Preliminary Stormwater Analysis

for

Wait Avenue Residential

Rolesville, North Carolina

Prepared By

STEWART
STRONGER BY DESIGN

December 23, 2020

Preliminary Stormwater Analysis

for

Wait Avenue Residential
Rolesville, North Carolina

Prepared for:

PULTE HOME COMPANY, LLC

Prepared by:

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Raleigh, NC 27603
919.380.8750

FOR REVIEW ONLY

Stewart Project No. C19003

December 23, 2020

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PRELIMINARY STORMWATER ANALYSIS
WAIT AVENUE RESIDENTIAL
ROLESVILLE, NORTH CAROLINA

1. Design Requirements

The Preliminary Stormwater Analysis has been prepared specifically to address water quality and quantity standards set forth in the Wake County Environmental Services Department, Water Quality Division, Watershed Management Section's – Pre-submittal Plan Review Checklist for Rolesville. Refer to Appendix A for the checklist. The proposed Wait Avenue Residential project will be designated as a High-Density development with more than 24% Built-Upon Area.

Standards for High-Density Projects in Rolesville [7.5.4(A)(4)] are as follows:

- Measures shall control and treat runoff from the 1st inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

- Structural Control Measures (SCMs) shall be designed to have a minimum of 85% average annual removal for Total Suspended Solids (TSS) and reduce Total Nitrogen Export (TNE) to less than 3.6 lbs/acre/year.

- Permanent SCMs are to be designed in accordance with and as specified in the North Carolina Department of Environmental Quality's BMP Design Manual and the Wake County Municipal Stormwater Tool.

- No net increase in peak flow leaving the site from the pre-development conditions for the 1-year-24 hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

- Location of development outside Riparian Buffer and Flood Protection Zones

2. Background Site Information

The Wait Avenue Residential site is located in the Town of Rolesville approximately 600-feet southwest of the intersection of Wait Avenue and Averette Road. The site is located within the Neuse River Basin, but not a water supply watershed. According to FIRM Panel #3720186000J, there are no floodplains or special flood hazard areas on the subject site. Soils on-site consist of mostly Vance, Helena, and Wedowee-Saw soils which are classified as Hydrologic Soil Group D. Refer to Appendix B for mapping information.

3. Design Approach

Improvements to the proposed site include construction of roadway and utility infrastructure for development of a maximum of 315 residential dwelling units with a mix of single family lots and townhomes. Enhanced landscape and streetscape will be designed for the outdoor amenity areas. Three (3) wet detention ponds are proposed to mitigate impacts to stormwater quality and quantity in accordance with the design standards.

4. Preliminary Stormwater Calculations

Calculated amounts of stormwater runoff from the proposed development including buildings, roadways, and sitewalks will be captured and directed to wet detention ponds for treatment and detention. The site has been spilt into three (3) phases of development on each side of two (2) stream features. Refer to Appendix C for the delineation of Drainage Areas and summary of Impervious Areas. Preliminary BMP Sizing Design Worksheets in Appendix C demonstrate compliance with NCDEQ's BMP Design Manual for the SCMs for each Phase:

- Phase 1 – SCM #1 Surface Area = 18,155 SF for 23.18 acres of runoff with 10.40 acres of impervious. Preliminary Grading provides a Surface Area of 23,034 SF

- Phase 2 – SCM #2 Surface Area = 25,481 SF for 25.63 acres of runoff with 15.11 acres of impervious. Preliminary Grading provides a Surface Area of 25,996 SF

- Phase 3 – SCM #3 Surface Area = 8,008 SF for 9.65 acres of runoff with 3.04 acres of impervious. Preliminary Grading provides a Surface Area of 8,945 SF

At a later date for Construction Drawings, the Wake County Municipal Stormwater Tool Discharge will be used to confirm pre- and post-development peak flows at the Point of Analysis for all three (3) SCMs at the southwest corner of the site. Total Nitrogen Export from the site will be calculated at the time of Construction Drawings using the apportioning method since the project is a new development.

Appendix A
Pre-submittal Plan Review Checklist

PPR – Pre-submittal Plan Review Checklist - Municipalities

Project Name	Wait Avenue Residential			Planning Number		Jurisdiction	Rolesville
Applicant	Pulte Home Company, LLC			Watershed	None	New or Expansion (N/E)?	New
Project Acreage	84.90	Existing Impervious SF	32,670	Proposed Impervious SF	1,243,638	Disturbed Acreage	67.70

☒	Residential	☐	Nonresidential

Review Status: **12/22/2020**	☒ Preliminary Subdivision Plan Comments Provided All checked items must be addressed and all applicable requirements met prior to approval of construction plans. Comments in red must be addressed prior to preliminary plan approval

Submittal Package Requirements
Items marked with an "X" were noted as either insufficient or not provided. Engineer comments are in **RED** and provide the necessary requirements for either pre-construction or construction plan approval.

