

Tookany Creek Feasibility Study

Hydraulic Modeling Portion

Bob Moore

Hydraulic Engineer

Philadelphia District

January 30, 2013



US Army Corps of Engineers
BUILDING STRONG



HYDRAULICS

Given a flow rate, Hydraulics allows one to calculate the water surface elevation and the velocity at a stream location.

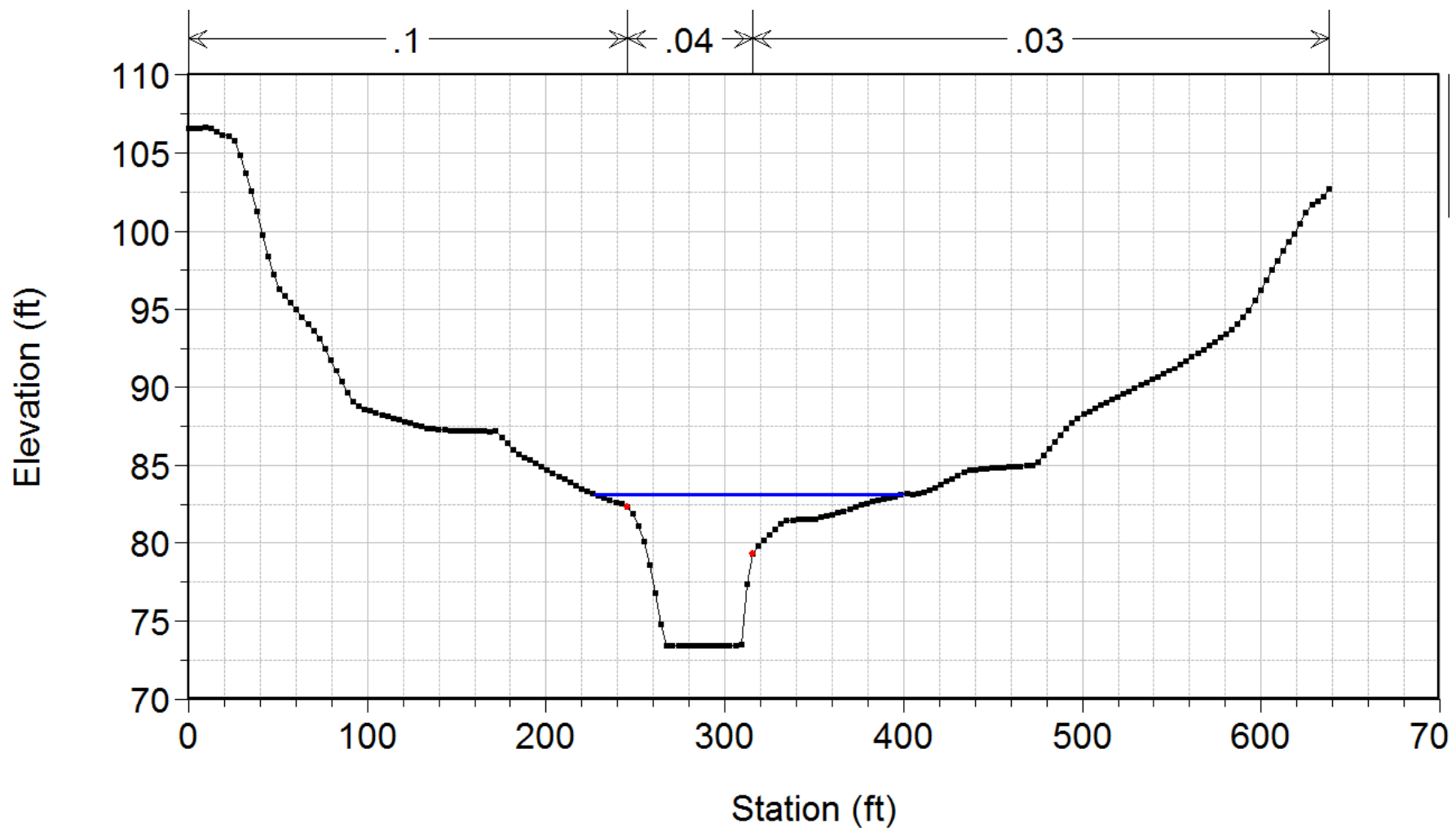
HOW TO BUILD A HYDRAULIC MODEL

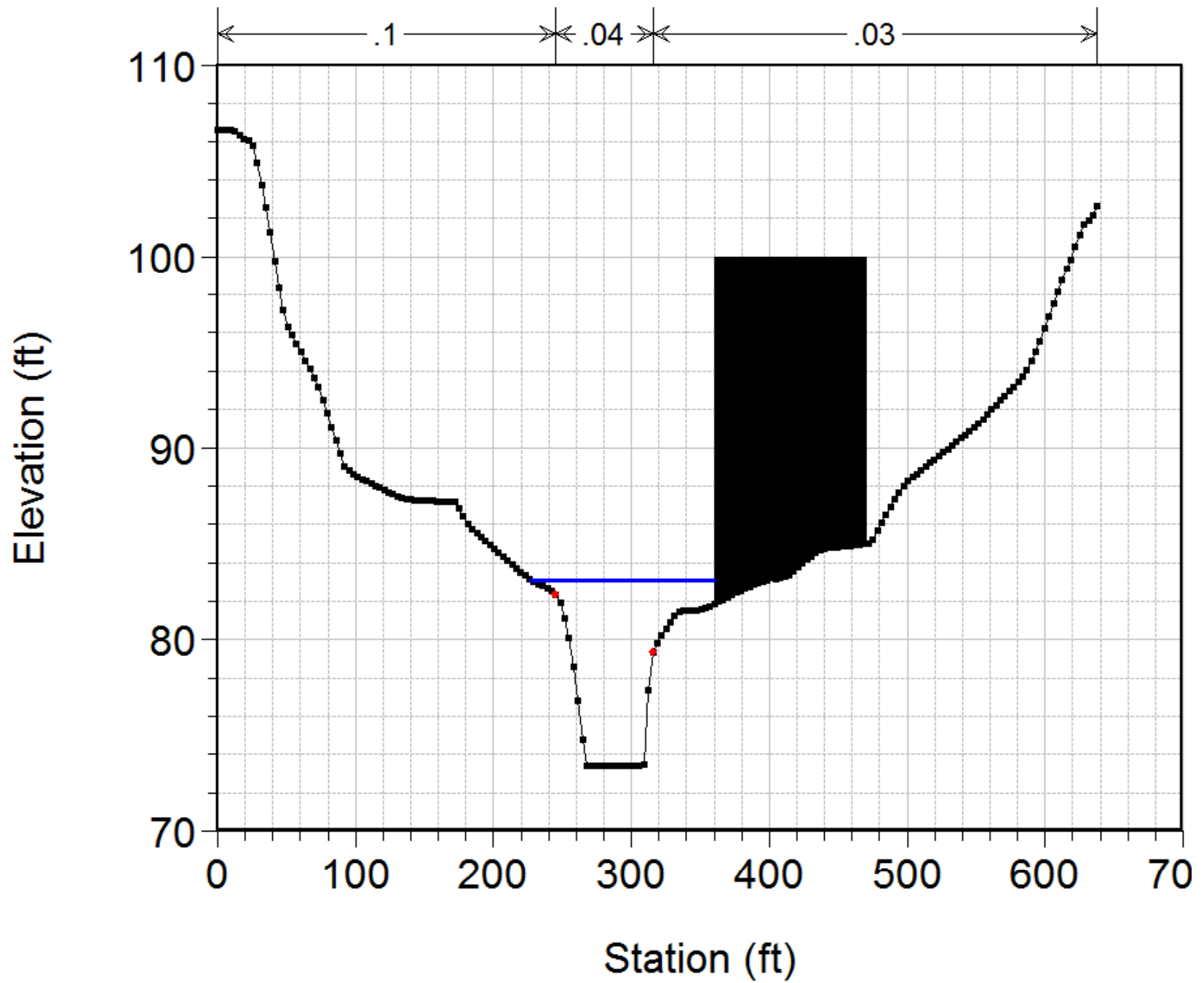
HEC-RAS

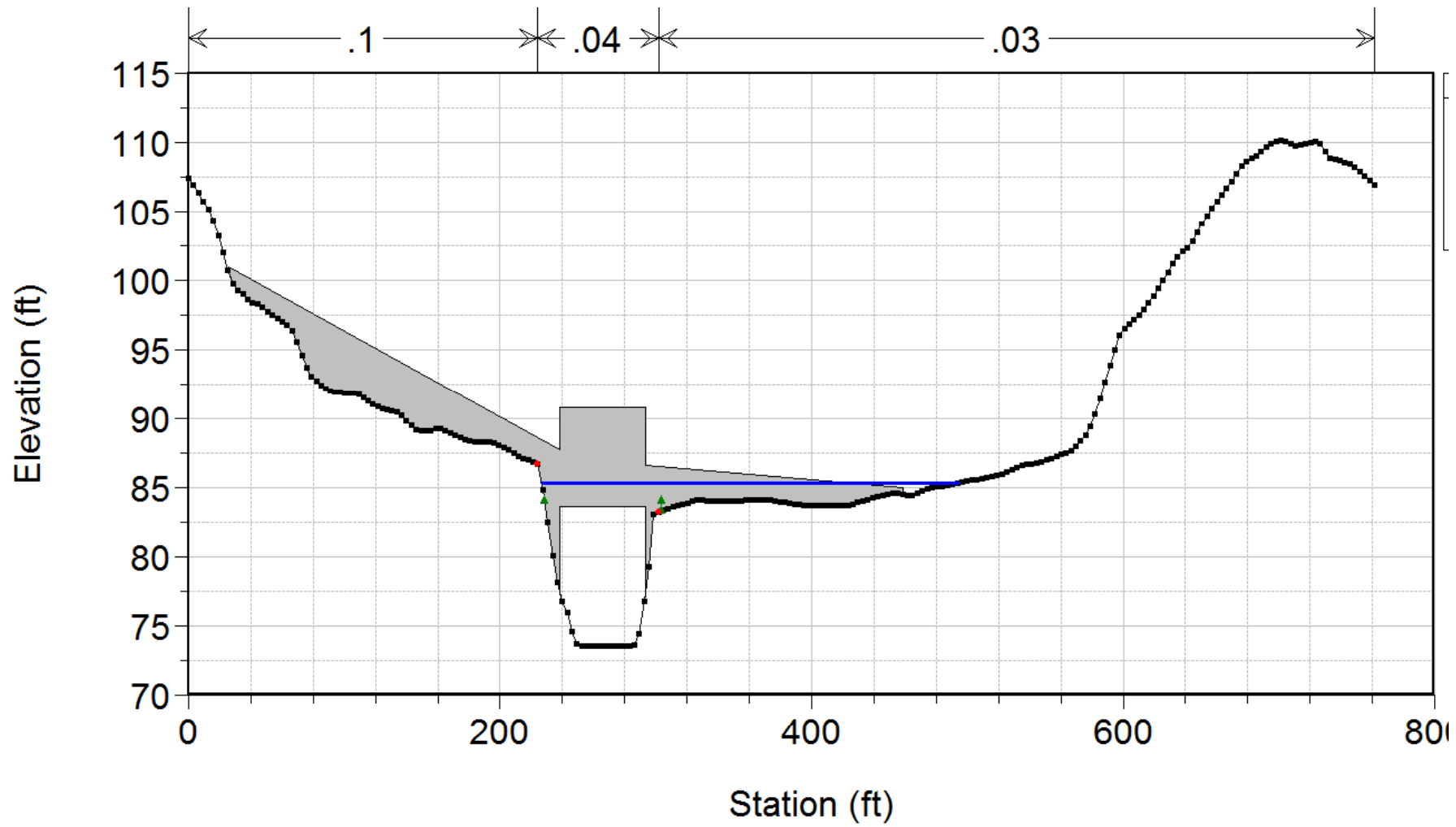
(Hydrologic Engineering Center – River Analysis System)

