## Project Overview:

South Green is a proposed office & retail redevelopment project in Carrboro, NC, located on the east side of S. Greensboro Street, approximately 800 feet north of the S. Greensboro Street's intersection with NC 54. The project will include the demolition of two existing warehouses and associated loading docks and parking areas and the construction of approximately 57,000 s.f. of office and retail space, along with supporting infrastructure. The project will also include the construction of a roundabout on South Greensboro Street and the realignment of Rand Road, an existing public road that runs through the site.

## Existing Site Description:

The existing site sits down in a depression and is bounded by S. Greensboro Street to the west, single family residential and an existing stormwater pond to the north, a school to the east, and a mini-storage facility to south. The ground cover on the existing 5.8-acre site includes approximately 2.4 acres of impervious in the form of rooftops, concrete, and compacted gravel parking areas. The remainder of the site is covered by approximately 2.4 acres of woods and 1.0 acre of open/landscaped areas. The site drains from generally from northeast to southwest, with slopes in the previously built-upon areas of the site ranging from 2-5%. The portions of the site outside the previously built-upon areas are lightly wooded with slopes ranging from 5-50%. A perennial stream draining approximately 125 acres of land enters the aforementioned existing stormwater pond to the north of the site from the northeast. The drainage area to this pond extends up to Merritt Mill Road and East Main Street. The discharge from the existing pond is conveyed through the subject site toward S. Greensboro Street in a 24" RCP storm pipe. The existing pond and 24" pipe are grossly undersized and flooding occurs regularly on the site. A large portion of the pond's dam is constructed on the subject property and a riser structure exists within the pond just north of the property line.

A copy of FIRM panel 3710977800J included in Appendix A confirms that no portion of this site lies within a special flood hazard area. A hardbound copy of the soils map and NRCS Soils Survey mapping is included in Appendix A, the maps show that the soils on the previously-developed portions of the site are "Ur" Urban Land Complex and "WmE" Wedowee sandy loam (15 to 25% slopes) and the soils in the eastern, predominately undeveloped portion of the site are "TaD" Taurus silt loam (8 to 15% slopes). Each of the soils on the site belongs to hydrologic soils group "B".

## Proposed Project Description:

The proposed site includes construction of retail and office space and associated infrastructure. The total post-development impervious cover on the site as it is currently proposed is 139,636 s.f. The stormwater management system, as described in detail below, has been designed assuming a post-development impervious cover of 142,000 s.f.. This provides a 2,364 s.f. buffer to account for construction tolerances and miscellaneous additional impervious cover that may need to be added later. The project also includes significant upgrade to the inadequate 24" RCP system that runs through the site, as described above. This pipe system will be replaced with an 8'w x 5'h reinforced concrete box culvert (by-pass pipe), which will carry the 100-year storm without overtopping. As part of the project, a stable, riprap-lined emergency spillway will be created in the existing pond's dam, which will safely convey larger storm events over the dam and into the 8'x5' box culvert inlet structure.

The project site will be raised up to nine feet (max) from the current grades using material excavated from the undeveloped eastern portion of the site. This will help ensure flooding is no longer a problem for this site and will give the site the presence it requires to be a successful retail destination.

## Stormwater Management Requirements:

According to the Town of Carrboro's current Land Use Ordinance, the following stormwater requirements apply to this site:

### Pollutant and Nutrient Control:

Developments must install and maintain stormwater management systems that will control and treat runoff from the first one inch of rain as follows:

- Achieve an eighty-five percent (85%) average annual removal rate for Total Suspended Solids.
- Nutrient Reduction - All redeveloped sites must meet the minimum required nutrient reduction rates for the entire site. There are two options to satisfy this requirement:
    - Option 1: Rule 15ANCAC 02B .0265 requires the post-developed site exports Nitrogen below the 2.2 lbs/ac/yr rate and Phosphorus at 0.82 lbs/ac/yr for sites in the Upper New Hope basin.
    - Option 2: Rule 15A NCAC 02B .0262 requires the post-developed nutrient export rate, when compared to the pre-developed nutrient export rate, must be reduced by 35% for Nitrogen & 5% for Phosphorus for sites in the Upper New Hope basin. This option applies to proposed new development that would replace or expand existing structures or improvements and would result in a net increase in built-upon area.
- To the extent reasonably practicable, draw down the treatment volume in accordance with the requirements of the North Carolina Division of Water Quality Best Management Practices (NC DWQ BMP) Manual.

