

FLOOD INSURANCE STUDY



ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

Volume 2 of 4

COMMUNITY NAME	COMMUNITY NUMBER
AMESBURY, CITY OF	250075
ANDOVER, TOWN OF	250076
BEVERLY, CITY OF	250077
BOXFORD, TOWN OF	250078
DANVERS, TOWN OF	250079
ESSEX, TOWN OF	250080
GEORGETOWN, TOWN OF	250081
GLOUCESTER, CITY OF	250082
GROVELAND, TOWN OF	250083
HAMILTON, TOWN OF	250084
HAVERHILL, CITY OF	250085
IPSWICH, TOWN OF	250086
LAWRENCE, CITY OF	250087
LYNN, CITY OF	250088
LYNNFIELD, TOWN OF	250089
MANCHESTER BY THE SEA, TOWN OF	250090
MARBLEHEAD, TOWN OF	250091
MERRIMAC, TOWN OF	250092
METHUEN, CITY OF	250093
MIDDLETON, TOWN OF	250094
NAHANT, TOWN OF	250095
NEWBURY, TOWN OF	250096
NEWBURYPORT, CITY OF	250097
NORTH ANDOVER, TOWN OF	250098
PEABODY, CITY OF	250099
ROCKPORT, TOWN OF	250100
ROWLEY, TOWN OF	250101
SALEM, CITY OF	250102
SALISBURY, TOWN OF	250103
SAUGUS, TOWN OF	250104
SWAMPSCOTT, TOWN OF	250105
TOPSFIELD, TOWN OF	250106
WENHAM, TOWN OF	250107
WEST NEWBURY, TOWN OF	250108

Essex County



PRELIMINARY:
SEPTEMBER 13, 2016

Federal Emergency Management Agency



FLOOD INSURANCE STUDY NUMBER
25009CV002C

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

<u>Old Zone</u>	<u>New Zone</u>
A1 through A30	AE
V1 through V30	VE
B	X
C	X

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components.

Initial Countywide FIS Effective Date: July 3, 2012

Revised Coastal FIS Effective Date: July 16, 2014

Revised Levee Accreditation FIS Effective Date:

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Flood Insurance Rate Map

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,400	76	571	0.6	20.6	18.3 ²	19.2 ²	0.9
B	3,500	13	36	9.5	30.4	30.4	31.1	0.7
C	6,650	162	619	0.6	49.8	49.8	50.7	0.9

¹ FEET ABOVE CONFLUENCE WITH JOHNSON CREEK

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM JOHNSON CREEK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

ARGILLA BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,495	50	93	7.5	27.5	13.4 ²	13.7 ²	0.3
B	1,725	50	207	3.3	27.5	17.8 ²	17.8 ²	0.0
C	2,495	50	187	3.7	27.5	18.3 ²	18.7 ²	0.4
D	2,710	50	411	1.7	27.5	25.4 ²	25.4 ²	0.0
E	6,150	50	304	2.3	27.5	25.5 ²	26.0 ²	0.5
F	7,655	45	143	2.8	28.8	28.8	29.8	1.0
G	8,410	12	44	9.2	33.0	33.0	33.0	0.0
H	8,965	80	605	0.7	35.4	35.4	36.0	0.6
I	10,005	20	52	7.7	39.4	39.4	39.7	0.3
J	10,720	17	46	8.8	50.1	50.1	50.4	0.3
K	11,765	20	77	5.2	60.2	60.2	61.0	0.8
L	12,010	25	106	2.2	64.6	64.6	64.8	0.2
M	12,390	20	100	2.3	67.1	67.1	67.1	0.0
N	13,320	50	287	0.8	67.2	67.2	67.4	0.2
O	14,695	50	99	0.8	67.2	67.2	67.7	0.5
P	15,345	245	1286	0.1	77.1	77.1	77.1	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATION COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BARE MEADOW BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	320	55	185	3.4	52.5	40.5 ²	40.6 ²	0.1
B	630	150	966	0.7	52.5	44.6 ²	44.6 ²	0.0
C	1,200	230	1,485	0.4	52.5	44.7 ²	44.7 ²	0.0
D	1,910	30	109	5.8	52.5	44.7 ²	44.7 ²	0.0
E	2,215	11	51	12.3	52.5	47.7 ²	47.7 ²	0.0
F	3,290	30	78	8.1	53.2	53.2	53.5	0.3
G	4,130	45	181	3.5	58.5	58.5	59.2	0.7
H	5,890	155	525	1.2	60.3	60.3	61.3	1.0
I	7,840	230	774	0.8	61.1	61.1	62.1	1.0
J	8,310	55	114	5.5	61.9	61.9	62.3	0.4

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATION COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BARTLETT BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A ²	700	9	15	7.7	98.2	98.2	98.2	0.0
B ²	750	9	46	2.6	101.8	101.8	101.8	0.0
C	880	20	118	1.0	101.9	101.9	101.9	0.0
D	980	4	19	6.2	101.9	101.9	102.0	0.1
E ²	1,435	12	111	1.1	104.3	104.3	104.6	0.3
F ²	1,845	12	93	2.3	104.3	104.3	105.1	0.8
G ²	2,165	115	820	0.3	104.3	104.3	105.2	0.9
H	2,455	20	40	6.9	106.4	106.4	106.4	0.0
I ²	2,705	8	40	6.9	109.3	109.3	109.3	0.0
J	2,720	8	41	6.7	109.4	109.4	109.4	0.0
K	2,960	9	29	10.3	110.4	110.4	110.4	0.0
L ²	3,200	31	31	9.6	112.9	112.9	112.9	0.0
M	3,360	64	280	1.1	113.5	113.5	114.3	0.8
N	3,525	98	572	0.5	113.5	113.5	114.4	0.9
O ²	3,980	6	33	9.1	113.5	113.5	114.4	0.9
P ²	4,075	12	45	6.7	114.9	114.9	115.7	0.8
Q	4,345	94	293	1.0	116.3	116.3	117.3	1.0
R	4,605	12	32	9.4	120.2	120.2	121.0	0.8

¹ FEET ABOVE CONFLUENCE WITH PILLINGS POND

² INTERPOLATED CROSS SECTION

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BATES BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,368	45	480	0.7	30.8	30.8	30.8	0.0
B	1,954	85	835	0.4	31.7	31.7	31.8	0.1
C	2,350	180	1,685	0.2	31.7	31.7	31.8	0.1
D	3,263	15	130	2.5	31.7	31.7	32.2	0.5
E	4,208	20	145	2.2	31.8	31.8	32.6	0.8
F	5,671	20	130	2.5	35.3	35.3	35.3	0.0
G	7,017	30	80	4.0	44.3	44.3	45.1	0.8
H	7,857	50	245	1.2	51.5	51.5	52.5	1.0
I	8,976	40	175	1.6	52.0	52.0	53.0	1.0
J	9,678	50	180	1.6	53.6	53.6	54.3	0.7
K	10,761	65	365	0.8	55.6	55.6	55.9	0.3

¹ FEET ABOVE SYLVAN STREET DAM

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BEAVER BROOK (TOWN OF DANVERS)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	9	38	3.9	69.2	69.2	69.2	0.0
B	935	187	507	0.2	69.8	69.8	69.8	0.0
C	2,715	4	8	8.7	77.0	77.0	77.0	0.0
D	2,975	18	68	1.0	78.8	78.8	79.4	0.6
E	3,135	4	18	3.9	78.8	78.8	79.4	0.6
F	4,195	141	311	0.2	79.5	79.5	79.9	0.4
G	6,285	10	11	6.1	85.6	85.6	86.2	0.6
H	7,435	16	31	2.2	93.4	93.4	94.0	0.6

¹ FEET ABOVE MIDDLE STREET

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BEAVER BROOK (TOWN OF WEST NEWBURY)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	5,500	8	18	5.8	73.5	73.5	73.5	0.0
B ²	5,560	8	20	5.2	74.1	74.1	74.1	0.0
C	5,900	11	40	2.6	74.9	74.9	75.5	0.6
D	6,200	3	10	10.5	75.7	75.7	75.7	0.0
E ²	6,246	3	19	5.5	78.3	78.3	78.3	0.0
F	7,356	48	237	0.4	79.0	79.0	79.1	0.1
G	9,126	10	27	0.4	79.2	79.2	79.3	0.1
H	10,186	28	70	1.5	84.7	84.7	85.4	0.7
I	11,766	37	86	1.2	88.1	88.1	89.0	0.9
J	13,616	3	10	10.5	102.6	102.6	102.6	0.0

¹ FEET ABOVE CONFLUENCE WITH SAUGUS RIVER

² INTERPOLATED CROSS SECTION

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BEAVERDAM BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	-50	20	126	4.9	37.7	37.7	38.0	0.3
B	192	16	124	5.0	38.9	38.9	39.5	0.6
C	1,232	46	234	2.6	41.1	41.1	42.1	1.0
D	1,382	61	268	2.3	42.9	42.9	43.3	0.4
E	1,922	65	297	2.1	43.4	43.4	43.9	0.5
F	2,065	103	552	1.1	44.8	44.8	45.0	0.2
G	2,945	57	282	2.2	45.3	45.3	45.7	0.4
H	3,097	94	407	1.5	47.2	47.2	48.2	1.0
I	3,201	94	505	1.2	47.3	47.3	48.3	1.0
J	3,271	95	453	1.4	47.3	47.3	48.3	1.0
K	3,428	98	448	1.4	47.5	47.5	48.4	0.9
L	3,678	52	255	2.4	47.6	47.6	48.5	0.9
M	3,844	65	345	1.8	49.2	49.2	49.4	0.2
N	4,044	25	151	4.1	49.3	49.3	49.6	0.3
O	4,202	26	170	3.6	50.1	50.1	50.2	0.1
P	4,977	37	171	3.6	51.3	51.3	52.0	0.7
Q	5,077	87	371	1.7	52.7	52.7	53.0	0.3
R	6,557	73	298	2.1	53.6	53.6	54.4	0.8
S	6,733	50	660	0.9	56.9	56.9	57.5	0.6
T	7,013	55	283	2.2	57.7	57.7	57.9	0.2
U	7,513	17	60	10.3	58.7	58.7	58.9	0.2
V	7,699	37	140	4.4	62.8	62.8	62.8	0.0
W	7,929	30	149	4.1	63.4	63.4	64.1	0.7
X	8,226	67	431	1.4	64.2	64.2	64.7	0.5
Y	8,332	170	1,093	0.6	64.3	64.3	64.8	0.5
Z	9,232	223	776	0.8	64.3	64.3	64.8	0.5

¹ FEET ABOVE U.S. ROUTE 1 (DOWNSTREAM FACE)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BENNETT'S POND BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	998	50	200	4.5	43.1	40.9 ²	41.5 ²	0.6
B	2,730	35	195	4.6	43.1	42.8 ²	43.6 ²	0.8
C	3,854	55	460	2.0	52.8	52.8	53.6	0.8
D	5,122	80	545	1.7	52.9	52.9	53.8	0.9
E	6,648	195	990	0.8	53.0	53.0	54.0	1.0
F	7,740	200	1045	0.8	56.0	56.0	56.0	0.0
G	8,506	120	585	1.4	56.0	56.0	56.0	0.0
H	9,414	20	70	10.2	63.8	63.8	63.8	0.0
I	12,456	35	150	4.8	72.3	72.3	73.1	0.8
J	13,981	30	210	3.5	77.4	77.4	78.3	0.9
K	14,974	550	2185	0.3	77.8	77.8	78.7	0.9
L	16,262	100	490	1.4	77.9	77.9	78.8	0.9
M	18,190	95	385	1.8	78.7	78.7	79.4	0.7
N	19,557	95	260	2.2	79.4	79.4	80.3	0.9
O	22,311	16	76	5.7	83.9	83.9	84.7	0.8
P	24,066	30	71	6.2	87.3	87.3	87.7	0.4
Q	24,711	26	117	3.7	91.3	91.3	91.4	0.1
R	25,586	30	159	2.7	94.4	94.4	94.5	0.1
S	26,951	20	116	3.7	94.8	94.8	95.4	0.6
T	28,361	50	401	1.1	100.9	100.9	101.6	0.7
U	29,158	150	1702	0.2	101.0	101.0	101.7	0.7
V	30,151	50	243	1.6	101.1	101.1	101.8	0.7
W	32,348	90	301	1.3	102.0	102.0	102.7	0.7
X	32,881	30	177	2.2	104.4	104.4	104.8	0.4
Y	34,576	90	358	1.0	104.7	104.7	105.7	1.0
Z	36,566	80	224	1.6	105.7	105.7	106.7	1.0

