



October 4, 2016

Mr. Mark Maynard
Echo Farms Apartments, LLC
10 S. Cardinal Drive
Wilmington, NC 28403

**Subject: Stormwater Management Permit No. 2016010R1
Echo Farms Apartments
High Density Development**

Dear Mr. Maynard:

The City of Wilmington Engineering Division has received a request for a revision to the Stormwater Management Permit for Echo Farms Apartments. Having reviewed the application and all supporting materials, the City of Wilmington has determined that the proposed revision meets the requirements of the City of Wilmington's Comprehensive Stormwater Ordinance.

The revisions include:

Adjustment of the parking and sidewalk in front of Building #2, the clubhouse, the sidewalk around the clubhouse, the mail kiosk and Wet Pond #1 resulting in additional impervious surface draining to Infiltration Basin #1 and Wet Pond #1.

Please be aware all terms and conditions of the permit issued on 3/3/2016 remain in full force and effect. Any additional changes to the approved plans must be approved by this office prior to construction. The issuance of the plan revision does not preclude the permittee from complying with all other applicable statutes, rules, regulations or ordinances which may have jurisdiction over the proposed activity, and obtaining a permit or approval prior to construction.

The revised stamped, approved stormwater management drawings will be released for construction by the Wilmington Planning Division under separate cover. Please replace any old plan sheets from the approved set with the new, revised sheet. An electronic copy of the approved drawing set, permit, application and supplementary documents will be maintained by the Wilmington Engineering Division. If you have any questions, or need additional information, please contact Richard Christensen at (910) 341-7813 or richard.christensen@wilmingtonnc.gov

Sincerely,

A handwritten signature in blue ink, appearing to read "Sterling Cheatham".

for Sterling Cheatham, City Manager
City of Wilmington

cc: Justin C. Bishop, PE, Malpass Engineering & Surveying, P.C.
Brian Chambers, Associate Planner, City of Wilmington

III. CONTACT INFORMATION

1. Print Applicant / Signing Official's name and title (specifically the developer, property owner, lessee, designated government official, individual, etc. who owns the project):

Applicant / Organization: Echo Farm Apartments, LLC

Signing Official & Title: Mark Maynard, Manager

- a. Contact information for Applicant / Signing Official:

Street Address: 10 S. Cardinal Drive

City: Wilmington State: NC Zip: 28403

Phone: 910-251-5030 Fax: _____ Email: matt@tributeproperties.com

Mailing Address (if different than physical address): _____

City: _____ State: _____ Zip: _____

- b. Please check the appropriate box. The applicant listed above is:

The property owner (Skip to item 3)

Lessee* (Attach a copy of the lease agreement and complete items 2 and 2a below)

Purchaser* (Attach a copy of the pending sales agreement and complete items 2 and 2a below)

Developer* (Complete items 2 and 2a below.)

2. Print Property Owner's name and title below, if you are the lessee, purchaser, or developer. (This is the person who owns the property that the project is on.)

Property Owner / Organization: _____

Signing Official & Title: _____

- a. Contact information for Property Owner:

Street Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____ Email: _____

Mailing Address (if different than physical address): _____

City: _____ State: _____ Zip: _____

3. (Optional) Print the name and title of another contact such as the project's construction supervisor or another person who can answer questions about the project:

Other Contact Person / Organization: _____

Signing Official & Title: _____

a. Contact information for person listed in item 3 above:

Street Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____ Email: _____

Mailing Address (if different than physical address): _____

City: _____ State: _____ Zip: _____

IV. PROJECT INFORMATION

1. In the space provided below, briefly summarize how the stormwater runoff will be treated.

Stormwater will be treated in three permeable pavement systems, an infiltration basin, & a wet pond.

2. Total Property Area: 475,805 square feet

3. Total Coastal Wetlands Area: 0 square feet

4. Total Surface Water Area: 0 square feet

5. Total Property Area (2) – Total Coastal Wetlands Area (3) – Total Surface Water Area (4) = Total Project Area: 475,805 square feet.

6. Existing Impervious Surface within Property Area: 20,504 square feet

7. Existing Impervious Surface to be Removed/Demolished: 20,504 square feet

8. Existing Impervious Surface to Remain: 0 square feet

9. Total Onsite (within property boundary) Newly Constructed Impervious Surface (*in square feet*):

Buildings/Lots (including overhang)	59,296
Impervious Pavement	71,700
Pervious Pavement (adj. total, with 75 % credit applied)	10,836
Impervious Sidewalks	13,628
Pervious Sidewalks (adj. total, with % credit applied)	0
Other (describe) (pool apron, trash compactor, mail kiosk)	6,027
Future Development	1,350
Total Onsite Newly Constructed Impervious Surface	162,837

10. Total Onsite Impervious Surface

(Existing Impervious Surface to remain + Onsite Newly Constructed Impervious Surface) = 162,837 square feet

11. Project percent of impervious area: (Total Onsite Impervious Surface / Total Project Area) x100 = 34.23 %

12. Total Offsite Newly Constructed Impervious Area (improvements made outside of property boundary, in square feet):

Impervious Pavement	1,476
Pervious Pavement (adj. total, with % credit applied)	0
Impervious Sidewalks	1,962
Pervious Sidewalks (adj. total, with % credit applied)	0
Other (describe)	0
Total Offsite Newly Constructed Impervious Surface	3,438

13. Total Newly Constructed Impervious Surface

(Total Onsite + Offsite Newly Constructed Impervious Surface) = 166,275 square feet

14. Complete the following information for each Stormwater BMP drainage area. If there are more than three drainage areas in the project, attach an additional sheet with the information for each area provided in the same format as below. Low Density projects may omit this section and skip to Section V.

Basin Information	Wet Pond #1 BMP # 1	Infiltration Basin #1 BMP # 2	Perm. Pvmt. Sys. #1 BMP # 3
Receiving Stream Name	Barnards Creek	Barnards Creek	Barnards Creek
Receiving Stream Index Number	18-80	18-80	18-80
Stream Classification	C; Sw	C;Sw	C;Sw
Total Drainage Area (sf)	239,060	61,901	36,178
On-Site Drainage Area (sf)	239,060	61,901	36,178
Off-Site Drainage Area (sf)	0	0	0
Total Impervious Area (sf)	111,276	21,200	22,521
Buildings/Lots (sf)	30,819	3,500	13,998
Impervious Pavement (sf)	65,872	16,354	1,129
Pervious Pavement (sf), 75% credit (sf)	0	0	4,553
Impervious Sidewalks (sf)	8,092	1,188	2,345
Pervious Sidewalks (sf)	0	0	0
Other (sf)	5,143	158	496
Future Development (sf)	1,350	0	0
Existing Impervious to remain (sf)	0	0	0
Offsite (sf)	0	0	0
Percent Impervious Area (%)	46.55	34.25	62.25

15. How was the off-site impervious area listed above determined? Provide documentation:

N/A

BMP Drainage area information (continued)

