Section IV Risk Assessment

INTRODUCTION

The Risk Assessment evaluates Cumberland County's vulnerability to natural hazards and provides sufficient information to identify and prioritize appropriate mitigation actions to reduce losses. The section starts with a brief overview of scientific research on climate variation and the possible effects on Cumberland County.

Climate Variation

The purpose of this part of the plan is to provide an overview of how climate has changed over time, as documented in various scientific studies, and how that change may be impacting the occurrence and severity of natural hazards in Cumberland County. Projecting future climate change can be problematic because, as stated in the document "Maine's Climate Future, 2015 Update" by the University of Maine, climate projections are uncertain for several reasons: natural climate variability, incomplete descriptions of the climate system in computer models, and difficulty in predicting future greenhouse gas emissions (page 6).

Table 1 provides a listing of resources used in researching the effects of climate variations in Cumberland County.

Table 1 Resources

Resources used in Planning	
Climate Change 2014: Impacts, Adaptation, and Vulnerability Fifth Assessment Report	November 2014 Intergovernmental Panel on Climate Change
Sebago Lake Watershed, Maine Climate Adaptation Plan	May 2013 Manomet Center for Conservation Sciences
Maine's Climate Future - 2015 Update	February 2015 University of Maine Climate Change Institute
York Adaptation to Sea Level Rise Chapter of Town of York Emergency Plan	November 2013 Southern Maine Regional Planning Commission
FEMA Mitigation Planning Toolkit	FEMA
National Flood Insurance Program Community Rating System Coordinator's Manual	2013 FEMA
Flood Insurance Manual, Effective October 1, 2014	2014 FEMA
Sea Level Rise and Casco Bay's Wetlands (individual reports on eight Cumberland County towns)	2013 Casco Bay Estuary Partnership/ University of Maine
2013 State Hazard Mitigation Plan	2013 MEMA
People and Nature: Adapting to Climate Change	2010 Maine EPA
Climate Change and Biodiversity in Maine: A Climate Change Exposure Summary for Species and Key Habitats	2013 Manomet Center for Conservation Sciences
Exercises and Trainings in Preparation	
Maine Climate Change Adaptation Tabletop Exercise (Regional Resiliency Assessment Program)	February 2015 FEMA Region 1
Maine Climate, Adaptation and Sustainability Conference	October 2014 University Of Maine Climate Change Institute

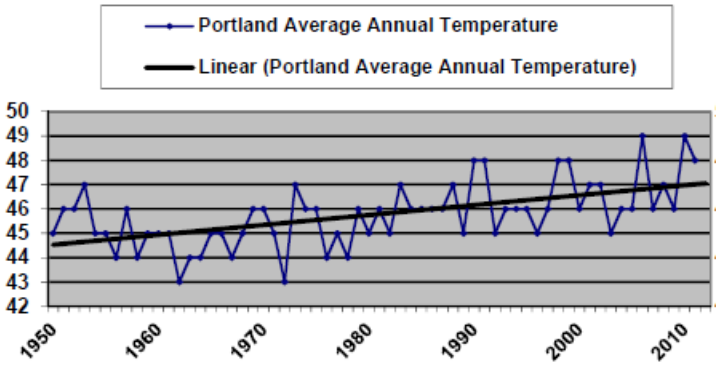
Temperature Changes: Excerpts from the report "Maine's Climate Future, 2015 Update," prepared by the University of Maine, include the following:

> "Average annual temperature across Maine warmed by about 3.0 degrees F between 1895 and 2014….Although the overall warming trend…is clear, Maine's temperature signal also features significant year to year fluctuations superimposed on a distinct pattern with periods of relative cold…and warmth…" (page 2).
>
> "Numerical models of the global atmosphere and ocean have been in development for over three decades. The most sophisticated of these models, such as those used by the Intergovernmental Panel on Climate Change (IPCC)…predict that annual temperature will increase another 3.0-5.0°F…across Maine between now and 2050" (page 3).

"Maine's warm season…increased by two weeks from the early 1900s to the 2000s. Global climate models predict that the warm season will increase by an additional two weeks over the next 50 years. Winter is warming at a faster rate than summer." (page 3)

The following is an excerpt from the Maine State Hazard Mitigation Plan 2013 Update: "The National Weather Service in Gray, Maine, has compiled monthly average and annual average temperatures for a long period of time at three locations in Maine: The Portland International Jetport (1940-present); the Bangor International Airport (1953-1994 and 1999-present), and the Caribou Airport. The data from all three measuring stations show that annual average temperatures have gradually increased at all three locations…although the increase has been greatest at the Portland Jetport station" (page 3-4).

The chart below, taken from the State's Hazard Mitigation Plan, page 3-5, shows how temperature has changed at the Portland Jetport between 1950 and 2010.



Precipitation Changes: Excerpts from the report "Maine's Climate Future, 2015 Update," include the following:

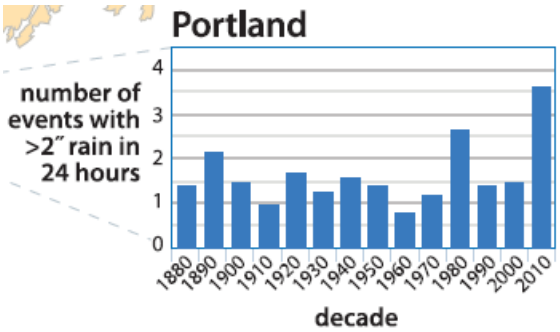
> "Since 1895, total annual precipitation has increased by about six inches…or 13%, with most of the additional amount falling in summer and fall. IPCC models predict that precipitation will continue to increase across the Northeast by 5-10% between now and 2050, although the distribution is likely to vary across the climate zones. Model predictions show greater increases in precipitation in interior Maine…whereas measurements to date from the weather stations across the Maine landscape show that precipitation has increased most along the coast" (page 8).

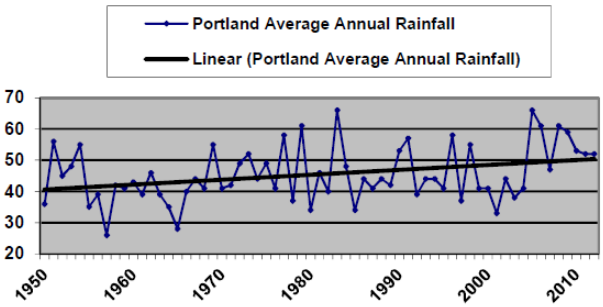
"A significant increase in extreme precipitation events (more frequent and intense storms) has been observed across Maine and other parts of the eastern U.S….we define an extreme precipitation event for this analysis

as one in which two or more inches (five or more cm) of precipitation falls within a 24-hour period. Historical measurements show that extreme events vary across the state, occurring most often in the coastal zone and western mountains... Higher total precipitation and a higher frequency of extreme precipitation events in coastal Maine are related to the zone's proximity to Atlantic storm tracks. (page 9).

The following is an excerpt from the Maine State Hazard Mitigation Plan 2013 Update: "The National Weather Service has also compiled monthly average and annual average precipitation at the Portland Jetport, the Bangor International Airport and the Caribou Municipal Airport. The data from all three measuring stations show that average annual precipitation …has gradually increased at all three locations…The increase has been greatest at the Portland Jetport and the Caribou Municipal Airport" (page 3-5).

The figure on the left below (from Maine's Climate Future 2015 Update p.9) shows extreme precipitation events from 1880-2010. The chart on the right, taken from the State's Hazard Mitigation Plan – 2013 Update, page 3-6, shows how precipitation has changed at the Portland Jetport between 1950 and 2010.





"In general, the snow season has declined on average across Maine since the late 1800s…On a simplified linear trend, the snowfall has declined by about 15%....although the amount and duration of snow may decline in the future, extreme snowfall events with significant accumulation – strong nor'easters – are likely to increase in frequency" (page 10).

"The Northeast has experienced a greater recent increase in extreme precipitation than any other region in the U.S.; between 1958 and 2010, the Northeast saw more than a 70% increase in the amount of precipitation falling in very heavy events, taxing an already stressed and aging infrastructure" (page 11).

Description of Hazards	
Requirement §201.6(c)(2)(i): (The plan shall include) a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	
Element	B1. Does the Plan include a description of the type, location and extent of all natural hazards that can affect each jurisdiction?
	B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction?

Table 2 below examines each hazard that may threaten Cumberland County. Rating their priority was accomplished through the 2013 County hazard vulnerability assessment and review of the State Mitigation Plan, as well as through discussions with town/city officials. CCEMA also reviewed past disaster declarations and other historical records. The first four High priority hazards that this plan targets remain the same as in the 2012 Plan: flooding (including dam failure/breach), severe summer storms (thunderstorms, hurricanes

and tornados), severe winter storms (snowstorms, blizzards, nor'easters, ice storms), and wildfire. The fifth High priority hazard, coastal erosion, has been added as the coastal towns have begun to recognize increasing erosion from more intense and more frequent coastal storms.

Table 2 Hazards Profiled in 2017 Plan

Summary of Hazards Profiled in the Plan		
Hazard	**How Identified**	**Why Identified**
Flooding (includes riverine, spring and stormwater runoff, ice jams, heavy rains) Includes dam failure/breach, as end result is flooding)	Review of FIRM maps Review of SLOSH maps Review of past disaster declarations (FEMA) Maine's Floodplain Management Coordinator CCEMA/MEMA records Review of repetitive loss properties Input from municipal staff	Cumberland County has suffered repeatedly from flood hazard events. These events have resulted in significant damage to property, economic disruption, reduced access for emergency vehicles, injury, and loss of life (at least three deaths).
Severe Summer Storms	Review of past disaster declarations Input from municipal staff Review of NOAA records	All of Cumberland County is subject to periodic severe summer storms. Summer storms have caused damage and injury from microbursts and tornado-like events in recent history (e.g., 2008 EF0 tornado in Gorham).
Severe Winter Storms	Review of past disaster declarations Input from municipal staff Review of NOAA records	All of Cumberland County is subject to periodic winter storms. Ice storms in 1998, 2008, and 2013 caused significant damage in Maine. The last two disaster declarations (DR-4108 in 2013, DR-4208 in 2015) that included Cumberland County were for winter storms/flooding
Wildfire	Review of Maine Forest Service records	Outside of the urbanized areas of the county, much of the land area is still forested, and while it puts the area at high risk of wildfire, it would depend on factors such as drought, humidity, or firefighting accessibility. Some areas in the county have a recent history of experiencing very small wildfires (<100 acres).
Coastal Erosion	Input from municipal staff Review of Maine Geological Survey maps Review of "Maine's Climate Future" (2015 – University of Maine Climate Change institute) Review of Fifth Intergovernmental Panel on Climate Change (IPCC) Review of Maine State Hazard Mitigation Plan.	Coastal communities have identified coastal erosion as an ongoing problem at specific locations. This hazard has been moved to high priority in recognition of rising sea levels, more intense storms predicted by climate change experts, and community concerns.

Table 3 identifies the hazards that were eliminated from further consideration in the 2017 plan, due to lack of historical evidence or lack of overall countywide severity. Although these disaster events are not profiled in the HMP, it does not mean that any of these events will not or could not occur and cause great damage. As the climate of Maine changes, the hazards may be added to the high priority list in the future. For this Plan, CCEMA's goal is to keep the plan relevant by profiling only the top five hazards.

Table 3 Table 3 Hazards Not Included in 2017 Plan

Hazard	How Identified	Reason for Non-Inclusion
Dam Failure	CCEMA dam records and files MEMA Dam Safety Program	Cumberland County has a number of high and significant hazard dams. Dam breach can cause rapid downstream flooding. Included under Flooding in the Priority Hazards section
Hurricanes	MEMA records National Weather Service NOAA website	Coastal communities are most at risk from tropical events. While hurricanes can produce heavy rains, intense winds, storm surges resulting in flooding and coastal erosion, they remain a rare event in Cumberland County. Extra-tropical events, such as nor'easters tend to cause more frequent damages (see Winter Storms). However, if hurricane probability were to increase, it would be included in future updates of the plan.
Avalanche	Review of USGS maps	There are no mountains in the county with topographic and vegetative characteristics that result in avalanches.
Blight/Infestation	MEMA data Input from stakeholders	Data indicates that there is limited history of damage, injury, or death resulting from blight and infestation in the county.
Drought	Review of NOAA records	Droughts have occurred in Cumberland County in the recent past. Thus far, the impacts of drought have been felt in limited areas. This is one hazard that will continue to bear scrutiny for the next plan revision due to the effects of climate variances.
Earthquake	Review of MEMA and FEMA data.	Maine has a steady rate of low magnitude earthquake occurrence (<4.0 and with little damage). No significant amount of motion has been shown for any fault since the last Ice Age, about 20,000 years ago, and geologic evidence demonstrates that many faults have been inactive since the formation of the Appalachians, over 300,000,000 years ago.
Ground Subsidence	Review of Maine Geological Survey records	There have been no reported incidences of sudden land subsidence occurring in Cumberland County.
Landslide	Review of Maine Geological Survey Coastal Bluffs Maps and Coastal Landslide Hazards Maps	Although landslides do occur in the county, they are localized and it is unknown as of this writing if they might pose a more widespread risk.

HAZARD PROFILES

The high priority hazards are profiled below.

HAZARD: FLOODING

Flooding is defined as a temporary inundation of normally dry land because of: the overflow of inland or tidal waters, or the unusual and rapid accumulation or runoff of surface waters from any source. The nature of Maine's geography, geology and hydrology is such that flooding is usually fast rising, but short in duration. Severe flooding in Cumberland County can cause loss of life, property damage, disruption of communications, transportation, electric service and community services, crop and livestock damage, health issues from contaminated water supplies, molds and mildew within structural components, and loss and interruption of business

In most years, Cumberland County receives a fairly high level of precipitation year round, as evidenced in Table 4 below. Widespread flooding occurs regularly in the spring and fall. Localized flooding occurs during the summer as a result of short high-intensity rainfall from thunderstorms.

Table 4 Average precipitation By Month in Cumberland County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation In Inches	3.39	3.27	4.25	4.33	4.02	3.78	3.62	3.15	3.7	4.88	4.92	4.02
Average Snowfall in Inches	19	12	13	3	0	0	0	0	0	0	2	13

- Average annual Precipitation rain 47.33" Average annual snowfall 62"
  http://www.usclimatedata.com/climate/portland/maine/united-states/usme0328

At least once in every decade, Cumberland County can expect a major flood event resulting in damage, primarily to roads.

Numerous types of floods have the potential to affect areas of Cumberland County. The flood types include: Dam Failure/Breach, Flash Flood, Ice Jam, Lacustrine (Lake Flooding), Riverine/Riparian, and Urban. Drafts of updated Floodplain boundaries (FIRM Maps) have recently been released. They are not yet finalized, so the older maps have been used in the Plan update

Generous precipitation contributes to the flood potential. The low-pressure system over the seaboard and the tendency for some storms to follow one another in rapid succession provide heavy, combined moisture. The documented gradual sea rise, as evidenced in the graph below from NOAA, coupled with wave action generated by winter storms, particularly nor'easters, have a profound effect on the nature of coastal flooding. Hurricanes occur far less frequently than severe winter storms, but could be just as, if not more, devastating depending on variables such as the tourist season.

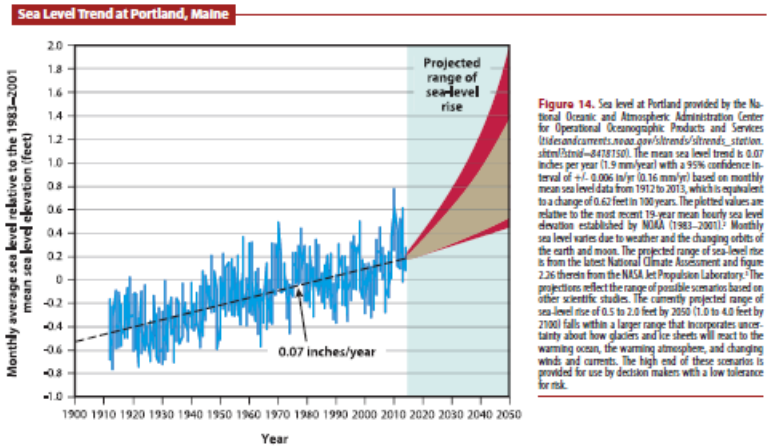
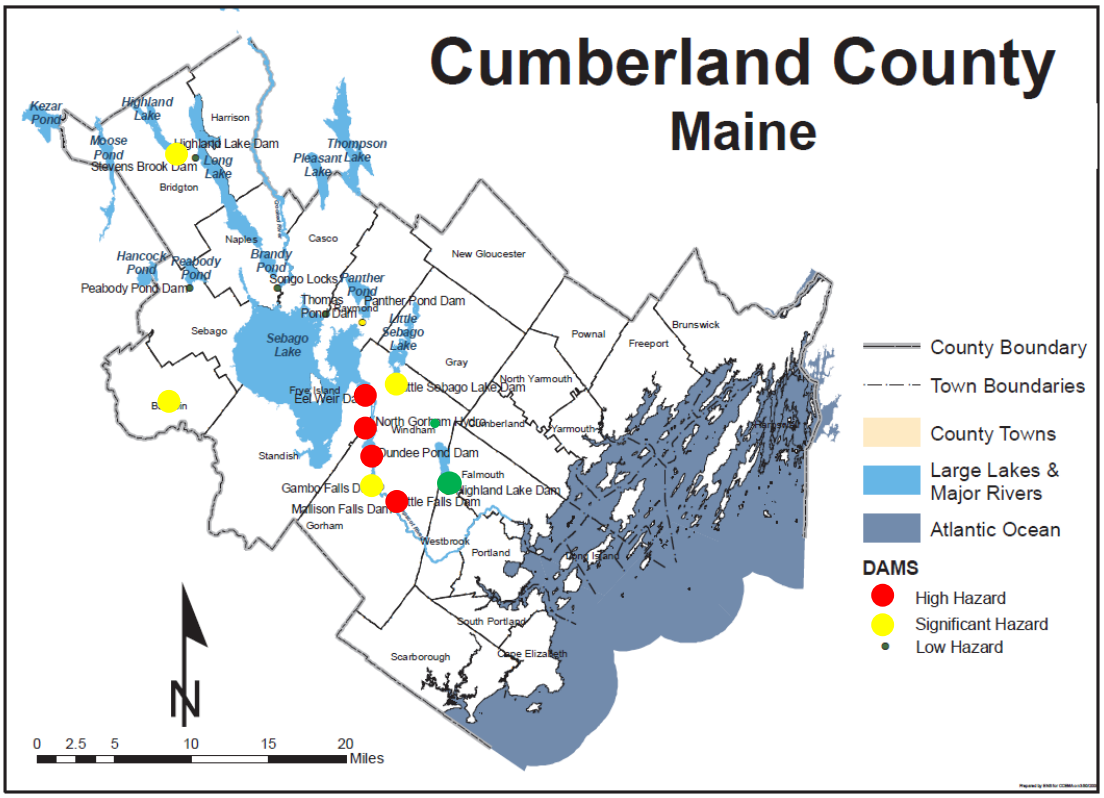


Figure 14. Sea level at Portland provided by the National Oceanic and Atmospheric Administration Center for Operational Oceanographic Products and Services (tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8418150). The mean sea level trend is 0.07 inches per year (1.9 mm/year) with a 95% confidence interval of +/- 0.006 in/yr (0.16 mm/yr) based on monthly mean sea level data from 1912 to 2013, which is equivalent to a change of 0.62 feet in 100 years. The plotted values are relative to the most recent 19-year mean hourly sea level elevation established by NOAA (1983–2001).[2] Monthly sea level varies due to weather and the changing orbits of the earth and moon. The projected range of sea-level rise is from the latest National Climate Assessment and figure 2.26 therein from the NASA Jet Propulsion Laboratory.[3] The projections reflect the range of possible scenarios based on other scientific studies. The currently projected range of sea-level rise of 0.5 to 2.0 feet by 2050 (1.0 to 4.0 feet by 2100) falls within a larger range that incorporates uncertainty about how glaciers and ice sheets will react to the warming ocean, the warming atmosphere, and changing winds and currents. The high end of these scenarios is provided for use by decision makers with a low tolerance for risk.

Dam failure/breach also has adverse effects related to the nature of flooding within the County. Many dams through the County are now aged (over 100-years old), and beyond typical design life. Maine law classifies the hazard potential of dams as follows:

- High - could cause loss of life
- Significant - could cause significant property damage
- low generally cause damage only to the owner's property -

In Cumberland County, there are four high hazard dams and four significant hazard dams, as shown in Table 5. The high-hazard dams are all regulated by the Federal Emergency Regulatory Commission, while the significant hazard dams are regulated by MEMA. The eight high and significant hazard dams all have Emergency Action Plans to mitigate the effects of failure. (One dam was reclassified from significant to low hazard as a result of road mitigation work.)The County also has 54 low hazard dams that are not included in the table. In Maine, High and Significant Hazard Dams must be inspected every six years.



