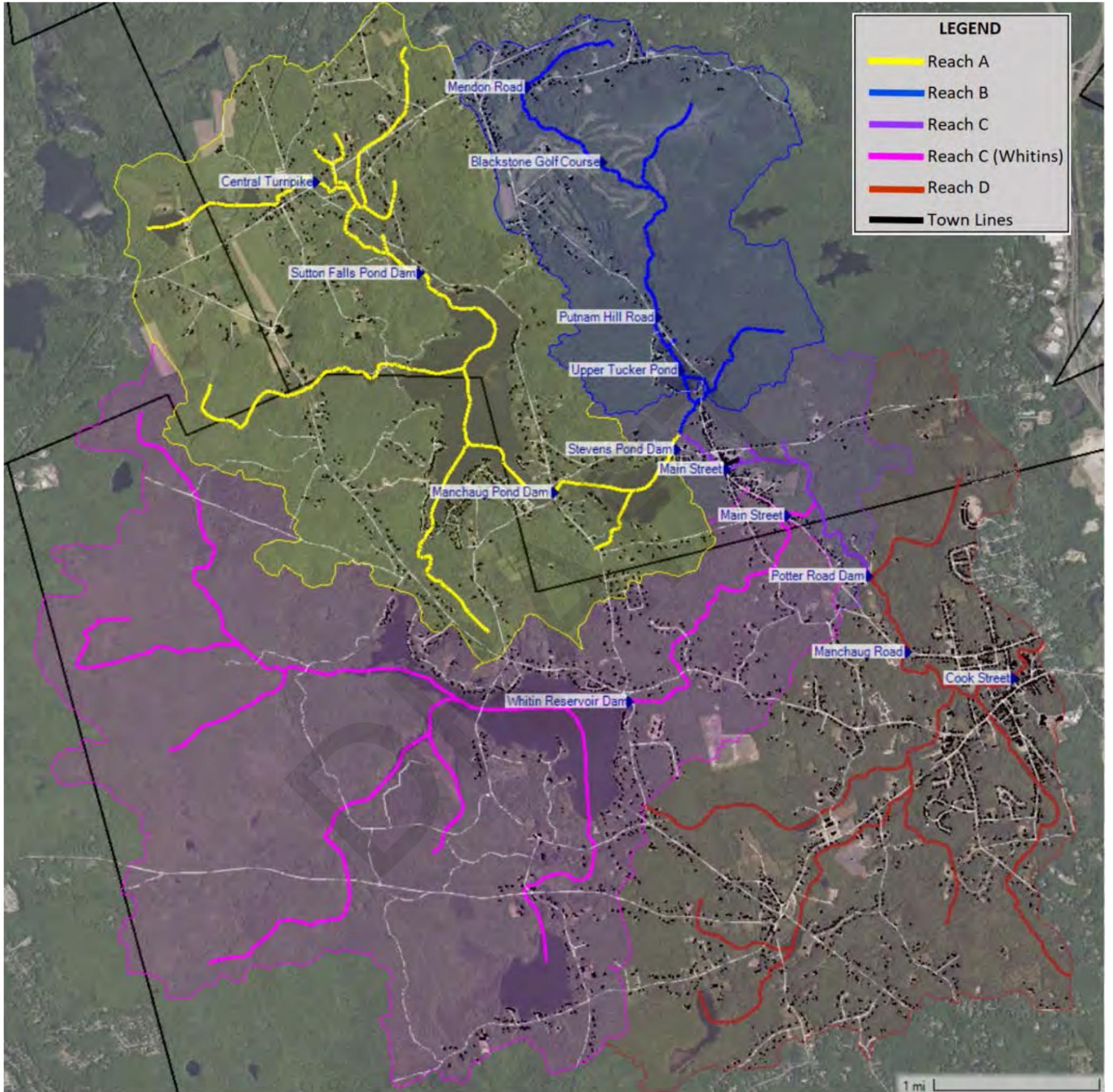


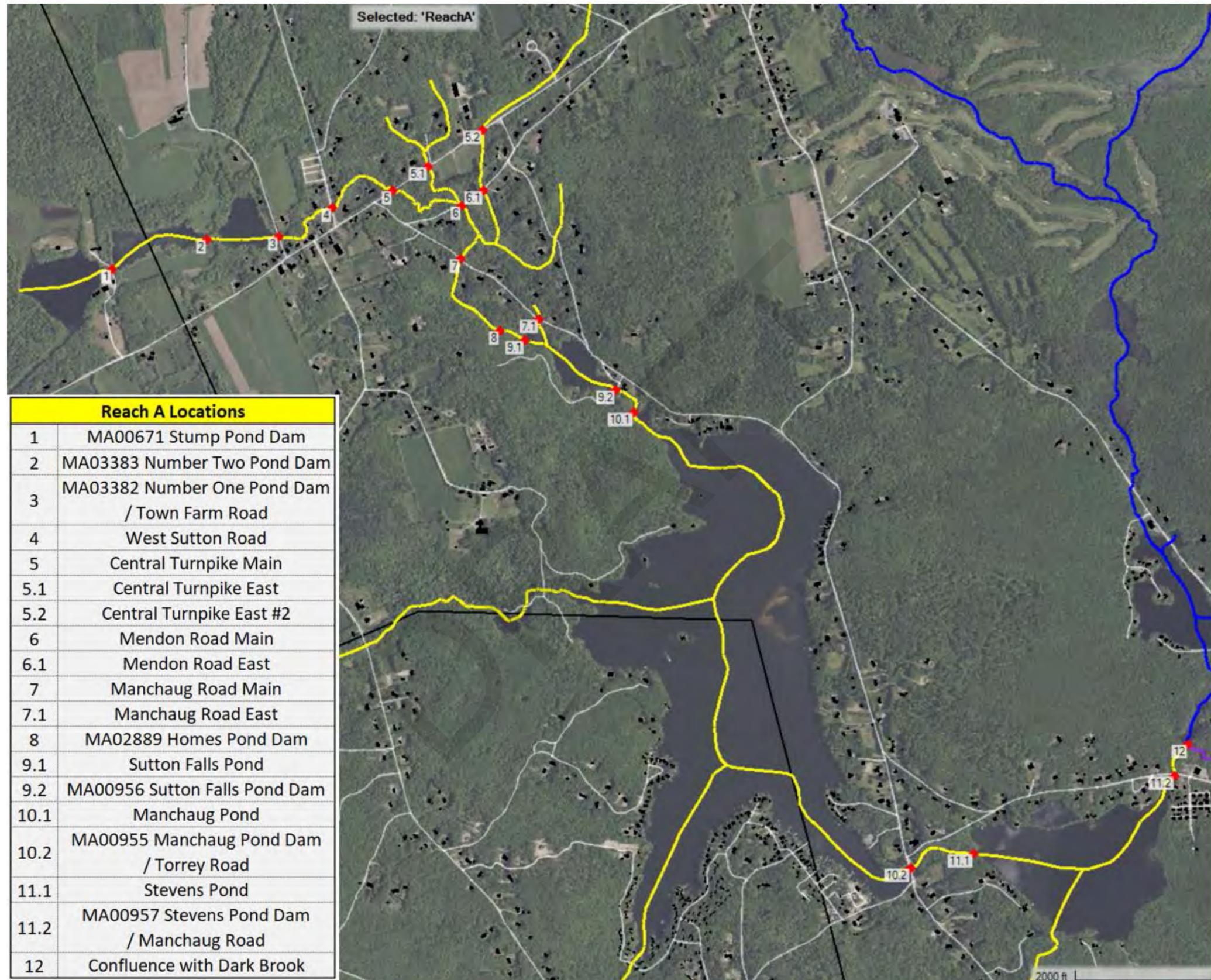
APPENDIX A:
Supporting Graphics

DRAFT



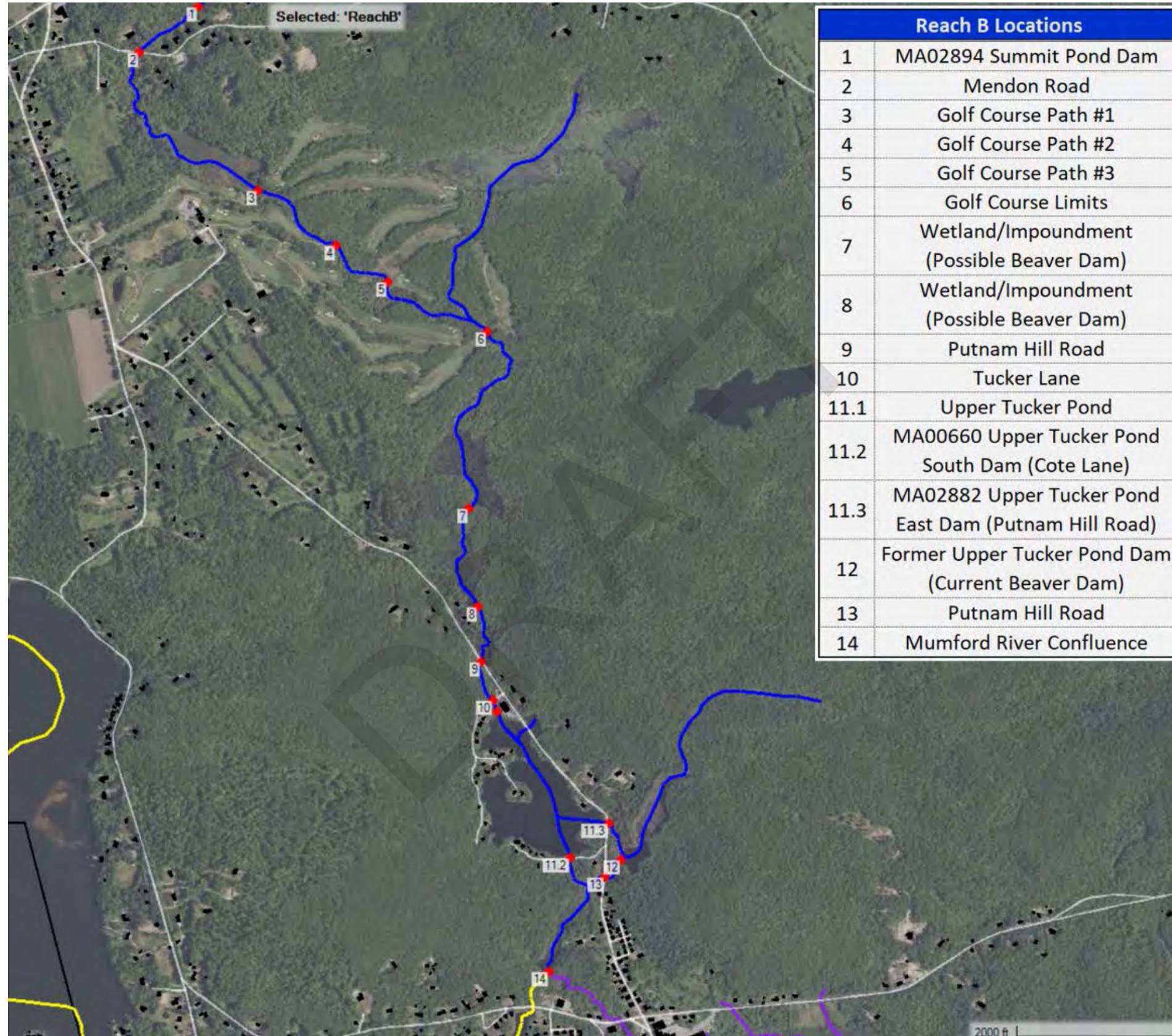


Graphic #1: Overview of the study area. (Report Section 1.0)



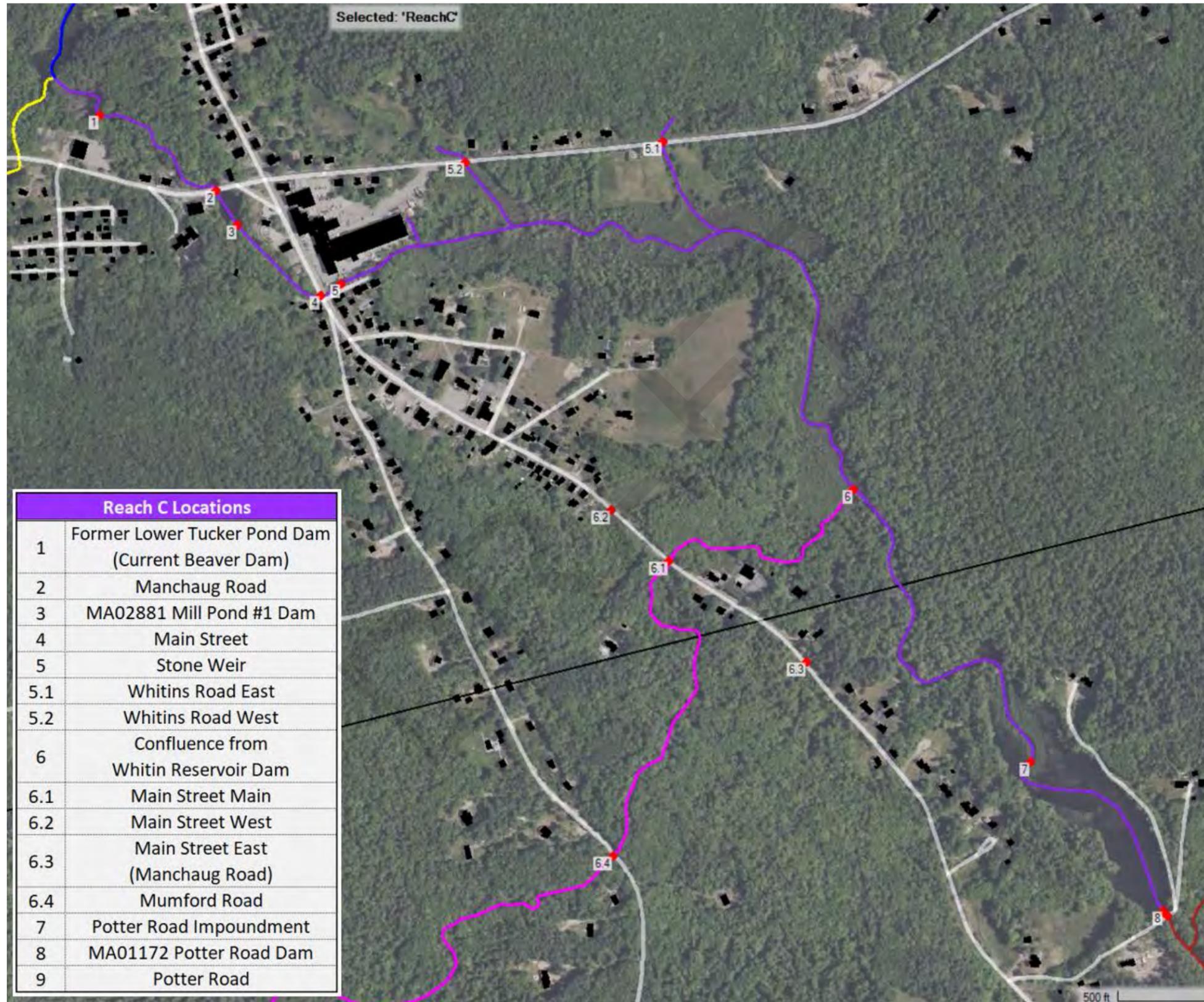
Graphic #2: Overview of Reach A (Upper Mumford River). (Report Section 1.1)





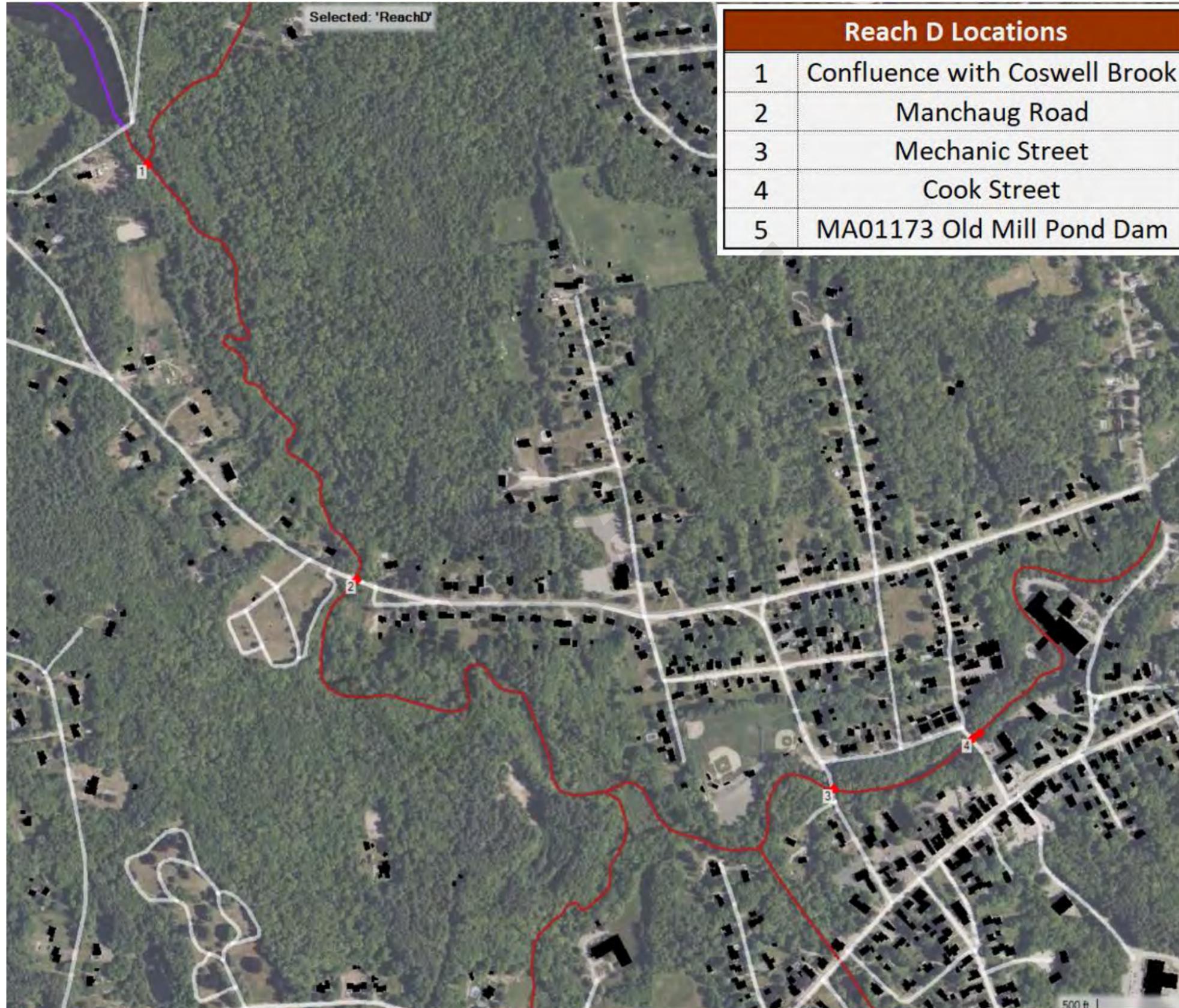
Graphic #3: Overview of Reach B (Dark Brook). (Report Section 1.2)





