Biltmore Forest Stormwater Master Plan – Phase 1

SUMMARY OF FIELD RECONNAISSANCE

October 2018

WR Job Number: 2170940

WithersRavenel
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INTRODUCTION

The Town of Biltmore has engaged WithersRavenel for the development of a stormwater master plan. The goal of the stormwater master plan is to identify and prioritize capital improvement projects that will allow the Town to improve and update its stormwater infrastructure with consideration for combining stormwater management and recreation areas while also recognizing the Town's historic approach to managing stormwater.

The stormwater master plan is to be carried out in phases. Phase 1 has been defined as the identification of areas of interest and collection of field data associated with those areas. Phase 2 of the master plan shall investigate capacity of the existing systems and provide prioritized improvements with funding strategies.

AREAS OF INTEREST

In order to determine the areas of interest, WithersRavenel combined anecdotal reports of flooding and maintenance with an analysis of existing GIS information. Seven focus areas were identified based on discussions with the Town and previous watershed studies. LiDAR topography was used to delineate watersheds to these areas. Additional focus areas were identified by expanding the topographic analysis and watershed delineation to include areas that appeared to be underserved by the existing infrastructure.

FIELD RECONNAISSANCE SUMMARY

The preliminary data analysis utilized existing GIS data provided by the Town to determine the structures within the areas of interest that would require additional inspection. The field crews collected information on the stormwater structures by pulling lids and making visual observations from ground level. A total of 108 structures were surveyed for additional information. The team was able to obtain measurements and note the general condition, all of which is documented in the ArcGIS database. The condition of each structure was categorized as either Excellent, Good, Fair, Poor, or Needs Repair.

The observed conditions are defined as follows:

Excellent New infrastructure in perfect condition;

Good Infrastructure with no discernable flaws, in optimal working condition without much sediment or debris;

Fair infrastructure is in working order but shows signs of age. There is a significant amount of wear and tear and/or debris and sediment is substantial;

Poor Infrastructure needs maintenance (signs of an active problem such as cracking, sedimentation, etc). These structures are visibly broken or in imminent danger of failure;

Needs Repair The infrastructure has failed and requires immediate maintenance action.

The table below tabulates the condition assessments of the structures:

Condition	Number of Structures
Excellent	2
Good	30
Fair	42
Poor	25
Needs Repair	9

Additional comments are included in the ArcGIS data when the condition is considered to be Poor or Needs Repair.

POTENTIAL PROJECT IDENTIFICATION

Potential Project Area #1 – Vanderbilt and Lone Pine Road

Potential Project Area #1 is located at the intersection of Vanderbilt and Lone Pine Road. This project area was identified by the Town as having consistent problems with flooding and standing water in the intersection. Within the project area, 4 inlets are classified as "Needs Repair", 4 as "Poor", and 7 as "Fair".

This Potential Project is a Repair, Replacement, Maintenance Project. Of the 4 structures classified as "Needs Repair", two of pipes were either buried or obstructed. It is recommended that the buried pipe be exposed and the debris be removed. Three of the inlets have stone tops that may be reducing inlet efficiency. Inlet efficiency may be improved by removing the stone covers and replacing them with appropriately sized grates. Two of the "Poor" inlets are nearly covered in soil and vegetation; it is recommended that the area be cleared, and inlet and pipe be cleaned out. The other two "Poor" inlets require maintenance; cleaning of catch basin and pipes. The remaining inlets in "Fair" condition require maintenance for the removal of excess sediment and debris.

Potential Project Area #2 – Park Road Cross Drainage

Potential Project Area #2 is located at 13 Park Road. This problem in this area has been described as nuisance flooding. The culvert on the property was identified as being in "Poor" condition.

This Potential Project is a Replacement and Maintenance Project. This culvert may be undersized for its drainage area and therefore replacement with a larger pipe may be warranted. Further study is required in order to make a definitive recommendation. The "Poor" condition was given for less than ideal inlet conditions, as well as sediment build up in the pipe. Maintenance will is recommended to ensure the effective conveyance.

Potential Project Area #3 – Brooklawn Chase and Hemlock Road

The Potential Project Area #3 is the pond located near the intersection of Brooklawn Chase and Hemlock Road. Based on discussions with the Town, the pond has experienced excessive sedimentation that has led to decreased depth and increased turbidity. This is recognized as being an ongoing Maintenance Project. It is recommended that a maintenance plan be developed for this area that includes a dredging and restoration plan.

