5.4.8 WILDFIRE

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the wildfire hazard in Burlington County.

2019 HMP UPDATE CHANGES

- The hazard profile has been significantly enhanced to include a detailed hazard description, location, extent, previous occurrences, probability of future occurrence, and potential change in climate and its impacts on the wildfire hazard is discussed.
- New and updated figures from federal and state agencies are incorporated. New Jersey Forest Fire Service (NJFFS) Wildfire Fuel Hazard data was used to identify wildfire fuel rankings in Burlington County. The 2010 NJFFS wildfire risk and fuel maps were also used to identify hazard areas in the county. U.S. 2010 Census data was incorporated, where appropriate.
- Previous occurrences were updated with events that occurred between 2013 and 2017.
- A vulnerability assessment was conducted for the wildfire hazard; it now directly follows the hazard profile. To determine exposure, a spatial analysis was conducted using the NJFFS Fuel Hazard Area guidelines.

5.4.8.1 PROFILE

Hazard Description

A wildland fire can be defined as any non-structural fire that occurs in the wildland. Three distinct types of wildland fires have been defined and include: naturally occurring wildfire, human-caused wildfire, and prescribed fire. Many of these are highly destructive and can be difficult to control. They occur in forested, semi-forested, or less developed areas. Wildland fires can be caused by lightning, human carelessness, and arson. Most frequently, wildland fires in the State of New Jersey are caused by humans. Wildfires result in the uncontrolled destruction of forests, brush, field crops, grasslands, real estate, and personal property, and have secondary impacts on other hazards such as flooding, by removing vegetation and destroying watersheds.

Wildfires can increase the probability of other natural disasters, specifically floods and mudflows. Wildfires, particular large-scale fires, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Lands impacted by wildfire increase the risk of flooding and mudflow in those areas impacted by wildfire. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water; thus, creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remain significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2013).

Flooding after a wildfire is often more severe, as debris and ash left from the fire can form mudflows. During and after a rain event, as water moves across charred and denuded ground, it can also pick up soil and sediment and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2013). For detailed information regarding flooding, see Section 5.4.4 (Flood).

The height of wildland fire season in New Jersey is typically in spring (March through May) and culminates in early May, corresponding with the driest live fuel moisture periods of the year. Although the spring months are the most severe, the summer and fall months may also experience extensive fires in the state. While the spring season is historically the period in which wildfire danger is the highest, wildland fires can occur every month of

the year. Drought, snow pack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires. Lightning generally is the cause of most fires in the peak season.

In the State of New Jersey, each year, an average of 1,500 wildfires damage or destroy 7,000 acres of the state's forests. Wildfires not only damage woodlands but threaten homeowners who live within or adjacent to forest environments. From January 1, 2018, to August 12, 2018, there were 552 wildfires in New Jersey that burned over 1,300 acres. In contrast, during this same period in 2017, the State experienced 588 fires, which burned over 5,024 acres (NJFFS 2017). Details regarding the number of fires in Burlington County were not included in these overall statistics.

NJFFS, a division of NJDEP, is responsible for protecting the 3.15 million acres of public and private wildland in the state. NJFFS is under the direction of the state fire warden and is headquartered in Trenton. It is broken up into three divisions (A, B, C). Each division is responsible for responding to wildfire events within their boundaries. Burlington County is located in Division B. NJFFS has 85 full-time employees that provide an array of services including staffing the state's 21 fire towers, which are operational during the months of March, April, May, October, and November.

Location

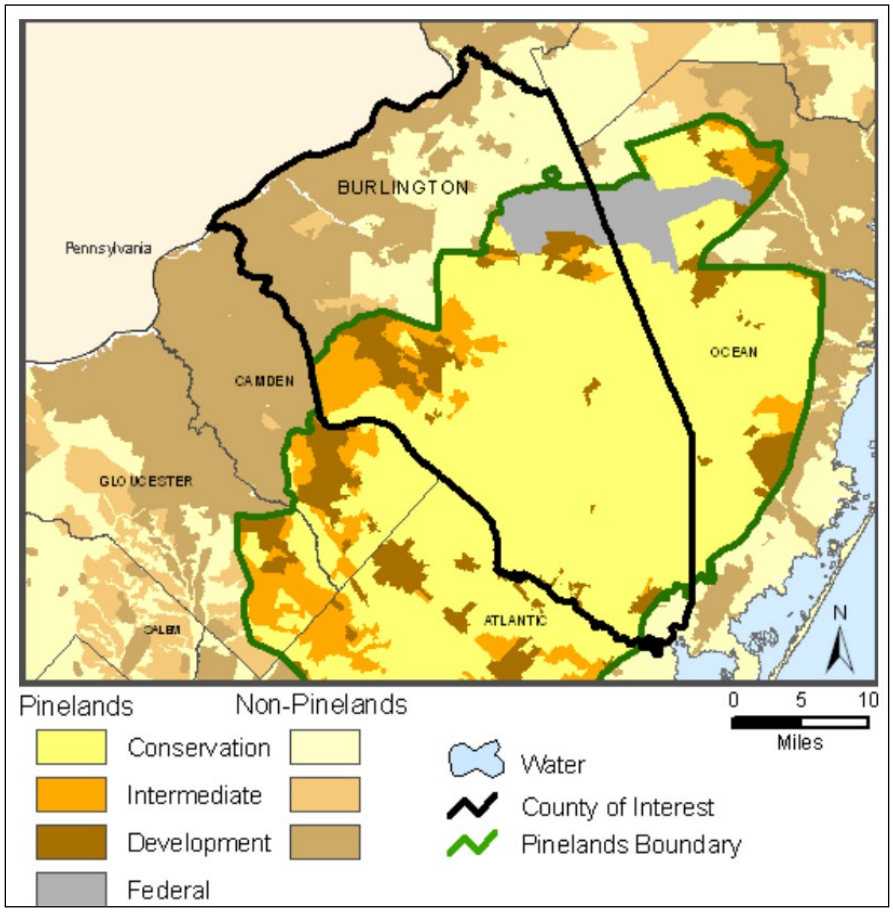
All of Burlington County is susceptible to wildfire and they can occur anywhere in the County. However, the greatest risk for wildfire is in the southeastern two thirds of the County which is located in the Pinelands National Reserve.

The Pinelands and Pine Barrens

The New Jersey Pine Barrens are characterized by low, dense forests of pine and oak, ribbons of cedar and hardwood swamps bordering drainage courses, pitch pine lowlands, and bogs and marshes combine to produce an expansive vegetative mosaic unsurpassed in the Northeast. The Pine Barrens was recognized as a nationally and internationally important ecological region when, in 1978, Congress created the Pinelands National Reserve, our country's first National Reserve and a U.S. Biosphere Reserve of the Man and the Biosphere Program. The Pinelands National Reserve encompasses approximately 1.1 million acres statewide, occupying 22% of New Jersey's land area and covering portions of seven counties and all or parts of 56 municipalities. It is the largest body of open space on the Mid-Atlantic seaboard between Richmond and Boston and is underlain by aquifers containing 17 trillion gallons of some of the purest water in the land. Through the creation of the Pinelands Commission, the State of New Jersey formed the necessary partnerships to preserve, protect and enhance the natural and cultural resources of the Pinelands (Burlington County HMP, 2008).

