Stormwater Management Plan

Broadmoor

Wake County

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PRELIMINARY

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Introduction/Project Data

The Broadmoor consists of 105.56 acres of land located at 1321 Rolesville Road in Rolesville, NC. See Table 1 for detailed site information. The site will be developed in three phases. This report serves as the stormwater impact analysis for all phases of Broadmoor.

Table 1 – Project Information Summary

Project Name	Broadmoor
Case Number (Case History)	REZ-23-02
Project Address	1321 Rolesville Rd, Rolesville, NC 27587
PIN(s)	1768511519
Zoning	RH, RM
River Basin	Neuse River Basin
Stormwater Regulatory Basin	Neuse River outside Falls Lake
Hydrologic Unit	Upper Buffalo Creek, HEC 12 030202011502
Total Site Area	105.5 AC
Total Project Area	105.56 AC
Land Disturbance Area	83.68 AC
Existing Impervious %	0%
Proposed Impervious %	23.7%

Site History

The property is in the Piedmont of North Carolina. The existing property is undeveloped, with wooded acreage in Hydrologic Soil Group (HSG) “B”, “C”, and “D” soils.

Broadmoor crosses a high divide in site overall topography resulting in four points of analysis (POAs) for peak runoff assessment. The majority of the site drains to Buffalo Creek on the east side of the property, denoted as the confluence point POA 1. Four SCM’s lead to this POA 1. There is an existing pond on the site that will remain in place; this is denoted as POA 2 and also leads to POA 1. There is an area offsite that will be bypassed through the site, leading to POA 1.

There are two areas on the west side of the site that drain towards the right-of-way and are split at the high point in Rolesville Road; each going towards POA 3 and POA 4.

Proposed Development

The Broadmoor property is zoned Residential-30 (R30). The site is being rezoned through Wake County to RH & RM. The site will consist of two single-family lot styles and townhomes. Their

associated infrastructure can be found in Table 2. The development will also include a private parking lot and an amenity center for the entire buildout.

Table 2 – Phase Lot Counts, Types, and Impervious Area

Lot	Type	Impervious Area per Lot (sf)	Count
1 - SF	41' Single-family	2,540	77
2 – SF	51' Single-family	3,156	80
Townhome	Multi-family	1,978	98

Quantifying Land Disturbance and Changes in Impervious Surface

The proposed development will increase the impervious area of the project area (Figure 1) from 0% to 23.7%. For the purposes of nutrient compliance and peak flow calculations, impervious area assumptions per lot type are detailed in Table 2.

Watershed Protection Overlay

The project lies within the Neuse River Basin, outside of Falls Lake and is not part of a water supply watershed.

Streams

The entirety of the site lies within the Upper Buffalo Creek sub-watershed of the Neuse River watershed. Buffalo Creek (classification C; NSW), flows from north to south along the eastern portion of the property.

Floodplains

There is a Special Flood Hazard Areas (SFHAs) located on the subject site per the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) 3720176800K dated July 19, 2022, and 3720176600K dated July 19, 2022. Copies of the previously mentioned FIRMs are included in the **Appendix**.

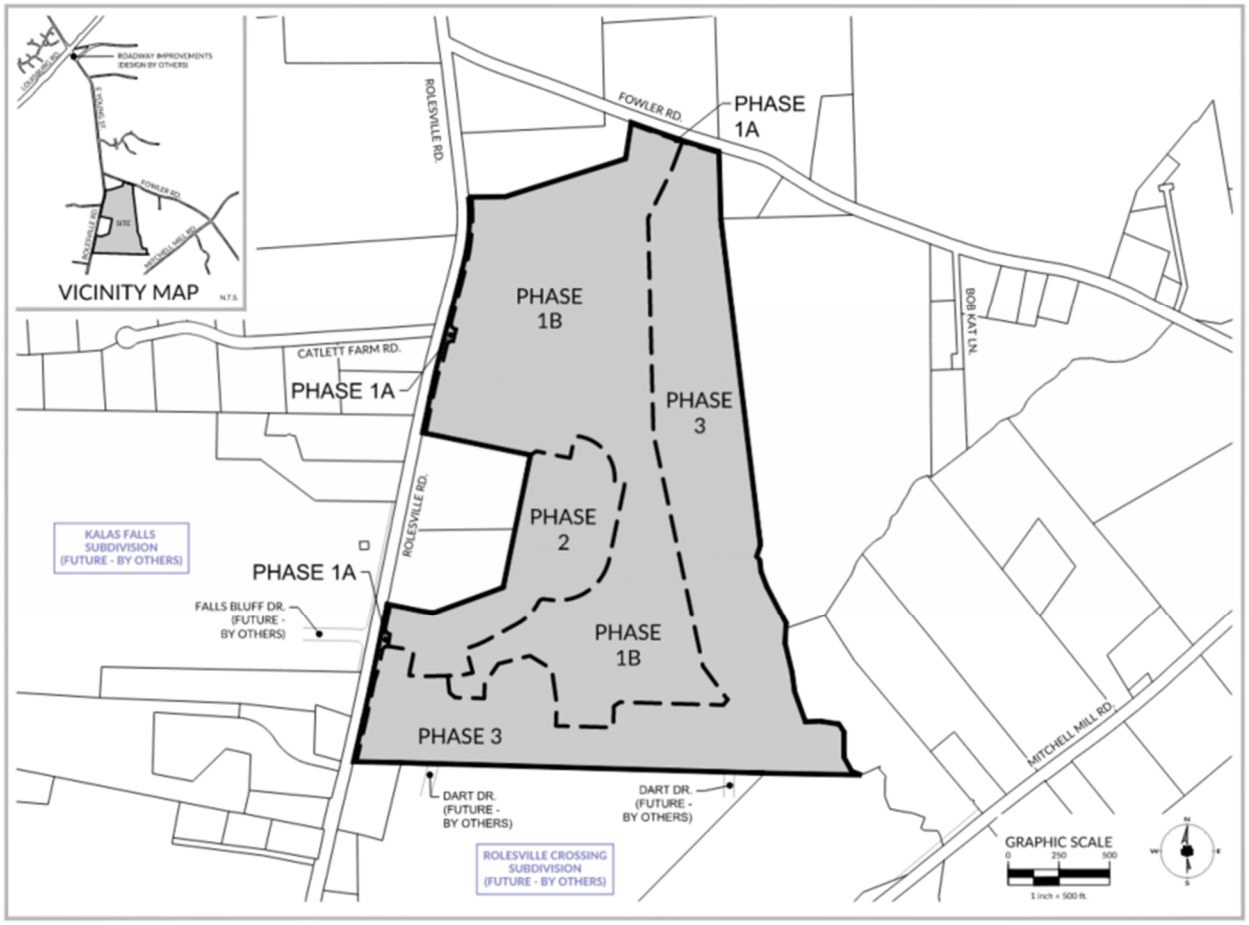

Figure 1 – Site Map

Applicable Requirements

The development shall comply with the requirements outlined in Article 9, "Stormwater Management" of the Wake County UDO. There are no stormwater requirements for Rolesville, NC.

The following requirements apply to the subject site:

Proposed nitrogen loading rates shall not exceed 3.6 lbs./ac./yr.

A Downstream Impact Analysis must be performed in accordance with the "ten percent rule" using the steps set forth in Section 9-23-2 of the UDO. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point. The 10-year peak discharge rate at that point shall be no greater than the existing peak discharge rate.

All engineered SCMs shall be designed as a primary SCM per the *North Carolina Stormwater Control Measure Credit Document* and sized to capture runoff from the first 1-

inch of rainfall from the corresponding drainage area to fulfill the minimum of 85% total suspended solids (TSS) removal.

No net increase in peak flow, from the existing to proposed flow conditions, for the 1-year 24-hour storm.

Water quality and peak discharge for The Broadmoor is accomplished via (4) wet ponds Minimum Design Criteria (MDC) of the North Carolina Department of Environmental Quality (NCDEQ) Stormwater Design Manual.

Methodology

The stormwater study was conducted using the natural drainage features as depicted by Light Detection and Ranging (LIDAR) topography and existing field surveys. Proposed drainage areas were based on field survey data and proposed development within the drainage areas.

The scope of work included the following analyses:

Hydrology

- Simulation of the 1-year, 10-year, and 100-year rainfall events for the Rolesville, NC area.
- Formulation of the 1-year, 10-year, and 100-year hydrographs for the existing development and proposed development drainage areas.
- Formulation of the 1-year, 10-year, and 100-year hydrographs for the drainage areas downstream of the site to the 10% analysis point.

Hydraulic

- Routing the 1-year, 10-year, and 100-year hydrographs for existing development runoff from the site.
- Routing the 1-year, 10-year, and 100-year hydrographs for proposed development runoff through the SCM.
- Analyzing results at the analysis points.

The results of the hydrology calculations were used for the hydraulic analyses. The hydraulic design requires the development of stage-storage and stage-discharge functions for the SCMs. The rainfall/runoff hydrographs, stage-storage, and stage-discharge functions have been compiled to create a computer routing simulation model using Bentley Systems PondPack v8i software. This PondPack model was then used to assess the peak water surface elevations in the SCM for the design rainfall events. The routing results, along with the hydrologic and hydraulic calculations, are provided as in the **PondPack Routing Calculations** sections of this report.

Hydrology Calculations

Runoff hydrographs for the 1-year, 10-year, and 100-year storm events were developed using the Soil Conservation Service (SCS) Method. A Type II SCS 24-hr dimensionless rainfall distribution was developed using National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation data for Rollesville, NC. The three basic parameters of the SCS method, including a curve number (CN), time of concentration (Tc), and drainage area (DA), were developed as follows.

Composite CNs were calculated according to soil type, land cover, and area. Soil types were delineated using the National Research Conservation Service (NRCS) Web Soil Survey database.

Directly connected impervious areas within SCM drainage basins were given a CN of 98, and remaining areas were calculated per land cover impervious assumptions to determine a composite CN for each DA.

Tc's for existing and proposed drainage areas were developed using the Technical Release 55 (TR-55) method. A minimum Tc of 5-minutes was used for the proposed piped drainage systems within the SCM drainage basins.

Drainage area maps showing Tc flow paths are presented in **Appendix 2** of this report.

Hydraulic Calculations

Computer simulated reservoir routing of the 1-year, 10-year, and 100-year design storms utilized stage-storage and stage-discharge functions. A stage-storage function was derived from the proposed geometry of the SCM. A non-linear regression relation for surface area versus elevation was derived for the SCM. This relation estimates the incremental volume of the basin to the stage or elevation of the basin. Stage-discharge functions were developed to size the proposed outlet structures for the SCM.

Nutrient Calculations

Nutrient export rates for the project area were calculated using the SNAP Tool (v4.2). Land cover and respective areas were entered according to proposed conditions.

The Wake County Stormwater Design Tool nutrient export worksheets are included in Appendix **3** of this report.

Conclusions

Water Quality

The routing analysis indicates that the proposed stormwater management plan has sufficient mitigation measures to comply with nutrient export and watershed protection overlay standards in accordance with local and state regulations.

The proposed SCMs have been designed per NCDEQ and Wake County MDCs to meet 85% TSS removal requirements (see **SCM Sizing Calculations** section of this report).

Per MDC and the SNAP Tool (v4.1), appropriate nutrient reduction credits for Total Nitrogen (TN) was applied to areas draining through the onsite SCMs (Table 3).

Per the SNAP Tool, we are meeting the target curve number requirements through the four proposed wetpond SCM's on the site.

Table 3 – Nutrient Loading Summary per SNAP Tool

Nutrient	Proposed Dev Untreated (lbs/ac/yr)	Proposed Dev w/ SCMs (lbs/ac/yr)	Loading Rate Target (lbs/ac/yr)
TN	3.68	2.32	3.60

Peak Flows

Peak Flow Attenuation at Property Boundary POAs

Proposed peak flows from the SCMs associated with the 1-year and 10-year (24-hour) design storms have been attenuated at the property boundary POAs so as not exceed existing conditions (Table 4). Peak flows from POAs 3 and 4, associated with the 1-year and 1-year (24-hour) storm, have not been attenuated at the property boundary POAs, but have an insignificant increase in flow (Tables 5-6).

Table 4 – Peak Summary at POA #1 – From SCM

Storm Event	Existing Dev Peak Flow (cfs)	Proposed Dev Peak Flow (cfs)	Net Change (cfs)	Net Change (%)
1-yr, 24-hr	64.18	55.25	-8.93	-13.91%
10-yr, 24-hr	203.60	178.73	-24.87	-12.22%
100-yr, 24-hr	392.60	339.69	-52.91	-13.48%

Table 5 – Peak Summary at POA #3 – From Bypass

Storm Event	Existing Dev Peak Flow (cfs)	Proposed Dev Peak Flow (cfs)	Net Change (cfs)	Net Change (%)
1-yr, 24-hr*	2.17	2.83	+0.66	+30.41%
10-yr, 24-hr*	7.82	8.95	+1.22	+15.60%
100-yr, 24-hr*	15.60	17.05	+1.45	+9.29%

*The drainage areas to POA 3 drain towards existing infrastructure along the right-of-way adjacent to Rolesville Road. The right-of-way trapezoidal ditch conveyance was analyzed using Bentley flowmaster, solving for the normal depths within the channels. It was determined there is no adverse impact on the right-of-way conveyance along Rolesville Road, despite the increase in bypass flow. Output calculations for the 10- and 25-year storms can be found in the Appendix.

Table 6 – Peak Summary at POA #4 – From Bypass

Storm Event	Existing Dev Peak Flow (cfs)	Proposed Dev Peak Flow (cfs)	Net Change (cfs)	Net Change (%)
1-yr, 24-hr*	0.57	1.56	+0.88	+154.39
10-yr, 24-hr*	2.65	4.62	+1.80	+67.92%
100-yr, 24-hr*	5.77	8.58	+2.60	+45.06%

*The drainage areas to POA 4 drain towards existing infrastructure along the right-of-way adjacent to Rolesville Road. The right-of-way trapezoidal ditch conveyance was analyzed using Bentley flowmaster, solving for the normal depths within the channels. It was determined there is no adverse impact on the right-of-way conveyance along Rolesville Road, despite the increase in bypass flow. Output calculations for the 10- and 25-year storms can be found in the Appendix.

Downstream Impact Analysis

Peak Flow Attenuation at Downstream 10% Point

In accordance with the "ten percent rule" the peak flow rate associated with the 10-year (24-hour) design storm has been attenuated at POA 1 as to not exceed existing peak flow rates (Table 4). The increased discharges from POA 3 and 4 were deemed insignificant, so a downstream impact analysis isn't required at those outfalls. The downstream analysis point is at a point of intersection on the stream where the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

Table 4 – Peak Summary for at Downstream POA – 10% Point

Storm Event	Existing Dev Peak Flow (cfs)	Proposed Dev Peak Flow (cfs)	Net Change (cfs)	Net Change (%)
10-yr, 24-hr	203.61	177.88	-25.73	-12.64%

SCM Design Summary

The proposed SCMs have been designed to safely pass the 100-year design storm event via the primary and emergency spillways. In addition, the SCMs maintain a freeboard of at least 1-ft during all design storm events.

Table 7 – SCM #1 (Wet Pond)

Drainage Area =	7.16 ac
Impervious Area =	3.73 ac
% Impervious =	59.09%
Top of Dam =	363.00
Emergency Spillway Crest =	362.00
Bottom Width =	16 ft
Side Slopes =	5:1 ft/ft
4 x 4 Riser Crest =	361.00
Normal Pool Orifice Elev. =	357.50
Normal Pool Surface Area =	10,412 sf
Drawdown Orifice Diameter =	2.25 in
Outlet Barrel Diameter =	30 in RCP

Table 8 – SCM #1 Routing Summary

Storm Event	Peak Discharge (cfs)	Peak WSEL (ft)	Freeboard (ft)
1-yr, 24-hr	0.21	360.01	2.99
10-yr, 24-hr	5.95	361.24	1.76
100-yr, 24-hr	33.83	361.79	1.21

Table 9 – SCM #2 (Wet Pond)

Drainage Area =	18.65 ac
Impervious Area =	8.85 ac
% Impervious =	47.45%
Top of Dam =	363.00
Emergency Spillway Crest =	362.00
Bottom Width =	16 ft
Side Slopes =	5:1 ft/ft
5 x 5 Riser Crest =	359.75
Water Quality Overflow Elev. =	359.00
Rectangular Weir L x H =	3.5 ft x 0.75 ft
Storage Volume =	26,985 cf
Normal Pool Orifice Elev. =	357.50
Normal Pool Surface Area =	23,300 sf
Drawdown Orifice Diameter =	3.5 in
Outlet Barrel Diameter =	30 in RCP

Table 10 – SCM #2 Routing Summary

Storm Event	Peak Discharge (cfs)	Peak WSEL (ft)	Freeboard (ft)
1-yr, 24-hr	1.94	359.28	3.72
10-yr, 24-hr	35.06	360.18	2.82
100-yr, 24-hr	47.00	361.56	1.44

Table 11 – SCM #3 (Wet Pond)

Drainage Area =	20.96 ac
Impervious Area =	5.92 ac
% Impervious =	28.24%
Top of Dam =	364.00
Emergency Spillway Crest =	363.00
Bottom Width =	16 ft
Side Slopes =	5:1 ft/ft
4 x 4 Riser Crest =	360.00
Water Quality Overflow Elev. =	357.25
Rectangular Orifice L x H =	3.5 ft x 1 ft
Storage Volume =	37,036 cf
Normal Pool Orifice Elev. =	354.50
Normal Pool Surface Area =	28,902 sf
Drawdown Orifice Diameter =	3.25 in
Outlet Barrel Diameter =	30 in RCP

Table 125 – SCM #3 Routing Summary

Storm Event	Peak Discharge (cfs)	Peak WSEL (ft)	Freeboard (ft)
1-yr, 24-hr	0.31	355.87	8.13
10-yr, 24-hr	3.78	357.53	6.47
100-yr, 24-hr	19.25	359.00	5

Table 136 – SCM #4 (Wet Pond)

Drainage Area =	8.88 ac
Impervious Area =	5.04 ac
% Impervious =	56.76%
Top of Dam =	370.0
Emergency Spillway Crest =	369.0
Bottom Width =	16 ft
Side Slopes =	5:1 ft/ft
4 x 4 Riser Crest =	368.0
Water Quality Overflow Elev. =	363.75
Rectangular Orifice L x H =	2.0 ft x 0.5 ft
Storage Volume =	19,522 cf
Normal Pool Orifice Elev. =	362.50
Normal Pool Surface Area =	16,709 sf
Drawdown Orifice Diameter =	2.75 in
Outlet Barrel Diameter =	30 in RCP

Table 147 – SCM #4 Routing Summary

Storm Event	Peak Discharge (cfs)	Peak WSEL (ft)	Freeboard (ft)
1-yr, 24-hr	1.03	363.92	6.08
10-yr, 24-hr	5.58	365.20	4.80
100-yr, 24-hr	8.57	366.88	3.12

Appendix 1: Municipal Submittal Checklist

Wake County Environmental Services Department
Water Quality Division, Watershed Management Section
336 Fayetteville St. • P.O. Box 550 • Raleigh, NC 27602
TEL 919 856-7400 • FAX 919 743-4772

PPR – PRELIMINARY PLAN REVIEW CHECKLIST

Project Name	Broadmoor	**Applicant**	WithersRavenel	**Zoning**	RH/RM
Applicant Contact Info	Brandon Miller	**Watershed**	Upper Little River	**New or Expansion (N/E)?**	N
Project Acreage	105.56 ac	**Existing Impervious SF**	3,060	**Proposed Impervious**	1,085,102
Disturbed Acreage	105.56 ac				

Preliminary S/D	☒	**Special Use**	☐	**Variance**	☐	**Planned Compliance Permit**	☐	**General Use**	☐	**Rezoning Request**	☐

Regular Subdivision	☒	**Cluster Lot By Lot Open**	☐ ☐	**Minor Subdivision**	☐	**Nonresidential**	☐

Submittal Package Requirements

Applicant shall select all applicable items below and provide with the submittal.

☒	**1.**		Cover letter stating the purpose of the submission
☒	**2.**		One (1) electronic copy of the Hybrid Stormwater Tool (click here); submit Excel workbook (Site Data Sheet, Drainage Area Sheets, Site Summary Sheet, BMP Sheets, and BMP Summary sheet) See the Wake County Stormwater Manual for guidance
☒	**3.**		Drainage Area Maps with stormwater discharge points (existing/post construction/post BMP)
	☐	**a.**	For Water Supply Watersheds: Provide drainage map showing drainage acres to the drainage features for properties in the water supply watershed zoning districts
☐	**4.**		Copy of the USGS Quad Map with delineated project limits in color
☐	**5.**		Copy of the Wake County Soil Survey map from 1970 manuscript with delineated project limits
☐	**6.**		Proposed Site Plan:
	☐	**a.**	North arrow, graphic scale, signed/dated engineer's seal, drafting version date, and legend
	☐	**b.**	Show all Riparian Buffers [*Article 9-21*]; (Neuse: [15A NCAC 02B.0233 & 0242]; Falls [15A NCAC 02B.0277(4)(h)]; Jordan: [15A NCAC 02B.0277(4)(h)]
	☐	**c.**	Delineation of all existing and proposed impervious surfaces: roads, well lots, recreation sites, single family residences, etc. (consistent with SW Hybrid Tool Inputs)
	☐	**d.**	Delineation of current FEMA boundaries (floodway, flood fringe & future/0.2%)
	☐	**e.**	Delineation of flood prone soil areas

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	☐	**f.**	Proposed drainage easements and widths *(in Feet)*
	☐	**g.**	Location and type of all proposed stormwater management structures *(grass swale, wet/dry detention basin, filtering/infiltration basin, bioretention, etc.)*. Must be located in a common area of development.
	☐	**h.**	Proposed stormwater easements, access lanes and backwater easements. Provide and label minimum 20 ft. Access easement and 10 ft. Maintenance easement from toe of stormwater pond embankment. Provide and label 20 ft. Drainage easement between every 4 residential lots or 4 acres of drainage area.
	☐	**i.**	Location of stormwater management structures should meet setback requirements from all wastewater system components in accordance with *Regulations Governing Wastewater Treatment and Dispersal Systems in Wake County*.
	☐	**j.**	A note should be added to the recorded plat distinguishing areas of disconnected impervious
☐	**7.**	Provide documentation of soil re-delineations (as needed)	
Standards and Requirements By marking items with an "X", applicant acknowledges potential standards to be applied to the proposed development.			
Wake County UDO Article 8 – Subdivision Design and Improvements			
☐	**8.**	**Streams or Drainageways [Article 8-37-2]** – Easements for streams or drainageways must be provided and must follow the existing course of such streams or drainageways. Easements for drainage of surface waters from 4 lots or less may cross lots only if the Planning Board or Planning Director determines that such location will not pose a hazard to persons or property.	
☐	**9.**	**Standards [Article 8-43]** – All subdivisions within the zoning districts R-40W, R-80W and overlay districts WSO-2NC, WSO-3CA, WSO-3NC and WSO-4P must be designed and constructed so that all development directly associated with the subdivision (e.g., roads, utilities, grading, drainage facilities) and all subsequent development (e.g., buildings, driveways, yards, on-site utilities, grading, drainage facilities) on the subdivision's lots and other parcels: • minimizes impervious or partially pervious surface coverage. • diffuses the flow of stormwater runoff, encourages sheet flow and avoids concentrated discharge of stormwater into surface waters. • incorporates Best Management Practices (BMPs) to minimize adverse water quality impacts. • transports stormwater runoff from the development by vegetated conveyances; and • avoids disturbance of vegetation within water supply watershed buffers.	
Wake County UDO Article 9 - Stormwater Management Requirements See Wake County's *Stormwater Manual: Submittal and Design Guidance*			

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☐	**10.**	**Stormwater Review Required -** All residential subdivision development must submit a plan to comply with Article 9. Minor subdivisions have the option of limiting impervious to 15%. Office, institutional, commercial or industrial development that disturbs greater than ½ acre is required to comply with the stormwater management regulations of Article 9.
☐	**11.**	**Stormwater Permit** – is required for all development and redevelopment unless exempt pursuant to the UDO. A permit may only be issued subsequent to a properly submitted, reviewed and approved stormwater management plan and permit application. [*Article 9*] Note: A permit may not be required if there are no post-construction requirements (i.e., SCMs).
☐	**12.**	**Volume Management** – is required for RESIDENTIAL regular subdivisions when the post development curve number exceeds the pre-development curve number using the Wake County Hybrid Stormwater Tool. Minor subdivisions have the option of limiting impervious to 15%.
☐	**13.**	**SCMs** - For projects requiring stormwater treatment for quality and/or quantity control, the applicant must comply with the NC BMP Manual, as well as *Article 9 Stormwater Management, Part 3 Completion and Maintenance of Improvements prior* to approval of the record plat.
☐	**14.**	**Downstream Impact Analysis** – Required analysis using the "10% rule" drainage area evaluation of the 10-year, 24-hour peak flow of the pre/post development to determine if the project will have any impacts on flooding or channel degradation downstream of the project site in accordance with Article 9-22.

Nutrient Management Strategies – Neuse Rules [15A NCAC 02B.0235]; Neuse Rules apply County-wide [Article 9-21]
See Wake County's *Stormwater Manual: Submittal and Design Guidance*
Select all that apply.

☐	**15.**		**Peak Flow –** new development shall not result in a net increase in peak flow leaving the site from the pre-development conditions for the 1 yr-24 hr. storm.
☐	**16.**		**Nitrogen Load**- contributed by the proposed new development activity shall not exceed the unit area mass loading rate for nitrogen of 3.6 of pounds per acre per year: nitrogen loading shall be calculated using the Wake County Hybrid Stormwater Tool.
	☐	**a.**	**Replacement or Expansion w/No Net Increase in BUA** – proposed development that would replace or expand structures or improvements that existed as of July 2001, ***and that would not result in a net increase in built-upon area*** shall not be required to meet nitrogen loading targets except to the extent that the developer shall provide stormwater control at least equal to the previous development.
	☐	**b.**	**Replacement or Expansion with Net Increase in BUA** proposed development that would replace or expand structures or improvements and **that would result in a net increase in built-upon area** shall meet the target of 3.6 lbs./ac/yr. for the entire site OR achieve a 30% reduction in nitrogen loading and no increase in phosphorus loading.

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	☐	**c.**	**LID option - Developments** that show volume matching using Storm-EZ shall be considered as meeting nutrient export requirements without making offset payments provided the following: • When analyzing a development site, the pre-development land cover shall be entered into Storm-EZ as "Woods" for the entire project area. • The Wake Couty Hybrid Tool must be run to estimate the pre-development, and post-development, pre-BMP nutrient export rates for the site. See NCDENR Memo on Coordination between LID & NSW Programs
Wake County UDO Article 10 - Erosion and Sedimentation Control Requirements			
☐	**17.**		**Erosion Control:** This project will require an Approved Erosion and Sediment Control Plan and Land Disturbance Permit if it involves greater than one acre of disturbance [10-13-1(A)]. **Note**: If the land disturbance is part of a common plan of development that is greater than one acre of disturbance, an Approved Erosion and Sediment Control Plan and Land Disturbance Permit are required for each individual tract or parcel disturbance within the common plan of development, regardless of land disturbance acreage in each tract/parcel.
Wake County UDO Article 11 - Environmental Standard Requirements			
☐	**18.**		**Water Supply Watershed Buffers (WSWB) *Article 11, Part 2* Select** all that apply.
	☐	**a.**	**Water Supply Impoundments with a drainage area of 25 acres or more [Article 11-21-2]:** • WSWB required with a minimum width of 100 feet around all water supply impoundments • Buildings must be setback at least 20 feet from the outer boundary of the required buffer area.
	☐	**b.**	**Water Supply Impoundments with a drainage area of 5 to 25 Acres [Article 11-21-3]:** • WSWB required with a minimum width of 30 feet provided around all water impoundments • Buildings must be setback at least 20 feet from the outer boundary of the required buffer area.
	☐	**c.**	**Non-Water Supply Impoundments with a drainage area of 25 Acres or more [Article 11-21-4]:** • WSWB required with minimum width of 50 feet around all non-water supply impoundments. • Buildings must be setback at least 20 feet from the outer boundary of the required buffer area.
	☐	**d.**	**Perennial Streams [Article 11-21-5]:** • WSWB required with a minimum width of 100 feet along each side of a stream shown as a perennial stream on the most recent edition of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps. • The area of the required buffer that begins at the stream bank and extends landward 50 feet is subject to the Zone 1 standards of Sec. Section 11-22-1(A). • The area of the required buffer that begins at the outer edge of Zone 1 and extends landward 50 feet is subject to the Zone 2 standards of Sec. Section 11-22-1(B). • No minimum building setback from the required buffer.