☒	1.		Cover letter stating the purpose of the submission
☐	2.		One copy of the Municipal Stormwater Tool (Site Data Sheet, Drainage Area Sheets, Site Summary Sheet, BMP Sheets, and BMP Summary sheet). The design tool is located at: http://www.wakegov.com/water/stormwater/management/program/Pages/default.aspx
☒	3.		Drainage Area Maps with stormwater discharge points (existing/post construction/post BMP)
☒	4.		Copy of the USGS Quad Map with delineated project limits
☒	5.		Copy of the Wake County Soil Survey map with delineated project limits
☒	6.		Proposed Site Plan:
	☒	a.	North arrow, graphic scale, drafting version date, and legend
	☒	b.	Show all Neuse Riparian Buffers : [15A NCAC 02B.0233 & 0242]
	☒	c.	Delineation of all existing and proposed impervious surfaces: roads, well lots, recreation sites, single family residences, etc. (consistent with Municipal SW Tool inputs)
	☒	d.	Delineation of current FEMA boundaries (floodway, flood fringe & future/0.2%)

PPR – Pre-submittal Plan Review Checklist - Municipalities

☒	**e.**	Proposed drainage easements and widths *(in Feet)*
☒	**f.**	Location and type of all proposed stormwater management structures *(grass swale, wet/dry detention basin, filtering/infiltration basin, bioretention, etc.).*
☒	**g.**	Proposed easement access lanes and sediment disposal areas for future maintenance of stormwater management facilities.
☐	**h.**	A note should be added to the recorded plat distinguishing areas of disconnected impervious (refer to town websites and ordinances for final plat requirements)

Standards and Requirements Items marked with an "X" note relevant standards to be applied to the proposed development. Notes in RED provide review comments and/or any required elements to comply with standard. References are shown in brackets for the municipalities. **ROLESVILLE**: *Town of Rolesville Unified Development Ordinance (UDO) Section 7.5: Stormwater Management Standards* **WENDELL**: *Town of Wendell Unified Development Ordinance (UDO) Chapter 6: Environmental Protection*, adopted 7/26/10. **ZEBULON**: *Town of Zebulon, NC Code of Ordinances: Chapter 151 and Chapter 152.249.*	

Stormwater Management Requirements

☒	**7.**	**Stormwater Review Required** - All residential subdivision development must submit a plan to comply with the applicable municipalities' stormwater ordinance. Office, institutional, commercial or industrial development that <u>disturbs</u> greater than 20,000 square feet is required to comply with the stormwater management regulations. Development and redevelopment that disturb less than 20,000 square feet are not exempt if such activities are part of a larger common plan of development or sale, even though multiple, separate or distinct activities take place at different times on different schedules. **Rolesville** [7.5.1(E)], **Wendell** [Chapter 6.5(F)], **Zebulon** [Chapter 151.05]
☒	**8.**	**Stormwater Permit** – is required for all development and redevelopment unless exempt pursuant to the Code of Ordinances. A permit may only be issued subsequent to a properly submitted, reviewed and approved stormwater management plan and permit application. **Rolesville** 7.5.1(E)(3)], **Wendell** [Chapter 6.5(F)(3)], **Zebulon** [Chapter 151.21(A)] Note: A permit may not be required if there are no post-construction requirements (i.e. SCMs).
☒	**9.**	**SCMs** - For projects requiring stormwater treatment for quality and/or quantity control, the applicant must: 1) comply with the NC BMP Manual **Rolesville** [7.5.1(G)], **Wendell** [6.5(H)], **Zebulon** [151.07] 2) as well as *Completion of Improvements and Maintenance,* prior to issuance of a certificate of compliance or occupancy. **Rolesville** [7.5.5], **Wendell** [Chapter 6.5(O)], **Zebulon** [Chapter 151.50 – 151.56]
☒	**10.**	**Standards Based on Project Density**- In accordance with the definitions, projects are identified as Ultra Low-Density (15%or less Built-Upon Area, referred to as BUA, and less than one dwelling unit per acre), Low-Density (more than 15% BUA and no more than 24% BUA), and High-Density (24% or more BUA). **Rolesville** [7.5.4], **Wendell** [Chapter 6.5(M)], **Zebulon** [Chapter 151.35]

