STORMWATER IMPACT ANALYSIS REPORT

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC

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REPORT

I. SITE HISTORY

The existing parcel use is agricultural. It is located at the intersection of Rolesville Road and Amazon Trail. The property is divided into two (2) tax parcels, totaling 51.78 acres, consisting of PIN: 1767-28-4304 and 1767-28-4925. The parcel is bordered by agricultural fields to the north, south, and west, with a new subdivision being built directly across the property to the east. An existing stream with surrounding wetlands spans the length of the property from east to west, with a portion of the wetlands also on the southern half of the property. All existing ponds but the one in the far northwest part of the project are to be breached in a separate operation. There is no FEMA flood plain on this site.

The soil on site predominately consists of Rawlings-Rion (RgB), Wedowee-Saw (Wfb), Chewacla and Wehadkee soils (ChA), and Altavista fine sandy loam (AaA) according to the US Department of Agriculture (USDA) NRCS soil report. More detailed soil information can be found in the project Geotechnical Report (see separate document uploaded with project submission).

The existing site is relatively hilly, with high points on the southern border and southeast portion of the site, directing the site drainage towards the wetlands in the middle of the site and discharging to the west. The contours on the site range from 335' to 385' above mean sea level.

II. PROJECT DESCRIPTION

The Preserve at Moody Farm project is predominately surrounded on the north, west and south side by another development in progress known as Kalas Falls. A few small tracts at the northeast side of this project are not part of this project. There is a parcel in the middle of the project which will be referred to as the Moody Homestead. The Moody Homestead is not part of this project, however, the parcel drains onto the Moody Farm project and will be considered in the drainage calculations. The eastern boundary of this project is Rolesville Road which is currently undergoing road improvements to accommodate development in the area.

The project drains to Harris Creek which is part of the Neuse River basin. It is approximately one mile northwest of the intersection of Mitchell Mill Road and Rolesville Road in Wake County, North Carolina. The area of the project is 48.28 acres which does not include the Moody Homestead but does include the existing cemetery between lot #3 and #4. The project at final build out will include 82 single-family homes.

III. STORMWATER CONVEYANCE

Pipe Network

The stormwater conveyance on site is split into seven (7) networks, five (5) of which are designated respective wet ponds, one (1) for bypasses, and one (1) for culvert crossings. Stormwater pipe material is proposed to be reinforced concrete pipe (RCP) within the rights-of-way. RCP pipes on site range from 15" to 54" in diameter. Proposed public easements to allow for future access and maintenance of each SCM and infrastructure can be seen in the

Construction Drawings (CD) Plan set.

Modeling was performed in *Autodesk Hydrograph Storm Sewers* for the 10 and 25-year storm events, see Appendix C. The 10-year modeling ensured hydraulic grade lines (HGL) were maintained within the pipe networks, see Appendix C: Attachment 12. The 25-year modeling ensured HGL's were maintained within the structures, see Appendix C: Attachment 13. To accomplish modeling, inlet areas were delineated for each structure that is to accept overland flow, see Appendix B: Attachment 3. A uniform rational C-value of 0.57 was determined by implementing the post-development impervious area being conveyed to SCM's and the post-development total area being conveyed to SCM's, see Appendix C: Attachment 1. A uniform time of concentration of 10 minutes was used during modeling.

Energy Dissipation

Riprap dissipater pads have been sized for pipe outlets following NCDOT charts and methodology to reduce sediment erosion in areas where water is discharging to the surface, see Appendix C: Attachment 2. Flared-end sections or headwalls are proposed at the outlets of each system entering/exiting SCM's or proposed ditches. Either class "B" or class "1" riprap is proposed at each of these outlets, determined by pipe size and exit velocity.

Inlet Spreads

Spreads were determined on site using a storm intensity of 4 in/hr, see Appendix C: Attachment 10. The method by Limited Area was used to calculate spread sizes and determine the max drainage area per structure based off several variables including road width, longitudinal slope, cross slope, and curb and gutter profile by implementing Manning's Equation. If the max drainage area exceeded the actual drainage area, then a double inlet was implemented in design. Max spreads for this project could not exceed 7.5-feet (5.5-foot half lane + 2-foot gutter).

Permanent Ditches

Permanent diversion ditches are implemented on site to channelize flow to SCM's and divert stormwater around SCM's in specific areas (bypass). Modeling was performed in the *Hydraflow Express Extension* of Autodesk to ensure velocities of less than 10 fps were achieved, see table below. Modeling also ensured that the ditches were adequately sized so that storm water would not over top the ditch during the 10-year storm event, see Appendix B: Attachment 4 and Appendix C: Attachment 9. The contractor should ensure these ditches are stabilized immediately following grading operations to minimize sediment loss on site. See permanent ditch schedule in the CD Plan set.

Ditch Label	V_{10} (fps)	Ditch Label	V_{10} (fps)
Ditch #1A	3.52	Ditch #4B	2.22
Ditch #1B	2.69	Ditch #5A	3.61
Ditch #2	3.10	Ditch #5B	2.38
Ditch #3A	3.45	Ditch #5C	3.73
Ditch #3B	3.71	Ditch #5D	1.74
Ditch #3C	2.61	Ditch #6	3.77
Ditch #3D	2.16	Ditch #7	5.89
Ditch #4A	3.80	-	-

Table 1: *Calculated Velocities for Ditches*

Culvert Crossings

There are two (2) culvert crossings within the Moody project, see Appendix B: Attachment 5. One culvert is to be a 36" RCP pipe that will convey stormwater runoff underneath Mulberry Tree Drive. This 36" culvert conveys stormwater received from the northeast existing pond on site and the drainage area upstream. The second culvert crossing will consist of two (2) 54" RCP pipes that will convey water underneath Tansley Crest Loop. These 54" culverts convey stormwater received from Moody SCM's #1, #2, #3, onsite bypass, Kalas Falls Phase 2 (POI #7), and the Mulberry culvert upstream. All culverts pipes are to be buried to a depth of 20% of the pipe diameter to meet environmental engineering requirements.

Autodesk Hydraflow Hydrograph Extension was used to determine the peaks flows for the 10-year, 25-year, and 100-year storm events for each culvert, see Table 2: *Culvert Peak Flows*. This modeling can be seen in Appendix C. *Autodesk Hydraflow Express Extension* was used to model each culvert, by implementing peaks flows obtained from *Hydrographs*, ensuring that the 10-year hydraulic grade line remained in the pipe and the 100-year storm event does not over top the roadway, see Appendix C: Attachments 4-6. Due to the *Hydraflow Express Extension* not being capable of factoring in the loss of hydraulic capacity with a portion of the culvert pipe being buried, additional hydraulic calculations were performed to ensure culverts are sized adequately, see Appendix C: *Attachment 7*.

Culvert Label	Q_{10} (cfs)	Q_{25} (cfs)	Q_{100} (cfs)
Mulberry Culvert: 36"	24.42	33.20	47.93
Tansley Culvert: Dbl 54"	134.54	192.31	306.41

Table 2: *Culvert Peak Flows*

IV. STORMWATER CONTROL MEASURE

Quantity Control

The primary SCM's proposed on site to detain, treat, and attenuate storm-events are wet ponds. The wet ponds have been designed following the *North Carolina Department of Environmental Quality (NCDEQ) Stormwater Manual* (C-3), see Appendix D: Attachment 3. Each pond is to first be used as a sediment basin, later to be converted to a fully functioning wet pond (per design and sequencing) following installation of stormwater infrastructure and site stabilization.

Each wet pond was designed with a partially submerged vegetative shelf and their specific design elevations, control structures, and geometry can be seen in the Construction Drawing Plan Set, sheets C8.0 through C8.4. Each pond has a control structure that is designed to attenuate the 1-year 24-hour storm event less than or equal to the pre-development peak flow, see Appendix D: Attachment 5. Each emergency spillway has been designed to an elevation that will not be utilized (overtopped) during a 10-year storm event. Each wet pond is designed so that one- foot of freeboard is available during the 100-year storm event.

The SCS Method was implemented to determine curve numbers (CN) per point of discharge (POD). To do so, hydrologic soil group (HSG) data was uploaded from the USDA for determining CN calculations in each POD exhibit, see Appendix B: Attachment 1 & 2 and Appendix D: Attachment 3. During calculations, if a HSG had two values (E.g. A/D), the more conservative CN value was selected for that area (E.g. D group). Calculations were performed following the NCDEQ design manual (Section B). In doing so, a composite CN value was determined for each

POD area. These POD areas and composite CN values were entered into the *Autodesk Hydraflow Hydrograph Extension* to allow for each wet pond to be modeled for desired storm events, see Appendix D: Attachment 4-7.

For modeling purposes, the site had two notable points of discharges. In the post-development scenario, POD #2 was split into five (5) smaller points of discharge areas and the cumulative flow is represented in Table 4: *Post-Development Peak Flow* (see below).

The pre-development calculated peak flow from each POD area combined for a respective storm event can be seen below in Table 3: *Pre-Development Peak Flow.*

	Q_1 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
POD 1	11.80	34.24	65.08
POD 2	48.86	138.98	263.30

Table 3: *Pre-Development POD flows*

The post-development calculated peak flow from each POD area combined for a respective storm event can be seen below in Table 4: *Post-Development Peak Flow.*

	Q_1 (cfs)	Q_{10} (cfs)	Q_{100} (cfs)
POD 1	9.37	22.90	40.90
POD 2	41.55	137.75	333.32

Table 4: *Post-Development Peak Flow*

As seen in the tables above, the 1-year and 10-year storm event peak flows are lower in the post-development. Due to the 100-year storm hydraulic grade lines being within SCM emergency spillways, post-development peak flows surpass pre-development peak flows during the 100-year storm event.

Quality Control

Nutrient reduction was quantified on site by implementing the *North Carolina Department of Environmental Quality SNAP Tool*, see Appendix D: Attachment 1. Due to the site being within the Neuse River Basin, maintaining a total nitrogen (TN) load rate equal to or lower than 3.60 lb/ac/yr is required. If the TN load rate for the project is between 3.60 lb/ac/yr 6.00 lb/ac/yr buydown is required and an acceptable alternative to providing additional SCM treatment. The *SNAP Tool* calculated the project has a nitrogen export rate of 2.87 lb/ac/yr and no offset payment is required to a private nutrient bank.