According to the New Jersey Pinelands Commission 2011-2012 Pinelands Long-Term Economic Monitoring Program, 35 percent of Burlington County's municipalities (or 14 of the 40 municipalities) are located within the Pinelands Area, as shown in Figure 5.4.8-1 below. Approximately 21 percent of Burlington County's 2010 population (93,385 residents) resided in the Pinelands Area. Approximately 20 percent of the county's housing units (35,141 housing units) and 64 percent of the county's total land area (334,250 acres) were also reported as located within the Pinelands Area (New Jersey Pinelands Commission, 2012).

Figure 5.4.8-1. Pinelands Management and Planning Areas in Burlington County



Source: New Jersey (State of) Pinelands Commission, 2012

Naturally occurring wildfires burning several thousands of acres per year have been a common occurrence in the Pinelands for many hundreds of years. Development of the unique flora of the Pinelands is closely related to the occurrence of fire, with many plant species relying on fire for a part of their reproductive cycle (Burlington County HMP, 2008).

Pinelands fires tend to burn extremely hot and spread rapidly. Crown fires here are fairly common (spreading from treetop to treetop). While Pinelands fires generally do not cause casualties due to the low population residing within its limits, property loss can run in the thousands of dollars per event, not including costs associated with emergency response and firefighting. Often, state roads have closed because of smoke conditions (Burlington County HMP, 2008).

Conditions conducive to forest fires are some of the most consistent and serious impacts of drought, a hazard profiled earlier in this plan. This applies particularly to the Pine Barrens, where drying conditions favor the combustion of forest fuels. Generally, a relative humidity of less than 40 percent, winds greater than 13 miles an hour, and precipitation of less than 0.01 inches during a month are ideal conditions for forest fires in the Pine Barrens. The season of greatest fire threat runs from March through May, though extensive fires have occurred in the summer and autumn months (NJOEM, 2012).

Wildfire Fuel Hazard Areas

NJFFS developed Wildfire Fuel Hazard data for the entire state based on NJDEP data. For details on the information was developed, refer to: https://www.state.nj.us/dep/gis/njfh.html. Figure 5.4.8-2 and Figure 5.4.8-3 illustrate the wildfire fuel hazard and wildfire risk for Burlington County. A majority of the county has extreme fuel hazard and moderate to high risk. With the exception of Fieldsboro, every municipality in Burlington County has at least a small portion of the community located within the high to extreme risk area, with Woodland Township having largest percentage of land within the high to extreme risk area (74.8%). Table 5.4.8-1 indicates the amount of land in each of the wildfire fuel hazard ranking zones for Burlington County. Table 5.4.8-2 summarizes the area within each hazard ranked area, specific to Burlington County jurisdictions.

Table 5.4.8-1. Area in the Wildfire Fuel Hazard Ranking Zones in Burlington County

Hazard Area	Area (Square Miles)
Extreme	195.75
Very High	11.95
High	106.32
Moderate	86.53
Low	165.69

Source: NJ Forest Fire Service

Note: The remainder of the County is classified as 'water', 'barren land', 'urban', or 'agriculture.'

Table 5.4.8-2. Approximate Area in Wildfire Fuel Hazard Ranking Zones in Burlington County

Municipality	Total Area (Square Miles)	New Jersey Forest Fire Service Risk Areas			
		Low to Moderate	% in Hazard Area	High to Extreme	% in Hazard Area
Bass River (T)	50,140	11,372	22.7%	35,840	71.5%
Beverly (C)	486	48	9.9%	3	0.7%
Bordentown (T)	5,926	2,225	37.5%	558	9.4%
Burlington (C)	2,426	605	24.9%	83	3.4%
Burlington (T)	8,992	3,142	34.9%	640	7.1%
Chesterfield (T)	13,736	5,718	41.6%	294	2.1%
Cinnaminson (T)	5,099	1,077	21.1%	240	4.7%
Delanco (T)	2,190	434	19.8%	105	4.8%
Delran (T)	4,654	1,203	25.8%	320	6.9%
Eastampton (T)	3,723	1,699	45.6%	92	2.5%
Edgewater Park (T)	1,976	515	26.1%	24	1.2%
Evesham (T)	18,943	6,846	36.1%	4,775	25.2%
Fieldsboro (B)	224	79	35.2%	0	0.1%
Florence (T)	6,559	2,223	33.9%	509	7.8%
Hainesport (T)	4,344	1,486	34.2%	768	17.7%
Lumberton (T)	8,327	3,422	41.1%	270	3.2%
Mansfield (T)	14,010	5,953	42.5%	494	3.5%
Maple Shade (T)	2,451	332	13.5%	60	2.5%
Medford (T)	812	108	13.3%	20	2.5%
Medford Lakes (B)	25,474	10,441	41.0%	7,203	28.3%
Moorestown (T)	9,585	3,393	35.4%	390	4.1%
Mt. Holly (T)	1,837	418	22.8%	40	2.2%
Mt. Laurel (T)	14,066	5,166	36.7%	808	5.7%
New Hanover (T)	14,483	4,846	33.5%	4,302	29.7%
North Hanover (T)	11,203	4,458	39.8%	482	4.3%
Palmyra (B)	1,673	314	18.8%	84	5.0%
Pemberton (B)	403	158	39.2%	53	13.1%
Pemberton (T)	40,171	15,654	39.0%	14,127	35.2%
Riverside (T)	1,048	118	11.3%	124	11.9%
Riverton (B)	614	62	10.1%	13	2.2%

Municipality	Total Area (Square Miles)	New Jersey Forest Fire Service Risk Areas			
		Low to Moderate	% in Hazard Area	High to Extreme	% in Hazard Area
Shamong (T)	28,791	9,155	31.8%	15,310	53.2%
Southampton (T)	28,446	14,630	51.4%	5,496	19.3%
Springfield (T)	18,924	9,618	50.8%	529	2.8%
Tabernacle (T)	31,688	8,249	26.0%	18,380	58.0%
Washington (T)	66,539	17,203	25.9%	46,795	70.3%
Westampton (T)	7,104	2,828	39.8%	513	7.2%
Willingboro (T)	5,175	1,062	20.5%	157	3.0%
Woodland (T)	61,001	11,603	19.0%	45,637	74.8%
Wrightstown (B)	1,146	439	38.3%	144	12.6%
Burlington County (Total)	**525,009**	**168,455**	**32.1%**	**205,714**	**39.2%**

Source: NJ Forest Fire Service

Note: The remainder of the County is classified as 'water', 'barren land', 'urban', or 'agriculture.'