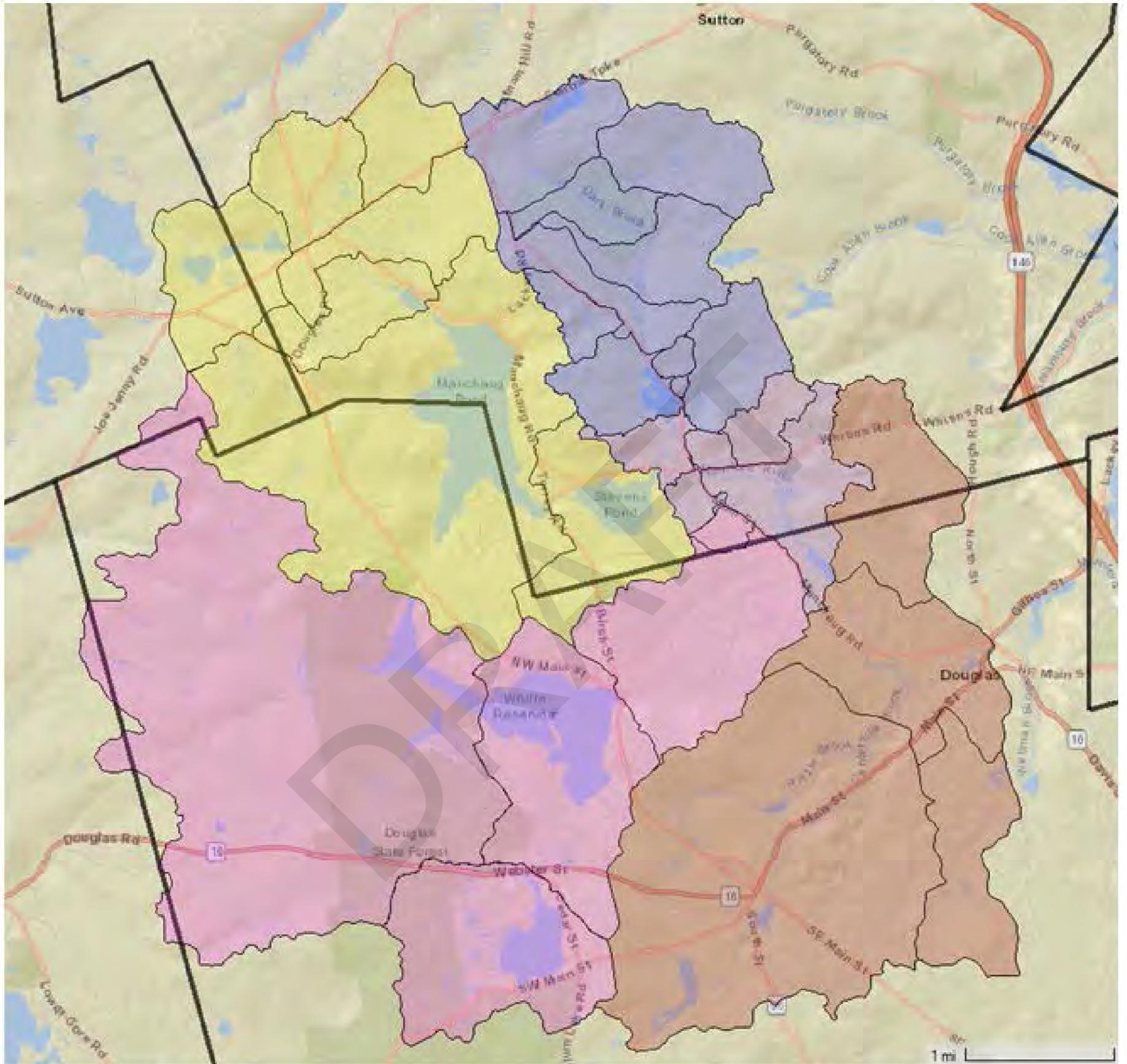
Graphic #4: Overview of Reach C (Mumford River – Manchaug Village). (Report Section 1.3)





Graphic #5: Overview of Reach D (Mumford River – Douglas). (Report Section 1.4)





Graphic #6: Overview of the drainage area subdivision. (Report Section 2.1)

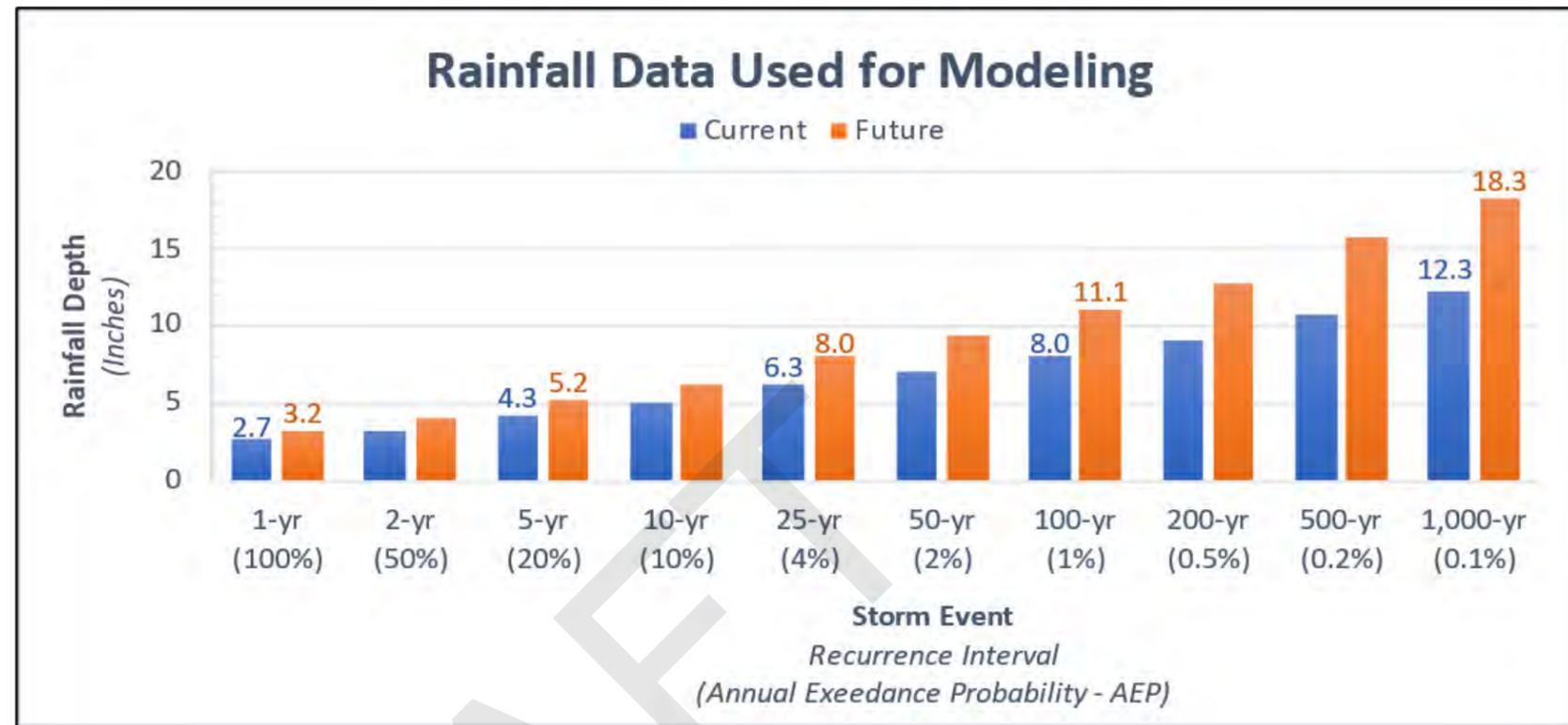
Drainage Area Parameters																				
Group	Reach	ID	Name	Size		Baseflow	Tc		Curve Number			HSG				LCG				
				s.m.	acres	CFS	Minutes	LFP	CN	% Imp	Imp acres	CN*	A	B	C	D	1	2	3	4
Mumford River US	A	A	Town Farm Road	0.74	473	1.5	461	2,700	78	9.0%	43	76	0%	0%	80%	20%	52%	32%	7%	9%
		B	Central Turnpike	0.91	582	1.8	443	4,300	70	5.3%	31	68	4%	44%	29%	23%	59%	25%	11%	5%
		C	ManchRoad US of SF Pond	0.67	427	1.3	388	4,500	73	4.6%	20	72	3%	27%	40%	30%	58%	24%	13%	5%
		D	Sutton Falls Pond	0.49	314	1.0	396	7,700	69	8.2%	26	66	4%	52%	18%	26%	57%	26%	9%	8%
		E	Manchaug Pond	3.94	2519	7.9	750	11,600	72	17.6%	443	66	2%	37%	23%	38%	68%	9%	5%	18%
		F	Stevens Pond	0.93	593	1.9	415	7,300	73	18.0%	107	68	3%	19%	52%	26%	72%	6%	4%	18%
Dark Brook	B	G	DarkBrook Mendon Road	0.60	382	1.2	267	4,000	77	10.4%	40	75	0%	8%	59%	33%	60%	21%	9%	10%
		H	DB Golf Course	0.30	193	0.6	127	2,000	69	1.9%	4	68	0%	65%	7%	28%	47%	44%	7%	2%
		I	DB NE of GC	0.59	375	1.2	280	3,300	70	2.0%	8	69	0%	41%	25%	34%	75%	5%	18%	2%
		J	DB DS of GC	0.48	306	1.0	280	4,000	63	0.6%	2	63	0%	72%	1%	27%	89%	3%	7%	1%
		K	DB PHR	0.37	237	0.7	217	3,800	73	3.5%	8	72	0%	30%	15%	55%	68%	23%	5%	4%
		L	PHR US of K	0.18	112	0.4	142	2,400	67	1.4%	2	67	0%	43%	37%	20%	88%	5%	6%	1%
		M	PHR US of TP N	0.06	35	0.1	77	1,800	60	1.8%	1	59	0%	82%	0%	18%	95%	1%	2%	2%
		N	PHR US of TP S	0.01	9	0.0	61	850	56	3.7%	0	55	11%	89%	0%	0%	81%	15%	0%	4%
		O	Tucker Pond	0.36	231	0.7	187	5,600	69	14.3%	33	64	0%	45%	37%	18%	81%	2%	3%	14%
Mumford River (Manchaug Village)	C	Q	Manchaug Road	0.19	121	0.4	141	3,200	63	7.9%	10	60	18%	58%	4%	20%	73%	9%	10%	8%
		R	Mumford Road	0.10	62	0.2	60	1,500	65	11.9%	7	61	26%	29%	36%	9%	77%	12%	0%	12%
		S	Whitins Road West	0.07	45	0.1	45	1,100	60	5.0%	2	58	37%	26%	9%	28%	80%	6%	9%	5%
		T	Whitins Road East	0.22	138	0.4	120	3,800	59	1.3%	2	58	0%	88%	3%	9%	92%	1%	6%	1%
Whitin Res Tributary	C	U	Potter Road	0.63	405	1.3	406	6,600	65	6.0%	24	63	21%	45%	21%	13%	62%	9%	23%	6%
		1	WRD - Causeway	6.04	3867	12.1	1235	20,000	62	2.9%	112	61	2%	71%	13%	14%	86%	1%	10%	3%
		2	WRD - BadluckLake	1.35	867	2.7	294	8,200	73	13.7%	119	69	2%	26%	59%	13%	66%	2%	18%	14%
		3	WRD - WRWest	1.55	992	3.1	258	10,000	74	31.6%	313	63	5%	23%	30%	42%	56%	9%	4%	32%
Mumford River (Douglas)	D	V	DS of WRD	1.44	920	2.9	461	6,600	66	3.7%	34	65	6%	41%	47%	6%	81%	8%	8%	4%
		W	Coswell Brook	0.89	571	1.8	660	12,500	67	2.0%	11	66	4%	56%	23%	17%	74%	5%	19%	2%
		X	Centerville Brook	3.96	2537	7.9	1000	12,000	61	7.1%	180	58	27%	45%	21%	7%	67%	14%	12%	7%
		Y	Trib US of Mechanic	0.79	504	1.6	500	10,800	58	5.7%	29	56	39%	24%	31%	6%	74%	11%	10%	6%
		Z	North Street	1.09	696	2.2	600	9,800	59	12.2%	85	54	41%	49%	10%	0%	59%	18%	11%	12%
			Totals	29.39	18809	58.8				9.0%	1697		11%	40%	27%	22%	69%	13%	9%	9%
HSG: Hydrologic Soil Group										LCG: Land Cover Group										
	A	High Absorption		Clean Sands & Gravels (<10% fines)						1	High Absorption				Forests, Shrubs, Grass					
	B	Moderate Absorption		Silty Sands & Gravels (10-20% fines)						2	Moderate Absorption				Bare, Cultivated/Pasture					
	C	Low Absorption		Sandy Silts & Silts (20-40% fines)						3	Low Absorption				Wetlands, Aquatic Beds					
	D	Very Low / No Absorption		Silts & Clays (>40% fines), Bedrock, Water						4	Very Low / No Absorption				Impervious					

Graphic #7: Drainage area hydrological parameters – tabulated summary of all 31 subbasins. (Report Section 2.1)



Rainfall Data Used for Modeling				
Storm Event			Rainfall Depth (Inches)	
Duration (Hours)	Percent Chance of Occurrence Any Given Year	Recurrence Interval (Years)	Current ¹	Future ²
24	99.9%	1-yr	2.7	3.2
	50.0%	2-yr	3.3	4.0
	20.0%	5-yr	4.3	5.2
	10.0%	10-yr	5.1	6.2
	4.0%	25-yr	6.3	8.0
	2.0%	50-yr	7.1	9.4
	1.0%	100-yr	8.0	11.1
	0.5%	200-yr	9.1	12.8
	0.2%	500-yr	10.8	15.8
	0.1%	1,000-yr	12.3	18.3
24 & 72	0.02% ⁴	1/2 PMF ³	20	-
	0.01% ⁴	PMF ³	38	-

1) Current Rainfall Obtained from NOAA Atlas 14
2) CCIPF: Climate Change Informed Predicted Future Rainfall obtained using NOAA Atlas 14++ methodologies
3) PMF: Probable Maximum Flood resulting from the Probable Maximum Precipitation (PMP) event determined from HMR 51/52 methodologies
4) Estimated recurrence intervals



Graphic #8: NOAA Atlas 14 24-hour rainfall data used for modelling. “Current” depths use the median value of the Atlas 14 data set, common practice for determining current rainfall. “CCIPF” depths are the upper bound of data set (Atlas 14++), a simple methodology for determining climate change informed predicted future (CCIPF) rainfall. (Report Section 2.1)