V. METHODOLOGY

The stormwater design calculations are conducted using the following methods:

- Precipitation intensity and depths for the site were obtained from https://hdsc.nws.noaa.gov/pfds/pfds_map_cont.html?bkmrk=nc.
- Rational method was used to determined Q-values for inlet areas.
- The composite runoff coefficients (C-Value) were computed using the C-values from NCDEQ Stormwater Design Manual and are included in Appendix C: Attachments 1.
- SCS method was used to determine Q-values for drainage areas (POD's)

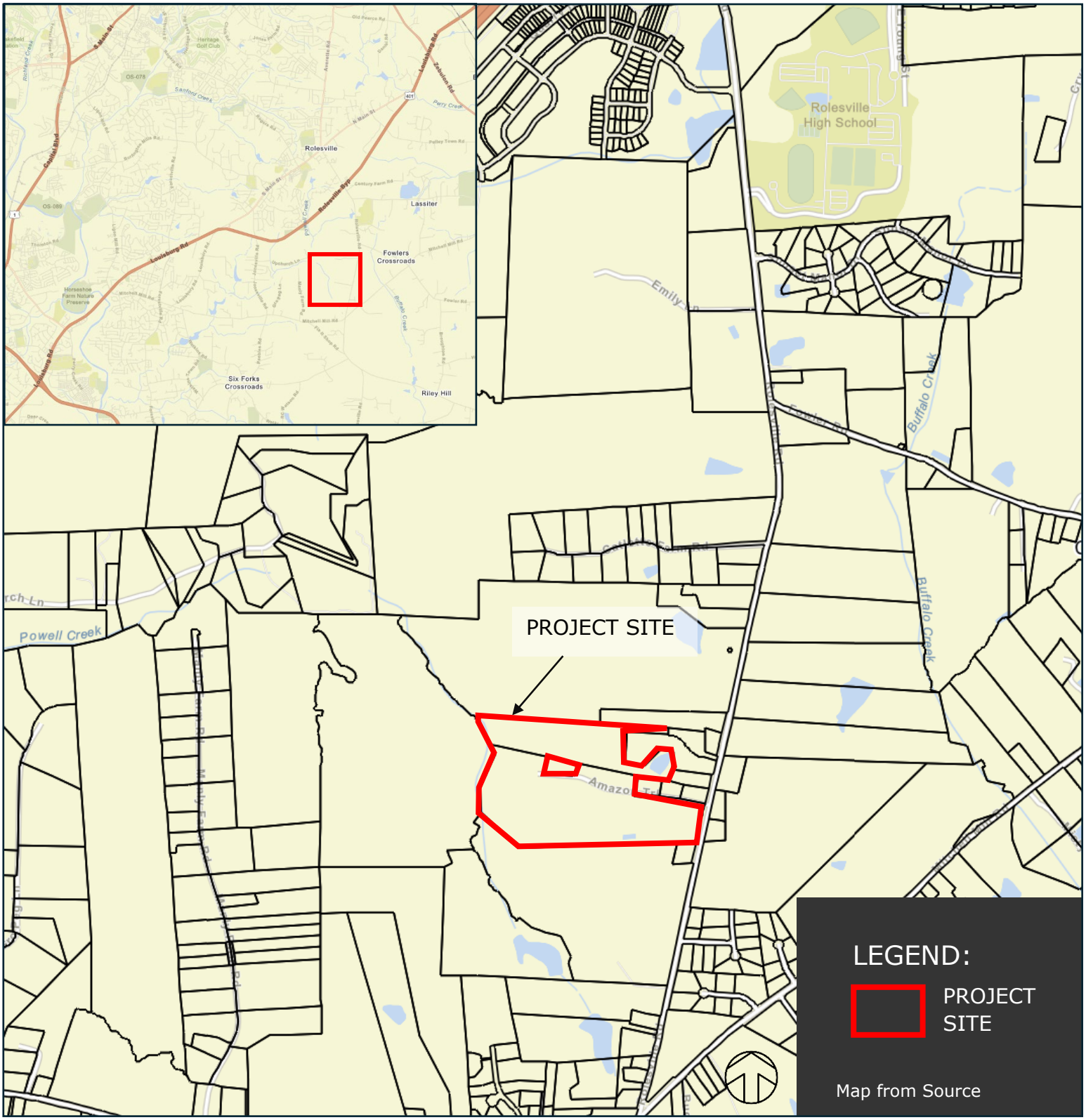
- The curve numbers (CN) were computed using the CN -values from NCDEQ Stormwater Design Manual and are included in Appendix D: Attachment 3.
- Time of concentration (Tc) was calculated using the Kirpich method where applicable. A minimum Tc of 10-minutes was used for stormwater conveyance calculations.
- For culvert modeling, TR-55 method was used to determine time of concentraions (Tc).
- *Autodesk Hydraflow Hydrograph Extension* program was used to model wet ponds and determine peak flows at culverts.
- *Autodesk Hydrograph Storm Sewers Extension* program was used to model storm pipes.
- *Autodesk Hydraflow Express Extension* program was used to model ditches and culverts.
- Riprap sizing for erosion and sediment control was determined using NCDOT standard detail #876.02 "*Guide for Rip Rap at Pipe Outlets*".
- Nutrient reduction was quantified by implementing the *NCDEQ SNAP Tool*.

VI. CONCLUSION

It is our professional opinion that the proposed stormwater design on site meets the requirements of the *NCDEQ Stormwater Manual* and the Wake County Stormwater Rules and Regulations.

APPENDIX A

PROJECT MAPS & DATA

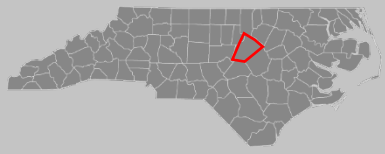


AMERICAN Engineering

VICINITY MAP

THE PRESERVE AT MOODY FARM

WAKE COUNTY



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 Wake County, North Carolina

November 19, 2024

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.

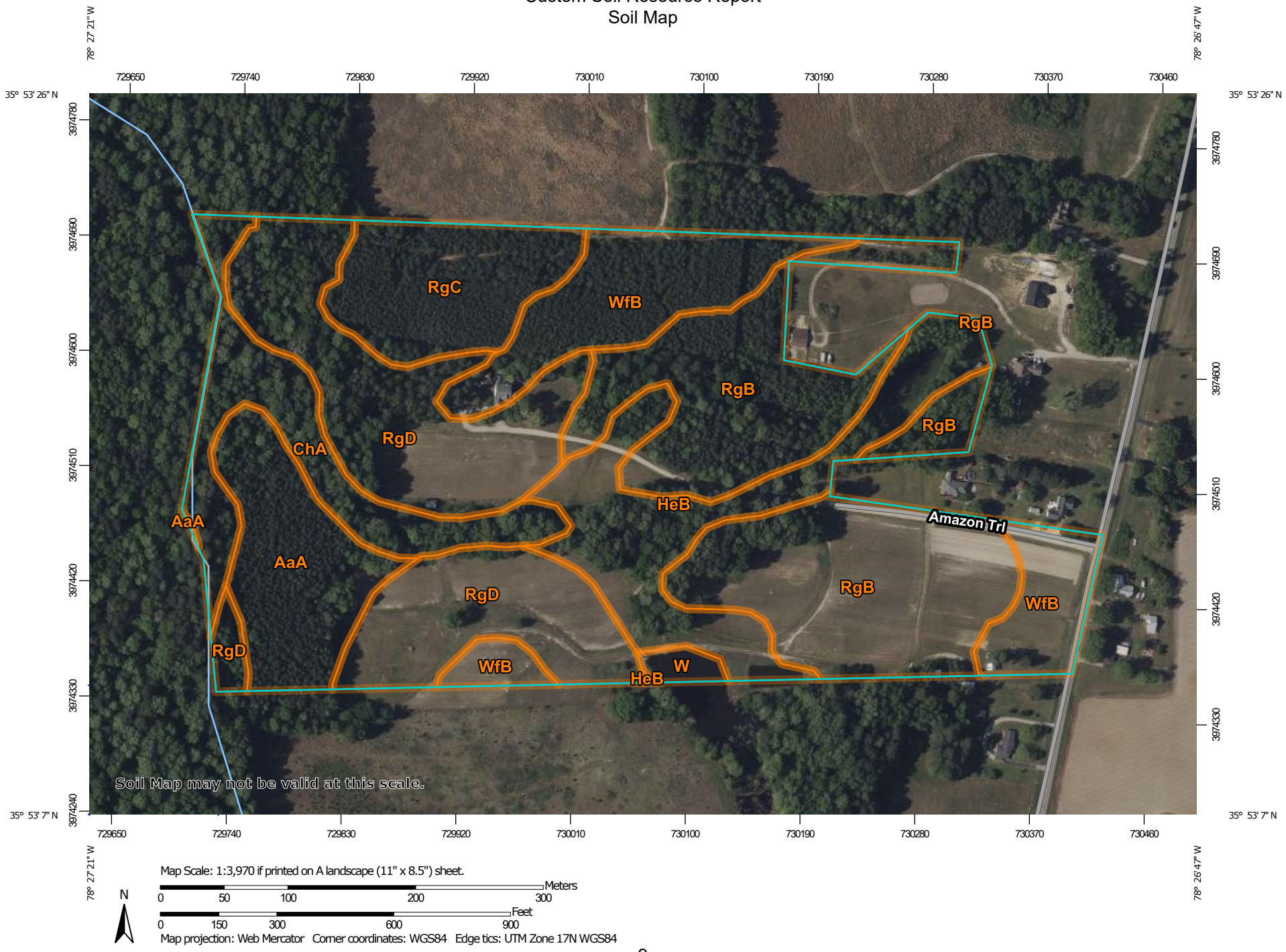
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,970 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N 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: Wake County, North Carolina
Survey Area Data: Version 26, Sep 9, 2024

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

Date(s) aerial images were photographed: Apr 24, 2022—May 9, 2022

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
AaA	Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded	4.5	8.5%
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	4.5	8.6%
HeB	Helena sandy loam, 2 to 6 percent slopes	6.3	12.0%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	14.3	27.2%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	4.2	7.9%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	11.8	22.4%
W	Water	0.4	0.7%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	6.7	12.8%
Totals for Area of Interest		**52.7**	**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.