Wake County Environmental Services Department
Water Quality Division, Watershed Management Section
336 Fayetteville St. • P.O. Box 550 • Raleigh, NC 27602
TEL 919 856-7400 • FAX 919 743-4772

PPR – PRELIMINARY PLAN REVIEW CHECKLIST

	☐	**e.**	**Non-Perennial Watercourses [Article 11-21-6]** • WSWB required with a minimum width of 50 feet along each side of non-perennial watercourses, channels, ditches or similar physiographic features with a drainage area of 25 acres or more • Buildings must be setback at least 20 feet from the outer boundary of the required buffer area.
	☐	**f.**	**Watercourses and Channels, 5 to 25 Acres [Article 11-21-7]** • WSWB required with a minimum width of 30 feet along each side of a watercourse, channel, ditch, or similar physiographic feature with a drainage area of at least 5 acres, but less than 25 acres • Buildings must be setback at least 20 feet from the outer boundary of the required buffer area.
	☐	**g.**	**Activities Allowed within Buffers [Article 11-22-2]:** Driveway crossings that access single-family dwellings, provided: • no alternative to their location in the buffer (including opportunity for shared driveways) exists. • buffer disturbance is no more than 60 feet wide. • buffer disturbance is no more than 6,000 SF. • the driveway crosses the buffer at an angle close to 90 degrees and not less than 60 degrees. • side slopes do not exceed a 2:1 (horizontal to vertical) ratio (bridging and/or retaining walls may be used to meet this and the disturbance width standard); and • all culverts are designed and constructed for the 25-year storm event
	☐	**h.**	**Activities Allowed within Buffers [Article 11-22-2]:** Road crossings (public or private roads), provided: • no alternative location in the buffer exists. • buffer disturbance does not extend beyond the required right-of-way or easement width, or in no case is more than 90 feet wide. • buffer disturbance is no more than 9,000 SF in area. • the road crosses the buffer at an angle close to 90 degrees and not less than 60 degrees. • side slopes do not exceed a 2:1 horizontal: vertical ratio (bridging and/or retaining walls may be used to meet this and the disturbance width standard); and • all culverts are designed and constructed for the 25-year storm
☐	**19.**		**Special Watershed Areas - Swift Creek Water Supply Watershed** Development in the Swift Creek Water Supply Watershed is subject to the requirements of the *Swift Creek Land Management Plan* in addition to other applicable standards.
	☐	**a.**	An as-built plan prepared by a licensed professional land surveyor is required for all lots before a Certificate of Occupancy may be issued. [11-30-3]
	☐	**b.**	In addition to the standards of the underlying zoning district, additional standards apply to all land within the Swift Creek Water Supply Watershed. (See [11-30-4])
☐	**20.**		**Special Watershed Areas - Little River Water Supply Watershed**
	☐	**a.**	An as-built plan prepared by a licensed professional land surveyor is required for all lots before a Certificate of Occupancy may be issued. [11-31-1]

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PPR – PRELIMINARY PLAN REVIEW CHECKLIST

	☐	**b.**	The following maximum impervious surface ratios apply to all nonresidential development in the Little River Water Supply Watershed: R-80W = 6% of lot/site R-40W = 12% of lot/site
☐	**21.**	**Special Watershed Areas - Smith Creek Water Supply Watershed**	
	☐	**a.**	All residential and commercial properties require a preliminary site plan prepared by a licensed professional land surveyor, landscape architect, architect, or engineer. [11-32-1]
	☐	**b.**	All residential and commercial properties require a preliminary site plan prepared by a licensed professional land surveyor, landscape architect, architect, or engineer. [11-20-1]
	☐	**c.**	The following maximum impervious surface ratios apply to all nonresidential development in the Smith Creek Water Supply Watershed: R-80W = 6% of lot/site R-40W = 12% of lot/site
Wake County UDO Article 14 - Flood Hazard Area Requirements			
☐	**22.**	**Flood Study Required [*Article 14*]** A study of the potential changes in the base flood elevation caused by the obstruction (fill), encroachment, alteration or relocation (including driveway or road crossings) of the following areas:	
	☐	**a.**	a FEMA mapped floodway (Note: No new structures may be constructed or placed within a floodway or non-encroachment area except as otherwise provided by subsection 14-19-2; **AND** No fill may be placed in a floodway or non-encroachment area except as otherwise provided by subsection 14-19-2; [Article 14-19-3(A-B)])
	☐	**b.**	a non-encroachment area [Article 14-19-3(A-B)], see note above
	☐	**c.**	a FEMA mapped area of special flood hazard that has not previously been studied in detail
	☐	**d.**	flood hazard soils areas with a total drainage area of more than 5 ac but no more than 25 ac [Article 14-15-3] – or -
	☐	**e.**	flood hazard soils areas with a total drainage area of more than 25 ac, but less than 100 ac [Article 14-15-4] – or -
	☐	**f.**	flood hazard soils area with a total drainage area of 100 ac or more [Article 14-15-5]
☐	**23.**	**Impoundments and Dams [14-23]**	

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PPR – PRELIMINARY PLAN REVIEW CHECKLIST

	☐	**a.**	Any construction, repair, alteration, or removal of a jurisdictional dam shall obtain State Agency Approval in accordance with Article 21, Chapter 143 of the North Carolina General Statutes. [Article 14-23-1]
	☐	**b.**	If an impoundment is proposed to be constructed or retained within any proposed subdivision, the following standards shall apply. These County standards are separate from and do not supersede any State Agency requirements. • The impoundment and its dam shall be constructed or structurally upgraded to accommodate the runoff from a 24-hour, 100-year frequency storm. • Runoff computations must use SCS methods or other acceptable engineering standards. [Article 14-23-2]

Applicant Signature: _____

Date: _____

Appendix 2: Reference Materials

- USGS 7.5-Minute Quadrangle Map
- Web Soil Survey Map
- FEMA Flood Insurance Rate Map
- NOAA Atlas 14 Precipitation Frequency Estimates
- Pondpack Input Storm Data Pre- and Post-Development

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

MN
GN
9°23'
167 MILS
1½°
27 MILS
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.

NORTH CAROLINA
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

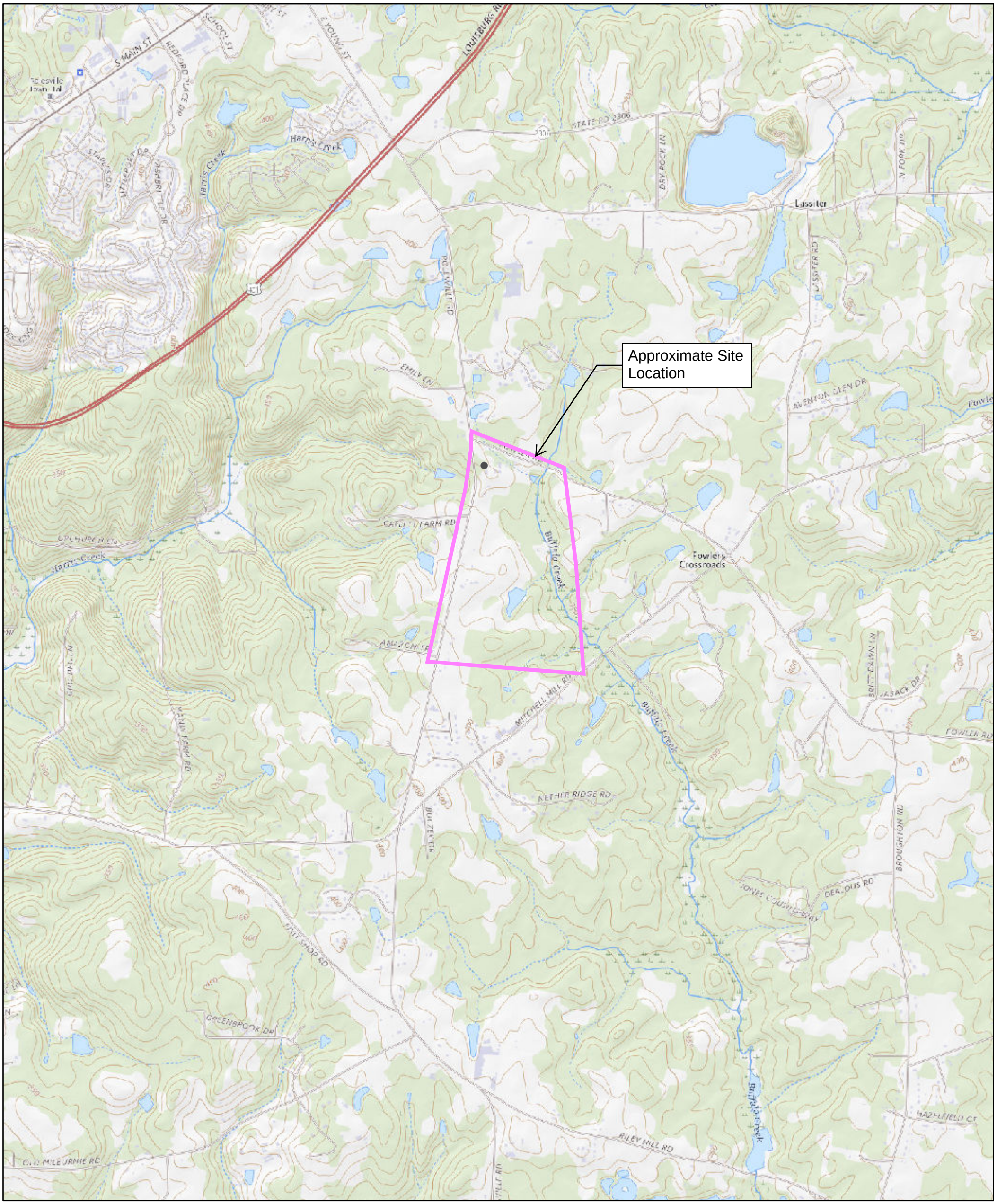
ADJOINING QUADRANGLES
1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

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

ROLESVILLE, NC
2022

NSN 7643016379170
NGA REF NO. USGSX24K38453

The National Map Advanced Viewer



4/29/2024, 11:28:32 AM

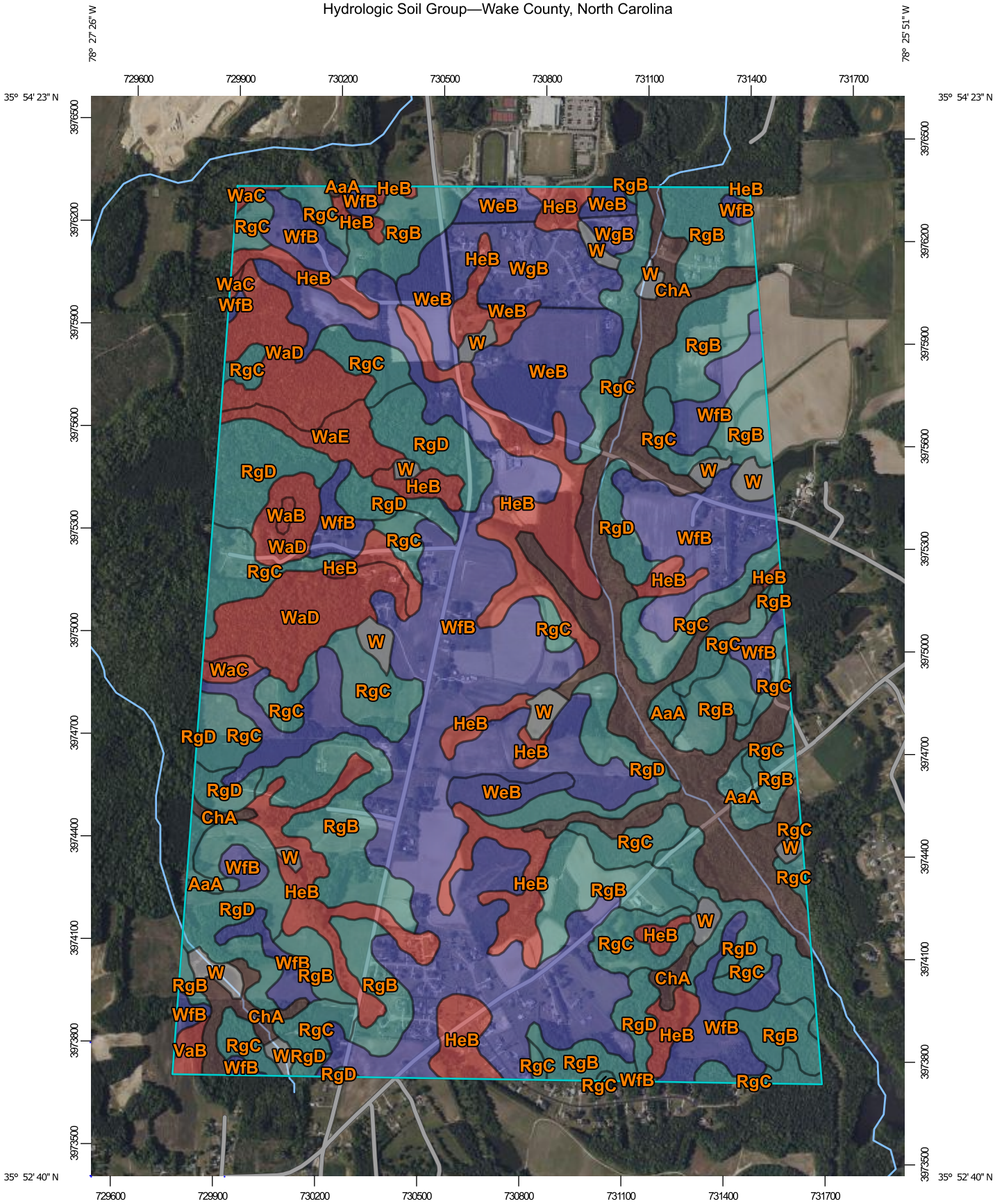
1:25,000

0 1,250 2,500 5,000 ft

0 380 760 1,520 m

USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S.

USGS
2021 USGS



Map Scale: 1:15,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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 Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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.

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 23, Sep 12, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AaA	Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded	C	10.0	0.9%
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	B/D	98.4	8.9%
HeB	Helena sandy loam, 2 to 6 percent slopes	D	120.1	10.9%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	148.7	13.5%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	140.8	12.7%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	109.7	9.9%
VaB	Vance sandy loam, 2 to 6 percent slopes	D	2.9	0.3%
W	Water		24.1	2.2%
WaB	Wake-Rolesville complex, 2 to 6 percent slopes, very rocky	D	0.9	0.1%
WaC	Wake-Rolesville complex, 6 to 10 percent slopes, very rocky	D	4.1	0.4%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	60.8	5.5%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	10.5	1.0%
WeB	Wedowee sandy loam, 2 to 6 percent slopes	B	53.9	4.9%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	B	292.0	26.4%
WgB	Wedowee-Urban land complex, 2 to 6 percent slopes	B	27.1	2.5%
Totals for Area of Interest			**1,104.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TOWN OF ROLESVILLE ETJ 370468

WAKE COUNTY UNINCORPORATED AREAS 370368

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.

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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.

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Limit of Moderate Wave Action (LiMWA)

SCALE

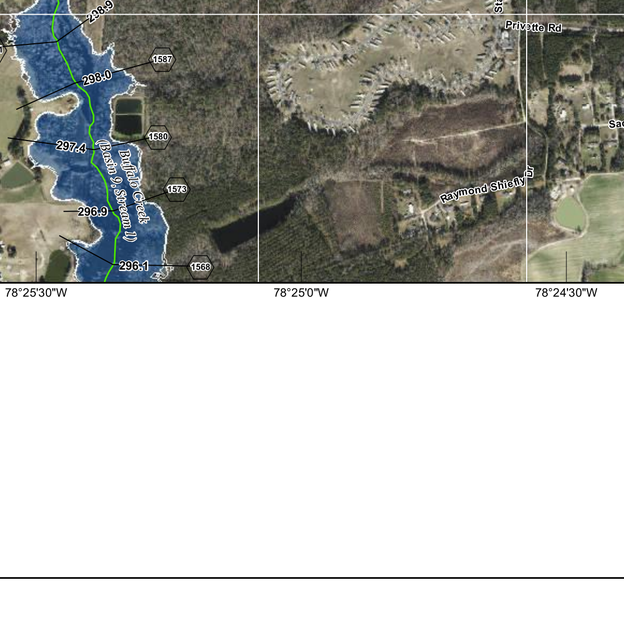
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

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

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

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	Limit of Study
	Jurisdiction Boundary

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Limit of Moderate Wave Action (LiMWA)

SCALE

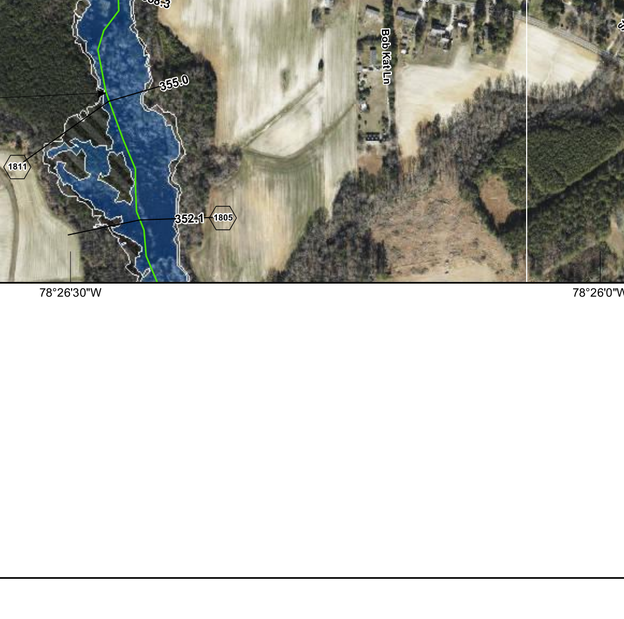
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR



FEMA National Flood Insurance Program

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

NORTH CAROLINA

PANEL 1768

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1768	K
WAKE COUNTY	370368	1768	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720176800K

MAP REVISED
July 19, 2022

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

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.

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.8971°, Longitude: -78.4444°
Elevation: 383 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	**0.403** (0.369-0.442)	**0.468** (0.430-0.512)	**0.534** (0.489-0.582)	**0.600** (0.549-0.654)	**0.666** (0.606-0.726)	**0.719** (0.652-0.784)	**0.766** (0.691-0.835)	**0.808** (0.724-0.882)	**0.855** (0.760-0.934)	**0.898** (0.791-0.982)
10-min	**0.644** (0.590-0.706)	**0.749** (0.687-0.819)	**0.855** (0.783-0.933)	**0.960** (0.877-1.05)	**1.06** (0.966-1.16)	**1.15** (1.04-1.25)	**1.22** (1.10-1.33)	**1.28** (1.15-1.40)	**1.35** (1.20-1.48)	**1.41** (1.24-1.55)
15-min	**0.806** (0.738-0.882)	**0.942** (0.864-1.03)	**1.08** (0.990-1.18)	**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** (1.81-2.17)	**2.18** (1.98-2.38)	**2.36** (2.12-2.57)	**2.52** (2.26-2.75)	**2.71** (2.41-2.96)	**2.87** (2.53-3.14)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.80-2.15)	**2.29** (2.09-2.50)	**2.65** (2.42-2.89)	**2.96** (2.68-3.23)	**3.25** (2.93-3.54)	**3.53** (3.16-3.85)	**3.89** (3.45-4.24)	**4.19** (3.70-4.59)
2-hr	**1.61** (1.46-1.78)	**1.92** (1.75-2.10)	**2.34** (2.13-2.56)	**2.75** (2.49-3.01)	**3.23** (2.92-3.54)	**3.66** (3.29-4.01)	**4.08** (3.63-4.46)	**4.50** (3.99-4.92)	**5.06** (4.43-5.53)	**5.55** (4.82-6.08)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.95** (2.67-3.24)	**3.50** (3.16-3.84)	**4.00** (3.58-4.39)	**4.50** (3.99-4.93)	**5.02** (4.42-5.50)	**5.71** (4.98-6.26)	**6.35** (5.47-6.98)
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** (4.87-5.98)	**6.13** (5.40-6.69)	**7.03** (6.12-7.66)	**7.85** (6.74-8.58)
12-hr	**2.41** (2.21-2.66)	**2.87** (2.64-3.15)	**3.54** (3.24-3.88)	**4.22** (3.84-4.62)	**5.07** (4.59-5.54)	**5.86** (5.26-6.37)	**6.65** (5.92-7.23)	**7.51** (6.60-8.16)	**8.69** (7.52-9.44)	**9.80** (8.35-10.7)
24-hr	**2.86** (2.66-3.08)	**3.46** (3.22-3.73)	**4.35** (4.04-4.69)	**5.06** (4.69-5.45)	**6.04** (5.58-6.50)	**6.82** (6.28-7.35)	**7.63** (7.00-8.22)	**8.47** (7.74-9.13)	**9.64** (8.76-10.4)	**10.6** (9.55-11.4)
2-day	**3.31** (3.08-3.57)	**3.99** (3.72-4.30)	**4.99** (4.64-5.37)	**5.77** (5.36-6.22)	**6.85** (6.33-7.38)	**7.70** (7.10-8.30)	**8.59** (7.89-9.26)	**9.51** (8.70-10.3)	**10.8** (9.79-11.7)	**11.8** (10.6-12.8)
3-day	**3.52** (3.28-3.77)	**4.23** (3.94-4.54)	**5.25** (4.90-5.64)	**6.06** (5.64-6.50)	**7.18** (6.65-7.70)	**8.07** (7.45-8.66)	**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** (3.47-3.98)	**4.46** (4.17-4.77)	**5.52** (5.15-5.90)	**6.36** (5.92-6.79)	**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	**4.31** (4.04-4.61)	**5.15** (4.82-5.50)	**6.29** (5.89-6.72)	**7.20** (6.72-7.69)	**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	**4.91** (4.61-5.24)	**5.85** (5.48-6.23)	**7.05** (6.61-7.51)	**8.00** (7.48-8.51)	**9.27** (8.65-9.88)	**10.3** (9.57-11.0)	**11.3** (10.5-12.1)	**12.4** (11.4-13.2)	**13.8** (12.7-14.8)	**14.9** (13.7-16.0)
20-day	**6.59** (6.20-7.02)	**7.79** (7.33-8.29)	**9.24** (8.68-9.82)	**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)	**18.7** (17.2-20.0)
30-day	**8.19** (7.72-8.69)	**9.63** (9.08-10.2)	**11.2** (10.6-11.9)	**12.5** (11.7-13.3)	**14.1** (13.2-15.0)	**15.4** (14.4-16.4)	**16.7** (15.6-17.7)	**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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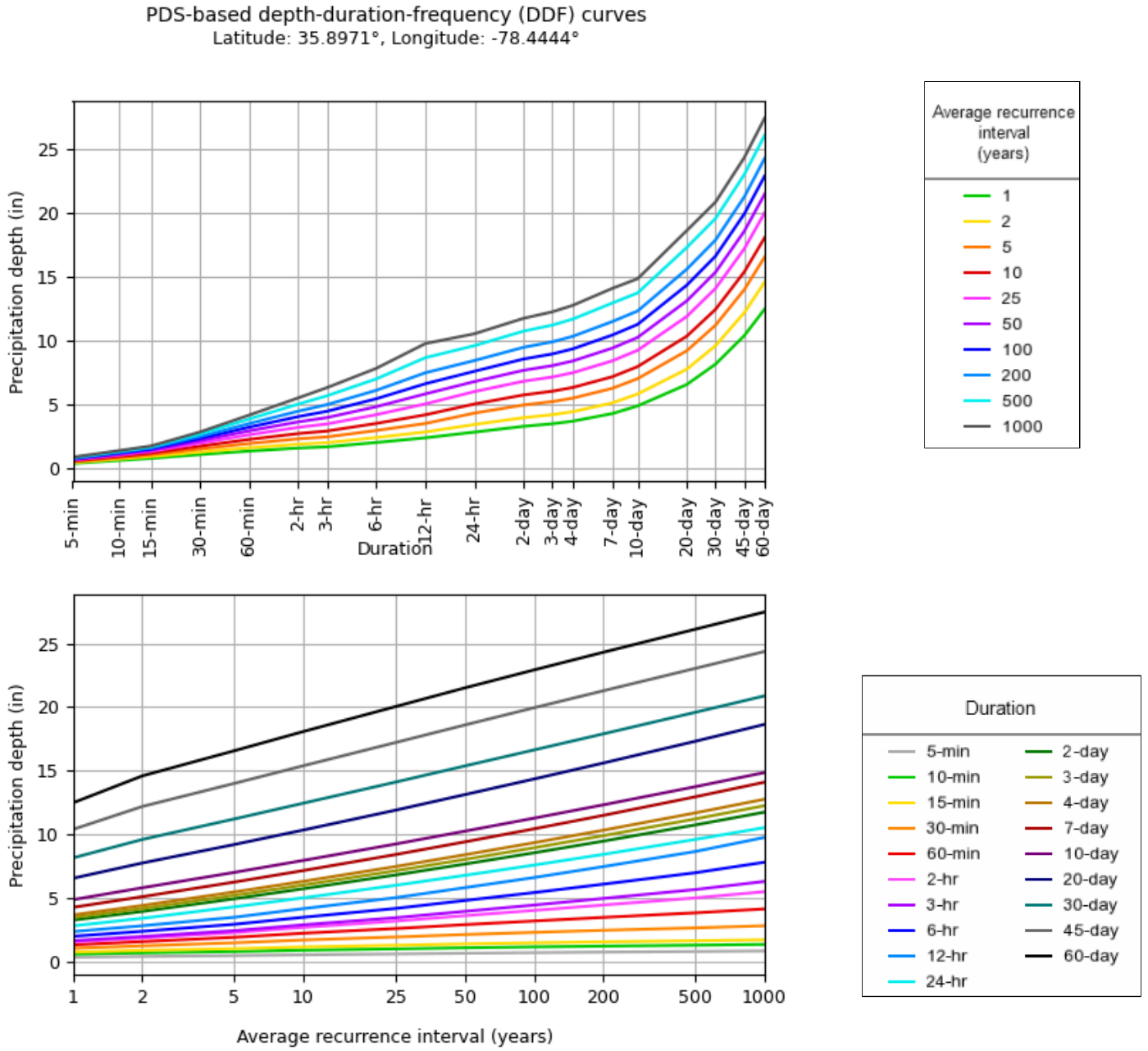
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Tue Apr 30 13:54:47 2024

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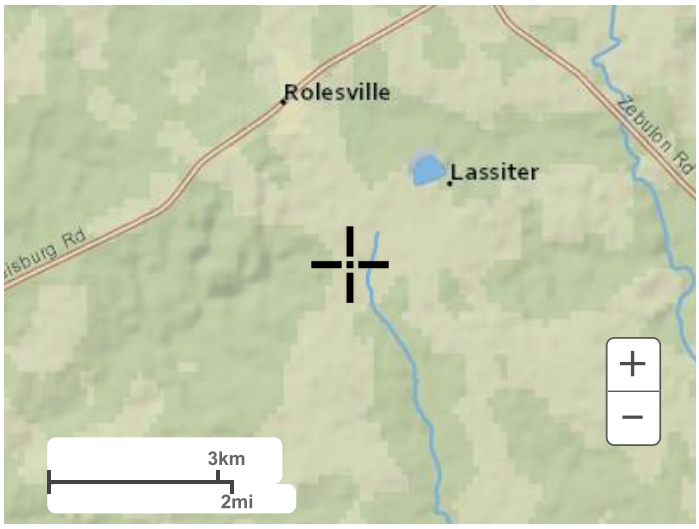
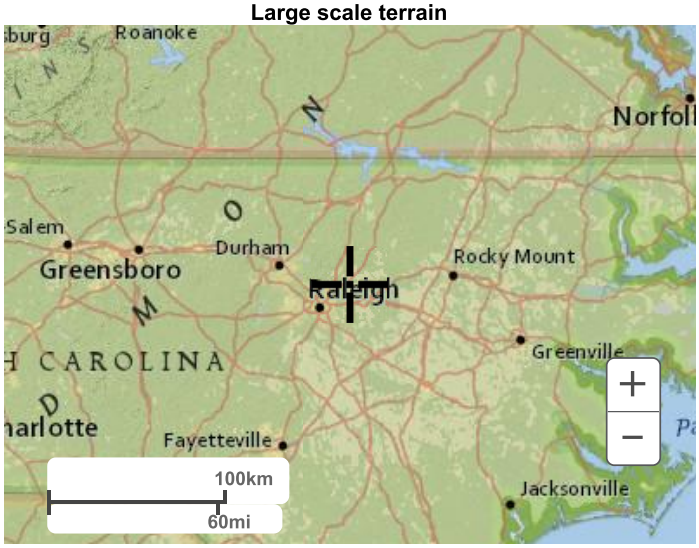
Maps & aerials

