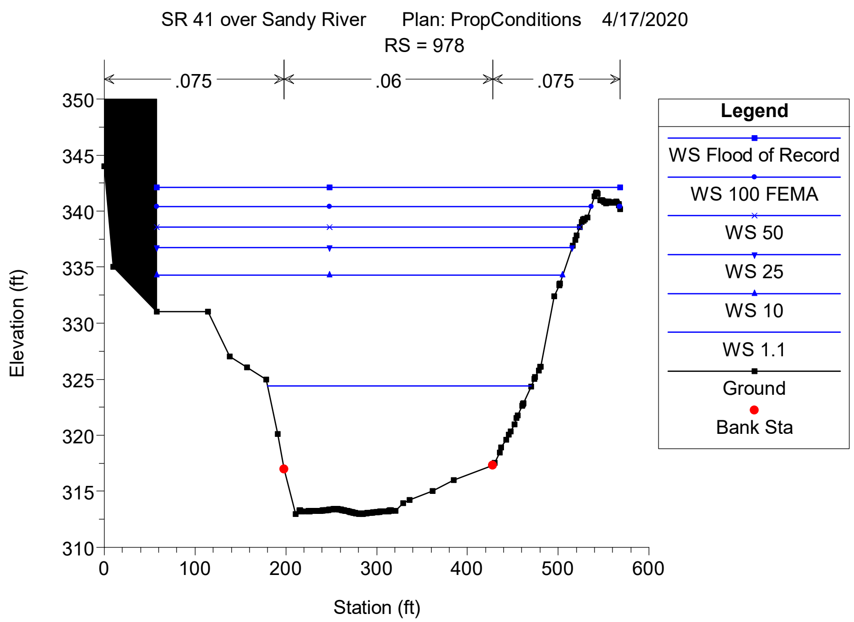

SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 988
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 987
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 986
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 985
.075
.06
.075
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
Elevation (ft)
Station (ft)



SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 984
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 983
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 982
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta
SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 981
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 980
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 979
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta


SR 41 over Sandy River Plan: PropConditions 4/17/2020
RS = 978
.075
.06
.075
Elevation (ft)
Station (ft)
Legend
WS Flood of Record
WS 100 FEMA
WS 50
WS 25
WS 10
WS 1.1
Ground
Bank Sta

HEC-RAS Plan: PropConditions   River: Sandy River   Reach: Reach 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	1000	1.1	6700.00	315.73	326.73	323.31	327.02	0.002806	4.36	1555.20	265.29	0.31
Reach 1	1000	10	23400.00	315.73	335.80	327.08	336.32	0.001542	5.91	4193.17	310.60	0.27
Reach 1	1000	25	29500.00	315.73	338.26	328.13	338.86	0.001454	6.34	4967.02	318.01	0.27
Reach 1	1000	50	34250.00	315.73	341.01	328.95	341.60	0.001185	6.30	5888.88	412.41	0.25
Reach 1	1000	Flood of Record	44290.00	315.73	344.56	330.58	345.20	0.001077	6.69	8238.85	815.71	0.24
Reach 1	1000	100 FEMA	39200.00	315.73	342.42	329.74	343.07	0.001217	6.68	6604.58	625.39	0.25
Reach 1	999	1.1	6700.00	317.82	326.38	323.93	326.83	0.005113	5.45	1272.57	252.91	0.41
Reach 1	999	10	23400.00	317.82	335.58	327.90	336.23	0.002064	6.67	3805.04	295.38	0.31
Reach 1	999	25	29500.00	317.82	338.04	328.78	338.77	0.001908	7.11	4544.76	305.52	0.30
Reach 1	999	50	34250.00	317.82	340.82	329.89	341.52	0.001515	7.01	5447.96	385.22	0.28
Reach 1	999	Flood of Record	44290.00	317.82	344.39	331.43	345.13	0.001342	7.36	7842.72	818.16	0.27
Reach 1	999	100 FEMA	39200.00	317.82	342.23	330.68	343.00	0.001543	7.40	6152.50	630.01	0.28
Reach 1	998	1.1	6700.00	317.44	326.20	323.87	326.70	0.005576	5.70	1216.84	243.91	0.43
Reach 1	998	10	23400.00	317.44	335.48	327.91	336.17	0.002207	6.92	3819.06	349.66	0.32
Reach 1	998	25	29500.00	317.44	337.99	329.06	338.72	0.001960	7.24	4776.75	413.33	0.31
Reach 1	998	50	34250.00	317.44	340.82	330.01	341.47	0.001470	6.94	6118.79	540.90	0.27
Reach 1	998	Flood of Record	44290.00	317.44	344.43	331.61	345.07	0.001227	7.08	8253.22	653.77	0.26
Reach 1	998	100 FEMA	39200.00	317.44	342.25	330.78	342.94	0.001435	7.18	6907.76	575.31	0.27
Reach 1	997	1.1	6700.00	316.31	325.98	322.93	326.41	0.003976	5.33	1294.31	220.97	0.37
Reach 1	997	10	23400.00	316.31	335.36	327.20	336.05	0.002008	6.93	3899.37	355.86	0.31
Reach 1	997	25	29500.00	316.31	337.89	328.49	338.61	0.001798	7.24	4848.26	390.59	0.30
Reach 1	997	50	34250.00	316.31	340.72	329.53	341.39	0.001407	7.05	6106.98	516.18	0.27
Reach 1	997	Flood of Record	44290.00	316.31	344.31	331.07	345.00	0.001222	7.30	8123.52	644.35	0.26
Reach 1	997	100 FEMA	39200.00	316.31	342.14	330.48	342.85	0.001390	7.32	6854.49	533.18	0.27
Reach 1	996	1.1	6700.00	317.91	325.67	323.32	326.23	0.005884	6.04	1134.79	211.12	0.44
Reach 1	996	10	23400.00	317.91	335.25	327.61	335.97	0.002217	7.14	3808.53	364.89	0.32
Reach 1	996	25	29500.00	317.91	337.78	329.12	338.54	0.001967	7.45	4797.16	411.82	0.31
Reach 1	996	50	34250.00	317.91	340.66	330.00	341.34	0.001492	7.17	6095.98	511.65	0.28
Reach 1	996	Flood of Record	44290.00	317.91	344.27	331.89	344.95	0.001273	7.37	8134.75	638.47	0.26
Reach 1	996	100 FEMA	39200.00	317.91	342.09	330.77	342.80	0.001458	7.41	6838.46	523.28	0.28
Reach 1	995	1.1	6700.00	315.07	325.72	322.07	326.10	0.003192	4.99	1388.89	224.67	0.34
Reach 1	995	10	23400.00	315.07	335.30	326.51	335.90	0.001697	6.54	4150.95	352.15	0.28
Reach 1	995	25	29500.00	315.07	337.82	327.73	338.48	0.001588	6.95	5080.86	382.65	0.28
Reach 1	995	50	34250.00	315.07	340.68	329.00	341.29	0.001252	6.78	6226.60	425.63	0.26