Wake County, North Carolina

AaA—Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 2xh95
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Altavista, rarely flooded, and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Altavista, Rarely Flooded

Setting

Landform: Stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old loamy alluvium derived from igneous and metamorphic rock

Typical profile

Ap - 0 to 8 inches: fine sandy loam
E - 8 to 12 inches: fine sandy loam
BE - 12 to 15 inches: sandy clay loam
Bt - 15 to 35 inches: clay loam
BC - 35 to 42 inches: sandy loam
C - 42 to 80 inches: coarse sandy loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F136XY660NC - High terraces, very rare inundation
Hydric soil rating: No

Minor Components

Roanoke, occasionally flooded, undrained

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

ChA—Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2qwpj
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Chewacla, frequently flooded, and similar soils: 50 percent
Wehadkee, frequently flooded, and similar soils: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chewacla, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium derived from igneous and metamorphic rock

Typical profile

A - 0 to 4 inches: loam
Bw1 - 4 to 26 inches: silty clay loam
Bw2 - 26 to 38 inches: loam
Bw3 - 38 to 60 inches: clay loam
C - 60 to 80 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: F136XY610GA - Flood plain forest, wet
Hydric soil rating: No

Description of Wehadkee, Frequently Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy alluvium derived from igneous and metamorphic rock

Typical profile

A - 0 to 7 inches: silt loam
Bg - 7 to 49 inches: clay loam
Cg - 49 to 80 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F136XY600NC - Flood plain forest, very wet
Hydric soil rating: Yes

HeB—Helena sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2qqgq

Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Helena and similar soils: 92 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helena

Setting
Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile
Ap - 0 to 12 inches: sandy loam
BE - 12 to 19 inches: sandy clay loam
Bt1 - 19 to 39 inches: clay
Bt2 - 39 to 43 inches: clay loam
BCg - 43 to 46 inches: clay loam
C - 46 to 80 inches: sandy loam

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F136XY810SC - Acidic upland forest, seasonally wet
Hydric soil rating: No

RgB—Rawlings-Rion complex, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2xhb9
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches

Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, depth restriction, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam

C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

RgC—Rawlings-Rion complex, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 2xhbb
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, depth restriction, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam
C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

RgD—Rawlings-Rion complex, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2xhb8
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, depth restriction, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam
C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 2qqjv
Elevation: 70 to 450 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

WfB—Wedowee-Saw complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2xn42
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wedowee and similar soils: 60 percent
Saw and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wedowee

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite residuum weathered from granite and gneiss and/or saprolite residuum weathered from schist

Typical profile

Ap - 0 to 4 inches: sandy loam
E - 4 to 7 inches: sandy loam
BC - 23 to 35 inches: clay loam
C - 35 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

Description of Saw

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: clay
BC - 20 to 26 inches: sandy clay loam
C - 26 to 29 inches: sandy loam
R - 29 to 80 inches: bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, depth restriction, dry-moist
Hydric soil rating: No

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PROJECT
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U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

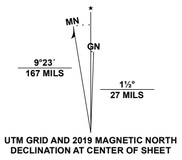
The National Map US Topo

ROLESVILLE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 17S

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP,	July 2020 - July 2020
Roads	U.S. Census Bureau,	2016
Names	GNIS,	1980 - 2022
Hydrography	National Hydrography Dataset,	2001 - 2021
Contours	National Elevation Dataset,	2008
Boundaries	Multiple sources; see metadata file	2019 - 2021
Wetlands	FWS National Wetlands Inventory	Not Available



UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
QV
Grid Zone Designation
17S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

ADJOINING QUADRANGLES

ROAD CLASSIFICATION

Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD
Interstate Route	US Route / State Route

ROLESVILLE, NC
2022

NSN 7643016379170
NGA REF NO. USGSX24K38453

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://FRIS.NC.GOV/FRIS

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
OTHER AREAS	Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
OTHER FEATURES	Hydrographic Feature
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at https://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at https://flood.nc.gov/ncflood, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the NCFMP. The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

SCALE

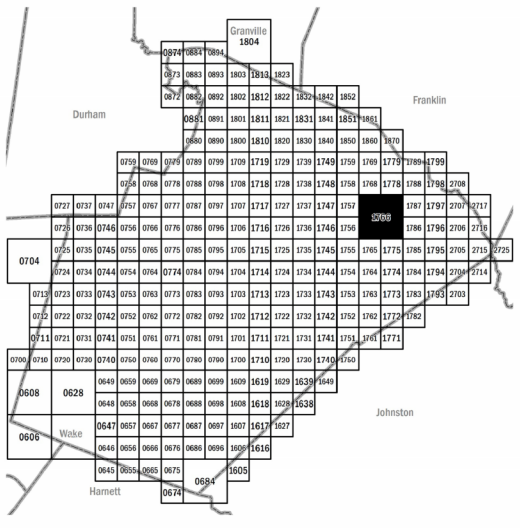
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 Feet

0 150 300 600 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 1766

FEMA

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1766	K
WAKE COUNTY	370368	1766	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720176600K

MAP REVISED
July 19, 2022

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.8876°, Longitude: -78.4479°
Elevation: 396 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

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.85** (4.44-5.30)	**5.63** (5.16-6.14)	**6.41** (5.87-7.00)	**7.20** (6.59-7.86)	**7.99** (7.28-8.72)	**8.64** (7.82-9.41)	**9.20** (8.29-10.0)	**9.71** (8.70-10.6)	**10.3** (9.12-11.2)	**10.8** (9.49-11.8)
10-min	**3.87** (3.55-4.24)	**4.50** (4.12-4.91)	**5.13** (4.70-5.60)	**5.76** (5.27-6.28)	**6.37** (5.80-6.95)	**6.88** (6.23-7.49)	**7.31** (6.59-7.97)	**7.69** (6.89-8.39)	**8.12** (7.22-8.87)	**8.48** (7.48-9.29)
15-min	**3.22** (2.95-3.53)	**3.77** (3.46-4.12)	**4.33** (3.96-4.72)	**4.86** (4.44-5.30)	**5.38** (4.90-5.87)	**5.80** (5.26-6.33)	**6.16** (5.55-6.71)	**6.47** (5.80-7.06)	**6.81** (6.06-7.44)	**7.10** (6.26-7.77)
30-min	**2.21** (2.02-2.42)	**2.60** (2.39-2.85)	**3.07** (2.82-3.35)	**3.52** (3.22-3.84)	**3.99** (3.63-4.35)	**4.37** (3.96-4.76)	**4.72** (4.25-5.14)	**5.04** (4.51-5.50)	**5.42** (4.82-5.92)	**5.75** (5.07-6.29)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.80-2.15)	**2.29** (2.10-2.50)	**2.66** (2.42-2.90)	**2.96** (2.68-3.23)	**3.25** (2.93-3.54)	**3.53** (3.16-3.86)	**3.89** (3.46-4.25)	**4.20** (3.70-4.59)
2-hr	**0.805** (0.732-0.889)	**0.958** (0.874-1.05)	**1.17** (1.06-1.28)	**1.38** (1.25-1.51)	**1.62** (1.46-1.77)	**1.83** (1.65-2.00)	**2.04** (1.82-2.23)	**2.25** (2.00-2.46)	**2.53** (2.22-2.77)	**2.78** (2.41-3.04)
3-hr	**0.568** (0.516-0.630)	**0.676** (0.617-0.746)	**0.828** (0.753-0.913)	**0.981** (0.890-1.08)	**1.17** (1.05-1.28)	**1.33** (1.19-1.46)	**1.50** (1.33-1.64)	**1.67** (1.47-1.83)	**1.90** (1.66-2.09)	**2.12** (1.82-2.32)
6-hr	**0.341** (0.311-0.377)	**0.407** (0.372-0.448)	**0.498** (0.454-0.548)	**0.591** (0.538-0.649)	**0.706** (0.638-0.773)	**0.810** (0.727-0.885)	**0.914** (0.814-0.998)	**1.02** (0.903-1.12)	**1.17** (1.02-1.28)	**1.31** (1.13-1.43)
12-hr	**0.200** (0.183-0.220)	**0.238** (0.219-0.261)	**0.293** (0.268-0.322)	**0.350** (0.319-0.383)	**0.420** (0.381-0.459)	**0.486** (0.436-0.529)	**0.552** (0.491-0.600)	**0.623** (0.548-0.677)	**0.721** (0.624-0.784)	**0.813** (0.693-0.884)
24-hr	**0.119** (0.110-0.128)	**0.144** (0.134-0.155)	**0.181** (0.168-0.195)	**0.211** (0.195-0.227)	**0.251** (0.232-0.271)	**0.284** (0.262-0.306)	**0.318** (0.292-0.343)	**0.353** (0.323-0.381)	**0.402** (0.365-0.434)	**0.441** (0.399-0.478)
2-day	**0.069** (0.064-0.074)	**0.083** (0.077-0.089)	**0.103** (0.096-0.111)	**0.120** (0.111-0.129)	**0.142** (0.132-0.153)	**0.160** (0.148-0.173)	**0.179** (0.164-0.193)	**0.198** (0.181-0.214)	**0.225** (0.204-0.243)	**0.246** (0.222-0.266)
3-day	**0.048** (0.045-0.052)	**0.058** (0.054-0.063)	**0.073** (0.068-0.078)	**0.084** (0.078-0.090)	**0.099** (0.092-0.107)	**0.112** (0.103-0.120)	**0.125** (0.115-0.134)	**0.138** (0.126-0.148)	**0.156** (0.142-0.168)	**0.171** (0.154-0.184)
4-day	**0.038** (0.036-0.041)	**0.046** (0.043-0.049)	**0.057** (0.053-0.061)	**0.066** (0.061-0.070)	**0.078** (0.072-0.083)	**0.087** (0.081-0.094)	**0.097** (0.090-0.104)	**0.108** (0.099-0.115)	**0.122** (0.111-0.131)	**0.133** (0.121-0.143)
7-day	**0.025** (0.024-0.027)	**0.030** (0.028-0.032)	**0.037** (0.035-0.040)	**0.042** (0.040-0.045)	**0.050** (0.046-0.053)	**0.056** (0.052-0.060)	**0.062** (0.057-0.066)	**0.068** (0.063-0.073)	**0.077** (0.070-0.083)	**0.084** (0.076-0.090)
10-day	**0.020** (0.019-0.021)	**0.024** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.035)	**0.038** (0.036-0.041)	**0.042** (0.039-0.045)	**0.047** (0.043-0.050)	**0.051** (0.047-0.055)	**0.057** (0.052-0.061)	**0.062** (0.056-0.066)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.027-0.031)	**0.032** (0.030-0.034)	**0.036** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.023** (0.021-0.024)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.026-0.031)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.011)	**0.012** (0.012-0.013)	**0.014** (0.013-0.015)	**0.015** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.013** (0.013-0.014)	**0.014** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.018** (0.017-0.019)	**0.019** (0.017-0.020)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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 average recurrence interval) 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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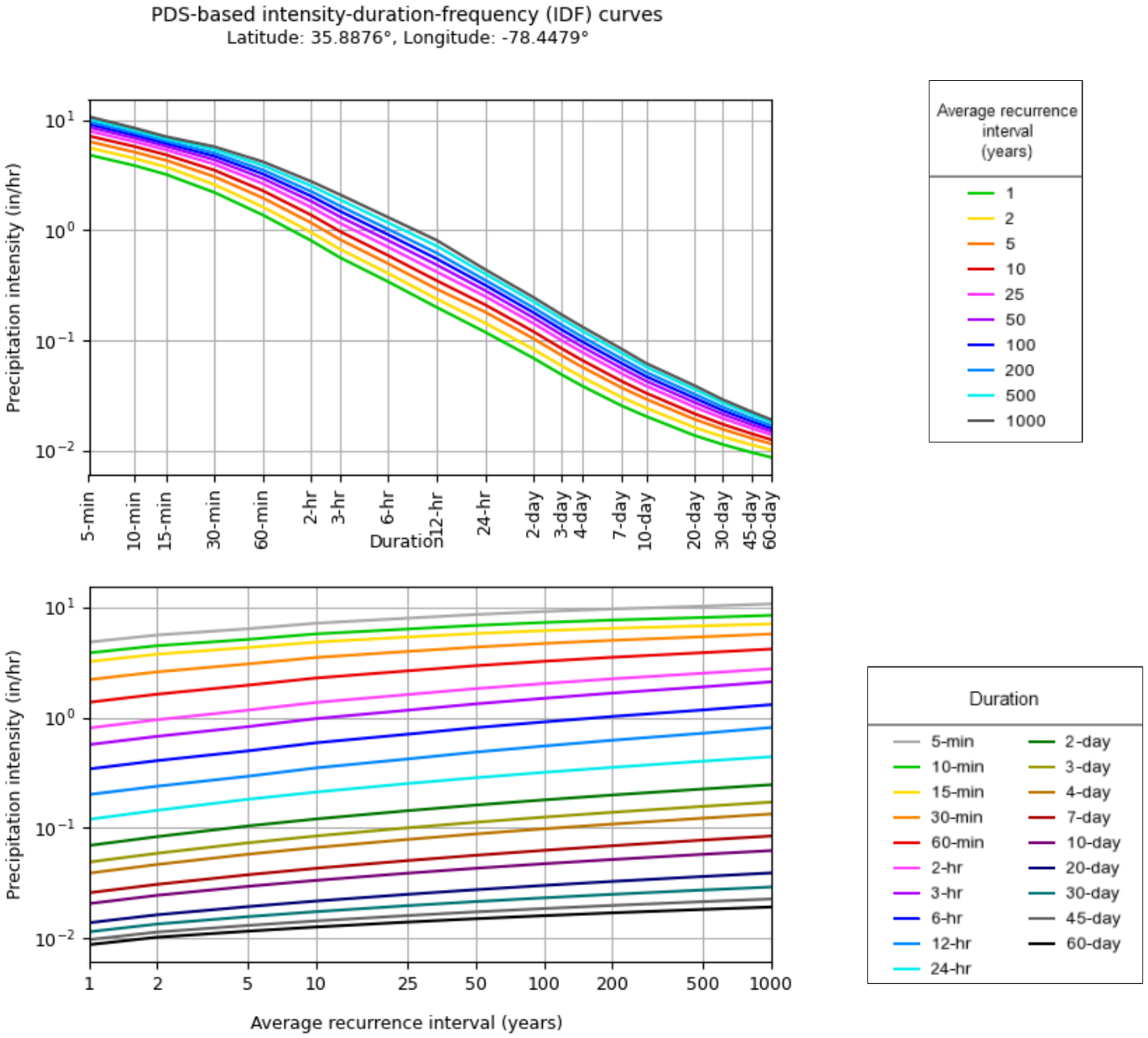
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Tue Nov 12 22:22:08 2024