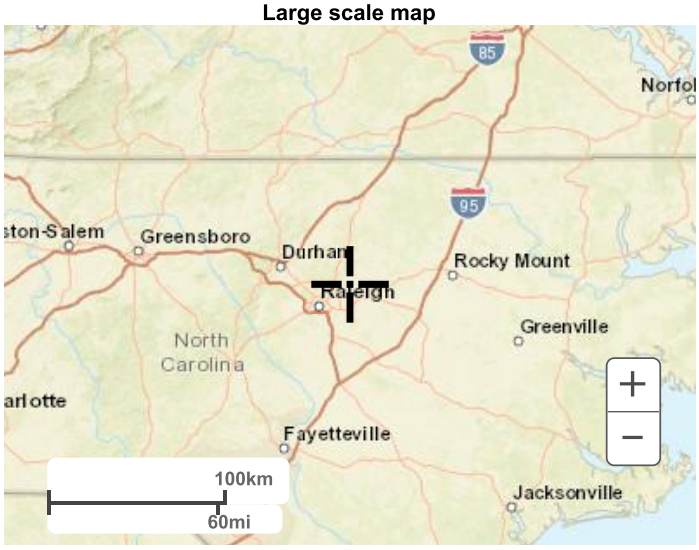
Small scale terrain



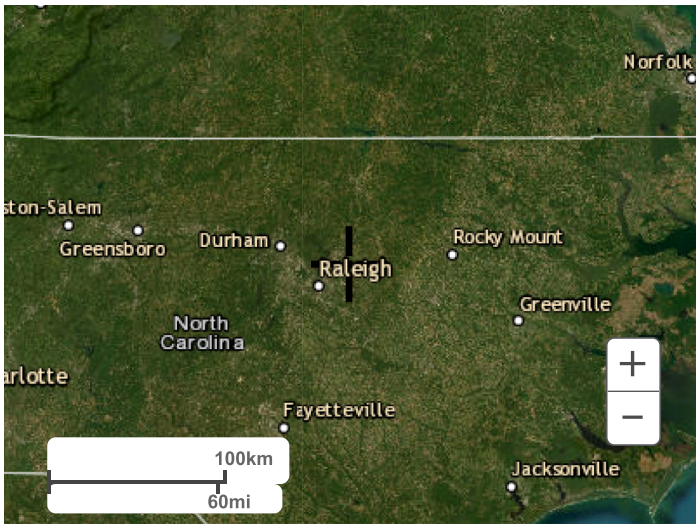
Large scale terrain



Large scale map



Large scale aerial



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Disclaimer

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
SCM 3	Post-Development 1 year	1	1.267	12.100	14.77
SCM 3	Post-Development 10 year	10	3.916	12.100	49.02
SCM 3	Post-Development 100 year	100	7.629	12.100	94.91
SCM 2	Post-Development 1 year	1	1.874	12.100	23.42
SCM 2	Post-Development 10 year	10	4.718	12.100	58.44
SCM 2	Post-Development 100 year	100	8.377	12.100	101.12
Bypass 2	Post-Development 1 year	1	1.045	12.100	13.02
Bypass 2	Post-Development 10 year	10	2.685	12.100	33.36
Bypass 2	Post-Development 100 year	100	4.813	12.100	58.37
SCM 1	Post-Development 1 year	1	0.920	12.100	11.49
SCM 1	Post-Development 10 year	10	2.101	12.100	25.44
SCM 1	Post-Development 100 year	100	3.562	12.100	41.81
Bypass-1	Post-Development 1 year	1	5.934	12.350	48.20
Bypass-1	Post-Development 10 year	10	14.954	12.300	123.55
Bypass-1	Post-Development 100 year	100	26.559	12.300	216.93
Bypass-3	Post-Development 1 year	1	0.274	12.150	2.83
Bypass-3	Post-Development 10 year	10	0.805	12.150	8.95
Bypass-3	Post-Development 100 year	100	1.535	12.150	17.05
Bypass-4	Post-Development 1 year	1	0.190	12.300	1.56
Bypass-4	Post-Development 10 year	10	0.533	12.300	4.62
Bypass-4	Post-Development 100 year	100	0.995	12.300	8.58
Pre DA-1	Pre-Development 1 year	1	6.901	12.350	54.49
Pre DA-1	Pre-Development 10 year	10	19.375	12.300	160.38
Pre DA-1	Pre-Development 100 year	100	36.164	12.300	299.75

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre DA-2	Pre-Development 1 year	1	1.518	12.400	9.95
Pre DA-2	Pre-Development 10 year	10	5.430	12.350	43.57
Pre DA-2	Pre-Development 100 year	100	11.241	12.300	92.85
Pre DA-3	Pre-Development 1 year	1	0.226	12.200	2.17
Pre DA-3	Pre-Development 10 year	10	0.719	12.150	7.82
Pre DA-3	Pre-Development 100 year	100	1.417	12.150	15.60
Pre DA-4	Pre-Development 1 year	1	0.099	12.500	0.57
Pre DA-4	Pre-Development 10 year	10	0.367	12.450	2.65
Pre DA-4	Pre-Development 100 year	100	0.769	12.400	5.77
SCM 4	Post-Development 1 year	1	1.037	12.100	12.98
SCM 4	Post-Development 10 year	10	2.459	12.100	30.10
SCM 4	Post-Development 100 year	100	4.246	12.100	50.45

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-1	Post-Development 1 year	1	8.962	12.300	55.25
POA-1	Post-Development 10 year	10	26.172	12.250	179.84
POA-1	Post-Development 100 year	100	50.411	12.250	352.48
POA-1	Pre-Development 1 year	1	8.419	12.350	64.18
POA-1	Pre-Development 10 year	10	24.804	12.350	203.60
POA-1	Pre-Development 100 year	100	47.405	12.300	392.60
POA-3	Pre-Development 1 year	1	0.226	12.200	2.17
POA-3	Pre-Development 10 year	10	0.719	12.150	7.82
POA-3	Pre-Development 100 year	100	1.417	12.150	15.60

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
POA-4	Pre-Development 1 year	1	0.099	12.500	0.57
POA-4	Pre-Development 10 year	10	0.367	12.450	2.65
POA-4	Pre-Development 100 year	100	0.769	12.400	5.77
POA-3	Post-Development 1 year	1	0.274	12.150	2.83
POA-3	Post-Development 10 year	10	0.805	12.150	8.95
POA-3	Post-Development 100 year	100	1.535	12.150	17.05
POA-4	Post-Development 1 year	1	0.190	12.300	1.56
POA-4	Post-Development 10 year	10	0.533	12.300	4.62
POA-4	Post-Development 100 year	100	0.995	12.300	8.58

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-3 (IN)	Post-Development 1 year	1	1.267	12.100	14.77	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 1 year	1	0.283	23.700	0.31	355.87	0.984
SCM-3 (IN)	Post-Development 10 year	10	3.916	12.100	49.02	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 10 year	10	1.810	14.050	3.78	357.53	2.319
SCM-3 (IN)	Post-Development 100 year	100	7.629	12.100	94.91	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 100 year	100	5.484	12.550	19.25	359.00	3.628
SCM-2 (IN)	Post-Development 1 year	1	1.874	12.100	23.42	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-2 (OUT)	Post-Development 1 year	1	0.985	13.900	1.95	359.27	1.047
SCM-2 (IN)	Post-Development 10 year	10	4.718	12.100	58.44	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 10 year	10	3.770	12.200	39.05	360.12	1.593
SCM-2 (IN)	Post-Development 100 year	100	8.377	12.100	101.12	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 100 year	100	7.380	12.200	60.00	361.11	2.283
SCM-1 (IN)	Post-Development 1 year	1	0.920	12.100	11.49	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 1 year	1	0.204	21.050	0.21	360.01	0.723
SCM-1 (IN)	Post-Development 10 year	10	2.101	12.100	25.44	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 10 year	10	1.038	12.500	5.95	361.24	1.149
SCM-1 (IN)	Post-Development 100 year	100	3.562	12.100	41.81	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 100 year	100	2.495	12.150	33.83	361.79	1.355
SCM-4 (IN)	Post-Development 1 year	1	1.037	12.100	12.98	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 1 year	1	0.511	13.900	1.03	363.92	0.601
SCM-4 (IN)	Post-Development 10 year	10	2.459	12.100	30.10	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 10 year	10	1.916	12.550	5.58	365.20	1.214

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-4 (IN)	Post-Development 100 year	100	4.246	12.100	50.45	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 100 year	100	3.680	12.550	8.57	366.88	2.118

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Time-Depth Curve: 1 year	
Label	1 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	1 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0
1.500	0.0	0.0	0.0	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.1
3.500	0.1	0.1	0.1	0.1	0.1
4.000	0.1	0.1	0.1	0.1	0.1
4.500	0.1	0.1	0.2	0.2	0.2
5.000	0.2	0.2	0.2	0.2	0.2
5.500	0.2	0.2	0.2	0.2	0.2
6.000	0.2	0.2	0.2	0.2	0.2
6.500	0.2	0.2	0.2	0.2	0.3
7.000	0.3	0.3	0.3	0.3	0.3
7.500	0.3	0.3	0.3	0.3	0.3
8.000	0.3	0.3	0.3	0.3	0.4
8.500	0.4	0.4	0.4	0.4	0.4
9.000	0.4	0.4	0.4	0.5	0.5
9.500	0.5	0.5	0.5	0.5	0.5
10.000	0.5	0.6	0.6	0.6	0.6
10.500	0.6	0.6	0.7	0.7	0.7
11.000	0.7	0.7	0.8	0.8	0.8
11.500	0.9	0.9	1.0	1.1	1.2
12.000	1.4	1.7	1.8	1.9	2.0
12.500	2.0	2.0	2.1	2.1	2.1
13.000	2.1	2.2	2.2	2.2	2.2
13.500	2.2	2.3	2.3	2.3	2.3
14.000	2.3	2.3	2.3	2.4	2.4
14.500	2.4	2.4	2.4	2.4	2.4
15.000	2.4	2.5	2.5	2.5	2.5
15.500	2.5	2.5	2.5	2.5	2.5
16.000	2.5	2.5	2.5	2.6	2.6
16.500	2.6	2.6	2.6	2.6	2.6
17.000	2.6	2.6	2.6	2.6	2.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	2.6	2.6	2.6	2.6	2.6
18.000	2.7	2.7	2.7	2.7	2.7
18.500	2.7	2.7	2.7	2.7	2.7
19.000	2.7	2.7	2.7	2.7	2.7
19.500	2.7	2.7	2.7	2.7	2.7
20.000	2.7	2.7	2.7	2.7	2.8
20.500	2.8	2.8	2.8	2.8	2.8
21.000	2.8	2.8	2.8	2.8	2.8
21.500	2.8	2.8	2.8	2.8	2.8
22.000	2.8	2.8	2.8	2.8	2.8
22.500	2.8	2.8	2.8	2.8	2.8
23.000	2.8	2.8	2.8	2.8	2.8
23.500	2.8	2.9	2.9	2.9	2.9
24.000	2.9	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 1 year	
Label	1 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	1 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0
1.500	0.0	0.0	0.0	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.1
3.500	0.1	0.1	0.1	0.1	0.1
4.000	0.1	0.1	0.1	0.1	0.1
4.500	0.1	0.1	0.2	0.2	0.2
5.000	0.2	0.2	0.2	0.2	0.2
5.500	0.2	0.2	0.2	0.2	0.2
6.000	0.2	0.2	0.2	0.2	0.2
6.500	0.2	0.2	0.2	0.2	0.3
7.000	0.3	0.3	0.3	0.3	0.3
7.500	0.3	0.3	0.3	0.3	0.3
8.000	0.3	0.3	0.3	0.3	0.4
8.500	0.4	0.4	0.4	0.4	0.4
9.000	0.4	0.4	0.4	0.5	0.5
9.500	0.5	0.5	0.5	0.5	0.5
10.000	0.5	0.6	0.6	0.6	0.6
10.500	0.6	0.6	0.7	0.7	0.7
11.000	0.7	0.7	0.8	0.8	0.8
11.500	0.9	0.9	1.0	1.1	1.2
12.000	1.4	1.7	1.8	1.9	2.0
12.500	2.0	2.0	2.1	2.1	2.1
13.000	2.1	2.2	2.2	2.2	2.2
13.500	2.2	2.3	2.3	2.3	2.3
14.000	2.3	2.3	2.3	2.4	2.4
14.500	2.4	2.4	2.4	2.4	2.4
15.000	2.4	2.5	2.5	2.5	2.5
15.500	2.5	2.5	2.5	2.5	2.5
16.000	2.5	2.5	2.5	2.6	2.6
16.500	2.6	2.6	2.6	2.6	2.6
17.000	2.6	2.6	2.6	2.6	2.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 1 year

Return Event: 1 years
Storm Event: 1 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	2.6	2.6	2.6	2.6	2.6
18.000	2.7	2.7	2.7	2.7	2.7
18.500	2.7	2.7	2.7	2.7	2.7
19.000	2.7	2.7	2.7	2.7	2.7
19.500	2.7	2.7	2.7	2.7	2.7
20.000	2.7	2.7	2.7	2.7	2.8
20.500	2.8	2.8	2.8	2.8	2.8
21.000	2.8	2.8	2.8	2.8	2.8
21.500	2.8	2.8	2.8	2.8	2.8
22.000	2.8	2.8	2.8	2.8	2.8
22.500	2.8	2.8	2.8	2.8	2.8
23.000	2.8	2.8	2.8	2.8	2.8
23.500	2.8	2.9	2.9	2.9	2.9
24.000	2.9	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 10 year

Return Event: 10 years
Storm Event: 10 year

Time-Depth Curve: 10 year	
Label	10 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.4
6.000	0.4	0.4	0.4	0.4	0.4
6.500	0.4	0.4	0.4	0.4	0.4
7.000	0.5	0.5	0.5	0.5	0.5
7.500	0.5	0.5	0.5	0.6	0.6
8.000	0.6	0.6	0.6	0.6	0.6
8.500	0.6	0.7	0.7	0.7	0.7
9.000	0.7	0.8	0.8	0.8	0.8
9.500	0.8	0.9	0.9	0.9	0.9
10.000	1.0	1.0	1.0	1.0	1.1
10.500	1.1	1.1	1.2	1.2	1.2
11.000	1.3	1.3	1.3	1.4	1.4
11.500	1.5	1.6	1.7	1.9	2.1
12.000	2.5	3.0	3.2	3.3	3.5
12.500	3.6	3.6	3.7	3.7	3.8
13.000	3.8	3.8	3.9	3.9	3.9
13.500	4.0	4.0	4.0	4.1	4.1
14.000	4.1	4.1	4.2	4.2	4.2
14.500	4.2	4.2	4.3	4.3	4.3
15.000	4.3	4.3	4.4	4.4	4.4
15.500	4.4	4.4	4.4	4.5	4.5
16.000	4.5	4.5	4.5	4.5	4.5
16.500	4.5	4.6	4.6	4.6	4.6
17.000	4.6	4.6	4.6	4.6	4.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 10 year

Return Event: 10 years
Storm Event: 10 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	4.7	4.7	4.7	4.7	4.7
18.000	4.7	4.7	4.7	4.7	4.7
18.500	4.7	4.7	4.8	4.8	4.8
19.000	4.8	4.8	4.8	4.8	4.8
19.500	4.8	4.8	4.8	4.8	4.8
20.000	4.8	4.8	4.9	4.9	4.9
20.500	4.9	4.9	4.9	4.9	4.9
21.000	4.9	4.9	4.9	4.9	4.9
21.500	4.9	4.9	4.9	5.0	5.0
22.000	5.0	5.0	5.0	5.0	5.0
22.500	5.0	5.0	5.0	5.0	5.0
23.000	5.0	5.0	5.0	5.0	5.0
23.500	5.0	5.0	5.0	5.1	5.1
24.000	5.1	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 10 year

Return Event: 10 years
Storm Event: 10 year

Time-Depth Curve: 10 year	
Label	10 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.4
6.000	0.4	0.4	0.4	0.4	0.4
6.500	0.4	0.4	0.4	0.4	0.4
7.000	0.5	0.5	0.5	0.5	0.5
7.500	0.5	0.5	0.5	0.6	0.6
8.000	0.6	0.6	0.6	0.6	0.6
8.500	0.6	0.7	0.7	0.7	0.7
9.000	0.7	0.8	0.8	0.8	0.8
9.500	0.8	0.9	0.9	0.9	0.9
10.000	1.0	1.0	1.0	1.0	1.1
10.500	1.1	1.1	1.2	1.2	1.2
11.000	1.3	1.3	1.3	1.4	1.4
11.500	1.5	1.6	1.7	1.9	2.1
12.000	2.5	3.0	3.2	3.3	3.5
12.500	3.6	3.6	3.7	3.7	3.8
13.000	3.8	3.8	3.9	3.9	3.9
13.500	4.0	4.0	4.0	4.1	4.1
14.000	4.1	4.1	4.2	4.2	4.2
14.500	4.2	4.2	4.3	4.3	4.3
15.000	4.3	4.3	4.4	4.4	4.4
15.500	4.4	4.4	4.4	4.5	4.5
16.000	4.5	4.5	4.5	4.5	4.5
16.500	4.5	4.6	4.6	4.6	4.6
17.000	4.6	4.6	4.6	4.6	4.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 10 year

Return Event: 10 years
Storm Event: 10 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	4.7	4.7	4.7	4.7	4.7
18.000	4.7	4.7	4.7	4.7	4.7
18.500	4.7	4.7	4.8	4.8	4.8
19.000	4.8	4.8	4.8	4.8	4.8
19.500	4.8	4.8	4.8	4.8	4.8
20.000	4.8	4.8	4.9	4.9	4.9
20.500	4.9	4.9	4.9	4.9	4.9
21.000	4.9	4.9	4.9	4.9	4.9
21.500	4.9	4.9	4.9	5.0	5.0
22.000	5.0	5.0	5.0	5.0	5.0
22.500	5.0	5.0	5.0	5.0	5.0
23.000	5.0	5.0	5.0	5.0	5.0
23.500	5.0	5.0	5.0	5.1	5.1
24.000	5.1	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 100 year

Return Event: 100 years
Storm Event: 100 year

Time-Depth Curve: 100 year	
Label	100 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.1	0.1	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.2	0.2	0.2	0.2	0.2
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.3	0.3	0.3
3.500	0.3	0.3	0.3	0.3	0.3
4.000	0.3	0.3	0.3	0.4	0.4
4.500	0.4	0.4	0.4	0.4	0.4
5.000	0.4	0.4	0.5	0.5	0.5
5.500	0.5	0.5	0.5	0.5	0.5
6.000	0.5	0.6	0.6	0.6	0.6
6.500	0.6	0.6	0.6	0.7	0.7
7.000	0.7	0.7	0.7	0.7	0.8
7.500	0.8	0.8	0.8	0.8	0.9
8.000	0.9	0.9	0.9	0.9	1.0
8.500	1.0	1.0	1.0	1.1	1.1
9.000	1.1	1.1	1.2	1.2	1.2
9.500	1.3	1.3	1.3	1.4	1.4
10.000	1.4	1.5	1.5	1.6	1.6
10.500	1.7	1.7	1.7	1.8	1.9
11.000	1.9	2.0	2.0	2.1	2.2
11.500	2.3	2.4	2.6	2.8	3.2
12.000	3.8	4.5	4.8	5.0	5.2
12.500	5.4	5.4	5.5	5.6	5.7
13.000	5.7	5.8	5.8	5.9	5.9
13.500	6.0	6.0	6.1	6.1	6.1
14.000	6.2	6.2	6.3	6.3	6.3
14.500	6.4	6.4	6.4	6.5	6.5
15.000	6.5	6.5	6.6	6.6	6.6
15.500	6.7	6.7	6.7	6.7	6.7
16.000	6.8	6.8	6.8	6.8	6.8
16.500	6.9	6.9	6.9	6.9	6.9
17.000	6.9	7.0	7.0	7.0	7.0

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 100 year

Return Event: 100 years
Storm Event: 100 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	7.0	7.0	7.0	7.1	7.1
18.000	7.1	7.1	7.1	7.1	7.1
18.500	7.1	7.2	7.2	7.2	7.2
19.000	7.2	7.2	7.2	7.2	7.2
19.500	7.3	7.3	7.3	7.3	7.3
20.000	7.3	7.3	7.3	7.3	7.3
20.500	7.4	7.4	7.4	7.4	7.4
21.000	7.4	7.4	7.4	7.4	7.4
21.500	7.4	7.4	7.5	7.5	7.5
22.000	7.5	7.5	7.5	7.5	7.5
22.500	7.5	7.5	7.5	7.5	7.6
23.000	7.6	7.6	7.6	7.6	7.6
23.500	7.6	7.6	7.6	7.6	7.6
24.000	7.6	(N/A)	(N/A)	(N/A)	(N/A)

Time-Depth Curve: 100 year	
Label	100 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.1	0.1	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.2	0.2	0.2	0.2	0.2
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.3	0.3	0.3
3.500	0.3	0.3	0.3	0.3	0.3
4.000	0.3	0.3	0.3	0.4	0.4
4.500	0.4	0.4	0.4	0.4	0.4
5.000	0.4	0.4	0.5	0.5	0.5
5.500	0.5	0.5	0.5	0.5	0.5
6.000	0.5	0.6	0.6	0.6	0.6
6.500	0.6	0.6	0.6	0.7	0.7
7.000	0.7	0.7	0.7	0.7	0.8
7.500	0.8	0.8	0.8	0.8	0.9
8.000	0.9	0.9	0.9	0.9	1.0
8.500	1.0	1.0	1.0	1.1	1.1
9.000	1.1	1.1	1.2	1.2	1.2
9.500	1.3	1.3	1.3	1.4	1.4
10.000	1.4	1.5	1.5	1.6	1.6
10.500	1.7	1.7	1.7	1.8	1.9
11.000	1.9	2.0	2.0	2.1	2.2
11.500	2.3	2.4	2.6	2.8	3.2
12.000	3.8	4.5	4.8	5.0	5.2
12.500	5.4	5.4	5.5	5.6	5.7
13.000	5.7	5.8	5.8	5.9	5.9
13.500	6.0	6.0	6.1	6.1	6.1
14.000	6.2	6.2	6.3	6.3	6.3
14.500	6.4	6.4	6.4	6.5	6.5
15.000	6.5	6.5	6.6	6.6	6.6
15.500	6.7	6.7	6.7	6.7	6.7
16.000	6.8	6.8	6.8	6.8	6.8
16.500	6.9	6.9	6.9	6.9	6.9
17.000	6.9	7.0	7.0	7.0	7.0

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 100 year

Return Event: 100 years
Storm Event: 100 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	7.0	7.0	7.0	7.1	7.1
18.000	7.1	7.1	7.1	7.1	7.1
18.500	7.1	7.2	7.2	7.2	7.2
19.000	7.2	7.2	7.2	7.2	7.2
19.500	7.3	7.3	7.3	7.3	7.3
20.000	7.3	7.3	7.3	7.3	7.3
20.500	7.4	7.4	7.4	7.4	7.4
21.000	7.4	7.4	7.4	7.4	7.4
21.500	7.4	7.4	7.5	7.5	7.5
22.000	7.5	7.5	7.5	7.5	7.5
22.500	7.5	7.5	7.5	7.5	7.6
23.000	7.6	7.6	7.6	7.6	7.6
23.500	7.6	7.6	7.6	7.6	7.6
24.000	7.6	(N/A)	(N/A)	(N/A)	(N/A)

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Appendix 3: Peak Flow Analysis

- Existing Drainage Area Map
- Existing Cn Calculations
- Existing Tc Calculations
- PONDPACK Existing Routing Schematic
- Existing PONDPACK Input Data
- Existing Peak Flow PONDPACK Results
- Proposed Drainage Area Map
- Proposed Cn Calculations
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- PONDPACK Proposed Routing Schematic
- Proposed PONDPACK Input Data
- Proposed Peak Flow PONDPACK Results
- BentleyFlowMaster Outputs for POA 3 and POA 4 – Normal Depths
- Downstream Impact Analysis Calculations & Results

LEGEND
- DRAINAGE AREA - EXISTING
- SHEET FLOW
- SHALLOW FLOW
- CHANNEL FLOW

DA POA #3
4.00 ACRES
CN: 71
TC: 0.19 HR

DA POA #1
90.39 ACRES
CN: 76
Tc: 0.44 hr

DA POA #4
2.51 ACRES
CN: 66
TC: 0.55 HR

DA POA #2
35.52 ACRES
CN: 67
Tc: 0.44 hr

POA 1
POA 2
POA 3
POA 4

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INITIAL PLAN DATE: 05/01/2024
REVISIONS:

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SCALE: 1 inch = 300 ft.

