5.4.7 WILDFIRE

This section provides a profile and vulnerability assessment for the wildfire hazard.

HAZARD PROFILE

This section provides profile information including description, location, extent, previous occurrences and losses and the probability of future occurrences.

Description

Wildfire is the term applied to any unwanted, unplanned, damaging fire burning in forest, shrub or grass and is one of the most powerful natural forces known to people. The Federal Emergency Management Agency's (FEMA) Fire Management Assistance Grant Program (FMAGP) indicates that a wildfire is also known as a forest fire, vegetation fire, grass fire, or brush fire, is an uncontrolled fire requiring suppression action and often occurring in wildland areas, but which can also consume houses or agricultural resources. Common causes of wildfires include lightning, negligent human behavior and arson (FMAGP, Date Unknown).

The Legislature declares it to be the policy of the State to prevent, control, and manage wildfires on or threatening the forest or wildland of New Jersey in order to preserve forests and other natural resources; to enhance the growth and maintenance of forests; to protect recreational, residential, wildlife, plant life, watershed, airshed, and other values; to promote the stability of forest using industries; and to prevent loss of life, bodily injury and damage to property from wildfire and conflagrations.

In the State of New Jersey, an average of 1,500 wildfires damage or destroy 7,000 acres of the State's forests. Wildfires not only damage woodlands, but are becoming an increasing threat to homeowners who live within or adjacent to forest environments. From January 1, 2012 to August 11, 2013, there have been 648 wildfires in New Jersey, burning approximately 852 acres (New Jersey Forest Fire Service, 2013).

There are three different classes of wildfires: surface fires, ground fires, and crown fires. Surface fires are the most common type and burns along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees.

FEMA indicates that there are four categories of wildfires that are experienced throughout the U.S. These categories are defined as follows:

- Wildland fires – fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where Federal agencies are responsible for fire management and suppression.
- Interface or intermix fires – urban/wildland fires in which vegetation and the built-environment provide fuel
- Firestorms – events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change or the available fuel is exhausted.
- Prescribed fires and prescribed natural burns – fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes (FEMA, 1997).

The potential for wildfire, and its subsequent development (growth) and severity, is determined by three principal factors including the area's topography, the presence of fuel, and weather. These factors are described below:

Topography - Topography can have a powerful influence on wildfire behavior. The movement of air over the terrain tends to direct a fire's course. Gulches and canyons can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread rates. Saddles on ridgetops tend to offer lower resistance to the passage of air and will draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior.

Slope is an important factor. If the percentage of uphill slope doubles, the rate at which the wildfire spreads will most likely double. On steep slopes, fuels on the uphill side of the fire are closer physically to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of wildfire's rapid spread (FEMA, 1997).

Fuel - Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading can be used to describe the amount of vegetative material available. If this doubles, the energy released can also be expected to double. Each fuel type is given a burn index, which is an estimate of the amount of potential energy that may be released, the effort required to obtain a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities and some burn more easily than others. Grass releases relatively little energy but can sustain very high rates of spread (FEMA, 1997). According to the U.S. Forest Service, a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels). Fire behavior is strongly influenced by these fuels. Each of these layers provides a different type of fuel source for wildfires.

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce the likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses, and any other combustible biomass located between the top of the surface fuels and the bottom of the overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consists mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies are the primary fuel layer in a forest crown fire (U.S. Forest Service, 2003).

Weather / Air Mass - Weather is the most important factor in the make-up of a fire's environment, yet it is always changing. Air mass, which is defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can impact wildfire through climate, including temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere at the time of the fire (NWS, 2009). Extreme weather leads to extreme events and it is often a moderation of the weather that marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that are capable of radical and sudden changes in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA, 1997).

Fire probability depends on local weather conditions, outdoor activities (e.g. camping, debris burning, and construction), and the degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase the likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase the probability of wildfires by producing fuel in both urban and rural areas. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks; pull down overhead power lines; or damage pavement and underground utilities (NVRC, 2006).

Extent

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger and growth including, but not limited to the following:

Wildland/Urban Interface (WUI) is the area where houses and wildland vegetation coincide. Interface neighborhoods are found all across the U.S., and include many of the sprawling areas that grew during the 1990s. Housing developments alter the structure and function of forests and other wildland areas. The outcomes of the fire in the WUI are negative for residents; some may only experience smoke or evacuation, while others may lose their homes to a wildfire. All states have at least a small amount of land classified as WUI. To determine the WUI, structures per acre and population per square mile are used. Across the U.S., 9.3-percent of all land is classified as WUI. The WUI in the area is divided into two categories: intermix and interface. Intermix areas have more than one house per 40 acres and have more than 50-percent vegetation. Interface areas have more than one house per 40 acres, have less than 50-percent vegetation, and are within 1.5 miles of an area over 1,235 acres that is more than 75-percent vegetated (Stewart et al., 2006).

Concentrations of WUI can be seen along the east coast of the U.S., where housing density rarely falls below the threshold of one housing unit per 40 acres and forest cover is abundant. In the mid-Atlantic and north central regions of the U.S., the areas not dominated by agriculture have interspersed WUI and low density vegetated areas. Areas where recreation and tourism dominate are also places where WUI is common, especially in the northern Great Lakes and Missouri Ozarks (Stewart et al., 2006).

Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps and satellite-derived "greenness" maps. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (USFS, Date Unknown).

Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS (NWS, Date Unknown). Fire Danger Rating level takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS, Date Unknown). Table 5.4.7-1 shows the fire danger rating and color code.

Table 5.4.7-1. Fire Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
Low (L) (Dark 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.

Fire Danger Rating and Color Code	Description
Moderate (M) (Light Green or 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 (H) (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 (VH) (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 burn into heavier fuels.
Extreme (E) (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 (trunks, branches, and tree tops) 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: USFS, Date Unknown

The ***Fire Potential Index (FPI)*** is derived by combining daily weather and vegetation condition information and can identify the areas most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of the live and dead vegetation. The weather information also identifies areas of low humidity, high temperature, and no precipitation to identify areas most susceptible to fire ignition. The FPI enables local and regional fire planners to quantitatively measure fire ignition risk (USGS, 2005). FPI maps are provided on a daily basis by the U.S. Forest Service. The scale ranges from 0 (low) to 100 (high). The calculations used in the NFDRS are not part of the FPI, except for a 10-hour moisture content (Burgan et al, 2000).

Fuel Moisture (FM) content is the quantity of water in a fuel particle expressed as a percent of the oven-dry weight of the fuel particle. FM content is an expression of the cumulative effects of past and present weather events and must be considered in evaluating the effects of current or future weather on fire potential. FM is computed by dividing the weight of the "water" in the fuel by the oven-dry weight of the fuel and then multiplying by 100 to get the percent of moisture in a fuel (NWS, Date Unknown).

There are two kinds of FM: live and dead. Live fuel moistures are much slower to respond to environmental changes and are most influenced by things such as a long drought period, natural disease and insect infestation, annuals curing out early in the season, timber harvesting, and changes in the fuel models due to blow down from windstorms and ice storms (NOAA, Date Unknown). Dead fuel moisture is the moisture in any cured or dead plant part, whether attached to a still-living plant or not. Dead fuels absorb moisture through physical contact with water (such as rain and dew) and absorb water vapor from the atmosphere. The drying of dead fuels is accomplished by evaporation. These drying and wetting processes of dead fuels are such that the moisture content of these fuels is strongly affected by fuel sizes, weather, topography, decay classes, fuel composition, surface coatings, fuel compactness and arrangement (Schroeder and Buck, 1970).

Fuels are classified into four categories which respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. The four categories include:

- 1-hour fuels: up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.
- 10-hour fuels: ¼-inch to one-inch in diameter - computed from observation time, temperature, humidity, and cloudiness or can be an observed value.
- 100-hour fuels: one-inch to three-inch in diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.
- 1000-hour fuels: three-inch to eight-inch in diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (National Park Service, Date Unknown).

The ***Keetch-Byram Drought Index (KBDI)*** is a drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS, Date Unknown). The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming that there is eight inches of moisture in a saturated soil that is readily available to the vegetation. For different soil types, the depth of soil required to hold eight inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression (Florida Forest Service, Date Unknown).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures the potential for existing fires to become large fires. It is named after its developer, Donald Haines, a Forest Service research meteorologist, who did the initial work and published the scale in 1988 (Storm Prediction Center [SPC], Date Unknown).

The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere is, the higher the index. It is calculated by combining the stability and moisture content to the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point different. The index, as listed below, has shown to correlate with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior (USFS, Date Unknown).

- Very Low Potential (2) – moist, stable lower atmosphere
- Very Low Potential (3)
- Low Potential (4)
- Moderate Potential (5)
- High Potential (6) – dry, unstable lower atmosphere (USFS, Date Unknown)

The Haines Index is intended to be used all over the U.S. It is adaptable for three elevation regimes: low elevation, middle elevation, and high elevation. Low elevation is for fires at or very near sea level. Middle elevation is for fires burning in the 1,000 to 3,000 feet in elevation range. High elevation is intended for fires burning above 3,000 feet in elevation (SPC, Date Unknown).

