SITE NARRATIVE
Caliber Carwash
2011 South Croatan Highway
Kill Devil Hills
Dare County, North Carolina

Prepared for:
MPF Investment Company
102 W. Airstrip Rd
Kitty Hawk, NC 27948

Prepared by:
Quible & Associates, P.C.
PO Drawer 870
Kitty Hawk, NC 27949

January 17, 2022
P21103

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Overview

The subject property is located at 2011 S. Croatan Highway Kill Devil Hills, NC approximately 8,112 feet south of the intersection of S. Croatan Highway (U.S. 158) and Colington Road. The property is located along the East side of Croatan Highway in Dare County. The site development proposes the construction of a drive through car wash and associated utilities, parking, and walks. The site is zoned "commercial" and a car wash is a by-right use within this zoning district.

Access

The development is proposed to be accessed from Eighth Street, a 50-ft public right-of-way maintained by the Town. At the entrance to the development on Eighth Street, 20 ft by 20 ft. sight triangles are provided on the plan sheets to demonstrate visibility at the proposed intersection. The proposed access will provide a minimum 24' wide drive aisle along the front of the building in between rows of vacuum spaces. This will allow for fire apparatus to come within 150' of all portions of the structure. The proposed pavement section is capable of withstanding 75,000 lbs. An existing hydrant is available north of the property on Croatan Highway. This existing hydrant placement has been reviewed to confirm hose length can reach within 400-ft of all parts of the proposed structure.

A loading and unloading zone is not required per The Kill Devil Hills UDO, 153.076(E) as the non-residential building is less than 10,000 sf.

Parking

The number of proposed parking spaces for the site development is 7. Parking requirements are calculated using 1 space per 1 employee. A total of 3 spaces are required and 7 spaces have been provided (including 1 ADA accessible parking spaces). Stacking spaces are required at 5x the capacity of the washing operation. The washing operation can account for 4 cars at a time, as such 20 stacking spaces have been provided.

Signage will be provided within the parking area to notify employees and visitors that the drive aisle is a provided fire lane. Security lighting will be provided at the building and a lighting plan has been provided to address the expected footcandles at the property lines.

Stormwater Management Plan

Per 15A NCAC 02H.1005 (a) (3) (B) High Density Coastal Development is required to meet particular criteria. This development is proposed to have 53.1% of impervious coverage. The proposed infiltration basin onsite is designed in accordance with NCDEQ Requirements and is designed to store, control, and treat the stormwater runoff from all surfaces generated in excess of the one and one-half inch of rainfall. In addition to these requirements, a minimum 50' vegetative buffer from surface waters is provided.

<u>Collection</u>

Runoff from the proposed vehicular area is to be collected and conveyed to the infiltration basin via sheet flow and ultimately a stormwater network. Runoff draining from the proposed building will be collected by roof drains and will discharge into the proposed infiltration basin.

Treatment

The proposed system will offer several methods of treatment prior to release.

Runoff from vehicular areas will be directed to the infiltration basin via an enclosed stormwater network. The sump within the stormwater structures will provide the first level treatment for these areas and small particles will settle out in the structures prior to entering the infiltration basin.

The primary treatment of runoff will be provided within the infiltration basin. The vegetated side slopes and vegetated shelf will provide filtration of runoff and nutrient uptake through natural biological processes.

Storage

Stormwater to serve the proposed site improvements will be managed by an infiltration basin. The basin is sized to account for the new building footprint and parking areas. The proposed stormwater management facilities have been designed to provide for greater than 4.3" of storage, which is in agreement with the Town 4.3-inch requirement. This storage capacity is in excess of the State required 1.5-inch and provides approximately 2.9 inches of storage within the basin. The storage required to completely capture the first 1.5 inch of rainfall is 2,700 cf. The proposed infiltration basin will have a storage capacity of 5,199 cf. The temporary storage capacity has been calculated between the bottom of the basin and the emergency overflow spillway invert (8.5').

Above Grade Storage Provided In Infiltration Basin (SHWT +/- 6.2')

A - Above Grade Storage				
Elev	Area (sf)	Avg area (sf)	Volume (cf)	Cum Vol. (cf)
7.20	2761			0
		3542	2834	
8.00	4323			2834
		4731	2366	
8.50	5139			5199 (Vg)

Above Grade Storage Provided = 5,199 cf

The season high water table (SHWT) is estimated at an elevation of 6.2 ft., per site evaluation.

Disposal

The infiltration basin's primary mode of disposal for elevations between 7.0 and 8.5 ft. is through infiltration. Per site evaluation, the soils at the site are anticipated to have an infiltration rate greater than 20 in/hr. The total drawdown time from an elevation of 8.5 ft. is 0.03 days (0.8 hr). Supporting calculations for the drawdown time and storage of the proposed infiltration basin have been provided within **Appendix C**.

Calculations for the proposed infiltration basin have been provided in **Appendix C**. Kill Devil Hills calculations have been provided to demonstrate the additional storage in subsurface void space and pipe storage. Above the storage elevation of 8.5', the basin would discharge into and adjacent ground water lowering system maintained and operated by the Town. The adjacent structure has a rim elevation of 8.2'. The storage available within the basin is available in **Appendix C**.

Soils

Per the Natural Resources Conservation Service, the predominant on-site soils belong to the following groups as described below:

CoB- Corolla Fine Sand
This soil typically has 0 to 6 percent slope. Newhan - Corolla Fine Sand typically has a very high runoff class and is well drained. This soil is categorized in Hydrologic Soil Group: A.

Quible and Associates conducted a soil boing test in the vicinity of the infiltration basin. The soils observed were consistent with the NRCS soil description.

Utilities

The site is proposed to have a two (2) meters and backflow preventers (irrigation line and domestic line). The existing water supply is provided by Kill Devil Hills and changes to the existing waterline within the right-of-way is not proposed, therefore, a permit to construct from NC DEQ Public Water Supply is not required. The proposed water service shall be installed per Kill Devil Hills standard water specifications and details.

The site has access to central wastewater through KDHWWTP, LLC. Downstream capacity has been purchased and an agreement to reflect the commitment to serve has been included with this application.

Buffers and Site Vegetation

A streetscape landscape buffer is required adjacent to Croatan Highway (U.S. 158), Eighth Street, and Wrightsville Avenue. A landscape buffer between incompatible uses is required adjacent to the residential development to the northwest. A 5' buffer has been provided adjacent to the similar commercial use to the west. Interior parking landscaping is not proposed as the site has less than 40 parking spaces per Town Ordinance 153.073(E)(1).

Appendices

Appendix A - On-site Soils Map and Data

MEMORANDUM

Quible SINCE 1959
& Associates, P.C.
ENGINEERING * CONSULTING * PLANNING
ENVIRONMENTAL SCIENCES * SURVEYING
Phone: (252) 261-3300
Fax: (252) 261-1260
Web: www.quible.com

To: **Cathleen Saunders, P.E.**

From: Brian Rubino, P.G.