Potential Project Area #4 – Cedar Hill Dr. Stream

The Potential Project Area #4 was suggested by the Town due to public interest. Preliminary inspection of the culverts between Lot 14 Cedar Chine Drive and 2 Hemlock Road found 2 culverts with "Fair" and "Poor" conditions for its inlet and outlet, respectively. One culvert provides routing for a stream across the lots while the other provides cross street drainage under Cedar Hill Drive.

This potential project is a Replacement, Repair, and Maintenance Project. The inlet and outlet of the corrugated metal pipe culvert are damaged due to rusting out along the bottom. The replacement of the cross-lot pipe may also present an opportunity to retrofit the outlet with a headwall perform some repair and maintenance on the Cedar Hill Drive culvert.

Potential Project Area #5 – Vanderbilt Road Storm Drain (Cedarcliff to Busbee Road)

The Potential Project Area #5 has been studied previously by others. Preliminary inspection of the storm drainage in the area resulted in the identification of 6 storm inlets; 5 area in "Fair" condition, and 1 is in "Poor" condition. Three outlets were identified as part of the network and were described as being in "Fair" condition. Two culverts were also identified in the area and were characterized as having "Poor" inlet and outlet conditions, however the pipes were rated as "Good".

This Potential Project is a Replacement, Repair, and Maintenance Project. The inlet in "Poor" condition is broken and needs to be replaced. The inlet and outlet pipes are vitrified clay pipes (VCP) and it is recommended that the material be upgraded based on current condition of the VCP. The other 5 "Fair" inlets show signs of age and the associated pipes may be undersized for present day design storms. Further study

is recommended to determine the capacity of the pipes. The 3 "Fair" outlets require show signs of heavy sedimentation build up at the inverts; they will require maintenance to ensure free flow conditions at the outfall. The presence of the accumulated sediment requires further investigation to determine the source.

The 2 culverts associated with this storm drain network require maintenance at their inlets and outlets to clear the area of sediment and debris. One culvert shows signs of a deteriorating headwall at the inlet and repair or replacement is recommended.

The previous watershed study in this area made recommendations for improvements along the roadway well as identified drainage improvements within private properties. These recommendations will be expanded upon in Phase 2 of the Stormwater Master Plan.

Potential Project Area #6 – Golf Course Pond Spillway

The Potential Project Area #6 was suggested by the Town after some accounts of Southwood Road overtopping at the nearby road sag. Preliminary inspection of the pond spillway showed that it is in "Good" condition.

This Potential Project is a Retrofit or Replacement Project. Further hydrologic and hydraulic study will be required to determine the frequency of flooding and if minor alterations can be done to retrofit the existing spillway structure in order to improve conveyance function and minimize overtopping of the road sag. Additional solutions may include revised grading at the road sag in conjunction with spillway alterations to reduce the risk of overtopping of the road.

Potential Project Area #7 – Greenwood Road Storm Drain

The Potential Project #7 was suggested by the Town due to flooding complaints. In this area, 11 storm inlets were inspected. Six of which were "Poor", 3 were "Fair", and 2 were "Good". There were 4 outfalls identified; 3 "Fair" and 1 "Poor". One pipe was observed to have a negative slope.

This Potential Project is a Replacement, Maintenance, and Repair Project. The 6 "Poor" inlets are brick risers with deteriorating mortar and stone tops. These stone tops lessen the inlet efficiency and could be hindering stormwater conveyance. It is advised that the brick structures be repaired or replaced with concrete risers. Of the 3 "Fair" inlets, two appear to have deteriorating mortar and should be replaced. There are 2 "Fair" and 1 "Poor" outfalls that require maintenance in the form of clearing away sediment and debris to allow free outfall. Upon the completion of this maintenance it may be found that one or more of the pipes needs to be repaired in some way due to deformation. It is also recommended that the negative slope pipe be replaced or repaired to improve conveyance function.

This project has the potential of being incorporated with the Greenwood Park master plan.

Potential Project Area #8 – Cedarcliff Road Storm Drain (Vanderbilt to Forest Road)

The Potential Project #8 was identified by WithersRavenel as an area of interest due to the local topography and apparent age of stream crossing. The stream crossing on Cedarcliff Road was observed to be in "Good" condition at the inlet and outlet. Three storm drain inlets were observed to be in "Good" condition, and one in "Fair" condition. Four storm drain outlets were inspected; 1 "Good", 1 "Fair", and 1 "Very Poor".