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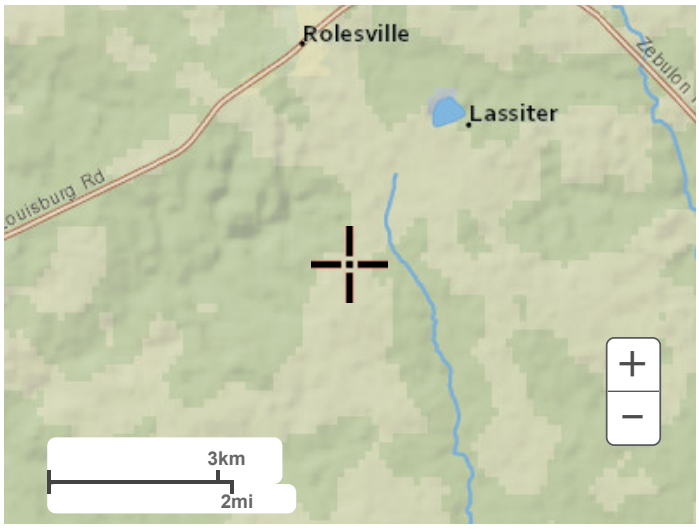
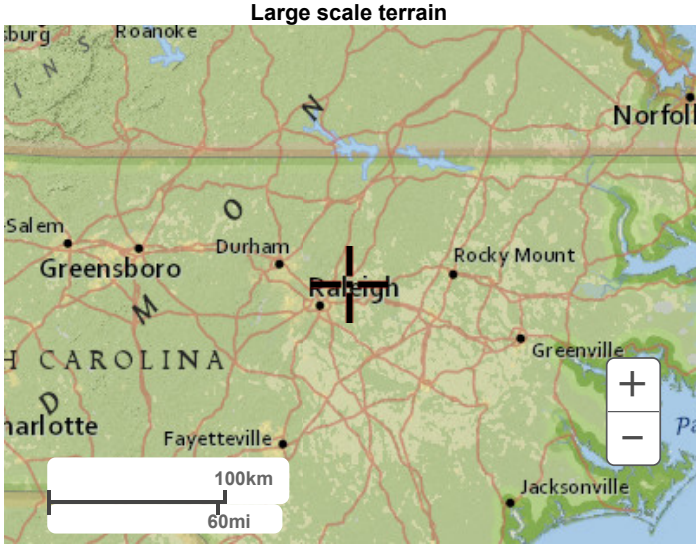
Maps & aerials

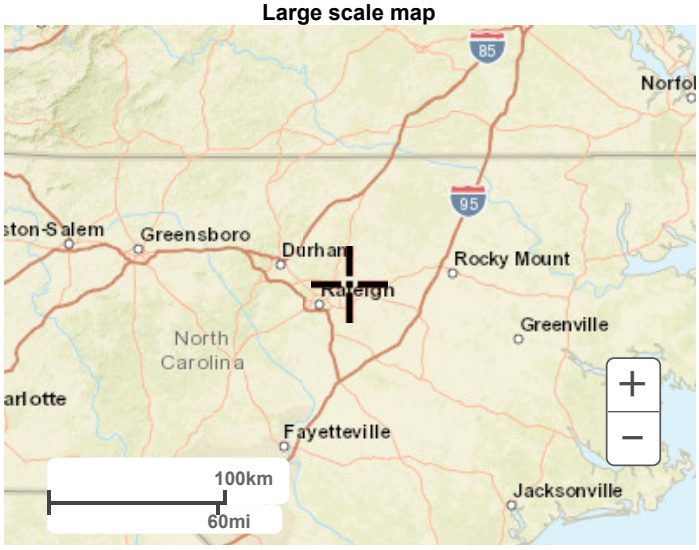
Small scale terrain



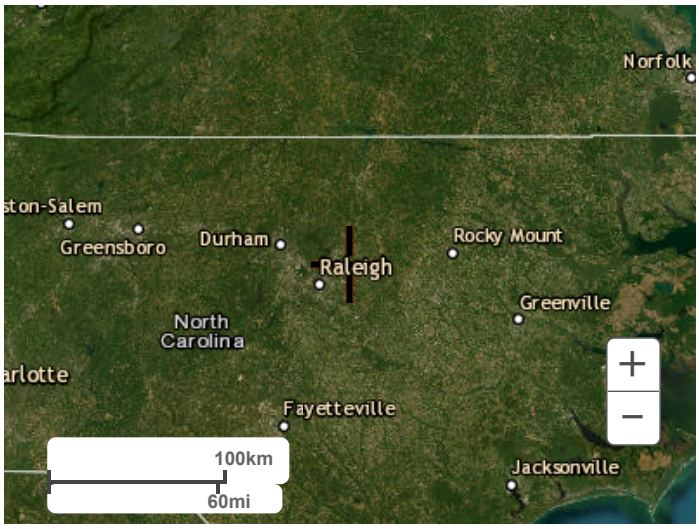
Large scale terrain



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

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.8876°, Longitude: -78.449°
Elevation: 385 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