Basin Information	(Perm. Pvmt. Sys. #2) BMP # 4	(Perm. Pvmt. Sys. #3) BMP # 5	(Type of BMP) BMP #
Receiving Stream Name	Barnards Creek	Barnards Creek	
Receiving Stream Index Number	18-80	18-80	
Stream Classification	C;Sw	C;Sw	
Total Drainage Area (sf)	29882	17713	0
On-Site Drainage Area (sf)	29882	17713	
Off-Site Drainage Area (sf)	0	0	
Total Impervious Area (sf)	17737	11012	0
Buildings/Lots (sf)	10499	3980	
Impervious Pavement (sf)	1027	3672	
Pervious Pavement, 75 % credit (sf)	4049	2234	
Impervious Sidewalks (sf)	1873	1027	
Pervious Sidewalks, % credit (sf)	0	0	
Other (sf)	289	99	
Future Development (sf)	0	0	
Existing Impervious to remain (sf)	0	0	
Offsite (sf)	0	0	
Percent Impervious Area (%)	59.36	62.17	
Basin Information	(Type of BMP) BMP #	(Type of BMP) BMP #	(Type of BMP) BMP #
Receiving Stream Name			
Receiving Stream Index Number			
Stream Classification			
Total Drainage Area (sf)	0	0	0
On-Site Drainage Area (sf)			
Off-Site Drainage Area (sf)			
Total Impervious Area (sf)	0	0	0
Buildings/Lots (sf)			
Impervious Pavement (sf)			
Pervious Pavement, % credit (sf)			
Impervious Sidewalks (sf)			
Pervious Sidewalks, % credit (sf)			
Other (sf)			
Future Development (sf)			
Existing Impervious to remain (sf)			
Offsite (sf)			
Percent Impervious Area (%)			

V. SUBMITTAL REQUIREMENTS

1. Supplemental and Operation & Maintenance Forms - One applicable City of Wilmington Stormwater BMP supplement form and checklist must be submitted for **each** BMP specified for this project. One applicable proposed operation and maintenance (O&M) form must be submitted for **each type** of stormwater BMP. Once approved, the operation and maintenance forms must be referenced on the final plat and recorded with the register of deeds office.
2. Deed Restrictions and Restrictive Covenants - For all subdivisions, outparcels, and future development, the appropriate property restrictions and protective covenants are required to be recorded prior to the sale of any lot. Due to variability in lot sizes or the proposed BUA allocations, a table listing each lot number, lot size, and the allowable built-upon area must be provided as an attachment to the completed and notarized deed restriction form. The appropriate deed restrictions and protective covenants forms can be downloaded at the link listed in section V (3). Download the latest versions for each submittal.

In instances where the applicant is different than the property owner, it is the responsibility of the property owner to sign the deed restrictions and protective covenants form while the applicant is responsible for ensuring that the deed restrictions are recorded.

By the notarized signature(s) below, the permit holder(s) certify that the recorded property restrictions and protective covenants for this project, if required, shall include all the items required in the permit and listed on the forms available on the website, that the covenants will be binding on all parties and persons claiming under them, that they will run with the land, that the required covenants cannot be changed or deleted without concurrence from the City of Wilmington, and that they will be recorded prior to the sale of any lot.

3. Only complete application packages will be accepted and reviewed by the City. A complete package includes all of the items listed on the City Engineering Plan Review Checklist, including the fee. Copies of the Engineering Plan Review Checklist, all Forms, Deed Restrictions as well as detailed instructions on how to complete this application form may be downloaded from:

<http://www.wilmingtonnc.gov/PublicServices/Engineering/PlanReview/StormwaterPermits.aspx>

The complete application package should be submitted to the following address:

City of Wilmington – Engineering
Plan Review Section
212 Operations Center Dr
Wilmington, NC 28412



VI. CONSULTANT INFORMATION AND AUTHORIZATION

1. Applicant: Complete this section if you wish to designate authority to another individual and/or firm (such as a consulting engineer and /or firm) so that they may provide information on your behalf for this project (such as addressing requests for additional information).

Consulting Engineer: Jeff Malpass & Justin C. Bishop

Consulting Firm: Malpass Engineering & Surveying, P.C.

a. Contact information for consultant listed above:

Mailing Address: 1134 Shipyard Blvd

City: Wilmington State: NC Zip: 28412

Phone: 910-392-5243 Fax: 910-392-5203 Email: jeffmalpass@bizec.rr.com

VII. PROPERTY OWNER AUTHORIZATION (If Section III(2) has been filled out, complete this section)

I, (*print or type name of person listed in Contact Information, item 2*) _____, certify that I own the property identified in this permit application, and thus give permission to (*print or type name of person listed in Contact Information, item 1*) _____ with (*print or type name of organization listed in Contact Information, item 1*) _____ to develop the project as currently proposed. A copy of the lease agreement or pending property sales contract has been provided with the submittal, which indicates the party responsible for the operation and maintenance of the stormwater system.

As the legal property owner I acknowledge, understand, and agree by my signature below, that if my designated agent (*entity listed in Contact Information, item 1*) dissolves their company and/or cancels or defaults on their lease agreement, or pending sale, responsibility for compliance with the City of Wilmington Stormwater Permit reverts back to me, the property owner. As the property owner, it is my responsibility to notify the City of Wilmington immediately and submit a completed Name/Ownership Change Form within 30 days; otherwise I will be operating a stormwater treatment facility without a valid permit. I understand that the operation of a stormwater treatment facility without a valid permit is a violation of the City of Wilmington Municipal Code of Ordinances and may result in appropriate enforcement including the assessment of civil penalties.

SEAL

Signature: _____

_____ Date: _____

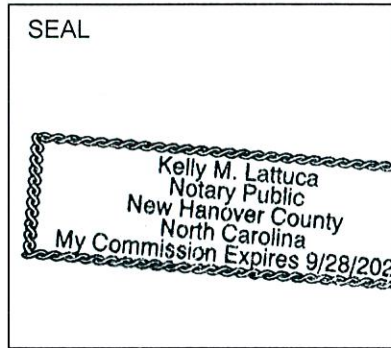
I, _____, a Notary Public for the State of _____, County of _____, do hereby certify that _____ personally appeared before me this day of _____, _____.

and acknowledge the due execution of the application for a stormwater permit. Witness my hand and official seal,

My commission expires: _____

VIII. APPLICANT'S CERTIFICATION

I, (print or type name of person listed in Contact Information, item 1), Mark Maynard certify that the information included on this permit application form is, to the best of my knowledge, correct and that the project will be constructed in conformance with the approved plans, that the required deed restrictions and protective covenants will be recorded, and that the proposed project complies with the requirements of the applicable stormwater rules under.



Signature: [Handwritten Signature]
Date: 8/23/16

I, Kelly M. Lattuca, a Notary Public for the State of North Carolina, County of New Hanover, do hereby certify that mark Maynard personally appeared before me this day of August 23, 2016, and acknowledge the due execution of the application for a stormwater

permit. Witness my hand and official seal,

Kelly M Lattuca
My commission expires: 9/28/20

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ENGINEERING

STORMWATER MANAGEMENT PERMIT APPLICATION FORM
 401 CERTIFICATION APPLICATION FORM
WET DETENTION BASIN SUPPLEMENT

This form must be filled out, printed and submitted.
 The Required Items Checklist (Part III) must be printed, filled out and submitted along with all of the required information.