HEC-RAS Plan: PropConditions River: Sandy River Reach: Reach 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	995	Flood of Record	44290.00	315.07	344.23	330.71	344.93	0.001196	7.33	8081.69	610.30	0.26
Reach 1	995	100 FEMA	39200.00	315.07	342.07	329.82	342.77	0.001332	7.29	6866.04	497.19	0.27
Reach 1	994	1.1	6700.00	310.95	325.83	318.21	325.99	0.000811	3.22	2153.47	244.54	0.18
Reach 1	994	10	23400.00	310.95	335.39	323.22	335.82	0.000944	5.41	4883.95	330.93	0.21
Reach 1	994	25	29500.00	310.95	337.90	324.47	338.40	0.000964	5.92	5737.33	354.90	0.22
Reach 1	994	50	34250.00	310.95	340.74	325.42	341.23	0.000829	5.95	6788.84	387.53	0.21
Reach 1	994	Flood of Record	44290.00	310.95	344.27	327.20	344.88	0.000874	6.67	8428.74	558.58	0.22
Reach 1	994	100 FEMA	39200.00	310.95	342.13	326.34	342.71	0.000911	6.46	7354.21	441.61	0.22
Reach 1	993	1.1	6700.00	311.34	325.84	318.06	325.96	0.000590	2.83	2475.25	264.81	0.15
Reach 1	993	10	23400.00	311.34	335.42	322.48	335.77	0.000753	4.93	5198.31	312.15	0.19
Reach 1	993	25	29500.00	311.34	337.93	323.69	338.36	0.000790	5.46	5942.64	337.16	0.20
Reach 1	993	50	34250.00	311.34	340.74	324.54	341.20	0.000715	5.62	6808.81	372.78	0.20
Reach 1	993	Flood of Record	44290.00	311.34	344.28	326.18	344.84	0.000747	6.27	7927.31	521.91	0.21
Reach 1	993	100 FEMA	39200.00	311.34	342.15	325.34	342.67	0.000772	6.05	7251.99	418.41	0.21
Reach 1	992	1.1	6700.00	312.03	325.77	319.40	325.94	0.000965	3.32	2064.28	254.13	0.19
Reach 1	992	10	23400.00	312.03	335.30	323.76	335.74	0.000997	5.43	4540.53	295.91	0.22
Reach 1	992	25	29500.00	312.03	337.78	324.92	338.32	0.001030	6.00	5198.94	314.22	0.23
Reach 1	992	50	34250.00	312.03	340.61	325.80	341.16	0.000910	6.14	5967.46	346.65	0.22
Reach 1	992	Flood of Record	44290.00	312.03	344.11	327.55	344.81	0.000942	6.84	6940.80	483.86	0.23
Reach 1	992	100 FEMA	39200.00	312.03	341.99	326.67	342.64	0.000979	6.61	6350.60	404.46	0.23
Reach 1	989.41		Bridge									
Reach 1	989	1.1	6700.00	316.22	325.18	321.47	325.53	0.002795	4.75	1440.40	223.15	0.32
Reach 1	989	10	23400.00	316.22	334.62	325.73	335.31	0.001829	6.80	3619.58	263.68	0.30
Reach 1	989	25	29500.00	316.22	337.05	326.98	337.87	0.001808	7.41	4207.70	276.04	0.30
Reach 1	989	50	34250.00	316.22	338.78	327.86	339.70	0.001805	7.85	4634.92	281.97	0.30
Reach 1	989	Flood of Record	44290.00	316.22	342.21	329.63	343.33	0.001812	8.72	5530.34	334.50	0.31
Reach 1	989	100 FEMA	39200.00	316.22	340.58	328.75	341.58	0.001774	8.23	5088.65	288.80	0.31
Reach 1	988	1.1	6700.00	316.83	325.11	321.75	325.49	0.003277	4.99	1376.23	222.73	0.34
Reach 1	988	10	23400.00	316.83	334.59	326.01	335.29	0.001909	6.88	3601.74	261.44	0.30
Reach 1	988	25	29500.00	316.83	337.01	327.23	337.85	0.001880	7.49	4205.19	273.08	0.31
Reach 1	988	50	34250.00	316.83	338.75	328.11	339.68	0.001867	7.93	4654.22	286.22	0.31
Reach 1	988	Flood of Record	44290.00	316.83	342.20	329.85	343.31	0.001832	8.72	5618.07	355.02	0.32
Reach 1	988	100 FEMA	39200.00	316.83	340.56	329.00	341.56	0.001824	8.29	5141.37	302.63	0.31