Figure 5.4.8-2. Wildfire Fuel Hazard for Burlington County

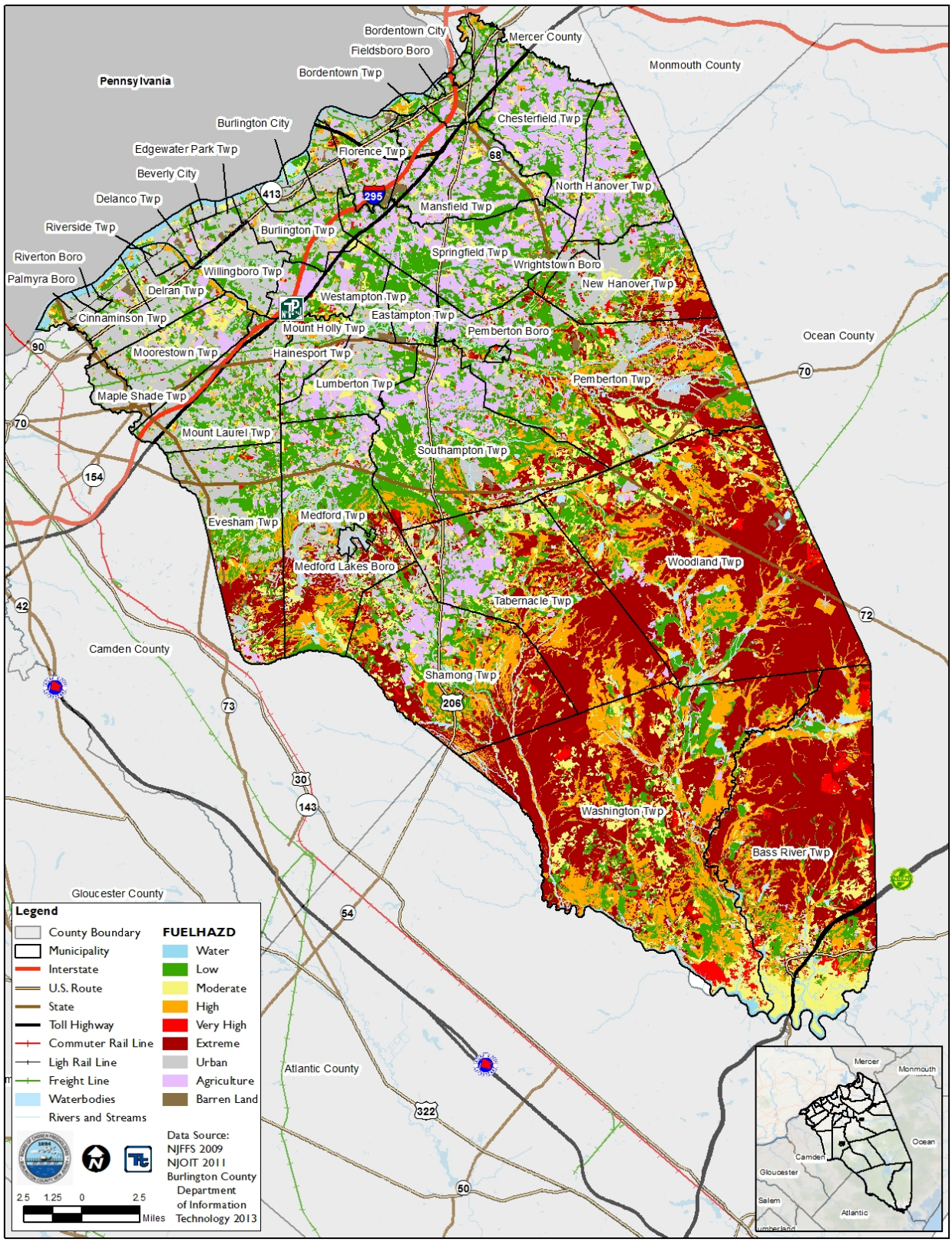
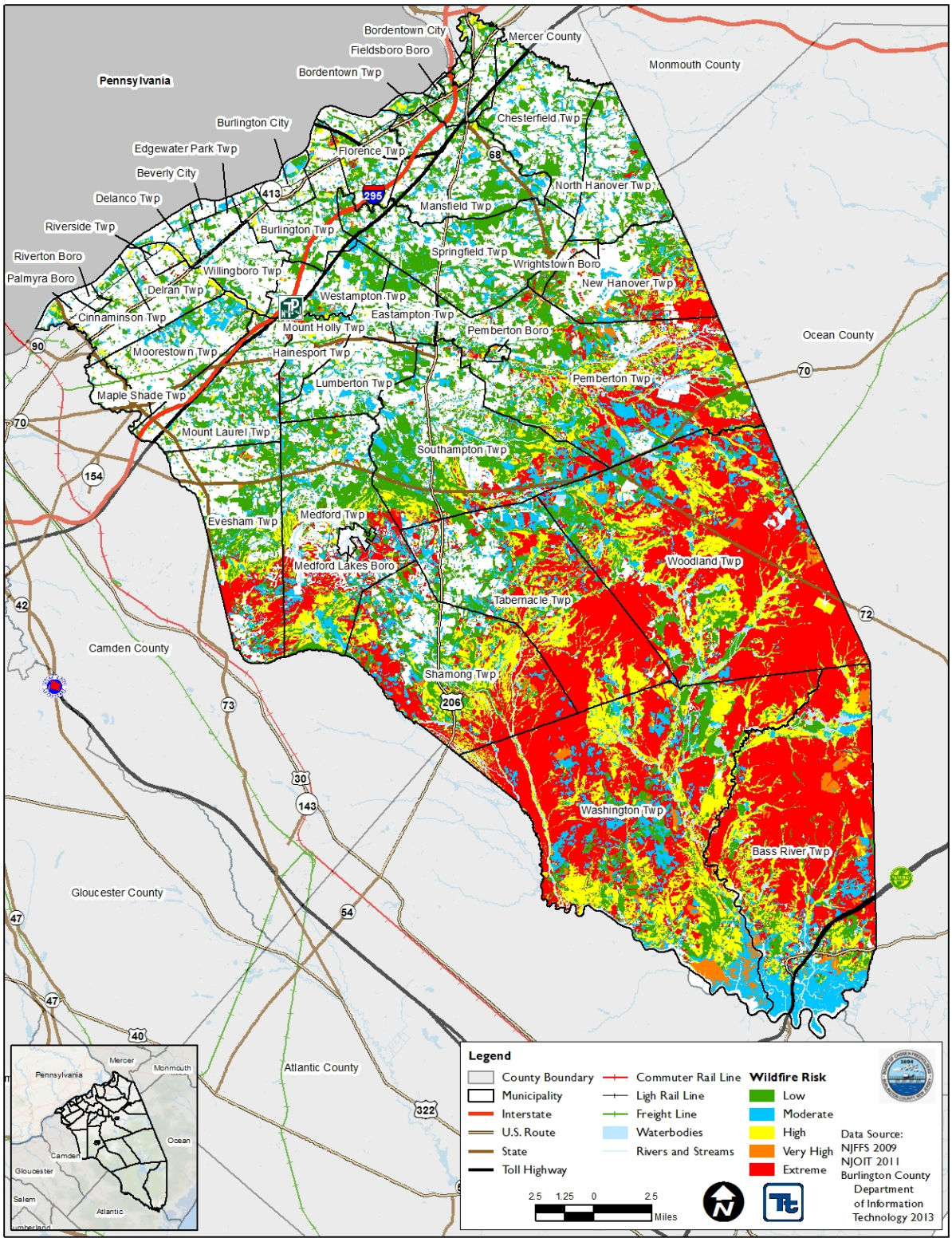


Figure 5.4.8-3. Wildfire Risk for Burlington County



Extent

The extent (that is, magnitude or severity) of wildfires depends on weather (dryness/drought) and human activity. To determine the potential for wildfires, the NJFFS uses two indices to measure and monitor the dryness of forest fuels and the possibility of fire ignitions becoming wildfires. This includes the National Fire Danger Rating System's Buildup Index and the Keetch-Byram Drought Index. Both are used for fire preparedness planning, which includes the following initiatives: campfire and burning restrictions, fire patrol assignments, staffing of fire lookout towers, and readiness status for both observation and firefighting aircraft.

