

LONGWOOD UNIVERSITY STORMWATER MASTER PLAN UPDATE

FARMVILLE, VIRGINIA

LONGWOOD
UNIVERSITY



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3RD PARTY REVIEW

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1.0 EXECUTIVE SUMMARY

In 2008, Longwood University (University) developed a Stormwater Master Plan to provide a campus-wide approach to meet stormwater regulations affecting planned building construction projects. The Master Plan created a regional stormwater basin to provide water quality compliance for campus building projects. However, this stormwater basin has little water quality credit capacity remaining and requires significant maintenance to maintain the credits already allocated. In addition, there have been significant changes to Virginia stormwater regulations since the last Master Plan update, which affect building project compliance for both stormwater quality and quantity. This document updates the Stormwater Master Plan for these changes and provides recommendations for continued compliance.

2.0 PURPOSE

The purpose of this report is to update the previous Stormwater Master Plan to reflect changes since the 2010 Stormwater Master Plan update, including changes to the Virginia Stormwater regulations and projects constructed during the last seven years. This update also addresses stormwater quality and quantity compliance for future planned projects.

This report only applies to property owned by Longwood University. Property owned by foundations or other private entities affiliated with the University such as Longwood University Real Estate Foundation, Longwood University Foundation INC, Longwood Housing Foundation LLC are not included in this report. See Appendix 1 for a map that delineates the property owned by the University.

3.0 PREVIOUS STORMWATER MASTER PLAN

3.1 2008 Stormwater Master Plan

The initial Stormwater Master Plan (*Longwood University Stormwater Management Master Plan*, January 2008, by Timmons Group) is included as Appendix 2. This document includes the following components:

3.1.1 Capacity analysis of the main trunk sewer running through the University campus for the 2-year and 10-year storm events for the existing land cover conditions to determine adequacy. The master plan analysis indicated that significant flooding would occur during the 10-year storm event at eight structures, however, University personnel have not observed flooding at these locations.

3.1.2 Proposed changes to impervious area, included the following. After each item is the current status:

- Removal of the Wynne Building - constructed
- Student Recreation Center - constructed
- Willett Hall Additions – not constructed
- Heating Plant Upgrade – constructed
- Bedford Hall and Wygal Hall Expansion – not constructed
- Construction of Theater Building – not constructed
- Construction of the Hull Promenade – not constructed

3.1.3 Evaluation of stormwater alternatives to provide quality compliance for planned projects. The recommended option was the regional BMP located at the corner of Franklin and Race Streets. The plan also recommended on-site detention for each project to address insufficient capacity in the storm sewer trunk system.

3.2 2010 Update

The last update to the Stormwater Master Plan (*Longwood University Stormwater Master Plan*, updated March 2010, by Timmons Group) is included as Appendix 3. This document includes the following components:

3.2.1 Capacity analysis of the main trunk sewer running through the University campus for the 2-year and 10-year storm events for the existing land cover conditions to determine

adequacy. The master plan analysis indicated that significant flooding would occur during the 10-year storm event at eight structures, however, University personnel have not observed flooding at these locations.

3.2.2 Analysis of future projects based on the 2020 Comprehensive Campus Master Plan to estimate the required water quality (phosphorus) removal using the draft Virginia Runoff Reduction Spreadsheets available at the time.

Projects included the following. After each item is the current status:

- New Student Union - constructed
- Putney Street Parking Lot (Longwood University Real Estate Foundation) - constructed
- Spruce Greenway and Plaza – not constructed
- Race Street Greenway – not constructed
- Stevens Greenway and Plaza – not constructed
- Renovation of French Hall and Construction of French Greenway – constructed
- New Convocation Center – not constructed
- Blackwell Greenway and Plaza – not constructed

The analysis also determined that these projects would likely result in a net decrease of impervious area. The master plan recommended that as these projects were constructed, any decreases be documented to assist the University in meeting overall water quality goals. As not all of these projects have been built as of the time of this update, this has not been accomplished.