The ***Landscape Fire and Resource Management Planning Tools Project (LANDFIRE)*** is a five-year, multi-partner project. The project is producing comprehensive and consistent maps and data describing vegetation, fire and fuel characteristics for the entire U.S. LANDFIRE is a shared project between the U.S. Department of Agriculture Forest Service and the U.S. Department of the Interior. The project has several principal partners, which include the USFS Missoula Fire Sciences Laboratory, the USGS Center for Earth Resources Observation and Science, and the Nature Conservancy (LANDFIRE, Date Unknown).

Additionally, the U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station developed a historical natural fire regimes dataset. The fire regimes are described in terms of frequency and severity and represent pre-settlement, historical fire processes. Fire regimes I and II represent frequent fire return intervals. The 0-35+ years/low severity fire regime (I) occurs mostly on forested land. The 0-35+years/stand-replacement regime (II) occurs mostly on grasslands and shrublands. Fire regimes III, IV, and V have longer fire return intervals and occur on forest lands, shrublands, and grasslands. These coarse-scale data were developed for national-level planning and were not intended to be used at finer spatial scales (Schmidt et al., 2002).

The ***Buildup Index (BUI)*** is a number that reflects the combined cumulative effects of daily drying and precipitation in fuels with a 10 day time lag constant. The BUI can represent three to four inches of compacted litter or can represent up to six inches or more of loose litter (North Carolina Forest Service, 2009).

New Jersey Wildfire Fuel Hazard

The New Jersey Forest Fire Service (NJFFS), a division of the New Jersey Departmental of Environmental Protection (NJDEP), has developed this Wildfire Fuel Hazard data based upon NJDEP's 2002 Land Use/Land Cover (LU/LC) datasets and NJDEP's 2002 10-meter Digital Elevation Grid datasets. The NJFFS took the NJDEP Modified Anderson Land Use/Land Cover Classification System 2002 and assigned Wildfire Fuel Hazard Rankings to it. The NJFFS used NJDEP's 2002 10-meter Digital Elevation Grids and calculated areas of 30% or greater slope throughout New Jersey. For areas of Wildfire Fuel Hazard 1 to 4 (i.e. Low to Very High) that were coincident with areas of 30% or greater slope, the Wildfire Fuel Hazard Ranking was increased by 1 value (i.e. Low was increased to Moderate, Moderate to High, etc.). For areas of Wildfire Fuel Hazard 0, and 5-8, the Wildfire Fuel Hazard Ranking remained the same. Once the LU/LC was coded according to Wildfire Fuel Hazard, taking into account 30% or greater slopes, the data was divided up by County. The project began in March 2009 and was completed in May 2009. Table 5.4.7-2 summarizes the County-wide area within each hazard ranked area, and Figure 5.4.7-1 displays the ranking across the County. Table 5.4.7-3 summarizes the area within each hazard ranked area, specific to Burlington County jurisdictions.

Table 5.4.7-2. 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

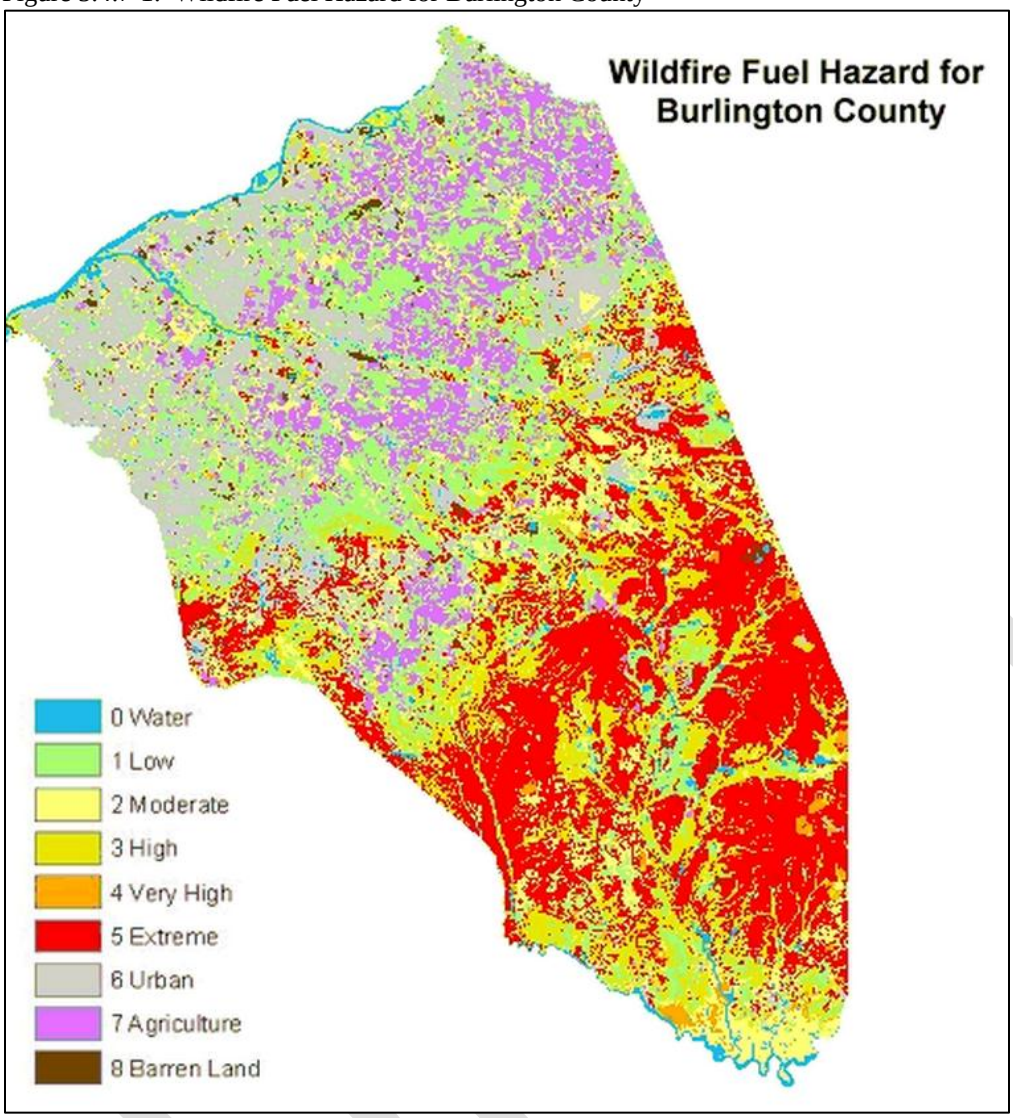
Source: NJ Forest Fire Service
Note: The remainder of the County is classified as 'water', 'barren land', 'urban', or 'agriculture.'

Table 5.4.7-3. Approximate Area in the New Jersey Forest Service Risk Areas in Burlington County (Acres)

Municipality	Total Area	NJ Forest 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 (C)	618	153	24.7%	31	5.1%
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%
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 5.4.7-1. Wildfire Fuel Hazard for Burlington County



Source: NJDEP NJFFS, 2009

Location

According to the U.S. Fire Administration (USFA), the fire problem in the U.S. varies from region to region. This often is a result of climate, poverty, education, demographics, and other causal factors (USFA, 2012). Wildfires occur in virtually all of the U.S. The western portion of the U.S. is subject to more frequent wildfires, due to their more arid climate and prevalent conifer and brush fuel types. Wildfires have proven to be the most destructive in California, but have become an increasingly frequent and damaging phenomenon nationwide (FEMA, 1997). States with a large amount of wooded, brush, and grassy areas, such as California, Colorado, New Mexico, Montana, Kansas, Mississippi, Louisiana, Georgia, Florida, North and South Carolina, Tennessee, Massachusetts, and the national forests of the western U.S. are at highest risk for wildfires (University of Florida, 1998).