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.404** (0.370-0.442)	**0.469** (0.430-0.512)	**0.534** (0.489-0.583)	**0.600** (0.549-0.655)	**0.666** (0.607-0.726)	**0.719** (0.652-0.784)	**0.766** (0.691-0.835)	**0.808** (0.724-0.882)	**0.854** (0.759-0.933)	**0.896** (0.790-0.981)
10-min	**0.645** (0.591-0.706)	**0.750** (0.688-0.819)	**0.855** (0.784-0.934)	**0.960** (0.878-1.05)	**1.06** (0.967-1.16)	**1.14** (1.04-1.25)	**1.22** (1.10-1.33)	**1.28** (1.15-1.40)	**1.35** (1.20-1.48)	**1.41** (1.24-1.54)
15-min	**0.806** (0.738-0.882)	**0.942** (0.864-1.03)	**1.08** (0.991-1.18)	**1.21** (1.11-1.32)	**1.35** (1.22-1.47)	**1.45** (1.32-1.58)	**1.54** (1.39-1.68)	**1.62** (1.45-1.76)	**1.70** (1.51-1.86)	**1.77** (1.56-1.94)
30-min	**1.10** (1.01-1.21)	**1.30** (1.19-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.92)	**1.99** (1.82-2.17)	**2.18** (1.98-2.38)	**2.36** (2.12-2.57)	**2.52** (2.25-2.74)	**2.71** (2.40-2.96)	**2.87** (2.53-3.14)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.81-2.15)	**2.29** (2.10-2.50)	**2.65** (2.42-2.89)	**2.96** (2.68-3.23)	**3.25** (2.93-3.54)	**3.53** (3.16-3.85)	**3.88** (3.45-4.24)	**4.19** (3.69-4.58)
2-hr	**1.61** (1.46-1.78)	**1.92** (1.75-2.10)	**2.34** (2.13-2.57)	**2.75** (2.49-3.02)	**3.24** (2.92-3.54)	**3.66** (3.29-4.01)	**4.07** (3.63-4.46)	**4.50** (3.98-4.92)	**5.05** (4.43-5.52)	**5.53** (4.81-6.07)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.86-2.24)	**2.49** (2.26-2.74)	**2.95** (2.67-3.24)	**3.50** (3.16-3.84)	**4.00** (3.58-4.39)	**4.49** (3.99-4.93)	**5.01** (4.42-5.49)	**5.70** (4.97-6.25)	**6.33** (5.46-6.96)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.72-3.28)	**3.54** (3.22-3.89)	**4.23** (3.82-4.63)	**4.85** (4.35-5.30)	**5.47** (4.87-5.97)	**6.12** (5.40-6.68)	**7.02** (6.10-7.65)	**7.84** (6.73-8.56)
12-hr	**2.41** (2.21-2.66)	**2.88** (2.64-3.15)	**3.54** (3.24-3.88)	**4.22** (3.84-4.62)	**5.07** (4.59-5.54)	**5.85** (5.26-6.37)	**6.64** (5.91-7.22)	**7.50** (6.60-8.14)	**8.68** (7.51-9.42)	**9.77** (8.33-10.6)
24-hr	**2.86** (2.66-3.09)	**3.46** (3.22-3.73)	**4.36** (4.05-4.70)	**5.07** (4.70-5.46)	**6.04** (5.58-6.51)	**6.82** (6.28-7.35)	**7.63** (7.00-8.22)	**8.47** (7.74-9.13)	**9.63** (8.75-10.4)	**10.6** (9.55-11.4)
2-day	**3.32** (3.08-3.57)	**3.99** (3.72-4.30)	**4.99** (4.64-5.38)	**5.78** (5.36-6.22)	**6.85** (6.33-7.38)	**7.71** (7.10-8.30)	**8.59** (7.89-9.26)	**9.50** (8.70-10.3)	**10.8** (9.79-11.6)	**11.8** (10.6-12.8)
3-day	**3.52** (3.28-3.77)	**4.23** (3.94-4.54)	**5.26** (4.90-5.64)	**6.07** (5.64-6.51)	**7.18** (6.65-7.70)	**8.07** (7.46-8.66)	**8.98** (8.27-9.65)	**9.93** (9.10-10.7)	**11.2** (10.2-12.1)	**12.3** (11.1-13.3)
4-day	**3.72** (3.48-3.98)	**4.46** (4.17-4.77)	**5.52** (5.15-5.90)	**6.36** (5.92-6.80)	**7.51** (6.97-8.03)	**8.44** (7.81-9.02)	**9.38** (8.65-10.0)	**10.4** (9.51-11.1)	**11.7** (10.7-12.6)	**12.8** (11.6-13.8)
7-day	**4.32** (4.04-4.61)	**5.15** (4.82-5.50)	**6.30** (5.89-6.72)	**7.20** (6.73-7.69)	**8.45** (7.87-9.02)	**9.44** (8.77-10.1)	**10.5** (9.68-11.2)	**11.5** (10.6-12.3)	**13.0** (11.9-13.9)	**14.1** (12.9-15.2)
10-day	**4.92** (4.61-5.24)	**5.85** (5.49-6.24)	**7.05** (6.61-7.51)	**8.00** (7.48-8.52)	**9.28** (8.65-9.88)	**10.3** (9.57-11.0)	**11.3** (10.5-12.1)	**12.3** (11.4-13.2)	**13.8** (12.7-14.7)	**14.9** (13.7-16.0)
20-day	**6.59** (6.20-7.02)	**7.79** (7.33-8.30)	**9.24** (8.68-9.83)	**10.4** (9.74-11.0)	**11.9** (11.2-12.7)	**13.1** (12.3-14.0)	**14.4** (13.4-15.3)	**15.6** (14.5-16.7)	**17.3** (16.0-18.5)	**18.6** (17.1-20.0)
30-day	**8.19** (7.72-8.70)	**9.64** (9.09-10.2)	**11.2** (10.6-11.9)	**12.5** (11.7-13.3)	**14.1** (13.2-15.0)	**15.4** (14.4-16.4)	**16.6** (15.5-17.7)	**17.9** (16.7-19.1)	**19.6** (18.2-20.9)	**20.9** (19.3-22.3)
45-day	**10.4** (9.89-11.0)	**12.2** (11.6-12.9)	**14.0** (13.3-14.8)	**15.4** (14.6-16.3)	**17.2** (16.3-18.2)	**18.6** (17.6-19.6)	**20.0** (18.8-21.1)	**21.3** (20.0-22.5)	**23.0** (21.6-24.4)	**24.4** (22.7-25.9)
60-day	**12.5** (11.9-13.2)	**14.6** (13.9-15.4)	**16.6** (15.7-17.4)	**18.1** (17.2-19.0)	**20.0** (19.0-21.1)	**21.5** (20.3-22.7)	**22.9** (21.6-24.2)	**24.3** (22.9-25.7)	**26.1** (24.5-27.6)	**27.5** (25.7-29.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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 average recurrence interval) 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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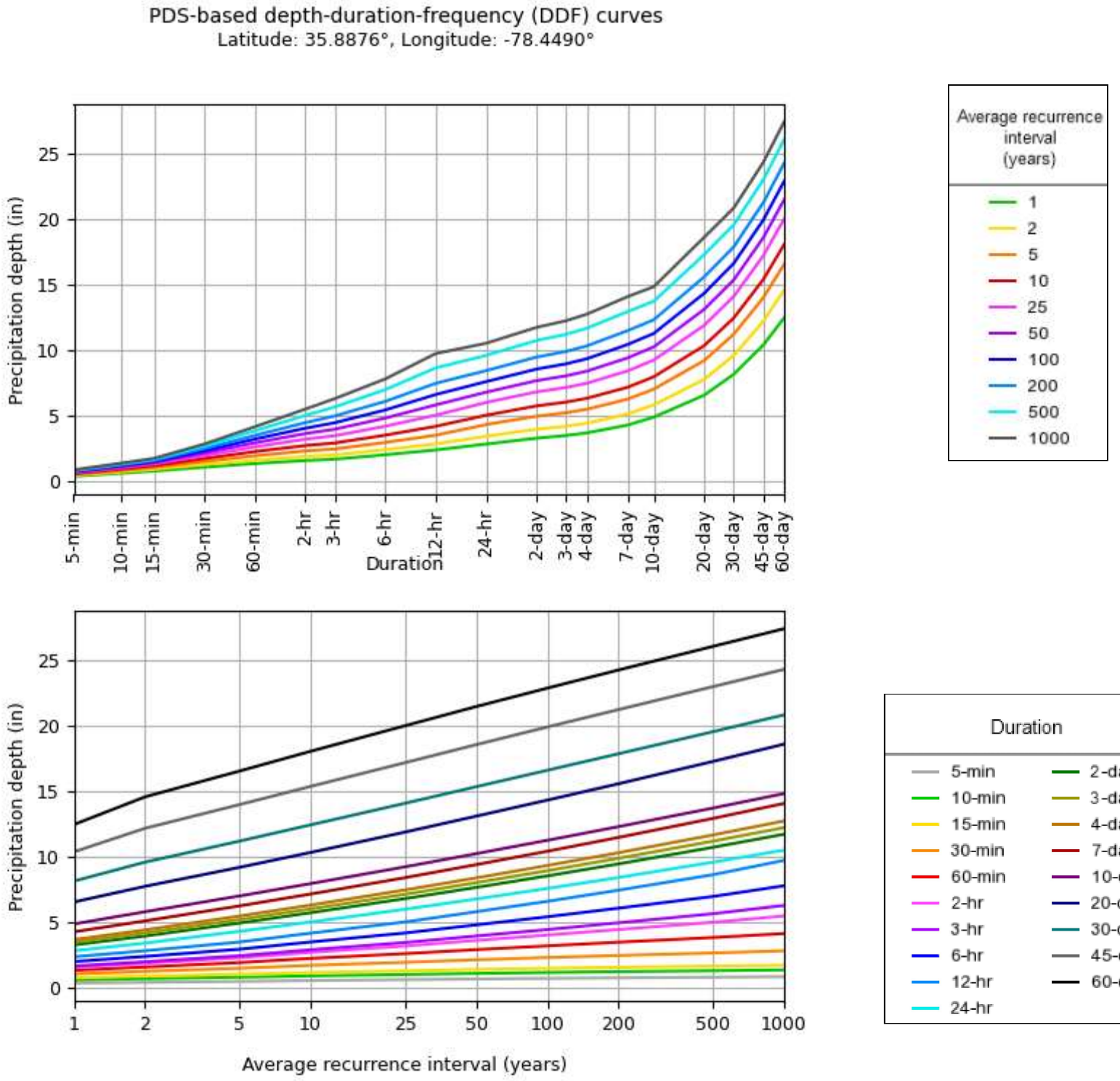
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Jan 15 19:30:08 2025