Preliminary
Broadmoor

1321 Rolesville Road Rolesville, NC 27587

WithersRavenel
Engineers | Planners | Surveyors

115 MacKenan Drive | Cary, NC 27511
t: 919.469.3340 | license #: F-1479 | www.withersravenel.com

WR Job No. 23-0045 | DATE 05/01/2024
DRN: EMM | DGN: BJM | CKD: WR

EXISTING DRAINAGE MAP

1

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Summary of Hydrology Inputs Per Sub-Drainage Area Area

Existing Conditions

ONSITE / OFFSITE	LAND USE	HSG	CN	% Total Imp	Total Imp Area	AREA (SF)	AREA (ACRE)
Drainage Area to POA #1							
Offsite	Building	B	98	100%	9,634	9,634	0.22
Onsite	Building	B	98	100%	3,060	3,060	0.07
Offsite	Building	D	98	100%	6,435	6,435	0.15
Offsite	Open Space	B	61	---	---	441,877	10.14
Onsite	Open Space	B	61	---	---	1,054,512	24.21
Offsite	Open Space	C	74	---	---	1,854	0.04
Onsite	Open Space	C	74	---	---	364,888	8.38
Offsite	Open Space	D	80	---	---	112,500	2.58
Onsite	Open Space	D	80	---	---	501,569	11.51
Onsite	Water	B	98	---	---	6	0.00
Onsite	Water	D	98	---	---	16,047	0.37
Onsite	Wetlands	B	98	-	---	52	0.00
Onsite	Wetlands	C	98	-	---	40,311	0.93
Onsite	Wetlands	D	98	-	---	862,326	19.80
Offsite	Woods	B	55	---	---	8,710	0.20
Onsite	Woods	B	55	---	---	48,419	1.11
Onsite	Woods	C	70	---	---	77,685	1.78
Offsite	Woods	D	77	---	---	56,878	1.31
Onsite	Woods	D	77	---	---	330,750	7.59
					Total Onsite Impervious Area:	**3,060**	**0.07**
					Total Onsite Area:	**3,299,625**	**75.75**
					Total Sub-Drainage Area Basin Area:	**3,937,513**	**90.39**
					Total Impervious Area:	**19,129**	**0.44**
					Cumulative Curve Number (CN):	**76**	
					CNp:	**76**	
					Disconnected Impervious Area:	**#REF!**	---
					Disconnected Impervious Area % of Total Area:	**#REF!**	
					Adjusted Cumulative Curve Number (CN):	**#REF!**	
Drainage Area to POA #2							
Offsite	Building	B	98	100%	3,510	3,510	0.08
Offsite	Open Space	B	61	---	---	319,000	7.32
Onsite	Open Space	B	61	---	---	802,250	18.42
Onsite	Open Space	D	80	---	---	189,586	4.35
Offsite	Roadway	B	98	100%	7,859	7,859	0.18
Onsite	Water	B	98	---	---	668	0.02
Onsite	Water	D	98	---	---	107,060	2.46
Onsite	Wetlands	D	98	-	---	36,932	0.85
Offsite	Woods	B	55	---	---	1,122	0.03
Onsite	Woods	B	55	---	---	61,297	1.41
Onsite	Woods	D	77	---	---	18,062	0.41
					Total Onsite Impervious Area:	---	---
					Total Onsite Area:	**1,215,855**	**27.91**
					Total Sub-Drainage Area Basin Area:	**1,547,346**	**35.52**
					Total Impervious Area:	**11,369**	**0.26**
					Cumulative Curve Number (CN):	**67**	

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Summary of Hydrology Inputs Per Sub-Drainage Area Area

Existing Conditions

ONSITE / OFFSITE	LAND USE	HSG	CN	% Total Imp	Total Imp Area	AREA (SF)	AREA (ACRE)
Drainage Area to POA #3							
Offsite	Building	B	98	100%	3,486	3,486	0.08
Onsite	Building	B	98	100%	47	47	0.00
Offsite	Building	C	98	100%	907	907	0.02
Offsite	Open Space	B	61	---	---	37,787	0.87
Onsite	Open Space	B	61	---	---	30,082	0.69
Offsite	Open Space	C	74	---	---	60,425	1.39
Onsite	Open Space	C	74	---	---	28,980	0.67
Offsite	Roadway	B	98	100%	5,622	5,622	0.13
Offsite	Roadway	C	98	100%	6,996	6,996	0.16
					Total Onsite Impervious Area:	**47**	**0.00**
					Total Onsite Area:	**59,109**	**1.36**
					Total Sub-Drainage Area Basin Area:	**174,332**	**4.00**
					Total Impervious Area:	**17,058**	**0.39**
					Cumulative Curve Number (CN):	**71**	
Drainage Area to POA #4							
Offsite	Building	B	98	100%	2,313	2,313	0.05
Offsite	Open Space	B	61	---	---	69,614	1.60
Onsite	Open Space	B	61	---	---	23,363	0.54
Offsite	Roadway	B	98	100%	13,883	13,883	0.32
					Total Onsite Impervious Area:	---	---
					Total Onsite Area:	**23,363**	**0.54**
					Total Sub-Drainage Area Basin Area:	**109,173**	**2.51**
					Total Impervious Area:	**16,196**	**0.37**
					Cumulative Curve Number (CN):	**66**	
Total Site Information							
					Total Onsite Impervious Area:	**3,060**	**0.07**
					Total Onsite Area:	**4,597,952**	**105.55**
					Total Watershed Area:	**5,768,364**	**132.42**

Broadmoor - Rolesville, NC

Summary of Time of Concentration (T_c) Calculations Per Sub-Drainage Area

Existing Conditions

Sub-Drainage To POA1	
User Defined T_c (hours)	
AND/OR	
Sheet Flow	
Length (ft):	100
Slope (ft/ft):	0.0313
Surface Cover:	Grass - Dense
Manning's n-value:	0.24
T_t (hrs):	0.189
Shallow Flow	
Length (ft):	860
Slope (ft/ft):	0.0235
Surface Cover:	Unpaved
T_t (hrs):	0.097
Channel Flow Sec 1	
Length (ft):	1445
Slope (ft/ft):	0.009
Manning's n-value:	0.035
Flow Area (ft^2):	15
Wetted Perimeter (ft):	30
T_t (hrs):	0.155
Total T_C =	**0.441 hr**

Sub-Drainage To POA2	
User Defined T_c (hours)	
AND/OR	
Sheet Flow	
Length (ft):	100
Slope (ft/ft):	0.015
Surface Cover:	Grass - Dense
Manning's n-value:	0.24
T_t (hrs):	0.254
Shallow Flow	
Length (ft):	769
Slope (ft/ft):	0.025
Surface Cover:	Unpaved
T_t (hrs):	0.084
Channel Flow Sec 1	
Length (ft):	888
Slope (ft/ft):	0.012
Manning's n-value:	0.035
Flow Area (ft^2):	8
Wetted Perimeter (ft):	21.5
T_t (hrs):	0.102
Total T_C =	**0.440 hr**

Sub-Drainage To POA3	
User Defined T_c (hours)	
AND/OR	
Sheet Flow	
Length (ft):	97
Slope (ft/ft):	0.038
Surface Cover:	Grass - Dense
Manning's n-value:	0.24
T_t (hrs):	0.171
Shallow Flow	
Length (ft):	200
Slope (ft/ft):	0.065
Surface Cover:	Unpaved
T_t (hrs):	0.013
Channel Flow Sec 1	
Length (ft):	64.5
Slope (ft/ft):	0.022
Manning's n-value:	0.035
Flow Area (ft^2):	1.6
Wetted Perimeter (ft):	7.6
T_t (hrs):	0.008
Total T_C =	**0.192 hr**

Sub-Drainage To POA4	
User Defined T_c (hours)	
AND/OR	
Sheet Flow	
Length (ft):	100
Slope (ft/ft):	0.013
Surface Cover:	Grass - Dense
Manning's n-value:	0.24
T_t (hrs):	0.272
Shallow Flow	
Length (ft):	250
Slope (ft/ft):	0.010
Surface Cover:	Unpaved
T_t (hrs):	0.043
Channel Flow Sec 1	
Length (ft):	624
Slope (ft/ft):	0.002
Manning's n-value:	0.035
Flow Area (ft^2):	1.2
Wetted Perimeter (ft):	4.3
T_t (hrs):	0.238
Total T_C =	**0.553 hr**

Scenario: Pre-Development 1 year

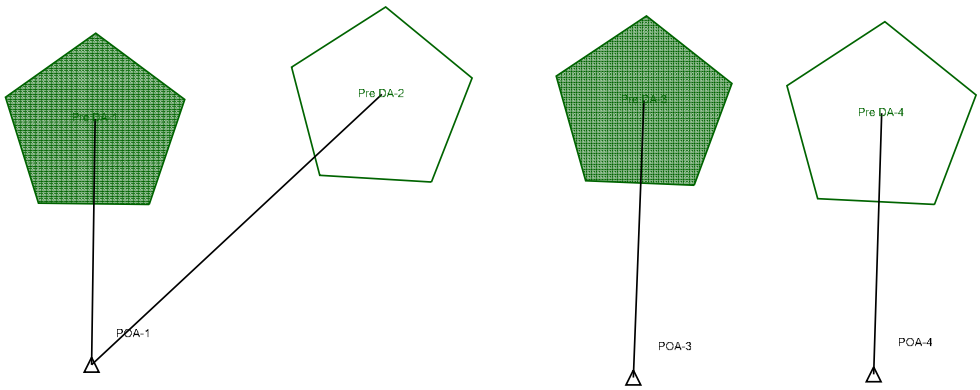

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre DA-1	Pre-Development 1 year	1	6.901	12.350	54.49
Pre DA-1	Pre-Development 10 year	10	19.375	12.300	160.38
Pre DA-1	Pre-Development 100 year	100	36.164	12.300	299.75
Pre DA-2	Pre-Development 1 year	1	1.518	12.400	9.95
Pre DA-2	Pre-Development 10 year	10	5.430	12.350	43.57
Pre DA-2	Pre-Development 100 year	100	11.241	12.300	92.85
Pre DA-3	Pre-Development 1 year	1	0.226	12.200	2.17
Pre DA-3	Pre-Development 10 year	10	0.719	12.150	7.82
Pre DA-3	Pre-Development 100 year	100	1.417	12.150	15.60
Pre DA-4	Pre-Development 1 year	1	0.099	12.500	0.57
Pre DA-4	Pre-Development 10 year	10	0.367	12.450	2.65
Pre DA-4	Pre-Development 100 year	100	0.769	12.400	5.77

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-1	Pre-Development 1 year	1	8.419	12.350	64.18
POA-1	Pre-Development 10 year	10	24.804	12.350	203.60
POA-1	Pre-Development 100 year	100	47.405	12.300	392.60
POA-3	Pre-Development 1 year	1	0.226	12.200	2.17
POA-3	Pre-Development 10 year	10	0.719	12.150	7.82
POA-3	Pre-Development 100 year	100	1.417	12.150	15.60
POA-4	Pre-Development 1 year	1	0.099	12.500	0.57
POA-4	Pre-Development 10 year	10	0.367	12.450	2.65

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-4	Pre-Development 100 year	100	0.769	12.400	5.77

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.441 hours
Area (User Defined)	3,937,513.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.348 hours
Flow (Peak, Computed)	54.53 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.350 hours
Flow (Peak Interpolated Output)	54.49 ft³/s

Drainage Area	
SCS CN (Composite)	76.000
Area (User Defined)	3,937,513.000 ft²
Maximum Retention (Pervious)	3.2 in
Maximum Retention (Pervious, 20 percent)	0.6 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.9 in
Runoff Volume (Pervious)	6.945 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	6.901 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.441 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	232.24 ft³/s

Subsection: Unit Hydrograph Summary
Label: Pre DA-1
Scenario: Pre-Development 1 year

Return Event: 1 years
Storm Event: 1 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.294 hours
Unit receding limb, Tr	1.176 hours
Total unit time, Tb	1.470 hours

Storm Event	10 year
Return Event	10 years
Duration	24.000 hours
Depth	5.1 in
Time of Concentration (Composite)	0.441 hours
Area (User Defined)	3,937,513.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.289 hours
Flow (Peak, Computed)	160.41 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.300 hours
Flow (Peak Interpolated Output)	160.38 ft³/s

Drainage Area	
SCS CN (Composite)	76.000
Area (User Defined)	3,937,513.000 ft²
Maximum Retention (Pervious)	3.2 in
Maximum Retention (Pervious, 20 percent)	0.6 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.6 in
Runoff Volume (Pervious)	19.472 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	19.375 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.441 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	232.24 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.294 hours
Unit receding limb, Tr	1.176 hours
Total unit time, Tb	1.470 hours

Storm Event	100 year
Return Event	100 years
Duration	24.000 hours
Depth	7.6 in
Time of Concentration (Composite)	0.441 hours
Area (User Defined)	3,937,513.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.289 hours
Flow (Peak, Computed)	300.38 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.300 hours
Flow (Peak Interpolated Output)	299.75 ft³/s

Drainage Area	
SCS CN (Composite)	76.000
Area (User Defined)	3,937,513.000 ft²
Maximum Retention (Pervious)	3.2 in
Maximum Retention (Pervious, 20 percent)	0.6 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	4.8 in
Runoff Volume (Pervious)	36.326 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	36.164 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.441 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	232.24 ft³/s

Subsection: Unit Hydrograph Summary
Label: Pre DA-1
Scenario: Pre-Development 100 year

Return Event: 100 years
Storm Event: 100 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.294 hours
Unit receding limb, Tr	1.176 hours
Total unit time, Tb	1.470 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.440 hours
Area (User Defined)	1,547,346.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.437 hours
Flow (Peak, Computed)	9.96 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.400 hours
Flow (Peak Interpolated Output)	9.95 ft³/s

Drainage Area	
SCS CN (Composite)	67.000
Area (User Defined)	1,547,346.000 ft²
Maximum Retention (Pervious)	4.9 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.5 in
Runoff Volume (Pervious)	1.530 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.518 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.440 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	91.47 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.293 hours
Unit receding limb, Tr	1.173 hours
Total unit time, Tb	1.467 hours

Storm Event	10 year
Return Event	10 years
Duration	24.000 hours
Depth	5.1 in
Time of Concentration (Composite)	0.440 hours
Area (User Defined)	1,547,346.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.320 hours
Flow (Peak, Computed)	43.81 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.350 hours
Flow (Peak Interpolated Output)	43.57 ft³/s

Drainage Area	
SCS CN (Composite)	67.000
Area (User Defined)	1,547,346.000 ft²
Maximum Retention (Pervious)	4.9 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.8 in
Runoff Volume (Pervious)	5.461 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	5.430 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.440 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	91.47 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.293 hours
Unit receding limb, Tr	1.173 hours
Total unit time, Tb	1.467 hours

Storm Event	100 year
Return Event	100 years
Duration	24.000 hours
Depth	7.6 in
Time of Concentration (Composite)	0.440 hours
Area (User Defined)	1,547,346.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.320 hours
Flow (Peak, Computed)	93.78 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.300 hours
Flow (Peak Interpolated Output)	92.85 ft³/s

Drainage Area	
SCS CN (Composite)	67.000
Area (User Defined)	1,547,346.000 ft²
Maximum Retention (Pervious)	4.9 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.8 in
Runoff Volume (Pervious)	11.297 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	11.241 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.440 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	91.47 ft³/s

Subsection: Unit Hydrograph Summary
Label: Pre DA-2
Scenario: Pre-Development 100 year

Return Event: 100 years
Storm Event: 100 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.293 hours
Unit receding limb, Tr	1.173 hours
Total unit time, Tb	1.467 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.192 hours
Area (User Defined)	174,332.000 ft²

Computational Time Increment	0.026 hours
Time to Peak (Computed)	12.186 hours
Flow (Peak, Computed)	2.21 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.200 hours
Flow (Peak Interpolated Output)	2.17 ft³/s

Drainage Area	
SCS CN (Composite)	71.000
Area (User Defined)	174,332.000 ft²
Maximum Retention (Pervious)	4.1 in
Maximum Retention (Pervious, 20 percent)	0.8 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.7 in
Runoff Volume (Pervious)	0.227 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.226 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.192 hours
Computational Time Increment	0.026 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	23.62 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.128 hours
Unit receding limb, Tr	0.512 hours
Total unit time, Tb	0.640 hours

Storm Event	10 year
Return Event	10 years
Duration	24.000 hours
Depth	5.1 in
Time of Concentration (Composite)	0.192 hours
Area (User Defined)	174,332.000 ft²

Computational Time Increment	0.026 hours
Time to Peak (Computed)	12.160 hours
Flow (Peak, Computed)	7.87 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.150 hours
Flow (Peak Interpolated Output)	7.82 ft³/s

Drainage Area	
SCS CN (Composite)	71.000
Area (User Defined)	174,332.000 ft²
Maximum Retention (Pervious)	4.1 in
Maximum Retention (Pervious, 20 percent)	0.8 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.2 in
Runoff Volume (Pervious)	0.721 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.719 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.192 hours
Computational Time Increment	0.026 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	23.62 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.128 hours
Unit receding limb, Tr	0.512 hours
Total unit time, Tb	0.640 hours

Storm Event	100 year
Return Event	100 years
Duration	24.000 hours
Depth	7.6 in
Time of Concentration (Composite)	0.192 hours
Area (User Defined)	174,332.000 ft²

Computational Time Increment	0.026 hours
Time to Peak (Computed)	12.160 hours
Flow (Peak, Computed)	15.63 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.150 hours
Flow (Peak Interpolated Output)	15.60 ft³/s

Drainage Area	
SCS CN (Composite)	71.000
Area (User Defined)	174,332.000 ft²
Maximum Retention (Pervious)	4.1 in
Maximum Retention (Pervious, 20 percent)	0.8 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	4.3 in
Runoff Volume (Pervious)	1.421 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.417 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.192 hours
Computational Time Increment	0.026 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	23.62 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.128 hours
Unit receding limb, Tr	0.512 hours
Total unit time, Tb	0.640 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.553 hours
Area (User Defined)	109,173.000 ft²

Computational Time Increment	0.074 hours
Time to Peak (Computed)	12.535 hours
Flow (Peak, Computed)	0.57 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.500 hours
Flow (Peak Interpolated Output)	0.57 ft³/s

Drainage Area	
SCS CN (Composite)	66.000
Area (User Defined)	109,173.000 ft²
Maximum Retention (Pervious)	5.2 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.5 in
Runoff Volume (Pervious)	0.100 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.099 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.553 hours
Computational Time Increment	0.074 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	5.14 ft³/s

Subsection: Unit Hydrograph Summary
Label: Pre DA-4
Scenario: Pre-Development 1 year

Return Event: 1 years
Storm Event: 1 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.369 hours
Unit receding limb, Tr	1.475 hours
Total unit time, Tb	1.843 hours

Storm Event	10 year
Return Event	10 years
Duration	24.000 hours
Depth	5.1 in
Time of Concentration (Composite)	0.553 hours
Area (User Defined)	109,173.000 ft²

Computational Time Increment	0.074 hours
Time to Peak (Computed)	12.461 hours
Flow (Peak, Computed)	2.65 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.450 hours
Flow (Peak Interpolated Output)	2.65 ft³/s

Drainage Area	
SCS CN (Composite)	66.000
Area (User Defined)	109,173.000 ft²
Maximum Retention (Pervious)	5.2 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.8 in
Runoff Volume (Pervious)	0.369 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.367 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.553 hours
Computational Time Increment	0.074 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	5.14 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.369 hours
Unit receding limb, Tr	1.475 hours
Total unit time, Tb	1.843 hours

Storm Event	100 year
Return Event	100 years
Duration	24.000 hours
Depth	7.6 in
Time of Concentration (Composite)	0.553 hours
Area (User Defined)	109,173.000 ft²

Computational Time Increment	0.074 hours
Time to Peak (Computed)	12.387 hours
Flow (Peak, Computed)	5.79 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.400 hours
Flow (Peak Interpolated Output)	5.77 ft³/s

Drainage Area	
SCS CN (Composite)	66.000
Area (User Defined)	109,173.000 ft²
Maximum Retention (Pervious)	5.2 in
Maximum Retention (Pervious, 20 percent)	1.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.7 in
Runoff Volume (Pervious)	0.774 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.769 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.553 hours
Computational Time Increment	0.074 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	5.14 ft³/s

Subsection: Unit Hydrograph Summary
Label: Pre DA-4
Scenario: Pre-Development 100 year

Return Event: 100 years
Storm Event: 100 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.369 hours
Unit receding limb, Tr	1.475 hours
Total unit time, Tb	1.843 hours

Index

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Pre DA-1	Pre-Development 1 year	1	6.901	12.350	54.49
Pre DA-1	Pre-Development 2 year	2	10.008	12.350	81.20
Pre DA-1	Pre-Development 10 year	10	19.375	12.300	160.38
Pre DA-1	Pre-Development 100 year	100	36.164	12.300	299.75
Pre DA-2	Pre-Development 1 year	1	1.518	12.400	9.95
Pre DA-2	Pre-Development 2 year	2	2.433	12.400	17.69
Pre DA-2	Pre-Development 10 year	10	5.430	12.350	43.57
Pre DA-2	Pre-Development 100 year	100	11.241	12.300	92.85
Pre DA-3	Pre-Development 1 year	1	0.226	12.200	2.17
Pre DA-3	Pre-Development 2 year	2	0.345	12.150	3.54
Pre DA-3	Pre-Development 10 year	10	0.719	12.150	7.82
Pre DA-3	Pre-Development 100 year	100	1.417	12.150	15.60
Pre DA-4	Pre-Development 1 year	1	0.099	12.500	0.57
Pre DA-4	Pre-Development 2 year	2	0.161	12.450	1.05
Pre DA-4	Pre-Development 10 year	10	0.367	12.450	2.65
Pre DA-4	Pre-Development 100 year	100	0.769	12.400	5.77

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-1	Pre-Development 1 year	1	8.419	12.350	64.18
POA-1	Pre-Development 2 year	2	12.441	12.350	98.88
POA-1	Pre-Development 10 year	10	24.804	12.350	203.60
POA-1	Pre-Development 100 year	100	47.405	12.300	392.60
POA-3	Pre-Development 1 year	1	0.226	12.200	2.17

Subsection: Master Network Summary

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-3	Pre-Development 2 year	2	0.345	12.150	3.54
POA-3	Pre-Development 10 year	10	0.719	12.150	7.82
POA-3	Pre-Development 100 year	100	1.417	12.150	15.60
POA-4	Pre-Development 1 year	1	0.099	12.500	0.57
POA-4	Pre-Development 2 year	2	0.161	12.450	1.05
POA-4	Pre-Development 10 year	10	0.367	12.450	2.65
POA-4	Pre-Development 100 year	100	0.769	12.400	5.77

LEGEND

- DRAINAGE AREA - EXISTING
- SHEET FLOW
- SHALLOW FLOW
- CHANNEL FLOW

DA POA #3
4.01 ACRES
CN: 74
TC: 0.186 HR

POA 3

DA SCM #1
7.16 ACRES
CN: 86
Tc: 0.083 hr

POA 4

DA SCM #4
8.88 ACRES
CN: 84
Tc: 0.083 hr

DA POA #1 BYPASS
59.33 ACRES
CN: 81
Tc: 0.446 hr

POA 1

DA POA #4
2.49 ACRES
CN: 76
TC: 0.392 HR

DA SCM #3
20.94 ACRES
CN: 72
Tc: 0.083 hr

POA 2

DA POA #2 BYPASS
(TO POA #1)
10.95 ACRES
CN: 80
Tc: 0.083 hr

DA SCM #2
18.65 ACRES
CN: 81
Tc: 0.083 hr

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INITIAL PLAN DATE: 05/01/2024
REVISIONS:

N W E S

0 150 300

SCALE: 1 inch = 300 ft.

Preliminary

Broadmoor

1321 Rolesville Road Rolesville, NC 27587

WithersRavenel
Engineers | Planners | Surveyors

115 MacKenan Drive | Cary, NC 27511
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WR Job No. 23-0045 DATE 05/01/2024
DRN: EMM DGN: BJM CKD: WR

PROPOSED DRAINAGE MAP

2

EST. 1983

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Broadmoor - Rolesville, NC

Summary of Hydrology Inputs Per Sub-Drainage Area Area

Proposed Conditions

AREA OF INTEREST	LAND USE	HSG	CN	% Total Imp	Total Imp Area	Disconnected Imp Area	AREA (SF)	AREA (OnsiteE)
Drainage Area to POA 1								
Bypass 1								
Offsite	Building	B	98	100%	9,446		9,446	0.22
Offsite	Building	D	98	100%	6,435		6,435	0.15
Offsite	Open Space	B	61	---	---		424,099	9.74
Offsite	Open Space	C	74	---	---		1,447	0.03
Offsite	Open Space	D	80	---	---		169,371	3.89
Offsite	Roadway	B	98	100%	26		26	0.00
Offsite	Sidewalk	B	98	100%	74		74	0.00
Offsite	Sidewalk	C	98	100%	18		18	0.00
Offsite	Sidewalk	D	98	100%	41		41	0.00
Site	Amenity	B	91	80%	5,466		6,832	0.16
Site	Open Space	B	61	---	---		187,331	4.30
Site	Open Space	C	74	---	---		210,542	4.83
Site	Open Space	D	80	---	---		303,428	6.97
Site	Parking Lot	B	98	100%	5,745		5,745	0.13
Site	Parking Lot	D	98	100%	57		57	0.00
Site	Roadway	B	98	100%	229		229	0.01
Site	SF-LARGE	B	78	45%	5,435		12,077	0.28
Site	SF-LARGE	C	85	45%	2,003		4,451	0.10
Site	SF-SMALL	B	82	55%	802		1,458	0.03
Site	SF-SMALL	C	88	55%	3,721		6,766	0.16
Site	SF-SMALL	D	90	55%	18,113		32,933	0.76
Site	Sidewalk	B	98	100%	1,847		1,847	0.04
Site	Sidewalk	C	98	100%	920		920	0.02
Site	Sidewalk	D	98	100%	642		642	0.01
Site	Townhomes	B	84	60%	3,588		5,980	0.14
Site	Townhomes	D	91	60%	564		940	0.02
Site	Water	B	98	---	---		6	0.00
Site	Water	D	98	---	---		16,047	0.37
Site	Wetlands	B	98	-	---		52	0.00
Site	Wetlands	C	98	-	---		39,784	0.91
Site	Wetlands	D	98	-	---		860,911	19.76
Site	Woods	B	55	---	---		15,618	0.36
Site	Woods	C	70	---	---		65,320	1.50
Site	Woods	D	77	---	---		193,379	4.44
						Total Onsite Impervious Area:	**49,132**	**1.13**
						Total Onsite Area:	**1,973,295**	**45.30**
						Total Sub-Drainage Area Basin Area:	**2,584,252**	**59.33**
						Total Impervious Area:	**65,172**	**1.50**
						Cumulative Curve Number (CN):	**81**	
						CNp:	**81**	
						Disconnected Impervious Area:	**0**	**0.00**
						Disconnected Impervious Area % of Total Area:	**0%**	
						Adjusted Cumulative Curve Number (CN):	**81**	
						Roof	**0**	**0**
						Roadway	**0**	**0**
						Parking/Driveway/Sidewalk	**0**	**0**
						Protected Forest	**0**	**0**
						Other Pervious/Landscaping	**1,973,295**	**1,973,295**
						Land Taken Up By SCM	**0**	**0**

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Broadmoor - Rolesville, NC

Summary of Hydrology Inputs Per Sub-Drainage Area Area

Proposed Conditions

AREA OF INTEREST	LAND USE	HSG	CN	% Total Imp	Total Imp Area	Disconnected Imp Area	AREA (SF)	AREA (OnsiteE)
SCM 1								
Offsite	Building	B	98	100%	164		164	0.00
Offsite	Open Space	B	61	---	---		8,167	0.19
Site	Open Space	B	61	---	---		14,269	0.33
Site	Open Space	D	80	---	---		32,106	0.74
Site	Parking Lot	B	98	100%	446		446	0.01
Site	Parking Lot	D	98	100%	22,026		22,026	0.51
Site	Roadway	B	98	100%	20,761		20,761	0.48
Site	Roadway	D	98	100%	15,168		15,168	0.35
Site	Sidewalk	B	98	100%	6,459		6,459	0.15
Site	Sidewalk	D	98	100%	4,684		4,684	0.11
Site	Townhomes	B	84	60%	52,973		88,288	2.03
Site	Townhomes	D	91	60%	39,732		66,220	1.52
Site	Woods	D	77	---	---		33,202	0.76
						Total Onsite Impervious Area:	**162,249**	**3.72**
						Total Onsite Area:	**303,629**	**6.97**
						Total Sub-Drainage Area Basin Area:	**311,960**	**7.16**
						Total Impervious Area:	**162,413**	**3.73**
						Cumulative Curve Number (CN):	**86**	
						CNp:	**73**	
						Disconnected Impervious Area:	**0**	**0.00**
						Disconnected Impervious Area % of Total Area:	**0%**	
						Adjusted Cumulative Curve Number (CN):	**86**	
SCM 2								
Offsite	Building	B	98	100%	3,688		3,688	0.08
Offsite	Open Space	B	61	---	---		44,381	1.02
Offsite	Roadway	B	98	100%	10,130		10,130	0.23
Site	Open Space	B	61	---	---		105,537	2.42
Site	Open Space	C	74	---	---		58,103	1.33
Site	Open Space	D	80	---	---		4,825	0.11
Site	Roadway	B	98	100%	83,859		83,859	1.93
Site	Roadway	C	98	100%	12,442		12,442	0.29
Site	Roadway	D	98	100%	7,544		7,544	0.17
Site	SF-LARGE	B	78	45%	53,688		119,307	2.74
Site	SF-LARGE	D	89	45%	7,214		16,031	0.37
Site	SF-SMALL	B	82	55%	144,629		262,962	6.04
Site	SF-SMALL	C	88	55%	8,780		15,963	0.37
Site	SF-SMALL	D	90	55%	17,419		31,671	0.73
Site	Sidewalk	B	98	100%	28,710		28,710	0.66
Site	Sidewalk	C	98	100%	4,334		4,334	0.10
Site	Sidewalk	D	98	100%	2,937		2,937	0.07
Site	Wetlands	D	98	-	---		14	0.00
						Total Onsite Impervious Area:	**371,556**	**8.53**
						Total Onsite Area:	**754,239**	**17.31**
						Total Sub-Drainage Area Basin Area:	**812,438**	**18.65**
						Total Impervious Area:	**385,374**	**8.85**
						Cumulative Curve Number (CN):	**81**	
						CNp:	**66**	