PPR – Pre-submittal Plan Review Checklist - Municipalities

	☐	a.	**Standards for Ultra-Low and Low-Density Projects:** • Use of vegetated conveyances to maximum extent practicable • Location of development and redevelopment outside Riparian Buffer and Flood Protection Zones • Recorded deed restrictions or protective covenants to ensure future development maintains consistency with approved project plans • Permanent SCMs (Stormwater Control Measures) are to be designed in accordance with and as specified in the North Carolina Department of Environmental Quality's Design Manual. • For Low-Density only, no net increase in peak flow leaving the site from the pre- development conditions for the 1 yr-24hr storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours. • Residential runoff after development must not exceed the Target Curve Numbers listed in the chart "Maximum Composite Curve Number, by Soil Group". • Ultra-Low and Low-Density projects may be eligible for target curve number credits. **Wendell Only**: Nitrogen export limited to 3.6 pounds per acre per year unless project achieves classification as an LID Project. **Rolesville** [7.5.4(A)(1-3)], **Wendell** [6.5(M)(1-3)], **Zebulon** [151.35(A-C)]
	☒	b.	**Standards for High-Density Projects:** • Measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours. • Structural measures shall be designed to have a minimum of 85 % average annual removal for Total Suspended Solids (TSS) • Permanent SCMs (Stormwater Control Measures) are to be designed in accordance with and as specified in the North Carolina Department of Environmental Quality's Design Manual. • No net increase in peak flow leaving the site from the pre -development conditions for the 1 yr-24hr storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours. • Location of development and redevelopment outside Riparian Buffer and Flood Protection Zones **Wendell Only:** Nitrogen export limited to 3.6 pounds per acre per year unless project achieves classification as an LID Project. **Rolesville** [7.5.4(A)(4)], **Wendell** [6.5(M)(4)], **Zebulon** [151.35(D)]
	☐	c.	**General Standards:** • Downstream Impact Analysis – DIA must be performed in accordance with the "10% rule", and a copy provided with the application. **Rolesville** [7.5.4(B)(1)], **Wendell** [6.5(N)(1)], **Zebulon** [151.36(A)]

PPR – Pre-submittal Plan Review Checklist - Municipalities

☐	d.	**Low Impact Development (LID) Classification:**
		• All development or redevelopment may be submitted for LID classification
		• Development must mimic the pre-developed hydrologic conditions of the site, as defined as "woods in good condition" for the 2-yr, 24 hr storm, within 10%.
		• Techniques required to achieve LID classification
		   ➜ Natural site design
		   ➜ Bio-retention systems or on-site infiltration (at least one must be used)
		   ➜ At least **two** other techniques from the list provided in **Rolesville** [7.5.4(B)(5)(e) and **Zebulon** [151.36(E)(5)
		   ➜ At least **one** other techniques from the list provided in **Wendell** [6.5(N)(5)(e)

Town of Wendell UDO Chapter 6.3 - Erosion and Sedimentation Control Requirements		

☐	11.	**Erosion Control:** This project will require a Land Disturbance Permit if it involves greater than one acre of disturbance. Adopting by reference the Wake County Soil Erosion and Sedimentation Control Ordinance. See website for details.

Riparian Buffer Rules

☐	12.	Due to the location of this project, it should be noted that a rule to protect and maintain existing buffers along watercourses in the Neuse River Basin became effective on July 22, 1997. The **Neuse River Riparian Area Protection and Maintenance Rule (15A NCAC 2B.0233)** applies to all perennial and intermittent streams, lakes, ponds and estuaries in the Neuse River Basin with forest vegetation on the adjacent land or "riparian area".

Suggested Changes/Comments

☐	13.	

Wake County PE: **Contact Info:**

Appendix B
Background Site Information

FEMA Flood Insurance Rate Map

U.S.G.S. Quadrangle Map

Wake County Soil Map

Watershed Map

National Flood Hazard Layer FIRMette

FEMA

35°57'47.91"N
78°27'34.48"W

WAKE COUNTY
370368

AREA OF MINIMAL FLOOD HAZARD
Zone X

3720186000J
eff. 5/2/2006

78°26'57.03"W

35°57'18.78"N

USGS The National Map: Orthoimagery. Data refreshed October 2017.

Feet
1:6,000

0   250   500   1,000   1,500   2,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

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*
	Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

NO SCREEN	Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

| – – – | Channel, Culvert, or Storm Sewer |
| |||||| | Levee, Dike, or Floodwall |

OTHER FEATURES

$\overset{20.2}{\underset{17.5}{B}}$	Cross Sections with 1% Annual Chance Water Surface Elevation
B – –	Coastal Transect
~~513~~	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
– – –	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature

MAP PANELS

| | Digital Data Available |
| | No Digital Data Available |
| | Unmapped |

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/4/2018 at 12:17:29 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

(Joins sheet 11)

(15)

