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Final Report

Siler City Stormwater Infrastructure Mapping and Assessment Project

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Siler City Stormwater Mapping and Assessment Project

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EXECUTIVE SUMMARY

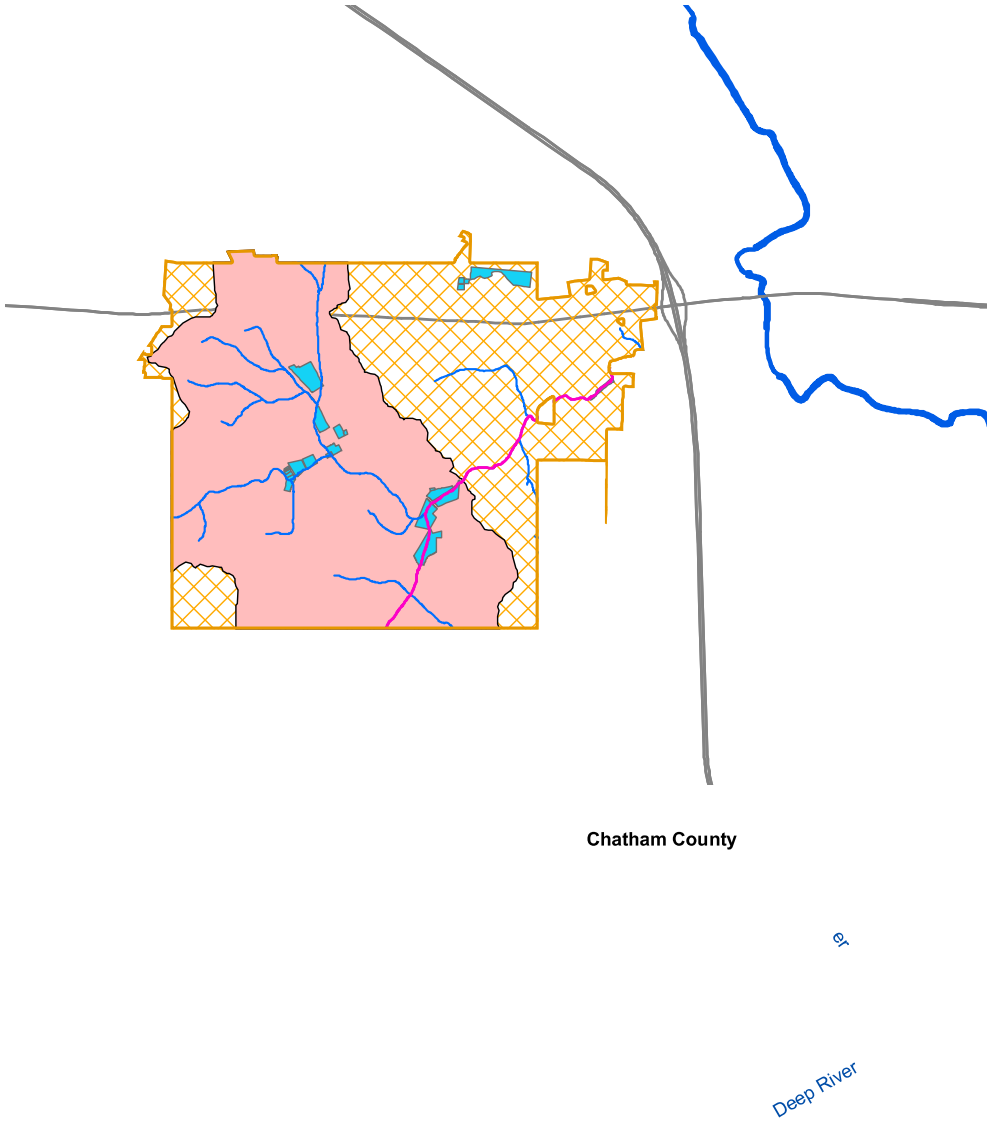
In 2019, Triangle J Council of Governments (TJCOG) and Biocenosis/Loves Creek Watershed Stewards obtained a grant from the NC Division of Water Resources to map and assess the condition of stormwater infrastructure on public roadways within a predetermined 2.7 square mile priority drainage area of Siler City. This priority drainage area contains the areas that most frequently flood within the 6.1 square mile town limits. The goal of this project was to help Town and DOT staff locate, manage, and maintain stormwater infrastructure and prioritize maintenance to help alleviate flooding concerns and improve water quality. In the priority watershed, field data collection showed approximately 30% of the stormwater point infrastructure (e.g., storm drains) and 40% of the stormwater pipes (e.g., road culverts) to be blocked by debris. Cleaning out stormwater infrastructure prioritized as part of this project would help these devices to function as designed, conveying floodwaters to streams more quickly. Added benefits of maintenance may include preventing safety hazards such as sinkholes and improving water quality as part of a broader stormwater management strategy. This may include preventing pollution such as litter and debris, and mitigating runoff by implementing green stormwater infrastructure practices such as rain gardens, which help rainwater soak into the ground or evaporate back into the air. This report outlines the approach, methods, results, and recommendations from this project in order to supply the Town of Siler City with the necessary information to establish a successful stormwater infrastructure inventory and maintenance program.

1 BACKGROUND AND PURPOSE

1.1 Geographic Context

The Town of Siler City is located in the Piedmont region of North Carolina in rural western Chatham County. The town has an incorporated area of just over six square miles and has held the status of the largest municipality in the county since 1930. Today the population of Siler City is just over 8,000 and continues to grow rapidly.

Figure 1: Context Map



Siler City grew from 6,966 residents in the 2000 Census to 7,887 in the 2010 Census (13% growth). The Census Bureau estimates that the population continued to grow to 8,396 by 2015 (21% growth since 2000). Significant changes to business and industry have contributed to this growth. Mountaire Farms reopened the former Townsends poultry plant in 2019, adding an estimated 1,250 new jobs in Siler City according to an April 2019 Chatham News and Record article. This plant also contributes poultry processing wastewater to Siler City's wastewater treatment plant, which discharges to Loves Creek. Additional growth is expected from an 1,818-acre Chatham-Siler City Advanced Manufacturing (CAM) development-ready site located within the town's planning jurisdiction boundary.

Established in 1887, Siler City has a long history as the industrial and commercial center for Chatham County; the main roads of the town were hard-surfaced between 1926 and 1927. Increases in impervious surfaces such as this roadway system, sidewalks, parking lots, roofs, and other hard surfaces associated with population growth also result in an increase in potentially hazardous stormwater runoff. Siler City staff have recognized the need for an enhanced understanding of the existing stormwater infrastructure in the Town to address growing concerns over flooding. In the 2017 Chatham County Resilient Redevelopment Plan, Town staff note that "A comprehensive Stormwater management plan is needed to investigate existing issues and make recommendations for projects to improve drainage and reduce flooding. Officials have expressed a need for comprehensive stormwater enhancements to solve recurring flooding issues at several locations."