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BOSTON BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BRANCH OF IPSWICH								
A	240	200	1,134	0.1	39.4	39.4	40.4	1.0
B	740	150	837	0.2	39.4	39.4	40.4	1.0
C	2,022	95	448	0.3	40.3	40.3	40.7	0.4
D	2,302	20	90	1.6	40.8	40.8	41.0	0.2
CLEVELAND BROOK								
E	2,522	16	104	1.2	43.2	43.2	43.3	0.1
F	3,222	40	203	0.6	43.2	43.2	43.3	0.1
G	4,120	76	673	0.2	46.8	46.8	46.8	0.0
H	4,390	35	140	0.9	46.8	46.8	47.1	0.3
I	4,752	10	19	6.7	47.4	47.4	47.7	0.3
J	5,775	40	127	1.0	54.6	54.6	54.6	0.0
K	6,575	40	118	1.1	54.7	54.7	54.8	0.1
L	6,950	30	64	0.6	55.7	55.7	55.9	0.2
M	7,290	19	27	1.3	57.8	57.8	58.8	1.0
N	7,800	16	18	2.0	72.6	72.6	72.6	0.0

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BRANCH OF IPSWICH AND CLEVELAND BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	250	3	14	0.6	79.8	79.8 ²	80.8 ²	1.0
B	1,500	132	282	0.0	79.8	79.8 ²	80.8 ²	1.0
C	2,600	8	14	0.6	79.8	79.8 ²	80.8 ²	1.0

¹ FEET ABOVE CONFLUENCE WITH PENN BROOK

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM PENN BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

BULFORD BROOK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQURE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
CENTERVILLE CREEK								
A	1,670	9	36	5.5	14.0	8.9 ²	9.5	0.6
B	1,872	20	134	1.5	14.0	12.9 ²	13.1	0.2
C	2,052	20	115	1.7	14.0	12.9 ²	13.1	0.2
D	2,267	20	68	2.9	14.0	12.9 ²	13.2	0.3
E	2,402	18	28	7.1	21.2	21.2	21.2	0.0
F	2,562	20	50	4.0	22.3	22.3	22.3	0.0
G	2,862	20	40	5.0	24.2	24.2	24.3	0.1
H	3,187	17	37	5.4	32.1	32.1	32.2	0.1
I	3,787	20	67	3.0	35.3	35.3	35.7	0.4
J	4,587	20	49	4.9	39.2	39.2	39.3	0.1
K	4,777	17	40	5.0	41.6	41.6	41.6	0.0
L	4,952	16	68	2.9	43.5	43.5	43.5	0.0
M	5,462	16	49	4.1	44.8	44.8	45.1	0.3
N	5,912	16	53	3.7	47.3	47.3	47.4	0.1
O	6,282	16	52	3.8	48.8	48.8	49.0	0.2
P	6,439	16	57	3.5	49.6	49.6	49.8	0.2
Q	6,739	57	113	1.8	49.9	49.9	50.2	0.3
R	7,339	16	71	2.8	50.2	50.2	51.2	1.0
S	7,468	22	119	1.7	53.9	53.9	53.9	0.0

¹FEET ABOVE CONFLUENCE WITH MASSACHUSETTS BAY

²ELEVATIONS COMPUTEED WITHOUT CONSIDERING BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	ESSEX COUNTY, MA (ALL JURISDICTIONS)	
		CENTERVILLE CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE
CHUBBS BROOK								
A	4,860	280	82	2.0	14.0	9.3 ²	9.3	0.0
B	5,450	130	249	0.7	14.0	9.8 ²	10.2	0.4
C	5,635	15	72	2.3	14.0	13.3 ²	13.3	0.0
D	5,785	25	100	1.7	14.0	13.3 ²	13.5	0.2
E	5,923	25	141	1.2	16.7	16.7	16.7	0.0
F	6,313	28	105	1.6	16.7	16.7	16.8	0.1
G	6,803	20	26	6.5	18.2	18.2	18.2	0.0
H	6,959	28	168	1.0	24.6	24.6	24.8	0.2

¹FEET ABOVE CONFLUENCE WITH CHUBB CREEK

²ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM CHUBB CREEK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

**ESSEX COUNTY, MA
(ALL JURISDICTIONS)**

FLOODWAY DATA

CHUBBS BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	310	7	47	6.6	32.6	23.3 ²	24.0 ²	0.7
B	360	22	114	2.7	32.6	24.1 ²	24.8 ²	0.7
C	580	12	73	4.3	32.6	24.4 ²	25.1 ²	0.7
D	890	34	55	5.6	32.6	32.5 ²	32.5 ²	0.0
E	1,110	18	39	7.9	47.9	47.9	47.9	0.0
F	2,200	80	462	0.7	49.1	49.1	49.1	0.0
G	2,560	16	36	8.5	52.5	52.5	52.5	0.0
H	2,630	22	115	2.7	53.9	53.9	53.9	0.0
I	2,650	22	40	7.7	73.2	73.2	73.2	0.0
J	3,100	80	291	1.1	74.4	74.4	74.4	0.0
K	3,350	38	105	3.0	74.4	74.4	74.4	0.0
L	4,170	45	167	1.9	75.9	75.9	75.9	0.0
M	4,200	140	591	0.5	88.9	88.9	88.9	0.0
N	4,900	43	67	4.6	88.9	88.9	88.9	0.0
O	5,370	50	107	2.9	90.3	90.3	90.3	0.0
P	6,070	14	54	5.8	93.3	93.3	93.4	0.1
Q	6,675	155	531	0.6	94.1	94.1	94.2	0.1
R	7,150	98	269	1.2	94.1	94.1	94.2	0.1
S	7,720	18	60	5.1	94.4	94.4	95.3	0.9
T	8,000	14	69	4.5	95.2	95.2	95.9	0.7
U	8,370	12	115	2.7	101.9	101.9	101.9	0.0
V	8,395	32	217	1.4	101.9	101.9	101.9	0.0
W	8,440	120	131	2.4	111.8	111.8	111.9	0.1
X	8,610	120	120	2.6	111.9	111.9	111.9	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

COCHICHEWICK BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CRANE RIVER								
A	1,663	330	3185	0.2	10.0	3.6 ²	4.6 ²	1.0
B	2,804	275	3180	0.2	10.0	3.6 ²	4.6 ²	1.0
C	3,384	265	2195	0.3	10.0	3.7 ²	4.7 ²	1.0
D	4,514	230	1380	0.4	10.0	3.7 ²	4.7 ²	1.0
E	5,961	25	95	6.6	10.0	4.6 ²	5.0 ²	0.4
F	8,337	40	175	3.6	10.0	8.5 ²	9.5 ²	1.0
G	8,733	30	195	3.2	12.9	12.9	12.9	0.0
H	10,058	20	105	5.9	16.7	16.7	16.7	0.0
CRANE BROOK								
I	10,333	585	5090	0.1	24.0	24.0	24.0	0.0
J	11,521	20	155	2.2	24.7	24.7	24.8	0.1
K	12,081	15	85	4.0	24.9	24.9	25.2	0.3
L	13,232	20	100	3.0	26.6	26.6	27.5	0.9
M	14,161	20	115	2.3	27.4	27.4	28.3	0.9
N	15,286	25	75	2.8	29.1	29.1	30.0	0.9
O	16,701	10	40	4.5	29.5	29.5	30.3	0.8
P	17,366	10	120	1.4	36.6	36.6	36.6	0.0
Q	18,242	10	55	3.1	36.7	36.7	37.1	0.4
R	18,892	20	145	1.0	39.9	39.9	40.5	0.6

¹ FEET ABOVE CONFLUENCE WITH PORTER RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM BEVERLY HARBOR

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

CRANE RIVER AND CRANE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	345	*	50	10.5	25.8	14.2 ²	14.2 ²	0.0
B	445	19	78	6.8	25.8	16.4 ²	16.4 ²	0.0
C	880	*	69	7.7	25.8	20.0 ²	20.3 ²	0.3
D	950	25	152	3.5	25.8	21.3 ²	21.3 ²	0.0
E	3,620	60	148	3.6	35.2	35.2	35.4	0.2
F	5,035	*	66	3.9	37.4	37.4	38.4	1.0
G	5,160	*	70	3.7	37.7	37.7	38.7	1.0
H	5,250	*	244	1.1	40.5	40.5	40.5	0.0
I	7,095	40	51	5.1	42.1	42.1	42.1	0.0
J	10,360	100	77	3.4	128.2	128.2	128.2	0.0
K	10,925	98	616	0.4	136.7	136.7	136.7	0.0
L	11,010	99	87	3.0	142.4	142.4	142.4	0.0
M	11,740	35	69	0.3	147.2	147.2	147.9	0.7
N	11,800	*	5	3.8	152.0	152.0	152.0	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATION COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM MERRIMACK RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

CREEK BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,093	50	140	3.4	43.1	41.8 ²	42.3 ²	0.5
B	2,635	120	660	0.7	58.0	58.0	58.0	0.0

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

EMERSON BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	300	600	2,302	0.5	40.6	40.6	41.6	1.0
B	1,160	600	2,012	0.6	40.8	40.8	41.8	1.0
C	2,443	110	769	1.5	43.9	43.9	44.2	0.3
D	4,482	200	938	1.0	45.1	45.1	45.4	0.3
E	6,395	300	1,299	0.7	45.4	45.4	47.0	1.6
F	7,095	300	875	1.0	45.5	45.5	46.2	0.7
G	7,802	80	603	1.4	46.2	46.2	47.0	0.8
H	9,995	80	240	3.4	48.1	48.1	48.4	0.3
I	13,005	90	161	4.7	54.1	54.1	54.1	0.0
J	13,304	30	136	5.5	56.3	56.3	56.3	0.0
K	13,545	70	530	1.4	61.3	61.3	61.3	0.0
L	16,895	40	230	3.2	61.5	61.5	61.5	0.0
M	18,981	80	698	1.1	69.4	69.4	69.4	0.0
N	19,225	160	674	1.1	80.0	80.0	80.1	0.1
O	19,495	370	3,110	0.2	80.0	80.0	80.1	0.1
P	21,095	40	223	3.4	80.0	80.0	80.0	0.0
Q	21,832	60	252	3.0	83.1	83.1	83.1	0.0
R	22,045	100	190	3.9	83.2	83.2	83.2	0.0
S	27,725	100	399	1.5	93.1	93.1	93.1	0.0
T	28,080	70	191	3.1	93.2	93.2	93.4	0.2
U	29,487	20	63	9.5	97.0	97.0	97.0	0.0
V	30,935	30	115	5.2	105.0	105.0	105.3	0.3
W	31,925	50	309	1.9	109.6	109.6	109.6	0.0
X	33,995	40	227	2.6	112.8	112.8	112.8	0.0
Y	35,520	30	239	2.5	112.9	112.9	113.6	0.7

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

FISH BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	260	50	688	0.8	54.3	54.3	55.3	1.0
B	1,000	36	93	5.9	63.4	63.4	64.0	0.6
C	4,440	380	1,127	0.5	83.5	83.5	83.6	0.1
D	9,900	568	169	3.2	105.9	105.9	106.6	0.7
E	14,400	140	402	0.3	115.9	115.9	116.3	0.4
F	15,465	80	372	0.3	121.3	121.3	121.6	0.3
G	18,480	60	358	0.4	121.9	121.9	122.1	0.2
H	20,470	44	174	0.7	121.9	121.9	122.1	0.2

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

FISH BROOK (TOWN OF ANDOVER)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	460	49	338	1.1	24.8	24.8	25.8	1.0
B	780	64	414	0.9	24.9	24.9	25.9	1.0

¹ FEET ABOVE CONFLUENCE WITH SHUTE BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

FISKE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	734	150	847	0.7	26.7	24.5 ²	25.3 ²	0.8
B	1,827	12	108	5.8	26.7	26.1 ²	26.3 ²	0.2
C	2,350	110	423	1.5	27.2	27.2	27.7	0.5
D	3,939	30	188	3.4	34.1	34.1	34.2	0.1
E	4,572	30	206	3.1	34.5	34.5	35.0	0.5
F	5,148	200	680	0.9	38.3	38.3	38.4	0.1
G	6,579	120	718	0.8	38.3	38.3	38.4	0.1
H	7,408	70	397	1.2	44.6	44.6	44.6	0.0
I	8,268	70	462	0.8	44.6	44.6	44.7	0.1
J	9,182	50	535	0.7	51.5	51.5	51.9	0.4
K	10,185	30	284	1.0	61.2	61.2	61.2	0.0
L	11,384	16	66	4.1	65.7	65.7	65.9	0.2
M	11,843	25	89	3.0	71.7	71.7	71.7	0.0
N	12,408	345	2,500	0.1	81.3	81.3	81.9	0.6
O	14,800	40	127	1.7	86.8	86.8	86.8	0.0
P	16,716	20	147	1.0	97.5	97.5	97.5	0.0