### Volume Control:

To the maximum extent practicable, developments shall install and maintain stormwater management systems such that the post-development total annual stormwater runoff volume shall not exceed the pre-development volume by more than the limits set forth in the following table. The pre-development and post-development annual stormwater runoff volume shall be calculated using the Jordan Lake Accounting Tool ("JLAT"), except that the following inputs for the use of permeable pavement shall apply. If the NCDENR Division of Water Quality (DWQ) revises the following table of inputs for the use of permeable pavement, this subsection shall be deemed amended to incorporate the most recent inputs established by DWQ.

| Infiltrating Permeable Pavement | | | |
|---|---|---|---|
| Soil Type | Infiltrating PP | Detention w/o Liner | Detention w/ Liner |

| | | | |
|---|---|---|---|
| A | 90% | - | 0 |
| B | 85% | - | 0 |
| C | 80% | 20% | 0 |
| D | 75% | 5% | 0 |

A composite curve number shall be assigned to the development site in the pre-development stage using the runoff curve number method described in USDA NRCS Technical Release 55, Urban Hydrology for small Watersheds (June, 1986).

| Preexisting Composite Curve Number | Maximum allowable increase in annual stormwater runoff volume |
|---|---|
| >78 | 50% |
| >70-78 | 100% |
| >64-70 | 200% |
| <=64 | 400% |

Peak Runoff Control:

Developments shall be constructed and maintained so that their stormwater management systems meet the following minimum standards:

- The post-development discharge rates shall be less than or equal to the pre-development discharge rates for the 1-, 2-, 5-, 10-, and 25-year 24-hour design storms.
- For upstream properties, the 1% chance flood elevation may not be increased.

## Proposed Stormwater Management:

The proposed Stormwater Management report is based off of Site Plan Option B. Option B is the worst case scenario for the Permeable Pavement Design (Larger roof and smaller parking lot).

## Water Quality Treatment:

- 85% TSS Removal –TSS removal for the project site will be provided by three (3) Permeable Pavement Systems and one (1) Sand Filters. The four (4) proposed BMP systems (See below) will treat a combined 142,000 SF (3.260 AC) of onsite impervious cover. Refer to Appendix B for BMP sizing calculations and to Appendix A for drainage area mapping showing the subareas described below:
  - Permeable Pavement #1: The Permeable Pavement #1 system will treat an impervious area of 24,434 SF (0.561 AC), this includes 500 SF of impervious allowance. Also, 412 SF of unavoidable pervious surfaces will be treated in the system. The Permeable Pavement B system is designed according to the 2007 NCDWQ Stormwater Best Management Practices Manual; Chapter 18 (revised Oct. 16, 2012).
  - Permeable Pavement #2: The Permeable Pavement #2 will treat a total onsite impervious area of 41,463 SF (0.952AC), this includes 500 SF of impervious allowance. Also, 1,324

SF of unavoidable pervious surfaces will be treated in the system. The Permeable Pavement B system is designed according to the 2007 NCDWQ Stormwater Best Management Practices Manual; Chapter 18 (revised Oct. 16, 2012).

- Permeable Pavement #3: The Permeable Pavement #3 system will treat an impervious area of 21,882 SF (0.502 AC), this includes 500 SF of impervious allowance. Also, 492 SF of unavoidable pervious surfaces will be treated in the system. The Permeable Pavement B system is designed according to the 2007 NCDWQ Stormwater Best Management Practices Manual; Chapter 18 (revised Oct. 16, 2012).
- Sand Filter #1: The Sand Filter #1 system will treat a total onsite impervious area of 52,720 SF (1.210 AC), this includes 864 SF of impervious allowance. In addition Sand Filter #1 will treat 98,958 SF of pervious surfaces. Sand Filter #1 is designed according to the 2007 NCDWQ Stormwater Best Management Practices Manual; Chapter 11 (revised Sep. 20, 2009).