Date: January 17, 2022

Re: **P21103 Soil Borings**
2011 S. Croatan Highway, Town of Kill Devil Hills, NC

Cathleen,

On January 17, 2022, I visited the Site to conduct shallow soil borings in the location of the future stormwater infiltration area. The purpose of our evaluation was to understand lithologic conditions, to determine the depth and elevation of the Season High Water Table (SHWT) and to measure infiltration rates for Stormwater Management System design. Soils from the borings were found to be loose, unconsolidated, quartz-dominated sand (fine-medium grained) from the ground surface down to at least 80 inches below ground surface (an elevation of 2.4 ft). There was, however, a minor color change at the season high water table elevation which was 35 inches blow ground surface, and also at 56 inches below ground surface.

A summary of boring data collected and observed is as follows:

Soil Boring	Ground Elevation (ft); (NAVD 88)	Approx. Groundwater Elevation (ft); (NAVD 88)	Approx. Elevation of SHWT (ft); (NAVD 88)
SB-1	9.1	5.9	6.2

A temporary piezomter, using a two-inch .010 slot pvc well screen, was installed in the boring location and was allowed to recover for a period of about 1 hour before the depth to groundwater was measured using an electronic water level checker.

Infiltration rate field testing of the in-situ soils in the immediate vicinity of SB-1 was conducted using a double ringed infiltrometer (12-inch inner diameter and 24-inch outer diameter). This procedure measures the natural downward movement of water to the groundwater table which can be relied upon to design Site stormwater collection, storage and treatment systems in the area tested. Prior to measuring the infiltration rates, water was added to the rings to saturate underlying soils until a constant infiltration rate was obtained. Duplicate 15-minute infiltration tests were conducted and the results were averaged. Based on the infiltration tests conducted, the infiltration rate was found to be approximately **22 inches/hr.**

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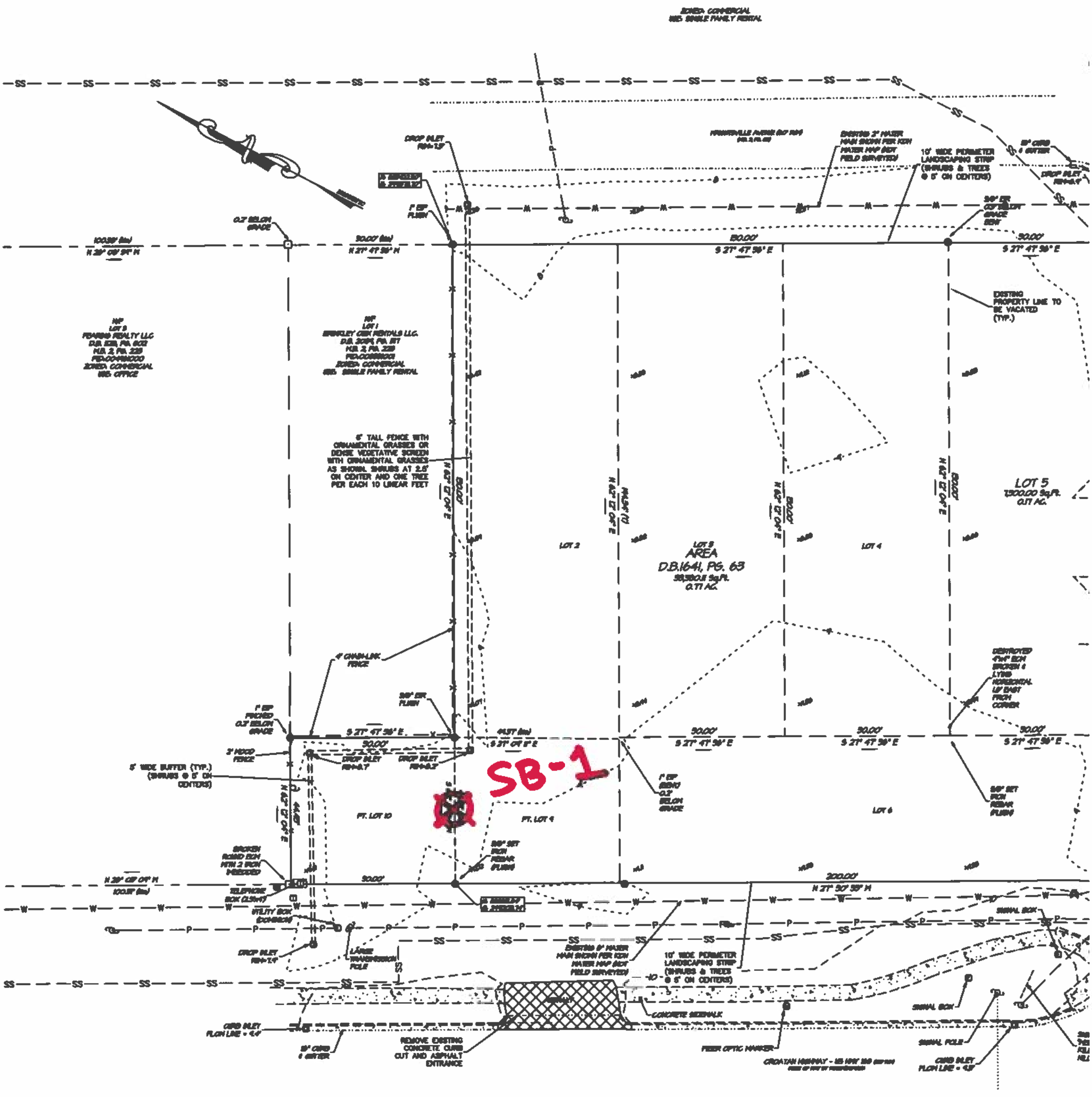
GRADING & DRAINAGE PLAN
SOIL EROSION & SEDIMENTATION CONTROL PLAN
SITE DETAILS
GRADING & DRAINAGE DETAILS
UTILITY DETAILS
EROSION & SEDIMENT CONTROL DETAILS



United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Dare County, North Carolina

January 4, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

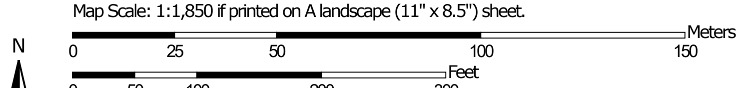
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,850 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Dare County, North Carolina
Survey Area Data: Version 21, Sep 3, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CoB	Corolla fine sand, 0 to 6 percent slopes, rarely flooded	13.7	98.9%
CrB	Corolla-Duckston complex, 0 to 6 percent slopes, rarely flooded	0.0	0.0%
DtA	Duckston fine sand, 0 to 2 percent slopes, occasionally flooded	0.2	1.1%
Totals for Area of Interest		**13.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Dare County, North Carolina

CoB—Corolla fine sand, 0 to 6 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 3qgs
Elevation: 0 to 10 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Corolla and similar soils: 85 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Corolla

Setting

Landform: Troughs on barrier islands
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 3 inches: fine sand
C - 3 to 26 inches: fine sand
Ab - 26 to 32 inches: sand
Cg - 32 to 80 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 39.96 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Duckston