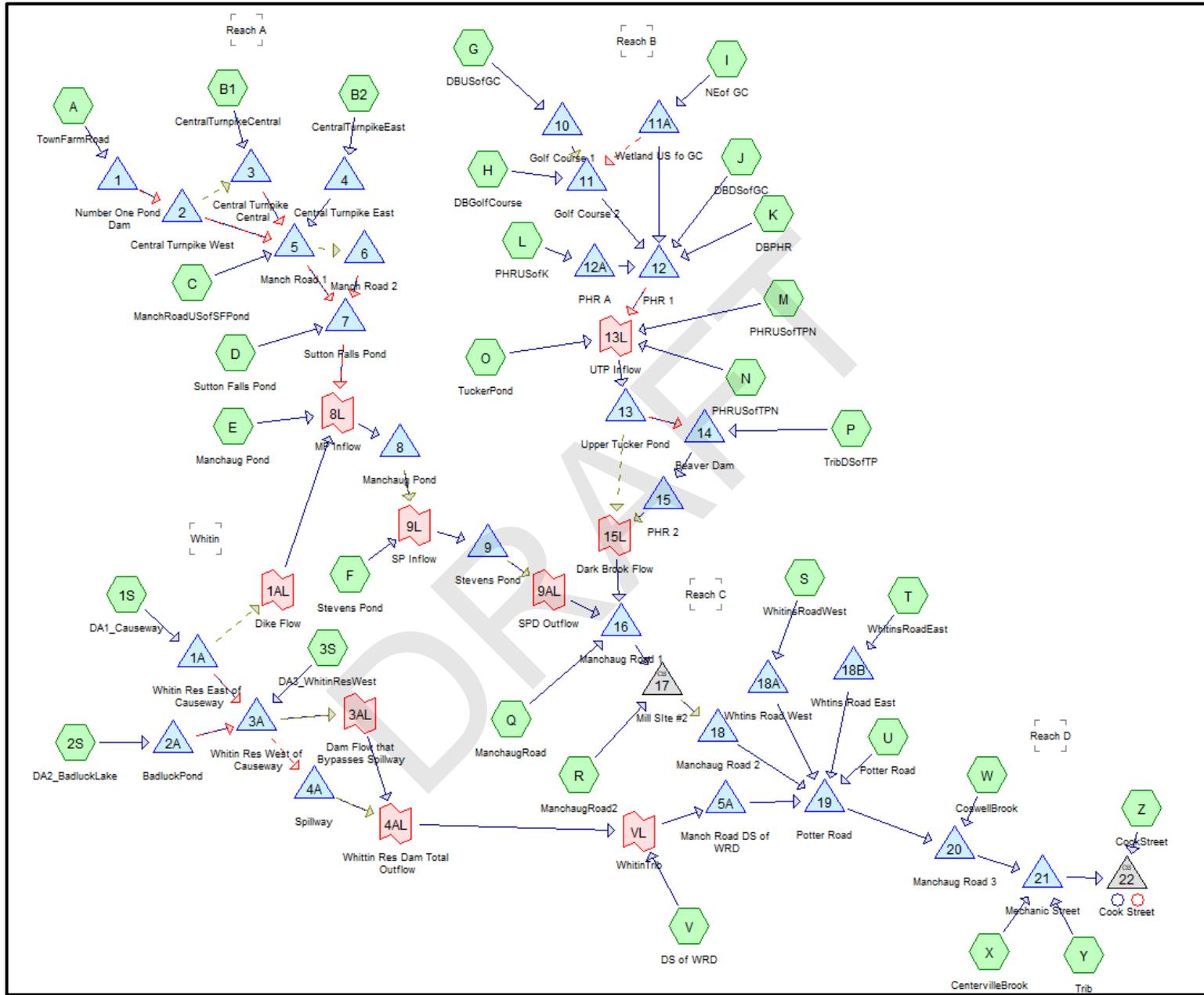
Recent Extreme Rain Events					
Past Event			Sutton Area		
Yrs Since	Name	Date	Days	Depth	Equiv
2	Ida	2021-09-02	1	4.5"	~ 5-yr
2		2021-08-20	1	3"	< 2-yr
4	Florence	2018-09-18	1	2.5"	< 1-yr
5		2018-03-03	1	1.9"	< 1-yr
5	Phillipe	2017-10-29	1	3"	< 2-yr
6		2017-04-01	1	1.8"	< 1-yr
9		2014-03-30	1	3.5"	~ 2-yr
10		2013-06-08	1	3.4"	~ 2-yr
10	Sandy	2012-10-29	2	2.7"	< 1-yr
11		2011-12-08	1	3.5"	~ 2-yr
12	Irene	2011-08-28	2	3.9"	< 1-yr
12		2011-03-07	1	2.4"	~ 2-yr
13	Note 1	2010-03-29	3	4.9"	< 5-yr
13	Note 2	2010-03-23	2	2.3"	< 1-yr
13	Note 3	2010-03-14	3	5.6"	~ 5-yr
14	Kyle	2008-09-27	3	3.5"	~ 1-yr
15	Hanna	2008-09-06	2	2.8"	~ 1-yr

Note 1: Harder hit areas closer to 10" ~ 100-yr
Note 2: Harder hit areas closer to 4" ~ 5-yr
Note 3: Sutton was one of the hardest hit areas at 5.6"
General Note: All rainfall depths obtained from CoCoRaS

Recent Extreme Rainfall Events - Mumford River & Dark Brook Watershed													
Past Event				Equivalent Recurrence Interval (AEP)									
Date	Name	Depth	Days	1-yr (100%)	2-yr (50%)	5-yr (20%)	10-yr (10%)	25-yr (4%)	50-yr (2%)	100-yr (1%)	200-yr (0.5%)	500-yr (0.2%)	1,000-yr (0.1%)
September 2, 2021	Ida	4.5"	1										
August 20, 2021		3"	1										
September 18, 2018	Florence	2.5"	1										
March 3, 2018		1.9"	1										
October 29, 2017	Phillipe	3"	1										
April 1, 2017		1.8"	1										
March 30, 2014		3.5"	1										
June 8, 2013		3.4"	1										
October 29, 2012	Sandy	2.7"	2										
December 8, 2011		3.5"	1										
August 28, 2011	Irene	3.9"	2										
March 7, 2011		2.4"	1										
March 29, 2010		4.9"	3										
March 23, 2010		2.3"	2										
March 14, 2010		5.6"	3										
September 27, 2008	Kyle	3.5"	3										
September 6, 2008	Hanna	2.8"	2										
Totals				11	4	2							

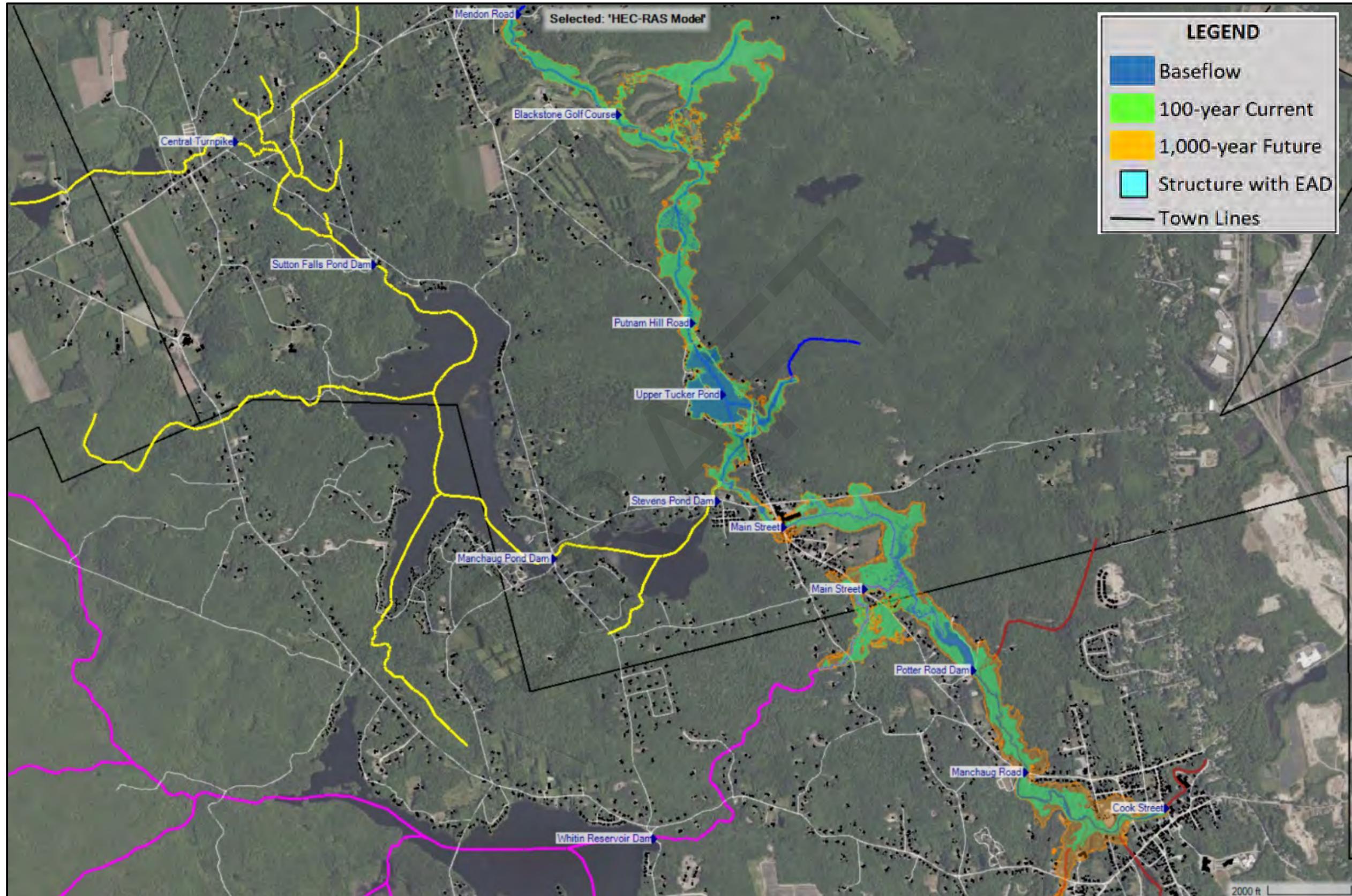
Graphic #9: Summary of available rainfall data near the study area for past extreme rain events. Data obtained from CoCoRaHS. (Report Section 2.1)





Graphic #10: HydroCAD Model overview / routing diagram. (Report Section 2.1)





Graphic #11: H&H Model Results Overview. (Report Section 2.1)



Reach A (Upper Mumford) Model Results

Dams

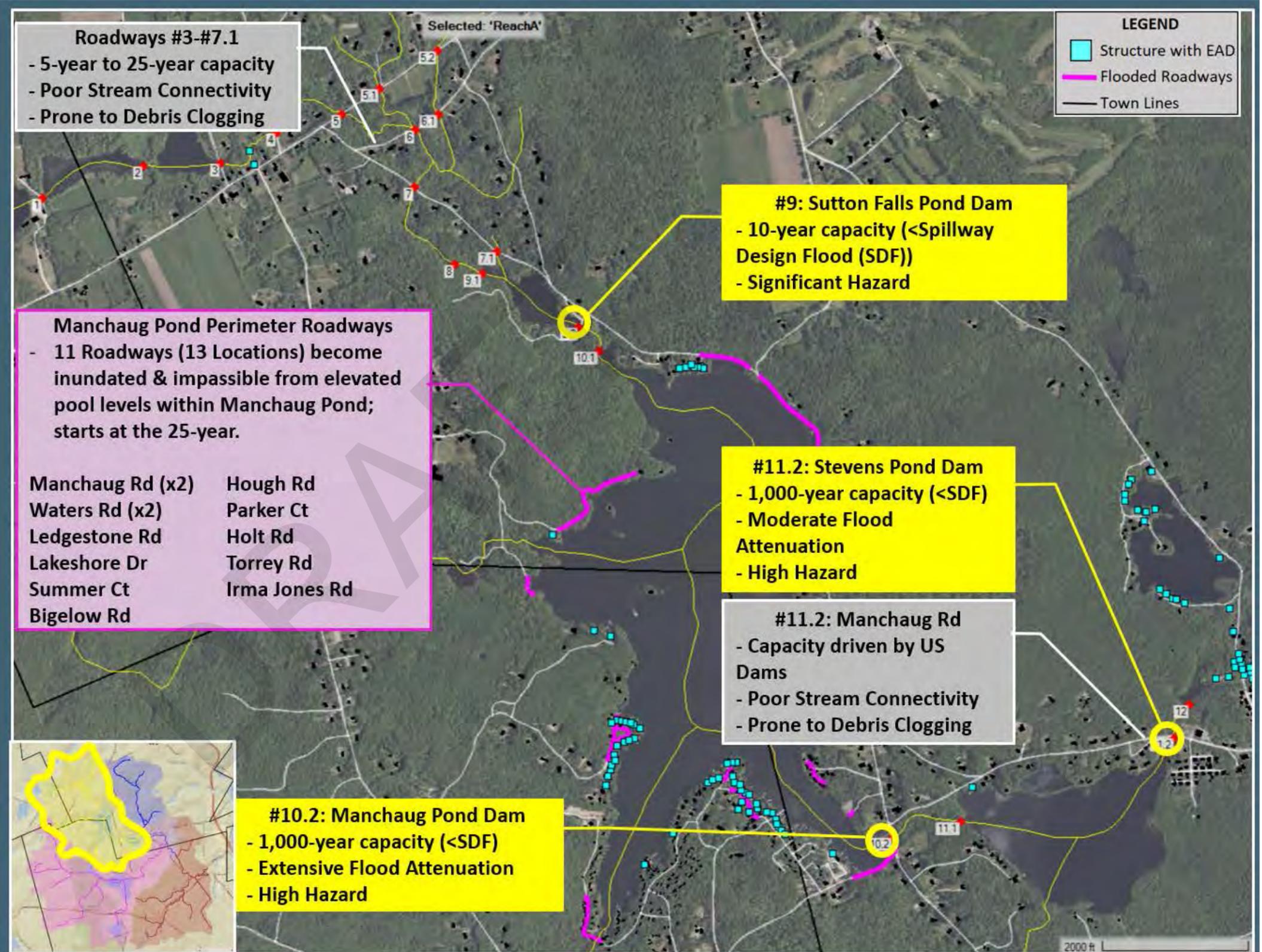
- #9 Sutton Falls Pond Dam (SFPD)
- #10 Manchaug Pond Dam (MPD)
- #11 Stevens Pond Dam (SPD)

Roads

- All upstream (US) of Sutton Falls Pond Dam
- Manchaug Pond Perimeter
- Manchaug Road downstream (DS) of SPD

Buildings

- 58 with potential for Equivalent Annual Damage (EAD)
- 4 US of Manchaug Pond
- 53 along Manchaug Pond



Graphic #12: Reach A (Upper Mumford) – Model Results (Report Section 2.2)



Buildings Impacted by Flooding Along Reach A										
ID	FID	Map-Par ID	Address	CITY	Description	FFE*	Start of Damage		EAD	
							Current	CCIPF	Current	CCIPF
1	1174	35-82	650 CENTRAL TURNPIKE	SUTTON	House in Close Proximity with River		ND	ND	ND	ND
2	798	35-143		SUTTON	Structure in Close Proximity with River		ND	ND	ND	ND
3	375	35-47	381 WEST SUTTON ROAD	SUTTON	House in Close Proximity with River		ND	ND	ND	ND
4	1211	0	90 MANCHAUG ROAD	SUTTON	Sutton Falls Camping Area Intake Building - May See Flooding during events that OT Sutton Falls Pond Dam		25-yr	10-yr	ND	ND
5	162	111-40	25 HOUGH RD	DOUGLAS	House likely to experience flooding during high pool levels in Manchaug Pond	523.5	10-yr	5-yr	\$5,478	\$12,224
6	158	111-37	37 HOUGH RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$5,464	\$12,194
7	86	110-14	115 LEDGESTONE RD	DOUGLAS	Same Description as #5	523.3	10-yr	5-yr	\$4,625	\$10,410
8	136	111-18	55 BIGELOW RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$4,254	\$9,493
9	159	111-38	33 HOUGH RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$4,142	\$9,244
10	93	110-20	101 LEDGESTONE RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$3,700	\$8,257
11	569	42_11	126 MANCHAUG RD	SUTTON	Same Description as #5	523.5	10-yr	5-yr	\$2,373	\$5,296
12	163	111-41	17 HOUGH RD	DOUGLAS	Same Description as #5	523.3	10-yr	2-yr	\$1,881	\$8,044
13	165	111-43	7 HOUGH RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$1,566	\$3,496
14	132	111-14	82 BIGELOW RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$1,334	\$2,976
15	730	48_35	3 PARKER RD	SUTTON	Same Description as #5	474	25-yr	10-yr	\$1,262	\$3,405
16	137	111-19	53 BIGELOW RD	DOUGLAS	Same Description as #5	523.5	10-yr	5-yr	\$1,227	\$2,739
17	95	110-22	89 LEDGESTONE RD	DOUGLAS	Same Description as #5	523.2	10-yr	5-yr	\$1,135	\$2,572
18	96	110-23	87 LEDGESTONE RD	DOUGLAS	Same Description as #5	523.2	10-yr	5-yr	\$1,103	\$2,501
19	85	110-13	117 LEDGESTONE RD	DOUGLAS	Same Description as #5	524	25-yr	10-yr	\$874	\$2,564
20	166	111-44	3 HOUGH RD	DOUGLAS	Same Description as #5	524	25-yr	10-yr	\$654	\$1,917
21	570	42_12	126.5 MANCHAUG RD	SUTTON	Same Description as #5	523.5	10-yr	5-yr	\$640	\$1,429
22	90	110-18	105 LEDGESTONE RD	DOUGLAS	Same Description as #5	524.3	50-yr	25-yr	\$615	\$3,114
23	133	111-15	84 BIGELOW RD	DOUGLAS	Same Description as #5	524.5	50-yr	25-yr	\$546	\$2,704
24	94	110-21	95 LEDGESTONE RD	DOUGLAS	Same Description as #5	523.7	25-yr	10-yr	\$533	\$1,605
25	169	111-47	12 PARKER CT	DOUGLAS	Same Description as #5	524.2	50-yr	25-yr	\$404	\$2,091
26	157	111-35	34 HOUGH RD	DOUGLAS	Same Description as #5	525	100-yr	25-yr	\$285	\$2,109
27	87	110-15	113 LEDGESTONE RD	DOUGLAS	Same Description as #5	524.5	100-yr	25-yr	\$283	\$1,401
28	617	42_7	122 MANCHAUG RD	SUTTON	Same Description as #5	524	50-yr	25-yr	\$265	\$777
29	123	110-7	107 LEDGESTONE RD	DOUGLAS	Same Description as #5	525	100-yr	25-yr	\$263	\$1,945
30	156	111-34	30 HOUGH RD	DOUGLAS	Same Description as #5	525.5	500-yr	50-yr	\$139	\$830
31	91	110-19	103 LEDGESTONE RD	DOUGLAS	Same Description as #5	525.4	200-yr	50-yr	\$127	\$753
32	89	110-17	109 LEDGESTONE RD	DOUGLAS	Same Description as #5	525.6	500-yr	50-yr	\$103	\$615
33	128	111-10	48 BIGELOW RD	DOUGLAS	Same Description as #5	525	200-yr	50-yr	\$95	\$703
34	135	111-17	65 BIGELOW RD	DOUGLAS	Same Description as #5	524.5	50-yr	25-yr	\$81	\$402
35	131	111-13	76 BIGELOW RD	DOUGLAS	Same Description as #5	526.5	1000-yr	100-yr	\$44	\$457
36	167	111-45	4 PARKER CT	DOUGLAS	Same Description as #5	526.2	500-yr	100-yr	\$37	\$399
37	125	110-8	0 LEDGESTONE RD	SUTTON	Same Description as #5	526.5	500-yr	100-yr	\$31	\$318
38	568	42_10	124.5 MANCHAUG RD	SUTTON	Same Description as #5	526	500-yr	100-yr	\$21	\$169
39	154	111-32	18 HOUGH RD	DOUGLAS	Same Description as #5	526.5	1000-yr	100-yr	\$12	\$121
40	168	111-46	8 PARKER CT	DOUGLAS	Same Description as #5	526.7	1000-yr	200-yr	\$7	\$207
41	170	111-48	18 PARKER CT	DOUGLAS	Same Description as #5	526.9	1000-yr	200-yr	\$6	\$124
42	171	111-49	24 PARKER CT	DOUGLAS	Same Description as #5	526.6	1000-yr	200-yr	\$6	\$58
43	100	110-27	77 LEDGESTONE RD	DOUGLAS	Same Description as #5	527	1000-yr	200-yr	\$3	\$85
44	1239	0	24 HOLT RD	SUTTON	Same Description as #5	527	200-yr	50-yr	\$3	\$85
45	634	42_9	124 MANCHAUG RD	SUTTON	Same Description as #5	527	1000-yr	200-yr	\$2	\$50
46	130	111-12	64 BIGELOW RD	DOUGLAS	Same Description as #5	528	-	500-yr	\$0	\$197
47	145	111-26	42 HOUGH RD	DOUGLAS	Same Description as #5	527.5	-	200-yr	\$0	\$165
48	98	110-25	81 LEDGESTONE RD	DOUGLAS	Same Description as #5	527.5	-	200-yr	\$0	\$153
49	88	110-16	111 LEDGESTONE RD	DOUGLAS	Same Description as #5	527.7	-	500-yr	\$0	\$118
50	97	110-24	85 LEDGESTONE RD	DOUGLAS	Same Description as #5	528.5	-	500-yr	\$0	\$109
51	8	102-7	38 LEDGEWOOD DR	DOUGLAS	Same Description as #5	528.5	-	500-yr	\$0	\$99
52	129	111-11	56 BIGELOW RD	DOUGLAS	Same Description as #5	528	-	500-yr	\$0	\$48
53	7	102-6	34 LEDGEWOOD DR	DOUGLAS	Same Description as #5	528	-	500-yr	\$0	\$44
54	624	42_8	122.5 MANCHAUG RD	SUTTON	Same Description as #5	530	-	1000-yr	\$0	\$26
55	118	110-43	8 SUMMER CT	DOUGLAS	Same Description as #5	529.5	-	1000-yr	\$0	\$23
56	1221	0	120 MANCHAUG RD	SUTTON	Same Description as #5	529	-	500-yr	\$0	\$18
57	280	121-1	76 OAK ST	DOUGLAS	Same Description as #5	528	-	500-yr	\$0	\$16
58	1214	0	62R WATERS RD	SUTTON	Same Description as #5	530	-	1000-yr	\$0	\$10
59	99	110-26	79 LEDGESTONE RD	DOUGLAS	House likely to experience flooding during high pool levels in Stevens Pond	528	-	500-yr	\$0	\$202