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Broadmoor - Rolesville, NC

Summary of Hydrology Inputs Per Sub-Drainage Area Area

Proposed Conditions

AREA OF INTEREST	LAND USE	HSG	CN	% Total Imp	Total Imp Area	Disconnected Imp Area	AREA (SF)	AREA (OnsiteE)
SCM 3								
Offsite	Open Space	B	61	---	---		279,275	6.41
Offsite	Roadway	B	98	100%	7,638		7,638	0.18
Offsite	Woods	B	55	---	---		1,122	0.03
Site	Open Space	B	61	---	---		132,863	3.05
Site	Open Space	C	74	---	---		15,397	0.35
Site	Open Space	D	80	---	---		6,936	0.16
Site	Roadway	B	98	100%	45,180		45,180	1.04
Site	Roadway	C	98	100%	9,426		9,426	0.22
Site	Roadway	D	98	100%	9,777		9,777	0.22
Site	SF-LARGE	B	78	45%	123,083		273,518	6.28
Site	SF-LARGE	C	85	45%	11,009		24,465	0.56
Site	SF-LARGE	D	89	45%	15,755		35,011	0.80
Site	Sidewalk	B	98	100%	16,654		16,654	0.38
Site	Sidewalk	C	98	100%	2,564		2,564	0.06
Site	Sidewalk	D	98	100%	3,691		3,691	0.08
Site	Wetlands	D	98	-	---		15	0.00
Site	Woods	B	55	---	---		37,229	0.85
Site	Woods	C	70	---	---		12,365	0.28
						Total Onsite Impervious Area:	**237,139**	**5.44**
						Total Onsite Area:	**625,091**	**14.35**
						Total Sub-Drainage Area Basin Area:	**913,126**	**20.96**
						Total Impervious Area:	**244,777**	**5.62**
						Cumulative Curve Number (CN):	**72**	
						CNp:	**62**	
						Disconnected Impervious Area:	**0**	**0.00**
						Disconnected Impervious Area % of Total Area:	**0%**	
						Adjusted Cumulative Curve Number (CN):	**72**	
SCM 4								
Offsite	Open Space	B	61	---	---		5,593	0.13
Site	Amenity	B	91	80%	36,850		46,063	1.06
Site	Open Space	B	61	---	---		58,760	1.35
Site	Open Space	C	74	---	---		115	0.00
Site	Open Space	D	80	---	---		9,400	0.22
Site	Parking Lot	B	98	100%	1,005		1,005	0.02
Site	Parking Lot	D	98	100%	6,759		6,759	0.16
Site	Roadway	B	98	100%	35,583		35,583	0.82
Site	Roadway	D	98	100%	8,343		8,343	0.19
Site	SF-SMALL	B	82	55%	39,355		71,554	1.64
Site	Sidewalk	B	98	100%	10,708		10,708	0.25
Site	Sidewalk	D	98	100%	3,048		3,048	0.07
Site	Townhomes	B	84	60%	43,193		71,988	1.65
Site	Townhomes	C	89	60%	1,502		2,504	0.06
Site	Townhomes	D	91	60%	33,258		55,430	1.27
Site	Wetlands	D	98	-	---		5	0.00
Site	Woods	D	77	---	---		15	0.00
						Total Onsite Impervious Area:	**219,604**	**5.04**
						Total Onsite Area:	**381,280**	**8.75**
						Total Sub-Drainage Area Basin Area:	**386,873**	**8.88**
						Total Impervious Area:	**219,604**	**5.04**
						Cumulative Curve Number (CN):	**84**	

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Broadmoor - Rolesville, NC

Summary of Hydrology Inputs Per Sub-Drainage Area Area

Proposed Conditions

AREA OF INTEREST	LAND USE	HSG	CN	% Total Imp	Total Imp Area	Disconnected Imp Area	AREA (SF)	AREA (OnsiteE)
Drainage Area to POA 2								
Bypass 2								
Site	Open Space	B	61	---	---		88,467	2.03
Site	Open Space	D	80	---	---		99,920	2.29
Site	SF-LARGE	B	78	45%	30,311		67,357	1.55
Site	SF-LARGE	D	89	45%	8,146		18,103	0.42
Site	Sidewalk	B	98	100%	157		157	0.00
Site	Sidewalk	D	98	100%	1		1	0.00
Site	Water	B	98	---	---		668	0.02
Site	Water	D	98	---	---		107,060	2.46
Site	Wetlands	D	98	-	---		36,025	0.83
Site	Woods	B	55	---	---		41,173	0.95
Site	Woods	D	77	---	---		18,062	0.41
						Total Onsite Impervious Area:	**38,615**	**0.89**
						Total Onsite Area:	**476,993**	**10.95**
						Total Sub-Drainage Area Basin Area:	**476,993**	**10.95**
						Total Impervious Area:	**38,615**	**0.89**
						Cumulative Curve Number (CN):	**80**	
						CNp:	**78**	
						Disconnected Impervious Area:	**0**	**0.00**
						Disconnected Impervious Area % of Total Area:	**0%**	
						Adjusted Cumulative Curve Number (CN):	**80**	
Drainage Area to POA 3								
Bypass 3								
Offsite	Building	B	98	100%	3,486		3,486	0.08
Offsite	Building	C	98	100%	907		907	0.02
Offsite	Open Space	B	61	---	---		30,029	0.69
Offsite	Open Space	C	74	---	---		56,734	1.30
Offsite	Roadway	B	98	100%	13,169		13,169	0.30
Offsite	Roadway	C	98	100%	10,180		10,180	0.23
Site	Open Space	B	61	---	---		29,672	0.68
Site	Open Space	C	74	---	---		22,541	0.52
Site	Roadway	B	98	100%	1,535		1,535	0.04
Site	SF-SMALL	B	82	55%	35	35	64	0.00
Site	Sidewalk	B	98	100%	2,660		2,660	0.06
Site	Sidewalk	C	98	100%	1,575		1,575	0.04
Site	Townhomes	B	84	60%	50	50	83	0.00
Site	Townhomes	C	89	60%	1,347	1,347	2,245	0.05
						Total Onsite Impervious Area:	**7,202**	**0.17**
						Total Onsite Area:	**60,375**	**1.39**
						Total Sub-Drainage Area Basin Area:	**174,880**	**4.01**
						Total Impervious Area:	**34,944**	**0.80**
						Cumulative Curve Number (CN):	**74**	
						CNp:	**68**	
						Disconnected Impervious Area:	**1,432**	**0.03**
						Disconnected Impervious Area % of Total Area:	**1%**	
						Adjusted Cumulative Curve Number (CN):	**74**	
Drainage Area to POA 4								
Bypass 4								
Offsite	Building	B	98	100%	2,135		2,135	0.05
Offsite	Open Space	B	61	---	---		46,531	1.07
Offsite	Roadway	B	98	100%	32,068		32,068	0.74
Offsite	Sidewalk	B	98	100%	4,321		4,321	0.10
Site	Open Space	B	61	---	---		17,753	0.41
Site	SF-SMALL	B	82	55%	1,850		3,364	0.08
Site	Sidewalk	B	98	100%	2,085		2,085	0.05
						Total Onsite Impervious Area:	**3,935**	**0.09**
						Total Onsite Area:	**23,202**	**0.53**
						Total Sub-Drainage Area Basin Area:	**108,257**	**2.49**
						Total Impervious Area:	**42,459**	**0.97**
						Cumulative Curve Number (CN):	**76**	
						CNp:	**62**	
						Disconnected Impervious Area:	**0**	**0.00**
						Disconnected Impervious Area % of Total Area:	**0%**	
						Adjusted Cumulative Curve Number (CN):	**76**	
Total Site Information								
						Total Onsite Impervious Area:	**1,089,432**	**25.01**
						Total Onsite Area:	**4,598,104**	**105.56**
						Total Watershed Area:	**5,768,779**	**132.43**

Broadmoor - Rolesville, NC

Summary of Time of Concentration (T_c) Calculations Per Sub-Drainage Area

Proposed Conditions

Sub-Drainage SCM #1 to POA 1	
User Defined T_c (hours)	0.0833

Sub-Drainage SCM #2 to POA 1	
User Defined T_c (hours)	0.0833

Sub-Drainage SCM #3 to POA 1	
User Defined T_c (hours)	0.0833

Sub-Drainage SCM #4 to POA 1	
User Defined T_c (hours)	0.0833

Sub-Drainage From Bypass To POA 1		
User Defined T_c (hours)		
AND/OR		
Sheet Flow		
Length (ft):	100	
Slope (ft/ft):	0.0313	
Surface Cover:	Grass - Dense	
Manning's n-value:	0.24	
T_t (hrs):	0.189	
Shallow Flow		
Length (ft):	783	
Slope (ft/ft):	0.0249	
Surface Cover:	Unpaved	
T_t (hrs):	0.085	
Channel Flow		
Length (ft):	1571	
Slope (ft/ft):	0.009	
Manning's n-value:	0.035	
Flow Area (ft^2):	15	
Wetted Perimeter (ft):	30	
T_t (hrs):	0.171	
Total T_C =		**0.446 hr**

Sub-Drainage Lake to POA 2		
User Defined T_c (hours)		
AND/OR		
Sheet Flow		
Length (ft):	16.55	
Slope (ft/ft):	0.298489426	
Surface Cover:	Grass - Dense	
Manning's n-value:	0.24	
T_t (hrs):	0.018	
Shallow Flow		
Length (ft):	37	
Slope (ft/ft):	0.067	
Surface Cover:	Unpaved	
T_t (hrs):	0.002	
Channel Flow		
Length (ft):	315	
Slope (ft/ft):	0.029	
Manning's n-value:	0.035	
Flow Area (ft^2):	8	
Wetted Perimeter (ft):	21.5	
T_t (hrs):	0.024	
Total T_C =		**0.083 hr**

Sub-Drainage to POA 3		
User Defined T_c (hours)		
AND/OR		
Sheet Flow		
Length (ft):	97	
Slope (ft/ft):	0.038	
Surface Cover:	Grass - Dense	
Manning's n-value:	0.24	
T_t (hrs):	0.171	
Shallow Flow		
Length (ft):	200	
Slope (ft/ft):	0.051	
Surface Cover:	Unpaved	
T_t (hrs):	0.015	
Channel Flow		
Length (ft):	64.5	
Slope (ft/ft):	51.171	
Manning's n-value:	0.013	
Flow Area (ft^2):	1.6	
Wetted Perimeter (ft):	7.6	
T_t (hrs):	0.000	
Total T_C =		**0.186 hr**

Sub-Drainage to POA 4		
User Defined T_c (hours)		
AND/OR		
Sheet Flow		
Length (ft):	100	
Slope (ft/ft):	0.0095	
Surface Cover:	Grass - Dense	
Manning's n-value:	0.24	
T_t (hrs):	0.304993258	
Shallow Flow		
Length (ft):	209	
Slope (ft/ft):	0.004	
Surface Cover:	Paved	
T_t (hrs):	0.043	
Channel Flow		
Length (ft):	610	
Slope (ft/ft):	0.004786885	
Manning's n-value:	0.012	
Flow Area (ft^2):	4.5	
Wetted Perimeter (ft):	15	
T_t (hrs):	0.044	
Total T_C =		**0.392 hr**

Scenario: Post-Development 1 year

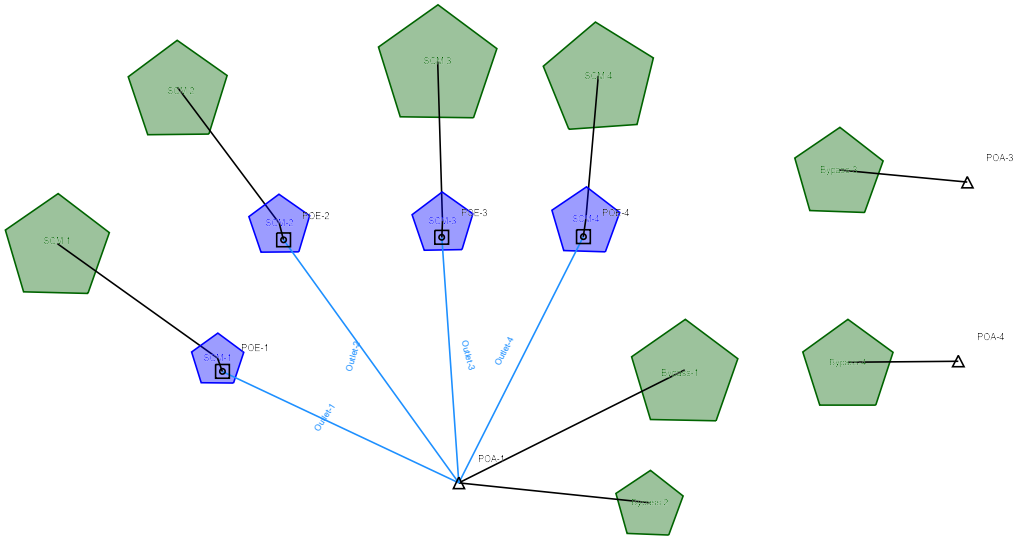

Table of Contents

Subsection: Unit Hydrograph Summary
Label: Bypass 2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	476,993.000 ft²

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.111 hours
Flow (Peak, Computed)	13.13 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.100 hours
Flow (Peak Interpolated Output)	13.02 ft³/s

Drainage Area	
SCS CN (Composite)	80.000
Area (User Defined)	476,993.000 ft²
Maximum Retention (Pervious)	2.5 in
Maximum Retention (Pervious, 20 percent)	0.5 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.1 in
Runoff Volume (Pervious)	1.046 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.045 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	148.89 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.446 hours
Area (User Defined)	2,584,213.000 ft²

Computational Time Increment	0.059 hours
Time to Peak (Computed)	12.310 hours
Flow (Peak, Computed)	48.39 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.350 hours
Flow (Peak Interpolated Output)	48.20 ft³/s

Drainage Area	
SCS CN (Composite)	81.000
Area (User Defined)	2,584,213.000 ft²
Maximum Retention (Pervious)	2.3 in
Maximum Retention (Pervious, 20 percent)	0.5 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.2 in
Runoff Volume (Pervious)	5.966 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	5.934 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.446 hours
Computational Time Increment	0.059 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	150.71 ft³/s

Subsection: Unit Hydrograph Summary
Label: Bypass-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.297 hours
Unit receding limb, Tr	1.189 hours
Total unit time, Tb	1.487 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.186 hours
Area (User Defined)	174,880.000 ft²

Computational Time Increment	0.025 hours
Time to Peak (Computed)	12.152 hours
Flow (Peak, Computed)	2.84 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.150 hours
Flow (Peak Interpolated Output)	2.83 ft³/s

Drainage Area	
SCS CN (Composite)	74.000
Area (User Defined)	174,880.000 ft²
Maximum Retention (Pervious)	3.5 in
Maximum Retention (Pervious, 20 percent)	0.7 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.8 in
Runoff Volume (Pervious)	0.275 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.274 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.186 hours
Computational Time Increment	0.025 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	24.46 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.124 hours
Unit receding limb, Tr	0.496 hours
Total unit time, Tb	0.620 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.392 hours
Area (User Defined)	108,257.000 ft²

Computational Time Increment	0.052 hours
Time to Peak (Computed)	12.335 hours
Flow (Peak, Computed)	1.56 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.300 hours
Flow (Peak Interpolated Output)	1.56 ft³/s

Drainage Area	
SCS CN (Composite)	76.000
Area (User Defined)	108,257.000 ft²
Maximum Retention (Pervious)	3.2 in
Maximum Retention (Pervious, 20 percent)	0.6 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.9 in
Runoff Volume (Pervious)	0.191 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.190 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.392 hours
Computational Time Increment	0.052 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	7.18 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.261 hours
Unit receding limb, Tr	1.045 hours
Total unit time, Tb	1.307 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	311,960.000 ft²

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.111 hours
Flow (Peak, Computed)	11.52 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.100 hours
Flow (Peak Interpolated Output)	11.49 ft³/s

Drainage Area	
SCS CN (Composite)	86.000
Area (User Defined)	311,960.000 ft²
Maximum Retention (Pervious)	1.6 in
Maximum Retention (Pervious, 20 percent)	0.3 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.5 in
Runoff Volume (Pervious)	0.921 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.920 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	97.37 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	812,438.000 ft²

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.111 hours
Flow (Peak, Computed)	23.58 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.100 hours
Flow (Peak Interpolated Output)	23.42 ft³/s

Drainage Area	
SCS CN (Composite)	81.000
Area (User Defined)	812,438.000 ft²
Maximum Retention (Pervious)	2.3 in
Maximum Retention (Pervious, 20 percent)	0.5 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.2 in
Runoff Volume (Pervious)	1.876 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.874 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	253.59 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	913,126.000 ft²

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.122 hours
Flow (Peak, Computed)	15.07 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.100 hours
Flow (Peak Interpolated Output)	14.77 ft³/s

Drainage Area	
SCS CN (Composite)	72.000
Area (User Defined)	913,126.000 ft²
Maximum Retention (Pervious)	3.9 in
Maximum Retention (Pervious, 20 percent)	0.8 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.7 in
Runoff Volume (Pervious)	1.268 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.267 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	285.02 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1 year
Return Event	1 years
Duration	24.000 hours
Depth	2.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	386,873.000 ft²

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.111 hours
Flow (Peak, Computed)	13.04 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.100 hours
Flow (Peak Interpolated Output)	12.98 ft³/s

Drainage Area	
SCS CN (Composite)	84.000
Area (User Defined)	386,873.000 ft²
Maximum Retention (Pervious)	1.9 in
Maximum Retention (Pervious, 20 percent)	0.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.4 in
Runoff Volume (Pervious)	1.038 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.037 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	120.76 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Elevation-Area Volume Curve
Label: SCM-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
357.50	0.0	10,412.000	0.000	0.000	0.000
358.00	0.0	11,638.000	33,057.945	0.126	0.126
363.00	0.0	18,608.000	44,961.974	1.720	1.847

Subsection: Elevation-Area Volume Curve
Label: SCM-2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
357.50	0.0	23,300.000	0.000	0.000	0.000
358.00	0.0	25,115.000	72,605.484	0.278	0.278
363.00	0.0	35,018.000	89,788.979	3.435	3.713

Subsection: Elevation-Area Volume Curve
Label: SCM-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
354.50	0.0	28,891.000	0.000	0.000	0.000
355.00	0.0	31,055.000	89,899.464	0.344	0.344
362.00	0.0	48,777.000	118,752.043	6.361	6.705

Subsection: Elevation-Area Volume Curve
Label: SCM-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr(A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
362.50	0.0	16,709.000	0.000	0.000	0.000
363.00	0.0	18,287.000	52,476.203	0.201	0.201
370.00	0.0	30,991.000	73,084.142	3.915	4.116

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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
SCM 3	Post-Development 1 year	1	1.267	12.100	14.77
SCM 3	Post-Development 2 year	2	1.910	12.100	23.25
SCM 3	Post-Development 10 year	10	3.916	12.100	49.02
SCM 3	Post-Development 100 year	100	7.629	12.100	94.91
SCM 2	Post-Development 1 year	1	1.874	12.100	23.42
SCM 2	Post-Development 2 year	2	2.603	12.100	32.60
SCM 2	Post-Development 10 year	10	4.718	12.100	58.44
SCM 2	Post-Development 100 year	100	8.377	12.100	101.12
Bypass 2	Post-Development 1 year	1	1.045	12.100	13.02
Bypass 2	Post-Development 2 year	2	1.463	12.100	18.32
Bypass 2	Post-Development 10 year	10	2.685	12.100	33.36
Bypass 2	Post-Development 100 year	100	4.813	12.100	58.37
SCM 1	Post-Development 1 year	1	0.920	12.100	11.49
SCM 1	Post-Development 2 year	2	1.230	12.100	15.25
SCM 1	Post-Development 10 year	10	2.101	12.100	25.44
SCM 1	Post-Development 100 year	100	3.562	12.100	41.81
Bypass-1	Post-Development 1 year	1	5.934	12.350	48.20
Bypass-1	Post-Development 2 year	2	8.245	12.300	67.63
Bypass-1	Post-Development 10 year	10	14.954	12.300	123.55
Bypass-1	Post-Development 100 year	100	26.559	12.300	216.93
Bypass-3	Post-Development 1 year	1	0.274	12.150	2.83
Bypass-3	Post-Development 2 year	2	0.405	12.150	4.36
Bypass-3	Post-Development 10 year	10	0.805	12.150	8.95
Bypass-3	Post-Development 100 year	100	1.535	12.150	17.05

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Bypass-4	Post-Development 1 year	1	0.190	12.300	1.56
Bypass-4	Post-Development 2 year	2	0.275	12.300	2.33
Bypass-4	Post-Development 10 year	10	0.533	12.300	4.62
Bypass-4	Post-Development 100 year	100	0.995	12.300	8.58
SCM 4	Post-Development 1 year	1	1.037	12.100	12.98
SCM 4	Post-Development 2 year	2	1.407	12.100	17.55
SCM 4	Post-Development 10 year	10	2.459	12.100	30.10
SCM 4	Post-Development 100 year	100	4.246	12.100	50.45

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-1	Post-Development 1 year	1	8.962	12.300	55.25
POA-1	Post-Development 2 year	2	12.880	12.300	81.15
POA-1	Post-Development 10 year	10	26.172	12.300	177.87
POA-1	Post-Development 100 year	100	50.411	12.250	353.72
POA-3	Post-Development 1 year	1	0.274	12.150	2.83
POA-3	Post-Development 2 year	2	0.405	12.150	4.36
POA-3	Post-Development 10 year	10	0.805	12.150	8.95
POA-3	Post-Development 100 year	100	1.535	12.150	17.05
POA-4	Post-Development 1 year	1	0.190	12.300	1.56
POA-4	Post-Development 2 year	2	0.275	12.300	2.33
POA-4	Post-Development 10 year	10	0.533	12.300	4.62
POA-4	Post-Development 100 year	100	0.995	12.300	8.58

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-3 (IN)	Post-Development 1 year	1	1.267	12.100	14.77	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 1 year	1	0.283	23.700	0.31	355.87	0.984
SCM-3 (IN)	Post-Development 2 year	2	1.910	12.100	23.25	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 2 year	2	0.360	24.000	0.39	356.60	1.550
SCM-3 (IN)	Post-Development 10 year	10	3.916	12.100	49.02	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 10 year	10	1.810	14.050	3.78	357.53	2.319
SCM-3 (IN)	Post-Development 100 year	100	7.629	12.100	94.91	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 100 year	100	5.484	12.550	19.25	359.00	3.628
SCM-2 (IN)	Post-Development 1 year	1	1.874	12.100	23.42	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 1 year	1	0.985	13.900	1.95	359.27	1.047
SCM-2 (IN)	Post-Development 2 year	2	2.603	12.100	32.60	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 2 year	2	1.694	12.650	5.29	359.60	1.253
SCM-2 (IN)	Post-Development 10 year	10	4.718	12.100	58.44	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 10 year	10	3.770	12.200	35.30	360.26	1.687
SCM-2 (IN)	Post-Development 100 year	100	8.377	12.100	101.12	(N/A)	(N/A)

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-2 (OUT)	Post-Development 100 year	100	7.380	12.200	61.31	361.24	2.374
SCM-1 (IN)	Post-Development 1 year	1	0.920	12.100	11.49	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 1 year	1	0.204	21.100	0.21	360.01	0.722
SCM-1 (IN)	Post-Development 2 year	2	1.230	12.100	15.25	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 2 year	2	0.241	20.300	0.24	360.81	0.993
SCM-1 (IN)	Post-Development 10 year	10	2.101	12.100	25.44	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 10 year	10	1.038	12.500	5.95	361.24	1.149
SCM-1 (IN)	Post-Development 100 year	100	3.562	12.100	41.81	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 100 year	100	2.495	12.150	33.83	361.79	1.355
SCM-4 (IN)	Post-Development 1 year	1	1.037	12.100	12.98	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 1 year	1	0.511	13.900	1.03	363.92	0.601
SCM-4 (IN)	Post-Development 2 year	2	1.407	12.100	17.55	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 2 year	2	0.876	12.800	2.35	364.19	0.724
SCM-4 (IN)	Post-Development 10 year	10	2.459	12.100	30.10	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 10 year	10	1.916	12.550	5.58	365.20	1.214

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-4 (IN)	Post-Development 100 year	100	4.246	12.100	50.45	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 100 year	100	3.680	12.550	8.57	366.88	2.118

POA 3 - 10 Year - Post

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.033 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	7.000 H:V
Bottom Width	5.00 ft
Discharge	8.28 cfs

Results	
Normal Depth	3.0 in
Flow Area	1.6 ft²
Wetted Perimeter	7.6 ft
Hydraulic Radius	2.5 in
Top Width	7.51 ft
Critical Depth	4.6 in
Critical Slope	0.007 ft/ft
Velocity	5.26 ft/s
Velocity Head	0.43 ft
Specific Energy	0.68 ft
Froude Number	2.028
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.0 in
Critical Depth	4.6 in
Channel Slope	0.033 ft/ft
Critical Slope	0.007 ft/ft

POA 3 - 10 Year - Pre

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.033 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	7.000 H:V
Bottom Width	5.00 ft
Discharge	7.35 cfs

Results	
Normal Depth	2.8 in
Flow Area	1.5 ft²
Wetted Perimeter	7.4 ft
Hydraulic Radius	2.4 in
Top Width	7.35 ft
Critical Depth	4.3 in
Critical Slope	0.007 ft/ft
Velocity	5.06 ft/s
Velocity Head	0.40 ft
Specific Energy	0.63 ft
Froude Number	2.008
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.8 in
Critical Depth	4.3 in
Channel Slope	0.033 ft/ft
Critical Slope	0.007 ft/ft

POA 3 - 25 Year - Post

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.033 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	7.000 H:V
Bottom Width	5.00 ft
Discharge	10.03 cfs

Results	
Normal Depth	3.4 in
Flow Area	1.8 ft²
Wetted Perimeter	7.9 ft
Hydraulic Radius	2.7 in
Top Width	7.80 ft
Critical Depth	5.2 in
Critical Slope	0.007 ft/ft
Velocity	5.60 ft/s
Velocity Head	0.49 ft
Specific Energy	0.77 ft
Froude Number	2.058
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.4 in
Critical Depth	5.2 in
Channel Slope	0.033 ft/ft
Critical Slope	0.007 ft/ft

POA 3 - 25 Year - Pre

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.033 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	7.000 H:V
Bottom Width	5.00 ft
Discharge	10.03 cfs

Results	
Normal Depth	3.4 in
Flow Area	1.8 ft²
Wetted Perimeter	7.9 ft
Hydraulic Radius	2.7 in
Top Width	7.80 ft
Critical Depth	5.2 in
Critical Slope	0.007 ft/ft
Velocity	5.60 ft/s
Velocity Head	0.49 ft
Specific Energy	0.77 ft
Froude Number	2.058
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.4 in
Critical Depth	5.2 in
Channel Slope	0.033 ft/ft
Critical Slope	0.007 ft/ft

POA 4 - 10 Year - Post

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.022 ft/ft
Left Side Slope	2.100 H:V
Right Side Slope	2.100 H:V
Bottom Width	2.70 ft
Discharge	6.42 cfs

Results	
Normal Depth	4.3 in
Flow Area	1.2 ft²
Wetted Perimeter	4.3 ft
Hydraulic Radius	3.4 in
Top Width	4.19 ft
Critical Depth	5.9 in
Critical Slope	0.007 ft/ft
Velocity	5.26 ft/s
Velocity Head	0.43 ft
Specific Energy	0.78 ft
Froude Number	1.716
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	4.3 in
Critical Depth	5.9 in
Channel Slope	0.022 ft/ft
Critical Slope	0.007 ft/ft

POA 4 - 10 Year - Pre

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.022 ft/ft
Left Side Slope	2.100 H:V
Right Side Slope	2.100 H:V
Bottom Width	2.70 ft
Discharge	3.91 cfs

Results	
Normal Depth	3.2 in
Flow Area	0.9 ft²
Wetted Perimeter	3.9 ft
Hydraulic Radius	2.7 in
Top Width	3.82 ft
Critical Depth	4.4 in
Critical Slope	0.007 ft/ft
Velocity	4.48 ft/s
Velocity Head	0.31 ft
Specific Energy	0.58 ft
Froude Number	1.653
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.2 in
Critical Depth	4.4 in
Channel Slope	0.022 ft/ft
Critical Slope	0.007 ft/ft

POA 4 - 25 Year - Post

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.022 ft/ft
Left Side Slope	2.100 H:V
Right Side Slope	2.100 H:V
Bottom Width	2.70 ft
Discharge	8.52 cfs

Results	
Normal Depth	5.0 in
Flow Area	1.5 ft²
Wetted Perimeter	4.6 ft
Hydraulic Radius	3.8 in
Top Width	4.45 ft
Critical Depth	6.9 in
Critical Slope	0.007 ft/ft
Velocity	5.74 ft/s
Velocity Head	0.51 ft
Specific Energy	0.93 ft
Froude Number	1.749
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.0 in
Critical Depth	6.9 in
Channel Slope	0.022 ft/ft
Critical Slope	0.007 ft/ft

POA 4 - 25 Year - Pre

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.018
Channel Slope	0.022 ft/ft
Left Side Slope	2.100 H:V
Right Side Slope	2.100 H:V
Bottom Width	2.70 ft
Discharge	5.58 cfs

Results	
Normal Depth	3.9 in
Flow Area	1.1 ft²
Wetted Perimeter	4.2 ft
Hydraulic Radius	3.2 in
Top Width	4.08 ft
Critical Depth	5.4 in
Critical Slope	0.007 ft/ft
Velocity	5.02 ft/s
Velocity Head	0.39 ft
Specific Energy	0.72 ft
Froude Number	1.697
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.9 in
Critical Depth	5.4 in
Channel Slope	0.022 ft/ft
Critical Slope	0.007 ft/ft

DOWNSTREAM IMPACT ANALYSIS

THE BROADMOOR

WithersRavenel
Our People. Your Success.
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license #: F-1479
www.withersravenel.com

This map is for informational purposes only.
All feature locations displayed are approximate based on available data sources.