HEC-RAS Plan: PropConditions River: Sandy River Reach: Reach 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	987	1.1	6700.00	316.88	325.02	321.37	325.35	0.002786	4.68	1474.95	232.29	0.32
Reach 1	987	10	23400.00	316.88	334.58	325.53	335.19	0.001656	6.46	3921.26	279.61	0.28
Reach 1	987	25	29500.00	316.88	337.03	326.72	337.74	0.001615	7.00	4625.39	295.10	0.28
Reach 1	987	50	34250.00	316.88	338.78	327.65	339.57	0.001595	7.39	5153.16	310.04	0.29
Reach 1	987	Flood of Record	44290.00	316.88	342.26	329.33	343.19	0.001547	8.07	6329.44	383.76	0.29
Reach 1	987	100 FEMA	39200.00	316.88	340.60	328.50	341.45	0.001556	7.72	5730.17	326.29	0.29
Reach 1	986	1.1	6700.00	316.25	324.94	320.91	325.25	0.002385	4.55	1524.68	227.45	0.30
Reach 1	986	10	23400.00	316.25	334.52	325.22	335.13	0.001596	6.50	3970.51	284.11	0.28
Reach 1	986	25	29500.00	316.25	336.97	326.39	337.68	0.001561	7.04	4683.76	296.61	0.28
Reach 1	986	50	34250.00	316.25	338.72	327.28	339.51	0.001551	7.43	5215.15	312.40	0.29
Reach 1	986	Flood of Record	44290.00	316.25	342.21	329.04	343.13	0.001514	8.13	6406.64	369.27	0.29
Reach 1	986	100 FEMA	39200.00	316.25	340.53	328.20	341.39	0.001526	7.79	5809.74	341.94	0.29
Reach 1	985	1.1	6700.00	315.47	324.81	320.74	325.11	0.002358	4.43	1530.00	230.30	0.29
Reach 1	985	10	23400.00	315.47	334.46	324.99	335.03	0.001463	6.19	4110.25	296.11	0.27
Reach 1	985	25	29500.00	315.47	336.93	326.17	337.58	0.001423	6.69	4851.96	306.30	0.27
Reach 1	985	50	34250.00	315.47	338.69	327.08	339.40	0.001404	7.04	5398.37	316.25	0.27
Reach 1	985	Flood of Record	44290.00	315.47	342.17	328.95	343.03	0.001382	7.74	6626.00	386.01	0.28
Reach 1	985	100 FEMA	39200.00	315.47	340.50	327.94	341.29	0.001396	7.42	6001.59	359.48	0.27
Reach 1	984	1.1	6700.00	315.91	324.65	320.22	324.91	0.001852	4.11	1694.12	247.86	0.26
Reach 1	984	10	23400.00	315.91	334.40	324.36	334.88	0.001227	5.80	4513.12	322.15	0.25
Reach 1	984	25	29500.00	315.91	336.87	325.52	337.43	0.001216	6.31	5328.16	347.40	0.25
Reach 1	984	50	34250.00	315.91	338.63	326.39	339.26	0.001223	6.70	5983.53	396.31	0.25
Reach 1	984	Flood of Record	44290.00	315.91	342.17	328.14	342.87	0.001149	7.19	7518.88	465.03	0.25
Reach 1	984	100 FEMA	39200.00	315.91	340.46	327.27	341.14	0.001186	6.97	6753.34	439.30	0.25
Reach 1	983	1.1	6700.00	315.78	324.59	319.85	324.81	0.001574	3.84	1803.90	261.96	0.24
Reach 1	983	10	23400.00	315.78	334.39	323.89	334.81	0.001056	5.42	4858.03	350.62	0.23
Reach 1	983	25	29500.00	315.78	336.86	325.10	337.35	0.001046	5.89	5755.26	379.91	0.23
Reach 1	983	50	34250.00	315.78	338.64	325.92	339.17	0.001035	6.20	6454.90	406.24	0.23
Reach 1	983	Flood of Record	44290.00	315.78	342.18	327.48	342.78	0.000973	6.65	7976.84	501.58	0.23
Reach 1	983	100 FEMA	39200.00	315.78	340.48	326.81	341.05	0.000995	6.42	7217.37	420.15	0.23
Reach 1	982	1.1	6700.00	314.91	324.56	319.31	324.74	0.001171	3.43	2006.61	268.74	0.21
Reach 1	982	10	23400.00	314.91	334.39	323.15	334.74	0.000855	4.96	5449.37	430.11	0.21
Reach 1	982	25	29500.00	314.91	336.89	324.28	337.28	0.000822	5.31	6541.92	446.17	0.21

HEC-RAS Plan: PropConditions River: Sandy River Reach: Reach 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	982	50	34250.00	314.91	338.68	325.08	339.10	0.000805	5.55	7360.92	464.26	0.21
Reach 1	982	Flood of Record	44290.00	314.91	342.24	326.78	342.70	0.000751	5.92	9092.31	542.29	0.21
Reach 1	982	100 FEMA	39200.00	314.91	340.53	325.89	340.97	0.000770	5.73	8228.14	471.12	0.21
Reach 1	981	1.1	6700.00	315.12	324.49	319.14	324.68	0.001183	3.45	1987.91	267.20	0.21
Reach 1	981	10	23400.00	315.12	334.36	323.07	334.69	0.000827	4.88	5656.72	459.08	0.20
Reach 1	981	25	29500.00	315.12	336.87	324.25	337.23	0.000785	5.18	6822.03	471.36	0.20
Reach 1	981	50	34250.00	315.12	338.65	325.09	339.05	0.000769	5.43	7684.79	499.73	0.20
Reach 1	981	Flood of Record	44290.00	315.12	342.22	326.86	342.66	0.000722	5.80	9676.24	621.90	0.20
Reach 1	981	100 FEMA	39200.00	315.12	340.51	325.94	340.92	0.000739	5.61	8668.47	551.93	0.20
Reach 1	980	1.1	6700.00	314.33	324.45	318.59	324.63	0.001018	3.39	2070.38	265.56	0.20
Reach 1	980	10	23400.00	314.33	334.33	322.72	334.66	0.000796	4.92	5779.67	470.63	0.20
Reach 1	980	25	29500.00	314.33	336.84	323.91	337.19	0.000757	5.21	6972.49	478.66	0.20
Reach 1	980	50	34250.00	314.33	338.63	324.75	339.01	0.000734	5.41	7835.01	482.85	0.20
Reach 1	980	Flood of Record	44290.00	314.33	342.20	326.49	342.62	0.000685	5.76	9735.07	606.34	0.20
Reach 1	980	100 FEMA	39200.00	314.33	340.49	325.62	340.89	0.000703	5.58	8747.85	518.94	0.20
Reach 1	979	1.1	6700.00	313.81	324.43	317.62	324.55	0.000630	2.81	2539.71	314.30	0.16
Reach 1	979	10	23400.00	313.81	334.32	321.51	334.59	0.000601	4.39	6398.16	494.42	0.18
Reach 1	979	25	29500.00	313.81	336.83	322.65	337.13	0.000588	4.71	7670.86	519.23	0.18
Reach 1	979	50	34250.00	313.81	338.62	323.46	338.94	0.000579	4.93	8619.63	539.72	0.18
Reach 1	979	Flood of Record	44290.00	313.81	342.19	325.02	342.56	0.000566	5.35	10951.81	756.47	0.18
Reach 1	979	100 FEMA	39200.00	313.81	340.49	324.22	340.82	0.000559	5.09	9724.90	643.50	0.18
Reach 1	978	1.1	6700.00	313.00	324.39	317.36	324.51	0.000600	2.81	2517.33	290.74	0.16
Reach 1	978	10	23400.00	313.00	334.27	321.28	334.54	0.000600	4.44	6221.53	446.84	0.18
Reach 1	978	25	29500.00	313.00	336.77	322.41	337.08	0.000601	4.81	7352.73	457.66	0.18
Reach 1	978	50	34250.00	313.00	338.56	323.20	338.90	0.000600	5.06	8178.08	465.69	0.18
Reach 1	978	Flood of Record	44290.00	313.00	342.11	324.81	342.51	0.000600	5.55	9906.35	510.32	0.19
Reach 1	978	100 FEMA	39200.00	313.00	340.41	324.03	340.78	0.000592	5.28	9053.60	479.50	0.18

Flood of April 1987 in Maine

United States Geological Survey Water-Supply Paper 2424

Prepared in cooperation with the Maine Department of Transportation

Flood of April 1987 in Maine

By RICHARD A. FONTAINE and JOSEPH P. NIELSEN

Prepared in cooperation with the
Maine Department of Transportation

U.S. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2424

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
GORDON P. EATON, Director

Published in the Eastern Region, Reston, Va.