I. PROJECT INFORMATION

Project name	Echo Farm Apartments
Contact person	Matt Maynard
Phone number	910-251-5030
Date	9/9/2016
Drainage area number	1

II. DESIGN INFORMATION

Site Characteristics

Drainage area	239,060 ft ²
Impervious area, post-development	111,276 ft ²
% impervious	46.55 %
Design rainfall depth	1.5 in

Storage Volume: Non-SA Waters

Minimum volume required	14,014 ft ³
Volume provided	13,868 ft ³

Storage Volume: SA Waters

1.5" runoff volume	ft ³
Pre-development 1-yr, 24-hr runoff	ft ³
Post-development 1-yr, 24-hr runoff	ft ³
Minimum volume required	ft ³
Volume provided	ft ³

Peak Flow Calculations

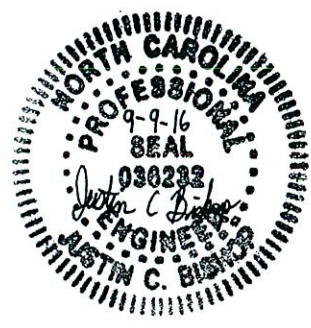
Is the pre/post control of the 1yr 24hr storm peak flow required?	Y (Y or N)
1-yr, 24-hr rainfall depth	3.9 in
Rational C, pre-development	0.17 (unitless)
Rational C, post-development	(unitless)
Rainfall intensity: 1-yr, 24-hr storm	2.96 in/hr
Pre-development 1-yr, 24-hr peak flow	2.76 ft ³ /sec
Post-development 1-yr, 24-hr peak flow	ft ³ /sec
Pre/Post 1-yr, 24-hr peak flow control	ft ³ /sec

Elevations

Temporary pool elevation	11.20 fmsl
Permanent pool elevation	10.00 fmsl
SHWT elevation (approx. at the perm. pool elevation)	11.64 fmsl
Top of 10ft vegetated shelf elevation	10.50 fmsl
Bottom of 10ft vegetated shelf elevation	9.50 fmsl
Sediment cleanout, top elevation (bottom of pond)	3.50 fmsl
Sediment cleanout, bottom elevation	2.50 fmsl
Sediment storage provided	1.00 ft

Is there additional volume stored above the state-required temp. pool? N (Y or N)
 Elevation of the top of the-additional volume _____ fmsl

2,772 ft³ required in Infiltration Basin #1,
 therefore only 11,242 ft³ is required
 in Wet Pond #1
 OK
 Does not include 3,367 cf of volume provided in Infiltration Basin #1.



II. DESIGN INFORMATION

Surface Areas

Area, temporary pool	13,260 ft ²	
Area REQUIRED, permanent pool	7,078 ft ²	
SA/DA ratio	2.96 (unitless)	
Area PROVIDED, permanent pool, A _{perm_pool}	8,686 ft ²	OK
Area, bottom of 10ft vegetated shelf, A _{bot_shelf}	6,728 ft ²	
Area, sediment cleanout, top elevation (bottom of pond), A _{bot_pond}	1,883 ft ²	

Based on impervious area that drains to Infiltration Basin #1 first being treated as grass

Volumes

Volume, temporary pool	13,868 ft ³	OK
Volume, permanent pool, V _{perm_pool}	28,041 ft ³	
Volume, forebay (sum of forebays if more than one forebay)	5,849 ft ³	
Forebay % of permanent pool volume	20.9% %	OK

SA/DA Table Data

Design TSS removal	90 %	
Coastal SA/DA Table Used?	Y (Y or N)	
Mountain/Piedmont SA/DA Table Used?	N (Y or N)	
SA/DA ratio	2.96 (unitless)	

Average depth (used in SA/DA table):

Calculation option 1 used? (See Figure 10-2b)	N (Y or N)	
Volume, permanent pool, V _{perm_pool}	28,041 ft ³	
Area provided, permanent pool, A _{perm_pool}	8,686 ft ²	
Average depth calculated	ft	Need 3 ft min.
Average depth used in SA/DA, d _{av} , (Round to nearest 0.5ft)	ft	
Calculation option 2 used? (See Figure 10-2b)	Y (Y or N)	
Area provided, permanent pool, A _{perm_pool}	8,686 ft ²	
Area, bottom of 10ft vegetated shelf, A _{bot_shelf}	6,728 ft ²	
Area, sediment cleanout, top elevation (bottom of pond), A _{bot_pond}	1,883 ft ²	
"Depth" (distance b/w bottom of 10ft shelf and top of sediment)	6.00 ft	
Average depth calculated	4.28 ft	OK
Average depth used in SA/DA, d _{av} , (Round to nearest 0.5ft)	4.5 ft	OK

Drawdown Calculations

Drawdown through orifice?	Y (Y or N)	
Diameter of orifice (if circular)	1.50 in	
Area of orifice (if-non-circular)	in ²	
Coefficient of discharge (C _D)	0.60 (unitless)	
Driving head (H _o)	0.38 ft	
Drawdown through weir?	N (Y or N)	
Weir type	(unitless)	
Coefficient of discharge (C _w)	(unitless)	
Length of weir (L)	ft	
Driving head (H)	ft	
Pre-development 1-yr, 24-hr peak flow	2.76 ft ³ /sec	
Post-development 1-yr, 24-hr peak flow	ft ³ /sec	
Storage volume discharge rate (through discharge orifice or weir)	0.04 ft ³ /sec	
Storage volume drawdown time	3.62 days	OK, draws down in 2-5 days.

Additional Information

Vegetated side slopes	3 :1	OK
Vegetated shelf slope	10 :1	OK
Vegetated shelf width	10.0 ft	OK
Length of flowpath to width ratio	3 :1	OK
Length to width ratio	4.5 :1	OK
Trash rack for overflow & orifice?	Y (Y or N)	OK
Freeboard provided	3.8 ft	OK
Vegetated filter provided?	N (Y or N)	OK
Recorded drainage easement provided?	Y (Y or N)	OK
Captures all runoff at ultimate build-out?	Y (Y or N)	OK
Drain mechanism for maintenance or emergencies is:	Pump	

Permit Number: _____
 (to be provided by City of Wilmington)
 BMP Drainage Basin #: 1

Wet Detention Basin Operation and Maintenance Agreement



I will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

The wet detention basin system is defined as the wet detention basin, pretreatment including forebays and the vegetated filter if one is provided.

This system (check one):

does does not incorporate a vegetated filter at the outlet.

This system (check one):

does does not incorporate pretreatment other than a forebay.

Important maintenance procedures:

- Immediately after the wet detention basin is established, the plants on the vegetated shelf and perimeter of the basin should be watered twice weekly if needed, until the plants become established (commonly six weeks).
- No portion of the wet detention pond should be fertilized after the first initial fertilization that is required to establish the plants on the vegetated shelf.
- Stable groundcover should be maintained in the drainage area to reduce the sediment load to the wet detention basin.
- If the basin must be drained for an emergency or to perform maintenance, the flushing of sediment through the emergency drain should be minimized to the maximum extent practical.
- Once a year, a dam safety expert should inspect the embankment.

After the wet detention pond is established, it should be inspected **once a month and within 24 hours after every storm event greater than 1.5 inches**. Records of operation and maintenance should be kept in a known set location and must be available upon request. Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

BMP element:	Potential problem:	How I will remediate the problem:
The entire BMP	Trash/debris is present.	Remove the trash/debris.
The side slopes of the wet detention basin	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Vegetation is too short or too long.	Maintain vegetation at a height of approximately six inches.