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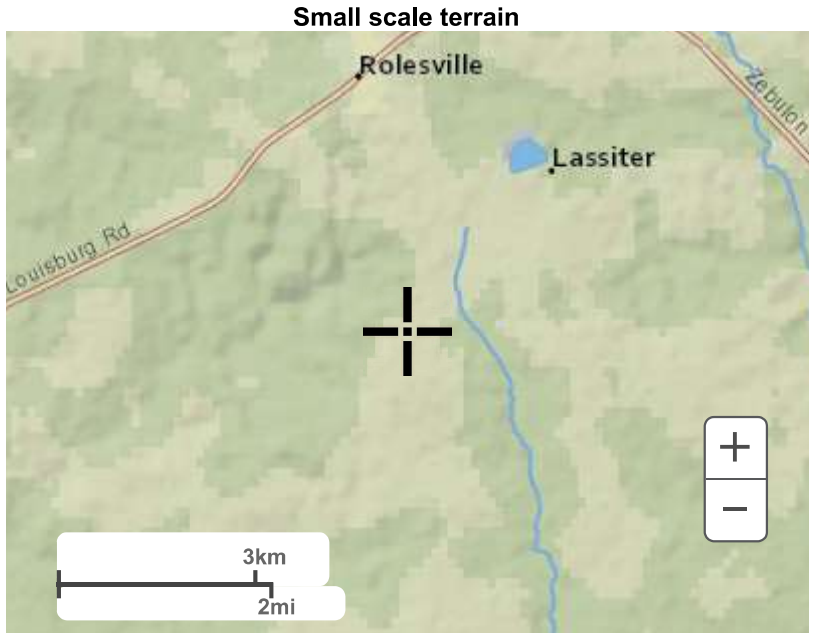
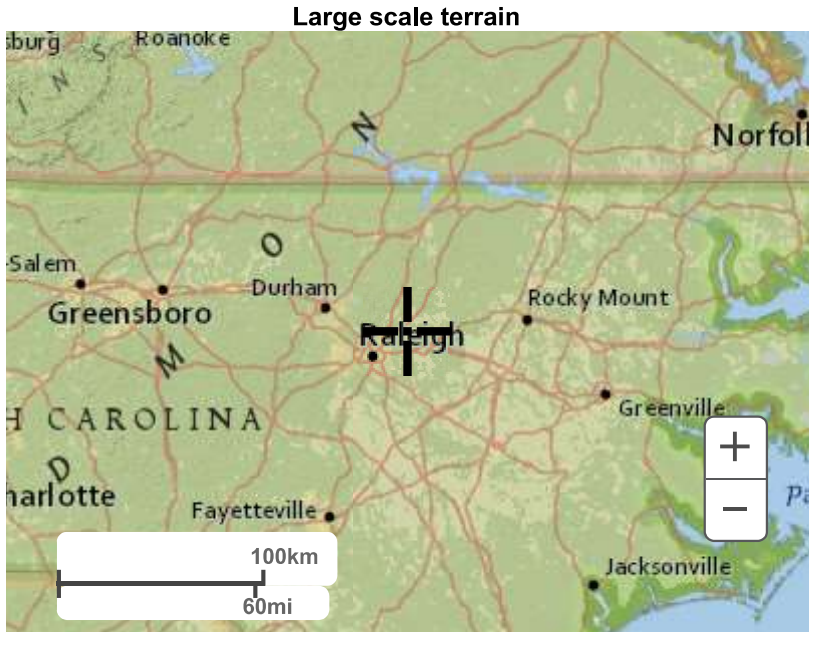
Maps & aerials

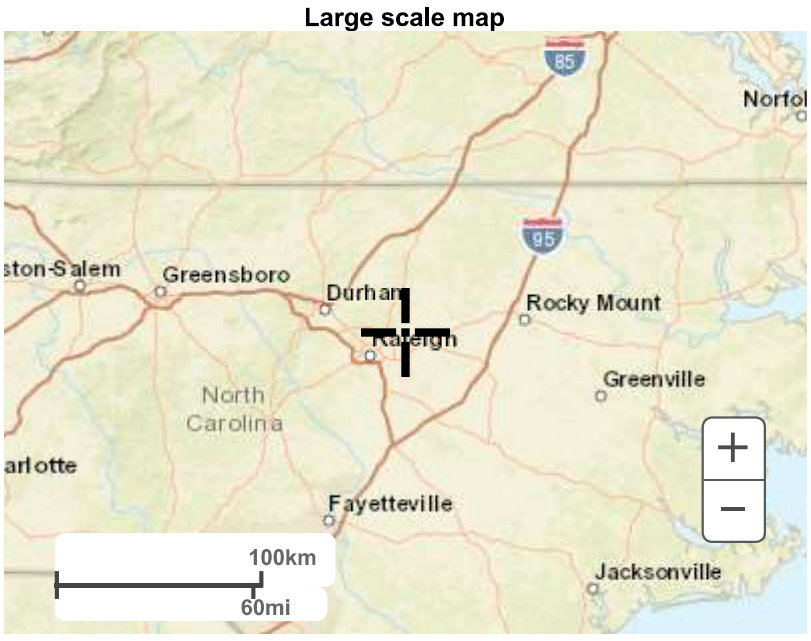
Small scale terrain



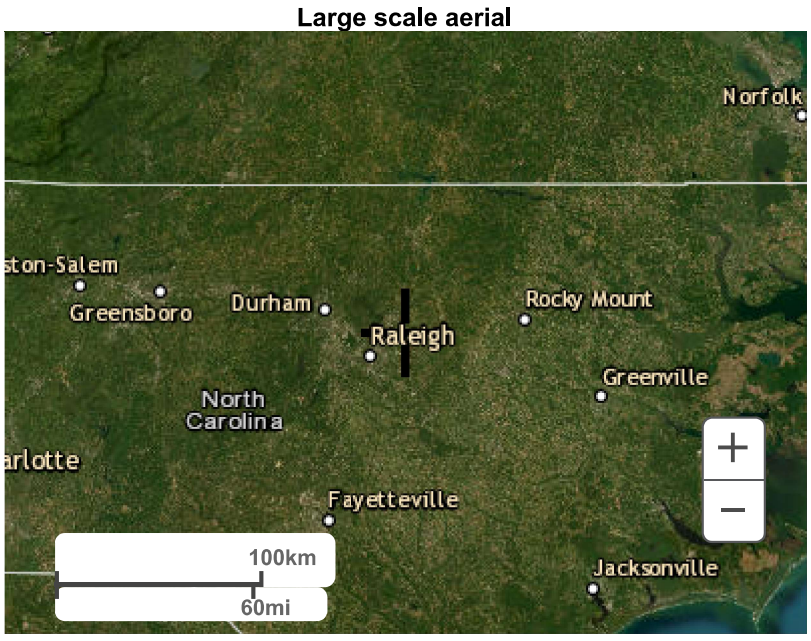
Large scale terrain



Large scale map



Large scale aerial



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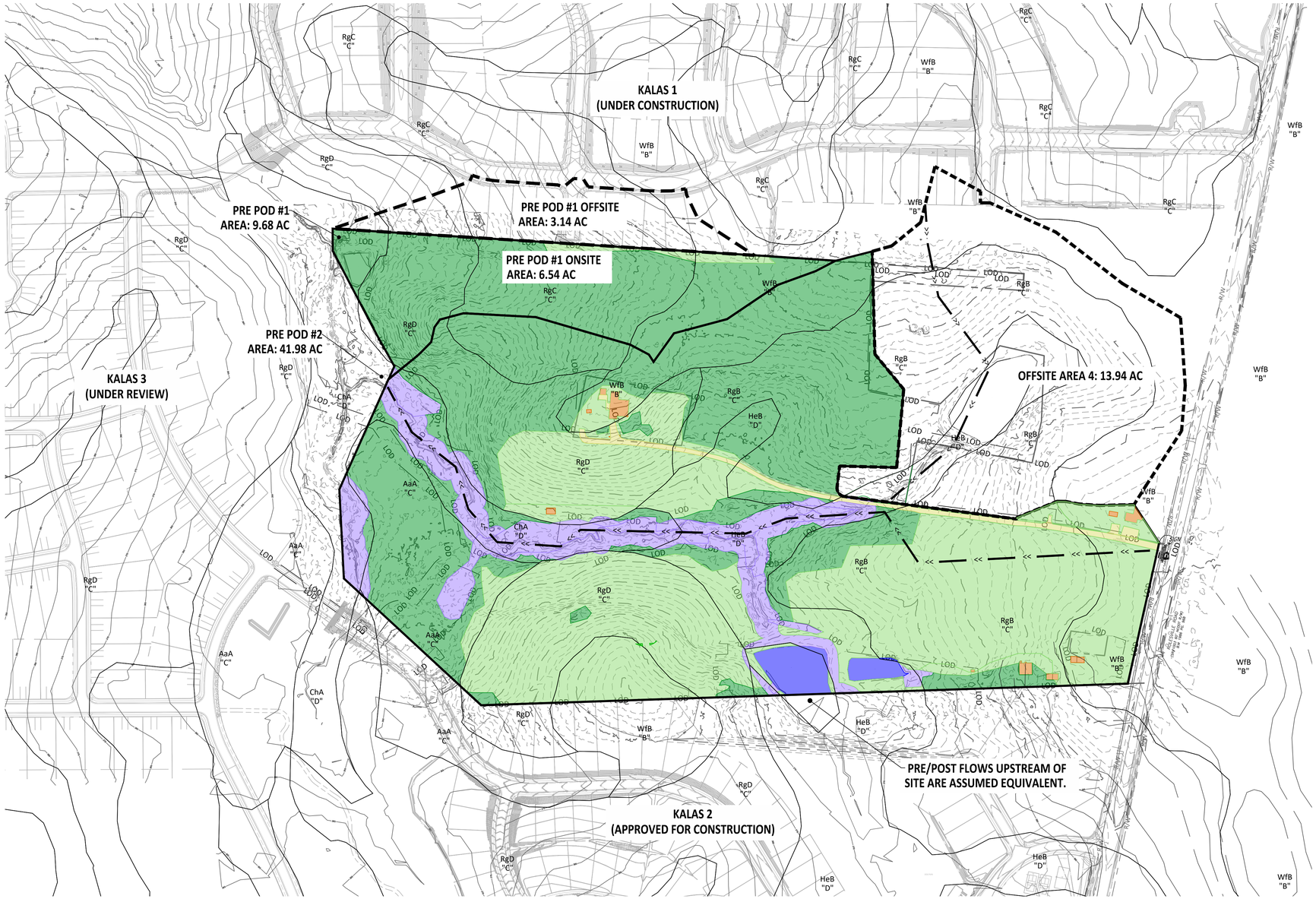
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

APPENDIX B

DRAINAGE AREA MAPS



LEGEND	
WOODS	
OPEN SPACE	
DIRT ROAD (COMPACTED)	
ROOF	
SCM/OPEN WATER	
WETLAND	
OFFSITE AREA	
POD AREA	
SOIL LINE	
TIME OF CONCENTRATION	

NOTE:

1. OFFSITE DRAINAGE AREAS ARE TO HAVE A Cn VALUE OF 74 APPLIED FOR MODELING PURPOSES.
2. THIS EXHIBIT IS TO BE USED ALONGSIDE HYDRAFLOW HYDROGRAPH MODELING FOR PEAK FLOW ATTENUATION.
4. OFFSITE DRAINAGE THAT IS UPSTREAM OF THE PROJECT AREA (SOUTH OF PROJECT) IS NOT INCLUDED IN POD 2 MODELING. THIS IS DUE TO NO CHANGE IN DRAINAGE PATTERNS FROM PRE TO POST DEVELOPMENT, ASSUMING ANY FLOWS FROM THIS AREA WOULD OFFSET.
5. IN WAKE COUNTY STORMWATER TOOL, THE SUMMATION OF DRAINAGE AREAS #2 & #3 ARE POD #2 IN THIS EXHIBIT.