*Approximated first floor elevation based upon available LiDAR

Graphic #13: Reach A (Upper Mumford) – Building Damage Assessment Tabulated Summary (Report Section 2.2.3)



Reach B (Dark Brook)

Model Results

Beaver Activity

- #12 & Other Areas

Dams

- #11.2 Upper Tucker Pond (UTP) South Dam
- #11.3 UTP East Dam

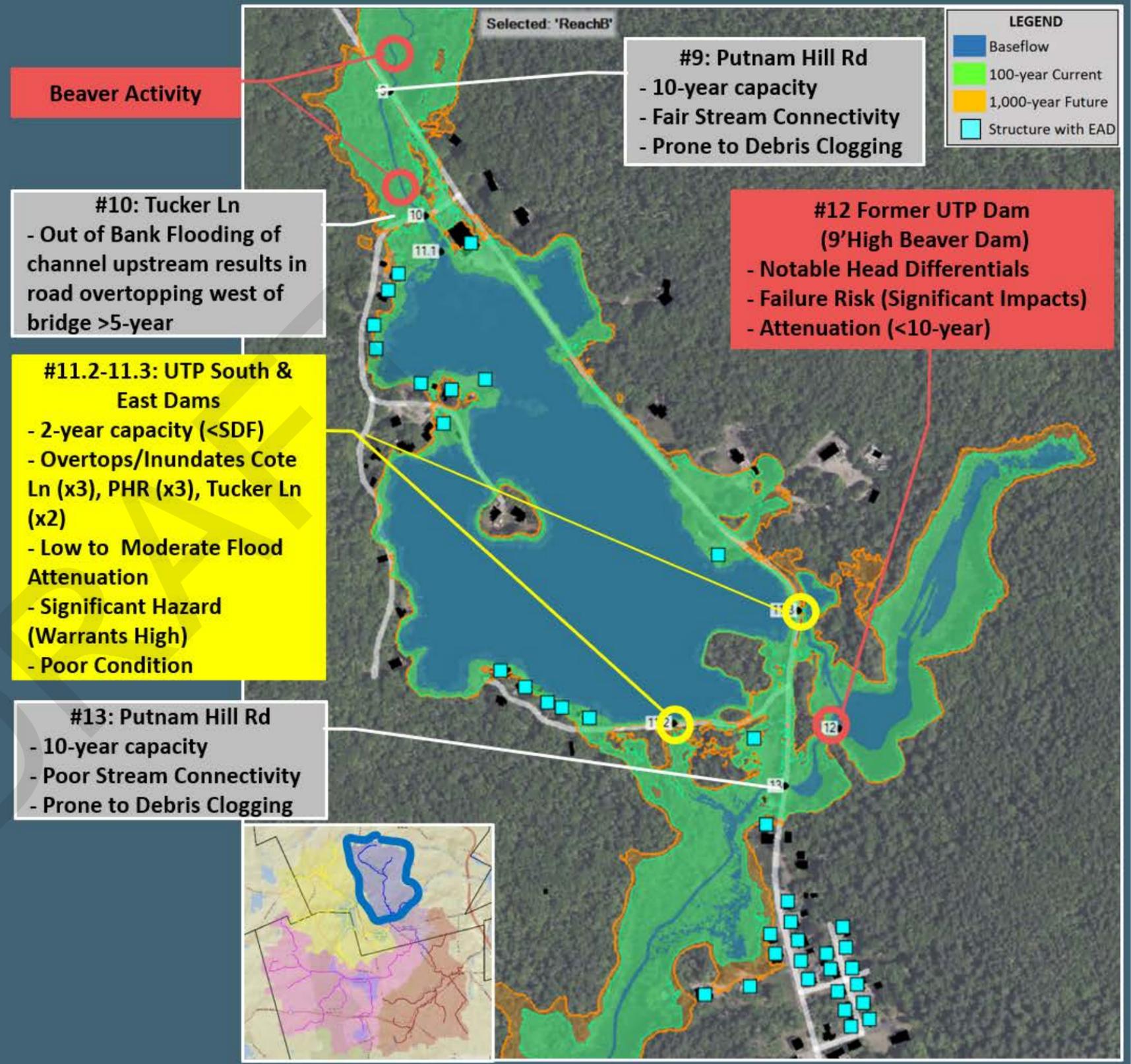
Roads

- Putnam Hill Road (5 locations)
- Tucker Lane (3 locations)
- Cote Lane (3 locations)

Buildings

- 37 with potential for EAD
- 15 along Upper Tucker Pond
- 11 downstream of UTP

Reach Specific Solutions



Graphic #14: Reach B (Dark Brook) – Model Results (Report Section 2.3)



Buildings Impacted by Flooding Along Reach B										
ID	FID	Map-Par ID	Address	City	Description	FFE*	Start of Damage		EAD	
							Current	CCIPF	Current	CCIPF
1	809	49_129	410 PUTNAM HILL RD	SUTTON	House	445.5	5-yr	5-yr	\$7,178	\$7,205
2	859	49_193	27 TUCKER LN	SUTTON	House	458.5	1-yr	1-yr	\$6,880	\$7,533
3	852	49_184	26 TUCKER LN	SUTTON	House	460.5	5-yr	2-yr	\$5,013	\$8,287
4	808	49_128	392 PUTNAM HILL RD	SUTTON	House	459	2-yr	1-yr	\$3,773	\$5,262
5	844	49_173	24 COTE LN	SUTTON	House	460.5	5-yr	2-yr	\$3,744	\$6,190
6	1272	0	18 COTE LN	SUTTON	House	460	5-yr	1-yr	\$1,107	\$1,514
7	1265	0	22 COTE LN	SUTTON	House	461.5	25-yr	10-yr	\$853	\$1,863
8	686	43_9	9 TUCKER LN	SUTTON	House	461.5	25-yr	10-yr	\$588	\$1,285
9	683	43_6	15 TUCKER LN	SUTTON	House	461.5	25-yr	10-yr	\$555	\$1,211
10	858	49_190	23.5 TUCKER LN	SUTTON	House	461.5	25-yr	10-yr	\$393	\$857
11	1263	0	23 TUCKER LN	SUTTON	House	461.5	25-yr	10-yr	\$230	\$503
12	1264	0	362 PUTNAM HILL RD	SUTTON	House	461.5	25-yr	25-yr	\$184	\$0
13	1268	0	20.5 COTE LN	SUTTON	House	461.5	25-yr	10-yr	\$146	\$319
14	817	49-136	428 PUTNAM HILL RD	SUTTON	House	441	1000-yr	500-yr	\$14	\$156
15	1270	0	20 COTE LN	SUTTON	House	462	500-yr	100-yr	\$8	\$53
16	813	49_132	424 PUTNAM HILL RD	SUTTON	House	441.5	1000-yr	100-yr	\$3	\$137
17	781	49_100	2.5 LEDGE ST	SUTTON	House	442.6	-	500-yr	\$0	\$55
18	958	49_99	2 LEDGE ST	SUTTON	House	442.6	-	500-yr	\$0	\$38
19	814	49_133	426 PUTNAM HILL RD	SUTTON	House	443	-	500-yr	\$0	\$36
20	792	49_116	425 PUTNAM HILL RD	SUTTON	House	443.3	-	500-yr	\$0	\$32
21	782	49_101	4 LEDGE ST	SUTTON	House	442.7	-	500-yr	\$0	\$32
22	811	49_130	420 PUTNAM HILL RD	SUTTON	House	443.5	-	500-yr	\$0	\$29
23	783	49_102	6 LEDGE ST	SUTTON	House	443.2	-	500-yr	\$0	\$27
24	685	43_8	11 TUCKER LN	SUTTON	House	464	-	500-yr	\$0	\$23
25	816	49-135	428 R PUTNAM HILL RD	SUTTON	House	442	-	200-yr	\$0	\$22
26	684	43_7	13 TUCKER LN	SUTTON	House	462.5	-	500-yr	\$0	\$18
27	794	49_118	421 PUTNAM HILL RD	SUTTON	House	443.5	-	1000-yr	\$0	\$15
28	791	49_115	425.5 PUTNAM HILL RD	SUTTON	House	443.6	-	1000-yr	\$0	\$13
29	793	49_117	423 PUTNAM HILL RD	SUTTON	House	443.5	-	1000-yr	\$0	\$11
30	785	49_104	10 LEDGE ST	SUTTON	House	443.6	-	1000-yr	\$0	\$9
31	788	49_112	5 LEDGE ST	SUTTON	House	443.7	-	1000-yr	\$0	\$9
32	790	49_114	427 PUTNAM HILL RD	SUTTON	House	443.7	-	1000-yr	\$0	\$9
33	1275	0	3 LEDGE ST	SUTTON	House	444	-	1000-yr	\$0	\$9
34	784	49_103	8 LEDGE ST	SUTTON	House	443.7	-	1000-yr	\$0	\$8
35	786	49_105	1 LEDGE ST	SUTTON	House	444	-	1000-yr	\$0	\$8
36	1277	0	1.5 LEDGE ST	SUTTON	House	442	-	500-yr	\$0	\$7
37	789	49_113	7 LEDGE ST	SUTTON	House	443.7	-	1000-yr	\$0	\$6

*Approximated first floor elevation based upon available LiDAR

Graphic #15: Reach B (Dark Brook) – Building Damage Assessment Tabulated Summary (Report Section 2.3.3)



Reach C (Village) Model Results

Beaver Activity

- #1 & Other Areas

Dams

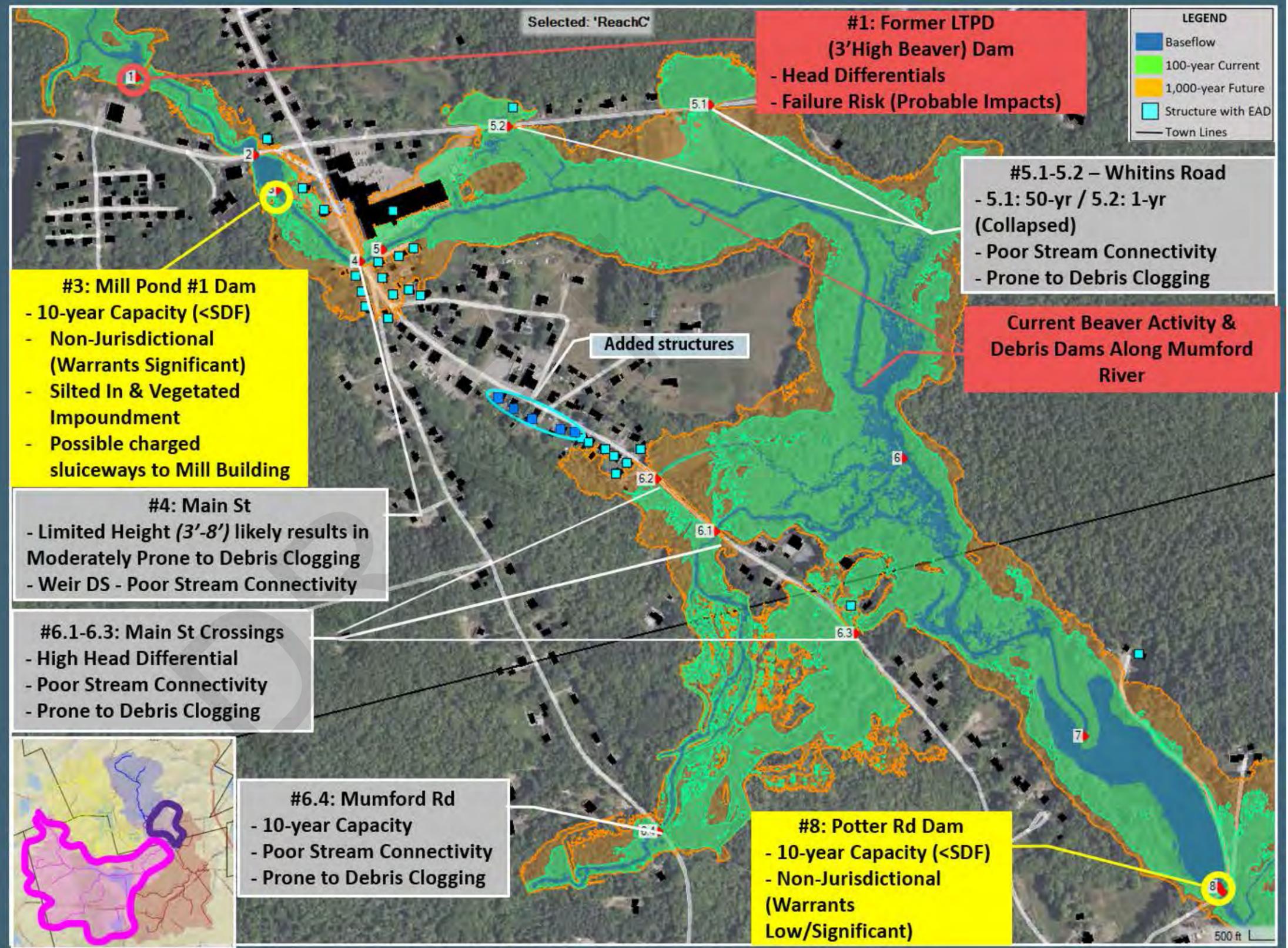
- #3 Mill Pond Dam
- #8 Potter Road Dam

Roads

- #4 Main Street
- #9 Potter Road
- All 6 Tribs (3 Main Street, 2 Whitins Road, 1 Mumford Road)

Buildings

- 25 w/ potential for EAD
- + 5 from Mtg Input
- Mill Site #1



Graphic #16: Reach C (Mumford River – Manchaug Village) – Model Results (Report Section 2.4)