Permit Number: _____
 (to be provided by City of Wilmington)
 BMP Drainage Basin #: 1

BMP element:	Potential problem:	How I will remediate the problem:
The inlet device: pipe or swale	The pipe is clogged.	Unclog the pipe. Dispose of the sediment off-site.
	The pipe is cracked or otherwise damaged.	Replace the pipe.
	Erosion is occurring in the swale.	Regrade the swale if necessary to smooth it over and provide erosion control devices such as reinforced turf matting or riprap to avoid future problems with erosion.
The forebay	Sediment has accumulated to a depth greater than the original design depth for sediment storage.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.
	Erosion has occurred.	Provide additional erosion protection such as reinforced turf matting or riprap if needed to prevent future erosion problems.
	Weeds are present.	Remove the weeds, preferably by hand. If pesticide is used, wipe it on the plants rather than spraying.
The vegetated shelf	Best professional practices show that pruning is needed to maintain optimal plant health.	Prune according to best professional practices
	The plant community and coverage is significantly (>25%) different from approved landscape plan.	Restore plant vegetation to approved condition. If landscape plan needs to be adjusted to specify vegetation more appropriate for site conditions, contact City Stormwater or Engineering Staff.
	Cattails or other invasive plants cover >25% of the veg't shelf. A monoculture of plants must be avoided)	Remove all invasives by physical removal or by wiping them with pesticide (do not spray) - consult a professional.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application to establish the ground cover if a soil test indicates it is necessary.
The main treatment area	Sediment has accumulated to a depth greater than the original design sediment storage depth.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.

Permit Number: _____
 (to be provided by City of Wilmington)
 BMP Drainage Basin #: 1

BMP element:	Potential problem:	How I will remediate the problem:
The main treatment area (continued)	Algal growth covers over 25% of the area.	Consult a professional to remove and control the algal growth.
	Cattails or other invasive plants cover >25% of the veg't shelf. A monoculture of plants must be avoided)	Remove all invasives by physical removal or by wiping them with pesticide (do not spray) - consult a professional.
The embankment	Shrubs have started to grow on the embankment.	Remove shrubs immediately.
	Evidence of muskrat or beaver activity is present.	Use traps to remove muskrats and consult a professional to remove beavers.
	A tree has started to grow on the embankment.	Consult a dam safety specialist to remove the tree.
	An annual inspection by an appropriate professional shows that the embankment needs repair. (if applicable)	Make all needed repairs.
The outlet device	Clogging has occurred.	Clean out the outlet device. Dispose of the sediment off-site.
	The outlet device is damaged	Repair or replace the outlet device.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the local NC Division of Water Quality Regional Office, or the 401 Oversight Unit at 919-733-1786.

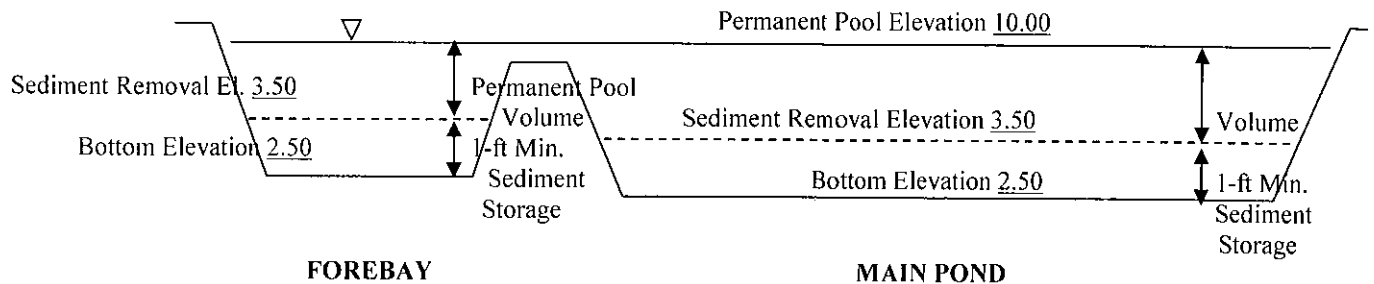
The measuring device used to determine the sediment elevation shall be such that it will give an accurate depth reading and not readily penetrate into accumulated sediments.

When the permanent pool depth reads 6.50 feet in the main pond, the sediment shall be removed.

When the permanent pool depth reads 6.50 feet in the forebay, the sediment shall be removed.

BASIN DIAGRAM

(fill in the blanks)



Permit Number: _____
(to be provided by City of Wilmington)

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed above. I agree to notify the City of Wilmington of any problems with the system or prior to any changes to the system or responsible party.

Project name: Echo Farm Apartments

BMP drainage basin number: 1

Print name: Mark Maynard

Title: Member/manager

Address: 10 S. Cardinal Drive, Wilmington, NC 28403

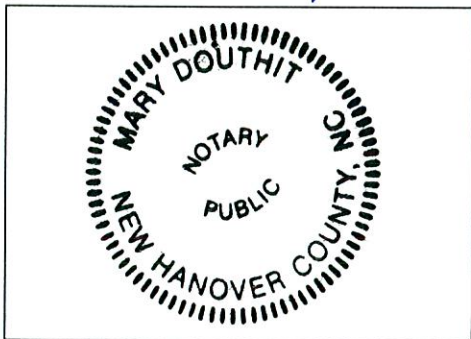
Phone: 910-251-5030

Signature: [Handwritten Signature]

Date: Dec. 17, 2015

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Mary Douthit, a Notary Public for the State of North Carolina, County of New Hanover, do hereby certify that Mark Maynard personally appeared before me this 14TH day of December, 2015, and acknowledge the due execution of the forgoing wet detention basin maintenance requirements. Witness my hand and official seal, Mary Douthit



SEAL

My commission expires 7-1-2020

**STORMWATER MANAGEMENT PERMIT APPLICATION FORM
 401 CERTIFICATION APPLICATION FORM
 INFILTRATION BASIN SUPPLEMENT**

*This form must be filled out, printed and submitted.
 The Required Items Checklist (Part III) must be printed, filled out and submitted along with all of the required information.*

I. PROJECT INFORMATION

Project Name	Echo Farm Apartments
Contact Person	Matt Maynard
Phone Number	910-251-5030
Date	8/22/2016
Drainage Area Number	2

II. DESIGN INFORMATION

Site Characteristics

Drainage area	61,901.00	ft ²
Impervious area	21,200.00	ft ²
Percent impervious	0.34	%
Design rainfall depth	1.50	in

Peak Flow Calculations

1-yr, 24-hr rainfall depth		in
1-yr, 24-hr intensity		in/hr
Pre-development 1-yr, 24-hr discharge		ft ³ /sec
Post-development 1-yr, 24-hr discharge		ft ³ /sec
Pre/Post 1-yr, 24-hr peak flow control		ft ³ /sec

Storage Volume: Non-SA Waters

Minimum design volume required	2,772.00	ft ³
Design volume provided	3,367.00	ft ³

OK for non-SA waters

Storage Volume: SA Waters

1.5" runoff volume		ft ³
Pre-development 1-yr, 24-hr runoff volume		ft ³
Post-development 1-yr, 24-hr runoff volume		ft ³
Minimum required volume		ft ³
Volume provided		ft ³

Soils Report Summary

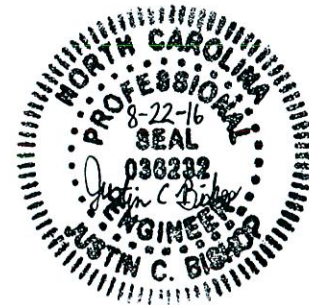
Soil type	Kureb & Leon	
Infiltration rate	24.03	in/hr
SHWT elevation	12.60	fmsl