¹ FEET ABOVE CONFLUENCE WITH PROCTOR BROOK

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM PROCTOR BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

GOLDTHWAITE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	320	80	353	1.1	110.5	104.8 ²	105.0 ²	0.2
B	2,530	80	231	1.7	110.5	105.2 ²	105.7 ²	0.5
C	2,690	80	300	1.3	110.5	108.2 ²	108.2 ²	0.0
D	5,000	80	229	1.7	110.5	108.8 ²	109.4 ²	0.6
E	7,830	80	172	2.3	111.5	111.5	112.0	0.5
F	8,590	80	236	1.7	112.2	112.2	112.8	0.6
G	8,715	80	395	1.0	115.7	115.7	115.9	0.2
H	10,450	39	58	6.9	139.0	139.0	139.0	0.0
I	10,710	60	127	2.2	142.4	142.4	142.4	0.0
J	13,270	80	294	1.0	142.7	142.7	143.4	0.7
K	14,550	80	267	1.0	142.8	142.8	143.7	0.9
L	14,700	80	333	0.8	143.6	143.6	144.4	0.8

¹ FEET ABOVE CONFLUENCE WITH SPICKET RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM SPICKET RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

HARRIS BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	220	40	138	3.3	27.7	24.5 ²	25.5 ²	1.0
B	1,120	40	108	4.2	27.7	26.9 ²	27.2 ²	0.3
C	3,750	32	66	5.1	72.9	72.9	72.9	0.0
D	4,945	20	48	7.1	97.9	97.9	98.0	0.1
E	6,800	130	374	0.9	116.1	116.1	117.0	0.9
F	7,720	80	294	1.0	118.0	118.0	118.3	0.3
G	7,780	100	361	0.8	118.0	118.0	118.4	0.4
H	9,070	30	48	6.2	119.5	119.5	119.6	0.1
I	10,730	40	189	1.6	123.2	123.2	124.2	1.0
J	11,455	25	44	6.8	124.6	124.6	125.0	0.4
K	12,038	100	708	0.4	130.4	130.4	131.1	0.7
L	14,118	40	127	2.4	130.5	130.5	131.2	0.7
M	14,838	9	29	10.3	131.4	131.4	131.4	0.0
N	15,035	36	148	2.0	134.3	134.3	134.6	0.3
O	15,930	40	165	1.1	134.4	134.4	135.2	0.8
P	17,092	50	158	1.1	134.5	134.5	135.5	1.0
Q	17,810	25	75	2.4	135.3	135.3	136.1	0.8
R	18,890	45	155	1.2	144.5	144.5	145.5	1.0

¹ FEET ABOVE CONFLUENCE WITH BARE MEADOW BROOK

² ELEVATIONS COMPUTED CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

HAWKES BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
HOWLETT BROOK								
A	1,045	180	690	0.8	34.6	34.6	35.6	1.0
B	1,156	67	291	1.8	38.3	38.3	38.3	0.0
C	1,272	90	471	1.1	42.4	42.4	42.4	0.0
D	1,447	86	450	1.2	44.1	44.1	44.1	0.0
E	1,885	150	796	0.7	44.2	44.2	44.2	0.0
F	4,372	150	496	1.1	45.0	45.0	45.5	0.5
G	4,488	150	751	0.7	46.9	46.9	47.2	0.3
H	8,195	150	618	0.8	48.5	48.5	49.3	0.8
I	8,358	150	817	0.6	50.5	50.5	50.7	0.2
J	8,680	150	822	0.6	50.5	50.5	50.8	0.3
K	8,950	150	753	0.6	50.6	50.6	50.9	0.3
L	10,792	150	701	0.7	50.7	50.7	51.3	0.6
M	11,030	150	1,008	0.5	52.8	52.8	53.3	0.5
N	12,133	150	414	1.1	52.8	52.8	53.6	0.8
PYE BROOK								
O	13,200	150	650	0.7	53.5	53.5	54.2	0.7
P	14,652	150	443	1.0	54.4	54.4	55.0	0.6
Q	16,442	60	220	2.1	59.4	59.4	59.8	0.4
R	16,579	150	563	0.8	63.7	63.7	63.9	0.2
S	17,176	150	1,045	0.4	63.7	63.7	64.0	0.3

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

HOWLETT BROOK AND PYE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	940	254	1,331	0.2	50.1	50.1	51.1	1.0
B	1,226	58	68	4.1	53.8	53.8	53.8	0.0
C	1,280	60	79	3.5	53.9	53.9	53.9	0.0
D	2,540	12	66	4.2	54.7	54.7	54.8	0.1
E	2,650	100	559	0.5	57.4	57.4	57.4	0.0
F	3,932	14	32	8.6	58.5	58.5	58.5	0.0
G	3,968	14	47	5.9	59.6	59.6	59.6	0.0
H	5,600	122	65	4.3	77.5	77.5	77.5	0.0
I	6,830	57	73	3.8	110.1	110.1	110.1	0.0
J	7,185	18	39	7.3	114.5	114.5	114.5	0.0
K	7,310	18	167	1.7	122.4	122.4	122.4	0.0
L	8,280	150	206	1.4	130.8	130.8	130.8	0.0
M	10,750	168	303	0.9	136.2	136.2	136.2	0.0

¹ FEET ABOVE CONFLUENCE WITH SHAWSHEEN RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

HUSSEY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,100	*	30	3.7	63.2	60.7 ²	61.3 ²	0.6
B	1,980	*	41	2.7	65.2	65.2	66.0	0.8
C	3,160	*	27	4.2	87.9	87.9	88.6	0.7
D	3,300	*	35	3.1	89.5	89.5	90.1	0.6
E	3,420	*	19	5.8	93.3	93.3	93.3	0.0

¹ FEET ABOVE CONFLUENCE WITH HUSSEY BROOK

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM HUSSEY BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

HUSSEY BROOK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	710	130	349	9.3	11.6	11.6	11.6	0.0
B	780	183	1,572	2.1	13.3	13.3	13.3	0.0
C	8,030	105	688	4.3	14.1	14.1	14.3	0.2
D	8,157	166	958	3.1	14.3	14.3	14.5	0.2
E	13,907	142	835	3.6	18.6	18.6	19.3	0.7
F	14,036	130	690	4.3	18.9	18.9	19.5	0.6
G	17,486	135	942	3.1	21.7	21.7	22.0	0.3
H	20,036	250	1,072	2.8	23.2	23.2	23.7	0.5
I	22,336	172	1,038	2.9	24.5	24.5	25.4	0.9
J	22,451	107	789	3.8	25.0	25.0	25.8	0.8
K	24,551	147	1,036	2.9	26.1	26.1	27.0	0.9
L	24,681	257	1,666	1.8	26.8	26.8	27.8	1.0
M	25,606	83	594	4.8	26.8	26.8	27.8	1.0
N	25,706	219	1,756	1.6	31.4	31.4	31.7	0.3
O	28,006	93	617	4.6	31.4	31.4	31.7	0.3
P	28,120	97	713	4.0	31.6	31.6	31.9	0.3
Q	28,490	136	749	4.1	31.6	31.6	32.6	1.0
R	31,494	150	1,132	2.7	33.4	33.4	34.2	0.8
S	33,294	250	1,782	1.7	34.4	34.4	35.1	0.7
T	34,989	335	2,335	1.3	34.5	34.5	35.3	0.8
U	36,473	195	2,326	1.3	35.1	35.1	35.9	0.8
V	41,727	600	2,697	1.1	35.3	35.3	36.3	1.0
W	45,159	800	3,847	0.8	35.8	35.8	36.7	0.9
X	47,513	429	2,290	1.2	36.0	36.0	36.9	0.9
Y	54,541	3,150	18,544	0.2	36.2	36.2	37.1	0.9
Z	60,249	2,825	7,484	0.4	36.2	36.2	37.1	0.9
AA	61,463	3,000	8,394	0.3	36.5	36.5	37.2	0.7

¹ FEET ABOVE STATE ROUTE 133

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

IPSWICH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	64,404	100	1,288	2.2	38.1	38.1	38.3	0.2
AC	64,716	75	950	3.0	39.2	39.2	39.4	0.2
AD	66,722	250	2,353	1.2	39.4	39.4	39.8	0.4
AE	68,670	250	2,281	1.1	39.4	39.4	39.8	0.4
AF	69,806	275	1,687	1.4	39.5	39.5	39.9	0.4
AG	70,434	200	1,018	2.4	39.6	39.6	40.3	0.7
AH	71,833	750	3,893	0.6	39.7	39.7	40.6	0.9
AI	73,185	500	2,952	0.8	39.8	39.8	40.6	0.8
AJ	74,283	414	2,189	1.1	39.9	39.9	40.7	0.8
AK	75,286	450	2,534	1.0	40.0	40.0	40.8	0.8
AL	77,414	488	2,596	0.9	40.2	40.2	41.0	0.8
AM	79,093	700	3,480	0.7	40.4	40.4	41.1	0.7
AN	82,673	700	3,601	0.7	40.5	40.6	41.4	0.8
AO	83,673	60	590	3.1	40.6	39.9	40.9	1.0
AP	85,125	105	715	2.6	40.6	40.6	41.6	1.0
AQ	86,635	140	2,240	0.8	40.6	40.6	41.6	1.0
AR	87,422	145	1,015	1.8	41.2	41.2	42.2	1.0
AS	88,636	205	1,235	1.5	41.4	41.4	42.4	1.0
AT	89,724	160	1,065	1.6	41.5	41.5	42.5	1.0
AU	91,324	115	810	2.2	42.9	42.9	43.6	0.7
AV	93,504	270	1,830	0.7	43.1	43.1	43.9	0.8
AW	96,884	110	905	1.5	43.5	43.5	44.3	0.8
AX	100,173	180	1,060	1.3	44.1	44.1	45.0	0.9
AY	101,741	130	1,705	0.8	44.2	44.2	45.1	0.9
AZ	102,449	200	1,450	0.9	45.0	45.0	45.8	0.8
BA	103,985	180	1,250	1.1	45.1	45.1	45.9	0.8
BB	106,293	105	850	1.6	45.3	45.3	46.2	0.9

¹ FEET ABOVE STATE ROUTE 133

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

IPSWICH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	106,926	200	1,220	1.1	45.4	45.4	46.3	0.9
BD	109,080	180	1,270	1.0	45.7	45.7	46.6	0.9
BE	110,400	420	2,410	0.5	45.8	45.8	46.7	0.9
BF	111,921	260	1,485	0.9	45.8	45.8	46.7	0.9
BG	113,442	145	900	1.4	46.0	46.0	47.0	1.0
BH	115,437	335	1,980	0.7	47.7	47.7	48.1	0.4
BI	118,621	1,340	7,135	0.2	47.8	47.8	48.2	0.4
BJ	121,578	585	2,565	0.5	47.8	47.8	48.2	0.4
BK	125,200	225	920	1.2	48.5	48.5	49.3	0.8
BL	128,405	70	485	2.3	50.6	50.6	51.6	1.0
BM	131,774	65	495	2.3	51.8	51.8	52.7	0.9
BN	132,693	45	370	3.0	52.7	52.7	53.4	0.7
BO	134,193	375	1,925	0.5	59.6	59.6	59.6	0.0
BP	134,793	70	345	3.0	59.6	59.6	59.6	0.0
BQ	136,093	60	380	2.7	60.2	60.2	60.6	0.4
BR	138,138	75	510	2.0	60.9	60.9	61.5	0.6
BS	138,248	55	370	2.8	61.1	61.1	61.6	0.5
BT	139,108	80	590	1.8	61.4	61.4	62.0	0.6
BU	139,168	50	410	2.5	61.6	61.6	62.1	0.5
BV	141,118	45	420	2.5	61.9	61.9	62.8	0.9
BW	143,158	100	675	2.4	62.2	62.2	62.2	0.0

¹ FEET ABOVE STATE ROUTE 133

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

IPSWICH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	9	21	2.2	18.2	16.7 ²	17.7 ²	1.0
B	2,560	3	7	6.9	27.1	27.1	27.2	0.1
C	3,775	10	5	4.2	28.9	28.9	28.9	0.0
D	5,905	1	1	6.0	55.9	55.9	55.9	0.0

¹ FEET ABOVE PARISH ROAD

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM PARKER RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

JACKMAN BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,700	64	335	2.6	20.6	11.1 ²	12.1 ²	1.0
B	2,900	158	435	1.2	20.6	12.1 ²	12.9 ²	0.8
C	4,400	200	280	1.8	34.6	34.6	34.6	0.0
D	6,150	115	571	0.6	39.1	39.1	39.5	0.4
E	6,800	10	30	9.8	40.5	40.5	41.4	0.9
F	8,400	139	1,168	0.2	75.3	75.3	75.3	0.0
G	10,500	206	1,125	0.2	75.3	75.3	75.3	0.0
H	11,200	316	2,004	0.1	76.6	76.6	76.6	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