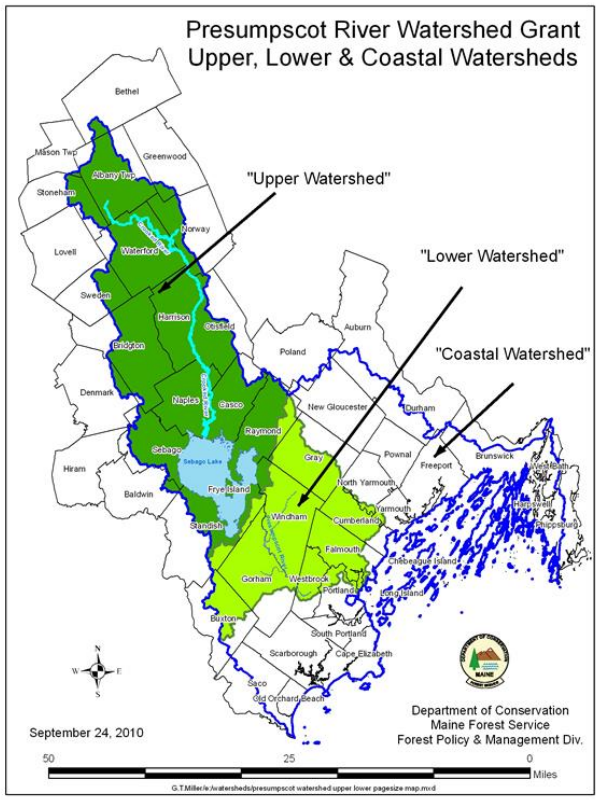
High and Significant Hazard Dams in Cumberland County.
The Dam marked with a large green dot was downgraded from Significant Hazard in 2014

Table 5 High and Significant Dams

CUMBERLAND COUNTY HIGH & SIGNIFICANT HAZARD DAMS					
MEMA ID	**DAM NAME**	**OTHER NAME**	**DAM OWNER**	**MUNICIPALITY**	**RIVER/LAKE**
High Hazard Dams					
417	Dundee Falls	Dundee Pond	SAPPI	Windham	Presumpscot
128	Eel Weir	Sebago Lake Dam	SAPPI	Windham	Presumpscot
123	Mallison Falls		SAPPI	Windham	Presumpscot
495	N. Gorham Hydro Station		FPLE Energy Maine Hydro	Windham	Presumpscot
Significant Hazard Dams					
117	Highland Lake		Bill Morrisseau	Bridgton	Highland Lake
1007	Sanborn Pond		Joel Sanborn and Daniel and Betsy Harrington	Baldwin	Pigeon Brook
127	Little Sebago Lake	Hopkins Dam	Bruce Micucci	Windham	Little Sebago
122	Panther Pond	Raymond Dam	IFW	Raymond	Panther Pond

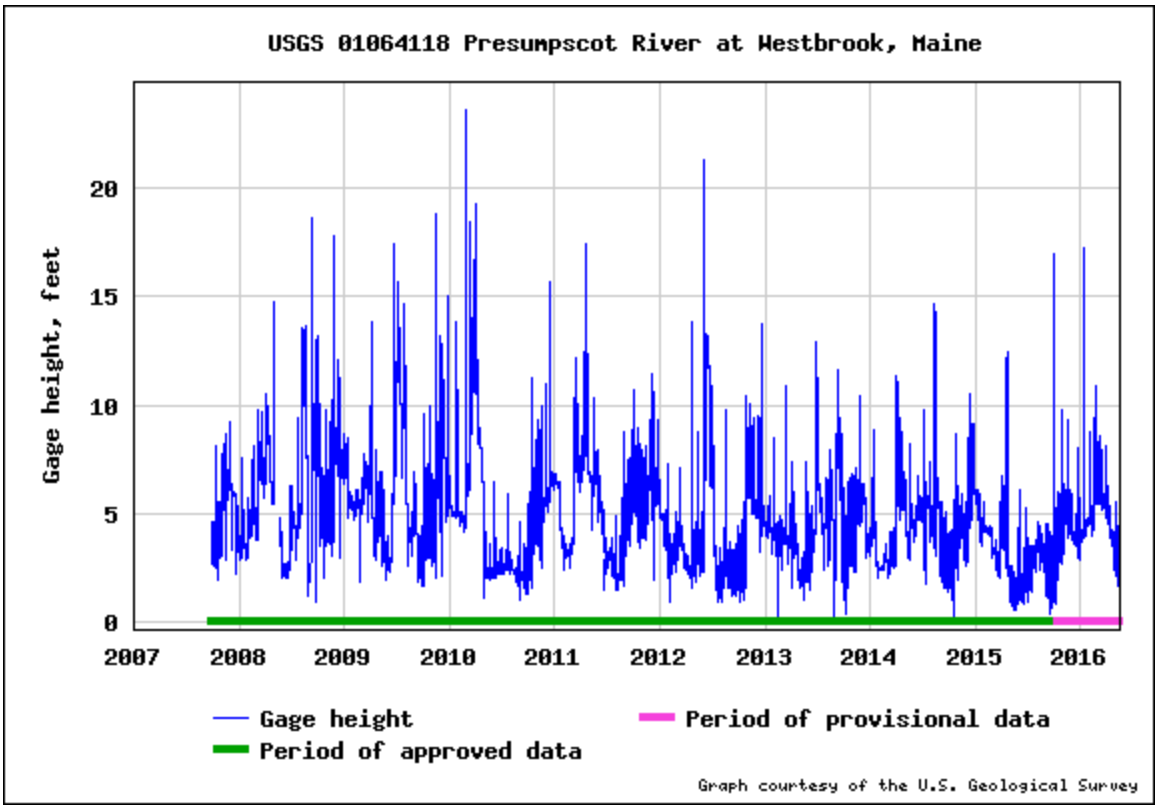
Location:

All of Cumberland County has areas that are susceptible to coastal and/or riverine flooding. Twelve of its 28 towns are located directly on the Atlantic Ocean. Several rivers and streams flow through portions of Cumberland County, the most predominant being the Presumpscot River. This river, with its tributary waters, extends from Sebago Lake through the towns of Naples, Casco (Crooked River), Standish, Windham, Gorham, Falmouth, and the cities of Westbrook and Portland before flowing into Casco Bay.



Extent:

The chart below demonstrates flood levels on the Presumpscot since 2008. In addition, urban flooding, particularly in Portland and Scarborough, has increasingly been a problem in the low lying areas.



U.S.G.S. Presumpscot River Gauge
http://nwis.waterdata.usgs.gov/usa/nwis/uv/?cb_00065=on&format=gif_default&site_no=01064118&period=&begin_date=2007-01-01&end_date=2016-05-17

Impact

Flood damages to roads, bridges and ditches continue to be the most common occurrence throughout Cumberland County, especially in heavy rain events (> 3-5" in 24 hours). Depending on the saturation level of the ground at the time of the event, and the duration of the storm, the extent of damages can vary from a few overwhelmed culverts to major road washouts throughout the county.
The extent of the flooding hazard under the various sea-level rise scenarios has not been determined for individual roads and culverts. This would have to be calculated on a case-by-case basis.

Flooding has been the most common hazard affecting Cumberland County in the past. Between 1987 and 2015, there were fourteen federally declared disasters in the County in which FEMA funds were utilized, eight of which were primarily flood events.

Probability:
Floods are described in local flood studies in terms of their extent, including the horizontal area affected, and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The most widely adopted design and regulatory standard for floods in the US is the 1-percent annual chance flood. This is the standard formally adopted by FEMA. The 1-percent annual flood, also known as the base flood, has a 1-percent chance of happening in any particular year. It is also referred to as the "100-year flood".

Table 7 below provides a~~n~~ historical summary of the flooding events affecting Cumberland County. (Data source: FEMA website.) Where damages are provided they reflect the damage estimate reported for Cumberland County only

Table 7 History of Occurrences

Date	Year	County Damages*	2015 Dollars	Event Type	Declaration
March 19	1936				n/a
August 28	1946				n/a
March 27 – 30	1953				n/a
February 12	1972	$90,836			n/a
May 8	1975				SBA
March 20	1977				SBA
June	1984				n/a
January	1986				n/a
April 1	1987	$45,757	63,082.47	Severe Storm/ Flooding	FEMA-788-DR-ME
May 5-13	1989	486,295	929,517	Severe Storms/Flooding	FEMA-830-DR-ME
August 18-21	1991	2,344,567	4,080,046	Hurricane Bob	FEMA-915-DR-ME
October 30 – November 2	1991	200,365	348,678	Severe Coastal Storm	FEMA-921-DR-ME
March 27	1992	$185,600	313,544.94	Flooding/Heavy Rain	FEMA-940-DR-ME
April	1993	$13,220	21,684.19	Flooding/Heavy Rain/Snowmelt	FEMA-988-DR-ME
April 16 -17	1996	$535,046	808,253.65	Severe Storm/ Flooding	FEMA-1114-DR-ME
October 20 - 21	1996	$4,924,698	7,439,369.95	Severe Storm/ Flooding	FEMA-1143-DR-ME
October 8 – 11	1998	$852,759	1,239,990.06	Severe Storm/ Flooding/High Wind/Coastal Erosion	FEMA-1263-DR-ME
September 16-19	1999	83,703.45	119,082.48	Hurricane Floyd	FEMA-1308-DR-ME
April 25	2007	$7,246,244	8,283,333.88	Severe Storms/Inland, Coastal Flooding	FEMA-1693-DR-ME
July 18 – Aug. 16	2008	$819,201	901,820.06	Severe Storms/Flooding/Tornadoes	FEMA-1788-DR-ME

*County damages are cost in the year of the event.

There have been no flooding declarations since 2008 in Cumberland County.

Table 8 Federally Declared Disaster Costs by Municipality

	DR 788 April 1987	**DR 830** May 1989	**DR 915** August 1991	**DR 921** November 1991	**DR 940** March 1992	**DR 988** April 1993	**DR 1114** April 1996	**DR 1143** October 1996	**DR 1263** October 1998	**DR 1308** September 1999	**DR 1693** April 2007	**DR 1788** July 2008
Baldwin	---	5,864	3,224	---	28,368	---	24,231	---	---	---	263,760	---
Bridgton	3,697	8,860	5,249	---	20,002	---	198,387	---	---	---	93,511	---
Brunswick	---	---	27,845	---	---	---	27,211	---	---	---	52,550	83,034
Cape Elizabeth	---	1,934	29,062	2,379	---	---	---	17,248	11,669	---	169,375	---
Casco	---	9,009	14,566	----	---	---	10,150	11,527	---	---	448,410	---
Chebeague Island*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	---	N/A	---
Cumberland	---	8,813	75,744	412	---	---	---	---	74,078	1,157	499,073	15,067
Falmouth	---	34,434	199,465	---	---	---	26,825	85,387	23,881	---	108,650	---
Freeport	---	7,915	109,730	---	---	---	18,716	---	41,738	2,913	120,986	436,150
Frye Island*	N/A	N/A	N/A	---	N/A	N/A	N/A	1,162	6,462	---	8,854	---
Gorham	---	---	293,343	---	---	---	22,681	171,470	---	---	82,366	82,640
Gray	---	38,514	99,067	---	---	---	14,436	27,109	---	11,868	171,641	---
Harpswell	---	---	---	---	---	---	---	---	---	---	48,931	---
Harrison	4,904	28,434	---	---	62,047	---	4,839	---	---	---	139,326	---
Long Island*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,265	---	326,377	---
Naples	13,557	1,297	1,297	---	15,666	---	---	5,754	---	---	252,876	---
New Gloucester	19,810	139,073	139,073	---	---	---	13,967	---	19,434	34,757	46,495	---
North Yarmouth	---	68,436	68,436	---	---	---	---	---	27,165	---	18,164	27,156
Portland	---	245,399	245,399	174,045	---	---	39,737	439,323	120,602		2,327,749	---
Pownal	3,789	64,691	64,691	---	---	---	23,385	---	452,008	4,203	20,024	75,658
Raymond	---	1,556	9,092	---	20,994	---	7,489	15,651	---	4,809	130,739	---
Scarborough	---	---	129,906	23,529	---	---	21,375	731,786	4,881	---	557,178	19,312
Sebago	---	6,290	16,105	---	38,523	13,220	4,928	---	---	23,993	139,276	---
South Portland	---	2,037	37,564	---	---	---	1,254	112,222	27,229	---	245,551	---
Standish	---	1,774	41,376	---	---	---	---	15,917	---	---	51,453	---

Westbrook	---	10,909	186,771	---	---	---	7,297	1,860,507	4,098	---	98,500	---
Windham	---	5,301	119,306	---	---	---	12,296	1,206,477	2,294	---	149,401	---
Yarmouth	---	43,841	332,390	---	---	---	51,540	3,867	32,000	---	63,679	67,373
County	---	---	26,249	---	---	---	---	7,720	1,598	---	9,295	---
Portland Water District	---	---	62,801	---	---	---	4,302	193,433	1,357	---	104,327	12,812
Freeport Sewer District	---	---	6,801	---	---	---	----	---	---	---	---	---
PNP's	---	1,981	---	---	---	---	---	18,168	---		225,433	---
TOTAL	**45,757**	**486,295**	**2,344,567**	**200,365**	**185,600**	**13,220**	**535,046**	**4,924,698**	**852,759**	**83,703**	**7,145,955**	**819,202**
In 2015 Dollars	**95,468**	**929,517**	**4,080,046**	**348,678**	**313,545**	**21,684**	**808,254**	**7,439,370**	**1,239,990**	**19,082**	**8,168,691**	**901,821**

Note[1] Figures derived from MEMA and Cumberland County documents
Note[2] 2015 dollars figured from Bureau of Labor CPI calculator http://data.bls.gov/cgi-bin/cpicalc.pl
* Long Island seceded from Portland 1993; Frye Island from Standish in 1998; Chebeague Island from Cumberland in 2007

HAZARD – SEVERE SUMMER STORMS

A severe summer storm is a violent weather phenomenon producing winds in excess of 50 knots (57.6 mph), heavy rains, lightning, and hail that can cause injuries, and destruction of property, crops and livestock. Severe summer storms include hurricanes, lightning, thunderstorms, microbursts and tornadoes.

Location

The entire County is vulnerable to one or more severe summer storms each year, usually in the form of thunderstorms.

Extent:

The damage from most of these storms is generally localized. As storms typically move from west to east, they may weaken so that a severe storm in the western communities may become a less severe storm as it reaches the coastal communities, but this is dependent on atmospheric conditions.

Impact:

When severe summer storms arrive in the County, high winds can fell trees and branches onto power lines causing power and communication outages. Heavy rains that often accompany thunderstorms can result in flash flooding or erosion. Hail can cause crop damage for farmers and backyard gardeners, lightning strikes can start fires. Any of these weather events can cause personal injury or property damage. The impact of these summer storms is usually restricted to power outages and to flooding caused by large amounts of moisture these storms can carry.

Probability:

The past thirty year history of summer storms indicates that Cumberland County will continue to experience storms on a regular basis. . According to the NOAA National Climactic Data Center "there are slightly more than 20 days a year with thunderstorms on average…" There are no probability studies available on summer storm occurrence. However, based on experience, as demonstrated above, the County can expect thunder and lightning every year, particularly in the summer months. Less frequently, the County will experience more damaging storms. Although microbursts or even small tornado-like events may occur periodically, these events typically affect fairly small localized areas. According NOAA data, Maine can expect an F0 or F1 tornado twice a year on average, but location is not predictable. The table below shows the Enhanced Fujita scale indicating wind speeds.

Enhanced Fujita Scale	
EF–0	65–85 mph winds
EF–1	86–110 mph
EF–2	111–135 mph
EF–3	136–165 mph
EF–4	166–200 mph
EF–5	>200 mph

Table 9 Tornados in Cumberland County Maine 1962 through 2014

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj
Totals:								0	1
CUMBERLAND CO.	CUMBERLAND CO.	ME	07/09/1962	10:55	CST	Tornado	F1	0	0

CUMBERLAND CO.	CUMBERLAND CO.	ME	10/03/1970	17:00	CST	Tornado		0	0
CUMBERLAND CO.	CUMBERLAND CO.	ME	08/11/1971	11:45	CST	Tornado	F1	0	0
CUMBERLAND CO.	CUMBERLAND CO.	ME	06/22/1974	13:30	CST	Tornado	F1	0	1
SEBAGO LAKE	CUMBERLAND CO.	ME	08/08/2004	17:00	EST	Tornado	F0	0	0
BRUNSWICK	CUMBERLAND CO.	ME	11/24/2005	13:16	EST	Tornado	F0	0	0
WEST GORHAM	CUMBERLAND CO.	ME	07/21/2010	17:48	EST-5	Tornado	EF0	0	0
THOMPSON PT	CUMBERLAND CO.	ME	07/27/2014	16:05	EST-5	Tornado	EF0	0	0
Totals:								0	1

Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries
Source: NOAA National Climactic Data center

Hurricanes are associated with flooding in this plan as the majority of storm damage is usually because of excessive rain.

Table 10 Hurricanes Affecting Cumberland County

Hurricane	Year	Category	Wind Speed In mph Sustained/gusts	Rainfall in Inches in Portland	Deaths/ Injuries Statewide
Carol	1954	Cat 1	60/74		7/3
Edna	1954	Cat 1	70	7.49	8
Bob	1991	TS	40/61	7.83	3/2
Floyd	1999	TS	50	4.4	---
Irene	2008	TS	52	1.13	---

Saffir–Simpson Hurricane Scale		
Category	Wind speed mph (km/h)	Storm surge ft (m)
Five	≥156 (≥250)	>18 (>5.5)
Four	131–155 (210–249)	13–18 (4.0–5.5)
Three	111–130 (178–209)	9–12 (2.7–3.7)
Two	96–110 (154–177)	6–8 (1.8–2.4)
One	74–95 (119–153)	4–5 (1.2–1.5)
Additional classifications		
Tropical storm	39–73 (63–117)	0–3 (0–0.9)
Tropical depression	0–38 (0–62)	0 (0)

http://serc.carleton.edu/download/images/10713/saffir-simpson-sm.gif

HAZARD – SEVERE WINTER STORMS

Severe winter weather conditions are distinguished by low temperatures, strong winds, and often large quantities of snow. The types of winter storms in Maine are blizzards, ice storms, nor'easters, sleet, and heavy snowstorms.

Location

The entire County is subject to severe storms every winter, but historically, northern and western portions of the County receive more snowfall while coastal areas are more likely to have freezing rain, sleet, tide surges and flood damage.

Impact

Loss of electrical power and communication services can occur when utility lines yield under the weight of ice and snow, which can also cause road closures. These conditions can impede the response time of emergency services. Roof structures can collapse. The melting of snow pack in March and April is often gradual enough to prevent serious flooding, although there have been times when a quick melt has led to disastrous flood conditions.

Extent

During the winter months, Cumberland County often has heavy snowfall, or snow combined with high winds, freezing rain or ice storms. Winter storm precipitation amounts can exceed several inches of water equivalent (20-30 inches of snow), while wind speeds can be equal to or greater than those of a hurricane. Total seasonal snowfall ranges between 50 and 90 inches. The snowfall season usually runs from November to April.

Previous Occurrences

The following is a summary of some of the most severe winter storms in Cumberland County in the past 20 years, as reflected in Presidential Disaster Declarations and Emergency Declarations. Note that in several instances, flooding accompanied the winter storms. In addition to those listed, multiple other severe storms occurred during the same period that did not reach the level of a disaster or emergency declaration.

FEMA-DR-4208 Commercial St. Portland, ME
Picture: Shawn Patrick Ouellette/Staff Photographer Portland Press Herald

Table 11 Disaster and Emergency Declarations 1998-2015

Date	Year	County Damages	2015 Dollars	Event Type	Declaration
Jan 5-25	1998	4,465,694	6,493,530.03	Ice Storm	FEMA-1198-DR
March	2001			Severe Winter Storm	EM-1364
Dec. 17 – January 1	2003	$396,919	511,285.60	Extreme Winter Weather	FEMA-1468-DR-ME
December	2004			Severe Winter Storm	EM-3190
January	2005			Severe Winter Storm	EM-3205
February	2005			Severe Winter Storm	EM-3206
March	2005			Severe Winter Storm	EM-3209
March	2005			Severe Winter Storm	EM-3210
December	2008			Severe Winter Storm	EM-3298
January 1	2009	$4,439,697	4,825,749.64	Severe winter Storm/Flooding	FEMA-1815-DR-ME
April 10	2010	$1,379,492	1,499,445.35	Severe winter Storm/Flooding	FEMA-1891-DR-ME
March 25	2013	1,458,799.92	1,484,224.04	Winter Storm/Flooding	FEMA-4108-DR-ME
March 12	2015	1,354,396.62	1,354,396.62	Severe Winter Storm/Flooding	FEMA-4208-DR-ME

Table 12 Breakdown of Cost to Communities for the Presidential Declarations.

Municipality	1198 January 1998	1468 December 2003	1815 January 2009	1891 April 2010	4108 March 2013	4208 March 2015
Baldwin	51,054	---	55,199	54,947	10,222	7,958
Bridgton	215,776	---	107,973	--	30,437	21,768
Brunswick	301,680	---	242,411	28,587	124,878	106,830
Cape Elizabeth	125,116	---	175,203	51,593	55,055	42,823
Casco	131,386	---	---	22,455	---	---
Chebeague Island	---	---	25,748	228,413	---	4,913
Cumberland	277,962	---	45,074	4,814	43,089	51,630
Falmouth	210,338	8,523	41,858	48,847	59,133	53,319
Freeport	213,453	---	121,856	8,237	---	41,181
Frye Island	---	---	---	--	---	---
Gorham	200,265	---	194,313	37,208	75,583	64,996
Gray	246,103	9,056	128,218	42,011	40,206	38,027
Harpswell	47,905	---	14,834	4,161	7,902	4,232
Harrison	149,697	---	---	--	---	---
Long Island	8,732	---	7,587	379,863	---	13,265
Naples	191,016	---	24,654	12,911	17,041	---
New Gloucester	262,309	---	127,316	--	38,458	37,116
North Yarmouth	55,664	---	54,817	--	14,977	10,778
Portland	859,489	---	1,174,088	2,109,056	417,153	309,445
Pownal	91,851	---	52,431	--	17,308	8,299
Raymond	153,949	---	33,853	--	10,887	12,989
Scarborough	107,024	---	426,908	67,067	85,373	69,578
Sebago	113,167	---	54,671	24,390	---	14,611
South Portland	322,433	16,495	261,563	29,167	188,128	109,024
Standish	248,458	---	126,357	57,201	41,544	29,307
Westbrook	252,604	---	189,947	32,411	69,933	58,282
Windham	438,534	---	205,577	14,094	69,281	56,106
Yarmouth	261,825	30,732	145,763	45,418	27,707	21,863
County	4,955	---	1,865	--	1,253	---
Bridgton Water District	2,676	10,919	---	--	---	---
Freeport Sewer District	1,739	---	---	--	---	---
Portland Water District	62,741	317,627	95,439	62,590	---	---
Brunswick/Topsham Water District	---	---	---	3,076	---	---
PNP's	165,373		131,930	11,681	---	166,056
Total	**5,775,274**	**396,919**	**4,272,667**	**3,391,202**	**1,458,800**	**1,354,397**
In 2015 Dollars	**8,397,780**	**511,286**	**4,720,373**	**3,686,083**	**1,484,224**	**1,354,397**

Probability
Probability
Based on its location in the Northeast and on the past 30 years of history, there is a high probability that Cumberland County will continue to experience winter snowstorms on a yearly basis, which will not likely produce significant damage. However, less frequently, the county will experience damaging snow and ice storms that rise to the level of disaster or emergency declaration, as evidenced by the chart above.

HAZARD – WILDFIRE

Wildfire is a natural phenomenon initially finding its origin in lightning; however, humans have become the greatest cause of fires in Maine. Wildland fires are those that burn vegetation such as grass, brush and timber. Wildland urban interface fires are created where homes meet highly volatile forest fuels. Both of these types of wild fire occur in Cumberland County.

Location and Extent:
Wildland fires can occur in any area of the County, but the most vulnerable areas are the smaller communities, especially those that have narrow roads inaccessible by today's fire equipment or lack of water supply. These fires typically extend to <100 acres.

Previous Occurrences:
The Maine Fire Service tracks all reported fire occurrences in the State on an annual basis. These are coded by cause: campfire, children, debris burning – which can include backyard burning as well as the agricultural practice of "burning over" blueberry fields, incendiary (includes arson), lightning, machinery (includes logging equipment, brush cutters as well as fires along power lines), miscellaneous, railroad and smoking. The chart below, provided by the Maine Fire Service, lists the wildland fires from 2010 through 2014 (the latest year analyzed as of the writing of this plan).

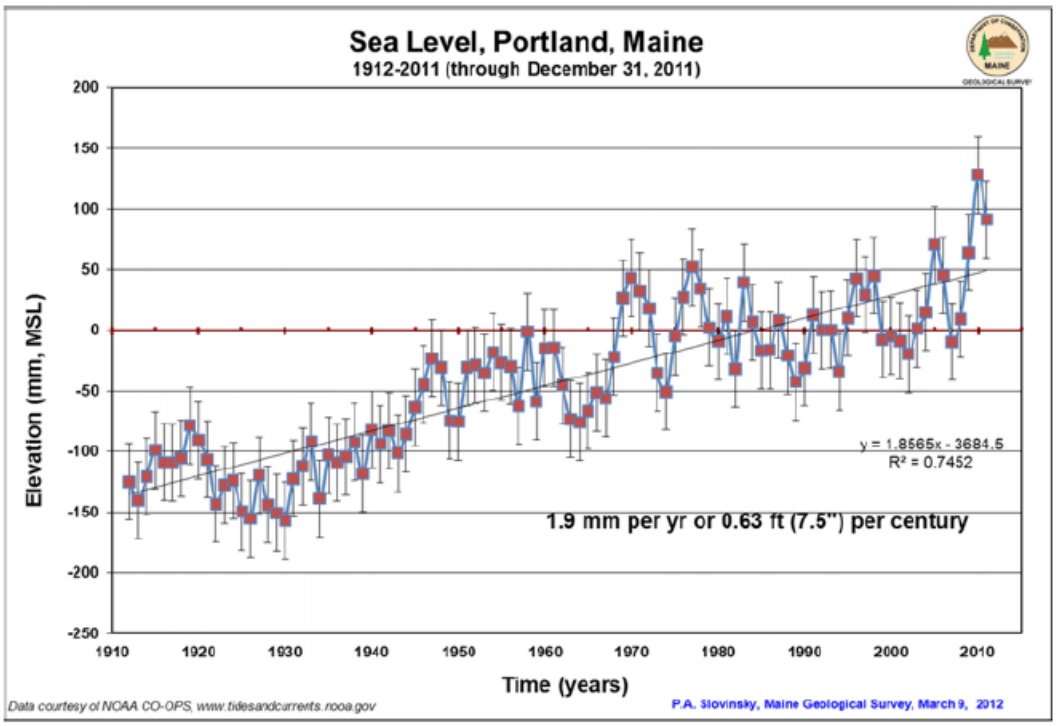
Fire County	CAUSE	# of Fires
CUMBERLAND	CAMPFIRE	7
CUMBERLAND	CHILDREN	9
CUMBERLAND	DEBRIS	18
CUMBERLAND	INCENDIARY	24
CUMBERLAND	MACHINE	21
CUMBERLAND	MISC	16
CUMBERLAND	RAILROAD	6
CUMBERLAND	SMOKING	11
	TOTALS	112
	AVERAGE / YEAR	14

Forest fires remain one of the County's most significant hazards. Today, about 90% of all forest fires are caused by human activity while lightning causes about 10%. During dry periods, fire danger increases rapidly, especially in the spring and fall.