Buildings Impacted by Flooding Along Reach C										
ID	FID	Map-Par ID	Address	CITY	Description	FFE*	Start of Damage		EAD	
							Current	CCIPF	Current	CCIPF
1	1313	0	9 MAIN ST	SUTTON	Mill Site # 1	393.5	10-yr	5-yr	\$25,967	\$53,841
2	916	49_54	8 RIVER ST	SUTTON	House	394	25-yr	10-yr	\$2,871	\$6,056
3	915	49_53	6 RIVER ST	SUTTON	House	394	25-yr	10-yr	\$2,322	\$4,899
4	947	49_88	23 WHITINS RD	SUTTON	Garage	396	1-yr	1-yr	\$1,206	\$1,694
5	908	49_46	6 MAIN ST	SUTTON	House	406	100-yr	25-yr	\$562	\$4,428
6	909	49_47	10 MAIN ST	SUTTON	House	401	100-yr	25-yr	\$138	\$1,085
7	1304	0	16 MAIN ST	SUTTON	House	398.5	500-yr	50-yr	\$56	\$407
8	1120	54_49	48 MAIN ST	SUTTON	House	397	500-yr	100-yr	\$40	\$336
9	1117	54_45	52.5 MAIN ST	SUTTON	House	397	500-yr	100-yr	\$38	\$314
10	1305	0	18 MAIN ST	SUTTON	House	399.5	500-yr	100-yr	\$36	\$398
11	1317	0	52 MAIN ST	SUTTON	House	397	500-yr	100-yr	\$35	\$291
12	914	49_52	15 MAIN ST	SUTTON	House	398	500-yr	100-yr	\$29	\$170
13	913	49_51	17 MAIN ST	SUTTON	House	398	500-yr	100-yr	\$21	\$124
14	1119	54-48	50 MAIN ST	SUTTON	House	398	1000-yr	200-yr	\$18	\$115
15	1127	54_55	19 MAIN ST	SUTTON	House	398.3	1000-yr	200-yr	\$17	\$69
16	1123	54_51	46 MAIN ST	SUTTON	House	398	1000-yr	200-yr	\$11	\$73
17	1122	54_50	46.5 MAIN ST	SUTTON	House	398	1000-yr	200-yr	\$11	\$69
18	1306	0	2 MUMFORD RD	SUTTON	House	400.2	500-yr	200-yr	\$4	\$132
19	279	119-9	153 MANCHAUG ST	DOUGLAS	House	397.5	1000-yr	1000-yr	\$4	\$51
20	258	118-1	22 POTTER RD	DOUGLAS	House	395	-	1000-yr	\$0	\$65
21	1101	54_29	20 MAIN ST	SUTTON	House	400	-	1000-yr	\$0	\$22
22	829	49_149	359 MANCHAUG RD	SUTTON	Post Office	422.7	-	1000-yr	\$0	\$11
23	1150	54_83	51 MAIN ST	SUTTON	House	396.5	-	1000-yr	\$0	\$6
24	1128	54_56	1 MORSE RD	SUTTON	House	399	-	200-yr	\$0	\$0
25	1129	54_57	3 MORSE RD	SUTTON	House	399	-	1000-yr	\$0	\$0
Five buildings added after public input during The Problem Meeting referencing a wetland area adjacent to Main Street that results in yard and basement flooding.										
26	1124	54-52	44 MAIN ST	SUTTON	House	400	-	-	-	-
27	1125	54-53	42 MAIN ST	SUTTON	House	400	-	-	-	-
28	1156	54-92	40 MAIN ST	SUTTON	House	402	-	-	-	-
29	1158	54-94	36 MAIN ST	SUTTON	House	403.7	-	-	-	-
30	1159	54-95	34 MAIN ST	SUTTON	House	402.6	-	-	-	-
*Approximated first floor elevation based upon available LiDAF										

Graphic #17: Reach C (Mumford River – Manchaug Village) – Building Damage Assessment Tabulated Summary (Report Section 2.4.3)



Reach D (Middle Mumford) Model Results

Dams

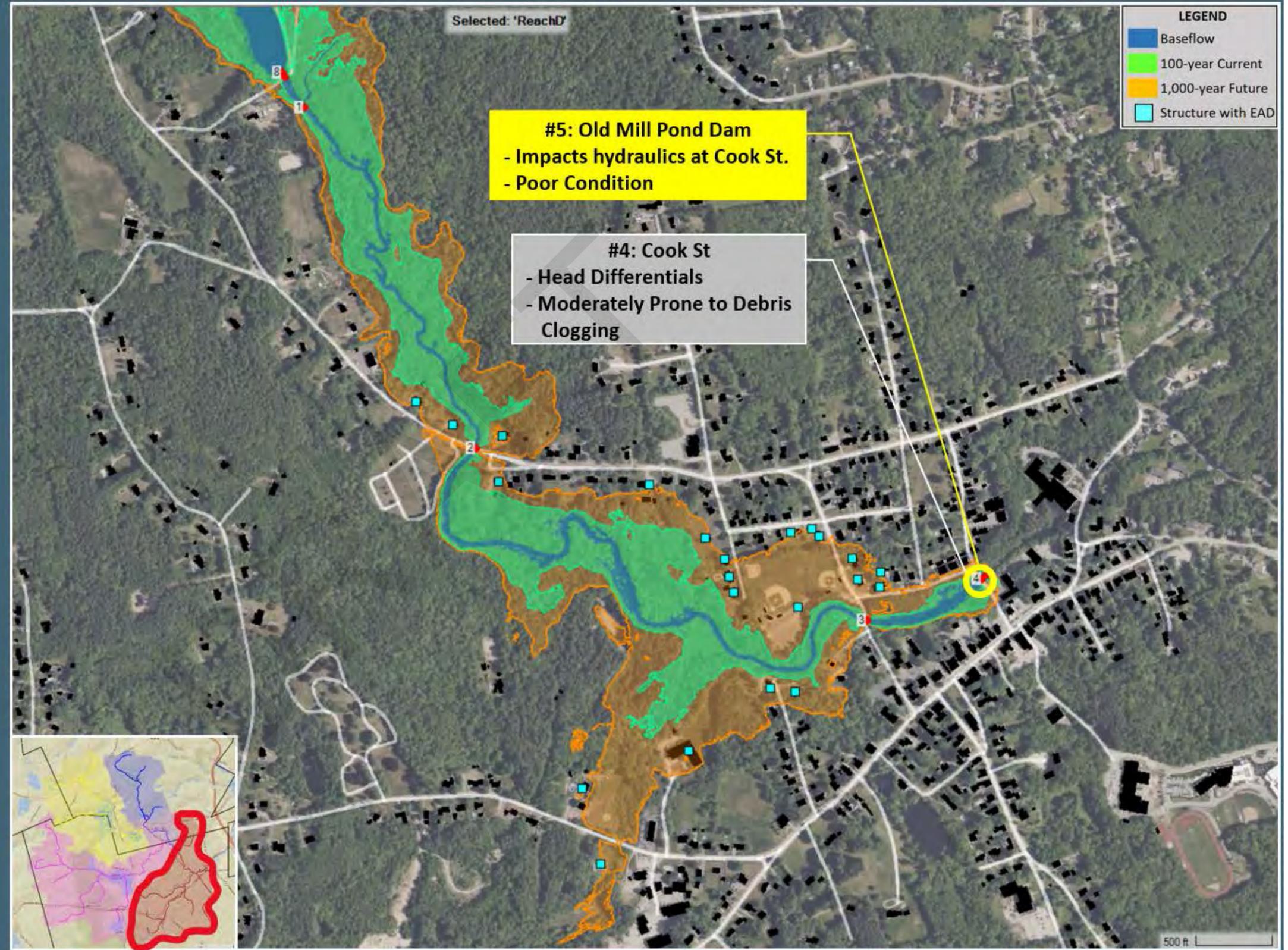
- #5 Old Mill Pond Dam

Roads

- #4 Cook Street

Buildings

- 22 with potential for EAD



Graphic #18: Reach D (Mumford River – Douglas) – Model Results (Report Section 2.5)

Buildings Impacted by Flooding Along Reach D										
ID	FID	Map-Par ID	Address	Town	Description	FFE*	Start of Damage		EAD	
							Current	CCIPF	Current	CCIPF
1	853	142-9	7 YACINO DR	DOUGLAS	House	382	200-yr	50-yr	\$153	\$1,080
2	1415	163-68	18 CUMMINGS CT	DOUGLAS	House	382	500-yr	100-yr	\$141	\$1,074
3	1416	163-69	17 CUMMINGS CT	DOUGLAS	House	381.8	500-yr	100-yr	\$137	\$1,050
4	713	142-10	5 YACINO DR	DOUGLAS	House	383.5	500-yr	100-yr	\$61	\$537
5	889	143-30	57 MANCHAUG ST	DOUGLAS	House	387	1000-yr	100-yr	\$32	\$422
6	761	142-2	2 MANCHAUG ST	DOUGLAS	House	381.8	500-yr	100-yr	\$11	\$96
7	887	143-29	63 MANCHAUG ST	DOUGLAS	House	388	1000-yr	200-yr	\$10	\$277
8	874	143-19	54 MANCHAUG ST	DOUGLAS	House	386	500-yr	500-yr	\$3	\$88
9	1398	163-52	13 WEST ST	DOUGLAS	House	386.6	-	500-yr	\$0	\$1,329
10	739	142-124	5 MANCHAUG ST	DOUGLAS	House	385.7	-	500-yr	\$0	\$273
11	771	142-29	36 MANCHAUG ST	DOUGLAS	House	386.3	-	500-yr	\$0	\$214
12	740	142-125	1 MANCHAUG ST	DOUGLAS	House	385.9	-	500-yr	\$0	\$176
13	890	143-31	51 MANCHAUG ST	DOUGLAS	House	390	-	200-yr	\$0	\$137
14	810	142-5	16 A ST	DOUGLAS	House	386	-	500-yr	\$0	\$120
15	741	142-126	13 B ST	DOUGLAS	House	386	-	500-yr	\$0	\$103
16	742	142-127	11 B ST	DOUGLAS	House	387.5	-	1000-yr	\$0	\$97
17	772	142-3	10 MANCHAUG ST	DOUGLAS	House	387	-	500-yr	\$0	\$83
18	724	142-11	3 YACINO DR	DOUGLAS	House	387.5	-	500-yr	\$0	\$79
19	788	142-4	12 A Street	DOUGLAS	House	387.3	-	500-yr	\$0	\$78
20	745	142-13	24 A ST	DOUGLAS	House	387	-	200-yr	\$0	\$71
21	1314	162-42	25 WEST ST	DOUGLAS	House	389	-	1000-yr	\$0	\$32
22	1265	162-1	20 WEST ST	DOUGLAS	House	389	-	1000-yr	\$0	\$7

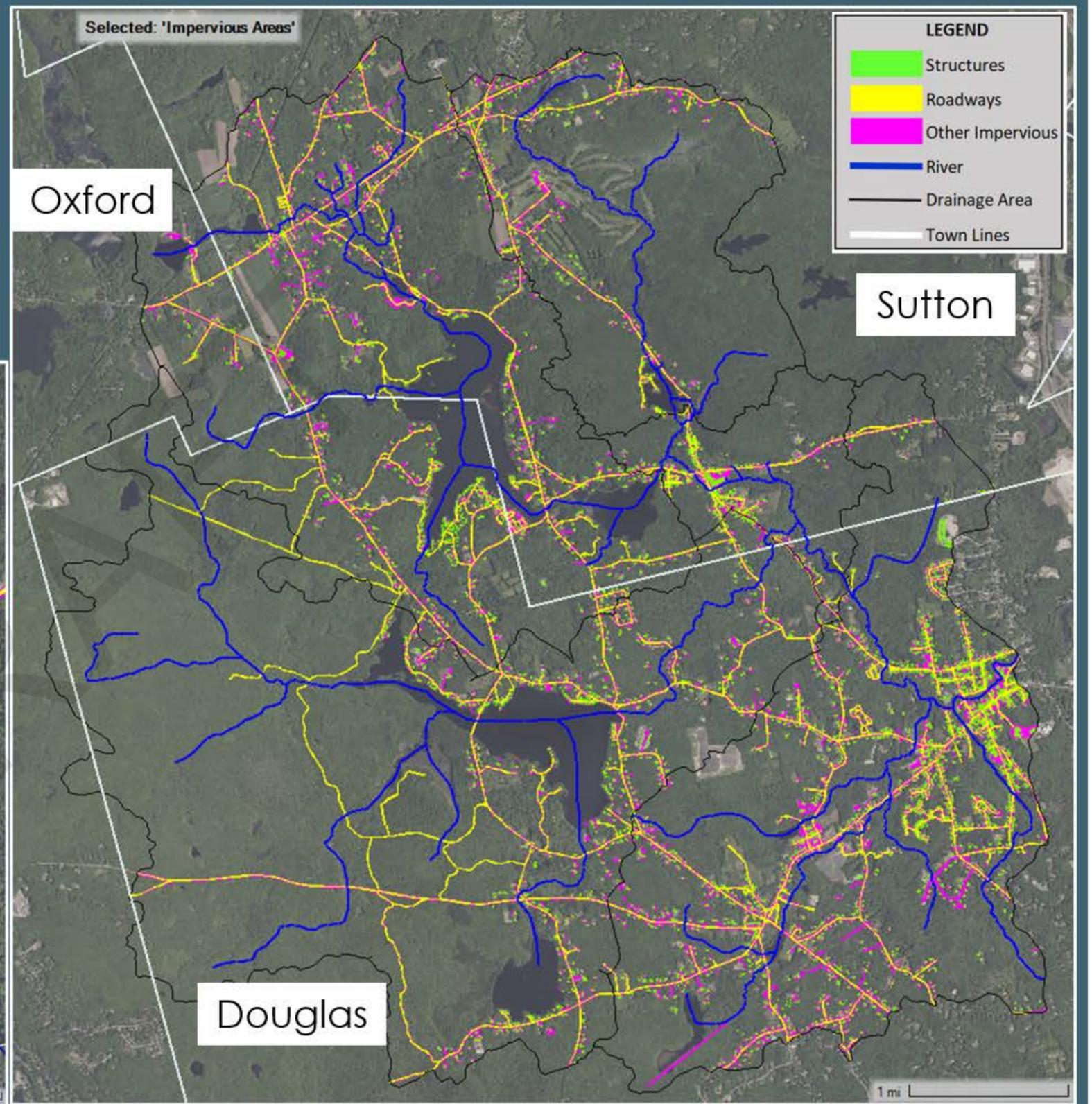
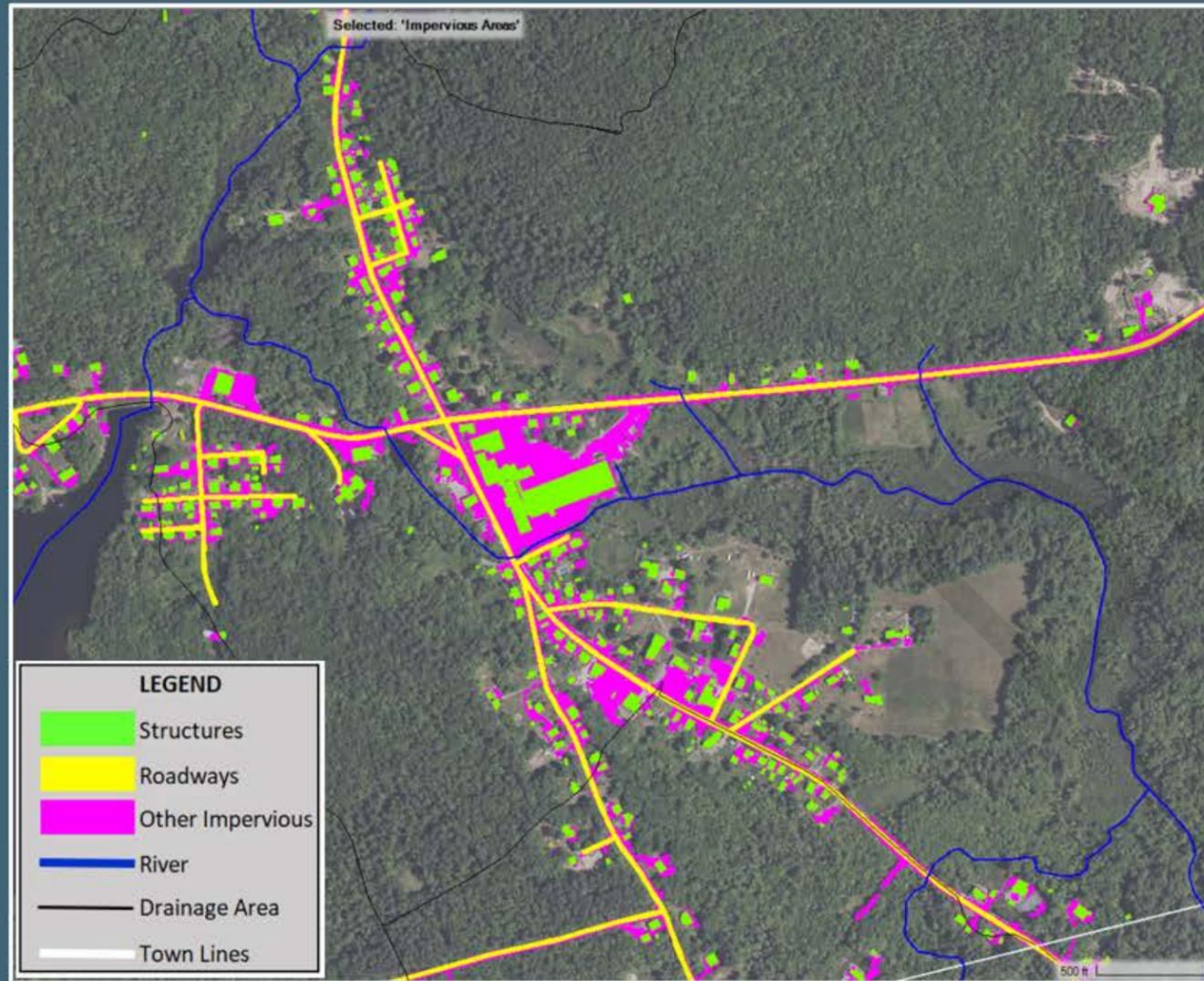
*Approximated first floor elevation based upon available LiDAR