JOHNSON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1775	*	248	9.4	22.4	15.7 ²	16.2 ²	0.5
B	1840	51	407	5.7	22.4	16.9 ²	17.4 ²	0.5
C	2310	*	259	9.0	22.4	17.0 ²	17.4 ²	0.4
D	2,380	*	226	10.3	22.4	17.0 ²	17.5 ²	0.5
E	4,025	*	1,121	2.1	24.2	24.2	24.3	0.1
F	5,995	95	785	3.0	26.3	26.3	26.4	0.1
G	6,065	160	1,590	1.5	26.6	26.6	26.7	0.1
H	7,215	197	1,544	1.5	26.9	26.9	27.1	0.2
I	7,995	*	721	3.2	27.1	27.1	27.3	0.2
J	10,820	*	520	4.5	27.6	27.6	28.0	0.4
K	11,240	*	318	7.3	28.2	28.2	28.9	0.7
L	11,310	62	383	6.1	28.2	28.2	29.1	0.9
M	12,940	695	2,997	0.7	30.2	30.2	30.6	0.4
N	15,140	240	2,535	0.8	34.8	34.8	34.9	0.1
O	20,160	45	733	1.7	38.0	38.0	38.2	0.2

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM MERRIMACK RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

LITTLE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	28,354	1,041	26,922	4.3	9.8	9.8	9.8	0.0
B	32,208	1,101	27,860	4.1	10.5	10.5	10.5	0.0
C	38,386	1,120	25,350	4.5	11.7	11.7	11.7	0.0
D	41,501	1,830	38,000	3.0	12.2	12.2	12.2	0.0
E	44,194	1,920	37,600	3.1	12.4	12.4	12.4	0.0
F	51,216	880	22,800	5.0	12.9	12.9	12.9	0.0
G	55,176	695	15,700	7.3	13.4	13.4	13.4	0.0
H	60,984	780	16,300	7.1	14.8	14.8	14.9	0.1
I	64,839	1,215	27,600	4.2	16.2	16.2	16.4	0.2
J	70,939	1,015	24,100	4.8	16.8	16.8	17.0	0.2
K	73,999	1,260	26,449	4.4	17.3	17.3	18.3	1.0
L	82,269	772	18,854	6.1	19.1	19.1	20.0	0.9
M	86,389	1,140	27,106	4.2	20.7	20.7	21.6	0.9
N	89,889	*	27,196	4.2	21.1	21.1	22.1	1.0
O	92,229	*	30,465	3.8	21.4	21.4	22.3	0.9
P	93,909	*	16,116	7.1	21.4	21.4	22.3	0.9
Q	97,289	616	16,645	6.9	22.0	22.0	23.0	1.0
R	100,049	*	17,981	6.4	22.7	22.7	23.7	1.0
S	100,294	*	19,426	5.9	22.9	22.9	23.9	1.0
T	100,594	*	15,437	7.5	22.9	22.9	23.9	1.0
U	102,619	*	13,575	8.5	23.1	23.1	24.0	0.9
V	105,599	*	24,161	4.8	24.3	24.3	25.3	1.0
W	108,299	*	16,070	7.2	24.4	24.4	25.3	0.9
X	111,924	*	17,163	6.7	25.1	25.1	26.0	0.9
Y	113,934	570	15,300	7.5	25.2	25.2	26.1	0.9
Z	114,899	570	15,150	7.6	25.8	25.8	26.4	0.6
AA	118,074	*	14,071	8.2	26.5	26.5	27.4	0.9

¹ FEET ABOVE NEWBURYPORT LIGHTHOUSE

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MERRIMACK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	119,394	*	14,717	7.8	27.0	27.0	27.9	0.9
AC	122,894	*	19,584	5.9	28.3	28.3	29.3	1.0
AD	124,649	*	16,034	7.2	28.5	28.5	29.5	1.0
AE	129,337	613	17,504	6.6	30.5	30.5	31.5	1.0
AF	135,039	508	16,609	6.9	31.8	31.8	32.8	1.0
AG	137,151	533	16,008	7.1	32.2	32.2	33.2	1.0
AH	141,428	480	14,479	7.9	32.6	32.6	33.6	1.0
AI	143,148	740	20,550	5.6	33.6	33.6	34.6	1.0
AJ	147,008	*	15,052	7.4	34.2	34.2	35.2	1.0
AK	147,228	490	14,238	7.8	34.2	34.2	35.2	1.0
AL	149,148	549	16,819	6.6	35.0	35.0	36.0	1.0
AM	150,548	540	16,005	6.9	35.2	35.2	36.2	1.0
AN	150,668	*	16,919	6.6	35.5	35.5	36.5	1.0
AO	150,868	*	23,685	4.7	35.9	35.9	36.9	1.0
AP	150,888	*	6,979	15.9	46.1	46.1	46.3	0.2
AQ	155,348	*	16,891	6.6	49.6	49.6	50.2	0.6
AR	158,008	*	13,183	8.4	49.9	49.9	50.5	0.6
AS	158,908	746	18,329	6.1	50.0	50.0	51.0	1.0
AT	162,658	819	19,842	5.6	51.1	51.1	51.9	0.8
AU	166,038	967	23,632	4.7	52.5	52.5	53.2	0.7
AV	169,628	865	21,093	5.3	53.4	53.4	54.1	0.7
AW	171,528	1,144	19,672	5.6	54.0	54.0	54.6	0.6
AX	175,798	787	20,143	5.5	55.1	55.1	55.6	0.5
AY	180,498	630	17,016	6.5	55.9	55.9	56.3	0.4
AZ	182,248	626	15,841	7.0	56.5	56.5	56.9	0.4
BA	185,458	802	14,757	7.5	57.7	57.7	58.1	0.4

¹ FEET ABOVE NEWBURYPORT LIGHTHOUSE

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MERRIMACK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	11,060	16	30	2.7	42.4	42.4	42.7	0.3
B	11,180	16	42	1.9	43.3	43.3	43.4	0.1
C	11,335	47	200	0.4	47.3	47.3	47.3	0.0
D	11,540	64	317	0.3	47.3	47.3	47.3	0.0
E	11,800	106	597	0.1	52.2	52.2	52.2	0.0
F	12,340	70	291	0.2	52.2	52.2	52.2	0.0
G	12,630	264	1,195	0.1	52.2	52.2	52.2	0.0
H	12,905	70	230	0.2	53.2	53.2	53.2	0.0
I	14,035	20	164	0.2	53.2	53.2	53.2	0.0

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MILE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	390	32	155	4.6	14.0	12.0 ²	12.0 ²	0.0
B	1,380	57	283	2.5	14.0	14.0	14.9	0.9
C	1,496	57	192	3.7	14.8	14.8	15.4	0.6
D	2,931	52	155	4.6	19.3	19.3	19.3	0.0
E	3,123	25	144	4.9	19.5	19.5	19.5	0.0
F	5,603	62	421	1.7	20.0	20.0	20.9	0.9
G	5,723	62	417	1.7	20.1	20.1	21.0	0.9
H	6,323	126	703	1.0	20.2	20.2	21.1	0.9
I	6,475	50	303	2.3	21.4	21.4	22.0	0.6
J	8,405	219	1,053	0.7	21.4	21.4	22.2	0.8
K	8,520	30	230	3.1	23.1	23.1	23.1	0.0
L	9,750	30	228	3.1	23.1	23.1	23.8	0.7
M	9,871	123	1,084	0.7	23.4	23.4	24.1	0.7
N	11,471	30	241	2.9	23.4	23.4	24.1	0.7
O	11,584	30	230	3.1	24.3	24.3	24.4	0.1
P	13,004	31	253	2.8	24.3	24.3	25.2	0.9
Q	13,114	31	242	2.9	24.4	24.4	25.4	1.0
R	17,104	300	2,435	0.3	24.4	24.4	25.1	0.7
S	18,269	300	2,435	0.3	24.4	24.4	25.1	0.7
T	19,749	100	630	1.1	26.3	26.3	26.7	0.4
U	20,974	200	969	0.7	26.5	26.5	26.9	0.4
V	23,124	300	1,880	0.4	26.6	26.6	27.1	0.5
W	24,404	300	2,085	0.3	26.6	26.6	27.1	0.5
X	26,144	140	538	1.3	26.6	26.6	27.2	0.6
Y	27,524	300	2,032	0.4	26.7	26.7	27.3	0.6
Z	29,319	245	754	1.0	26.7	26.7	27.4	0.7
AA	30,064	100	959	0.8	30.2	30.2	30.5	0.3

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MILES RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	31,514	200	1,690	0.4	30.2	30.2	30.5	0.3
AC	33,724	200	1,416	0.5	30.2	30.2	30.5	0.3
AD	36,924	285	1,360	0.4	30.9	30.9	31.8	0.9
AE	37,458	100	510	1.1	31.8	31.8	32.4	0.6
AF	41,124	195	701	0.8	32.4	32.4	33.3	0.9
AG	41,620	100	801	0.7	37.9	37.9	38.9	1.0
AH	42,970	150	1,474	0.4	37.9	37.9	38.9	1.0
AI	53,484	22	122	4.2	41.9	41.9	42.3	0.4

¹ FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MILES RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
MILL RIVER (CITY OF GLOUCESTER)								
A	120	230	1,097	0.3	13.0	6.1 ²	6.1	0.0
B	1,520	90	100	2.9	13.0	7.1 ²	7.1	0.0
C	1,870	90	350	0.6	13.0	11.3 ²	11.3	0.0
D	2,220	20	40	5.6	13.0	12.4 ²	12.8	0.4
E	2,392	10	39	5.8	15.3	15.3	15.3	0.0
F	2,590	15	40	5.7	17.1	17.1	17.8	0.7
G	2,704	30	140	1.6	20.4	20.4	20.4	0.0
H	3,104	25	82	2.7	20.5	20.5	20.9	0.4

¹FEET ABOVE DR.OSMAN BABSON ROAD (DOWNSTREAM FACE)

²ELEVATIONS COMPUTEED WITHOUT CONSIDERING BACKWATER EFFECTS FROM ATLANTIC OCEAN

TABLE 12	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOODWAY DATA
	ESSEX COUNTY, MA (ALL JURISDICTIONS)	
		MILL RIVER (CITY OF GLOUCESTER)

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
MILL RIVER (TOWN OF ROWLEY)								
A	-27	28	102	8.2	10.0	4.2 ²	4.2	0.0
B	51	90	547	1.5	10.0	8.0 ²	8.0	0.0
C	828	42	224	3.7	10.0	8.2 ²	8.3	0.1
D	1518	30	138	6.0	10.0	9.9 ²	10.5	0.6
E	1595	18	106	7.9	11.5	11.5	11.5	0.0
F	1885	16	77	10.8	14.8	14.8	15.6	0.8
G	1909	15	98	8.5	17.5	17.5	17.5	0.0
H	2058	60	282	2.9	18.2	18.2	18.5	0.3
I	2080	72	116	7.2	21.3	21.3	21.3	0.0

¹FEET ABOVE U.S. ROUTE 1

²ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM PARKER RIVER

TABLE 12	FEDERAL EMERGENCY MANAGEMENT AGENCY <small>ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM PARKER RIVER</small>	FLOODWAY DATA
	ESSEX COUNTY, MA (ALL JURISDICTIONS)	MILL RIVER (TOWN OF ROWLEY)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	70	78	155	3.2	17.8	2.2 ²	2.2 ²	0.0
B	960	*	84	5.8	17.8	10.8 ²	11.0 ²	0.2
C	1,115	*	178	2.8	17.8	17.4 ²	17.4 ²	0.0
D	2,615	*	104	4.7	19.2	19.2	19.8	0.6
E	3,710	*	58	6.0	26.7	26.7	27.2	0.5
F	3,840	*	161	2.2	30.2	30.2	31.0	0.8
G	4,350	*	71	5.0	31.0	31.0	31.3	0.3
H	4,420	*	70	5.0	44.6	44.6	44.6	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MILLVALE RESERVOIR BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVDL)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2,762	350	1,728	0.3	113.0	113.0	114.0	1.0
B	3,420	400	1,923	0.3	113.2	113.2	114.1	0.9
C	6,074	110	300	1.3	113.2	113.2	114.2	1.0
D	7,300	80	254	1.6	114.5	114.5	114.9	0.4
E	9,272	100	609	0.5	123.0	123.0	123.4	0.4
F	11,840	100	363	0.8	123.7	123.7	124.2	0.5
G	14,182	40	246	1.2	128.0	128.0	128.2	0.2
H	17,220	100	160	1.7	129.8	129.8	130.3	0.5
I	18,650	51	240	1.1	139.8	139.8	139.8	0.0
J	20,170	20	81	2.2	147.6	147.6	148.5	0.9
K	23,415	11	23	5.3	169.0	169.0	169.5	0.5
L	25,799	12	19	6.3	220.7	220.7	220.8	0.1
M	27,162	10	105	1.2	237.4	237.4	238.4	1.0