- The ***Buildup Index*** is a number that reflects the combined cumulative effects of daily drying and precipitation fuels with a 10-day time lag constant. It is a rating of the total amount of fuel available for combustion.
- The ***Keetch-Byram Drought Index*** (KBDI) is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8-inches) and is expressed in hundredths of an inch of soil moisture depletion.

In addition to the two indices, the NJFFS uses the National Fire Danger Rating System (NFDRS) to provide a measure of relative seriousness of burning conditions and threat of fire in the State. It allows the NJFFS to estimate the daily fire danger for a given area. The NFDRS uses a five-color coded system to help the public understand fire potential. The NJFFS slightly adapted the color system for their purposes. The NFDRS, with the NFFS color scheme, is as follows:

Table 5.4.8-3. Fire Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
Low (Green)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (Blue)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (Yellow)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (Orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they bum into heavier fuels.
Extreme (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: NJFFS 2018

Previous Occurrences and Losses

Many sources provided wildfire information regarding previous occurrences and losses associated with wildfire throughout New Jersey and Burlington County. With so many sources reviewed for the purpose of this HMP Update, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP update.

Between 1954 and 2018, New Jersey was included in two FEMA fire management assistance (FMA) declarations. Generally, these disasters cover a wide range of the State; therefore, the disaster may have impacted many counties. Burlington County was included in one FEMA FMA declaration (see Table 5.4.8-4).

Table 5.4.8-4. FEMA Declarations for Wildfire Events in Burlington County

FEMA Declaration Number	Date(s) of Event	Incident Type / Title	Declared Counties
FM-2695	May 15, 2007	Warren Gove Fire	Burlington and Ocean

Source: FEMA 2018

For this 2018 Plan update, wildfire events were summarized from 2013 to 2018. For events prior to 2013, refer to Appendix G (Supplementary Data). Known wildfire events, including FEMA disaster declarations, which have impacted Burlington County are identified in Table 5.4.8-5. Please note that not all events that have occurred in Burlington County are included due to the extent of documentation and the fact that not all sources may have been identified or researched. Loss and impact information could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP update.

Table 5.4.8-5. Wildfire Events in Burlington County, 2013 to 2018

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
April 6, 2013	Wildfire	N/A	N/A	A wildfire that started within Wharton State Forest in Shamong Township burned 150 acres of woodland.
April 6, 2014	Wildfire	N/A	N/A	A wildfire consumed approximately 1,600 acres of forest in Wharton State Forest. The smell of smoke moved across the state and even reached parts of New York City. Crews dropped water on the fire from airplanes and used backfires to contain the fire. No injuries or structural damages were associated with this wildfire.
April 19, 2014	Wildfire	N/A	N/A	A wildfire burned 25 wooded acres in Lumberton Township. Portions of westbound New Jersey State Route 38 and U.S. Route 206 were closed due to poor visibility.
April 25, 2014	Wildfire	N/A	N/A	250 acres of forest in Wharton State Forest in Shamong Township burned.
May 3, 2015	Wildfire	N/A	N/A	8 wildfires were reported in Burlington County. One fire consumed 80 acres in Pemberton Township.
May 7, 2015	Wildfire	N/A	N/A	Wildfire consumed 710 acres of forest in Shamong Township. Smoke forced the closure of U.S. Route 206 between U.S. Route 30 and Atsion Road. Evacuations were recommended for homes in the vicinity.
July 21, 2017	Wildfire	N/A	N/A	A 2,800-acre wildfire burned north of Batsto Village in Washington Township. It began during the early afternoon on the 20th about three miles north of the fire tower at Batsto. It burned in several directions

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
				overnight and into the morning of the 21st. Heavy smoke from the fire moved above Batsto Village and south along Route 542 and through Mullica and Hamilton Townships.
September 7, 2015	Wildfire	N/A	N/A	Wildfire consumed 1,012 acres of woodland along the Burlington and Ocean County borders starting in Woodland Township and spreading into Manchester Township.
April 22, 2018	Wildfire	N/A	N/A	During the afternoon of April 22nd, a wildfire was spotted by the Cedar Bridge and Batso fire towers. At first, about 50 acres were involved but a sea breeze caused the fire to quickly grow to 843 acres. The fire was located in Washington Township, just north of Lake Oswego. By April 23rd, the fire was 90% contained.

Source: NOAA-NCDC, 2018; FEMA, 2018

Probability of Future Occurrences

Estimating the approximate number of wildfires to occur in Burlington County is difficult to predict in a probabilistic manner. This is because a number of variable factors impact the potential for a fire to occur and because some conditions (for example, ongoing land use development patterns, location, fuel sources, and construction sites) exert increasing pressure on the WUI zone. Based on available data, urban fires and wildfires will continue to present a risk to Burlington County. Given the numerous factors that can impact urban fire and wildfire potential, the likelihood of a fire event starting and sustaining itself should be gauged by professional fire managers on a daily basis. Although a definite prediction of future wildfire events cannot be noted, an analysis of the frequency of past occurrences can give professionals a rough guide as to how many potential events may occur each year if current trends continue.

For the purpose of this HMP update, the most up-to-date data was collected to calculate the probability of future occurrence. Information from the NJFFS and the 2014 New Jersey State HMP were used to identify the number of wildfires that occurred between 1950 and 2018. Using these sources ensures the most accurate probability estimates possible. The table below shows these statistics, as well as the annual average number of events and the estimated percent chance of a wildfire occurring in a given year. Based on these statistics, there is an estimated 100% chance of a wildfire occurring in any given year in Burlington County.

Table 5.4.8-6. Probability of Future Occurrence of Wildfire Events

Hazard Type	Number of Occurrences Between 1950 and 2015	Rate of Occurrence or Annual Number of Events (average)	Recurrence Interval (in years) (# Years/Number of Events)	Probability of Event in any given year	Percent chance of occurrence in any given year
Wildfire	924	13.59	0.07	13.39	100%

Source: Burlington County HMP 2013; NOAA-NCEI 2018; New Jersey State HMP 2014

In Section 5.3, the identified hazards of concern for Burlington County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for wildfire in the county is considered 'frequent' (likely to occur within 25 years, as presented in Table 5.3-3).