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Carteret, high

Percent of map unit: 2 percent
Landform: Tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

CrB—Corolla-Duckston complex, 0 to 6 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 3qgt
Elevation: 0 to 10 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Corolla and similar soils: 50 percent
Duckston and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Corolla

Setting

Landform: Troughs on barrier islands
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 3 inches: fine sand
C - 3 to 26 inches: fine sand
Ab - 26 to 32 inches: sand
Cg - 32 to 60 inches: sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 39.96 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Duckston

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 8 inches: fine sand
Cg - 8 to 13 inches: sand
Ab - 13 to 17 inches: sand
C'g - 17 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 39.96 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

DtA—Duckston fine sand, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 3qgw
Elevation: 0 to 10 feet
Mean annual precipitation: 42 to 58 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 190 to 270 days
Farmland classification: Not prime farmland

Map Unit Composition

Duckston and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duckston

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Eolian sands and/or beach sand

Typical profile

A - 0 to 8 inches: fine sand
Cg - 8 to 13 inches: sand
Ab - 13 to 17 inches: sand
C'g - 17 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 39.96 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

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Appendix B - Stormwater Calculations

NCDEQ Stormwater Calculations

Storage Calculations

	Infiltration Basin (A) (sq.ft.)	(acre)
Drainage Area =	33,377	0.77
Open Space	11,248	0.26
Permeable Concrete =	0	0.00
Building =	3,467	0.08
Asphalt/concrete =	18,662	0.43
Impervious =	22,129	0.51
Existing to be removed (State Credit) =	0	0.00
Total Impervious (including permeable) =	22,129	0.51

Runoff generated by Rainfall Event (NCDEQ Simplified Method)

Ia = Impervious Percentage = Impervious Area/Drainage Area
Rv= Runoff Coefficient, 0.05+0.9Ia
Rd= Rain fall depth
V= Runoff Volume, 3630*Rd*Rv*A

	A (1.5")
Ia =	66.3%
Rv=	0.65
Rd (in.)=	1.5
A (ac.) =	0.77
V (cf.)=	**2699**

Total Storage Required by NCDEQ = 2700 cf

Infiltration Basin Stormwater Calculations for Town

Above Grade Storage Provided In Infiltration Basin (SHWT +/- 6.2' Assumed)

A - Above Grade Storage				
Elev	Area (sf)	Avg area (sf)	Volume (cf)	Cum Vol. (cf)
7.20	2761			0
		3542	2834	
8.00	4323			2834
		4731	2366	
8.50	5139			5199 (Vg)

A - Below Grade Storage	
Storage Area (A) =	6148.00 sf
Storage Elev. (E)	9.00 ft
Season High Water Table (Wt) =	6.20 ft
Soil Depth Above SWHT (Ds) = B-Wt	2.80 ft
Soil Volume (Sv) = A*Ds-Vg =	12015 cf
Void Ratio (Vr)=	20%
Subsurface Void Vol. (Vss) = A*Ds*Vr=	2403 cf

Above Grade Storage Provided = 5199 cf
2.9 in

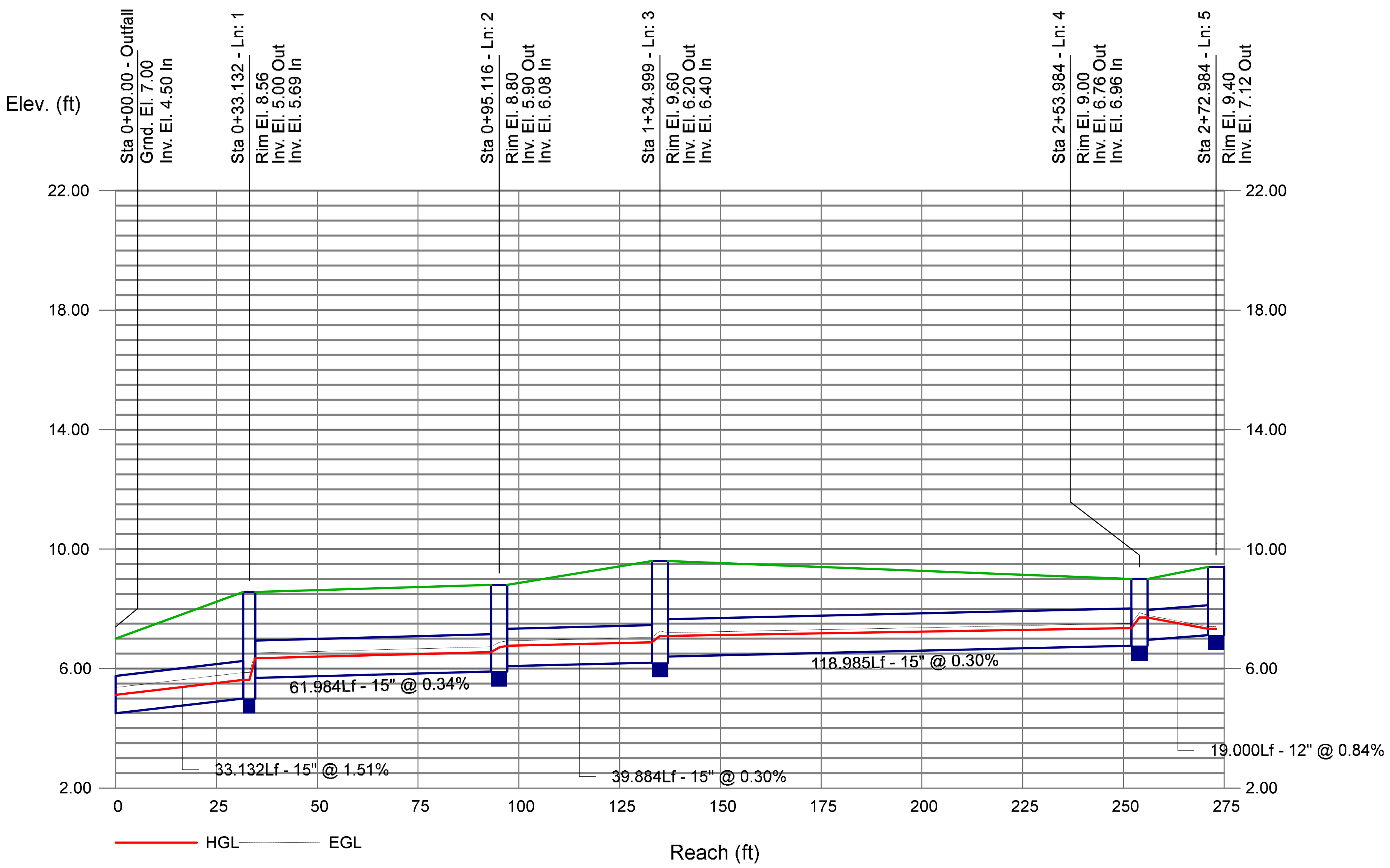
Below Grade (Voids) Storage Provided = 2403 cf