Impact:
Despite containing a high percentage of heavily forested areas, Cumberland County has not experienced major wildfire events in recent years, with the last widespread wildfire occurring in 1947. This wildfire event caused multiple deaths and resulted in the burning of over 200,000 acres throughout the state of Maine, with the greatest impacts being in York County and on Mount Desert Island. Since the 1947 fire, the County experienced a major wildfire on May 3, 1951 and in October of 1961. As well, it is typical for the county to experience several minor wildfires per year. These fires are typically relatively small and quickly contained (depending on fire apparatus accessibility).

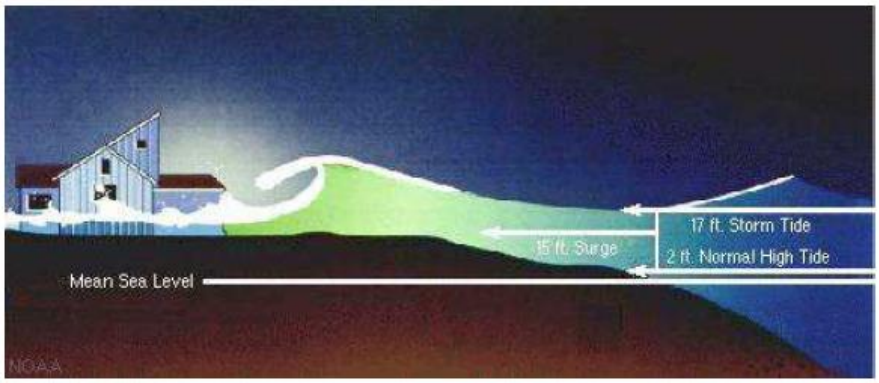
Probability of Occurrence.
Based on the past thirty years of historical records of forest fires, the Maine Forest Service Forest Protection Division anticipates that on a state level there will be between 600 – 700 low acreage fires (a low acreage fire is less than 100-acres) from all causes each year. However, using the last three decades of fire records, the probability of a major wildfire (>1,000 acres, according to the Maine Forest Service) is once a decade.

Hazard: Coastal Erosion
This hazard, newly moved to the High Hazard category, is included because of increasing intensity of storms and greater effects of storm damage along the coasts of the 12 municipalities affected. Rising sea levels increase the effect of these storms. While the damages are currently localized and minimal, the trend is increasing, and communities are experiencing more damage or damage in areas not previously affected.



According to the Maine State Hazard Mitigation Plan – 2013 Update:

> One of the consequences of sea level rise is the damage that can occur from storm surges. Storm surge is simply water that is pushed toward the shore by the force of the winds swirling around the storm as well as low barometric pressure. This advancing surge combines with the normal tides to create the storm tide. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides. The following illustration shows how storm surge can increase flooding risk.



> No one knows for sure how high the sea will rise or how quickly it will occur, but the IPCC has prepared a range of scenarios based on a scientific analysis of a number of variables including glacial ice melt, thermal expansion of water due to global warming, slowing of the Gulf Stream (there has been a 25% reduction during the past decade), and the melting of ice caps in Greenland and Antarctica. Based on the IPCC's projections, the Maine Geological Survey (MGS) is using for its studies a conservative, mid-range estimate of two (2) additional feet of sea level rise by the year 2100.

Location:
The coastal communities of Scarborough, Cape Elizabeth, Portland, South Portland, Falmouth, Cumberland, Yarmouth, Freeport, Brunswick and Harpswell, and the island towns of Long Island and Chebeague Island are those affected.

Extent:
Low-lying areas such as marshes, roads that run parallel and close to the shore and homes build on bluffs of the geologic Presumpscot formation mud are most vulnerable. Island communities express most concern with their ferry terminals and the effects coastal erosion will have on these fixed structures. The extent of the erosion hazard under the various se-level rise scenarios has not been determined for individual roads and culverts. This would have to be calculated on a case-by-case basis.

Impact:
Damage to roads, erosion of protective barriers, and loss of property are among the largest impacts in Cumberland County to date. Other concerns, while outside the scope of this plan, include wetland migration and the effects of erosion on the natural habitat.

Probability:
According to the Maine State Hazard Mitigation Plan – 2013 Update, "…the gradual rise in the level of the sea is having a profound effect on the nature of coastal flooding. The sea has risen about 7.5 inches since

1900, and is conservatively projected by the Maine Geological Survey to rise by roughly two additional feet by 2100. Along the Maine Coast, if the 10-year and 100-year storm elevations are only one foot apart, a sea level rise of one (1) foot means that a storm that had a 1% chance of occurring in any one year (the 100-year storm) at the original elevation will have a 10% chance of occurring in any one year (the 10-year storm) at the new elevation. As a result, more homes, businesses, public infrastructure such as roads, and entire communities will be subject to more devastating coastal storms, as well as coastal erosion and landslides, on a more frequent basis. There is also concern in the scientific community that global warming may be increasing the intensity of coastal storms."

PRIORITIZATION OF HAZARDS

The preceding profiles describe the range of hazards for which Cumberland County is at risk. The history of hazard events in the County is the best indicator of future risks faced by the County. In order to prioritize future mitigation efforts, the range of hazard types was evaluated for frequency, impacts, and extent of affected population. The hazards were then ranked by order of priority, based on these criteria. Only the top five have been evaluated further. The prioritization matrix is shown below:

Table 13

Hazard Type	Frequency	Impact	% of County at risk	Total Score
High Priority				
Flooding	4	4	4	12
Severe Winter Storm	4	4	4	12
Severe Summer Storm	4	2	4	10
Wildfire	3	2	4	9
Coastal Erosion	4	2	2	8
Medium Priority				
Hurricane (included in summer storms	2	4	2	8
Low Priority				
Drought	1	2	4	7
Earthquake	1	2	4	7
Blight/infestation	1	2	3	6
Landslide	2	2	1	5
Avalanche	1	2	1	4
Ground subsidence	1	1	1	4

Frequency of events:

1- 10 years =4
Greater than 10 years =3
Greater than 50 years =2
Greater than 100 years =1

Impact:

Significant (multiple deaths, mass casualties, or millions of dollars in damages) =4
Major (injuries, or 100,000's of dollars in damages) =3
Moderate (injuries or 1,000's of dollars in damages) =2
Minimal (no injuries or 100's of dollars in damages) =1

% of County at risk:

All parts of county are vulnerable to hazard and might be impacted by an event	=4
All parts of county are vulnerable, but not all parts are likely to be impacted by an event	=3
Vulnerability and impacts are limited to certain regions of the county	=2
Vulnerability and impacts are localized	=1

This prioritization method remains valid for the 2017 Update. Coastal Erosion moved to High Priority in recognition of rising sea levels and community concerns.

ASSESSING VULNERABILITY: OVERVIEW

Requirement §201.6(c)(2)(ii):	The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

The hazard mitigation planning team identified critical facilities located within each municipality, using GIS data from the Maine Office of GIS, and Northeast States Emergency Consortium HAZUS documents. Critical facilities are defined by FEMA as "facilities that are critical to the health and welfare of the population and that are especially important following hazard events". Critical facilities include, but are not limited to, shelters, police and fires stations, and hospitals. The critical facilities identified in Cumberland County are: municipal offices, fire stations, police stations, water treatment facilities, wastewater treatment plants, libraries, schools, shelters, hospitals, airports, dams, rescue units, armories, roads, electric lines, and telephone lines.

As seen in the above table, the five highest priority hazards identified for Cumberland County are flooding, severe winter storms, severe summer storms, wildfires, and coastal erosion. The following describes the vulnerability of critical facilities to each of these hazards:

Flooding: The typical damage resulting from flooding in Cumberland County is structural damage to roads and utility infrastructure. There may be other types of critical facilities that are susceptible to damage from flooding, but insufficient data was available to determine these facilities. Mitigation measures in the future might include a more comprehensive field analysis of vulnerability. However, due to the varied topography within the county and the availability of higher elevation sites within all municipalities, nearly all critical facility structures are located outside of the flood zones, with the ~~possible~~ exception of roads, some wastewater treatment plants, and island ferry terminals.

Severe Winter Storms: Winter storms damage overhead utility lines, cause flooding (ice jams and spring melt off) and dump debris and large amounts of snow on the roads. The County is also susceptible to ice storms, which can affect the same infrastructure. The more widespread events, such as blizzards and ice storms will typically impact the county through severe damage to overhead electric and utility line infrastructure and blockage of roads by debris. When accompanied by flooding, the impacts will be as described above.

Severe Summer Storms: Localized events, such as microbursts or small tornados have the potential to cause significant damage to structures, should they happen to occur in direct proximity to a critical structure. The more widespread events, such as hurricanes and tornados will typically impact the County through severe damage to overhead electric and utility line infrastructure and blockage of roads by debris. When accompanied by flooding, the impacts will be as described above.

Wildfire: The combination of a high degree of development within the County, which is still primarily heavily forested, creates the potential for significant damage to critical facilities, homes and commercial

property in Cumberland County resulting from wildfires.

Coastal Erosion: Critical infrastructures such as roads running close to shorelines, wastewater treatment plants and ferry terminals are all subject to damage from coastal erosion caused by intense storms combined with rising sea levels.

ASSESSING VULNERABILITY: ADDRESSING REPETITIVE LOSS PROPERTIES

Requirement §201.6(c)(2)(ii):	The risk assessment must address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged by floods.

Repetitive Loss Properties. Based on January 2016 information from the NFIP State Coordinator for the Maine Floodplain Management Program, there were 13 repetitive loss properties located in Cumberland County. Due to privacy laws, the plan only identifies the Town and the number of repetitive losses suffered within each Town. The properties were all single or multi-family residential properties except two properties which were non-residential, commercial properties. The Towns and number of properties in each Town, which reported repetitive losses include the following:

Table 14

Municipality	Number of Properties	Property Type	Number of Claims
Cape Elizabeth	1	Residential	3
Casco	3	Residential	8
Falmouth	1	Residential	2
Gorham	1	Residential	2
Gray	1	Residential	3
Harrison	1	Residential	2
Scarborough	2	Residential	3
South Portland	1	Residential	5
Westbrook	1	Non-residential	3
Yarmouth	1	Non-residential	2

ASSESSING VULNERABILITY: IDENTIFYING STRUCTURES

Requirement §201.6(c)(2)(ii)(A):	The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the hazard area.

The following table lists the type and numbers of critical facilities in each municipality in Cumberland County.

Table 15

Municipality	Municipal Office	Fire Station	Police Station	Water Treatment	WWTP – Major	WWTP – Minor	Schools	Shelters	Hospital/ Clinic	Airport/ Seaport	Dams	Rescue	Electrical Sub-Stations	Telecom Structures
Baldwin	1	3	0	0	0	0	2	1	0	0	1	0	0	0
Bridgton	1	4	1	1	0	1	3	1	1	1	5	1	0	2
Brunswick	1	2	1	1	1	4	8	5	2	2	1	2	0	5
Cape Elizabeth	1	2	1	0	0	1	5	2	0	1	0	1	0	2
Casco	1	2	0	0	0	0	2	2	0	0	0	2	0	2
Chebeague Isl.	1	1	0	0	0	0	1	1	0	0	0	1	0	0
Cumberland	1	2	1	0	0	0	5	1	0	0	1	3	0	1
Falmouth	1	4	1	0	1	1	5	3	0	1	1	2	0	4

Freeport	1	1	1	0	1	0	5	2	0	0	0	1	0	1
Frye Island	1	1	0	0	0	0	0	1	0	0	0	0	0	0
Gorham	1	3	1	0	0	2	5	0	0	1	0	2	1	10
Gray	1	3	0	0	0	0	3	2	0	0	1	1	0	4
Harpswell	1	3	0	0	0	1	2	2	0	1	0	3	0	1
Harrison	1	1	0	0	0	0	1	1	0	1	1	0	0	
Long Island	1	1	0	0	0	0	1	2	0	0	0	1	0	1
Naples	1	1	0	0	0	0	4	3	0	0	2	2	0	0
New Gloucester	1	1	0	0	0	0	3	1	0	1	4	1	0	1
North Yarmouth	1	1	0	1	0	0	1	1	0	1	0	1	0	2
Portland	1	8	6	1	1	5	34	5	3	1	0	3	0	1
Pownal	1	1	0	0	0	0	1	1	0	1	1	0	0	20
Raymond	1	3	0	0	0	0	3	1	0	0	1	3	0	1
Scarborough	1	6	1	1	1	1	8	1	0	0	0	2	0	1
Sebago	1	3	0	0	0	0	1	2	0	0	4	1	0	6
South Portland	1	6	1	0	1	9	13	7	0	0	0	2	0	0
Standish	1	3	0	0	1	0	4	2	0	0	1	2	0	8
Westbrook	1	2	1	0	1	0	9	2	1	1	3	2	0	2
Windham	1	4	1	0	3	0	4	4	1	1	1	2	0	2
Yarmouth	1	4	1	0	1	0	5	2	0	0	2	2	1	2
TOTAL	28	76	18	5	12	26	138	60	8	14	30	43	2	1
														80

Source: Cumberland County Emergency Management Agency

Vulnerability of existing buildings, infrastructure and critical facilities.

Flooding:

- Buildings. There are very few buildings in Cumberland County that are vulnerable to flood damages. Most of the developed areas in the County are located outside of designated floodplains and are thus not very vulnerable to flooding.
- Infrastructure. Roads and their associated storm drainage systems are the most vulnerable category of infrastructure. Much of the County is still rural in nature and is serviced by a network of rural roads that do not have proper storm drainage systems. These roads are very vulnerable to flooding caused by heavy downpours and/or the blockage of drainage systems by ice or debris.
- Critical facilities. Due to varied topography within the County and the availability of higher elevation sites within all municipalities, nearly all critical facilities are located outside of floodplains.

Severe Winter Storms:

- Buildings. All buildings in Cumberland County are vulnerable to winter storm damage. Damages can include burst water pipes during power outages, interior water damages due to ice dams forming on roofs and occasionally roof collapses due to heavy loads.
- Infrastructure. Roads and their associated storm drainage systems are the most vulnerable category of infrastructure. They can become temporarily blocked due to heavy snow falling over a short period of time or ice, which can build up on their surfaces. Water main breaks due to cold weather can also occur. Roads and their storm drainage systems can become blocked due to heavy snow, ice, and debris such as tree limbs.

- Critical facilities. All critical facilities in Cumberland County are vulnerable to winter storms in the same manner that individual buildings are vulnerable. However, some of the critical facilities throughout the County have back-up generator systems that allow heating systems to continue during a power outage.

Severe Summer Storms:

- Buildings. There are very few buildings in Cumberland County that are vulnerable to summer storms and associated flooding. With the exception of some areas in the outlying towns, most of the developed areas in the County are located outside of designated floodplains and are thus not very vulnerable to flooding.
- Infrastructure. Roads and their associated storm drainage systems are the most vulnerable category of infrastructure. They can become flooded over a short period of time during intense periods of rain. Roads and their storm drainage systems can become blocked due to debris such as tree limbs.
- Critical facilities. Due to varied topography within the County and the availability of higher elevation sites within all municipalities, nearly all critical facilities are located outside of floodplains.

Wildfires:

- Buildings. Almost all buildings within Cumberland County could be vulnerable to wildfire damages if not easily accessible by firefighting crews. Most of the rural areas are heavily forested and could be vulnerable to fire under certain conditions such as prolonged drought.
- Infrastructure. Roads and their associated storm drainage systems are the least vulnerable category of infrastructure. Although during wildfire events roads may become closed, it would be expected that once the fire is under control, the road could reopen without experiencing heavy damages.
- Critical facilities. All critical facilities in Cumberland County could be vulnerable to wildfires in the same manner that individual buildings could be vulnerable.

Coastal Erosion:

- Buildings: Those buildings which were built before zoning and shoreline ordinances were placed into effect may be vulnerable to damage to buildings or property.
- Infrastructure: Roads and low bridges are most at risk due to erosion and higher storm surges.
- Critical facilities: Those facilities built in low lying areas or into the water are most at risk.

Vulnerability of future buildings, infrastructure and critical facilities.

Flooding:

- Buildings. All of the municipalities in Cumberland County are in the flood insurance program, and all have municipal Shoreline zoning ordinances that generally prohibit the construction of residential, commercial and industrial structures in floodplains. Therefore, flooding of future buildings is not likely to be a serious issue.
- Infrastructure. Future roads and their associated storm drainage systems are the most vulnerable category of infrastructure. However, State and local road construction standards generally ensure that new roads are properly constructed with adequate drainage systems. Most roads (with the exception of some camp roads) in the public domain must be designed by a licensed professional engineer. Therefore, flooding of future roads is not likely a serious issue.
- Critical facilities. Conditions for future critical facilities would be the same as those described above for buildings.

Severe Winter Storms:

- Buildings. New buildings in Cumberland County are less vulnerable to winter storm damage. Damages can include burst water pipes during power outages, interior water damages due to ice dams forming on roofs and occasionally roof collapses due to heavy loads; however, with current building codes for new construction, water damage and failure from snow load should be limited.
- Infrastructure. Roads and their associated storm drainage systems will continue to be the most vulnerable category of infrastructure. They can become temporarily blocked due to heavy snow falling over a short period of time or ice that can build up on their surfaces. Water main breaks due to cold weather can also occur. Roads and their storm drainage systems can become blocked due to heavy snow, ice, and debris such as tree limbs.
- Critical facilities. Future critical facilities in Cumberland County are vulnerable to winter storms in the same manner that individual buildings are vulnerable. However, some of them will have back-up generator systems that allow heating systems to continue during a power outage.

Severe Summer Storms:

- Future buildings in Cumberland County will be vulnerable to summer storms and associated flooding in the same manner as existing buildings. With the exception of some areas in the outlying towns, most of the future development within the County will be located outside of designated floodplains and are thus not very vulnerable to flooding.
- Infrastructure. New roads and their associated storm drainage systems are the most vulnerable category of infrastructure. However, State and local road construction standards generally ensure that new roads are properly constructed with adequate drainage systems. Most roads (with the exception of some camp roads) in the public domain must be designed by a licensed professional engineer. Therefore, flooding of future roads is not likely a serious issue.
- Critical facilities. Future critical facilities in Cumberland County are vulnerable to summer storms in the same manner that individual buildings are vulnerable. However, some of them will have back-up generator systems which allow heating systems to continue during a power outage.

Wildfires:

- Buildings. New buildings within Cumberland County will be vulnerable to wildfire damages in the same manner as existing buildings. With the exception of some areas in the metropolitan areas, most of the rural areas are heavily forested and thus are very vulnerable to fire.
- Infrastructure. New roads and their associated storm drainage systems are the least vulnerable category of infrastructure. Although during wildfire events roads may become closed, it would be expected that once the fire is under control, the road could reopen without experiencing heavy damages.
- Critical facilities. All future critical facilities in Cumberland County are vulnerable to wildfires in the same manner that individual buildings are vulnerable.

Coastal Erosion:

New buildings will be subject to shoreline zoning ordinances, which many communities are now strengthening. Old structures will be vulnerable to coastal erosion. The same holds true for infrastructure and critical facilities. Some critical facilities, by nature of their usage must remain in low-lying or vulnerable areas (wastewater treatment, etc.). This is a developing situation and will be addressed through engineering studies and policies put in place by each municipality.

ASSESSING VULNERABILITY: ESTIMATING POTENTIAL LOSSES

Overview:
This section of the Plan relies on historical damages as the basis for estimating future losses, subject to the following:

- Presidential Disaster Declarations have been used where possible, updated for inflation using the Consumer Price Index calculator from the U.S. Department of Labor, Bureau of Labor Statistics.
- Where statewide or county damages are used to determine damages for a specific jurisdiction, the damages are pro-rated using the 2010 Census.

Flooding. This plan uses worst-case, real-life damages to calculate potential flood losses, and assumes that historic patterns will hold for the future. The worst-case flood is the Patriot's Day Flood of 2007, which resulted in a Presidential Disaster Declaration of $7,145,955 in damages to Cumberland County alone. Using the Consumer Price Index, the damages in 2015 dollars would be $8,168,691.

In the same way, the winter storm of record is the 1998 Ice Storm with damages of $5,775,274, or $8,397,780 in 2015 dollars.

The per capita cost of $29.00 for the Patriot's Day Storm is calculated by taking the population of Cumberland County in 2010 (281,674) and dividing it into total 2007 flood damages in 2015 dollars ($8,168,691) . Similarly, the Ice Storm of 1998 cost $31.62 per capita. (population of Cumberland County 265,612; storm cost in 2015 dollars ($8,397,780) Census figures from U.S. Census Bureau.

The methodology for calculating potential losses in Cumberland County is to assume the greater of:
1) Actual damages updated using the Consumer Price Index, or
2) Flood losses based on $29.54 per capita . Each town's population is multiplied by $29.54 to get potential damages.

Potential losses were figured using the following:

Table 16

Consumer Price Index 1982-1984 = 100		
1947 = 22.3		
1980 = 82.4	**1992 = 140.3**	**2004 = 188.9**
1981 = 90.9	**1993 = 144.5**	**2005 = 195.3**
1982 = 96.5	**1994 = 148.2**	**2006 = 201.6**
1983 = 99.6	**1995 = 152.4**	**2007 = 207.3**
1984 = 103.9	**1996 = 156.9**	**2008 = 215.3**
1985 = 107.6	**1997 = 160.5**	**2009 = 214.5**
1986 = 109.6	**1998 = 163.0**	**2010 = 218.1**
1987 = 113.6	**1999 = 166.6**	**2011 = 224.9**
1988 = 118.3	**2000 = 172.2**	**2012 = 229.6**
1989 = 124.0	**2001 = 177.1**	**2013 = 232.9**
1990 = 130.7	**2002 = 179.9**	**2014 = 236.7**
1991 = 136.2	**2003 = 184.0**	**2015 = 237.0**

Table 17 Cumberland County Population by municipality

Town	2000	2010	Net Change	Growth Rate
Baldwin	1,290	1,525	235	18.22%
Bridgton	4,883	5,210	327	6.70%
Brunswick	21,172	20,278	(894)	-4.22%
Cape Elizabeth	9,068	9,015	(53)	-0.58%
Casco	3,469	3,742	273	7.87%
Chebeague Island	341	341	-	0.00%
Cumberland	7,159	7,211	52	0.72%
Falmouth	10,310	11,185	875	8.50%
Freeport	7,800	7,879	79	1.00%
Frye Island	-	5	5	
Gorham	14,141	16,381	2,240	15.84%
Gray	6,820	7,761	941	13.80%
Harpswell	5,239	4,740	(499)	-9.50%
Harrison	2,315	2,730	415	17.90%
Long Island	202	230	28	13.80%
Naples	3,274	3,872	598	18.30%
New Gloucester	4,803	5,542	739	15.38%
North Yarmouth	3,210	3,565	355	11.05%
Portland	64,249	66,194	1,945	3.02%
Pownal	1,491	1,474	(17)	-1.14%
Raymond	4,299	4,436	137	9.12%
Scarborough	16,970	18,919	1,949	11.48%
Sebago	1,433	1,719	286	19.95%
South Portland	23,324	25,002	1,678	7.19%
Standish	9,285	9,874	589	6.34%
Westbrook	16,142	17,494	1,352	8.38%
Windham	14,904	17,001	2,097	14.07%
Yarmouth	8,360	8,349	(11)	-0.13%
County	**265,953**	**281,674**	**15,721**	**5.91%**

Population figures from US Census Bureau

The maximum flood loss is the greater of 2015 loss or per capita loss.

