"Stormwater Master Plan" for

City of Conway

January 2023

Project No. 031989.00

PREPARED FOR:

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Table of Contents

List of Figures

List of Tables

List of Appendices

List of Abbreviations and Acronyms

ac .... Acres
ac-ft .... Acre-Feet
ASOS .... Automated Surface Observation System
CCTV .... Closed Circuit Television Video
CIPP .... Cured In Place Pipe
CMA .... Corrugated Metal Arch
CMP .... Corrugated Metal Pipe
CN .... Curve Number
EPA .... Environmental Protection Agency
FFE .... Finished Floor Elevation
ft .... Feet
GIS .... Geographic Information System
GNSS .... Global Navigation Satellite System
GPS .... Global Positioning System
hr .... Hour
in .... Inch
mi .... Mile
NAVD88 .... North American Vertical Datum of 1988
NGS .... National Geodetic Survey
NOAA .... National Oceanic and Atmospheric Administration
NRCS .... Natural Resources Conservation Service
NPDES .... National Pollutant Discharge Elimination System
PRF .... Peak Rate Factor
RCBC .... Reinforced Concrete Box Culvert
RCP .... Reinforced Concrete Pipe
RTK .... Real Time Kinematic
ROW .... Right of Way
SCDNR .... South Carolina Department of Natural Resources
SCDOT .... South Carolina Department of Transportation
SCS .... Soil Conservation Service
SWMM .... Stormwater Management Model
SWMU .... Solid Waste Management Unit

T_c .... Time of Concentration
USDA .... United States Department of Agriculture
VRS .... Virtual Reference Station
yr .... Year

1.0 – Introduction, Background, and Overview

Over the past few years, the City of Conway has been subject to natural hazards that have tested the resiliency of its stormwater infrastructure. Hurricane Matthew (2016) and Hurricane Florence (2018) are examples of such hazards that have proved overwhelming to the City's existing drainage system.

Figure 1: Waccamaw River overflowing into Riverfront Park.

The overall purpose of the stormwater Master Plan was to analyze and assess the capacity and condition of drainage infrastructure within the study limits (see **Figure 2**). The City provided access to their existing drainage infrastructure database within the Master Plan Study Area. These data were used to guide field staff through the data collection process. Hydrologic and hydraulic modeling was completed for the Master Plan Study Area (see **Figure 2**) using field observations and collected data. Hydrologic and hydraulic modeling results were used to form the baseline for drainage improvements. Recommendations for improvements were identified based on a combination of observed structural failures and modeling results. Individual system component recommendations were grouped into projects (as Phases and associated sub-projects) and prioritized using hydraulic modeling results and engineering judgement. The final step of the Master Planning process was to develop estimated costs.

An additional component of the Master Plan process was to complete a limited environmental and community review. These components were aimed at providing an overview of potential environmental concerns that may arise during Project implementation and how overall Project implementation may affect low-to-moderate income populations.

1.1 – Study Area

The Master Plan Study Area was determined by approximating the limits of the stormwater system and accompanying drainage basins serving downtown Conway and surrounding areas based on conversations with City staff. In total, the Study Area for this Master Plan covers approximately 703 acres of the City. Drainage systems contained within the Study Areas eventually outfall to the Waccamaw River. The Study Area boundaries are presented in **Figure 2**.

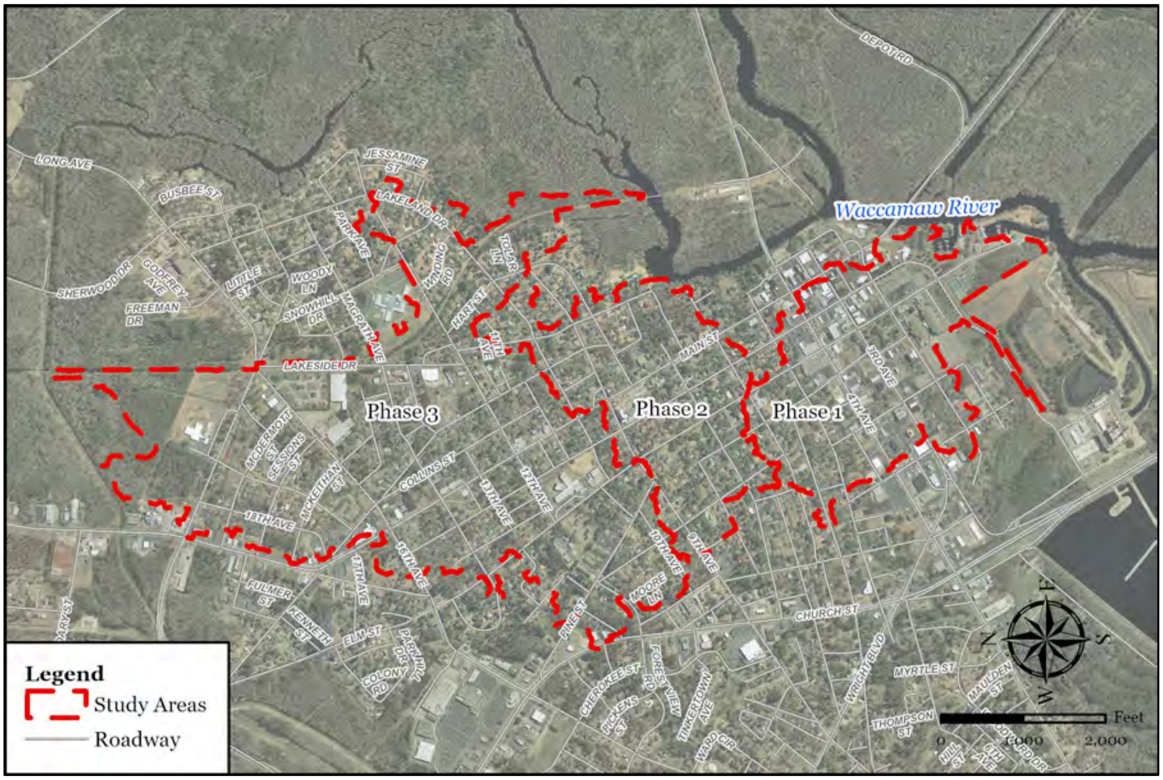


Figure 2 – City of Conway stormwater Master Plan Study Areas.

2.0 – Assumptions and Limitations

Assumptions and limitations associated with this study are identified in this section of the report. Generally, assumptions made result in limitations in model results for certain areas, conditions, or analysis points. Understanding this, assumptions that were made were carried out were based on engineering judgement in accordance with commonly accepted engineering practice.

As previously stated, limitations are inherent to any engineering analysis and are due to limits in the available information, scope of work to be performed, engineering methodology, and budgetary considerations. While scope, budget, and methodology limitations are normally understood at the beginning of the project, input data limitations are generally not completely quantified until the analysis has begun.

It is essential that model input data accurately reflects existing conditions when completing stormwater analyses to support improvement recommendations. While field data collection and visual condition assessment practices were utilized across the Study Area, modeled geometry may vary slightly from actual existing geometry conditions where no access to the closed piping system was available. In such cases, system geometries were inferred using engineering judgement. Efforts were made to record observed occurrences and simulate occurrences of siltation, debris accumulation, and system restrictions in the modeled drainage system structures.

2.1 – Assessment of Climate Conditions

Current and future climate conditions were used to evaluate the performance of the City's drainage systems. Climate condition scenarios involved the use of varying rainfall data, described more fully in this report. Results from climate condition analyses were compared to develop a holistic assessment of existing system capacity. The same climate conditions were used again to re-evaluate proposed system improvements in terms of long-term reliability and resiliency.

2.1.1 – Existing Conditions Assessment

The existing conditions assessment served as a representation of the present-day climate. Twenty-four-hour design storm precipitation depths obtained from the Horry County Stormwater Management Design Manual and were combined with the dimensionless Type-III National Resource Conservation (NRCS)/Soil Conservation Service (SCS) rainfall distribution to generate design cumulative rainfall curves. Additional design cumulative rainfall curves were developed from a less intense, South Carolina based rainfall distribution for the existing conditions assessments. More information on the methodology used for existing conditions rainfall data is provided in **Section 4.1.4.1**.

2.1.2– Future Conditions Assessment

With consideration to potential increases in rainfall depth and intensity, a future conditions assessment on the City's drainage system was completed. The year 2072 was selected as the basis for the future conditions assessment to represent 50-years into the future. Increases in 24-hour design storm depths (Hutton et. al, 2015) were applied to current rainfall data reported for NOAA rain gauge ID 38-1997 located in Conway. These increased rainfall depths were combined with the dimensionless Type B NOAA rainfall distribution to generate design cumulative rainfall curves for future condition assessments. The Type B NOAA distribution was selected as the basis for future condition rainfall curves due to its higher intensity compared to the traditional Type-III NRCS/SCS distribution in order to provide a more conservative approach to potential future conditions. More information on the methodology used for future rainfall acquisition and processing is provided in **Section 4.1.4.2.**

2.1.3– Analysis/Design Conditions

Analysis of the City's existing drainage system was completed using results from the existing and future climate conditions assessments. Existing conditions were utilized in the initial set up and execution of the hydrologic and hydraulic models. Results of the existing conditions assessment were validated by comparing to observed conditions using monitoring data, historic assessment results, and photo documentation.

Recommended improvements were developed and analyzed using stormwater design standards set forth by South Carolina Department of Transportation (SCDOT). This was done since most roads in the Study Area are currently owned and maintained by SCDOT. The SCDOT generally requires that roadside drainage systems be designed to the 10-year design event with peak flow depths not exceeding 94% capacity in closed piping. Accordingly, improvement recommendations were developed using 10-year design event existing conditions.

Recommendations were further evaluated under future conditions to evaluate resiliency to withstand potential climate change impacts and develop project prioritization rankings.

2.2 - Flow through Private Property

In some instances, portions of the stormwater system serving the City is located beneath yards and homes of private residences. The nearest size, material, and slope of pipes observed in these locations were assumed based on observations made at the nearest accessible upstream or downstream structure or inlet. Assumed structure locations were modeled, and recorded as such, on private property where the path of drainage appeared to change direction, based on observations made at the pipe's inflow and outflow location.