Total Storage Provided (above & below) = 7602 cf
Pipe Storage Provided = 335 cf
Total Storage Provided = 7937 cf
Total Storage Rainfall Equivalent Storage = 4.4 in

Front Infiltration Basin Drawdown Calculations

Hydraulic Conductivity = 20 in/hr (minimum for permitted basin)
Max Stored Depth = 15.6 in
Drawdown Time = Stored Depth / Hydraulic Conductivity
Drawdown Time = 0.78 hrs or 0.03 days

Storm Sewer Profile



Appendix C - NOAA Precipitation Intensity (Kill Devil Hills)

NOAA Atlas 14, Volume 2, Version 3
Location name: Kill Devil Hills, North Carolina, USA*
Latitude: 36.0167°, Longitude: -75.6667°
Elevation: 7.6 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	**0.491** (0.448-0.536)	**0.608** (0.556-0.663)	**0.690** (0.629-0.752)	**0.785** (0.712-0.852)	**0.856** (0.771-0.930)	**0.927** (0.834-1.00)	**0.995** (0.890-1.08)	**1.08** (0.962-1.18)	**1.16** (1.02-1.26)
10-min	**0.786** (0.717-0.859)	**0.973** (0.891-1.06)	**1.10** (1.01-1.20)	**1.25** (1.14-1.36)	**1.36** (1.23-1.48)	**1.47** (1.33-1.60)	**1.58** (1.41-1.71)	**1.72** (1.52-1.86)	**1.83** (1.61-1.99)
15-min	**0.988** (0.902-1.08)	**1.23** (1.13-1.35)	**1.40** (1.27-1.52)	**1.59** (1.44-1.72)	**1.73** (1.56-1.88)	**1.86** (1.68-2.02)	**1.99** (1.78-2.16)	**2.16** (1.92-2.35)	**2.29** (2.02-2.49)
30-min	**1.36** (1.25-1.49)	**1.75** (1.60-1.91)	**2.02** (1.85-2.21)	**2.35** (2.13-2.55)	**2.60** (2.34-2.82)	**2.85** (2.57-3.09)	**3.10** (2.77-3.36)	**3.44** (3.05-3.73)	**3.71** (3.27-4.04)
60-min	**1.71** (1.56-1.87)	**2.24** (2.05-2.45)	**2.64** (2.40-2.87)	**3.13** (2.84-3.40)	**3.53** (3.18-3.83)	**3.93** (3.53-4.26)	**4.34** (3.89-4.71)	**4.93** (4.37-5.36)	**5.42** (4.77-5.89)
2-hr	**1.95** (1.77-2.14)	**2.61** (2.38-2.86)	**3.13** (2.85-3.42)	**3.80** (3.43-4.14)	**4.36** (3.93-4.74)	**4.94** (4.43-5.37)	**5.57** (4.96-6.05)	**6.45** (5.69-7.00)	**7.18** (6.29-7.80)
3-hr	**2.15** (1.96-2.35)	**2.89** (2.64-3.17)	**3.49** (3.17-3.81)	**4.29** (3.87-4.68)	**4.97** (4.47-5.40)	**5.70** (5.10-6.19)	**6.50** (5.77-7.04)	**7.64** (6.71-8.27)	**8.64** (7.50-9.34)
6-hr	**2.63** (2.40-2.88)	**3.55** (3.23-3.89)	**4.29** (3.89-4.69)	**5.29** (4.77-5.76)	**6.16** (5.53-6.67)	**7.07** (6.30-7.67)	**8.09** (7.14-8.76)	**9.57** (8.34-10.4)	**10.9** (9.39-11.8)
