EFFECTS OF SEA LEVEL RISE ON

NON-MOTORIZED TRANSPORTATION

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Civil Engineering

Summer 2017

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ACKNOWLEDGMENTS

The completion of this thesis would not have been possible without the motivation and support of my advisor, Ardeshir Faghri. His guidance has enabled me to step beyond my boundaries and find my passion in transportation engineering.

I am also thankful for the love and support of my mother, my father, and my brother. Their encouragement has enabled me to pursue my education as a graduate student.

Additional thanks are due to the many individuals whose help has been fundamental throughout this research. A special thank is to Paul Moser who helped me in obtaining required data for this research. I appreciate the participation of Delaware Department of Transportation (DelDOT), Delaware Department of Natural Resources and Environmental Control (DNREC), and Mid-Atlantic Transportation Sustainability University Transportation Center (MATS-UTC). I am also grateful for the support of University of Delaware University Transportation Center (UDUTC).

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ABSTRACT

There are certain evidences that greenhouse gas emissions resulted from human activities have caused climate change. The intergovernmental panel for climate change (IPCC) has certified 0.2°C of increase in mean temperature per decade. Non-motorized transportation is considered not only as one of the major mitigation strategies to reduce the amount of greenhouse gas emissions but also as solution to bring safety, livelihood and health back to urbanized communities. This proves the importance of identifying facilities that are more vulnerable to the effects of climate change to start adaptations as early as possible. Sea level rise and the associated increase in frequency and intensity of storm surges and flooding incidences are perhaps among the most worrying consequences of climate change, especially for coastal areas.

Trails and bike routes are the non-motorized transportation facilities that are studied in this research. The distance of inundation (distance of trails and bike routes that will be under water), and the maximum depth of water on affected facilities are estimated by Geographic Information System (GIS) based analysis. The two measures then have been used to indicate the extent of vulnerability of facilities against sea level rise. Since there is a great amount of uncertainty around sea level rise (SLR), the analysis was done for three sea level rise projections. The result of this vulnerability assessment is reported as the level of service of each facility under different sea level rise projections.

Number of damaged trails under the medium SLR projection shows an increase of 56.76% compared to the number of damaged trails under low SLR scenario. This percent increases to 78.9% when the comparison was done between low and high SLR projections. To investigate the severity of different projections, we compared the total distance of damaged trails. Analysis showed that there will be 60.95% increase in mileage of damaged trails under medium SLR scenario compared to low scenario and this percent will be 90.3% if the comparison is done between the lowest and the highest SLR projections. The analysis results for the bike routes showed that under the low scenario bike routes will not vanish. However, the number of damaged bike routes will increase by 50% if sea level rises 6 feet rather than 4 feet. Also, there will be a 55.48% increase in distance of damaged bike routes when the comparison is made between medium and high sea level rise projections. These drastic changes prove that management corporations should plan their adaptation strategies for the worst-case scenario because the gap between low and high future sea level rise projections is considerable. In addition, all the analysis results prove that as sea level rise projection gets higher the number of trails with lower level of service increases.

Chapter 1

INTRODUCTION

1.1 Motivation

There are certain evidences that greenhouse gas emissions resulted from human activities have caused global warming and in general climate change. The intergovernmental panel for climate change (IPCC) has certified 0.2 °C of increase in mean temperature per decade. It is predictable that without mitigation efforts all around the world the rate of warming will be faster in future.

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (Stocker, 2014). Several Studies show that the transportation sector contributes to 27 percent of U.S. greenhouse gas emissions, which is the major cause of climate change, so the Department of Transportation (DOT) clearly needs to think about emissions (Titus, 2002). As the transport sector is highly responsible for generating greenhouse gas emissions, many academic studies have addressed mitigation strategies such as using alternative fuels or more investments in public transportation. In addition, policies and regulations are making the mitigation process more convenient. For instance, clean air act which is a federal law, is designed to reduce air pollution on national level. From religious leaders (including Pope Francis) to many political leaders (including President Obama) have addressed the importance of pro-actively preparing the world and especially the future generations for these impacts. The

National Climate Assessment indicates that the impact of weather on human activities is inescapable and growing. In addition, climate change-related events such as sea level rise, extreme weather events, including heat waves, floods, and drought that have become more frequent and intense over parts of the country during the past 50 years will increase disruptions of infrastructure service in the future (Marchi, 2015). Non-motorized infrastructure such as sidewalks, bike lanes, shared use paths, parks and trails, can all be used for transportation, recreation, and fitness. These types of infrastructures have been shown to create many benefits for their users as well as the rest of the community (Garrett-Peltier, 2011). The effects of climate change either positive or negative on non-motorized transportation facilities should be studied for planning future mitigation strategies.

Non-motorized transportation is considered not only as one of the major mitigation strategies to reduce the amount of greenhouse gas emissions but also as solution to bring safety, livelihood and health back to urbanized communities. This proves the importance of identifying facilities that are more vulnerable to the effects of climate change to start adaptations as early as possible.

Three climate change derivatives have been identified to have the most effects on non-motorized transportation: sea level rise, increased frequency of intense precipitation and flooding, and increased temperature and heat waves. This study's focus is on the effects of sea level rise on trails and roadways with bike lane marking (bike routes) in Delaware.

1.2 Problem Statement

Direct impacts of climate change including exposure to weather extremes such as heatwaves and winter cold, increase in extreme weather events like floods, cyclones, storm surge drought, and sea level rise on civil infrastructure facilities such as roadways, bridges, tunnels and subways, rail stations, bus stations, parking lots, and airports have been studied by numerous scientists and engineers. However, there is lack of knowledge and analysis regarding the effects of climate change on pedestrian and bicycle facilities. Non-motorized transportation facilities such as pedestrian sidewalks, pedestrian and hiking trails, paths, bicycle paths, routes and trails, as well as public parks and recreation facilities have seen very little to no coverage in the literature. Several non-motorized transportation facilities with recreational purposes are located on low lying lands near shore lines in Delaware. This is a source of major problem in future in Delaware, which is a plain state, because many of these facilities are exposed to sea level rise and flooding caused by increased precipitation and storm surges. These facilities are going to be covered by water permanently or temporarily thus some questions arise: what is the level of exposure of each facility? are they going to be damaged? If so, how much will they be damaged?

Uncertainty around climate change and lack of knowledge and analysis regarding its impacts on non-motorized transportation will cause major problems in near future especially in plain areas like Delaware.

1.3 Objectives

This study is trying to assess the vulnerability of non-motorized transportation facilities against sea level rise in the State of Delaware. The objectives of the research can be summarized as follow:

- Assessing the number of trails that are going to be affected due to three scenarios of sea level rise.

- Assessing the length of trails that will be inundated due to three scenarios of sea level rise.
- Determining the level of service for affected trails based on vulnerability assessment
- Assessing the number of bike routes in Delaware that will be affected under three scenarios of sea level rise.
- Assessing the length of bike routes in Delaware that will be inundated under three scenarios of sea level rise.
- Determining the level of service for affected bike routes based on vulnerability assessment

The ultimate results that are expected to gain from this study are divided into three different sections. First, vulnerable trails and bike routes against sea level rise in 2100 are identified. The distance of the facilities that will be covered by water and the maximum depth of water on affected facilities are estimated by GIS-based analysis. In the third step, the vulnerability of facilities is estimated and reported as the level of service of that facility under different sea level rise scenarios.

1.4 Overview of Approach

As was mentioned in the previous section, this study includes three different parts. First, maps consisting of the location of non-motorized transportation facilities (trails and bike routes) were obtained and used to determine how much of these facilities will to be affected by sea level rise either completely or partially. It is worthwhile mentioning that three scenarios of sea level rise developed by the Delaware Department of Natural Resources and Environmental Control (DNREC) was used in this research. Based on these scenarios Delaware will experience either 2 feet, 4 feet, or 6 feet rise in sea level. The GIS-based data of sea level rise was obtained from the National Oceanic and Atmospheric Administration (NOAA). For each of the affected facilities based on the length of inundation and maximum depth of water, a vulnerability assessment is performed to demonstrate the risk which the facility will be confronted with by 2100. This risk is presented by the level of service that each facility will have under three sea level rise scenarios.

1.5 Scope

The science of climate change is both dynamic and complex thus there are a variety of climate change derivatives and indicators that will be addressed and covered in this research. These derivatives include frost days, cooling degree days, maximum 5-day rainfall, etc. The thesis concentrates on one climate change vectors; sea level rise. Flooding caused by storm surges and intense precipitation; and increased temperature and heat waves are the two most destructive consequences of climate change that their effect on non-motorized transportation should be studied in further researches.

There are several different types of non-motorized facilities, even shoulders of the road with widths more than 4 feet can be counted as biking facilities. However, in this study our focus is on two types of facilities; trails and bike routes.

As was mentioned earlier, the science of climate change is complex. Climate change derivatives for different geographic locations differ from each other. For example, in California heat waves are more important than freezing days which is reversed in northern States. Therefore, this research address climate change vectors that are more important in the mid-Atlantic region especially Delaware. Since Delaware is a flat state with a long coast line, sea level rise and flooding will become hazardous.

1.6 Implications and Outcomes

Although there is a great deal of uncertainty associated with climate change and weather projection, based on current observations and researches, climate change impacts are obvious all around the world. The major expected benefits and impacts of this project will be how planners and engineers can protect us and future generations from the negative impacts that climate change in particular sea level rise will have on our non-motorized transportation facilities. Transportation agencies and Department of Transportation (DOT) can use the methodology of this research to assess the vulnerability of non-motorized transportation facilities against climate change derivatives especially in the Mid-Atlantic region.

Government transportation agencies at different levels such as Delaware Department of Transportation (DelDOT) can use the results from this study both now and for their future non-motorized facilities planning. Since exact locations of affected facilities are indicated in the results section of the study, they can use the results of this work as a foundation for future adaptation planning and decision. Different adaptation strategies for different facilities can be selected by the management of the facility. For instance, elevating some parts of a trail that will be inundated or moving the trail land-ward to prevent frequent flooding. In addition, DelDOT can apply the results from this research for their future non-motorized transportation facilities planning. They can build new trails and shared use paths in locations that will not be affected in a hundred years. Thus, they can invest in non-motorized facilities in a smart way. Another significant outcome of this research is that management authorities of trails and bike routes can stop investing on maintenance of highly vulnerable facilities and spend the budget on building new facilities and retrofitting less vulnerable ones.

1.7 Organization of the Thesis

This thesis includes six chapters.

Chapter one- is an introduction to the research explaining what motivated this group to initiate doing research on this topic. This chapter also includes the questions that this work is trying to answer under the title of problem statement, the objectives of the research, the overview of approach, the scope of the study and finally implications and outcomes.

Chapter two- describes a brief background on climate change. This section includes a brief overview of climate change, how climate change affects human health.

Chapter three- describes the impacts of climate change on different modes of transportation including surface, air, and non-motorized transportation.

Chapter four- explains the methods of analysis that is used. This includes the sources of data, GIS-based analysis, and vulnerability assessment.

Chapter five- presents the results of analysis. The results include the level of service for trails and bike routes, and maps presenting the condition of Delaware's non-motorized facilities under three different scenarios.

Chapter six- summarizes conclusions, and recommendations. In addition, future research that could complete studying the effects of climate change on non-motorized transportation is explained.

Chapter 2

BACKGROUND ON CLIMATE CHANGE

2.1 Overview of Climate Change

The term climate is defined by very long-term processes over many years to decades, whereas the term weather deals with day to day weather variations that we experience. Despite, the fact that climate is simply a long-term average of many weather events, it is often the impact of the latter (e.g., Hurricane Katrina in 2005, Super storm Sandy in 2012, California drought of 2013–2014) that is more vividly remembered (Marchi, 2015). In the past, few decades, the term global warming was used frequently to address changes in climatic pattern however global warming is one of the several outcomes of the climate change. Although other features of climate are changing, they usually have been neglected in the literature reviews of this field.

Global warming describes as an average increase in temperatures near the earth's surface and in the lowest layer of the atmosphere. Increases in temperature in the atmosphere contribute to changes in global climate patterns. In addition to global, other significant outcomes of climate change are changes in precipitation, sea level rise etc. (Division of Energy and Climate, DNREC, 2014).

Climate change is described as any significant change in the measures of climate persisting for an extended time span (decades or longer). Many climate models project that future climate are likely to increase beyond the range of variability experienced in the past. Historical data and trends may no longer be reliable indicators for future climate conditions (US EPA, 2012).

2.1.1 Anthropogenic Activities and Climate Change

Humans are changing the composition of the atmosphere by adding carbon dioxide and visible particulates, called aerosols, mainly by burning fossil fuels. Other activities add methane and nitrous oxide, which along with carbon dioxide are greenhouse gases, so that they trap outgoing infrared radiation and warm the planet. In addition to changing the atmospheric concentrations of gases and aerosols, humans are affecting both the energy and water budget of the planet by changing the land surface, including redistributing the balance between latent and sensible heat fluxes. Land use changes, such as the conversion of forests to cultivated land, change the characteristics of vegetation, including its color, seasonal growth and carbon content (Foley et al., 2005;Houghton, 2003). For example, clearing and burning a forest to prepare agricultural land reduces carbon storage in the vegetation, adds CO2 to the atmosphere, and changes the reflectivity of the land (surface albedo), rates of evapotranspiration and longwave emissions (Stocker, 2014). From 1990 to 2013, the total warming effect from greenhouse gases added by humans to the Earth's atmosphere increased by 34 percent. The warming effect associated with carbon dioxide alone increased by 27 percent (United States Environmental Protection Agency, 2014).

Greenhouse gases are defined as any of various gaseous compounds that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse gas effect (Knutti, 2010). These include: CO2, methane (CH4), nitrous oxide (N2O), and fluorinated gases (F-gases, which include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6)). Greenhouse gases can remain in the atmosphere for varying lengths of time, from a few years to thousands of years. Consequently, the concentration of greenhouse gases increases over time. Water vapor is also considered a greenhouse gas in that it contributes to the warming of the earth, primarily because of the feedbacks related to increasing temperatures (Division of Energy and Climate, DNREC, 2014). There are several different sources contributing in emission of greenhouse gases. For example, in the United States electricity generation is the largest source of greenhouse gas emissions, followed by transportation. Greenhouse gas emissions caused by human activities increased by 5 percent from 1990 to 2012. However, since 2005, total U.S. greenhouse gas emissions have decreased by 10 percent (United States Environmental Protection Agency, 2014).

2.1.2 Greenhouse Gases

As energy from the sun reaches the earth, it warms the land and ocean surface. As the earth's surface warms, it radiates some of this energy back toward outer space as terrestrial or longwave radiation. Greenhouse gases in the atmosphere absorb some of that outgoing terrestrial radiation, and re-radiate it back toward the earth's surface, creating a "greenhouse effect" (Division of Energy and Climate, DNREC, 2014). Albedo (reflectivity) effect is a positive feedback that can cause less radiation absorbed by the earth surface. Ice and snow have a higher albedo or reflectivity than vegetation, soil, or water. As more of the land surface is covered by ice or snow, more solar radiation is reflected to space, less is absorbed by the surface, and temperatures decrease. Cooler temperatures lead to more ice growth, more reflection of solar radiation back to space, and even cooler temperatures (Division of Energy and Climate, DNREC, 2014). In addition, some aerosols increase atmospheric reflectivity, whereas others (e.g., particulate black carbon) are strong absorbers. Indirectly, aerosols also affect cloud albedo, because many aerosols serve as cloud condensation nuclei or ice nuclei. This means that changes in aerosol types and distribution can result in small but important changes in cloud albedo and lifetime. Clouds play a critical role in climate because they not only can increase albedo, thereby cooling the planet, but also because of their warming effects through infrared radiative transfer. Whether the net radiative effect of a cloud is one of cooling or of warming depends on its physical properties (level of occurrence, vertical extent, water path and effective cloud particle size) as well as on the nature of the cloud condensation nuclei population (Stocker, 2014).

2.1.3 Climate Change Stressors

There are many indicators of climate change. These include physical responses such as changes in the following: surface temperature, atmospheric water vapor, precipitation, severe events, glaciers, ocean and land ice, and sea level (Stocker, 2014). In addition, there are several climate stressors caused by climate change such as sea level rise, flooding, increased temperature etc. The key point is that a single climate stressor can result in a range of impacts. It is also important to note that the same type of change (e.g., warming air temperatures) can cause seemingly opposite effects depending on local topography, the season, urbanization, and other factors. Consider the case of winter precipitation in a region that typically experiences snowy winters. On the positive side, warmer winters throughout the United States may translate into less need for snow and ice removal for many airports. Conversely, in some locations, warmer temperatures may result in an increase in ice events (as snow events are replaced by rain, freezing rain, and sleet), presenting more severe adverse impacts in some locations. It is important to understand the range of impacts that changing climate may cause (Marchi, 2015).

Three of the most important climate change stressors are thoroughly described in this chapter.

2.1.3.1 Sea Level Rise and Flooding

Sea level rise and the associated increase in frequency and intensity of storm surges and flooding incidences are perhaps among the most worrying consequences of climate change, especially for coastal areas (Koetse and Rietveld, 2009).

Ocean levels have always fluctuated with changes in global temperatures. During the ice ages when the earth was 9°F (5°C) colder than today, much of the ocean's water was frozen in glaciers and sea level often was more than 300 feet (100 meters) below the present level (Kennett, 1982;Oldale, 1985). Conversely, during the last interglacial period (100,000 years ago) when the average temperature was about 2°F (1°C) warmer than today, sea level was approximately 20 feet higher than the current sea level (Mercer, 1968).

Many studies suggest that during the last century, worldwide sea level has risen 4 to 6 inches (10 to 15 centimeters) (Barnett, 1984;Fairbridge and Krebs, 1962). Much of this rise has been attributed to the global warming that has occurred during the last century (Gornitz et al., 1982;Meier, 1984).

Hughes and Bentley (1983) estimated that a complete disintegration of West Antarctica in response to global warming would require 200 to 500-year period, and that such a disintegration would raise sea level 20 feet (Smith, 1990).

Global warming from the greenhouse effect could raise sea level approximately 1 meter by thermal expansion of the upper ocean layers, melting mountain glaciers, and causing ice sheets in Greenland to melt or slide into the oceans. The frozen parts of the planet, known collectively as the cryosphere, are affected by, local changes in temperature. The amount of ice contained in glaciers globally has been declining every year for more than 20 years, and the lost mass contributes, in part, to the observed rise in sea level. Snow cover is sensitive to changes in temperature, particularly during the spring, when snow starts to melt. Spring snow cover has shrunk across the northern hemisphere since the 1950s. Substantial losses in Arctic sea ice have been observed since satellite records began, particularly at the time of the minimum extent, which occurs in September at the end of the annual melt season. By contrast, the increase in Antarctic sea ice has been smaller (Stocker, 2014). Climate change could also affect local sea level by changing ocean currents, winds, and atmospheric pressure; no one has estimated these impacts (Smith, 1990). Human modification of the hydrologic cycle could also affect sea level rise. Sequestration of water on land in reservoirs and through irrigation losses could exceed amounts transferred seaward by groundwater mining and increased runoff due to urbanization and deforestation (Vivien Gornitz, 2000). Although most studies have focused on the impact of global warming on global sea level, the greenhouse effect would not necessarily raise sea level by the same amount everywhere. Removal of water from the world's ice sheets would move the earth's center of gravity away from Greenland and Antarctica and would thus redistribute the oceans' water toward the new center of gravity (Smith, 1990).

The range of future sea level is uncertain as result of the varying projections of temperature increase, rate of thermal expansion, and anticipated melting of land-bound ice. Because of these series of uncertainties, scenario analysis is frequently used for assessing future sea level conditions (Marchi, 2015). In majority of the climate and sea level rise projections there are two or more scenarios which represent high, medium or low prediction. The lower scenarios represent a future in which people shift to clean energy sources in the coming decades, reducing emissions of carbon dioxide (CO2) and other greenhouse (heat-trapping) gases that are causing climate to change so quickly. The higher scenarios represent a future in which people continue to depend heavily on fossil fuels, and emissions of greenhouse gases continue to grow (Division of Energy and Climate, DNREC, 2014).

The land slope especially along coasts are one factors that affects the amount of rising sea level in different regions. The visible part of the beach is much steeper than the underwater portion, which comprises most of the active "surf zone". While inundation alone is determined by the slope of the land just above the water, Bruun (1962) and others have shown that the total shoreline retreat from a sea level rise depends on the average slope of the entire beach profile. For instance, one meter rise could drown approximately 25 to 80% of the U.S. coastal wetlands. Coastal wetlands' ability to survive would depend largely on whether they could migrate inland or whether levees and bulkheads blocked their migration. This amount of rise could inundate 5,000 to 10,000 square miles of dryland if shores were not protected and 4,000 to 9,000 square miles of dryland if only developed areas were protected. A rise in sea level would enable saltwater to penetrate farther inland and upstream into rivers, bays, wetlands, and aquifers. Salinity increases would be harmful to some aquatic plants and animals, and would threaten human uses of water (Smith, 1990).

Sea level rise has direct and indirect effects in coastal regions. Extreme weather events are a key driver of these impacts. For example, coastal storms that produce high waves and storm surge cause significant damage when they occur during high tides. Rising sea levels amplify high tides, resulting in greater frequency, duration, and extent of coastal flooding. Even relatively small increases in sea level over the past several decades have contributed to higher storm surge and wind waves (Dettinger et al., 2004). With respect to North America the Intergovernmental Panel on Climate Change (2007a) report states that coastal flooding due to sea level rise and storm surge is one of the most serious effects of climate change, especially along the Gulf and Atlantic coasts (Fields et al., 2007). Some studies even predict that transport infrastructure in some coastal areas along the Gulf of Mexico and the Atlantic will be permanently inundated sometime in the next century (Dingerson, 2005).

Four reasons can be addressed as the causes of flooding due to sea level rise in coastal regions: (1) A higher sea level provides a higher base for storm surges to build upon. A 1-meter sea level rise would enable a 15-year storm to flood many areas that today are flooded only by a 100-year storm (Kana et al., 1984;Leatherman, 1984). (2) Beach erosion also would leave oceanfront properties more vulnerable to storm waves. (3) Higher water levels would reduce coastal drainage and thus would increase flooding attributable to rainstorms. In artificially drained areas such as New Orleans, the increased need for pumping could exceed current capacities. (4) Finally, a rise in sea level would raise water tables and would flood basements, and in cases where the groundwater is just below the surface, perhaps raise it above the surface.

Evidences show that sea level rise, storm surges and flooding incidences will become increasingly relevant for various coastal regions around the globe. Studies that analyze the impact of sea level rise on the transport system generally (if not all) analyze the land elevation data by Geographical Information Systems (GIS) to show the effects are likely substantial. For example, many elements of the transportation system in the US Metropolitan East Coast region lie at 6 to 20 feet above the current sea level, which is well within the range of future storm surge predictions assuming a global sea level rise of 3 feet (Jacob et al., 2007). More recently, Jacob et al. (2007) estimated that a meter global sea level rise would increase the frequency of coastal storm surges and flooding incidences by a factor 2 to 10, with an average of 3. They show that especially the lowest critical elevations of important infrastructure elements in the New York metropolitan area are at-risk of being flooded more often and more intensely (Koetse and Rietveld, 2009).

2.1.3.2 Intense Precipitation and Droughts

An extreme weather event such as tornadoes, severe thunderstorms, hurricanes, derechos, droughts, extreme heat waves, coastal flooding, storm surge, and extreme snowfall and rainfall (Marchi, 2015), is one that is rare at a particular place and/or time of year. Definitions of 'rare' vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations. When a pattern of extreme weather persists for some time, such as a season, it may be classified as an extreme climate event, especially if it yields an average or total that is itself extreme (e.g., drought or heavy rainfall over a season) (Stocker, 2014). For some climate extremes, such as drought, floods and heat waves, several factors such as duration and intensity need to be combined to produce an extreme event (Seneviratne et al., 2012).

Climate records show that changes are already being observed in the amount, intensity, frequency, and type of precipitation (Division of Energy and Climate, DNREC, 2014). Hydrological extreme events are typically defined as floods and droughts. As global temperatures increase, the warming climate is expected to increase precipitation in many areas, due to increased evaporation and cloud formation. Floods are associated with extremes in rainfall (from tropical storms, thunderstorms, orographic rainfall, widespread extra-tropical cyclones, etc.), while drought is associated with a lack of precipitation and often extreme high temperatures that contribute to drying (Trenberth and Shea, 2005). Overall, changes in patterns of drought and flooding are complex. In some regions, the extremes of wet and dry climate have a greater impact than changes in average precipitation. Heavy rain events have increased in many areas, even where average or total amounts of precipitation have decreased. The amount of rain falling in the heaviest rain events has increased by roughly 20 percent over the past century; this trend is expected to continue, with the greatest increases in the wettest areas (Vrac et al., 2007).

There is a direct influence of global warming on changes in precipitation and heavy rains. Increased heating leads to greater evaporation and thus surface drying, thereby increasing intensity and duration of drought. However, the water-holding capacity of air increases by about 7% per 1 $^{\circ}$C warming, which leads to increased water vapor in the atmosphere, and this probably provides the biggest influence on precipitation (Trenberth and Shea, 2005). The distribution and timing of floods and droughts are most profoundly affected by the cycle of El Ni˜no events, particularly in the tropics and over much of the mid-latitudes of Pacific countries (Diaz and Markgraf, 2000). For instance, opposite phases of El Niño/Southern Oscillation (the interaction between the atmosphere and ocean in the tropical Pacific that results in a somewhat periodic variation between below-normal and above-normal sea surface temperatures and dry and wet conditions over the course of a few years) were shown by Trenberth and Guillemot to play a role in the 1988 drought and 1993 floods in North America. They showed that both the 1988 drought and 1993 floods developed as the result of a change in the large scale atmospheric circulation in the Pacific and across North America that altered the storm tracks into North America.

Precipitation has generally increased at high northern latitudes north of about 40 ◦N over the twentieth century and decreased since about 1950 in the tropics and subtropics, and especially from 10 ◦S to 30◦N (see Figure 2.1; (Jones et al., 2007)). In particular, it has become significantly wetter in the eastern parts of North and South America, northern Europe, and northern and central Asia, in part, because higher temperatures increase water-holding capacity and more precipitation falls as rain instead of snow (Trenberth and Shea, 2005), but drier in the Sahel (the arid area on the south wing of the Sahara desert that stretches across six countries from Senegal to Chad), the Mediterranean, southern Africa, and parts of southern Asia. In the more northern regions, more precipitation falls as rain rather than snow (Knowles et al., 2007; Mote, 2003). The liquid precipitation season has become longer by up to three weeks in some regions of the boreal high latitudes over the last 50 years (Jones et al., 2007) owing, in particular to an earlier onset of spring. In summary, the patterns of precipitation change have developed a distinctive pattern whereby higher latitudes have become wetter and the subtropics and much of the tropics have become drier (Trenberth and Shea, 2005).

An analysis of the future climate simulations by the latest generation of coupled climate models (Sun et al., 2007) shows that globally for each 1 ◦C of surface warming, atmospheric precipitable water increases by ∼9% and daily precipitation intensity increases by ∼2%, whereas daily precipitation frequency decreases by 0.7%. However, for very heavy precipitation which can be defined as more than 50mm per day, the percentage increase in frequency is much larger than in intensity (31.2% vs.

2.4%) so that there is a shift toward increased heavy precipitation. As temperature rises, the likelihood of precipitation falling as rain rather than snow increases, especially in autumn and spring at the beginning and end of the snow season, and in areas where temperatures are near freezing. Such changes are already observed in many places, especially over land, in middle and high latitudes of the Northern Hemisphere, leading to increased rains but reduced snow, and consequently diminished water resources in summer, when they are most needed (Knowles et al., 2007;Mote, 2003).

2.1.3.3 Temperature Change

Concentrations of heat-trapping greenhouse gases are increasing in the Earth's atmosphere. In response, average temperatures at the Earth's surface are rising and are expected to continue rising. However, because climate change can shift the wind patterns and ocean currents that drive the world's climate system, some areas are warming more than others, and some have experienced cooling (United States Environmental Protection Agency, 2014).

Based on one study, carbon dioxide concentration increased from 190 (ppm) in 800,000 BC to around 310 (ppm) in 1950. However, CO2 concentration increased by almost 90 (ppm) between 1950 and 2013 which shows a drastic change during this short time span (Lins, 2012). This proves that in recent decades the production of carbon dioxide has increased rapidly due to various reasons such as uncontrolled industrial activities.