Basin Design Parameters

Drawdown time	0.04	days	OK
Basin side slopes	3.00	:1	OK
Basin bottom elevation	15.00	fmsl	OK
Storage elevation	16.00	fmsl	
Storage Surface Area	3,817.00	ft ²	
Top elevation	17.50	fmsl	

Basin Bottom Dimensions

Basin length	88.06	ft
Basin width	67.66	ft
Bottom Surface Area	2,925.00	ft ²



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ENGINEERING

Additional Information

Maximum runoff to each inlet to the basin?	0.76	ac-in	OK
Length of vegetative filter for overflow	N/A	ft	OK
Distance to structure	>15	ft	OK
Distance from surface waters	>30	ft	OK
Distance from water supply well(s)	>100	ft	OK
Separation from impervious soil layer	>2	ft	OK
Naturally occurring soil above shwt	4.00	ft	OK
Bottom covered with 4-in of clean sand?	Y	(Y or N)	OK
Proposed drainage easement provided?	Y	(Y or N)	OK
Captures all runoff at ultimate build-out?	Y	(Y or N)	OK
Bypass provided for larger storms?	Y	(Y or N)	OK
Pretreatment device provided			
Catch Basin			

Infiltration Basin Operation and Maintenance Agreement



will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

Important maintenance procedures:

- The drainage area will be carefully managed to reduce the sediment load to the infiltration basin.
- Immediately after the infiltration basin is established, the vegetation will be watered twice weekly if needed until the plants become established (commonly six weeks).
- No portion of the infiltration basin will be fertilized after the initial fertilization that is required to establish the vegetation.
- The vegetation in and around the basin will be maintained at a height of approximately six inches.

After the infiltration basin is established, it will be inspected **once a quarter and within 24 hours after every storm event greater than 1.5 inches**. Records of operation and maintenance will be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

BMP element:	Potential problem:	How I will remediate the problem:
The entire BMP	Trash/debris is present.	Remove the trash/debris.
The perimeter of the infiltration basin	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
The inlet device: pipe or swale	The pipe is clogged (if applicable).	Unclog the pipe. Dispose of the sediment off-site.
	The pipe is cracked or otherwise damaged (if applicable).	Replace the pipe.
	Erosion is occurring in the swale (if applicable).	Regrade the swale if necessary to smooth it over and provide erosion control devices such as reinforced turf matting or riprap to avoid future problems with erosion.

BMP element:	Potential problem:	How I will remediate the problem:
The forebay	Sediment has accumulated and reduced the depth to 75% of the original design depth.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.
	Erosion has occurred or riprap is displaced.	Provide additional erosion protection such as reinforced turf matting or riprap if needed to prevent future erosion problems.
	Weeds are present.	Remove the weeds, preferably by hand. If pesticides are used, wipe them on the plants rather than spraying.
The main treatment area	A visible layer of sediment has accumulated.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP. Replace any media that was removed in the process. Revegetate disturbed areas immediately.
	Water is standing more than 5 days after a storm event.	Replace the top few inches of filter media and see if this corrects the standing water problem. If so, revegetate immediately. If not, consult an appropriate professional for a more extensive repair.
	Weeds and noxious plants are growing in the main treatment area.	Remove the plants by hand or by wiping them with pesticide (do not spray).
The embankment	Shrubs or trees have started to grow on the embankment.	Remove shrubs or trees immediately.
	An annual inspection by an appropriate professional shows that the embankment needs repair.	Make all needed repairs.
The outlet device	Clogging has occurred.	Clean out the outlet device. Dispose of the sediment off-site.
	The outlet device is damaged	Repair or replace the outlet device.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the NC Division of Water Quality 401 Oversight Unit at 919-733-1786.

Permit Number: _____
(to be provided by City of Wilmington)

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed above. I agree to notify the City of Wilmington of any problems with the system or prior to any changes to the system or responsible party.

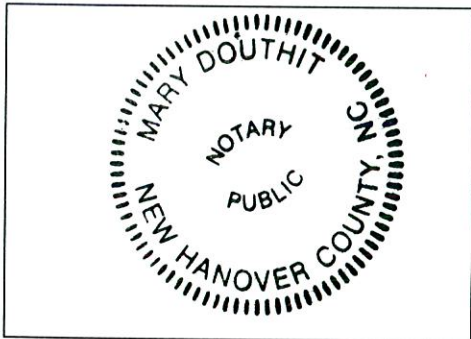
Project name: Echo Farm Apartments
BMP drainage basin number: 2 (Infiltration Basin #1)

Print name: Mark Maynard
Title: Member / Manager
Address: 10 S. Cardinal Drive, Wilmington, NC 28403
Phone: 910-251-5030
Signature: [Handwritten Signature]
Date: Dec. 14, 2015

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Mary Douthit, a Notary Public for the State of North Carolina, County of New Hanover, do hereby certify that Mark Maynard personally appeared before me this 14TH day of December, 2015, and acknowledge the due execution of the forgoing infiltration basin maintenance requirements. Witness my hand and official seal,

Mary Douthit



SEAL

My commission expires 7-1-2020



STORMWATER MANAGEMENT PERMIT APPLICATION FORM
401 CERTIFICATION APPLICATION FORM
PERMEABLE PAVEMENT SUPPLEMENT



This form must be completely filled out, printed and submitted.
The Required Items Checklist (Part III) must be printed, filled out and submitted along with all of the required information.

I. PROJECT INFORMATION

Project Name	Echo Farm Apartments
Contact Person	Matt Maynard
Phone Number	910-251-5030
Date	10/26/2015
Drainage Area	3

II. DESIGN INFORMATION

Soils Report Summary

Hydrologic soil group (HSG) of subgrade	A
Infiltration rate	20.32 in/hr

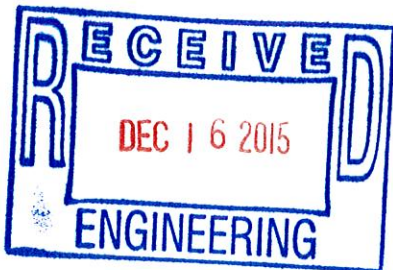
Pavement Design Summary

Permeable Pavement (PP) design type	Infiltration - HSG A/B	
SA of PP being proposed (A _p)	18,210	ft ²
Resulting BUA counted as impervious for main application form	4,553	ft ²
Adjacent BUA directed to PP (A _c)	17,968	ft ² OK
Ratio of A _c to A _p	0.99	(unitless) OK
Flow from pervious surfaces is directed away from PP?	Yes	OK
Design rainfall depth	1.5"	in
Permeable pavement surface course type	PC	
Layer 1 - Washed aggregate size (ex. No. 57)	No. 57 stone	
Layer 1 - Aggregate porosity (n)	0.40	(unitless) OK
Layer 2 - Washed aggregate size (ex. No. 57)		
Layer 2 - Aggregate porosity (n)		(unitless)
Minimum total aggregate depth for design rainfall (D _{wq})	7.5	in
Drawdown/infiltration time for D _{wq}	0.0	days OK
How is 10-yr, 24-hr storm handled?	infiltrated	
Aggregate depth to infiltrate 10-yr, 24-hr storm (D ₁₀)	-210.5	in
Drawdown/infiltration time of 10-yr, 24-hr storm	0.14	days
Actual provided total aggregate depth	8.5	in OK
Top of aggregate base layer elevation	23.51, 24.35, 25.88	fmsl
Storage elevation of design rainfall depth	23.43, 24.27, 25.80	fmsl
Overflow elevation	24.01, 24.85, 26.38	fmsl
Bottom elevation at subgrade	22.80, 23.64, 25.17	fmsl
SHWT elevation	21.48, 22.21, 24.17	fmsl
Underdrain diameter		in

BUA Credit for Permeable Pavement Footprint:
75% BUA Credit



#REF!