This Potential Project is a Repair and Maintenance Project. The outlet deemed "Very Poor" is a 12" VCP that is broken and fractured. It is advised the end section either be replaced or repaired; the fractured section should be removed and the slope around it reinforced with proper ground cover to stabilize any earthwork required. The "Fair" outlet is an 18-inch CMP that has been tapped into the side of the arch culvert under Cedarcliff Road. There is some evidence of preferential flow from the backfill of the CMP that is causing some deterioration of the arch walls. Further investigation is recommended to determine the condition of the CMP. It is advised that all inlets and outlets be maintained by clearing any sediment and debris.

Potential Project Area #9 – Vanderbilt and Park Road Intersection Storm Drain Network

The Potential Project #9 was identified by WithersRavenel as an area of interest due to the proximity to Potential Project #1. The outfall at the Vanderbilt and Park Road intersection is downstream of the five-way

intersection on Vanderbilt that is known to have flooding issues. Five inlets were inspected in this area; 4 were in "Fair" condition, and 1 "Needs Repair". Two culverts were identified; 1 in "Poor" condition and 1 in "Fair".

This Potential Project is a Repair, Replacement, and Maintenance Project. There 4 of the inlets are made of brick with deteriorating mortar and small inlet openings. The brick risers can be cleaned and repaired with new grout. It is advised that the "Needs Repair" inlet be replaced with either a brick or concrete riser. Many of the pipes within this network are 10-inch VCP and a hydraulic analysis is recommended to determine if these pipes provide adequate capacity. The "Poor" condition culvert has a reversed slope and broken outlet end. This culvert should possibly be replaced to improve hydraulic function. The "Fair" condition culvert is made up of two materials and appears to have sediment build up at the outlet. This culvert requires maintenance in the form of clearing sediment and debris from the inlet and outlet to ensure positive drainage to the outfall and increase the flow efficiency. In addition, the culvert should be inspected for gaps and cracks where backfill may be leaching and causing sedimentation at the outlet.

Potential Project Area #10 – Browntown and Amherst Road Intersection Storm Drain Network

The Potential Project #10 was requested by the Town after WithersRavenel identified the general area as one of interest. There are four inlets in the area; 3 in "Fair" conditions and 1 "Good". One culvert was identified in "Poor" condition.

This Potential Project is an Expansion and Replacement Project. The "Fair" inlets may require some cleaning and additional grouting for deteriorating mortar, however network pipe sizes range from 6-inches to 12-inches and further study is required to determine if the available hydraulic capacity is sufficient for the desired level of service. The flooding issues noted in the area could be from the shallow risers becoming overwhelmed. The number of inlets may be unable to capture the runoff associated with the network drainage area. Additional inlets may be proposed in order improve the efficiency of the network. Further analysis is required.

CONCLUSION

The results of the field reconnaissance yielded some projects that require immediate assistance to improve drainage conditions due to structures in need of repair. Other projects were found to be ongoing maintenance projects that can be implemented with a proper maintenance plan. Further hydrologic and hydraulic analysis is required for the majority of the potential projects. These projects will be expanded upon and developed further in Phase 2 of the Stormwater Master Plan.