3.0 – Field Survey and Data Collection

An inventory of existing stormwater and drainage features was required to evaluate existing system capacities and evaluate upgrades to improve existing flood risk. Typically, a system inventory is composed of pipes, inlets, manholes, channels, ponds, and outfall structures. Collection of this data is usually accomplished by field survey. Other data sources needed to conduct the analysis include topographic data, roadway as-built plans obtained from the SCDOT, and recent aerial imagery. Topographic data provides a mechanism to determine where runoff will drain, and allows for the delineation of drainage basins, as well as relevant parameters for the subject basins, which are then served by the stormwater system. Aerial imagery allows for the quantification of land cover/use which is utilized in determining relevant hydrologic parameters.

Figure 3 – Example of drainage system inventory using GPS units at outfall in the phase 1 Study Area.

3.1 – Field Survey and Visual Condition Assessments

Inventory and visual condition assessments were completed for the drainage systems within the Master Plan Study Area.

A review of drainage inventory data provided by the City of Conway and recent aerial imagery was completed to identify system features to evaluate system capacity and subsequent flood risk. Flow paths generated from topographic data and known conveyance paths were used to identify probable system paths and outfall locations for system evaluation. ESRI ArcGIS Field Maps and GPS survey-grade units were used to catalogue drainage feature data previously identified, as well as those discovered in the field. Data collected during field investigations included existing visual conditions assessment (e.g., visual review of level of clogging, material), geometric parameters (e.g., size), and elevations. Quality reviews of system data were completed to support the cataloguing of reasonably accurate data. System features flagged during the quality review were revisited, and additional field data was collected and/or verified.

In some cases, tree cover or other site features (e.g., building shadows) interfered with GPS accuracy. In such cases, surrounding/nearby system data was used to assume geospatial information. In addition to elevation and geometric data, field crews completed visual assessments and collected photographic documentation of the system. Photos were geotagged within geographic information system (GIS) databases based on the respective infrastructure feature for which they were collected. This enabled office personnel to have a visual reference to structures or conduits where photographs were taken.

3.2 – Rainfall and Water Level Monitoring

Water level and rain gauges were installed at the stormwater canal crossings of McDermott Street and Lakeland Drive to support hydrologic and hydraulic modeling. A real-time remote monitoring station, complete with water level gauge and rain gauge, was installed at these locations. Data collected from these monitoring stations was used in the verification of hydrologic and hydraulic modeling parameters. Approximate locations of the monitoring stations and sample observation data are provided in **Figure 4**.

4.0 – Hydrologic and Hydraulic Modeling Platform

Hydrologic and hydraulic models were constructed and used to identify system capacity improvement opportunities and evaluate existing flood risk. Simulated existing flood risk was then used to develop drainage improvement recommendations. The following sections outline hydrologic and hydraulic analysis modeling methods used to evaluate existing system capacity and flood risk, as well as evaluate improvements and develop recommendations to mitigate existing flood risk.

Hydrologic and hydraulic modeling was completed using Computational Hydraulics Incorporated's (CHI's) PCSWMM software. This software uses version 5 of the Environmental Protection Agency stormwater management model (EPA SWMM). PCSWMM is a GIS integrated, highly advanced, comprehensive, hydrologic, hydraulic, and water quality simulation model used to analyze the management of urban stormwater, wastewater, and water distribution systems. Existing and proposed hydraulic models were developed using unsteady shallow water momentum equations (i.e., diffusive wave equation).

4.1 – Hydrologic Analysis

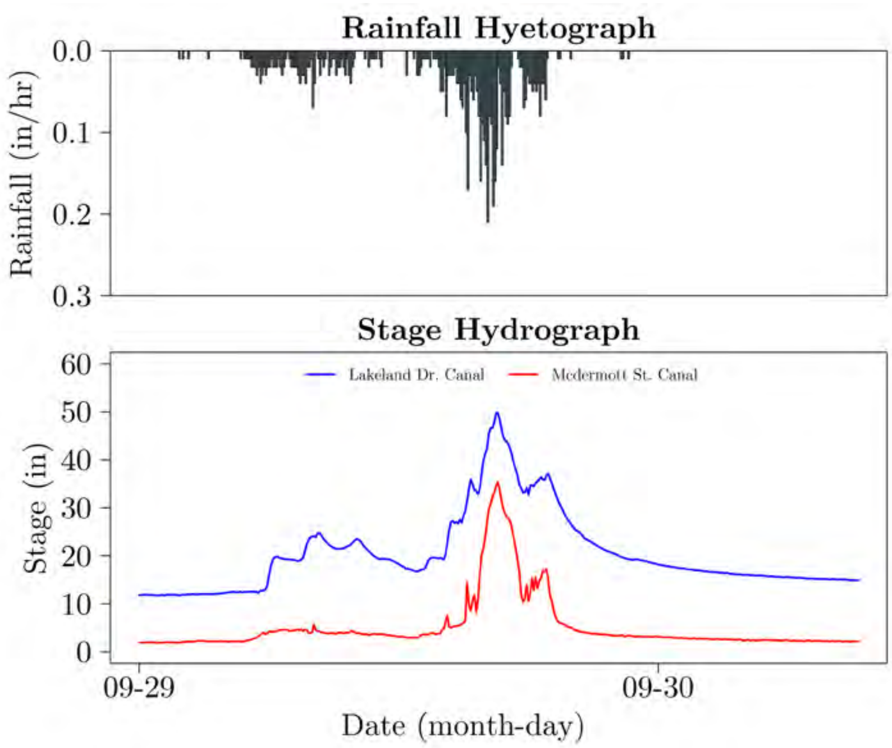
A hydrologic analysis of the Study Area was completed to develop direct runoff time series used in the hydraulic analysis. Horry County 2020 LiDAR was analyzed and used to develop drainage basins and sub-basins. Field inventory and inspections of the drainage system were used to confirm basin boundaries. A runoff hydrograph was developed for the basins/sub-basins and runoff was assumed to flow to an outlet (i.e., inlet or channel). Herein, the nonlinear reservoir runoff method (i.e., SWMM method) was selected to estimate direct runoff. Parameters estimated for the nonlinear reservoir runoff method are explained in the following sections.

4.1.1 – Hydrologic Soil Groups

The analysis completed for this study adopted United States Department of Agricultural (USDA) soils data from the soil survey geographic (SSURGO) database for South Carolina published on September 18, 2018.

Hydrologic soil groups were determined based on the published SSURGO database when single soil groups were encountered. When dual soil groups were encountered (e.g., A/D), SSURGO soil drainage classes were used to determine the hydrologic soil group. For example, soils classified as excessively drained, somewhat excessively drained, well drained, or moderately well drained were assigned the higher drainage soil group (e.g., A/D would be assigned A). Soils that did not fall into a well-drained classification were assigned the lower drainage group.

(a)



(b)

Figure 4 – Monitoring station (a) locations and (b) sample observations for the Lakeland Drive and Mcdermott canals.

4.1.2 – Land Use Classification

Land cover conditions were combined with soils data to obtain infiltration parameters used in the nonlinear reservoir runoff method. Ground cover conditions were derived from the 2019 National Land Use Dataset (NLCD) published by the United States Geological Survey (USGS). The 2019 NLCD resolution is limited at approximately 33 feet (10 meters) and is representative of regional conditions.

4.1.3 – Runoff Curve Numbers

The curve number (CN) is a parameter used in the nonlinear reservoir runoff method to estimate infiltration. The CN parameter was originally developed based on agricultural land but has been adapted for use in predicting runoff volumes for urban areas. The calculation of CN for a specific sub-basin is typically based upon three input data sources which include basin area, USDA soils data (i.e., hydrologic soil group of each soil type), and land use/land cover. **Table 1** summarizes land cover classifications and CN values used in the analysis. From these input variables, an area-weighted CN value was determined for each basin/sub-basin.

Table 1 – Curve numbers based on the 2019 NLCD dataset.

Land Cover Type	Hydrologic Soil Group			
	A	B	C	D
Open Water	98	98	98	98
Developed, Open Space	52	68	78	84
Developed, Low Intensity	81	88	90	93
Developed, Medium Intensity	84	89	93	94
Developed, High Intensity	88	92	93	94
Barren Land	70	81	88	92
Deciduous Forest	30	30	41	48
Evergreen Forest	30	55	70	77
Mixed Forest	36	60	73	79
Shrub/Scrub	42	42	55	62
Herbaceous	63	63	75	85
Hay/Pasture	40	61	73	79
Cultivated Crops	62	74	82	86
Woody Wetlands	86	86	86	86
Emergent Herbaceous Wetlands	80	80	80	80

4.1.4– Rainfall Data

4.1.4.1– Current Conditions Rainfall

Current stormwater design standards dictate that closed collection systems be designed using 24-hour, SCS rainfall distributions based on rainfall totals published by NOAA, SCDHEC, or other appropriate sources. Herein, the 24-hour, type III SCS rainfall distribution paired with 24-hour storm totals from NOAA station 38-1997 (see **Table 2**.) were adopted. The SCS distribution and 24-hour storm totals were combined to provide an overall cumulative rainfall distribution curve for each recurrence interval evaluated herein (i.e., 2-, 10-, and 25-year).

4.1.4.2– Future Conditions Rainfall

Future rainfall conditions were developed to consider changes in both rainfall total and storm intensity (see **Table 2.**) Fifty-year rainfall totals were forecasted for the City of Conway (i.e., NOAA station 38-1997) based on estimates provided by Hutton et al. (2015). These estimates were based on historical NOAA rainfall records accompanied with 134 realizations of 21 global climate models across the state of South Carolina. Although 24-hour rainfall totals are expected to increase over the next 50 years, the overall average increase was estimated at approximately 0.38 inches for 10- through 100-year design events.

Table 2 – Current and future 24-hour cumulative rainfall data for Horry County, SC.