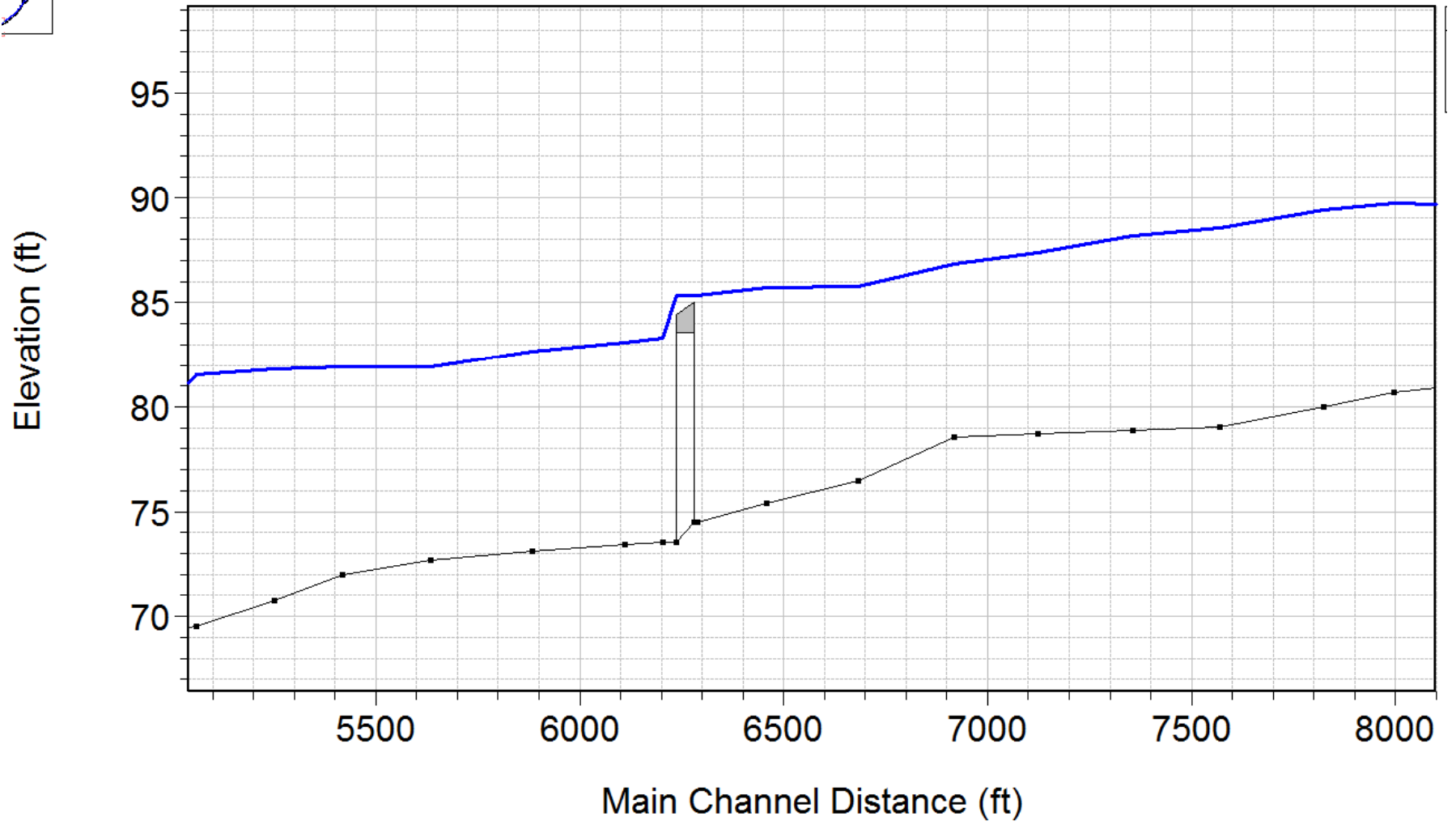




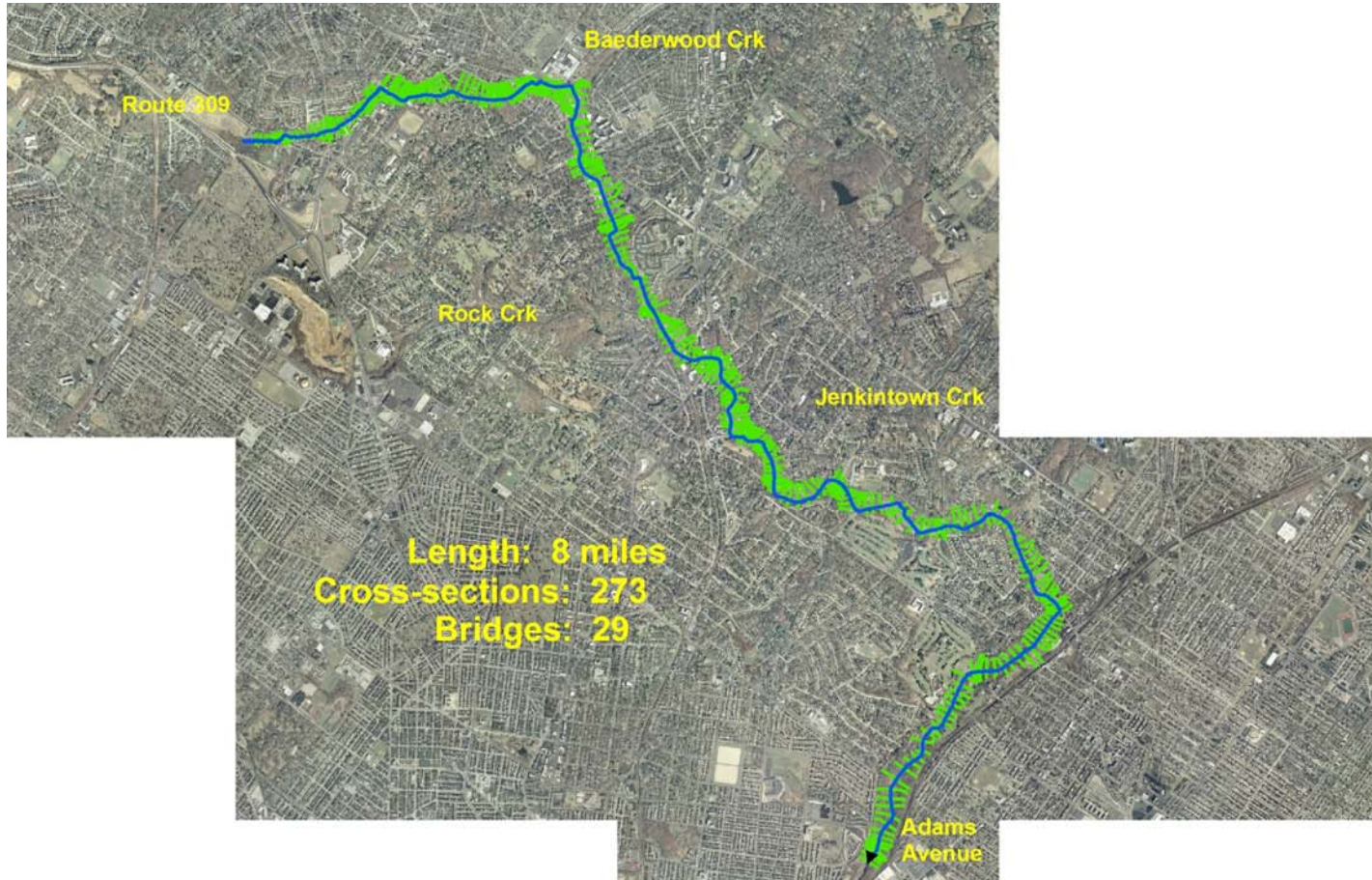


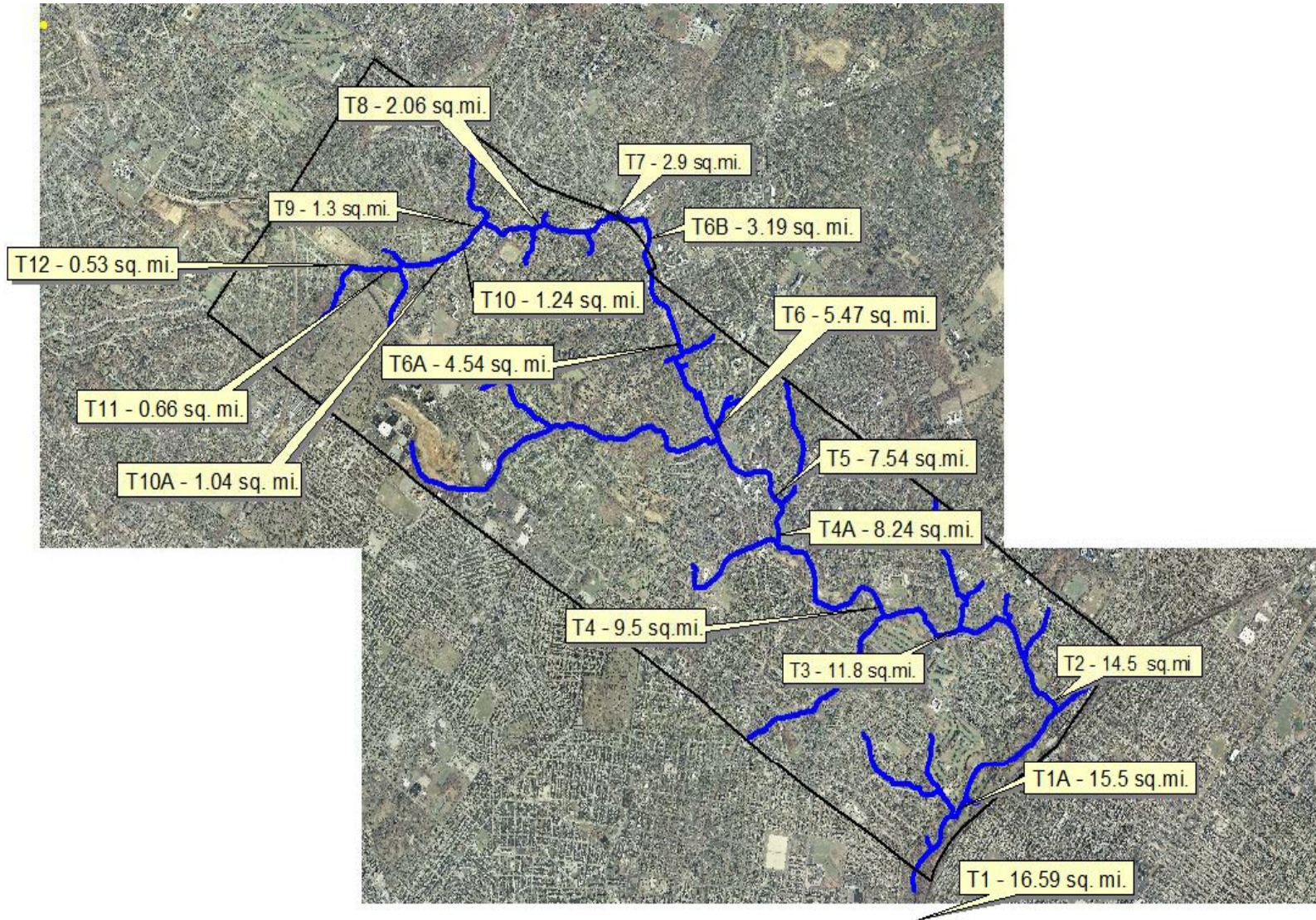




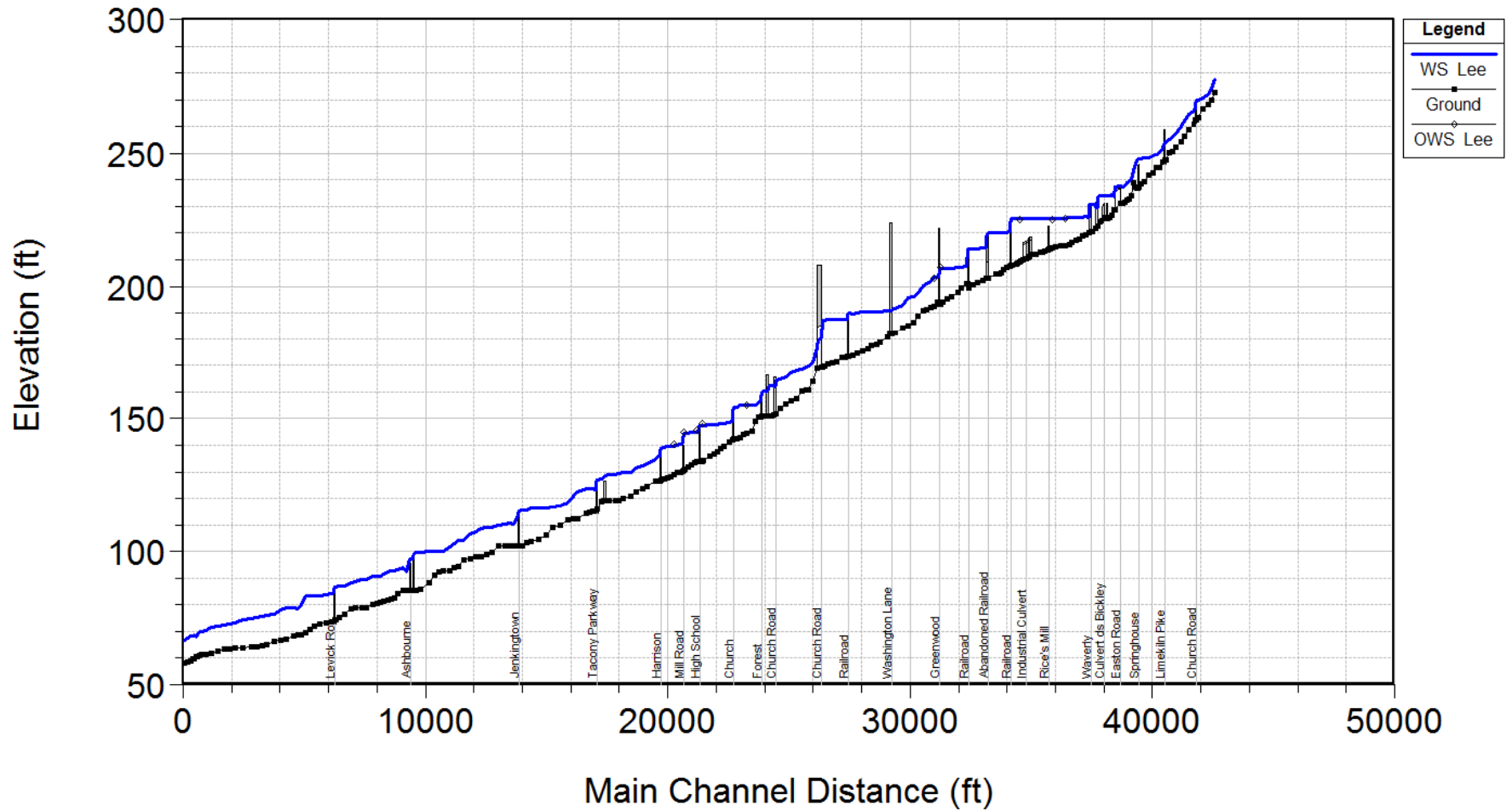


EXISTING CONDITION TOOKANY CREEK HYDRAULIC MODEL

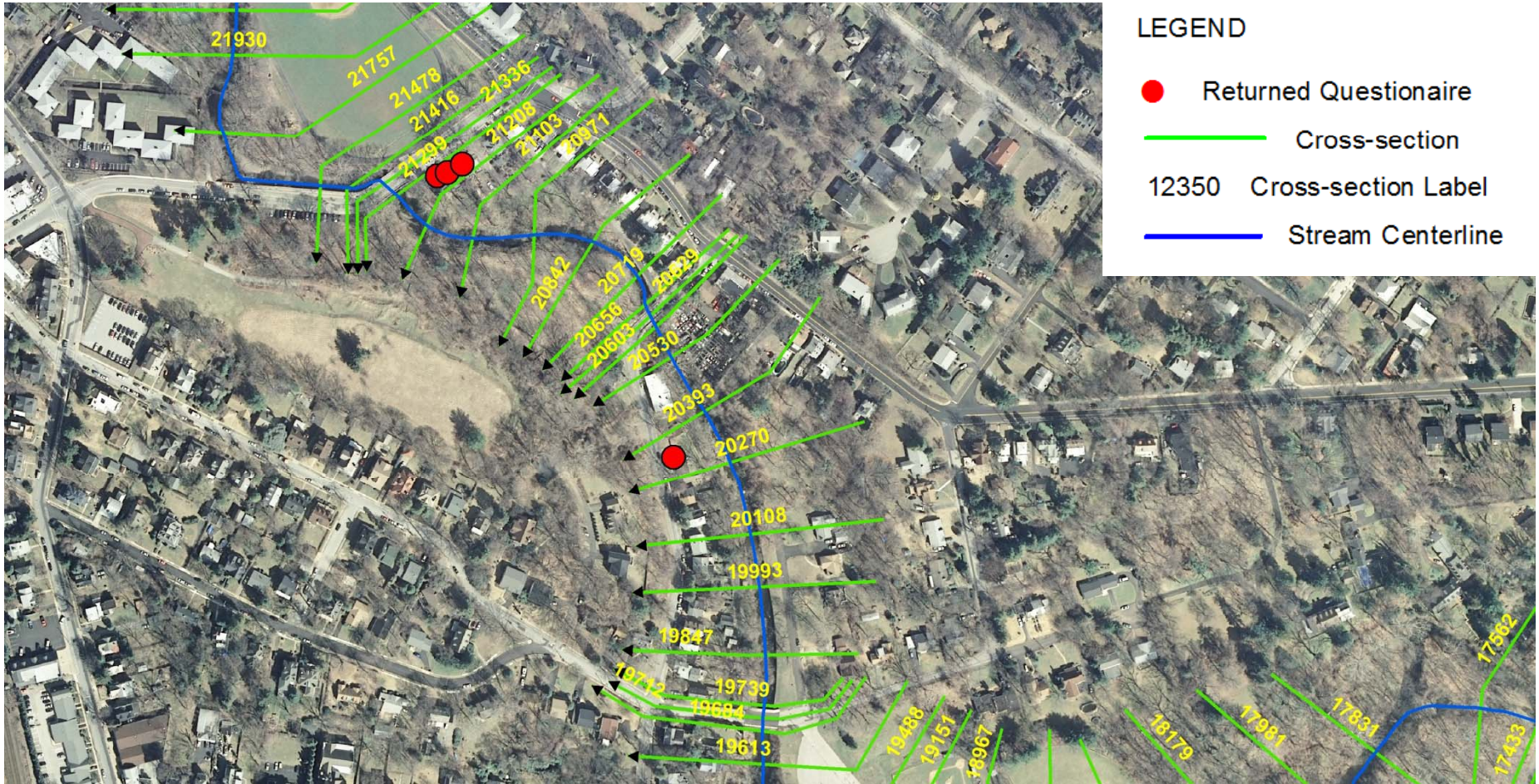




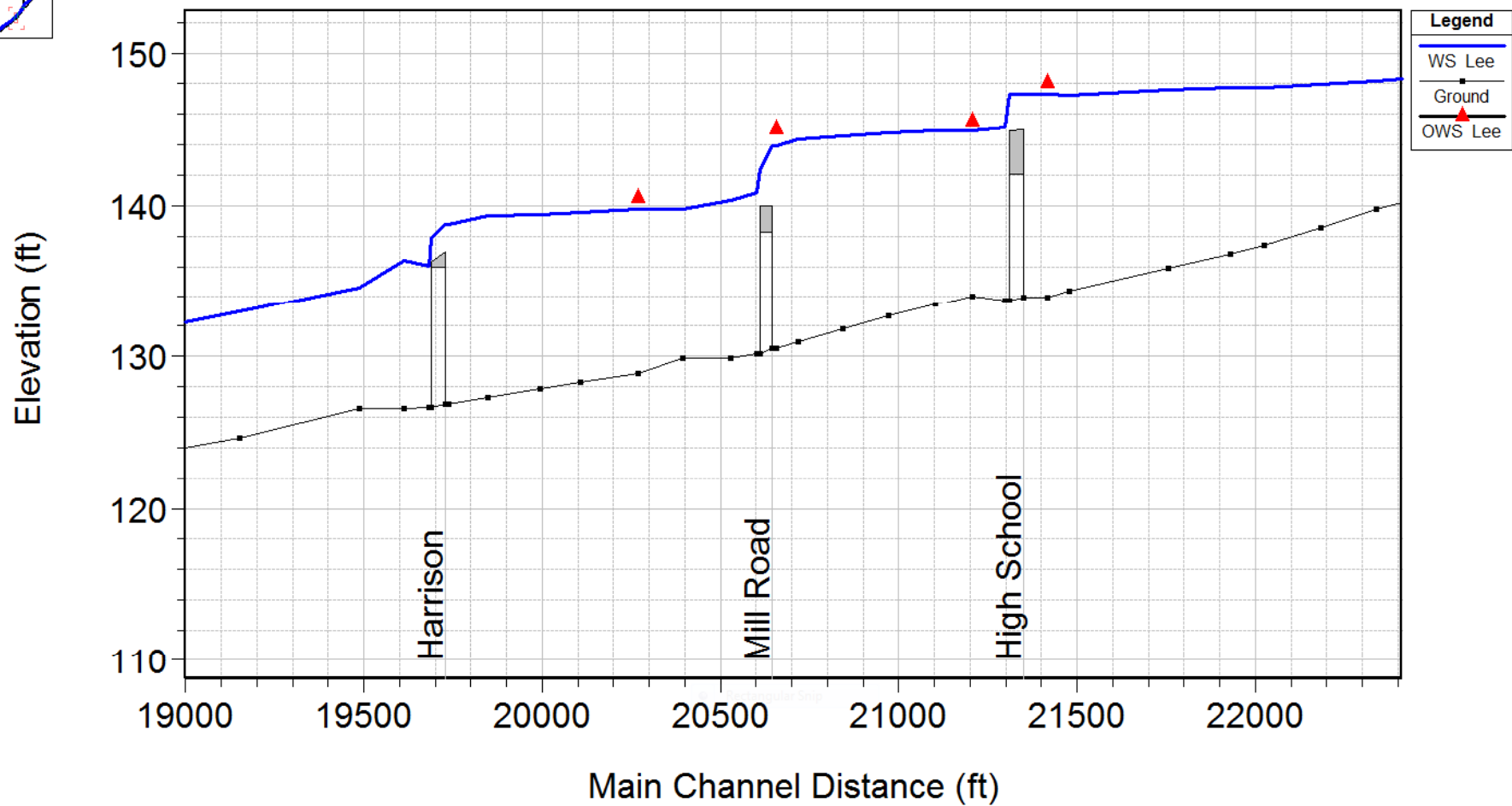
TOOKANY LEE WATER SURFACE PROFILE



Harrison Avenue to High School Road



TOOKANY LEE WATER SURFACE PROFILE



Tropical Storm Lee High Water Mark (HWM) Summary Harrison Avenue to High School Road			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Downstream of Mill Rd on ROB	140.5	139.74	0.8
Water Depth on Mill Road	145	143.9	1.1
On High School Road (front of houses)	148	147.3	0.7
Downstream of High School Road on LOB behind houses	145.5	145	0.5