The increases in surface air temperature and surface absolute humidity result in even larger increases in the heat index (a measure of the combined effects of temperature and moisture). The increases in surface air temperature also results in an increase in the annual cooling degree days and a decrease in heating degree days (Cubasch et al., 2001). It is important to note that warming has not been globally uniform. The recent warming has been greatest between 40°N and 70°N latitude, though some areas such as the North Atlantic Ocean have cooled in recent decades (IPCC Forth Assessment Report, 2007).

2.1.3.4 El Niño and ENSO

El Niño and the Southern Oscillation, also known as ENSO is a periodic fluctuation in sea surface temperature (El Niño) and the air pressure of the overlying atmosphere (Southern Oscillation) across the equatorial Pacific Ocean.

The Southern Oscillation describes a bimodal variation in sea level barometric pressure between observation stations at Darwin, Australia and Tahiti. It is quantified in the Southern Oscillation Index (SOI), which is a standardized difference between the two barometric pressures. Normally, lower pressure over Darwin and higher pressure over Tahiti encourage a circulation of air from east to west, drawing warm surface water westward and bringing precipitation to Australia and the western Pacific. When the pressure difference weakens, which is strongly coincidental with El Niño conditions, parts of the western Pacific, such as Australia experience severe drought, while across the ocean, heavy precipitation can bring flooding to the west coast of equatorial South America.

Although the exact initiating causes of an ENSO warm or cool event are not fully understood, the two components of it, sea surface temperature and atmospheric pressure, are strongly related. During an El Niño event, the easterly trade winds converging across the equatorial Pacific weaken. This in turn slows the ocean current that draws surface water away from the western coast of South America and reduces the upwelling of cold, nutrient–rich water from the deeper ocean, flattening out the thermocline and allowing warm surface water to build in the eastern part of the basin.

The strengthening and weakening of the trade winds is a function of changes in the pressure gradient of the atmosphere over the tropical Pacific. Ironically, the warming of the sea surface works to decrease the atmospheric pressure above it by transferring more heat to the atmosphere and making it more buoyant. So, in summary, the pressure gradient affects the sea surface temperatures, and the sea surface temperatures affect the pressure gradient.

The connection between the Southern Oscillation and precipitation is also manifest in the quantity of long–wave (e.g., infrared) radiation leaving the atmosphere. Under clear skies, a great deal of the long–wave radiation released into the atmosphere from the surface can escape into space. Under cloudy skies, some of this radiation is prevented from escaping. Satellites can measure the amount of long–wave radiation reaching space, and from these observations, the relative amount of convection in different parts of the basin can be estimated.

In addition, the thermal expansion of the warming water in the eastern part of the basin measurably raises sea level in these regions, and this change in sea level can be measured by satellite sensors. Therefore, variations in sea level are good indicators of the presence of an El Niño. During an El Niño, sea level in the eastern Pacific is well above average, while during a La Niña, the increased flow of cold deep water to the surface acts to lower the sea level.

2.2 Climate Change Impacts on Human Health

Recognition that climate change can affect human health in numerous ways is a recent development that represents the depth of scientific knowledge. Since centuries ago climatic disasters distort communities and populations causing famine, infectious diseases, floods, social collapse and disappearance of whole populations, etc. In some case, it causes new health threats and in other cases it exacerbates existing health threats. Age, economic resources and location indicate the level of risk for different people. Climate change is also likely to affect biodiversity and the ecosystem goods and services that we rely on for human health. Direct impacts of climate change are exposure to weather extremes such as heatwaves and winter cold, increase in extreme weather events like floods, cyclones, storm surge and drought, increased air pollution and production of aeroallergens. Indirect impacts include economic and political disruption such as effect on regional food yields and water resources. Modeling of climate change demonstrates that there will be an increase of 5-10% in future underfed people (McMichael et al., 2006). In the longer term and with considerable variation between populations as a function of geography and vulnerability, these indirect impacts are likely to have greater magnitude than the more direct (Campbell-Lendrum et al., 2003).

2.2.1 Temperature Rise

The IPCC, intergovernmental panel for climate change, estimates about two degree Celsius rise in global average warming by the end of the century (Patz and Hatch, 2014). The unusually rapid temperature rise since the mid-1970s is substantially attributable to this anthropogenic increase in greenhouse gases) (McMichael et al., 2006). There are numerous adverse climate events associated with increase in temperature. High temperature expedites evaporation of moisture from soil causing droughts. On the other hand, warm air preserves humidity resulting in intense precipitation and flooding (Patz and Hatch, 2014). Both rising temperature and increase in rainfall will decline the air quality of indoor areas by rising the probability of growing indoor fungi and molds which lead to increase in respiratory illnesses such asthma-related conditions (John Balbus, 2014).

2.2.2 Heat Wave

From 1999 through 2009, 7800 deaths are recorded in United States caused by exposure to extreme heat (White House, 2014). As temperature continues to rise due to climate change, heat waves are expected to become more frequent, intense and longer lasting in coming decades. Extreme heat increases cardiovascular, cerebrovascular, respiratory and kidney diseases and deaths from heat stroke and other related conditions. Recently, variability in climate change in future has been studied. Small changes in temperature variability, along with a shift in mean temperature can greatly increase the frequency of extreme heat (McMichael et al., 2006).

Urban and non-urban population act differently towards heat waves. People living in urban environment are at greater risk than those who live in non-urban regions. Two major factor cause this discrepancy, first inefficient housing and second, urban heat island effect. Inner urban environment, with high thermal mass and low ventilation, absorb and retain heat which results in higher temperature than surrounding sub-urban and rural areas.

2.2.3 Flood

Increase in both extreme precipitation and total precipitation result in increase of severe flooding events in certain regions. The most frequent natural weather disaster was flooding (43%), killing almost 100,000 people and affecting over 1·2 billion people (McMichael et al., 2006). In 2010, Flood has been reported the deadliest among other natural disasters by having 175 million victims. Immediate effects of flooding are physical injury, morbidity and mortality. In some cases, flooding may lead to mobilization of dangerous chemicals from storage or remobilization of chemicals already in the environment, e.g. pesticides. In addition to immediate health hazards associated with extreme precipitation events when flooding occurs, other hazards can often appear once a storm event has passed. Following flood, food-borne illnesses, diarrheal diseases, respiratory diseases and vector-borne disease transmitted by mosquitos and mice like Malaria, and Dengue fever have been reported. As a result of overflowing water excessive rainfall also facilitate entry of human swage, animal wastes and agricultural field pollution in to waterways and drinking water supplies, increasing the risk of water-borne diseases.

2.2.4 Drought

Droughts associated with climate change may lead to population displacement and more environmental refugees (Haines et al., 2006). Famine and malnutrition are the results of droughts and crop failure. Nelson (2009) found that by 2050 yields of staple crops would decline in developing countries and that child underweight would be approximately 20 percent higher, equivalent to approximately 25 million children being affected (Nelson et al., 2009). Long periods of high temperature are associated with occurrence of wildfires in some areas. Wildfires contain particulate matter, carbon monoxide, nitrogen oxides and volatile organic compounds that can significantly reduce air quality.

2.2.5 Aeroallergens

As frost-free days and air temperature increase due to climate change, the production of plant-based allergens would be greater. For example, in some communities in northern states the length of ragweed seasons has increased (White House, 2014). Experimental research has demonstrated that doubling CO2 levels from 300 to 600 ppm causes a four-fold increase in the production of ragweed pollen. Pollen-related allergies have been increased because of longer pollen season and greater pollen concentration. In addition, asthma episodes that lead to diminish productivity and loss of school days will increase.

2.3 Summary of the Chapter

Climate refers to weather patterns in a long period of time and climate change refers to any extreme changes in these patterns. Over past centuries especially last century, human activities have caused drastic changes in weather patterns by increasing atmosphere temperature. Anthropogenic activities like transportation produce cast amount of greenhouse gases (carbon dioxide, methane, nitrous oxide, fluorinated gases, perfluorocarbons, and sulfur hexafluoride) which eventually result in increased temperature.

Increased temperature has caused different climatic stressors such as sea level rise, more frequent flooding, intense precipitation, droughts, and heat waves. Different regions in the world are experience different climate change stressors for instance while in Mid-Atlantic region sea level rise in coastal areas is of a great importance, droughts and its consequences are noticeable. In this chapter of the thesis the climate change stressors are addressed and a comprehensive literature review is performed for each of the stressors.

In addition, how these climatic extremes will affect human health is discussed in this chapter. As it was mentioned earlier floods, droughts, and other climate change consequences have positive and negative influences on human life and health. This chapter explained these effects in details.

Chapter 3

CLIMATE CHANGE AND TRANSPORTATION

3.1 Climate Change and Transportation

As Environmental Protection Agency reported, transportation is responsible for about one-third of carbon dioxide emissions in the United States (Hockstad and Cook, 2012). In addition to carbon dioxide, transportation contributes to the emissions of other greenhouse gases. As result, most of the attentions and efforts are towards mitigations and reducing the effects of transportation in emitting greenhouse gases (Valsson and Ulfarsson,) to decrease its adverse consequences like climate change. While the technologies used in motor vehicles continue to improve in greenhouse gas emission efficiency, the increasing weight and power of vehicles that comprise the global fleet counter-balances these increases in efficiency, and, at the same time, the world auto fleet continues to grow in number, particularly in the developing world (Love et al., 2010).

It is undeniable that climate change is happening with the pace that its impacts are tangible especially on transportation infrastructures. Thus, along with mitigation plans to lower the speed of climate change happening, adaptation planning is crucial to maintain the resilience of transportation infrastructures.

Decisions relating to the maintenance, redesign, or retrofitting the existing transportation infrastructures, and design of new ones in response to climate change stressors will affect whether the transportation system works properly or poorly (TRB, 2008). Based on the current climatic knowledge five climate changes or weather events have been addressed as the ones that have the most drastic impacts on transportation. These five stressors are: (1) increases in very hot days and heat waves, (2) increases in arctic temperatures, (3) rising sea levels, (4) increases in intense precipitation events, and (5) increases in hurricane intensity (TRB, 2008).

3.1.1 Climate Change and Surface Transportation

Different types of climatic and weather events affect surface transportation in different ways. Surface transportation is usually considered as vehicles on roadways, and trains. Therefore, the transportation infrastructures that might be affected are rail lines, bridges, tunnels, and roadways.

Sea level rise will cause more frequent interruption of roadway traffic and railroads in coastal regions and low-lying lands. This climate change stressor also causes inundation of roads, rail lines and tunnels in low-lying regions (TRB, 2008). Sea level rise will make storm surges more frequent and intense which cause temporary inundation of transportation facilities, damage to pavements and rail substructure, and finally chain disruption of roads, railroad, port, and airport (Love et al., 2010).

Intense precipitation usually affects roadway traffic condition due to more congestion which consequently results in increase of travel time. Unusually heavy rain leads to reduction in traction. Although this phenomenon will increase in the number of vehicles collision and accidents, increased precipitation appears to decrease accident's severity that positively affects number of injuries and fatalities (Love et al., 2010). Compared to a day without rainfall 1.5 to 3 cm of rainfall will fatalities by 8.6% (Leard and Roth, 2015). Road and railroad flooding, and mudslide associated with heavy rainfall would cause interruption of transportation systems(McGuirk et al., 2009).

As it was stated earlier, one of the key features of climate change affecting surface transportation is increased temperature or in the other word heat wave. This stressor has severe impacts especially on infrastructures such as bridges. Thermal expansion of bridge joint and pavement, asphalt rutting, and railway track buckling are among the infrastructures' damages due to extreme heat. Heat waves and rise in temperature also change commuter travel behavior. For instance, one study that was done in Toronto on the impact of weather on five modes of transportation, auto drive, auto passenger, transit, bike, and walk (Saneinejad et al., 2012). The travel data for this study was obtained from the 2001 Transportation Tomorrow Survey (TTS). Based on this research for six temperature change scenarios travel behavior changes drastically in each mode (Saneinejad et al., 2012). Based on this study the most drastic changes in the number of trips due to increased temperature, belongs to biking. 1 ℃ increase in temperature increases biking by 3%, 2 ℃ increase in temperature increases biking by 5%, 3 ℃ increase in temperature increases biking by 8%, 4 ℃ increase in temperature increases biking by 11%, 5 ℃ increase in temperature increases biking by 14%, and 6 ℃ increase in temperature increases biking by 17%. Temperature change has less effect on walking. For instance, 1 ℃ increase in temperature increases walking less than 1%, and 6 ℃ increase in temperature increases walking by 2.5%.

3.1.2 Climate Change and Air Transportation

Aircraft contribute to climate change in two principal ways. First, through the emission of greenhouse gases such as CO2, NOx and radiatively significant particles such as soot, and second through the generation of contrails which in turn may have an impact on the global heat balance (Love et al., 2010). Thus, finding ways to reduce the amount of energy consumption by aircraft will lower negative environmental footprints. Improved weather forecasts, provided in conjunction with improved air traffic management, offer opportunities to reduce fuel burn. The benefits can flow from number of areas. Improved destination terminal forecasts lead to lower amounts of fuel being carried and, all things being equal a lighter aircraft burns less fuel than a heavy one. Improved wind forecasts provide an opportunity for airline to maximize their tailwind components through the choice of track and flight level (Love et al., 2010).

Climate change stressors (e.g. sea level rise, flooding, intense precipitation, and heat waves) influence air transportation from two points of view. First, they cause damage and deterioration to runways and other airport infrastructures. Second, these events disrupt airport's services ranging from an hour to several days, or in case of sea level rise permanent inundation of runways. Wind speed and visibility are the two most important weather features in aviation sector which can be influenced by climate change. A good example of economic loss due to different types of bad weather is San Francisco International Airport. A study by Eads et al (2000) shows that poor visibility in the summer months and rain storms in the winter months' lead to substantial delays and numerous cancellations. Compared to good weather, cancellations per day increase by a factor 2 to 3 when weather is bad in the morning, and by a factor 3 to 4 when weather is bad all day.

3.1.3 Climate Change and Maritime Transportation

International shipping in 2007 accounted for about 2.7 per cent (870 million tonnes) of the global manmade CO2 emissions, and based on medium emission scenarios by 2050, in the absence of reduction policies, emissions produced by maritime transportation may grow 150 to 250 per cent (compared to 2007 emissions) due to growth in world trade (Buhaug et al., 2009).

There are serious efforts in shipping industry to reduce the amount of emissions through International Maritime Organization (IMO). A plan which addresses greenhouse gas emissions from trading goods by ships internationally, has been made by IMO. This plan is committed to reduce emissions through rules and regulations and at the same time promises a robust trading system (Love et al., 2010).

The International Maritime Organization's study confirms that there is substantial potential for GHG emissions in international shipping both by technical regulations and operational strategies. These mitigation strategies are two sided: first by reducing the speed on which ships are operation that cause significant decrease in emitting greenhouse gases this is called slow steaming. The second strategy is designing the engines in a way which produce less emissions and be more environmental friendly (Love et al., 2010).

Maritime transportation like other modes of transportation has reciprocal relationship with climate change and global warming. This means that climate change has adverse effects on this mode. Lowering the water level on rivers due to droughts and less precipitation in many regions of the world such as middle east and Africa makes shipping and sea transportation impossible. This has socioeconomic impacts on societies in these regions.

3.1.4 Extreme Weather Events and Transportation

As it was mentioned in previous section, heavy rainfall will increase accidents and traffic casualties. Although these accidents are caused by a multitude of factors including driver error and dangerous driving, the influence of weather on accidents and disruption is a major contributing factor, with over 20% of accidents being associated with the effects of meteorology (Edwards, 1999a). As a sector, transport is almost continuously subjected to meteorological hazards which impact upon the efficiency of its operations (Thornes, 1992)and cause injuries and fatalities across all modes (Edwards, 1999b). The impacts of rain (Andrey et al., 2003;Changnon, 1996), wind (Baker, 1993), high temperatures (Chapman et al., 2006;Dobney et al., 2009), ice and snow (Chapman and Thornes, 2006) have been well documented, and affect road, rail and water transportation (Jaroszweski et al., 2010).

Preliminary studies have highlighted the range of impacts that predicted climate change will have on all modes of transportation. This includes direct impacts on vehicles (e.g. heavy rain reducing tire friction or increased winds overturning heavy goods vehicles) as well as impacts to hard infrastructure (e.g. rail cuttings which may subside causing hazards and costs in repairs). However, there are also potential benefits and positive effects including the reduction of cold weather hazards such as ice and snow, all of which must be considered when ensuring a resilient future transport network, again emphasizing the need for a formal assessment (Jaroszweski et al., 2010).

Andrey et al (2003) show that the relative risk of collisions increases for every type of precipitation event in Canada while Andrey shows that collision rates for those precipitation events not involving snowfall are generally decreasing. McGuirk et al (2009) note that heavy rains also lead to road and railway flooding and mudslides that can further disrupt transportation systems. A similar situation has been reported more recently in Australia, with up to 200 train cancellations per day in the summer of 2009 as extreme heat led to buckling of lines throughout the above ground rail network. Clearly rail infrastructure faces some major challenges globally if these two examples are representative of the issues more generally. Although coastal inundation by global sea-level rise will be a problem for unprotected transportation infrastructure in low lying areas, Gornitz et al (1982) show that the most devastating impacts are likely to be associated with changes in extreme sea levels resulting from the passage of storms in coastal regions, especially as more intense tropical and extra-tropical storms are expected (Love et al., 2010).

3.2 Climate Change and Non-Motorized Transportation

Sidewalks, bike lanes, and trails can all be used for transportation, recreation, and fitness. There are several benefits associated with the development of non-motorized transportation in a society. Some of these advantages are economic, such as increased revenues and jobs for local businesses, and some are non-economic benefits such as reduced congestion, better air quality, safer travel routes, and improved health outcomes. United States is currently experiencing high unemployment rate, unsustainable use of carbon-based energy, and a national obesity epidemic. All three of these problems can be partly addressed through increased walking and cycling. Providing pedestrian and cycling infrastructure for the purposes of commuting, recreation, and fitness, is arguably more important than ever before. In addition, designing and building infrastructure suitable for pedestrian and bicyclists can also alleviate the problem of unemployment, by creating jobs for engineers, construction workers, and workers who produce the asphalt, signs, and other construction materials (Ahmed et al., 2010).

Two factor of temperature and humidity have substantial impacts on the pedestrian volume. Extreme temperatures (very cold or very hot temperatures) decrease pedestrian volume drastically with a non-linear pattern which makes pedestrian travel behavior more complicated. For instance, weather condition is responsible for about 30% of variation of pedestrian volume during noon, or precipitation reduces the volume by 13% and winter weather causes 16% of reduction in the same measure (Ahmed et al., 2010).

There are numerous studies addressing weather condition such as precipitation or changes in temperature on cycling. Both Phung et al (2007) and Richardson (2000) explored how weather variations affect bicycle ridership in Melbourne, Australia. Rain was identified as the most influential weather parameter which significantly decreased commuting cyclist volumes. These two researches, found that rainfall has a non-linear effect. Richardson (2000) identified that daily rainfall of around 8 mm, reduces cyclist volumes by about 50% compared to days when there is no rain. On the other hand, Phung et al (2007) found that light rain (defined as daily rainfall less than 10 mm) prohibit between 8 and 19% of all cyclists from using this mode of transportation while heavy rain (defined as daily rainfall greater than 10 mm) prohibit about one-third more (13 to 25%). Air temperature has been identified to have a non-linear and non-symmetrical relationship with commuter cyclist volume. By reviewing multiple studies in this area, a conclusion can be made that perfect temperature for riding is between 25°C and 28°C.In addition, based on these studies as temperature rises above the perfect temperature, cyclist volume decreases drastically.

Active mode of transportation is the most exposed mode compared to other means of transportation. This makes wind and wind speed another factor that affect walking and cycling behavior. For example, ridership on the Bay Trail, that locates near the coast of Port Phillip Bay, was the most sensitive to wind change. Strong wind (defined as 40-62 kph) reduced the volume of commuter cyclist by between 11 and 23% (Phung and Rose, 2007).

3.3 Mitigation to Climate Change

Mitigation can be defined as strategies, regulations, policies and actions to reduce greenhouse gas emissions (Pew Center on Global Climate Change, 2009). There are different sets of mitigation strategies for different modes of transportation like energy efficiency techniques, land use changes aligned with smart growth, use of renewable energy such as wind, solar, geothermal, or hydropower. There are different mitigation strategies for each mode of transportation.

3.3.1 Road Mitigation

One of the most effective methods of reducing greenhouse gas emissions is encouraging public transport like buses, trains, and active mode of transport (walking and cycling). Increasing the price of car ownership or fuel. Anable et al (2005) stated that a 10% increase in fuel price leads to 1-3% reduction in travel. Also, increase in tolling is another way of encouraging drivers to shift from travelling their own cars to use of public transportation (Chapman, 2007). These sets of strategies will decrease road congestion which is known as one of the reasons of increasing emissions. Another aspect of surface transportation generating CO2 emissions is freight movement. Dependence of freight transportation on trucks and heavy duty vehicles is one of the factors that exacerbates the environmental condition of this industry. The slow movement of heavy vehicles leads to more congestion which is identified as a reason of increasing emission. According World Business Council for Sustainable Development study on the world mobility and its sustainability, freight movement is responsible for 43% of all the energy consumed in transportation. This proves the importance of mitigation in this area. In recent years, manufacturers have made significant progress in improving vehicles' engine performance and vehicles' design leading to 20% improvement in fuel efficiency of freight movement (Chapman, 2007). Exploiting new routing and scheduling software program is also effective in making freight transport more environmental friendly (McKinnon, 1999).

3.3.2 Air Mitigation

Air transport is the second more pollutant mode of transportation after vehicles using diesel as fuel (Chapman, 2007). One of the most effective way of making aviation more sustainable is through enacting policies in order to increase tax which lead to shift to other modes of transportation that are more sustainable. Use of alternative fuels or low carbon fuels for aircraft can be considered as a mitigation strategy in this area which is improving due to recent technologies.

3.3.3 Other Mitigation Strategies

Shifting the movement of passenger and freight by car and aircraft to other modes of transportation such as ships, buses, rail, and active transportation is one of the methods of mitigation that is widely accepted (Chapman, 2007). Shipping is known as a sustainable mode of good movement especially to overseas. However, shipping can still become more environmental friendly by exploiting modern engines which works with the latest technology, and more efficient hulls. These methods can lower the CO2 emissions by 50%. Rail is considered as one the most sustainable modes of transport. Although encouraging people to use trains and manufacturer to move their products by rail rather than cars will have substantial effect of reducing GHG emissions, is a difficult mission. Active mode of transportation is called zero-carbon transportation. Walking and cycling is not only a mitigation factor but also making society more physically, and psychologically healthy.

3.4 Adaptation to Climate Change

Although mitigation efforts are necessary to decrease the amount of emissions and reduce the rate of global warming and climate change, currently the consequences of years of GHG production during last century is tangible throughout the world. Therefore, to live with these consequences adaptation to different climate change stressors should be done.

Climate change adaptation is defined by the IPCC (2007) “as the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harms or exploits beneficial opportunities”.

The adaptation process requires significant preparation in regards to the following areas (Pew Center on Global Climate Change, 2009):

- Risk assessment
- Prioritization of projects
- Solution development and implementation
- Information sharing
- Decision-support tools
- Collaboration across agencies, sectors, and geographic boundaries
- Creativity in design
- Funding and allocation of both financial and human resources

An example of an adaptation strategy in response to rising sea level is shore protection. Construction of dikes, bulkheads, and beach nourishment can prevent the impacts of sea level rise such as flooding, eroding beaches, and inundation of low-lying coastal properties. Another adaptation effort against sea level rise is relocating infrastructures instead of investing to the maintenance of existing ones. The adaptation strategy should be selected based on its associated costs and benefits.

3.5 Summary of the Chapter

As Environmental Protection Agency reported, transportation is responsible for about one-third of carbon dioxide emissions in the United States. Also, transportation is responsible for the emissions of other greenhouse gases. Five types of climate change impacts that have the most influence on transportation are increases in very hot days and heat waves, increases in arctic temperatures, rising sea levels, increases in intense precipitation events, and increases in hurricane intensity.

Surface transportation is affected by these climatic stressors in different ways. Sea level rise will cause more frequent interruption of roadway traffic and railroads, and inundation of roads, rail lines and tunnels in low-lying regions. Intense precipitation causes increase in travel time due to congestion. As it was thoroughly explained in this chapter one the most important stressors that affects infrastructure is increase temperature. Also, it has a great influence on travel behavior for different modes of transportation.

Air transportation has a reciprocal relation with climate change meaning that it contributes to the production of greenhouse gases which cause global warming and it is impacted by the consequences of climate change. Climate change has two most important effects on avian transportation. First, it results in damage and deterioration of facilities such as runways. Second, it causes disruption in airport's services due to various weather extremes such as storms. Maritime transportation is another mode that has the same relationship with climate change which is discussed in this chapter.

Non-Motorized transportation or in other word active transportation is defined as walking or cycling. Sidewalks, walkways, bike lanes, and trails can be addressed as facilities for this mode of transport. Climate change has drastic effects on this mode since pedestrian and cyclists are more exposed to weather extremes. Temperature, humidity, and precipitation are identified as weather measures that has the most effects on pedestrian and cyclists' travel behavior.

The practice of reducing the amount of emissions is defined as mitigation. There are different sets of mitigation strategies for different modes of transportation like energy efficiency techniques, land use changes aligned with smart growth, use of renewable energy such as wind, solar, geothermal, or hydropower. In this chapter, a summary of mitigation strategies for road transportation and other modes are provided. Although these strategies will cause reduction in the production of greenhouse gases and alleviate the climate change, the impacts of climate change are already tangible all around the world. Thus, adaptation strategies are required to live with these impacts for example road elevation is one method of surviving against sea level rise. Several adaptation strategies are discussed in this chapter.

Chapter 4

METHODOLOGY

4.1 Identified Climate Change Stressors in the State of Delaware

In this research the three most important climate change stressors that affect surface transportation in general and trail and bike routes in particular are identified. Sea level rise, flooding due to increase in storm surges and more frequent intense precipitation, and increase in mean temperature along with heat waves are climate change stressors that their effects on non-motorized transportation are significant. Since Delaware has a long coastal line and several number of trails and bike routes locate near coast the effect of rising sea level is considerable in this state. Although the other two derivatives of climate change (more frequent flooding, and increased temperature) have their own effects on non-motorized transportation facilities, this research's focus is on the influence of sea level rise on these facilities.

4.2 Descriptions of Analyzed Data

To evaluate future sea level rise risks on transportation infrastructure in Delaware, a Geographic Information System (GIS) was used to perform quantitative spatial analysis. The input data used in the analysis consisted of roadway geospatial data, topographic data, and sea level rise projections.

4.2.1 Trails and Bike Routes Geospatial Data

The geospatial data of existing trails in the state is directly obtained from Delaware Department of Transportation (DelDOT). In this inventory, each trail is associated with an ID. Trail’s name, management, county where the trail locates, and type of operation (pedestrian, bicyclists, pedestrian and bicyclists) are provided in the data set. In order to, proceed with the Geographic Information Systems (GIS) analysis geometric attributes of trails such as distance were added to the current inventory.

Bike routes are defined as roadways that are considered safe for bicyclist. The geospatial data of bike routes is obtained from a self-service Enterprise Geographic Information System organization called “Firstmap”. The inventory of bike routes is classified based on the type of roadway which could be statewide, regional, or connector. Statewide bike routes are the ones that that run the length of the State of Delaware from north to south. Regional bike routes run mainly east to west across the state. Finally, connector bike routes connect the regional and statewide bike routes. This inventory was completed by adding geometric attributes of the features.

4.2.2 Topographic Data

A LiDAR-derived digital elevation model (DEM), with a horizontal accuracy of 1 meter, was obtained from the National Oceanic and Atmospheric Administration (NOAA). This digital elevation model (DEM) is a part of a series of DEMs produced for the National Oceanic and Atmospheric Administration Coastal Services Center's Sea Level Rise. The DEMs created for this project were developed using the NOAA National Weather Service's Weather Forecast Office (WFO) boundaries. The DEM includes the best available Lidar known to exist at the time of DEM creation that met project specifications for the Philadelphia WFO, which includes the coastal counties of Delaware. These DEMs serve as source datasets used to derive data to visualize the impacts of inundation resulting from sea level rise along the coastal United States and its territories.