UNITED STATES GOVERNMENT PRINTING OFFICE: 1994

For sale by
U.S. Geological Survey, Map Distribution
Box 25286, MS 306, Federal Center
Denver, CO 80225

Library of Congress Cataloging in Publication Data

Fontaine, Richard A.
Flood of April 1987 in Maine / by Richard A. Fontaine and Joseph P. Nielsen.
p. cm. — (U.S. Geological Survey water-supply paper ; 2424)
Prepared in cooperation with the Maine Department of Transportation.
Includes bibliographical references.
Supt. of Docs. no.: I19.13:2424
1. Floods—Maine. I. Nielsen, Joseph P. II. Maine. Dept. of Transportation.
III. Title. IV. Series.
GB1399.4.M2F66 1994
551.48'9'09741—dc20 93–36752
CIP

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
	Length	
inch (in.)	25.40	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
square mile (mi^2)	2.590	square kilometer
	Volume	
cubic foot (ft^3)	0.02832	cubic meter
gallon (gal)	3.785	liter
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile ($ft^3/s/mi^2$)	0.01093	cubic meter per second per square kilometer

Temperature

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) as follows:

$$°C=(°F-32)/1.8$$

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Flood of April 1987 in Maine

By Richard A. Fontaine *and* Joseph P. Nielsen

Abstract

Snowmelt and precipitation from two storms caused record flooding in April 1987 in central and southwestern Maine. Record peak streamflows were recorded at 13 streamflow-gaging stations. Several peaks were the highest known since the area was settled more than 200 years ago. Statewide damage exceeded $74 million, and 14 of Maine's 16 counties were declared Federal Disaster Areas; fortunately, no lives were lost.

The maximum flood peaks and precipitation were associated with the storm of March 30 through April 2. Precipitation from the storm was concentrated along the eastern side of Maine's western mountains. The two greatest amounts of storm precipitation, 8.36 and 7.33 inches, were observed at Pinkham Notch, N.H., and Blanchard, Maine. Runoff from the first storm was augmented by as much as 4 inches of meltwater from the residual snowpack. Maximum precipitation of 3–5 inches was associated with the storm of April 4–8, primarily in southern Maine.

Rainfall-runoff and storage analyses indicated that flood peaks were reduced by reservoir systems in headwaters of the Penobscot, Kennebec, Androscoggin, and Presumpscot River basins. Flood-crest data obtained at 378 locations along 600 miles of rivers and streams were used to aid in the evaluation of the flood.

INTRODUCTION

Maine's annual spring flooding typically results from runoff of snowmelt accelerated by seasonally high temperatures, rainfall, or a combination of both. Spring floods are often intensified by frozen or saturated soils, lack of evapotranspiration, and ice jams. An additional variable is the influence of reservoir storage on flood peaks. Major reservoirs in Maine are operated primarily to meet commercial needs for hydropower and process water. During the spring runoff season, dam operators attempt to fill their reservoirs. As a result, their management of the reservoirs often helps to mitigate flooding.

The realization that spring flooding in Maine is a complex interaction of hydrologic factors led to the formation of the Maine River Flow Advisory Committee. The committee consists of representatives from operators of eight major reservoir systems, five State agencies, and three Federal agencies. The committee was formed after the spring flood of 1983 to improve the exchange of hydrologic information collected by the members of the committee and to provide information to emergency action agencies and the public. Much of the information contained in this report was obtained from members of the committee.

Data collected before, during, and after floods are valuable to those who must plan for the effects of flooding. Peak-stage, peak-discharge, and flood-frequency data are used in the design of hydraulic structures, such as bridges, culverts, and dams; in calibration of flow models used in flood insurance studies to establish insurance rates; and in local, State, and Federal plans for flood plain development. Snowpack, precipitation, temperature, and runoff data are used in reservoir operations and as advance warning of potential flooding. Analyses of rainfall-runoff relations increase the understanding of the complex interaction of these variables that affect spring flooding; this increased understanding, in turn, helps in planning for mitigation of flood damage.

Provisional rainfall, snow-survey, and peak-stage and discharge data for the April 1987 flood have been published by the U.S. Geological Survey (Fontaine, 1987). This study, done by the U.S. Geological Survey (USGS) in cooperation with the Maine Department of Transportation, updates the previous report and provides additional descriptive data.

Purpose and Scope

This report provides a detailed hydrometeorologic description of the flood of April 1987 in Maine. Precipitation, snow cover, temperature, streamflow, and reservoir storage before and during the flood are documented, and storm characteristics, including temporal and spatial variations of the storm precipitation, are described with reference to data from the statewide precipitation-gage networks and meteorological reports of the National Weather Service. Descriptive flood data include flood discharges and frequencies at 35 streamflow-gaging stations and miscellaneous sites; flood-crest elevations at 378 locations along 600 river miles; and analyses of the effects of reservoir storage, rainfall, and runoff in the Penobscot, Kennebec, Androscoggin, and Presumpscot River basins. In addition, the relation of the April 1987 flood to historical records of previous floods in Maine is reviewed.

Acknowledgments

Precipitation, snow-survey, reservoir-storage, and selected flood-crest data were provided by the National Weather Service, the U.S. Army Corps of Engineers, Central Maine Power Company, Georgia-Pacific Corporation, Great Northern Paper Company, International Paper Company, Kennebec Water Power Company, Maine Public Service Company, Union Water Power Company, U.S. Soil Conservation Service, and Maine Department of Transportation.