The contiguous town limits of Siler City lie almost completely within the Loves Creek watershed, which drains into the Rocky River. According to the Cape Fear River Basinwide Water Quality Plan (October 2005), several sections of Loves Creek in Siler City are on the 303(d) list of Impaired Waters for aquatic life due to "Fair" benthic macroinvertebrate community ratings at multiple sampling sites. In 2000, the Basinwide plan states that "Siler City was encouraged to develop a stormwater program and other watershed initiatives to improve water quality in this creek." The 2005 Basinwide Plan reported that a stressor study completed in the Loves Creek watershed indicated toxic chemicals in urban stormwater runoff and noted that streambank erosion, sedimentation, and excessive algal growth were also stressors.

For the past several years, Piedmont Conservation Council, Biocenosis, NCSU, the Town of Siler City, Chatham County Soil and Water Conservation District, and Triangle J Council of Governments have successfully worked in partnership to obtain North Carolina state funding to implement BMP/SCM restoration activities targeting stormwater reductions, improving Loves Creek tributary water quality and ecological habitat in the Town of Siler City. Prior to this project, these organizations' partnership has successfully obtained grant funding to complete several other stormwater management planning and

restoration projects.

1.2 What is Stormwater?

Stormwater runoff is created when rain hits pavement, rooftops, or bare soil, then picks up and transports anything on the ground (oil, gas, litter, yard waste, dirt, fertilizers, pet waste, etc.) into storm drains, ditches and culverts. These flow directly to Siler City's creeks without being treated. The Loves Creek Watershed Stewards will use data generated through this project to help identify locations where green infrastructure projects such as rain gardens or stream restoration can treat stormwater runoff while also providing a space for enjoying the outdoors. The Stormwater Control System shown below, installed on Chatham Avenue next to Chatham Rabbit and the Arts Incubator is one example of a completed green infrastructure project that improves the water quality of stormwater runoff in Siler City.

Figure 2: One of two raised bioretention beds outside the Arts Incubator

1.3 Why Map and Assess Stormwater Infrastructure in Siler City?

Flooding may be worsened by aging and unmaintained stormwater infrastructure. When it rains, debris stuck in storm drains and culverts may prevent stormwater infrastructure components from moving water off the streets as designed and prevent floodwaters from receding. Additionally, when water cannot pass through stormwater infrastructure it will find a path around or through, often resulting in safety hazards such as broken storm drain grates, collapsed pipes, and/or sinkholes forming around clogged infrastructure features. Finally, cleaning out stormwater infrastructure improves water quality by reducing the debris and other pollution flowing from the stormwater system to streams in Siler City. Photos of selected stormwater infrastructure features and their condition are shown in Figure 2.

Figure 3: Examples of Stormwater Infrastructure in Siler City

Clear catch basin *Clogged catch basin* *Clear culvert*

Mostly buried culvert *Clogged/broken catch basin* *Broken (not clogged) curb inlet*

Biocenosis and Town staff elected for this project to target the 2.7 square mile priority watershed area within the contiguous Siler City Town Limits that included the majority of the parcels identified as frequently flooding for the "Hurricane Matthew Resilient Redevelopment Plan" submitted by Chatham County to FEMA in May 2017. The drainage area was delineated using ArcGIS 10.7's Spatial Analyst Hydrology Watershed tool on a point on Loves Creek just downstream of South Second Avenue, and downstream of 17 of the 22 parcels identified as frequently flooding. This drainage area was clipped to the town's contiguous town limits.

In addition, the priority drainage area includes Tributary 2 of Loves Creek watershed, which has a long history of flooding during any large rain event. In August of 2019, the Loves Creek Watershed Stewards (LCWS) completed the "Park Shopping Center/Loves Creek Tributary 2 Restoration Study," which explored stormwater control measures and restoration methodologies that could be applied within the Tributary 2 watershed to improve water quality and habitat while addressing flooding issues. As part of this study, students from Elon University and a NCSU intern worked with Biocensosis LLC to assess 102 stormwater catchment basins in the Park Shopping Center vicinity. During their assessment the students found that many of the stormwater catch basins in both in the Town of Siler City and in the NC Department of Transportation street rights-of-way needed maintenance. This finding led the Town of Siler City to seek assistance from TJCOG to map and assess stormwater infrastructure in the priority watershed more comprehensively and rigorously.

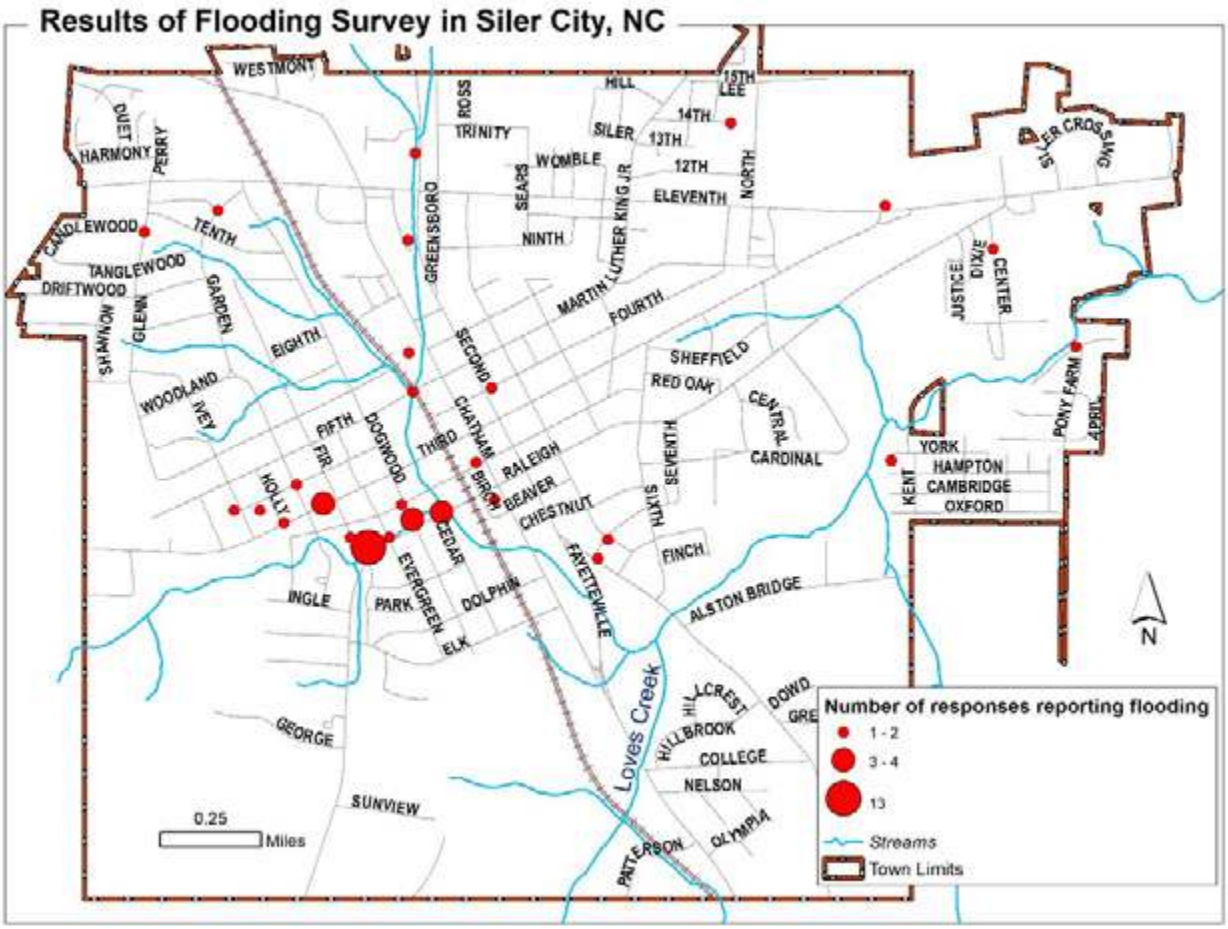
Final project deliverables to be provided to Town and DOT staff include maps, data, and associated photographic documentation showing the location and condition of all assessed stormwater infrastructure on public roadways in the priority watershed. These deliverables will assist Town and NCDOT staff with locating, managing, and addressing identified cleanout or maintenance needs. While not a silver bullet, fixing impaired stormwater infrastructure would help alleviate the impacts of flooding in the priority watershed.