The DEM was used to estimate the elevation of trails and bike routes centerlines throughout the study area. This was done by using a mask operation in ArcGIS where the DEM raster cells that intersected the trails and bike routes centerline retained their value but all raster cells not intersecting these facilities' centerline were set to NoData. The resulting raster dataset included elevation values only along the centerlines.

4.2.3 Sea Level Rise Projections

As it was thoroughly explained in the literature review, rise of sea level till the end of this century is significant however there are uncertainty around the height of rise because of different reason. For instance, if developing countries start the mitigation process the amount of greenhouse gas emissions produced by different industrial sectors will definitely decrease which have a tremendous positive effect on global warming and climate change. Thus, political decisions can be count as one of the sources of this uncertainty around climate change and sea level rise.

Therefore, National Oceanic and Atmospheric Administration (NOAA) developed a model for sea level rise. In this model three scenarios, low, medium and high are proposed for the sea level rise by 2100. The lowest scenario suggests that there will be 2 (ft) rise in the sea level by the end of this century. The highest scenario which represents the worst situation estimates that there will be 6 (ft) of sea level rise by 2100 and the amount of sea level rise for the medium scenario recommended by NOAA is 4 (ft).

4.3 GIS-Based Analysis

In this research, a GIS model of sea level rise has been developed which include several layers. The inventories containing trails and bike routes in the State of Delaware were imported to the model. The sea level rise model containing three projection developed by NOAA was added to the GIS-based model. By applying the intersection tool of the ArcMap (a GIS platform), the interactions between different layers were identified. In this step of the analysis, number of trails and bike routes that will be affected by three different scenarios of sea level rise.

Each facility is investigated separately. The distance of inundation (distance of trails and bike routes that will be under water) is estimated by the analysis done using ArcMap. The maximum depth of water on each affected facility is determined using the GIS-based analysis. By these two variables (distance of inundation and maximum depth of inundation), a rank is allocated to a facility showing vulnerability of that facility against sea level rise. If the distance of inundation is minor and the maximum depth of water is low for a certain facility, the facility (trail or bike route) can be maintained and saved by a low-cost adaptation strategy. In this situation, the facility acquires a high rank. On other hand, a facility that loses a considerable length due to land inundation and the maximum depth of water is significant needs tremendous budget for adaptation. In this case, the facility will acquire a low ran showing that the management of the facility should allocate considerable funding to save it.

4.4 Vulnerability Assessment

The core goal of this research is assessing the vulnerability of trails and bike routes in the State against different scenarios of sea level rise (low, medium, and high). The assessment is based on two factors: first the distance of the facility that will be under water due to rising sea level, and second the maximum depth of water on each facility. The depth of water is important because the possibility of rehabilitation and maintenance depends on it. Based on these two measures, level of service for each trail under different scenarios is decided. As it was mentioned earlier, the vulnerability assessment of each facility is presented by the suggested level of service under different sea level rise scenarios. The level of service is determined by the following tables based on the inundation mileage of the facility and maximum depth of water on that facility. A facility could obtain a level service A to F based on different measures for different sea level rise scenarios.

The result of this vulnerability assessment can be used by the State DOT or other organizations which are responsible for trails and bike routes management. For example, if a trail's level of service is determined to be F, the management corporation could shut the trail down and invest in building a new trail in a location that will not be in danger of rising sea level.

Table 4.1: Level of service estimation based on depth of water and length of inundation for low SLR scenario

			Inundation Distance (%)					
			0-10	**10-30**	**30-50**	**50-70**	**70-90**	**90-100**
Sea Level Rise Projection	**Low (2ft)**	**Maximum Depth of Water less than 1 (ft)**	LOS A	LOS A	LOS B	LOS D	LOS E	Out of Service
		Maximum Depth of Water More than 1 (ft)	LOS A	LOS B	LOS C	LOS D	LOS F	Out of Service
	Medium (4ft)	**Maximum Depth of Water less than 2 (ft)**	LOS A	LOS B	LOS D	LOS E	LOS F	Out of Service
		Maximum Depth of Water More than 2 (ft)	LOS B	LOS C	LOS D	LOS F	LOS F	Out of Service
	High (6ft)	**Maximum Depth of Water less than 3 (ft)**	LOS A	LOS C	LOS D	LOS F	LOS F	Out of Service
		Maximum Depth of Water More than 3 (ft)	LOS B	LOS C	LOS E	LOS F	LOS F	Out of Service

Chapter 5

RESULTS AND ANALYSIS

5.1 Analysis for Trails

Trails are considered as areas that motor vehicles are not allowed to use. Trails are pathways that are designed to be suitable for non-motorized transportation means such as bicycle, skates, scooters, and pedestrians. As it was mentioned earlier, the ultimate goal of this research is to estimate the vulnerability of these facilities against sea level rise in 2100. The results are classified by counties to be more convenient to use for management corporations.

5.1.1 Assessment of Trails' Affection for Sea Level Rise Projections

The following table shows the number of affected trails under three different sea level rise scenarios. The trails are classified by county so local government and management agencies could plan adaptation strategies and budget allocations accordingly. It is observable that the number affected facilities in the Sussex county is more than two other counties.

Table 5.1: Number of affected trails by sea level rise in the Delaware

		Number of Affected Facilities under Three SLR Projections		
County	**Total Number of Trails**	**Low (2ft)**	**Medium (4ft)**	**High (6ft)**
New Castle	539	38	49	53
Kent	122	34	38	40
Sussex	248	76	113	128

5.1.2 Assessment of Trails' Inundation Distance for Sea Level Rise Projections

The State of Delaware has 713.5 (mile) of trails. Figure 1, demonstrates the total distance of affected facilities under three scenarios as well as the portion of the land that will remain on land and the distance that is going to be inundated. The total distance of the land that is going to be inundated for the high sea level rise scenario (6 feet) by the end of 2100 which is 103 (mile) is more significant than the inundation distance for the low sea level rise scenario (2 feet) which is estimated to be 30 (mile).

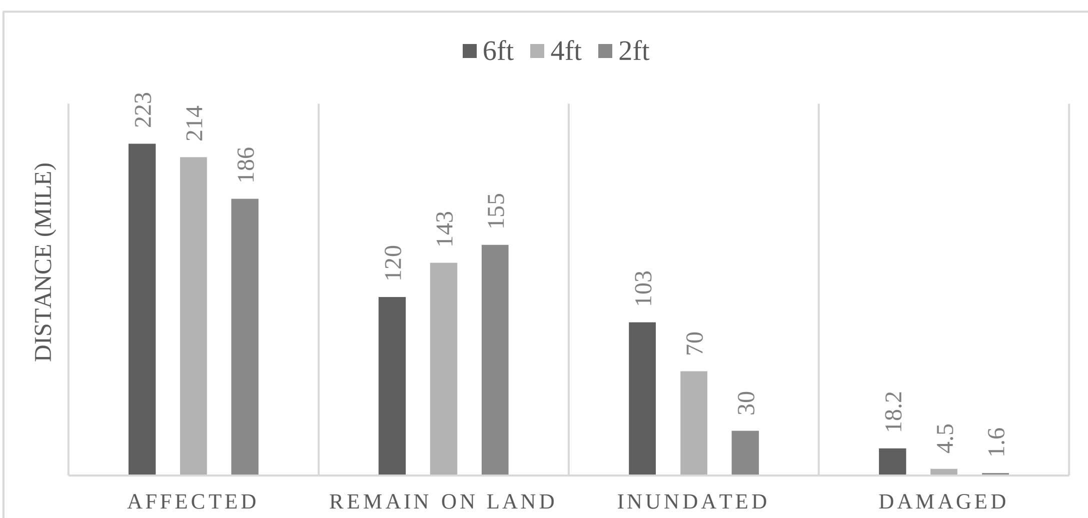

Figure 5.1: Distance of affected trails by sea level rise in Delaware (mile)

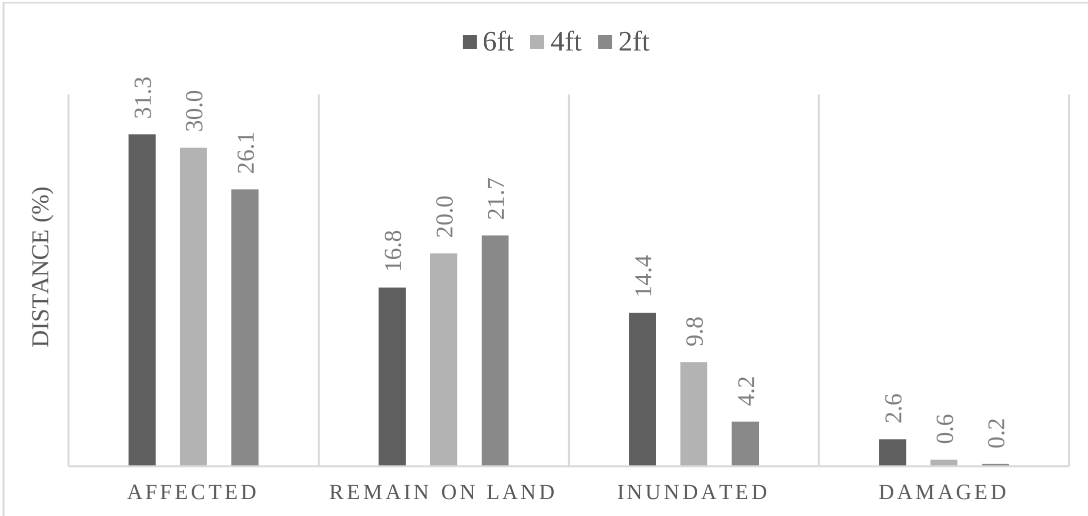

Figure 5.2: Distance of affected trails by sea level rise in Delaware (percent)

5.1.3 Damaged Trails under Sea Level Rise Projections

As mentioned, one of the objectives of this research is identifying those trails that will be vanished due to different sea level rise projections. Following tables represent completely collapsed trails. In these tables each trail is addressed by its ID, and name. In addition, the facility distance and the county where it locates is addressed in this table.

Table 5.2: Fully inundated trails under low sea level rise projection (2 feet)

Trail ID	Trail Name	Distance of Trail (mile)	County
426	Peterson Refuge Boardwalk	0.312	New Castle
25	Bear Swamp	0.121	Kent
26	Boardwalk	0.219	Kent
78	Boardwalk	0.195	Kent
270	AREC Trail	0.18	Kent
287	St. Jones Reserve	0.171	Kent
288	Unnamed Trail	0.021	Kent
5	Unnamed Trail	0.045	Sussex
84	Natter Park Trail	0.08	Sussex
85	Natter Park Trail	0.08	Sussex
179	Canalfront Park Pathway	0.113	Sussex
717	Mispillion Riverwalk	0.032	Sussex
777	Governors Walk	0.016	Sussex
780	Governors Walk	0.048	Sussex
781	Governors Walk	0.022	Sussex
783	Memorial Park Loop	0.112	Sussex
Total Distance (mile)		1.765	

Table 5.3: Fully inundated trails under medium sea level rise projection (4 feet)

Trail ID	Trail Name	Distance of Trail (mile)	County
2	Port Penn	0.152	New Castle
386	Connector	0.074	New Castle
426	Peterson Refuge Boardwalk	0.312	New Castle
24	Bear Swamp	0.138	Kent
25	Bear Swamp	0.121	Kent
26	Boardwalk	0.22	Kent
68	Raymond Pool	0.151	Kent
69	Shearness	0.13	Kent
185	Dirt Road	0.25	Kent
186	Unnamed Trail	0.034	Kent
270	AREC Trail	0.18	Kent
287	St. Jones Reserve	0.171	Kent
288	Unnamed Trail	0.021	Kent
743	Mispillion Riverwalk	0.078	Kent
477	Pedestrian Beach Crossing	0.026	Kent
5	Unnamed Trail	0.045	Sussex
84	Natter Park Trail	0.08	Sussex
85	Natter Park Trail	0.08	Sussex
107	Dirt Road	0.317	Sussex
109	Unnamed Trail	0.222	Sussex
176	Janosik Park Path	0.235	Sussex
179	Canalfront Park Pathway	0.113	Sussex
243	Connector	0.292	Sussex
245	Fred Hudson Road Trail	0.074	Sussex
273	Connector	0.034	Sussex
345	Connector	0.235	Sussex
347	Connector	0.017	Sussex
356	Gordons Pond Trail	0.051	Sussex
375	Unnamed Trail	0.008	Sussex
442	Photography Blind	0.303	Sussex
561	Richard Hall Memorial Park Path	0.112	Sussex
592	James Farm Ecological Preserve Trail	0.017	Sussex
717	Mispillion Riverwalk	0.032	Sussex
777	Governors Walk	0.016	Sussex
780	Governors Walk	0.048	Sussex
781	Governors Walk	0.022	Sussex
783	Memorial Park Loop	0.112	Sussex
Total Distance (mile)		4.52	

Table 5.4: Fully inundated trails under high sea level rise projection (6 feet)

Trail ID	Trail Name	Distance of Trail (mile)	County
2	Port Penn	0.152	New Castle
117	Port Penn	0.515	New Castle
271	Delaware City Promenade	1.142	New Castle
386	Connector	0.074	New Castle
426	Peterson Refuge Boardwalk	0.312	New Castle
24	Bear Swamp	0.138	Kent
25	Bear Swamp	0.121	Kent
26	Boardwalk	0.22	Kent
67	Parsons Point	0.482	Kent
68	Raymond Pool	0.151	Kent
69	Shearness	0.13	Kent
78	Boardwalk	0.194	Kent
183	Boardwalk Trail	0.08	Kent
185	Dirt Road	0.25	Kent
186	Unnamed Trail	0.034	Kent
266	Unnamed Trail	0.259	Kent
270	AREC Trail	0.18	Kent
285	St. Jones Reserve	0.456	Kent
287	St. Jones Reserve	0.171	Kent
288	Unnamed Trail	0.021	Kent
467	AREC Trail	0.099	Kent
468	AREC Trail	0.335	Kent
476	Dune Crossing	0.023	Kent
477	Pedestrian Beach Crossing	0.026	Kent
478	Pedestrian Beach Crossing	0.022	Kent
566	Unnamed Trail	0.21	Kent
716	Mispillion Riverwalk	0.163	Kent
742	Mispillion Riverwalk	0.041	Kent
743	Mispillion Riverwalk	0.078	Kent
5	Unnamed Trail	0.045	Sussex
66	Burton Island Trail	0.951	Sussex
84	Natter Park Trail	0.08	Sussex
85	Natter Park Trail	0.08	Sussex
107	Dirt Road	0.317	Sussex
108	Refuge	2.757	Sussex
109	Unnamed Trail	0.222	Sussex
175	Broad Creek Greenway	0.067	Sussex

Table 5.4: Continued

Trail ID	Trail Name	Distance of Trail (mile)	County
176	Janosik Park Path	0.235	Sussex
179	Canalfront Park Pathway	0.113	Sussex
180	Canary Creek Trail	0.641	Sussex
182	Sidewalk or Pathway	0.218	Sussex
242	Connector	0.207	Sussex
243	Connector	0.292	Sussex
244	Fred Hudson Road Trail	0.312	Sussex
245	Fred Hudson Road Trail	0.074	Sussex
246	Fred Hudson Road Trail	0.588	Sussex
248	Prickly Pear Trail	0.016	Sussex
250	Prickly Pear Trail cut-off	0.09	Sussex
252	Access Trail	0.051	Sussex
253	Access Trail	0.092	Sussex
256	Connector	0.019	Sussex
273	Connector	0.034	Sussex
275	Pathway	0.024	Sussex
278	Sidewalk or Pathway	0.492	Sussex
316	Sidewalk or Pathway	0.218	Sussex
345	Connector	0.235	Sussex
347	Connector	0.017	Sussex
351	Connector	0.363	Sussex
356	Gordons Pond Trail	0.051	Sussex
373	Sidewalk or Pathway	0.068	Sussex
374	Unnamed Trail	0.023	Sussex
375	Unnamed Trail	0.008	Sussex
440	Boardwalk	0.483	Sussex
441	Dike Trail	0.506	Sussex
442	Photography Blind	0.303	Sussex
444	Unnamed Trail	0.566	Sussex
446	Dirt Road	0.586	Sussex
524	Seaford Riverwalk	0.102	Sussex
561	Richard Hall Memorial Park Path	0.112	Sussex
592	James Farm Ecological Preserve Trail	0.017	Sussex
594	James Farm Ecological Preserve Trail	0.17	Sussex
717	Mispillion Riverwalk	0.032	Sussex
777	Governors Walk	0.016	Sussex
780	Governors Walk	0.048	Sussex
781	Governors Walk	0.022	Sussex
783	Memorial Park Loop	0.112	Sussex
Total Distance (mile)		18.151	

5.1.4 Level of Service for Sea Level Rise Projections

As it was explained in the previous chapter, the vulnerability assessment is done for each facility separately based on the inundation distance and maximum depth of water for three sea level rise projections (Low, medium, and high).

Table 6, represents all the elements of vulnerability assessment. This table contains trail's name, ID, length, county, length remaining on land after sea level rise, length of inundation after sea level rise, maximum depth of water, and level of service that was processed for one trail as a sample. For all existing trails throughout the State this table is developed.

Table 5.5: Vulnerability assessment of a sample trail under three sea level rise scenarios

			Low (2ft)	Medium (4ft)	High (6ft)
		Distance on Land (mile)	------	0.024	------
		Inundated Distance (mile)	------	0.077	------
Trail's Name	Seaford Riverwalk	**Land Loss (%)**	------	75.904	------
Trail's ID	524.000	**Min Elevation (ft)**	------	1.247	------
Distance (mile)	0.102	**Max Depth (ft)**	------	2.753	------
County	Sussex	**Level of Service**	LOS A	LOS F	Out of Service

The scope of this research covers trails and bike routes through the state of Delaware. Since the result of this study is applicable by the Delaware Department of Transportation (DelDOT) and other management organizations responsible for maintenance and rehabilitation of these facilities, trails' results are classified by counties: New Castle, Kent, and Sussex.

Following graphs show the trails level of service under low (2 feet), medium (4 feet), and high (6 feet) sea level rise for each county.

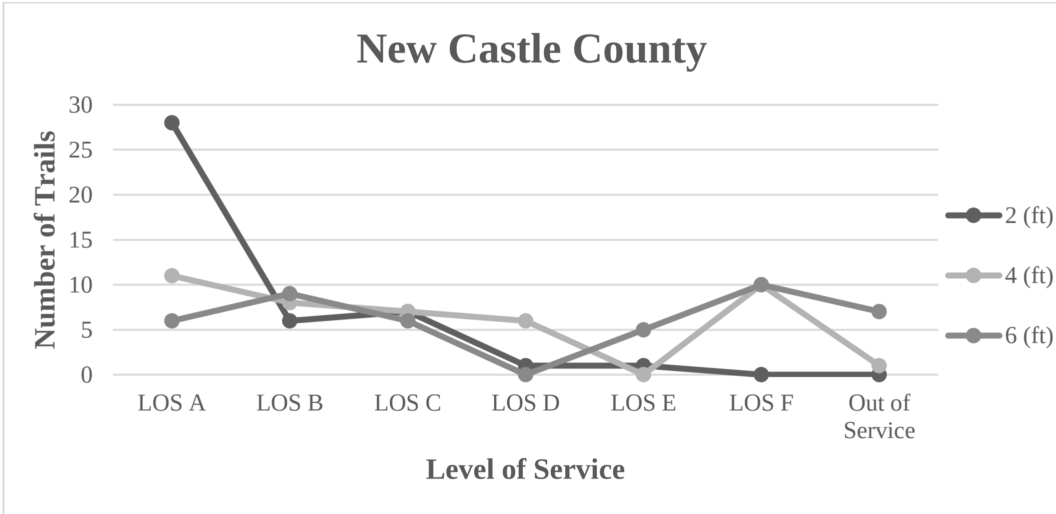

Figure 5.3: Trail’s level of service under three sea level rise scenarios in New Castel County

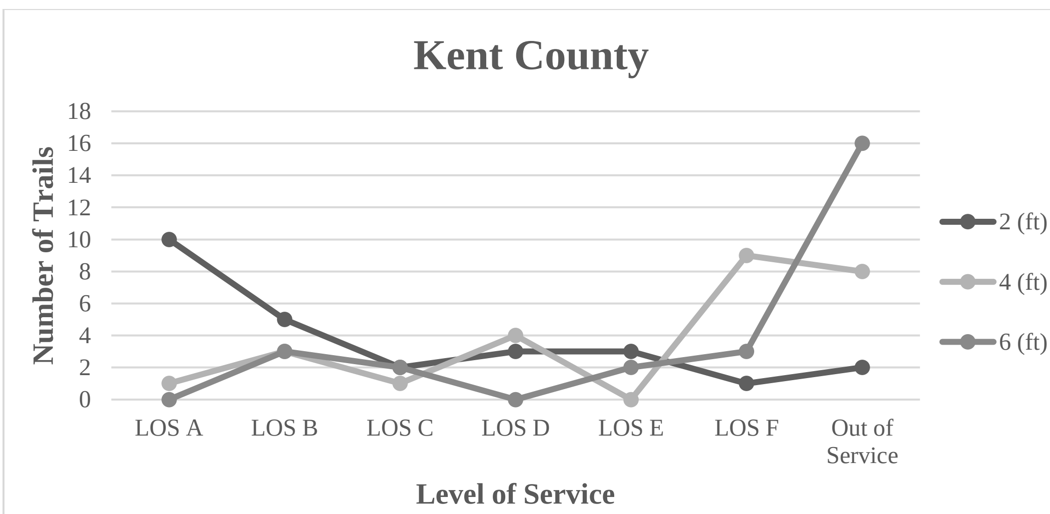

Figure 5.4: Trail’s level of service under three sea level rise scenarios in Kent County

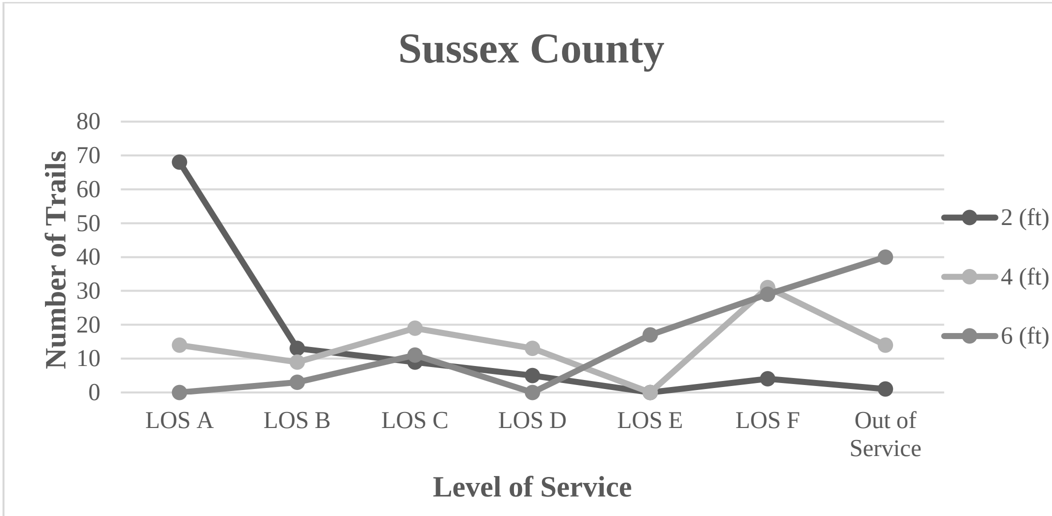

Figure 5.5: Trail's level of service under three sea level rise scenarios in Sussex County

5.1.5 Maps of Affected Trails under Sea Level Rise Projections

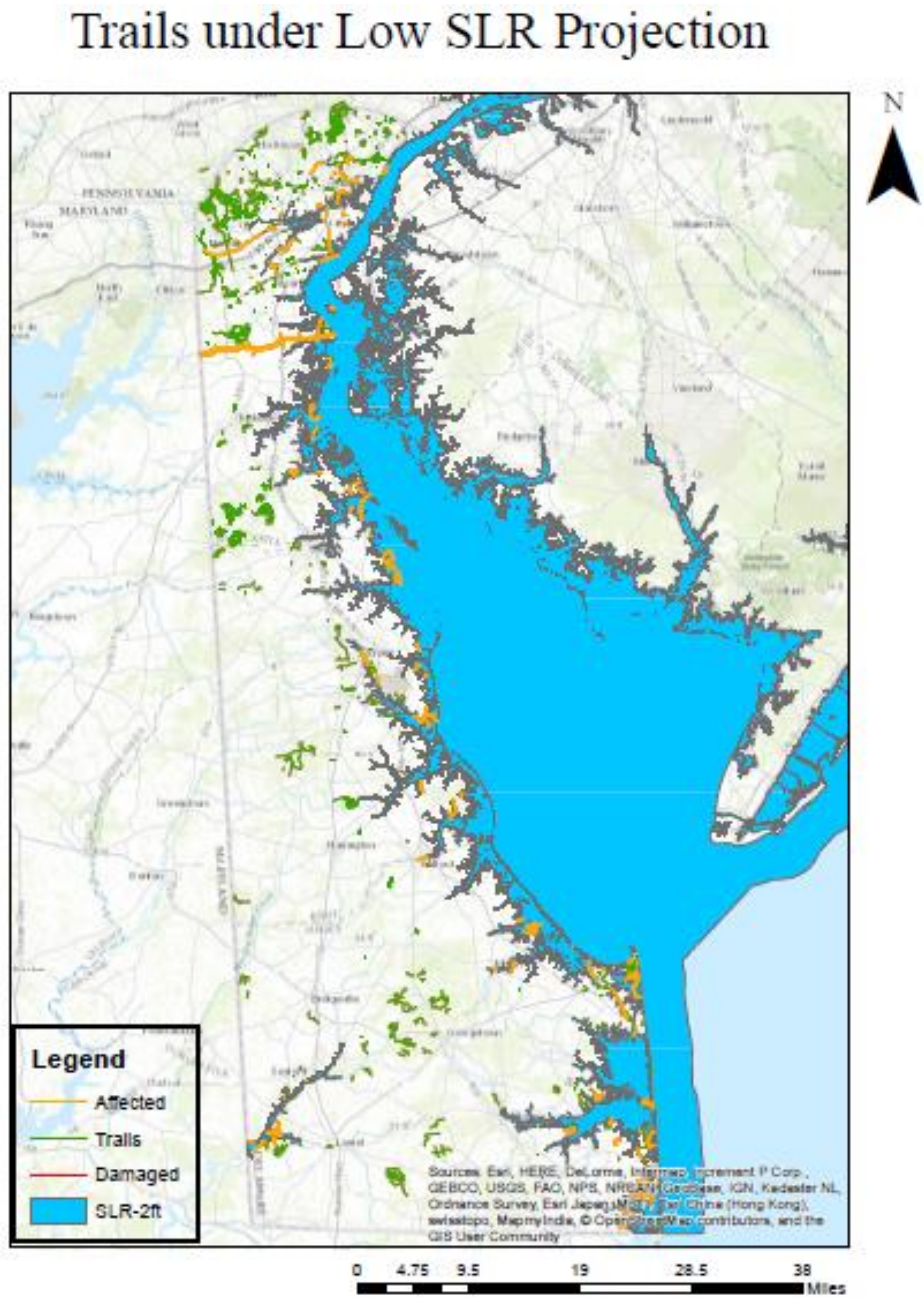

Figure 5.6: Trails condition under low sea level rise scenario (2 feet)