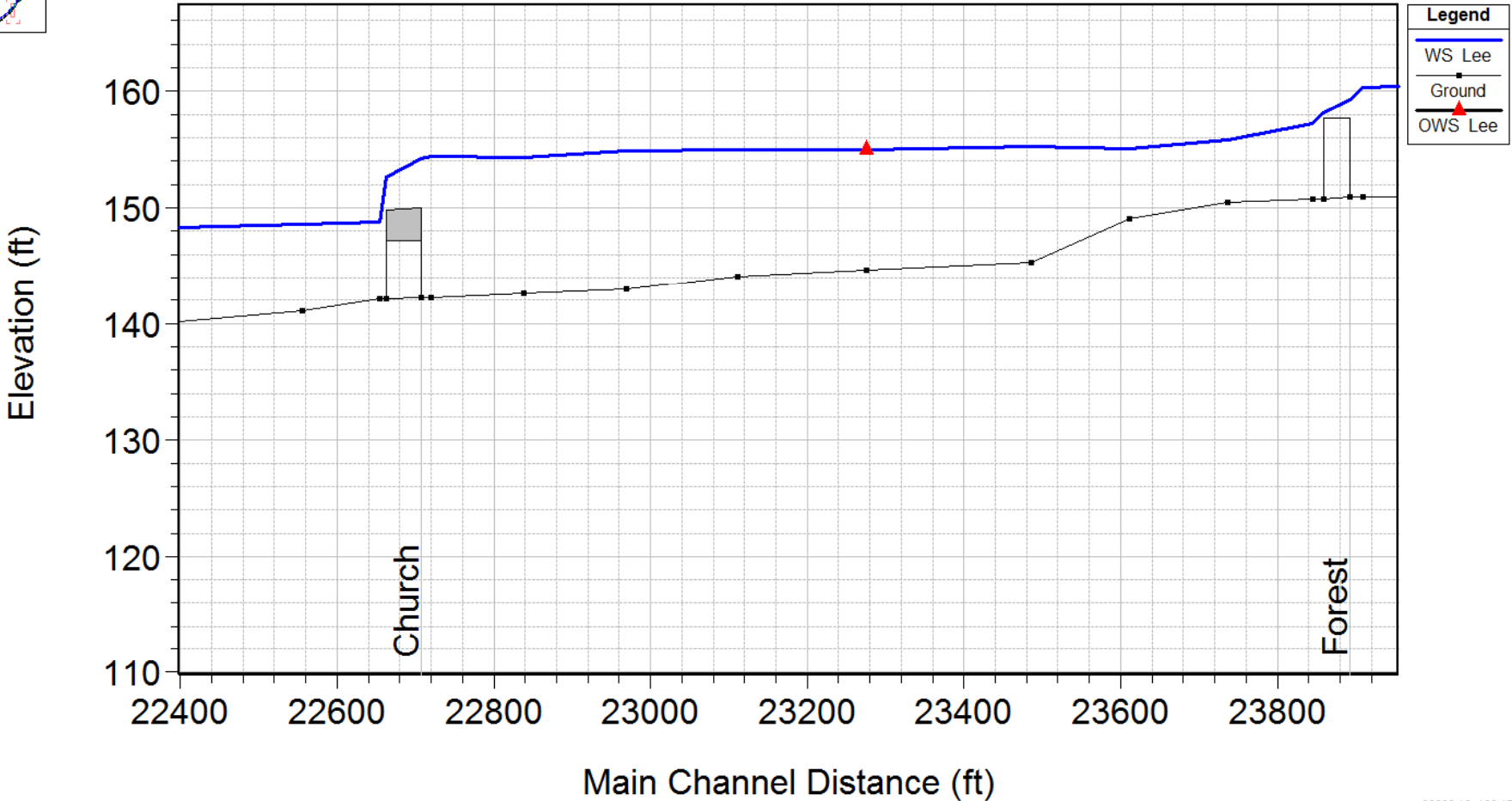
Church Road to Forrest Avenue



LEGEND

- Returned Questionnaire
- Cross-section
- 12350 Cross-section Label
- Stream Centerline

TOOKANY LEE WATER SURFACE PROFILE

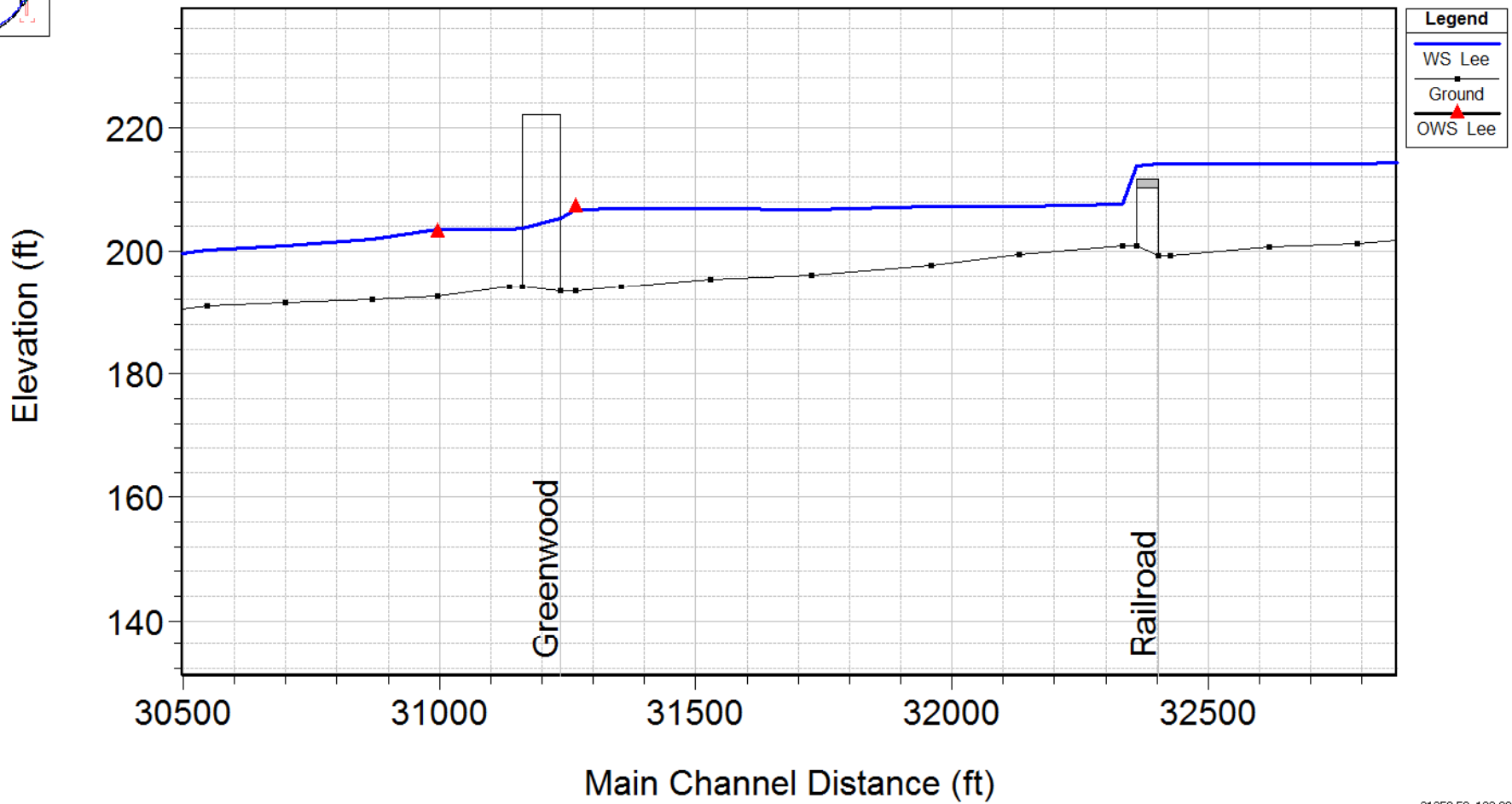


Tropical Storm Lee High Water Mark (HWM) Summary Church Road to Forrest Avenue			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Houses along Shoemaker	155	154.9	0.1

Jenkintown Station to Railroad



TOOKANY LEE WATER SURFACE PROFILE

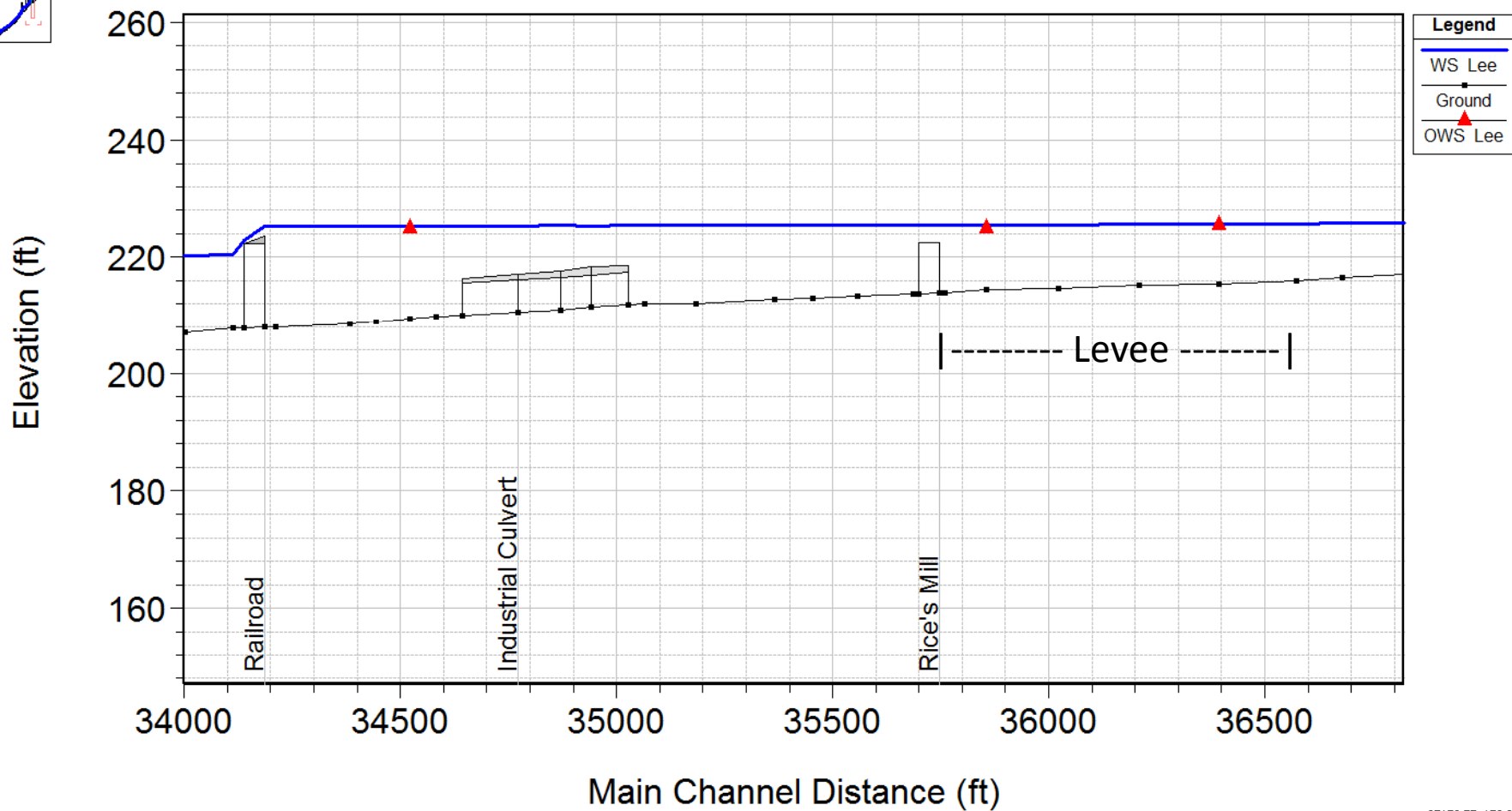


Tropical Storm Lee High Water Mark (HWM) Summary Jenkintown Station to Railroad			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Intersection of Cliff Terrace and Glenside	203	203.5	0.5
Intersection of Greenwood and Glenside	207	206.7	0.3