2 METHODS

2.1 Public Input

In April 2019, TJCOG staff developed a survey which Town staff distributed to solicit public input about locations where Siler City residents had noticed reoccurring flooding (Appendices I and II). Town staff facilitated a public meeting on May 14, 2019 which yielded further input about flooding locations. It was clear that flooding frequently occurs in the lowest-lying areas, particularly in the vicinity of the Park Shopping Center on Raleigh Street, as shown in Figure 3 below. TJCOG staff used these findings to prioritize field data collection.

Figure 4: Flooding Locations Identified Through Public Input



2.2 Field Data Collection

After testing different data collection methods and equipment, TJCOG staff ultimately surveyed stormwater infrastructure in the priority watershed using a Trimble R1 GNSS Bluetooth device to collect data via the ArcGIS Collector app on an Android field tablet, show in Figure 4 below.

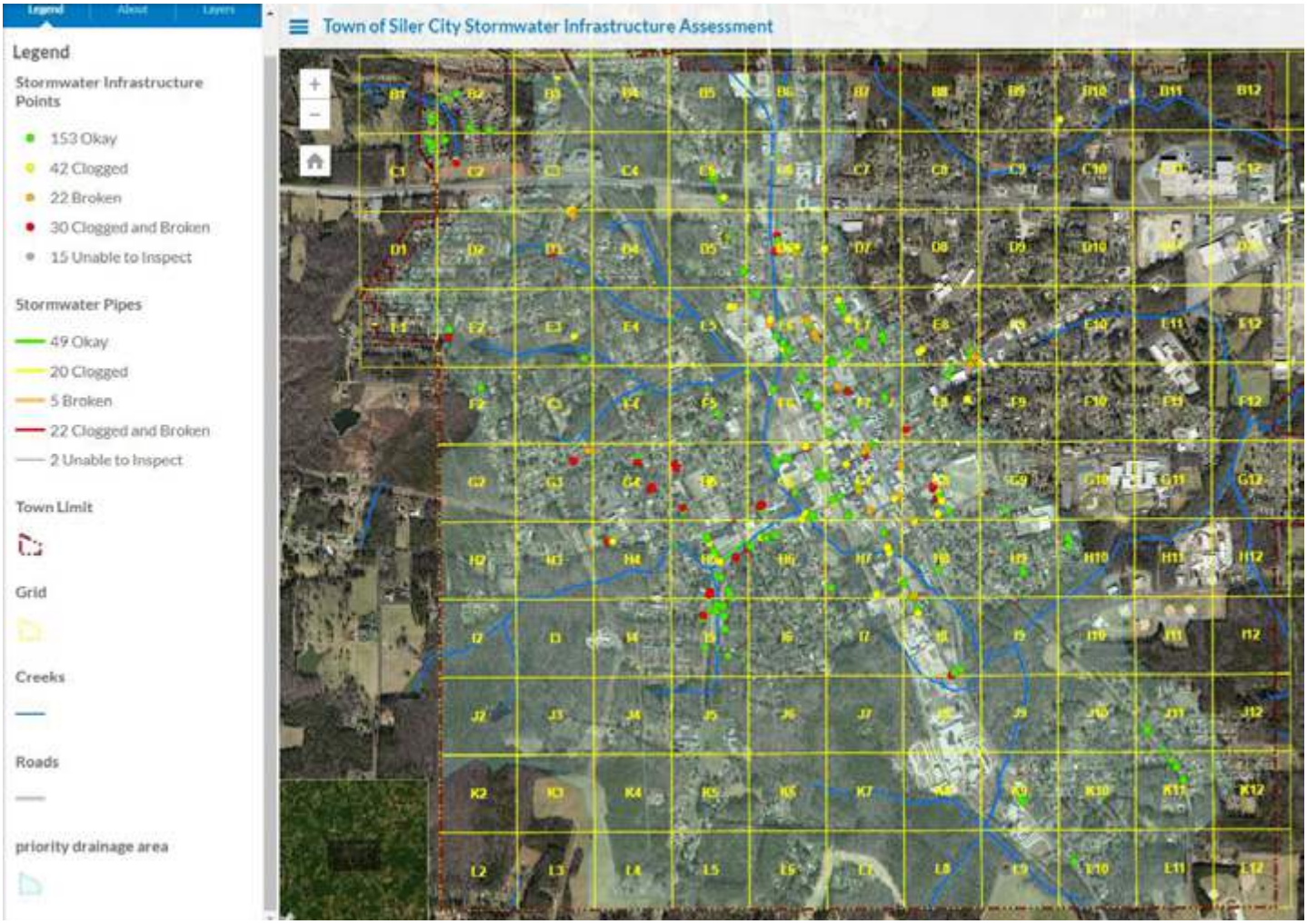
Figure 5: TJCOG Staff Performing Data Collection via Tablet and GNSS Receiver

Biocenosis staff created a geodatabase in ESRI ArcGIS to house stormwater infrastructure data on public roadways in the priority watershed. The completed database was uploaded to an online web map in ArcGIS Online so that it could be populated during field work. Stormwater attribute data collected in the field consisted of stormwater infrastructure type, location (x-y coordinates), material, condition, cleanout needs, visual pollution, description of problems/failures, and a high-resolution hyperlinked photo linked to each stormwater feature. At the end of each fieldwork day, data points from the Android tablet were synced back to the geodatabase. TJCOG staff mapped and assessed 364 stormwater infrastructure features on public streets in the priority watershed over 12 days of fieldwork. (An additional 50 storm drains or culverts and 14 miles of ditch were mapped based on aerial photography.)