Climate Change Impacts

A gradual change in temperatures will alter the growing environment of many tree species throughout the United States and New Jersey, reducing the growth of some trees and increasing the growth of others. Tree growth and regeneration may be affected more by extreme weather events and climatic conditions than by gradual changes in temperature or precipitation. Warmer temperatures may lead to longer dry seasons and multi-year droughts, creating triggers for wildfires, insects, and invasive species. Increased temperature and change in precipitation will also affect fuel moisture during wildfire season and the length of time during while wildfires can burn during a given year (U.S. Department of Agriculture [USDA] 2012). Climate change may also increase the frequency of lightning strikes. A warmer atmosphere holds more moisture which is one of the key items for triggering a lightning strike. Lightning strikes cause approximately half the wildfires in the United States. If the frequency of lightning strikes increases, the potential for wildfires from these strikes also increases (Lee 2014). Wildfire incidents are predicted to increase throughout the United States due to climate change, causing at least a doubling of areas burned within the next century (USDA 2012).

By the 2020s, the average annual temperature in New Jersey is projected to increase by 1.5°F to 3°F above the statewide baseline (1971 to 2000), which was 52.7°F. By 2050, the temperature is projected to increase 3°F to 5°F (Sustainable Jersey Climate Change Adaptation Task Force 2013). As for precipitation, Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970 (Office of New Jersey State Climatologist). Average annual precipitation is projected to increase in the region up to 10% by the 2020s and up to 15% by the 2050s. Most of the additional precipitation is expected to come during the winter months (New York City Panel on Climate Change [NPCC] 2013).

As stated above, according to the temperature projections for Northern New Jersey, including Burlington County, this area can expect warmer and drier conditions which may increase the frequency and intensity of wildfires. Higher temperatures are expected to increase the amount of moisture that evaporates from land and water. These changes have the potential to lead to more frequent and severe droughts, which, in turn, increases the likelihood of wildfires (U.S. EPA 2009).

5.4.8.2 VULNERABILITY ASSESSMENT

A spatial analysis was conducted using the NJFFS Wildfire Fuel Hazard spatial layer. For the purposes of the vulnerability assessment, an asset (population, structures, critical facilities, and lifelines) is considered potentially vulnerable to the wildfire hazard if it is located in the 'extreme', 'very high' and 'high' areas. Refer to Section 5.1 for additional details on the methodology used to assess wildfire risk.

Impact on Life, Health and Safety

As demonstrated by historic wildfire events in New Jersey and other parts of the country, potential losses include impacts to human health and life of residents and responders, structures, infrastructure and natural resources. In addition, wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. The most vulnerable populations include emergency responders and those within a short distance of the interface between the built environment and the wildland environment. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Table 5.4.8-7 summarizes the estimated population exposed by municipality.

Based on the analysis, an estimated 92,172 people, or 20.5% of the county's population, are located in the high, very high and extreme wildfire hazards. Overall, the Township of Pemberton, Township of Evesham, and Township of Medford have the greatest number of individuals located in the extreme/very high/high hazard areas, while the Township of Washington, the Township of Woodland, and the Borough of Pemberton have the

greatest percent of population located in the extreme/very high/high hazard areas. Socially vulnerable populations (e.g. the elderly and low-income populations) are particularly vulnerable to a hazard event. Within the NJFFS Fuel Hazard boundaries, there are approximately 2,653 people over the age of 65 and 1,656 people considered low income populations.

Table 5.4.8-7. Estimated Population Located in the Wildfire Fuel Hazard Area in Burlington County

Municipality	US. Census 2010 Population	Estimated Population Exposed			
		Extreme, Very High and High	Percent of Total Population Exposed	Moderate and Low	Percent of Total Population Exposed
Bass River Township	1,443	205	14.2%	1,015	70.3%
Beverly City	2,577	0	0.0%	125	4.9%
Bordentown City	3,924	69	1.8%	603	15.4%
Bordentown Township	11,367	578	5.1%	2,447	21.5%
Burlington City	9,920	233	2.3%	1,035	10.4%
Burlington Township	22,594	130	0.6%	4,904	21.7%
Chesterfield Township	7,699	112	1.5%	4,098	53.2%
Cinnaminson Township	15,569	490	3.1%	2,684	17.2%
Delanco Township	4,283	82	1.9%	590	13.8%
Delran Township	16,896	94	0.6%	3,106	18.4%
Eastampton Township	6,069	7	0.1%	1,913	31.5%
Edgewater Park Township	8,881	0	0.0%	763	8.6%
Evesham Township	45,538	2,977	6.5%	10,831	23.8%
Fieldsboro Borough	540	0	0.0%	188	34.8%
Florence Township	12,109	208	1.7%	1,180	9.7%
Hainesport Township	6,110	558	9.1%	1,024	16.8%
Lumberton Township	12,559	467	3.7%	1,661	13.2%
Mansfield Township	8,544	227	2.7%	2,496	29.2%
Maple Shade Township	19,131	12	0.1%	1,819	9.5%
Medford Lakes Borough	4,146	67	1.6%	37	0.9%
Medford Township	23,033	3,582	15.6%	8,403	36.5%
Moorestown Township	20,726	104	0.5%	3,832	18.5%
Mount Holly Township	9,536	490	5.1%	1,701	17.8%
Mount Laurel Township	41,864	534	1.3%	10,430	24.9%
New Hanover Township	7,385	190	2.6%	371	5.0%
North Hanover Township	7,678	112	1.5%	2,069	26.9%
Palmyra Borough	7,398	0	0.0%	91	1.2%
Pemberton Borough	1,409	327	23.2%	199	14.1%
Pemberton Township	27,912	4,478	16.0%	4,362	15.6%
Riverside Township	8,079	95	1.2%	515	6.4%
Riverton Borough	2,779	0	0.0%	177	6.4%
Shamong Township	6,490	1,397	21.5%	3,053	47.0%
Southampton Township	10,464	1,626	15.5%	3,849	36.8%
Springfield Township	3,414	383	11.2%	1,838	53.8%
Tabernacle Township	6,949	1,399	20.1%	3,234	46.5%
Washington Township	687	501	72.9%	144	21.0%
Westampton Township	8,813	721	8.2%	2,650	30.1%

Table 5.4.8-7. Estimated Population Located in the Wildfire Fuel Hazard Area in Burlington County

Municipality	US. Census 2010 Population	Estimated Population Exposed			
		Extreme, Very High and High	Percent of Total Population Exposed	Moderate and Low	Percent of Total Population Exposed
Willingboro Township	31,629	31	0.1%	2,991	9.5%
Woodland Township	1,788	815	45.6%	341	19.1%
Wrightstown Borough	802	17	2.1%	103	12.8%
Burlington County	**448,734**	**23,318**	**5.2%**	**92,172**	**20.5%**

Source: 2010 US Census, NJFFS, 2009
Note: The NJFFS Fuel Hazard boundaries were overlaid on the U.S. Census block; the blocks with their centroids within hazard areas were totaled for each municipality.

Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Impact on General Building Stock

The most vulnerable structures to wildfire events are those located within the NJFFS identified extreme, very high or high fuel hazard areas. Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. Table 5.4.8-8 and Table 5.4.8-9 summarizes the estimated building stock inventory exposed by municipality. Approximately 25.9-percent ($266 million) of the County's building RCV is located in the extreme/very high/high hazard areas. Pemberton Township has the greatest number of buildings and RCV within wildfire hazard areas (358 structures).

Table 5.4.8-8. Estimated Replacement Cost Value Located in Wildfire Fuel Hazard Ranking Zones

Municipality	Total Replacement Cost Value (Structure and Contents)	Replacement Cost in Hazard Area			
		Extreme, Very High and High	Percent of Total Exposed	Moderate and Low	Percent of Total Exposed
Bass River Township	$1,027,917,130	$266,341,415	25.9%	$418,492,047	40.7%
Beverly City	$471,487,138	$0	0.0%	$9,975,457	2.1%
Bordentown City	$1,244,995,904	$0	0.0%	$27,088,344	2.2%
Bordentown Township	$2,820,041,247	$8,038,450	<1%	$338,345,056	12.0%
Burlington City	$3,215,233,092	$4,208,960	<1%	$280,531,607	8.7%
Burlington Township	$8,013,259,672	$81,719,940	1.0%	$1,114,832,310	13.9%
Chesterfield Township	$2,443,294,418	$32,219,051	1.3%	$911,284,555	37.3%
Cinnaminson Township	$5,703,895,752	$3,828,195	<1%	$749,892,697	13.1%
Delanco Township	$1,422,201,479	$1,117,160	<1%	$154,328,143	10.9%
Delran Township	$5,145,622,596	$13,364,332	<1%	$505,593,230	9.8%
Eastampton Township	$1,687,017,512	$2,886,276	<1%	$274,466,475	16.3%
Edgewater Park Township	$2,307,285,215	$4,201,130	<1%	$186,875,936	8.1%
Evesham Township	$14,666,082,424	$691,213,944	4.7%	$1,770,607,597	12.1%
Fieldsboro Borough	$139,371,126	$0	0.0%	$13,040,160	9.4%

Table 5.4.8-8. Estimated Replacement Cost Value Located in Wildfire Fuel Hazard Ranking Zones

Municipality	Total Replacement Cost Value (Structure and Contents)	Replacement Cost in Hazard Area			
		Extreme, Very High and High	Percent of Total Exposed	Moderate and Low	Percent of Total Exposed
Florence Township	$2,787,263,607	$80,818,969	2.9%	$804,140,438	28.9%
Hainesport Township	$3,447,208,735	$125,318,585	3.6%	$499,131,332	14.5%
Lumberton Township	$5,459,557,257	$41,156,082	<1%	$1,203,501,152	22.0%
Mansfield Township	$4,056,501,589	$96,584,672	2.4%	$1,202,821,773	29.7%
Maple Shade Township	$4,385,500,913	$0	0.0%	$296,908,255	6.8%
Medford Lakes Borough	$1,280,050,871	$1,171,001	<1%	$37,686,128	2.9%
Medford Township	$12,845,907,494	$869,929,438	6.8%	$3,496,164,727	27.2%
Moorestown Township	$10,108,801,626	$183,116,944	1.8%	$2,111,184,272	20.9%
Mount Holly Township	$3,498,352,996	$1,200,893	<1%	$76,759,469	2.2%
Mount Laurel Township	$14,653,800,804	$115,431,134	<1%	$1,540,465,533	10.5%
New Hanover Township	$3,022,835,486	$36,558,890	1.2%	$170,424,876	5.6%
North Hanover Township	$3,079,878,987	$12,769,977	<1%	$1,295,296,819	42.1%
Palmyra Borough	$1,788,398,557	$0	0.0%	$79,079,604	4.4%
Pemberton Borough	$345,869,906	$253,071	<1%	$5,783,540	1.7%
Pemberton Township	$9,374,914,679	$655,542,382	7.0%	$1,929,913,555	20.6%
Riverside Township	$2,039,139,951	$793,375	<1%	$72,652,276	3.6%
Riverton Borough	$916,434,789	$0	0.0%	$18,576,284	2.0%
Shamong Township	$2,738,384,433	$68,978,608	2.5%	$1,021,613,432	37.3%
Southampton Township	$6,722,347,774	$341,146,488	5.1%	$2,087,376,458	31.1%
Springfield Township	$3,853,514,909	$231,732,916	6.0%	$1,696,760,901	44.0%
Tabernacle Township	$3,619,040,765	$94,730,791	2.6%	$1,229,083,768	34.0%
Washington Township	$597,426,933	$44,640,482	7.5%	$350,673,830	58.7%
Westampton Township	$4,269,433,407	$127,122,403	3.0%	$1,009,630,768	23.6%
Willingboro Township	$8,259,747,413	$0	0.0%	$209,878,839	2.5%
Woodland Township	$1,656,748,246	$240,866,796	14.5%	$516,791,009	31.2%
Wrightstown Borough	$411,963,035	$0	0.0%	$10,811,288	2.6%
Burlington County	**$165,526,729,867**	**$4,479,002,749**	**2.7%**	**$29,728,463,939**	**18.0%**

Source: Burlington County, NJFFS 2009
Note: The NJFFS Fuel Hazard boundaries were overlaid on the custom general building stock inventory; the structures with their centroids within the hazard areas were totaled for each municipality.

Table 5.4.8-9. Estimated Number of Buildings Located in Wildfire Fuel Hazard Ranking Zones

Municipality	Total Number of Buildings	Number of Buildings in Hazard Area			
		Extreme, Very High and High	Percent of Total Exposed	Moderate and Low	Percent of Total Exposed
Bass River Township	1,863	208	11.2%	1,048	56.3%
Beverly City	964	0	0.0%	10	1.0%
Bordentown City	1,219	0	0.0%	25	2.1%
Bordentown Township	3,113	11	0.4%	249	8.0%
Burlington City	3,644	10	0.3%	94	2.6%
Burlington Township	7,757	37	0.5%	670	8.6%
Chesterfield Township	2,093	17	0.8%	950	45.4%
Cinnaminson Township	6,358	4	0.1%	255	4.0%

Table 5.4.8-9. Estimated Number of Buildings Located in Wildfire Fuel Hazard Ranking Zones