- Nutrient Reduction - Onsite – Option #2 will be used to comply with the nutrient reduction requirements. The Sand Filter and the Permeable Pavement Systems will provide the on-site portion of the required nutrient reduction for this project. See the JLSLAT (Jordan/Falls Lake Stormwater Load Accounting Tool), with the Development Name "South Green" results in Appendix B for total nutrient export rate, which can be summarized as follows:
  - Pre-development nutrient export: 5.96 lbs/AC/yr TN; 1.10 lbs/AC/yr TP
  - Post-development nutrient export (without treatment): 8.08 lbs/AC/yr TN; 1.81 lbs/AC/yr TP
  - Post-development nutrient export (after treatment): 2.96 lbs/AC/yr TN; 0.51 lbs/AC/yr TP

The Post-development nutrient export from the site is 2.96 lbs/AC/yr TN (50.3% Reduction) and 0.51 lbs/AC/yr TP (53.6% Reduction) which both meet option #2 of the Jordan Lake Rules. Refer to Appendix B for calculations.

## Volume Control:

- The pre-development composite curve number for the development is CN = 71.225. This curve number is greater than 70 but less than 78, which allows a maximum increase of annual stormwater runoff to be 100% according to Carrboro's volume control requirements.
- As documented in the Jordan Lake Accounting Tool located in Appendix B, the proposed BMPs will limit the post-development runoff volume to a 37% reduction over the pre-development runoff volume, which exceeds this requirement.

## Detention:

In addition to providing water quality treatment, the four BMP's described above will each provide varying degrees of detention storage. The manner in which the proposed BMP's provide the required detention treatment is described below:

- Permeable Pavement #1 contains a minimum of 16" of washed stone. A combination of #4, #57 and #78 will be used beneath the Permeable Pavement, each with a minimum porosity of stone = 0.405 (see rock quarry report in appendix B). The void space in the stone will be used to store water and allow the required detention/treatment for each system. A 6" perforated underdrain at the bottom of the stone is tied to a solid section of 6" PVC that will hydraulically connect the stone with a stormwater control junction box. Inside the junction box, the 6" dia. PVC will tee into a 12" PVC riser pipe, which will serve as the outlet control structure for the permeable pavement system. A 1.0" orifice is drilled into the 12" riser structure at the subgrade elevation and will bleed the Water Quality Volume into the junction box over a period of 2-5 days (See appendix B). . The top of the 12" PVC riser pipe will be set 4.8" above the subgrade elevation (which is just above the water quality volume) and will provide detention control for the larger storms.
- Permeable Pavement #2 contains a minimum of 15" of washed stone. A combination of #4, #57 and #78 will be used beneath the Permeable Pavement, each with a minimum porosity of stone = 0.405 (see rock quarry report in appendix B). The void space in the stone will be used to store water and allow the required detention/infiltration for each system. A 6" perforated underdrain at the bottom of the stone is tied to a solid section of 6" PVC that will hydraulically connect the stone with a stormwater control junction box. Inside the junction box, the 6" dia. PVC will tee into a 8" PVC riser pipe, which will serve as the outlet control structure for the permeable pavement system. A 1.25" orifice is drilled into the 8" riser structure at the subgrade elevation and will bleed the Water Quality Volume into the junction box over a period of 2-5 days (See appendix B). . The top of the 8" PVC riser pipe will be set 4.0" above the subgrade elevation (which is just above the water quality volume) and will provide detention control for the larger storms.
- Permeable Pavement #3 contains a minimum of 15" of washed stone. A combination of #4, #57 and #78 will be used beneath the Permeable Pavement, each with a minimum porosity of stone = 0.405 (see rock quarry report in appendix B). The void space in the stone will be used to store water and allow the required detention/infiltration for each system. A 6" perforated underdrain at the bottom of the stone is tied to a solid section of 6" PVC that will hydraulically connect the stone with a stormwater control junction box. Inside the junction box, the 6" dia. PVC will tee into a 8" PVC riser pipe, which will serve as the outlet control structure for the permeable pavement system. A 1.0" orifice is drilled into the 8" riser structure at the subgrade elevation and will bleed the Water Quality Volume into the junction box over a period of 2-5 days (See appendix B). The top of the 8" PVC riser pipe will be set 4.0" above the subgrade elevation (which is just above the water quality volume) and will provide detention control for the larger storms.
- Sand Filter #1 will provide a small amount of detention in the system. The Sand Filter contains a 4" perforated underdrain that will drain the WQV after it has been treated. Just before

stormwater enters the sand filter a flow splitter will provide flow control for the 1, 2, 5, 10 and 25-year storm events and will allow larger storms to by-pass the system.