Table 18 **Patriot's Day Storm**	**DR 1693** April 2007	**In 2015 Dollars**	**Potential Losses based on Per Capita $29.00**	**Maximum Potential Flood Loss in dollars**		**Great Ice Storm of '98**	**DR 1198 Jan. 1998**	**In 2015 Dollars**	**Potential Losses based on Per Capita $32**	**Maximum Potential Winter Storm Loss in dollars**
Baldwin	263,760	301,591	44,225	301,591		Baldwin	51,054	58,361	48,800	58,361
Bridgton	93,511	106,894	151,090	151,090		Bridgton	215,776	246,658	166,720	246,658
Brunswick	52,550	60,071	588,062	588,062		Brunswick	301,680	344,857	648,896	648,896
Cape Elizabeth	169,375	193,616	261,435	261,435		Cape Elizabeth	125,116	143,023	288,480	288,480
Casco	448,410	512,587	108,518	512,587		Casco	131,386	150,190	119,744	150,190
Chebeague Island	N/A	N/A	N/A	N/A		Chebeague Island	N/A	N/A	N/A	N/A
Cumberland	499,073	570,886	209,119	570,886		Cumberland	277,962	317,744	230,752	317,744
Falmouth	108,650	124,200	324,365	324,365		Falmouth	210,338	240,442	357,920	357,920
Freeport	120,986	138,302	228,491	228,491		Freeport	213,453	244,003	252,128	252,128
Frye Island	8,854	10,121	145	10,121		Frye Island	---	---	---	---
Gorham	82,366	94,154	475,049	475,049		Gorham	200,265	228,927	524,192	524,192
Gray	171,641	196206	225,069	225,069		Gray	246,103	281,325	248,352	281,352
Harpswell	48,931	55,934	137,460	137,460		Harpswell	47,905	54,761	151,680	151,680
Harrison	139,326	159,266	79,170	159,266		Harrison	149,697	171,122	87,360	171,122
Long Island	326,377	373,088	6,670	373,088		Long Island	8,732	9,982	736	9,982
Naples	252,876	289,068	112,288	289,068		Naples	191,016	218,354	123,904	218,354
New Gloucester	46,495	53,149	160,718	160,718		New Gloucester	262,309	299,851	177,344	299,851
North Yarmouth	18,164	20,764	103,385	103,385		North Yarmouth	55,664	63,631	114,080	114,080
Portland	2,327,749	2,660,899	1,919,626	2,660,899		Portland	859,489	982,500	2,118,208	2,118,208
Pownal	20,024	22,890	42,746	42,746		Pownal	91,851	104,997	47,168	104,997
Raymond	130,739	149,450	128,644	149,450		Raymond	153,949	175,982	141,952	175,982
Scarborough	557,178	636,922	548,651	636,922		Scarborough	107,024	122,341	605,408	605,408

Sebago	139,276	159,209	49,851	159,209		Sebago	113,167	129,364	55,008	129,364
South Portland	245,551	280,695	725,058	725,058		South Portland	322,433	368,580	800,064	800,064
Standish	51,453	58,817	286,346	286,346		Standish	248,458	284,018	315,968	315,968
Westbrook	98,500	112,597	507,326	507,326		Westbrook	252,604	288,757	559,808	559,808
Windham	149,401	170,783	493,029	493,029		Windham	438,534	501,297	544,032	544,032
Yarmouth	63,679	72,793	242,121	242,121		Yarmouth	261,825	299,298	267,168	299,298
County	9,295	10,625	--	--		County	4,955	5,664	--	--
Other	329,760	376,956	---	---		Other	232,529	265,809	---	---
Totals	**7,145,955**	**8,168,691**				**Total**	**5,775,274**	**8,397,780**		

2015 dollars figured from Bureau of Labor CPI calculator http://data.bls.gov/cgi-bin/cpicalc.pl

Summer Storms This plan uses worst-case, real-life damages to calculate potential summer storm damages, and assumes that in the future, historic pattern the historic pattern will repeat itself. Hurricane Edna (1954) was the most devastating summer storm to hit Maine, and impacted the State ten days after Hurricane Carol. (DR 24) It caused an estimated $25,000,000 in damages (from US Weather Bureau Office (https://noaahrd.wordpress.com/2014/09/10/60th-anniversary-of-**hurricane-edna**/). The Disaster Declaration was for the entire state.

The damage in 2015 dollars would be approximately $220.2 million (multiply $25 million by 237– the CPI for 2015, and divide by 26.9 – the CPI for 1954). There has been substantial development, especially in the coastal areas since 1954. The low incidence of hurricanes in Maine keeps this within the category of summer storms; however, if hurricane probability were to increase, it would be included in future updates of the plan as a High Priority.

The methodology for calculating potential summer storm damages in Cumberland County is based on the damages that occurred in the State of Maine in 1954 with Hurricane Edna. The population of the State (from the 2010 census) is 1,328,361. Divide $220.2 million (the 1954 damages in 2015 dollars) by 1,328,361 to get a per capita cost of $166. Multiply each town's population by $166 to get potential summer storm damages.

Potential Summer Storm Damage in Cumberland County		
Baldwin	1,525	$253,150
Bridgton	5,210	$864,860
Brunswick	20,278	$3,36,6,148
Cape Elizabeth	9,015	$1,496,490
Casco	3,742	$621,172
Chebeague Island	341	$56,606
Cumberland	7,211	$1,197,026
Falmouth	11,185	$1,856,710
Freeport	7,879	$1,307,914
Frye Island	5	$830
Gorham	16,381	$2,719,246
Gray	7,761	$1,288,326
Harpswell	4,740	$786,840
Harrison	2,730	$453,180
Long island	230	$38,180
Naples	3,872	$642,752
New Gloucester	5,542	$919,972
North Yarmouth	3,565	$591,790
Portland	66,194	$10,988,204
Pownal	1,474	$244,684
Raymond	4,436	$736,376
Scarborough	18,919	$3,140,554
Sebago	1,719	$285,354
South Portland	25,002	$4,150,332
Standish	9,874	$1,639,084
Westbrook	17,494	$2,904,004
Windham	17,001	$2,822,166
Yarmouth	8,349	$1,385,934
TOTAL for County	**281,674**	**46,757,884**

Wildfires. This plan uses worst-case, real-life damages to calculate potential wildfire losses, and assumes that in the futures, the historic pattern will repeat itself.. The 1947 fire was the worst on record, although it was actually a series of wildfires that flared over Eastern and Southern Maine. The 1947 fire caused an estimated $30,000,000 (www.uninets.net/~dsrowley/Fires%20of%201947.pdf) in damages to Cumberland, Hancock, Oxford, and York Counties.

The damage in 2015 dollars would be about $318.8 million (multiply $30 million by 237– the CPI for 2015, and divide by 22.3 – the CPI for 1947). While there is significantly more development in each of these counties today than there was in 1947, fire-fighting capabilities have also increased so there may be no need to further increase the damage estimate. The probability that a wildfire such as the 1947 fire will hit Maine during the five-year period covered by this Plan is dependent upon such factors as rainfall, winds, and ignition sources, as well as fire apparatus accessibility.

The methodology for calculating potential wildfire losses in Cumberland County is based on the damages that occurred in the 1947 fire in Cumberland, Hancock, Oxford and York Counties. The population of these counties is 591,055; divide $318.8 million (the 1947 fire in 2015 dollars) by 591,055 to get a per capita cost of $540. Then multiply each town's population by $540 to get potential wildfire damages.

Potential Wildfire Damages in Cumberland County		
Municipality	**2010 Population**	**Potential Losses based on Per Capita $540.00**
Baldwin	1,525	$823,500
Bridgton	5,210	$2,813,400
Brunswick	20,278	$10,950,120
Cape Elizabeth	9,015	$4,868,100
Casco	3,742	$2,020,680
Chebeague Island	341	$184,140
Cumberland	7,211	$3,893,940
Falmouth	11,185	$6,039,900
Freeport	7,879	$4,254,660
Frye Island	5	$2,700
Gorham	16,381	$8,845,740
Gray	7,761	$4,190,940
Harpswell	4,740	$2,559,600
Harrison	2,730	$1,474,200
Long island	230	$124,200
Naples	3,872	2,090,880
New Gloucester	5,542	2,992,680
North Yarmouth	3,565	1,925,100
Portland	66,194	$35,744,760
Pownal	1,474	$795,960
Raymond	4,436	$2,395,440
Scarborough	18,919	$10,216,260
Sebago	1,719	$928,260
South Portland	25,002	$13,501,080
Standish	9,874	$5,331,960
Westbrook	17,494	$9,446,760
Windham	17,001	$9,180,540
Yarmouth	8,349	$4,508,460
County Total	**281,674**	**$152,103,960**

Coastal Erosion. Since this is a developing hazard with increasing sea levels and more intense storms, it is not yet possible to calculate the per capita estimate of damages (from coastal erosion) due to insufficient data and lack of reporting methodology by communities. In the next five years, CCEMA will work with local communities to document these damages separately from other storm damage.

ASSESSING VULNERABILITY: ANALYZING DEVELOPMENT TRENDS

Requirement §201.6(c)(2)(ii)(C):	The plan should describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land uses decisions.

Cumberland County is Maine's most populous County. Land use within the County ranges from densely populated urbanized areas to suburban residential areas to farm and forestland. The County contains Portland, which is Maine's most populous city. All of the communities in the County have enacted comprehensive plans, in compliance with Maine statute. All communities are participants in the NFIP program and all communities have floodplain ordinances to regulate development within flood zones. All but one community have enacted zoning and/or shoreline ordinances.

As can be seen by the population table above, overall population growth in the County between 2000 and 2010 was almost 6%. However, some communities experienced growth rates of up to 20% or during this period, while other communities experienced practically no growth at all. Several communities lost population including Brunswick and Harpswell, possibly as a result of the closure of Naval Air Station Brunswick. A clear trend in the county is that much of the residential growth is occurring in the suburban and rural communities.

As the populations of the suburban towns grows, so too does the demand for land that encroaches on historically forested and riparian areas. New population growth in these areas may contribute to hazard affects particularly when buffers between human activities and wild lands are not protected. This has placed a burden on the suburban towns as they deal with urban interface fire issues and expansion of infrastructure into these more remote areas.

Mitigation options used for future land-use decisions are being incorporated into municipality development and community planning goals. Because of these options and ordinances, little development in hazard prone areas has taken place affecting the vulnerability of the jurisdictions. Regional cooperation is required in order to analyze land use practices, which may exacerbate hazards, and to implement strategies to deal with the changing demographics. At the community level, land use planning goals include ensuring the efficient allocation and management of resources and protection of the environment through compliance with federal, state and local laws and regulations.

MULTI-JURISDICTIONAL RISK ASSESSMENT

Requirement §201.6(c)(2)(iii):	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

The following are hazards for which all areas of the County are subject to the same general risk:

- Severe winter storms
- Severe summer storms
- Riverine Flooding
- Wildfires (with some limited variance among the communities, particularly a lower degree of risk within the immediate Greater Portland area).

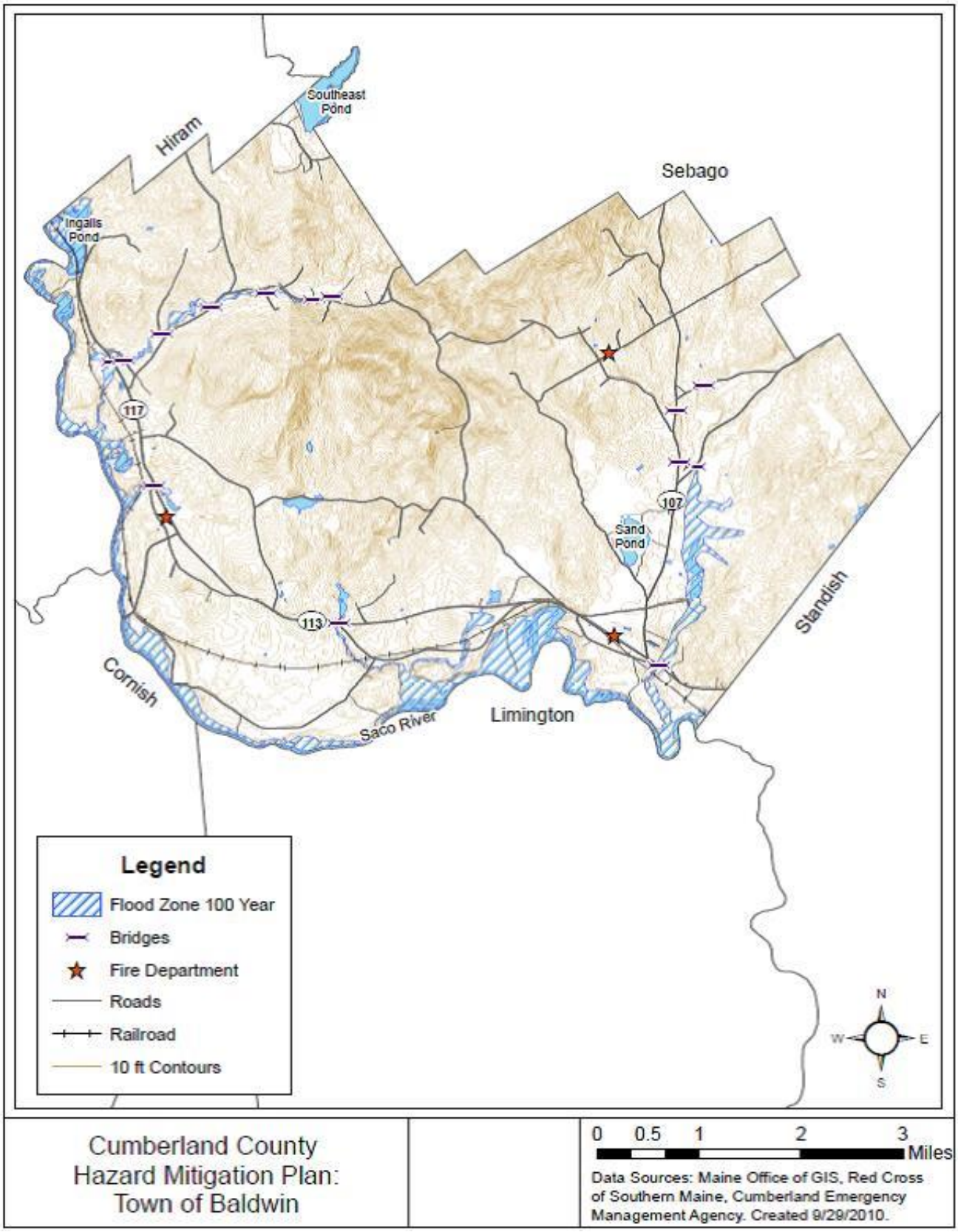
The following hazards primarily affect the coastal communities of Scarborough, Cape Elizabeth, South Portland, Portland, Falmouth, Cumberland, Yarmouth, Freeport, Brunswick, Long Island, Chebeague Island, and Harpswell:

- Coastal erosion

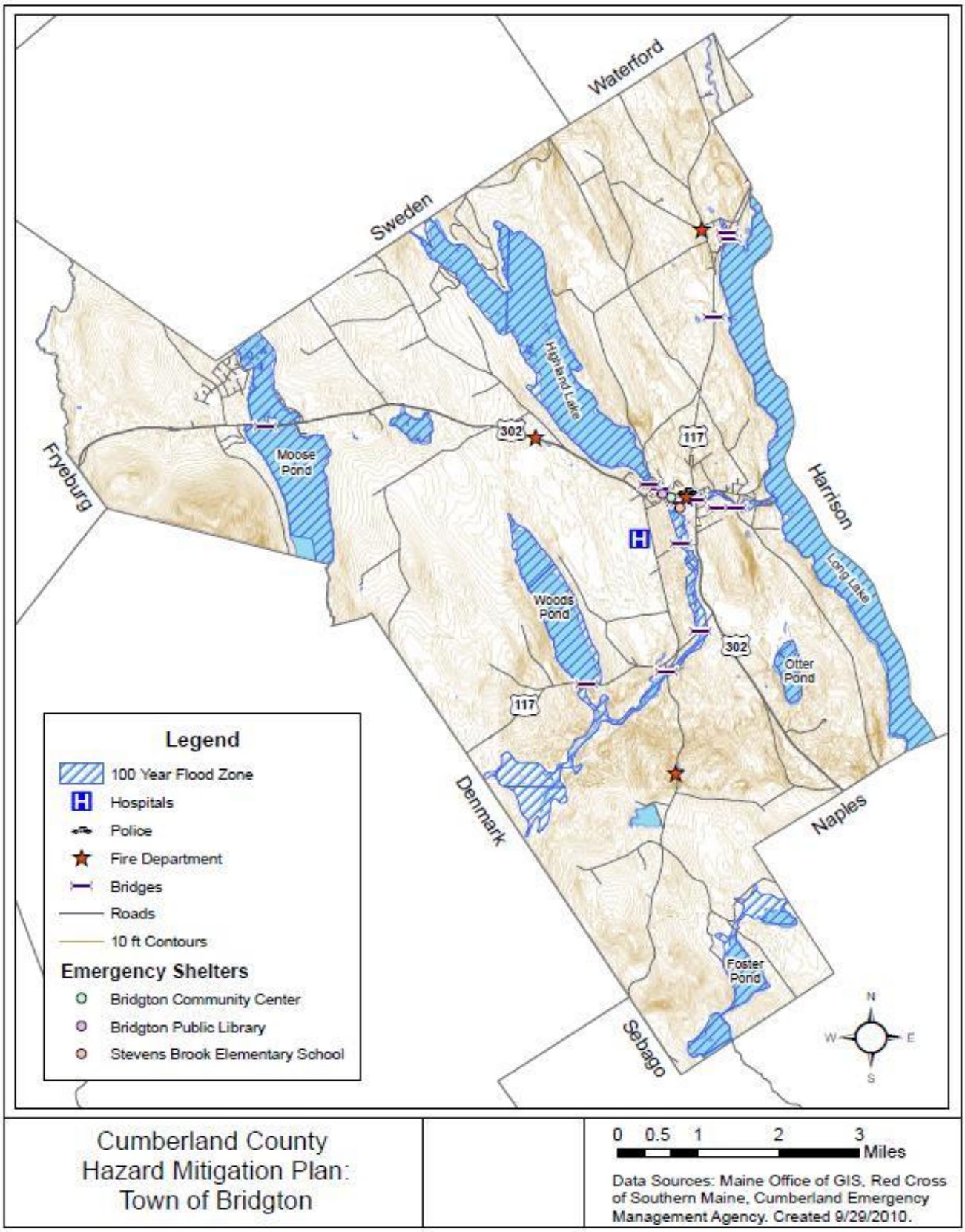
COUNTY BASE MAPS

Following are base maps of the 28 cities and towns in Cumberland County. Data was obtained from the Maine Office of GIS, Maine DEP, Maine Geological Survey, Maine Department of Transportation and the individual municipalities. Each figure shows the municipal boundary, topographic relief, floodplains, critical facilities and principal roads. The maps were created for the 2012 Plan and were reviewed for accuracy for the 2017 Plan.

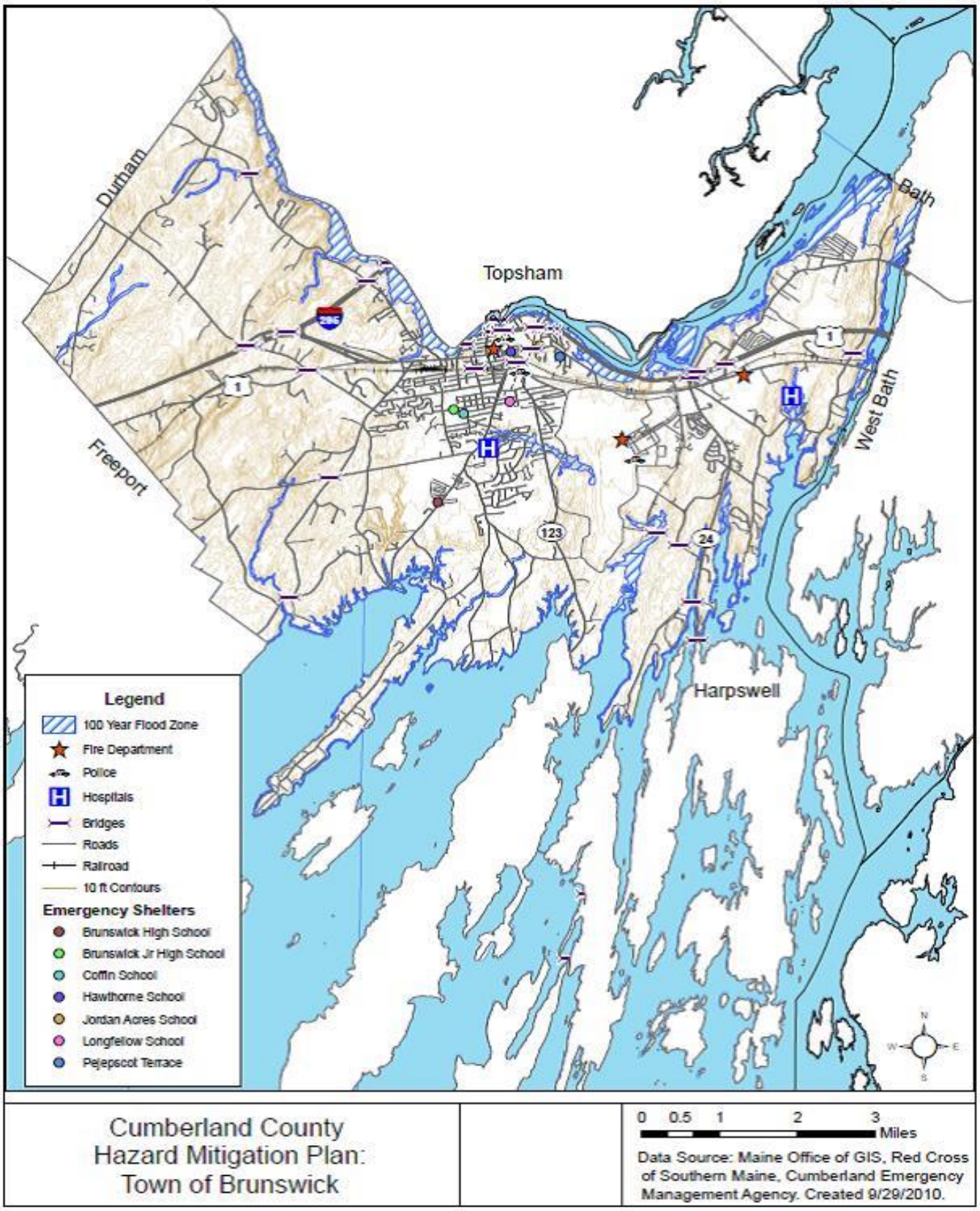
The primary flood analysis data used was the FEMA FIRM flood zone areas. The Army Corps of Engineers SLOSH data for Cumberland County was obtained and examined for storm surge inundation areas. These areas appeared to follow roughly with the FEMA FIRM data. LIDAR mapping has been done on many areas of the county, but the analysis is still in process.