HYDROMETEOROLOGIC SETTING

The quantity of runoff and the magnitude of flood peaks derived from a particular storm event depends on the physiography and geology of the watersheds, the antecedent hydrologic conditions within the watersheds, the characteristics of the storm in question, and the relations among these factors (Benson, 1962).

Physiography and Geology

Maine is in the New England physiographic province of the Appalachian Highlands. The diverse topography ranges from the Seaboard Lowlands in southwestern Maine to the White Mountain section in northwestern Maine (Fenneman, 1938). Maine's physiographic divisions are shown in figure 1. The White Mountain section is characterized by irregular uplands and numerous mountain peaks with elevations higher than 3,000 ft. Mount Katahdin, at an elevation of 5,267 ft, is Maine's highest peak and a principal feature in the section. The New England Upland section is an area of gently sloping highlands of as much as 500 ft in elevation, rising above valleys that are often wide and flat. The section is interspersed with some mountains. The Seaboard Lowland section is characterized by flat, plain-like areas and some low hills of as much as 500 ft in elevation.

Bedrock formations in Maine originated primarily as ocean sediments or molten rock from deep within the earth (Maine State Planning Office, 1987, p. 15). During the time when the Appalachian Mountains were formed, the sediments were subjected to intense pressures and temperatures. Resultant metamorphic rocks were subjected to folding, faulting, and uplift, accompanied by intense volcanic activity. Maine's igneous and metamorphic bedrocks are widely exposed in the mountainous and coastal areas of the State. A map of the bedrock geology of Maine was prepared by Osberg and others (1985).

The surficial geology of Maine is primarily the result of glacial erosion and deposition and subsequent marine sedimentation. Most of the State is blanketed by till and stratified drift deposited in irregular depths. In mountainous areas, thin layers of till predominate. In valleys, thick till deposits are commonly buried under marine deposits such as clay. Many areas of sorted sands and gravels are present along rivers and streams; these sorted sand and gravels form the principal aquifers in Maine. A map describing the surficial features of Maine was prepared by Thompson and Borns (1985).

The physiography and geology of the flood-study area are defining factors in the hydrologic response of the river basins. For example, steep headwater areas with little or no overburden lead to rapid rainfall-runoff response. The complexity of Maine's physiography and geology and the large

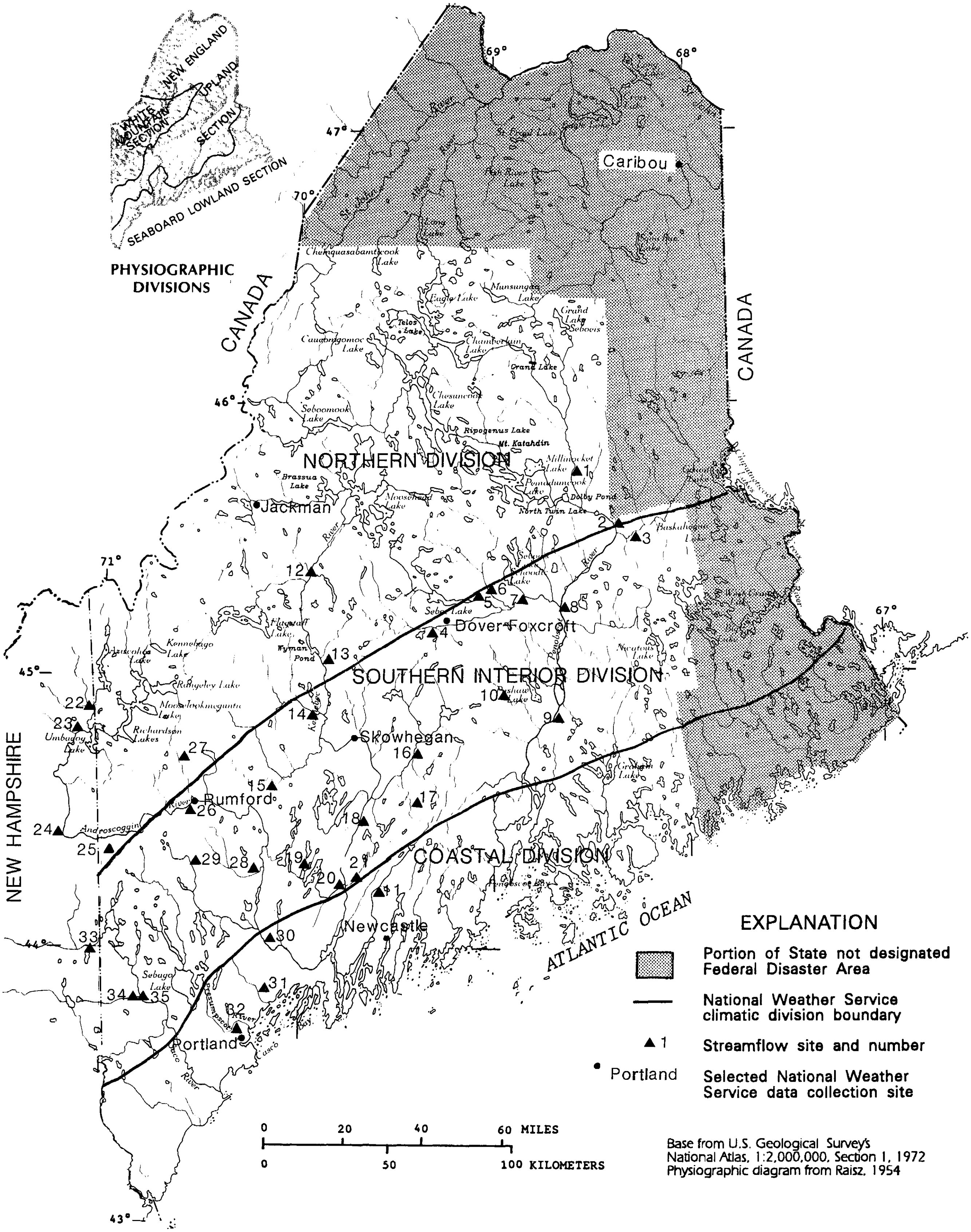


Figure 1. Locations of National Weather Service climatic divisions, physiographic divisions, and streamflow-data-collection sites in the flood-study area.

estimates, which eventually require updates, are made. Indirect determinations of the 1987 peak-flood discharge were made for sites 4, 14, 15, and 29 (table 11) by use of the slope-area method (Dalrymple and Benson, 1967).