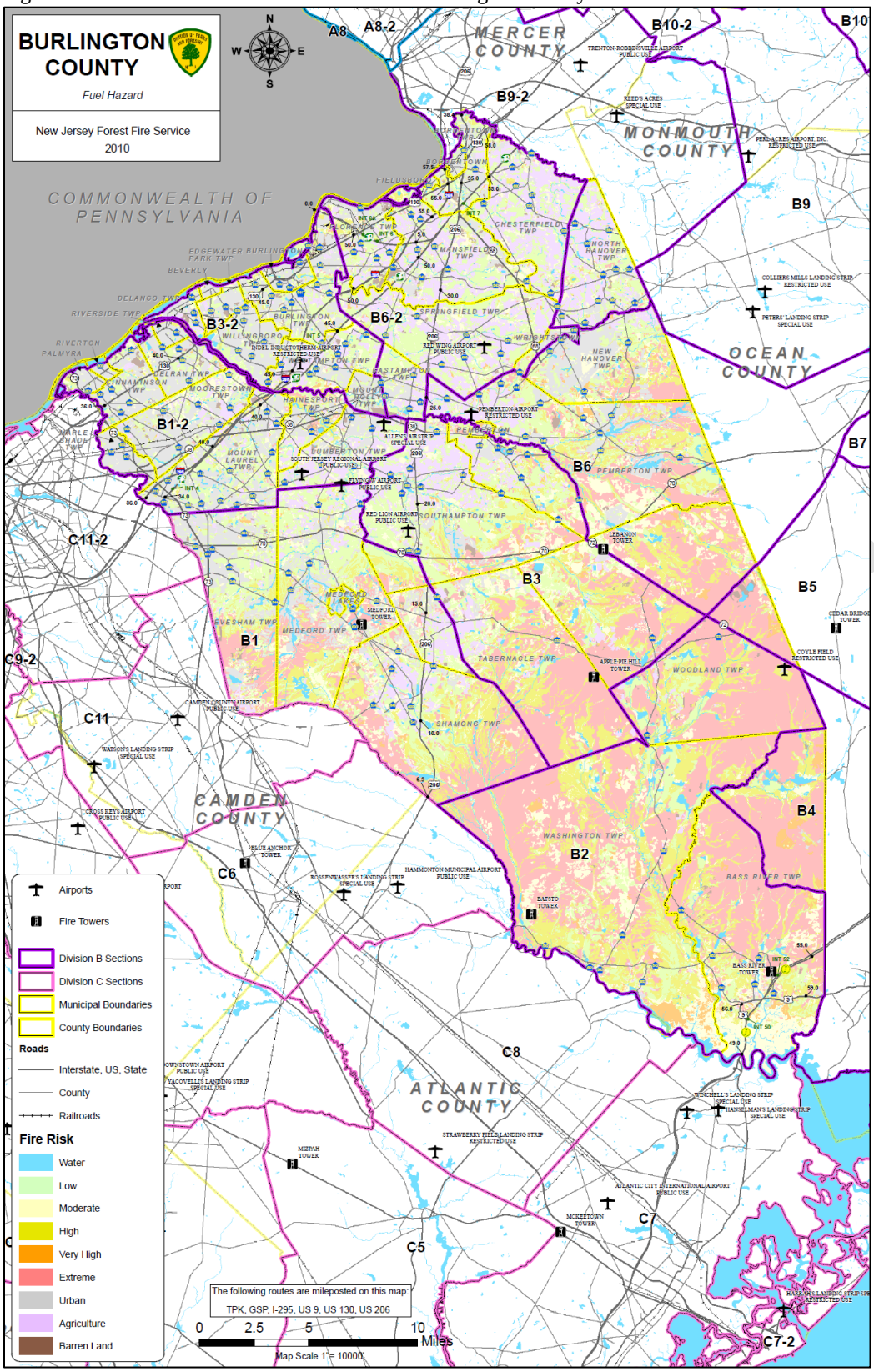
Although wildfires can occur during all months of the year, spring is the period when the most devastating incidents typically happen. With the coming of longer days, drying conditions, stronger winds, the weather provides excellent conditions for the rapid spread of fire. A second "season" develops

in the northern part of the State during the fall when the abundance of freshly fallen leaves provide a bed of fuel for wildfire to race rapidly up the slopes. Wildfire locations in the State tend to be in the less developed areas because they are more likely to have sources of fuel for fires, and because detection and suppression are somewhat less likely because there is lower population.

Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity, at steeper slopes. These less developed areas are prone to wildfire not only because they are more likely to have sources of fuel for fires, but also because detection and suppression are somewhat less likely because there is lower population. Although wildfires can occur during all months of the year, spring is the period when the most devastating incidents typically happen. With the coming of longer days, drying conditions, stronger winds, the weather provides excellent conditions for the rapid spread of fire (NJOEM, 2012).

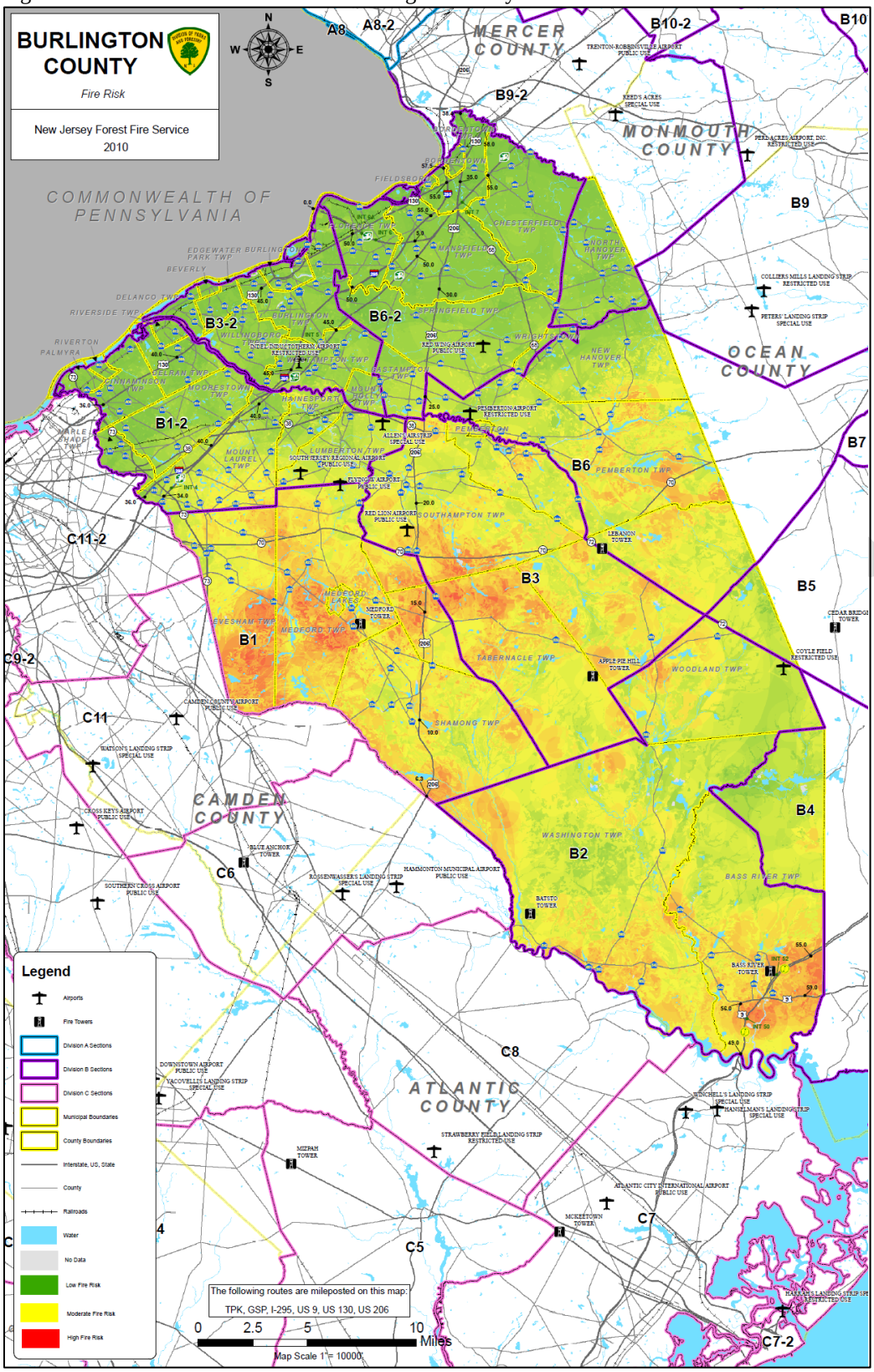
The New Jersey Forest Fire Service (NJFFS) cites the major contributing factors to the state's continuing wildfire problems as two parts of the "Wildfire Equation," which can be grouped into the two areas of hazard and risk. NJFFS has conducted a Wildfire Hazard Assessment for much of the State, and published maps of fuel hazard and fire risk areas, representing both parts of the "wildfire equation" for all New Jersey counties. Figures 5.4.7-2 and 5.4.7-3 illustrate this data for Burlington County. The figures show that wildfire hazard areas are located predominantly in the southeast portions of the county, coinciding with the location of the New Jersey Pine Barrens.

Figure 5.4.7-2. Fuel Hazard Risk Areas within Burlington County



Source: New Jersey Forest Fire Service, 2010.