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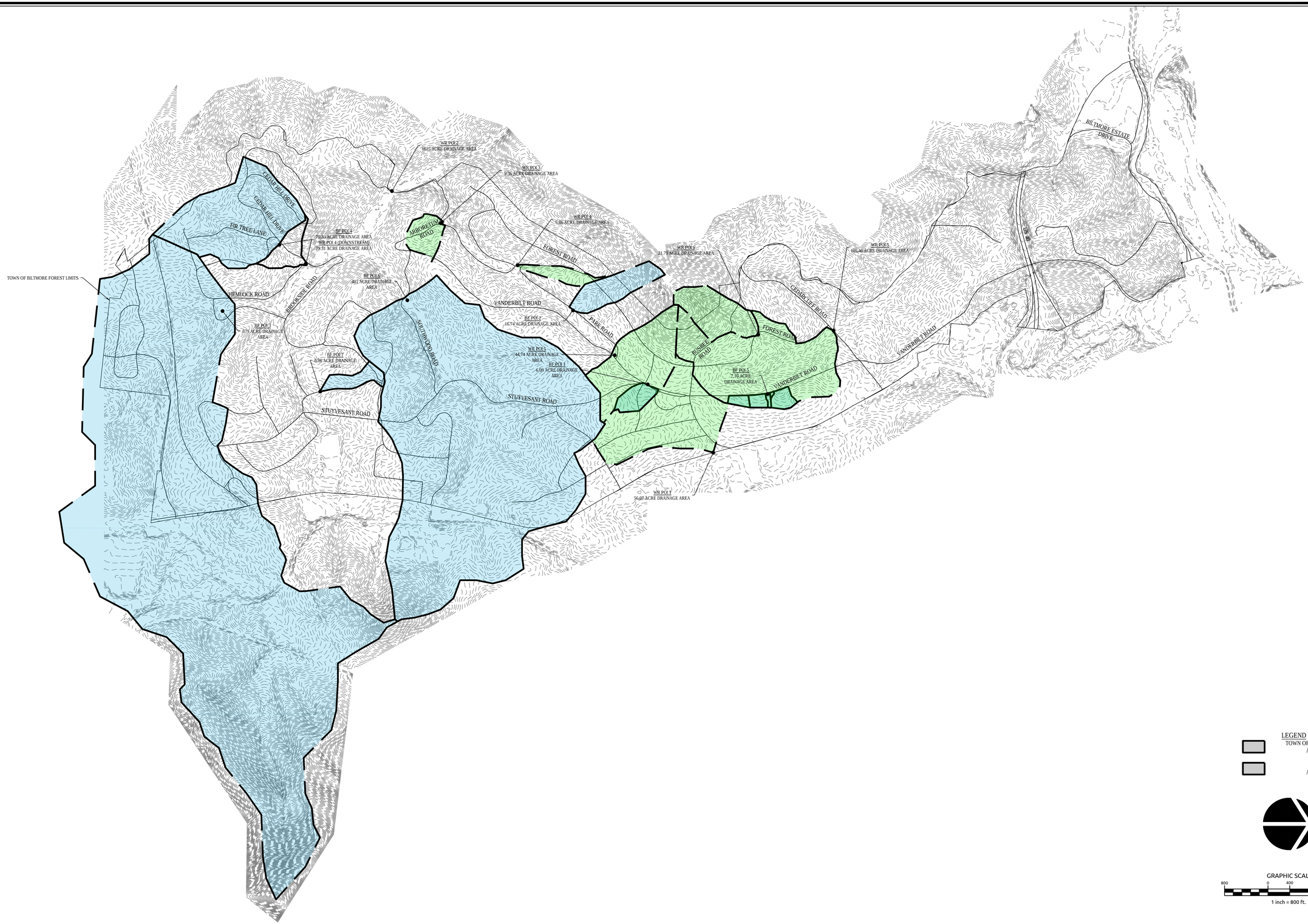
WATERSHED MAP



LEGEND

TOWN OF BILTMORE FOREST
AREAS OF INTEREST

WITHERSRAVENEL
AREAS OF INTEREST

GRAPHIC SCALE

800 0 400 800 1600

1 inch = 800 ft.

No.	Revision	Date	By

Designer WR	Scale 1" = 600'
Drawn By BJM	Date 5/3/2018
Checked By JCD	Job No. 02170940.00

BILTMORE FOREST
STORMWATER MASTER PLAN

BILTMORE FOREST BUNCOMBE NORTH CAROLINA

DRAINAGE AREA MAP

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Sheet No.

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PROJECT AREA MAP

Biltmore Forest Project Areas

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0 250 500 1,000 Feet

1 inch = 500 feet

Potential Project Area #1 - Vanderbilt and Lone Pine Road

Potential Project Area #2 - Cedarcliff Road Storm Drain (Vanderbilt to Forest Road)

Potential Project Area #3 - Vanderbilt Road Storm Drain (Cedarcliff to Busbee Road)

Potential Project Area #4 - Cedar Hill Dr

Potential Project Area #5 - Vanderbilt and Park Road Intersection Storm Drain Network

Potential Project Area #6 - Golf Course Pond Spillway

Potential Project Area #7 - Greenwood Road Storm Drain

Potential Project Area #8 - Brooklawn Chase and Hemlock Road

Potential Project Area #9 - Park Road Cross Drainage

Potential Project Area #10 - Brownlown and Amherst Road Intersection Storm Drain Network

Legend

- Storm Inlets
- Culvert Points
- Storm Manholes
- Storm Discharge Points
- Storm Network Structures
- Stormwater Weirs
- Storm Open Drains
- Storm Virtual Drainlines
- Culvert Pipes
- Gravity Main Pipes
- Road Centerlines
- Municipal Limits
- Tax Parcels
- Project Areas