¹ FEET ABOVE CONFLUENCE WITH FISH BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

MOSQUITO BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
NORTH RIVER								
A	2,212	80	325	3.5	10.0	10.0	11.0	1.0
B	2,841	70	345	3.3	12.4	12.4	12.5	0.1
C	3,326	60	270	3.8	13.6	13.6	14.0	0.4
PROCTOR BROOK								
D	8,152	150	440	1.0	39.6	39.6	39.7	0.1
E	8,939	60	245	1.7	40.8	40.8	40.8	0.0
F	9,604	100	255	1.6	42.0	42.0	42.0	0.0
G	10,344	100	265	1.6	42.5	42.5	42.8	0.3
H	11,436	100	515	0.8	46.9	46.9	46.9	0.0
I	12,862	60	260	1.6	47.1	47.1	47.3	0.2
J	13,306	45	300	1.0	51.4	51.4	52.1	0.7
K	13,712	60	570	0.5	51.5	51.5	52.2	0.7
L	14,404	60	360	0.9	54.9	54.9	55.4	0.5
M	14,837	50	235	1.3	55.1	55.1	55.5	0.4
N	15,808	90	325	0.9	55.2	55.2	55.6	0.4
O	17,778	90	215	1.3	57.1	57.1	57.8	0.7
P	19,626	100	255	1.1	61.4	61.4	61.4	0.0
Q	20,724	100	155	1.7	61.8	61.8	62.0	0.2
R	21,614	65	210	1.1	64.5	64.5	64.5	0.0
S	22,709	50	145	1.6	65.3	65.3	65.3	0.0

¹ FEET ABOVE GROVE STREET

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

NORTH RIVER AND PROCTOR BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	970	17	23	6.6	22.5	22.5	22.5	0.0
B	1,120	5	24	6.3	33.1	33.1	33.1	0.0
C	1,250	8	31	4.9	35.6	35.6	35.6	0.0
D	4,360	18	64	2.5	49.3	49.3	50.1	0.8
E	7,000	162	447	0.5	49.7	49.7	50.6	0.9

¹ FEET ABOVE CONFLUENCE WITH ARTICHOKE RIVER - RESERVOIR

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

NORTH TRIBUTARY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	55,533	40	148	2.2	86.5	86.5	87.3	0.8
B	55,933	40	114	2.8	86.8	86.8	87.7	0.9
C	56,633	60	183	1.8	87.8	87.8	88.7	0.9
D	57,533	60	199	1.6	88.5	88.5	89.3	0.8
E	58,783	60	175	1.9	89.2	89.2	89.9	0.7
F	59,333	60	202	1.6	89.6	89.6	90.2	0.6
G	60,097	80	245	1.1	93.4	93.4	93.4	0.0
H	60,303	60	193	1.4	93.4	93.4	93.4	0.0
I	61,033	80	245	1.1	93.7	93.7	93.9	0.2
J	62,033	80	258	1.1	93.8	93.8	94.2	0.4
K	63,183	50	104	2.6	94.2	94.2	95.0	0.8
L	63,533	60	159	1.7	96.1	96.1	96.2	0.1
M	64,653	60	117	1.9	98.0	98.0	98.8	0.8
N	64,983	40	56	4.1	101.2	101.2	101.2	0.0
O	65,333	60	180	1.3	107.2	107.2	107.2	0.0
P	65,437	60	231	1.0	107.8	107.8	107.8	0.0
Q	65,883	50	49	4.6	110.3	110.3	110.3	0.0
R	66,233	55	81	2.8	114.8	114.8	114.9	0.1
S	66,833	60	552	0.4	129.5	129.5	129.5	0.0

¹ FEET ABOVE CENTRAL STREET DAM

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PARKER RIVER (TOWN OF BOXFORD)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	26,000	36	87	4.4	61.7	61.7	62.7	1.0
B	27,464	20	96	4.0	64.0	64.0	64.7	0.7
C	35,144	16	74	4.6	69.3	69.3	70.3	1.0
D	35,464	28	121	2.8	70.7	70.7	71.5	0.8
E	36,344	175	69	4.9	73.2	73.2	73.2	0.0
F	37,280	10	35	6.4	74.5	74.5	75.5	1.0
G	37,720	19	66	3.4	76.6	76.6	77.3	0.7
H	42,050	59	345	0.6	81.9	81.9	82.6	0.7
I	42,750	12	81	2.8	81.9	81.9	82.7	0.8
J	43,445	43	150	1.5	84.4	84.4	85.2	0.8
K	45,150	82	387	0.5	84.4	84.4	85.4	1.0
L	46,270	30	177	1.1	84.4	84.4	85.4	1.0
M	47,550	76	304	0.5	84.4	84.4	85.4	1.0

¹ FEET ABOVE CENTRAL STREET DAM

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PARKER RIVER (TOWN OF GEORGETOWN)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	45	89	8.0	16.7	16.7	16.7	0.0
B	6,635	51	230	2.8	18.4	18.4	18.7	0.3
C	6,745	47	252	2.6	19.2	19.2	19.5	0.3
D	7,695	38	279	2.3	25.7	25.7	25.7	0.0
E	9,037	171	1,381	0.5	25.8	25.8	25.8	0.0
F	9,177	17	61	10.8	26.3	26.3	26.3	0.0
G	10,287	33	227	2.9	29.6	29.6	30.5	0.9
H	10,767	60	92	7.1	33.7	33.7	33.7	0.0
I	10,872	26	166	3.9	40.9	40.9	40.9	0.0
J	10,922	140	864	0.8	41.3	41.3	41.3	0.0
K	11,482	42	201	3.3	41.3	41.3	41.3	0.0
L	11,612	30	159	4.1	41.9	41.9	41.9	0.0
M	11,872	77	100	6.5	47.5	47.5	47.5	0.0
N	13,157	14	57	11.5	58.3	58.3	58.3	0.0
O	13,287	30	174	3.7	61.0	61.0	61.0	0.0
P	13,387	39	326	2.0	61.9	61.9	61.9	0.0

¹ FEET ABOVE CENTRAL STREET DAM

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PARKER RIVER (TOWN OF NEWBURY)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	200	85	120	1.7	109.0	104.0 ²	104.4 ²	0.4
B	960	50	74	2.7	109.0	106.1 ²	106.8 ²	0.7
C	2,020	35	105	1.9	110.7	110.7	111.2	0.5
D	2,500	120	411	0.5	110.9	110.9	111.5	0.6
E	3,365	490	3,908	0.1	111.0	111.0	111.6	0.6
F	4,150	60	304	0.6	111.0	111.0	111.6	0.6
G	4,670	36	72	2.4	111.3	111.3	112.0	0.7
H	5,510	20	68	2.5	112.7	112.7	113.3	0.6
I	5,950	90	245	0.7	114.5	114.5	114.6	0.1
J	6,790	100	401	0.4	114.5	114.5	114.6	0.1
K	8,650	100	312	0.4	114.5	114.5	114.6	0.1
L	9,370	60	96	1.4	114.5	114.5	114.9	0.4
M	11,920	90	75	1.8	122.5	122.5	122.5	0.0
N	14,070	9	17	4.0	127.6	127.6	128.2	0.6

¹ FEET ABOVE CONFLUENCE WITH SPICKET RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM SPICKET RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PEAT MEADOW BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	300	10	36	3.0	74.5	74.5	75.5	1.0
B	1,260	8	27	3.9	77.6	77.6	77.9	0.3
C	2,700	8	31	3.4	79.3	79.3	79.4	0.1
D	3,516	4	16	6.1	80.5	80.5	80.9	0.4
E	4,476	6	25	3.9	81.8	81.8	82.1	0.3
F	6,025	51	206	0.4	82.2	82.2	82.6	0.4
G	8,953	16	15	5.5	83.5	83.5	83.5	0.0
H	10,697	3	11	7.4	89.1	89.1	89.9	0.8
I	12,300	53	204	0.4	92.6	92.6	93.4	0.8
J	14,100	123	533	0.1	93.5	93.5	94.3	0.8

¹ FEET ABOVE CONFLUENCE WITH PARKER RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PENN BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
PORTER RIVER								
A	9,335	380	3685	0.1	10.0	3.6 ²	4.6 ²	1.0
B	10,090	385	4660	0.1	10.0	4.0 ²	5.0 ²	1.0
C	10,497	460	2305	0.2	10.0	4.0 ²	5.0 ²	1.0
D	11,442	55	375	1.1	10.0	4.0 ²	5.0 ²	1.0
E	12,350	65	350	1.2	10.0	4.1 ²	5.1 ²	1.0
F	13,533	85	430	1.0	10.0	4.2 ²	5.2 ²	1.0
FROST FISH BROOK								
G	14,721	20	100	3.9	10.0	8.0 ²	8.1 ²	0.1
H	15,418	50	100	3.8	10.0	9.8 ²	10.5 ²	0.7
I	16,320	10	35	10.5	12.7	12.7	12.9	0.2
J	16,838	20	110	3.4	15.1	15.1	16.1	1.0

¹ FEET ABOVE COPORATE LIMITS

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM BEVERLY HARBOR

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

PORTER RIVER AND FROST FISH BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	250	123	1818	0.9	10.8	7.9 ²	8.9 ²	1.0
B	380	145	1808	0.9	10.8	7.9 ²	8.9 ²	1.0
C	1,960	236	2161	0.8	10.8	7.9 ²	8.9 ²	1.0
D	2,250	39	577	2.9	10.8	7.9 ²	8.9 ²	1.0
E	2,400	39	423	4.0	10.8	7.9 ²	8.9 ²	1.0
F	2,680	48	658	2.6	10.8	8.3 ²	9.3 ²	1.0
G	2,814	38	545	3.1	10.8	8.3 ²	9.3 ²	1.0
H	5,350	222	2483	0.7	10.8	8.5 ²	9.5 ²	1.0
I	6,500	629	4823	0.4	10.8	8.5 ²	9.5 ²	1.0
J	7,800	106	1029	1.5	10.8	8.5 ²	9.5 ²	1.0
K	8,360	46	182	8.2	10.8	8.5 ²	9.5 ²	1.0
L	8,750	13	97	15.5	32.2	32.2 ²	32.2 ²	0.0
M	9,000	32	130	11.5	51.6	51.6 ²	51.6 ²	0.0
N	9,250	29	125	12.0	66.5	66.5 ²	66.5 ²	0.0
O	9,470	49	359	4.2	74.6	74.6 ²	74.6 ²	0.0
P	9,600	57	353	4.2	74.8	74.8 ²	74.8 ²	0.0
Q	10,350	86	703	2.1	75.2	75.2 ²	75.2 ²	0.0
R	10,470	94	833	1.8	76.7	76.7 ²	76.7 ²	0.0
S	10,940	77	715	2.1	76.7	76.7	76.8	0.1
T	11,060	73	755	2.0	77.1	77.1	77.2	0.1
U	11,330	115	894	1.7	77.1	77.1	77.2	0.1
V	11,405	74	250	6.0	89.0	89.0	89.0	0.0

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

POWWOW RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	565	*	19	6.4	18.9	12.7 ²	12.9 ²	0.2
B	1,185	15	111	1.1	22.7	22.7	23.3	0.6
C	2,430	*	25	4.7	30.4	30.4	30.9	0.5
D	2,485	50	334	0.4	30.4	30.4	31.4	1.0
E	3,315	120	485	0.2	30.5	30.5	31.5	1.0
F	4,625	50	74	1.6	36.3	36.3	36.4	0.1
G	5,770	100	265	0.5	50.7	50.7	51.6	0.9
H	5,840	98	355	0.3	50.8	50.8	51.6	0.8