Figure 5.4.7-3. Fire Risk Areas within Burlington County

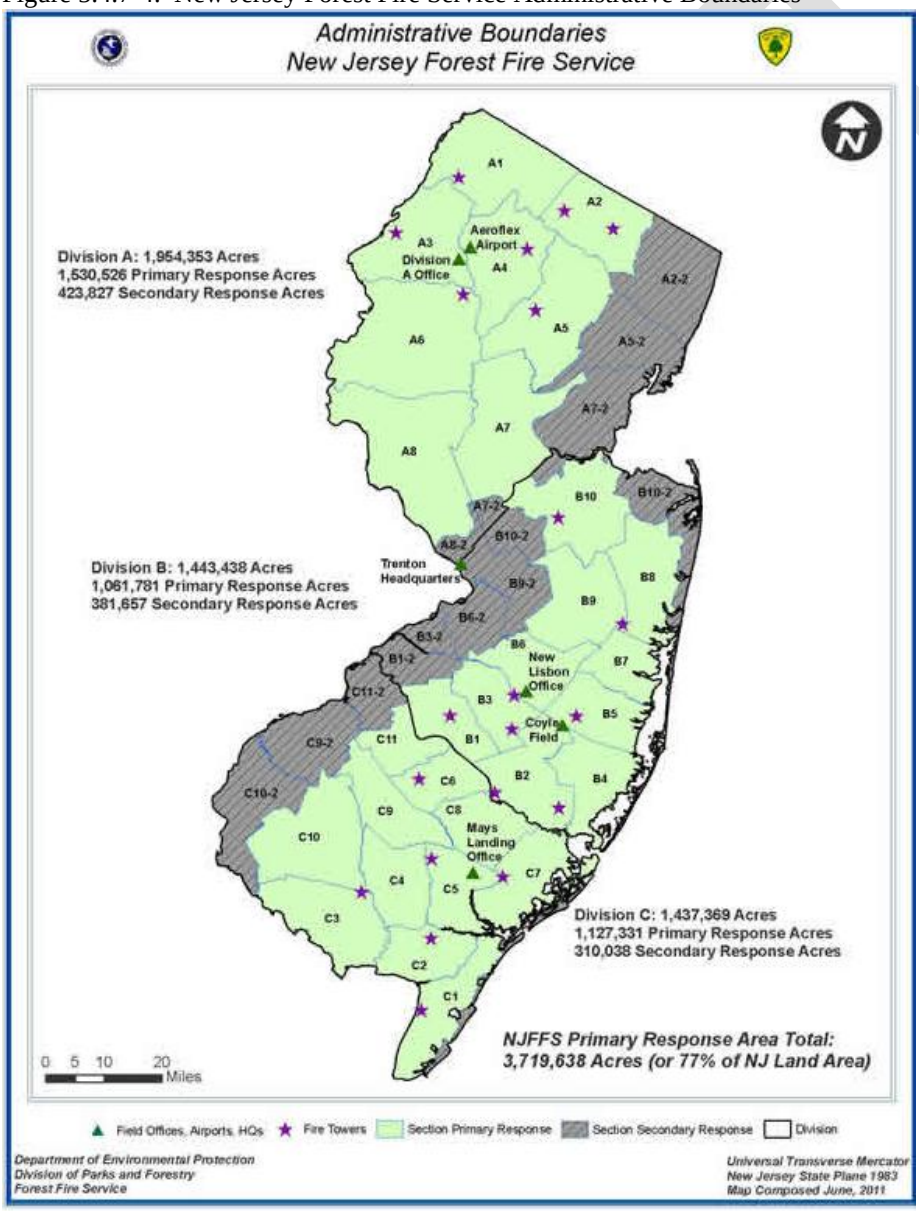


Source: New Jersey Forest Fire Service 2010

As noted in the New Jersey State HMP, New Jersey's high population density has created land use pressures in which more people are moving from urban areas to build homes in rural wildland areas. With more people living in the state's wildlands, as well as visiting them for various forms of recreation, the number of fires started and the seriousness of their consequences increases. The danger and risk are compounded when the factors of hazardous wildland fuels, interface home development, and an increased risk of human caused ignition come together under extreme fire weather conditions (NJOEM).

The New Jersey Forest Fire Service consists of three divisions: A, B, and C. Division A contains Bergen, Essex, Hudson, Morris, Passaic, Somerset, Sussex Warren, Hopewell township within Mercer, Union, Hunterdon, and northern Middlesex Counties. Division B contains Burlington, Monmouth, Ocean, southern Middlesex, and the remainder of Mercer. Division C contains Atlantic, Camden, Cape May, Cumberland, Gloucester, and Salem. Refer to Figure 5.4.7-4 below.

Figure 5.4.7-4. New Jersey Forest Fire Service Administrative Boundaries



Source: State of New Jersey Forest Fire Service, 2011

Input from Planning Committee

- *Moorestown Township* noted residential construction in heavily forested areas with limited firefighting access along the Rancocas Creek (particularly during drought conditions) (Burlington County HMP, 2008).
- *Township of Medford* – the Township indicated that wildfires occur throughout the southeastern portion of the Township. Beginning in 1933 and through the 1960s, large wildfires (>100 acres) burned frequently with at least one extremely large fire (>1,000 acres) each decade. In the 1960s, eight large wildfires burned over 11,000 acres (Township of Medford, 2013).
- *Borough of Medford Lakes* – the Township stated that beginning in 1933 through the 1960s, large wildfires (>100 acres) burned frequently in Medford Township and Medford Lakes Borough areas, with at least one extremely large fire (>1,000 acres) each decade. In the 1960s, eight large wildfires burned over 11,000 acres (Township of Medford Lakes, 2013)
- *Township of Mount Laurel* – the Rancocas Woods Development is located in the WUI and adjacent to the Rancocas State Park (Township of Mount Laurel, 2013).
- *Woodland* reported that wildfires pose a major problem for the Township (Burlington County HMP, 2008).
- *Tabernacle* reports that wildfires are a major concern for their Township, as lands are heavily forested and have extensive farmland, both of which dry out in the summer and fall months (Burlington County HMP, 2008).
- *Florence* indicated that there is a concern regarding some heavily wooded areas that have a limited water supply or a water supply that would have to be brought in by water tenders with remote fill sites (Burlington County HMP, 2008).
- *Pemberton Township* reported that they have experienced several wildfires throughout the years, since their jurisdiction is surrounded with vegetation that is prone to wildfires. They reported a total of 15 wildfires, 13 of which burned over 100 acres. One of the largest fires they reported occurred in April of 1963, when a fire started in the New Lisbon section of the Township and burned to the Barnegate Bay in Ocean County, killing and injuring several people. It also caused significant property damage. Today, they report that the same problem exists but on a much larger scale due to the human population inhabiting the area (Burlington County HMP, 2008).
- *Mount Laurel* reports that multiple parks and open space lands in the Township are located within and around developments, including the Rancocas Woods development bordering the state park. Some major concerns expressed by the Township are traffic problems and possible property losses (Burlington County HMP, 2008).
- While *Cinnaminson* is generally at a low risk from wildfires, they did express a concern for some wooded areas that may have limited nearby water supplies (Burlington County HMP, 2008).
- *Mansfield Township* reports that they have no past incidences of any significant wildfires (Burlington County HMP, 2008).
- *Evesham* notes that there are several developments in local forested areas with greater hazard extent, namely: Kings Grant and Marlton Lakes Sanctuary (Burlington County HMP, 2008).

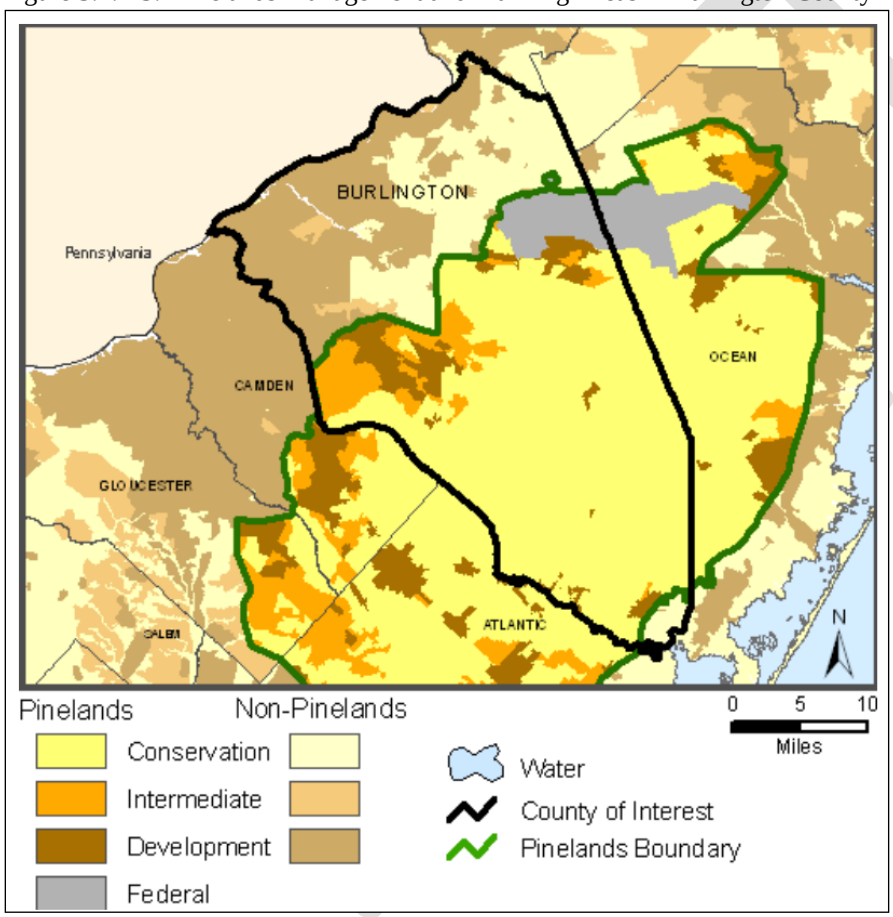
The Pinelands and Pine Barrens

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 5.4.7-5 below. 21 percent of Burlington County's 2010 population (93,385 residents) resided in the Pinelands Area. 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 5.4.7-5. 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).