Data features are not based on professional field survey unless stated otherwise.

Legend

- Tc Line
- Site Boundary
- POA Watershed

0 50 100 200 Feet

1 inch = feet

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Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
SCM 3	Post-Development 10 year	10	3.916	12.100	49.02
SCM 2	Post-Development 10 year	10	4.718	12.100	58.44
Bypass 2	Post-Development 10 year	10	2.685	12.100	33.36
SCM 1	Post-Development 10 year	10	2.101	12.100	25.44
Bypass-1	Post-Development 10 year	10	14.954	12.300	123.55
Bypass-3	Post-Development 10 year	10	0.805	12.150	8.95
Bypass-4	Post-Development 10 year	10	0.533	12.300	4.62
Pre DA-1	Pre-Development 10 year	10	19.375	12.300	160.38
Pre DA-2	Pre-Development 10 year	10	5.430	12.350	43.57
Pre DA-3	Pre-Development 10 year	10	0.719	12.150	7.82
Pre DA-4	Pre-Development 10 year	10	0.367	12.450	2.65
SCM 4	Post-Development 10 year	10	2.459	12.100	30.10
EXISTING STREAM DA	Pre-Development 10 year	10	0.006	12.900	0.03
EXISTING STREAM DA	Post-Development 10 year	10	0.006	12.900	0.03

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
POA-3	Pre-Development 10 year	10	0.719	12.150	7.82
POA-4	Pre-Development 10 year	10	0.367	12.450	2.65
POA-3	Post-Development 10 year	10	0.805	12.150	8.95
POA-4	Post-Development 10 year	10	0.533	12.300	4.62
DOWNSTREAM STREAM	Pre-Development 10 year	10	24.810	12.350	203.61
DOWNSTREAM STREAM	Post-Development 10 year	10	26.178	12.300	177.88

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM-3 (IN)	Post-Development 10 year	10	3.916	12.100	49.02	(N/A)	(N/A)
SCM-3 (OUT)	Post-Development 10 year	10	1.810	14.050	3.78	357.53	2.319
SCM-2 (IN)	Post-Development 10 year	10	4.718	12.100	58.44	(N/A)	(N/A)
SCM-2 (OUT)	Post-Development 10 year	10	3.770	12.200	35.30	360.26	1.687
SCM-1 (IN)	Post-Development 10 year	10	2.101	12.100	25.44	(N/A)	(N/A)
SCM-1 (OUT)	Post-Development 10 year	10	1.038	12.500	5.95	361.24	1.149
SCM-4 (IN)	Post-Development 10 year	10	2.459	12.100	30.10	(N/A)	(N/A)
SCM-4 (OUT)	Post-Development 10 year	10	1.916	12.550	5.58	365.20	1.214

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 10 year

Return Event: 10 years
Storm Event: 10 year

Time-Depth Curve: 10 year	
Label	10 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.4
6.000	0.4	0.4	0.4	0.4	0.4
6.500	0.4	0.4	0.4	0.4	0.4
7.000	0.5	0.5	0.5	0.5	0.5
7.500	0.5	0.5	0.5	0.6	0.6
8.000	0.6	0.6	0.6	0.6	0.6
8.500	0.6	0.7	0.7	0.7	0.7
9.000	0.7	0.8	0.8	0.8	0.8
9.500	0.8	0.9	0.9	0.9	0.9
10.000	1.0	1.0	1.0	1.0	1.1
10.500	1.1	1.1	1.2	1.2	1.2
11.000	1.3	1.3	1.3	1.4	1.4
11.500	1.5	1.6	1.7	1.9	2.1
12.000	2.5	3.0	3.2	3.3	3.5
12.500	3.6	3.6	3.7	3.7	3.8
13.000	3.8	3.8	3.9	3.9	3.9
13.500	4.0	4.0	4.0	4.1	4.1
14.000	4.1	4.1	4.2	4.2	4.2
14.500	4.2	4.2	4.3	4.3	4.3
15.000	4.3	4.3	4.4	4.4	4.4
15.500	4.4	4.4	4.4	4.5	4.5
16.000	4.5	4.5	4.5	4.5	4.5
16.500	4.5	4.6	4.6	4.6	4.6
17.000	4.6	4.6	4.6	4.6	4.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Post-Development 10 year

Return Event: 10 years
Storm Event: 10 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	4.7	4.7	4.7	4.7	4.7
18.000	4.7	4.7	4.7	4.7	4.7
18.500	4.7	4.7	4.8	4.8	4.8
19.000	4.8	4.8	4.8	4.8	4.8
19.500	4.8	4.8	4.8	4.8	4.8
20.000	4.8	4.8	4.9	4.9	4.9
20.500	4.9	4.9	4.9	4.9	4.9
21.000	4.9	4.9	4.9	4.9	4.9
21.500	4.9	4.9	4.9	5.0	5.0
22.000	5.0	5.0	5.0	5.0	5.0
22.500	5.0	5.0	5.0	5.0	5.0
23.000	5.0	5.0	5.0	5.0	5.0
23.500	5.0	5.0	5.0	5.1	5.1
24.000	5.1	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 10 year

Return Event: 10 years
Storm Event: 10 year

Time-Depth Curve: 10 year	
Label	10 year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.3	0.3	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.4
6.000	0.4	0.4	0.4	0.4	0.4
6.500	0.4	0.4	0.4	0.4	0.4
7.000	0.5	0.5	0.5	0.5	0.5
7.500	0.5	0.5	0.5	0.6	0.6
8.000	0.6	0.6	0.6	0.6	0.6
8.500	0.6	0.7	0.7	0.7	0.7
9.000	0.7	0.8	0.8	0.8	0.8
9.500	0.8	0.9	0.9	0.9	0.9
10.000	1.0	1.0	1.0	1.0	1.1
10.500	1.1	1.1	1.2	1.2	1.2
11.000	1.3	1.3	1.3	1.4	1.4
11.500	1.5	1.6	1.7	1.9	2.1
12.000	2.5	3.0	3.2	3.3	3.5
12.500	3.6	3.6	3.7	3.7	3.8
13.000	3.8	3.8	3.9	3.9	3.9
13.500	4.0	4.0	4.0	4.1	4.1
14.000	4.1	4.1	4.2	4.2	4.2
14.500	4.2	4.2	4.3	4.3	4.3
15.000	4.3	4.3	4.4	4.4	4.4
15.500	4.4	4.4	4.4	4.5	4.5
16.000	4.5	4.5	4.5	4.5	4.5
16.500	4.5	4.6	4.6	4.6	4.6
17.000	4.6	4.6	4.6	4.6	4.6

Subsection: Time-Depth Curve
Label: MyStorms
Scenario: Pre-Development 10 year

Return Event: 10 years
Storm Event: 10 year

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	4.7	4.7	4.7	4.7	4.7
18.000	4.7	4.7	4.7	4.7	4.7
18.500	4.7	4.7	4.8	4.8	4.8
19.000	4.8	4.8	4.8	4.8	4.8
19.500	4.8	4.8	4.8	4.8	4.8
20.000	4.8	4.8	4.9	4.9	4.9
20.500	4.9	4.9	4.9	4.9	4.9
21.000	4.9	4.9	4.9	4.9	4.9
21.500	4.9	4.9	4.9	5.0	5.0
22.000	5.0	5.0	5.0	5.0	5.0
22.500	5.0	5.0	5.0	5.0	5.0
23.000	5.0	5.0	5.0	5.0	5.0
23.500	5.0	5.0	5.0	5.1	5.1
24.000	5.1	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Addition Summary
Label: DOWNSTREAM STREAM
Scenario: Post-Development 10 year

Return Event: 10 years
Storm Event: 10 year

Summary for Hydrograph Addition at 'DOWNSTREAM STREAM'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Bypass 2
<Catchment to Outflow Node>	Bypass-1
Outlet-9	SCM-3
Outlet-6	SCM-1
<Catchment to Outflow Node>	EXISTING STREAM DA
Outlet-10	SCM-4
Outlet-8	SCM-2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	Bypass 2	2.685	12.100	33.36
Flow (From)	Bypass-1	14.954	12.300	123.55
Flow (From)	Outlet-9	1.810	14.050	3.78
Flow (From)	Outlet-6	1.038	12.500	5.95
Flow (From)	EXISTING STREAM DA	0.006	12.900	0.03
Flow (From)	Outlet-10	1.916	12.550	5.58
Flow (From)	Outlet-8	3.770	12.200	35.30
Flow (In)	DOWNSTREAM STREAM	26.178	12.300	177.88

Summary for Hydrograph Addition at 'DOWNSTREAM STREAM'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	EXISTING STREAM DA
<Catchment to Outflow Node>	Pre DA-1
<Catchment to Outflow Node>	Pre DA-2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EXISTING STREAM DA	0.006	12.900	0.03
Flow (From)	Pre DA-1	19.375	12.300	160.38
Flow (From)	Pre DA-2	5.430	12.350	43.57
Flow (In)	DOWNSTREAM STREAM	24.810	12.350	203.61

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Appendix 4: Water Quality Calculations

- SNAP Tool v4.2 Calculations
- Nutrient Reporting Form

Project Information

Complete this sheet if required by your reviewing authority.
Contact them for any questions. Grey boxes/text are optional.

SNAP v4.2.0

LOCATION

Project Name (optional):	Broadmoor		Parcel ID (optional):		
Submission Date (optional):		date	Nutrient Management Watershed:	Neuse	menu
Local Jurisdiction / Reviewing Agency:	Rolesville	menu	Subwatershed:	Neuse-Upper	menu
Project Latitude Coordinates (optional):		N	Phosphorus Delivery Zone:	Neuse - Upper 03020201	menu
Project Longitude Coordinates (optional):		W	Nitrogen Delivery Zone:	Neuse - Upper 03020201	menu

PROJECT DETAILS

Development Land Use Type:	Multi-Family Residential	menu	Disturbed Area:		ft^2
Part of Common Development Plan?	no	y/n	Project Activity:	New Development	menu
Designated Downtown Area?	no	y/n	Project Drains to SA Waters?	no	y/n
Public Linear Road/Sidewalk Project?	no	y/n	Pre-Project Land Use:	fallow/open	menu
Project Owner Type:	Private	menu	Project Description (optional):		

STORMWATER DETAILS

(Falls ONLY) Onsite Reduction % Req.		%	Project Uses LID/Runoff Volume Match?	no	y/n
Existing BUA/Development Onsite?	no	y/n	Local Gov't nutrient req's same as State?	yes	y/n
Local Gov't cutoff date for Existing BUA:		date	Project Drains to Regional SCM?	no	y/n
Nitrogen Export Rate Target:	3.60	lb/ac/yr	Total Nitrogen Offset Credits Needed:	0.0	lb/yr
Phosphorus Export Rate Target:		lb/ac/yr	Total Phosphorus Offset Credits Needed:	0.0	lb/yr

SNAP v4.2.0

Project Area and Offsite Land Cover Characteristics

Precipitation Station:	**Neuse**

Copy & Paste VALUES ONLY for Best Results

Click here to scroll down to error messages on this sheet.

PROJECT AREA LAND COVERS		TN EMC (mg/L)	TP EMC (mg/L)	**Pre-Project Area (ft^2)**	**Post-Project Area (ft^2)**	*Change pre-to-post (ft^2)*
Roof		1.18	0.11	3,107	534,044	*530,937*
Roadway		1.64	0.34		249,847	*249,847*
Parking/Driveway/Sidewalk		1.42	0.18		305,541	*305,541*
Protected Forest		0.97	0.03	536,213	416,363	*-119,850*
Managed Pervious/Landscaping		2.48	1.07	2,995,230	1,956,957	*-1,038,273*
Offsite or Existing Roof		1.18	0.11	26,285	26,261	*-24*
Offsite or Existing Roadway		1.64	0.34	34,360	73,211	*38,851*
Offsite or Existing Parking/Driveway/Sidew		1.42	0.18		4,454	*4,454*
Offsite Protected Forest		0.97	0.03	66,710	1,122	*-65,588*
Offsite Managed Pervious		2.48	1.07	1,043,057	1,065,364	*22,307*
CUSTOM LAND COVER 1	0.00	1.18	0.11	123,781	123,781	*0*
CUSTOM LAND COVER 2	0.00	1.18	0.11	939,621	936,806	*-2,815*
CUSTOM LAND COVER 3						*0*
LAND TAKEN UP BY SCM		1.18	0.11		74,613	*74,613*
		Total (Regulated & UnReg) Area		***5,768,364.00***	***5,768,364.00***	
		Project (Regulated) Area		***4,597,952.00***	***4,597,952.00***	

Stormwater Control Measure (SCM) Characteristics

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Copy & Paste VALUES ONLY for Best Results

Click here to go to SCM101's Land Cover Data | Click here to review Errors | Click here to go to Summary Data | Click here to go back to the top

Catchment ID	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6
SCM ID	101	102	103	201	202	203	301	302	303	401	402	403	501	502	503	601	602	603
Type of SCM	Wet Pond			Wet Pond			Wet Pond			Wet Pond								
Hydrologic soil group at SCM location	D			B			C			C								
SCM Description	BMP			BMP			BMP			BMP								
Design Storm Size (inches/24hrs)																		
Percent of Full Size	103%			134%			200%			144%								
% Annual Effluent	77%	0%	0%	74%	0%	0%	83%	0%	0%	80%	0%	0%	0%	0%	0%	0%	0%	0%
% Annual Overflow	14%	0%	0%	7%	0%	0%	2%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%
% Annual ET/Infiltrated	9%	0%	0%	19%	0%	0%	15%	0%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%
Custom % Annual Effluent																		
Custom % Annual Overflow																		
Custom % Annual ET/Infiltrated																		
SCM Effluent TP EMC (mg/L)	0.13	0.00	0.00	0.13	0.00	0.00	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCM Effluent TN EMC (mg/L)	0.86	0.00	0.00	0.86	0.00	0.00	0.86	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom Effluent TP EMC																		
Custom Effluent TN EMC																		
SCM Land Cover TP EMC (mg/L)	0.11	0.00	0.00	0.11	0.00	0.00	0.11	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCM Land Cover TN EMC (mg/L)	1.18	0.00	0.00	1.18	0.00	0.00	1.18	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
This SCM Drains to Numbered SCM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Catchment Routing	Catchments Draining to SCM 101	Catchments Draining to SCM 102	Catchments Draining to SCM 103	Catchments Draining to SCM 201	Catchments Draining to SCM 202	Catchments Draining to SCM 203	Catchments Draining to SCM 301	Catchments Draining to SCM 302	Catchments Draining to SCM 303	Catchments Draining to SCM 401	Catchments Draining to SCM 402	Catchments Draining to SCM 403	Catchments Draining to SCM 501	Catchments Draining to SCM 502	Catchments Draining to SCM 503	Catchments Draining to SCM 601	Catchments Draining to SCM 602	Catchments Draining to SCM 603
Catchment 1																		
Catchment 2																		
Catchment 3																		
Catchment 4																		
Catchment 5																		
Catchment 6																		
Error Check - Missing SCM Area:																		
Error Check - Min/Max Size:																		
Error Check - Hydrology:																		
Error Check - Missing SCM Info:																		
Error Check - Drainage Data w/o SCM:																		
Error Checks - SCM Type:																		
SCM ID:	101	102	103	201	202	203	301	302	303	401	402	403	501	502	503	601	602	603
SCM Drainage Area Land Covers	Area Draining Directly to SCM 101 (ft2)	Area Draining Directly to SCM 102 (ft2)	Area Draining Directly to SCM 103 (ft2)	Area Draining Directly to SCM 201 (ft2)	Area Draining Directly to SCM 202 (ft2)	Area Draining Directly to SCM 203 (ft2)	Area Draining Directly to SCM 301 (ft2)	Area Draining Directly to SCM 302 (ft2)	Area Draining Directly to SCM 303 (ft2)	Area Draining Directly to SCM 401 (ft2)	Area Draining Directly to SCM 402 (ft2)	Area Draining Directly to SCM 403 (ft2)	Area Draining Directly to SCM 501 (ft2)	Area Draining Directly to SCM 502 (ft2)	Area Draining Directly to SCM 503 (ft2)	Area Draining Directly to SCM 601 (ft2)	Area Draining Directly to SCM 602 (ft2)	Area Draining Directly to SCM 603 (ft2)	Total Land Use Area Treated By All SCMs (ft^2)	Allowable Total Land Use Area to be Treated Based on Post-Project Areas (ft^2)	Post-Project Untreated Land Area (ft^2)
Roof	74,164			185,384			119,878			93,846									473,272	534,044	60,772
Roadway	35,929			103,845			64,383			43,926									248,083	249,847	1,764
Parking/Driveway/Sidewalk	52,156			82,327			52,878			81,832									269,193	305,541	36,348
Protected Forest	33,202			0			49,594			15									82,811	416,363	333,552
Managed Pervious/Landscaping	100,743			361,103			309,440			144,947									916,233	1,956,957	1,040,724
Offsite or Existing Roof	164			3,688			0			0									3,852	26,261	22,409
Offsite or Existing Roadway	0			10,130			7,638			0									17,768	73,211	55,443
Offsite or Existing Parking/Driveway/Sidew	0			0			0			0									0	4,454	4,454
Offsite Protected Forest	0			0			1,122			0									1,122	1,122	0
Offsite Managed Pervious	8,167			44,381			279,275			5,593									337,416	1,065,364	727,948
CUSTOM LAND COVER 1	0			0			0			0									0	123,781	123,781
CUSTOM LAND COVER 2	0			14			15			5									34	936,806	936,772
CUSTOM LAND COVER 3	0			0			0			0									0	0	0
LAND TAKEN UP BY SCM	7,435			21,566			28,903			16,709									74,613	74,613	0
TOTAL AREA DRAINING TO SCM (ft^2):	311,960	0	0	812,438	0	0	913,126	0	0	386,873	0	0	0	0	0	0	0	0	2,424,397	5,768,364	3,343,967
CATCHMENT AREA (ft^2):	311,960			812,438			913,126			386,873			0			0					

Nutrient Export Summary

SNAP v4.2.0

Landcover & SCM Data Review

		Errors / Advisories
Avg Annual precip (in) =	45.76	
Total (Regulated + Unregulated) Area (ft^2) =	5,768,364	
Project (Regulated) Area (ft^2) =	4,597,952	
Net BUA (Project Area BUA only ft^2) =	1,086,325	Net BUA indicates new development or expansion.
Custom Landcovers are present:	yes	
Total Nitrogen Export Target Scaled to Project Area (lb/yr):	380.00	

		Errors / Advisories
SCM Area (ft^2) =	74,613	
SCM Treated Area (ft^2) =	2,424,397	
Catchment Routing:	No errors	
Treating Runoff from Existing BUA or Offsite:	yes	Offsite Area or Existing BUA drains to an SCM. See Users' Manual for instructions to determine nutrient reduction needs and reduction provided by SCMs.
Disturbed Area (ft^2) =	missing or not matching	If using tool for Stormwater Compliance, check Project Info for missing Disturbed Area.
Total Phosphorus Export Target Scaled to Project Area (lb/yr):	0.00	

Nutrient Export Summary	Total Area (Onsite + Offsite) Pre-Project	Project Area (Onsite Only) Pre-Project	Total Area Post-Project before Treatment	Project Area Post-Project before Treatment	Total Area Post-Project after Treatment	Project Area Post-Project after Treatment	Total Area Post-Project SCM-Treated Area Only	Project Area Post-Project SCM-Treated Area Only	Total Area Post-Project Untreated Areas	Project Area Post-Project Untreated Areas
Area (All Landcover Types) (acres)	132.4234	105.5545	132.4234	105.5545	132.4234	105.5545	55.6565	47.3884	76.7669	58.1660
Percent Built-Upon Area (BUA) (%)	1%	0%	21%	19%	21%	19%	42%	48%	5%	4%
Built-Upon Area (BUA) (sqft)	63,752	3,107	1,193,358	868,384	1,193,358	868,384	1,012,168	990,548	181,190	98,884
Annual Runoff Volume (ft^3/yr)	1,186,768	798,605	4,919,164	4,397,314	4,349,139	3,848,086	3,215,655	3,107,868	1,133,484	740,218
Annual Runoff % Change			315%	451%	266%	382%				
Total Runoff Change (cuft/yr)			3,732,395	3,598,709	3,162,371	3,049,480				
Total Nitrogen EMC (mg/L)	1.96	1.68	1.46	1.42	1.09	1.02	0.90	0.90	1.62	1.52
Total Nitrogen Load Leaving Site (lb/yr)	**145.56**	**99.36**	**449.02**	**388.65**	**295.59**	**244.94**	180.84	174.72	114.76	70.23
Total Nitrogen Loading Rate (lb/ac/yr)	*1.10*	*0.94*	*3.39*	*3.68*	*2.23*	*2.32*	*3.25*	*3.69*	*1.49*	*1.21*
Total Nitrogen % Change Pre-to-Post			208%	291%	103%	147%				
Total Nitrogen Change (lb/yr) Pre-to-Post			303.46	289.30	150.04	145.59				
Total Phosphorus EMC (mg/L)	0.69	0.61	0.27	0.24	0.21	0.18	0.14	0.14	0.41	0.35
Total Phosphorus Load Leaving Site (lb/yr)	**50.78**	**35.84**	**84.06**	**66.03**	**56.45**	**42.59**	27.50	26.48	28.95	16.10
Total Phosphorus Loading Rate (lb/ac/yr)	*0.38*	*0.34*	*0.63*	*0.63*	*0.43*	*0.40*	*0.49*	*0.56*	*0.38*	*0.28*
Total Phosphorus % Change Pre-to-Post			66%	84%	11%	19%				
Total Phosphorus Change (lb/yr)Pre-to-Post			33.28	30.19	5.67	6.75				

SCM/Catchment Summary

SCM ID and Type	Volume Reduction (%)	TN Reduction (%)	TP Reduction (%)	*TN Out (lbs/ac/yr)*	*TP Out (lbs/ac/yr)*
Catchment 1	8.55%	37.82%	37.38%	*4.35*	*0.66*
101: Wet Pond	8.55%	37.82%	37.38%	*4.35*	*0.66*
102: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
103: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
Catchment 2	18.57%	47.75%	51.37%	*3.46*	*0.53*
201: Wet Pond	18.57%	47.75%	51.37%	*3.46*	*0.53*
202: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
203: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
Catchment 3	14.67%	48.86%	58.07%	*2.23*	*0.34*
301: Wet Pond	14.67%	48.86%	58.07%	*2.23*	*0.34*
302: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
303: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
Catchment 4	14.10%	44.51%	43.63%	*4.32*	*0.65*
401: NA	14.10%	44.51%	43.63%	*4.32*	*0.65*
402: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
403: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
Catchment 5	0.00%	0.00%	0.00%	*0.00*	*0.00*
501: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
502: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
503: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
Catchment 6	0.00%	0.00%	0.00%	*0.00*	*0.00*
601: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
602: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*
603: NA	0.00%	0.00%	0.00%	*0.00*	*0.00*

Falls Lake ONLY: Onsite Reduction Compliance Check	Nitrogen	Phosphorus
Onsite % Reduction Requirement		
Export Target Scaled to Area (lb/yr)	**380.00**	
Export Load Post-Project Before Treatment	**388.65**	**66.03**
Total Reduction Need (lb/yr)		
Onsite Reduction Need (lb/yr)		
Onsite Export Target (lb/yr)		
Project Area Post-Project After Treatment	**244.94**	**42.59**

Nutrient Management Strategy Watershed - Nutrient Offset Credit Reporting Form

SNAP v4.2.0

Please complete and submit the following information to the local government permitting your development project to characterize it and assess the need to purchase nutrient offset credits. Contact and rule implementation information can be found online at:
http://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-offset-information

PROJECT INFORMATION

Applicant Name:			
Project Name:	Broadmoor		
Project Address:	1321 Rolesville Rd, Rolesville, NC 27587		
Date: *(mm/dd/yyyy)*	11/1/2024	**Development Land Use Type:**	Multi-Family Residential
County:	Wake	**Project Activity Type:**	New Development
Project Area (sqft):	4,597,952	**Project Latitude:**	0.000000
Post-Project Built-Upon Area %:	18.89%	**Project Longitude:**	0.000000

WATERSHED INFORMATION

Nutrient Management Watershed:	Neuse	**N Target Export Rate (lb/ac/yr):**	3.60
Subwatershed:	Neuse-Upper	**P Target Export Rate (lb/ac/yr):**	0.00
Nitrogen Delivery Zone:	Neuse - Upper 03020201	**Nitrogen Delivery Factor:**	100%
Phosphorus Delivery Zone:	Neuse - Upper 03020201	**Phosphorus Delivery Factor:**	100%

PERMANENT NUTRIENT OFFSET REQUEST

Post-Project Nitrogen Calculations - Projects with No Offsite or Built-Upon Area

(A)	(B)	(C)	(D)		(F)	(G)	*(Where Applicable)*	
TN Untreated Load (lb/yr)	TN Export Target Load (lb/yr)	TN Treated Load (lb/yr)	TN Remaining Reduction Need (lb/yr)		TN Delivery Factor (%)	TN Permanent Offsets Required (lb/yr)	Additional Local Gov't Offsets (lb/yr)	**Total TN Permanent Offsets to Buy (lb/yr)**
388.7	380.0	244.9	0.0		100.0%	0.0		**0.0**

Post-Project Phosphorus Calculations - Projects with No Offsite or Built-Upon Area

(A)	(B)	(C)	(D)		(F)	(G)	*(Where Applicable)*	
TP Untreated Load (lb/yr)	TP Export Target Load (lb/yr)	TP Treated Load (lb/yr)	TP Remaining Reduction Need (lb/yr)		TP Delivery Factor (%)	TP Permanent Offsets Required (lb/yr)	Additional Local Gov't Offsets (lb/yr)	**Total TP Permanent Offsets to Buy (lb/yr)**
								0.0

LOCAL GOVERNMENT AUTHORIZATION

Local Government Name:			
Staff Name:		**Phone:**	
Staff Email:		**Date:**	
Local Government Authorizing Signature:			

Appendix 5: SCM Design Calculations

- SCM 1 – Wet Pond MDC Requirements
- SCM 2 – Wet Pond MDC Requirements
- SCM 3 – Wet Pond MDC Requirements
- SCM 4 – Wet Pond MDC Requirements

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/31/24

SCM #1 - Stormwater Wet Pond Design

Table 1: Surface Area to Drainage Area Ratio for Permanent Pool Sizing (Adapted from Driscoll, 1986)
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

% Impervious	Permanent Pool Depth (feet)					
	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

SCM #1 Drainage Area Information

Total Drainage Area = **7.16 acres** → *See Summary of Hydrology Inputs per Sub-Drianage Area*

Total Impervious Area = **3.73 acres**

% Impervious Surface Area = **52.09 %**

SCM #1 Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.00 ft	Normal Pool Elevation =	357.5
SA/DA ratio =	1.85 *From Table 1*	Main Pool SA Provided =	10412 sq. ft.
			0.239 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 5,779 sq. ft.
0.133 acres

SCM #1 Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	358.65 ft
As described by Schueler (1987)		Overflow Elev =	**361.00 ft**
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.)	Storage Volume Provided =	46,316 cu. ft.
	I = Percent impervious		1.063 acre-ft

Rv = 0.52 in/in

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 13,485 cu. ft.
0.310 acre-ft

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/31/24

SCM #1 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Storage Volume	363.00	18,608	17,850	80,538	←**Top of Dam**
	362.00	17,102	16,372	62,688	
	361.00	15,652	14,950	46,316	
	360.00	14,258	13,584	31,367	
	359.00	12,920	12,273	17,783	
	358.00	11,638	5,510	5,510	
Normal Pool	357.50	10,412	0	0	←**Normal Pool**

SCM #1 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	357.50	10,412	4,182	25,316	←**Normal Pool**
	357.00	6,471	6,161	21,134	←**Bottom of Littoral Shelf**
	356.00	5,857	5,559	14,972	
	355.00	5,267	4,982	9,413	
	354.00	4,703	4,431	4,431	←**Sediment Storage Volume**
	353.00	4,164	0	0	←**Pond Bottom**
Forebay	357.50	10,412	2,719	6,101	←**Normal Pool**
	357.00	1,699	1,491	3,382	←**Bottom of Littoral Shelf**
	356.00	1,293	1,110	1,890	
	355.00	937	780	780	←**Sediment Storage Volume**
	354.00	633	0	0	←**Forebay Bottom**

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/31/24

SCM #1 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where:
- D_{avg} = Average Depth (ft)
- V_{perm_pool} = Volume of Permanent Pool (cf)
- A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 20,885 cf (Total Volume - Sediment Storage Volume)

A_{perm_pool} = 10,412 sf

D_{avg} = 2.01 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
- D_{avg} = Average Depth (ft)
- V_{perm_pool} = Volume of Permanent Pool (cf)
- $D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
- P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
- $W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
- A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 20,885 cf (Total Volume - Sediment Storage Volume)

$D_{max\_over\_shelf}$ = 0.50 ft

P_{perm_pool} = 326 ft

$W_{submerged\_shelf}$ = 3.00 ft

A_{bot_shelf} = 6,471 sf

D_{avg} = 3.19 ft

Use Average Depth = 3.00 ft

SCM #1 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **20,885 cf** (Total Volume - Sediment Storage Volume)

Forebay Volume = 5,321

Forebay Volume =25.5% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/31/24

SCM #1 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.310 acre-ft	13485 cf	g =	32.2 ft/s
Head / Driving Head:	1.15 ft	0.38 ft	C_d=	0.6
Draw down time:	**48 hours**	172800 sec		

Orifice Area = 0.026 sq. ft. 3.770 sq. in.