Railroad to Brookdale Levee



TOOKANY LEE WATER SURFACE PROFILE



Tropical Storm Lee High Water Mark (HWM) Summary Railroad to Brookdale Levee			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Intersection of North Ave and Paxson Ave	225	225.4	0.4
Average of d/s Houses Behind Brookdale Levee	225	225.5	0.5
Average of u/s Houses Behind Brookdale Levee	225.4	225.7	0.3

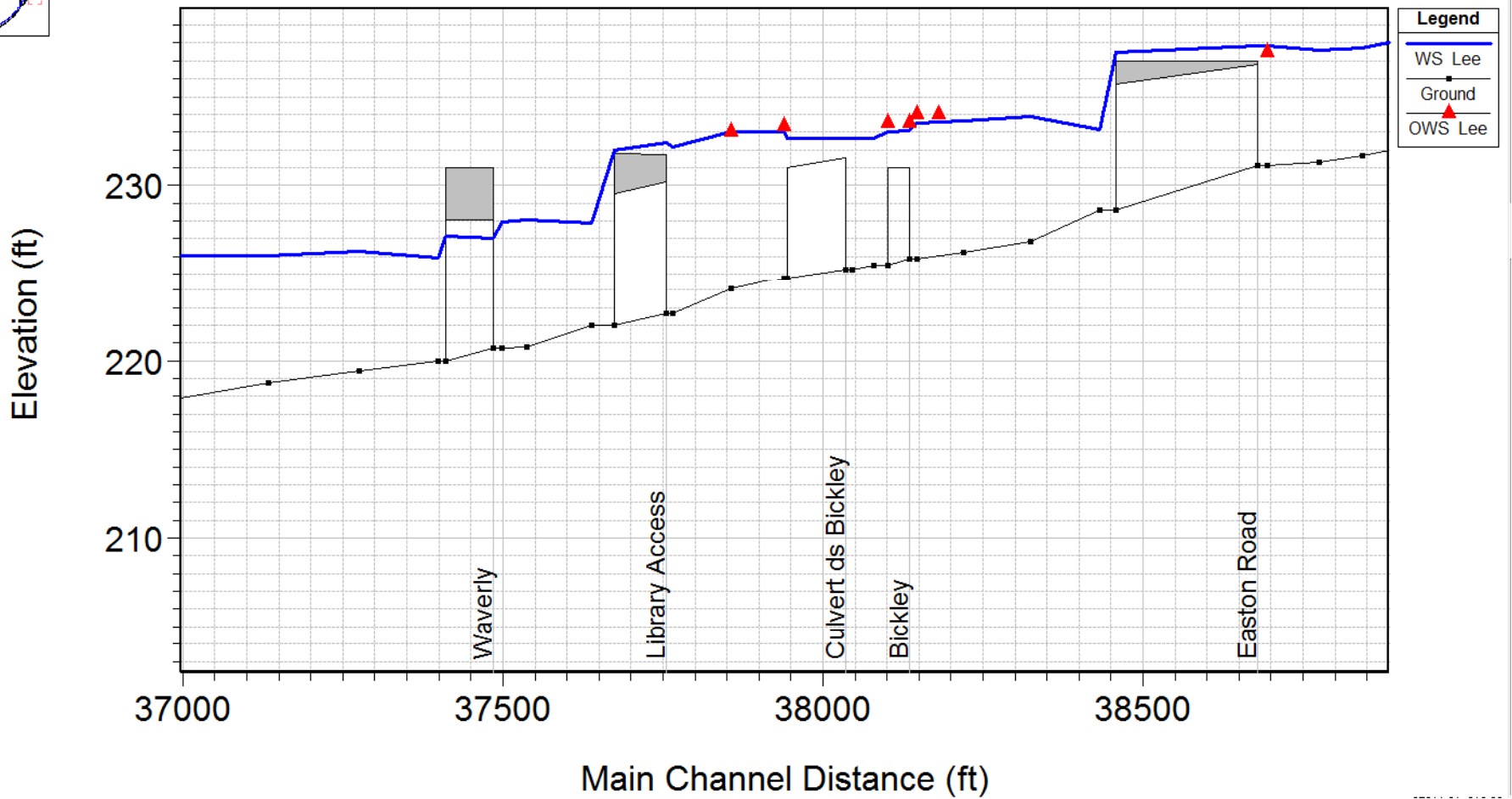
Waverly Road to Easton Road

LEGEND

- Returned Questionnaire
- Cross-section
- 12350 Cross-section Label
- Stream Centerline



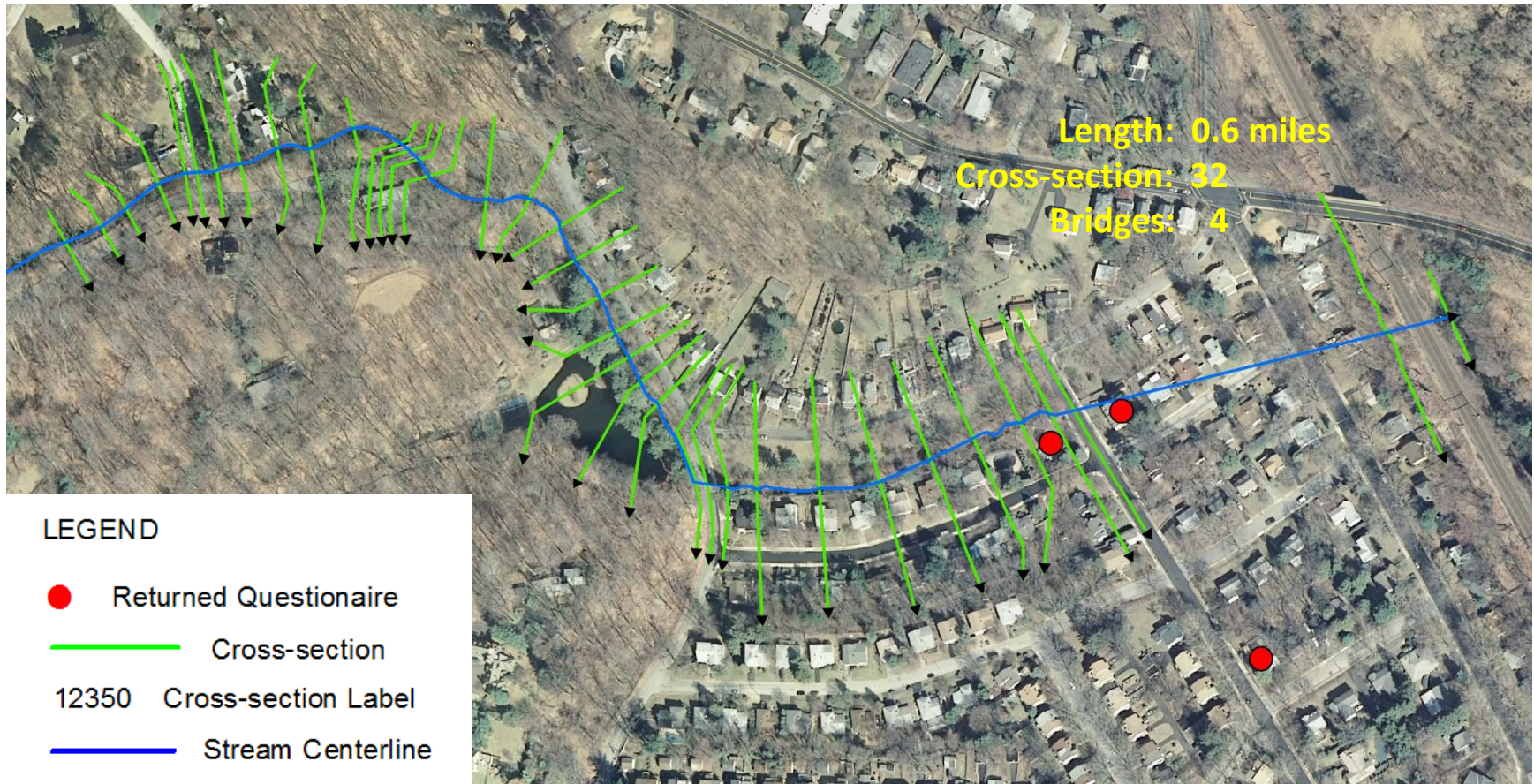
TOOKANY LEE WATER SURFACE PROFILE



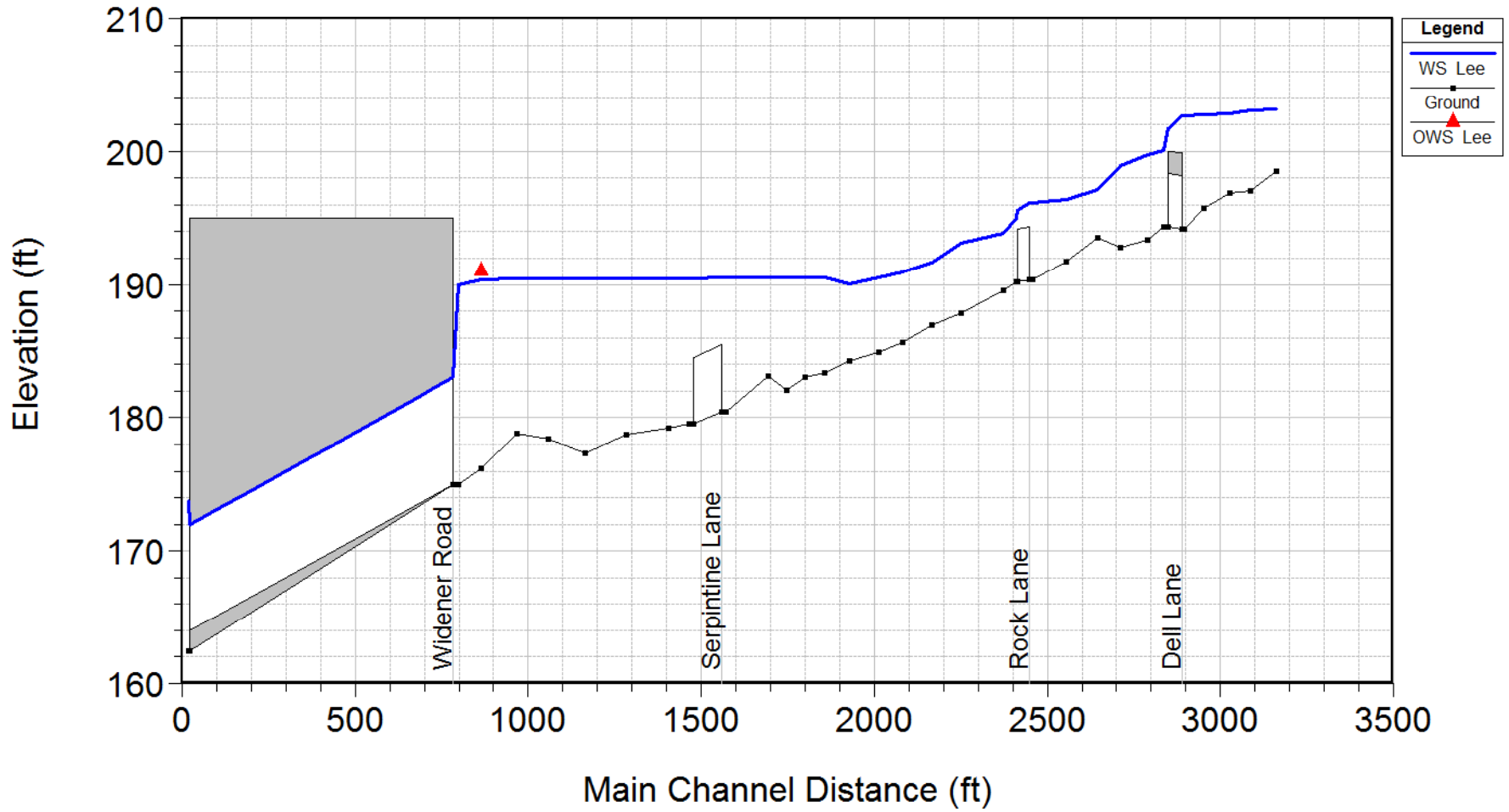
Tropical Storm Lee High Water Mark (HWM) Summary Glenside Avenue to Easton Road			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Behind Houses along Bickley Ave	233.2	233.0	0.2
In Front of Houses along Bickley Ave	233.8	233.3	0.5
Harrison Avenue	237.5	237.8	0.3

EXISTING CONDITION ROCK CREEK HYDRAULIC MODEL

Rock Creek



ROCK CREEK LEE WATER SURFACE PROFILE



Tropical Storm Lee High Water Mark (HWM) Summary Rock Creek			
Location	QUESTIONAIRE HWM Elevation (ft-NAVD88)	Calculated Elevation (ft-NAVD88)	Difference (feet)
Inlet to Widener Road Culvert	191	190.5	0.5

FLows REQUIRED FOR THE ECONOMIC ANALYSIS

FREQUENCY DISCHARGE

Exceedance Event	Exceedance Frequency	Discharge (cfs)
2 year	50%	?
5 year	20%	?
10 year	10%	?
25 Year	4%	?
50 year	2%	?
100 year	1%	?
250 year	0.4%	?
500 year	0.2%	?

STATION.--01467086 TACONY CREEK AT COUNTY LINE, PHILADELPHIA, PA

LOCATION.--Lat 40`02'47", long 75`06'40", Philadelphia County, Hydrologic Unit 02040202.

DRAINAGE AREA.--16.6 mi2.