Previous Occurrences and Losses

There are a number of early accounts and newspaper stories of fires burning thousands of acres of New Jersey woodlands, causing extensive damage to improved property and untold loss of life. One such account from 1755 reports a fire 30 miles long between Barnegat and Little Egg Harbor. In 1895, John Gifford reported to the state geologist that 49 fires burned 60,000 acres in Burlington, Atlantic and Ocean counties. Other early surveys, including those of 1872 and 1885, indicate that as many as 100,000 to 130,000 acres burned annually in the Pine Barrens region alone.

Between 1929 and 2006, there were 2,233 wildfire incidents in Burlington County. These incidents burned over 42,000 acres and destroyed 831 acres. Of those incidents, 193 of them burned over 10 acres in Burlington County. The following table presents a summary of historic wildfires in Burlington County, reported by the NJFFS, the NOAA-NCDC, and the NJSHMP.

Table 5.4.7-4. Wildfire Events in New Jersey and Burlington County between 1755 and 2013

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
1755	Wildfire - Pine Barrens	N/A	N/A	30 mile long wildfire from Barnegat to Little Egg Harbor	NJOEM, NJDEP, FEMA
September 7-10, 1838	Wildfire - Burlington and Monmouth Counties	N/A	N/A	A 14-mile wide and 20-mile long fire reported, burned approximately 179,200 acres, property damage reported, possible fatalities	NJOEM, NJDEP, FEMA, Burlington County HMP
1871	Wildfire - Burlington County	N/A	N/A	50,000 acres burned in Bass River	NJOEM, NJDEP, FEMA, Burlington County HMP
May 20, 1872	Wildfire - Sussex and Morris Counties	N/A	N/A	Forest fire burned 25,000 acres and caused $1 M in property damage, houses and 2 churched destroyed in Coleville and Middle Forge (Green Pond Mountains)	NJOEM, NJDEP, FEMA
July 25, 1885	Wildfire - Atco, Jackson, Atsion, and Barnegat	N/A	N/A	15,000-acre fire near Atco, 47,000-acre fire near Barnegat	NJOEM, NJDEP, FEMA, Burlington County HMP
1930	Wildfire - Multi-County	N/A	N/A	Worst year for fires, 267,547 acres burned, huge fire in May destroyed Forked River	NJOEM, NJDEP, FEMA
1936	Wildfire - Bass River	N/A	N/A	58,000-acre fire killed five Civilian Conservation Corps fire fighters	NJOEM, NJDEP, FEMA, Burlington County HMP
1941	Wildfire - Lakewood and Lakehurst	N/A	N/A	Huge fires destroyed 400 structures	NJOEM, NJDEP, FEMA
1954	Wildfire - Chatsworth and Moore's Meadows	N/A	N/A	20,000 acre wildfire threatened Chatsworth	NJOEM, NJDEP, FEMA, Burlington County HMP
1955	Wildfire - Ocean County	N/A	N/A	Easter Sunday fire killed the section firewarden	NJOEM, NJDEP, FEMA
April 20-22, 1963	Wildfire	N/A	N/A	Series of 37 wildfires burned 193,000 acres, 186 homes and 197 buildings destroyed, 7 fatalities, $8.5 M in property damages, one fire burned 76,000 acres and traveled 21 miles from New Lisbon to the Garden State Parkway	NJOEM, NJDEP, FEMA, Burlington County HMP
1971	Wildfire - Manahawkin	N/A	N/A	Manahawkin Fire burned 21,000 acres in 7 hours and 13 minutes	NJOEM, NJDEP, FEMA
1977	Wildfire - Burlington, Ocean, and Atlantic Counties	N/A	N/A	A 15,000-acre fire on March 31 burned six homes and caused extensive damage in Burlington, Ocean and Atlantic counties. On July 22, a 2,300-acre fire in Bass River State Forest killed four volunteer firefighters from Eagleswood Volunteer Fire Department and forced the evacuation of the Bass River	NJOEM, NJDEP, FEMA, Burlington County HMP

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				Recreation Area.	
1992	Wildfire - Ocean and Burlington Counties	N/A	N/A	Four major fires burned 14,000 acres on May 3rd; a 4,800-acre fire in Lacey threatened and closed down Oyster Creek Nuclear Power Plant; 2,900-acre fire in Woodland destroyed one home and threatened 100 others; June 13th – 5,400-acre fire burned through Lacey	NJOEM, NJDEP, FEMA, Burlington County HMP
April 4, 1995	Wildfire - Ocean County	N/A	N/A	Wind-driven 19,225-acre fire burned through Manchester, Lacey, and Ocean	NJOEM, NJDEP, FEMA
July 1997	Wildfire - Ocean and Atlantic Counties	N/A	N/A	July 19th – Wrangle Brook wildfire - 800-acre fire damaged 52 homes and threatened over 300 homes in Ocean County July 29th – Rockwood II wildfire - 1,900-acre fire threatened Batsto Historic Site and 80 Atlantic County homes	NJOEM, NJDEP, FEMA, Burlington County HMP
April 30, 1999	Wildfire - Burlington County	N/A	N/A	Bass River fire burned over 11,000 acres. The fire was located primarily in the Bass River State Forest. It was reportedly caused by an errant missile from the Warren Grove Bombing Range.	NJOEM, NJDEP, FEMA, Burlington County HMP
2001	Wildfire - Multi-County	N/A	N/A	Airport Fire – 765-acre fire, 60 homes evacuated Cheesequake Creek Fire – 151-acre fire, 25 homes evacuated Warren Grove Fire – 1,600 acres destroyed	NJOEM, NJDEP, FEMA
May 1, 2001	Wildfire	N/A	N/A	In Burlington County in Bordentown Township, sparks from a passing train around 120 p.m. EDT was enough to ignite a dozen brush fires along the tracks from Amboy Road north to Groveville Road. One firefighter was taken to the hospital suffering from heat exhaustion. The siding of a barn on Amboy Road sustained minor heat damage; otherwise no other damage was reported. The fire was extinguished at 630 p.m. EDT. Another smaller train related brush fire occurred the same afternoon in Mansfield Township.	Burlington County HMP
May 15, 2001	Wildfire	N/A	N/A	In Florence, approximately 100 acres burned. No other information was reported.	Burlington County HMP
June 10, 2011	Wildfire	N/A	N/A	In Wading River, about 1,600 acres were burned, mainly pygmy pine trees on state and federal land south of New Jersey State Route 72 and west of County Route 539. The fire was reportedly started by a 25 pound practice bomb.	Burlington County HMP
June 2002 "Double Trouble Fire"	Wildfire - Berkeley and Beachwood	FM-2411	No	Jake's Branch Fire – started in Berkeley and destroyed 3 homes and 15 outbuildings before it was controlled at 1,277-acres, the fire seriously damaged 18 homes and outbuildings, forced the evacuation of 500 residents in Beachwood, closed the Garden State Parkway for 2 days	NJOEM, NJDEP, FEMA
August 15, 2002	Wildfire	N/A	N/A	A wildfire on the Fort Dix Military Reservation consumed about 3,000 acres of forest, fields, old cranberry bogs and swamps. The fire was reportedly caused when the Sun's heat ignited a	Burlington County HMP

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				practice round of ammunition.	
February 12, 2007	Wildfire - Somerset and Union Counties	N/A	N/A	Extremely dry weather caused brush fires in these two counties. In SC, dense brush burned near Bridgewater and headed towards the Darby Tract.	NJOEM, NJDEP, FEMA
May 2007 "Warren Grove Fire"	Wildfire	FM-2695	Yes	A wildfire likely sparked at the Warren Grove Gunnery Range in the Pine Barrens burned along the County border. The fire burned 14,000 acres, damaged or destroyed a handful of homes, and forced thousands to evacuate. The fire originated in Little Egg Harbor and traveled toward Stafford and Barnegat Townships. Numerous neighborhoods and mobile homes in Burlington and Ocean counties were evacuated.	Burlington County HMP
August 3, 2007	Wildfire	N/A	N/A	A forest fire started in Wharton State Forest in Washington Township, burning 2,443 acres in Washington and Shamong Townships before it was contained. The fire jumped the Mullica River and spread into Shamong Township quickly. U.S. Route 206 was sporadically closed in the area. As a precaution, the Atsion Lake recreational area, the Mullica and Lower Forge Camping areas and canoeing sites on the Mullica and Batsto Rivers were closed until the fire was completely contained at 8 a.m. Aug. 6th. The fire was believed to have been the work of an arsonist. No injuries or property damage was reported.	NOAA-NCDC
June 27, 2008	Wildfire	N/A	N/A	A lightning strike helped ignite a fire that burned 8 acres of woodland in Shamong Township. The lightning struck a tree and ignited dry leaves, pine needles and underbrush in Wharton State Forest surrounded by swampy ground, making firefighting difficult. The fire was five miles off of U.S. Route 206. The fire smoldered for about twenty-four hours before it was spotted. No homes or campers were threatened.	NOAA-NCDC
October 21, 2008	Wildfire	N/A	N/A	The Sauder Ditch Wildfire consumed about 1950 acres of forest before it was contained. The fire began in Camden County on the 21st, west of U.S. Route 206 and south of the Atsion Recreational Area. It spread into parts of Shamong Township (Burlington County) and Hammonton Township (Atlantic County). Gusty northwest winds along with recent dry weather helped spread the fire quickly and hampered firefighting efforts on the 21st and 22nd. The fire reached up to 100 feet in the air and was visible from Atlantic City. Smoke was smelled as far away as Ocean County. A state of emergency was declared in Shamong Township (Burlington County) on the 21st and lifted on the 22nd. Sections of U.S. Route 206 were closed in Shamong Township	NOAA-NCDC, SHELDUS