Recurrence Interval (year)	Depth (inches)		Intensity (inches/hour)	
	Current	Future	Current (Type III SCS)	Future (NOAA B)
10	6.41	6.76	5.38	5.68
25	7.86	8.28	6.60	6.96
100	10.40	10.77	8.74	9.05

4.1.5 – Runoff Time Series

Runoff time series were developed using the nonlinear reservoir runoff method which conceptualizes a sub-basin as a rectangular reservoir with a width, W, and a uniform slope, S, which drains to an outlet. Using the conservation of mass, a change in depth of the reservoir per unit time is defined as

$$\frac{\partial d}{\partial t} = i - e - f - q \tag{1}$$

where i is rate of rainfall, e is the surface evaporation rate, f is the infiltration rate, and q is the runoff rate. When assuming the surface runoff acts as uniform flow in a rectangular channel of width W, slope S, and depth $d - d_s$, where d is the depth of flow and d_s is the depressional storage depth, Manning's equation can be used to calculate the runoff volumetric flow rate which is expressed as

$$Q = \frac{1.49}{n} S^{1/2} R_x^{2/3} A_x \tag{2}$$

where n is Manning's roughness coefficient, R_x is the hydraulic radius, and A_x is the area across the sub-basin's width in which runoff flows. Assuming that W will always be much greater than d, A_x and R_x can be expressed as

$$A_x = W(d - d_s) \tag{3}$$

and

$$R_x = d - d_s. \tag{4}$$

Substituting Equations (3) and (4) into Equation (2), Manning's equation becomes

$$Q = \frac{1.49}{n} W S^{\frac{1}{2}} (d - d_s)^{5/3} \tag{5}$$

By dividing Equation (5) by the surface area of the sub-basin, the unit flow rate equals

$$q = \frac{1.49}{An} W S^{\frac{1}{2}} (d - d_s)^{5/3} \tag{6}$$

which can be substituted back into the conservation of mass, Equation (1), to obtain the final partial differential equation

$$\frac{\partial d}{\partial t} = i - e - f - \alpha (d - d_s)^{5/3} \tag{7}$$

where

$$\alpha = \frac{1.49}{An} W S^{\frac{1}{2}} \tag{8}$$

is the runoff rate for each time step which is then calculated by solving Equation (7) for the depth of flow and using the depth to solve Equation (6).

4.2– Hydraulic Analysis

A hydraulic analysis was completed by routing runoff time series generated from the hydrologic analysis through the City's drainage system (e.g., pipes, channels, ponds, etc.). The focus of the hydraulic analysis was to evaluate existing system capacity and simulate potential flooding due to limited system capacity and/or changes in future rainfall patterns. Results from the existing conditions analysis were then used to develop recommended system improvements.

4.2.1 – Development of Model Domain

Field survey data was used to establish horizontal/vertical elevations (i.e., inverts and top of banks/rim elevations) of pipelines, ditches, and channels included in the hydraulic model. Hydraulic and geometric attributes (e.g., size and Manning's roughness) were assigned to drainage features based on field survey. A combined one-dimensional (1D)/two-dimensional (2D) hydraulic modeling domain was created and used herein. In this approach, piping and channels were represented as 1D links while overland flow was represented using 2D links. A summary of 1D Manning's n values used in the study are presented in **Table 3**.

Channels were modeled if they were in-line with a trunk system or they were needed to provide connections between closed conveyances in 1D portions of the model. In most cases, channel sections were irregular and were derived from LiDAR data. Storage relationships for ponds and other inline storage facilities were generated based on LiDAR data or field survey. Storage contained within offsite drainage systems (i.e., channels, swales, and depressions) was accounted for through the development of a basin stage-storage relationship and applied to a storage node on the upstream node of the hydraulic structure.

2D hydraulic modeling domains used throughout the study were developed using an 18-foot to 75-foot mesh resolution wherein underlying elevations were based on 2020 Horry County LiDAR. Homes and detached building footprints were developed based on aerial imagery and were considered in the 2D domain.

Table 3 – Summary of Manning's n roughness values for 1D hydraulic modeling domains (Chow, 1959). Materials with adjusted roughness values listed as "-" indicate no blockage was detected at the time of field investigations.

Material/Description	Level of Blockage		
	Clear	Moderate	Heavy
Brick	0.015	-	-
Cast Iron	0.013	0.024	0.074
Concrete	0.013	0.022	0.068
Corrugated HDPE	0.018	0.033	0.101
Corrugated Metal	0.024	0.041	0.136
Ductile Iron	0.011	-	-
Grass Channel	0.040	-	-
PVC	0.010	0.018	0.057
Smooth HDPE	0.009	-	-
Smooth Metal	0.012	0.022	0.068
Steel	0.016	-	-
Vitrified Clay	0.012	0.022	0.068

4.2.2 – Outfall Boundary Conditions

A normal flow boundary condition was used for each outfall in the analysis. For the more low-lying outfalls near the Waccamaw River, the water surface elevation was set to the 2-year river stage.

5.0 –Recommendations and Prioritization of Improvements

Proposed drainage system improvements were evaluated after completing field survey and associated investigations and existing conditions hydrologic and hydraulic modeling. Varying improvements (e.g., larger piping and/or additional piping and storage) were built upon the existing conditions model to reach a post construction hydraulic model result reflecting little to no inundation based upon the 10-year storm event with exception to areas downstream of the Waccamaw, which was based upon the 2-year storm event as further described in Section 6.1.3. Recommended improvements seek to mitigate existing conditions flooding for the 10-year, 24-hour existing conditions design event such that modeling results for conveyances (e.g., pipes or channels) reflect no more than 94% full. This basis of design is a typical minimum standard as required by SCDOT. After developing an initial list of improvement recommendations based on the 10-year design event, future conditions were evaluated to assist the City in its assessment of the future economic values of recommended improvements.

5.1 – Construction Recommendations

Drainage system components identified in the analysis as undersized or inadequate were analyzed to determine what improvement(s) may support providing the City the improved level-of-service as described above. Individual improvements were analyzed along the entire sub-system reach to assess whether modeling results of recommended conceptual improvements on the upstream portion of the sub-system reach showed probable adverse conditions on the downstream portion of the sub-system reach. Improvements were generally limited to increased pipe capacity, additional piping, and increased number of drainage inlets.

Curb and gutter replacement and full road width asphalt milling and overlay is included in the recommendations, where necessary, since damage to and / or demolition of these components would be expected as a result of construction.

Individual improvements were grouped together to form proposed capital improvement Phases made up of several sub-projects, identified as Phases 1, 2, and 3 in this report. For example, a three-block drainage collection system improvement project may have been broken up into one block segments wherein each individual block may represent a sub-project. This level of planning was done to provide the City with a greater level of detail and flexibility to assist the City in its cost estimating for future capital planning and grant funding pursuits.

5.2 – Maintenance Recommendations

Occurrences of debris build up and structural conditions of consideration visually observed during the data collection process were cataloged and documented. Of the 2160 structures and inlets documented in the Study Areas, 31 structural conditions of considerations and 42 debris blockages were documented. Of the 2242 pipes documented in the Study Areas, 26 structural conditions of consideration and 23 debris blockages were documented.

It is recommended that repair and cleanout measures be taken to address debris blockages and point failures (e.g., broken inlet tops) to support the operation of the City's drainage system. Partial structural damage and debris blockage occurrences were also noted for surveyed structures and conveyances. Overall, it is recommended that major point repairs and cleanout measures be taken to reduce impacts from these issues. It is our opinion that most debris clogging may be addressed using a vacuum truck. **Figure 5** illustrates typical instances of major structural conditions of consideration and debris blockage for structures and conveyances mentioned previously. Appendices **A.1**, **B.1**, **and C.1** include exhibits depicting visually observed field conditions of surveyed drainage features for Phase 1, 2, and 3 Study Areas, respectively.

5.3 – Prioritization of Recommended Improvements

In total, 41 drainage improvement sub-projects were recommended across the Study Area (i.e., Phase 1 through 3). Prioritization rankings were developed for each recommended sub-project. Recommendations were prioritized utilizing a three-tiered ranking system which assigned a priority level of high, medium, or low to each sub-project.

Hydrologic/hydraulic models were carried out in each Study Area. Simulated existing flood results were recorded from each rainfall distribution. Flood depth and time values were assigned unique weights (see **Table 4**) to develop an overall project score.

(a)

(b)

(c)

(d)

(e)

(f)

Figure 5 – Examples of existing condition visual assessment documenting general maintenance considerations for: (a) covered inlet; (b) missing curb at inlet structure; (c) pipe entrance covered by ground and foliage; (d) root grown over the inlet structure; (e) covered culvert; and (f) broken pipe.

Table 4: Prioritization weights by flood modeling criteria.

Criteria	Weight
Number of Contributing Areas/Projects	1
Contributing Area	0.5
Average Flood Depth	1.5
Flooded Area Per Project	2.5
Total Flooded Area	2.5

It is recommended that the proposed improvements be implemented based on a top-down approach (or upstream to downstream) for storage, and a bottom-down (or downstream to upstream) approach for conveyance. The governing principle behind this approach is to attenuate runoff at the top of the system using storage to provide relief to downstream facilities; then continuing downstream with storage improvements to further attenuate flows. It is expected that this approach will avoid replacement/upgrade of the entire system and should result in a lower total capital cost. Following storage improvements, conveyance upgrades and improvements are prioritized utilizing the aforementioned approach where system capacity is incrementally increased moving upstream. This approach generally serves to avoid adversely impacting downstream stormwater infrastructure and properties.

5.4 – Cost Estimating

Project and sub-project costs were estimated by establishing unit costs for project elements and summing the cost of the associated elements for the identified sub-projects. Unit costs were developed based on recently awarded projects and engineering judgement to generate sub-total construction costs. Allowances for incidentals (e.g., replacement of landscaping, signs, driveway aprons, etc.) and utility conflicts were then included as percentages of the sub-total construction cost. Construction contingencies were included based on a cost contingency curve wherein contingencies ranged from 15% on larger projects to 300% on smaller projects. Contingencies were included as a part of each project estimate to account for unforeseen project elements and project details that would be developed during detailed design. Estimated permitting, engineering, and construction engineering and inspection costs were also included for each project.

Estimated costs represent the engineer's estimate of project costs and are in 2022 dollars and are intended to provide rough order of magnitude costs for use in programming funds for implementation of improvements. Estimated costs are based upon conceptual improvements and these cost estimates should be carefully reviewed and updated in the future during programming/budgeting of projects to consider changes in the cost of construction materials and labor, as well as final design.

5.5 – Benefit Cost Analysis

The benefit cost analyses (BCA) for the proposed Phases 1, 2, and 3 were calculated through the use of FEMA's BCA Toolkit Version 6.0. The estimated damages included in this BCA were obtained using HAZUS FEMA reports. BCA results reflect information known to the engineer and do not account for personal estimated damage or other non-design considerations which the City may wish to evaluate, and likely resulting in a higher BCA ratio for each Phase. Additionally, while this Master Plan includes sub-projects grouped by Phases, should the City identify individual sub-project BCAs separately (as opposed to the proposed Phased Projects presented in this report), independent BCAs may be performed. Results of the Master Plan BCA are shown in **Table 5**.