Detention Systems *(skip for infiltration systems)*

Diameter of orifice	_____	in
Coefficient of discharge (C _d)	_____	(unitless)
Driving head (H _o)	_____	ft
Storage volume discharge rate (through discharge orifice)	_____	ft ³ /sec
Storage volume drawdown time	_____	days
Pre-development 1-yr, 24-hr peak flow	_____	ft ³ /sec
Post-development 1-yr, 24-hr peak flow	_____	ft ³ /sec

Additional Information

Slope of soil subgrade at bottom of permeable pavement	_____	0.00	%	OK
Slope of the permeable pavement surface	_____	6.00	%	OK
Construction sequence minimizes compaction to soils?	_____	Yes		OK
Subsoil preparation specified (must select one)	_____	scarified		
Meets industry standards for structural requirements?	_____			OK
<u>Washed</u> stone is specified for the aggregate?	_____	Yes		OK
Required signage specified on plans?	_____	Yes		OK
Number of observation wells provided	_____	4		OK
Distance to structure	_____	15.00	ft	
Distance to surface waters	_____	>30	ft	OK
Distance to water supply well(s)	_____	>100	ft	OK

Permeable Pavement

Please indicate the page or plan sheet numbers where the supporting documentation can be found. **An incomplete submittal package will result in a request for additional information. This will delay final review and approval of the project.** Initial in the space provided to indicate the following design requirements have been met. If the applicant has designated an agent, the agent may initial below. **If a requirement has not been met, attach justification.**

Initials	Page/ Plan Sheet No.	Version 1.0
<u>JCB</u>	<u>9, 10</u>	Plans (1" = 50' or larger) of the entire site showing: - Design at ultimate build-out, 1. - Location of permeable pavement, - Roof and other surface flow directed away from permeable pavement,
<u>JCB</u>	<u>13</u>	Section view of the permeable pavement (1" = 20' or larger) showing: 2. - Layers, and - SHWT
<u>JCB</u>	<u>see soils report</u>	3. A soils report that is based upon an actual field investigation, soil borings, and infiltration tests. County soil maps are not an acceptable source of soils information.
<u>JCB</u>	<u>13</u>	4. A construction sequence that shows how the permeable pavement will be protected from sediment until the entire drainage area is stabilized.
<u>JCB</u>	<u>see calcs</u>	5. The supporting calculations.
<u>JCB</u>	<u>see O+M Agreement</u>	6. A copy of the signed and notarized operation and maintenance (O&M) agreement.
<u>N/A</u>	<u>_____</u>	7. A copy of the deed restrictions (if required).
<u>JCB</u>	<u>13</u>	8. Installation must be at a slope of 0.5% or less.

Example #1

Project is a lot with a maximum allowed BUA of 5,000 sq. ft. that drains to class SC waters.

Project proposes a 1,000 sq. ft. permeable concrete driveway with a 6" gravel base.

Managed grass factor = 0.6

$1000 \times 0.6 = 600$ square feet is counted as managed grass.

$1000 - 600 = 400$ square feet is counted as built-upon area.

$5000 - 400 = 4,600$ square feet available for house and other BUA.

Example #2

Project is a high density commercial site with a 5,000 square foot parking lot.

Project is within 1/2 mile of and draining to SA waters. An infiltration system is proposed.

The parking lot will handle <100 cars per day and is a flexible pavement with a 4" gravel base.

Managed grass factor is one half of 0.4. = 0.2

$5000 \times 0.2 = 1000$ square feet is counted as managed grass.

$5000 - 1000 = 4,000$ square is counted as impervious.

The total BUA used to calculate the minimum volume draining to the infiltration system can be reduced by 1,000 square feet.



STORMWATER MANAGEMENT PERMIT APPLICATION FORM
 401 CERTIFICATION APPLICATION FORM
PERMEABLE PAVEMENT SUPPLEMENT



*This form must be completely filled out, printed and submitted.
 The Required Items Checklist (Part III) must be printed, filled out and submitted along with all of the required information.*

I. PROJECT INFORMATION

Project Name	Echo Farm Apartments
Contact Person	Matt Maynard
Phone Number	910-251-5030
Date	10/26/2015
Drainage Area	4

II. DESIGN INFORMATION

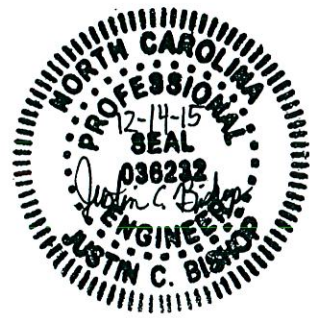
Soils Report Summary

Hydrologic soil group (HSG) of subgrade	A
Infiltration rate	18.50 in/hr

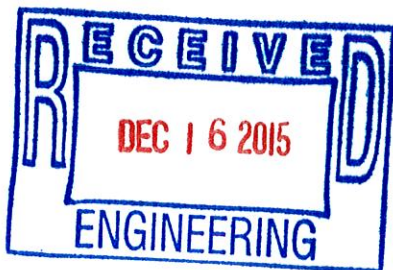
Pavement Design Summary

Permeable Pavement (PP) design type	Infiltration - HSG A/B	
SA of PP being proposed (A _p)	16,194	ft ²
Resulting BUA counted as impervious for main application form	4,049	ft ²
Adjacent BUA directed to PP (A _c)	13,688	ft ² OK
Ratio of A _c to A _p	0.85	(unitless) ✓
Flow from pervious surfaces is directed away from PP?	Yes	OK
Design rainfall depth	1.5"	in
Permeable pavement surface course type	PC	
Layer 1 - Washed aggregate size (ex. No. 57)	No. 57 stone	
Layer 1 - Aggregate porosity (n)		(unitless)
Layer 2 - Washed aggregate size (ex. No. 57)		(unitless)
Layer 2 - Aggregate porosity (n)		(unitless)
Minimum total aggregate depth for design rainfall (D _{wa})	6.9	in
Drawdown/infiltration time for D _{wa}	0.03	days OK
How is 10-yr, 24-hr storm handled?	infiltrated	
Aggregate depth to infiltrate 10-yr, 24-hr storm (D ₁₀)	-191.0	in ✓
Drawdown/infiltration time of 10-yr, 24-hr storm	0.14	days OK
Actual provided total aggregate depth	7.8	in
Top of aggregate base layer elevation	26.50, 27.03	fmsl
Storage elevation of design rainfall depth	26.43, 26.96	fmsl
Overflow elevation	27.0, 27.53	fmsl
Bottom elevation at subgrade	25.85, 26.38	fmsl
SHWT elevation	24.40	fmsl ✓
Underdrain diameter		in

BUA Credit for Permeable Pavement Footprint:
75% BUA Credit



#REF!