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				through the 25th. About 200 fire fighters battled the blaze and used brush trucks, helicopters, bull dozers and air tankers in their efforts. A firefighter suffered an irregular heartbeat from battling the blaze and one traffic cop was struck by a vehicle. Heavy rain on the 25th helped firefighting efforts. Prior to the 25th, only 0.16 of an inch of rain had fallen at Atlantic City International Airport during the month of October.	
April 7, 2010	Wildfire	N/A	N/A	Unseasonably warm and dry weather coupled with gusty southwest winds made it easy for wildfires to spread in New Jersey on the 7th. In Burlington County, a wildfire occurred at the intersection of Magnolia Road and New Jersey State Route 70 in Pemberton Township. The fire was reported at 3:35 p.m. and was contained at 7:00 p.m. No traffic disruptions or evacuations were reported. Local firefighters remained on the scene to extinguish hot spots and flare ups.	NOAA-NCDC
May 8, 2010	Wildfire	N/A	N/A	Strong gusty west winds and dry weather during the past couple of days helped spread a wildfire in Pemberton Township on the 8th. The fire burned 500 acres in the Brendan Byrne State Forest, forcing the closure of busy New Jersey State Route 70 on the 8th. No homes were damaged or injuries reported.	NOAA-NCDC
July 25, 2010	Wildfire	N/A	N/A	A lightning strike on the 25th started a wildfire within the Bass River State Forest, in a swampy area north of Dan Bridge Road in Bass River Township. The fire was first spotted on the 26th and caused the evacuation of about twenty-two families that were within the camp site and recreation area. The park was reopened on the 27th. The wildfire also forced the closures of portions of Stage Road and East Greenbush Road. The smoke was visible as far away as Atlantic County. Approximately 677 acres were consumed by the wildfire.	NOAA-NCDC
June 9, 2011	Wildfire	N/A	N/A	A lightning strike started a wildfire in Wharton State Forest off of U.S. Route 206 in Shamong Township. Approximately 152 acres were consumed before it was contained.	NOAA-NCDC
June 27, 2011	Wildfire	N/A	N/A	A lightning strike started a wildfire in Wharton State Forest off of U.S. Route 206 in Shamong Township. The swampy terrain made it cumbersome to battle the blaze. About 50 firefighters battled the blaze. No property was in danger, but a state campground about seven miles from the blaze was closed. Approximately 171 acres were consumed before it was contained.	NOAA-NCDC
April 8 – 10, 2012	Wildfire	N/A	N/A	The unseasonably dry weather coupled with strong winds helped quickly spread two wildfires on the 9th in central Burlington	NOAA-NCDC

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
				County. The South Park fire started just after Midnight in Woodland Township in near South Park and Sooy Roads, burning mostly on the grounds of the South Park Hunting Club. The strong winds helped spread the fire quickly. It was suspected that gypsy moth tree damage also contributed to the rapid spread of the fire. Air resources and over 250 local and state forestry fire fighters helped battle the blaze. By 8 a.m. the fire was partially contained and already burned 400 acres. Sections of Sooy Road and South Park Roads were closed in Tabernacle and Woodland Townships. On noon on the 10th, the wildfire reached 75 percent containment. It was expected to consume about 1000 acres before total containment was reached. A second wildfire occurred on the Fort Dix Military Installation, near the Burlington and Ocean County border on the 9th, and spread toward a controlled burn area. It was totally contained on the 10th. There were no reported injuries or damage. The fire consumed about 300 acres.	
July 5, 2012	Wildfire	N/A	N/A	A wildfire began during the afternoon of the 5th and before it was contained on the evening of the 6th scorched about 300 acres along the Camden and Burlington County line in the Wharton State Forest in Waterford and Shamong Townships. The fire could be seen as far away as Atlantic City. The wildfire was believed to have started as a small brush fire in the Goshen Pond Camping Area within the state forest off of Atsion Road and the Raritan Avenue Spur. By the middle of the day on the 6th, it was ninety percent contained. About forty firefighters battled the blaze in this remote area off of U.S. Route 206. Aggressive bulldozer lines and back fires were undertaken to mitigate and bring the fire under containment. Some traffic control was required along U.S. Route 206 and Jackson Road. No property was damaged or serious injuries reported.	NOAA-NCDC

Sources: Burlington County HMP, 2008; NOAA-NCDC, 2013; FEMA, 2013

Note: Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

FEMA Federal Emergency Management Agency
HMP Hazard Mitigation Plan
K Thousand ($)
M Million ($)
N/A Not available/not applicable
NCDC National Climatic Data Center
NJDEP New Jersey Department of Environmental Protection
NJOEM New Jersey Office of Emergency Management
NOAA National Oceanic and Atmospheric Administration
SHELDUS Spatial Hazard Events and Losses Database for the United States

Probability of Future Events

New Jersey is unique, in that it is the most densely populated state with over 8.7 million residents, and over 50 percent of the land is used for individual residences and housing developments. The continual increase of developments expands into forested regions. This spread of development into the forested regions is known as the wildland urban interface. According to the New Jersey Hazard Mitigation Plan, the wildland urban interface is defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildlands or vegetative fuel (NJOEM, 2012.) The New Jersey Forest Fire Service is faced with a significant threat with the increase of wildland urban interface. This means that many parts of the state, including Burlington County, will continue to face wildfires as a threat due to growing population, development, and increased wildland urban interface areas. At the time of completion of this plan, a comprehensive forest fire hazard analysis is being planned, documented, and published by the New Jersey Bureau of Forest Fire Management.

Although it is not necessary for a fire to be large to possess a serious threat or loss to homes and improved property, the New Jersey Forest Fire Service regards fires over 100-acres as "major". Analysis of fire data for the last several years reveal trends that can help predict the probability of major fire events. New Jersey Office of Emergency Management expects an average of three fires greater than 100 acres each year (NJOEM 2012.)

Mr. Ronald Neilson of the U.S. Forest Service's Pacific Northwest Research Station stated that climate change may bring a greater wildfire risk not just to the western U.S., but to the eastern and southeastern portions of the country as well. It is in the east and southeast where these climate change risks, such as dried out vegetation, heat and drought, will grow most dramatically. Currently, forests typically dry out just as the trees are going dormant for the winter. In the future, however, forests in the east may dry long before the trees have a chance to shut down. An increasing number of eastern woodlands could become prime wildfire fuel with the combination of forests drying out and infestation (Shapley, 2007). However, not enough information has been made available to support these studies or theories and too many uncertainties exist in regards to climate change and global warming to claim that wildfires will increase within the eastern U.S., without further research.

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).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of the wildfire hazard on Burlington County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health of residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time

Overview of Vulnerability

Wildfire hazards can impact significant areas of land, as evidenced by wildfires throughout the U.S. over the past several years. Fire in urban areas has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas. Wildfire, however can spread quickly, become a huge fire complex consisting of thousands of acres, and present greater challenges for allocating resources, defending isolated structures, and coordinating multi-jurisdictional response. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas.

Data and Methodology

Information regarding the wildfire hazard included input and data from NJ DEP NJ Forest Fire Service and the Steering Committee. The NJ Forest Fire Service Wildfire Fuel Hazard data assigns wildfire fuel hazard rankings across Burlington County. This data, developed in 2009, is based upon NJDEP's 2002 Land Use/Land Cover datasets and NJDEP's 2002 10-meter Digital Elevation Grid datasets. Refer to Figure 1-X earlier in this section for an illustration of these defined wildfire fuel hazard rankings. The asset data (population, building stock and critical facilities) presented in the County Profile (Section 2) was used to support an evaluation of assets exposed and the potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate GIS data was overlaid upon the NJ Forest Fire Service Fuel hazard area. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate.

Impact on Life, Health and Safety

As demonstrated by historic wildfire events in New Jersey and other parts of the country, potential losses include 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.

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 work to fight these fires.

As a way to estimate the County's population vulnerable to the wildfire hazard, the population located within low to moderate and high to extreme NJ Forest Service risk areas were overlaid upon the 2010 Census population data to calculate the estimated population exposed (approximately 115,889 people in Burlington County). Table 5.4.7-5 summarizes the estimated population exposed by municipality.