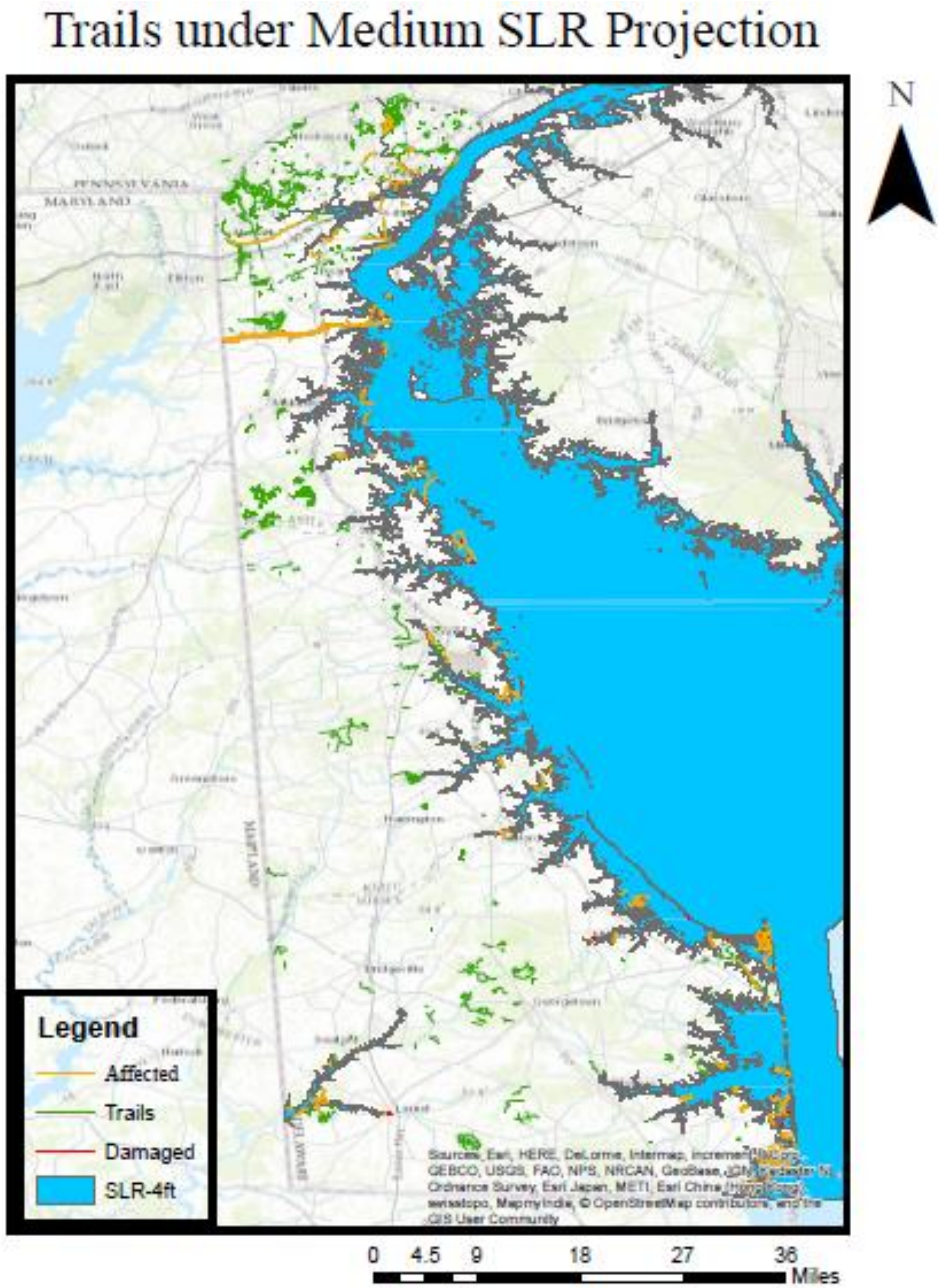

Figure 5.7: Trails condition under medium sea level rise scenario (4 feet)

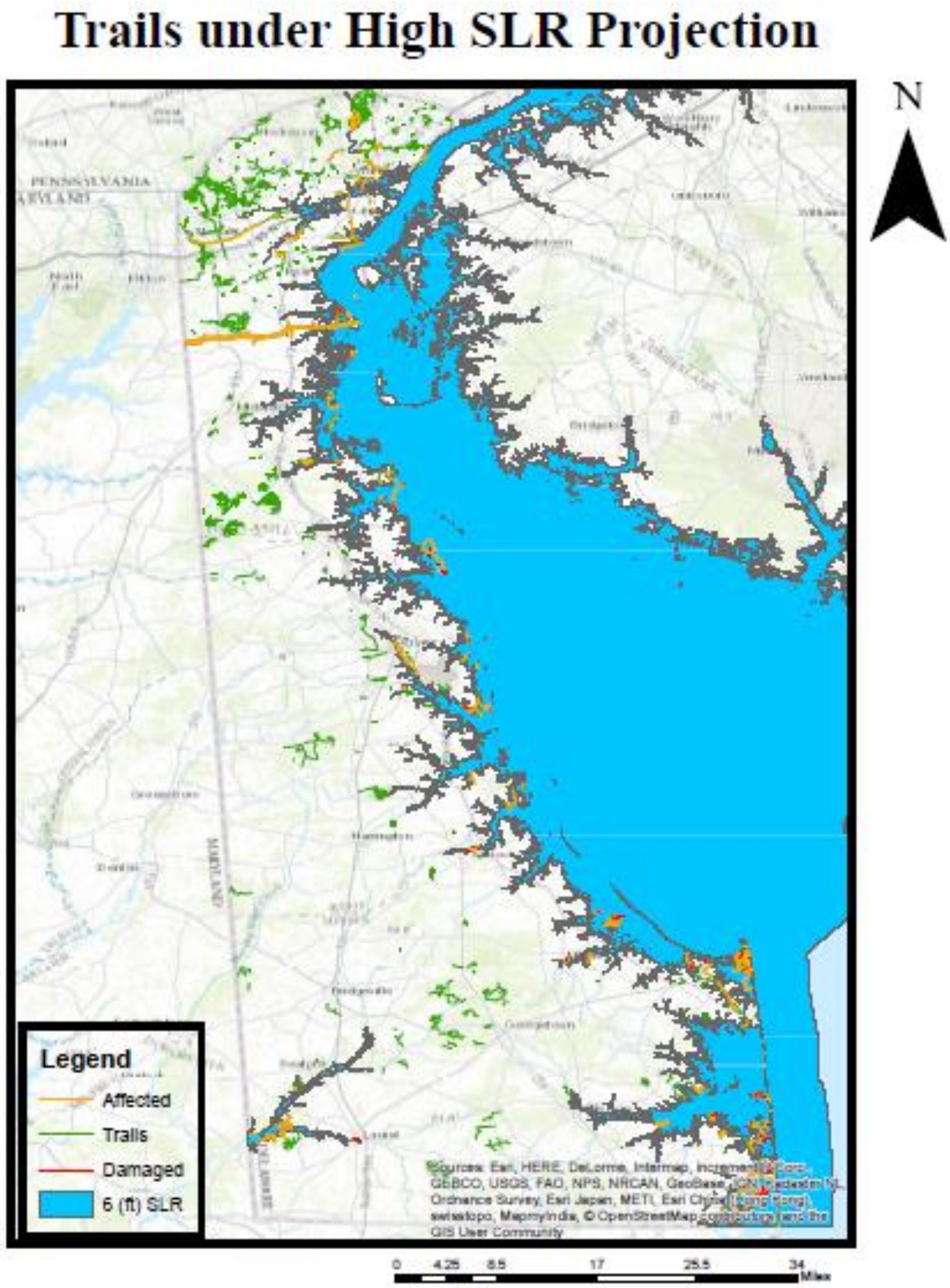

Figure 5.8: Trails condition under high sea level rise scenario (6 feet)

5.2 Analysis for Bike Routes

Bike routes are roadways that are considered as safe and suitable roads for cycling. As it was mentioned earlier, the ultimate goal of this research is to estimate the vulnerability of these facilities against sea level rise in 2100. The results are classified by DOT class (statewide, regional, and connector) so they will be more convenient to use for management corporations.

5.2.1 Assessment of Bike Routes' Affection under Sea Level Rise Projections

The following table shows the number of affected bike routes under three different sea level rise scenarios. The bike routes are classified by Department of Transportation (DOT) type so local government and management agencies could plan adaptation strategies and budget allocations accordingly.

Table 5.6: Number of affected bike routes by sea level rise in the Delaware

DOT Class	Total Number of Bike Routes	Number of Affected Facilities under Three SLR Projections		
		Low (2ft)	Medium (4ft)	High (6ft)
Connector	497	57	74	83
Regional	145	24	28	32
Statewide	211	24	35	38

5.2.2 Assessment of Bike Routes' Inundation Distance under Sea Level Rise Projections

The State of Delaware has 1715.49 (mile) of Bike Routes. Figure 10, demonstrates the total distance of affected facilities under three scenarios as well as the portion of the land that will remain on land and the distance that is going to be inundated. The total distance of the land that is going to be inundated for the high sea level rise scenario (6 feet) by the end of 2100 which is 90 (mile) is more significant than the inundation distance for the low sea level rise scenario (2 feet) which is estimated to be 30 (mile).

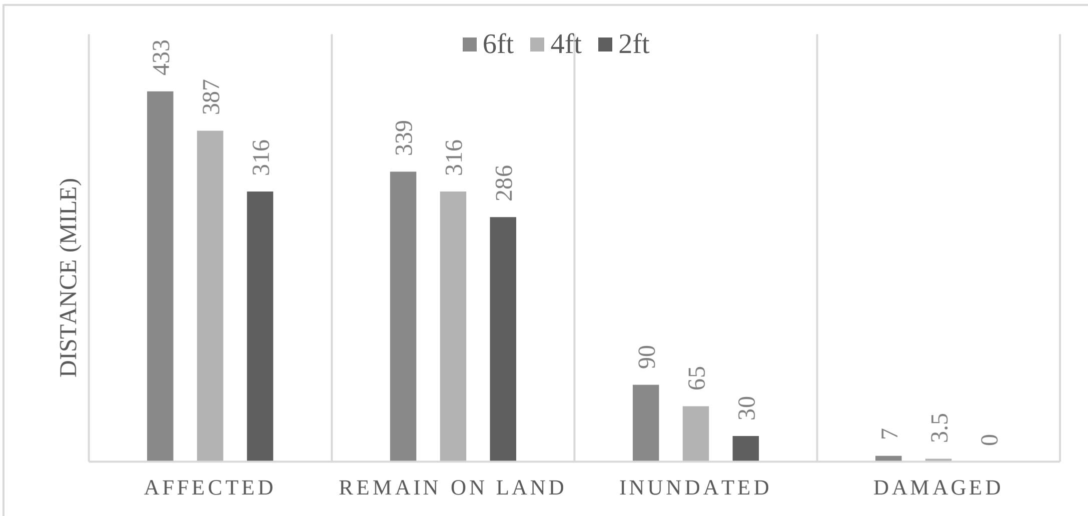

Figure 5.9: Distance of affected bike routes by sea level rise in Delaware (mile)

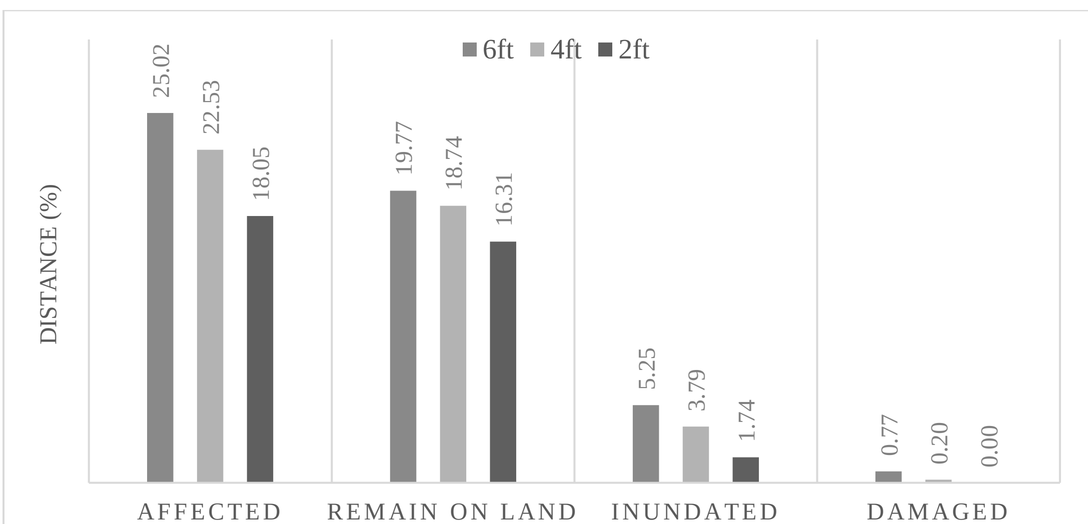

Figure 5.10: Distance of affected bike routes by sea level rise in Delaware (percent)

5.2.3 Damaged Bike Routes under Sea Level Rise Projections

As mentioned, one of the objectives of this research is identifying those bike routes that will be vanished due to different sea level rise projections. Following tables represent completely collapsed bike routes. In these tables, each bike route is addressed by its ID. In addition, the facility's distance and DOT's classification is addressed in this table.

Under the low projection of sea level rise (2 feet), bike routes will not be damaged or completely inundated.

Table 5.7: Fully inundated bike routes under medium sea level rise projection (4 feet)

Bike Route ID	DOT Classification	Bike Way	Distance (mile)
131	Connector	no	1.121
391	Connector	no	0.533
485	Connector	yes	1.236
667	Statewide	yes	0.273
668	Statewide	yes	0.28
Total Distance (mile)			3.114

Table 5.8: Fully inundated bike routes under high sea level rise projection (6 feet)

Bike Route ID	DOT Classification	Bike Way	Distance (mile)
189	Connector	yes	1.919
131	Connector	no	1.121
391	Connector	no	0.533
485	Connector	yes	1.236
648	Regional	no	0.193
264	Statewide	no	0.658
626	Statewide	yes	0.229
643	Statewide	no	0.553
667	Statewide	yes	0.273
668	Statewide	yes	0.28
Total Distance (mile)			6.995

5.2.4 Level of Service under Sea Level Rise Projections

As it was explained in the previous chapter, the vulnerability assessment is done for each facility separately based on the inundation distance and maximum depth of water for three sea level rise projections (Low, medium, and high).

Table 6, represents all the elements of vulnerability assessment. This table contains bike route's ID, length, DOT classification, length remaining on land after sea level rise, length of inundation after sea level rise, maximum depth of water, and level of service that was processed for one bike route as a sample. For the existing bike routes throughout the State this table is developed.

Table 5.9: Vulnerability assessment of a sample bike route under three sea level rise scenarios

			Low (2ft)	Medium (4ft)	High (6ft)
		Distance on Land (mile)	------	0.048	0.000
Bike Route's ID	626	**Inundated Distance (mile)**	------	0.066	0.229
Distance (mile)	0.229	**Land Loss (%)**	------	29.041	100.000
DOT Class	Statewide	**Min Elevation (ft)**	------	1.629	------
		Max Depth (ft)	------	2.371	------
		Level of Service	LOS A	LOS C	Out of Service

The scope of this research covers trails and bike routes through the state of Delaware. Since the result of this study is applicable by the Delaware Department of Transportation (DelDOT) and other management organizations responsible for maintenance and rehabilitation of these facilities, bike routes' results are classified by counties: Connector, Regional, and Statewide.

Following graphs show the trails level of service under low (2 feet), medium (4 feet), and high (6 feet) sea level rise for each county.

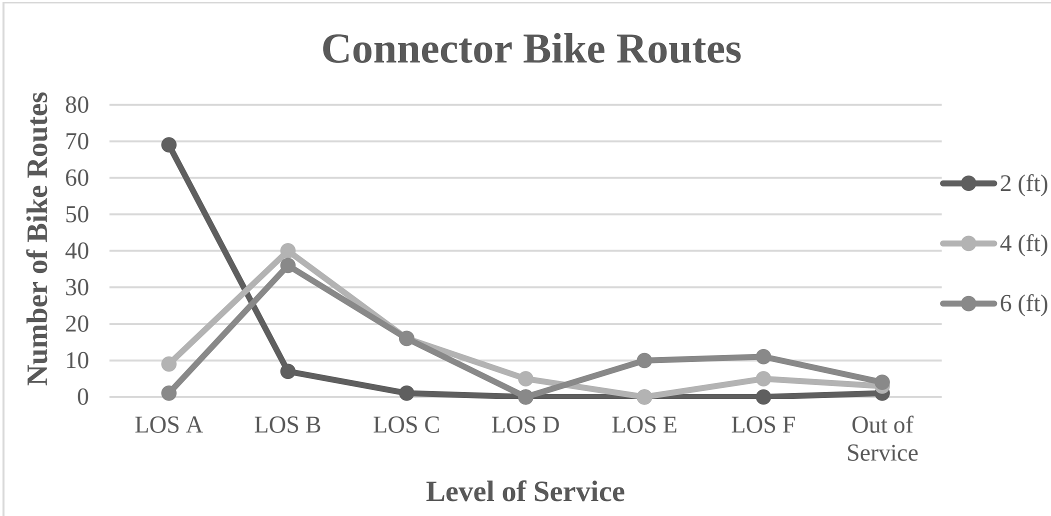

Figure 5.11 Connector bike routes' level of service under three sea level rise scenarios

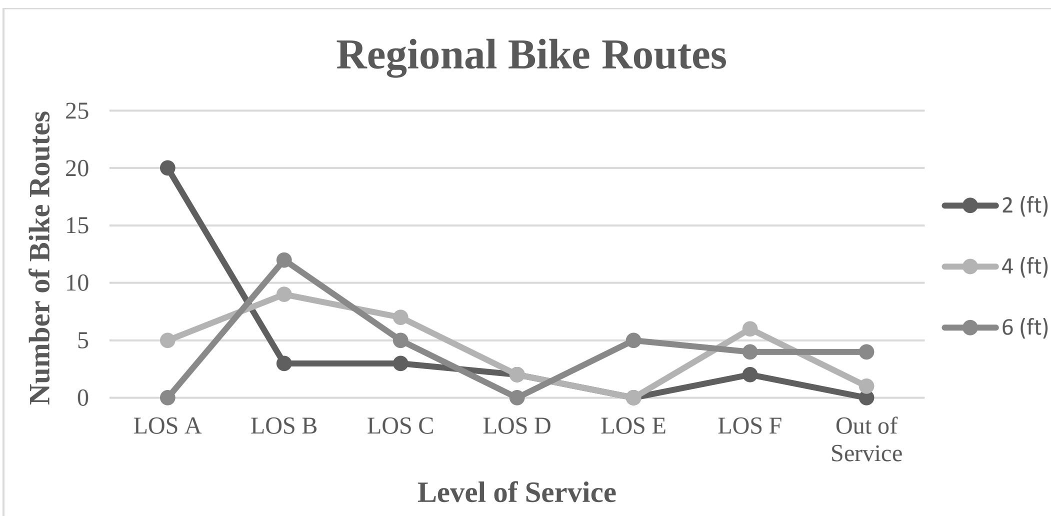

Figure 5.12: Regional bike routes' level of service under three sea level rise scenarios

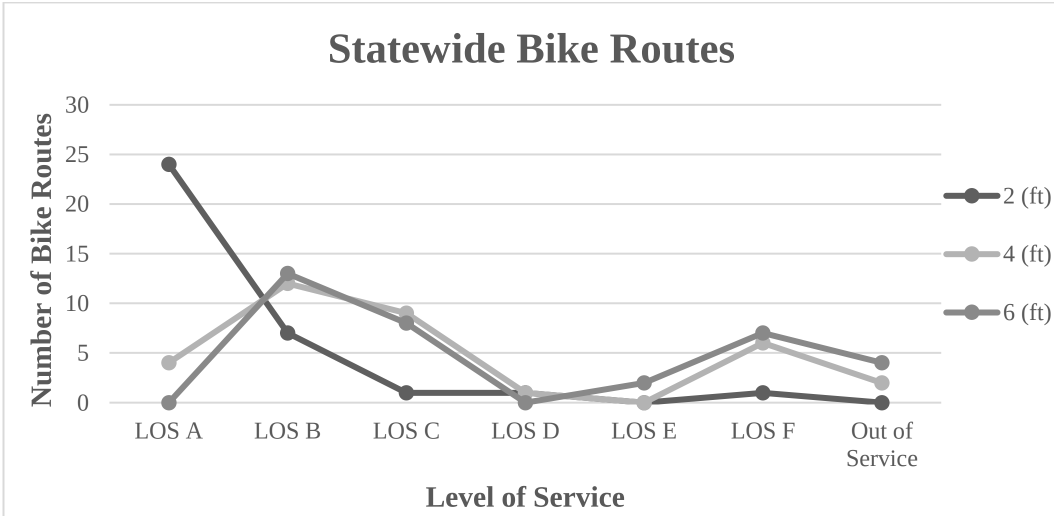

Figure 5.13: Statewide bike routes' level of service under three sea level rise scenarios

5.2.5 Maps of Affected Bike Routes under Sea Level Rise Projections

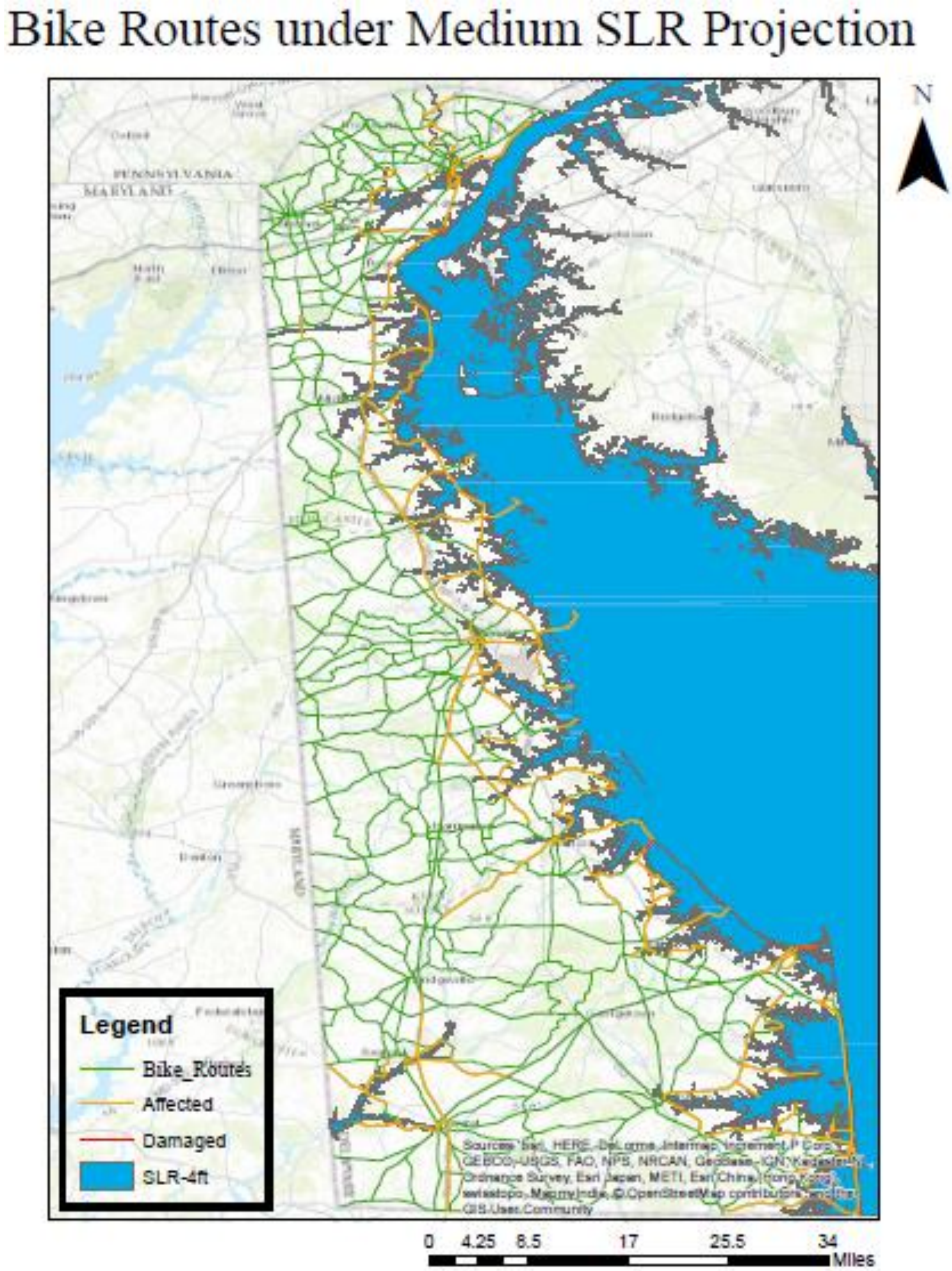

Figure 5.14: Bike routes condition under medium sea level rise scenario (4 feet)

Bike Routes under High SLR Projection

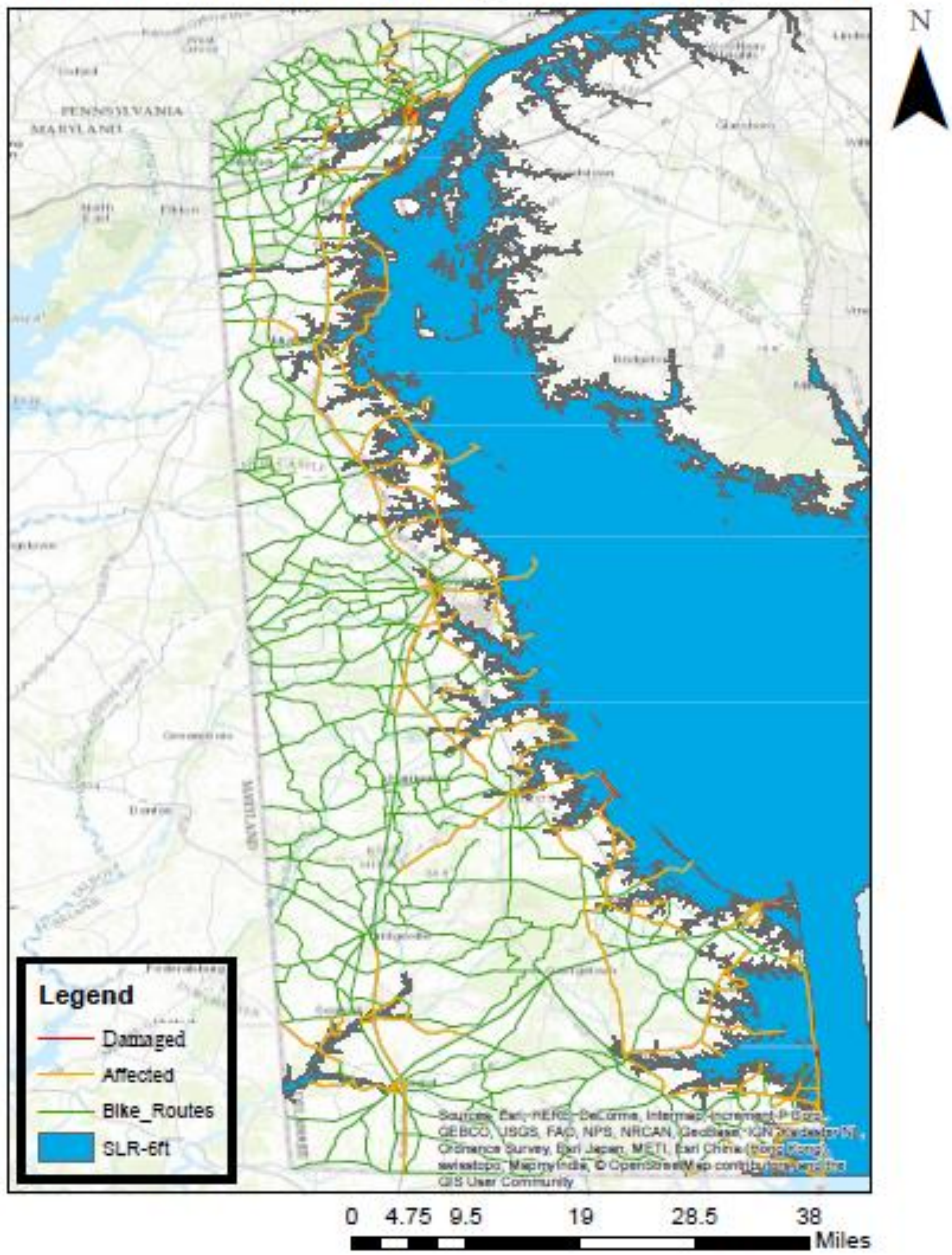

Figure 5.15: Bike routes condition under high sea level rise scenario (6 feet)

5.3 Summary of the Chapter

This chapter provides a comprehensive report of the GIS-based analysis and results of this study for trails and bike routes respectively. For all three sea level rise projections, there are tables containing number of affected facilities, and completely damaged facilities. The mileage of affected facilities, the distance that will remain on land, the distance that will be inundated, and the distance of damaged facilities under three sea level rise projections were reported in charts for trails and bike routes separately. These values were presented in a different chart based on percentage too.