Field data collection confirmed, and expanded, information collected via the public input process. A summary of features requiring maintenance is outlined in this document, and data may be viewed in full on Biocenosis' - interactive webmap (link: http://ow.ly/LiCc50zshH5). The 262 stormwater point features and 102 stormwater line features surveyed primarily included storm drains (or "catch basins") and road culverts, as well as manholes, outfalls, pipe inlets/outlets and those stormwater pipes that could be seen from aboveground. Of the assessed stormwater infrastructure features, 204 drain Town-maintained streets and 155 drain NCDOT-maintained streets.

For this project, stormwater points were defined as catch basins, outfalls, manholes, and visible pipe inlets/outlets. Stormwater lines were defined as road culverts and stormwater pipes that could be confidently assessed from aboveground. The project scope included only publicly maintained stormwater infrastructure along roadways. Initially, TJCOG staff mapped driveway culverts, as they are in the public-right-of-way and their clogging may contribute to flooding on residential streets lined by ditches. Ultimately, this project only delineated road culverts, as driveway culverts have not historically been maintained by city staff. The partial dataset of driveway culverts will be provided to Town staff for future use if desired.

Figure 6: Interactive Stormwater Infrastructure Webmap



2.3 ArcGIS Data Analysis

Upon TJCOG completion of the stormwater infrastructure data collection, Biocenosis reviewed the data in ESRI's ArcGIS. Field data sets were sorted and merged create a single stormwater point feature layer (to include catch basins, inlets, and outlets) and a separate line feature layer for linear features (stormwater pipes and road culverts). Necessary data edits were made to snap collected data points to aerial imagery. A ditch lines data layer was created using aerial imagery. Each data point was assigned a unique structure ID based on the infrastructure's location in the grid, owner (Town or State), and infrastructure type to make it easy to locate in the Stormwater Infrastructure Map Book provided to Town of Siler City.

Final stormwater infrastructure data products include:

- A "Lookbook" of the top 50 stormwater infrastructure features that need both structural improvement and cleanout which maintenance staff can to prioritize maintenance needs (separated by Town / State maintenance responsibility);
- Printed map book for use by maintenance staff in the field, organized by grid square as shown in Figure 5;
- Full stormwater geodatabase to be housed on the Chatham County Open GIS Data portal as a public repository that Town and other staff can use;
- Individual shapefiles for Town staff use;
- Interactive webmap for staff and the public to view data.

2.4 Database Access and Use

Collected stormwater data were organized into a final Stormwater Master Geodatabase enabling Town and DOT staff to view and query infrastructure locations, attributes, and hyperlinked photos using ESRI ArcGIS or any similar GIS software. The geodatabase contains two feature datasets: Points and Pipes. The stormwater points layer includes all stormwater inlets, manholes, outlets, and outfalls assessed. By clicking on each point or linear feature, users can view additional information, including pipe or catch basin size and material, number of pipe connections, clean out needs, visual condition, presence of pollution, any other relevant notes, and photos. As previously mentioned, the final stormwater infrastructure network is also being provided as a web map in ArcGIS Online for public viewing.

3 RESULTS

The total number of stormwater infrastructure features mapped and assessed included 262 stormwater points (138 owned by the Town of Siler City and a 124 owned by NC DOT) and 98 stormwater pipes (77 owned by the Town of Siler City and 16 owned by NCDOT). Catch basins made up 96% of the stormwater point infrastructure assessed, and culverts made up 96% of stormwater pipe infrastructure assessed.

To assist Town staff in prioritizing near-term maintenance, TJCOG staff developed a Lookbook of the stormwater infrastructure features observed to both require cleanout and be in poor structural condition. Below summarizes cleanout and condition issues for all stormwater infrastructure that was both mapped and had its condition assessed in the field:

Table 1: Summary of Stormwater Infrastructure Assessed in Person

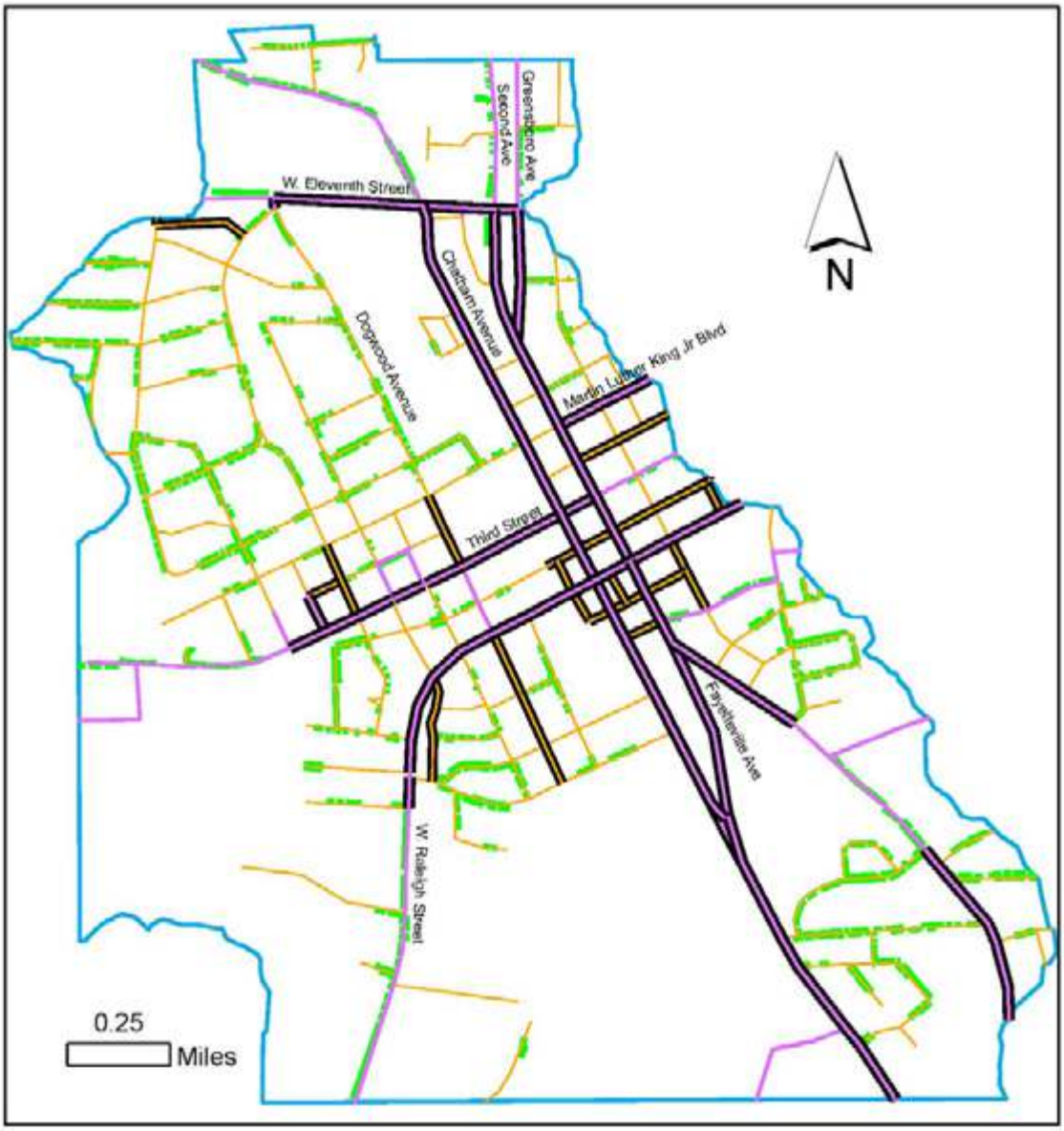
	Point Infrastructure Type						**Linear Infrastructure Type**			**Total**
Owner	Catch Basin	Manhole	Outfall	Pipe Inlet	Pipe Outlet	Total Points	Road Culvert	SW Pipe	Total lines	All assessed infrastructure
Town	114	2	4	1	3	124	81	2	84	208
State	133	0	2	0	3	138	17	2	19	157
Total	247	2	6	1	6	262	98	4	102	**364**