3.2.3 Proposed strategies to achieve necessary quality compliance for the future projects. Several options were recommended, included projects specific Low Impact Development (LID) BMPs, conversion of impervious area to green space, regional BMPs, and retrofits to existing BMPs. These measures are in addition to the regional BMP (enhanced extended-detention wetland) constructed in 2009 at the corner of Race and Franklin Streets.

3.2.4 Stormwater management recommendations for properties located off the main campus. The recommendation was that off-campus properties did not present any compliance opportunities for projects located on the main campus.

4.0 EXISTING STORM SEWER SYSTEM

4.1 General

Since the date of the original stormwater master plan and the subsequent update, the University has mapped the existing storm sewer system, see Appendix 4. The mapping is current as of 2014 and does not reflect the most current conditions.

5.0 EXISTING STORMWATER BMPS

5.1 General

Existing stormwater BMPs at the University are shown below in Table 1 and locations are shown on the map in Appendix 5. There are 11 BMPs constructed for specific projects and a single regional BMP that has provided compliance for multiple projects.

Table 1: Existing Stormwater BMPs

	Description	Quality/ Quantity	Type	Approx. Year Installed	Remarks
A.	Regional Water Quality BMP	Quality	Enhanced Extended Detention Basin (11.6% removal based on volume provided) Some quantity benefit, but not calculated	2008	Sediment recently removed
B.	Gateway	Quality & Quantity	Underground Storage, Arches with Isolator Row (50% removal)	2016	Condition unknown
C.	New Heating Plant	Quantity Only	Underground Storage, 60" CMP Pipe	2008	May require sediment removal
D.	Communications Studies	Quantity Only	Underground Storage, 54" RCP Pipe	2009	Condition unknown
E.	Johnston Drive Athletic Fields #1	Quality & Quantity	Cisterns for Irrigation, Tank 1: 2,000 gal, Tank 2: 2,000 gal & Tank 3: 40,000 gal,	2009	Cistern collect water from artificial turf underdrains to reuse for irrigation of adjacent grass fields
F.	Johnston Drive Athletic Fields #2	Quality Only	Bioretention (50% removal)	2006	Condition unknown
G.	Student Health & Fitness Center – Upper Frazer Lot	Quality Only	Bioretention (50% removal)	2007	Banks along sidewalks are heavily eroded
H.	Student Health & Fitness Center – Pine Street	Quality Only	Filterra (65% removal)	2007	Requires sediment removal, tree trimming, and mulch replacement.
I.	Biomass Fuel Depot #1	Quantity Only	Basin	2011	Condition unknown
J.	Biomass Fuel Depot #2	Quantity Only	Basin	2011	Condition unknown
K.	Wynne Tier Parking Lot #1	Quality Only	Bioretention (50% removal)	2002	Requires tree & brush removal
L.	Wynne Tier Parking Lot #2	Quality Only	Bioretention (50% removal)	2002	Lawn cover
M	Register and Sharp Residence Hall	Quantity Only	Underground Storage, 36" RCP Pipe	2016	Condition unknown
N	Jarman Hall	Quantity Only	Underground Storage, 15" HDPE Pipe	2010	Condition unknown

5.2 BMP Inspections and Maintenance

Under Virginia stormwater regulations, the University is responsible for annual inspections of existing stormwater BMPs and the performance of periodic maintenance. To assist the University in this effort, included in the Appendices are the as-built drawings of the existing stormwater BMPs (Appendix 6) and the inspection checklist currently used by the University (Appendix 7).

6.0 CURRENT STORMWATER REGULATIONS

6.1 General

The University has been delegated authority to review and approve University projects under Annual Standards that are reviewed and approved by DEQ on an Annual basis (*Annual Standards and Specifications for Erosion & Sediment Control and Stormwater Management*, dated FY2017). A copy is included in Appendix 8.

Under the delegated authority, the University reviews plans for proposed projects and ensures compliance with regulations and laws pertaining to stormwater runoff issued by the Commonwealth of Virginia, Prince Edward County, and the University's own standards and specifications.