Table 5.4.7-5. Estimated Population Exposed to the Wildfire Hazard in Burlington County

Municipality	U.S. Census 2010 Population	NJ Forest Service Risk Area			
		Low to Moderate	% of Total	High to Extreme	% of Total
Bass River Township	1,443	1,015	70.3%	205	14.2%
Beverly City	2,577	125	4.9%	0	0.0%
Bordentown City	3,924	603	15.4%	69	1.8%
Bordentown Township	11,367	2,856	25.1%	578	5.1%
Burlington City	9,920	1,035	10.4%	233	2.3%
Burlington Township	22,594	4,904	21.7%	130	0.6%
Chesterfield Township	7,699	4,098	53.2%	112	1.5%
Cinnaminson Township	15,569	2,684	17.2%	490	3.1%
Delanco Township	4,283	590	13.8%	82	1.9%
Delran Township	16,896	3,106	18.4%	94	0.6%
Eastampton Township	6,069	1,913	31.5%	7	0.1%
Edgewater Park Township	8,881	763	8.6%	0	0.0%
Evesham Township	45,538	10,831	23.8%	2,977	6.5%
Fieldsboro Borough	540	188	34.8%	0	0.0%
Florence Township	12,109	1,180	9.7%	208	1.7%
Hainesport Township	6,110	1,024	16.8%	558	9.1%
Lumberton Township	12,559	1,661	13.2%	467	3.7%
Mansfield Township	8,544	2,496	29.2%	227	2.7%
Maple Shade Township	19,131	1,819	9.5%	12	0.1%
Medford Lakes Borough	4,146	37	0.9%	67	1.6%
Medford Township	23,033	8,403	36.5%	3,582	15.6%
Moorestown Township	20,726	3,832	18.5%	104	0.5%
Mount Holly Township	9,536	1,701	17.8%	490	5.1%
Mount Laurel Township	41,864	10,430	24.9%	534	1.3%
New Hanover Township	7,385	371	5.0%	190	2.6%
North Hanover Township	7,678	2,069	26.9%	112	1.5%
Palmyra Borough	7,398	91	1.2%	0	0.0%
Pemberton Borough	1,409	199	14.1%	327	23.2%
Pemberton Township	27,912	4,362	15.6%	4,478	16.0%
Riverside Township	8,079	515	6.4%	95	1.2%
Riverton Borough	2,779	177	6.4%	0	0.0%
Shamong Township	6,490	3,053	47.0%	1,397	21.5%
Southampton Township	10,464	3,849	36.8%	1,626	15.5%
Springfield Township	3,414	1,838	53.8%	383	11.2%
Tabernacle Township	6,949	3,234	46.5%	1,399	20.1%
Washington Township	687	144	21.0%	501	72.9%
Westampton Township	8,813	2,650	30.1%	721	8.2%
Willingboro Township	31,629	2,291	7.2%	31	0.1%
Woodland Township	1,788	341	19.1%	815	45.6%

Municipality	U.S. Census 2010 Population	NJ Forest Service Risk Area			
		Low to Moderate	% of Total	High to Extreme	% of Total
Wrightstown Borough	802	103	12.8%	17	2.1%
Burlington County	**448,734**	**92,581**	**20.6%**	**23,318**	**5.2%**

Source: Burlington County GIS 2013; NJ Forest Fire Service

Impact on General Building Stock

The most vulnerable structures to wildfire events are those within the high to extreme NJ Forest Service risk 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. To estimate the buildings exposed to the wildfire hazard, the assessed improved value in the NJ Forest Service risk areas are summarized in Table 5.4.7-6 by municipality. In addition, the default HAZUS-MH general building stock replacement cost values (Census block) located within the NJ Forest Service risk areas are summarized in Table 5.4.7-7.

Table 5.4.7-6. Estimated Assessed Value of Improvements Exposed to the Wildfire Hazard in Burlington County

Municipality	Total Assessed Value of Improvements	NJ Forest Service Risk Area			
		Low to Moderate	% Total	High to Extreme	% Total
Bass River Township	$112,293,600	$45,499,000	40.5%	$17,140,100	15.3%
Beverly*	$72,091,800	$0	0.0%	$0	0.0%
Bordentown	$298,534,950	$12,071,000	4.0%	$455,000	0.2%
Bordentown Township	$997,461,800	$247,446,700	24.8%	$26,066,100	2.6%
Burlington	$571,882,875	$27,559,900	4.8%	$179,200	0.0%
Burlington Township	$2,097,110,708	$127,788,000	6.1%	$8,196,200	0.4%
Chesterfield Township	$666,455,492	$149,925,800	22.5%	$25,586,900	3.8%
Cinnaminson Township	$1,304,483,700	$94,118,400	7.2%	$4,826,300	0.4%
Delanco Township	$290,621,560	$22,910,400	7.9%	$350,000	0.1%
Delran Township	$1,474,866,100	$176,568,500	12.0%	$36,520,800	2.5%
Eastampton Township	$421,225,400	$31,566,400	7.5%	$4,767,700	1.1%
Edgewater Park Township	$528,294,400	$29,948,800	5.7%	$1,781,000	0.3%
Evesham Township	$4,389,240,875	$695,492,100	15.8%	$182,403,600	4.2%
Fieldsboro Borough	$48,903,400	$7,435,300	15.2%	0	0.0%
Florence Township	$1,040,584,300	$126,038,500	12.1%	$8,692,600	0.8%
Hainesport Township	$367,702,666	$32,486,533	8.8%	$5,731,033	1.6%
Lumberton Township	$1,164,991,807	$150,415,700	12.9%	$31,198,600	2.7%
Mansfield Township	$899,612,400	$175,876,300	19.6%	$28,973,900	3.2%
Maple Shade Township	$1,405,067,900	$86,845,200	6.2%	$76,792,000	5.5%
Medford Lakes Borough	$1,297,069,100	$270,611,600	20.9%	$84,977,800	6.6%
Medford Township	$980,612,600	$3,524,800	0.4%	$3,849,400	0.4%
Moorestown Township	$3,410,132,200	$556,387,100	16.3%	$27,837,100	0.8%
Mount Holly Township	$1,079,081,000	$88,406,800	8.2%	$6,068,000	0.6%
Mount Laurel Township	$2,396,695,600	$228,148,900	9.5%	$36,195,400	1.5%
New Hanover Township	$852,205,300	$6,825,700	0.8%	$804,829,700	94.4%
North Hanover Township	$498,418,446	$153,362,650	30.8%	$52,369,000	10.5%
Palmyra Borough	$254,304,240	$5,958,300	2.3%	$4,900	0.0%

Municipality	Total Assessed Value of Improvements	NJ Forest Service Risk Area			
		Low to Moderate	% Total	High to Extreme	% Total
Pemberton Borough	$63,520,200	$4,707,000	7.4%	$17,324,200	27.3%
Pemberton Township	$2,014,515,095	$257,378,920	12.8%	$110,647,170	5.5%
Riverside Township	$349,218,580	$804,000	0.2%	$509,700	0.1%
Riverton Borough	$207,879,600	$4,662,900	2.2%	$1,517,000	0.7%
Shamong Township	$294,159,200	$107,663,400	36.6%	$21,427,200	7.3%
Southampton Township	$549,437,950	$180,316,800	32.8%	$31,940,700	5.8%
Springfield Township	$282,324,750	$171,059,200	60.6%	$6,017,600	2.1%
Tabernacle Township	$580,603,200	$204,393,100	35.2%	$45,289,600	7.8%
Washington Township	$13,020,400	$5,955,300	45.7%	$5,211,500	40.0%
Westampton Township	$919,859,000	$158,050,100	17.2%	$35,676,800	3.9%
Willingboro Township	$1,705,779,550	$61,941,500	3.6%	$776,000	0.0%
Woodland Township	$305,887,600	$141,310,500	46.2%	$100,321,700	32.8%
Wrightstown Borough	$47,025,100	$9,089,050	19.3%	$2,410,500	5.1%
Burlington County	**$36,253,174,444**	**$4,860,550,153**	**13.4%**	**$1,854,862,003**	**5.1%**

Source: NJ Forest Service, 2013; HAZUS-MH v2.1
*Beverly data source: 2011 NJGIN MODIV
Notes: GBS = General Building Stock; RV = Replacement Value

Table 5.4.7-7. Estimated Replacement Cost Value Exposed to the Wildfire Hazard in Burlington County