Municipality	Total Number of Buildings	Number of Buildings in Hazard Area			
		Extreme, Very High and High	Percent of Total Exposed	Moderate and Low	Percent of Total Exposed
Delanco Township	1,562	2	0.1%	97	6.2%
Delran Township	5,191	4	0.1%	304	5.9%
Eastampton Township	2,499	8	0.3%	297	11.9%
Edgewater Park Township	2,567	1	0.0%	193	7.5%
Evesham Township	14,319	267	1.9%	1,483	10.4%
Fieldsboro Borough	242	0	0.0%	21	8.7%
Florence Township	2,522	39	1.5%	511	20.3%
Hainesport Township	2,747	40	1.5%	406	14.8%
Lumberton Township	4,009	15	0.4%	872	21.8%
Mansfield Township	2,798	39	1.4%	936	33.5%
Maple Shade Township	6,006	0	0.0%	78	1.3%
Medford Lakes Borough	1,909	3	0.2%	27	1.4%
Medford Township	10,627	307	2.9%	2,385	22.4%
Moorestown Township	8,736	35	0.4%	1,436	16.4%
Mount Holly Township	4,573	5	0.1%	91	2.0%
Mount Laurel Township	12,900	45	0.3%	1,351	10.5%
New Hanover Township	1,964	23	1.2%	196	10.0%
North Hanover Township	2,901	14	0.5%	757	26.1%
Palmyra Borough	2,713	0	0.0%	22	0.8%
Pemberton Borough	514	2	0.4%	13	2.5%
Pemberton Township	13,511	358	2.6%	1,647	12.2%
Riverside Township	2,868	2	0.1%	39	1.4%
Riverton Borough	1,274	0	0.0%	17	1.3%
Shamong Township	3,623	39	1.1%	1,342	37.0%
Southampton Township	7,982	100	1.3%	2,611	32.7%
Springfield Township	2,876	27	0.9%	1,597	55.5%
Tabernacle Township	4,452	70	1.6%	1,557	35.0%
Washington Township	939	59	6.3%	558	59.4%
Westampton Township	3,006	25	0.8%	624	20.8%
Willingboro Township	12,395	0	0.0%	128	1.0%
Woodland Township	1,323	123	9.3%	583	44.1%
Wrightstown Borough	485	0	0.0%	10	2.1%
Burlington County	**173,044**	**1,939**	**1.1%**	**25,490**	**14.7%**

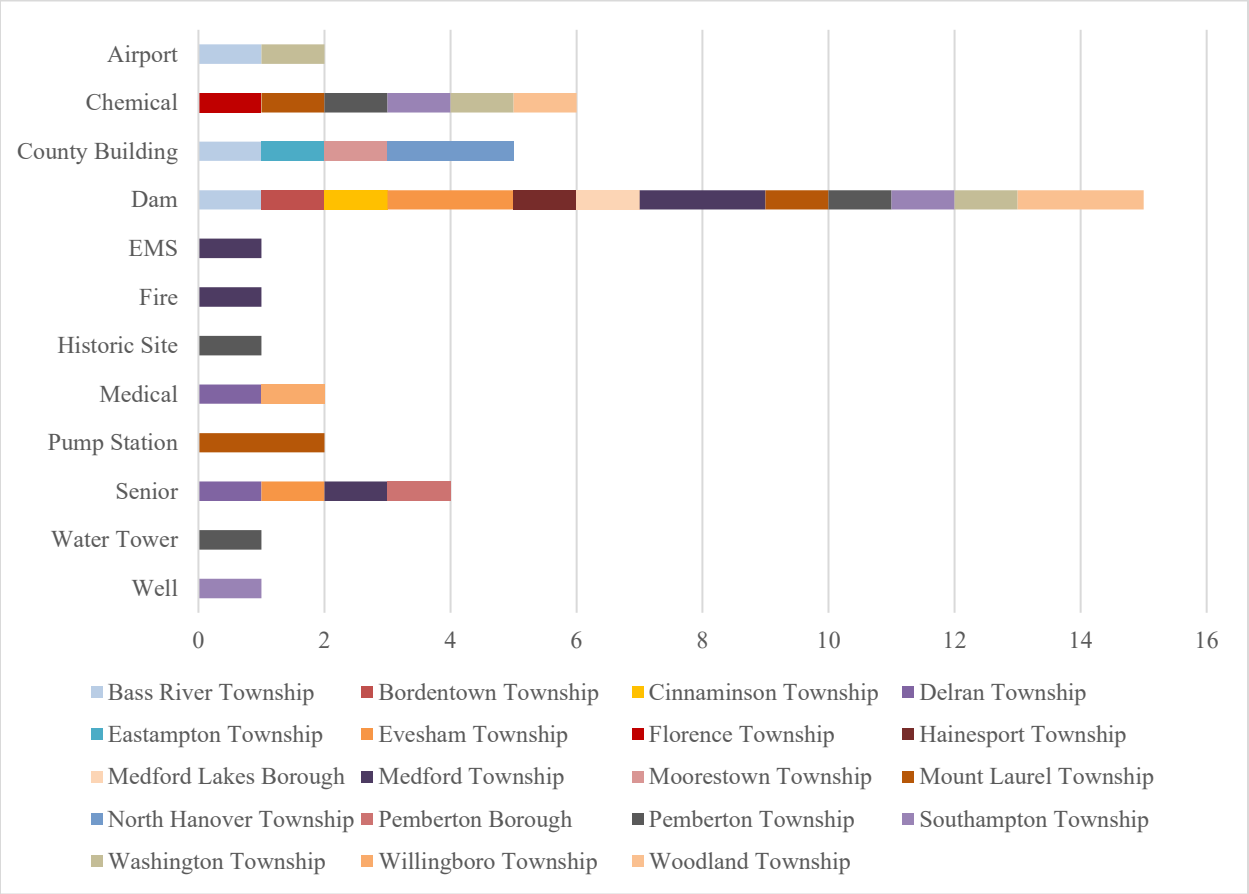
Source: Burlington County, NJFFS 2009
Note: The NJFFS Fuel Hazard boundaries were overlaid on the custom general building stock inventory; the structures with their centroids within the hazard areas were totaled for each municipality.

Impact on Critical Facilities

It is recognized that a number of critical facilities are located in the wildfire hazard area and are also vulnerable to the threat of wildfire. Many of these facilities are the locations for vulnerable populations (i.e., schools, senior facilities) and responding agencies to wildfire events (i.e., fire, police). Figure 5.4.8-4 displays the critical facilities located within the wildfire fuel hazard ranking zones by jurisdiction.

Roads and bridges in areas of fire risk are important because they provide ingress and egress to large areas and, in some cases, to isolated neighborhoods. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Regarding facility types, dams have the greatest exposure; there are 15 dams in Burlington County's located within the wildfire hazard areas. Wildfires may not directly impact dams, but it can create conditions in which dams can be obstructed or damaged by falling tree debris.

Figure 5.4.8-4. Critical Facilities within the Wildfire Hazard Area in Burlington County



Source: Burlington County, NJFFS 2009

Note: Only communities with exposed critical facilities were included in the above figure.

Impact on Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires.

Wildfire can also severely impact roads and infrastructure. Route 206 which runs north to south through the county is located in portions of the wildfire hazard areas that are associated with the Pineland forests. This should be considered for evacuation route purposes since it serves as the major north/south corridor in the interior of the county. No major utilities such as power generation facilities are located in fire hazard areas.

Due to a lack of data regarding past structural and economic losses specific to Burlington County or its municipalities, it is not possible to estimate future losses due to wildfire events at this time.