The recurrence interval or frequency of the flood (table 11) is the average number of years between floods equal to or greater than the April 1987 flood. Because recurrence interval is an average number of years, it is not an indication of when a flood of a given magnitude will be repeated. In fact, floods of equal or greater magnitude can occur within the same year. The reciprocal of the recurrence interval is the probability that such a flood will occur in any one year. For instance, a 100-year flood has a 0.01 probability, or a 1-percent chance, of occurring in any year. A 10-year flood has a 0.10 probability, or a 10-percent chance, of occurring in any year. Log Pearson type III procedures, described by the Water Resources Council (1981), were used to compute individual station frequency curves. According to Benson (1962, p. 8), when usable storage in a basin exceeds 4.5 million ft^3 (103 acre-ft) per mi^2, peak discharges may be affected by more than 10 percent. Stations where this criterion is exceeded are footnoted in table 11. Frequency analyses at these sites are based on the station skew coefficient.

Data from the St. John and St. Croix River basins and from eastern coastal basins are not included in table 11. Precipitation in northern and eastern Maine was minor during both storms. Recurrence intervals for all April 1987 flood peaks at St. John River basin stations were less than 10 years. Recurrence intervals for all April 1987 flood peaks at downeast coastal and St. Croix River basin stations were less than 5 years.

Most of the significant flood peaks in the Penobscot River basin were in the Piscataquis River basin. New peaks of record and floods whose recurrence intervals were greater than 100 years were noted at two of the four stations (sites 4 and 7) in the basin. Peaks during the 1987 flood were 64 and 41 percent higher than the previous maximum peaks at the Dover-Foxcroft and Medford stations, respectively. Lows Bridge, built in 1857 across the Piscataquis River at the Dover-Foxcroft gage and declared a National Historic Landmark, was destroyed during the flood (Fontaine and Maloney, 1990, p. 42). The Piscataquis River basin has a total drainage area of 1,453 mi^2 (Fontaine, 1981, p. 83), which represents about 22 and 19 percent of Penobscot River basin upstream from the West Enfield gaging station (site 8) and the Eddington gaging station (site 9), respectively. According to a U.S. Army Corps of Engineers study (1990, p. A–31), the Piscataquis basin contributed 53 and 44 percent of the flood peaks at the West Enfield and Eddington gages, respectively, during the 1987 flood. New peaks of record also were established at two gaging stations: Eddington (site 9) and Kenduskeag Stream near Kenduskeag (site 10).

The USGS currently (1992) operates only one gaging station in the coastal basins between the mouths of the Penobscot and Kennebec Rivers: the Sheepscot River at North Whitefield (site 11). During the 1987 flood, a new peak of record was established at the North Whitefield gage, which has been in operation since 1939.

Flooding during 1987 was most extreme in the Kennebec River basin. About 60 percent of the flood damage took place in the Kennebec basin (table 10). New peaks of record were recorded at 7 of the 10 gaging stations located in the basin. The most significant sources of runoff contributing to the flood peak in Augusta were the intervening drainages between Bingham and Waterville, most notably the Sandy and Carrabassett Rivers. The intervening drainages represent 31 percent of the total Kennebec watershed area at Augusta but contributed about 60 percent of the peak-flood flow (U.S. Army Corps of Engineers, 1987, p. 19). Flood peaks at the Carrabassett (site 14) and Sandy River (site 15) gages were 65 and 32 percent higher than the previous maximum peaks (March 1936). Crippen and Bue (1977, fig. 3) prepared an envelope curve relating maximum flood flows to drainage area for sites in New England. The gaging station in Maine that came the closest to the envelope curve (the theoretical maximum potential flood flow) during the 1987 flood was the Kennebec River at North Sidney (site 18).

In the Androscoggin River basin, flood peaks in 1987 were within 25 percent of previous maximum floods at all but one of the nine stations. The 1987 flood peak on the Little Androscoggin River near South Paris (site 29) was 17 percent greater than the previous maximum, and the recurrence interval was greater than 100 years. The peak runoff rate of 195 $ft^3/s/mi^2$ recorded at the Wild River station (site 25) was the highest for any station in Maine during the 1987 flood.

Table 16. Historical flood-damage estimates for Maine
[In 1987 dollars; all figures rounded to nearest ten thousand dollars]

River Basin	Floods					
	March 1936[a]	March 1953[a]	December 1969[a]	April 1973[a]	December 1973[a]	April 1987[b]
Androscoggin	75,030,000	12,590,000	2,050,000	0	1,180,000	14,900,000
Kennebec	33,060,000	4,090,000	3,560,000	0	3,520,000	44,600,000
Penobscot	7,280,000	1,280,000	4,440,000	500,000	1,460,000	10,600,000
Presumpscot	0	0	540,000	0	0	200,000
Saco	27,760,000	5,070,000	390,000	0	130,000	1,600,000
Other rivers and general	0	290,000	1,720,000	2,850,000	920,000	2,600,000
Total	143,130,000	23,320,000	12,700,000	3,350,000	7,210,000	74,500,000

[a]Data from U.S. Army Corps of Engineers (1978, table 24).
[b]Data from Hasbrouck (1987, p. 10).

Management Agency, 1991a), major damage was caused by ice jams. During the 1991 flood, damage was substantial even though the peak flow had a low recurrence interval.

Although flow rates and volumes are critical, the ultimate variable of concern is often maximum elevations of flood waters. Data summarized in table 11 include peak stages of the 1987 flood and those for the previously known maximum floods at USGS streamflow-gaging stations. Flood-crest data along approximately 600 mi of rivers and streams in the flood-affected area are presented in table 12. Flood-stage data extending back as far as 1776 are available for selected locations (Thomson, 1964) and a comparison to 1987 flood levels follows.

According to Grover (1937, p. 44), the May 1923 flood was the largest of record in the Penobscot River basin. Grover (1937, p. 439) compared 1936 flood elevations at selected locations to those from 1923. During the 1987 flood, elevations were determined at two of the same locations. These data are listed below.

Location	Maximum elevation (in feet) 1923	1936	1987
East Branch Penobscot River at Grindstone	311.3	308.8	[a]308.7
Penobscot River above Milford Dam	110.2	107.1	[b]107.2

[a]See table 11.
[b]See table 12.

Thomson and others (1964, p. 75) noted that the 1936 flood was the greatest on the Sandy River at Farmington Falls since 1776, when the area was settled. Stages relative to the 1936 flood stage, given by Thomson and others include:

Date		Relative stage (in feet)
	1785	97
	1820	96
	1832	94
October	1855	99.0
December	1901	96.76
April	1923	94.36
March	1936	100.0

Although the exact location of the relative stages is unknown, an indirect comparison is still possible. According to Grover (1937, p. 381), the elevation of the 1936 flood at river mile 22.5 on the Sandy River at Farmington Falls was 339.8 ft. The elevation of the 1987 flood at this site was 2.8 ft higher at 342.6 ft.

