STORMWATER SYSTEM & EROSION CONTROL CALCULATIONS

WELLS INSURANCE OLEANDER DRIVE SITE

5712 Oleander Drive

Wilmington, North Carolina

For

Wells Real Estate Holdings, LLC
1 North Third Street
Wilmington, NC 28401

(910) 251-5402

Revised August 2016

Revised July 2016

May 2016

Final SW Calcs
DP2016024
8/22/2016
Rac

Prepared by:

NORRIS & TUNSTALL CONSULTING ENGINEERS, P.C.

902 Market Street
Wilmington, North Carolina 28401

(910) 343-9653
(910) 343-9604 (Fax)

License # C-3641
N&T Project No. 15005

RUD: 8/3/16

Date	Design	NORRIS & TUNSTALL — CONSULTING ENGINEERS P.C.	Wilmington, NC / Brunswick County, NC	Sheet / Of
7/13/16	JJC			
Check	Job: Wells Jax (5712 Okander Dr.)	For: SW Coles		Job No. 15005

-Project Proposes Less than 10,000 SF of NEW Imp (After Pervious Credits)

-Total Site = 0.715 Ac. / 32,625 SF
Existing Imp = 2,720 SF (Asphalt to Remain)
NOT INCLUDED IN NEW/TOTAL

New Imp (ON-SITE)

- Proposed Building ——————————→ 6,509 SF
- Pervious Pavement Parking - 3,126 SF @ 75% Credit → 2,037 SF
- Pervious Pavement Sidewalk - 1,950 SF @ 75% Credit → 488 SF
- Concrete C&G ——————————→ 855 SF

9,879 SF / 32,625 SF = 30.28%

*DOES NOT INCLUDE Required Concrete Sidewalk (CCW) Along Okander Dr.

-- Soils S_2 - 21" 75% Credit
SHWT @ 18" = 16' (From 17.5')
i = 1.2 in/hr

[Please See ECS Report Done For Previous Approval. Can be used per Rob Gordon]

A_{IP} = 10,576 SF A_C = 850 (C=0.8)
R = 0.084

190' ——— PC - 6"
185' ——— 6" NO 57 (washed) 4.1"
180' ~~5~~ 7" ~~6~~ JJC

Determine Aggregate Depth

$D_{req} = \frac{1"(1+R)}{n} = \frac{1.5"(1.084)}{0.4} = 4.07"$ => USE 6" MIN JJC

$T_{req} = \frac{D_{req}(1+R)}{24 \times 3F \times i} = \frac{1.5"(1.084)}{24 \times 2 \times 1.2} = 0.282$ days

$D_{10} = \frac{4.72"(1.084)}{0.4} = 24 \times 1.2 \times .2 = 7.17"$ ← NOT Required for UC Plan By-passing 10-yr Storm

$T_{10} = \frac{7.22(1.084)}{24 \times 0.2 \times 1.2} = 1.36$ days

*Runoff from Building Roof Leaders will drain through Perforated Pipe in Stone trench and then into Storm Drainage System.