GRAPHIC SCALE
100 0 50 100 200 400
(IN FEET)
1 inch =100

PRE-DEVELOPMENT POINT OF DISCHARGE AREAS

AMERICAN Engineering

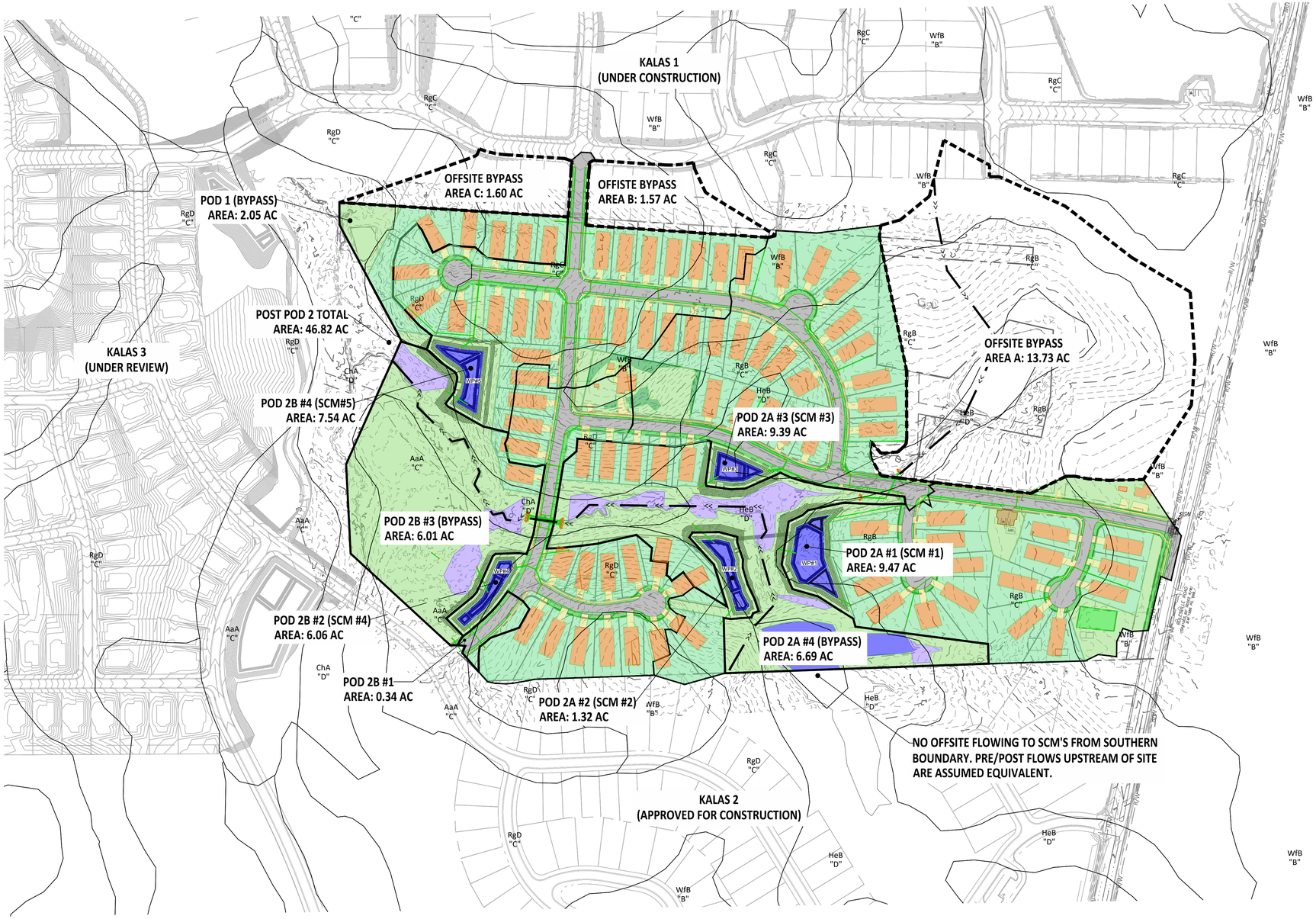
RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC | WAKE COUNTY

March 31, 2025



LEGEND	
WOODS	
OPEN SPACE	
SIDEWALK	
ROADWAY	
GRASS IN R/W	
ROOF	
SCM/OPEN WATER	
WETLAND	
OFFSITE AREA	
POD AREA	
SOIL LINE	
TIME OF CONCENTRATION	>>

NOTE:

1. OFFSITE DRAINAGE AREAS ARE TO HAVE A Cn VALUE OF 74 APPLIED FOR MODELING PURPOSES.
2. THIS EXHIBIT IS TO BE USED ALONGSIDE HYDRAFLOW HYDROGRAPH MODELING FOR PEAK FLOW ATTENUATION.
3. NO OFFSITE DRAINAGE BYPASS DELINEATED IS PROPOSED TO BE CONVEYED TO PROJECT SCM'S (DASH LINE).
4. OFFSITE DRAINAGE THAT IS UPSTREAM OF THE PROJECT AREA (SOUTH OF PROJECT) IS NOT INCLUDED IN POD 2 MODELING. THIS IS DUE TO NO CHANGE IN DRAINAGE PATTERNS FROM PRE TO POST DEVELOPMENT, ASSUMING ANY FLOWS FROM THIS AREA WOULD OFFSET.
5. IN THE WAKE COUNTY STORMWATER TOOL, THE SUMMATION OF DRAINAGE AREAS #2 & #3 ARE POD #2 IN THIS EXHIBIT.

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch =100

POST-DEVELOPMENT POINT OF DISCHARGE AREAS

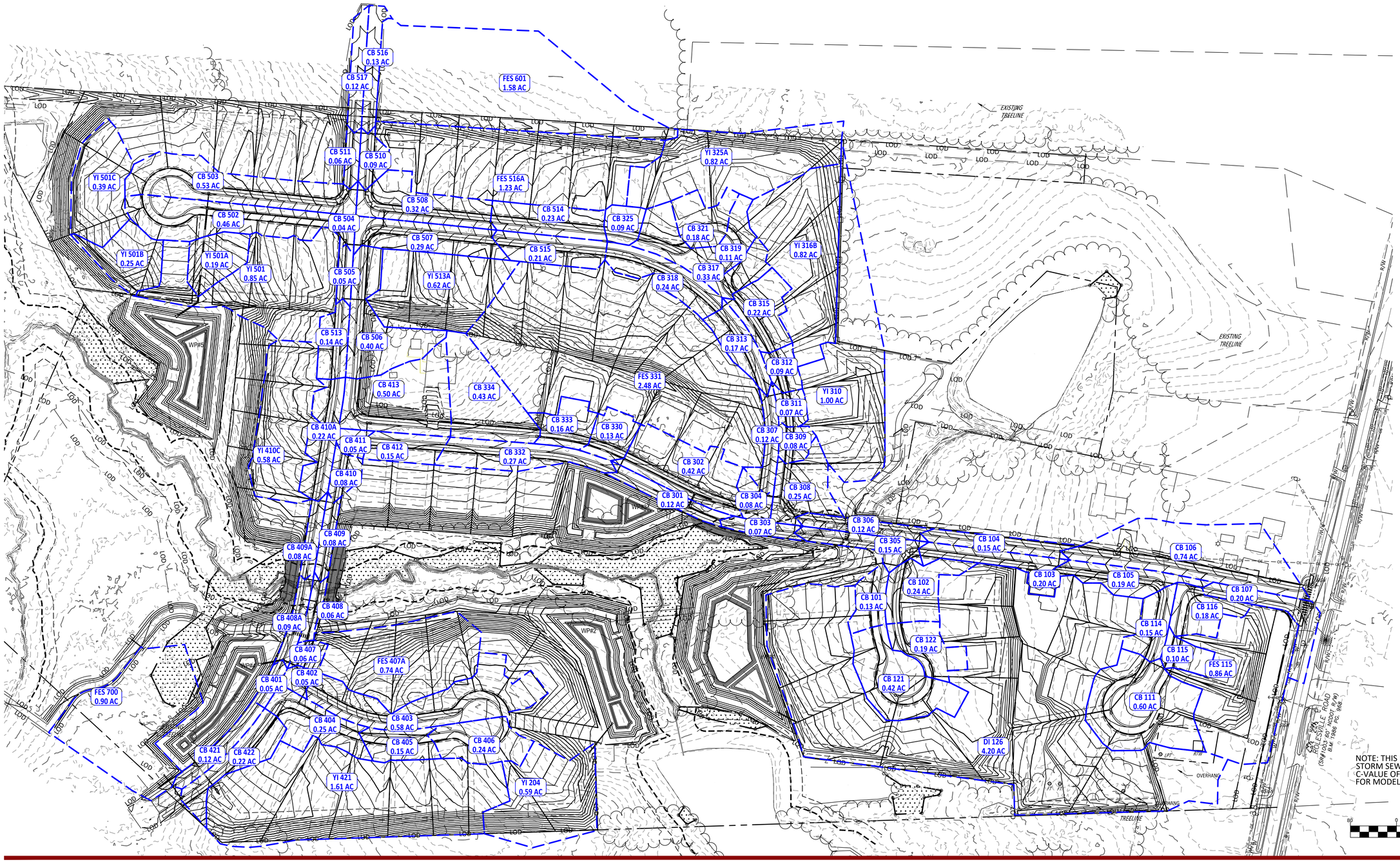
AMERICAN Engineering
RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 210002

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC | WAKE COUNTY

May 29, 2025



NOTE: THIS EXHIBIT IS TO BE USED IN TANDEM WITH HYDRAFLOW STORM SEWERS MODELING FOR CONVEYANCE CALCULATIONS. A C-VALUE OF 0.57 HAS BEEN USED WITH THESE DRAINAGE AREAS FOR MODELING PURPOSES.

GRAPHIC SCALE

80 0 40 80 160 320

(IN FEET)

1 inch = 80 ft

POST-DEVELOPMENT INLET AREAS

AMERICAN Engineering

RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC | WAKE COUNTY

May 28, 2025

NOTE: THIS EXHIBIT IS TO BE USED IN TANDEM WITH HYDRAFLOW EXPRESS MODELING FOR DITCH VELOCITIES AND CAPACITY.