Grover (1937, p. 441) tabulated elevations reached during various historical floods on the Kennebec River at a gristmill in Norridgewock, Maine, as follows:

Date		Elevation (in feet)
October	1855	168.6
November	1863	163.4
October	1869	169.1
May	1882	169.7
December	1901	170.0
June	1917	162.9
April	1923	168.0
March	1926	171.7
April	1987	177 (estimated)

A highwater elevation of 177.7 ft (table 12) was determined for the 1987 flood at a location approximately 0.4 mi upstream, at the U.S. Route 201A highway bridge. From these data and flood profiles published by the Federal Emergency Management Agency (1988c, panel 02P), the elevation at the gristmill site during the 1987 flood was estimated to be about 177 ft.

The elevations reached during historical floods on the Kennebec River have been marked on the corner of the building at 136 Water Street in Hallowell, Maine (Grover, 1937, p. 438). Elevations determined for these marks (Grover, 1937, p. 442) follow:

Date		Elevation (in feet)
March	1826	22.2
February	1870	24.1
March	1896	26.0
March	1936	29.6
April	1987	29.1

During the 1987 flood a maximum elevation of 29.1 feet was determined (table 12).

Long-term historical elevations of previous floods are available at only a few locations (Thomson and others, 1964). In addition, hydrologic conditions at the time of these historical floods are often poorly documented and may differ from those during the 1987 flood.

To this point, discussion of historical floods has focused on relative measures of severity. Equally important is a knowledge of when floods occur. For example, are peak floods seasonal or are they likely to occur at anytime in the year? Although a complete analysis of this topic is beyond the scope of this report, some simple temporal relations can be explored.

Two factors were examined for possible influence on the seasonality of floods in Maine: (1) the size of the basin and (2) seasonal variations in climate, temperature, precipitation, and snowmelt.

Three separate watersheds were selected for analysis: North Branch Tanning Brook near Manchester (not included in table 11), Piscataquis River near Dover-Foxcroft (site 4 in table 11), and Androscoggin River near Auburn (site 30 in table 11). Drainage areas of the Tanning Brook (Manchester), Piscataquis River (Dover), and Androscoggin River (Auburn) watersheds are 0.93, 298, and 3,263 mi^2, respectively. Annual peak discharge is plotted against day of occurrence in figure 14 and the monthly occurrence of annual peak discharges is plotted in figure 15.

The data in figures 14 and 15 show distinct seasonal patterns in the distribution of annual peaks for all three watersheds. Annual peaks are in two groups (spring and fall). In the period of record at Manchester, Dover, and Auburn, 60, 58, and 68 percent of the annual peaks occurred during March, April and May. During October, November, and December, 20, 27, and 13 percent of the annual peaks occurred at Manchester, Dover, and Auburn, respectively. These spring and fall months combined to account for an average of 82 percent of the annual peaks at the three sites. Of the 166 annual peaks, only 1 peak occurred during July and August.

Distribution of precipitation alone cannot account for the seasonality of annul peak discharges. Fontaine and Cowing (1986, p. 259) noted that precipitation in Maine does not exhibit a strong seasonal pattern. In spring and fall, evapotranspiration is small, and during most spring peaks and several of the later fall peaks, snowmelt was a factor. The evapotranspiration and snowmelt variables may be the greatest contributors to the spring and fall seasonality of annual peaks. Because most peaks occur in spring, snowmelt is likely the more significant variable.

No significant difference in the seasonality of annual peaks as a function of the drainage area of the three sites was noted, although the short period of record at Manchester (20 years) may have masked any differences. (Manchester was selected as the site in Maine with the longest period of record among sites whose drainage area is less than 5.0 mi^2.)

The data used to generate the scatterplots in figure 14 were reviewed to determine the relations, if any, between magnitude of annual peaks and seasons. At Manchester, all but one of the highest flood peaks occurred in the winter-spring season when snow was melting. The one peak not associated with snowmelt was the peak of record in December 1973 (no data are available at Manchester in 1987). At Dover-Foxcroft, of the 10 largest floods, the second, eighth and ninth highest peaks occurred in the fall and the remainder occurred in the spring snowmelt season. At Auburn, the nine highest peaks occurred in the winter-spring season when snowmelt was likely. Snowmelt peaks were dominant among the highest peaks at each of the three sites. Only at the Manchester and Dover sites, however, were recurrence intervals of annual peaks greater than 10 years when snowmelt was not a probable factor.