N
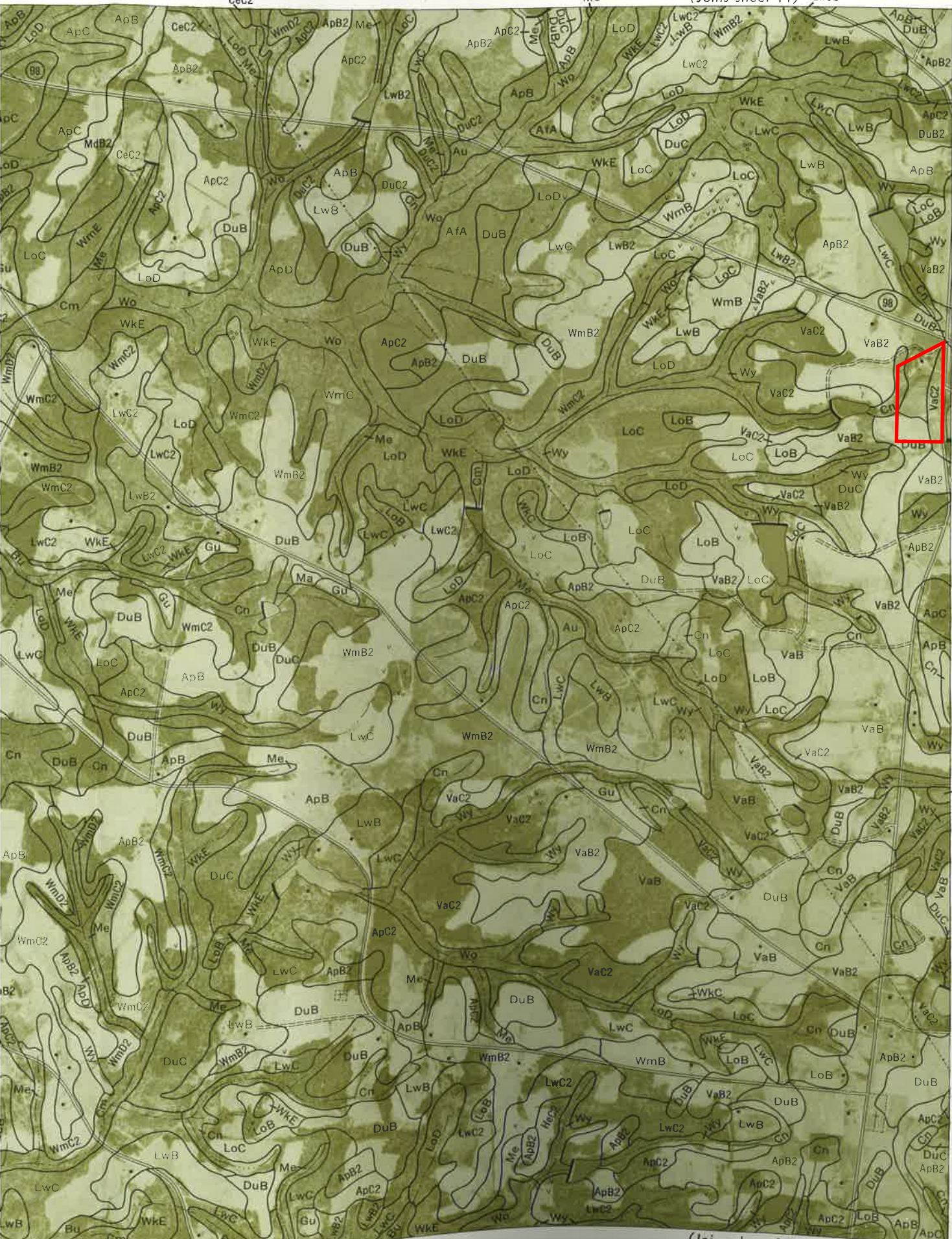
(Joins sheet 16)

Scale 1:15840

(Joins sheet 22)

≡USGS
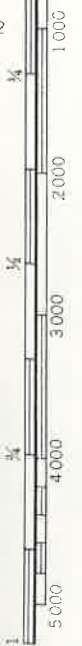
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