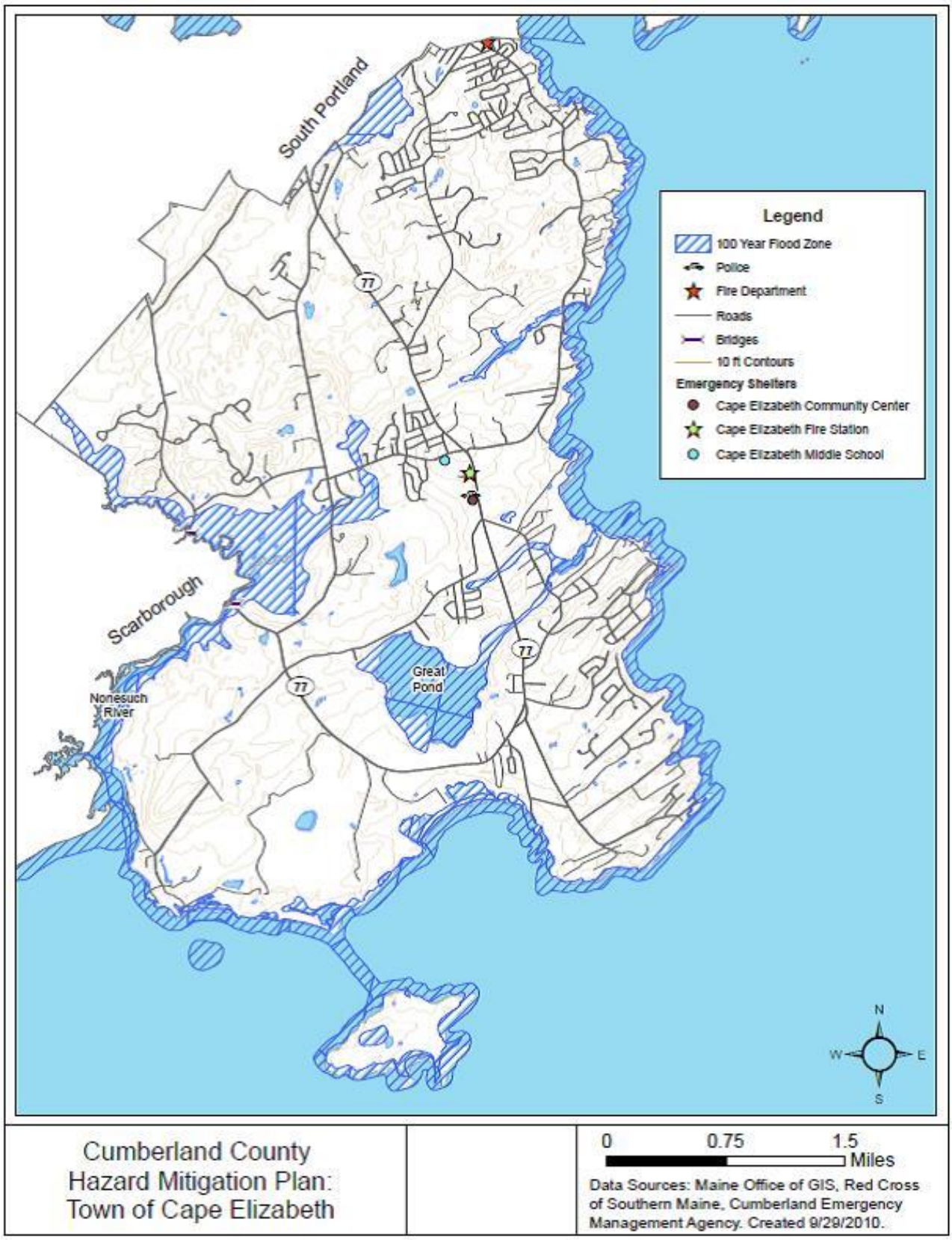
Cumberland County Hazard Mitigation Plan: Town of Baldwin



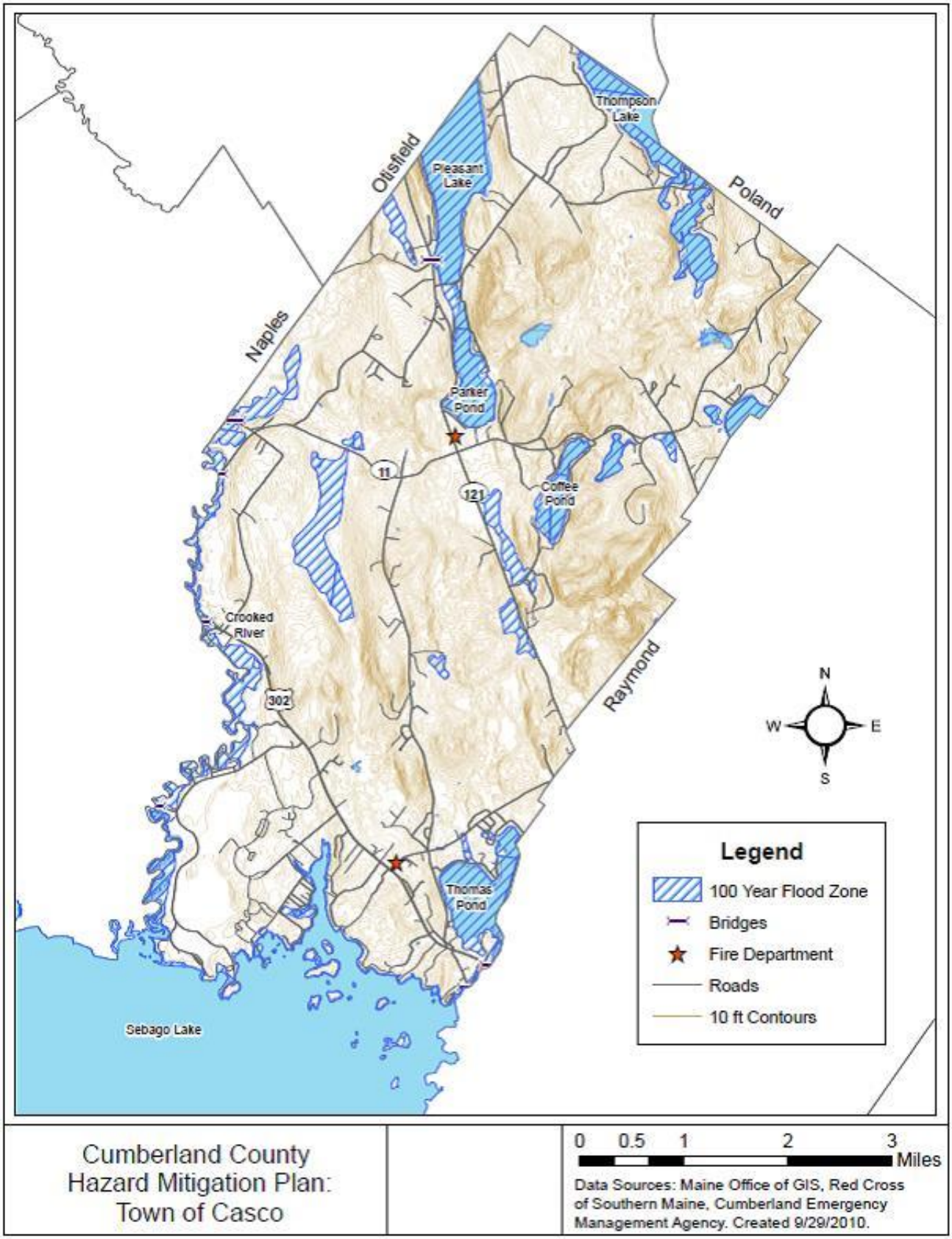
Cumberland County Hazard Mitigation Plan: Town of Bridgton



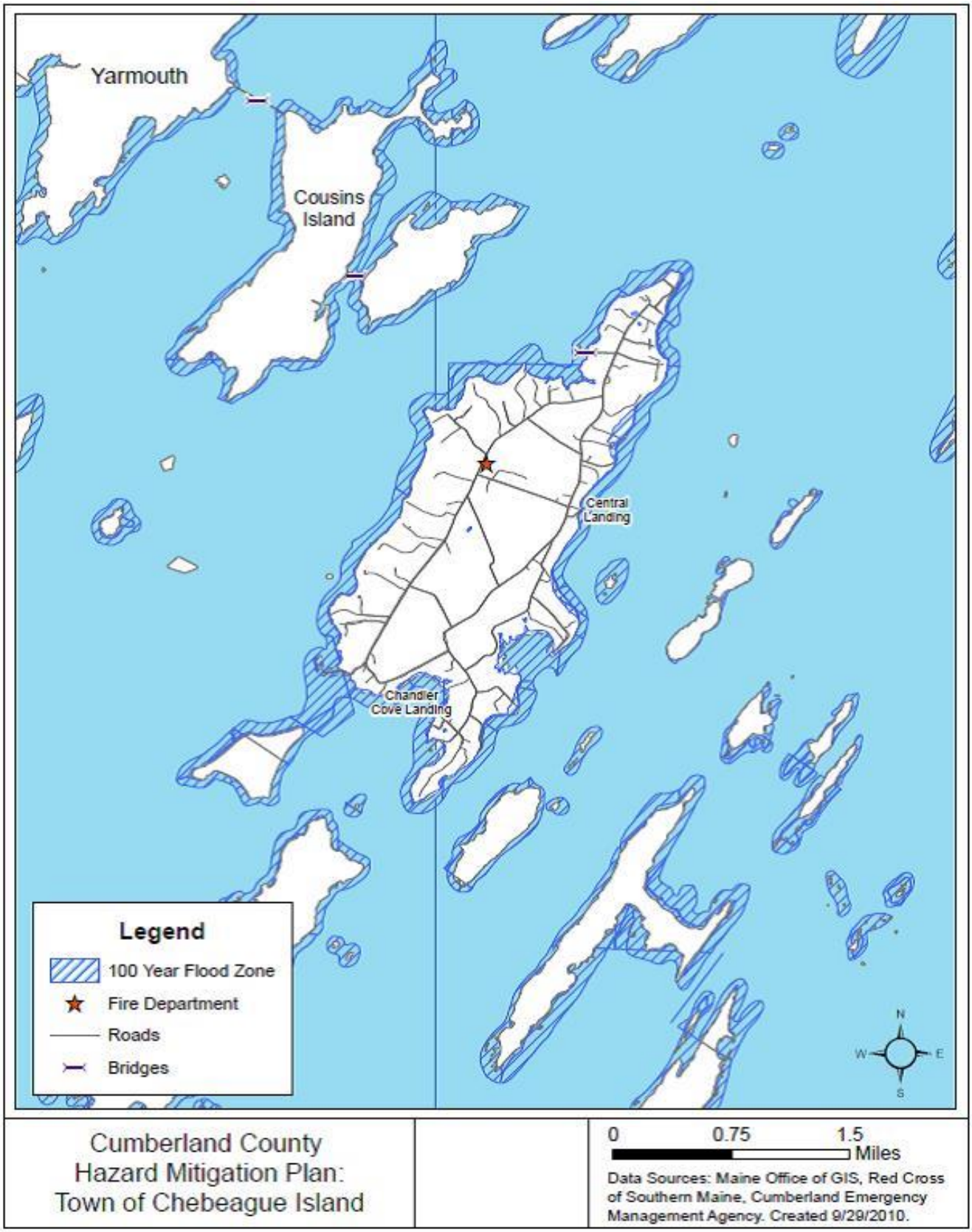
Cumberland County
Hazard Mitigation Plan:
Town of Brunswick

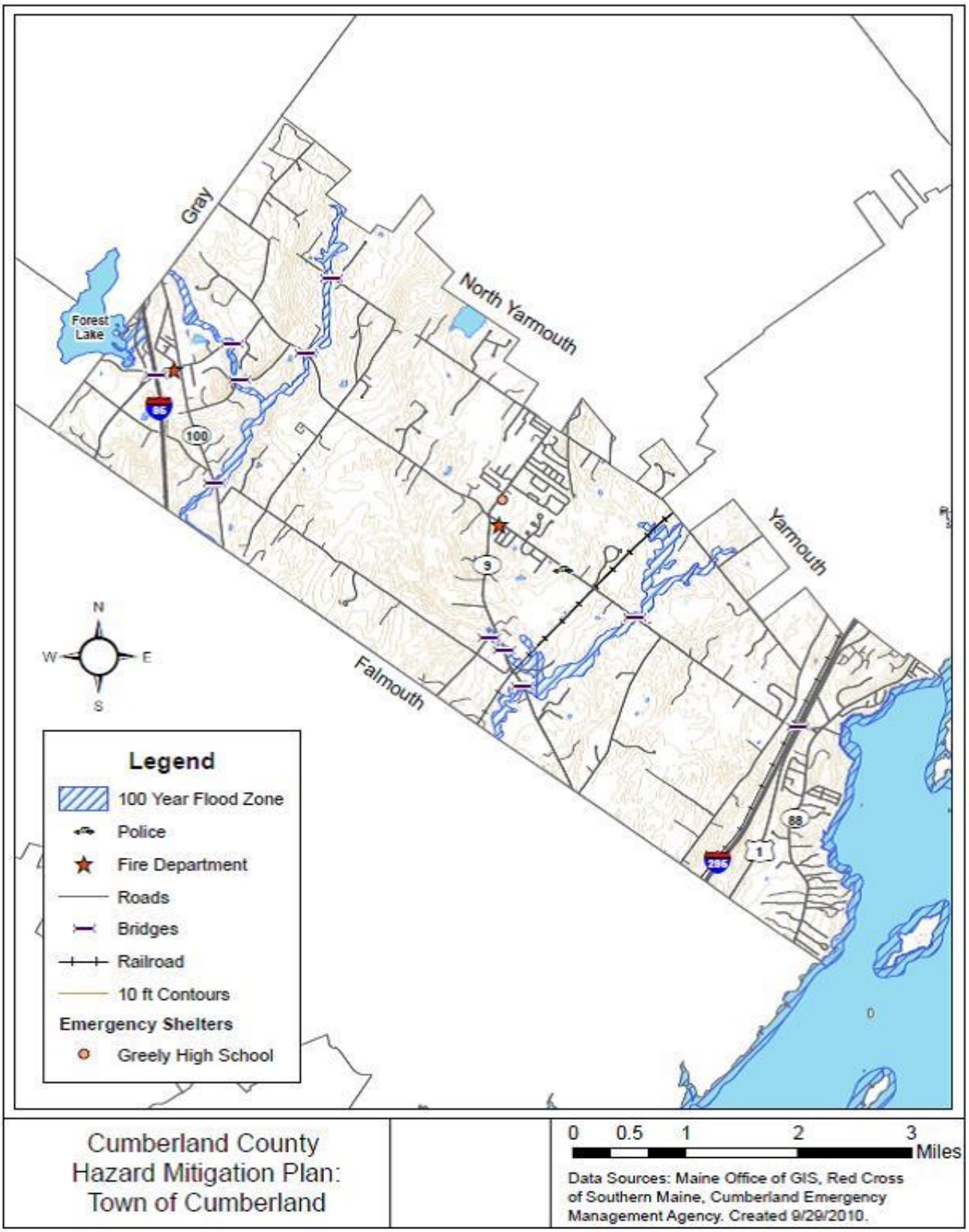


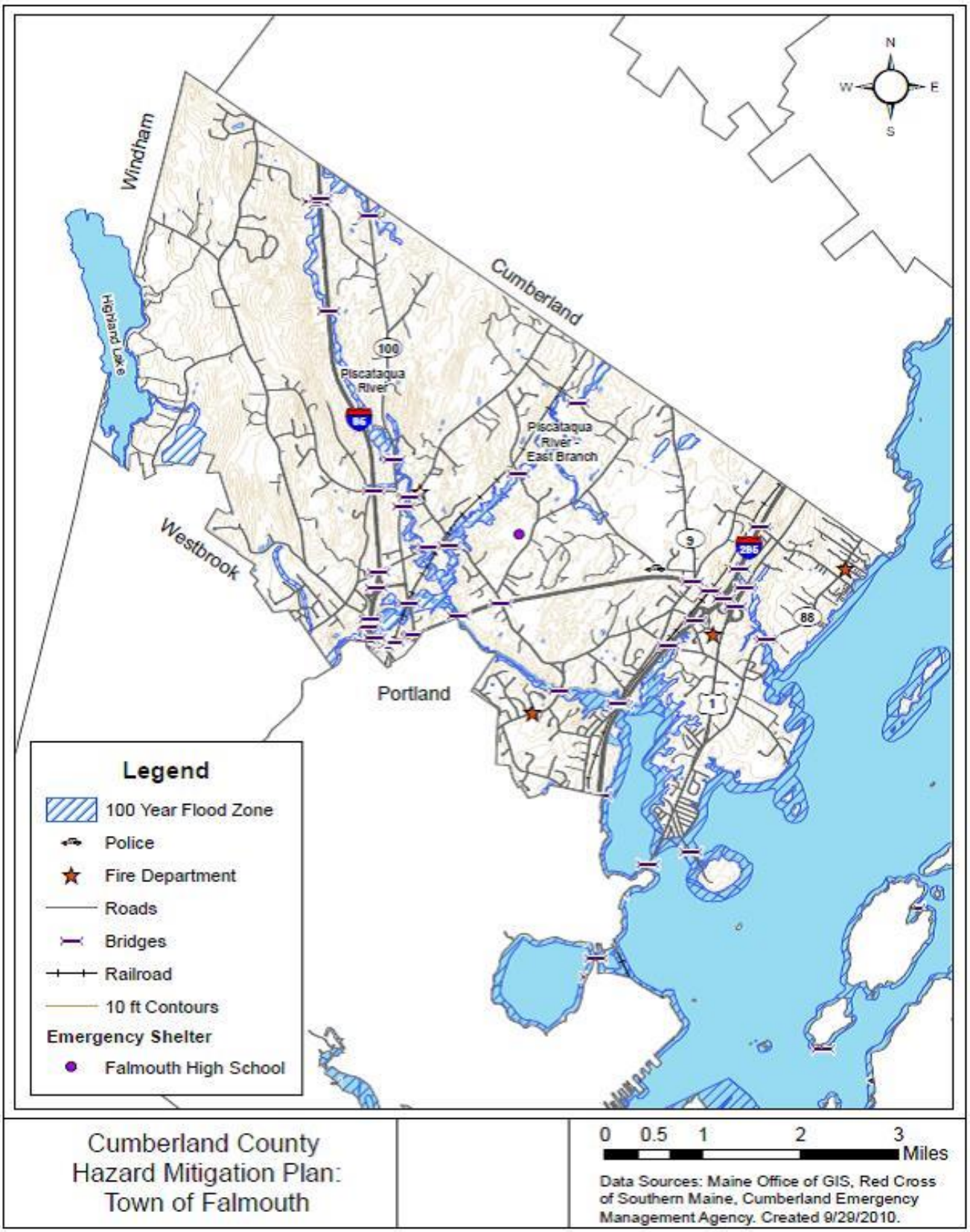
Cumberland County
Hazard Mitigation Plan:
Town of Cape Elizabeth



Cumberland County Hazard Mitigation Plan: Town of Casco


Yarmouth
Cousins Island
Central Landing
Chandler Cove Landing
Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
N
W
E
S
Cumberland County Hazard Mitigation Plan: Town of Chebeague Island
0
0.75
1.5
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Gray
North Yarmouth
Yarmouth
Falmouth
Forest Lake
95
100
9
1
88
295
N
W
E
S
Legend
100 Year Flood Zone
Police
Fire Department
Roads
Bridges
Railroad
10 ft Contours
Emergency Shelters
Greely High School
Cumberland County
Hazard Mitigation Plan:
Town of Cumberland
0 0.5 1 2 3
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