Orifice Diameter = 2.19 in

USE 2.25 INCH DIAMETER ORIFICE

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/31/24

SCM #1 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**5.00 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**137.50 CF**
Concrete in Riser (no openings)	**57.50 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**63.94 CF**

Weight Calculations	
Weight of Offset Water	**8,580 lbs**
Total Weigth of Concrete	**9,079 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**1,217 lbs**

Minimum Volume of Ballast Concrete Required = 0.5 CY

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/31/24

SCM #1 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 5.2 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 2.50

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

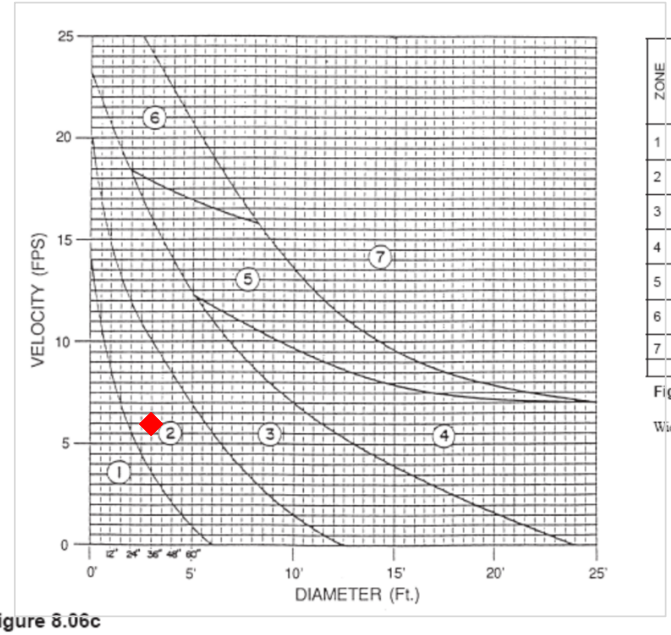

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	2
Min Apron Length =	15.00 ft
Min Apron Width =	7.50 ft
Min Apron Depth =	1.50 ft
Min Riprap Size =	NCDOT Class 'B'

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Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #2 - Stormwater Wet Pond Design

Table 1: Surface Area to Drainage Area Ratio for Permanent Pool Sizing (Adapted from Driscoll, 1986)
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

% Impervious	Permanent Pool Depth (feet)					
	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

SCM #2 Drainage Area Information

Total Drainage Area = **18.65 acres** → *See Summary of Hydrology Inputs per Sub-Drianage Area*
Total Impervious Area = **8.85 acres**
% Impervious Surface Area = **47.45 %**

SCM #2 Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.00 ft	Normal Pool Elevation =	357.5
SA/DA ratio =	1.72 *From Table 1*	Main Pool SA Provided =	23300 sq. ft.
			0.535 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 13,963 sq. ft.
0.321 acres

SCM #2 Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	358.78 ft
As described by Schueler (1987)		Overflow Elev =	**359.00 ft**
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.)	Storage Volume Provided =	38,145 cu. ft.
	I = Percent impervious		0.876 acre-ft
Rv = 0.48 in/in			

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 32,298 cu. ft.
0.741 acre-ft

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Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/24/24

SCM #2 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
	363.00	35,018	33,967	161,854	←**Top of Dam**
	362.00	32,927	31,904	127,887	
	361.00	30,891	29,896	95,983	
	360.00	28,911	27,942	66,088	
	359.00	26,985	26,044	38,145	
	358.00	25,115	12,101	12,101	
Normal Pool	357.50	23,300	0	0	←**Normal Pool**

SCM #2 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	357.50	23,300	9,853	66,953	←**Normal Pool**
	357.00	16,317	15,794	57,101	←**Bottom of Littoral Shelf**
	356.00	15,276	14,765	41,307	
	355.00	14,259	13,761	26,542	
	354.00	13,268	12,782	12,782	←**Sediment Storage Volume**
	353.00	12,302	0	0	←**Pond Bottom**
Forebay	357.50	23,300	6,246	16,624	←**Normal Pool**
	357.00	4,238	3,970	10,378	←**Bottom of Littoral Shelf**
	356.00	3,707	3,451	6,409	
	355.00	3,201	2,958	2,958	←**Sediment Storage Volume**
	354.00	2,721	0	0	←**Forebay Bottom**

83,577

357.00	63331
356.00	61218
355.00	59130
354.00	57065
353.00	55024
352.00	53007

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #2 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:
The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 54,171 cf (Total Volume - Sediment Storage Volume)
A_{perm_pool} = 23,300 sf
D_{avg} = 2.32 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 54,171 cf (Total Volume - Sediment Storage Volume)
$D_{max\_over\_shelf}$ = 0.50 ft
P_{perm_pool} = 549 ft
$W_{submerged\_shelf}$ = 3.00 ft
A_{bot_shelf} = 16,317 sf

D_{avg} = 3.29 ft

Use Average Depth = 3.00 ft

SCM #2 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:
The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **54,171 cf** (Total Volume - Sediment Storage Volume)
Forebay Volume = 13,666

Forebay Volume =25.2% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #2 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.741 acre-ft	32298 cf	g =	32.2 ft/s
Head / Driving Head:	1.28 ft	0.43 ft	C_d=	0.6
Draw down time:	**48 hours**	172800 sec		

Orifice Area = 0.060 sq. ft. 8.573 sq. in.

Orifice Diameter = 3.30 in

USE 3.5 INCH DIAMETER ORIFICE

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #2 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**9.00 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**237.50 CF**
Concrete in Riser (no openings)	**93.50 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**99.94 CF**

Weight Calculations	
Weight of Offset Water	**14,820 lbs**
Total Weigth of Concrete	**14,191 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**3,593 lbs**

Minimum Volume of Ballast Concrete Required = 1 CY

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/24/24

SCM #2 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 6.2 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type =	Circular Pipe
Pipe Diameter (ft) =	3.00
Single or Mulitple Openings =	Single
D_o =	ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

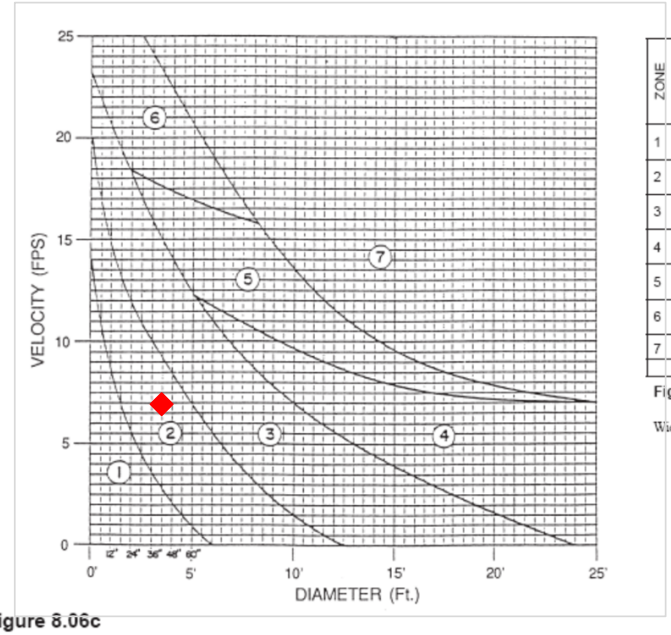

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	3
Min Apron Length =	24.00 ft
Min Apron Width =	9.00 ft
Min Apron Depth =	2.13 ft
Min Riprap Size =	NCDOT Class '1'

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Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/24/24

SCM #2 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
	363.00	35,018	33,967	65,875	←**Top of Dam**
	362.00	32,927	31,904	31,908	
	361.00	30,891	29,896	5	
	360.00	28,911	27,942	66,088	
	359.00	26,985	26,044	38,145	
	358.00	25,115	12,101	12,101	
Normal Pool	357.50	23,300	0	0	←**Normal Pool**

SCM #2 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	357.50	23,300	9,853	66,953	←**Normal Pool**
	357.00	16,317	15,794	57,101	←**Bottom of Littoral Shelf**
	356.00	15,276	14,765	41,307	
	355.00	14,259	13,761	26,542	
	354.00	13,268	12,782	12,782	←**Sediment Storage Volume**
	353.00	12,302	0	0	←**Pond Bottom**
Forebay	357.50	23,300	6,246	16,624	←**Normal Pool**
	357.00	4,238	3,970	10,378	←**Bottom of Littoral Shelf**
	356.00	3,707	3,451	6,409	
	355.00	3,201	2,958	2,958	←**Sediment Storage Volume**
	354.00	2,721	0	0	←**Forebay Bottom**

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #2 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

4.5

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 54,171 cf (Total Volume - Sediment Storage Volume)
A_{perm_pool} = 23,300 sf
D_{avg} = 2.32 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 54,171 cf (Total Volume - Sediment Storage Volume)
$D_{max\_over\_shelf}$ = 0.50 ft
P_{perm_pool} = 549 ft
$W_{submerged\_shelf}$ = 3.00 ft
A_{bot_shelf} = 16,317 sf

D_{avg} = 3.29 ft

Use Average Depth = 3.00 ft

SCM #2 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **54,171 cf** (Total Volume - Sediment Storage Volume)
Forebay Volume = 13,666

Forebay Volume =25.2% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #2 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh} \quad 4.5$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.741 acre-ft	32298 cf	g =	32.2 ft/s
Head / Driving Head:	4.51 ft	1.50 ft	C_d=	0.6
Draw down time:	**48 hours**	172800 sec		

Orifice Area = 0.032 sq. ft. 4.558 sq. in.

Orifice Diameter = 2.41 in

USE 2.5 INCH DIAMETER ORIFICE

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #2 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**4.50 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**36 in**
Barrel Outside Diameter (Dbo)	**3.67 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**125.00 CF**
Concrete in Riser (no openings)	**53.00 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**3.73 CF**
Concrete Collar Volume	**9.67 CF**
Total Concrete Volume	**58.94 CF**

Weight Calculations	
Weight of Offset Water	**7,800 lbs**
Total Weigth of Concrete	**8,369 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**0,991 lbs**

Minimum Volume of Ballast Concrete Required = 0.5 CY

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #2 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 6.2 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o 4.5

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 3.00

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

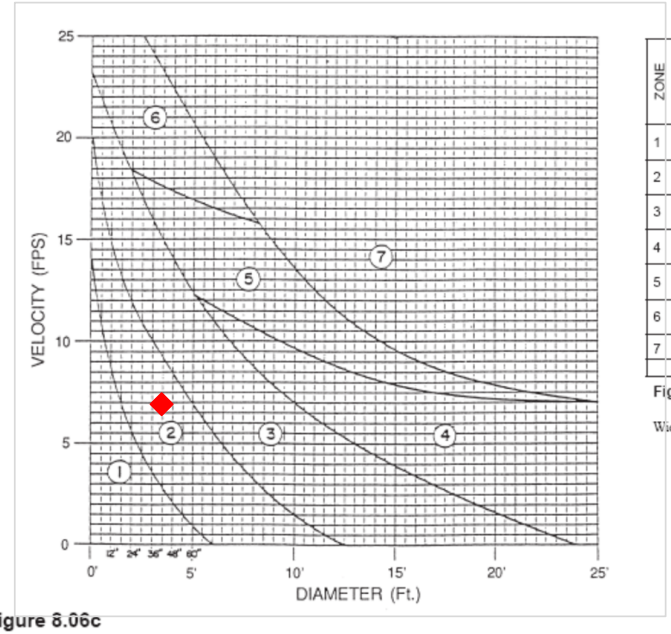

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	2
Min Apron Length =	18.00 ft
Min Apron Width =	9.00 ft
Min Apron Depth =	1.50 ft
Min Riprap Size =	NCDOT Class 'B'

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #3 - Stormwater Wet Pond Design

Table 1: Surface Area to Drainage Area Ratio for Permanent Pool Sizing (Adapted from Driscoll, 1986)
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

% Impervious	Permanent Pool Depth (feet)					
	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

SCM #3 Drainage Area Information

Total Drainage Area = **20.96 acres** → *See Summary of Hydrology Inputs per Sub-Drianage Area*
Total Impervious Area = **5.62 acres**
% Impervious Surface Area = **26.81 %**

SCM #3 Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.00 ft	Normal Pool Elevation =	354.5
SA/DA ratio =	1.06 *From Table 1*	Main Pool SA Provided =	23115 sq. ft.
			0.531 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 9,722 sq. ft.
0.223 acres

SCM #3 Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	355.22 ft
As described by Schueler (1987)		Overflow Elev =	**358.00 ft**
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.)	Storage Volume Provided =	118,840 cu. ft.
	I = Percent impervious		2.728 acre-ft

Rv = 0.29 in/in

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 22,165 cu. ft.
0.509 acre-ft

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #3 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Storage Volume	362.00	48,777	92,128	292,604	←**Top of Dam**
	360.00	43,403	42,100	200,477	
	359.00	40,810	39,537	158,377	
	358.00	38,278	37,036	118,840	
	357.00	35,808	34,597	81,803	
	356.00	33,400	32,220	47,206	
	355.00	31,055	14,986	14,986	
Normal Pool	354.50	28,902	0	0	←**Normal Pool**

SCM #3 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	354.50	23,115	11,048	85,062	←**Normal Pool**
	354.00	21,094	20,433	74,014	←**Bottom of Littoral Shelf**
	353.00	19,779	19,130	53,581	
	352.00	18,488	17,852	34,451	
	351.00	17,223	16,599	16,599	←**Sediment Storage Volume**
	350.00	15,983	0	0	←**Pond Bottom**
Forebay	354.50	5,339	2,433	15,519	←**Normal Pool**
	354.00	4,409	4,111	13,086	←**Bottom of Littoral Shelf**
	353.00	3,821	3,535	8,974	
	352.00	3,256	2,983	5,439	
	351.00	2,718	2,457	2,457	←**Sediment Storage Volume**
	350.00	2,204	0	0	←**Forebay Bottom**

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #3 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 68,463 cf (Total Volume - Sediment Storage Volume)
A_{perm_pool} = 23,115 sf
D_{avg} = 2.96 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 68,463 cf (Total Volume - Sediment Storage Volume)
$D_{max\_over\_shelf}$ = 0.50 ft
P_{perm_pool} = 683 ft
$W_{submerged\_shelf}$ = 3.00 ft
A_{bot_shelf} = 21,094 sf

D_{avg} = 3.22 ft

Use Average Depth = 3.00 ft

SCM #3 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **68,463 cf** (Total Volume - Sediment Storage Volume)
Forebay Volume = 13,062

Forebay Volume =19.1% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #3 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.509 acre-ft	22165 cf	g =	32.2 ft/s
Head / Driving Head:	0.72 ft	0.24 ft	C_d=	0.6
Draw down time:	**50 hours**	180000 sec		

Orifice Area = 0.052 sq. ft. 7.503 sq. in.

Orifice Diameter = 3.09 in

USE 3.25 INCH DIAMETER ORIFICE

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Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #3 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**9.00 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**237.50 CF**
Concrete in Riser (no openings)	**93.50 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**99.94 CF**

Weight Calculations	
Weight of Offset Water	**14,820 lbs**
Total Weigth of Concrete	**14,191 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**3,593 lbs**

Minimum Volume of Ballast Concrete Required = 1 CY

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/24/24

SCM #3 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 5.2 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 2.50

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

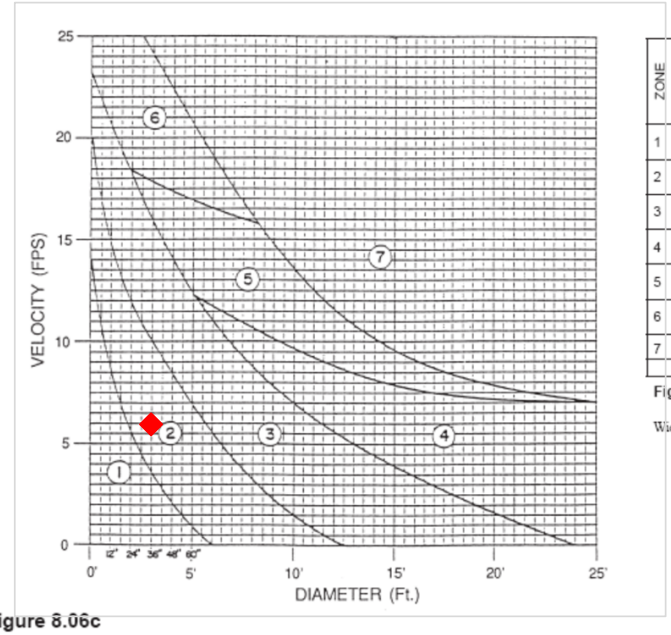

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	3
Min Apron Length =	20.00 ft
Min Apron Width =	7.50 ft
Min Apron Depth =	2.13 ft
Min Riprap Size =	NCDOT Class '1'

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Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/31/24

SCM #3 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Storage Volume	362.00	48,777	92,128	134,234	←**Top of Dam**
	360.00	43,403	42,100	42,106	
	359.00	40,810	39,537	7	
	358.00	38,278	37,036	118,840	
	357.00	35,808	34,597	81,803	
	356.00	33,400	32,220	47,206	
	355.00	31,055	14,986	14,986	
Normal Pool	354.50	28,902	0	0	←**Normal Pool**

SCM #3 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	354.50	23,115	11,048	85,062	←**Normal Pool**
	354.00	21,094	20,433	74,014	←**Bottom of Littoral Shelf**
	353.00	19,779	19,130	53,581	
	352.00	18,488	17,852	34,451	
	351.00	17,223	16,599	16,599	←**Sediment Storage Volume**
	350.00	15,983	0	0	←**Pond Bottom**
Forebay	354.50	5,339	2,433	15,519	←**Normal Pool**
	354.00	4,409	4,111	13,086	←**Bottom of Littoral Shelf**
	353.00	3,821	3,535	8,974	
	352.00	3,256	2,983	5,439	
	351.00	2,718	2,457	2,457	←**Sediment Storage Volume**
	350.00	2,204	0	0	←**Forebay Bottom**

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/31/24

SCM #3 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

6.5

Where:

D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (cf)

A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 68,463 cf (Total Volume - Sediment Storage Volume)

A_{perm_pool} = 23,115 sf

D_{avg} = 2.96 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:

D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (cf)

$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)

P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)

$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)

A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 68,463 cf (Total Volume - Sediment Storage Volume)

$D_{max\_over\_shelf}$ = 0.50 ft

P_{perm_pool} = 683 ft

$W_{submerged\_shelf}$ = 3.00 ft

A_{bot_shelf} = 21,094 sf

D_{avg} = 3.22 ft

Use Average Depth = 3.00 ft

SCM #3 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **68,463 cf** (Total Volume - Sediment Storage Volume)

Forebay Volume = 13,062

Forebay Volume =19.1% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/31/24

SCM #3 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh} \quad 6.5$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.509 acre-ft	22165 cf	g =	32.2 ft/s
Head / Driving Head:	5.03 ft	1.68 ft	C_d=	0.6
Draw down time:	**50 hours**	180000 sec		

Orifice Area = 0.020 sq. ft. 2.845 sq. in.

Orifice Diameter = 1.90 in

USE 2 INCH DIAMETER ORIFICE

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Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/31/24

SCM #3 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**6.50 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**175.00 CF**
Concrete in Riser (no openings)	**71.00 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**77.44 CF**

Weight Calculations	
Weight of Offset Water	**10,920 lbs**
Total Weigth of Concrete	**10,996 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**2,108 lbs**

Minimum Volume of Ballast Concrete Required = 0.75 CY

Project Name:	**Broadmoor**			Project #:	23-0045
City/State:	Rolesville, NC		########	Date:	10/31/24

SCM #3 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 5.2 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o 6.5

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 2.50

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

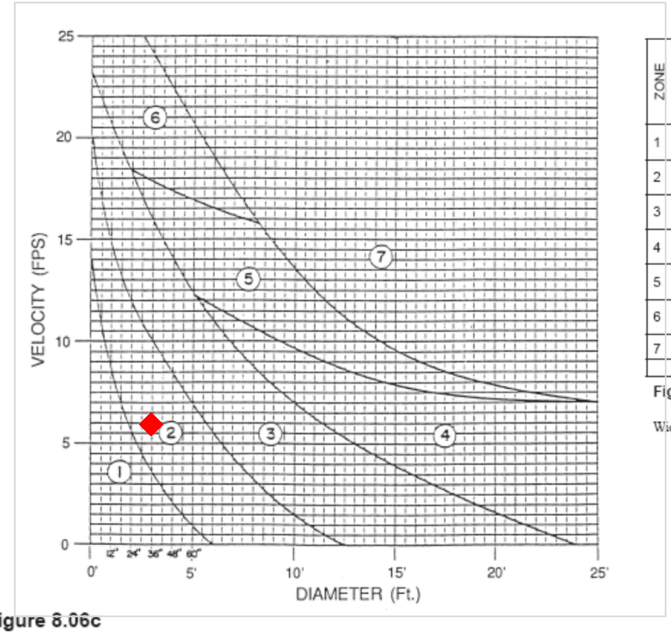

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

Riprap Dissipator Sizing Information

Zone =	2
Min Apron Length =	15.00 ft
Min Apron Width =	7.50 ft
Min Apron Depth =	1.50 ft
Min Riprap Size =	NCDOT Class 'B'

NCDOT Rip Rap Material Classiciation

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

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Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #4 - Stormwater Wet Pond Design

Table 1: Surface Area to Drainage Area Ratio for Permanent Pool Sizing (Adapted from Driscoll, 1986)
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

% Impervious	Permanent Pool Depth (feet)					
	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

SCM #4 Drainage Area Information

Total Drainage Area = **8.88 acres** → *See Summary of Hydrology Inputs per Sub-Drianage Area*
Total Impervious Area = **5.04 acres**
% Impervious Surface Area = **56.76 %**

SCM #4 Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.50 ft	Normal Pool Elevation =	362.5
SA/DA ratio =	1.84 *From Table 1*	Main Pool SA Provided =	13040 sq. ft.
			0.299 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 7,114 sq. ft.
0.163 acres

SCM #4 Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	363.49 ft
As described by Schueler (1987)		Overflow Elev =	**363.75 ft**
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.)	Storage Volume Provided =	23,074 cu. ft.
	I = Percent impervious		0.530 acre-ft
Rv = 0.56 in/in			
Total runoff volume from 1-inch precipitation:			

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 18,077 cu. ft.
0.415 acre-ft

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #4 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Storage Volume	370.00	30,991	29,994	179,613	←Top of Dam
	369.00	29,008	28,039	149,619	
	368.00	27,082	26,141	121,580	
	367.00	25,211	24,298	95,439	
	366.00	23,396	22,511	71,141	
	365.00	21,637	20,780	48,630	
	364.00	19,934	19,105	27,851	
	363.00	18,287	8,746	8,746	
Normal Pool	362.50	16,709	0	0	←Normal Pool

SCM #4 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	362.50	13,040	6,182	54,272	←Normal Pool
	362.00	11,700	11,266	48,090	←Bottom of Littoral Shelf
	361.00	10,838	10,417	36,823	
	360.00	10,002	9,593	26,406	
	359.00	9,190	8,794	16,813	
	358.00	8,403	8,019	8,019	←Sediment Storage Volume
	357.00	7,642	0	0	←Pond Bottom
Forebay	362.50	3,163	1,377	8,067	←Normal Pool
	362.00	2,365	2,126	6,690	←Bottom of Littoral Shelf
	361.00	1,896	1,682	4,564	
	360.00	1,477	1,288	2,881	
	359.00	1,107	944	1,594	
	358.00	789	650	650	←Sediment Storage Volume
	357.00	521	0	0	←Forebay Bottom

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #4 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 46,252 cf (Total Volume - Sediment Storage Volume)
A_{perm_pool} = 13,040 sf
D_{avg} = 3.55 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 46,252 cf (Total Volume - Sediment Storage Volume)
$D_{max\_over\_shelf}$ = 0.50 ft
P_{perm_pool} = 456 ft
$W_{submerged\_shelf}$ = 3.00 ft
A_{bot_shelf} = 11,700 sf

D_{avg} = 3.92 ft

Use Average Depth = 3.50 ft

SCM #4 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **46,252 cf** (Total Volume - Sediment Storage Volume)
Forebay Volume = 7,417

Forebay Volume =16% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/24/24

SCM #4 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.415 acre-ft	18077 cf	g =	32.2 ft/s
Head / Driving Head:	0.99 ft	0.33 ft	C_d=	0.6
Draw down time:	**50 hours**	180000 sec		

Orifice Area = 0.036 sq. ft. 5.233 sq. in.

Orifice Diameter = 2.58 in

USE 2.75 INCH DIAMETER ORIFICE

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/24/24

SCM #4 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**9.00 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**237.50 CF**
Concrete in Riser (no openings)	**93.50 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**99.94 CF**

Weight Calculations	
Weight of Offset Water	**14,820 lbs**
Total Weigth of Concrete	**14,191 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**3,593 lbs**

Minimum Volume of Ballast Concrete Required = 1 CY

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/24/24

SCM #4 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 11.0 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 2.50

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

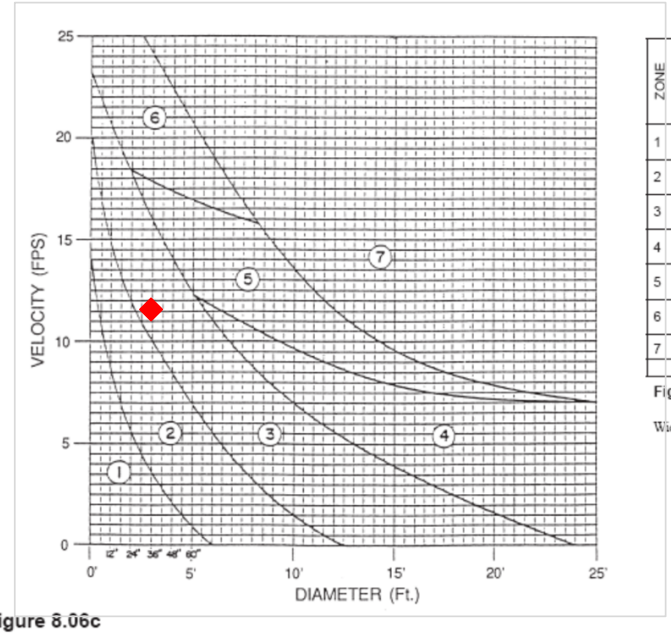

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	3
Min Apron Length =	20.00 ft
Min Apron Width =	7.50 ft
Min Apron Depth =	2.13 ft
Min Riprap Size =	NCDOT Class '1'

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/31/24

SCM #4 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Storage Volume	370.00	30,991	29,994	179,613	←Top of Dam
	369.00	29,008	28,039	149,619	
	368.00	27,082	26,141	121,580	
	367.00	25,211	24,298	95,439	
	366.00	23,396	22,511	71,141	
	365.00	21,637	20,780	48,630	
	364.00	19,934	19,105	27,851	
	363.00	18,287	8,746	8,746	
Normal Pool	362.50	16,709	0	0	←Normal Pool

SCM #4 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	362.50	13,040	6,182	54,272	←Normal Pool
	362.00	11,700	11,266	48,090	←Bottom of Littoral Shelf
	361.00	10,838	10,417	36,823	
	360.00	10,002	9,593	26,406	
	359.00	9,190	8,794	16,813	
	358.00	8,403	8,019	8,019	←Sediment Storage Volume
	357.00	7,642	0	0	←Pond Bottom
Forebay	362.50	3,163	1,377	8,067	←Normal Pool
	362.00	2,365	2,126	6,690	←Bottom of Littoral Shelf
	361.00	1,896	1,682	4,564	
	360.00	1,477	1,288	2,881	
	359.00	1,107	944	1,594	
	358.00	789	650	650	←Sediment Storage Volume
	357.00	521	0	0	←Forebay Bottom

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/31/24

SCM #4 Main Pool Average Depth Information

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:
The average depth of a wet pond is to be calculated by one of these two options:

OPTION 1: Average depth when the shelf is not submerged or the shelf is included in calculation

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
A_{perm_pool} = Area of Permanent Pool (sf)

V_{perm_pool} = 46,252 cf (Total Volume - Sediment Storage Volume)
A_{perm_pool} = 13,040 sf
D_{avg} = 3.55 ft

OPTION 2: Average depth when the shelf is being excluded from average depth calculation

$$D_{avg} = \frac{V_{perm\_pool} - 0.5 \times D_{\max\_over\_shelf} \times P_{perm\_pool} \times W_{submerged\_shelf}}{A_{bot\_shelf}}$$

Where:
D_{avg} = Average Depth (ft)
V_{perm_pool} = Volume of Permanent Pool (cf)
$D_{max\_over\_shelf}$ = Depth of water at the deep side of the shelf to permanent pool (ft)
P_{perm_pool} = Perimeter of the main pool at the bottom of the shelf (ft)
$W_{submerged\_shelf}$ = Width of the shelf at permanent pool (ft)
A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (sf)

V_{perm_pool} = 46,252 cf (Total Volume - Sediment Storage Volume)
$D_{max\_over\_shelf}$ = 0.50 ft
P_{perm_pool} = 456 ft
$W_{submerged\_shelf}$ = 3.00 ft
A_{bot_shelf} = 11,700 sf

D_{avg} = 3.92 ft

Use Average Depth = 3.50 ft

SCM #4 Forebay Sizing Information

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:
The forebay volume shall be 15-20% of the main pool.