Municipality	Total Replacement Cost Value (Structure and Contents)	NJ Forest Service Risk Area			
		Low to Moderate	% Total	High to Extreme	% Total
Bass River Township	$158,762,000	$72,483,000	45.7%	$54,030,000	34.0
Beverly City	$351,041,000	$16,793,000	4.8%	$0	0.0
Bordentown City	$611,161,000	$75,010,000	12.3%	$11,329,000	1.9
Bordentown Township	$1,225,803,000	$201,799,000	16.5%	$41,994,000	3.4
Burlington City	$1,419,313,000	$128,499,000	9.1%	$94,196,000	6.6
Burlington Township	$3,257,758,000	$1,020,110,000	31.3%	$64,987,000	2.0
Chesterfield Township	$482,451,000	$197,052,000	40.8%	$14,165,000	2.9
Cinnaminson Township	$2,375,176,000	$323,958,000	13.6%	$22,325,000	0.9
Delanco Township	$484,972,000	$81,957,000	16.9%	$0	0.0
Delran Township	$2,136,079,000	$238,043,000	11.1%	$252,654,000	11.8
Eastampton Township	$712,944,000	$205,895,000	28.9%	$12,732,000	1.8
Edgewater Park Township	$959,473,000	$72,222,000	7.5%	$0	0.0
Evesham Township	$6,451,252,000	$2,055,424,000	31.9%	$416,656,000	6.5
Fieldsboro Borough	$72,125,000	$22,612,000	31.4%	$0	0.0
Florence Township	$1,509,320,000	$187,295,000	12.4%	$58,649,000	3.9
Hainesport Township	$839,062,000	$103,023,000	12.3%	$33,537,000	4.0
Lumberton Township	$1,504,149,000	$294,473,000	19.6%	$30,036,000	2.0
Mansfield Township	$1,954,839,000	$239,536,000	12.3%	$21,300,000	1.1
Maple Shade Township	$2,346,098,000	$266,654,000	11.4%	$13,391,000	0.6
Medford Lakes Borough	$560,603,000	$3,683,000	0.7%	$1,897,000	0.3
Medford Township	$3,746,510,000	$1,700,503,000	45.4%	$509,028,000	13.6
Moorestown Township	$4,209,509,000	$771,267,000	18.3%	$114,129,000	2.7
Mount Holly Township	$1,650,406,000	$259,958,000	15.8%	$42,323,000	2.6
Mount Laurel Township	$6,985,988,000	$1,887,036,000	27.0%	$127,914,000	1.8
New Hanover Township	$1,604,641,000	$986,959,000	61.5%	$14,175,000	0.9
North Hanover Township	$685,211,000	$197,201,000	28.8%	$8,301,000	1.2
Palmyra Borough	$942,785,000	$11,987,000	1.3%	$172,000	0.0
Pemberton Borough	$187,379,000	$41,397,000	22.1%	$9,502,000	5.1
Pemberton Township	$3,248,981,000	$569,149,000	17.5%	$544,733,000	16.8
Riverside Township	$885,809,000	$48,205,000	5.4%	$18,422,000	2.1
Riverton Borough	$352,198,000	$16,705,000	4.7%	$11,333,000	3.2
Shamong Township	$797,191,000	$300,344,000	37.7%	$168,386,000	21.1
Southampton Township	$1,305,540,000	$455,362,000	34.9%	$181,483,000	13.9
Springfield Township	$461,104,000	$208,967,000	45.3%	$39,104,000	8.5
Tabernacle Township	$931,897,000	$401,226,000	43.1%	$139,789,000	15.0
Washington Township	$108,601,000	$63,223,000	58.2%	$44,542,000	41.0
Westampton Township	$1,326,163,000	$292,260,000	22.0%	$103,879,000	7.8
Willingboro Township	$3,602,996,000	$363,124,000	10.1%	$39,156,000	1.1
Woodland Township	$115,483,000	$29,840,000	25.8%	$64,191,000	55.6
Wrightstown Borough	$140,021,000	$39,295,000	28.1%	$3,294,000	2.4

Municipality	Total Replacement Cost Value (Structure and Contents)	NJ Forest Service Risk Area			
		Low to Moderate	% Total	High to Extreme	% Total
Burlington County	**$62,700,794,000**	**$14,450,529,000**	**23.0%**	**$3,327,734,000**	**5.3**

Source: Radeloff et al, 2005; HAZUS-MH v2.1
Notes: GBS = General Building Stock; RV = Replacement Value

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). Table 5.4.7-8 summarizes critical facilities located within the high to extreme NJ Forest Service risk areas.

Table 5.4.7-8. Facilities in the High to Extreme NJ Forest Service Risk Areas in Burlington County

Name	Municipality	Type
Davita Delran	Delran	Dialysis
Medford Emergency Medical Services	Medford Township	EMS
Taunton Fire Co Of Medford	Medford Township	Fire
Davita Willingboro	Willingboro	Dialysis

Source: Burlington County 2013

Impact on the Economy

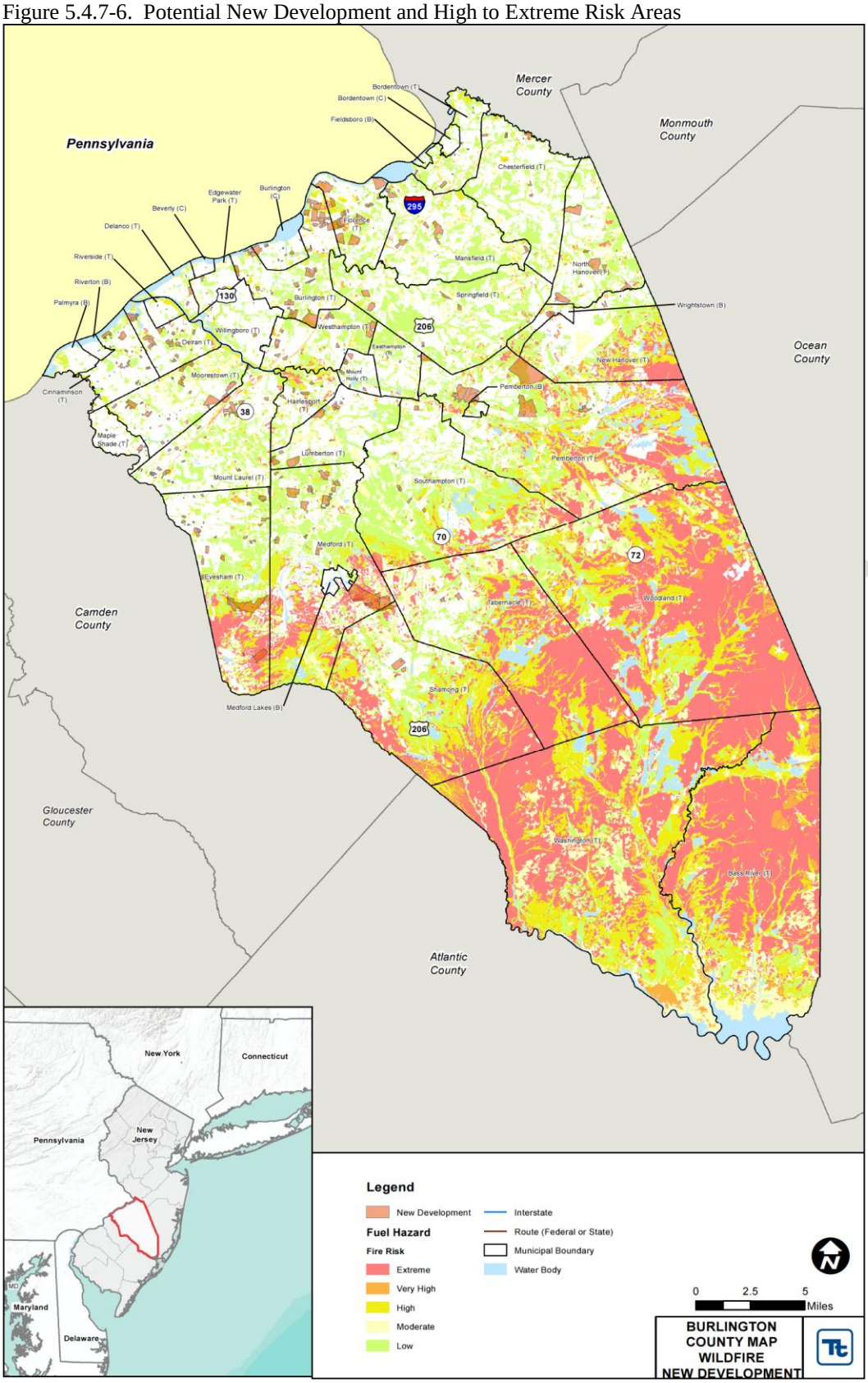
Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and decreases in tourism. Wildfire can also severely impact roads and infrastructure. Route 206 which runs north to south through the county 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 (5) years have been identified across Burlington County at the municipal level. Refer to the jurisdictional annexes in Volume II of this HMP. It is anticipated that any new development and new residents in the high to extreme hazard areas will be exposed to the wildfire hazard. Refer to Figure 5.4.7-6 of the potential new development in the County and the high to extreme risk areas.

Figure 5.4.7-6. Potential New Development and High to Extreme Risk Areas



Source: Burlington County GIS 2013

Additional Data and Next Steps

The custom building inventory developed for this Plan should be updated as data regarding the construction of structures, such as roofing material, fire detection equipment, structure age, etc. are available. As stated earlier, 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. The proximity of these building types to the WUI and high to extreme risk areas should be identified for further evaluation. Development and availability of such data would permit a more detailed estimate of potential vulnerabilities, including loss of life and potential structural damages.