ROLESVILLE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES

SITE

WAKE
FOREST

Rolesville

Harris
Crossroads

Lassiter

Fowlers
Crossroads

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
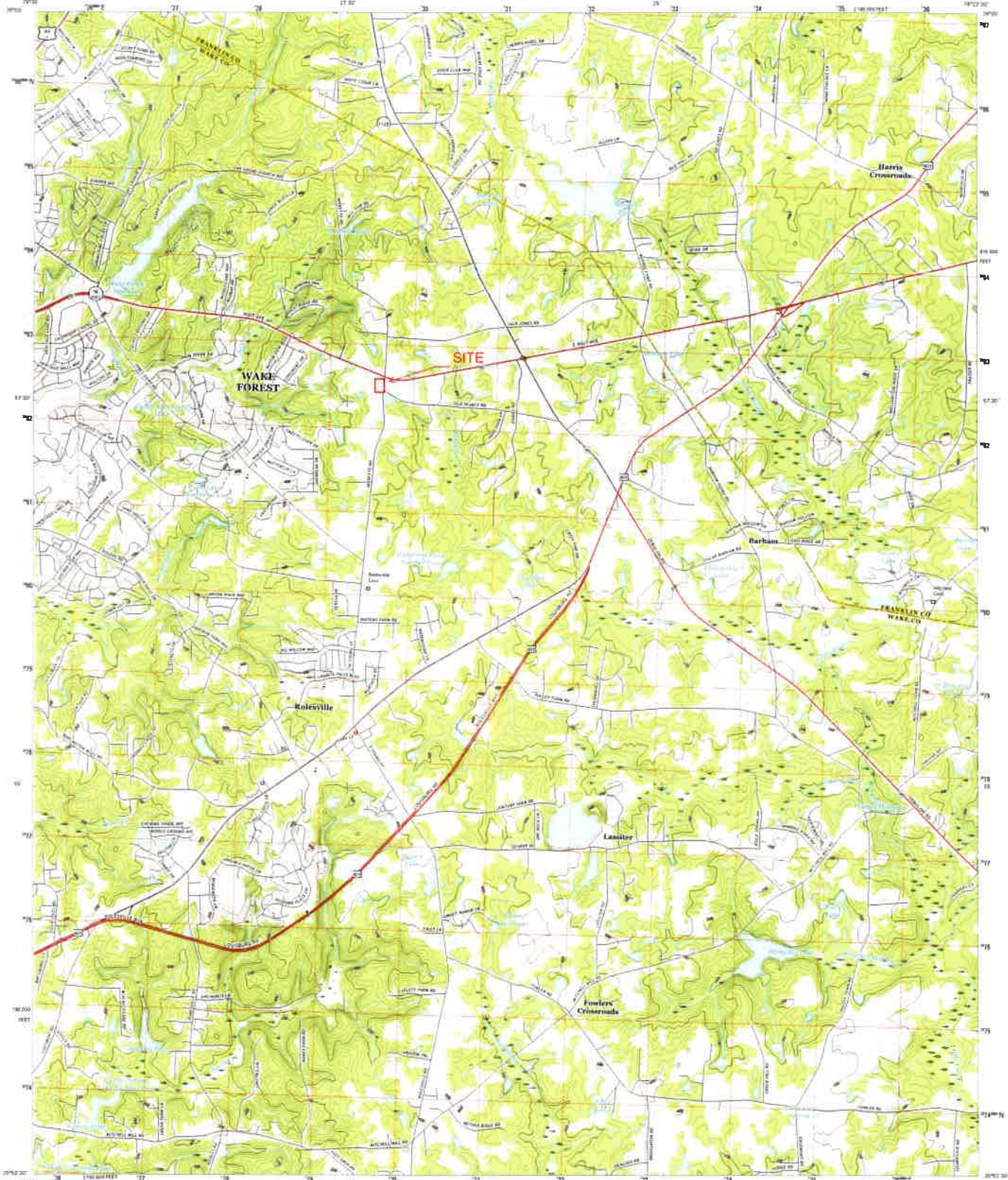
Produced by the United States Geological Survey

ROAD CLASSIFICATION

ROLESVILLE, NC

2016

NC Water Supply Watersheds

7/5/2018, 9:10:38 AM

Water Supply Watersheds

WS-II NSWP

1:5,000
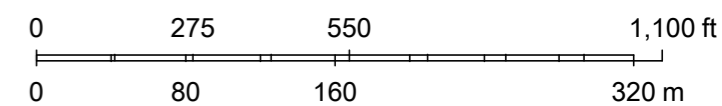
| 0 | 275 | 550 | 1,100 ft |

| 0 | 80 | 160 | 320 m |

Appendix C
Preliminary Stormwater Calculations

Drainage and Impervious Area Map

BMP Sizing Design Worksheets

POND A
Drainage Area: 951,840
Lots: 55 SF, 32 THs(28'), 22 THs (22')
4,000 SF / Lot, 2,000 THs / unit
Total Lot Impr: 328,000
Road: 126,548
Sidewalk: 44,050

POND B
Drainage Area: 807,063
Lots:135 TH, 25SF
4000SF / Lot, 2000 TH / Unit
Total Lot Impr: 320,000
Road: 148,607
Sidewalk:43,226