*Does not include ditch and other features identified via aerial photographs mentioned above

Approximately 14 road miles of ditch were also mapped using aerial photography and Google Maps Street View (including some roads with ditches on both sides.) Of the 40 road miles in the priority watershed, approximately 28% are drained by curb and gutter 36% by ditches. The remaining 35% either have grassy swales that convey stormwater to drop inlets or do not have any drainage infrastructure. Within the priority drainage 11% of the town maintained streets and 61% of state maintained streets have curb and gutter, as shown in Figure 6, below.

Biocenosis' use of aerial photographs and Google Maps to map ditches identified an additional 15 culverts and 35 catch basins inaccessible via field data collection on foot (i.e., along highways). These features were included in the online webmap/stormwater infrastructure geodatabase.

Figure 7: Presence of Curb and Gutter, Ditch, or Neither in the Priority Watershed Area



Streets with Curb and Gutter and Stormwater Ditches in the Stormwater Infrastructure Asssessment Project Priority Watershed

- Curb & Gutter on State Maintained Streets
- State Maintained Streets
- Curb & Gutter on Town Maintained Streets
- Town Maintained Streets
- Stormwater Ditches
- Priority Watershed

3.1 Assessed Cleanout Needs

Infrastructure features were designated as in need of cleanout if they were more than half full of debris. Of the catch basins assessed, 28% of them needed to be cleaned out (33% owned by the Town of Siler City and 23% owned by NCDOT). The number of stormwater point infrastructure in need of cleanout is shown in the table below.

Table 2: Stormwater Infrastructure Points in Need of Clean-out

	Catch Basin	Manhole	Outfall	Pipe Inlet	Pipe Outlet	Total
Town	38	1	1	1	0	41
State	30		0		1	31
Total	68	1	6	1	6	72

Of the stormwater pipes (road culverts and stormwater lines) 43% of them needed to be cleaned out (44% maintained by NCDOT and 43% maintained by the Town). The number of stormwater pipes in need of cleanout is shown in the table below.

Table 3: Stormwater Pipes in Need of Cleanout

	Road Culvert	Stormwater Line
Town	33	2
State	6	2
Total	39	4

Figure 8: Catch Basin with Sediment, Leaves, Sticks

Based on preliminary results that TJCOG and Biocenosis shared with Siler City staff at a May meeting, Siler City staff cleaned out the following infrastructure features:

Figure 9: Stormwater Infrastructure Cleaned Out May 2020

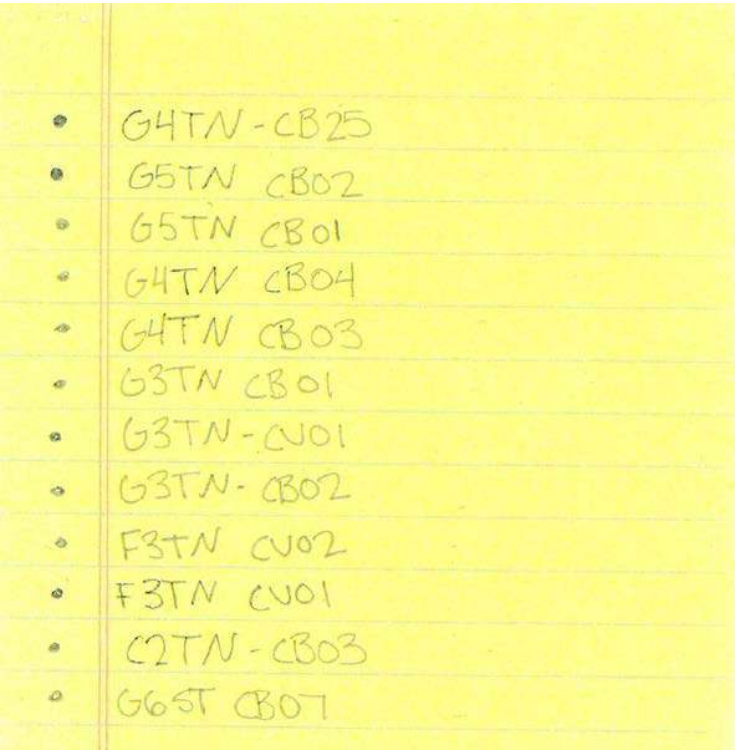


Figure 10: Catch Basin Full of Sediment (Cleaned 5/2020)

The infrastructure cleaned out in May 2020 has been noted in all map formats while remaining in the "cleanout needed" field due to likelihood of these infrastructure features filling up again as they drain low-lying areas which receive large volumes of debris in stormwater runoff.