FEMA | Benefit-Cost Calculator
V.6.0 (Build 20230103.1822 | Release Notes)

Select	Project Title ▾	County, State	Using 7% Discount Rate			Using 3% Discount Rate (For FY22 BRIC and FMA only)		
			Benefits (B)	Costs (C)	BCR (B/C)	Benefits (B)	Costs (C)	BCR (B/C)
☑	Phase 1 - Proposed City of Conway Drainage Improvements	Horry, SC	$ 36,128,084	$ 14,802,693	2.44	$ 80,004,755	$ 14,975,989	5.34
☑	Phase 2 - Proposed City of Conway Drainage Improvements	Horry, SC	$ 33,815,187	$ 17,242,693	1.96	$ 74,882,902	$ 17,415,989	4.30
☑	Phase 3 - Proposed City of Conway Drainage Improvements	Horry, SC	$ 74,526,840	$ 50,942,693	1.46	$ 165,037,856	$ 51,115,989	3.23
TOTAL (SELECTED)			**$ 144,470,111**	**$ 82,988,079**	**1.74**	**$ 319,925,513**	**$ 83,507,967**	**3.83**
TOTAL			**$ 144,470,111**	**$ 82,988,079**	**1.74**	**$ 319,925,513**	**$ 83,507,967**	**3.83**

Table 5 - Results of Benefit Cost Analysis prepared for Master Plan Phases 1 ,2 ,and 3 using FEMA BCA Toolkit Version 6.0.

6.0 Results and Recommendations

This section presents hydrologic and hydraulic modeling results for the three Phases included within this report. Results include a review of hydrology for each area and a summary of existing conditions results for the 10% (10-year) existing and predicted future design storm events.

Recommendations for improvements supported by system hydraulic modeling results and / or field observations made at the time of survey are presented and discussed.

Summaries of environmental and community reviews are also presented.

6.1 – Phase 1 Study Area

The Phase 1 Study Area (see **Figure 6**) is located in the southeast portion of the City of Conway along the Waccamaw River. The Study Area is primarily urban and encompasses the downtown portion of the City. The entire phase 1 Study Area drains to the Waccamaw River. Detailed results for the Phase 1 Study Area are provided in **Appendix A**.

6.1.1 – Field Survey and Visual Conditions Assessment

Existing drainage systems within the area are characterized by approximately 6.87 miles of closed piping and 0.05 miles of open channel (see **Table 7**). This Study Area was the first area studied in Conway, as it contains a considerable amount of small businesses within the City limits. Drainage systems serving this area were mapped to using collected field survey data, available SCDOT road plans, and drainage system data provided by the City of Conway.

Most of the drainage system assessed during field investigations was noted to be in good condition with little blockage. Northern portions of the Study Area were noted to have the most damage and blockage. This section of the drainage system also contained the smallest pipes and was in mainly flat areas.

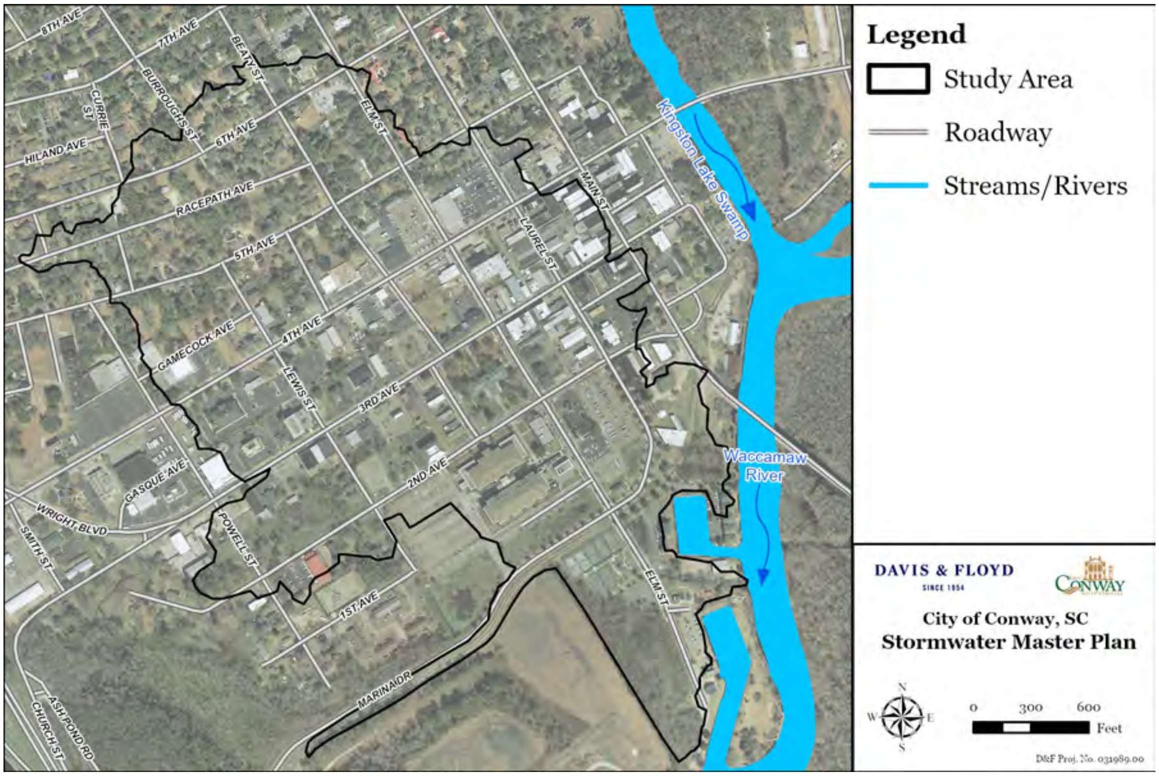


Figure 6 – Phase 1 study region.

Table 6 – Phase 1 Study Area drainage system conveyance summary.

Conveyance Summary		
Type	**Length (mi)**	
Pipe	6.87	
Channel	0.05	
Pipe Summary		
Material	**Length (ft)**	**Average Diameter (in)**
Concrete	31280.66	15
Cast Iron	17.71	10
Corrugated HDPE	1244.25	12
Smooth HDPE	1762.73	6
PVC	148.67	8
Smooth Steel	0.00	-
Vitrified Clay	1822.24	21

6.1.2 – Hydrologic Analysis Results

The hydrologic analysis of the Phase 1 Study Area was composed of four outfalls. Major outfall drainage areas were further sub-delineated into 357 sub-basins with a total overall basin area of 137.5 acres. Analysis of USDA soils data and 2019 NLCD showed that the Phase 1 Study Area has a wide range of soil conditions and land uses. Hydrologic parameters for the Phase 1 Study Area are summarized in **Table 7**.

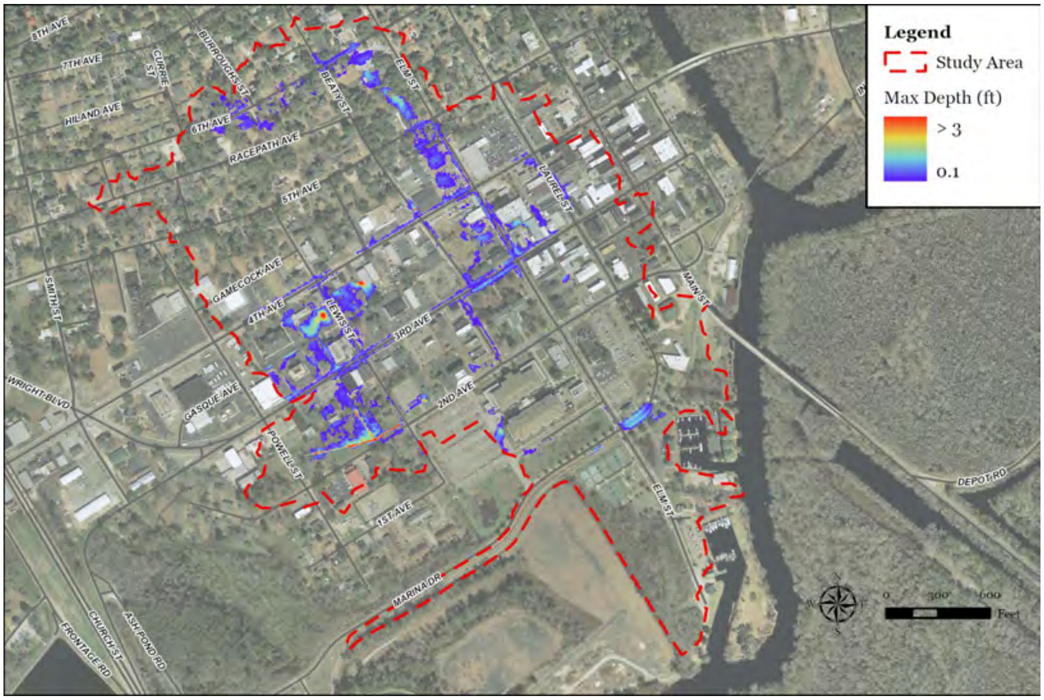
Table 7 - Phase 1 Study Area hydrologic analysis summary.