Stream and location	Miles upstream[a] from mouth	Elevation (in feet)
KENNEBEC RIVER BASIN—Continued		
Carrabassett River—Continued:		
New Portland, Maine, upstream side Route 146 bridge, right bank	12.5	437.9
North Anson, Maine, U.S. Geological Survey station 01047000, 3.4 miles upstream from mouth of Mill Stream, left bank.	4.6	330.0
North Anson, Maine, 2.0 miles upstream from mouth of Mill Stream, left bank	3.2	323.8
North Anson, Maine, 150 feet upstream from railroad bridge, left bank	1.3	309.5
North Anson, Miane, 150 feet downstream from railroad bridge, left bank	1.3	305.8
North Anson, Maine, 50 feet upstream from mouth of Mill Stream, left bank	1.2	300.4
North Anson, Maine, downstream side mouth of Mill Stream, left bank	1.2	299.0
North Anson, Maine, 100 feet upstream from Route 201A bridge, right bank	1.0	281.6
North Anson, Maine, 500 feet downstream from Route 201A bridge, right bank	.9	273.9
Sandy River:		
Phillips, Maine, 100 feet upstream from Route 142 bridge, left bank	51.5	607.2
Phillips, Maine, 20 feet downstream from Route 142 bridge, right bank	51.5	597.2
Phillips, Maine, 1,000 feet upstream from Route 149 bridge, right bank	50.1	569.2
Avon, Maine, upstream from mouth of Bean Brook, left bank	44.3	487.2
Strong, Maine, 100 feet upstream from Route 145 bridge, right bank	41.5	443.4
Strong, Maine, 100 feet downstream from Route 145 bridge, right bank	41.5	441.4
Strong, Maine, 4.1 miles downstream from Route 145 bridge, right bank	37.4	399.1
Farmington, Maine, 175 feet upstream from Route 4 bridge, right bank	33.0	373.9
Farmington, Maine, 500 feet downstream from Route 4 bridge, right bank	32.9	370.8
Farmington, Maine, upstream side of railroad bridge, left bank	29.9	360.1
Farmington, Maine, 150 feet downstream of railroad bridge, left bank	29.9	358.9
Farmington, Maine, 500 feet upstream from Route 2 bridge, right bank	29.6	359.2
Farmington, Maine, 100 feet downstream from Route 2 bridge, right bank	29.6	357.9
Farmington, Maine, mouth of Temple Stream, right bank	29.0	356.1
Farmington, Maine, across Route 2 from State picnic area, right bank	26.3	351.2
Farmington, Maine, 500 feet upstream from Route 41 bridge, left bank	22.7	345.7
Farmington, Maine, 100 feet downstream from Route 41 bridge, left bank	22.6	342.6
New Sharon, Maine, 0.5 mile upstream from mouth of Muddy Brook, left bank	17.9	338.6
New Sharon, Maine, mouth of Muddy Brook, left bank	17.4	332.5
New Sharon, Maine, 60 feet upstream from Route 2 bridge, left bank	16.3	324.0
New Sharon, Maine, 60 feet downstream from Route 2 bridge, left bank	16.3	323.3
Mercer, Maine, U.S. Geological Survey station 01048000, 0.9 mile upstream from mouth of Bog Stream, right bank.	8.7	216.4
Norridgewock, Maine, Madison Electric Company dam, headwater	3.9	[m]197.0
tailwater	3.9	195.5
Starks, Maine, confluence with the Kennebec River	0.0	192.8
Temple Stream:		
Farmington, Maine, 50 feet upstream from Russells Mill Bridge, left bank	4.3	449.8
Farmington, Maine, 50 feet downstream from Russells Mill Bridge, left bank	4.3	445.0
Farmington, Maine, 150 feet upstream from Temple Road bridge, right bank	3.0	382.2
Farmington, Maine, 75 feet downstream from Temple Road bridge, right bank	3.0	379.2
Farmington, Maine, Temple Stream Dam, left bank, headwater	1.5	[n]370.9
tailwater	1.5	[n]360.0
Farmington, Maine, upstream from Morrison Hill Road bridge, right bank	1.4	355.9

Table 12. Flood-crest stages for April 1987 flood in Maine—Continued

Stream and location	Miles upstream[a] from mouth	Elevation (in feet)
KENNEBEC RIVER BASIN—Continued		
Temple Stream—Continued:		
Farmington, Maine, downstream from Morrison Hill Road bridge, right bank	1.4	355.8
Farmington, Maine, 250 feet upstream from Route 2 bridge, left bank	.6	356.1
Farmington, Maine, 250 feet downstream from Route 2 bridge, left bank	.5	356.1
Wilson Stream:		
Wilton, Maine, upstream from Canal Street bridge, left bank	16.4	575.6
Wilton, Maine, downstream from Canal Street bridge, left bank	16.4	575.2
Wilton, Maine, 400 feet upstream from Library Bridge, left bank	16.3	556.1
Wilton, Maine, 100 feet downstream from Library Bridge, right bank	16.2	549.2
Wilton, Maine, upstream side gas station, left bank	16.0	531.2
Wilton, Maine, 20 feet upstream from intersection of Davis Street and Stickney Court, left bank	15.2	476.6
Wilton, Maine, upstream from mouth of Coubers Brook, left bank	15.1	471.0
Wilton, Maine, downstream from Backus Garage, left bank	13.2	424.1
Wilton, Maine, U.S. Geological Survey gage 01047730, 0.1 mile upstream from railroad bridge, left bank.	12.7	416.9
Wilton, Maine, downstream side East Wilton Bridge, right bank	12.6	407.0
Wilton, Maine, 40 feet upstream from railroad bridge, right bank	12.6	397.4
Wilton, Maine, 40 feet downstream from railroad bridge, right bank	12.6	395.4
Wilton, Maine, 100 feet upstream from Route 2 bridge, right bank	12.0	389.7
Wilton, Maine, 100 feet downstream from Route 2 bridge, right bank	12.0	386.5
Wilton, Maine, 0.2 mile downstream from Route 2 bridge, right bank	11.8	386.3
Wilton, Maine, upstream side, Butterfield Road bridge, left bank	10.6	383.2
Wilton, Maine, downstream side, Butterfield Road bridge, right bank	10.6	381.5
Farmington, Maine, upstream side Route 133 bridge, left bank	9.6	368.7
Farmington, Maine, downstream side Route 133 bridge, right bank	9.6	366.8
Farmington, Maine, 100 feet upstream from Webster Road bridge, right bank	7.5	359.4
Farmington, Maine, 100 feet downstream from Webster Road bridge, right bank	7.5	358.7
North Chesterville, Maine, 140 feet upstream from Knowltons Corner Road bridge, average of left and right bank elevations.	3.8	351.4
North Chesterville, Maine, downstream side Knowltons Corner Road bridge, right bank	3.8	350.2
Chesterville, Maine, upstream side Route 156 bridge, right bank	.4	347.5
Chesterville, Maine, 300 feet downstream from Route 156 bridge, right bank	.4	345.5
Chesterville, Maine, confluence with Sandy River, right bank	0	345.4
Sebasticook River:		
Hartland, Maine, 150 feet upstream from dam at outlet of Great Moose Lake, right bank	40.6	[c]249.6
Hartland, Maine, 40 feet upstream from bridge located just downstream from Great Moose Lake Dam, left bank.	40.6	244.3
Hartland, Maine, 125 feet downstream from bridge located just downstream from Great Moose Lake Dam, average left and right bank elevations.	40.5	241.8
Hartland, Maine, 250 feet upstream from Route 43 bridge, left bank	40.3	240.3
Hartland, Maine, 250 feet upstream from Route 43 bridge, right bank	40.3	239.7
Hartland, Maine, 100 feet downstream from Route 43 bridge, right bank	40.3	239.0
Palmyra, Maine, upstream side Route 2 bridge, left bank	35.9	223.9
Palmyra, Maine, downstream side Route 2 bridge, left bank	35.9	223.9
Pittsfield, Maine, 75 feet upstream from Waverly Street bridge, right bank	33.1	220.7
Pittsfield, Maine, 30 feet downstream from Waverly Street bridge, right bank	33.1	220.4