Graphic #19: Reach D (Mumford River – Douglas) – Building Damage Assessment Tabulated Summary (Report Section 2.5.3)



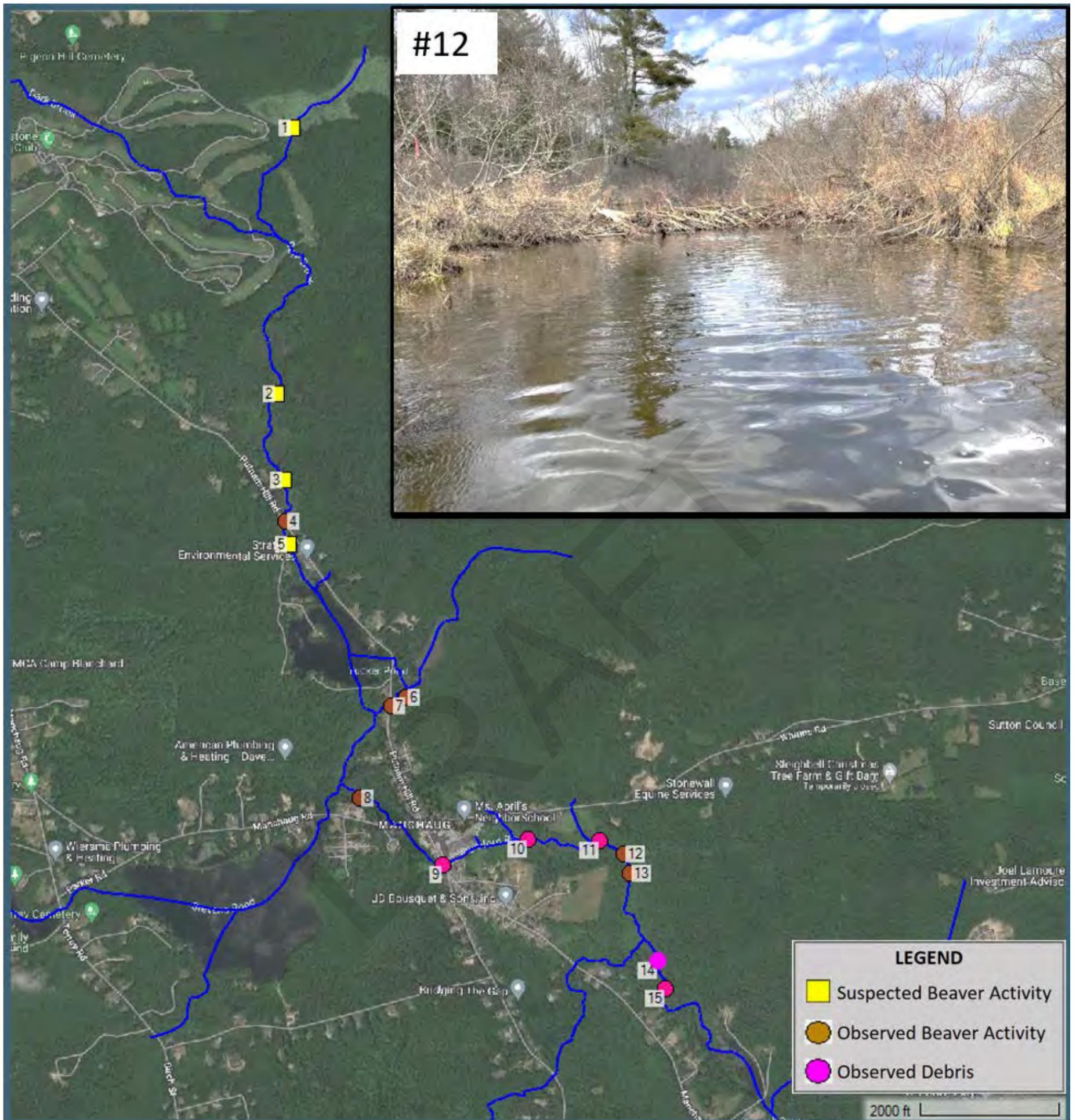
Impervious Surfaces

Impervious Area Type	Count	Area (acres)	Percent of Drainage Area
Structures	4,520	13	0.1%
Roadways	670	24	0.1%
Other Impervious	3,610	22	0.1%
Total Paved	8,800	59	0.3%
Surface Water	20	1,638	8.7%



Graphic #20: Impervious surfaces map for watershed. Map to the right shows the full watershed limits and map to the left shows a zoomed in view of the Manchaug Village area. (Report Section 2.2.3)





Graphic #21: Beaver Activity and River Debris Map. Note picture shown is location #12, a 4-foot high beaver dam creating a 2-foot head differential in the river and forcing flows to the left (East) overbank. (Report Section 6.3.3)

Reach A (Upper Mumford) Solutions

Dam Modifications

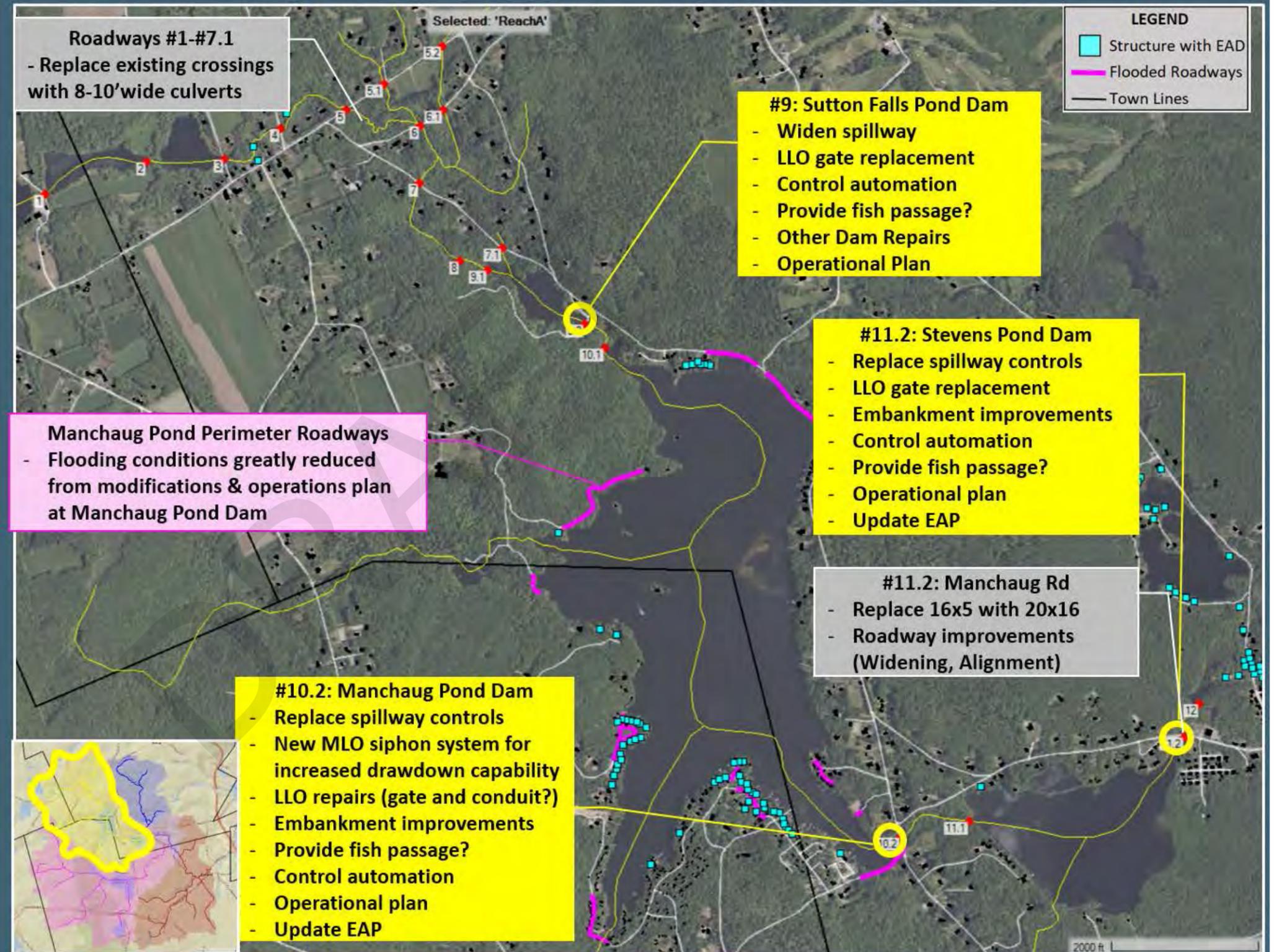
- SFPD: From 10yr to 500
- MPD: From 1,000 to >1/2PMF
- SPD: From 1,000 to >1/2PMF

Culvert Replacements

- #1-#7.1: From 5-25 to 100
- MPP Roads
- #11.2: SPD Capacity

Buildings

- Modifications at most 58
- 55 along ponds benefit greatly from dam modifications
- 3 US greatly benefited by culvert replacements



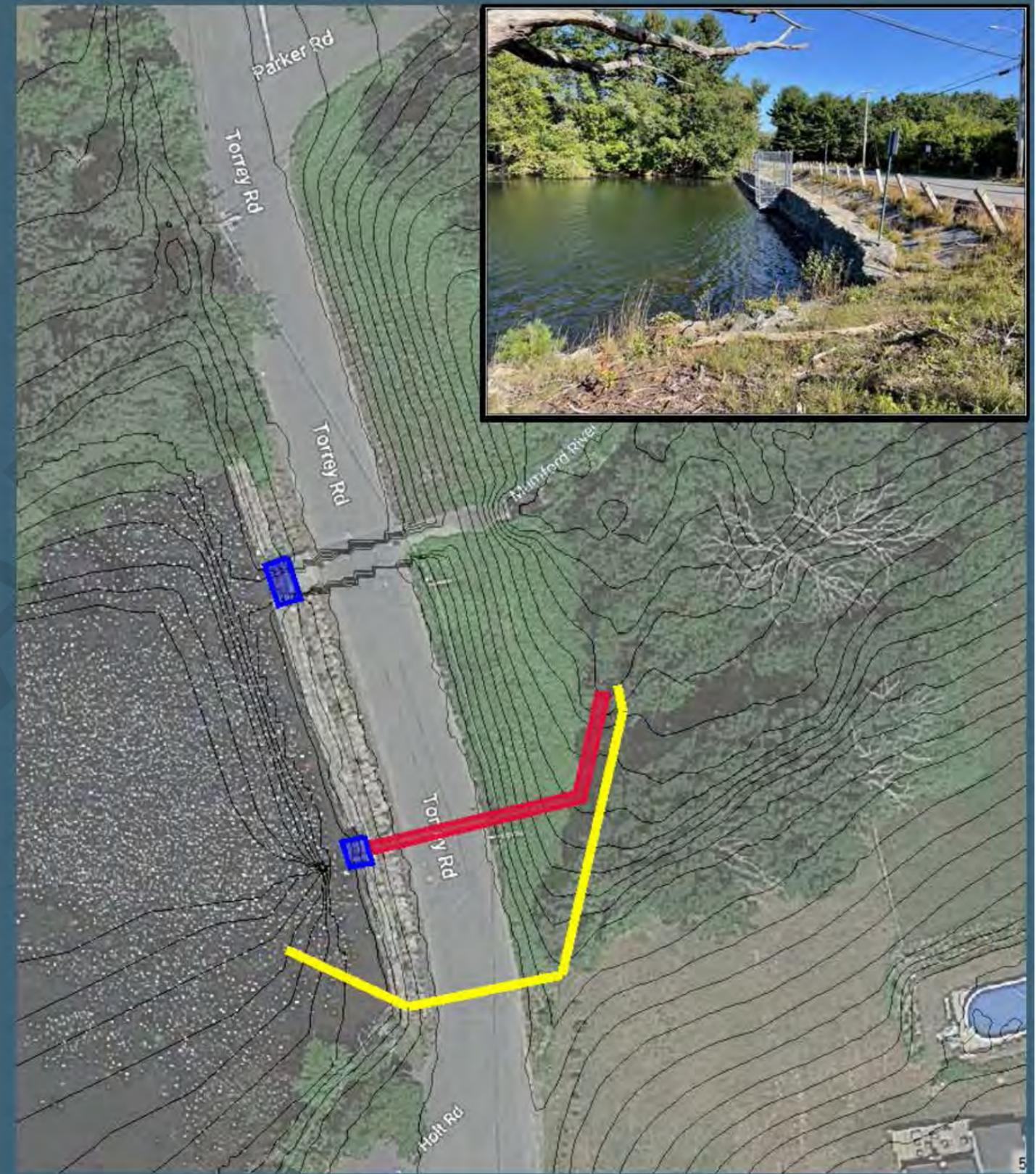
Graphic #22: Reach A (Upper Mumford River) Solutions – Overview Map. (Report Section 8.1)



Reach A (Upper Mumford)

Manchaug Pond Dam Modifications

1. **Replace Spillway Controls:** Replace stop logs with 10'w x 4'h rotary/tainter gate; automate operations
2. **Low Level Outlet (LLO) Controls:** Replace gate with 2' square upward operating orifice gate; automate operations
3. **LLO Conduit:** Inspect conduit. If replacement is warranted, install a larger conduit
4. **Siphon System:** If new LLO conduit is not needed, install a siphon system to provide improved drawdown capacity; conceptually developed as three 18" diameter conduits at the right abutment
5. **Other Dam Repairs and Modifications:** If Needed
6. **Operational Plan:** Pre-storm (1/2 PMF) drawdown to El. 517 (~1.8' below normal pool – El. 518.8); Other operational procedures to limit outflows & pool level rises



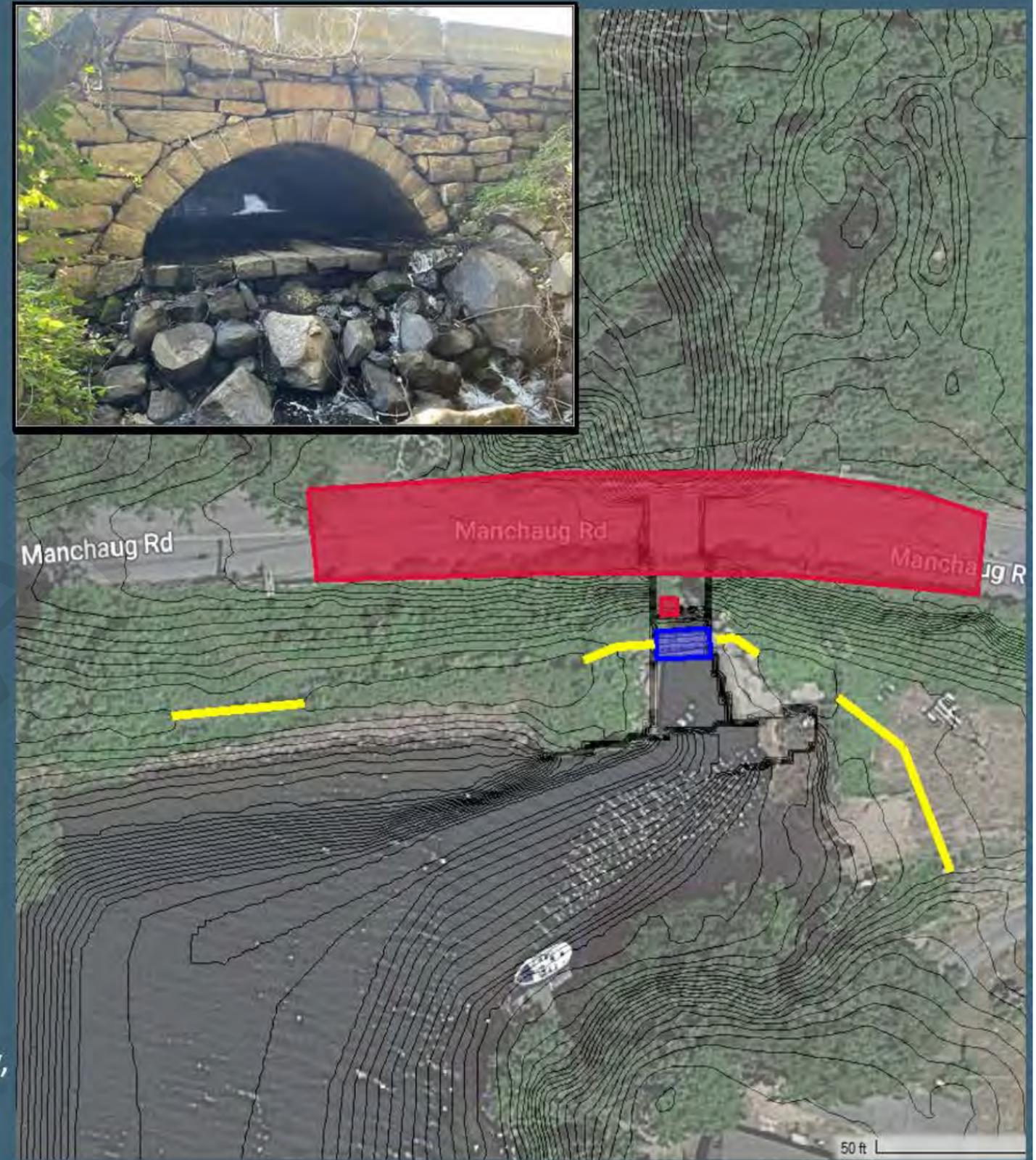
Graphic #23: Reach A (Upper Mumford River) Solutions – Manchaug Pond Dam Modifications (Report Section 8.1.1.2)