Main Pool Volume = **46,252 cf** (Total Volume - Sediment Storage Volume)
Forebay Volume = 7,417
Forebay Volume =16% of Main Pool

Project Name: **Broadmoor** Project #: 23-0045

City/State: Rolesville, NC Date: 10/31/24

SCM #4 Water Quality Drawdown Information

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual*" Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables			**Constants**	
WQ Volume:	0.415 acre-ft	18077 cf	g =	32.2 ft/s
Head / Driving Head:	0.99 ft	0.33 ft	C_d=	0.6
Draw down time:	**50 hours**	180000 sec		

Orifice Area = 0.036 sq. ft. 5.233 sq. in.

Orifice Diameter = 2.58 in

USE 2.75 INCH DIAMETER ORIFICE

Project Name: **Broadmoor** Project #: 23-0045
City/State: Rolesville, NC Date: 10/31/24

SCM #4 Anti-Flotation Calculations

Density Values	
Unit Weight of Water	**62.4 lbs/cf**
Unit Weight of Concrete	**142 lbs/cf**

Riser/Barrel Details	
Riser Inside Height (Hr)	**7.50 ft**
Riser Wall Thickness (Dro)	**6 in**
Riser Inside Wall Dimension (Dri)	**4.00 ft**
Floor Thickness (Fl)	**6 in**
Exposed Barrel Length (Lb)	**0.00 ft**
Barrel Inside Diameter (Dbi)	**30 in**
Barrel Outside Diameter (Dbo)	**3.08 ft**
Total Overflow Weir/Orifice Area (if present)	**0.00 SF**
ID of Drawdown Pipe (if present)	**4 in**
ID of Drain Pipe (if present)	**6 in**
Is there a Concrete Pipe Collar Present?	**Yes**

Volume Calculations	
Water Offset by Riser/Barrel	**200.00 CF**
Concrete in Riser (no openings)	**80.00 CF**
Concrete Removed for Overflows	**0.00 CF**
Concrete Removed for Pipe Penetrations	**2.65 CF**
Concrete Collar Volume	**9.08 CF**
Total Concrete Volume	**86.44 CF**

Weight Calculations	
Weight of Offset Water	**12,480 lbs**
Total Weigth of Concrete	**12,274 lbs**
Factor of Safety	**1.2**
Minimum Weight of Ballast Concrete	**2,702 lbs**

Minimum Volume of Ballast Concrete Required = 0.75 CY

Project Name:	**Broadmoor**	Project #:	23-0045
City/State:	Rolesville, NC	Date:	10/31/24

SCM #4 - Design of Riprap Outlet Protection

Per NYDOT Dissipator Method for Use in Defined Channels

Step 1: Compute flow velocity at culvert outlet.

Velocity (V_o) = 11.0 ft/s

OR

Based on Q_{10} =

Step 2: Determine D_o

For circular pipe culverts, D_o = Pipe Diameter

For pipe archs, archs, box culverts, and paved channel outlets, $D_o = \sqrt{A_o}$

Where A_o = cross-sectional area of flow at outlet

For multiple openings, D_o = 1.25 x Do of single culvert

Culvert Type = Circular Pipe

Pipe Diameter (ft) = 2.50

Single or Mulitple Openings = Single

D_o = ft

Step 3: Determine zone for apron material per Figure 8.06C.

Note: For apron slopes ≥ 10%, use next higher zone.

Determine apron size per Figure 8.06d

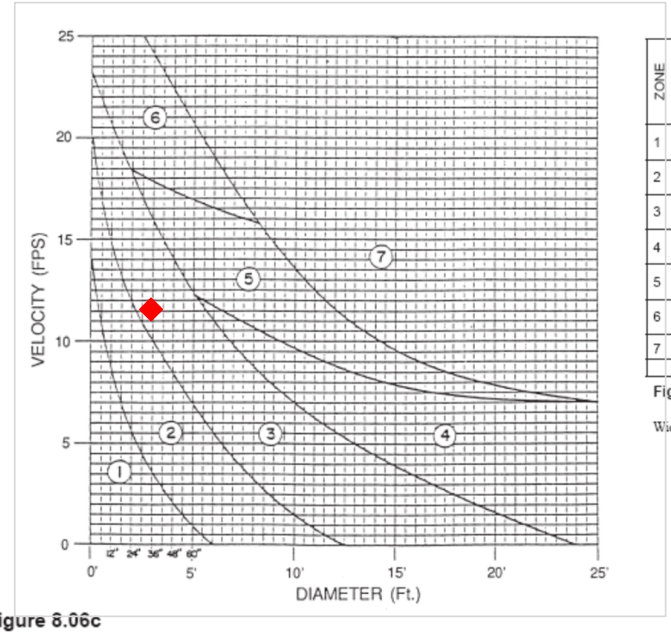

Figure 8.06c

ZONE	APRON MATERIAL	LENGTH OF APRON: TO PROTECT CULVERT L1	LENGTH OF APRON: TO PREVENT SCOUR HOLE USE L2 ALWAYS L2
1	STONE FILLING (FINE) CL. A	3 X D_o	4 x D_o
2	STONE FILLING (LIGHT) CL. B	3 X D_o	6 x D_o
3	STONE FILLING (MEDIUM) CL. 1	4 X D_o	8 x D_o
4	STONE FILLING (HEAVY) CL. 1	4 X D_o	8 x D_o
5	STONE FILLING (HEAVY) CL. 2	5 X D_o	10 x D_o
6	STONE FILLING (HEAVY) CL. 2	6 X D_o	10 x D_o
7	SPECIAL STUDY REQUIRED (ENERGY DISSIPATORS, STILLING BASIN OR LARGER SIZE STONE).		

Figure 8.06d

Width = 3 times pipe dia. (min.)

NCDOT Rip Rap Material Classification

Class	D_{min}	D_{50}	D_{max}
Class 'A'	2	4	6
Class 'B'	5	8	12
Class '1'	5	10	17
Class '2'	9	14	23

Per NCDOT 2018 Standard Specifications, Section 1042

Riprap Dissipator Sizing Information

Zone =	3
Min Apron Length =	20.00 ft
Min Apron Width =	7.50 ft
Min Apron Depth =	2.13 ft
Min Riprap Size =	NCDOT Class '1'

Appendix 6: SCM Design Summaries

- SCM 1 Outlet Structure Design
- SCM 1 Elevation-Volume Table
- SCM 2 Outlet Structure Design
- SCM 2 Elevation-Volume Table
- SCM 3 Outlet Structure Design
- SCM 3 Elevation-Volume Table
- SCM 4 Outlet Structure Design
- SCM 4 Elevation-Volume Table

Table of Contents

Subsection: Outlet Input Data
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Requested Pond Water Surface Elevations	
Minimum (Headwater)	355.50 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	363.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser - 1	Forward	Culvert - Outlet	361.00	363.00
Orifice-Circular	Orifice - NP	Forward	Culvert - Outlet	357.50	363.00
Culvert-Circular	Culvert - Outlet	Forward	TW	356.25	363.00
Irregular Weir	Weir - ESPY	Forward	TW	362.00	363.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Structure ID: Culvert - Outlet Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	30.0 in
Length	182.75 ft
Length (Computed Barrel)	182.75 ft
Slope (Computed)	0.007 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.009
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.303
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	356.25 ft	T1 Flow	27.16 ft³/s
T2 Elevation	359.51 ft	T2 Flow	31.05 ft³/s

Structure ID: Riser - 1 Structure Type: Inlet Box	
Number of Openings	1
Elevation	361.00 ft
Orifice Area	16.0 ft²
Orifice Coefficient	0.600
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Orifice - NP Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	357.50 ft
Orifice Diameter	2.3 in
Orifice Coefficient	0.600

Structure ID: Weir - ESPY
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	363.00
3.00	362.00
13.00	362.00
16.00	363.00

Lowest Elevation	362.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft

Convergence Tolerances	
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
357.50	0.00	(N/A)	0.00
357.60	0.01	(N/A)	0.00
357.70	0.04	(N/A)	0.00
357.80	0.06	(N/A)	0.00
357.90	0.07	(N/A)	0.00
358.00	0.09	(N/A)	0.00
358.10	0.09	(N/A)	0.00
358.20	0.10	(N/A)	0.00
358.30	0.11	(N/A)	0.00
358.40	0.12	(N/A)	0.00
358.50	0.13	(N/A)	0.00
358.60	0.13	(N/A)	0.00
358.70	0.14	(N/A)	0.00
358.80	0.15	(N/A)	0.00
358.90	0.15	(N/A)	0.00
359.00	0.16	(N/A)	0.00
359.10	0.16	(N/A)	0.00
359.20	0.18	(N/A)	0.00
359.30	0.18	(N/A)	0.00
359.40	0.18	(N/A)	0.00
359.50	0.18	(N/A)	0.00
359.60	0.19	(N/A)	0.00
359.70	0.19	(N/A)	0.00
359.80	0.20	(N/A)	0.00
359.90	0.20	(N/A)	0.00
360.00	0.21	(N/A)	0.00
360.10	0.21	(N/A)	0.00
360.20	0.21	(N/A)	0.00
360.30	0.22	(N/A)	0.00
360.40	0.22	(N/A)	0.00
360.50	0.23	(N/A)	0.00
360.60	0.23	(N/A)	0.00
360.70	0.23	(N/A)	0.00
360.80	0.24	(N/A)	0.00
360.90	0.24	(N/A)	0.00
361.00	0.25	(N/A)	0.00
361.10	1.78	(N/A)	0.00
361.20	4.56	(N/A)	0.00
361.30	8.14	(N/A)	0.00
361.40	12.38	(N/A)	0.00
361.50	17.19	(N/A)	0.00
361.60	22.53	(N/A)	0.00
361.70	28.29	(N/A)	0.00
361.80	34.50	(N/A)	0.00

Subsection: Composite Rating Curve
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
361.90	41.11	(N/A)	0.00
362.00	47.37	(N/A)	0.00
362.10	48.83	(N/A)	0.00
362.20	51.14	(N/A)	0.00
362.30	54.06	(N/A)	0.00
362.40	57.53	(N/A)	0.00
362.50	61.50	(N/A)	0.00
362.60	65.97	(N/A)	0.00
362.70	70.90	(N/A)	0.00
362.80	76.29	(N/A)	0.00
362.90	82.14	(N/A)	0.00
363.00	88.46	(N/A)	0.00

Contributing Structures
(no Q: Riser - 1,Orifice - NP,Culvert - Outlet,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Riser - 1,Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-1
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Riser - 1,Culvert - Outlet (no Q: Orifice - NP,Weir - ESPY)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)
Riser - 1,Culvert - Outlet,Weir - ESPY (no Q: Orifice - NP)

Subsection: Outlet Input Data
Label: OCS-2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Requested Pond Water Surface Elevations	
Minimum (Headwater)	357.50 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	363.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 2	Forward	Culvert-Outlet	359.00	363.00
Inlet Box	Riser - 2	Forward	Culvert-Outlet	359.75	363.00
Orifice-Circular	Orifice - NP	Forward	Culvert-Outlet	357.50	363.00
Culvert-Circular	Culvert-Outlet	Forward	TW	356.25	363.00
Irregular Weir	Weir - ESPY	Forward	TW	362.00	363.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Orifice - NP Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	357.50 ft
Orifice Diameter	3.5 in
Orifice Coefficient	0.600

Subsection: Outlet Input Data
Label: OCS-2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Structure ID: Culvert-Outlet Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	80.75 ft
Length (Computed Barrel)	80.75 ft
Slope (Computed)	0.009 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.007
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1.156
T2 ratio (HW/D)	1.302
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	359.72 ft	T1 Flow	42.85 ft³/s
T2 Elevation	360.16 ft	T2 Flow	48.97 ft³/s

Structure ID: Riser - 2 Structure Type: Inlet Box	
Number of Openings	1
Elevation	359.75 ft
Orifice Area	25.0 ft²
Orifice Coefficient	0.600
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Weir - ESPY
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	363.00
3.00	362.00
13.00	362.00
16.00	363.00

Lowest Elevation	362.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Weir - 2 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	359.00 ft
Weir Length	3.50 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft

Convergence Tolerances	
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: OCS-2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
357.50	0.00	(N/A)	0.00
357.60	0.02	(N/A)	0.00
357.70	0.06	(N/A)	0.00
357.80	0.13	(N/A)	0.00
357.90	0.16	(N/A)	0.00
358.00	0.19	(N/A)	0.00
358.10	0.22	(N/A)	0.00
358.20	0.24	(N/A)	0.00
358.30	0.26	(N/A)	0.00
358.40	0.28	(N/A)	0.00
358.50	0.30	(N/A)	0.00
358.60	0.31	(N/A)	0.00
358.70	0.33	(N/A)	0.00
358.80	0.35	(N/A)	0.00
358.90	0.36	(N/A)	0.00
359.00	0.37	(N/A)	0.00
359.10	0.73	(N/A)	0.00
359.20	1.34	(N/A)	0.00
359.30	2.16	(N/A)	0.00
359.40	3.09	(N/A)	0.00
359.50	4.15	(N/A)	0.00
359.60	5.33	(N/A)	0.00
359.70	6.61	(N/A)	0.00
359.75	7.29	(N/A)	0.00
359.80	8.65	(N/A)	0.00
359.90	12.88	(N/A)	0.00
360.00	18.39	(N/A)	0.00
360.10	24.90	(N/A)	0.00
360.20	31.76	(N/A)	0.00
360.30	38.18	(N/A)	0.00
360.40	44.32	(N/A)	0.00
360.50	49.94	(N/A)	0.00
360.60	53.74	(N/A)	0.00
360.70	55.50	(N/A)	0.00
360.80	56.62	(N/A)	0.00
360.90	57.72	(N/A)	0.00
361.00	58.79	(N/A)	0.00
361.10	59.87	(N/A)	0.00
361.20	60.89	(N/A)	0.00
361.30	61.92	(N/A)	0.00
361.40	62.92	(N/A)	0.00
361.50	63.92	(N/A)	0.00
361.60	64.90	(N/A)	0.00
361.70	65.85	(N/A)	0.00

Subsection: Composite Rating Curve
Label: OCS-2
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
361.80	66.79	(N/A)	0.00
361.90	67.73	(N/A)	0.00
362.00	68.64	(N/A)	0.00
362.10	70.53	(N/A)	0.00
362.20	73.25	(N/A)	0.00
362.30	76.58	(N/A)	0.00
362.40	80.45	(N/A)	0.00
362.50	84.81	(N/A)	0.00
362.60	89.65	(N/A)	0.00
362.70	94.95	(N/A)	0.00
362.80	100.72	(N/A)	0.00
362.90	106.94	(N/A)	0.00
363.00	113.61	(N/A)	0.00

Contributing Structures
(no Q: Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Orifice - NP,Culvert-Outlet (no Q: Weir - 2,Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Orifice - NP,Culvert-Outlet (no Q: Riser - 2,Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Weir - 2,Riser - 2,Orifice - NP,Culvert-Outlet (no Q: Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Weir - 2,Riser - 2,Culvert-Outlet (no Q: Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet (no Q: Weir - 2,Orifice - NP,Weir - ESPY)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)
Riser - 2,Culvert-Outlet,Weir - ESPY (no Q: Weir - 2,Orifice - NP)

Subsection: Outlet Input Data
Label: OCS-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Requested Pond Water Surface Elevations	
Minimum (Headwater)	354.50 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	362.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Area	Orifice - 2 Year	Forward	Culvert - Outlet	357.25	362.00
Inlet Box	Riser - 3	Forward	Culvert - Outlet	360.00	362.00
Orifice-Circular	Orifice - NP	Forward	Culvert - Outlet	354.50	362.00
Culvert-Circular	Culvert - Outlet	Forward	TW	354.25	362.00
Irregular Weir	Weir - ESPY	Forward	TW	361.00	362.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: OCS-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Structure ID: Culvert - Outlet Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	30.0 in
Length	74.00 ft
Length (Computed Barrel)	74.00 ft
Slope (Computed)	0.003 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.009
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1.159
T2 ratio (HW/D)	1.305
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	357.15 ft	T1 Flow	27.16 ft³/s
T2 Elevation	357.51 ft	T2 Flow	31.05 ft³/s

Structure ID: Orifice - NP Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	354.50 ft
Orifice Diameter	3.3 in
Orifice Coefficient	0.600

Structure ID: Riser - 3 Structure Type: Inlet Box	
Number of Openings	1
Elevation	360.00 ft
Orifice Area	16.0 ft²
Orifice Coefficient	0.600
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Weir - ESPY
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	362.00
3.00	361.00
13.00	361.00
16.00	362.00

Lowest Elevation	361.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Orifice - 2 Year Structure Type: Orifice-Area	
Number of Openings	1
Elevation	357.25 ft
Orifice Area	3.5 ft²
Top Elevation	358.25 ft
Datum Elevation	357.75 ft
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: OCS-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
354.50	0.00	(N/A)	0.00
354.60	0.02	(N/A)	0.00
354.70	0.06	(N/A)	0.00
354.80	0.11	(N/A)	0.00
354.90	0.14	(N/A)	0.00
355.00	0.17	(N/A)	0.00
355.10	0.19	(N/A)	0.00
355.20	0.21	(N/A)	0.00
355.30	0.23	(N/A)	0.00
355.40	0.24	(N/A)	0.00
355.50	0.26	(N/A)	0.00
355.60	0.28	(N/A)	0.00
355.70	0.29	(N/A)	0.00
355.80	0.30	(N/A)	0.00
355.90	0.31	(N/A)	0.00
356.00	0.32	(N/A)	0.00
356.10	0.34	(N/A)	0.00
356.20	0.35	(N/A)	0.00
356.30	0.36	(N/A)	0.00
356.40	0.37	(N/A)	0.00
356.50	0.38	(N/A)	0.00
356.60	0.39	(N/A)	0.00
356.70	0.40	(N/A)	0.00
356.80	0.41	(N/A)	0.00
356.90	0.42	(N/A)	0.00
357.00	0.43	(N/A)	0.00
357.10	0.43	(N/A)	0.00
357.20	0.44	(N/A)	0.00
357.25	0.46	(N/A)	0.00
357.30	1.04	(N/A)	0.00
357.40	2.23	(N/A)	0.00
357.50	3.40	(N/A)	0.00
357.60	4.59	(N/A)	0.00
357.70	5.77	(N/A)	0.00
357.80	6.97	(N/A)	0.00
357.90	8.15	(N/A)	0.00
358.00	9.34	(N/A)	0.00
358.10	10.54	(N/A)	0.00
358.20	11.71	(N/A)	0.00
358.30	12.90	(N/A)	0.00
358.40	13.98	(N/A)	0.00
358.50	15.00	(N/A)	0.00
358.60	15.94	(N/A)	0.00
358.70	16.82	(N/A)	0.00

Subsection: Composite Rating Curve
Label: OCS-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
358.80	17.67	(N/A)	0.00
358.90	18.49	(N/A)	0.00
359.00	19.25	(N/A)	0.00
359.10	19.99	(N/A)	0.00
359.20	20.70	(N/A)	0.00
359.30	21.39	(N/A)	0.00
359.40	22.06	(N/A)	0.00
359.50	22.72	(N/A)	0.00
359.60	23.35	(N/A)	0.00
359.70	23.97	(N/A)	0.00
359.80	24.56	(N/A)	0.00
359.90	25.16	(N/A)	0.00
360.00	25.73	(N/A)	0.00
360.10	27.79	(N/A)	0.00
360.20	31.10	(N/A)	0.00
360.30	34.47	(N/A)	0.00
360.40	37.32	(N/A)	0.00
360.50	40.39	(N/A)	0.00
360.60	43.58	(N/A)	0.00
360.70	46.68	(N/A)	0.00
360.80	49.67	(N/A)	0.00
360.90	52.40	(N/A)	0.00
361.00	54.62	(N/A)	0.00
361.10	56.96	(N/A)	0.00
361.20	59.33	(N/A)	0.00
361.30	62.31	(N/A)	0.00
361.40	65.83	(N/A)	0.00
361.50	69.85	(N/A)	0.00
361.60	74.36	(N/A)	0.00
361.70	79.33	(N/A)	0.00
361.80	84.77	(N/A)	0.00
361.90	90.67	(N/A)	0.00
362.00	97.03	(N/A)	0.00

Contributing Structures
(no Q: Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - NP,Culvert - Outlet (no Q: Orifice - 2 Year,Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-3
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)
Orifice - 2 Year,Orifice - NP,Culvert - Outlet (no Q: Riser - 3,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet (no Q: Weir - ESPY)
Orifice - 2 Year,Riser - 3,Orifice - NP,Culvert - Outlet,Weir - ESPY
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)

Composite Outflow Summary

Contributing Structures
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)
Riser - 3,Culvert - Outlet,Weir - ESPY (no Q: Orifice - 2 Year,Orifice - NP)

Subsection: Outlet Input Data
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Requested Pond Water Surface Elevations	
Minimum (Headwater)	362.50 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	370.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Area	Orifice - WQ	Forward	Culvert - 4	363.75	370.00
Inlet Box	Riser - 4	Forward	Culvert - 4	368.00	370.00
Orifice-Circular	Orifice - NP	Forward	Culvert - 4	362.50	370.00
Culvert-Circular	Culvert - 4	Forward	TW	360.50	370.00
Irregular Weir	Weir - ESPY	Forward	TW	369.00	370.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Structure ID: Culvert - 4 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.0 in
Length	78.50 ft
Length (Computed Barrel)	78.51 ft
Slope (Computed)	0.013 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.012
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1.154
T2 ratio (HW/D)	1.300
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	362.81 ft	T1 Flow	15.55 ft³/s
T2 Elevation	363.10 ft	T2 Flow	17.77 ft³/s

Structure ID: Riser - 4 Structure Type: Inlet Box	
Number of Openings	1
Elevation	368.00 ft
Orifice Area	16.0 ft²
Orifice Coefficient	0.600
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: Orifice - NP Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	362.50 ft
Orifice Diameter	2.8 in
Orifice Coefficient	0.600

Structure ID: Orifice - WQ Structure Type: Orifice-Area	
Number of Openings	1
Elevation	363.75 ft
Orifice Area	1.0 ft²
Top Elevation	364.25 ft
Datum Elevation	364.00 ft
Orifice Coefficient	0.600

Structure ID: Weir - ESPY
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	370.00
3.00	369.00
13.00	369.00
16.00	370.00

Lowest Elevation	369.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
362.50	0.00	(N/A)	0.00
362.60	0.01	(N/A)	0.00
362.70	0.05	(N/A)	0.00
362.80	0.09	(N/A)	0.00
362.90	0.11	(N/A)	0.00
363.00	0.12	(N/A)	0.00
363.10	0.14	(N/A)	0.00
363.20	0.15	(N/A)	0.00
363.30	0.16	(N/A)	0.00
363.40	0.18	(N/A)	0.00
363.50	0.19	(N/A)	0.00
363.60	0.20	(N/A)	0.00
363.70	0.21	(N/A)	0.00
363.75	0.21	(N/A)	0.00
363.80	0.46	(N/A)	0.00
363.90	0.95	(N/A)	0.00
364.00	1.44	(N/A)	0.00
364.10	1.93	(N/A)	0.00
364.20	2.41	(N/A)	0.00
364.30	2.89	(N/A)	0.00
364.40	3.33	(N/A)	0.00
364.50	3.67	(N/A)	0.00
364.60	4.01	(N/A)	0.00
364.70	4.31	(N/A)	0.00
364.80	4.60	(N/A)	0.00
364.90	4.87	(N/A)	0.00
365.00	5.12	(N/A)	0.00
365.10	5.36	(N/A)	0.00
365.20	5.59	(N/A)	0.00
365.30	5.81	(N/A)	0.00
365.40	6.02	(N/A)	0.00
365.50	6.23	(N/A)	0.00
365.60	6.43	(N/A)	0.00
365.70	6.63	(N/A)	0.00
365.80	6.82	(N/A)	0.00
365.90	6.99	(N/A)	0.00
366.00	7.17	(N/A)	0.00
366.10	7.35	(N/A)	0.00
366.20	7.52	(N/A)	0.00
366.30	7.69	(N/A)	0.00
366.40	7.85	(N/A)	0.00
366.50	8.00	(N/A)	0.00
366.60	8.15	(N/A)	0.00
366.70	8.30	(N/A)	0.00

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
366.80	8.47	(N/A)	0.00
366.90	8.60	(N/A)	0.00
367.00	8.74	(N/A)	0.00
367.10	8.89	(N/A)	0.00
367.20	9.03	(N/A)	0.00
367.30	9.17	(N/A)	0.00
367.40	9.30	(N/A)	0.00
367.50	9.44	(N/A)	0.00
367.60	9.58	(N/A)	0.00
367.70	9.70	(N/A)	0.00
367.80	9.83	(N/A)	0.00
367.90	9.96	(N/A)	0.00
368.00	10.08	(N/A)	0.00
368.10	11.73	(N/A)	0.00
368.20	14.61	(N/A)	0.00
368.30	18.32	(N/A)	0.00
368.40	22.66	(N/A)	0.00
368.50	26.71	(N/A)	0.00
368.60	30.87	(N/A)	0.00
368.70	35.07	(N/A)	0.00
368.80	38.97	(N/A)	0.00
368.90	41.81	(N/A)	0.00
369.00	42.18	(N/A)	0.00
369.10	43.44	(N/A)	0.00
369.20	45.56	(N/A)	0.00
369.30	48.29	(N/A)	0.00
369.40	51.57	(N/A)	0.00
369.50	55.35	(N/A)	0.00
369.60	59.62	(N/A)	0.00
369.70	64.36	(N/A)	0.00
369.80	69.57	(N/A)	0.00
369.90	75.25	(N/A)	0.00
370.00	81.38	(N/A)	0.00

Contributing Structures
(no Q: Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)

Composite Outflow Summary

Contributing Structures
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - NP,Culvert - 4 (no Q: Orifice - WQ,Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Orifice - NP,Culvert - 4 (no Q: Riser - 4,Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Orifice - WQ,Riser - 4,Orifice - NP,Culvert - 4 (no Q: Weir - ESPY)
Riser - 4,Culvert - 4 (no Q: Orifice - WQ,Orifice - NP,Weir - ESPY)

Subsection: Composite Rating Curve
Label: OCS-4
Scenario: Post-Development 1 year

Return Event: 1 years
Storm Event: 1 year

Composite Outflow Summary

Contributing Structures
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)
Riser - 4,Culvert - 4,Weir - ESPY (no Q: Orifice - WQ,Orifice - NP)

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