N
W
E
S
Windham
Cumberland
Highland Lake
100
Piscataqua River
95
Piscataqua River - East Branch
Westbrook
9
295
88
Portland
1
Legend
100 Year Flood Zone
Police
Fire Department
Roads
Bridges
Railroad
10 ft Contours
Emergency Shelter
Falmouth High School
Cumberland County Hazard Mitigation Plan: Town of Falmouth
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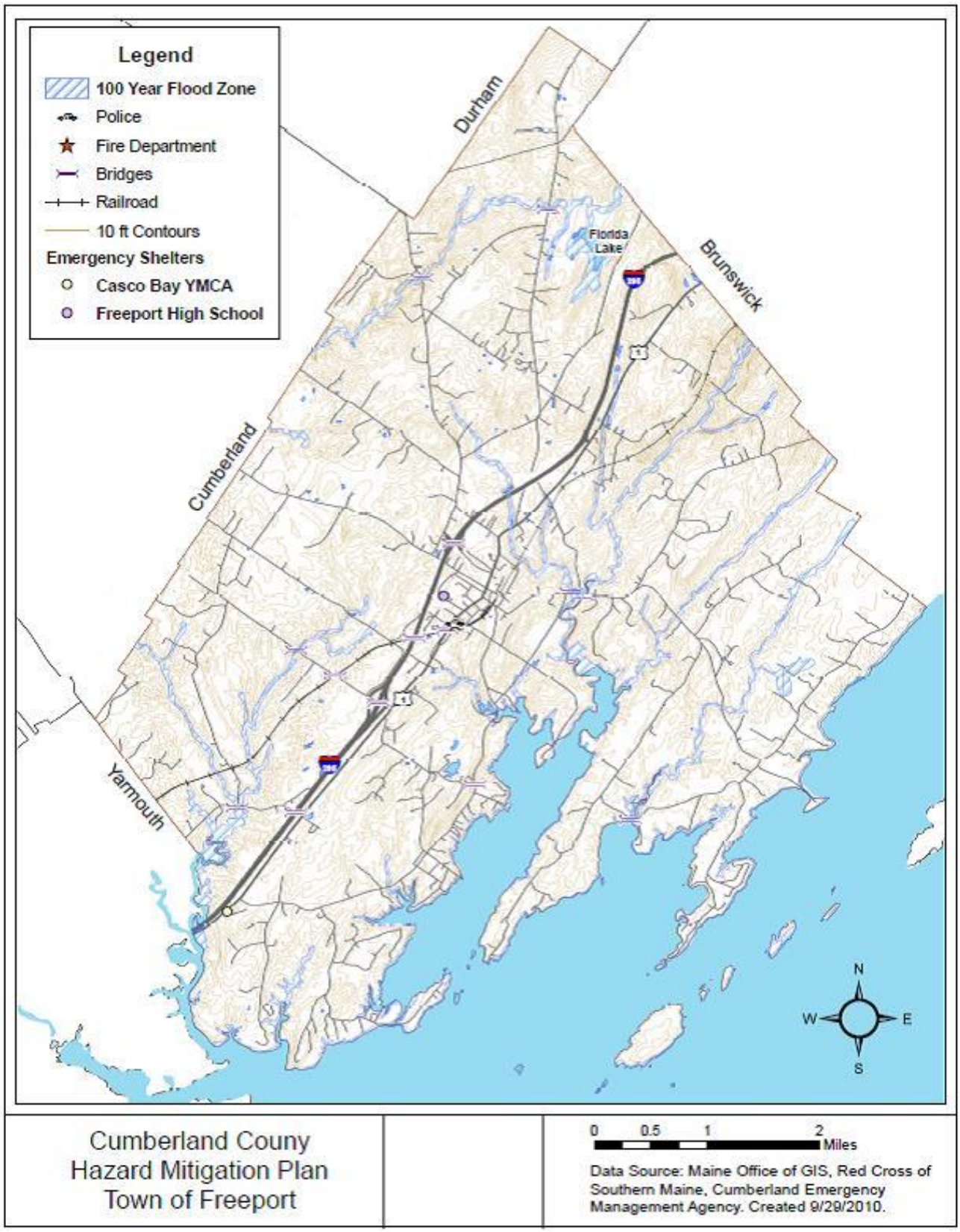
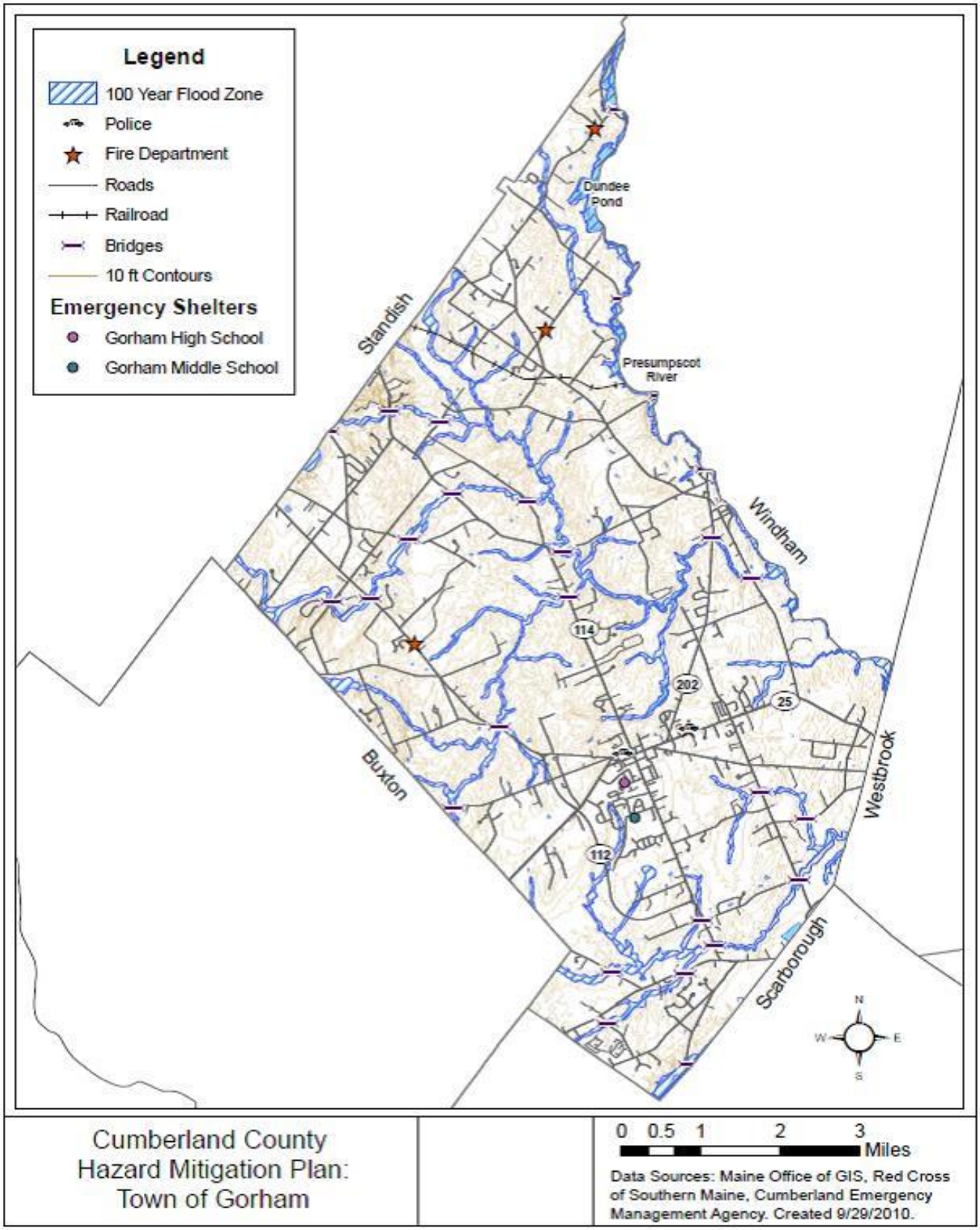
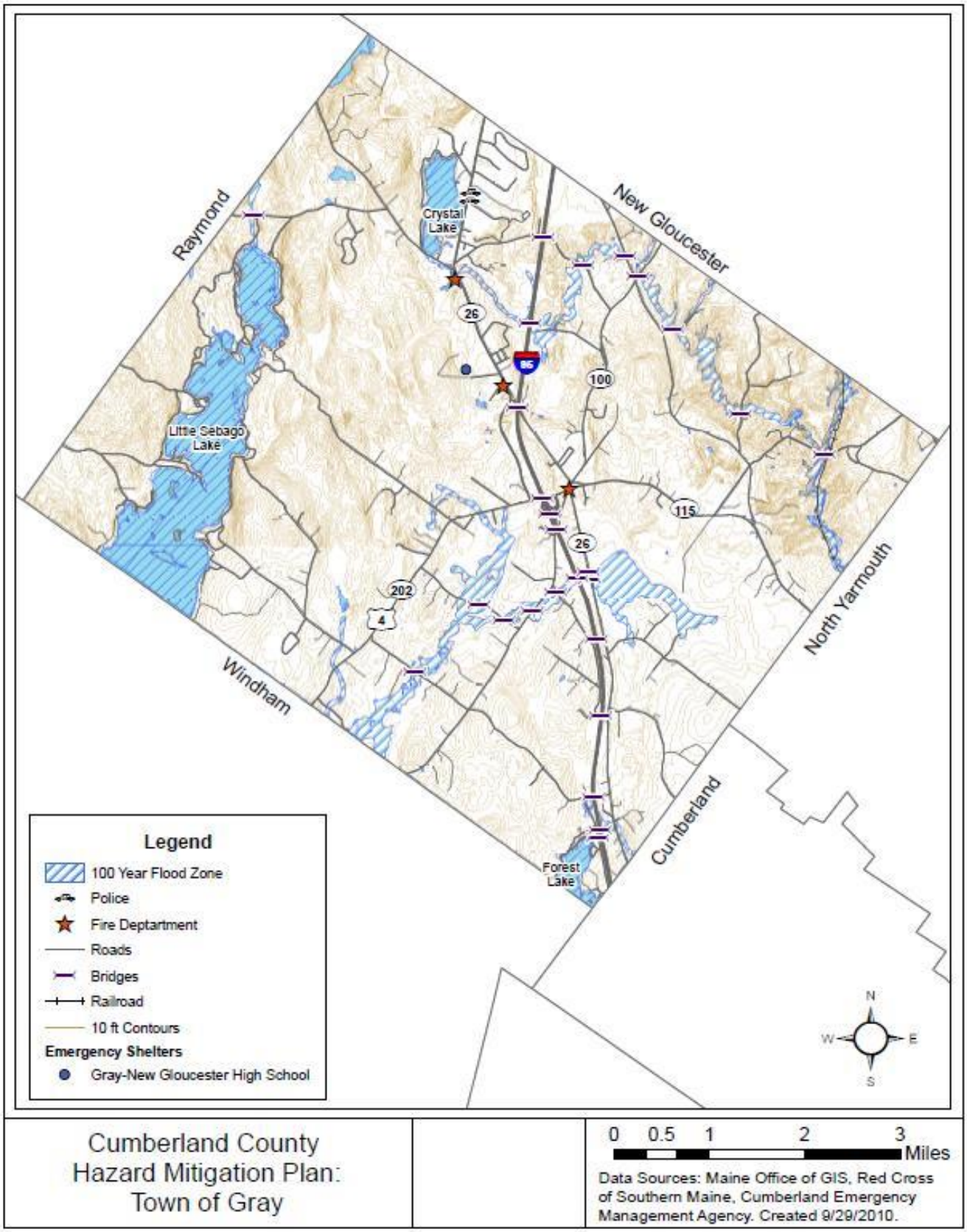
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Legend
100 Year Flood Zone
Police
Fire Department
Bridges
Railroad
10 ft Contours
Emergency Shelters
Casco Bay YMCA
Freeport High School
Durham
Brunswick
Cumberland
Yarmouth
Florida Lake
N
W
E
S
Cumberland Couny
Hazard Mitigation Plan
Town of Freeport
0 0.5 1 2 Miles
Data Source: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

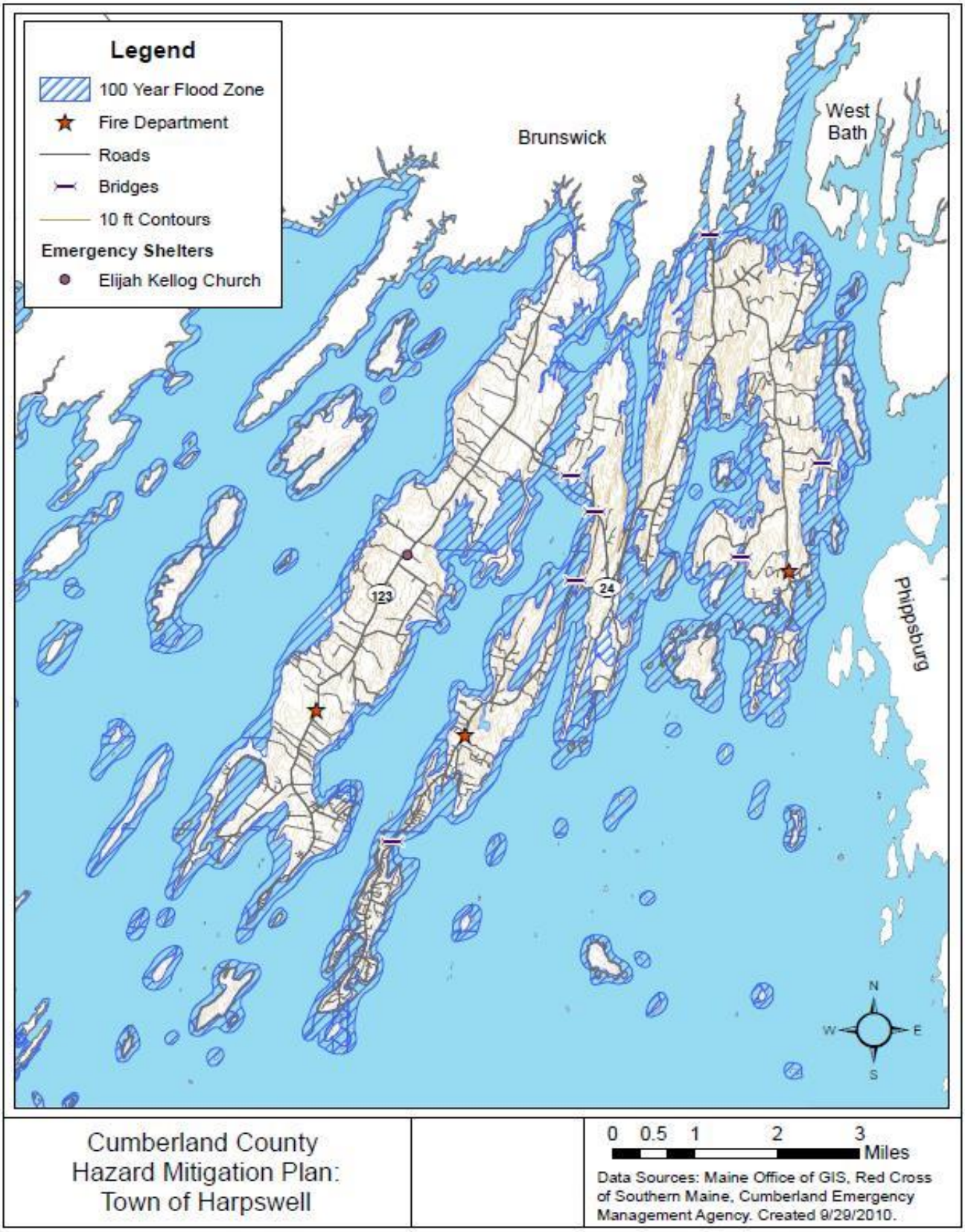
Raymond
Legend
100 Year Flood Zone
Fire Department
Roads
10 ft Contours
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
Town of Frye Island
0 0.125 0.25 0.5
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

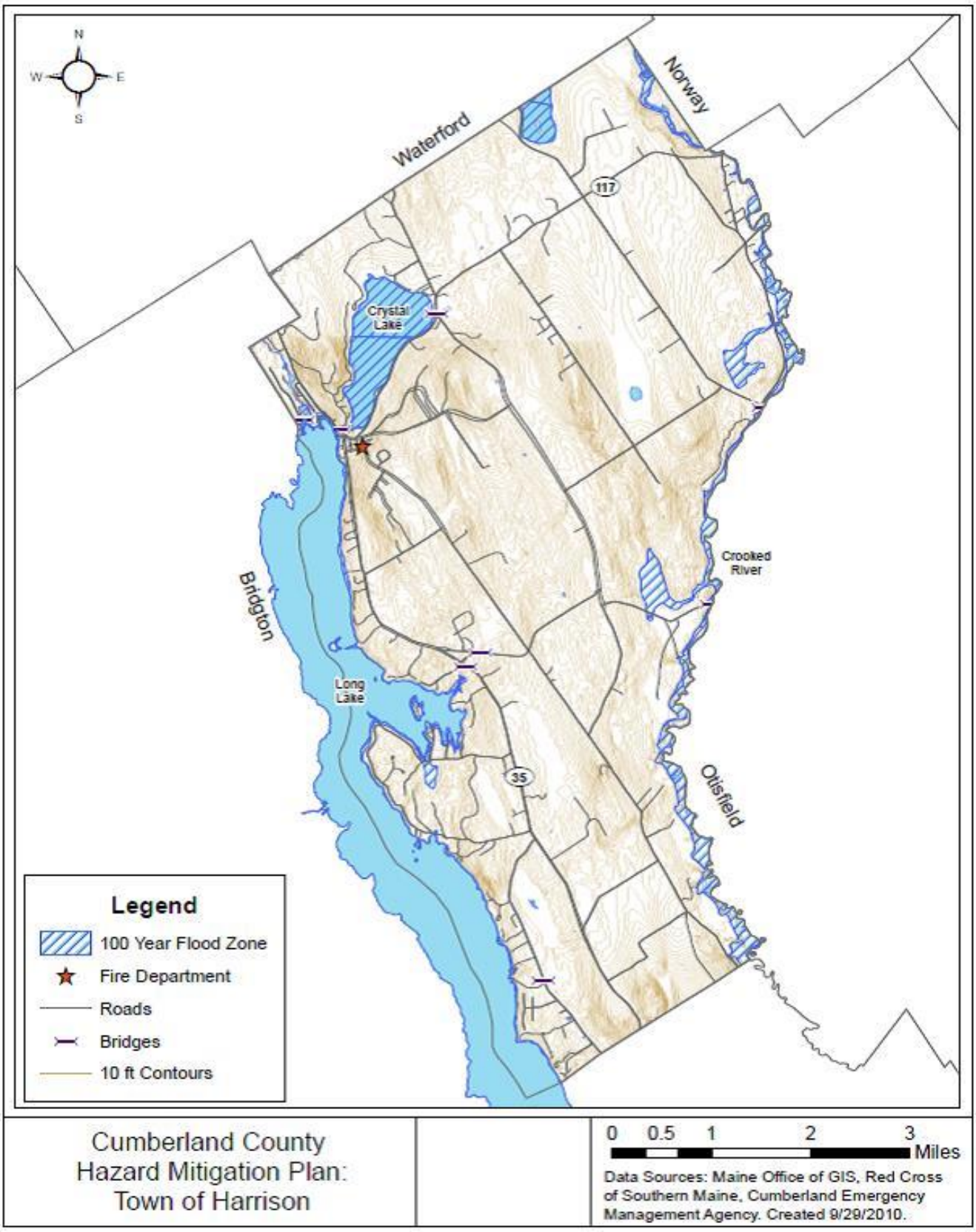


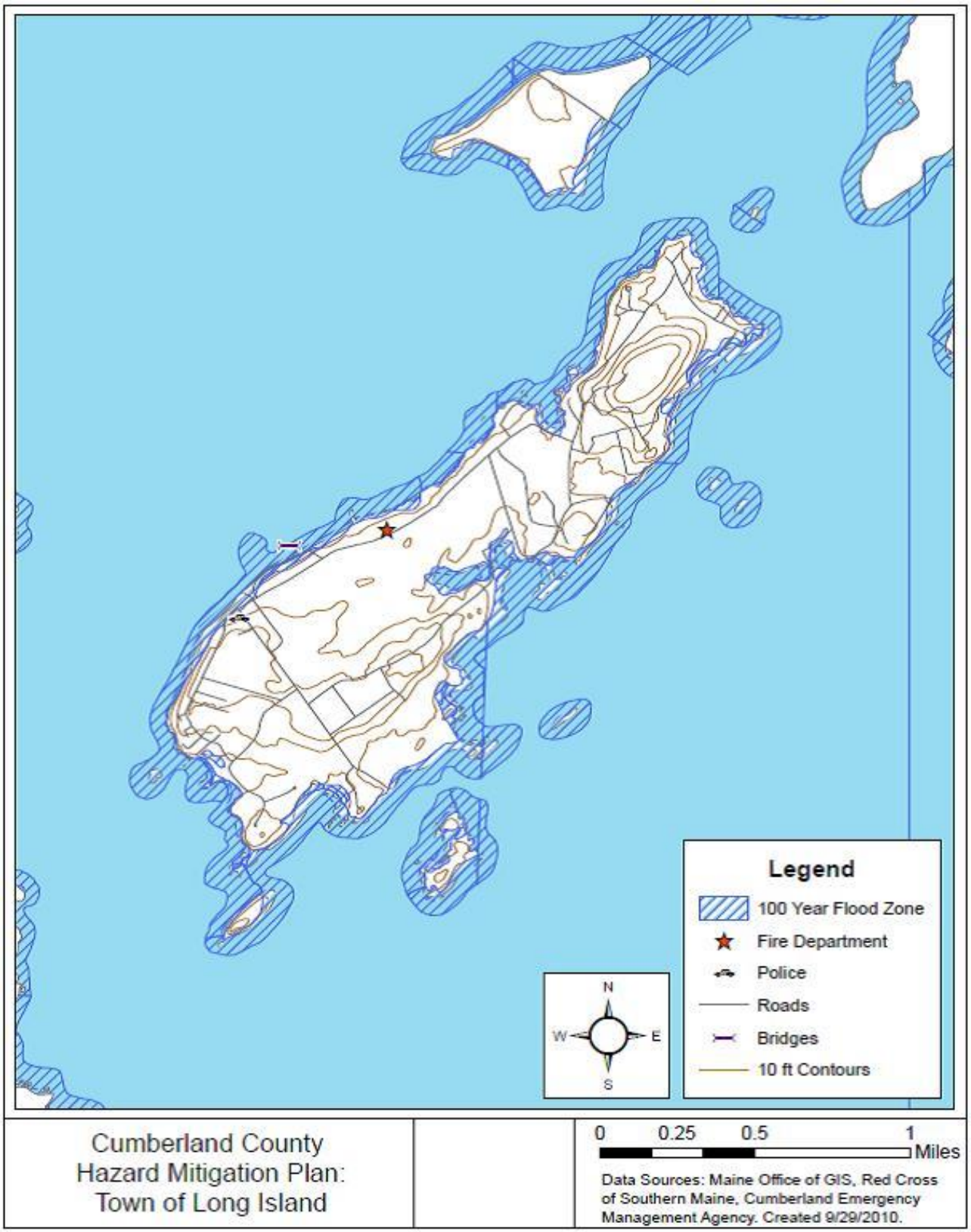
Cumberland County Hazard Mitigation Plan: Town of Gorham

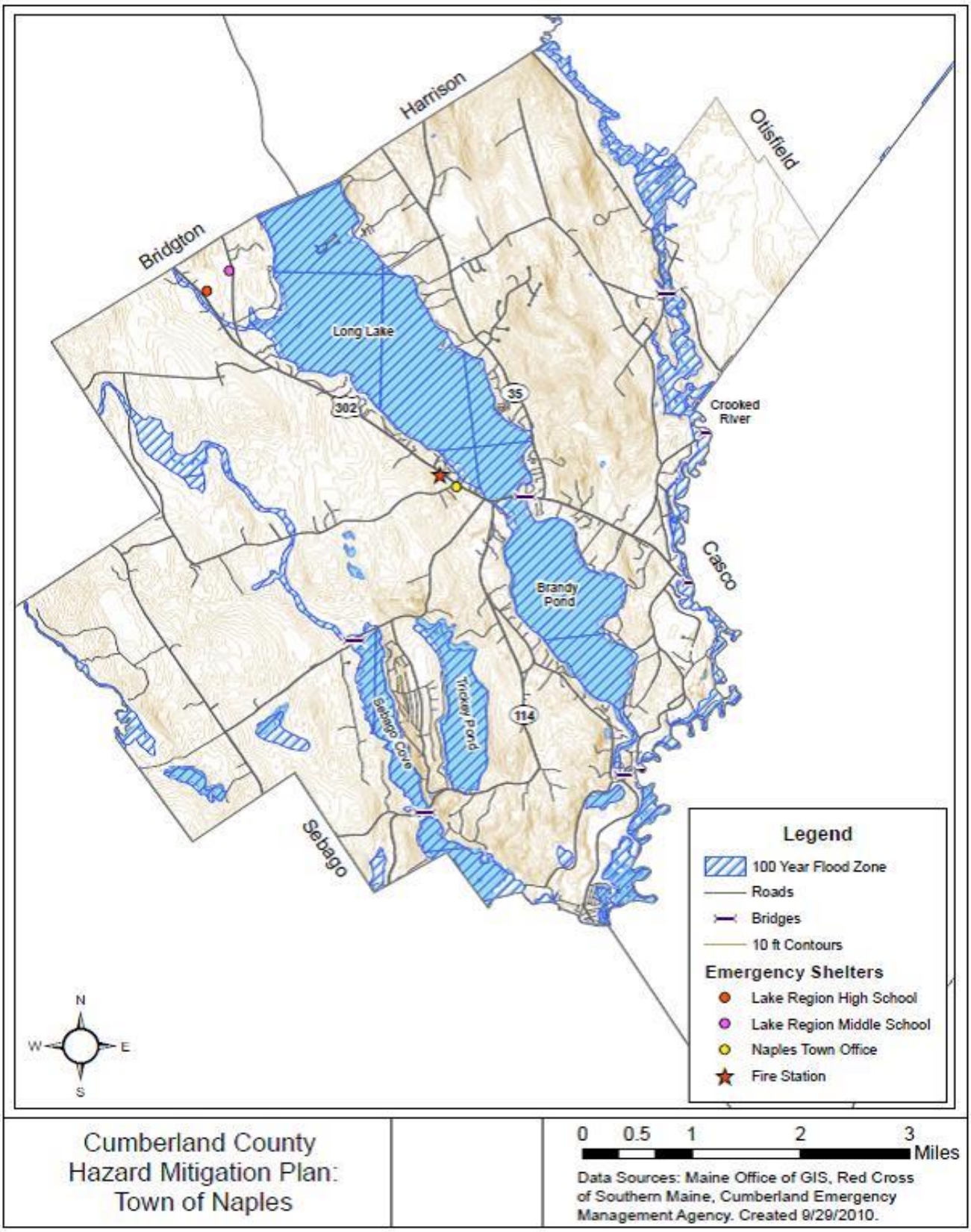


Cumberland County Hazard Mitigation Plan: Town of Gray

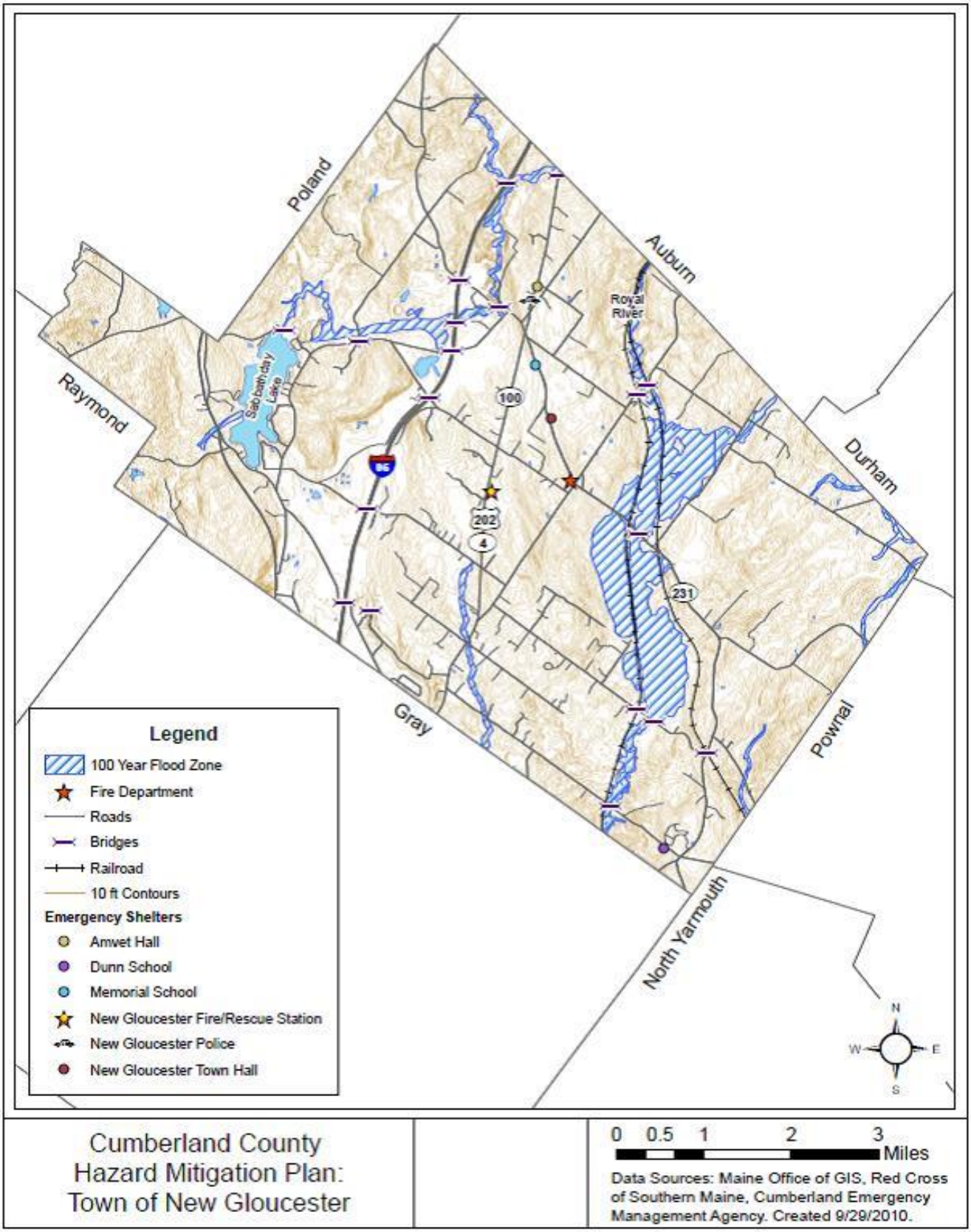

Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
10 ft Contours
Emergency Shelters
Elijah Kellog Church
Brunswick
West Bath
Phippsburg
123
24
N
W
E
S
Cumberland County Hazard Mitigation Plan: Town of Harpswell
0 0.5 1 2 3 Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