The results of vulnerability assessment against sea level rise were presented in the form of level of service in different graphs for trails and bike routes respectively.

This section of the thesis includes maps that shows the condition of non-motorized transportation facilities (trails and bike routes) under sea level rise projections.

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 Summary

Climate refers to weather patterns in a long period of time and climate change refers to any extreme changes in these patterns. Over past centuries especially last century, human activities have caused drastic changes in weather patterns by increasing atmosphere temperature. Anthropogenic activities like transportation produce cast amount of greenhouse gases (carbon dioxide, methane, nitrous oxide, fluorinated gases, perfluorocarbons, and sulfur hexafluoride) which eventually result in increased temperature.

Increased temperature has caused different climatic stressors such as sea level rise, more frequent flooding, intense precipitation, droughts, and heat waves. Different regions in the world are experience different climate change stressors for instance while in Mid-Atlantic region sea level rise in coastal areas is of a great importance, droughts and its consequences are noticeable.

As Environmental Protection Agency reported, transportation is responsible for about one-third of carbon dioxide emissions in the United States. Also, transportation is responsible for the emissions of other greenhouse gases. Five types of climate change impacts that have the most influence on transportation are increases in very hot days and heat waves, increases in arctic temperatures, rising sea levels, increases in intense precipitation events, and increases in hurricane intensity.

Surface transportation is affected by these climatic stressors in different ways. Sea level rise will cause more frequent interruption of roadway traffic and railroads, and inundation of roads, rail lines and tunnels in low-lying regions. Intense precipitation causes increase in travel time due to congestion. As it was thoroughly explained in this chapter one the most important stressors that affects infrastructure is increase temperature. Also, it has a great influence on travel behavior for different modes of transportation.

Air transportation has a reciprocal relation with climate change meaning that it contributes to the production of greenhouse gases which cause global warming and it is impacted by the consequences of climate change. Climate change has two most important effects on avian transportation. First, it results in damage and deterioration of facilities such as runways. Second, it causes disruption in airport's services due to various weather extremes such as storms.

Non-Motorized transportation or in other word active transportation is defined as walking or cycling. Sidewalks, walkways, bike lanes, and trails can be addressed as facilities for this mode of transport. Climate change has drastic effects on this mode since pedestrian and cyclists are more exposed to weather extremes. Temperature, humidity, and precipitation are identified as weather measures that has the most effects on pedestrian and cyclists' travel behavior.

The practice of reducing the amount of emissions is defined as mitigation. There are different sets of mitigation strategies for different modes of transportation like energy efficiency techniques, land use changes aligned with smart growth, use of renewable energy such as wind, solar, geothermal, or hydropower. A summary of mitigation strategies for road transportation and other modes are discussed Although these strategies will cause reduction in the production of greenhouse gases and alleviate the climate change, the impacts of climate change are already tangible all around the world. Thus, adaptation strategies are required to live with these impacts for example road elevation is one method of surviving against sea level rise.

Although there are several climatic stressors, the effect of sea level rise on non-motorized transportation facilities is studied in this research. Other impacts such as increased temperature or more frequent flooding can be studied in future.

For further analysis, trails' and bike routes' geospatial data were obtained from multiple sources such as Delaware Department of Transportation (DelDOT). The model that represents sea level rise in 2100 was obtained from National Oceanic and Atmospheric Administration (NOAA). Digital elevation model (DEM) is used to assign elevation to the existing GIS-based inventory of trails and bike routes.

Based on the GIS model developed using the geospatial data and sea level rise projection, the distance of each facility that will be inundated under three sea level rise scenarios (low, medium, high) is estimated. We used the same datum for assigning elevation to trails and bike routes as the sea level rise projection's datum. As result, the maximum depth of water on each facility was estimated. These two measures (inundation distance, and maximum depth of water) are required to assess the vulnerability of each facility against sea level rise. Bases on the vulnerability assessment which thoroughly explained in chapter four, all non-motorized facilities in the State is assigned with a level of service.

6.2 Conclusions

The most important objective of this research is to estimate the condition of trails and bike routes in the State. The results of analysis can be used by management authorities to plan for their future maintenance programs and their future developments.

Since there is a great amount of uncertainty around sea level rise (SLR), the analysis was done for three sea level rise projections. The number of damaged trails under the medium SLR projection shows an increase of 56.76% compared to the number of damaged trails under low SLR scenario. This percent increases to 78.9% when the comparison was done between low and high SLR projections. To investigate the severity of different projections, we compared the total distance of damaged trails. Analysis showed that there will be 60.95% increase in mileage of damaged trails under medium SLR scenario compared to low scenario and this percent will be 90.3% if the comparison was done between the lowest and the highest SLR projections. The analysis results for the bike routes showed that under the low scenario bike routes will not vanish. However, the number of damaged bike routes will increase by 50% if sea level rises 6 feet rather than 4 feet. Also, there will be a 55.48% increase in distance of damaged bike routes when the comparison is made between medium and high sea level rise projections. These drastic changes prove that management corporations should plan their adaptation strategies for the worst scenario because the gap between low and high future sea level rise projections is considerable.

All the analysis results prove that as sea level rise projection gets higher the number of trails with lower level of service increase. For instance, in Kent county, Delaware there is 87.5% increase in number of out of service facilities when the sea level rise projection changes from medium to high. This percent is 97.5% for Sussex County, Delaware which has a long coastal line and is more vulnerable to sea level rise. In addition, GIS-based analysis for bike routes shows that there is a 100%

increase in the number of out of service bike routes as the sea level rise projection changes from medium to high.

Since the results of this research is operational for management corporations which are responsible for trails and bike routes in the State, it is essential for them to pay more attention to Sussex county because the number of trails affected by sea level rise in this region is almost twice as New Castle county and about four times more than Kent county.

Connector bike routes show a high vulnerability against sea level rise. DelDOT should invest in maintaining these facilities not only because they are more exposed to sea level rise but also because connector routes provide connection between statewide and regional network. This connection is substantial for the performance of the entire network. By investing in adapting connector bike routes to sea level rise, the performance of the whole system will be improved.

6.2.1 Merits

This research is the first study that evaluates the effect of sea level rise due to climate change on non-motorized transportation facilities in the state of Delaware. Thus, as it was mentioned earlier the result of this study is applicable for future planning of non-motorized transportation facilities. Also, the methodology that is used to assess the vulnerability of trails and bike routes against sea level rise is unique and it is applicable for any management corporations to evaluate the conditions of facilities.

6.2.2 De-merits

The uncertainty around the climate change is one of the features that can be counted as disadvantages of this research. There are other non-motorized transportation facilities that are not addressed in this research such as sidewalks, walkway, shared used path, etc. The scope of this study was limited to trails and bike routes.

6.3 Recommendations

This is a case by case study meaning that management corporations could refer to this research to find out the condition of each non-motorized facilities. Thus, it is recommended for them to use the results if they want to plan any adaptation strategies for trails and bike routes. For example, if a facility's level of service will be F in 2100 under projections, then there is no value in investing adapting the facility against sea level rise. Instead, new facilities can be built using the available funds.

In addition, based on the literature review, there are two other climate change stressors that affect transportation, flooding due to intense precipitation, and increased temperature. The effects of these climatic stressors on non-motorized facilities, pedestrians and cyclists' travel behavior can be estimated in future researches. For the purpose of evaluating the condition of trails and bike routes against intense flooding the same analysis path can be followed. Instead of using a GIS sea level rise model, the GIS flood frequency model should be used. There are different methods of assessing travel behavior under extreme conditions such as increased temperature. For example, a survey can be conducted asking people how their walking and cycling habits change when the temperature goes up.

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Appendix A

TRAILS' LEVEL OF SERVICE

As it was described previously, the scope of this research covers the entire state of Delaware's trails. The result of the vulnerability assessment against sea level rise for trails is presented in this appendix. It is worthwhile mentioning that this vulnerability assessment was processed only for those facilities that will be affected by different sea level rise projections.

Each affected trail has a correspondent table in which trail's name, ID (a number that DelDOT uses to identify trails), total distance, and county are reported. Also, the vulnerability assessment's result is presented as level of service for each trail under low (2 feet), medium (4 feet), and high (6feet) sea level rise projections in year 2100. Appendix A.1 contains New Castle County's trail, appendix A.2 contains Kent County's trails, and appendix A.3 contains Sussex County's trails.

A.1 Trails' Level of Service in New Castle County

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Port Penn	**Distance on Land (mile)**	0.303	0.134	0.026
Trail's ID	1 & 2	**Inundated Distance (mile)**	0.614	0.779	0.892
Distance (mile)	0.917	**Land Loss (%)**	66.957	84.866	97.185
County	New Castle	**Min Elevation (ft)**	-0.176	-0.176	-0.176
		Max Depth (ft)	2.176	4.176	6.176
		Level of Service	**LOS D**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Creekside	**Distance on Land (mile)**		0.270	0.270
Trail's ID	28	**Inundated Distance (mile)**		0.017	0.017
Distance (mile)	0.287	**Land Loss (%)**		5.801	5.801
County	New Castle	**Min Elevation (ft)**		-0.460	-0.460
		Max Depth (ft)		4.460	1.540
		Level of Service	**LOS A**	**LOS B**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Creekside	**Distance on Land (mile)**		1.488	1.484
Trail's ID	29	**Inundated Distance (mile)**		0.011	0.014
Distance (mile)	1.498	**Land Loss (%)**		0.705	0.946
County	New Castle	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**LOS A**	**LOS A**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Hidden Pond	**Distance on Land (mile)**		1.042	1.042
Trail's ID	32	**Inundated Distance (mile)**		0.028	0.028
Distance (mile)	1.070	**Land Loss (%)**		2.622	2.622
County	New Castle	**Min Elevation (ft)**		-0.277	-0.277
		Max Depth (ft)		4.277	6.277
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**		2.438	2.426
Trail's ID	51	**Inundated Distance (mile)**		0.023	0.036
Distance (mile)	2.461	**Land Loss (%)**		0.942	1.445
County	New Castle	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**LOS A**	**LOS A**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pathway	**Distance on Land (mile)**	0.923	0.915	0.913
Trail's ID	57	**Inundated Distance (mile)**	0.029	0.037	0.038
Distance (mile)	0.952	**Land Loss (%)**	3.055	3.918	4.044
County	New Castle	**Min Elevation (ft)**	3.935	0.187	0.187
		Max Depth (ft)	-1.935	3.813	2.187
		Level of Service	**LOS A**	**LOS B**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pathway	**Distance on Land (mile)**	0.035	0.035	0.035
Trail's ID	58	**Inundated Distance (mile)**	0.023	0.023	0.023
Distance (mile)	0.058	**Land Loss (%)**	40.370	40.370	40.370
County	New Castle	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS C**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	0.495	0.484	0.474
Trail's ID	59	**Inundated Distance (mile)**	0.080	0.091	0.104
Distance (mile)	0.575	**Land Loss (%)**	13.881	15.784	18.010
County	New Castle	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	0.047	0.047	0.040
Trail's ID	60	**Inundated Distance (mile)**	0.041	0.041	0.049
Distance (mile)	0.089	**Land Loss (%)**	46.636	46.636	54.835
County	New Castle	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS C**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pathway	**Distance on Land (mile)**			1.300
Trail's ID	93	**Inundated Distance (mile)**			0.014
Distance (mile)	1.315	**Land Loss (%)**			1.090
County	New Castle	**Min Elevation (ft)**			-0.455
		Max Depth (ft)			6.455
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	North Canal Road	**Distance on Land (mile)**		0.153	0.000
Trail's ID	105	**Inundated Distance (mile)**		0.006	0.158
Distance (mile)	0.159	**Land Loss (%)**		3.794	99.706
County	New Castle	**Min Elevation (ft)**			1.809
		Max Depth (ft)			4.191
		Level of Service	**LOS A**	**LOS A**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	1.372	2.070	1.689
Trail's ID	115 & 116	**Inundated Distance (mile)**	0.226	0.754	1.135
Distance (mile)	2.824	**Land Loss (%)**	8.016	26.696	40.193
County	New Castle	**Min Elevation (ft)**	1.038	0.922	0.922
		Max Depth (ft)	0.962	3.078	5.078
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Port Penn	**Distance on Land (mile)**	0.313	0.081	0.000
Trail's ID	117	**Inundated Distance (mile)**	0.202	0.434	0.515
Distance (mile)	0.515	**Land Loss (%)**	39.256	84.268	100.000
County	New Castle	**Min Elevation (ft)**	0.371	0.371	
		Max Depth (ft)	1.629	3.629	
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Prison Camp Trail	**Distance on Land (mile)**	0.594	0.227	0.012
Trail's ID	226	**Inundated Distance (mile)**	0.029	0.395	0.611
Distance (mile)	0.623	**Land Loss (%)**	4.584	63.481	98.143
County	New Castle	**Min Elevation (ft)**	1.325	1.218	
		Max Depth (ft)	0.675	2.782	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Riverview Trail	**Distance on Land (mile)**	1.220	0.437	0.110
Trail's ID	227 & 228 &229	**Inundated Distance (mile)**	0.068	0.851	0.939
Distance (mile)	1.287	**Land Loss (%)**	5.251	66.087	72.980
County	New Castle	**Min Elevation (ft)**	1.370	1.009	1.009
		Max Depth (ft)	0.630	2.991	4.991
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Riverview Trail	**Distance on Land (mile)**	0.705	0.693	0.670
Trail's ID	240	**Inundated Distance (mile)**	0.007	0.019	0.042
Distance (mile)	0.712	**Land Loss (%)**	1.030	2.696	5.952
County	New Castle	**Min Elevation (ft)**	1.361	1.361	1.361
		Max Depth (ft)	0.639	2.639	4.639
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Delaware City Promenade	**Distance on Land (mile)**	0.667	0.066	0.000
Trail's ID	271	**Inundated Distance (mile)**	0.475	1.076	1.142
Distance (mile)	1.142	**Land Loss (%)**	41.563	94.201	100.000
County	New Castle	**Min Elevation (ft)**	-0.240	-0.240	
		Max Depth (ft)	2.240	4.240	
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	2k Bishop Loop	**Distance on Land (mile)**	0.242	0.241	0.241
Trail's ID	282	**Inundated Distance (mile)**	0.982	0.982	0.982
Distance (mile)	1.223	**Land Loss (%)**	80.250	80.250	80.250
County	New Castle	**Min Elevation (ft)**	1.119	1.119	1.119
		Max Depth (ft)	0.881	2.881	4.881
		Level of Service	**LOS E**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	5K Blackbird Loop	**Distance on Land (mile)**	2.113	2.011	1.925
Trail's ID	283	**Inundated Distance (mile)**	0.997	0.900	1.185
Distance (mile)	3.110	**Land Loss (%)**	32.059	28.938	38.097
County	New Castle	**Min Elevation (ft)**	1.276	1.276	1.276
		Max Depth (ft)	0.724	2.724	4.724
		Level of Service	**LOS B**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Other Trails	**Distance on Land (mile)**			0.778
Trail's ID	284	**Inundated Distance (mile)**			0.012
Distance (mile)	0.790	**Land Loss (%)**			1.514
County	New Castle	**Min Elevation (ft)**			2.334
		Max Depth (ft)			3.666
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Route 273	**Distance on Land (mile)**		1.859	1.789
Trail's ID	313	**Inundated Distance (mile)**		0.016	0.086
Distance (mile)	1.875	**Land Loss (%)**		0.858	4.565
County	New Castle	**Min Elevation (ft)**			2.016
		Max Depth (ft)			3.984
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	St Georges Bridge Bike Lane	**Distance on Land (mile)**	2.242	2.083	1.974
Trail's ID	322	**Inundated Distance (mile)**	0.285	0.444	0.553
Distance (mile)	2.527	**Land Loss (%)**	11.281	17.574	21.901
County	New Castle	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Michael Castle Trail	**Distance on Land (mile)**	1.405	1.053	0.468
Trail's ID	334	**Inundated Distance (mile)**	0.133	0.484	1.069
Distance (mile)	1.537	**Land Loss (%)**	8.634	31.487	69.564
County	New Castle	**Min Elevation (ft)**	1.127	1.127	1.127
		Max Depth (ft)	0.873	2.873	4.873
		Level of Service	**LOS A**	**L OSD**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Michael Castle Trail	**Distance on Land (mile)**	0.818	0.818	0.791
Trail's ID	335	**Inundated Distance (mile)**	0.003	0.003	0.029
Distance (mile)	0.820	**Land Loss (%)**	0.318	0.318	3.550
County	New Castle	**Min Elevation (ft)**			0.935
		Max Depth (ft)			5.065
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Michael Castle Trail	**Distance on Land (mile)**	5.471	3.891	1.541
Trail's ID	336	**Inundated Distance (mile)**	0.720	2.300	4.650
Distance (mile)	6.191	**Land Loss (%)**	11.624	37.154	75.113
County	New Castle	**Min Elevation (ft)**	0.500	0.500	0.299
		Max Depth (ft)	1.500	3.500	5.701
		Level of Service	**LOS B**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Michael Castle Trail	**Distance on Land (mile)**	1.375	1.327	1.111
Trail's ID	337	**Inundated Distance (mile)**	0.005	0.053	0.270
Distance (mile)	1.380	**Land Loss (%)**	0.396	3.864	19.533
County	New Castle	**Min Elevation (ft)**			1.936
		Max Depth (ft)			4.064
		Level of Service	**LOS A**	**LOS A**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Michael Castle Trail	**Distance on Land (mile)**			0.755
Trail's ID	338	**Inundated Distance (mile)**			0.026
Distance (mile)	0.780	**Land Loss (%)**			3.301
County	New Castle	**Min Elevation (ft)**			3.971
		Max Depth (ft)			2.029
		Level of Service	**LOS A**	**LOS A**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	20.803	19.298	16.649
Trail's ID	381 & 382	**Inundated Distance (mile)**	1.112	2.618	5.267
Distance (mile)	21.916	**Land Loss (%)**	5.075	11.945	24.031
County	New Castle	**Min Elevation (ft)**	0.006	0.006	0.006
		Max Depth (ft)	1.994	3.994	5.994
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	North Canal Road	**Distance on Land (mile)**	1.617	1.017	0.753
Trail's ID	384	**Inundated Distance (mile)**	0.574	1.174	1.438
Distance (mile)	2.190	**Land Loss (%)**	26.188	53.587	65.638
County	New Castle	**Min Elevation (ft)**	0.792	0.659	0.659
		Max Depth (ft)	1.208	3.341	5.341
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Road	**Distance on Land (mile)**	1.462	0.608	
Trail's ID	385	**Inundated Distance (mile)**	0.638	1.491	
Distance (mile)	2.100	**Land Loss (%)**	30.375	71.026	
County	New Castle	**Min Elevation (ft)**	0.643	-0.085	
		Max Depth (ft)	1.357	4.085	
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	2.711	2.270	1.826
Trail's ID	387	**Inundated Distance (mile)**	0.619	1.061	1.504
Distance (mile)	3.331	**Land Loss (%)**	18.595	31.840	45.170
County	New Castle	**Min Elevation (ft)**	0.714	0.716	0.716
		Max Depth (ft)	1.286	3.284	5.284
		Level of Service	**LOS B**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Northern Delaware Greenway Trail	**Distance on Land (mile)**			0.160
Trail's ID	390	**Inundated Distance (mile)**			0.009
Distance (mile)	0.219	**Land Loss (%)**			4.009
County	New Castle	**Min Elevation (ft)**			1.776
		Max Depth (ft)			4.224
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	13.200	12.661	12.114
Trail's ID	392	**Inundated Distance (mile)**	0.558	1.097	1.644
Distance (mile)	13.758	**Land Loss (%)**	4.053	7.972	11.946
County	New Castle	**Min Elevation (ft)**	0.447	-0.250	-0.250
		Max Depth (ft)	1.553	4.250	6.250
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	1.213	1.207	1.201
Trail's ID	393	**Inundated Distance (mile)**	0.051	0.057	0.063
Distance (mile)	1.264	**Land Loss (%)**	4.048	4.542	4.996
County	New Castle	**Min Elevation (ft)**	-0.429	-0.429	-0.429
		Max Depth (ft)	2.429	4.429	6.429
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Coventry Farm Trail	**Distance on Land (mile)**	0.325	0.148	0.814
Trail's ID	406	**Inundated Distance (mile)**	0.212	0.389	0.456
Distance (mile)	0.537	**Land Loss (%)**	39.488	72.519	84.838
County	New Castle	**Min Elevation (ft)**	-0.039	-0.039	-0.039
		Max Depth (ft)	2.039	4.039	6.039
		Level of Service	**LOS C**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		1.855	1.780
Trail's ID	428	**Inundated Distance (mile)**		0.025	0.100
Distance (mile)	1.880	**Land Loss (%)**		1.332	5.333
County	New Castle	**Min Elevation (ft)**		1.906	1.906
		Max Depth (ft)		2.094	4.094
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Coventry Park Trail	**Distance on Land (mile)**		0.408	0.246
Trail's ID	431	**Inundated Distance (mile)**		0.170	0.332
Distance (mile)	0.578	**Land Loss (%)**		29.419	57.399
County	New Castle	**Min Elevation (ft)**		1.521	1.270
		Max Depth (ft)		2.479	4.730
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Wilmington RiverFront	**Distance on Land (mile)**		1.160	0.716
Trail's ID	464	**Inundated Distance (mile)**		0.656	1.100
Distance (mile)	1.816	**Land Loss (%)**		36.121	60.588
County	New Castle	**Min Elevation (ft)**		0.853	0.853
		Max Depth (ft)		3.147	5.147
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Industrial Track Greenway Trail	**Distance on Land (mile)**	2.884	2.884	2.759
Trail's ID	472	**Inundated Distance (mile)**	0.215	0.215	0.341
Distance (mile)	3.099	**Land Loss (%)**	6.952	6.952	10.991
County	New Castle	**Min Elevation (ft)**	-0.907	-0.907	-0.907
		Max Depth (ft)	2.907	4.907	6.907
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Lewden Greene	**Distance on Land (mile)**	1.617	1.461	1.186
Trail's ID	503	**Inundated Distance (mile)**	0.096	0.252	0.528
Distance (mile)	1.713	**Land Loss (%)**	5.612	14.711	30.799
County	New Castle	**Min Elevation (ft)**	0.453	0.453	0.453
		Max Depth (ft)	1.547	3.547	5.547
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	13.915	13.915	13.909
Trail's ID	584	**Inundated Distance (mile)**	0.014	0.014	0.020
Distance (mile)	13.929	**Land Loss (%)**	0.104	0.104	0.146
County	New Castle	**Min Elevation (ft)**	-0.403	-0.403	-0.403
		Max Depth (ft)	2.403	4.403	6.403
		Level of Service	**LOS A**	**LOS A**	**LOS A**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Battery Park Trail	**Distance on Land (mile)**	1.423	0.653	0.040
Trail's ID	685	**Inundated Distance (mile)**	0.734	1.503	1.924
Distance (mile)	2.157	**Land Loss (%)**	34.026	69.715	89.224
County	New Castle	**Min Elevation (ft)**	-0.482	-0.482	-0.482
		Max Depth (ft)	2.482	4.482	6.482
		Level of Service	**LOS C**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Christina Park Trail	**Distance on Land (mile)**	0.221	0.119	0.005
Trail's ID	900	**Inundated Distance (mile)**	0.091	0.194	0.308
Distance (mile)	0.313	**Land Loss (%)**	29.085	62.099	98.285
County	New Castle	**Min Elevation (ft)**	1.168	1.168	0.568
		Max Depth (ft)	0.832	2.832	5.432
		Level of Service	**LOS A**	**LOS F**	**Out Of Service**

A.2 Trails' Level of Service in Kent County

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Parsons Point	**Distance on Land (mile)**	0.340	0.038	0.000
Trail's ID	67	**Inundated Distance (mile)**	0.076	0.378	0.482
Distance (mile)	0.482	**Land Loss (%)**	15.736	78.359	100.000
County	Kent	**Min Elevation (ft)**	1.203	1.203	
		Max Depth (ft)	0.797	3.203	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Raymond Pool	**Distance on Land (mile)**	0.040	0.000	0.000
Trail's ID	68	**Inundated Distance (mile)**	0.112	0.151	0.151
Distance (mile)	0.151	**Land Loss (%)**	73.848	100.000	100.000
County	Kent	**Min Elevation (ft)**	0.618		
		Max Depth (ft)	1.382		
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Shearness	**Distance on Land (mile)**	0.029	0.000	0.000
Trail's ID	69	**Inundated Distance (mile)**	0.101	0.130	0.130
Distance (mile)	0.130	**Land Loss (%)**	77.877	100.000	100.000
County	Kent	**Min Elevation (ft)**	1.572		
		Max Depth (ft)	0.428		
		Level of Service	**LOS E**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Wildlife Drive	**Distance on Land (mile)**	5.511	2.411	0.067
Trail's ID	70	**Inundated Distance (mile)**	0.927	4.026	6.371
Distance (mile)	6.438	**Land Loss (%)**	14.394	62.544	98.957
County	Kent	**Min Elevation (ft)**	-0.477	-0.477	
		Max Depth (ft)	2.477	4.477	
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Boardwalk	**Distance on Land (mile)**	0.003	0.003	0.000
Trail's ID	78	**Inundated Distance (mile)**	0.191	0.192	0.195
Distance (mile)	0.195	**Land Loss (%)**	98.318	98.515	100.000
County	Kent	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**Out of Service**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Boardwalk Trail	**Distance on Land (mile)**	0.022	0.007	0.000
Trail's ID	183	**Inundated Distance (mile)**	0.057	0.073	0.080
Distance (mile)	0.080	**Land Loss (%)**	71.813	91.025	100.000
County	Kent	**Min Elevation (ft)**	1.120	1.120	
		Max Depth (ft)	0.880	2.880	
		Level of Service	**LOS E**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	1.229	0.497	0.184
Trail's ID	184	**Inundated Distance (mile)**	0.698	1.431	1.744
Distance (mile)	1.928	**Land Loss (%)**	36.231	74.205	90.466
County	Kent	**Min Elevation (ft)**	0.882	0.879	0.879
		Max Depth (ft)	1.118	3.121	5.121
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	0.061	0.000	0.000
Trail's ID	185	**Inundated Distance (mile)**	0.189	0.250	0.250
Distance (mile)	0.250	**Land Loss (%)**	75.459	100.000	100.000
County	Kent	**Min Elevation (ft)**	1.125		
		Max Depth (ft)	0.875		
		Level of Service	**LOS E**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	0.000	0.000	0.000
Trail's ID	186	**Inundated Distance (mile)**	0.033	0.034	0.034
Distance (mile)	0.034	**Land Loss (%)**	98.947	100.000	100.000
County	Kent	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**Out of Service**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Silver Lake Recreation Area Dover	**Distance on Land (mile)**	0.692	0.436	0.321
Trail's ID	205	**Inundated Distance (mile)**	0.153	0.409	0.523
Distance (mile)	0.845	**Land Loss (%)**	18.066	48.378	61.963
County	Kent	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	0.192	0.162	0.080
Trail's ID	264	**Inundated Distance (mile)**	0.262	0.292	0.373
Distance (mile)	0.454	**Land Loss (%)**	57.799	64.327	82.275
County	Kent	**Min Elevation (ft)**	0.694	0.738	0.738
		Max Depth (ft)	1.306	3.262	5.262
		Level of Service	**LOS D**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	1.491	0.345	0.125
Trail's ID	265	**Inundated Distance (mile)**	0.534	1.679	1.900
Distance (mile)	2.025	**Land Loss (%)**	26.375	82.939	93.825
County	Kent	**Min Elevation (ft)**	1.100	1.100	
		Max Depth (ft)	0.900	2.900	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	0.226	0.053	0.000
Trail's ID	266	**Inundated Distance (mile)**	0.033	0.206	0.259
Distance (mile)	0.259	**Land Loss (%)**	12.719	79.397	100.000
County	Kent	**Min Elevation (ft)**	1.308	1.308	
		Max Depth (ft)	0.692	2.692	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	St. Jones Reserve	**Distance on Land (mile)**	0.511	0.187	0.035
Trail's ID	285 & 286 &287 & 288	**Inundated Distance (mile)**	0.540	0.864	1.016
Distance (mile)	1.051	**Land Loss (%)**	51.368	82.178	96.675
County	Kent	**Min Elevation (ft)**	0.776	0.776	0.776
		Max Depth (ft)	1.224	3.224	5.224
		Level of Service	**LOS D**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Bike Lane	**Distance on Land (mile)**	0.402	0.402	0.402
Trail's ID	292	**Inundated Distance (mile)**	0.021	0.021	0.021
Distance (mile)	0.422	**Land Loss (%)**	4.855	4.855	4.855
County	Kent	**Min Elevation (ft)**	-0.498	-0.498	-0.498
		Max Depth (ft)	2.498	4.498	6.498
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Capital City Trail Phase 1	**Distance on Land (mile)**	0.655	0.655	0.655
Trail's ID	327	**Inundated Distance (mile)**	0.011	0.011	0.011
Distance (mile)	0.666	**Land Loss (%)**	1.693	1.693	1.693
County	Kent	**Min Elevation (ft)**	-0.499	-0.499	-0.499
		Max Depth (ft)	2.499	4.499	4.499
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Capital City Trail Phase 2	**Distance on Land (mile)**	0.193	0.182	0.182
Trail's ID	328	**Inundated Distance (mile)**	0.023	0.035	0.035
Distance (mile)	0.217	**Land Loss (%)**	10.829	16.200	16.200
County	Kent	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Capital City Trail Phase 3	**Distance on Land (mile)**		0.142	0.052
Trail's ID	329	**Inundated Distance (mile)**		0.111	0.201
Distance (mile)	0.253	**Land Loss (%)**		43.789	79.565
County	Kent	**Min Elevation (ft)**		1.703	1.703
		Max Depth (ft)		2.297	4.297
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	AREC Trail	**Distance on Land (mile)**	0.115	0.009	
Trail's ID	468	**Inundated Distance (mile)**	0.219	0.325	
Distance (mile)	0.335	**Land Loss (%)**	65.567	97.163	
County	Kent	**Min Elevation (ft)**	-0.249	-0.249	
		Max Depth (ft)	2.249	4.249	
		Level of Service	**LOS D**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	3.400	2.729	2.253
Trail's ID	565	**Inundated Distance (mile)**	0.522	1.193	1.668
Distance (mile)	3.921	**Land Loss (%)**	13.301	30.416	42.551
County	Kent	**Min Elevation (ft)**	1.025	1.017	0.745
		Max Depth (ft)	0.975	2.983	5.255
		Level of Service	**LOS A**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	0.148	0.003	
Trail's ID	566	**Inundated Distance (mile)**	0.062	0.207	
Distance (mile)	0.210	**Land Loss (%)**	29.529	98.767	
County	Kent	**Min Elevation (ft)**	1.131	1.131	
		Max Depth (ft)	0.869	2.869	
		Level of Service	**LOS A**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Tidbury Creek Trail	**Distance on Land (mile)**			0.602
Trail's ID	597	**Inundated Distance (mile)**			0.219
Distance (mile)	0.822	**Land Loss (%)**			26.674
County	Kent	**Min Elevation (ft)**			2.269
		Max Depth (ft)			3.731
		Level of Service	**LOS A**	**LOS A**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Mispillion Riverwalk	**Distance on Land (mile)**	0.208	0.303	0.048
Trail's ID	716 & 717 & 741 &742	**Inundated Distance (mile)**	0.372	0.788	1.043
Distance (mile)	1.091	**Land Loss (%)**	34.065	72.197	95.611
County	Kent	**Min Elevation (ft)**	0.108	-0.500	-0.500
		Max Depth (ft)	1.892	4.500	6.500
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Mispillion Riverwalk	**Distance on Land (mile)**	0.357	0.062	0.004
Trail's ID	718 & 743	**Inundated Distance (mile)**	0.075	0.447	0.505
Distance (mile)	0.509	**Land Loss (%)**	14.675	87.817	99.209
County	Kent	**Min Elevation (ft)**	-0.487	-0.487	-0.487
		Max Depth (ft)	2.487	4.487	6.487
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	3.881	3.018	2.228
Trail's ID	746	**Inundated Distance (mile)**	0.532	1.395	2.186
Distance (mile)	4.413	**Land Loss (%)**	12.064	31.613	49.528
County	Kent	**Min Elevation (ft)**	0.706	0.706	0.706
		Max Depth (ft)	1.294	3.294	5.294
		Level of Service	**LOS B**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Issaacs Branch Trail Phase 2	**Distance on Land (mile)**	1.159	1.129	1.089
Trail's ID	884	**Inundated Distance (mile)**	0.025	0.054	0.095
Distance (mile)	1.184	**Land Loss (%)**	2.102	4.585	8.008
County	Kent	**Min Elevation (ft)**	-0.046	-0.046	-0.046
		Max Depth (ft)	2.046	4.046	6.046
		Level of Service	**LOS A**	**LOS B**	**LOS B**