Reach A (Upper Mumford)

Stevens Pond Dam Modifications

1. **Replace Spillway Controls:** Remove flash boards & top 2' of concrete control section; replace with 16'w x 3'h rotary/tainter gate; automate operations
2. **Low Level Outlet (LLO) Controls:** Remove existing gate; Square DS end of conduit & install 3' square upward operating orifice gate; automate operations
3. **Crest Elevation:** Establish a consistent crest elevation of El. 475 (Current mins El. 474.2)
4. **Embankment Improvements:** Upstream slope riprap, regrade crest & downstream slope, toe drain system, grass vegetation
5. **Other Dam Repairs and Modifications:** If Needed
6. **Operational Plan:** Pre-storm (1/2 PMF) drawdown to El. 467 (~2.5' below normal pool – El. 469.5); Other operational procedures to limit outflows
7. **Manchaug Road Improvements:** Replace bridge, widen roadway, improve site distance



Graphic #24: Reach A (Upper Mumford River) Solutions – Stevens Pond Dam Modifications (Report Section 8.1.1.1)

Reach B (Dark Brook) Solutions

Beaver/River M&M

- Previously Discussed; #12 Specifics

Dam Modifications

- UTPD: From 5yr to 1/2 PMF

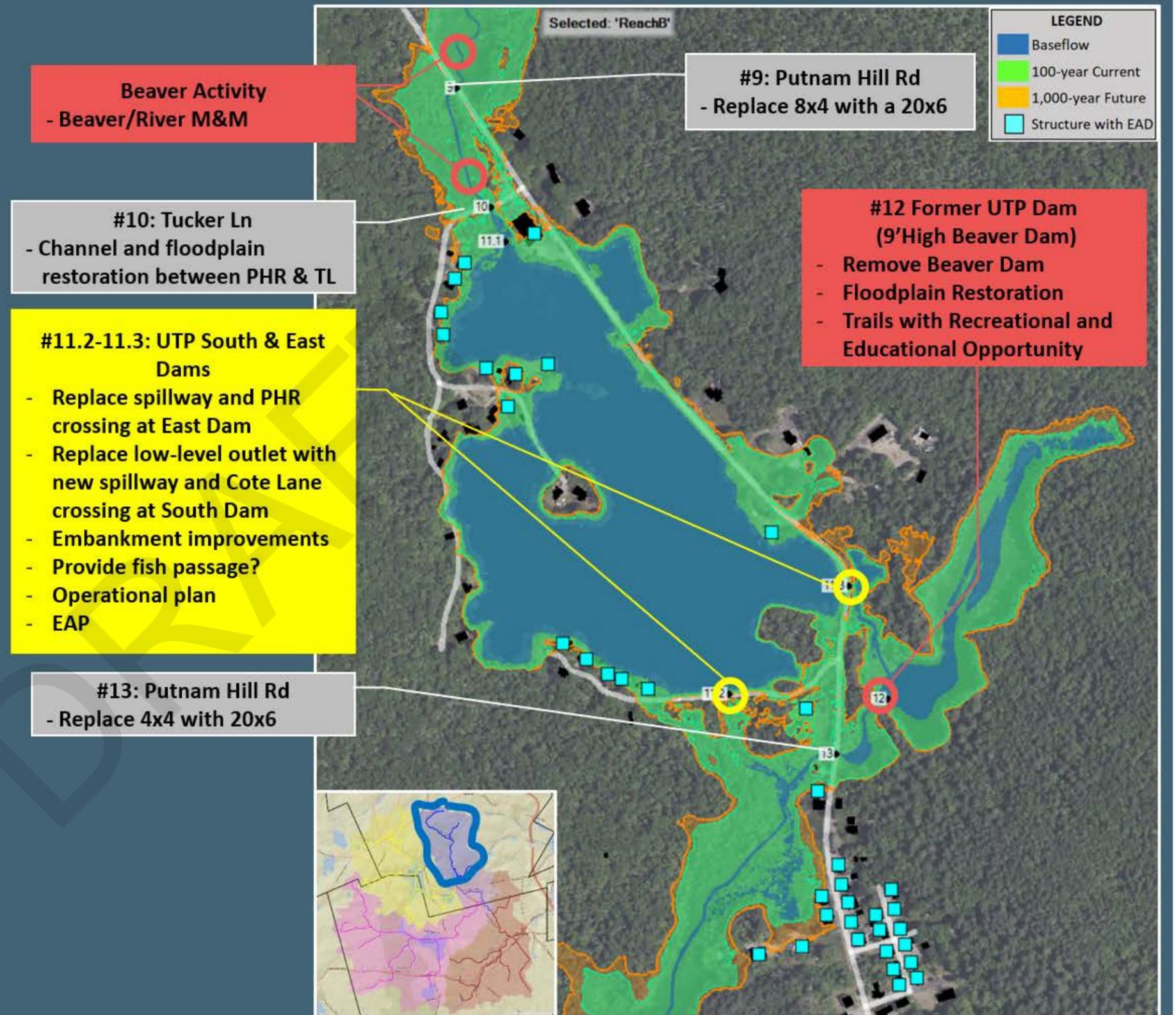
Culvert Replacements

- PHR #9: From 25 to 100
- TL: From 5 to 100
- PHR#13: From 10 to 200

Building Modifications

- Modifications at most 37
- 15 along UTP greatly benefited by UTPD modifications
- 11 downstream of UTP greatly benefited by UTPD modifications, #12 & #13 improvements, & river/beaver M&M

Reach Specific Solutions



Graphic #25: Reach B (Dark Brook) Solutions – Overview Map (Report Section 8.2)



Reach B (Dark Brook)

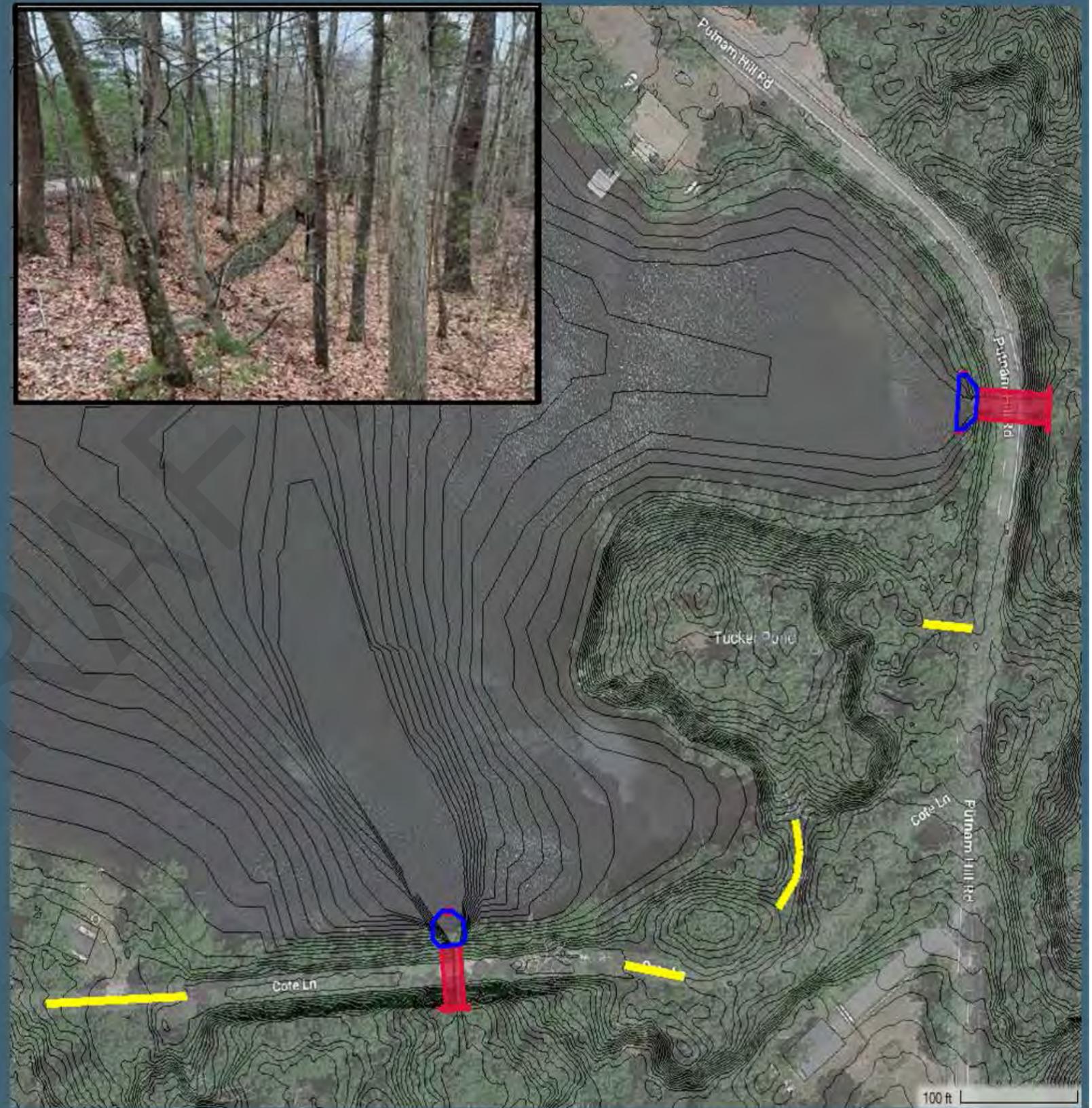
UTP East and South Dam Modifications

East Dam

1. **New Spillway:** 40'w x 15'd x 10'h trapezoidal concrete spillway
2. **Operations:** Two 4'w x 5'h MLO gates; automate operations
3. **Putnam Hill Road Crossing:** New 20'w x 12'h bridge
4. **Crest Elevation:** Regrade low RA area
5. **Embankment Improvements:** US slope riprap, DS slope riprap/veg, toe drain system/rock toe, grass vegetation

South Dam

1. **New Spillway:** 35'w x 35'd x 17'h octagon concrete spillway
2. **Operations:** One 2' square LLO gate and one 8'w x 6'h MLO gate built into new spillway; automate operations
3. **Cote Lane Crossing:** New 14' square concrete culvert
4. **Crest Elevation:** Regrade all low areas
5. **Embankment Improvements:** Sheetpile cutoff wall, US slope riprap, DS slope buttress, blanket & toe drain system, grass vegetation



Graphic #26: Reach B (Dark Brook) Solutions – Upper Tucker Pond Dams (East and South) Modifications (Report Section 8.2.1.1)



Reach C (Village) Solutions

Beaver/River M&M

- Previously Discussed; #1, #4, & #5 Specifics

Dam Modifications

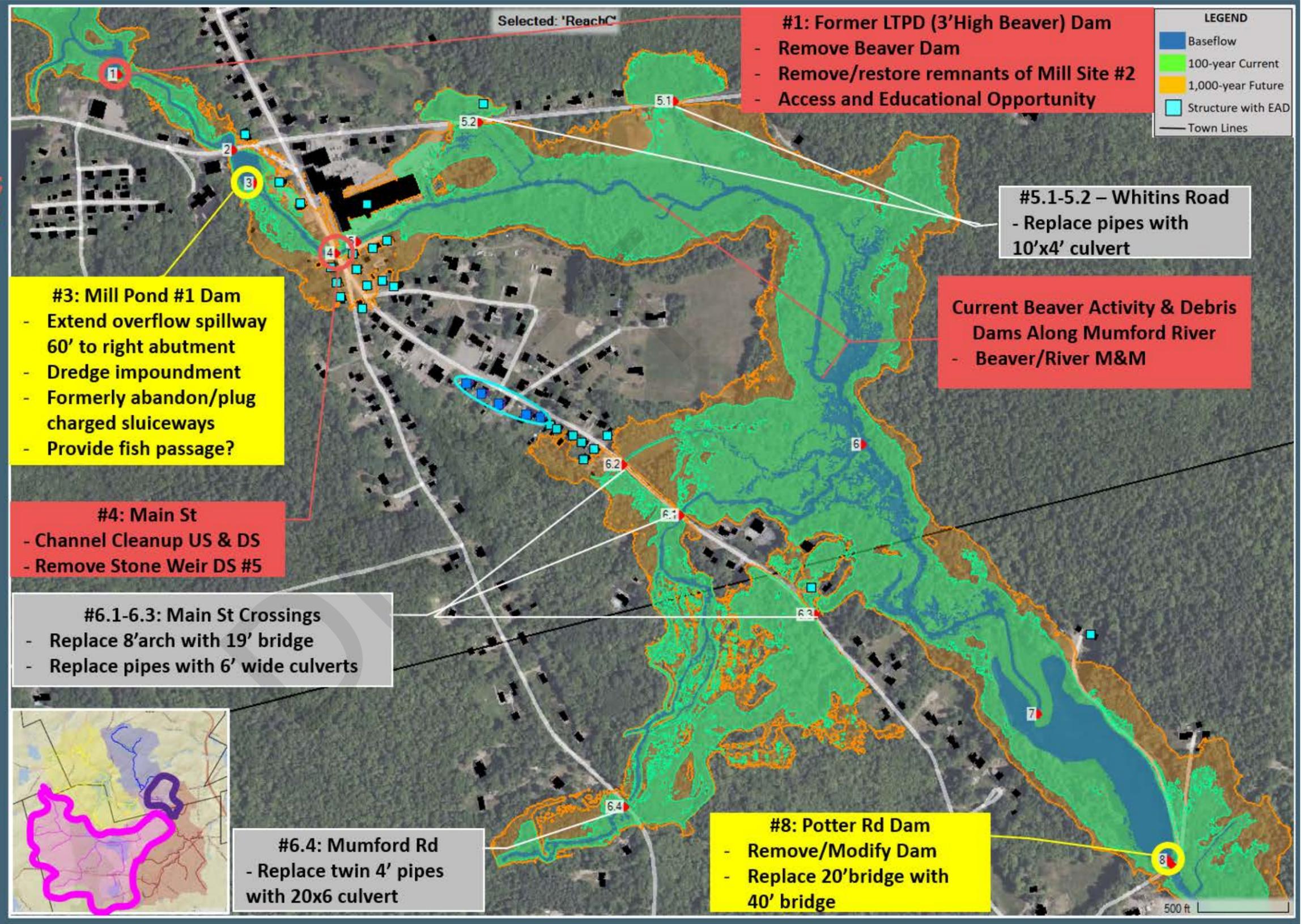
- #3: From 10 to 500
- #8: Removed / Modified

Culvert Replacements

- #5.1-5.2: From 1-50 to 1,000
- #6.1-6.3: From 50-200 to 1,000
- #6.4: From 10 to 500

Buildings

- Modifications at most 30



Reach Specific Solutions

Graphic #27: Reach C (Mumford River – Manchaug Village) Solutions – Overview Map. (Report Section 8.3)



Reach C (Village)

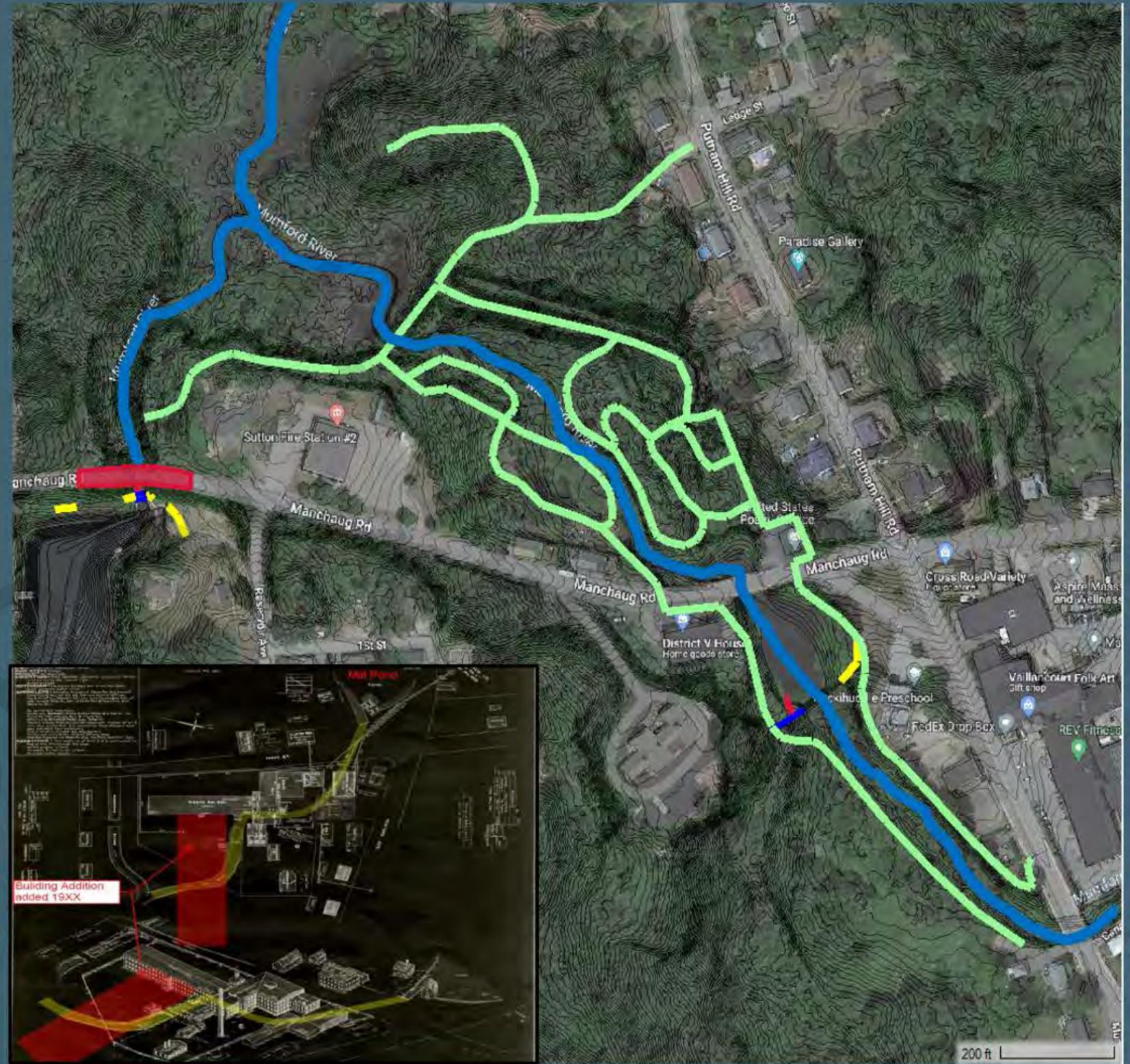
Mill Site Trails & Mill Pond Dam #1 Modifications