POND C
Drainage Area: 540,963
Lots: 41
4000SF / Lot
Total Lot Impr: 154,000
Road: 86,108
Sidewalk: 30,781
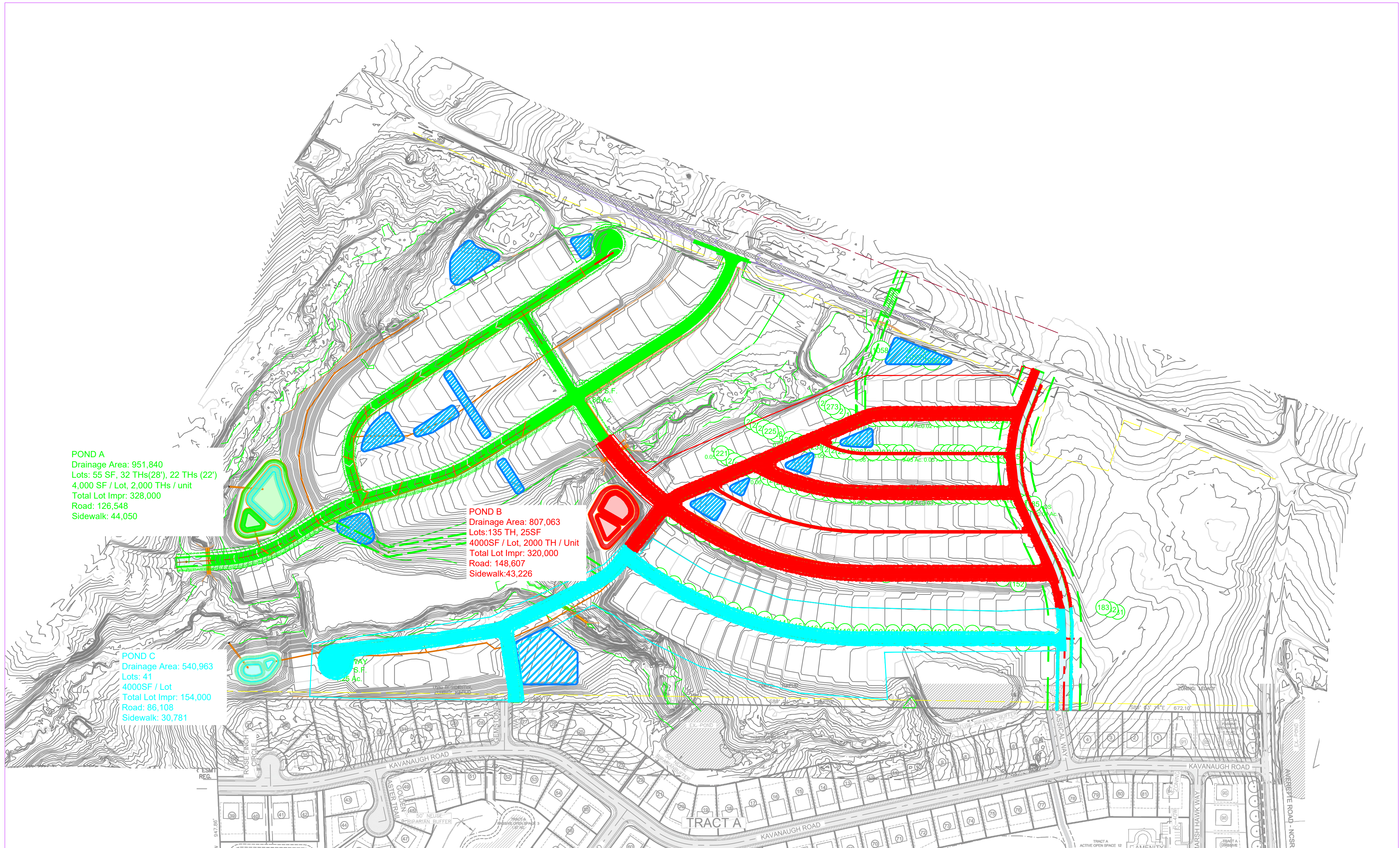
	POND A	POND B	POND C	
Surface Area Required at Normal Pool =	19,103	19,668.60	15,544.65	sf
Surface Area Provided at Normal Pool =	**23,034**	**13,191.00**	**5,476.00**	**sf**
Temporary Storage Volume Required =	41,361	41,750.24	22,570.69	cf
Temporary Storage Volume Provided =	**43,812**	**42,530.96**	**24,595.01**	**cf**

Project:	Wait Avenue	Date:	12/23/20
Project No:	C19003	By:	MLP

Wet Detention Pond Sizing Calculations (90% TSS Removal)

Drainage Area A - SCM#1   *Input values in red*

Drainage Area	
Total Drainage Area (sf)	1,009,753
On-site Drainage Area (sf)	884,335
Off-site Drainage Area (sf)	125,418

Pervious Surface Area	
Managed Pervious Area (sf)	
Unmanged Pervious Area (pasture) (sf)	
Forest (sf)	
Total Pervious Area (sf)	556,873

Impervious Surface Area	
On-site Buildings/Lots (sf)	273,000
On-site Roadway (sf)	137,192
On-site Rural (sf)	0
On-site Sidewalk (sf)	42,688
Future (sf)	0
Off-site (sf)	0
Existing BUA* (sf)	0
Total Impervious Area (sf)	**452,880**

* = Report only amount of existing BUA that will remain after development. Do not report any existing BUA that is to be removed and which will be replaced by new BUA

Required Surface Area			Required Storage		
Total Drainage Area =	23.18	ac	Simple Method for 1st inch of runoff		
Total Impervious Area =	10.40	ac			
Percent Impervious =	44.85%		$Rv = 0.05 + 0.009(I)$		
Design Rainfall Depth =	1	in	I = % impervious =	45%	
Average Perm. Pool Depth =	5.65	ft			
Max. Perm. Pool Depth =	8	ft			
SA/DA Ratio =	1.80		Rv =	0.45	in
Surface Area Required =	**18,155**	**sf**	**Volume =**	**38,173**	**cf**
=	**0.42**	**ac**			