6.1 Commonwealth of Virginia Regulations

6.1.1 VSMP Regulations (2013)

The Virginia Stormwater Management Program (VSMP) regulations govern the post-construction quality and quantity control of stormwater runoff from land development projects (see Appendix 9). The regulations affect design by requiring compliance in the areas of water quality, channel protection, and flood protection for all projects with more than one acre of disturbance. Water quality compliance requirements usually require a reduction of phosphorus in the project site runoff through on-site BMPs, regional BMPs, or purchase of nutrient credits.

Channel protection and flood protection requirements require analysis of the stormwater conveyance system downstream to a point where the total drainage area is at least 100 times the project drainage area. For channel protection, reductions in the proposed 1-year peak flow rate and/or volume from the project site are required if there are natural conveyance systems within the analyzed downstream area. If only manmade conveyances are present, then no measures are required. For flood protection, reductions in the 10-year peak flow rate from the project site are required if the conveyance systems within the analyzed downstream areas are not adequate to convey the 10-year peak flow rate from the total contributing area. In both cases, compliance usually requires BMPs that detain the runoff and/or allow some of the runoff to remain on the site or to be temporarily detained.

A guide to complying with these regulations and required forms can be found on the DEQ website at the following link:

<http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx>

6.2 Local Regulations

6.2.1 Prince Edward County

Under its delegated review authority, the University must comply with the technical requirements contained in local stormwater regulations where they are more stringent than the state regulations. Prince Edward County is the VSMP authority for both the County and the Town of Farmville. For the University, the local regulations are currently equivalent to the state regulations (see Appendix 10). The County requires stormwater quality and quantity to be addressed in compliance with the Virginia regulations for all projects over one acre of land disturbance. The County has adopted a revised stormwater ordinance that is similar to the model ordinance issued by DEQ.

7.0 CONSTRUCTION PROJECTS (2010 – 2017)

7.1 General

Projects constructed at the University since 2010 are listed in the table below:

Table 2: Projects 2010 - Present

Description	Approximate Disturbed Area (acres)	Year Built	Water Quantity Compliance	Water Quality Compliance
Drop Off Entrance at Jarmin Auditorium	1.4	2010	Onsite Underground Detention	Regional Water Quality BMP
University Center	2.7	Currently Under Construction	Onsite Underground Detention	Regional Water Quality BMP
Register and Sharp Residence Halls	1.7	2016	Onsite Underground Detention	Regional Water Quality BMP
Student Success Center	0.9	2018	Site's Contributing Drainage Area is less than 1% of Total Watershed Area	Stormwater Quality Compliance Not Required
Willett Hall Plaza	0.3	2016	Site's Contributing Drainage Area is less than 1% of Total Watershed Area	Stormwater Quality Compliance Not Required
Willett Hall Façade and Lobby Renovation	0.08	2016	Site's Contributing Drainage Area is less than 1% of Total Watershed Area	Stormwater Quality Compliance Not Required
Admissions Building	1.09	Currently Under Construction	Onsite Underground Detention	Regional Water Quality BMP
Academic Building	1.07	Currently Under Construction	Not required, Site's Contributing Drainage Area is less than 1% of Total Watershed Area	Regional Water Quality BMP

A map of project locations is included in Appendix 11.

These projects used the water quality credits created by the regional BMP at the corner of Race and Franklin Streets. The water quality tracking spreadsheet is included in Appendix 12. As of the date of this update, there remains 1.46 pounds of phosphorus that can be utilized for future projects.

8.0 PLANNED FUTURE CONSTRUCTION PROJECTS (2018 – 2020)

8.1 General

Future planned projects to be constructed at the University are listed in the table below:

Table 3: Future Planned Projects

Description	Approximate Disturbed Area (acres)	Water Quantity Compliance	Estimated Water Quality Required (pounds/year)
Music Hall	1.8	TBD	1.5*
Longwood Iler Field Improvements	2.0	TBD	0.5*
Curry and Frazer renovations Design Complete, but not yet permitted (Foundation Property, but Longwood University is responsible for providing credits for water quality compliance)	3.5	Onsite Underground Detention	1.73**
Facilities Relocation (Lumber Yard)	3.4	None required by regulations	1.7*
TOTAL	10.7		5.43

* - Based on University projects of comparable size

** - Based on calculations

A map of project locations is included in Appendix 13. It is estimated that a total of 5.43 pounds of phosphorus credits will be required for the future planned projects listed. The actual amount will be based on the actual disturbed area, and areas of impervious and lawn.