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

RIVERSIDE AIRPORT BROOK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
SAUGUS RIVER								
A	0	22	97	11.5	10.0	4.8	4.9	0.1
B	1,200	55	233	4.8	10.0	7.7	7.7	0.0
C	2,100	55	219	5.1	10.0	8.2	9.1	0.9
D	2,241	38	164	6.8	11.8	11.8	11.8	0.0
E	2,341	42	202	5.5	12.1	12.1	12.4	0.3
F	2,681	34	111	10.1	13.8	13.8	13.8	0.0
G	3,231	30	183	6.1	21.2	21.2	21.8	0.6
H	3,420	30	271	4.1	25.3	25.3	25.3	0.0
I	3,800	20	159	7.0	25.3	25.3	25.4	0.1
J	4,013	35	231	4.8	25.6	25.6	26.4	0.8
K	4,303	24	102	10.9	28.8	28.8	29.0	0.2
L	5,803	198	752	1.5	32.4	32.4	33.0	0.6
M	7,113	85	444	2.5	35.2	35.2	35.9	0.7
N	8,543	149	725	1.5	36.1	36.1	36.8	0.7
O	9,823	53	247	3.4	37.0	37.0	37.7	0.7
P	10,081	129	386	2.2	38.3	38.3	39.0	0.7
Q	11,381	24	150	5.6	40.5	40.5	40.9	0.4
R	13,181	163	921	0.9	41.5	41.5	42.1	0.6
S	15,556	30	172	4.9	42.2	42.2	42.7	0.5
T	16,095	61	147	5.7	45.0	45.0	45.0	0.0
U	17,464	48	191	4.4	45.6	45.6	46.1	0.5
V	18,204	186	862	1.0	45.8	45.8	46.7	0.9
W	18,854	27	119	7.1	46.1	46.1	46.7	0.6
X	19,894	92	314	2.7	49.6	49.6	50.5	0.9
Y	20,574	191	578	1.5	50.6	50.6	51.4	0.8
Z	21,194	85	299	2.8	51.0	51.0	51.9	0.9
AA	21,744	192	461	1.8	51.8	51.8	52.7	0.9

¹FEET ABOVE HAMILTON STREET (UPSTREAM FACE)

²ELEVATIONS COMPUTEED WITHOUT CONSIDERING BACKWATER EFFECTS FROM ATLANTIC OCEAN

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SAUGUS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	22,964	104	468	0.9	54.5	54.5	55.5	1.0
AC	23,704	74	337	1.3	54.9	54.9	55.9	1.0
AD	24,924	85	325	0.7	55.6	55.6	56.6	1.0
AE	25,984	45	181	1.2	56.6	56.6	57.1	0.5
AF	26,984	24	76	2.8	57.6	57.6	58.6	1.0
AG	27,834	52	142	1.5	59.4	59.4	60.1	0.7
AH	29,474	24	69	3.1	62.0	62.0	62.3	0.3
AI	29,734	23	70	3.1	62.7	62.7	63.1	0.4
AJ	29,814	15	55	3.9	63.0	63.0	63.5	0.5
AK ³	29,864	15	67	3.2	63.5	63.5	63.9	0.4
AL	29,889	13	38	5.6	63.7	63.7	63.9	0.2
AM	30,099	19	66	3.2	64.9	64.9	65.7	0.8
AN	30,199	24	74	2.9	65.4	65.4	66.0	0.6
AO ³	30,369	24	74	2.9	65.4	65.4	66.0	0.6
AP	30,530	14	41	5.2	65.6	65.6	66.0	0.4
AQ	30,579	19	57	3.8	66.9	66.9	67.3	0.4
AR	30,784	300	343	0.6	72.7	72.7	72.7	0.0
AS	30,864	300	175	1.2	72.7	72.7	72.7	0.0
AT	31,094	540	1,836	0.1	72.8	72.8	72.8	0.0
AU	31,304	400	2,127	0.1	72.8	72.8	72.8	0.0
AV	31,784	23	109	3.2	72.8	72.8	72.8	0.0
AW	32,734	246	1,278	0.4	72.9	72.9	72.9	0.0
AX	36,664	206	1,228	1.0	73.0	73.0	73.1	0.1
AY	41,584	210	930	1.0	73.7	73.7	74.1	0.4
AZ	41,619	294	177	5.0	74.5	74.5	74.5	0.0
BA	41,679	303	1,164	0.8	75.0	75.0	75.0	0.0
BB	42,729	35	121	2.7	75.5	75.5	75.6	0.1

¹ FEET ABOVE HAMILTON STREET (UPSTREAM FACE)

³ INTERPOLATED CROSS SECTION

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SAUGUS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	42,789	23	74	4.5	75.5	75.5	75.6	0.1
BD	42,969	38	119	2.8	76.0	76.0	76.1	0.1
BE	43,659	50	232	1.4	76.8	76.8	77.0	0.2
BF	43,694	20	120	2.8	76.8	76.8	77.0	0.2
BG	43,819	50	239	1.4	77.0	77.0	77.2	0.2
BH	44,079	31	144	2.3	77.5	77.5	77.8	0.3
BI	44,104	20	93	3.5	77.5	77.5	77.8	0.3
BJ	44,260	21	109	3.0	77.9	77.9	78.2	0.3

¹ FEET ABOVE HAMILTON STREET (UPSTREAM FACE)

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SAUGUS RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	390	53	191	0.7	44.3	44.3	44.5	0.2
B	670	15	20	6.2	44.1	44.1	44.1	0.0
C	970	30	134	0.9	44.7	44.7	45.4	0.7
D	1,350	30	101	1.3	45.1	45.1	45.7	0.6
E	1,850	17	29	4.4	45.3	45.3	45.9	0.6
F	2,380	20	85	1.5	53.0	53.0	53.0	0.0
G	3,050	15	24	5.2	53.2	53.2	53.3	0.1
H	3,500	18	34	3.7	58.2	58.2	58.2	0.0
I	3,725	30	120	1.1	61.9	61.9	62.8	0.9
J	4,082	20	89	1.4	63.6	63.6	63.6	0.0

¹ FEET ABOVE CONFLUENCE WITH BRANCH OF IPSWICH

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SCHOOL BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,109	72	786	4.7	33.6	23.0 ²	23.4 ²	0.4
B	1,657	94	767	4.8	33.6	25.2 ²	25.5 ²	0.3
C	15,337	89	1,069	3.5	33.6	30.1 ²	30.6 ²	0.5
D	15,474	66	931	4.0	33.6	31.3 ²	31.5 ²	0.2
E	18,922	115	1,053	3.4	33.6	32.4 ²	32.8 ²	0.4
F	19,143	98	1,144	3.1	35.7	35.7	35.7	0.0
G	27,092	171	1,182	2.8	39.8	39.8	40.3	0.5
H	27,227	139	1,096	3.1	40.7	40.7	41.1	0.4
I	28,060	98	1,319	2.5	41.3	41.3	41.8	0.5
J	28,122	127	938	3.6	44.7	44.7	44.8	0.1
K	30,566	61	466	7.2	48.3	48.3	48.4	0.1
L	30,614	47	441	7.6	49.7	49.7	49.8	0.1
M	30,714	61	652	5.1	50.8	50.8	50.9	0.1
N	31,469	145	607	5.5	52.0	52.0	52.1	0.1
O	33,909	76	574	5.8	57.6	57.6	57.7	0.1
P	33,989	65	568	5.9	61.3	61.3	61.3	0.0
Q	34,444	84	912	3.5	62.2	62.2	62.3	0.1
R	34,576	84	946	3.4	63.8	63.8	64.1	0.3
S	44,619	80	638	5.0	63.8	63.8	64.3	0.5
T	45,270	87	742	4.3	64.8	64.8	65.2	0.4
U	45,340	91	1,397	2.3	71.2	71.2	71.6	0.4
V	49,199	128	1,176	2.8	72.0	72.0	72.4	0.4
W	49,280	670	4,283	0.8	74.6	74.6	74.8	0.2

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING THE BACKWATER EFFECTS FROM MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SHAWSHEEN RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
SHUTE BROOK								
A	-2,540	38	218	3.5	10.0	6.2 ²	6.8	0.6
B	-240	31	179	4.2	10.0	9.7 ²	10.4	0.7
C	0	12	72	10.5	13.1	13.1	13.1	0.0
D	50	26	201	3.8	15.4	15.4	15.4	0.0
E	730	27	188	4.0	15.5	15.5	16.1	0.6
F	830	27	209	3.6	15.6	15.6	16.3	0.8
G	985	32	196	3.9	15.6	15.6	16.4	0.8
H	2,445	26	130	4.6	18.0	18.0	18.8	0.8
I	2,540	12	85	7.1	21.2	21.2	21.3	0.1
J	2,642	12	130	4.5	24.3	24.3	24.3	0.0
K	3,467	30	280	2.1	24.5	24.5	24.6	0.1
L	3,558	15	152	3.9	24.6	24.6	24.9	0.3
M	3,698	31	307	1.9	24.6	24.6	25.2	0.6
N	3,836	57	449	1.3	24.8	24.8	25.7	0.9
O	4,008	34	321	1.8	24.8	24.8	25.7	0.9
P	4,348	28	248	1.1	24.8	24.8	25.8	1.0
Q	4,423	22	203	1.4	24.9	24.9	25.9	1.0

¹FEET ABOVE CENTRAL STREET CULVERT (UPSTREAM FACE)

²ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM ATLANTIC OCEAN

TABLE 12	FEDERAL EMERGENCY MANAGEMENT AGENCY <small>(UPSTREAM FACE)</small> ESSEX COUNTY, MA (ALL JURISDICTIONS)	FLOODWAY DATA
		SHUTE BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
B	647	323 ²	2,109	1.5	79.3	79.3	79.8	0.5
C	823	287 ²	1,885	1.0	80.0	80.0	81.0	1.0

¹ FEET ABOVE DOWNSTREAM CORPORATE LIMITS

² FLOODWAY WIDTH EXTENDS BEYOND CORPORATE LIMITS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SKUG RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	655	*	232	10.3	33.6	17.6 ²	17.8 ²	0.2
B	735	78	710	3.4	33.6	19.7 ²	19.8 ²	0.1
C	1,112	52	330	7.3	33.6	22.5 ²	22.5 ²	0.0
D	1,172	46	291	8.3	33.6	22.5 ²	22.5 ²	0.0
E	1,805	67	314	7.6	33.6	25.4 ²	25.4 ²	0.0
F	2,295	68	375	6.4	33.6	26.5 ²	26.5 ²	0.0
G	2,925	*	303	7.9	33.6	33.3 ²	33.3 ²	0.0
H	3,760	57	252	9.5	37.8	37.8	37.9	0.1
I	4,805	82	436	5.5	40.7	40.7	40.8	0.1
J	4,855	89	641	3.7	41.1	41.1	41.2	0.1
K	5,496	55	609	3.9	48.1	48.1	48.7	0.6
L	6,260	60	726	3.3	48.4	48.4	48.9	0.5
M	6,367	*	731	3.3	48.9	48.9	49.6	0.7
N	7,260	*	529	4.5	49.5	49.5	50.3	0.8
O	8,100	*	713	3.4	50.0	50.0	50.6	0.6
P	8,150	*	783	3.1	50.2	50.2	50.6	0.4
Q	8,950	*	774	3.1	50.2	50.2	50.7	0.5
R	9,052	*	546	4.4	50.2	50.2	50.7	0.5
S	9,750	*	738	3.3	50.6	50.6	51.0	0.4
T	10,966	*	545	4.0	51.4	51.4	52.2	0.8
U	11,016	*	475	4.6	51.4	51.4	52.2	0.8
V	11,055	*	489	4.5	51.9	51.9	52.6	0.7
W	11,484	*	1142	1.9	52.5	52.5	53.5	1.0
X	11,498	*	232	9.5	56.8	56.8	56.9	0.1
Y	12,598	*	524	4.2	58.7	58.7	58.7	0.0
Z	14,500	80	783	2.8	59.4	59.4	60.3	0.9
AA	14,650	80	658	3.3	59.5	59.5	60.4	0.9

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM MERRIMACK RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

SPICKET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AB	15,550	80	754	2.9	60.1	60.1	60.9	0.8
AC	15,710	80	677	3.3	60.8	60.8	61.4	0.6
AD	17,240	71	571	3.9	61.1	61.1	61.8	0.7
AE	17,450	70	550	4.0	61.3	61.3	61.9	0.6
AF	18,665	40	264	8.3	70.4	70.4	70.4	0.0
AG	18,880	38	178	12.4	71.6	71.6	71.6	0.0
AH	19,200	50	515	3.9	106.2	106.2	106.2	0.0
AI	19,400	76	532	3.8	107.1	107.1	107.5	0.4
AJ	20,620	80	510	3.9	107.1	107.1	107.8	0.7
AK	20,780	80	548	3.7	108.0	108.0	108.6	0.6
AL	22,785	80	738	8.7	109.1	109.1	109.5	0.4
AM	23,000	80	677	3.0	109.4	109.4	109.7	0.3
AN	23,950	80	742	2.7	109.7	109.7	110.0	0.3
AO	27,060	80	674	3.0	110.5	110.5	111.1	0.6
AP	28,700	80	739	2.7	110.7	110.7	111.6	0.9