Calculation Methods are taken from DEHNR Stormwater Best Management Practices Manual, Latest Version

Surface Area Required at Normal Pool =	18,155 sf
Surface Area Provided at Normal Pool =	**23,034 sf**
Temporary Storage Volume Required =	38,173 cf
Temporary Storage Volume Provided =	**40,836 cf**

Project:	Wait Avenue	Date:	12/23/20
Project No:	C19003	By:	MLP

Water Quality Drawdown Calculations

Drainage Area A - SCM#1   *Input values in red*

Storage Volume Required (Simple Method)	Basin Characteristics
Total Drainage Area = 23.18 ac	Pond Invert = 348.50 ft
Total Impervious Area = 10.40 ac	Normal Pool Elevation = 356.50 ft
Percent Impervious = 45%	Next available Outlet = 358.00 ft
	Storage Depth = 1.50 ft
Rv = 0.05 + 0.009(I)	Driving Head (H/3)= 0.50 ft
I = % impervious = 45%	Ks = 26,249
Rv = 0.45 in	b= 1.09
	Minimum depth
Runoff Volume Required = **38,173 cf**	required for storage = 1.41 ft

Temporary Storage Volume = **40,836 cf**
Temporary Storage Surface Area = **29,673 sf**

Find orifice size for 2-day drawdown time

Flow Rate = Volume (cf) / Time (sec) = 0.2363 cfs

$Q=C_D*A*(2*g*h)^{\wedge}(1/2)$ (Orifice Equation - solve for A (area))
A= 0.06941 ft^2
9.99509 in^2

Orifice Size (2 day) = 3.57 " (dia)

Find orifice size for 5-day drawdown time

Flow Rate = Volume (cf) / Time (sec) = 0.0884 cfs

$Q=C_D*A*(2*g*h)^{\wedge}(1/2)$ (Orifice Equation - solve for A (area))
A= 0.02595 ft^2
3.73731 in^2
Orifice Size (5 day) = 2.18 " (dia)

Select Orifice Size: **2.5 " dia**

Actual Drawdown Time

Volume = 40,836 cf
Pipe Size = 2.5 "dia
Area = 0.03409 ft^2
Flow Rate = 0.11606 cfs

Drawdown Time = **4.07 days**

Project: Wait Avenue
Project No: C19003

Date: 12/23/20
By: MLP

Wet Detention Pond Sizing Calculations (90% TSS Removal)

Drainage Area 2 - SCM#2

Input values in red

Drainage Area	
Total Drainage Area (sf)	1,116,387
On-site Drainage Area (sf)	1,116,387
Off-site Drainage Area (sf)	0

Pervious Surface Area	
Managed Pervious Area (sf)	
Unmanged Pervious Area (pasture) (sf)	
Forest (sf)	
Total Pervious Area (sf)	458,105

Impervious Surface Area	
On-site Buildings/Lots (sf)	408,000
On-site Roadway (sf)	192,206
On-site Rural (sf)	0
On-site Sidewalk (sf)	58,076
Future (sf)	0
Off-site (sf)	0
Existing BUA* (sf)	0
Total Impervious Area (sf)	**658,282**

* = Report only amount of existing BUA that will remain after development. Do not report any existing BUA that is to be removed and which will be replaced by new BUA

Required Surface Area			Required Storage		
Total Drainage Area =	25.63	ac	Simple Method for 1st inch of runoff		
Total Impervious Area =	15.11	ac			
Percent Impervious =	58.97%		$Rv = 0.05 + 0.009(I)$		
Design Rainfall Depth =	1	in	I = % impervious =	59%	
Average Perm. Pool Depth =	5.59	ft			
Max. Perm. Pool Depth =	8	ft			
SA/DA Ratio =	2.28			$Rv =$	0.58	in
Surface Area Required =	**25,481**	**sf**	**Volume =**	**54,023**	**cf**
=	0.58	ac			

Calculation Methods are taken from DEHNR Stormwater Best Management Practices Manual, Latest Version

Surface Area Required at Normal Pool =	25,481 sf
Surface Area Provided at Normal Pool =	**25,996 sf**
Temporary Storage Volume Required =	54,023 cf
Temporary Storage Volume Provided =	**54,563 cf**

Water Quality Drawdown Calculations

Drainage Area 2 - SCM#2   *Input values in red*

Storage Volume Required (Simple Method)	Basin Characteristics
Total Drainage Area = 25.62872 ac	Pond Invert = 377.50 ft
Total Impervious Area = 15.11208 ac	Normal Pool Elevation = 385.50 ft
Percent Impervious = 59%	Next available Outlet = 387.32 ft
	Storage Depth = 1.82 ft
$Rv = 0.05 + 0.009(I)$	Driving Head (H/3) = 0.61 ft
I = % impervious = 59%	Ks = 28711
Rv = 0.58 in	b = 1.07
	Minimum depth
Runoff Volume Required = 54,023 cf	required for storage = 1.80 ft