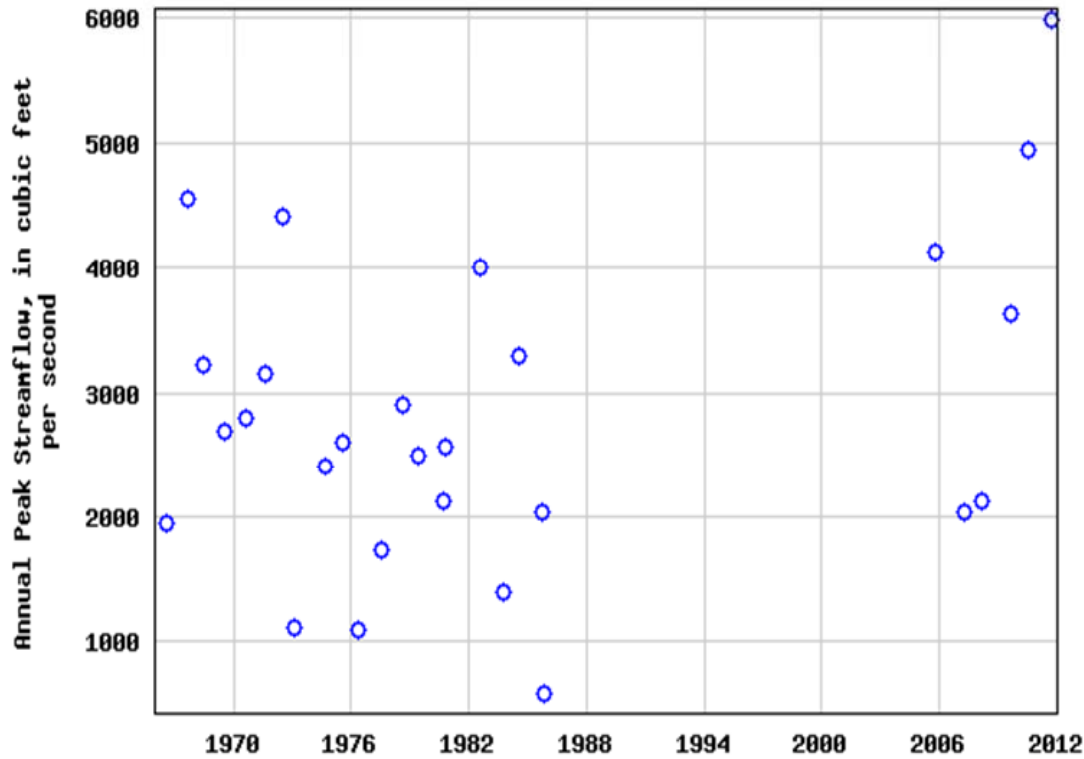
PERIOD OF RECORD.--

**October 1965 to September 1986.
September 2005 to current year.**





USGS 01467086 Tacony Creek ab Adams Avenue, Philadelphia, PA



Tacony Creek Above Adams Ave 01467086 Period of Record	
Date of Peak Flow For the Year	Peak Flow (cfs)
1966-07-19	1950
1967-08-27	4550
1968-06-12	3230
1969-07-28	2700
1970-08-23	2800
1971-08-28	3150
1972-06-22	4410
1973-02-02	1120
1974-08-23	2400
1975-07-14	2600
1976-05-01	1100
1977-08-01	1740
1978-08-28	2910
1979-05-23	2500
1980-09-18	2120
1980-10-25	2570
1982-07-28	4000
1983-09-21	1390
1984-07-07	3290
1985-09-27	2040
1985-11-05	575
2005-10-08	4120
2007-04-16	2040
2008-03-08	2120
2009-08-02	3630
2010-07-13	4950
2011-09-08	5990



**Guidelines
For
Determining**

**Flood
Flow
Frequency**

Bulletin # 17B
of the
Hydrology Subcommittee

Revised September 1981
Editorial Corrections March 1982

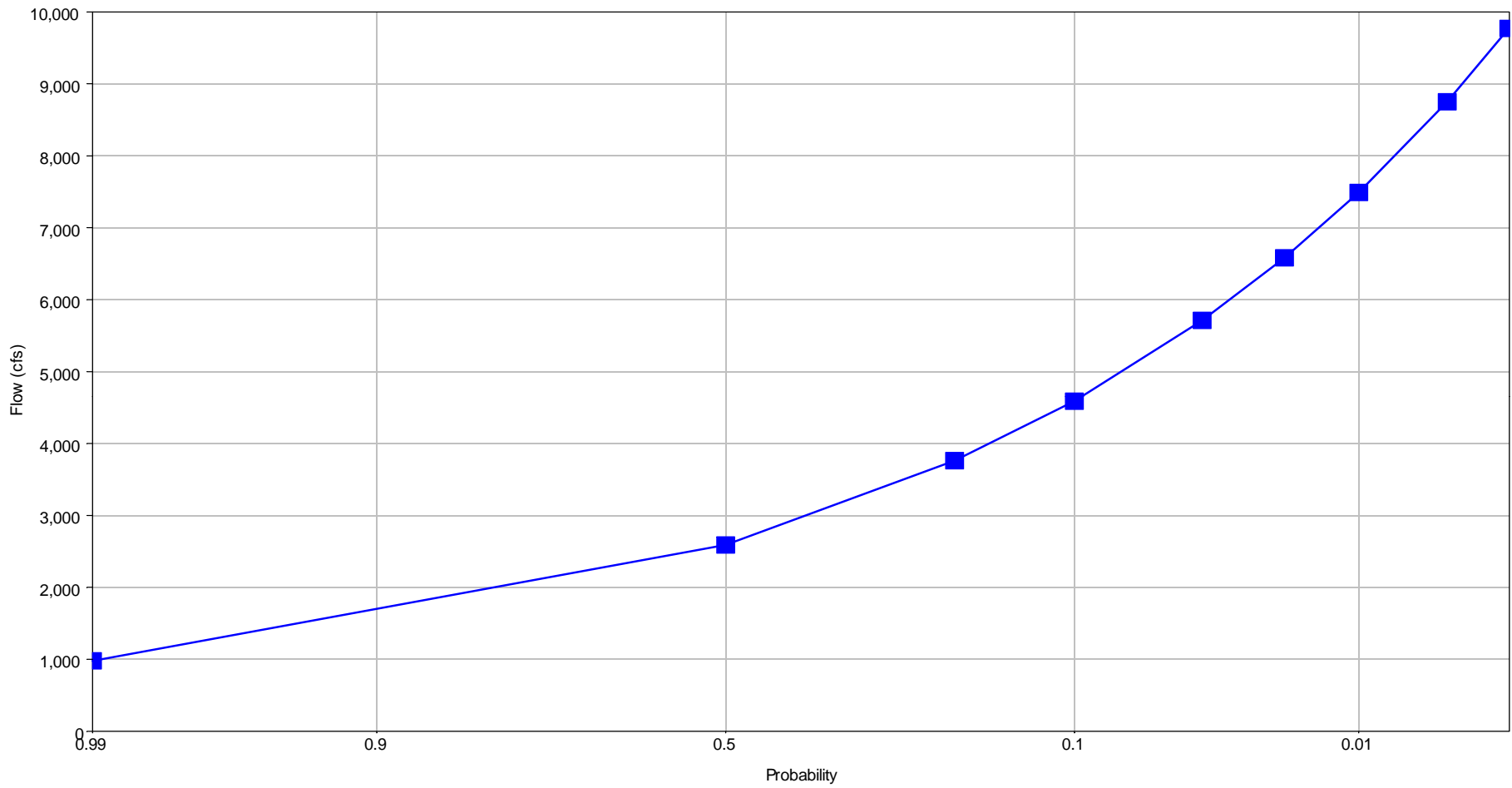
INTERAGENCY ADVISORY COMMITTEE
ON WATER DATA



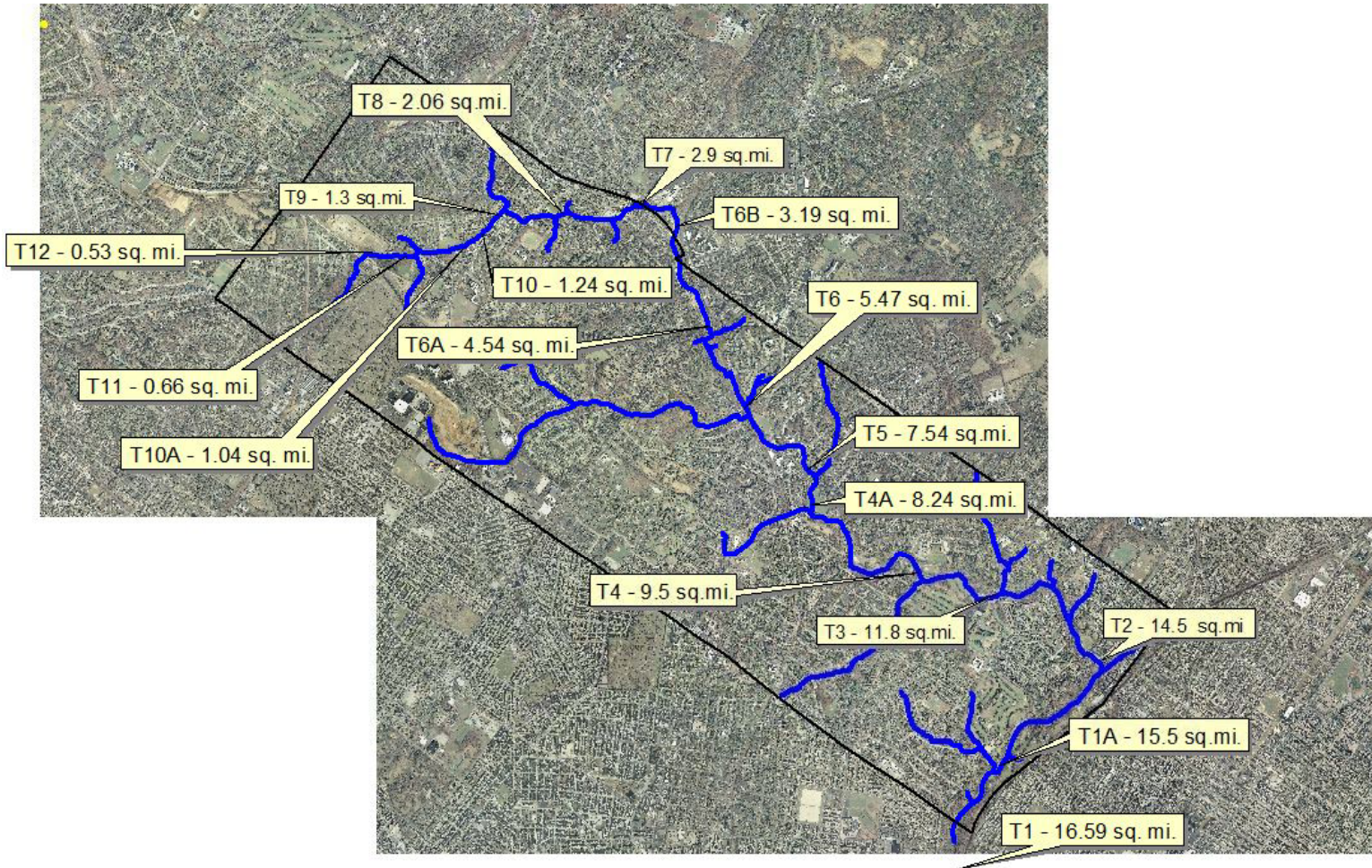
U.S. Department of the Interior
Geological Survey
Office of Water Data Coordination
Reston, Virginia 22092

Peak Annual Frequency Discharge USGS Gage 01467086 Taony Creek above Adams Ave EXISTING CONDITION		
Exceedance Event	Exceedance Frequency	Discharge (cfs)
1 year	99	979
2 year	50	2590
5 year	20	3760
10 year	10	4590
25 year	4	5710
50 year	2	6580
100 year	1	7490
250 year	0.4	8750
500 year	0.2	9770

Lee flow at the gage was 5990 cfs and was approximately a 30 year exceedance event.