¹ FEET ABOVE CONFLUENCE WITH MERRIMACK RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

**ESSEX COUNTY, MA
(ALL JURISDICTIONS)**

FLOODWAY DATA

SPICKET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	1,267	10	27	5.3	18.2	18.2	18.2	0.0

¹ FEET ABOVE CONFLUENCE WITH NORTH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

STRONGWATER BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	422	80	137	1.2	44.6	39.5 ²	40.2 ²	0.7
B	539	40	90	1.8	44.6	40.2 ²	40.3 ²	0.1
C	792	90	154	1.1	44.6	40.3 ²	41.1 ²	0.8
D	1,030	10	21	7.8	44.6	42.1 ²	42.1 ²	0.0
E	1,214	10	34	4.9	44.6	44.6	44.6	0.0
F	1,985	220	1195	0.1	47.0	47.0	47.0	0.0
G	2,318	40	164	1.0	47.0	47.0	47.0	0.0
H	2,640	270	1156	0.1	47.0	47.0	47.0	0.0
I	3,168	130	425	0.4	47.0	47.0	47.0	0.0
J	3,453	20	44	3.8	47.0	47.0	47.0	0.0

¹ FEET ABOVE CONFLUENCE WITH GOLDTHWAITE BROOK

² ELEVATIONS COMPUTED WITHOUT CONSIDERING BACKWATER EFFECTS FROM GOLDTHWAITE BROOK

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

TAPLEY BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2,952	15	25	6.6	53.1	53.1	53.6	0.5
B	4,536	20	45	2.6	65.2	65.2	66.0	0.8
C	5,401	5	20	6.1	72.1	72.1	72.1	0.0
D	6,072	15	20	5.7	79.5	79.5	80.1	0.6
E	6,563	60	185	0.6	88.5	88.5	88.5	0.0
F	7,492	60	395	0.3	89.4	89.4	89.4	0.0

¹ DISTANCE IN FEET ABOVE CONFLUENCE WITH IPSWICH RIVER

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY A TO IPSWICH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	30	30	122	1.4	101.8	101.8	102.2	0.4
B	80	50	260	0.7	101.9	101.9	102.3	0.4
C	700	50	134	1.3	101.9	101.9	102.3	0.4
D	776	50	194	0.9	103.1	103.1	103.9	0.8
E	1,660	150	706	0.2	103.1	103.1	103.9	0.8
F	2,987	50	166	1.0	106.1	106.1	107.0	0.9

¹ FEET ABOVE BIRCH MEADOW ROAD

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

ESSEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

TRIBUTARY TO NEAL POND

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is

less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Essex County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as flood-prone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 13, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Amesbury, City of	June 14, 1974	February 11, 1977	June 18, 1980	August 3, 1992
Andover, Town of	July 26, 1974	None	August 1, 1978	June 5, 1989
Beverly, City of	August 16, 1974	December 10, 1976	March 18, 1986	June 2, 1992
Boxford, Town of	August 30, 1974	October 15, 1976 July 26, 1977	June 3, 1991	None
Danvers, Town of	July 26, 1974	January 7, 1977	July 2, 1980	None
Essex, Town of	July 26, 1974	July 23, 1976	July 17, 1986	July 2, 1992 July 20, 1998
Georgetown, Town of	July 26, 1974	December 3, 1976	June 4, 1980	None
Gloucester, City of	July 26, 1974	February 18, 1977 October 1, 1983	January 17, 1986	July 2, 1992 July 20, 1998
Groveland, Town of	June 28, 1974	January 21, 1977 November 1, 1977	October 1, 1980	None
Hamilton, Town of	November 26, 1976	None	June 4, 1990	None
Haverhill, City of	July 19, 1974	February 13, 1976	February 16, 1983	None
Ipswich, Town of	October 18, 1974	September 17, 1976 October 1, 1983	August 5, 1985	July 2, 1992

T A B L E 13	FEDERAL EMERGENCY MANAGEMENT AGENCY ESSEX COUNTY, MA (ALL JURISDICTIONS)	COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Lawrence, City of	February 8, 1974	August 6, 1976	August 2, 1982	None
Lynn, City of	June 28, 1974	September 17, 1976	February 1, 1985	None
Lynnfield, Town of	September 6, 1974	September 3, 1976	February 1, 1980	July 16, 1990
Manchester by the Sea, Town of	April 5, 1974	October 29, 1976	September 4, 1986	July 2, 1992
Marblehead, Town of	June 28, 1974	June 18, 1976	July 3, 1985	None
Merrimac, Town of	October 18, 1974	September 3, 1976	July 5, 1982	None
Methuen, City of	August 30, 1974	April 8, 1977	July 2, 1980	July 18, 1987
Middleton, Town of	December 6, 1974	November 12, 1976	November 5, 1980	None
Nahant, Town of	June 7, 1974	None	July 19, 1976	September 28, 1984
Newbury, Town of	March 15, 1977	None	March 15, 1977	July 17, 1986 July 2, 1992
Newburyport, City of	July 26, 1974	October 22, 1976	February 15, 1978	November 1, 1985
North Andover, Town of	June 28, 1974	May 10, 1977	June 15, 1983	June 2, 1993
Peabody, City of	August 2, 1974	August 20, 1976	May 15, 1980	None

T A B L E 13	FEDERAL EMERGENCY MANAGEMENT AGENCY ESSEX COUNTY, MA (ALL JURISDICTIONS)	COMMUNITY MAP HISTORY

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Rockport, Town of	August 9, 1974	October 8, 1976	June 19, 1985	July 2, 1992
Rowley, Town of	July 26, 1974	November 12, 1976	August 5, 1986	June 30, 1999
Salem, City of	July 26, 1974	None	March 15, 1977	August 5, 1985
Salisbury, Town of	September 13, 1974	None	May 2, 1977	June 24, 1977 September 4, 1986 July 2, 1992 July 7, 2009
Saugus, Town of	September 13, 1974	December 10, 1976	January 19, 1983	None
Swampscott, Town of	May 24, 1974	None	September 3, 1976	July 3, 1985 July 2, 1992
Topsfield, Town of	September 13, 1974	July 23, 1976	June 4, 1980	June 17, 1991
Wenham, Town of	July 26, 1974	July 23, 1976	June 19, 1989	August 19, 1991
West Newbury, Town of	August 16, 1974	None	June 15, 1979	None

T A B L E 13	FEDERAL EMERGENCY MANAGEMENT AGENCY ESSEX COUNTY, MA (ALL JURISDICTIONS)	COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Essex County has been compiled in this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FIRMs, and/or FHBMs for all of the incorporated jurisdictions within Essex County.

Essex County is bordered by Suffolk County, MA to the south, Middlesex County, MA to the west, and Rockingham County, New Hampshire to the north. At the time of this revision, both of the Massachusetts counties were undergoing countywide revisions. They will all be in agreement with this countywide FIS.

This FIS report either supersedes or is compatible with all previous studies published on flooding sources studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA Region I, 99 High Street, 6th Floor, Boston, MA 02110.

9.0 BIBLIOGRAPHY AND REFERENCES

- 1 Federal Emergency Management Agency. Flood Insurance Study, Town of Amesbury, Essex County, Massachusetts, Washington, D. C., August 3, 1992.
- 2 Federal Emergency Management Agency. Flood Insurance Study, Town of Andover, Essex County, Massachusetts, Washington, D.C., June 5, 1989.
- 3 Federal Emergency Management Agency. Flood Insurance Study, City of Beverly, Essex County, Massachusetts, Washington, D.C., March 18, 1986.
- 4 Federal Emergency Management Agency. Flood Insurance Study, Town of Boxford, Essex County, Massachusetts, Washington, D.C., June 3, 1991.
- 5 Federal Emergency Management Agency, Federal Insurance Administration. Flood Insurance Study, Town of Danvers, Essex County, Massachusetts, Washington, D.C., January, 1980
- 6 Federal Emergency Management Agency. Flood Insurance Study, Town of Essex, Essex County, Massachusetts, Washington D.C., July 17, 1986.
- 7 Federal Emergency Management Agency. Flood Insurance Study, Town of Georgetown, Essex County, Massachusetts, Washington D.C., December 4, 1979.

- 8 Federal Emergency Management Agency. Flood Insurance Study, City of Gloucester, Essex County, Massachusetts, Washington, D.C., January 17, 1986.
- 9 Federal Emergency Management Agency, Federal Insurance Administration. Flood Insurance Study, Town of Groveland, Essex County, Massachusetts, Washington, D.C., April 1, 1980.
- 10 Federal Emergency Management Agency. Flood Insurance Study, Town of Hamilton, Essex County, Massachusetts, Washington, D.C., June 4, 1990.
- 11 Federal Emergency Management Agency. Flood Insurance Study, City of Haverhill, Essex County, Massachusetts, Washington, D.C., February 16, 1983.
- 12 Federal Emergency Management Agency. Flood Insurance Study, Town of Ipswich, Essex County, Massachusetts, Washington, D.C., February 5, 1985.
- 13 Federal Emergency Management Agency. Flood Insurance Study, City of Lawrence, Essex County, Massachusetts, Washington, D.C., February 2, 1982.
- 14 Federal Emergency Management Agency. Flood Insurance Study, City of Lynn, Essex County, Massachusetts, Washington, D.C., August 1, 1984.
- 15 Federal Emergency Management Agency. Flood Insurance Study, Town of Lynnfield, Essex County, Massachusetts, Washington, D.C., July 16, 1990.
- 16 Federal Emergency Management Agency. Flood Insurance Study, Town of Manchester, Essex County, Massachusetts, Washington, D.C., September 4, 1986.
- 17 Federal Emergency Management Agency. Flood Insurance Study, Town of Marblehead, Essex County, Massachusetts, Washington, D.C., July 3, 1985.
- 18 Federal Emergency Management Agency. Flood Insurance Study, Town of Merrimac, Essex County, Massachusetts, Washington, D.C., January 5, 1982.
- 19 Federal Emergency Management Agency. Flood Insurance Study, Town of Methuen, Essex County, Massachusetts, Washington, D.C., June 18, 1987.
- 20 Federal Emergency Management Agency. Flood Insurance Study, Town of Middleton, Essex County, Massachusetts, Washington, D.C., November 5, 1980.
- 21 Federal Emergency Management Agency. Flood Insurance Study, Town of Nahant, Essex County, Massachusetts, Washington, D.C., March 28, 1984.
- 22 Federal Emergency Management Agency. Flood Insurance Study, Town of Newbury, Essex County, Massachusetts, Washington, D.C., July 17, 1986.

- 23 Federal Emergency Management Agency. Flood Insurance Study, City of Newburyport, Essex County, Massachusetts, Washington, D.C., November 1, 1985.
- 24 Federal Emergency Management Agency. Flood Insurance Study, Town of North Andover, Essex County, Massachusetts, Washington, D.C., June 2, 1993.
- 25 Federal Emergency Management Agency. Flood Insurance Study, City of Peabody, Essex County, Massachusetts, Washington, D.C., November 15, 1979.
- 26 Federal Emergency Management Agency. Flood Insurance Study, Town of Rockport, Essex County, Massachusetts, Washington, D.C., December 19, 1984.
- 27 Federal Emergency Management Agency. Flood Insurance Study, Town of Rowley, Essex County, Massachusetts, Washington, D.C., August 5, 1986.
- 28 Federal Emergency Management Agency. Flood Insurance Study, City of Salem, Essex County, Massachusetts, Washington, D.C., August 5, 1985.
- 29 Federal Emergency Management Agency. Flood Insurance Study, Town of Salisbury, Essex County, Massachusetts, Washington, D.C., July 7, 2009.
- 30 Federal Emergency Management Agency. Flood Insurance Study, Town of Saugus, Essex County, Massachusetts, Washington, D.C., July 19, 1982.
- 31 Federal Emergency Management Agency. Flood Insurance Study, Town of Swampscott, Essex County, Massachusetts, Washington, D.C., January 3, 1985.
- 32 Federal Emergency Management Agency. Flood Insurance Study, Town of Topsfield, Essex County, Massachusetts, Washington, D.C., June 2, 1994.
- 33 Federal Emergency Management Agency. Flood Insurance Study, Town of Wenham, Essex County, Massachusetts, Washington, D.C., August 19, 1991.
- 34 Federal Emergency Management Agency, Federal Insurance Administration. Flood Insurance Study, Town of West Newbury, Essex County, Massachusetts, Washington, D.C., December 15, 1978.
- 35 U.S. Census Massachusetts/prepared by the U.S. Census Bureau 2010 www.census.gov/.
- 36 North Andover League of Women Voters, North Andover Know Your Town, North Andover, Massachusetts, 1988.
- 37 U. S. Army Corps of Engineers, New England Division, Floodplain Information, Merrimack-Shawsheen-Spicket Rivers, Waltham, Massachusetts, 1972.