The combination of the proposed BMP's described above will reduce peak stormwater flows rates being released from the sites outlet point in the post-development conditions to below pre-developed conditions during the 1, 2, 5, 10, 25 and 100-year (not required), 24-hour storm events - and this project therefore meets the Town's detention requirements. Calculations supporting this conclusion are provided in Appendix C, and a summary of the results is provided below.

## Conclusion:

This project as proposed will meet the Town of Carrboro's current stormwater management requirements as follows:

Pollutant and Nutrient Control:

- 85% TSS Removal

  This requirement is met with the treatment of proposed impervious surfaces with BMP's rated for a minimum of 85% TSS removal.

- Nutrient load limits: must be reduced by 35% for Nitrogen & 5% for Phosphorus for sites in the Upper New Hope basin

  The completed Jordan Lake Accounting Tool in Appendix F shows that with the BMP's proposed as part of this project. The nitrogen and phosphorus exported from the site has been reduced substantially more than the minimum reduction amount and an offset payment will not be needed.

- Draw down the treatment volume per the NC DWQ BMP Manual.

  This requirement is met with the proposed BMP's.

Volume Control:

- The pre-development composite curve number for the development is CN = 71.225. This curve number is greater than 70 but less than 78, which allows a maximum increase of annual stormwater runoff to be 100% according to Carrboro's volume control requirements.

- As documented in the Jordan Lake Accounting Tool located in Appendix B, the proposed BMPs will limit the post-development runoff volume to a 37% reduction over the pre-development runoff volume, which exceeds this requirement

  As directed by NCDWQ, each Permeable Pavement system shall be entered into the JLAT as a Rain Harvesting System with an input per the table depending on the soil type

Peak Runoff Control:

- The post-development discharge rates shall be less than or equal to the pre-development discharge rates for the 1-, 2-, 5-, 10-, and 25-year 24-hour design storms.

  The following table demonstrates that this project will meet the peak runoff control requirements:

| | 1-Year | | | 2-Year | | | 5-Year | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post w/o BMP | Post | Pre | Post w/o BMP | Post | Pre | Post w/o BMP | Post |
| Study Point | 5.83 | 12.73 | 1.90 | 8.91 | 16.75 | 7.50 | 14.98 | 24.19 | 13.10 |

| | 10-Year | | | 25-Year | | | 100-Year | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post w/o BMP | Post | Pre | Post w/o BMP | Post | Pre | Post w/o BMP | Post |
| Study Point | 19.55 | 29.51 | 17.03 | 26.35 | 37.25 | 22.75 | 37.25 | 49.42 | 31.93 |

- For upstream properties, the 1% chance flood elevation will not be increased.

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  - DA-2 Post-Developed Drainage Area Map
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- Appendix B – Stormwater Design Calculations
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  - Sand Filter Design Calcs
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  - Stormwater Management Schematic Map
  - Table of Contents
  - Master Network Summary
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- Appendix D – Culvert master (Bypass)
  - Bypass Pipe Summary of Results
  - South Green Bypass Pipe – Existing Conditions
  - 8'x5' Culvert master Report – 25 Year
  - 8'x5' Culvert master Report – 100 Year
  - 90 inch RCP – 25 Year
  - 90 inch RCP – 50 Year
  - Box Culvert Inlet Structure Analysis - Outfall to Box Culvert
  - Box Culvert Inlet Structure Analysis - Outfall to Tail Water

- Appendix E – Environmental Reports
  - June 6, 2014 Geotechnologies, Inc. "Report of Subsurface Investigation"
  - Nationwide Permit 3