12-hr	**3.14** (2.84-3.48)	**4.24** (3.84-4.70)	**5.15** (4.65-5.69)	**6.40** (5.75-7.04)	**7.50** (6.69-8.21)	**8.68** (7.66-9.49)	**9.99** (8.74-10.9)	**11.9** (10.3-13.0)	**13.6** (11.6-14.9)
24-hr	**3.72** (3.39-4.07)	**5.10** (4.65-5.56)	**6.15** (5.58-6.69)	**7.64** (6.89-8.29)	**8.90** (7.94-9.65)	**10.3** (9.10-11.1)	**11.8** (10.4-12.8)	**14.1** (12.1-15.3)	**16.0** (13.6-17.5)
2-day	**4.33** (3.94-4.77)	**5.90** (5.38-6.50)	**7.10** (6.47-7.81)	**8.86** (7.99-9.73)	**10.3** (9.26-11.4)	**12.0** (10.6-13.2)	**13.9** (12.2-15.3)	**16.6** (14.3-18.4)	**19.1** (16.1-21.1)
3-day	**4.59** (4.19-5.07)	**6.23** (5.69-6.86)	**7.46** (6.79-8.20)	**9.22** (8.32-10.1)	**10.7** (9.56-11.7)	**12.3** (10.9-13.5)	**14.1** (12.3-15.5)	**16.8** (14.5-18.6)	**19.2** (16.3-21.3)
4-day	**4.85** (4.44-5.36)	**6.56** (5.99-7.22)	**7.81** (7.11-8.58)	**9.58** (8.64-10.5)	**11.0** (9.86-12.1)	**12.6** (11.2-13.8)	**14.3** (12.5-15.7)	**17.0** (14.7-18.8)	**19.4** (16.6-21.5)
7-day	**5.53** (5.06-6.10)	**7.37** (6.74-8.12)	**8.72** (7.94-9.57)	**10.6** (9.57-11.6)	**12.1** (10.9-13.3)	**13.7** (12.2-15.0)	**15.5** (13.6-17.0)	**18.0** (15.6-19.8)	**20.1** (17.2-22.2)
10-day	**6.20** (5.73-6.75)	**8.15** (7.53-8.86)	**9.57** (8.81-10.4)	**11.5** (10.5-12.5)	**13.1** (11.9-14.2)	**14.8** (13.3-16.0)	**16.6** (14.7-18.0)	**19.1** (16.8-20.9)	**21.2** (18.4-23.3)
20-day	**8.19** (7.67-8.83)	**10.6** (9.90-11.4)	**12.3** (11.5-13.2)	**14.6** (13.5-15.7)	**16.4** (15.1-17.6)	**18.3** (16.8-19.8)	**20.3** (18.5-21.9)	**23.2** (20.8-25.1)	**25.5** (22.6-27.7)
30-day	**10.0** (9.40-10.7)	**12.8** (12.0-13.6)	**14.7** (13.7-15.6)	**17.2** (16.0-18.3)	**19.2** (17.8-20.4)	**21.1** (19.5-22.6)	**23.2** (21.2-24.8)	**25.9** (23.5-28.0)	**28.1** (25.2-30.5)
45-day	**12.3** (11.5-13.0)	**15.5** (14.6-16.5)	**17.9** (16.8-19.0)	**21.0** (19.5-22.3)	**23.4** (21.7-24.9)	**26.0** (23.9-27.6)	**28.6** (26.2-30.5)	**32.3** (29.2-34.6)	**35.2** (31.6-37.9)
60-day	**14.6** (13.8-15.4)	**18.3** (17.3-19.3)	**20.8** (19.7-22.0)	**24.1** (22.7-25.4)	**26.6** (24.9-28.1)	**29.1** (27.2-30.8)	**31.6** (29.3-33.6)	**35.1** (32.2-37.4)	**37.8** (34.3-40.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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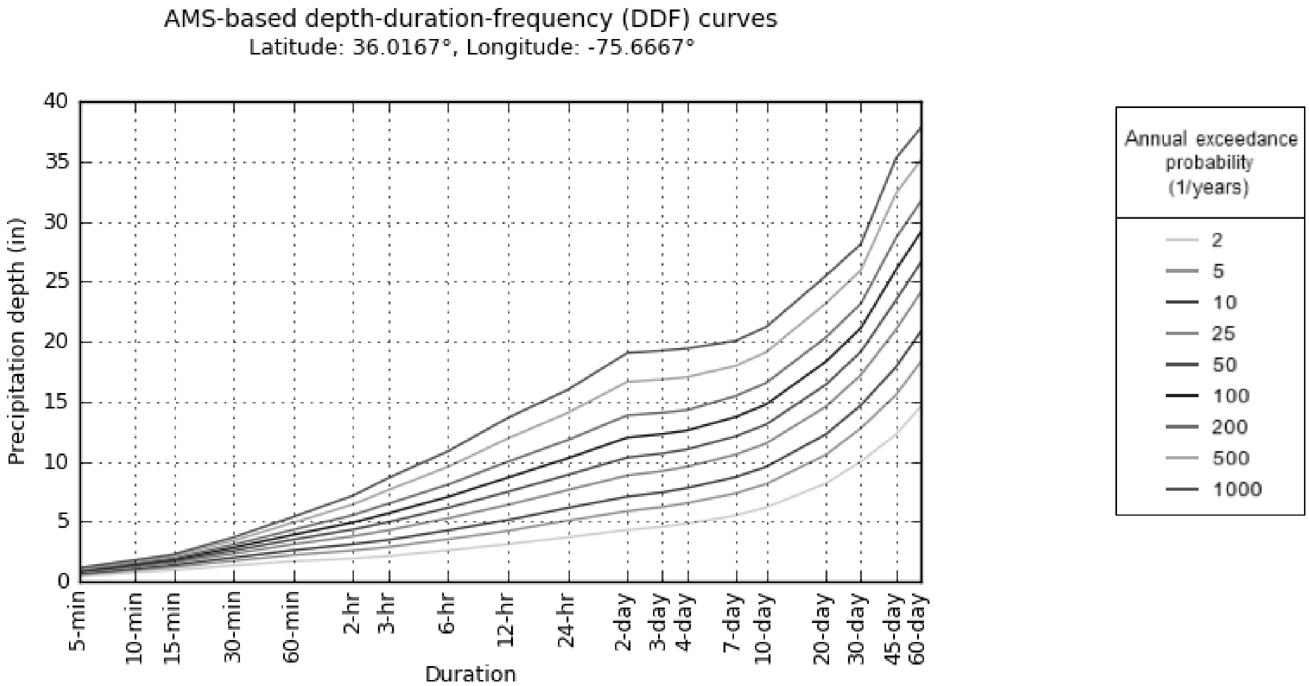
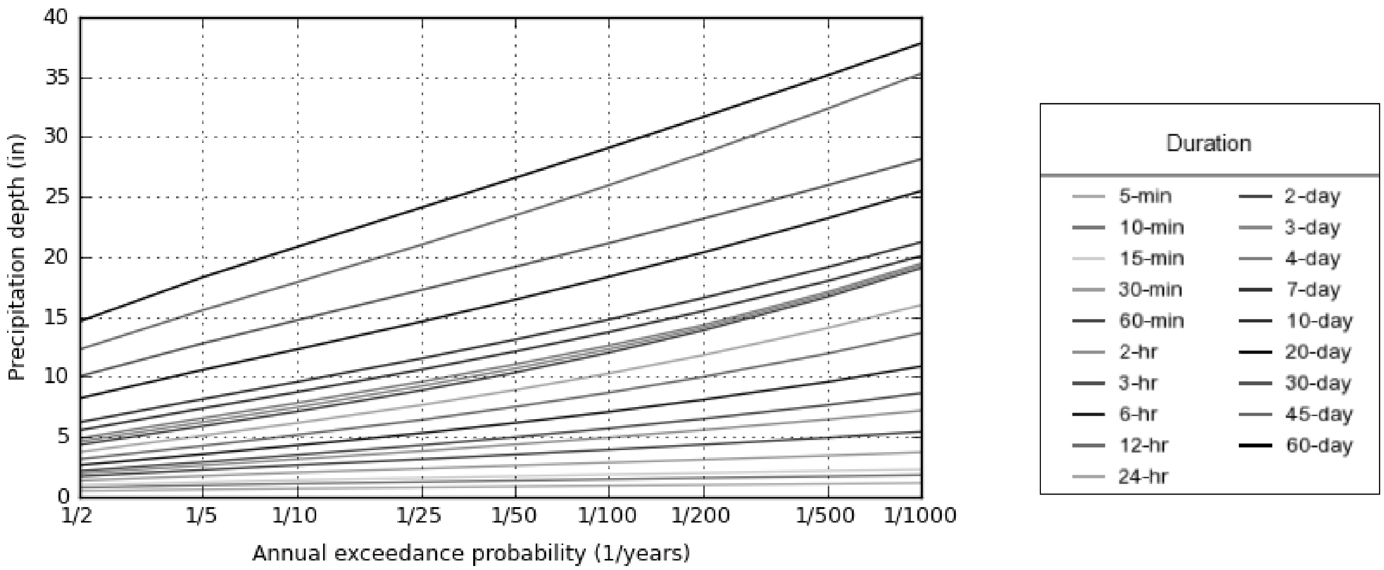
PF graphical