A.3 Trails' Level of Service in Sussex County

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Barnes Woods Nature Trail	**Distance on Land (mile)**	0.723	0.627	0.531
Trail's ID	3	**Inundated Distance (mile)**	0.031	0.127	0.223
Distance (mile)	0.754	**Land Loss (%)**	4.112	16.787	29.550
County	Sussex	**Min Elevation (ft)**	0.617	0.260	0.260
		Max Depth (ft)	1.383	3.740	5.740
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**	0.050	0.023	0.011
Trail's ID	4	**Inundated Distance (mile)**	0.000	0.027	0.039
Distance (mile)	0.050	**Land Loss (%)**	0.816	53.693	77.266
County	Sussex	**Min Elevation (ft)**		0.636	0.636
		Max Depth (ft)		3.364	5.364
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Burton Island Trail	**Distance on Land (mile)**	0.497	0.053	0.000
Trail's ID	66	**Inundated Distance (mile)**	0.454	0.898	0.951
Distance (mile)	0.951	**Land Loss (%)**	47.780	94.468	100.000
County	Sussex	**Min Elevation (ft)**	-0.500	-0.500	
		Max Depth (ft)	2.500	4.500	
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Assawoman Canal (Phase 1)	**Distance on Land (mile)**	1.013	0.968	0.703
Trail's ID	106	**Inundated Distance (mile)**	0.043	0.088	0.352
Distance (mile)	1.056	**Land Loss (%)**	4.061	8.289	33.358
County	Sussex	**Min Elevation (ft)**	-0.055	-0.468	-0.468
		Max Depth (ft)	2.055	4.468	6.468
		Level of Service	**LOS A**	**LOS B**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	0.133	0.000	0.000
Trail's ID	107	**Inundated Distance (mile)**	0.001	0.317	0.317
Distance (mile)	0.317	**Land Loss (%)**	0.373	100.000	100.000
County	Sussex	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**LOS A**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Refuge	**Distance on Land (mile)**	0.803	0.087	0.000
Trail's ID	108	**Inundated Distance (mile)**	1.954	2.670	2.757
Distance (mile)	2.757	**Land Loss (%)**	70.884	96.843	100.000
County	Sussex	**Min Elevation (ft)**	-0.478	-0.478	
		Max Depth (ft)	2.478	1.522	
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	0.156	0.000	0.000
Trail's ID	109	**Inundated Distance (mile)**	0.066	0.222	0.222
Distance (mile)	0.222	**Land Loss (%)**	29.554	100.000	100.000
County	Sussex	**Min Elevation (ft)**	-0.005		
		Max Depth (ft)	2.005		
		Level of Service	**LOSB**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	2.457	1.190	0.498
Trail's ID	111	**Inundated Distance (mile)**	0.334	1.301	2.294
Distance (mile)	2.792	**Land Loss (%)**	11.976	46.619	82.171
County	Sussex	**Min Elevation (ft)**	0.527	0.501	0.501
		Max Depth (ft)	1.473	3.499	5.499
		Level of Service	**LOS B**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Broad Creek Greenway	**Distance on Land (mile)**		0.008	0.000
Trail's ID	175	**Inundated Distance (mile)**		0.059	0.067
Distance (mile)	0.067	**Land Loss (%)**		88.422	100.000
County	Sussex	**Min Elevation (ft)**		1.154	
		Max Depth (ft)		2.846	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Laurel River Park Trail	**Distance on Land (mile)**		0.068	0.053
Trail's ID	177	**Inundated Distance (mile)**		0.085	0.100
Distance (mile)	0.153	**Land Loss (%)**		55.542	65.165
County	Sussex	**Min Elevation (ft)**		0.831	0.831
		Max Depth (ft)		3.169	5.169
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Canary Creek Trail	**Distance on Land (mile)**	0.328	0.109	0.000
Trail's ID	180	**Inundated Distance (mile)**	0.314	0.532	0.641
Distance (mile)	0.641	**Land Loss (%)**	48.913	83.008	100.000
County	Sussex	**Min Elevation (ft)**	0.579	0.579	
		Max Depth (ft)	1.421	3.421	
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	New Road Pathway	**Distance on Land (mile)**	1.098	1.011	0.847
Trail's ID	181	**Inundated Distance (mile)**	0.082	0.168	0.333
Distance (mile)	1.180	**Land Loss (%)**	6.920	14.257	28.207
County	Sussex	**Min Elevation (ft)**	0.929	0.929	0.929
		Max Depth (ft)	1.071	3.071	5.071
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Canary Creek Trail	**Distance on Land (mile)**	0.069	0.031	0.000
Trail's ID	182	**Inundated Distance (mile)**	0.008	0.188	0.218
Distance (mile)	0.218	**Land Loss (%)**	3.703	85.839	100.000
County	Sussex	**Min Elevation (ft)**	0.830	0.150	
		Max Depth (ft)	1.170	3.850	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**		0.006	0.006
Trail's ID	210	**Inundated Distance (mile)**		0.012	0.012
Distance (mile)	0.018	**Land Loss (%)**		65.625	65.625
County	Sussex	**Min Elevation (ft)**		1.457	1.457
		Max Depth (ft)		2.543	4.543
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dune Crossing	**Distance on Land (mile)**		0.092	0.059
Trail's ID	211	**Inundated Distance (mile)**		0.010	0.043
Distance (mile)	0.102	**Land Loss (%)**		9.585	41.923
County	Sussex	**Min Elevation (ft)**		1.650	1.476
		Max Depth (ft)		2.350	4.524
		Level of Service	**LOS A**	**LOS B**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**		0.545	0.526
Trail's ID	212	**Inundated Distance (mile)**		0.008	0.027
Distance (mile)	0.553	**Land Loss (%)**		1.430	4.797
County	Sussex	**Min Elevation (ft)**		1.321	1.321
		Max Depth (ft)		2.679	4.679
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**	0.181	0.065	0.000
Trail's ID	242	**Inundated Distance (mile)**	0.026	0.142	0.207
Distance (mile)	0.207	**Land Loss (%)**	12.487	68.504	100.000
County	Sussex	**Min Elevation (ft)**	0.511	0.511	
		Max Depth (ft)	1.489	3.489	
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**	0.112	0.000	0.000
Trail's ID	243	**Inundated Distance (mile)**	0.180	0.292	0.292
Distance (mile)	0.292	**Land Loss (%)**	61.608	100.000	100.000
County	Sussex	**Min Elevation (ft)**	-0.482		
		Max Depth (ft)	2.482		
		Level of Service	**LOS D**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Fred Hudson Road Trail	**Distance on Land (mile)**	0.070	0.014	0.000
Trail's ID	244	**Inundated Distance (mile)**	0.242	0.298	0.312
Distance (mile)	0.312	**Land Loss (%)**	77.456	95.392	100.000
County	Sussex	**Min Elevation (ft)**	0.404	0.401	
		Max Depth (ft)	1.596	3.599	
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Fred Hudson Road Trail	**Distance on Land (mile)**	0.001	0.000	0.000
Trail's ID	245	**Inundated Distance (mile)**	0.073	0.074	0.074
Distance (mile)	0.074	**Land Loss (%)**	98.585	100.000	100.000
County	Sussex	**Min Elevation (ft)**			
		Max Depth (ft)			
		Level of Service	**Out of Service**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Fred Hudson Road Trail	**Distance on Land (mile)**	0.387	0.018	0.000
Trail's ID	246	**Inundated Distance (mile)**	0.201	0.571	0.588
Distance (mile)	0.588	**Land Loss (%)**	34.188	96.993	100.000
County	Sussex	**Min Elevation (ft)**	-0.085	-0.085	
		Max Depth (ft)	2.085	4.085	
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Prickly Pear Trail	**Distance on Land (mile)**	0.918	0.506	0.025
Trail's ID	247	**Inundated Distance (mile)**	0.021	0.434	0.915
Distance (mile)	0.940	**Land Loss (%)**	2.256	46.147	97.344
County	Sussex	**Min Elevation (ft)**	0.695	0.695	0.695
		Max Depth (ft)	1.305	3.305	5.305
		Level of Service	**LOS A**	**LOS D**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Prickly Pear Trail	**Distance on Land (mile)**		2.183	0.899
Trail's ID	249	**Inundated Distance (mile)**		0.293	1.576
Distance (mile)	2.476	**Land Loss (%)**		11.832	63.672
County	Sussex	**Min Elevation (ft)**		0.850	0.850
		Max Depth (ft)		3.150	5.150
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Prickly Pear Trail cut-off	**Distance on Land (mile)**		0.037	0.000
Trail's ID	250	**Inundated Distance (mile)**		0.053	0.090
Distance (mile)	0.090	**Land Loss (%)**		58.892	100.000
County	Sussex	**Min Elevation (ft)**		1.134	
		Max Depth (ft)		2.866	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Prickly Pear Trail cut-off	**Distance on Land (mile)**			0.031
Trail's ID	251	**Inundated Distance (mile)**			0.052
Distance (mile)	0.084	**Land Loss (%)**			62.457
County	Sussex	**Min Elevation (ft)**			1.671
		Max Depth (ft)			4.329
		Level of Service	**LOS A**	**LOS A**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Access Trail	**Distance on Land (mile)**	0.048	0.026	0.000
Trail's ID	252	**Inundated Distance (mile)**	0.003	0.025	0.051
Distance (mile)	0.051	**Land Loss (%)**	5.328	48.600	100.000
County	Sussex	**Min Elevation (ft)**		-0.139	
		Max Depth (ft)		4.139	
		Level of Service	**LOS A**	**LOS D**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Access Trail	**Distance on Land (mile)**	0.069	0.010	0.000
Trail's ID	253	**Inundated Distance (mile)**	0.023	0.081	0.092
Distance (mile)	0.092	**Land Loss (%)**	24.943	88.615	100.000
County	Sussex	**Min Elevation (ft)**	0.479	0.281	
		Max Depth (ft)	1.521	3.719	
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sea Hawk /Seahorse Trail	**Distance on Land (mile)**	0.341	0.272	0.154
Trail's ID	258	**Inundated Distance (mile)**	0.024	0.093	0.211
Distance (mile)	0.365	**Land Loss (%)**	6.488	25.529	57.800
County	Sussex	**Min Elevation (ft)**	0.928	0.826	0.772
		Max Depth (ft)	1.072	3.174	5.228
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sea Hawk Trail	**Distance on Land (mile)**		0.164	0.070
Trail's ID	259	**Inundated Distance (mile)**		0.050	0.143
Distance (mile)	0.214	**Land Loss (%)**		23.411	67.079
County	Sussex	**Min Elevation (ft)**		0.831	0.831
		Max Depth (ft)		3.169	5.169
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sea Hawk Trail	**Distance on Land (mile)**	0.465	0.274	0.066
Trail's ID	260	**Inundated Distance (mile)**	0.064	0.256	0.463
Distance (mile)	0.529	**Land Loss (%)**	12.168	48.293	87.494
County	Sussex	**Min Elevation (ft)**	0.387	0.489	0.387
		Max Depth (ft)	1.613	3.511	5.613
		Level of Service	**LOS B**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Seahorse Trail	**Distance on Land (mile)**			0.514
Trail's ID	261	**Inundated Distance (mile)**			0.305
Distance (mile)	0.819	**Land Loss (%)**			37.208
County	Sussex	**Min Elevation (ft)**			1.246
		Max Depth (ft)			4.754
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**			0.140
Trail's ID	262	**Inundated Distance (mile)**			0.016
Distance (mile)	0.156	**Land Loss (%)**			10.487
County	Sussex	**Min Elevation (ft)**			2.147
		Max Depth (ft)			3.853
		Level of Service	**LOS A**	**LOS A**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Fishermans Walkway	**Distance on Land (mile)**	0.191	0.048	0.025
Trail's ID	274	**Inundated Distance (mile)**	0.121	0.264	0.287
Distance (mile)	0.312	**Land Loss (%)**	38.677	84.580	91.993
County	Sussex	**Min Elevation (ft)**	-0.297	-0.297	-0.297
		Max Depth (ft)	2.297	4.297	6.297
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**			0.469
Trail's ID	276	**Inundated Distance (mile)**			0.049
Distance (mile)	0.519	**Land Loss (%)**			9.500
County	Sussex	**Min Elevation (ft)**			1.252
		Max Depth (ft)			4.748
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**		0.137	0.131
Trail's ID	277	**Inundated Distance (mile)**		0.040	0.046
Distance (mile)	0.177	**Land Loss (%)**		22.827	26.006
County	Sussex	**Min Elevation (ft)**		1.422	1.422
		Max Depth (ft)		2.578	4.578
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	0.396	0.095	0.000
Trail's ID	278	**Inundated Distance (mile)**	0.096	0.397	0.493
Distance (mile)	0.493	**Land Loss (%)**	19.579	80.705	100.000
County	Sussex	**Min Elevation (ft)**	0.612	0.612	
		Max Depth (ft)	1.388	3.388	
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Fred Hudson Road Pathway	**Distance on Land (mile)**		0.484	0.338
Trail's ID	298	**Inundated Distance (mile)**		0.298	0.444
Distance (mile)	0.782	**Land Loss (%)**		38.084	56.771
County	Sussex	**Min Elevation (ft)**		1.074	1.074
		Max Depth (ft)		2.926	4.926
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Route 1 Bike Lane	**Distance on Land (mile)**	0.421	0.199	0.129
Trail's ID	312	**Inundated Distance (mile)**	0.094	0.316	0.385
Distance (mile)	0.514	**Land Loss (%)**	18.235	61.344	74.931
County	Sussex	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		0.019	0.000
Trail's ID	316	**Inundated Distance (mile)**		0.199	0.218
Distance (mile)	0.218	**Land Loss (%)**		91.226	100.000
County	Sussex	**Min Elevation (ft)**		0.850	
		Max Depth (ft)		3.150	
		Level of Service	**LOS A**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**			0.003
Trail's ID	317	**Inundated Distance (mile)**			0.079
Distance (mile)	0.082	**Land Loss (%)**			96.712
County	Sussex	**Min Elevation (ft)**			1.825
		Max Depth (ft)			4.175
		Level of Service	**LOS A**	**LOS A**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	0.833	0.420	0.021
Trail's ID	318	**Inundated Distance (mile)**	0.255	0.668	1.066
Distance (mile)	1.087	**Land Loss (%)**	23.411	61.409	98.066
County	Sussex	**Min Elevation (ft)**	0.506	0.402	0.402
		Max Depth (ft)	1.494	3.598	5.598
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	American Discovery Trail	**Distance on Land (mile)**			0.091
Trail's ID	339	**Inundated Distance (mile)**			0.040
Distance (mile)	0.131	**Land Loss (%)**			30.668
County	Sussex	**Min Elevation (ft)**			1.876
		Max Depth (ft)			4.124
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	American Discovery Trail	**Distance on Land (mile)**		0.119	0.016
Trail's ID	340	**Inundated Distance (mile)**		0.057	0.161
Distance (mile)	0.177	**Land Loss (%)**		32.473	90.922
County	Sussex	**Min Elevation (ft)**		1.547	1.547
		Max Depth (ft)		2.453	4.453
		Level of Service	**LOS A**	**LOS D**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	American Discovery Trail	**Distance on Land (mile)**		0.075	0.057
Trail's ID	341	**Inundated Distance (mile)**		0.017	0.034
Distance (mile)	0.092	**Land Loss (%)**		18.493	37.475
County	Sussex	**Min Elevation (ft)**		1.161	1.161
		Max Depth (ft)		2.839	4.839
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	American Discovery Trail/Bike Loop	**Distance on Land (mile)**		0.341	0.024
Trail's ID	342	**Inundated Distance (mile)**		0.409	0.726
Distance (mile)	0.750	**Land Loss (%)**		54.577	96.858
County	Sussex	**Min Elevation (ft)**		1.579	1.579
		Max Depth (ft)		2.421	4.421
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Bike Loop	**Distance on Land (mile)**		1.879	1.356
Trail's ID	343	**Inundated Distance (mile)**		0.795	1.318
Distance (mile)	2.674	**Land Loss (%)**		29.721	49.284
County	Sussex	**Min Elevation (ft)**		1.255	1.255
		Max Depth (ft)		2.745	4.745
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**		0.086	0.085
Trail's ID	346	**Inundated Distance (mile)**		0.075	0.077
Distance (mile)	0.162	**Land Loss (%)**		46.576	47.710
County	Sussex	**Min Elevation (ft)**		1.352	1.352
		Max Depth (ft)		2.648	4.648
		Level of Service	**LOS A**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**		0.039	0.013
Trail's ID	349	**Inundated Distance (mile)**		0.016	0.042
Distance (mile)	0.055	**Land Loss (%)**		29.951	76.727
County	Sussex	**Min Elevation (ft)**		1.422	1.422
		Max Depth (ft)		2.578	4.578
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Connector	**Distance on Land (mile)**	0.211	0.044	
Trail's ID	351	**Inundated Distance (mile)**	0.152	0.319	
Distance (mile)	0.363	**Land Loss (%)**	41.857	87.816	
County	Sussex	**Min Elevation (ft)**	0.805	0.805	
		Max Depth (ft)	1.195	3.195	
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dune overlook	**Distance on Land (mile)**			0.073
Trail's ID	355	**Inundated Distance (mile)**			0.050
Distance (mile)	0.123	**Land Loss (%)**			40.990
County	Sussex	**Min Elevation (ft)**			1.955
		Max Depth (ft)			4.045
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Gordons Pond Trail	**Distance on Land (mile)**	0.035		
Trail's ID	356	**Inundated Distance (mile)**	0.016		
Distance (mile)	0.051	**Land Loss (%)**	32.021		
County	Sussex	**Min Elevation (ft)**	0.930		
		Max Depth (ft)	1.070		
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Gordons Pond Trail	**Distance on Land (mile)**	1.048	0.784	0.643
Trail's ID	357 & 358	**Inundated Distance (mile)**	2.102	2.366	2.507
Distance (mile)	3.150	**Land Loss (%)**	66.743	75.109	79.584
County	Sussex	**Min Elevation (ft)**	0.456	0.456	0.456
		Max Depth (ft)	1.544	3.544	5.544
		Level of Service	**LOS D**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Junction & Breakwater Trail	**Distance on Land (mile)**	2.572	2.351	2.187
Trail's ID	361	**Inundated Distance (mile)**	0.273	0.494	0.658
Distance (mile)	2.845	**Land Loss (%)**	9.588	17.374	23.122
County	Sussex	**Min Elevation (ft)**	-0.019	-0.019	-0.324
		Max Depth (ft)	2.019	4.019	6.324
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**		0.072	0.049
Trail's ID	362	**Inundated Distance (mile)**		0.014	0.037
Distance (mile)	0.086	**Land Loss (%)**		16.350	42.626
County	Sussex	**Min Elevation (ft)**		1.783	1.783
		Max Depth (ft)		2.217	4.217
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**	0.428	0.349	0.206
Trail's ID	364	**Inundated Distance (mile)**	0.011	0.089	0.233
Distance (mile)	0.439	**Land Loss (%)**	2.497	20.326	53.048
County	Sussex	**Min Elevation (ft)**	1.230	1.230	1.123
		Max Depth (ft)	0.770	2.770	4.877
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**		0.076	0.058
Trail's ID	365	**Inundated Distance (mile)**		0.011	0.029
Distance (mile)	0.087	**Land Loss (%)**		12.994	33.459
County	Sussex	**Min Elevation (ft)**		1.484	1.484
		Max Depth (ft)		2.516	4.516
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**		0.076	0.058
Trail's ID	365	**Inundated Distance (mile)**		0.011	0.029
Distance (mile)	0.087	**Land Loss (%)**		12.994	33.459
County	Sussex	**Min Elevation (ft)**		1.484	1.484
		Max Depth (ft)		2.516	4.516
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**			0.012
Trail's ID	366	**Inundated Distance (mile)**			0.046
Distance (mile)	0.058	**Land Loss (%)**			79.398
County	Sussex	**Min Elevation (ft)**			1.644
		Max Depth (ft)			4.356
		Level of Service	**LOS A**	**LOS A**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pedestrian Beach Crossing	**Distance on Land (mile)**			0.056
Trail's ID	367	**Inundated Distance (mile)**			0.085
Distance (mile)	0.140	**Land Loss (%)**			60.350
County	Sussex	**Min Elevation (ft)**			1.885
		Max Depth (ft)			4.115
		Level of Service	**LOS A**	**LOS A**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pinelands Nature Trail	**Distance on Land (mile)**		0.238	0.078
Trail's ID	369	**Inundated Distance (mile)**		1.248	1.409
Distance (mile)	1.487	**Land Loss (%)**		83.962	94.749
County	Sussex	**Min Elevation (ft)**		1.174	1.174
		Max Depth (ft)		2.826	4.826
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Salt Marsh Spur	**Distance on Land (mile)**	0.412	0.191	0.066
Trail's ID	370	**Inundated Distance (mile)**	0.113	0.333	0.458
Distance (mile)	0.524	**Land Loss (%)**	21.496	63.575	87.405
County	Sussex	**Min Elevation (ft)**	0.681	0.681	0.681
		Max Depth (ft)	1.319	3.319	5.319
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Salt Marsh Spur	**Distance on Land (mile)**	0.284	0.099	0.007
Trail's ID	371	**Inundated Distance (mile)**	0.379	0.565	0.657
Distance (mile)	0.663	**Land Loss (%)**	57.121	85.099	98.966
County	Sussex	**Min Elevation (ft)**	0.372	0.372	
		Max Depth (ft)	1.628	3.628	
		Level of Service	**LOS D**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Seaside Nature Trail	**Distance on Land (mile)**	0.568	0.299	0.075
Trail's ID	372	**Inundated Distance (mile)**	0.082	0.351	0.575
Distance (mile)	0.650	**Land Loss (%)**	12.596	53.950	88.521
County	Sussex	**Min Elevation (ft)**	0.584	0.584	0.584
		Max Depth (ft)	1.416	3.416	5.416
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		0.020	
Trail's ID	373	**Inundated Distance (mile)**		0.048	
Distance (mile)	0.068	**Land Loss (%)**		70.843	
County	Sussex	**Min Elevation (ft)**		1.399	
		Max Depth (ft)		2.601	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**		0.015	
Trail's ID	374	**Inundated Distance (mile)**		0.008	
Distance (mile)	0.023	**Land Loss (%)**		34.027	
County	Sussex	**Min Elevation (ft)**		1.163	
		Max Depth (ft)		2.837	
		Level of Service	**LOS A**	**LOS D**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Walking Dunes Trail	**Distance on Land (mile)**	0.761	0.920	0.886
Trail's ID	376 & 377 & 378	**Inundated Distance (mile)**	0.627	0.825	1.041
Distance (mile)	1.927	**Land Loss (%)**	32.530	42.800	54.040
County	Sussex	**Min Elevation (ft)**	0.434	0.426	0.426
		Max Depth (ft)	1.566	3.574	5.574
		Level of Service	**LOS C**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Walking Dunes Trail	**Distance on Land (mile)**	0.356	0.243	0.060
Trail's ID	379	**Inundated Distance (mile)**	0.016	0.130	0.313
Distance (mile)	0.372	**Land Loss (%)**	4.373	34.857	83.984
County	Sussex	**Min Elevation (ft)**	0.006	0.006	0.006
		Max Depth (ft)	1.994	3.994	5.994
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Black Farm	**Distance on Land (mile)**	0.123	0.064	0.013
Trail's ID	414	**Inundated Distance (mile)**	0.030	0.088	0.140
Distance (mile)	0.152	**Land Loss (%)**	19.503	57.693	91.591
County	Sussex	**Min Elevation (ft)**	1.056	1.056	1.056
		Max Depth (ft)	0.944	2.944	4.944
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Junction & Breakwater Trail	**Distance on Land (mile)**		0.217	0.198
Trail's ID	423	**Inundated Distance (mile)**		0.017	0.035
Distance (mile)	0.234	**Land Loss (%)**		7.152	15.196
County	Sussex	**Min Elevation (ft)**		0.881	0.881
		Max Depth (ft)		3.119	5.119
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Black Farm	**Distance on Land (mile)**	1.462	0.830	0.226
Trail's ID	438	**Inundated Distance (mile)**	0.038	0.671	1.275
Distance (mile)	1.500	**Land Loss (%)**	2.521	44.705	84.959
County	Sussex	**Min Elevation (ft)**	0.749	0.749	0.568
		Max Depth (ft)	1.251	3.251	5.432
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Blue Goose	**Distance on Land (mile)**	0.964	0.536	0.141
Trail's ID	439	**Inundated Distance (mile)**	0.657	1.085	1.480
Distance (mile)	1.621	**Land Loss (%)**	40.510	66.938	91.288
County	Sussex	**Min Elevation (ft)**	0.593	0.593	0.452
		Max Depth (ft)	1.407	3.407	5.548
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Boardwalk	**Distance on Land (mile)**	0.159	0.043	
Trail's ID	440	**Inundated Distance (mile)**	0.324	0.440	
Distance (mile)	0.483	**Land Loss (%)**	67.045	91.133	
County	Sussex	**Min Elevation (ft)**	0.258	0.258	
		Max Depth (ft)	1.742	3.742	
		Level of Service	**LOS D**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dike Trail	**Distance on Land (mile)**	0.066		
Trail's ID	441	**Inundated Distance (mile)**	0.441		
Distance (mile)	0.506	**Land Loss (%)**	87.066		
County	Sussex	**Min Elevation (ft)**	0.575		
		Max Depth (ft)	1.425		
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Photography Blind	**Distance on Land (mile)**	0.063		
Trail's ID	442	**Inundated Distance (mile)**	0.240		
Distance (mile)	0.303	**Land Loss (%)**	79.293		
County	Sussex	**Min Elevation (ft)**	0.504		
		Max Depth (ft)	1.496		
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Pine Grove	**Distance on Land (mile)**	0.671	0.291	0.070
Trail's ID	443	**Inundated Distance (mile)**	0.130	0.509	0.730
Distance (mile)	0.800	**Land Loss (%)**	16.201	63.648	91.236
County	Sussex	**Min Elevation (ft)**	0.988	0.720	0.658
		Max Depth (ft)	1.012	3.280	5.342
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	0.383	0.168	
Trail's ID	444	**Inundated Distance (mile)**	0.184	0.398	
Distance (mile)	0.556	**Land Loss (%)**	32.984	71.520	
County	Sussex	**Min Elevation (ft)**	0.998	0.981	
		Max Depth (ft)	1.002	3.019	
		Level of Service	**LOS C**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**		0.296	0.186
Trail's ID	445	**Inundated Distance (mile)**		0.043	0.154
Distance (mile)	0.339	**Land Loss (%)**		12.664	45.225
County	Sussex	**Min Elevation (ft)**		1.136	1.136
		Max Depth (ft)		2.864	4.864
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	0.542	0.020	
Trail's ID	446	**Inundated Distance (mile)**	0.044	0.566	
Distance (mile)	0.586	**Land Loss (%)**	7.465	96.612	
County	Sussex	**Min Elevation (ft)**	0.805	0.690	
		Max Depth (ft)	1.195	3.310	
		Level of Service	**LOS A**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Seaford Riverwalk	**Distance on Land (mile)**		0.024	
Trail's ID	524	**Inundated Distance (mile)**		0.077	
Distance (mile)	0.102	**Land Loss (%)**		75.904	
County	Sussex	**Min Elevation (ft)**		1.247	
		Max Depth (ft)		2.753	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		0.426	0.426
Trail's ID	562	**Inundated Distance (mile)**		0.338	0.338
Distance (mile)	0.764	**Land Loss (%)**		44.250	44.250
County	Sussex	**Min Elevation (ft)**		1.033	1.033
		Max Depth (ft)		2.967	4.967
		Level of Service	**LOS A**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Thompson Island Trail	**Distance on Land (mile)**		0.276	0.105
Trail's ID	567	**Inundated Distance (mile)**		0.387	0.558
Distance (mile)	0.663	**Land Loss (%)**		58.419	84.173
County	Sussex	**Min Elevation (ft)**		0.322	0.322
		Max Depth (ft)		3.678	5.678
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Greenway Trail	**Distance on Land (mile)**	1.814	1.749	1.646
Trail's ID	568	**Inundated Distance (mile)**	0.123	0.188	0.291
Distance (mile)	1.937	**Land Loss (%)**	6.367	9.684	15.033
County	Sussex	**Min Elevation (ft)**	0.406	0.406	0.406
		Max Depth (ft)	1.594	3.594	5.594
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail	**Distance on Land (mile)**			0.140
Trail's ID	591	**Inundated Distance (mile)**			0.062
Distance (mile)	0.202	**Land Loss (%)**			30.876
County	Sussex	**Min Elevation (ft)**			2.115
		Max Depth (ft)			3.885
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Blue Trail	**Distance on Land (mile)**	0.142	0.051	
Trail's ID	594	**Inundated Distance (mile)**	0.028	0.119	
Distance (mile)	0.170	**Land Loss (%)**	16.582	70.122	
County	Sussex	**Min Elevation (ft)**	0.714	0.714	
		Max Depth (ft)	1.286	3.286	
		Level of Service	**LOS B**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Green Trail	**Distance on Land (mile)**			0.130
Trail's ID	595	**Inundated Distance (mile)**			0.087
Distance (mile)	0.217	**Land Loss (%)**			40.092
County	Sussex	**Min Elevation (ft)**			0.640
		Max Depth (ft)			5.360
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Orange Trail	**Distance on Land (mile)**		0.138	0.015
Trail's ID	596	**Inundated Distance (mile)**		0.195	0.318
Distance (mile)	0.333	**Land Loss (%)**		58.511	95.501
County	Sussex	**Min Elevation (ft)**		0.640	0.358
		Max Depth (ft)		3.360	0.358
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Purple Trail	**Distance on Land (mile)**		0.491	0.291
Trail's ID	611	**Inundated Distance (mile)**		0.257	0.457
Distance (mile)	0.748	**Land Loss (%)**		34.348	61.137
County	Sussex	**Min Elevation (ft)**		1.042	1.042
		Max Depth (ft)		2.958	4.958
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Red Trail	**Distance on Land (mile)**		0.373	0.323
Trail's ID	612	**Inundated Distance (mile)**		0.103	0.153
Distance (mile)	0.477	**Land Loss (%)**		21.658	32.127
County	Sussex	**Min Elevation (ft)**		0.876	0.876
		Max Depth (ft)		3.124	5.124
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	James Farm Ecological Preserve Trail - Yellow Trail	**Distance on Land (mile)**		0.116	0.090
Trail's ID	613	**Inundated Distance (mile)**		0.014	0.040
Distance (mile)	0.130	**Land Loss (%)**		10.598	30.559
County	Sussex	**Min Elevation (ft)**		1.258	0.846
		Max Depth (ft)		2.742	5.154
		Level of Service	**LOS A**	**LOS B**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		2.559	1.077
Trail's ID	699	**Inundated Distance (mile)**		0.446	1.928
Distance (mile)	3.004	**Land Loss (%)**		14.838	64.167
County	Sussex	**Min Elevation (ft)**		0.868	0.458
		Max Depth (ft)		3.132	5.542
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**		0.501	0.166
Trail's ID	727	**Inundated Distance (mile)**		0.152	0.487
Distance (mile)	0.653	**Land Loss (%)**		23.241	74.593
County	Sussex	**Min Elevation (ft)**		1.121	0.785
		Max Depth (ft)		2.879	5.215
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	1.068	1.034	0.471
Trail's ID	728	**Inundated Distance (mile)**	0.022	0.056	0.619
Distance (mile)	1.090	**Land Loss (%)**	2.049	5.177	56.769
County	Sussex	**Min Elevation (ft)**	0.410	-0.246	-0.246
		Max Depth (ft)	1.590	4.246	6.246
		Level of Service	**LOS A**	**LOS B**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	2.713	2.051	1.891
Trail's ID	731	**Inundated Distance (mile)**	0.069	0.732	0.892
Distance (mile)	2.783	**Land Loss (%)**	2.488	26.304	32.040
County	Sussex	**Min Elevation (ft)**	0.269	0.269	0.269
		Max Depth (ft)	1.731	3.731	5.731
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Governors Walk	**Distance on Land (mile)**	0.305	0.205	0.180
Trail's ID	778 & 780 & 781 & 783 & 784 & 785	**Inundated Distance (mile)**	0.671	0.771	0.795
Distance (mile)	0.976	**Land Loss (%)**	68.756	79.017	81.528
County	Sussex	**Min Elevation (ft)**	-0.451	-0.451	-0.451
		Max Depth (ft)	2.451	4.451	6.451
		Level of Service	**LOS D**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Sidewalk or Pathway	**Distance on Land (mile)**	1.710	1.649	1.406
Trail's ID	804	**Inundated Distance (mile)**	0.029	0.090	0.332
Distance (mile)	1.738	**Land Loss (%)**	1.651	5.151	19.094
County	Sussex	**Min Elevation (ft)**	0.283	0.283	0.283
		Max Depth (ft)	1.717	3.717	5.717
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Dirt Road	**Distance on Land (mile)**	0.487	0.405	0.175
Trail's ID	817	**Inundated Distance (mile)**	0.017	0.098	0.328
Distance (mile)	0.504	**Land Loss (%)**	3.369	19.526	65.226
County	Sussex	**Min Elevation (ft)**	0.775	0.775	0.685
		Max Depth (ft)	1.225	3.225	5.315
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	1.069	0.509	0.257
Trail's ID	818	**Inundated Distance (mile)**	0.249	0.809	1.061
Distance (mile)	1.318	**Land Loss (%)**	18.875	61.400	80.487
County	Sussex	**Min Elevation (ft)**	0.479	0.479	0.386
		Max Depth (ft)	1.521	3.521	5.614
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**	4.574	4.357	3.452
Trail's ID	819	**Inundated Distance (mile)**	0.111	0.328	1.233
Distance (mile)	4.685	**Land Loss (%)**	2.376	7.000	26.321
County	Sussex	**Min Elevation (ft)**	0.063	0.063	0.063
		Max Depth (ft)	1.937	3.937	5.937
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**			1.586
Trail's ID	820	**Inundated Distance (mile)**			0.087
Distance (mile)	1.673	**Land Loss (%)**			5.211
County	Sussex	**Min Elevation (ft)**			1.638
		Max Depth (ft)			4.362
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**			0.142
Trail's ID	845	**Inundated Distance (mile)**			0.030
Distance (mile)	0.171	**Land Loss (%)**			17.259
County	Sussex	**Min Elevation (ft)**			2.036
		Max Depth (ft)			3.964
		Level of Service	**LOS A**	**LOS A**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
Trail's Name	Unnamed Trail	**Distance on Land (mile)**		1.083	1.014
Trail's ID	847	**Inundated Distance (mile)**		0.101	0.170
Distance (mile)	1.184	**Land Loss (%)**		8.539	14.348
County	Sussex	**Min Elevation (ft)**		0.964	0.964
		Max Depth (ft)		3.036	5.036
		Level of Service	**LOS A**	**LOS B**	**LOS C**