3.2 Assessed Infrastructure Condition

Infrastructure features were assigned to the categories "Good," "Fair," and "Needs Improvement." The category "Needs Improvement" was assigned for infrastructure features that were physically broken (ie, collapsed pipes or broken catch basin grates), abutting sinkholes or another safety hazard, or otherwise clearly not able to meet their designated function. The category "Fair" was assigned for infrastructure features which might become compromised in future (e.g., due to a minor crack around a catch basin or pipe) or which were not functioning fully (e.g., the entrance to a storm drain was partly blocked by road repaving.) "Good" infrastructure had no observed problems. Of the catch basins assessed, 53% were in "Good" condition, 21% "Fair", and 22% "Needs Improvement." TJCOG staff were unable to access the remaining 3% without special equipment or stopping traffic and has flagged these for Town/DOT staff to investigate. The number of catch basins in each condition category is given in the table below. Of the 6 stormwater outfalls to streams that were assessed, 50% were in "Good" condition, 33% "Fair", and 17% (one instance) "Needs Improvement".

Table 4: Assessed Condition of Catch Basins

	Good	Fair	Needs Improvement	Unable to Access
Town	67	25	22	0
State	65	28	32	8
Total	132	53	54	8

Observed issues with stormwater infrastructure condition included grates that were broken or absent, erosion around features, cracked or crushed features, and sinkholes, shown in the figures below.

Figure 11: Sinkhole and Broken Pipes on West Second Street

Figure 12: Erosion of Curb Next to Catch Basin on West Raleigh Street

Of the stormwater pipes mapped, 27% fell into the "Needs Improvement" category. Approximately 80% of the 98 stormwater culverts and stormwater lines assessed are owned by the Town. The number of pipes and their assessed condition are given in the table below.

Table 5: Assessed condition of stormwater pipes

	Good	Fair	Needs Improvement
Town	42	16	21
Town?	1	1	2
State	9	5	3
Total	52	22	26

3.3 Observed Pollution

Pollution such as litter, sediment, oil, yard waste or a combination of these was visible in 30% of all stormwater infrastructure features; the most observed pollutants were litter and sediment.

Figure 12 below shows how stormwater has picked up litter and dropped it a low-lying storm drain (here, outside the Piggly Wiggly on West Raleigh St.) after which it will be washed into the creek.

Figure 13: Litter in Catch Basin Outside Piggly Wiggly

Visible pollution was evident at 50% of the stormwater outfalls of concern; the figures below show examples of pollution washing off the street and/or out of a stormwater outfall to a ditch:

Figure 14: Clogged/Broken Outfall Pipe and Litter on Third Ave.

Figure 16: Outfall Pipe with Oil Sheen

3.4 Data Gaps

Twenty-five points were flagged for Public Works staff to revisit because TJCOG staff could not see in due to:

- Curb inlets on busy roads that would require stopping traffic and laying in the street to see in; these were noted in the Flag field as “Can’t see in safely”
- A metal or concrete cover that may require machinery to lift and investigate (though some covers appeared to be cemented into the sidewalk); these were noted in the Flag field as “Need PW staff to investigate”
- Could not see in due to road repaving narrowing the opening of a curb inlet to a crack; these were noted in the Flag field as “other”

4 DISCUSSION

Fieldwork revealed a great variety in the location, density, type, and condition of stormwater infrastructure across the priority watershed. Observed by TJCOG staff based on field data collection are noted below.

4.1 Patterns in Stormwater Infrastructure Location and Density

- Town staff informed TJCOG/Biocenosis that the stormwater infrastructure webmap included several stormwater infrastructure features that they had not been aware of. This showcases the benefit of continuing to map stormwater infrastructure, which has been installed at various points in Siler City's history.
- Within the priority watershed, data showed the density of stormwater infrastructure to vary by elevation, land use and ownership, with higher density of stormwater infrastructure:
  - At lower elevation than higher elevation
  - In commercial than in residential areas
  - On Town-owned streets than DOT-owned streets (this may be due to there being relatively more Town- than DOT-owned streets in Siler City.)
- There are more frequently catch basins along newer roads/developments, presumably per new development stormwater rules.
- There appears to be denser stormwater infrastructure in areas with curb and gutter, regardless of age.

4.2 Patterns in Types of Stormwater Infrastructure

- Downtown Siler City generally has more consistent curb and gutter (and thus catch basins) than outlying area. However, some residential areas closer to and north of downtown also lack curb and gutter.
- Stormwater infrastructure in residential areas is more likely to be comprised of ditches and culverts rather than catch basins, particularly in the case of residential areas further from downtown. However, some catch basins are present in residential neighborhoods, particularly close to downtown, including on non-curbed streets and occasionally in residents' front yards.

4.3 Patterns in Stormwater Infrastructure Condition and Cleanout Needs

- Stormwater infrastructure at the lowest elevation parts of the watershed, near streams, were most likely to be broken or clogged, as they received the highest volume of stormwater and debris it carries.
  - In low-elevation areas with less dense catch basins, those catch basins are more likely to be clogged since they receive all the stormwater/debris.

  - The field data and public input showed that there was more flooding in areas with clogged or otherwise non-functioning stormwater infrastructure (see map in Appendix 4.)

- Some stormwater infrastructure at low elevation points was clear, as Town staff has cleaned out some of the "problem" spots based on citizen complaints.
  - A list of infrastructures cleaned out between February 2020, when data collection concluded for this project, and May 2020, when this report was written, was provided by Public Works staff and noted in the webmap/ Figure 8.
  - After June 2020, Siler City Public Works staff stated their intention to keep a running list of stormwater infrastructure that they clean out to keep stormwater infrastructure condition data current.
  - Project data will be readily updateable on Chatham County's Open GIS Data page.

4.4 Data Limitations/ Areas for Further Exploration

This project focused on a subset of the full Town limits based on priority watershed and known flooding areas in order to best utilize existing resources; as such, additional opportunities exist to augment this data set and create a more robust and comprehensive stormwater infrastructure inventory:

  - Mapping the stormwater infrastructure in the remainder of Siler City outside the priority watershed would help provide a full picture of infrastructure location and maintenance needs.
  - Additional assessment and inventory of the subsurface infrastructure both within the study area and other areas of the Town limits is recommended when resources exist.
  - Condition and maintenance needs of public and privately-owned ditch systems within and outside the study area should be gathered as feasible, as well as condition of additional features identified by aerial photography that were not accessible via field data collection on foot.
  - Data about infrastructure cleanout needs represents a "snapshot in time;" logging cleanouts as they occur will make it possible to keep the data reflecting current cleanout status.

