WITHERS & RAVENEL

PRELIMINARY STORMWATER MANAGEMENT REPORT

Forest Ridge Subdivision
Hillsborough, North Carolina

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INTRODUCTION

Forest Ridge Subdivision is a planned development located in Hillsborough southeast of downtown on US Highway 70A. The majority of Forest Ridge is proposed residential, with a mixed-use section in the southwest portion of the site. The site is subject to the North Carolina Division of Water Quality Neuse River Basin rules for stormwater management. The development will also be subject to the stormwater management ordinances of the Town of Hillsborough and Orange County. The purpose of this report is to demonstrate the site's proposed compliance with all stormwater regulations.

STORMWATER MANAGEMENT REQUIREMENTS

Because the proposed development is within the Neuse River Basin, the site must meet the site requirements relating to the Neuse River Basin rules. To meet these requirements, the nitrogen export from the site must be calculated and brought under 3.60 lbs/ac/yr using Best Management Practices (BMP) and/or a buydown payment. This is done for Forest Ridge Subdivision with a combination of 5 stormwater wetlands and a nitrogen buydown payment.

Peak flows from the site for the 1-year, 24-hour storm must also be attenuated to the pre-development conditions, according to the Town and County ordinances.

METHODOLOGY

The stormwater study was conducted using the natural drainage features as depicted by Orange County LIDAR topography (1-ft contours) and existing field surveys. Proposed drainage areas were based on field survey data and proposed development within the drainage areas.

The scope of work included the following analyses:

Hydrology

- Simulation of the 1-year, 10-year, and 100-year rainfall events for the Hillsborough, NC area
- Formulation of the 1-year, 10-year, and 100-year flood hydrographs for the pre- and post-development drainage areas

Hydraulic

- Routing the 1-year, 10-year, and 100-year flood hydrographs for pre-development runoff from the site.
- Routing the 1-year, 10-year, and 100-year flood hydrographs for post-development runoff through the proposed wetlands.
- Analyzing results at each analysis point

The results of the hydrology calculations are used in the hydraulic analyses. The hydraulic design requires the development of a stage-storage and stage-discharge function for the proposed wetlands. The rainfall/runoff hydrographs, stage-storage and stage-discharge functions have been compiled to create a routing computer simulation model using Haestad Methods PondPack v10.0 software. This PondPack model was then used to assess the peak water surface elevations in each basin for the design rainfall events. The outflow from each wetland was then combined at junctions within the model to reflect each analysis point. The PondPack modeling results are provided as appendices to this report.

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HYDROLOGY

The SCS Method was used to develop runoff hydrographs for the Type II, 24-hour duration, 1-year, 10-year, and 100-year storm event in the Orange County area. This method requires three basic parameters: a curve number (CN), time of concentration (t_c), and drainage area.

Curve numbers were based on soil type and land use. Soil types were delineated from the Soil Survey of Orange County, North Carolina. The curve numbers used in this study are listed in the appendix of this report.

Times of concentration for pre-development drainage areas were calculated using the SCS method, with input data based on Orange County topographic maps and field survey data. The post-development time of concentration for each sub-basin was assumed to be 5 minutes to reflect the impact of piped storm drainage networks. The breakdown of the time of concentrations and the calculated values are found in the appendices of this report.

HYDRAULICS

Computer simulated reservoir routing of the 1-year, 10-year, and 100-year design storms utilized stage-storage and stage-discharge functions. Stage-storage functions were derived from the proposed grading of the new wetlands. A non-linear regression relation for surface area versus elevation was derived for each wetland. This relation estimates the incremental volume of the basins to the stage or elevation of the basins. Stage-discharge functions were developed to size the proposed outlet structure for the each wetland.

NITROGEN

Nitrogen was calculated using Method 1 from the NC DWQ's methodologies for computing nitrogen loading. Chart 1 of Method 1 was utilized to estimate nitrogen loading based on the percent impervious of the right-of-way area. To determine the nitrogen loading from the lot area, Chart 2 was used. The dwelling units per acre was determined based on the proposed number of lots and the lot area acreage.