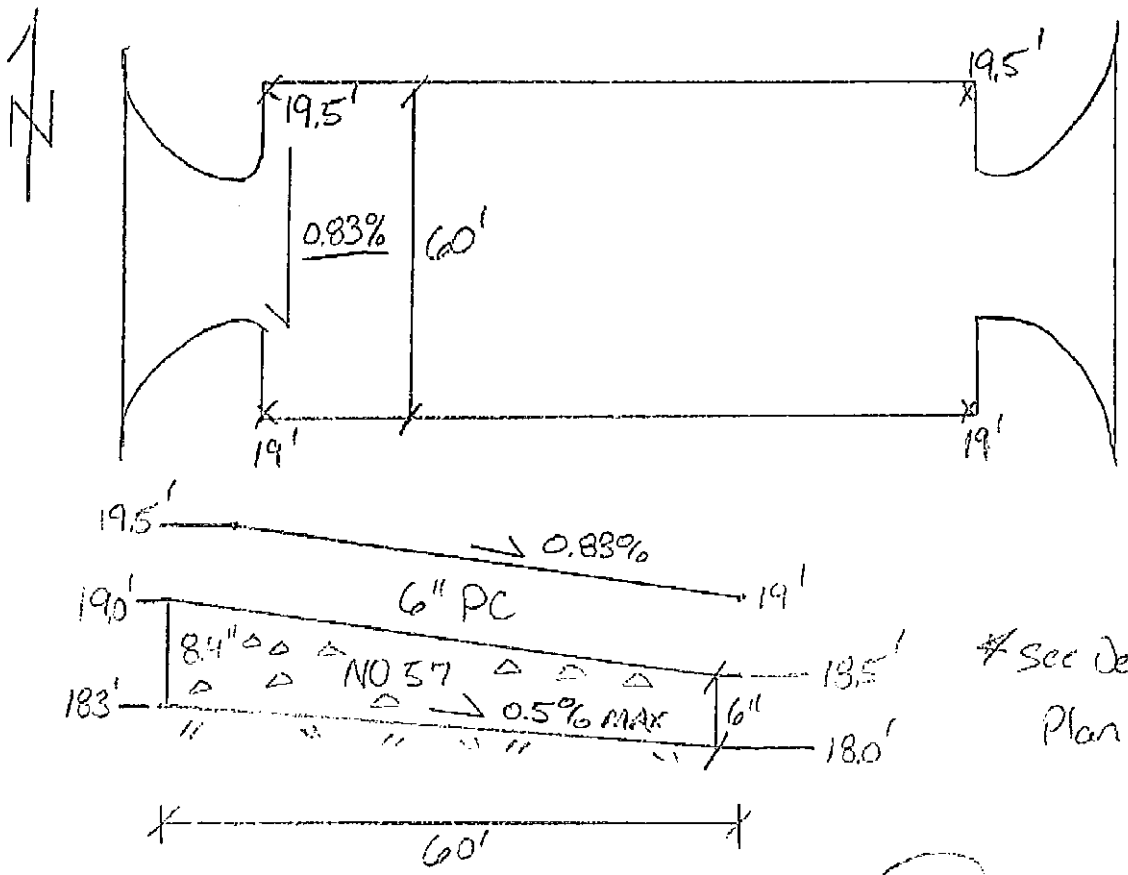
*All pervious Areas (Grassed / Landscaped) Shall be directed away from Pervious Concrete.

Date	Design	NORRIS & TUNSTALL CONSULTING ENGINEERS P.C.	Wilmington, NC Brunswick County, NC	Sheet / Of
8/3/16	JJC			
Check	Job		For	Job No.
	Wells Ins.		SW Coles	15005

D_{WQ} Required = 41" ⇒ use 60" MIN

Max Slope @ Aggregate Base = 0.5%

* Must maintain 0.5% Slope @ Agg Base. If cannot maintain 0.5% Slope, Baffels must be used.



* See Detail on Plan

8.4" more than twice Required D_{WQ} = 4.1" ⇒ OK

* North Parking Lot Line Required to have 3" Min Aggregate
* South Parking Lot Line Required to have 6" Min Aggregate

Date	Design	NORRIS & TUNSTALL CONSULTING ENGINEERS P.C.	Wilmington, NC Brunswick County, NC	Sheet / Of
8/3/16	JJC			
Check	Job	For		Job No.
	Wells Ins (5712 Oleander Dr.)	EC Calcs : SWALES		15005

- Per your e-mail this Address has an existing EC Permit For other Land Disturbance.
- To date Nothing has been Constructed. There is an Existing SW POND For The Shopping Center Behind Property. However, This Parcel IS NOT FINCLUDED IN THE APPROVED SW DESIGN. ∴ Runoff Cannot Flow into this Pond.

TRACT/PARCEL AREA = 0.75 Ac. ⇒ Disturbed Area = 0.76 Ac.