LEGEND & ABBREVIATIONS	
DITCH DRAINAGE AREA	
PERMANENT DIVERSION DITCH	PDD
STORMWATER CONTROL MEASURE	SCM

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft

PERMANENT DIVERSION DITCH DRAINAGE AREAS

AMERICAN Engineering

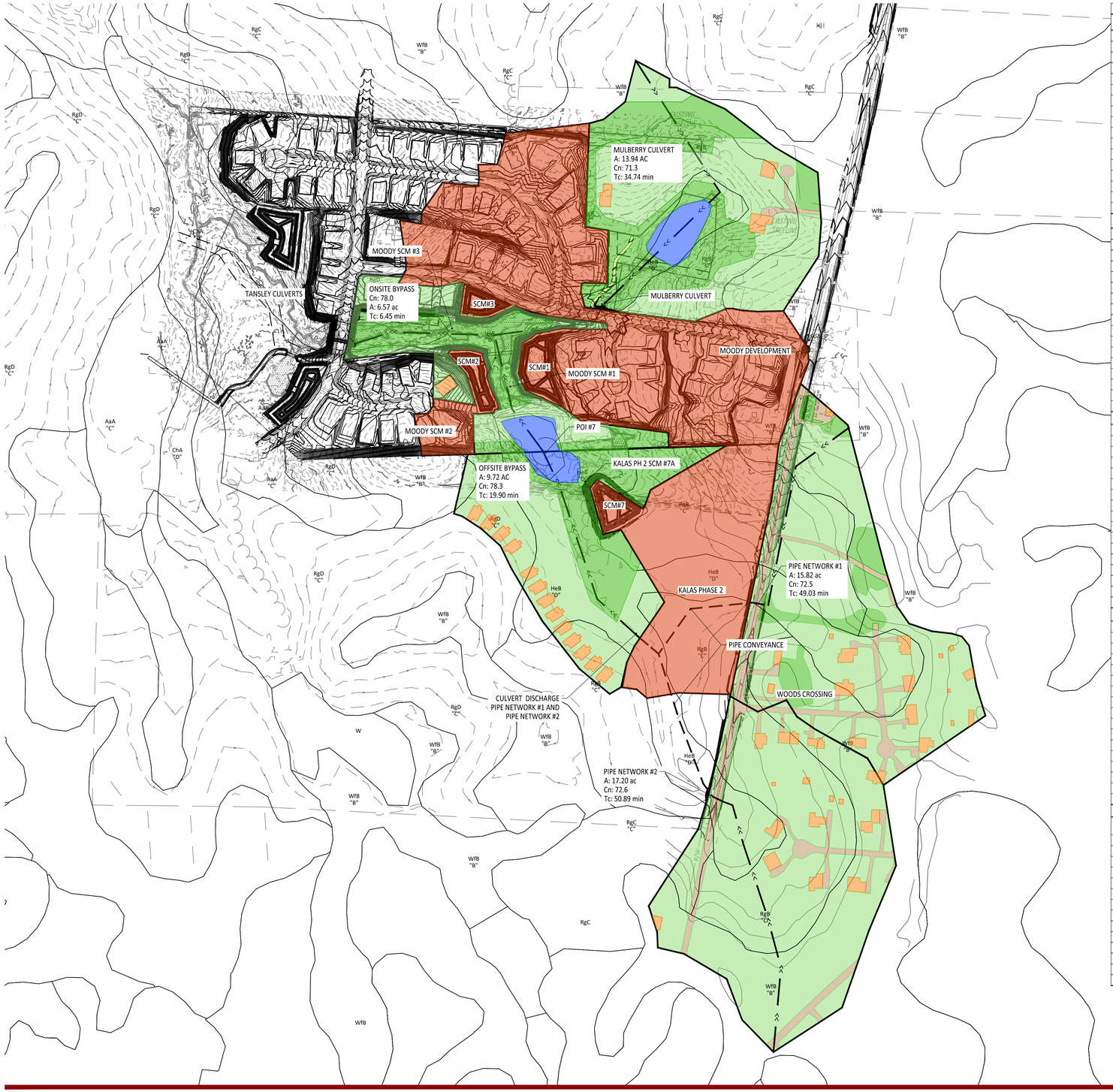
RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC

May 30, 2025



CULVERT DRAINAGE AREA SUPPORTING CALCULATIONS

PIPE NETWORK #1 AREA	**689195**	**S.F.**	**15.82**	**Ac**
Land Use	**Area, Ac.**	**"CN"**	**Wtd'd "CN"**	
Roadways + C&G (not Sidewalks)	1.94	98	12.02	
Roofs	0.62	98	3.82	
Driveways/Parking	0.00	98	0.00	
Sidewalks	0.00	98	0.00	
Openspace- A Soils Good Condition	0.00	39	0.00	
Openspace- B Soils Good Condition	5.99	61	23.11	
Openspace- C Soils Good Condition	3.07	74	14.35	
Openspace- D Soils Good Condition	2.40	80	12.11	
Woods-A Soils Good Condition	0.00	30	0.00	
Woods-B Soils Good Condition	1.24	55	4.30	
Woods-C Soils Good Condition	0.00	70	0.00	
Woods-D Soils Good Condition	0.57	77	2.78	
Lands Taken Up by BMP	0.00	98	0.00	
Open Water (Exist'g or Proposed Ponds)	0.00	98	0.00	
Total (Check):	**15.82**	Composite "CN"	**72.5**	
	Percent Impervious		16.2%	

PIPE NETWORK #2 AREA	**749114**	**S.F.**	**17.20**	**Ac**
Land Use	**Area, Ac.**	**"CN"**	**Wtd'd "CN"**	
Roadways + C&G (not Sidewalks)	1.61	98	9.20	
Roofs	0.67	98	3.80	
Driveways/Parking	0.00	98	0.00	
Sidewalks	0.00	98	0.00	
Openspace- A Soils Good Condition	0.00	39	0.00	
Openspace- B Soils Good Condition	6.74	61	23.89	
Openspace- C Soils Good Condition	6.75	74	29.03	
Openspace- D Soils Good Condition	1.43	80	6.67	
Woods-A Soils Good Condition	0.00	30	0.00	
Woods-B Soils Good Condition	0.00	55	0.00	
Woods-C Soils Good Condition	0.00	70	0.00	
Woods-D Soils Good Condition	0.00	77	0.00	
Lands Taken Up by BMP	0.00	98	0.00	
Open Water (Exist'g or Proposed Ponds)	0.00	98	0.00	
Total (Check):	**17.20**	Composite "CN"	**72.6**	
	Percent Impervious		13.3%	

OFFSITE BYPASS AREA	**423210**	**S.F.**	**9.72**	**Ac**
Land Use	**Area, Ac.**	**"CN"**	**Wtd'd "CN"**	
Roadways + C&G (not Sidewalks)	0.00	98	0.00	
Roofs	0.67	98	6.73	
Driveways/Parking	0.00	98	0.00	
Sidewalks	0.00	98	0.00	
Openspace- A Soils Good Condition	0.00	39	0.00	
Openspace- B Soils Good Condition	0.17	61	1.08	
Openspace- C Soils Good Condition	2.21	74	16.81	
Openspace- D Soils Good Condition	2.63	80	21.64	
Woods-A Soils Good Condition	0.00	30	0.00	
Woods-B Soils Good Condition	0.00	55	0.00	
Woods-C Soils Good Condition	1.20	70	8.68	
Woods-D Soils Good Condition	2.41	77	19.11	
Lands Taken Up by BMP	0.00	98	0.00	
Open Water (Exist'g or Proposed Ponds)	0.43	98	4.29	
Total (Check):	**9.72**	Composite "CN"	**78.3**	
	Percent Impervious		11.2%	

MULBERRY CULVERT AREA	**613925**	**S.F.**	**14.09**	**Ac**
Land Use	**Area, Ac.**	**"CN"**	**Wtd'd "CN"**	
Roadways + C&G (not Sidewalks)	0.19	98	1.30	
Roofs	0.26	98	1.78	
Driveways/Parking	0.00	98	0.00	
Sidewalks	0.07	98	0.51	
Openspace- A Soils Good Condition	0.00	39	0.00	
Openspace- B Soils Good Condition	2.39	61	10.34	
Openspace- C Soils Good Condition	4.55	74	23.87	
Openspace- D Soils Good Condition	0.25	80	1.41	
Woods-A Soils Good Condition	0.00	30	0.00	
Woods-B Soils Good Condition	1.62	55	6.32	
Woods-C Soils Good Condition	2.94	70	14.60	
Woods-D Soils Good Condition	1.04	77	5.70	
Lands Taken Up by BMP	0.00	98	0.00	
Open Water (Exist'g or Proposed Ponds)	0.79	98	5.48	
Total (Check):	**14.09**	Composite "CN"	**71.3**	
	Percent Impervious		9.3%	

ONSITE BYPASS AREA	**286108**	**S.F.**	**6.57**	**Ac**
Land Use	**Area, Ac.**	**"CN"**	**Wtd'd "CN"**	
Roadways + C&G (not Sidewalks)	0.00	98	0.00	
Roofs	0.00	98	0.00	
Driveways/Parking	0.00	98	0.00	
Sidewalks	0.00	98	0.00	
Openspace- B Soils Good Condition	0.00	61	0.00	
Openspace- C Soils Good Condition	1.51	74	16.97	
Openspace- D Soils Good Condition	1.66	80	20.25	
Woods-B Soils Good Condition	0.00	55	0.00	
Woods-C Soils Good Condition	0.68	70	7.23	
Woods-D Soils Good Condition	2.22	77	25.97	
Lands Taken Up by BMP	0.00	98	0.00	
Open Water (Exist'g or Proposed Ponds)	0.51	98	7.56	
Total (Check):	**6.57**	Composite "CN"	**78.0**	
	Percent Impervious		7.7%	

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft

LEGEND	
WOODS B/C/D	
OPEN SPACE B/C/D	
SIDEWALK	
ROADWAY	
SCM AREA	
ROOF	
SCM/OPEN WATER	
DRAINAGE AREA	
SOIL LINE	

NOTE:

1. EACH RESPECTIVE SCM FLOW (Q) HAS BEEN DETERMINED BY UTILIZING AUTODESK HYDROGRAPH SOFTWARE AND WILL BE ADDED TO THE TOTAL FLOW FOR ANALYZING THE CULVERT OF INTEREST.
2. FOR RECORD KEEPING PURPOSES, THE CALCULATED DRAINAGE AREA TO RESPECTIVE SCM IS HATCHED IN RED (AREA USED IN HYDROGRAPH TO DETERMINE Q).
3. PLEASE REFER TO PROJECT STORMWATER IMPACT ANALYSIS REPORT FOR COMPLETE CALCULATIONS.

CULVERT DRAINAGE AREA EXHIBIT (SUPPORTS HYDROGRAPH MODELING & ALLOWS FOR CULVERT SIZING)

AMERICAN Engineering

RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

THE PRESERVE AT MOODY FARM

ROLESVILLE, NC

March 31, 2025