CONCLUSIONS

Based on the routing study, each proposed detention basin has sufficient volume to safely pass the 100-year storm without overtopping the dam. The grading of each wetland provides sufficient depth and area at normal pool to meet DWQ surface area requirements. The outlets were designed to discharge the first 1" over 2 to 5 days to meet water quality guidelines.

Because the first 1" of runoff is being discharged over 2-5 days, a 40% nitrogen reduction credit was taken for the areas draining through the wetlands.

WETLAND DESIGN SUMMARY

BMP #1 - PROPOSED WETLAND

DRAINAGE AREA = 11.67 ACRES
PERCENT IMPERVIOUS AREA = 16.8%

- 2" drawdown orifice @ 657.00
- 5' x 5' slab top inlet box, crest @ 658.00
- 36" RCP outlet barrel
- 10' Emergency spillway, crest @ 659.00
- Top of Dam = 660.00

Storm Event	Peak Water Surface Elevation	Freeboard	Q_{peak} Inflow	Q_{peak} Outflow
1-Year	658.03	1.97	7.78	0.54
10-Year	658.55	1.45	31.61	27.51
100-Year	658.97	1.03	66.67	61.20

BMP #2 - PROPOSED WETLAND

DRAINAGE AREA = 9.72 ACRES
PERCENT IMPERVIOUS AREA = 38.0%

- 2" drawdown orifice @ 658.00
- 6' x 6' slab top inlet box, crest @ 659.00
- 36" RCP Outlet Barrel
- 20' Emergency spillway, crest @ 660.00
- Top of Dam = 661.00

Storm Event	Peak Water Surface Elevation	Freeboard	Q_{peak} Inflow	Q_{peak} Outflow
1-Year	659.08	1.92	14.11	1.92
10-Year	659.59	1.08	39.58	33.45
100-Year	660.51	0.49	72.26	49.77

BMP #3 - PROPOSED WETLAND
DRAINAGE AREA = 20.70 ACRES
PERCENT IMPERVIOUS AREA = 34.9%

- 2" drawdown orifice @ 601.00
- 6' x 6' slab top inlet box, crest @ 602.00
- 42" RCP Outlet Barrel
- 10' Emergency spillway, crest @ 603.00
- Top of Dam = 604.00

Storm Event	Peak Water Surface Elevation	Freeboard	Q_{peak} Inflow	Q_{peak} Outflow
1-Year	602.15	1.85	32.02	4.77
10-Year	602.91	1.09	87.21	69.27
100-Year	603.40	0.60	157.25	132.73

BMP #4 - PROPOSED WETLAND
DRAINAGE AREA = 6.70 ACRES
PERCENT IMPERVIOUS AREA = 42.3%

- 2" drawdown orifice @ 601.00
- 5' wide weir, crest @ 602.00
- 6' x 6' slab top inlet box, crest @ 603.00
- 42" RCP Outlet Barrel
- Top of Dam = 604.00

Storm Event	Peak Water Surface Elevation	Freeboard	Q_{peak} Inflow	Q_{peak} Outflow
1-Year	602.15	1.85	11.02	1.08
10-Year	603.05	0.95	29.18	18.80
100-Year	603.43	0.57	51.97	46.61

BMP #5 - PROPOSED WETLAND
DRAINAGE AREA = 33.57 ACRES
PERCENT IMPERVIOUS AREA = 33.1%

- 4" drawdown orifice @ 539.00
- 7' x 7' slab top inlet box, crest @ 540.00
- 60" RCP Outlet Barrel
- Top of Dam = 542.00

Storm Event	Peak Water Surface Elevation	Freeboard	Q_{peak} Inflow	Q_{peak} Outflow
1-Year	540.08	1.92	42.59	2.59
10-Year	540.88	1.12	127.59	77.77
100-Year	541.69	0.31	239.15	160.11