Hydrologic Soil Group Summary	
Soil Group	**% of Area**
A	78%
A/D	< 1%
B	9%
B/D	< 1%
C/D	13%
Land Use Summary	
Use	**% of Area**
Developed, High Intensity	17%
Developed, Low Intensity	27%
Developed, Medium Intensity	32%
Developed, Open Space	19%
Emergent Herbaceous Wetlands	< 1%
Evergreen Forest	< 1%
Open Water	< 1%
Shrub/Scrub	< 1%
Woody Wetlands	4%

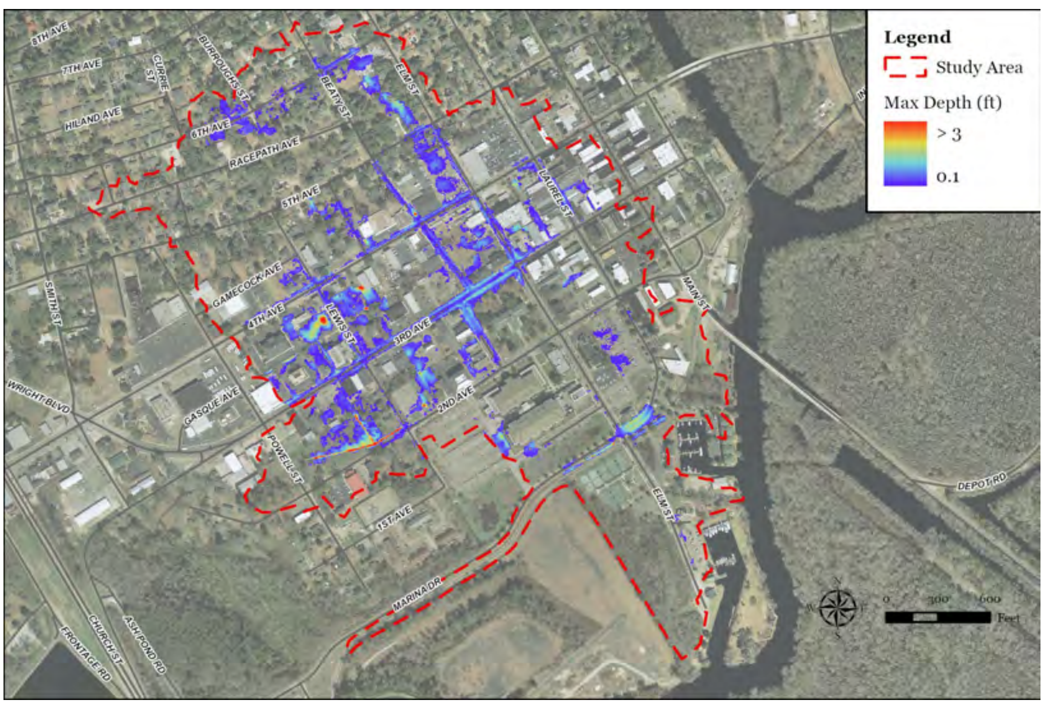
6.1.3 – Existing Conditions Results

A combined 1D/2D hydrualic modleing approach was used to simulate existing system performance. Modeling results are graphically depicted in detail in **Appendices A.2 - A.7.** For comparison purposes, the 10-year, 24-hour hydrualic modeling results for existing conditons and future conditons are shown in **Figure 7** The current 10-year, 24-hour hydraulic model in **Figure 7**(a) shows that flooding is focused in the areas along Elm St and Lewis St. The future 10-year, 24-hour hydraulic model in **Figure 7** (b) shows the flooding will spread into further areas as the climate change in the future will cause more flooding to occur. Streets such as 4th Ave and 3rd Ave are more heavily affected with flooding in the future conditions.

It is important to note that the Phase 1 area is is located within the floodplains of the Wacacamaw River. During extreme flood events the Waccamaw River can rise to a level that floods the south end of the Phase 1 Study Area. A typical recommened solution to prevent local flooding from the Waccamaw would be a levee system, however, such a system may not be feasible for the construction by the City, as such, a 2-year riverine flood event was used as a downstream boundary conditon for proposing drainage improvements along the Waccamaw River.



(a)



(b)

Figure 7 – Simulated maximum flood depths for the **(a)** current and **(b)** future 10-year, 24-hour rainfall event for the Phase 1 Study Area.

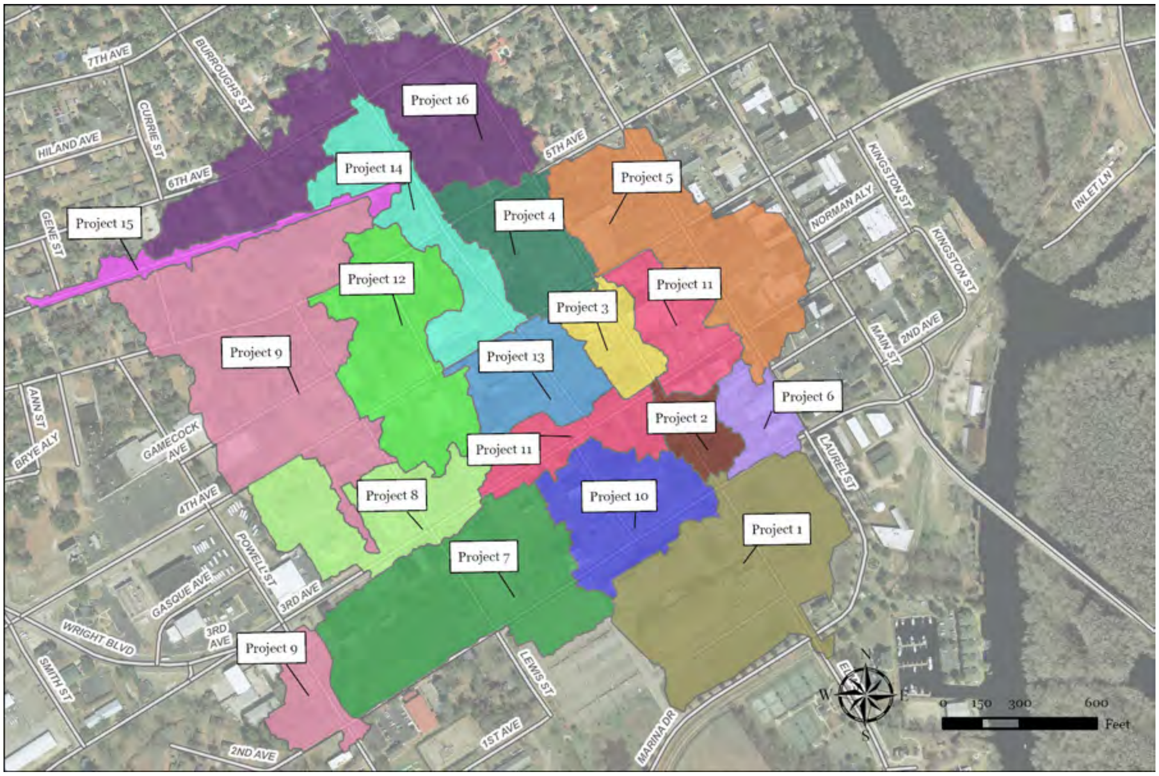


Figure 8 – Proposed sub-project services areas for the Phase 1 Study Area.

6.1.4 – Recommendations for Improvements

Results of the existing conditions analysis indicted much of the downtown area could be subject to flood risk for the 10% (10-year) design event. Recommended improvements are presented in map (see **Figure 8**) and tabular format, which are provided in **Appendix D.1**. The sub-project footprints shown in **Figure 8** encompasses the areas of the sub-project(s) that the associated recommended improvements make a direct impact to the system. The encompassed areas are not representative of the total area in which flooding is affected by each sub-project since a project downstream of the other projects can improve the flooding in those project areas as well. In summary, recommendations for Phase 1 Study Area include the installation of approximately 13,753 linear feet of piping, which includes upgrading old pipe networks and installing new pipes. No pond, channel, or ditch upgrades are recommended for this area. **Table 8** summarizes the recommendations.

Table 8 - Phase 1 Study Area recommended improvements summary.

Feature	Quantity	Size Range
Structure	159 EA	-
Piping	13,753 LF	12" - 54"
Ponds	0	-
Paving	41,406.6 SY	-
Curbing	13,664.2 LF	-
Riprap Armoring	32 TON	-
Inspect, Clean, and Rehab	0	-

6.1.5 – Cost Estimate and Prioritization

As discussed in Section 5.4 of this report, cost estimates were developed for the recommended. Sixteen sub-projects of varying size were developed from individual recommended improvements with estimated costs of $14.5 million as seen in **Table 9**. Detailed project cost estimates and prioritization are tabulated in **Appendix E.1**.

Table 9 - Cost estimates for each project in Phase 1 Study Area ranked by priority.

Rank	Estimated Cost of Improvements	Project
1	$ 692,478.03	7
2	$ 504,872.37	10
3	$ 487,425.31	11
4	$ 413,125.89	8
5	$ 808,596.15	1
6	$ 561,829.47	13
7	$ 1,425,329.51	2
8	$ 818,001.86	14
9	$ 1,372,205.84	9
10	$ 1,206,105.66	3
11	$ 1,538,593.44	4
12	$ 837,967.22	16
13	$ 653,342.92	12
14	$ 1,272,760.33	5
15	$ 652,941.83	6
16	$ 1,271,722.92	15
Total	$ 14,517,298.74	

6.2 – Phase 2 Study Area

Analysis area 2 (see **Figure 9**) encompasses the middle portion of the Master Plan study limits. The area includes drainage flowing east to the Waccamaw River. Analysis area 2 is characterized as mostly urban due to presence of residential neighborhoods and commercial district. Study results for analysis area 2 are provided in **Appendix B**.

6.2.1– Field Survey and Visual Conditions Assessment

Analysis area 2 is characterized by approximately 5.3 miles of closed piping and 0.27 miles of open channel (see **Table 10**). Survey data was collected for the entire analysis area to accurately model the hydraulics of the drainage system. Dimensions for channels were obtained using 2022 LiDAR of Horry County. The overall condition of the drainage system was satisfactory, although was determined to be undersized in many areas.

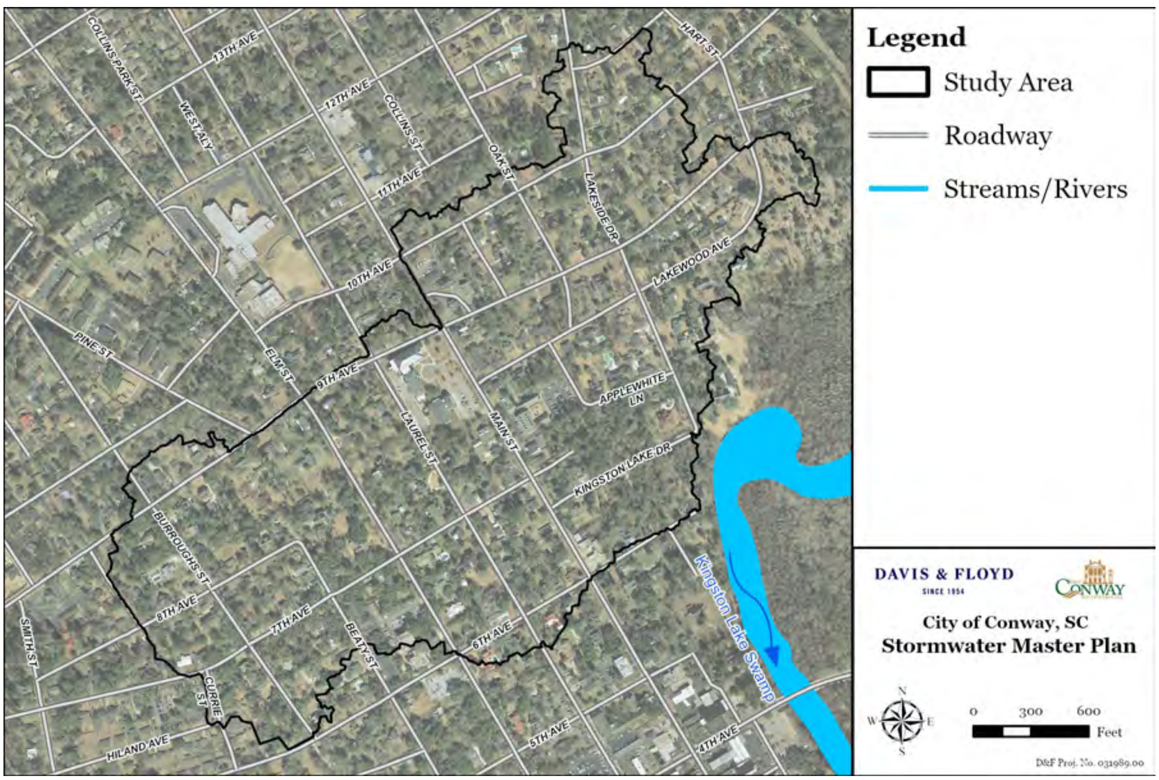


Figure 9 – Phase 2 study region.