5 NEXT STEPS

The stormwater infrastructure features prioritized in the Lookbook, maps and database that TJCOG and Biocenosis share with Town staff and DOT staff can be targeted for initial cleanout or maintenance. In the near term, Town staff can use this data to prioritize cleanout and repair of stormwater infrastructure features observed to be broken or abutting safety hazards like sinkholes. Town staff can share the Lookbook with DOT when they are working; they are furloughed at time of writing (June 2020.)

As mentioned previously, Town Public Works staff has suggested keeping a record of stormwater infrastructure as they clean it out. An infrastructure "cleanout log" will show when the same infrastructure features regularly become clogged. This could also inform other stormwater management strategies, such as working to ensure effective sediment and erosion control practices at construction sites upslope of these "problem" infrastructure features, or siting of green infrastructure practices to help treat a portion of the runoff flowing to infrastructure features that cannot adequately treat the amount of runoff they receive.

Designating Town and DOT staff responsible for cleaning out catch basins and developing a cleanout schedule will help ensure that cleanouts are effective. Since water flows from catch basins and culverts on state-maintained streets like Second Ave to town-maintained streets like Second Street, coordination between Town DOT staff will be important. Regularly cleaning out stormwater infrastructure will help to alleviate flooding worsened by clogged infrastructure and prevent pollutants such as litter, sediment, oil, gas, and yard waste from washing into Siler City's streams.

Continuing to implement green infrastructure projects on public or interested private property owners' lots would contribute towards the goals of maintaining stormwater infrastructure, helping to alleviate localized flooding and improving water quality. The Loves Creek Watershed Stewards, NCSU and the Town have obtained a 319 Nonpoint Source Grant to implement stormwater control measures within the Loves Creek Tributary 2 watershed, which has a history of frequent flooding. Over the next two years, this project will involve constructing roadside rain gardens along local public right-of-ways within this subwatershed, as shown in Figure 17 below. Additional potential green infrastructure project sites identified through this project site are included in Appendix IV for further consideration.

In the longer term, as budget allows, dedicated stormwater program staff would expand Town staff's ability to maintain stormwater infrastructure. Similarly, an adequate number of dedicated maintenance staff could help DOT to maintain their infrastructure on state-owned streets in Siler City. Town staff could coordinate with Chatham County about the possibility of partnering to implement a stormwater utility, which could potentially provide part of the revenue for a Town stormwater staff position.

Figure 17: Rendering by Coaly Design of a linear rain garden along Cardinal Street

6 APPENDICES

6.1 Appendix I. Survey distributed on 5/14/10: Runoff and Flooding on Public Property in Siler City

Siler City, like many historical towns, is experiencing increased flooding. Triangle J Council of Governments and the Loves Creek Watershed Stewards are working together to map stormwater infrastructure (storm drains, ditches, and culverts) on public roadways in downtown Siler City. We want to identify the roads/intersections that have the worst problems with flooding after it rains, so that public works staff can fix any clogged or broken storm drains that may be contributing to flooding. Your participation is completely voluntary, and your input will help us to focus our assessment and help Town staff prioritize where to maintain stormwater infrastructure.

1. We are interested in learning about places on public property that flood after it rains, so that public works staff can fix the clogged or broken storm drains if they are contributing to flooding.

After it rains, where have you noticed flooding? (Note as many locations as are issues; you don't need to fill all blanks.) Please tell us the cross-streets or other landmark that would help us find the site(s).

Location 1 _____

Location 2 _____

Location 3 _____

(add as needed)

2. If you had to prioritize which of the locations above have the worst flooding, how would you rank them? (please write out location cross streets or landmarks)

1. (Worst)

2.

3.

4.

5. (least bad)

3. Please note any locations on public property where you have noticed a stormwater inlet or ditch blocked by leaves, sticks, trash, etc. You can report as many locations as needed. (These may or may not be the same locations as those above.)

Location 1

Location 2

Location 3

Location 4

Location 5

4. Have you noticed any damaged stormwater infrastructure, such as missing grates, collapsed pavement around storm drain, etc? If so, please note location and type of damage.

Location 1

Location 2

Location 3

Location 4

Location 5

6.2 Appendix II. Flooding Locations Ranked by Respondents

Respondent 1

- The drain at the SW corner of The Dykers Bldg

Respondent 2

- Location 1: 11th street near Exxon station
- Location 3: Street between 3rd and Martin LK Blv. near church
- Location 2: Maxway and Boiling park area

Respondent 3

- Location 3: In front of Southern States
- Location 1: Zone Fitness 308 W Raleigh St
- Location 2: Piggly Wiggly Fir Street
- Location 4: In front of Marathon Gas on W Raleigh

Respondent 4

- Location 2: 223 W Raleigh Street
- Location 3: Piggly Wiggly W Raleigh Street
- Location 1: 308 W Raleigh Street

Respondent 5

- West 3rd Street

Respondent 6

- 1111 N 2ND AVENUE

Respondent 7

- Location 1: Business on Fir Ave
- Location 2: Piggly Wiggly and Compare Foods Shopping Centers
- Location 3: Southern States area near Evergreen
- Location 4: 2nd Street
- Location 5: Dogwood Ave in between Southern States and Marathon

Respondent 8

- Fir (depending on how much it rains, it can flood all the way up the to Marathon gas station just past Southern States)

Respondent 9

- West 3rd Street is the worst for us. I know it's DOT, but the catch basins are full of silt and it gets bottlenecked behind the corner of North Fir & 3rd Street after it goes under West 3rd Street.

Respondent 10

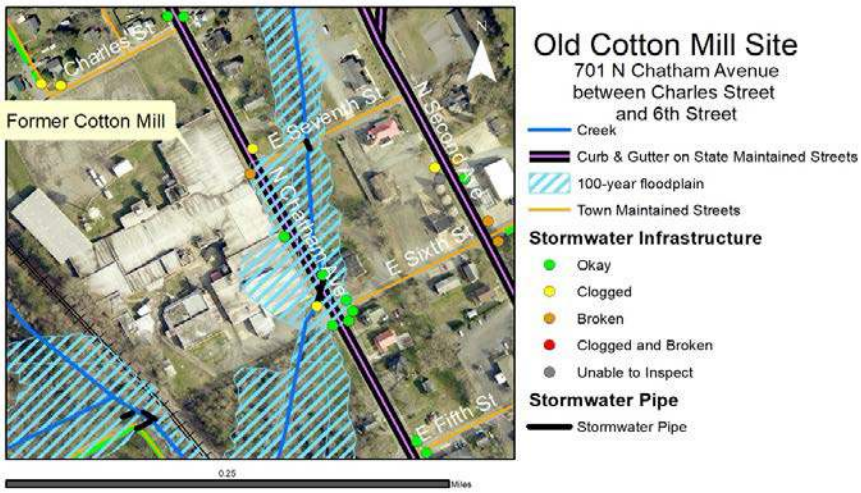
- Back Alley behind WINLAND GROUP'S building (private property?)