Appendix B

BIKE ROUTES' LEVEL OF SERVICE

As it was described previously, the scope of this research covers the entire state of Delaware's bike routes. The result of the vulnerability assessment against sea level rise for these facilities is presented in this appendix. It is worthwhile mentioning that this vulnerability assessment was processed only for those facilities that will be affected by different sea level rise projections.

Each affected bike route has a correspondent table in which the bike route's ID (a number that DelDOT uses to identify bike routes), total distance, and DOT class are reported. Also, the vulnerability assessment's result is presented as level of service for each roadway under low (2 feet), medium (4 feet), and high (6feet) sea level rise projections in year 2100. Appendix B.1 contains Statewide bike routes, appendix B.2 contains Regional bike routes, and appendix B.3 contains Connector bike routes.

B.1 Statewide Bike Routes' Level of Service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	5.703	5.499	5.257
Bike Route's ID	41	Inundated Distance (mile)	1.052	1.256	1.498
Distance (mile)	6.754	Land Loss (%)	15.569	18.591	22.176
DOT Class	Statewide	Min Elevation (ft)	-0.770	-0.784	-0.784
		Max Depth (ft)	2.770	4.784	6.784
		Level of Service	LOS B	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.504	0.497	0.488
Bike Route's ID	42	Inundated Distance (mile)	0.024	0.030	0.040
Distance (mile)	0.527	Land Loss (%)	4.481	5.778	7.548
DOT Class	Statewide	Min Elevation (ft)	0.771	0.771	0.771
		Max Depth (ft)	1.229	3.229	5.229
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.739
Bike Route's ID	44	Inundated Distance (mile)			0.034
Distance (mile)	0.527	Land Loss (%)			6.355
DOT Class	Statewide	Min Elevation (ft)			2.074
		Max Depth (ft)			3.926
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	4.491	3.089	2.569
Bike Route's ID	56	Inundated Distance (mile)	1.897	3.299	3.819
Distance (mile)	6.388	Land Loss (%)	29.702	51.649	59.787
DOT Class	Statewide	Min Elevation (ft)	-0.500	-0.500	-0.587
		Max Depth (ft)	2.500	4.500	6.587
		Level of Service	LOS B	LOS F	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	11.091	10.251	9.344
Bike Route's ID	58	Inundated Distance (mile)	1.656	2.495	3.402
Distance (mile)	12.746	Land Loss (%)	12.988	19.576	26.694
DOT Class	Statewide	Min Elevation (ft)	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	LOS B	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.685	2.599	2.552
Bike Route's ID	86	**Inundated Distance (mile)**	0.145	0.231	0.279
Distance (mile)	2.831	**Land Loss (%)**	5.136	8.176	9.846
DOT Class	Statewide	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.840	1.840	1.826
Bike Route's ID	88	**Inundated Distance (mile)**	0.143	0.143	0.158
Distance (mile)	1.984	**Land Loss (%)**	7.232	7.231	7.956
DOT Class	Statewide	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		4.320	4.297
Bike Route's ID	186	**Inundated Distance (mile)**		0.033	0.056
Distance (mile)	4.353	**Land Loss (%)**		0.754	1.283
DOT Class	Statewide	**Min Elevation (ft)**		0.851	0.851
		Max Depth (ft)		3.149	5.149
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		3.169	2.942
Bike Route's ID	192	**Inundated Distance (mile)**		0.121	0.349
Distance (mile)	3.291	**Land Loss (%)**		3.688	10.605
DOT Class	Statewide	**Min Elevation (ft)**		1.501	1.501
		Max Depth (ft)		2.499	4.499
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.375	1.322	1.257
Bike Route's ID	193	**Inundated Distance (mile)**	0.268	0.320	0.386
Distance (mile)	1.643	**Land Loss (%)**	16.300	19.503	23.485
DOT Class	Statewide	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.398	0.157	0.104
Bike Route's ID	235	**Inundated Distance (mile)**	0.050	0.291	0.344
Distance (mile)	0.448	**Land Loss (%)**	11.179	64.956	76.795
DOT Class	Statewide	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	7.0136	2.4242	2.1555
Bike Route's ID	262	**Inundated Distance (mile)**	2.4864	7.0758	7.3445
Distance (mile)	9.4999	**Land Loss (%)**	26.1730	74.4828	77.3113
DOT Class	Statewide	**Min Elevation (ft)**	0.6162	0.6162	0.6216
		Max Depth (ft)	1.3838	3.3838	5.3784
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.5226	1.1561
Bike Route's ID	263	**Inundated Distance (mile)**		6.1927	7.5592
Distance (mile)	8.7152	**Land Loss (%)**		71.0562	86.7357
DOT Class	Statewide	**Min Elevation (ft)**		0.9523	0.9523
		Max Depth (ft)		3.0477	5.0477
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.2068	0.0000
Bike Route's ID	264	**Inundated Distance (mile)**		0.4508	0.6577
Distance (mile)	0.6577	**Land Loss (%)**		68.5505	100.0000
DOT Class	Statewide	**Min Elevation (ft)**		0.9653	
		Max Depth (ft)		3.0347	
		Level of Service	**LOS A**	**LOS F**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.1335	0.0612
Bike Route's ID	316	**Inundated Distance (mile)**		0.0363	0.1086
Distance (mile)	0.1698	**Land Loss (%)**		21.3849	63.9535
DOT Class	Statewide	**Min Elevation (ft)**		1.6284	1.6284
		Max Depth (ft)		2.3716	4.3716
		Level of Service	**LOS A**	**LOS C**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.7515	0.6730	0.6557
Bike Route's ID	351	**Inundated Distance (mile)**	0.0289	0.1074	0.1247
Distance (mile)	0.7804	**Land Loss (%)**	3.6984	13.7630	15.9768
DOT Class	Statewide	**Min Elevation (ft)**	-0.1356	-0.4523	-0.4523
		Max Depth (ft)	2.1356	4.4523	6.4523
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.5321	0.4652	0.3832
Bike Route's ID	352	**Inundated Distance (mile)**	0.1602	0.2270	0.3091
Distance (mile)	0.6923	**Land Loss (%)**	23.1396	32.7949	44.6450
DOT Class	Statewide	**Min Elevation (ft)**	0.6159	0.4170	0.4170
		Max Depth (ft)	1.3841	3.5830	5.5830
		Level of Service	**LOS B**	**LOS D**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.9610
Bike Route's ID	354	**Inundated Distance (mile)**			0.0184
Distance (mile)	1.9793	**Land Loss (%)**			0.9272
DOT Class	Statewide	**Min Elevation (ft)**			1.6715
		Max Depth (ft)			4.3285
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.9563	0.9412
Bike Route's ID	422	**Inundated Distance (mile)**		0.0225	0.0376
Distance (mile)	0.9788	**Land Loss (%)**		2.2972	3.8424
DOT Class	Statewide	**Min Elevation (ft)**		0.2505	0.2505
		Max Depth (ft)		3.7495	5.7495
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.009	1.997
Bike Route's ID	466	**Inundated Distance (mile)**		0.024	0.035
Distance (mile)	2.033	**Land Loss (%)**		1.172	1.734
DOT Class	Statewide	**Min Elevation (ft)**		-0.310	-0.310
		Max Depth (ft)		4.310	6.310
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.444	2.397	2.360
Bike Route's ID	467	**Inundated Distance (mile)**	0.159	0.206	0.244
Distance (mile)	2.603	**Land Loss (%)**	6.107	7.911	9.365
DOT Class	Statewide	**Min Elevation (ft)**	-0.499	-0.500	-0.500
		Max Depth (ft)	2.499	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	5.562	5.533	5.519
Bike Route's ID	507	**Inundated Distance (mile)**	0.050	0.079	0.093
Distance (mile)	5.612	**Land Loss (%)**	0.896	1.408	1.665
DOT Class	Statewide	**Min Elevation (ft)**	0.776	0.776	0.776
		Max Depth (ft)	1.224	3.224	5.224
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.838	2.838	2.838
Bike Route's ID	509	**Inundated Distance (mile)**	0.021	0.021	0.021
Distance (mile)	2.860	**Land Loss (%)**	0.752	0.752	0.752
DOT Class	Statewide	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.166	1.148	1.130
Bike Route's ID	619	**Inundated Distance (mile)**	1.430	1.448	1.466
Distance (mile)	2.596	**Land Loss (%)**	55.078	55.780	56.477
DOT Class	Statewide	**Min Elevation (ft)**	-0.314	-0.314	-0.314
		Max Depth (ft)	2.314	4.314	6.314
		Level of Service	**LOS D**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.979	1.935
Bike Route's ID	622	**Inundated Distance (mile)**		0.037	0.081
Distance (mile)	4.031	**Land Loss (%)**		0.915	2.011
DOT Class	Statewide	**Min Elevation (ft)**		-0.308	-0.308
		Max Depth (ft)		4.308	6.308
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.300
Bike Route's ID	624	**Inundated Distance (mile)**			0.348
Distance (mile)	0.649	**Land Loss (%)**			53.696
DOT Class	Statewide	**Min Elevation (ft)**			2.569
		Max Depth (ft)			3.431
		Level of Service	**LOS A**	**LOS A**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.048	0.000
Bike Route's ID	626	**Inundated Distance (mile)**		0.066	0.229
Distance (mile)	0.229	**Land Loss (%)**		29.041	100.000
DOT Class	Statewide	**Min Elevation (ft)**		1.629	
		Max Depth (ft)		2.371	
		Level of Service	**LOS A**	**LOS C**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.291	0.002	0.000
Bike Route's ID	643	**Inundated Distance (mile)**	0.262	0.551	0.553
Distance (mile)	0.553	**Land Loss (%)**	47.338	99.708	100.000
DOT Class	Statewide	**Min Elevation (ft)**	0.654	0.654	
		Max Depth (ft)	1.346	3.346	
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.453
Bike Route's ID	666	**Inundated Distance (mile)**			0.098
Distance (mile)	0.551	**Land Loss (%)**			17.841
DOT Class	Statewide	**Min Elevation (ft)**			2.058
		Max Depth (ft)			3.942
		Level of Service	**LOS A**	**LOS A**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.035	0.000	0.000
Bike Route's ID	667	**Inundated Distance (mile)**	0.238	0.274	0.274
Distance (mile)	0.274	**Land Loss (%)**	87.147	100.000	100.000
DOT Class	Statewide	**Min Elevation (ft)**	0.170		
		Max Depth (ft)	1.830		
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.617	1.371	1.096
Bike Route's ID	669	**Inundated Distance (mile)**	0.127	0.373	0.648
Distance (mile)	1.744	**Land Loss (%)**	7.258	21.395	37.163
DOT Class	Statewide	**Min Elevation (ft)**	0.917	0.860	0.860
		Max Depth (ft)	1.083	3.140	5.140
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.878	1.609
Bike Route's ID	671	**Inundated Distance (mile)**		0.299	0.568
Distance (mile)	2.178	**Land Loss (%)**		13.742	26.106
DOT Class	Statewide	**Min Elevation (ft)**		1.403	1.403
		Max Depth (ft)		2.597	4.597
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.836	1.832	1.825
Bike Route's ID	835	**Inundated Distance (mile)**	0.034	0.037	0.044
Distance (mile)	1.870	**Land Loss (%)**	1.808	2.003	2.367
DOT Class	Statewide	**Min Elevation (ft)**	-0.473	-0.473	-0.473
		Max Depth (ft)	2.473	4.473	6.473
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.360	1.146	1.056
Bike Route's ID	852	**Inundated Distance (mile)**	0.116	0.330	0.420
Distance (mile)	1.476	**Land Loss (%)**	7.837	22.364	28.457
DOT Class	Statewide	**Min Elevation (ft)**	-0.501	-0.501	-0.500
		Max Depth (ft)	2.501	4.501	6.500
		Level of Service	**LOS A**	**LOS C**	**LOS C**

B.2 Regional Bike Routes' Level of Service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.895	2.895	2.891
Bike Route's ID	19	**Inundated Distance (mile)**	0.049	0.049	0.053
Distance (mile)	2.944	**Land Loss (%)**	1.674	1.674	1.805
DOT Class	Regional	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	5.130	4.650	4.431
Bike Route's ID	27	Inundated Distance (mile)	2.401	2.881	3.100
Distance (mile)	7.531	Land Loss (%)	31.880	38.255	41.158
DOT Class	Regional	Min Elevation (ft)	-0.497	-0.497	-0.497
		Max Depth (ft)	2.497	4.497	6.497
		Level of Service	LOS C	LOS D	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.151	0.075	0.002
Bike Route's ID	28	Inundated Distance (mile)	0.398	0.474	0.547
Distance (mile)	0.549	Land Loss (%)	72.519	86.266	99.720
DOT Class	Regional	Min Elevation (ft)	0.790	0.790	0.790
		Max Depth (ft)	1.210	3.210	5.210
		Level of Service	LOS F	LOS F	Out of service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.058	1.028	0.974
Bike Route's ID	57	Inundated Distance (mile)	0.326	0.355	0.410
Distance (mile)	1.383	Land Loss (%)	23.535	25.671	29.627
DOT Class	Regional	Min Elevation (ft)	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	LOS B	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.887	0.940	0.254
Bike Route's ID	60	Inundated Distance (mile)	1.933	2.880	3.566
Distance (mile)	3.820	Land Loss (%)	50.611	75.394	93.355
DOT Class	Regional	Min Elevation (ft)	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	LOS D	LOS F	Out of service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		3.329	3.261
Bike Route's ID	120	Inundated Distance (mile)		0.093	0.161
Distance (mile)	3.422	Land Loss (%)		2.711	4.706
DOT Class	Regional	Min Elevation (ft)		0.230	0.230
		Max Depth (ft)		3.770	5.770
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			2.695
Bike Route's ID	121	Inundated Distance (mile)			0.076
Distance (mile)	2.772	Land Loss (%)			2.757
DOT Class	Regional	Min Elevation (ft)			2.117
		Max Depth (ft)			3.883
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.426	0.233	0.048
Bike Route's ID	122	Inundated Distance (mile)	0.168	0.318	0.547
Distance (mile)	0.595	Land Loss (%)	28.297	53.396	91.995
DOT Class	Regional	Min Elevation (ft)	1.260	-0.120	-0.120
		Max Depth (ft)	0.740	4.120	6.120
		Level of Service	LOS A	LOS F	Out of service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.153
Bike Route's ID	141	Inundated Distance (mile)			0.012
Distance (mile)	1.165	Land Loss (%)			1.026
DOT Class	Regional	Min Elevation (ft)			1.981
		Max Depth (ft)			4.019
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.798	0.753
Bike Route's ID	164	Inundated Distance (mile)		0.060	0.105
Distance (mile)	0.857	Land Loss (%)		6.963	12.195
DOT Class	Regional	Min Elevation (ft)		0.869	0.869
		Max Depth (ft)		3.131	5.131
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.660	2.438
Bike Route's ID	194	Inundated Distance (mile)		0.346	0.568
Distance (mile)	3.005	Land Loss (%)		11.501	18.893
DOT Class	Regional	Min Elevation (ft)		1.470	1.346
		Max Depth (ft)		2.530	4.654
		Level of Service	LOS A	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.503	1.378	1.104
Bike Route's ID	195	Inundated Distance (mile)	0.652	0.778	1.051
Distance (mile)	2.155	Land Loss (%)	30.244	36.082	48.785
DOT Class	Regional	Min Elevation (ft)	0.739	0.739	0.739
		Max Depth (ft)	1.261	3.261	5.261
		Level of Service	LOS C	LOS D	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.612	0.857	0.452
Bike Route's ID	253	Inundated Distance (mile)	0.106	0.862	1.266
Distance (mile)	1.719	Land Loss (%)	6.190	50.162	73.681
DOT Class	Regional	Min Elevation (ft)	0.755	0.755	0.755
		Max Depth (ft)	1.245	3.245	5.245
		Level of Service	LOS A	LOS F	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		3.200	2.958
Bike Route's ID	254	Inundated Distance (mile)		0.034	0.277
Distance (mile)	3.235	Land Loss (%)		1.060	8.554
DOT Class	Regional	Min Elevation (ft)		1.149	1.160
		Max Depth (ft)		2.851	4.840
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		5.408	5.262
Bike Route's ID	270	Inundated Distance (mile)		0.088	0.234
Distance (mile)	5.495	Land Loss (%)		1.597	4.251
DOT Class	Regional	Min Elevation (ft)		-0.500	-0.500
		Max Depth (ft)		4.500	6.500
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.310	1.310
Bike Route's ID	282	Inundated Distance (mile)		0.017	0.017
Distance (mile)	1.327	Land Loss (%)		1.269	1.270
DOT Class	Regional	Min Elevation (ft)		-0.498	-0.498
		Max Depth (ft)		4.498	6.498
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.097	2.052	1.988
Bike Route's ID	294	Inundated Distance (mile)	0.116	0.161	0.225
Distance (mile)	2.213	Land Loss (%)	5.221	7.286	10.168
DOT Class	Regional	Min Elevation (ft)	-0.500	-0.497	-0.500
		Max Depth (ft)	2.500	4.497	6.500
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			11.420
Bike Route's ID	295	Inundated Distance (mile)			0.231
Distance (mile)	11.652	Land Loss (%)			1.986
DOT Class	Regional	Min Elevation (ft)			1.490
		Max Depth (ft)			4.510
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	4.749	3.949	3.101
Bike Route's ID	363	Inundated Distance (mile)	0.687	1.487	2.335
Distance (mile)	5.436	Land Loss (%)	12.647	27.363	42.955
DOT Class	Regional	Min Elevation (ft)	0.278	0.278	0.278
		Max Depth (ft)	1.722	3.722	5.722
		Level of Service	LOS B	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.033	2.636	2.083
Bike Route's ID	365	Inundated Distance (mile)	0.727	1.124	1.676
Distance (mile)	3.760	Land Loss (%)	19.327	29.905	44.588
DOT Class	Regional	Min Elevation (ft)	0.611	0.592	0.592
		Max Depth (ft)	1.389	3.408	5.408
		Level of Service	LOS B	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.816
Bike Route's ID	366	Inundated Distance (mile)			0.031
Distance (mile)	0.847	Land Loss (%)			3.671
DOT Class	Regional	Min Elevation (ft)			2.228
		Max Depth (ft)			3.772
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.535	1.490
Bike Route's ID	367	**Inundated Distance (mile)**		0.068	0.113
Distance (mile)	1.603	**Land Loss (%)**		4.240	7.062
DOT Class	Regional	**Min Elevation (ft)**		1.347	1.347
		Max Depth (ft)		2.653	4.653
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	9.376	8.439	6.372
Bike Route's ID	419	**Inundated Distance (mile)**	0.670	1.607	3.674
Distance (mile)	10.046	**Land Loss (%)**	6.669	15.994	36.569
DOT Class	Regional	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.248	1.149	0.495
Bike Route's ID	441	**Inundated Distance (mile)**	1.799	2.898	3.552
Distance (mile)	4.047	**Land Loss (%)**	44.453	71.603	87.760
DOT Class	Regional	**Min Elevation (ft)**	0.602	-0.231	-0.231
		Max Depth (ft)	1.398	4.231	6.231
		Level of Service	**LOS C**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.992	2.772	2.727
Bike Route's ID	479	**Inundated Distance (mile)**	0.192	0.412	0.457
Distance (mile)	3.184	**Land Loss (%)**	6.040	12.952	14.360
DOT Class	Regional	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			3.521
Bike Route's ID	516	**Inundated Distance (mile)**			0.167
Distance (mile)	3.688	**Land Loss (%)**			4.541
DOT Class	Regional	**Min Elevation (ft)**			1.319
		Max Depth (ft)			4.681
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.204	0.679	0.479
Bike Route's ID	646	**Inundated Distance (mile)**	2.539	3.064	3.264
Distance (mile)	3.743	**Land Loss (%)**	67.824	81.860	87.194
DOT Class	Regional	**Min Elevation (ft)**	0.321	0.219	0.014
		Max Depth (ft)	1.679	3.781	5.986
		Level of Service	**LOS D**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.035	0.012	0.000
Bike Route's ID	648	**Inundated Distance (mile)**	0.158	0.181	0.193
Distance (mile)	0.193	**Land Loss (%)**	81.803	93.923	100.000
DOT Class	Regional	**Min Elevation (ft)**	0.852	-0.471	
		Max Depth (ft)	1.148	4.471	
		Level of Service	**LOS F**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.909	3.904	3.903
Bike Route's ID	664	**Inundated Distance (mile)**	0.053	0.059	0.060
Distance (mile)	3.963	**Land Loss (%)**	1.343	1.477	1.508
DOT Class	Regional	**Min Elevation (ft)**	-0.496	-0.499	-0.499
		Max Depth (ft)	2.496	4.499	6.499
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.797	0.617	0.315
Bike Route's ID	791	**Inundated Distance (mile)**	0.072	0.252	0.554
Distance (mile)	0.869	**Land Loss (%)**	8.245	28.955	63.734
DOT Class	Regional	**Min Elevation (ft)**	-0.395	-0.395	-0.395
		Max Depth (ft)	2.395	4.395	6.395
		Level of Service	**LOS A**	**LOS C**	**LOS F**