- 38 Commonwealth of Massachusetts, Geodetic Survey, High-Water Data, Flood of March 1936 in Massachusetts, Boston, Massachusetts, November 1963.
- 39 U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1826, Water Resources of the Ipswich River Basin, Massachusetts by E. A. Samuel, J. A. Baker, and R. A. Brackley, Washington, D. C., 1966.
- 40 U. S. Department of the Interior, Geological Survey, Water-Supply Paper 1671, Magnitude and Frequency of Floods in the United States, Part I-A, North Atlantic Slope Basin, Maine to Connecticut by Rice A. Green, Washington, D. C., 1964.
- 41 U. S. Department of the Interior, Geological Survey, Water Resources Data for Massachusetts, Boston, Massachusetts, Published Annually 1961-76.
- 42 U. S. Department of the Interior, Geological Survey, Hydrologic Investigations Atlas HA-482, Flood of March 1968, The Ipswich River, Massachusetts by L. A. Swallow and D. J. Fogarty, Washington, D. C., 1973.
- 43 U. S. Army Corps of Engineers, North Atlantic Division, National Shoreline Study, Regional Inventory Report, North Atlantic Region, Volume I, New York, 1971.
- 44 Town of Boxford, Zoning Bylaw of the Town of Boxford, Boxford, Massachusetts, August 1985
- 45 Town of Danvers, Zoning Map, Section XI A, Inland Floodplain Watershed Protection Districts, Scale 1"=600', Danvers, Massachusetts, 1974.
- 46 Duffill Associates, Inc., Department of Public Works of Massachusetts, Division of Waterways, Proposed Drainage Improvements, Beaver Brook, Danvers, Massachusetts, Boston, Massachusetts, April 1957.
- 47 Duffill Associates, Inc., Department of Public Works of Massachusetts, Division of Waterways, Proposed Stream Improvements, Crane Brook, Mill Pond to Vicinity of Collins Street, Danvers, Boston, Massachusetts, August 1957.
- 48 Duffill Associates, Inc., Department of Public Works of Massachusetts, Division of Waterways, Proposed Stream Improvements, Crane Brook and Tributaries, Danvers, Boston, Massachusetts, April 1958.
- 49 Alan M. Voorhees & Associates, Inc., Hydraulic Report, Purchase Street, Crane River (Unpublished).
- 50 Town of Hamilton, Town of Hamilton Zoning By-Law, Hamilton, Massachusetts, July 1986.
- 51 U. S. Army Corps of Engineers, New England Division, Floodplain Information, Merrimack-Shawsheen-Spicket Rivers, Waltham, Massachusetts, 1972.
- 52 U. S. Army Corps of Engineers, New England Division, National Shoreline Study, Regional Inventory Report, North Atlantic Region, Volume 1, Waltham, Massachusetts, 1971.

- 53 City of Peabody, Revised Zoning Ordinance of the City of Peabody, Peabody, Massachusetts, December 16, 1975.
- 54 Town of Topsfield, Town of Topsfield Zoning By-Law, Topsfield, Massachusetts, July 1986.
- 55 U.S. Department of the Interior, Geological Survey, Estimating the Magnitude and Frequency of Floods on Natural Flow Streams in Massachusetts, Water Resources Investigation 77-39, Boston, Massachusetts, 1977.
- 56 U. S. Department of Agriculture, Soil Conservation Service, SCS National Engineering Handbook, Hydrology, Section i, Washington, D. C., August 1972.
- 57 U.S. Army Corps of Engineers; New England Division; Water Resources Investigation; Merrimack River Basin. August 1972.
- 58 Water Resources Council, "Guidelines for Determining Flood Flow Frequency", Bulletin 17, Washington, D. C., March 1976.
- 59 U. S. Department of the Interior; Geological Survey, Water-Resources Investigations Report 84-4284, Gazetteer of Hydrologic Characteristics of Streams in Massachusetts-Merrimack River Basin, Boston, Massachusetts, 1984.
- 60 Federal Emergency Management Agency, Flood Insurance Study. Town of South Hampton, Rockingham County, New Hampshire. Washington, D.C., July 15, 1992.
- 61 U. S. Department of the Interior, Geological Survey, Water-Supply Paper 2214, Estimating Peak Discharges of Small; Rural Streams in Massachusetts, Washington, D. C., 1983.
- 62 Carl G. Johnson and Gary D. Tasker, Hydrologic Study: Small Watersheds, Progress Report on Flood Magnitude and Frequency of Massachusetts Streams, March 1974.
- 63 U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps: Scale 1:24,000, Contour Interval 10 feet: Haverhill, Massachusetts (1972), Newburyport West, Massachusetts (1968), South Groveland, Massachusetts (1966), Georgetown, Massachusetts (1966)
- 64 U.S. Weather Bureau, Blue Hills Observatory, Milton, Massachusetts
- 65 U. S. Department of Commerce, National Oceanic and Atmospheric Administration, United States Coast Pilot 1, Atlantic Coast, Eastport to CapeCod, Asheville, North Carolina, National Climatic Center, November 1976.
- 66 U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Town of North Reading, Massachusetts, June 1977
- 67 U.S. Department of Agriculture, Soil Conservation Service, Technical Paper No. 149, A Method for Estimating Volume and Rate of Runoff in Small Watersheds, April 1973
- 68 Technical Release No. 55, Urban Hydrology for Small Watersheds, January 1975

- 69 U.S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall-Frequency Atlas of the United States, January 1963
- 70 Ven Te Chow, ed., Handbook of Applied Hydrology, New York, McGraw-Hill, 1964.
- 71 U. S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, Washington, D. C., 1977.
- 72 W. Viessman, Jr., et al., Introduction to Hydrology, New York, New York, 1972.
- 73 Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Town of Tewksbury, Middlesex County, Massachusetts, Washington, D.C, July 2, 1981.
- 74 G. M. Fair, and J. C. Geyer, Water-Supply and Wastewater Disposal, New York: John Wiley & Sons Inc., 1954
- 75 U.S. Department of the Interior, Geological Survey, Water Resources Data for Massachusetts, New Hampshire, Rhode Island, and Vermont, 1960, 1977.
- 76 Federal Emergency Management Agency, Flood Insurance Study, Town of Rowley, Essex County, Massachusetts (Unpublished).
- 77 U. S. Department of the Interior, Geological Survey, Water-Supply Paper 2207, Flood Characteristics of Urban Watersheds in the United States, by V.B. Sauer, W.O. Thomas, Jr., V.A. Stricher, and K.V. Wilson, Washington, D. C., 1983.
- 78 U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Town of Wakefield, Middlesex County, Massachusetts, Washington, D. C., April 17, 1978.
- 79 U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles. Generalized Computer Program, Davis, California, May 1991.
- 80 U. S. Army Corps of Engineers, Hydrologic Engineering Center, Application of the HEC-2 Bridge Routines. Training Document No.6, Davis, California, June 1974.
- 81 U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Intervals 10 Feet and 3 Meters: Georgetown, Massachusetts; Salem, Massachusetts.
- 82 U. S. Department of Agriculture, Soil Conservation Service, Technical Paper No. 149, A Method for Estimating Volume of Rate of Runoff In Small Watersheds, April 1973.
- 83 U. S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, January 1963.
- 84 Fair, G. M., and J. C. Geyer, Water Supply and Wastewater Disposal. New York: John Wiley & Sons, Inc., 1954.
- 85 Teledyne Geotronics of Long Beach, California, Topographic Maps, Scale 1:4,800, Contour Interval 5 Feet: Merrimac, Massachusetts, April 1979.
- 86 U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Salem, Massachusetts (Unpublished).

- 87 New England Coastal Engineering, One Dimensional Storm Surge Model for Coastal Rivers Including Application to the Damariscotta and Sheepscot Rivers, Maine, and Chatham Harbor, Massachusetts, Bangor, Maine, July 1977.
- 88 U. S. Department of the Interior, Geological Survey, Water Resources Investigations 79-61, Coastal Flood of February 2, 1978, in Maine, Massachusetts, and New Hampshire, Boston, Massachusetts, 1979.
- 89 National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surges, Washington, DC, 1977
- 90 U.S. Army Corps of Engineers, Coastal Engineering Research Center, Coastal Engineering Technical Note No. 6, Revised Method for Wave Forecasting in Shallow Water, Fort Belvoir, Virginia, March 1981.
- 91 Stone and Webster Engineering Corporation, Manual for Wave Runup Analysis, Coastal Flood Insurance Studies, Boston, Massachusetts, November 1981.
- 92 U.S. Department of the Interior, Geological Survey, No. 79-61, Coastal Flood of February 7, 1978, in Maine, Massachusetts, and New England, Augusta, Maine, 1979.
- 93 Stone & Webster Engineering Corporation, Determination of Coastal Storm Tide Levels, Boston, Massachusetts, October 1978.
- 94 Jonathon French, Camp, Dresser & McKee, Memorandum on "Special Computation Procedure Developed for Wave Runup Analysis for Casco Bay, FIS-Maine, 9700-153," December 29, 1982.
- 95 P. Williams, PRC Harris, Interoffice Correspondence on "Wave Runup Methodology, Massachusetts and Rhode Island Flood Insurance Study," April 7, 1983.
- 96 Federal Emergency Management Agency. (April 2003). Guidelines and Specifications for Flood Hazard Mapping Partners. Appendix D: Guidance for Coastal Flooding Analyses and Mapping. Washington, D.C.
- 97 Federal Emergency Management Agency, Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update, February 2007
- 98 U.S. Army Corp of Engineers, Hydraulics and Water Quality Section. Tidal Flood Profiles New England Coastline. September 1988.
- 99 Goda, Y. (2000). Random Seas and Design of Maritime Structures. World Scientific, Singapore.
- 100 STARR, (2012). *Updating tidal profiles for the New England coastline*
- 101 Hoskings, J. R. M. (1997). Regional frequency analysis: An approach based on moments. Cambridge, U.K.: Cambridge University Press.
- 102 Federal Emergency Management Agency, User's Manual for Wave Height Analysis, Washington, D.C., February 1981.
- 103 Federal Emergency Management Agency, Coastal Hazard Analysis Modeling Program (CHAMP), Version 2.0, Washington, D.C., August 2007.
- 104 U.S. Army Corps of Engineers, Coastal Engineering Research Center. (1984). Shore Protection Manual. (Volumes I and II, 4th Edition). Washington, D.C.
- 105 U.S. Department of Commerce, Coast and Geodetic Survey, Gulf of Maine Coastal Chart, #13009, 34th Edition, March 1, 2009.
- 106 Geod Surveying and Aerial Mapping Corporation, of Oak Ridge, New Jersey, Aerial Photographs.

- 107 National Oceanic and Atmospheric Administration, Coastal Services Center, 2000 Fall East Coast, <http://maps.csc.noaa.gov/TCM/>.
- 108 U. S. Army Corps of Engineers, New England Division, Topographic Maps, Scale 1:4,800, Contour Interval 5 Feet: Andover, Massachusetts.
- 109 James W. Sewall, Co., of Old Town, Maine, photogrammetric Maps, Scale 1"=400', Contour Interval 5 Feet: Beverly, Massachusetts, 1979.
- 110 Dewbury and Davis of Arlington, Virginia, Work Maps for Parker River and Fish Brook in Boxford, Massachusetts, 1:4800, Contour Interval 4 Feet, 1987.
- 111 Massachusetts Department of Public Works, Topographic Maps, Beverly Danvers, Peabody, Scale 1"=200', Contour Interval 5 feet, Boston, Massachusetts, December 1971.
- 112 Moore Survey and Mapping Corporation, Topographic Maps, Scale 1"-400', Contour Interval 5 Feet: Danvers, Massachusetts, December 1977.
- 113 James W. Sewall, Co., of Old Town, Maine, Topographic Maps, Scale 1:2,400, Contour Interval 5 Feet: Ipswich, Massachusetts, 1979.
- 114 U.S.. Department of the Interior, Geological Survey, Topographic M~, Scale 1:24,000, Contour Interval 10 feet: Reading, Massachusetts, (1966); Salem, Massachusetts (1970)
- 115 Commonwealth of Massachusetts, Department of Public Works, Topographic Maps, Route 128, Scale 1:24,000, Contour Interval 5 feet: Stoneham, Reading, Wakefield, and Lynnfield, Massachusetts, April 1973
- 116 James W. Sewall, Co., of Old Town, Maine, Topographic Maps, Scale 1:2,400, Contour Interval 5 Feet: Nahant, Massachusetts, December 1978.
- 117 U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:25,000, Contour Interval 10 Feet: South Groveland, 1979; Georgetown, 1979.