Mill Site Trails with Recreational, Educational, GSI

1. **Trails:** Establish trails with educational & recreational amenities throughout the historic mill sites
2. **Mill Site Restoration:** Restore certain features of Mill Sites #2 and #3 with educational amenities
3. **GSI:** Incorporate GSI along trails with educational amenities: Fire Station, Post Office, others

Mill Pond Dam #1 Modifications

1. **Extend “Waterfall Spillway”:** Extend the waterfall spillway 60 feet right to the right abutment.
2. **Low Level Outlet (LLO) Controls:** Install new upward operating orifice gate; automate operations.
3. **Impoundment Dredging:** Dredge impoundment
4. **Abandon Sluiceway:** Formally plug/abandon sluiceway to Mill Building #1



Graphic #28: Reach C (Mumford River – Manchaug Village) Solutions – Mill Site Trails & Mill Pond Dam #1 Modifications (Report Sections 6.3_#8 and 8.3.1.1)

Potential "Solutions" - Abbreviated Tabulated Summary													
#	Location		Report Section	Action Item	Capacity - Current		Capacity - CCIPF		Estimate Range (\$K's)		Potential Funding		
	Reach	#			Name	Owner	EC	PC	EC	PC		Lower	Higher
1	All	-	Watershed Wide	Private, Town, State	6.1	Emergency Action Plan	-	-	-	-	\$ 50	\$ 100	EOEEA, FEMA
2	All	-	Watershed Wide	Private, Town, State	6.2.1	Land Cover Preservation	-	-	-	-	\$ 50	\$ 300	EOEEA, FEMA
3	All	-	Watershed Wide	Private, Town, State	6.2.2	Land Cover Conversion	-	-	-	-	\$ 200	\$ 2,000	EOEEA, FEMA
4	All	-	Watershed Wide	Private, Town, State	6.2.3	Green Stormwater Infrastructure	-	-	-	-	\$ 100	\$ 5,000	EOEEA, FEMA
5	All	-	River Wide	Private, Town, State	6.3.3	Beaver Dam and River Debris Removal, Monitoring & Maintenance (M&M)	-	-	-	-	\$ 750	\$ 3,000	MADER, NOAA
6	A	-	Reach A Buildings	Private	7.6	Building Modifications (59EA)	1	-	1	-	\$ 1,000	\$ 3,000	FEMA
7	B	-	Reach B Buildings	Private	7.6	Building Modifications (37EA)	1	-	1	-	\$ 500	\$ 1,000	FEMA
8	C	-	Reach C Buildings	Private	7.6	Building Modifications (30EA)	10	-	5	-	\$ 500	\$ 1,000	FEMA
9	B	11.2&11.3	Upper Tucker Pond (UTP) East and South Dams	Private, State	8.2.1.1	Hazard Reclassification, Spillway Design Flood (SDF) Modifications & Operational Plan	5	>1/2 PMF	2	>1,000	\$ 6,000	\$ 9,000	EOEEA, FEMA
10	A	11.2	Stevens Pond Dam (SPD)	Town	8.1.1.1	SDF Modifications & Operational Plan	>1,000	>1/2 PMF	200	>1,000	\$ 2,000	\$ 3,000	EOEEA, FEMA
10	A	11.2	Manchaug Road	Town	8.1.1.1	Crossing Replacement	-	-	-	-	\$ 2,500	\$ 5,000	MassDOT, MADER
11	A	10.2	Manchaug Pond Dam (MPD)	Town	8.1.1.2	SDF Modifications & Operational Plan	>1,000	>1/2 PMF	500	>1,000	\$ 1,500	\$ 4,000	EOEEA, FEMA
12	B	13	Putnam Hill Road	State	8.2.2	Crossing Replacement	10	200	5	50	\$ 2,000	\$ 3,000	MADER
13	B	9	Putnam Hill Road	State	8.2.2	Crossing Replacement	25	100	10	25	\$ 2,000	\$ 3,000	MADER
14	B	10	Tucker Lane Channel	Private	6.3.3 #5	Channel and Floodplain Regrading Upstream of Crossing	5	100	2	50	\$ 500	\$ 1,000	MADER, NOAA
15	A	1-7.1	Crossings US of SFPD	Town, Private	8.1.2	Crossing Replacements (11EA)	5-25	100	2-10	25-50	\$ 8,000	\$ 12,000	MADER
16	C	1	Mill #2 Site	Town, Private	6.3.3 #8	Floodplain Restoration at Mill #2 Site	-	-	-	-	\$ 500	\$ 1,000	EOEEA, MADER
17	C	3	Mill Pond Dam #1	Private	8.3.1.1	Modifications at Mill Pond Dam #1	10	500	5	100	\$ 1,000	\$ 1,500	EOEEA
18	C	5	Channel Weir	Private	8.3.1.3	Remove Weir and Restore Channel	-	-	-	-	\$ 50	\$ 100	MADER, NOAA
19	A	9	Sutton Falls Pond Dam (SFPD)	Private	8.1.1.3	SDF Modifications & Operational Plan	10	500	5	100	\$ 1,500	\$ 3,000	EOEEA, FEMA
20	C	5.2	Whitins Road	Town	8.3.2	Crossing Replacement	1	>1,000	<1	1,000	\$ 1,000	\$ 1,500	MADER
21	C	5.1	Whitins Road	Town	8.3.2	Crossing Replacement	50	>1,000	25	1,000	\$ 1,000	\$ 1,500	MADER
22	C	6.1-6.3	Main Street	State	8.3.2	Crossing Replacements (3EA)	50-200	1,000	25-50	500	\$ 3,000	\$ 5,000	MADER
23	C	8-9	Potter Road Dam & Bridge	Town, Private	8.3.1.2	Dam Removal/Modification and Crossing Replacement	10	200	5	50	\$ 2,000	\$ 4,000	EOEEA, MADER, MassDOT
24	C	6.4	Mumford Street	Town	8.3.2	Crossing Replacement	10	500	5	100	\$ 2,000	\$ 3,000	MassDOT, MADER
25	D	-	Reach D Buildings	Private	7.6	Building Modifications (22EA)	200	-	50	-	\$ 300	\$ 500	FEMA
Channel / Ecosystem Restoration											\$ 40	\$ 77	\$M's
Infrastructure Upgrade with Ecosystem Benefit											\$ 40,000,000	\$ 76,500,000	\$
Dam Modifications													
Structure Floodproofing													

Graphic #29: Abbreviated tabulated summary of solution strategies. (Report Section 9.0)



Potential "Solutions" - Detailed Tabulated Summary															
#	Location			Action Item	Report Section	Scope	Hazard Reduction / Benefits	Capacity - Current		Capacity - CCIPF		Estimate Range (\$K's)		Potential Funding	
	Reach	#	Name					Owner	EC	PC	EC	PC	Lower		Higher
1	All	-	Watershed Wide	Private, Town, State	Emergency Action Plan	6.1	Utilize the results of this study to develop a watershed-specific Emergency Action Plan (EAP) to be utilized by emergency response personnel in advance of and/or in response to both extreme rainfall and dam failure events.	Increased level of emergency response preparedness, reduced potential for injury and/or loss of life, increased knowledge of risks, decreased impact (shock factor) on the community, increased capability and decreased duration of post-event restoration efforts.	-	-	-	-	\$ 50	\$ 100	EOEEA, FEMA
2	All	-	Watershed Wide	Private, Town, State	Land Cover Preservation	6.2.1	Policy and action to preserve (and improve) existing areas of forests, wetlands, and other land cover areas that offer multiple watershed benefits.	Watershed will maintain its ability to absorb rainfall, recharge groundwater, filter runoff, attenuate runoff, etc.	-	-	-	-	\$ 50	\$ 300	EOEEA, FEMA
3	All	-	Watershed Wide	Private, Town, State	Land Cover Conversion	6.2.2	Conversion of areas with poor infiltration/absorption land cover (parking lots, other paved areas, bare land) to land covers that offer improved absorption/infiltration and/or underground storage	Specific areas will have increased ability to absorb rainfall leading to multiple benefits including reduced runoff, increased groundwater recharge, and improved water quality within the river.	-	-	-	-	\$ 200	\$ 2,000	EOEEA, FEMA
4	All	-	Watershed Wide	Private, Town, State	Green Stormwater Infrastructure	6.2.3	Installation of green storm water infrastructure where practical; particularly adjacent to roadways and other impervious areas	Specific areas will have increased ability to absorb rainfall leading to multiple benefits including reduced runoff, increased groundwater recharge, and improved water quality within the river.	-	-	-	-	\$ 100	\$ 5,000	EOEEA, FEMA
5	All	-	River Wide	Private, Town, State	Beaver Dam and River Debris Removal, Monitoring & Maintenance (M&M)	6.3.3	Remove beavers, remove beaver dams (Former Upper Tucker Dam, Former Lower Tucker Dam, Mumford River, PHR crossings, others), M&M to ensure they remain removed	Removed risk of beaver dam failure and resulting flooding, reduced river levels (baseflow and storm events), improved ecosystem and river health	-	-	-	-	\$ 750	\$ 3,000	MADER, NOAA
6	A	-	Reach A Buildings	Private	Building Modifications (59 EA)	7.6	Wet and Dry Floodproofing Measures	Reduced flood damage to structures	1	-	1	-	\$ 1,000	\$ 3,000	FEMA
7	B	-	Reach B Buildings	Private	Building Modifications (37 EA)	7.6	Wet and Dry Floodproofing Measures	Reduced flood damage to structures	1	-	1	-	\$ 500	\$ 1,000	FEMA
8	C	-	Reach C Buildings	Private	Building Modifications (30 EA)	7.6	Wet and Dry Floodproofing Measures	Reduced flood damage to structures	10	-	5	-	\$ 500	\$ 1,000	FEMA
9	B	11.2 & 11.3	Upper Tucker Pond (UTP) East and South Dams	Private, State	Hazard Reclassification, Spillway Design Flood (SDF) Modifications & Operational Plan	8.2.1.1	Spillway replacement at East Dam with culvert replacement of Putnam Hill Road, auxiliary spillway installation at South Dam with LLO and culvert replacement of Cote Lane, consistent dam crest elevation, other dam safety repairs, operational plan, updated EAP	SDF compliance, reduces frequency of overtopping, reduces likelihood of dam failure, reduces outflows and flood levels downstream of dam, reduces flood levels within the impoundment; could incorporate fish passage	5	>1/2 PMF	2	>1,000	\$ 6,000	\$ 9,000	EOEEA, FEMA
10	A	11.2	Stevens Pond Dam (SPD)	Town	SDF Modifications & Operational Plan	8.1.1.1	Increase capacity of spillway, consistent dam crest elevation, automation of controls, other dam safety repairs, operational plan, updated EAP	SDF compliance, reduces frequency of overtopping, reduces likelihood of dam failure, reduces outflows and flood levels downstream of dam, reduces flood levels within the impoundment; could incorporate fish passage	>1,000	>1/2 PMF	200	>1,000	\$ 2,000	\$ 3,000	EOEEA, FEMA
10.1	A	11.2	Manchaug Road	Town	Crossing Replacement	8.1.1.1	Bridge replacement and roadway realignment during Stevens Pond Dam Modifications; widen span from 16 to 20, drop invert 8' and raise chord 5' to have total height of 16' (5' existing); realign roadway for site distance improvements	Addresses current roadway embankment issues, increases operational hydraulic capacity of SPD, improved stream connectivity; could incorporate fish passage	-	-	-	-	\$ 2,500	\$ 5,000	MassDOT, MADER
11	A	10.2	Manchaug Pond Dam (MPD)	Town	SDF Modifications & Operational Plan	8.1.1.2	Spillway control replacement, automation of controls, LLO/MLO modifications, new siphon system to help with pre-storm impoundment drawdown, other dam safety repairs, operational plan, updated EAP	SDF compliance, reduces frequency of overtopping, reduces likelihood of dam failure, reduces outflows and flood levels downstream of dam, reduces flood levels within the impoundment; could incorporate fish passage	>1,000	>1/2 PMF	500	>1,000	\$ 1,500	\$ 4,000	EOEEA, FEMA
12	B	13	Putnam Hill Road	State	Crossing Replacement	8.2.2	Replace existing 4x4 box with a 20x6 bridge	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	10	200	5	50	\$ 2,000	\$ 3,000	MADER
13	B	9	Putnam Hill Road	State	Crossing Replacement	8.2.2	Replace existing 8.5x4 box with a 20x6 bridge	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	25	100	10	25	\$ 2,000	\$ 3,000	MADER
14	B	10	Tucker Lane Channel	Private	Channel and Floodplain Regrading Upstream of Crossing	6.3.3 #5	Rework channel and floodplain between PHR and TL to limit out of bank flooding that overtops Tucker Lane	Reduction in frequency of road overtopping caused by out of bank flow	5	100	2	50	\$ 500	\$ 1,000	MADER, NOAA
15	A	1-7.1	Crossings US of SFPD	Town, Private	Crossing Replacements (11EA)	8.1.2	Replacing existing with 8-10'w culverts	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	5-25	100	2-10	25-50	\$ 8,000	\$ 12,000	MADER
16	C	1	Mill #2 Site	Town, Private	Floodplain Restoration at Mill #2 Site	6.3.3 #8	Removal/resotation of remnants of Mill Site #2, regrading and vegetation establishment of river and floodplain, hiking trail and amenities	Improved hydraulics, ecosystem, and aesthetics along river and floodplain	-	-	-	-	\$ 500	\$ 1,000	EOEEA, MADER
17	C	3	Mill Pond Dam #1	Private	Modifications at Mill Pond Dam #1	8.3.1.1	Extend overflow spillway 60 feet to right abutment (RA) - replace spillway so always a waterfall, new LLO controls, automation of controls, impoundment dredging. Dam Removal is also an option	"SDF" compliance, reduces frequency of overtopping, reduces likelihood of dam failure, reduces outflows and flood levels downstream of dam, reduces flood levels within the impoundment; could incorporate fish passage	10	500	5	100	\$ 1,000	\$ 1,500	EOEEA
18	C	5	Channel Weir	Private	Remove Weir and Restore Channel	8.3.1.3	Remove the 2' high weir from the channel	Lowers flood levels between weir and US Bridge (Manchaug Road), increases capacity of bridge, reduces flood levels to adjacent structures, improved stream connectivity	-	-	-	-	\$ 50	\$ 100	MADER, NOAA
19	A	9	Sutton Falls Pond Dam (SFPD)	Private	SDF Modifications & Operational Plan	8.1.1.3	Increase capacity of spillway, consistent dam crest elevation, automation of controls, LLO replacement, other dam safety repairs, operational plan, updated EAP	SDF compliance, reduces frequency of overtopping, reduces likelihood of dam failure, reduces outflows and flood levels downstream of dam, reduces flood levels within the impoundment; could incorporate fish passage	10	500	5	100	\$ 1,500	\$ 3,000	EOEEA, FEMA
20	C	5.2	Whitins Road	Town	Crossing Replacement	8.3.2	Replace collapsed pipe with 10x4 culvert	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	1	>1,000	<1	1,000	\$ 1,000	\$ 1,500	MADER
21	C	5.1	Whitins Road	Town	Crossing Replacement	8.3.2	Replace 3' pipe with 10x4 culvert	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	50	>1,000	25	1,000	\$ 1,000	\$ 1,500	MADER
22	C	6.1-6.3	Main Street	State	Crossing Replacements (3EA)	8.3.2	Replace 8' arch with 19' bridge; Other two pipes with 6'w culverts	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	50-200	1,000	25-50	500	\$ 3,000	\$ 5,000	MADER
23	C	8-9	Potter Road Dam & Bridge	Town, Private	Dam Removal/Modification and Crossing Replacement	8.3.1.2	(Douglas) Remove or modify dam, replace bridge with 40' span	Reduction in river levels upstream, reduction in frequency of dam, driveway, and road overtopping, improved stream connectivity	10	200	5	50	\$ 2,000	\$ 4,000	EOEEA, MADER, MassDOT
24	C	6.4	Mumford Street	Town	Crossing Replacement	8.3.2	(Douglas) Replace twin 4'pipes with 20x6 culvert	Increased capacity of crossing, reduction in river levels upstream, reduction in frequency of road overtopping, improved stream connectivity	10	500	5	100	\$ 2,000	\$ 3,000	MassDOT, MADER
25	D	-	Reach D Buildings	Private	Building Modifaitions (22 EA)	7.6	(Douglas) Wet and Dry Floodproofing Measures	Reduced flood damage to structures	200	-	50	-	\$ 300	\$ 500	FEMA
Channel / Ecosystem Restoration												\$ 40	\$ 77	\$M's	
Infrastructure Upgrade with Ecosystem Benefit												\$ 40,000,000	\$ 75,500,000	\$	
Dam Modifications															
Structure Floodproofing															

Graphic #30: Detailed tabulated summary of solution strategies. (Report Section 9.0)