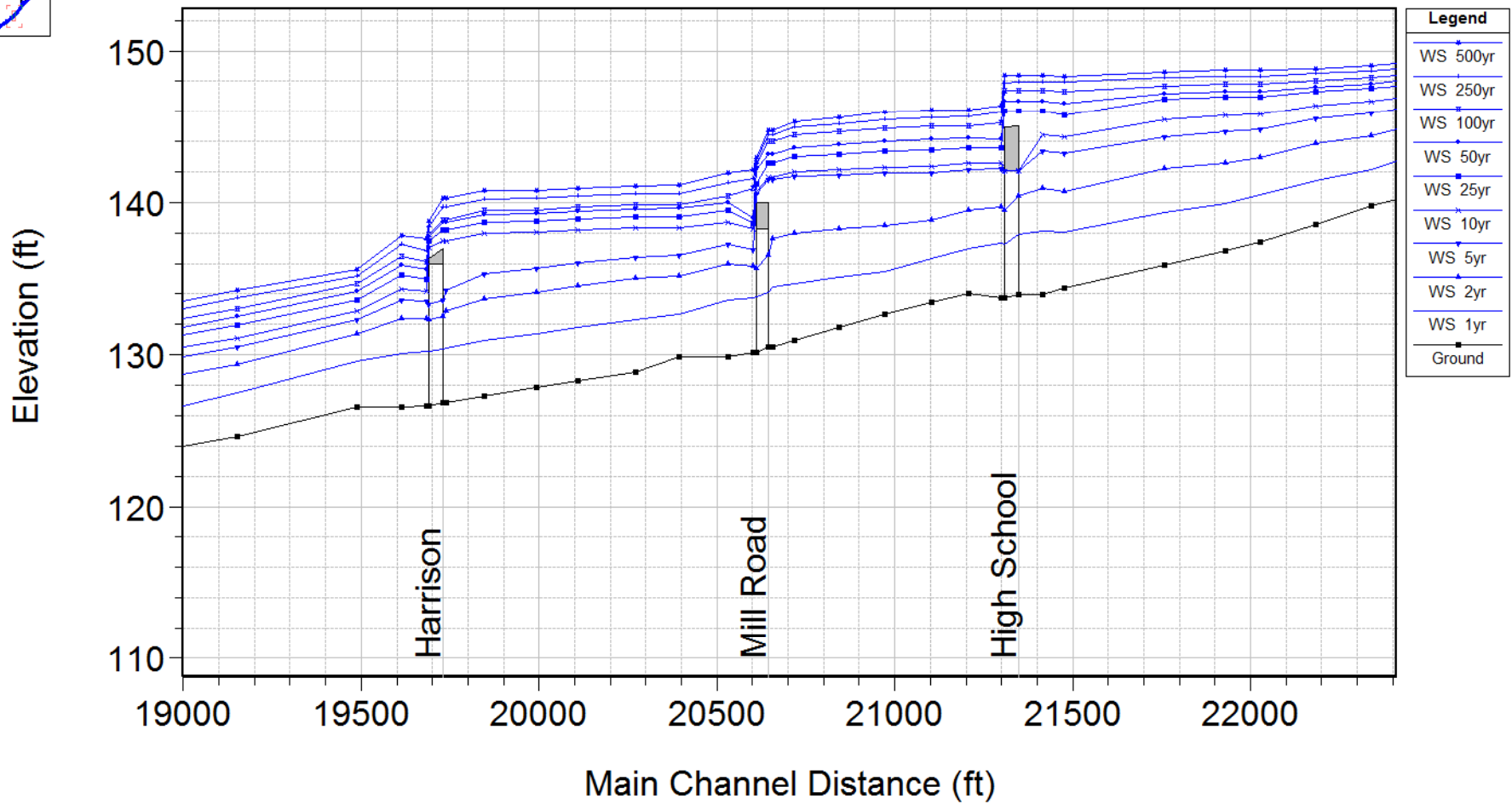
Adams-Ave CFS



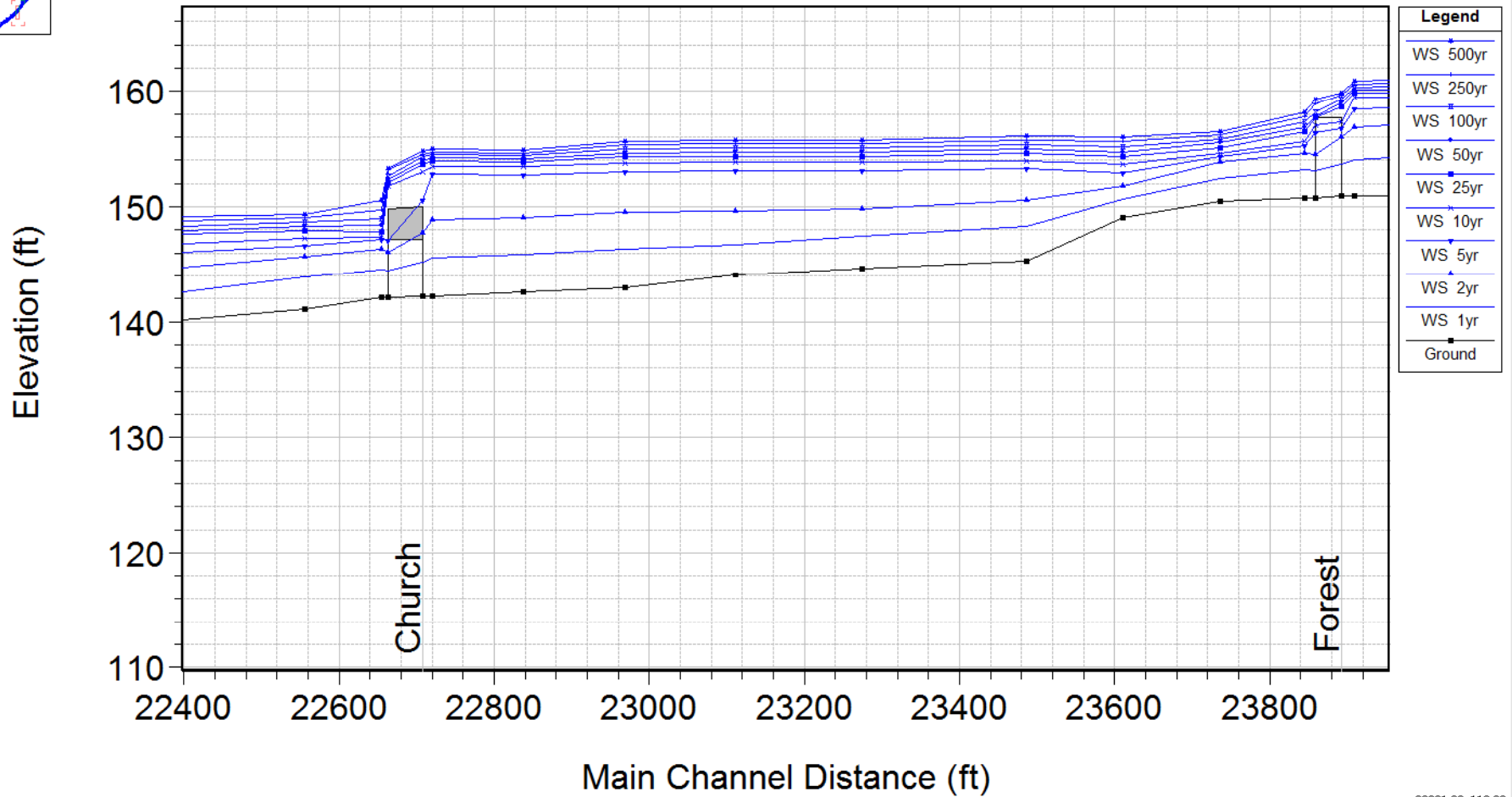
Tookany Creek Frequency Discharges (cfs)
At Flow Change Locations
EXISTING CONDITION

Event	Location																
	1	1A	2	3	4	4A	5	6	6A	6B	7	8	9	10	10A	11	12
1yr	979	969	963	788	696	644	586	451	375	373	234	210	191	189	148	106	71
2yr	2590	2564	2549	2085	1841	1704	1551	1194	992	987	619	557	505	500	390	280	188
5yr	3760	3722	3700	3027	2673	2474	2252	1733	1440	1433	899	808	733	726	566	406	272
10yr	4590	4544	4517	3695	3263	3020	2749	2116	1758	1749	1097	987	895	886	691	496	332
25yr	5710	5653	5619	4597	4060	3757	3420	2632	2187	2176	1365	1228	1113	1102	860	617	413
50yr	6580	6514	6475	5297	4678	4330	3941	3033	2520	2507	1573	1415	1283	1270	991	711	476
100yr	7490	7415	7370	6029	5325	4928	4487	3453	2869	2854	1790	1610	1461	1446	1128	809	542
250yr	8750	8663	8610	7044	6221	5758	5241	4034	3351	3334	2091	1881	1706	1689	1317	945	633
500yr	9770	9672	9614	7865	6946	6429	5852	4504	3742	3722	2335	2100	1905	1886	1471	1055	707