N
W
E
S
Waterford
Norway
117
Crystal Lake
Crooked River
Bridgton
Long Lake
35
Otisfield
Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
10 ft Contours
Cumberland County Hazard Mitigation Plan: Town of Harrison
0 0.5 1 2 3 Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

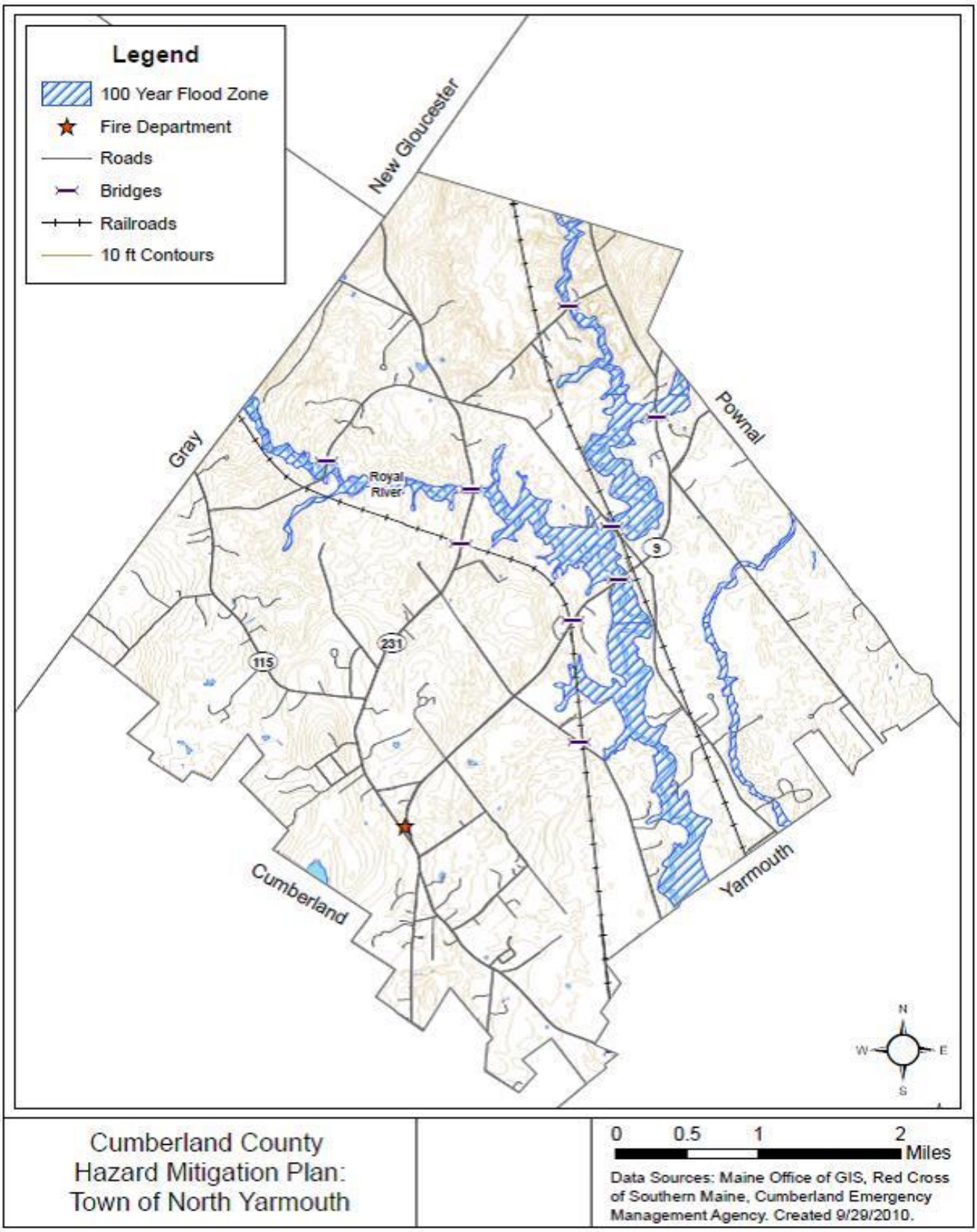

Legend
100 Year Flood Zone
Fire Department
Police
Roads
Bridges
10 ft Contours
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
Town of Long Island
0
0.25
0.5
1
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

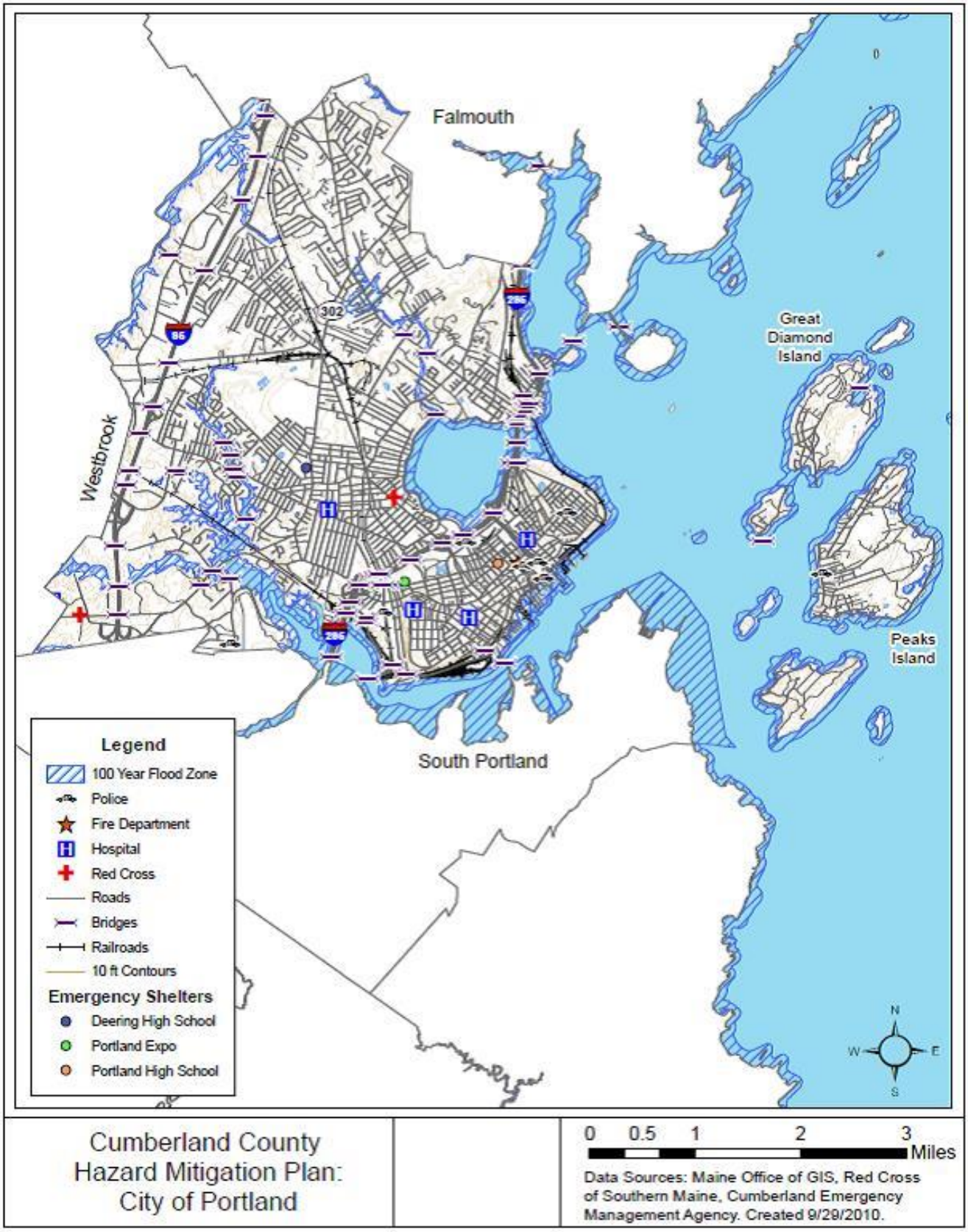


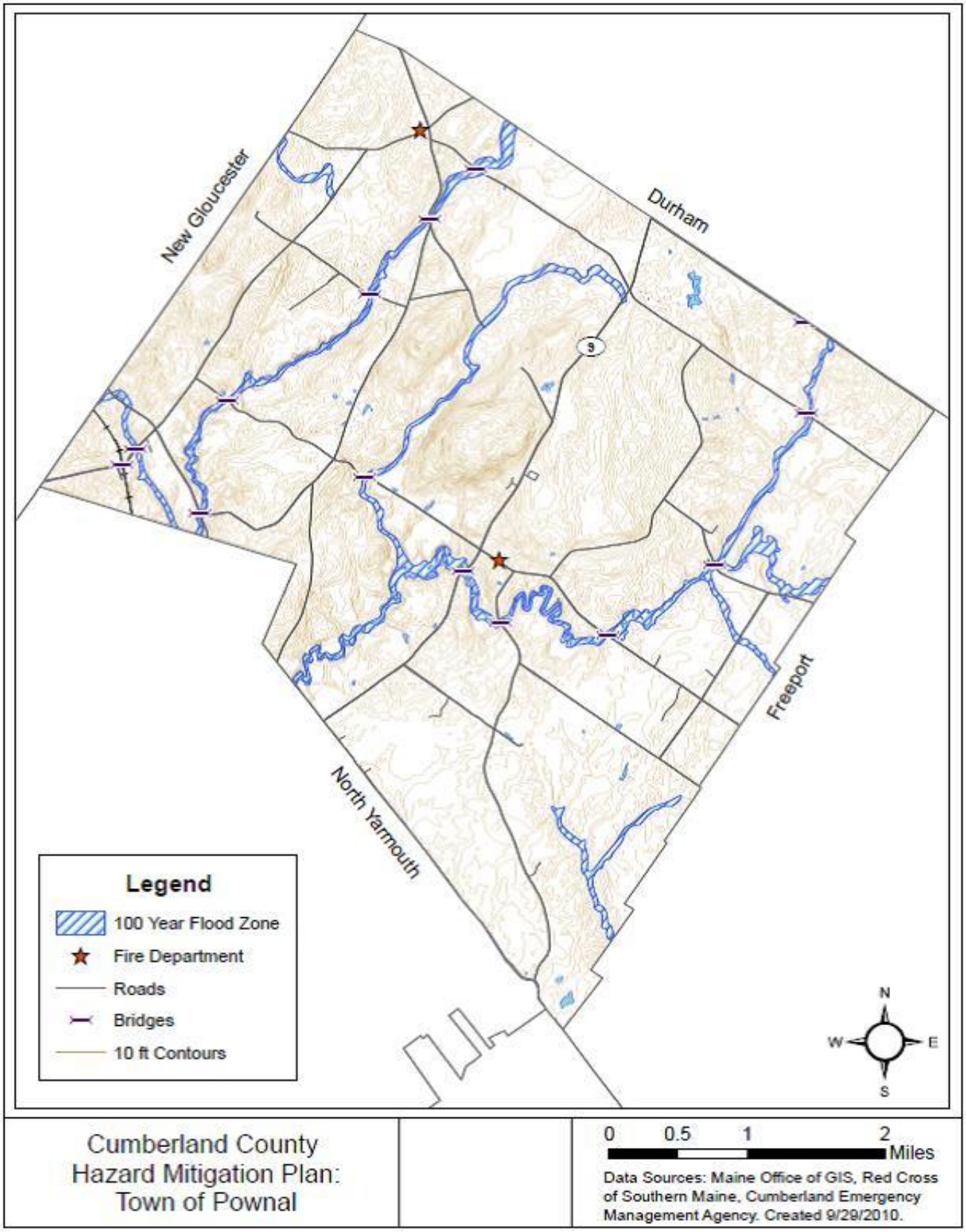
Cumberland County Hazard Mitigation Plan: Town of Naples



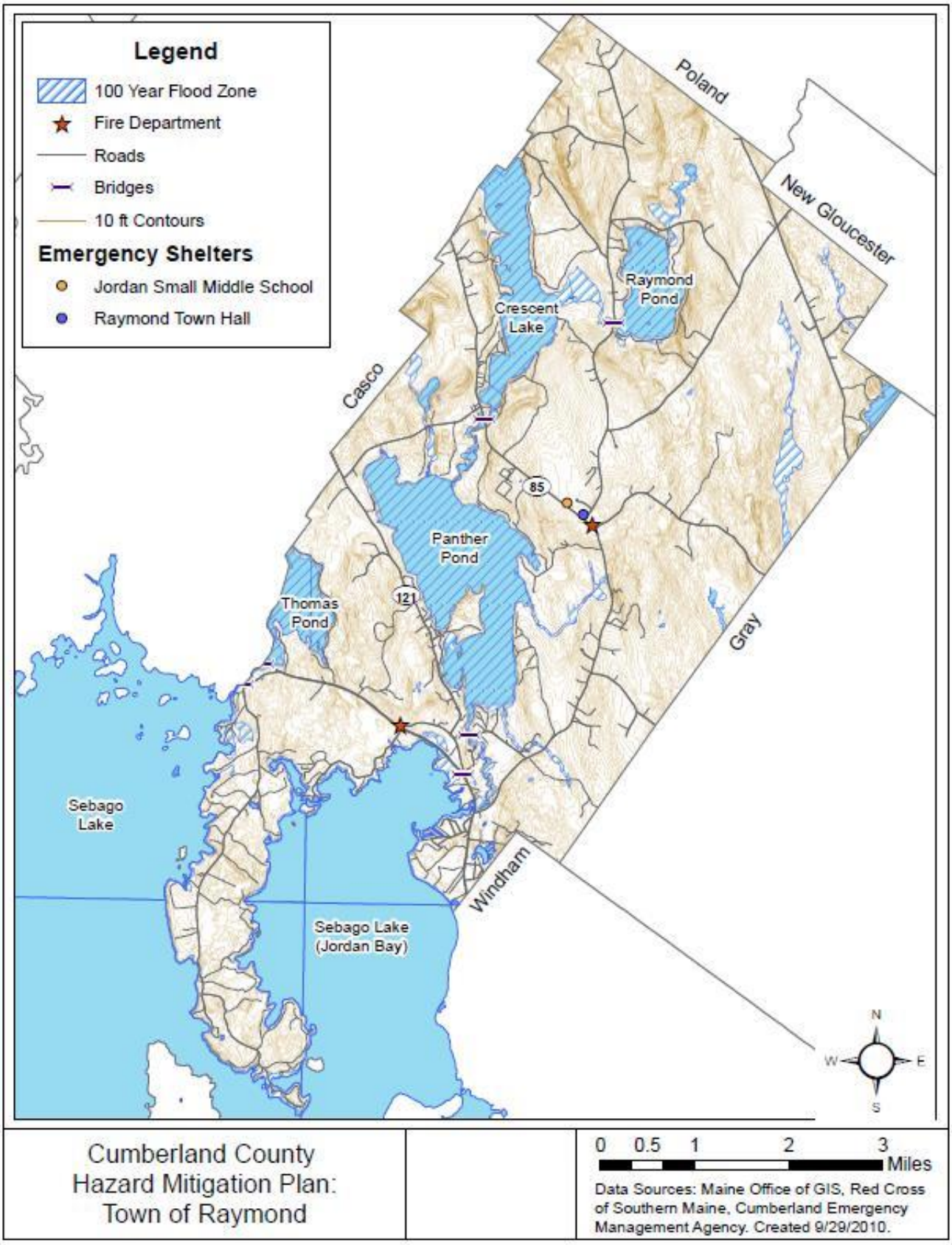
Cumberland County
Hazard Mitigation Plan:
Town of New Gloucester

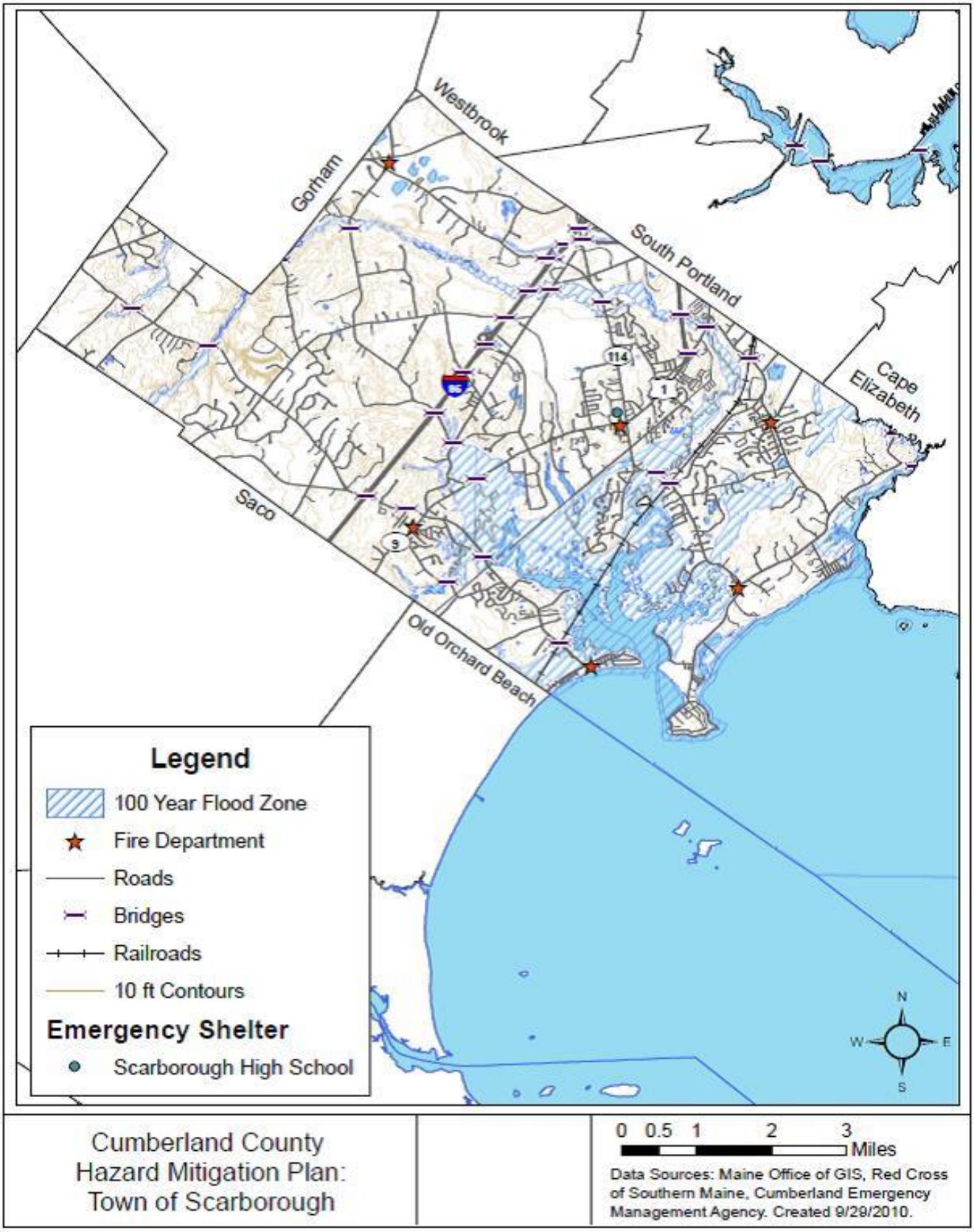

Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
Railroads
10 ft Contours
New Gloucester
Gray
Pownal
Royal River
9
231
115
Cumberland
Yarmouth
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
Town of North Yarmouth
0 0.5 1 2
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