6.3 Appendix III: Flooding Locations Identified by Public Input Survey and Field Assessment

Screenshot of Webmap Showing Flooding Locations; Click to Zoom In

6.4 Appendix IV: Potential Stormwater Control Measure Sites

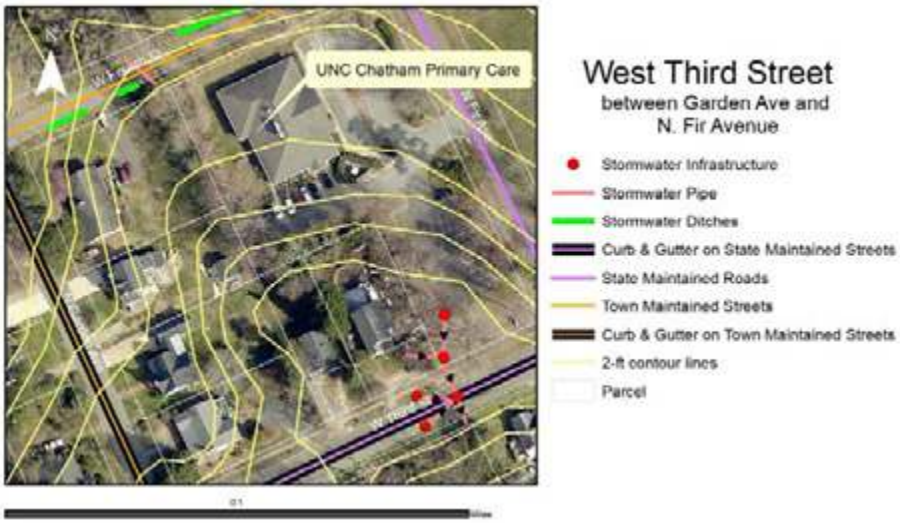
Former Cotton Mill Site (Grid E6)
The area around a former cotton mill located on N. Chatham Avenue has for decades seen frequent flooding and erosion issues. The mill is located partially within the 100-year floodplain and just upstream of the confluence of Tributary 1 of Loves Creek with a headwater stream. Some surrounding properties have open space that could potentially be used to implement stormwater control measures (SCM) to capture and slow stormwater runoff from the mill site before it enters the creeks.



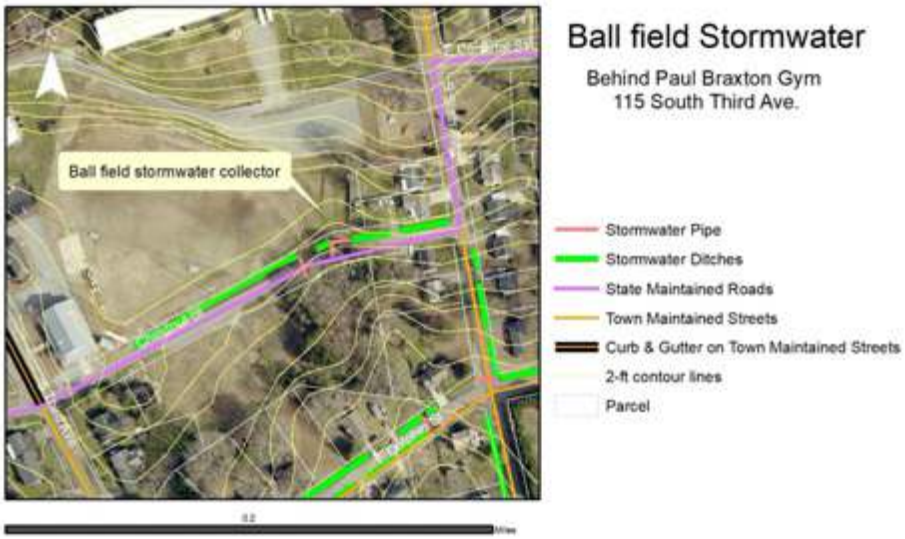
Creek after it flows under 7th St. prior to flowing past the old cotton mill.

West Third Street (Grids G4 to G5)
The section of West Third Street between Garden Avenue and North Fir Avenue carries a lot of stormwater runoff overwhelming the State's stormwater infrastructure. Clogged and broken stormwater infrastructure doesn't appear to be the problem. On April 22, 2020, a NC DOT Engineer sketched the stormwater drains as shown in map below and noted that "All inlets and pipes are working well, and none require maintenance at this time." Rather than expanding stormwater infrastructure to move the stormwater downstream quicker and exacerbating downstream flooding, a SCM such as a bioretention cell could be installed. Potential sites for SCMs located on private property that would capture runoff before it enters the stormwater drains can be seen in the map below.

Stormwater runoff on W. Third Street

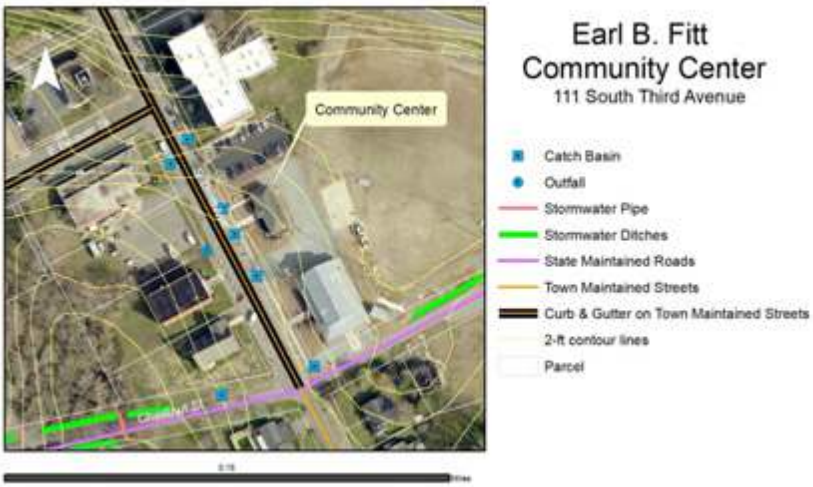


Paul Braxton Gym Ball Field Stormwater Collector (Grid G9)
A stormwater collection system east of the Paul Braxton Ball Field on Town property directs stormwater to the stormwater pipe that flows under Chestnut Street. The outflow system is broken and eroding. Potentially a SCM such as a Regenerative Stormwater Conveyance system could be installed to slow and reduce the flow.



Stormwater outflow to system from ball field.

Outfall to ditch on Third Ave across from Earl Fitt Community Center (Grid G8)
Rain gardens could be installed on town property to reduce stormwater runoff to storm drains that empty into a ditch that ultimately joins Loves Creek.



Outfall from stormwater pipe under Third Ave into ditch