Temporary Storage Volume = **54,563 cf**

Temporary Storage Surface Area = **32,144 sf**

Find orifice size for 2-day drawdown time

     Flow Rate = Volume (cf) / Time (sec) =   0.3158   cfs

     $Q = C_D \cdot A \cdot (2 \cdot g \cdot h)^{(1/2)}$ (Orifice Equation - solve for A (area))

         A = 0.08419 ft^2

         12.12406 in^2

     Orifice Size (2 day) =   3.93 " (dia)

Find orifice size for 5-day drawdown time

     Flow Rate = Volume (cf) / Time (sec) =   0.1251 cfs

     $Q = C_D \cdot A \cdot (2 \cdot g \cdot h)^{(1/2)}$ (Orifice Equation - solve for A (area))

         A = 0.03334 ft^2

         4.80160 in^2

     Orifice Size (5 day) =   2.47 " (dia)

     Select Orifice Size: **2.5 " dia**

Actual Drawdown Time

     Volume = 54,563 cf

     Pipe Size = 2.5 "dia

     Area = 0.034088 ft^2

     Flow Rate = 0.127843 cfs

     Drawdown Time = **4.94 days**

Project: Wait Avenue   **Date:** 12/23/20
Project No: C19003   **By:** MLP

Wet Detention Pond Sizing Calculations (90% TSS Removal)

Drainage Area C - SCM#3   *Input values in red*

Drainage Area	
Total Drainage Area (sf)	420,524
On-site Drainage Area (sf)	284,891
Off-site Drainage Area (sf)	135,633

Pervious Surface Area	
Managed Pervious Area (sf)	
Unmanged Pervious Area (pasture) (sf)	
Forest (sf)	
Total Pervious Area (sf)	287,968

Impervious Surface Area	
On-site Buildings/Lots (sf)	54,583
On-site Roadway (sf)	42,508
On-site Rural (sf)	0
On-site Sidewalk (sf)	13,465
Future (sf)	0
Off-site (sf)	22,000
Existing BUA* (sf)	0
Total Impervious Area (sf)	**132,556**

* = Report only amount of existing BUA that will remain after development. Do not report any existing BUA that is to be removed and which will be replaced by new BUA

Required Surface Area				Required Storage			
Total Drainage Area =	9.65	ac		Simple Method for 1st inch of runoff			
Total Impervious Area =	3.04	ac					
Percent Impervious =	31.52%			$Rv = 0.05 + 0.009(I)$			
Design Rainfall Depth =	1	in		I = % impervious =	32%		
Average Perm. Pool Depth =	3.35	ft					
Max. Perm. Pool Depth =	4.5	ft					
SA/DA Ratio =	1.90				Rv =	0.33	in
Surface Area Required =	**8,008**	**sf**		**Volume =**	**11,694**	**cf**	
=	**0.18**	**ac**					

Calculation Methods are taken from DEHNR Stormwater Best Management Practices Manual, Latest Version

Surface Area Required at Normal Pool =	8,008 sf
Surface Area Provided at Normal Pool =	**8,945 sf**
Temporary Storage Volume Required =	11,694 cf
Temporary Storage Volume Provided =	**11,800 cf**

Water Quality Drawdown Calculations

Drainage Area C - SCM#3 *Input values in red*

Storage Volume Required (Simple Method)		Basin Characteristics	
Total Drainage Area =	9.6539 ac	Pond Invert =	349.00 ft
Total Impervious Area =	3.04307 ac	Normal Pool Elevation =	353.50 ft
Percent Impervious =	32%	Next available Outlet =	354.60 ft
		Storage Depth =	1.10 ft
Rv = 0.05 + 0.009(I)		Driving Head (H/3)=	0.37 ft
I = % impervious =	32%	Ks =	10605
Rv =	0.33 in	b=	1.12
		Minimum depth	
Runoff Volume Required =	**11,694 cf**	required for storage =	1.09 ft

Temporary Storage Volume = **11,800 cf**
Temporary Storage Surface Area = **12,015 sf**

Find orifice size for 2-day drawdown time

Flow Rate = Volume (cf) / Time (sec) = 0.0683 cfs

$Q=C_D*A*(2*g*h)^{(1/2)}$ (Orifice Equation - solve for A (area))
A= 0.02342 ft^2
3.37253 in^2

Orifice Size (2 day) = 2.07 " (dia)

Find orifice size for 5-day drawdown time

Flow Rate = Volume (cf) / Time (sec) = 0.0271 cfs

$Q=C_D*A*(2*g*h)^{(1/2)}$ (Orifice Equation - solve for A (area))
A= 0.00928 ft^2
1.33693 in^2

Orifice Size (5 day) = 1.30 " (dia)

Select Orifice Size: **2 " dia**

Actual Drawdown Time

Volume = 11800 cf
Pipe Size = 2 "dia
Area = 0.02182 ft^2
Flow Rate = 0.06361 cfs

Drawdown Time = **2.15 days**