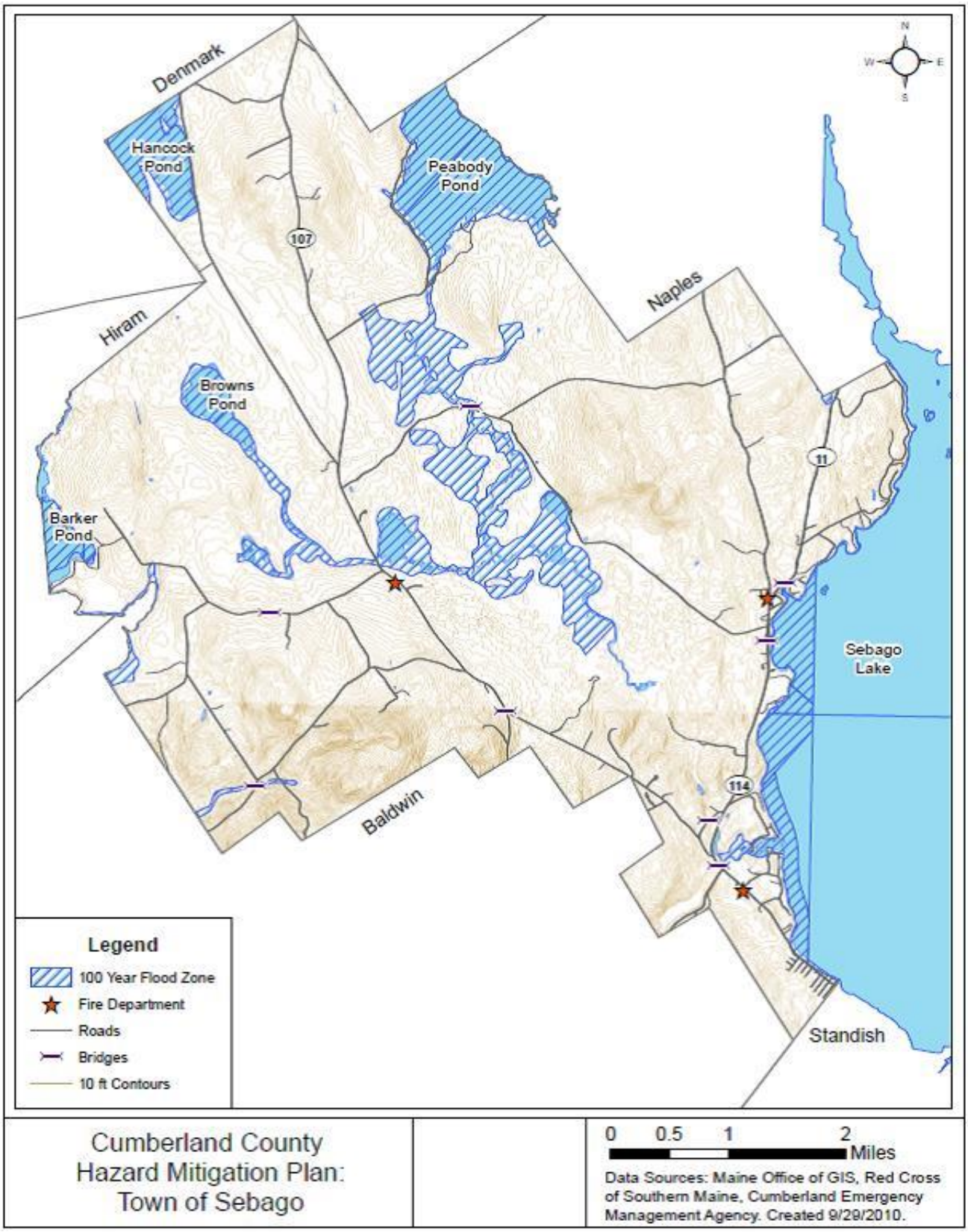

Falmouth
Great Diamond Island
Westbrook
Peaks Island
South Portland
302
295
95
Legend
100 Year Flood Zone
Police
Fire Department
Hospital
Red Cross
Roads
Bridges
Railroads
10 ft Contours
Emergency Shelters
Deering High School
Portland Expo
Portland High School
N
W
E
S
Cumberland County Hazard Mitigation Plan: City of Portland
0 0.5 1 2 3 Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

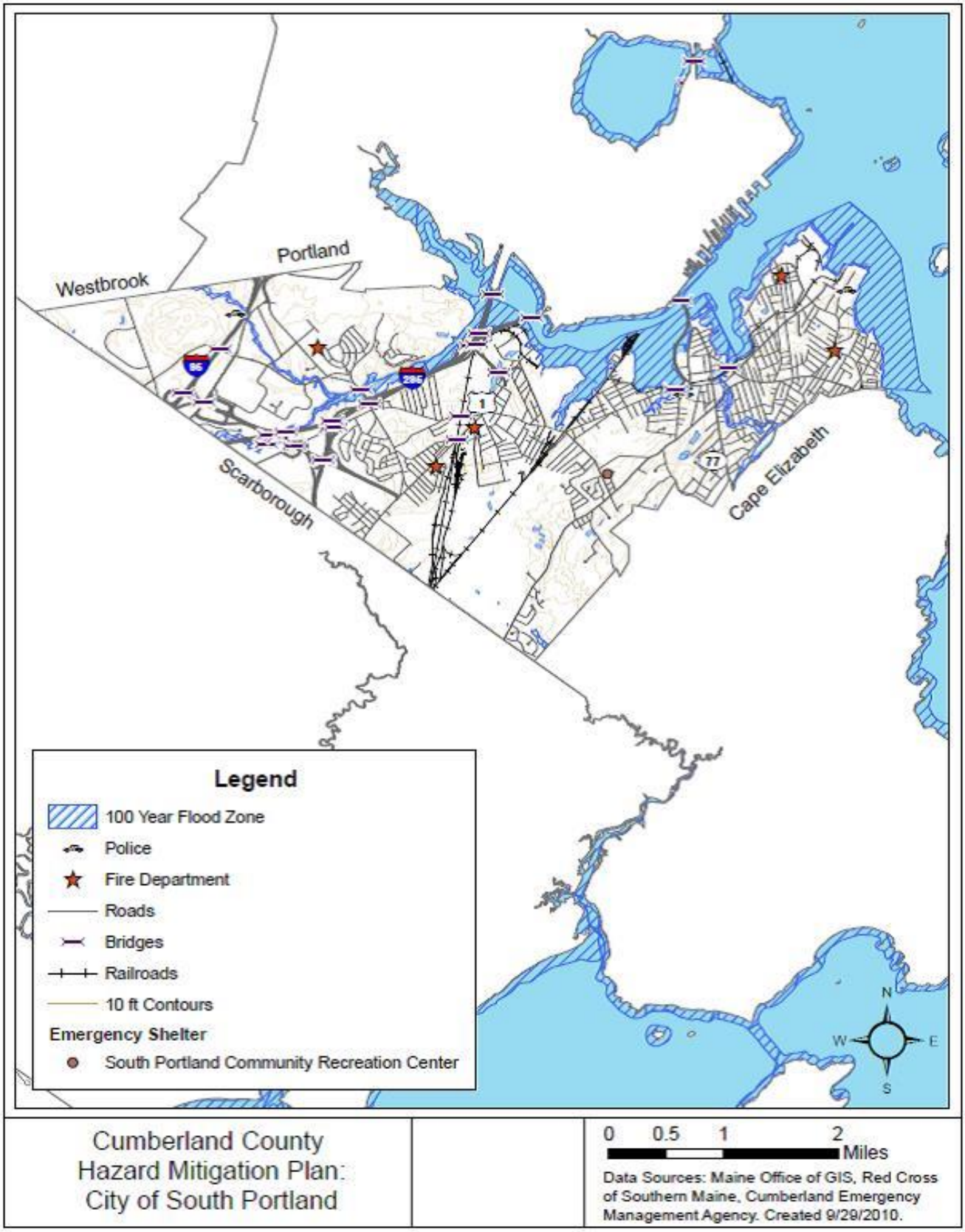


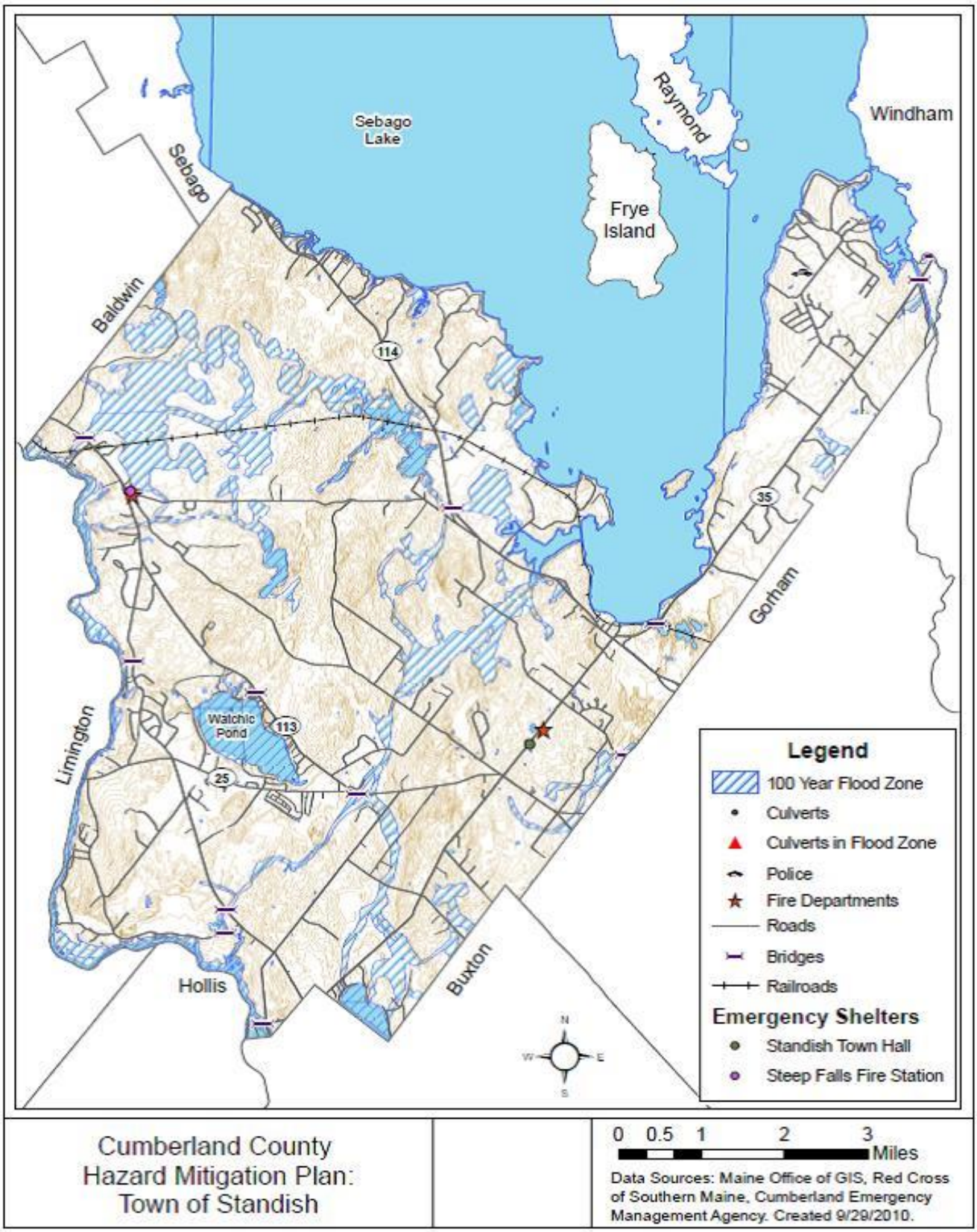
Cumberland County Hazard Mitigation Plan: Town of Pownal

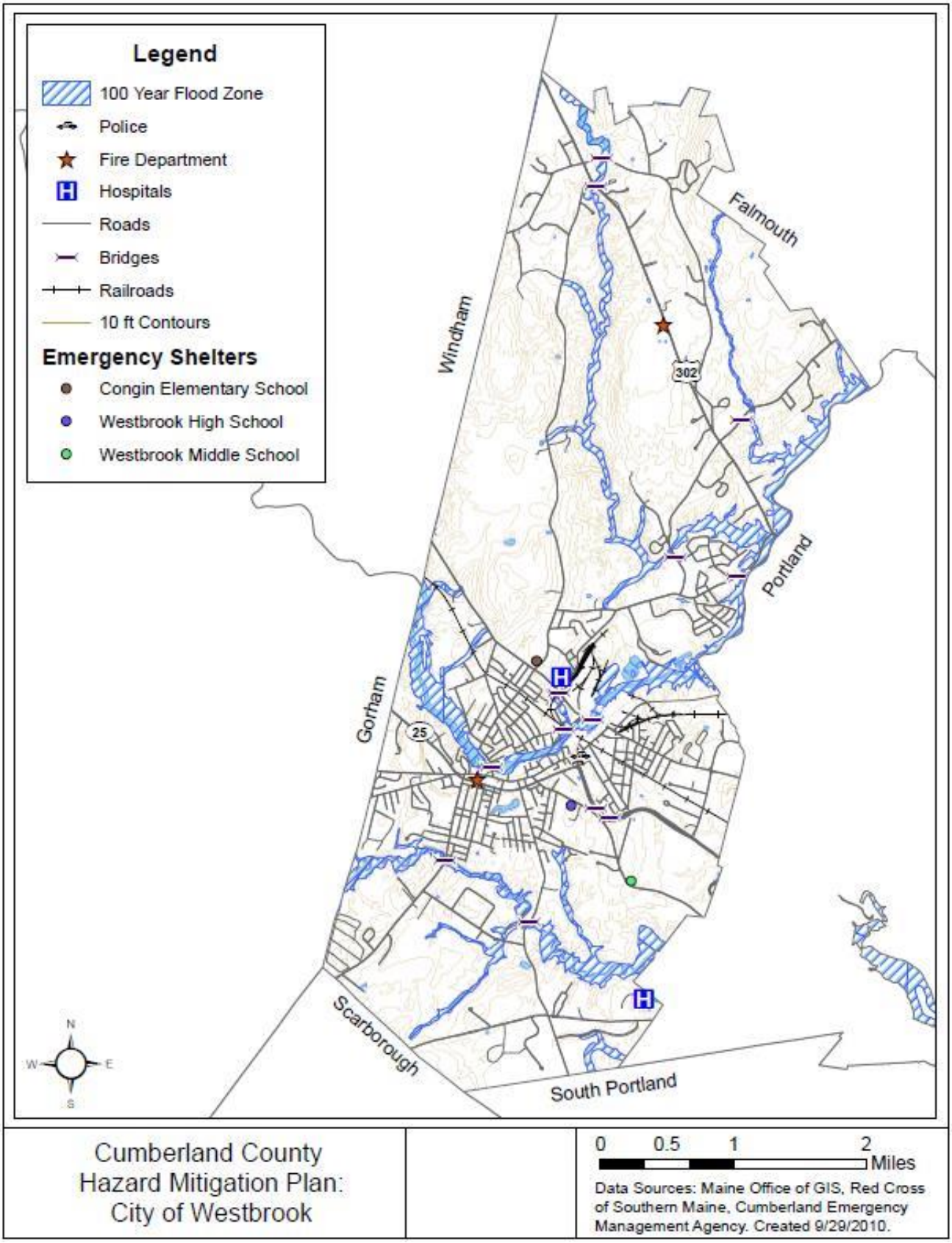

Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
10 ft Contours
Emergency Shelters
Jordan Small Middle School
Raymond Town Hall
Poland
New Gloucester
Casco
Gray
Windham
Raymond Pond
Crescent Lake
Panther Pond
Thomas Pond
Sebago Lake
Sebago Lake (Jordan Bay)
85
121
N
W
E
S
0 0.5 1 2 3 Miles
Cumberland County Hazard Mitigation Plan: Town of Raymond
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

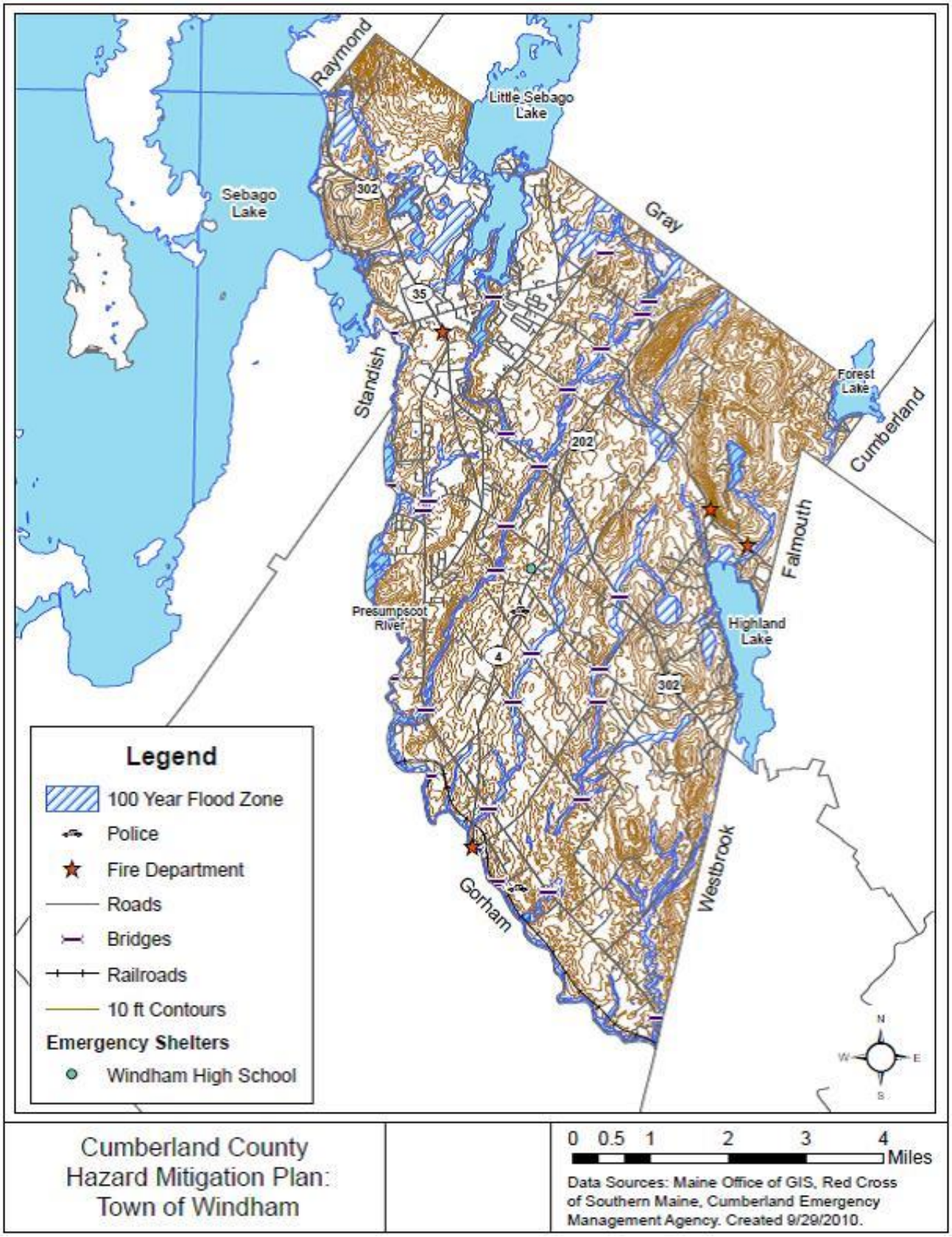

Westbrook
Gorham
South Portland
Cape Elizabeth
Saco
Old Orchard Beach
114
1
9
Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
Railroads
10 ft Contours
Emergency Shelter
Scarborough High School
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
Town of Scarborough
0 0.5 1 2 3
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.

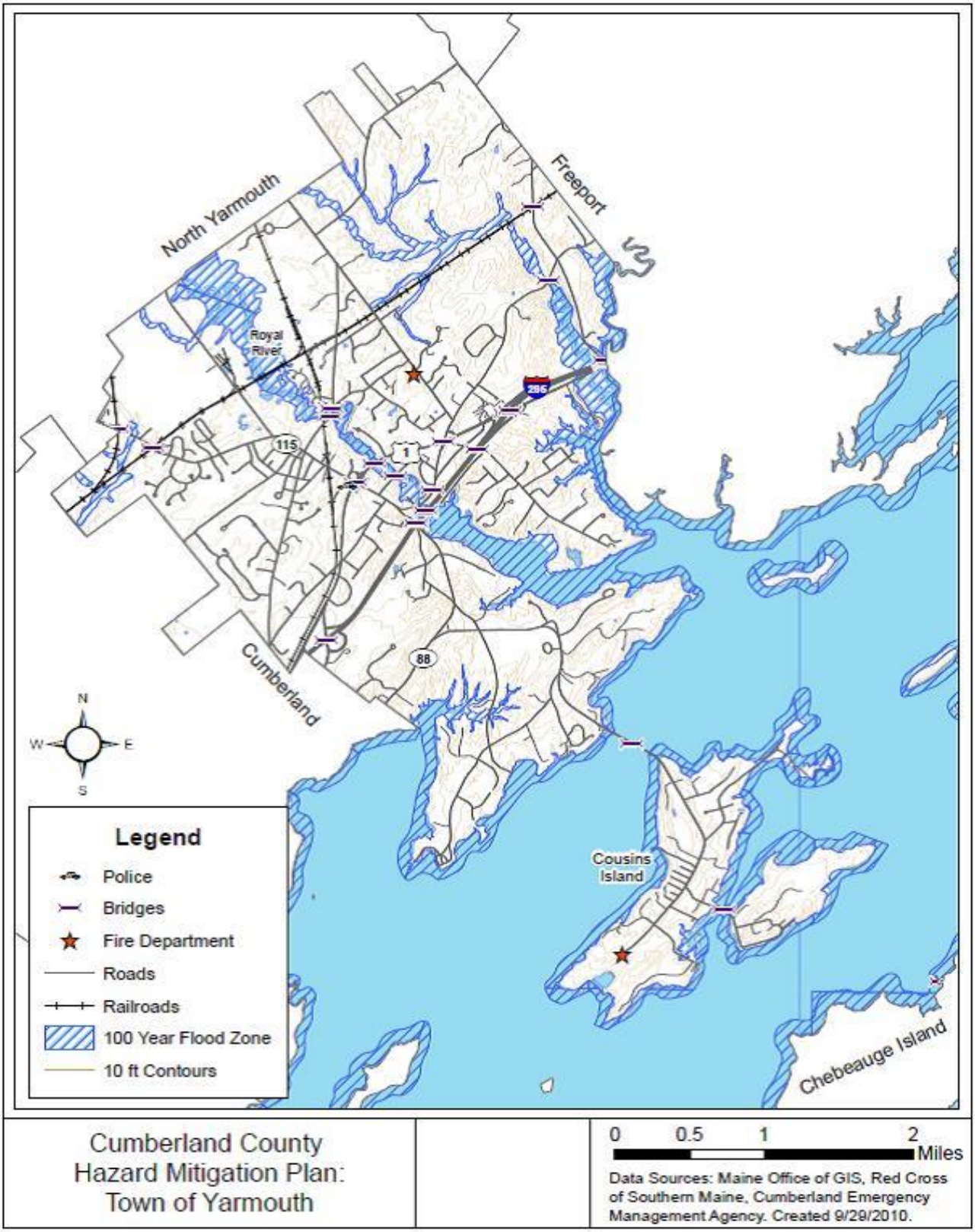

Denmark
Hancock Pond
Peabody Pond
107
Naples
Hiram
Browns Pond
Barker Pond
11
Sebago Lake
114
Baldwin
Standish
Legend
100 Year Flood Zone
Fire Department
Roads
Bridges
10 ft Contours
Cumberland County Hazard Mitigation Plan: Town of Sebago
0 0.5 1 2 Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Westbrook
Portland
Scarborough
Cape Elizabeth
Legend
100 Year Flood Zone
Police
Fire Department
Roads
Bridges
Railroads
10 ft Contours
Emergency Shelter
South Portland Community Recreation Center
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
City of South Portland
0 0.5 1 2
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Sebago Lake
Raymond
Windham
Sebago
Frye Island
Baldwin
114
35
Gorham
Limington
Walchic Pond
113
25
Hollis
Buxton
Legend
100 Year Flood Zone
Culverts
Culverts in Flood Zone
Police
Fire Departments
Roads
Bridges
Railroads
Emergency Shelters
Standish Town Hall
Steep Falls Fire Station
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
Town of Standish
0 0.5 1 2 3
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Legend
100 Year Flood Zone
Police
Fire Department
Hospitals
Roads
Bridges
Railroads
10 ft Contours
Emergency Shelters
Congin Elementary School
Westbrook High School
Westbrook Middle School
Windham
Falmouth
Portland
Gorham
Scarborough
South Portland
302
25
N
W
E
S
Cumberland County
Hazard Mitigation Plan:
City of Westbrook
0
0.5
1
2
Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.


Raymond
Little Sebago Lake
Sebago Lake
302
Gray
35
Standish
Forest Lake
Cumberland
202
Falmouth
Presumpscot River
Highland Lake
4
302
Westbrook
Gorham
Legend
100 Year Flood Zone
Police
Fire Department
Roads
Bridges
Railroads
10 ft Contours
Emergency Shelters
Windham High School
N
W
E
S
Cumberland County Hazard Mitigation Plan: Town of Windham
0 0.5 1 2 3 4 Miles
Data Sources: Maine Office of GIS, Red Cross of Southern Maine, Cumberland Emergency Management Agency. Created 9/29/2010.



Cumberland County Hazard Mitigation Plan: Town of Yarmouth