- All Inlets will be Protected with Inlet Protection and the Site will be wrapped with Silt Fence in Areas where runoff Could Possibly Leave Site
- 2 minor Swales are being established to ensure runoff Doesn't Flow off-site to the South.
- The Site has to obtain a Drainage Plan Approval through the City of Wilmington.
  - Parking, Drives ! Proposed Sidewalks Are to Be Pervious (With the Exception of the COW required Sidewalk Along Oleander Dr.

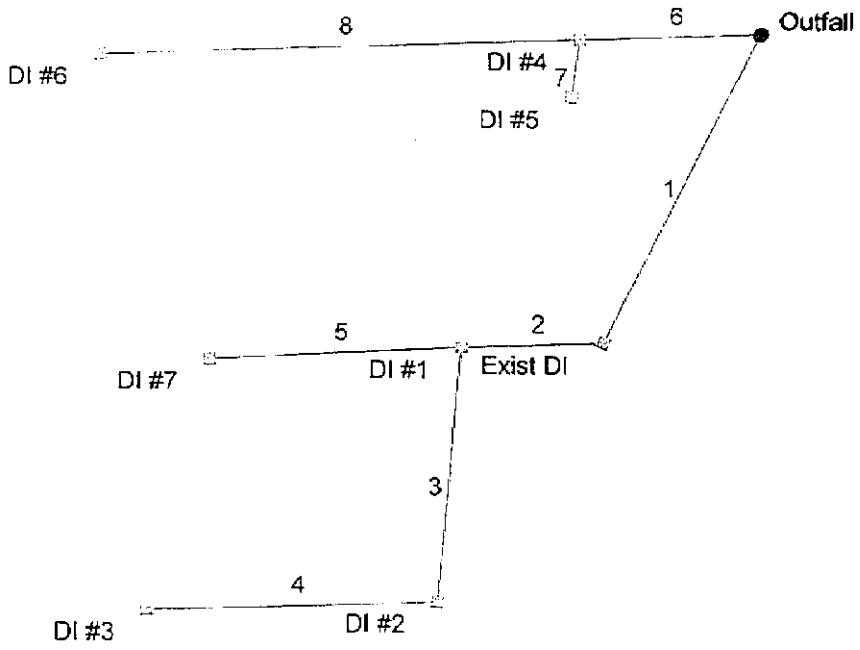
Required Silt Fence ⇒ 400 lf/Ac

Total Disturbance = 0.76 Ac × 400 lf/Ac = 304 lf Required.

- Provide Minimum 304 lf 6sf

= 520 lf Provided (OK)

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: sd Calcs Aug 3.stm	Number of lines: 8	Date: 8/3/16

Wells Insurance

Drainage ID	Total Area (SF)	Total Area (AC)	Impervious Area (SF)	Impervious Area (AC)	Rational 'C'
DA-1	3423	0.08	1722	0.04	0.58
DA-2	1218	0.03	0	0.00	0.20
DA-3	1300	0.03	0	0.00	0.20
DA-4	9850	0.23	6268	0.14	0.68
DA-5	7022	0.16	3337	0.08	0.56
DA-7	3438	0.08	1722	0.04	0.58
DA-8	3810	0.09	2400	0.06	0.67
DA-PC	10926	0.25	850	0.02	0.26

Inlet ID	Contributing DA	Total Area (AC)	IMP Area (AC)	Rational 'C'
DI-1	DA-1	0.08	0.04	0.58
DI-2	DA-2, 1/2 PC	0.15	0.01	0.25
DI-3	DA-3, 1/2 PC	0.16	0.01	0.25
DI-4	DA-4	0.23	0.14	0.68
DI-5	DA-5	0.16	0.08	0.56
DI-6	-	0.02	0.0155	0.78
DI-7	DA-7	0.08	0.04	0.58
Existing DI	DA-8	0.09	0.06	0.67