Table 10 - Phase 2 Study Area drainage system conveyance summary.

Conveyance Summary		
Type	**Length (mi)**	
Pipe	5.3	
Channel	0.27	
Pipe Summary		
Material	**Length**	**Average Diameter**
Concrete	24510.5	15
Cast Iron	33.2	-
Corrugated HDPE	515.8	18
Smooth HDPE	1309.5	12
PVC	631.2	6
Smooth Steel	80.3	15
Vitrified Clay	803.9	15

6.2.2 – Hydrologic Analysis Results

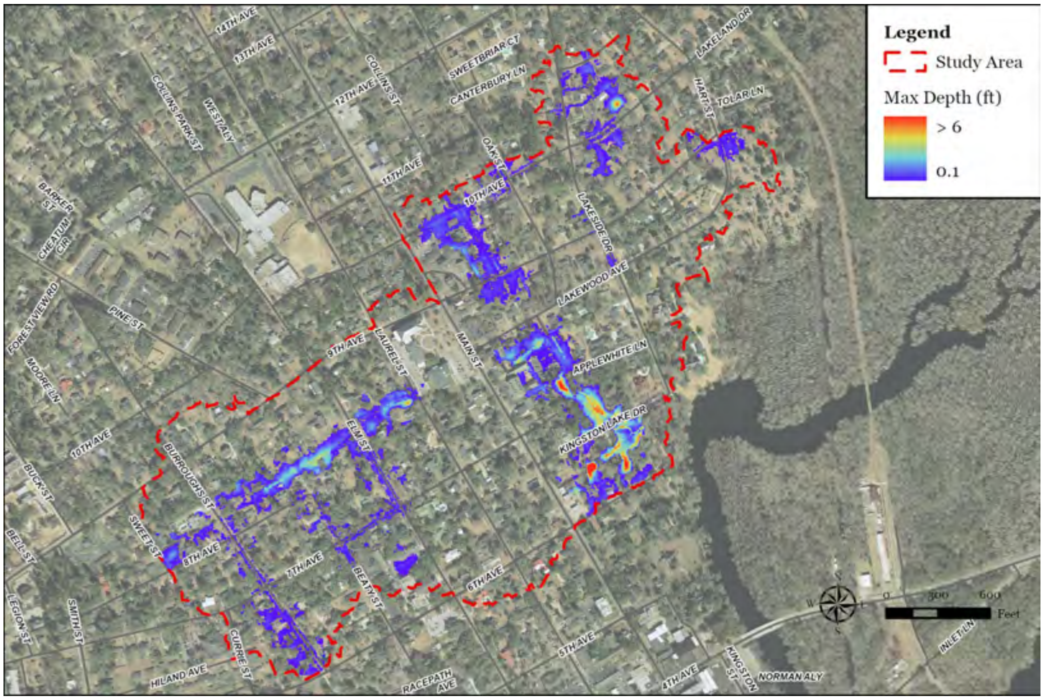
Results of the hydrologic analysis determined that all drainage basins in analysis area 2 outfall into the Waccamaw River. A total of 381 sub-basins were delineated in area 2, making up a total of 143.4 acres. Analysis of USDA soils data and 2019 NLCD shows that analysis area 2 has a wide range of soil conditions and land uses. Average hydrologic parameters for analysis area 2 are summarized in **Table 11** with additional results provided in **Appendix B.1**.

Table 11 – Phase 2 Study Area hydrologic analysis summary.

Hydrologic Soil Group Summary	
Soil Group	**% of Area**
A	46%
A/D	16%
B	< 1%
B/D	17%
C/D	21%
Land Use Summary	
Use	**% of Area**
Developed, High Intensity	< 1%
Developed, Low Intensity	24%
Developed, Medium Intensity	6%
Developed, Open Space	59%
Emergent Herbaceuous Wetlands	< 1%
Evergreen Forest	7%
Open Water	< 1%
Shrub/Scrub	2%
Woody Wetlands	2%

6.2.3 – Existing Conditions Results

2D hydraulic modeling was used to simulate existing system performance for analysis area 2. Results of the hydraulic model are graphically depicted for the 10-year, 24-hour rainfall event in **Figure 10** and all results are found in **Appendices B.2 – B.7.** The current 10-year, 24-hour rainfall event in **Figure 10** (a) shows flooding occurs near Elm St, 8th Ave, Applewhite Ln, and Kingston Lake Dr. The future 10-year, 24-hour rainfall event show in **Figure 10** (b) shows flooding in the same areas as the current 10-year, 24-hour rainfall event, but shows that the flooding depth is greater in those areas. The topography of analysis area 2 is such that all drainage eventually flows into the Waccamaw River on the eastern side of the Study Area. At the upper portions of the Study Area, in the far western and northern sections, there are relatively flat areas where ponding occurred during the design rainfall events. Once runoff made its way into the drainage system, the system held up well until near the outfalls, where the system appears to be undersized, which causes more flooding in low lying areas.



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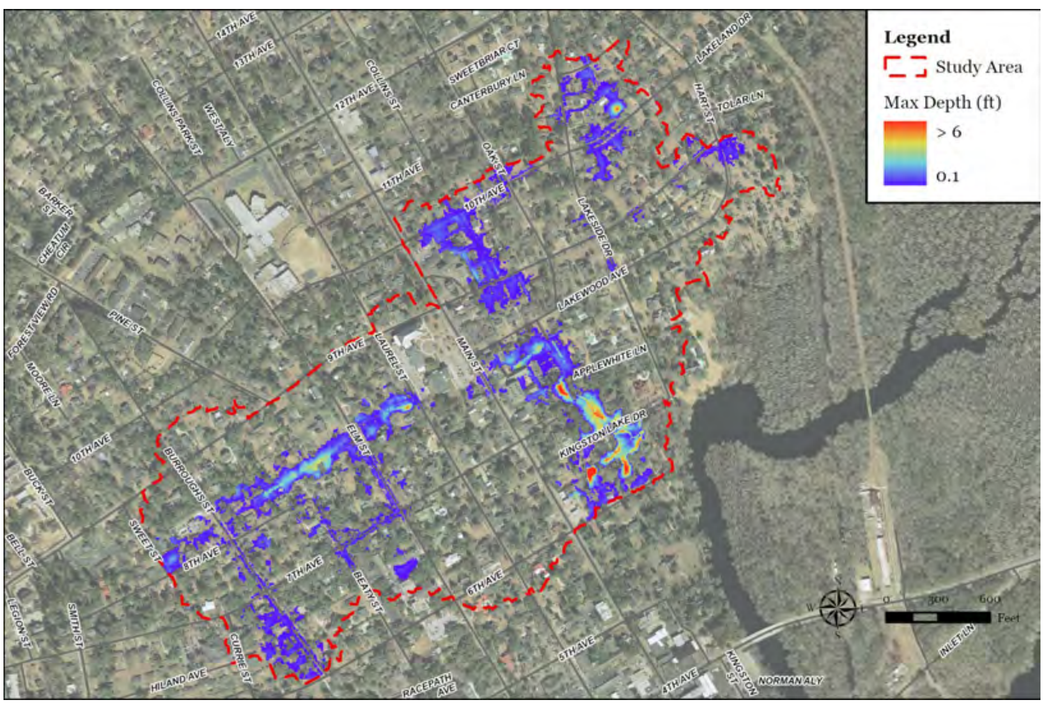


(b)

Figure 10 – Simulated maximum flood depths for the **(a)** current and **(b)** future 10-year, 24-hour rainfall event for Phase 2 Study Area.

6.2.4 – Recommendations for Improvements

Recommendations for analysis area 2 include installation of approximately 13,908 linear feet of piping and 169 new structures in 14 sub-projects. No channel or ditch upgrades were recommended for this area. The service areas for the 14 proposed sub-projects are shown in **Figure 11** and a detailed summary of improvement recommendations are given in **Table 12**.