Detention Systems (skip for infiltration systems)

Diameter of orifice	_____	in
Coefficient of discharge (C _D)	_____	(unitless)
Driving head (H _o)	_____	ft
Storage volume discharge rate (through discharge orifice)	_____	ft ³ /sec
Storage volume drawdown time	_____	days
Pre-development 1-yr, 24-hr peak flow	_____	ft ³ /sec
Post-development 1-yr, 24-hr peak flow	_____	ft ³ /sec

Additional Information

Slope of soil subgrade at bottom of permeable pavement	0.00	%	OK
Slope of the permeable pavement surface	4.09	%	OK
Construction sequence minimizes compaction to soils?	Yes		OK
Subsoil preparation specified (must select one)	scarified		
Meets industry standards for structural requirements?	_____		OK
<u>Washed</u> stone is specified for the aggregate?	Yes		OK
Required signage specified on plans?	Yes		OK
Number of observation wells provided	3		OK
Distance to structure	7.66	ft	
Distance to surface waters	>30	ft	OK
Distance to water supply well(s)	>100	ft	OK

Permeable Pavement

Please indicate the page or plan sheet numbers where the supporting documentation can be found. **An incomplete submittal package will result in a request for additional information. This will delay final review and approval of the project.** Initial in the space provided to indicate the following design requirements have been met. If the applicant has designated an agent, the agent may initial below. **If a requirement has not been met, attach justification.**

Initials	Page/ Plan Sheet No.	Version 1.0
<u>JCB</u>	<u>9, 10</u>	Plans (1" = 50' or larger) of the entire site showing: - Design at ultimate build-out, 1. - Location of permeable pavement, - Roof and other surface flow directed away from permeable pavement,
<u>JCB</u>	<u>13</u>	Section view of the permeable pavement (1" = 20' or larger) showing: 2. - Layers, and - SHWT
<u>JCB</u>	<u>see Soils report</u>	A soils report that is based upon an actual field investigation, soil borings, and 3. infiltration tests. County soil maps are not an acceptable source of soils information.
<u>JCB</u>	<u>13</u>	4. A construction sequence that shows how the permeable pavement will be protected from sediment until the entire drainage area is stabilized.
<u>JCB</u>	<u>see calcs</u>	5. The supporting calculations.
<u>JCB</u>	<u>see O + M Agreement</u>	6. A copy of the signed and notarized operation and maintenance (O&M) agreement.
<u>N/A</u>	<u>_____</u>	7. A copy of the deed restrictions (if required).
<u>JCB</u>	<u>13</u>	8. Installation must be at a slope of 0.5% or less.

Example #1

Project is a lot with a maximum allowed BUA of 5,000 sq. ft. that drains to class SC waters. Project proposes a 1,000 sq. ft. permeable concrete driveway with a 6" gravel base.
Managed grass factor = 0.6
1000 x 0.6 = 600 square feet is counted as managed grass.
1000 - 600 = 400 square feet is counted as built-upon area.
5000 - 400 = 4,600 square feet available for house and other BUA.

Example #2

Project is a high density commercial site with a 5,000 square foot parking lot. Project is within 1/2 mile of and draining to SA waters. An infiltration system is proposed. The parking lot will handle <100 cars per day and is a flexible pavement with a 4" gravel base. Managed grass factor is one half of 0.4. = 0.2
5000 x 0.2 = 1000 square feet is counted as managed grass.
5000 - 1000 = 4,000 square is counted as impervious.
The total BUA used to calculate the minimum volume draining to the infiltration system can be reduced by 1,000 square feet.



STORMWATER MANAGEMENT PERMIT APPLICATION FORM
401 CERTIFICATION APPLICATION FORM
PERMEABLE PAVEMENT SUPPLEMENT



This form must be completely filled out, printed and submitted.
The Required Items Checklist (Part III) must be printed, filled out and submitted along with all of the required information.

I. PROJECT INFORMATION

Project Name	Echo Farm Apartments
Contact Person	Matt Maynard
Phone Number	910-251-5030
Date	10/26/2015
Drainage Area	5

II. DESIGN INFORMATION

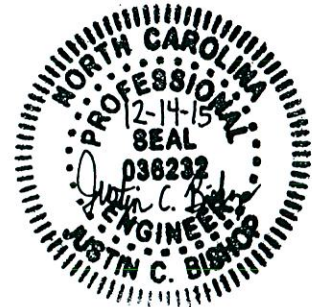
Soils Report Summary

Hydrologic soil group (HSG) of subgrade	A	
Infiltration rate	12.94	in/hr

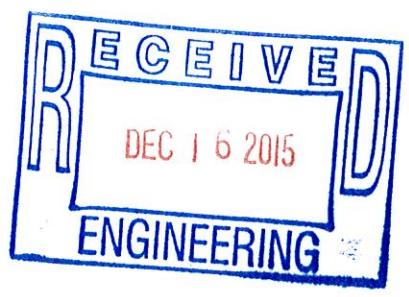
Pavement Design Summary

Permeable Pavement (PP) design type	Infiltration - HSG A/B	
SA of PP being proposed (A _p)	8,935	ft ²
Resulting BUA counted as impervious for main application form	2,234	ft ²
Adjacent BUA directed to PP (A _c)	8,778	ft ² OK
Ratio of A _c to A _p	0.98	(unitless)
Flow from pervious surfaces is directed away from PP?	Yes	OK
Design rainfall depth	1.5"	in
Permeable pavement surface course type	PC	
Layer 1 - Washed aggregate size (ex. No. 57)	No. 57 stone	
Layer 1 - Aggregate porosity (n)		(unitless)
Layer 2 - Washed aggregate size (ex. No. 57)		
Layer 2 - Aggregate porosity (n)		(unitless)
Minimum total aggregate depth for design rainfall (D _{wq})	7.4	in
Drawdown/infiltration time for D _{wq}	0.1	days OK
How is 10-yr, 24-hr storm handled?	bypassed	Underdrain Required
Aggregate depth to infiltrate 10-yr, 24-hr storm (D ₁₀)		in
Drawdown/infiltration time of 10-yr, 24-hr storm		days
Actual provided total aggregate depth	8.5	in OK
Top of aggregate base layer elevation	26.68	fmsl
Storage elevation of design rainfall depth	26.59	fmsl
Overflow elevation	27.18	fmsl
Bottom elevation at subgrade	25.97	fmsl
SHWT elevation	23.97	fmsl
Underdrain diameter		in

BUA Credit for Permeable Pavement Footprint:
75% BUA Credit



#REF!