Swale ID	Contributing DA	Total Area (AC)	IMP Area (AC)	Rational 'C'	tc	Q10 (CFS)	Q25 (CFS)	Slope (%)	Velocity-10 yr (fps)	Velocity - 25yr (fps)
Swale 1	DA-2, 1/2 PC	0.15	0.01	0.25	5	0.27	0.31	0.56	0.88	0.89
Swale 2	DA-3, 1/2 PC	0.16	0.01	0.25	5	0.28	0.31	0.4	0.76	0.8
Existing SW 1		0.23	0.15	0.68		1.13	1.26	1	1.53	1.61

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	100	0.09	0.56	0.67	0.06	0.23	5.0	12.2	6.8	1.57	1.85	2.00	12	0.27	14.18	14.45	15.85	16.04	16.29	16.95	1
2	1	40	0.08	0.47	0.58	0.05	0.17	5.0	11.8	6.9	1.17	1.78	1.49	12	0.25	14.45	14.55	16.07	16.12	16.95	19.00	2
3	2	70	0.15	0.31	0.25	0.04	0.08	5.0	10.3	7.1	0.55	1.90	0.70	12	0.29	14.55	14.75	16.14	16.16	19.00	17.25	3
4	3	133	0.16	0.16	0.25	0.04	0.04	5.0	5.0	8.1	0.33	2.18	0.42	12	0.38	14.75	15.25	16.16	16.18	17.25	17.10	4
5	2	122	0.08	0.08	0.58	0.05	0.05	5.0	5.0	8.1	0.38	3.88	1.22	12	1.19	14.55	16.00	16.15	16.29	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	36.3	4.5	1.18	11.69	0.78	18	1.24	14.18	14.80	15.85	15.85	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	5.0	8.1	0.73	13.10	1.71	15	4.12	14.80	15.50	15.86	15.83	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	8.1	0.13	12.78	0.89	18	1.48	14.80	16.80	15.87	16.93	18.00	19.00	8

Project File: sd Calcs Aug 3.stm

Number of lines: 8

Run Date: 8/3/16

NOTES:Intensity = 155.43 / (Inlet time + 26.20) ^ 0.86; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	100	0.09	0.56	0.67	0.06	0.23	5.0	13.1	5.8	1.35	1.85	1.72	12	0.27	14.18	14.45	15.75	15.89	16.29	16.95	1
2	1	40	0.08	0.47	0.58	0.05	0.17	5.0	12.7	5.9	1.01	1.78	1.28	12	0.25	14.45	14.55	15.91	15.95	16.95	19.00	2
3	2	70	0.15	0.31	0.25	0.04	0.08	5.0	11.0	6.1	0.48	1.90	0.61	12	0.29	14.55	14.75	15.97	15.98	19.00	17.25	3
4	3	133	0.16	0.16	0.25	0.04	0.04	5.0	5.0	7.2	0.29	2.18	0.42	12	0.38	14.75	15.25	15.98	15.99	17.25	17.10	4
5	2	122	0.08	0.08	0.58	0.05	0.05	5.0	5.0	7.2	0.34	3.88	1.37	12	1.19	14.55	16.00	15.97	16.24	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	40.3	3.7	0.96	11.69	0.68	18	1.24	14.18	14.80	15.75	15.75	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	5.0	7.2	0.65	13.10	1.66	15	4.12	14.80	15.50	15.76	15.81	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	7.2	0.11	12.78	0.87	18	1.48	14.80	16.80	15.76	16.92	18.00	19.00	8