9.0 PROPOSED WATER QUALITY COMPLIANCE

9.1 General

As the water quality requirements for future planned projects exceed the credits remaining from the regional BMP, additional water quality credits must be obtained. The following three options were evaluated: project level BMPs, a new regional BMP, and nutrient credit purchase.

9.2 Project Level BMPs

In the project level approach, each project includes BMPs that provide the removal required for that project. This evaluation assumed that for the 4 future projects, 6 bioretention BMPs will be required. The 6 BMPs will occupy approximately 10,000 - 12,000 sf in land area that will increase the area of the project footprint and occupy space that could be used for program elements. Additionally, these BMPs will increase the number of BMPs that the University's must maintain by 67% with a corresponding annual cost in BMP maintenance.

9.3 New Regional BMP

A new regional BMP could provide the 5.43 lbs/year of phosphorus credits required for future projects plus a reasonable allowance for future development. The previous stormwater master plan update provided three recommendation locations for regional BMPs:

- Restoration and stabilization of the natural stream located upstream of the existing regional BMP previously constructed. The University would need to acquire residential parcels to construct this project. The previous stormwater masterplan update did not provide an estimate of the nutrient removal, but would likely be less than the 6.83 pounds/year provided by the existing regional BMP. The cost provided in the previous stormwater masterplan update was approximately \$117,000 (2009 dollars), not including property acquisition.
- A stormwater BMP west of the intersection of Wynne Drive and Race Street on both a 0.547 acre parcel owned by the Longwood Real Estate Foundation and the adjacent 0.538 acre parcel owned by the Longwood University Board of Visitors. Contributing drainage area is approximately 11

acres. This would most likely be a stormwater basin type BMP. The cost provided in the previous stormwater masterplan update was approximately \$272,500. It is estimated that the land value is an additional \$1,000,000 based on a typical land cost of \$1,000,000 provided by the University.

- A stormwater basin east of the intersection of Griffin Boulevard and Edmunds Street on either a 0.572 acre parcel or the adjacent 0.513 acre parcel owned by Longwood University. Contributing drainage area is approximately 19 acres. The previous stormwater masterplan update did not provide a cost. It is estimated that the land value is an additional \$1,000,000 based on a typical land cost of \$1,000,000 provided by the University.
- Retrofits to the existing Wynne Tier Parking Lot BMPs. The stormwater master plan assumed that the existing BMPs were basins, when they are actually bioretention areas, so this option is not valid.

9.4 Bulk Nutrient Credit Purchase

Virginia regulations allow for the purchase of water quality credits for project compliance under any of the following conditions as they apply to each project:

1. Less than five acres of land will be disturbed;
2. The post-construction phosphorus control requirement is less than 10 pounds per year; or
3. At least 75% of the required phosphorus nutrient reductions are achieved on-site. If at least 75% of the required phosphorus nutrient reductions cannot be met on-site, and the operator can demonstrate to the satisfaction of the VSMP authority that (i) alternative site designs have been considered that may accommodate on-site best management practices, (ii) on-site best management practices have been considered in alternative site designs to the maximum extent practicable, (iii) appropriate on-site best management practices will be implemented, and (iv) full compliance with post-development nonpoint nutrient runoff compliance requirements cannot practicably be met on-site, then the required phosphorus nutrient reductions may be achieved, in whole or in part, through the use of off-site compliance options.

Even if these criteria are applied to the total of the future projects listed in Table 3, water quality compliance through nutrient credit purchase is allowed because the total water quality requirement is less than 10 pounds per year.