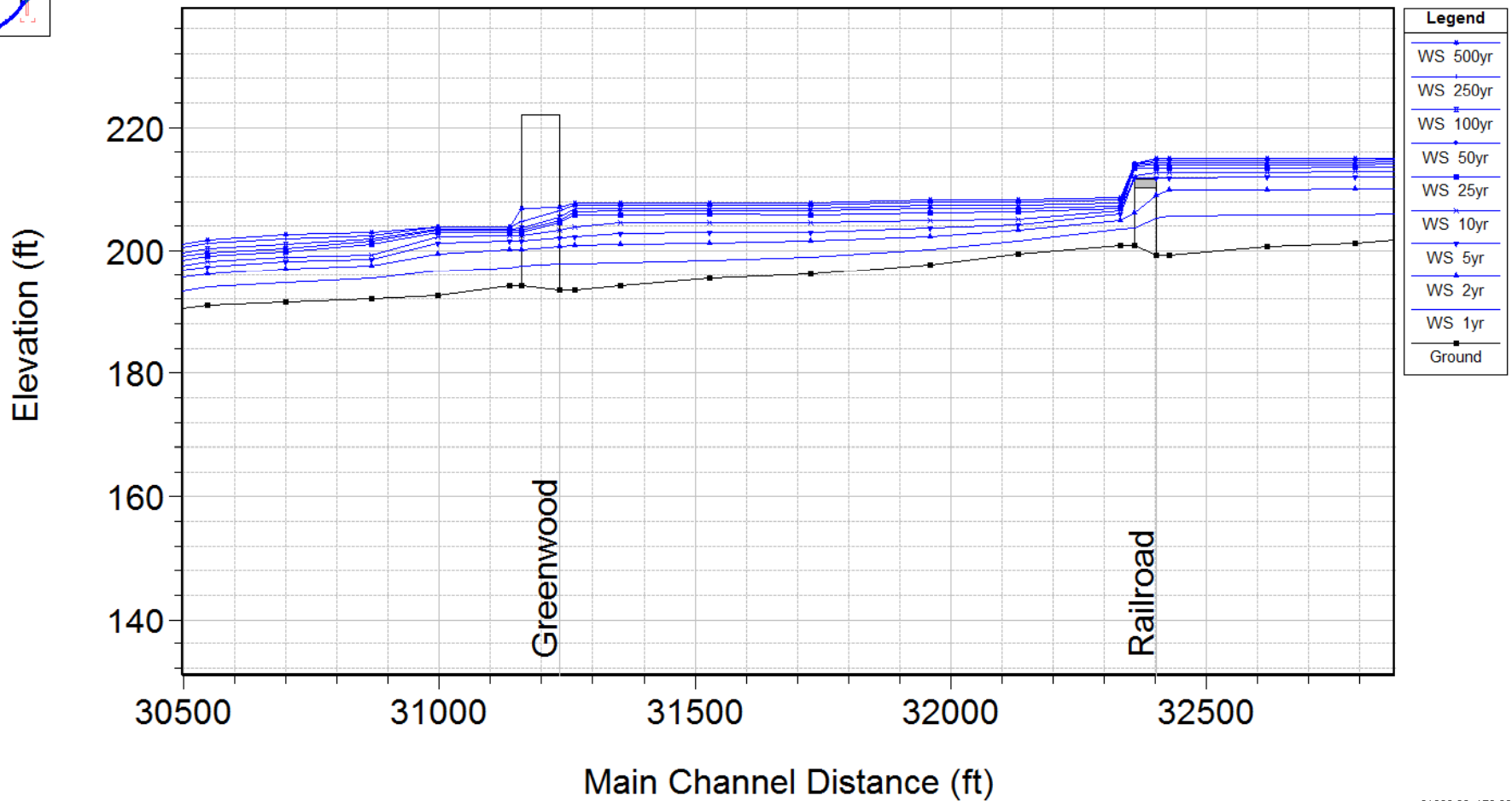
EXISTING CONDITION TOOKANY FREQUENCY WATER SURFACE PROFILES



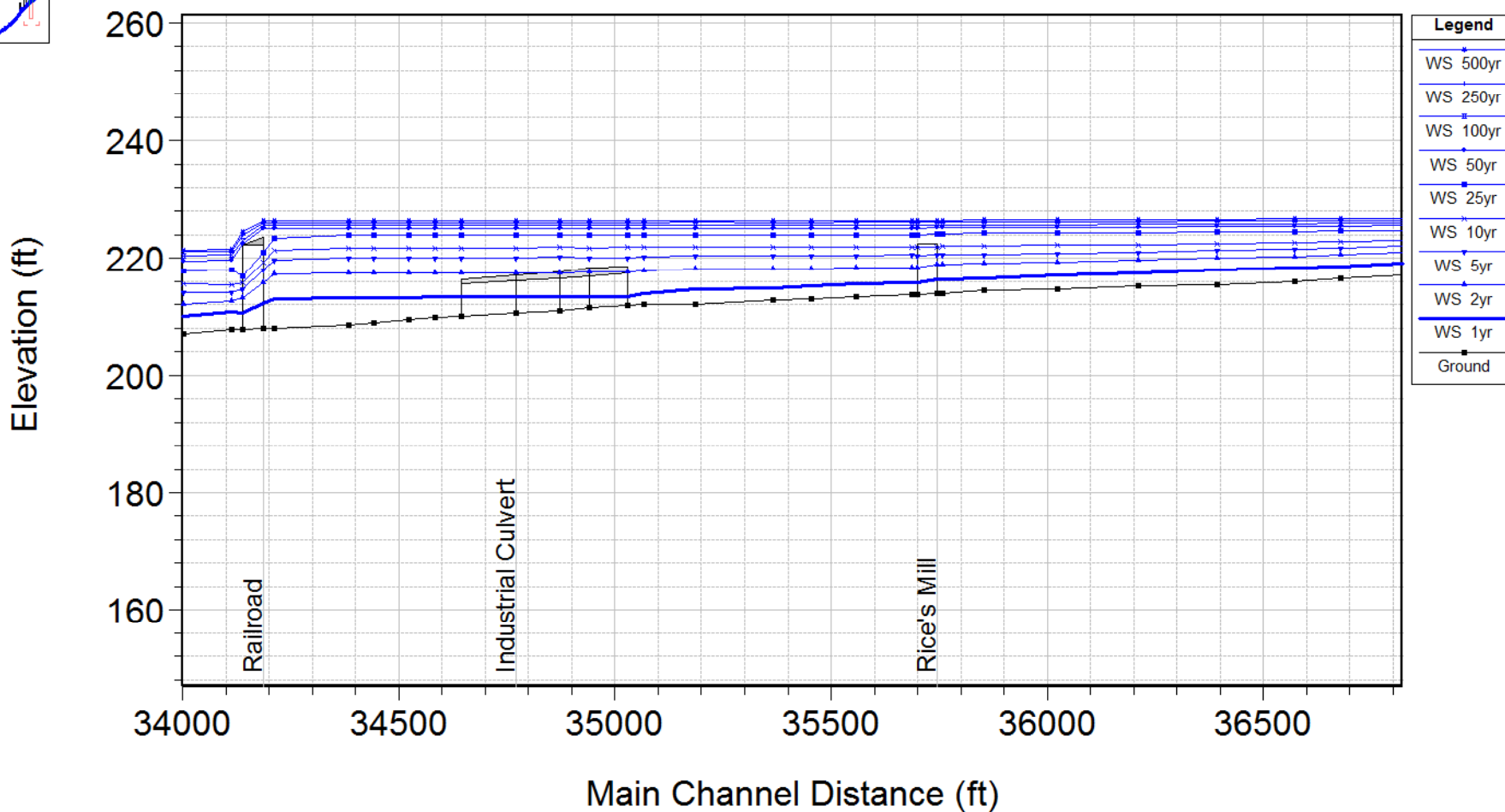
EXISTING CONDITION TOKANY FREQUENCY WATER SURFACE PROFILES



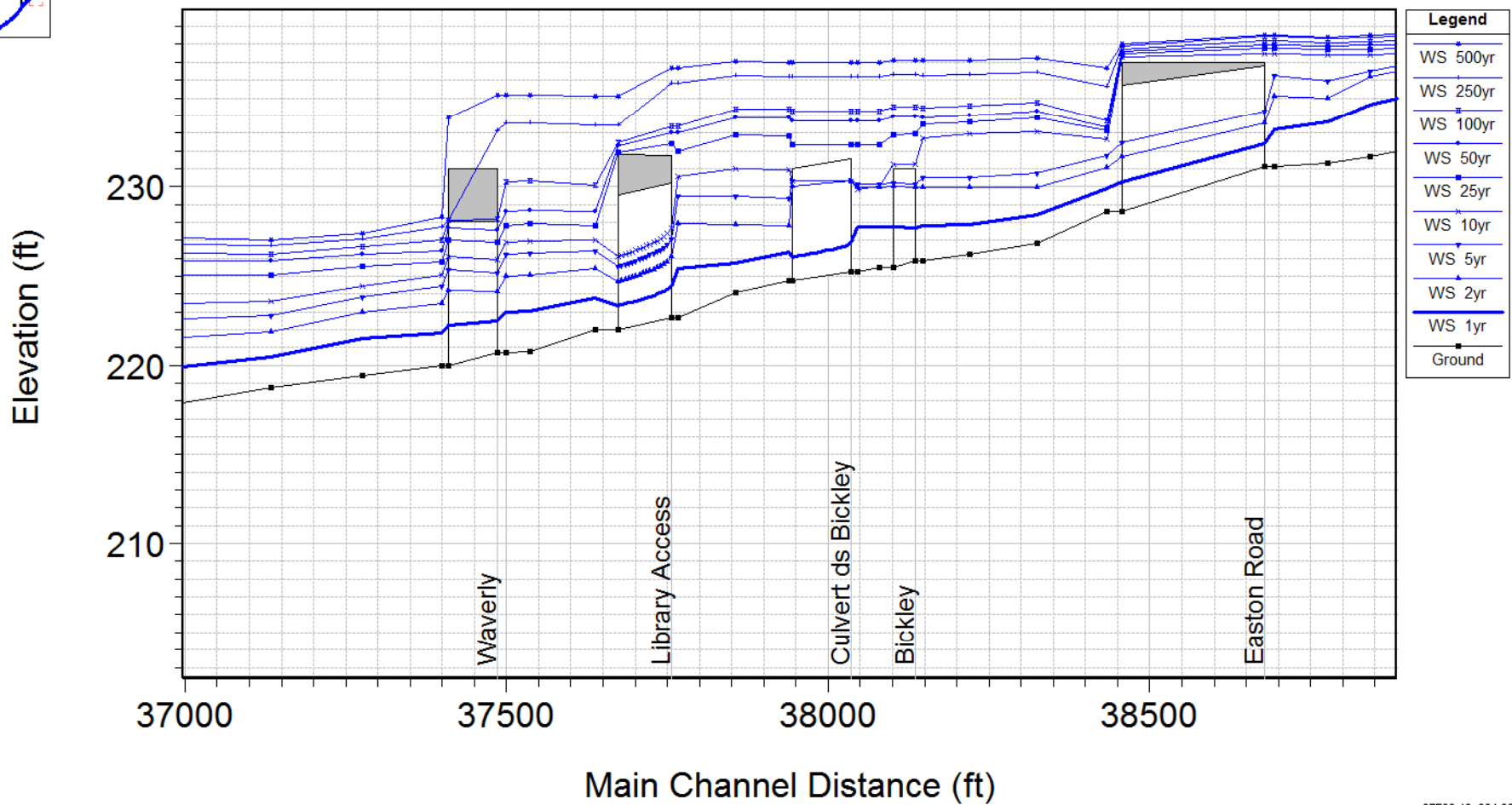
EXISTING CONDITION TOOKANY FREQUENCY WATER SURFACE PROFILES



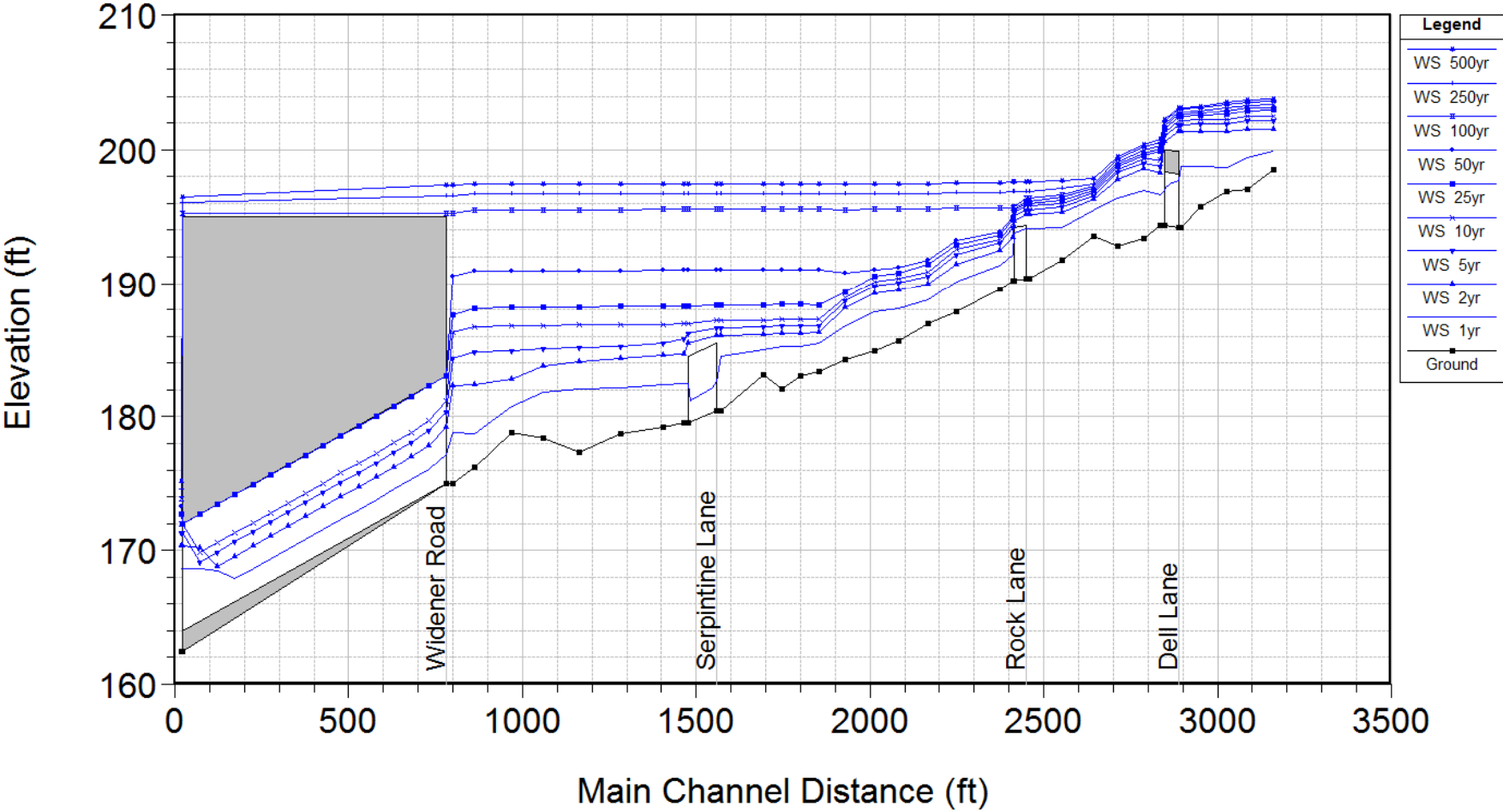
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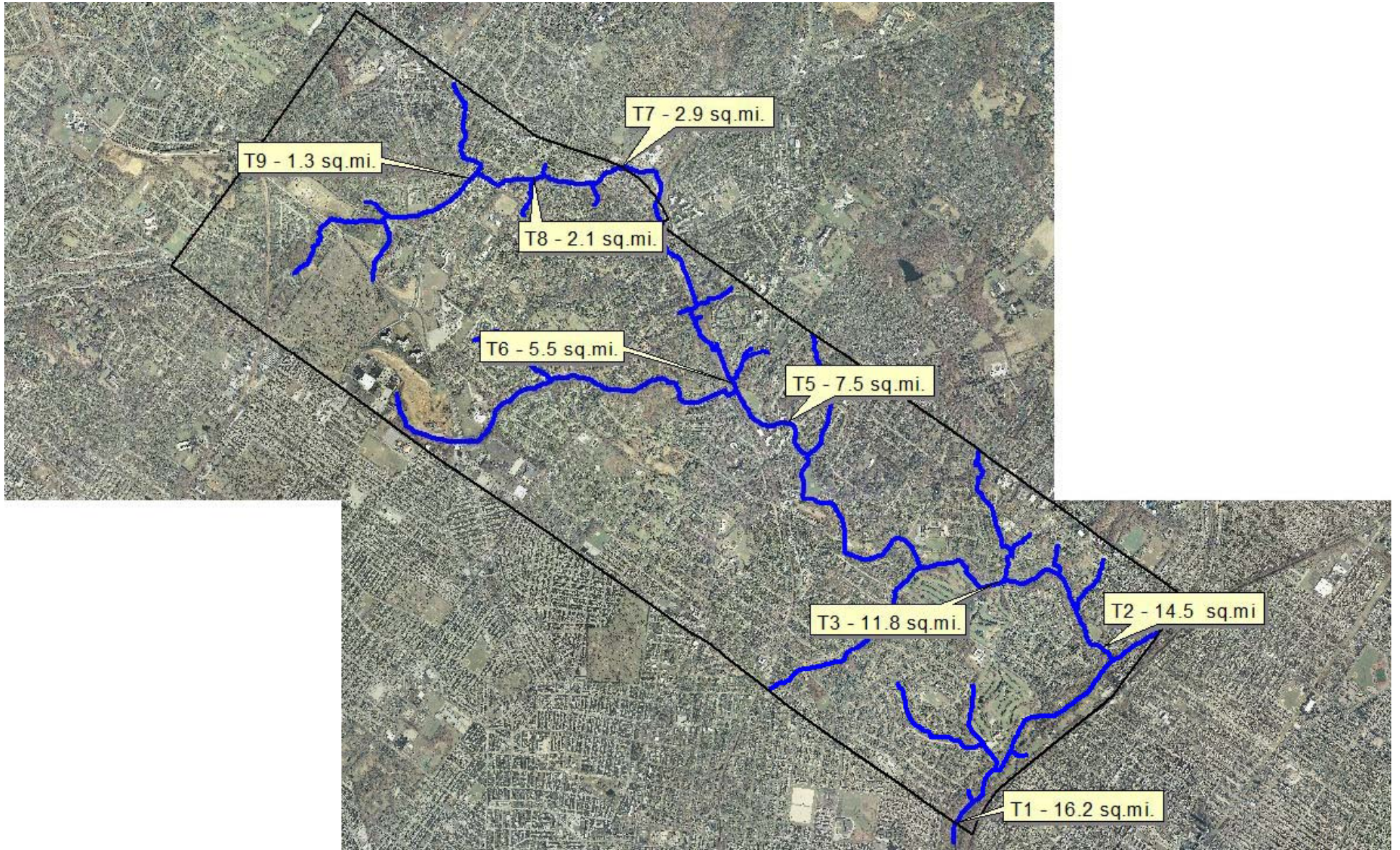
EXISTING CONDITION TOOKANY FREQUENCY WATER SURFACE PROFILES