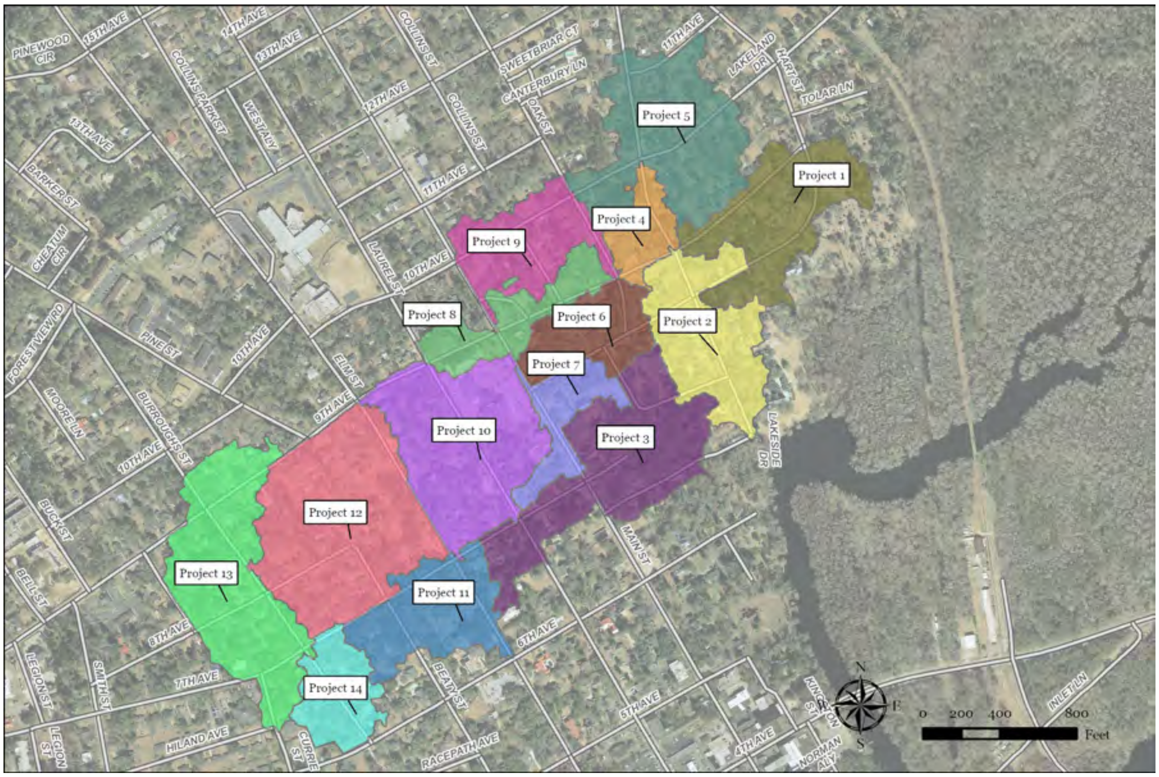


Figure 11 – Service areas for the proposed projects in Phase 2 Study Area.

Results of the existing conditions analysis indicted much of the downtown area could be subject to flood risk for the 10% (10-year) design event. Recommended improvements are presented in map (see **Figure 11**) and tabular format, which are provided in **Appendix D.2**. The sub-project areas in the map in **Figure 11** encompasses the areas of the projects that the improvements are being made and make a direct impact to the system. The encompassed areas are not representative of the total area in which flooding is affected by each project, since a project downstream of the other projects can improve the flooding in those project areas as well. In summary, recommendations for analysis area 1 include the installation of approximately 13,908 linear feet of piping, which includes upgrading old pipe networks and installing new pipes. No pond, channel, or ditch upgrades are recommended for this area. **Table 12** summarizes the recommendations.

Table 12 – Phase 2 Study Area recommended improvements summary.

Feature	Quantity	Size Range
Structure	169 EA	-
Piping	13908 LF	12" - 60"
Ponds	0	-
Paving	46360 SY	-
Curbing	15298.8 LF	-
Riprap Armoring	176 TON	-
Inspect, Clean, and Rehab	0	-

6.2.5 – Cost Estimate and Prioritization

As discussed in Section 5.4 of this report, cost estimates were developed for the recommended improvements. Fourteen sub-projects of varying size were developed from individual recommended improvements with estimated costs of $17.1 million as seen in **Table 13**. Detailed estimated project costs and prioritization are tabulated in **Appendix E.2**.

Table 13 – Cost estimates for each project in Phase 2 Study Area ranked by priority.

Rank	Estimated Cost of Improvements	Project
1	$ 1,145,576.63	3
2	$ 1,494,997.66	7
3	$ 1,419,676.35	10
4	$ 1,138,172.18	12
5	$ 839,845.29	2
6	$ 727,873.31	6
7	$ 1,019,838.67	13
8	$ 931,503.61	4
9	$ 1,857,933.02	8
10	$ 1,526,661.90	9
11	$ 760,055.31	5
12	$ 1,736,889.08	11
13	$ 1,408,672.57	14
14	$ 1,069,940.40	1
Total	$ 17,077,635.99	

6.3 – Phase 3 Study Area

Analysis area 3 (see **Figure 12**) encompasses the middle portion of the project study limits. The area includes drainage flowing north and east to the Waccamaw River. Analysis area 3 is characterized as mostly urban due to presence of residential neighborhoods and commercial district. Study results for analysis area 3 are provided in **Appendix C**.

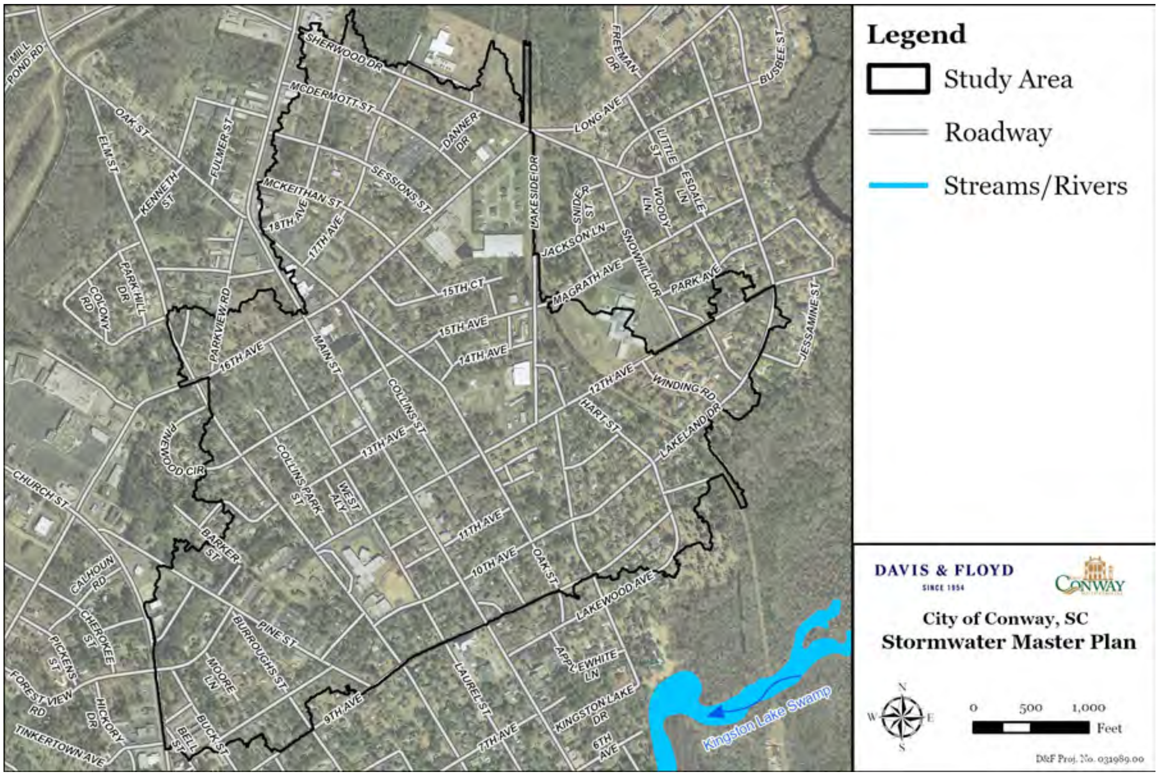


Figure 12 – Phase 3 Study Area study region.

6.3.1– Field Survey and Visual Conditions Assessment

Analysis area 3 is characterized by approximately 15.54 miles of closed piping and 3.66 miles of open channel (see **Table 14**). Survey data was collected for the entire analysis area to accurately model the hydraulics of the drainage system. Dimensions for channels were obtained using 2022 LiDAR of Horry County. The overall condition of the drainage system was satisfactory, although was determined to be undersized in many areas.

Table 14 – Phase 3 Study Area drainage system conveyance summary.

Conveyance Summary	
Type	**Length (mi)**
Pipe	15.54
Channel	3.66

Pipe Summary		
Material	**Length**	**Average Diameter**
Concrete	76186.3	15
Cast Iron	85.5	6
Corrugated HDPE	2141.5	12
Smooth HDPE	790.2	15
PVC	1229.0	6
Smooth Steel	197.5	8
Vitrified Clay	408.0	12

6.3.2 – Hydrologic Analysis Results

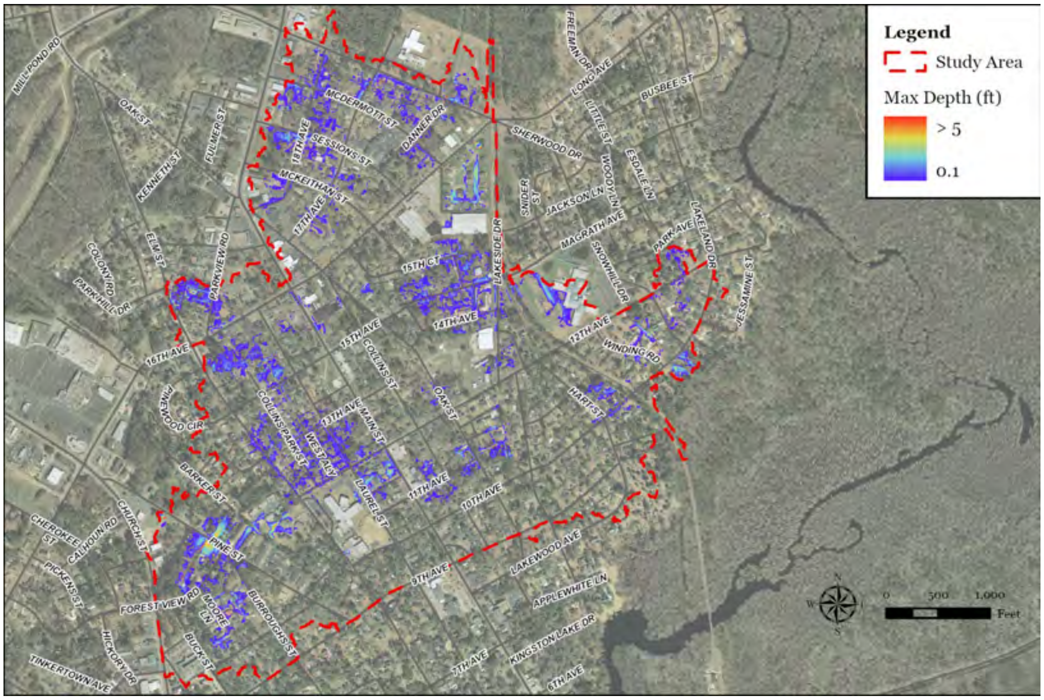
Results of the hydrologic analysis determined that the drainage basins in analysis area 3 ultimately outfall into the Waccamaw River. A total of 1600 sub-basins were delineated in area 3, making up a total of 431.3 acres. Analysis of USDA soils data and 2019 NLCD shows that analysis area 3 has a wide range of soil conditions and land uses. Average hydrologic parameters for analysis area 3 are summarized in **Table 15** with additional results provided in **Appendix C.1**.