Future Growth and Development

Areas targeted for potential future growth and development in the next five years have been identified across Burlington County at the municipal level. Refer to the jurisdictional annexes in Volume II of this HMP. As stated earlier, buildings constructed of wood or vinyl siding are generally more likely to be damaged by fire than are buildings constructed of brick or concrete. Major new developments located in the wildfire hazard area can be retrofitted with flame-resistant materials or adjacent communities can institute vegetation maintenance programs to reduce the risk of wildfires spreading into developed areas. It is anticipated that any new development and new residents in the extreme, very high or high fuel hazard areas will be exposed to the wildfire hazard (refer to Figure 5.4.8-5 below).

There are 51 recent and proposed developments around the County exposed to the wildfire hazard areas; 30 of these developments are located within 'high' NJFFS Fuel Hazard areas, 10 are located within the 'very high' hazard area, and 11 are located within the 'extreme' hazard area. Mount Laurel Township has the most developments located in the hazard area (13 developments in all three of the NJFFS Fuel Hazard areas); this includes 8 located in the 'high' hazard area, 2 located in the 'very high' hazard area, and 3 located in the 'extreme' hazard area. Refer to each jurisdictional annex for the results of each exposure analysis on new development.

Effect of Climate Change on Vulnerability

According to the U.S. Fire Service (USFS), climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition. Climate change associated with elevated greenhouse gas concentrations may create an atmospheric and fuel environment that is more conductive to large, severe fires. Under a changing climate, wildfires are expected to increase by 50-percent across the U.S. (USFS, 2013).

Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species and an increasing wildland-urban interface (USFS, 2011).

It is projected that higher summer temperatures will likely increase the high fire risk by 10 to 30-percent. Fire occurrence and/or area burned could increase across the U.S. due to the increase of lightning activity, the frequency of surface pressure and associated circulation patterns conductive to surface drying, and fire-weather conditions, in general, which is conductive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels and extending fire seasons and areas burned (USFS, 2011).

With temperatures anticipated to increase, suitability of habitats for specific types of trees potentially changes, altering the fire regime and resulting in more frequent fire events and changes in intensity. Prolonged and more frequent heat waves have the potential to increase the likelihood of a wildfire. Climate change may also increase winds that spread fires. The increased potential combined with stronger winds can increase the County's vulnerability. If stronger winds occur near a wildfire and emergency services are unable to initially contain the event, the fast-moving fire can spread to nearby developments. This can directly impact the County's population

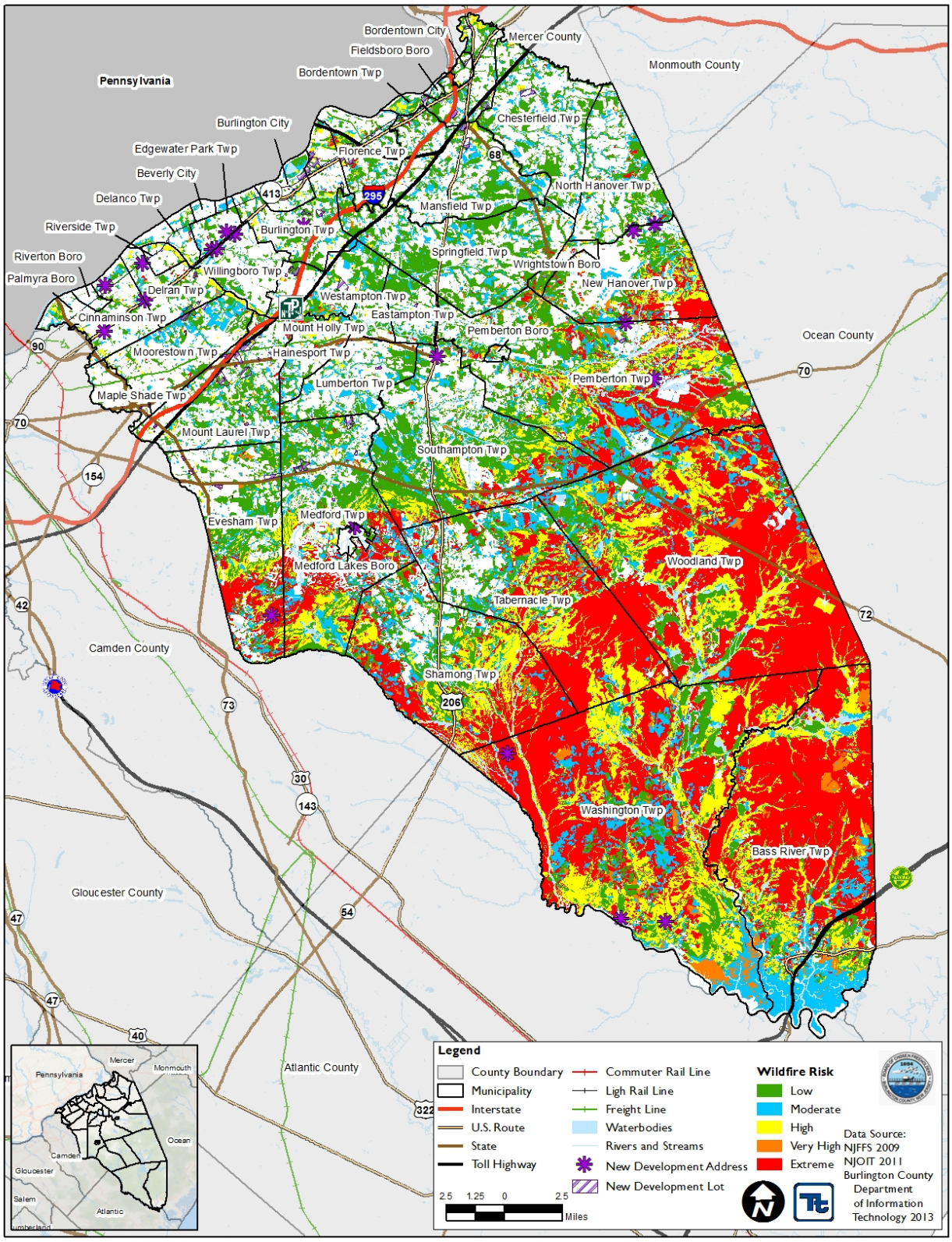
and built environment in the vicinity of the fire, and also indirectly affect those served by utility infrastructure that can be damaged by a fire.

Future changes in fire frequency and severity are difficult to predict. Global and regional climate changes associated with elevated greenhouse gas concentrations could alter large weather patterns, thereby affecting fire-weather conducive to extreme fire behavior (USFS, 2011).

Change of Vulnerability Since the 2014 HMP

Burlington County and all plan participants continue to be vulnerable to the wildfire hazard. Several differences exist between the 2014 Plan and this update. For this plan update, an updated general building stock based upon replacement cost value from MODIV tax assessment data and 2018 RS Means, and an updated critical facility inventory were used to assess the county's risk to the hazard areas. Due to differences in data used for the vulnerability assessment, a direct comparison could not be conducted to determine whether there has been a change in vulnerability since the last HMP. The updated vulnerability assessment provides a more current exposure analysis for the county.

Figure 5.4.8-5. Potential New Development and Wildfire Hazard Boundaries



Source: NJFFS 2009 and Burlington County