This option can allow the University to retire the existing regional BMP as a regulated BMP by purchasing credits in the amount created by the original construction. The regional BMP was constructed and approved as an Enhanced Extended-Detention Basin under Standard 3.07 of the Virginia Stormwater Management Handbook, see Appendix 14. The key components of this type of basin are volume above and below the normal water line and wetlands plantings in a marsh. This basin receives large amounts of sediment from the upstream stream channel and requires sediment removal every 8-10 years to maintain the original volume below the water surface. The cost to remove sediment is approximately \$35,000 each time, or \$3,500 per year. Additionally, the majority of the required wetlands plants in the 6,558 square feet of marsh have died and are required to be replanted to restore their original function. By making the basin a non-regulated BMP, the University will save a considerable amount in periodic maintenance, approximately \$3,500 annually in sediment removal and approximately \$20,000 to replant the marsh. If the basin is made non-regulatory, it will still provide some water quality and quantity benefits and the maintenance cost will be decreased significantly.

If this option is pursued, the total one-time nutrient purchase will be 12.26 lb/yr, 6.83 lb/yr for the regional BMP and 5.43 pounds per year for future projects. For the estimate in the section below, a cost of \$9,000 per lb/yr was used. The actual price will likely be less as there are multiple providers available and prices can be negotiated for larger quantities.

9.5 Cost Comparison

Estimated costs associated with each option are presented below:

Table 4: Estimated Costs

Option	Estimated Cost (2018 dollars)			Phosphorus Removal (lb/yr)	Unit Cost (\$/lb/yr)	Annual Maintenance Costs (2018 dollars)
	Initial	Land Value	Total			
Regional BMP at Wynne Drive & Race Street	\$355,600	\$1,000,000	\$1,355,600	4.28	\$316,730	\$13,,000
Project Specific BMPs	\$240,000	\$27,550	\$267,550	5.43	\$49,270	\$16,000
Nutrient Credit Purchase	\$110,340	\$0	\$110,340	12.26	\$9,000	\$0

9.6 Recommendations

The recommended option is to purchase 12.26 lbs/year of phosphorus credits to allow the existing regional BMP to be converted to a non-regulatory quantity only BMP and to provide water quality compliance for the proposed future projects. This option not only has the lowest costs in all categories, has no additional annual maintenance cost, and decreases the existing annual maintenance costs for the regional BMP.

10.0 PROPOSED WATER QUANTITY COMPLIANCE

10.1 General

In addition to stormwater quality compliance, stormwater regulations require compliance with the two regulatory parts of stormwater quantity compliance; channel protection and flood protection. The specific requirements for both parts depend on the size of the area to be disturbed and where the project is located in the local watershed, specifically, the type of conveyance downstream of the project to a point of consideration where the total drainage area is 100 times the drainage area of the project.

10.2 Channel Protection

The channel protection criteria requires that manmade downstream conveyances can accept the resultant velocity. Projects where there is a natural channel in any portion of the downstream conveyance to the point of consideration must provide reductions in the peak discharge rate and/or the volume of runoff

from the one-year storm event in accordance with the energy balance criteria in the stormwater regulations.

In the case of the University, the previous stormwater master plan indicates that the main Longwood trunk storm sewer system outfalls into a tributary of Gross Creek near the intersection of Longwood Avenue and South Street. The drainage area to this point is approximately 142.8 acres (see Figure 2 - Drainage Area Map in the previous stormwater master plan) and the storm sewer is adequate up to this point, so any project with an area of disturbance of 1.4 acres or less should not require compliance with the energy balance criteria.

Projects outside the drainage area of the trunk sewer should analyze the downstream conveyance to the point of consideration and provide detention and/or volume reduction only if required by the presence of natural channels.

10.3 Flood Protection

The flood protection criteria requires that all conveyances, either manmade or natural, can accommodate the peak flow rate from the 10-year event without overflowing, to the point of consideration. The previous stormwater master plan indicates that there likely are portions of the Longwood trunk storm sewer that cannot adequately convey the peak runoff from the 10-year storm event without flooding.

Proposed projects that drain to the trunk sewer will exacerbate any existing flooding issues. For this reason, the University may allow projects to incorporate detention of the 10-year peak flow rate to pre-developed rates. This can be achieved with underground detention.

Projects outside the drainage area of the trunk sewer should analyze the downstream conveyance to the point of consideration and provide detention only if required.