Detention Systems (skip for infiltration systems)

Diameter of orifice	_____	in
Coefficient of discharge (C_D)	_____	(unitless)
Driving head (H_0)	_____	ft
Storage volume discharge rate (through discharge orifice)	_____	ft ³ /sec
Storage volume drawdown time	_____	days
Pre-development 1-yr, 24-hr peak flow	_____	ft ³ /sec
Post-development 1-yr, 24-hr peak flow	_____	ft ³ /sec

Additional Information

Slope of soil subgrade at bottom of permeable pavement	0.00	%	OK
Slope of the permeable pavement surface	1.04	%	OK
Construction sequence minimizes compaction to soils?	Yes		OK
Subsoil preparation specified (must select one)	scarified		
Meets industry standards for structural requirements?	_____		OK
<u>Washed</u> stone is specified for the aggregate?	Yes		OK
Required signage specified on plans?	Yes		OK
Number of observation wells provided	1		OK
Distance to structure	7.66	ft	
Distance to surface waters	>30	ft	OK
Distance to water supply well(s)	>100	ft	OK

Permeable Pavement

Please indicate the page or plan sheet numbers where the supporting documentation can be found. **An incomplete submittal package will result in a request for additional information. This will delay final review and approval of the project.** Initial in the space provided to indicate the following design requirements have been met. If the applicant has designated an agent, the agent may initial below. **If a requirement has not been met, attach justification.**

Initials	Page/ Plan Sheet No.	Version 1.0
<u>JCB</u>	<u>9, 10</u>	Plans (1" = 50' or larger) of the entire site showing: - Design at ultimate build-out, 1. - Location of permeable pavement, - Roof and other surface flow directed away from permeable pavement,
<u>JCB</u>	<u>13</u>	Section view of the permeable pavement (1" = 20' or larger) showing: 2. - Layers, and - SHWT
<u>JCB</u>	<u>see Soils report</u>	A soils report that is based upon an actual field investigation, soil borings, and 3. infiltration tests. County soil maps are not an acceptable source of soils information.
<u>JCB</u>	<u>13</u>	A construction sequence that shows how the permeable pavement will be 4. protected from sediment until the entire drainage area is stabilized.
<u>JCB</u>	<u>see calcs</u>	5. The supporting calculations.
<u>JCB</u>	<u>see O+M Agreement</u>	A copy of the signed and notarized operation and maintenance (O&M) 6. agreement.
<u>N/A</u>	<u>_____</u>	7. A copy of the deed restrictions (if required).
<u>JCB</u>	<u>13</u>	8. Installation must be at a slope of 0.5% or less.

Example #1

Project is a lot with a maximum allowed BUA of 5,000 sq. ft. that drains to class SC waters.
 Project proposes a 1,000 sq. ft. permeable concrete driveway with a 6" gravel base.
 Managed grass factor = 0.6
 $1000 \times 0.6 = 600$ square feet is counted as managed grass.
 $1000 - 600 = 400$ square feet is counted as built-upon area.
 $5000 - 400 = 4,600$ square feet available for house and other BUA.

Example #2

Project is a high density commercial site with a 5,000 square foot parking lot.
 Project is within 1/2 mile of and draining to SA waters. An infiltration system is proposed.
 The parking lot will handle <100 cars per day and is a flexible pavement with a 4" gravel base.
 Managed grass factor is one half of 0.4. = 0.2
 $5000 \times 0.2 = 1000$ square feet is counted as managed grass.
 $5000 - 1000 = 4,000$ square is counted as impervious.
 The total BUA used to calculate the minimum volume draining to the infiltration system can be reduced by 1,000 square feet.

Permeable Pavement Operation and Maintenance Agreement

I will keep a maintenance record on this BMP. This maintenance record will be kept in a log in a known set location. Any deficient BMP elements noted in the inspection will be corrected, repaired or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the removal efficiency of the BMP.

Important operation and maintenance procedures:

- Stable groundcover will be maintained in the drainage area to reduce the sediment load to the permeable pavement.
- The area around the perimeter of the permeable pavement will be stabilized and mowed, with clippings removed.
- Any weeds that grow in the permeable pavement will be sprayed with pesticide immediately. Weeds will not be pulled, since this could damage the fill media.
- Once a year, the permeable pavement surface will be vacuum swept.
- At no time shall wet sweeping (moistening followed by sweeping) be allowed as a means of maintenance.
- There shall be no repair or treatment of Permeable Pavement surfaces with other types of pavement surfaces. All repairs to Permeable Pavement surfaces must be accomplished utilizing permeable pavement which meets the original pavement specifications.
- Concentrated runoff from roof drains, piping, swales or other point sources, directly onto the permeable pavement surface shall not be allowed. These areas must be diverted away from the permeable pavement.

Initial Inspection: Permeable Pavements shall be inspected monthly for the first three months for the following:

BMP element:	Potential problem:	How to remediate the problem:
The perimeter of the permeable pavement	Areas of bare soil and/or erosive gullies have formed.	In the event that rutting or failure of the groundcover occurs, the eroded area shall be repaired immediately and permanent groundcover re-established. Appropriate temporary Erosion Control measures (such as silt fence) shall be installed in the affected area during the establishment of permanent groundcover, and any impacted area of permeable pavement is to be cleaned via vacuum sweeping.
The surface of the permeable pavement	Rutting / uneven settlement	This indicates inadequate compaction of the pavement base / sub-base. If rutting or uneven settlement on the order of ½ inch or greater occurs, permeable pavement shall be removed and base / sub-base re-compacted, smoothed, and permeable pavement shall then be re-installed. Base and sub-base compaction shall be monitored by a licensed geotechnical engineer to ensure that infiltration capacity of base and sub-base are not compromised by compaction and smoothing processes.
	The pavement does not dewater between storms, or water is running off.	Vacuum sweep the pavement. If the pavement still does not dewater, consult a professional.

The permeable pavement will be inspected **once a quarter and within 24 hours after every storm event greater than 1.5 inches**. Records of operation and maintenance will be kept in a known set location and will be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

BMP element:	Potential problem:	How to remediate the problem:
The perimeter of the permeable pavement	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Vegetation is too short or too long.	Maintain vegetation at a height of 3 to 6 inches (remove clippings).
The surface of the permeable pavement	Trash/debris is present.	Remove the trash/debris.
	Weeds are growing on the surface of the permeable pavement.	Do not pull the weeds (may pull out media as well). Spray them with pesticide.
	Sediment is present on the surface.	Vacuum sweep the pavement.
	The structure is deteriorating or damaged.	Consult an appropriate professional. Damaged areas of the pavement shall be removed and repaired.
	The pavement does not dewater between storms.	Vacuum sweep the pavement. If the pavement still does not dewater, consult a professional. Permanently clogged pavement shall be removed and repaired.

Permit Number: _____
(to be provided by City of Wilmington)

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed above. I agree to notify City of Wilmington of any problems with the system or prior to any changes to the system or responsible party.

Project name: Echo Farm Apartments

BMP drainage area or lot number: 3, 4, & 5 (Permeable Pavement Systems #1, #2, #3)

Print name: Mark Maynard

Title: Member / Manager

Address: 10 S. Cardinal Drive, Wilmington, NC 28403

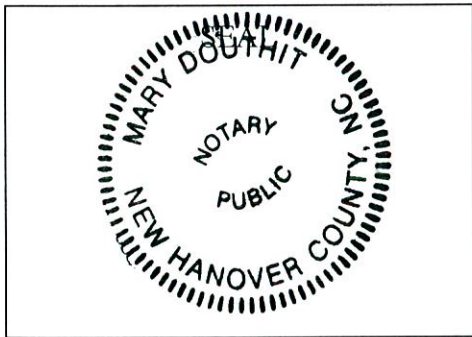
Phone: 910-251-5030

Signature: [Handwritten Signature]

Date: Dec. 14, 2015

Note: The legally responsible party should not be a homeowners association unless more than 50% of the lots have been sold and a resident of the subdivision has been named the president.

I, Mary Douthit, a Notary Public for the State of North Carolina, County of New Hanover, do hereby certify that Mark Maynard personally appeared before me this 14TH day of December, 2015, and acknowledge the due execution of the forgoing permeable pavement maintenance requirements. Witness my hand and official seal, Mary Douthit



My commission expires 7-1-2020