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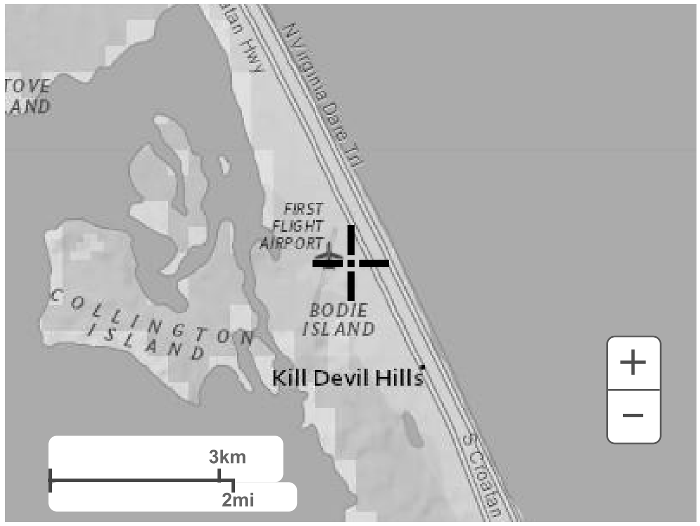
Maps & aerials

Small scale terrain



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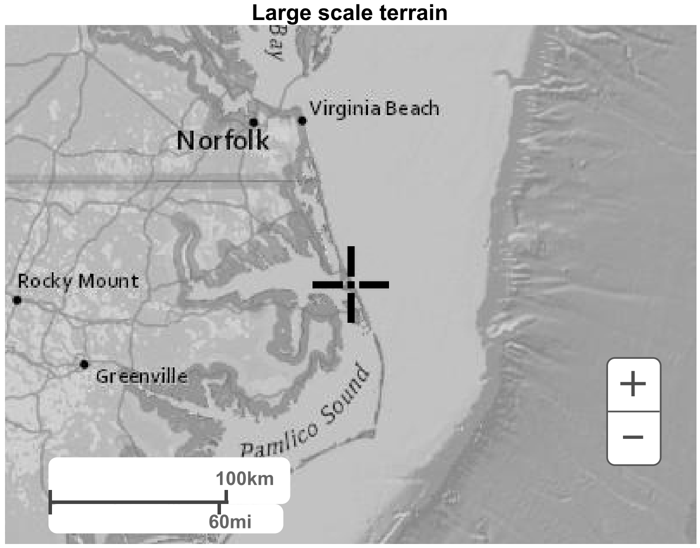
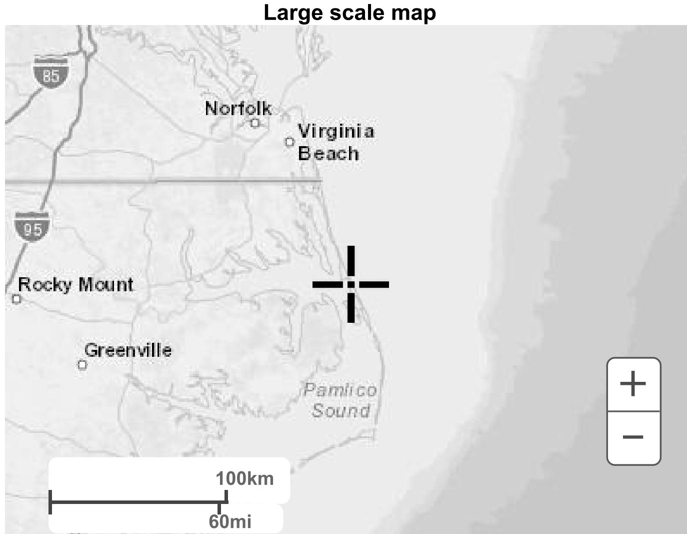
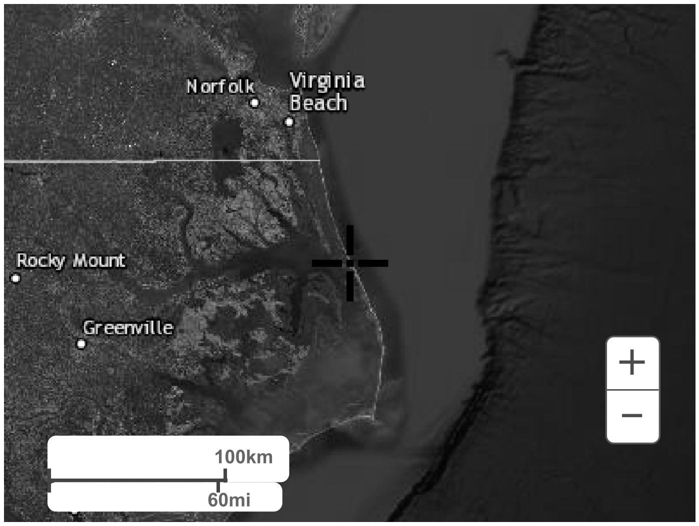


Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 2, Version 3
Location name: Kill Devil Hills, North Carolina, USA*
Latitude: 36.0167°, Longitude: -75.6667°
Elevation: 7.6 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	**1/5**	**1/10**	**1/25**	**1/50**	**1/100**	**1/200**	**1/500**	**1/1000**
5-min	**5.89** (5.38-6.43)	**7.30** (6.67-7.96)	**8.28** (7.55-9.02)	**9.42** (8.54-10.2)	**10.3** (9.25-11.2)	**11.1** (10.0-12.1)	**11.9** (10.7-12.9)	**13.0** (11.5-14.1)	**13.9** (12.3-15.1)
10-min	**4.72** (4.30-5.15)	**5.84** (5.35-6.38)	**6.62** (6.04-7.22)	**7.51** (6.81-8.15)	**8.18** (7.38-8.89)	**8.84** (7.95-9.59)	**9.46** (8.46-10.3)	**10.3** (9.13-11.2)	**11.0** (9.65-11.9)
15-min	**3.95** (3.61-4.32)	**4.92** (4.51-5.38)	**5.59** (5.09-6.09)	**6.34** (5.75-6.89)	**6.91** (6.22-7.50)	**7.44** (6.70-8.08)	**7.96** (7.12-8.62)	**8.64** (7.66-9.38)	**9.16** (8.08-9.96)
30-min	**2.73** (2.49-2.98)	**3.50** (3.20-3.82)	**4.05** (3.69-4.41)	**4.70** (4.26-5.10)	**5.20** (4.69-5.65)	**5.70** (5.13-6.19)	**6.19** (5.54-6.71)	**6.87** (6.09-7.47)	**7.42** (6.54-8.07)
60-min	**1.71** (1.56-1.87)	**2.24** (2.05-2.45)	**2.64** (2.40-2.87)	**3.13** (2.84-3.40)	**3.53** (3.18-3.83)	**3.93** (3.53-4.26)	**4.34** (3.89-4.71)	**4.93** (4.37-5.36)	**5.42** (4.77-5.89)
2-hr	**0.975** (0.886-1.07)	**1.31** (1.19-1.43)	**1.57** (1.42-1.71)	**1.90** (1.72-2.07)	**2.18** (1.96-2.37)	**2.47** (2.21-2.68)	**2.78** (2.48-3.02)	**3.22** (2.85-3.50)	**3.59** (3.15-3.90)
3-hr	**0.716** (0.653-0.783)	**0.963** (0.878-1.05)	**1.16** (1.06-1.27)	**1.43** (1.29-1.56)	**1.66** (1.49-1.80)	**1.90** (1.70-2.06)	**2.16** (1.92-2.34)	**2.55** (2.23-2.75)	**2.88** (2.50-3.11)
6-hr	**0.439** (0.400-0.480)	**0.593** (0.539-0.650)	**0.716** (0.649-0.783)	**0.884** (0.797-0.962)	**1.03** (0.923-1.11)	**1.18** (1.05-1.28)	**1.35** (1.19-1.46)	**1.60** (1.39-1.73)	**1.81** (1.57-1.96)
12-hr	**0.260** (0.236-0.289)	**0.352** (0.319-0.390)	**0.427** (0.386-0.472)	**0.532** (0.477-0.584)	**0.622** (0.555-0.681)	**0.720** (0.636-0.788)	**0.829** (0.725-0.908)	**0.990** (0.853-1.08)	**1.13** (0.962-1.24)
24-hr	**0.155** (0.141-0.169)	**0.212** (0.194-0.232)	**0.256** (0.233-0.279)	**0.318** (0.287-0.345)	**0.371** (0.331-0.402)	**0.428** (0.379-0.464)	**0.491** (0.432-0.533)	**0.586** (0.506-0.639)	**0.665** (0.565-0.730)
2-day	**0.090** (0.082-0.099)	**0.123** (0.112-0.135)	**0.148** (0.135-0.163)	**0.185** (0.166-0.203)	**0.216** (0.193-0.237)	**0.250** (0.222-0.275)	**0.289** (0.253-0.318)	**0.347** (0.298-0.383)	**0.397** (0.335-0.440)
3-day	**0.064** (0.058-0.070)	**0.086** (0.079-0.095)	**0.104** (0.094-0.114)	**0.128** (0.116-0.141)	**0.148** (0.133-0.163)	**0.171** (0.151-0.187)	**0.195** (0.171-0.215)	**0.234** (0.201-0.258)	**0.267** (0.227-0.296)
4-day	**0.051** (0.046-0.056)	**0.068** (0.062-0.075)	**0.081** (0.074-0.089)	**0.100** (0.090-0.110)	**0.115** (0.103-0.126)	**0.131** (0.116-0.144)	**0.149** (0.130-0.163)	**0.178** (0.153-0.195)	**0.202** (0.172-0.224)
7-day	**0.033** (0.030-0.036)	**0.044** (0.040-0.048)	**0.052** (0.047-0.057)	**0.063** (0.057-0.069)	**0.072** (0.065-0.079)	**0.082** (0.073-0.089)	**0.092** (0.081-0.101)	**0.107** (0.093-0.118)	**0.119** (0.102-0.132)
10-day	**0.026** (0.024-0.028)	**0.034** (0.031-0.037)	**0.040** (0.037-0.043)	**0.048** (0.044-0.052)	**0.055** (0.050-0.059)	**0.062** (0.055-0.067)	**0.069** (0.061-0.075)	**0.080** (0.070-0.087)	**0.088** (0.077-0.097)
20-day	**0.017** (0.016-0.018)	**0.022** (0.021-0.024)	**0.026** (0.024-0.028)	**0.030** (0.028-0.033)	**0.034** (0.032-0.037)	**0.038** (0.035-0.041)	**0.042** (0.039-0.046)	**0.048** (0.043-0.052)	**0.053** (0.047-0.058)
30-day	**0.014** (0.013-0.015)	**0.018** (0.017-0.019)	**0.020** (0.019-0.022)	**0.024** (0.022-0.025)	**0.027** (0.025-0.028)	**0.029** (0.027-0.031)	**0.032** (0.029-0.034)	**0.036** (0.033-0.039)	**0.039** (0.035-0.042)
45-day	**0.011** (0.011-0.012)	**0.014** (0.014-0.015)	**0.017** (0.016-0.018)	**0.019** (0.018-0.021)	**0.022** (0.020-0.023)	**0.024** (0.022-0.026)	**0.026** (0.024-0.028)	**0.030** (0.027-0.032)	**0.033** (0.029-0.035)
60-day	**0.010** (0.010-0.011)	**0.013** (0.012-0.013)	**0.014** (0.014-0.015)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.020** (0.019-0.021)	**0.022** (0.020-0.023)	**0.024** (0.022-0.026)	**0.026** (0.024-0.028)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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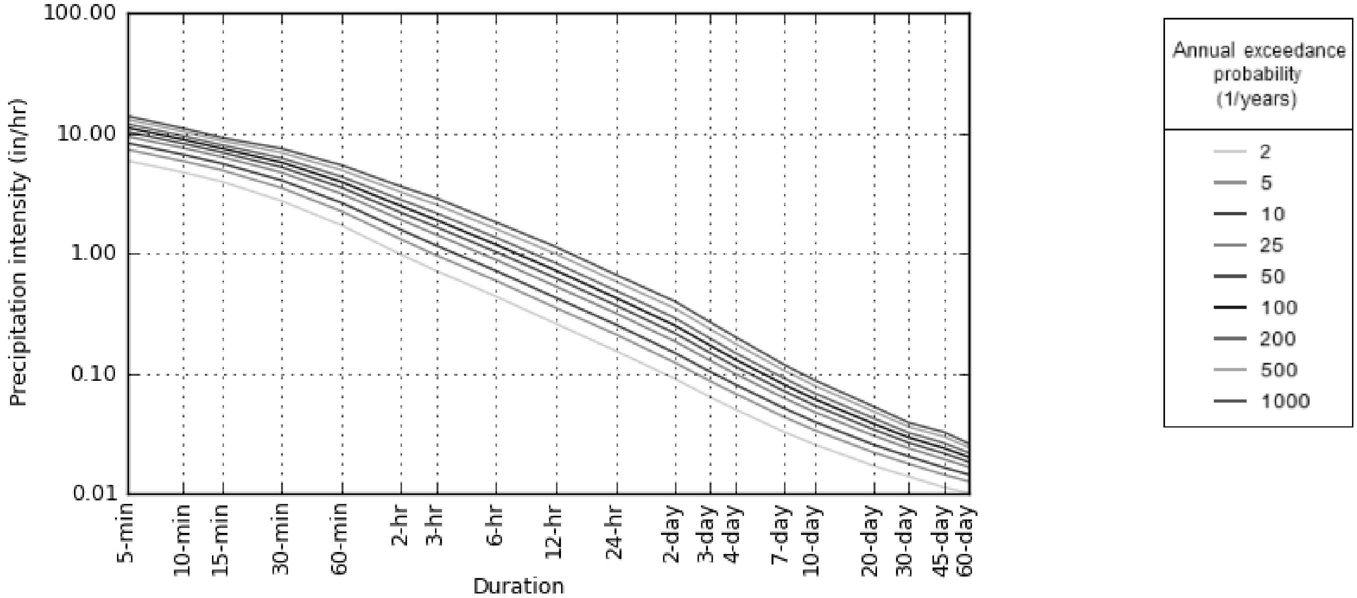
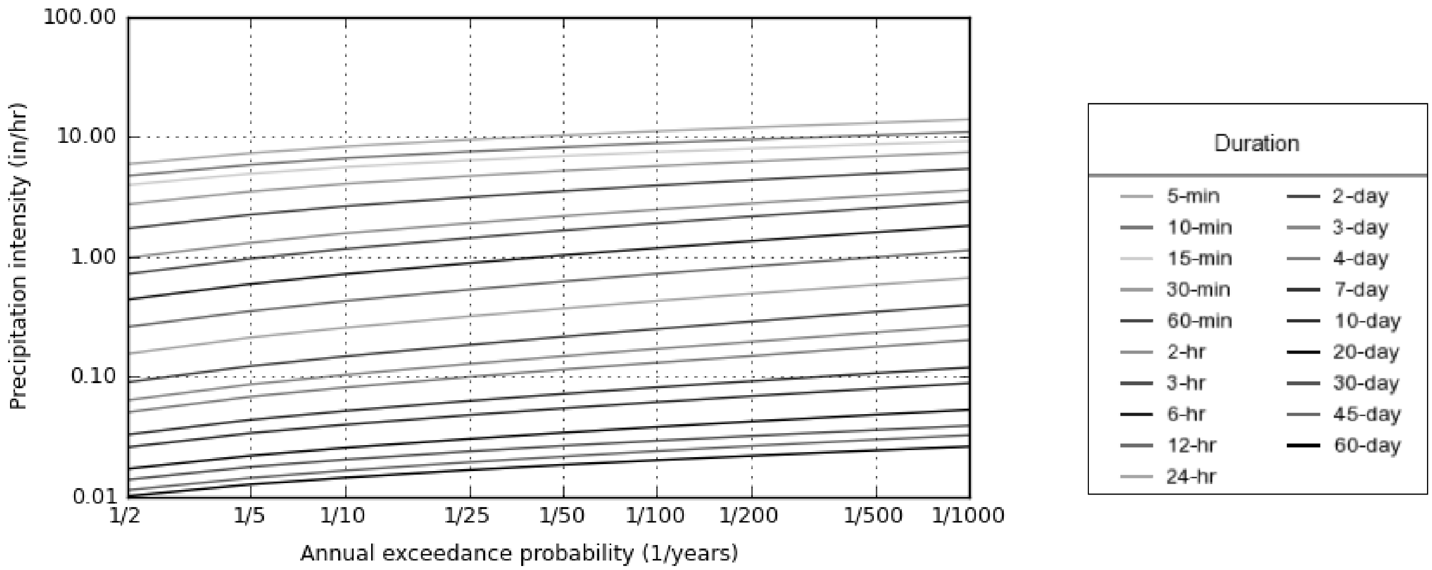
PF graphical