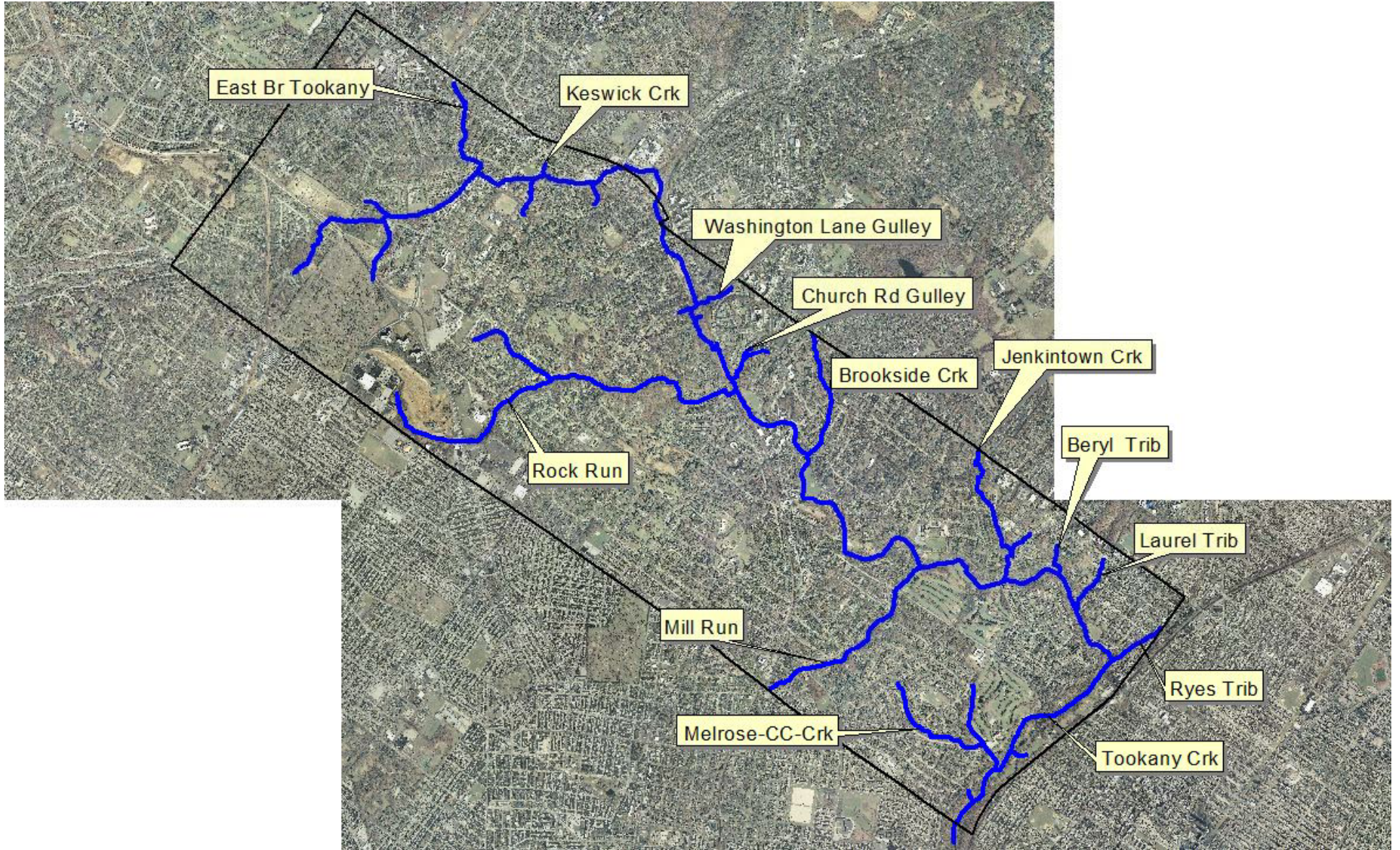


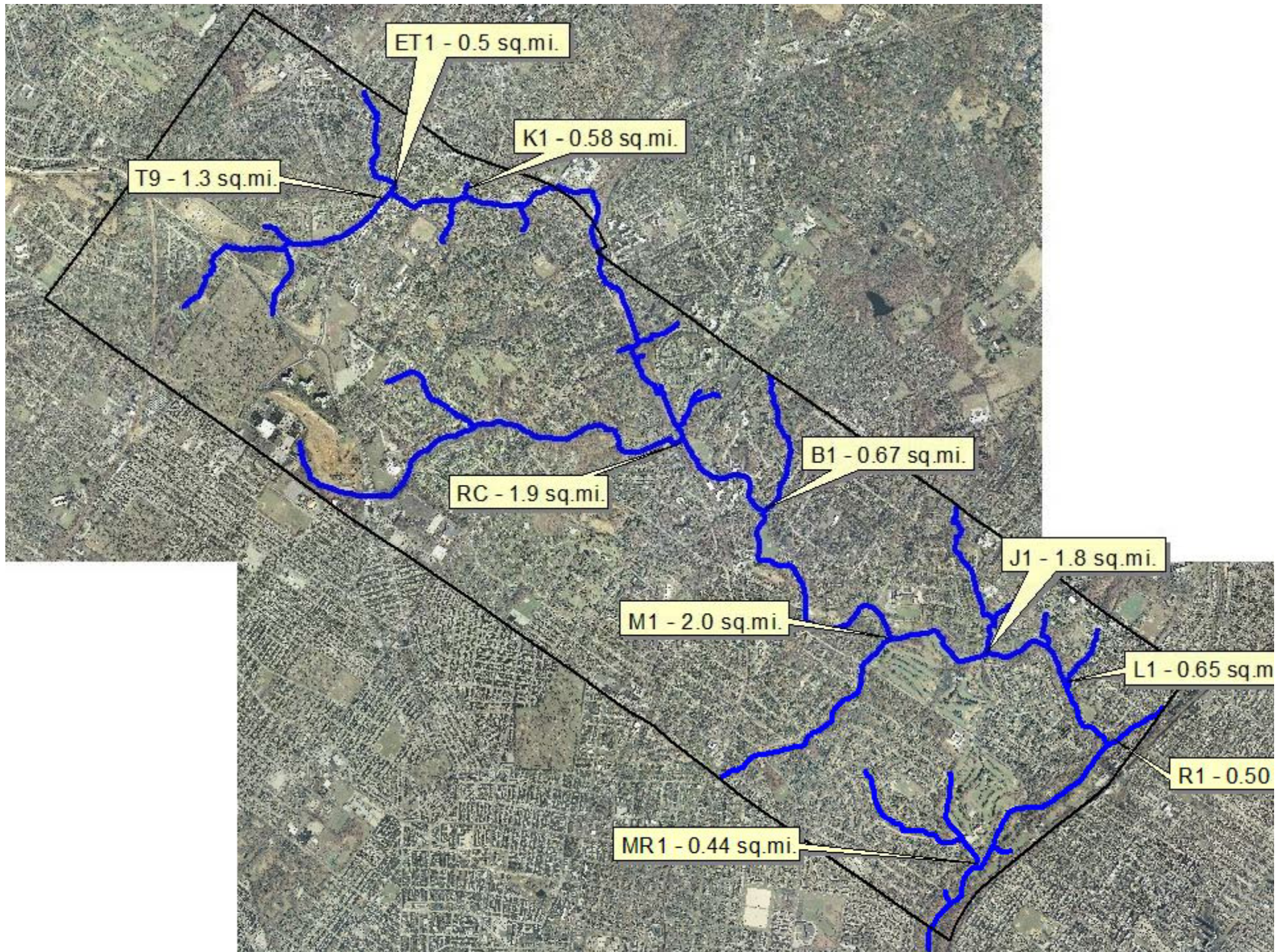
EXISTING CONDITION ROCK CREEK FREQUENCY WATER SURFACE PROFILES



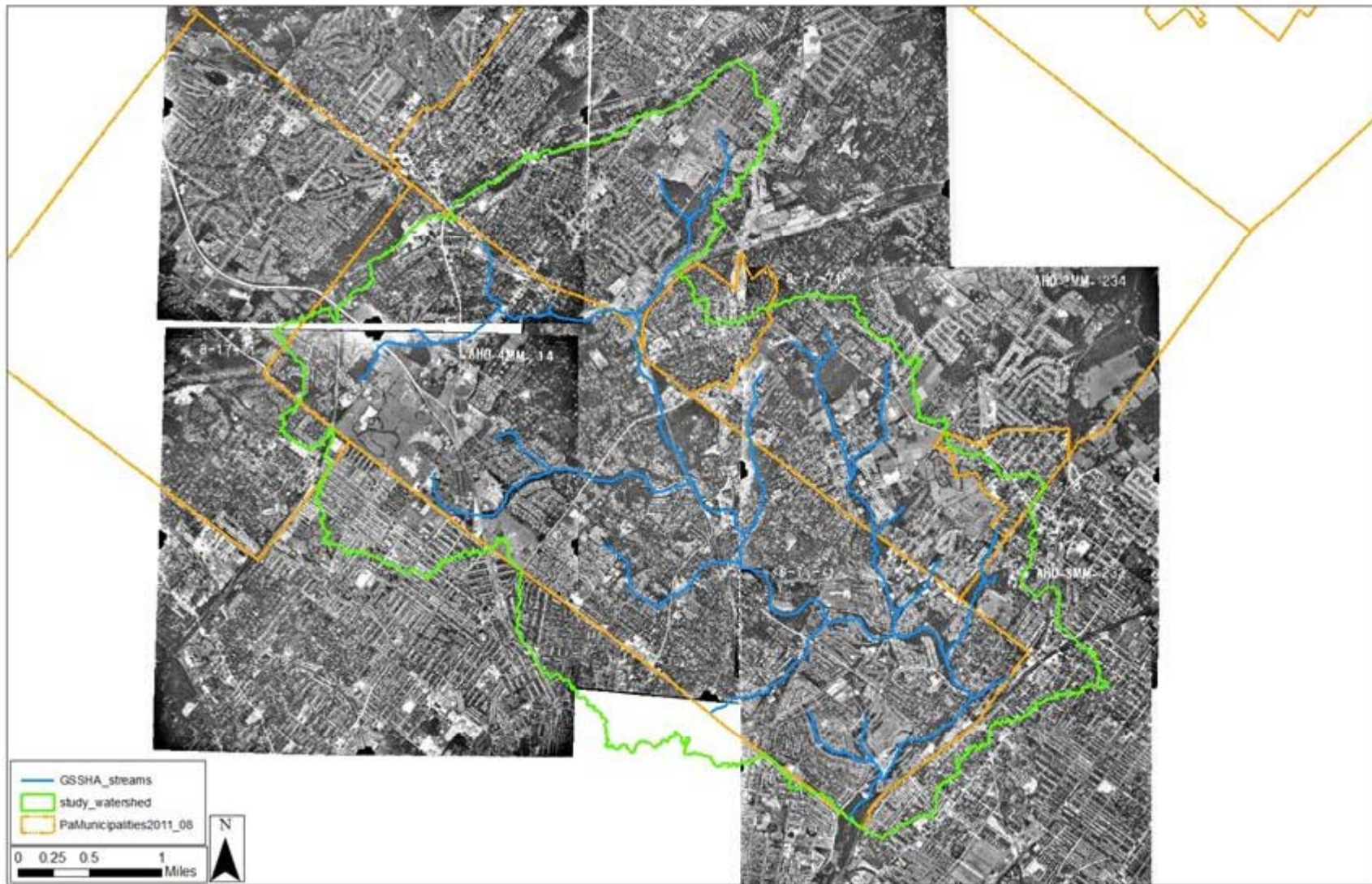
THE END



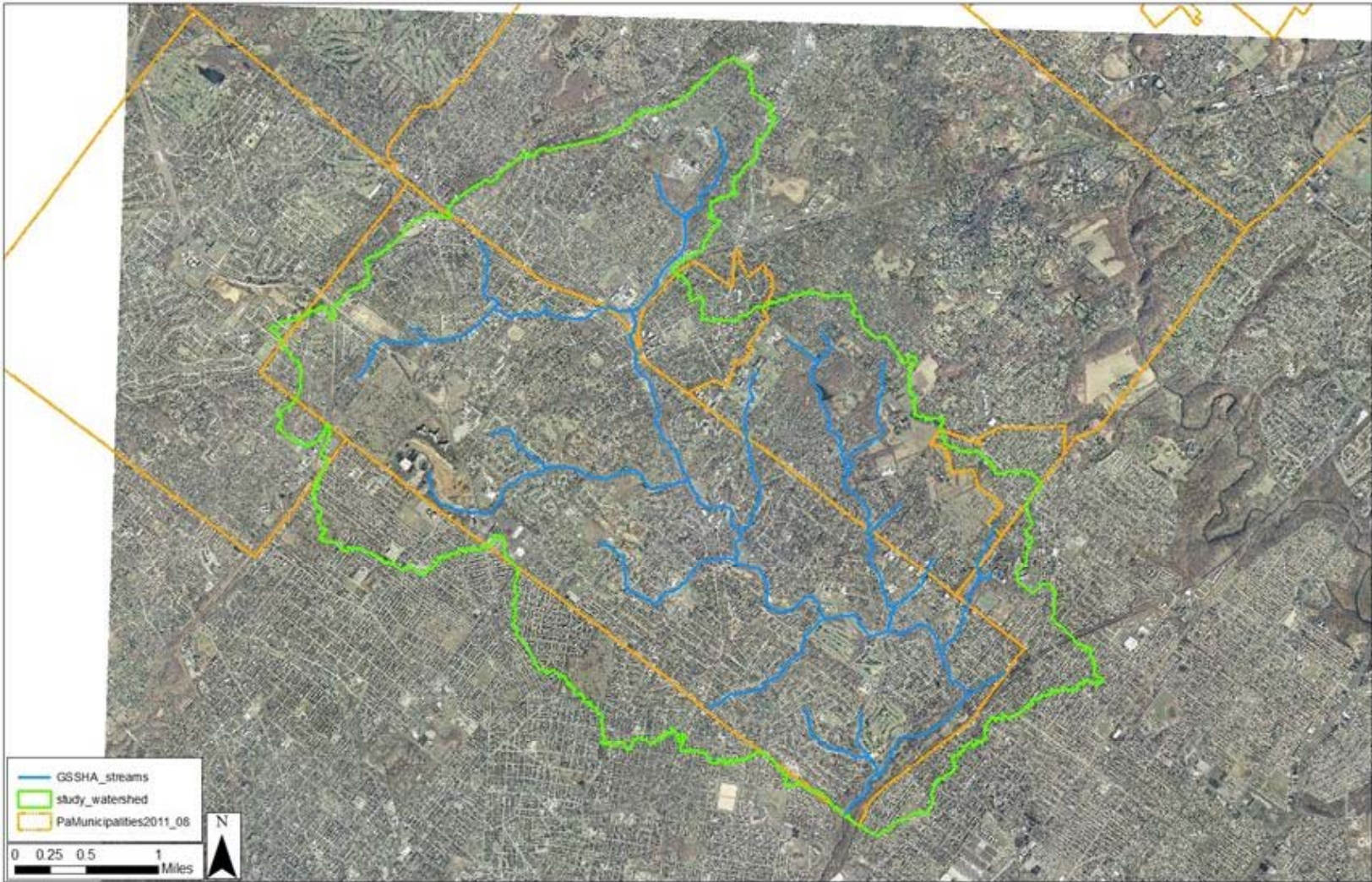




year	rank	Inst. value (CFS)	Date
2006	1	2,650.00	28 Jun 2006, 06:15
2006	2	1,250.00	08 Nov 2006, 10:00
2006	3	1,240.00	28 Jul 2006, 01:45
2006	4	1,010.00	02 Jun 2006, 23:45
2007	1	1,520.00	16 Apr 2007, 04:30
2007	2	1,510.00	01 Jan 2007, 08:00
2007	3	1,290.00	15 Apr 2007, 10:00
2007	4	1,020.00	12 Jun 2007, 17:30
2008	1	1,580.00	08 Mar 2008, 13:45
2008	2	1,410.00	06 Sep 2008, 19:15
2008	3	1,340.00	11 Dec 2008, 22:30
2008	4	1,230.00	28 Sep 2008, 17:30
2009	1	2,610.00	02 Aug 2009, 13:30
2009	2	1,870.00	22 Aug 2009, 20:30
2009	3	1,780.00	09 Aug 2009, 09:15
2009	4	1,750.00	24 Oct 2009, 20:00
2010	1	3,690.00	13 Jul 2010, 11:15
2010	2	3,010.00	01 Oct 2010, 04:15
2010	3	1,520.00	13 Mar 2010, 16:30
2010	4	1,180.00	29 Mar 2010, 03:45
2011	1	5,990.00	08 Sep 2011, 05:45
2011	2	5,830.00	28 Aug 2011, 00:45
2011	3	3,440.00	21 Aug 2011, 16:30
2011	4	2,930.00	16 Apr 2011, 22:15
2012	1	2,840.00	16 May 2012, 03:15
2012	2	2,100.00	27 May 2012, 07:30
2012	3	1,260.00	15 Jul 2012, 23:15
2012	4	963	20 Jul 2012, 06:45



1971 Land Use



2008 Land Use

Bulletin 17B Results

Tacony Creek at Adams Ave

FINAL RESULTS

-FREQUENCY CURVE-467086

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#####N#####N#####»
° COMPUTED   EXPECTED   * PERCENT   * CONFIDENCE LIMITS °
° CURVE     PROBABILITY * CHANCE     * .05 .95 °
° FLOW IN CFS * EXCEEDANCE * FLOW IN CFS °
C#####¶
° 10800.    13300. * .10 * 17000.  8080. °
° 9770.     11500. * .20 * 14900.  7410. °
° 8750.     9990.  * .40 * 12900.  6760. °
° 8440.     9540. * .50 * 12300.  6560. °
° 7490.     8230. * 1.00 * 10600.  5930. °
° 6580.     7060. * 2.00 * 9010.   5310. °
° 5710.     5990. * 4.00 * 7540.   4700. °
° 5430.     5670. * 5.00 * 7090.   4510. °
° 4590.     4720. * 10.00 * 5770.   3890. °
° 3760.     3810. * 20.00 * 4530.   3240. °
° 2590.     2590. * 50.00 * 2980.   2240. °
° 2140.     2130. * 67.00 * 2460.   1820. °
° 1800.     1780. * 80.00 * 2090.   1490. °
° 1500.     1460. * 90.00 * 1770.   1200. °
° 1290.     1240. * 95.00 * 1550.   994. °
° 979.      905.  * 99.00 * 1220.   705. °
° 726.      621. * 99.90 * 950.    482. °
#####'
° SYNTHETIC STATISTICS
C#####¶
° LOG TRANSFORM: FLOW, CFS * NUMBER OF EVENTS
C#####¶
° MEAN 3.4164 * HISTORIC EVENTS 0 °
° STANDARD DEV .1899 * HIGH OUTLIERS 0 °
° COMPUTED SKEW -.2757 * LOW OUTLIERS 1 °
° REGIONAL SKEW .1780 * ZERO OR MISSING 0 °
° ADOPTED SKEW .1158 * SYSTEMATIC EVENTS 27 °
#####%
```



Tacony Creek Gage at Adams Avenue Various Estimates of Discharge Frequency													
Analysis Report	DA (sq.mi.)	1yr	2yr	5yr	10yr	20yr	25yr	50yr	100yr	200yr	250yr	500yr	Remarks
(1) 2010 FEMA FIS(1974)	17.0				3400			4400	5100			6400	Analysis from 1974; freq rain and runoff model
(2) USGS Regression Equations	16.6		2370	3380	4070			5670	6380			8100	SIR2008-5102 17B,21yrs
(3) 17B Full Record Station Skew	16.7	864	2660	3790	4500	5170	5370	5990	6600	7180	7370	7940	WY1966 to WY1986 WY2006 to WY2011
(4) 17B Full Record Weighted Skew	16.7	979	2590	3760	4590	5430	5710	6580	7490	8440	8750	9770	WY1966 to WY1986 WY2006 to WY2011 Skew: PR-70 (G=0.178; MSE=0.033)
(5) 17B Partial Record Weighted Skew	16.7	926	2370	3370	4060	4740	4960	5650	6360	7080	7320	8080	WY1966 to WY1986 Skew: 17B-MAP (G=0.700; MSE=0.302)
(6) Act 167	16.7				5017			8068	9953				
(7) PWD	16.7	476	2502	3491	3976		4436	4694	4896				

June 06 Measured Q= 2645cfs between 2yr and 5yr
Irene Measured Q=5830cfs between 25yr and 50yr
Lee Measured Q=5990cfs between 25yr and 50yr



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