* TW Accounts For Existing Pipe System

Project File: sd Calcs Aug 3.stm

Number of lines: 8

Run Date: 8/3/16

NOTES:Intensity = 121.80 / (Inlet time + 23.50) ^ 0.84; Return period =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	100	0.09	0.56	0.67	0.06	0.23	5.0	11.1	8.3	1.92	1.85	2.44	12	0.27	14.18	14.45	15.90	16.19	16.29	16.95	1
2	1	40	0.08	0.47	0.58	0.05	0.17	5.0	10.8	8.4	1.43	1.78	1.82	12	0.25	14.45	14.55	16.23	16.30	16.95	19.00	2
3	2	70	0.15	0.31	0.25	0.04	0.08	5.0	9.5	8.6	0.67	1.90	0.85	12	0.29	14.55	14.75	16.34	16.36	19.00	17.25	3
4	3	133	0.16	0.16	0.25	0.04	0.04	5.0	5.0	9.6	0.38	2.18	0.49	12	0.38	14.75	15.25	16.37	16.38	17.25	17.10	4
5	2	122	0.08	0.08	0.58	0.05	0.05	5.0	5.0	9.6	0.45	3.88	1.03	12	1.19	14.55	16.00	16.34	16.40	19.00	19.00	5
6	End	50	0.23	0.41	0.68	0.16	0.26	5.0	31.6	5.8	1.52	11.69	0.98	18	1.24	14.18	14.80	15.90	15.90	16.29	18.00	6
7	6	17	0.16	0.16	0.56	0.09	0.09	5.0	5.0	9.6	0.86	13.10	1.82	15	4.12	14.80	15.50	15.92	15.86	18.00	18.00	7
8	6	135	0.02	0.02	0.78	0.02	0.02	5.0	5.0	9.6	0.15	12.78	0.94	18	1.48	14.80	16.80	15.92	16.94	18.00	19.00	8

Project File: sd Calcs Aug 3.stm

Number of lines: 8

Run Date: 8/3/16

NOTES:Intensity = 198.56 / (Inlet time + 26.80) ^ 0.86; Return period =Yrs. 100 ; c = cir e = ellip b = box

ECS CAROLINAS, LLP
Geotechnical • Construction Materials • Environmental • Facilities

July 22, 2008

Mr. Harry Stovall
Stovall-Belmont, LLC
P.O. Box 4577
Wilmington, North Carolina 28406

Re: Infiltration Evaluation
5712 Oleander Drive
Wilmington, North Carolina

ECS Project No. 22.14269

Dear Mr. Stovall,

ECS Carolinas, LLP (ECS) recently conducted an infiltration evaluation for the proposed infiltration area at the site located at 5712 Oleander Drive in Wilmington, North Carolina. This letter, with attachments, is the report of our evaluation.

Field Testing

On July 21, 2008 ECS conducted an exploration of the subsurface soil and ground water conditions at one requested location shown on the attached Site Diagram. The test area was field located by utilizing a site location map provided by Mr. Harry Stovall. The purpose of this exploration was to obtain subsurface information of the in-place soils for the proposed infiltration area. We explored the subsurface soil and ground water conditions by advancing one hand auger boring into the existing ground surface at the requested boring location. We visually classified the subsurface soils and obtained representative samples of each soil type encountered. We also recorded the ground water level observed at the time of the hand auger boring. The attached Infiltration Evaluation Form provides a summary of the subsurface conditions encountered at each hand auger boring location.

The ground water level and the seasonal high ground water level (SHWL) were estimated at the boring location below the existing grade elevation. Below is a summary of each boring location.

Location	Water Level	SHWL
1	48 inches	18 inches

We have conducted an infiltration test utilizing a compact constant head permeameter near the hand auger boring to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWL.

Infiltration Evaluation
5712 Oleander Drive
Wilmington, North Carolina
ECS Project No. 22.14269

Field Test Results

Below is a summary of the infiltration test results:

Location	Description	Depth	Inches/hour	Inches/minute
1	Grey silty fine SAND	10 inches	1.2	0.02

Infiltration rates and SHWL may vary within the proposed site due to changes in elevation and subsurface conditions.

If you have any questions regarding this report, please contact us at (910) 686-9114.

Respectfully,

ECS CAROLINAS, LLP

K. Brooks Wall
Staff Geologist

Walid M. Sobh, P. E.
Principal Engineer
NC License No. 22983

Attachments: Site Diagram
Infiltration Evaluation