AMS-based intensity-duration-frequency (IDF) curves
Latitude: 36.0167°, Longitude: -75.6667°





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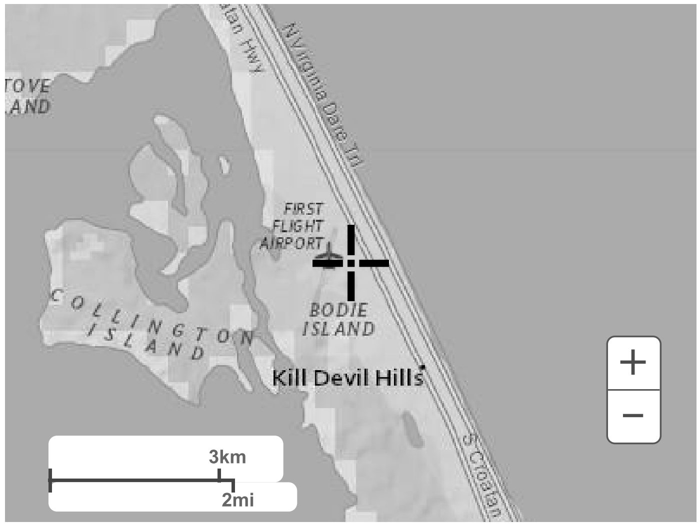
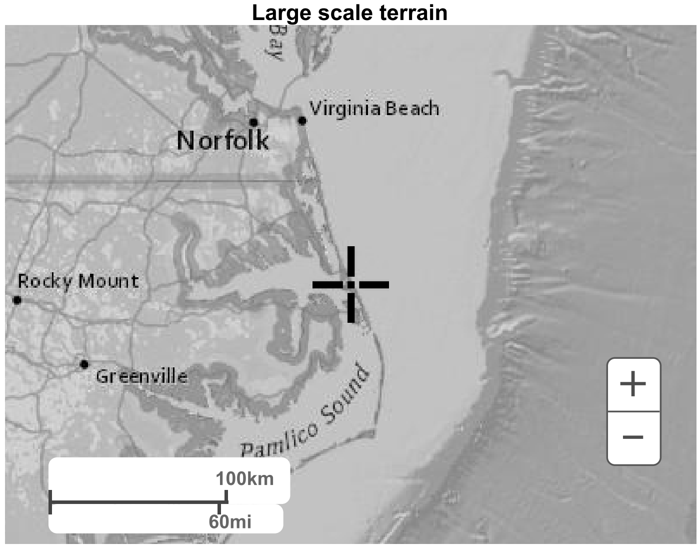
Maps & aerials

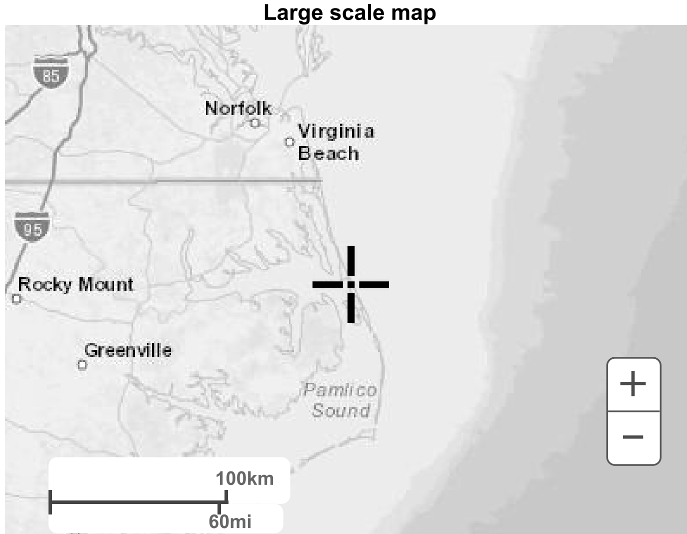
Small scale terrain



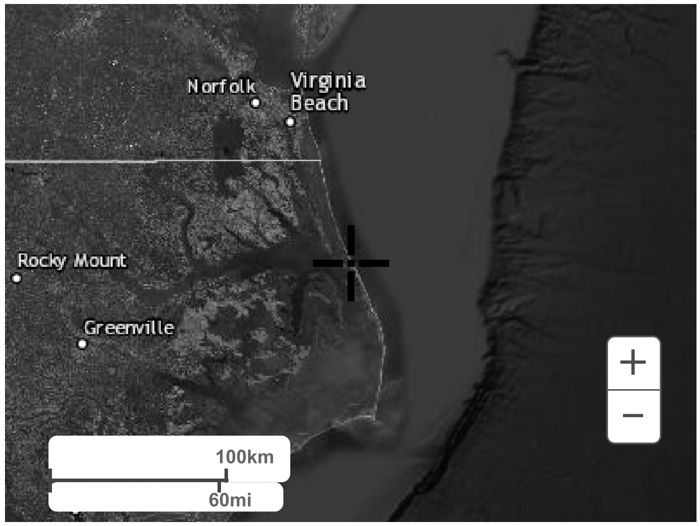
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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