B.3 Connector Bike Routes' Level of Service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.569	2.269	2.094
Bike Route's ID	2	**Inundated Distance (mile)**	0.545	0.845	1.020
Distance (mile)	3.114	**Land Loss (%)**	17.498	27.141	32.762
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.455	3.056	2.718
Bike Route's ID	16	**Inundated Distance (mile)**	0.072	0.471	0.809
Distance (mile)	3.527	**Land Loss (%)**	2.041	13.353	22.931
DOT Class	Connector	**Min Elevation (ft)**	1.417	0.724	0.724
		Max Depth (ft)	0.583	3.276	5.276
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.107	0.567	0.450
Bike Route's ID	55	**Inundated Distance (mile)**	0.288	0.828	0.946
Distance (mile)	1.396	**Land Loss (%)**	20.659	59.347	67.741
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.590	0.565	0.556
Bike Route's ID	75	**Inundated Distance (mile)**	0.028	0.052	0.062
Distance (mile)	0.618	**Land Loss (%)**	4.501	8.447	10.025
DOT Class	Connector	**Min Elevation (ft)**	0.421	0.421	0.421
		Max Depth (ft)	1.579	3.579	5.579
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	4.670	4.481	4.330
Bike Route's ID	83	**Inundated Distance (mile)**	0.101	0.290	0.441
Distance (mile)	4.771	**Land Loss (%)**	2.121	6.080	9.253
DOT Class	Connector	**Min Elevation (ft)**	-0.318	-0.500	-0.500
		Max Depth (ft)	2.318	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		16.804	16.372
Bike Route's ID	85	**Inundated Distance (mile)**		0.275	0.707
Distance (mile)	17.078	**Land Loss (%)**		1.608	4.139
DOT Class	Connector	**Min Elevation (ft)**		-0.499	-0.499
		Max Depth (ft)		4.499	6.499
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		18.535	18.505
Bike Route's ID	126	**Inundated Distance (mile)**		0.072	0.102
Distance (mile)	18.607	**Land Loss (%)**		0.385	0.549
DOT Class	Connector	**Min Elevation (ft)**		-0.500	-0.500
		Max Depth (ft)		4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.125	2.119
Bike Route's ID	128	**Inundated Distance (mile)**		0.011	0.017
Distance (mile)	2.136	**Land Loss (%)**		0.526	0.788
DOT Class	Connector	**Min Elevation (ft)**		1.801	1.612
		Max Depth (ft)		2.199	4.388
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.117	2.009
Bike Route's ID	136	**Inundated Distance (mile)**		0.143	0.251
Distance (mile)	2.259	**Land Loss (%)**		6.321	11.090
DOT Class	Connector	**Min Elevation (ft)**		0.513	0.513
		Max Depth (ft)		3.487	5.487
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.157	0.999	0.826
Bike Route's ID	137	**Inundated Distance (mile)**	0.054	0.212	0.385
Distance (mile)	1.211	**Land Loss (%)**	4.477	17.481	31.812
DOT Class	Connector	**Min Elevation (ft)**	0.716	0.716	0.716
		Max Depth (ft)	1.284	3.284	5.284
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			2 (ft)	4 (ft)	6 (ft)
		Distance on Land (mile)	1.411	1.347	1.340
Bike Route's ID	138	**Inundated Distance (mile)**	0.063	0.127	0.134
Distance (mile)	1.474	**Land Loss (%)**	4.283	8.590	9.059
DOT Class	Connector	**Min Elevation (ft)**	0.141	0.141	0.141
		Max Depth (ft)	1.859	3.859	5.859
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.648	0.598
Bike Route's ID	140	**Inundated Distance (mile)**		0.033	0.083
Distance (mile)	0.681	**Land Loss (%)**		4.855	12.205
DOT Class	Connector	**Min Elevation (ft)**		1.141	1.141
		Max Depth (ft)		2.859	4.859
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.017	1.003	0.997
Bike Route's ID	166	**Inundated Distance (mile)**	0.027	0.041	0.048
Distance (mile)	1.044	**Land Loss (%)**	2.570	3.953	4.562
DOT Class	Connector	**Min Elevation (ft)**	-0.559	-0.559	-0.559
		Max Depth (ft)	2.559	4.559	6.559
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.052	0.463	0.314
Bike Route's ID	173	**Inundated Distance (mile)**	0.248	0.836	0.985
Distance (mile)	1.299	**Land Loss (%)**	19.065	64.372	75.842
DOT Class	Connector	**Min Elevation (ft)**	-0.409	-0.433	-0.433
		Max Depth (ft)	2.409	4.433	6.433
		Level of Service	**LOS B**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.956	0.750
Bike Route's ID	188	**Inundated Distance (mile)**		0.126	0.333
Distance (mile)	1.083	**Land Loss (%)**		11.645	30.737
DOT Class	Connector	**Min Elevation (ft)**		1.288	1.288
		Max Depth (ft)		2.712	4.712
		Level of Service	**LOS A**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.098	0.021	0.000
Bike Route's ID	189	**Inundated Distance (mile)**	0.821	1.897	1.919
Distance (mile)	1.919	**Land Loss (%)**	42.784	98.886	100.000
DOT Class	Connector	**Min Elevation (ft)**	0.712	0.712	
		Max Depth (ft)	1.288	3.288	
		Level of Service	**LOS C**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.677	3.493	3.426
Bike Route's ID	244	**Inundated Distance (mile)**	0.111	0.294	0.362
Distance (mile)	3.788	**Land Loss (%)**	2.929	7.775	9.561
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.870	1.780	1.469
Bike Route's ID	245	**Inundated Distance (mile)**	0.050	0.140	0.451
Distance (mile)	1.921	**Land Loss (%)**	2.612	7.298	23.502
DOT Class	Connector	**Min Elevation (ft)**	0.514	0.350	0.350
		Max Depth (ft)	1.486	3.650	5.650
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.117	2.106	2.094
Bike Route's ID	261	**Inundated Distance (mile)**	0.023	0.034	0.045
Distance (mile)	2.140	**Land Loss (%)**	1.062	1.592	2.124
DOT Class	Connector	**Min Elevation (ft)**	0.085	0.085	0.085
		Max Depth (ft)	1.915	3.915	5.915
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.695	3.647	3.608
Bike Route's ID	268	**Inundated Distance (mile)**	0.032	0.080	0.119
Distance (mile)	3.727	**Land Loss (%)**	0.857	2.147	3.181
DOT Class	Connector	**Min Elevation (ft)**	-0.223	-0.269	-0.269
		Max Depth (ft)	2.223	4.269	6.269
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.222	2.211
Bike Route's ID	279	**Inundated Distance (mile)**		0.020	0.031
Distance (mile)	2.242	**Land Loss (%)**		0.877	1.367
DOT Class	Connector	**Min Elevation (ft)**		0.715	0.715
		Max Depth (ft)		3.285	5.285
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.206	0.693	0.377
Bike Route's ID	297	Inundated Distance (mile)	0.388	0.901	1.218
Distance (mile)	1.595	Land Loss (%)	24.362	56.528	76.358
DOT Class	Connector	Min Elevation (ft)	1.175	1.175	1.151
		Max Depth (ft)	0.825	2.825	4.849
		Level of Service	LOS A	LOS F	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.374	1.870
Bike Route's ID	318	Inundated Distance (mile)		0.114	0.619
Distance (mile)	2.488	Land Loss (%)		4.599	24.869
DOT Class	Connector	Min Elevation (ft)		1.268	1.268
		Max Depth (ft)		2.732	4.732
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.611	1.000	0.092
Bike Route's ID	319	Inundated Distance (mile)	0.102	0.713	1.621
Distance (mile)	1.714	Land Loss (%)	5.975	41.625	94.623
DOT Class	Connector	Min Elevation (ft)	0.323	0.161	0.161
		Max Depth (ft)	1.677	3.839	5.839
		Level of Service	LOS A	LOS D	Out of Service

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.916	0.855	0.834
Bike Route's ID	320	Inundated Distance (mile)	0.032	0.093	0.114
Distance (mile)	0.948	Land Loss (%)	3.343	9.774	12.049
DOT Class	Connector	Min Elevation (ft)	0.937	0.937	0.937
		Max Depth (ft)	1.063	3.063	5.063
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.993	0.753
Bike Route's ID	321	Inundated Distance (mile)		0.152	0.392
Distance (mile)	1.145	Land Loss (%)		13.298	34.215
DOT Class	Connector	Min Elevation (ft)		1.131	1.131
		Max Depth (ft)		2.869	4.869
		Level of Service	LOS A	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.784	1.202
Bike Route's ID	322	Inundated Distance (mile)		0.394	0.976
Distance (mile)	2.178	Land Loss (%)		18.094	44.800
DOT Class	Connector	Min Elevation (ft)		1.447	1.447
		Max Depth (ft)		2.553	4.553
		Level of Service	LOS A	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.468	1.411
Bike Route's ID	324	Inundated Distance (mile)		0.018	0.076
Distance (mile)	1.486	Land Loss (%)		1.239	5.085
DOT Class	Connector	Min Elevation (ft)		1.685	1.685
		Max Depth (ft)		2.315	4.315
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.543	1.042	0.519
Bike Route's ID	333	Inundated Distance (mile)	0.134	0.635	1.158
Distance (mile)	1.677	Land Loss (%)	8.013	37.867	69.042
DOT Class	Connector	Min Elevation (ft)	0.692	0.424	0.259
		Max Depth (ft)	1.308	3.576	5.741
		Level of Service	LOS A	LOS D	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.442	0.297	0.217
Bike Route's ID	342	Inundated Distance (mile)	0.165	0.310	0.390
Distance (mile)	0.607	Land Loss (%)	27.221	51.015	64.207
DOT Class	Connector	Min Elevation (ft)	1.045	1.045	1.045
		Max Depth (ft)	0.955	2.955	4.955
		Level of Service	LOS A	LOS F	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.806	1.745	1.640
Bike Route's ID	345	Inundated Distance (mile)	0.161	0.223	0.327
Distance (mile)	1.967	Land Loss (%)	8.201	11.317	16.622
DOT Class	Connector	Min Elevation (ft)	0.542	-0.194	-0.194
		Max Depth (ft)	1.458	4.194	6.194
		Level of Service	LOS A	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.439	0.393	0.351
Bike Route's ID	347	**Inundated Distance (mile)**	0.096	0.141	0.184
Distance (mile)	0.535	**Land Loss (%)**	17.888	26.451	34.434
DOT Class	Connector	**Min Elevation (ft)**	0.892	0.889	0.889
		Max Depth (ft)	1.108	3.111	5.111
		Level of Service	**LOS B**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.064	1.933	1.817
Bike Route's ID	348	**Inundated Distance (mile)**	0.204	0.335	0.451
Distance (mile)	2.268	**Land Loss (%)**	9.003	14.779	19.870
DOT Class	Connector	**Min Elevation (ft)**	0.600	-0.387	-0.387
		Max Depth (ft)	1.400	4.387	6.387
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		3.333	3.274
Bike Route's ID	358	**Inundated Distance (mile)**		0.114	0.172
Distance (mile)	3.446	**Land Loss (%)**		3.301	4.999
DOT Class	Connector	**Min Elevation (ft)**		-0.361	-0.361
		Max Depth (ft)		4.361	6.361
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			10.091
Bike Route's ID	364	**Inundated Distance (mile)**			0.047
Distance (mile)	10.138	**Land Loss (%)**			0.461
DOT Class	Connector	**Min Elevation (ft)**			2.365
		Max Depth (ft)			3.635
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.021	0.000	0.000
Bike Route's ID	391	**Inundated Distance (mile)**	0.512	0.533	0.533
Distance (mile)	0.533	**Land Loss (%)**	95.995	100.000	100.000
DOT Class	Connector	**Min Elevation (ft)**	0.792		
		Max Depth (ft)	1.208		
		Level of Service	**Out of Service**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.627	0.627	0.627
Bike Route's ID	412	Inundated Distance (mile)	0.045	0.045	0.045
Distance (mile)	0.824	Land Loss (%)	5.470	5.470	5.470
DOT Class	Connector	Min Elevation (ft)	-0.499	-0.499	-0.499
		Max Depth (ft)	2.499	4.499	6.499
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	2.087	1.627	1.247
Bike Route's ID	417	Inundated Distance (mile)	0.118	0.578	0.958
Distance (mile)	2.205	Land Loss (%)	5.363	26.196	43.449
DOT Class	Connector	Min Elevation (ft)	0.645	0.468	0.468
		Max Depth (ft)	1.355	3.532	5.532
		Level of Service	LOS A	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.889
Bike Route's ID	418	Inundated Distance (mile)			0.037
Distance (mile)	0.926	Land Loss (%)			3.979
DOT Class	Connector	Min Elevation (ft)			1.708
		Max Depth (ft)			4.292
		Level of Service	LOS A	LOS A	LOS A

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.092	1.092	1.092
Bike Route's ID	420	Inundated Distance (mile)	0.029	0.029	0.029
Distance (mile)	1.121	Land Loss (%)	2.618	2.618	2.618
DOT Class	Connector	Min Elevation (ft)	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.075
Bike Route's ID	452	Inundated Distance (mile)			0.067
Distance (mile)	1.142	Land Loss (%)			5.840
DOT Class	Connector	Min Elevation (ft)			0.636
		Max Depth (ft)			5.364
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		3.356	3.248
Bike Route's ID	464	**Inundated Distance (mile)**		0.022	0.130
Distance (mile)	3.377	**Land Loss (%)**		0.638	3.838
DOT Class	Connector	**Min Elevation (ft)**		1.690	1.690
		Max Depth (ft)		2.310	4.310
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.665	0.914
Bike Route's ID	465	**Inundated Distance (mile)**		1.035	1.787
Distance (mile)	2.701	**Land Loss (%)**		38.336	66.176
DOT Class	Connector	**Min Elevation (ft)**		1.487	1.487
		Max Depth (ft)		2.513	4.513
		Level of Service	**LOS A**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.437	1.334	1.203
Bike Route's ID	483	**Inundated Distance (mile)**	0.050	0.153	0.284
Distance (mile)	1.486	**Land Loss (%)**	3.359	10.272	19.091
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.108	0.000	0.000
Bike Route's ID	485	**Inundated Distance (mile)**	0.128	1.236	1.236
Distance (mile)	1.236	**Land Loss (%)**	10.341	100.000	100.000
DOT Class	Connector	**Min Elevation (ft)**	1.005		
		Max Depth (ft)	0.995		
		Level of Service	**LOS A**	**Out of Service**	**Out of Service**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.378	2.190
Bike Route's ID	486	**Inundated Distance (mile)**		0.102	0.290
Distance (mile)	2.480	**Land Loss (%)**		4.107	11.695
DOT Class	Connector	**Min Elevation (ft)**		1.179	1.179
		Max Depth (ft)		2.821	4.821
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.789	1.671
Bike Route's ID	488	Inundated Distance (mile)		0.211	0.329
Distance (mile)	2.000	Land Loss (%)		10.551	16.469
DOT Class	Connector	Min Elevation (ft)		0.760	0.760
		Max Depth (ft)		3.240	5.240
		Level of Service	LOS A	LOS C	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.652
Bike Route's ID	490	Inundated Distance (mile)			0.017
Distance (mile)	0.669	Land Loss (%)			2.480
DOT Class	Connector	Min Elevation (ft)			-0.119
		Max Depth (ft)			6.119
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.847	2.395
Bike Route's ID	493	Inundated Distance (mile)		0.050	0.502
Distance (mile)	2.897	Land Loss (%)		1.729	17.331
DOT Class	Connector	Min Elevation (ft)		0.770	0.770
		Max Depth (ft)		3.230	5.230
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.232	1.013	0.488
Bike Route's ID	496	Inundated Distance (mile)	0.173	0.392	0.917
Distance (mile)	1.405	Land Loss (%)	12.343	27.925	65.274
DOT Class	Connector	Min Elevation (ft)	-0.127	-0.404	-0.404
		Max Depth (ft)	2.127	4.404	6.404
		Level of Service	LOS B	LOS C	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		1.946	1.492
Bike Route's ID	497	Inundated Distance (mile)		0.100	0.554
Distance (mile)	2.046	Land Loss (%)		4.888	27.068
DOT Class	Connector	Min Elevation (ft)		0.784	0.784
		Max Depth (ft)		3.216	5.216
		Level of Service	LOS A	LOS B	LOS C

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.076	2.047
Bike Route's ID	499	Inundated Distance (mile)		0.054	0.084
Distance (mile)	2.131	Land Loss (%)		2.557	3.952
DOT Class	Connector	Min Elevation (ft)		0.487	0.487
		Max Depth (ft)		3.513	5.513
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.300	2.967	2.388
Bike Route's ID	500	Inundated Distance (mile)	0.138	0.472	1.050
Distance (mile)	3.438	Land Loss (%)	4.016	13.719	30.532
DOT Class	Connector	Min Elevation (ft)	0.686	0.686	0.266
		Max Depth (ft)	2.333	3.314	5.734
		Level of Service	LOS A	LOS C	LOS E

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		10.941	10.941
Bike Route's ID	501	Inundated Distance (mile)		0.030	0.030
Distance (mile)	10.971	Land Loss (%)		0.272	0.272
DOT Class	Connector	Min Elevation (ft)		-0.500	-0.500
		Max Depth (ft)		4.500	6.500
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.381	0.971	0.637
Bike Route's ID	510	Inundated Distance (mile)	0.017	0.427	0.761
Distance (mile)	1.399	Land Loss (%)	1.229	30.550	54.428
DOT Class	Connector	Min Elevation (ft)	-0.478	-0.478	-0.478
		Max Depth (ft)	2.478	4.478	6.478
		Level of Service	LOS A	LOS D	LOS F

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.138
Bike Route's ID	512	Inundated Distance (mile)			0.045
Distance (mile)	1.183	Land Loss (%)			3.820
DOT Class	Connector	Min Elevation (ft)			1.830
		Max Depth (ft)			4.170
		Level of Service	LOS A	LOS A	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.273	0.182
Bike Route's ID	513	**Inundated Distance (mile)**		0.463	0.554
Distance (mile)	0.736	**Land Loss (%)**		62.890	75.281
DOT Class	Connector	**Min Elevation (ft)**		0.774	0.757
		Max Depth (ft)		3.226	5.243
		Level of Service	**LOS A**	**LOS F**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	3.528	3.486	3.256
Bike Route's ID	533	**Inundated Distance (mile)**	0.041	0.083	0.313
Distance (mile)	3.569	**Land Loss (%)**	1.156	2.325	8.764
DOT Class	Connector	**Min Elevation (ft)**	-0.002	-0.002	-0.203
		Max Depth (ft)	2.002	4.002	6.203
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			0.099
Bike Route's ID	549	**Inundated Distance (mile)**			0.075
Distance (mile)	0.174	**Land Loss (%)**			43.083
DOT Class	Connector	**Min Elevation (ft)**			2.468
		Max Depth (ft)			3.532
		Level of Service	**LOS A**	**LOS A**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.087	0.973	0.712
Bike Route's ID	576	**Inundated Distance (mile)**	0.165	0.279	0.539
Distance (mile)	1.252	**Land Loss (%)**	13.144	22.260	43.076
DOT Class	Connector	**Min Elevation (ft)**	0.980	0.980	0.980
		Max Depth (ft)	1.020	3.020	5.020
		Level of Service	**LOS B**	**LOS C**	**LOS E**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.759	0.759
Bike Route's ID	579	**Inundated Distance (mile)**		0.014	0.014
Distance (mile)	0.774	**Land Loss (%)**		1.845	1.845
DOT Class	Connector	**Min Elevation (ft)**		-0.468	-0.468
		Max Depth (ft)		4.468	6.468
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.671	0.671
Bike Route's ID	599	Inundated Distance (mile)		0.013	0.013
Distance (mile)	0.684	Land Loss (%)		1.918	1.934
DOT Class	Connector	Min Elevation (ft)		-0.052	-0.052
		Max Depth (ft)		4.052	6.052
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.614	0.611
Bike Route's ID	601	Inundated Distance (mile)		0.008	0.011
Distance (mile)	0.622	Land Loss (%)		1.265	1.806
DOT Class	Connector	Min Elevation (ft)		-0.297	-0.297
		Max Depth (ft)		4.297	6.297
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	7.179	7.179	7.179
Bike Route's ID	604	Inundated Distance (mile)	0.016	0.016	0.016
Distance (mile)	7.195	Land Loss (%)	0.217	0.218	0.217
DOT Class	Connector	Min Elevation (ft)	-0.297	-0.297	-0.297
		Max Depth (ft)	2.297	4.297	6.297
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.103	2.103
Bike Route's ID	658	Inundated Distance (mile)		0.022	0.022
Distance (mile)	2.126	Land Loss (%)		1.054	1.054
DOT Class	Connector	Min Elevation (ft)		-0.500	-0.500
		Max Depth (ft)		4.500	6.500
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		9.087	9.086
Bike Route's ID	674	Inundated Distance (mile)		0.044	0.045
Distance (mile)	9.131	Land Loss (%)		0.484	0.497
DOT Class	Connector	Min Elevation (ft)		-0.499	-0.499
		Max Depth (ft)		4.499	6.499
		Level of Service	LOS A	LOS B	LOS B

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.594	0.594	0.594
Bike Route's ID	686	**Inundated Distance (mile)**	0.012	0.012	0.012
Distance (mile)	0.607	**Land Loss (%)**	2.055	2.055	2.055
DOT Class	Connector	**Min Elevation (ft)**	-0.102	-0.468	-0.468
		Max Depth (ft)	2.102	4.468	6.468
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	6.379	6.286	5.692
Bike Route's ID	711	**Inundated Distance (mile)**	0.066	0.158	0.753
Distance (mile)	6.445	**Land Loss (%)**	1.019	2.458	11.683
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.505	0.505	0.505
Bike Route's ID	713	**Inundated Distance (mile)**	0.035	0.035	0.035
Distance (mile)	0.540	**Land Loss (%)**	6.486	6.486	6.486
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		2.846	2.848
Bike Route's ID	715	**Inundated Distance (mile)**		0.023	0.021
Distance (mile)	2.869	**Land Loss (%)**		0.789	0.737
DOT Class	Connector	**Min Elevation (ft)**		-0.500	-0.500
		Max Depth (ft)		4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.530	0.372	0.328
Bike Route's ID	756	**Inundated Distance (mile)**	0.219	0.377	0.421
Distance (mile)	0.749	**Land Loss (%)**	29.193	50.277	56.229
DOT Class	Connector	**Min Elevation (ft)**	0.845	0.845	0.845
		Max Depth (ft)	1.155	3.155	5.155
		Level of Service	**LOS B**	**LOS D**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)		0.398	0.198
Bike Route's ID	757	**Inundated Distance (mile)**		0.031	0.232
Distance (mile)	0.430	**Land Loss (%)**		7.314	54.049
DOT Class	Connector	**Min Elevation (ft)**		1.611	1.611
		Max Depth (ft)		2.389	4.389
		Level of Service	**LOS A**	**LOS B**	**LOS F**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.236	1.236	1.236
Bike Route's ID	760	**Inundated Distance (mile)**	0.024	0.024	0.024
Distance (mile)	1.260	**Land Loss (%)**	1.908	1.908	1.908
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			3.980
Bike Route's ID	793	**Inundated Distance (mile)**			0.004
Distance (mile)	3.983	**Land Loss (%)**			0.091
DOT Class	Connector	**Min Elevation (ft)**			-0.176
		Max Depth (ft)			6.176
		Level of Service	**LOS A**	**LOS A**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	0.961	0.961	0.961
Bike Route's ID	806	**Inundated Distance (mile)**	0.023	0.023	0.023
Distance (mile)	0.984	**Land Loss (%)**	2.360	2.360	2.360
DOT Class	Connector	**Min Elevation (ft)**	-0.500	-0.500	-0.500
		Max Depth (ft)	2.500	4.500	6.500
		Level of Service	**LOS A**	**LOS B**	**LOS B**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)	1.780	1.721	1.646
Bike Route's ID	808	**Inundated Distance (mile)**	0.171	0.230	0.305
Distance (mile)	1.951	**Land Loss (%)**	8.790	11.793	15.612
DOT Class	Connector	**Min Elevation (ft)**	-0.165	-0.390	-0.390
		Max Depth (ft)	2.165	4.390	6.390
		Level of Service	**LOS A**	**LOS C**	**LOS C**

			SLR-2 (ft)	SLR-4 (ft)	SLR-6 (ft)
		Distance on Land (mile)			1.803
Bike Route's ID	819	**Inundated Distance (mile)**			0.029
Distance (mile)	1.833	**Land Loss (%)**			1.594
DOT Class	Connector	**Min Elevation (ft)**			2.021
		Max Depth (ft)			3.979
		Level of Service	**LOS A**	**LOS A**	**LOS B**