Table 15 – Phase 3 Study Area hydrologic analysis summary.

Hydrologic Soil Group Summary	
Soil Group	**% of Area**
A	19%
A/D	< 1%
B	< 1%
B/D	58%
C/D	22%
Land Use Summary	
Use	**% of Area**
Developed, High Intensity	2%
Developed, Low Intensity	33%
Developed, Medium Intensity	9%
Developed, Open Space	47%
Emergent Herbaceous Wetlands	< 1%
Evergreen Forest	4%
Cultivated Crop	< 1%
Shrub/Scrub	3%
Woody Wetlands	1%

6.3.3 – Existing Conditions Results

2D hydraulic modeling was used to simulate existing system performance for analysis area 3. Results of the hydraulic model are graphically depicted for the 10-year, 24-hour rainfall event in **Figure 13** and all results are found in **Appendices C.2 –C.7.** The current 10-year, 24-hour rainfall event shown in **Figure 13** shows flooding occurring in a majority of the Phase 3 Study Area. Most of the flooding for the current 10-year, 24-hour rainfall event occurs at Pine St, 18th Ave, Collins Park St, and 15th Ave. The future 10-year, 24-hour rainfall event in **Figure 13** shows slightly more flooding in some areas, such as near 15th Ave. Most of the impact of the future rainfall event is the increased depth of the flooding. The topography of analysis area 3 is such that all drainage eventually flows into the Waccamaw River on the eastern and northern side of the Study Area. Once runoff made its way into the drainage system, the system held up well until near the outfalls, where the system appears to be undersized, which causes more flooding in low lying areas.



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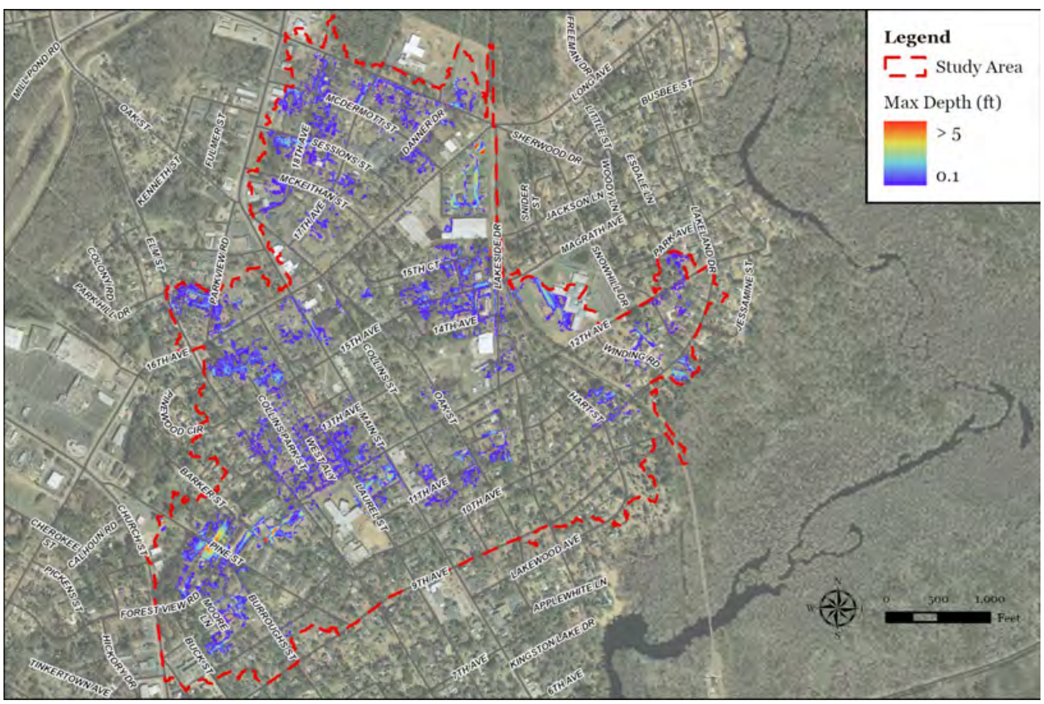

(b)

Figure 13 – Simulated maximum flood depths for the (a) current and (b) future 10-year, 24-hour rainfall event for Phase 3 Study Area.

6.3.4 – Recommendations for Improvements

Recommendations for analysis area 3 include installation of approximately 46646 linear feet of piping and 468 new structures in 14 separate sub-projects. No channel or ditch upgrades were recommended for this area. The service areas for the 14 proposed sub-projects are shown in **Figure 14** and a detailed summary of improvement recommendations are given in **Table 16**.

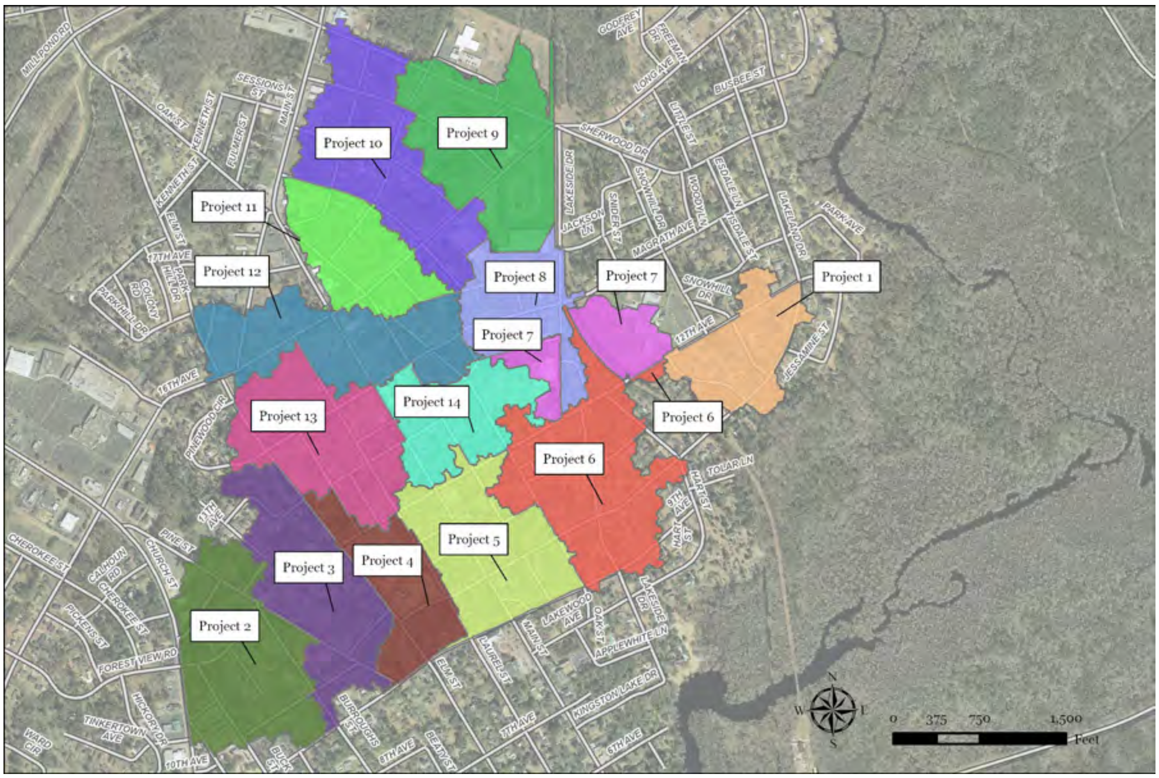

Figure 14 – Service areas for the proposed projects in Phase 3 Study Area.

Results of the existing conditions analysis indicted much of the downtown area could be subject to flood risk for the 10% (10-year) design event. Recommended improvements are presented in map (see **Figure 14**) and tabular format, which are provided in **Appendix D.3**. The project areas in the map in **Figure 14** encompass the areas of the projects that the improvements are being made and make a direct impact to the system. The encompassed areas are not representative of the total area in which flooding is affected by each project, since a project downstream of the other projects can improve the flooding in those project areas as well. In summary, recommendations for analysis area 3 include the installation of approximately 46,646 linear feet of piping, which includes upgrading old pipe networks and installing new pipes. No pond, channel, or ditch upgrades are recommended for this area. **Table 16** summarizes the recommendations.

Table 16 – Phase 3 Study Area recommended improvements summary.

Feature	Quantity	Size Range
Structure	468 EA	-
Piping	46646 LF	12" – (68" x 106" ERCP)
Ponds	0	-
Paving	135806.6 SY	-
Curbing	51310.6 LF	-
Riprap Armoring	1243 TON	-
Inspect, Clean, and Rehab	0	-

6.3.5 – Cost Estimate and Prioritization

As described in Section 5.4 of this report, cost estimates were developed for the recommended improvements . Fourteen sub-projects of varying size were developed from individual recommended improvements with estimated costs of $50.6 million as seen in **Table 17**. Detailed estimated project costs and prioritization are tabulated in **Appendix E.3**.

Table 17 – Cost estimates for each project in Phase 3 Study Area ranked by priority.

Rank	Estimated Cost of Improvements	Project
1	$ 2,608,983.92	9
2	$ 2,758,692.65	6
3	$ 2,547,773.41	10
4	$ 2,840,270.63	5
5	$ 5,076,393.11	11
6	$ 5,466,401.63	12
7	$ 2,110,084.37	4
8	$ 3,444,787.94	3
9	$ 3,507,926.91	13
10	$ 4,476,418.03	2
11	$ 3,490,679.86	7
12	$ 5,655,657.33	14
13	$ 3,425,695.44	8
14	$ 3,242,119.73	1
Total	$ 50,651,884.95	

7.0 – Limited Community Review

A limited community review was completed to assess how recommended improvements within Phase 1, 2, and 3 may or may not affect low-to-moderate income (LMI) populations. The percentage of LMI populations for Phase 1, 2, and 3 Study Areas are 43.32%, 33.82%, and 32.16% respectively. The percentages are based on a weighted average of the Census blocks intersecting the Study Areas. **Figure 15** shows the census data for the percentage of low to moderate income populations. The observed affected areas will be positively affected by the improvement of the stormwater drainage system. Since over 35% of the population in the Master Plan Study Areas include low to moderate income populations, it may be assumed that construction of some or all of the recommended sub-projects would provide an improvement low / moderate income residents.

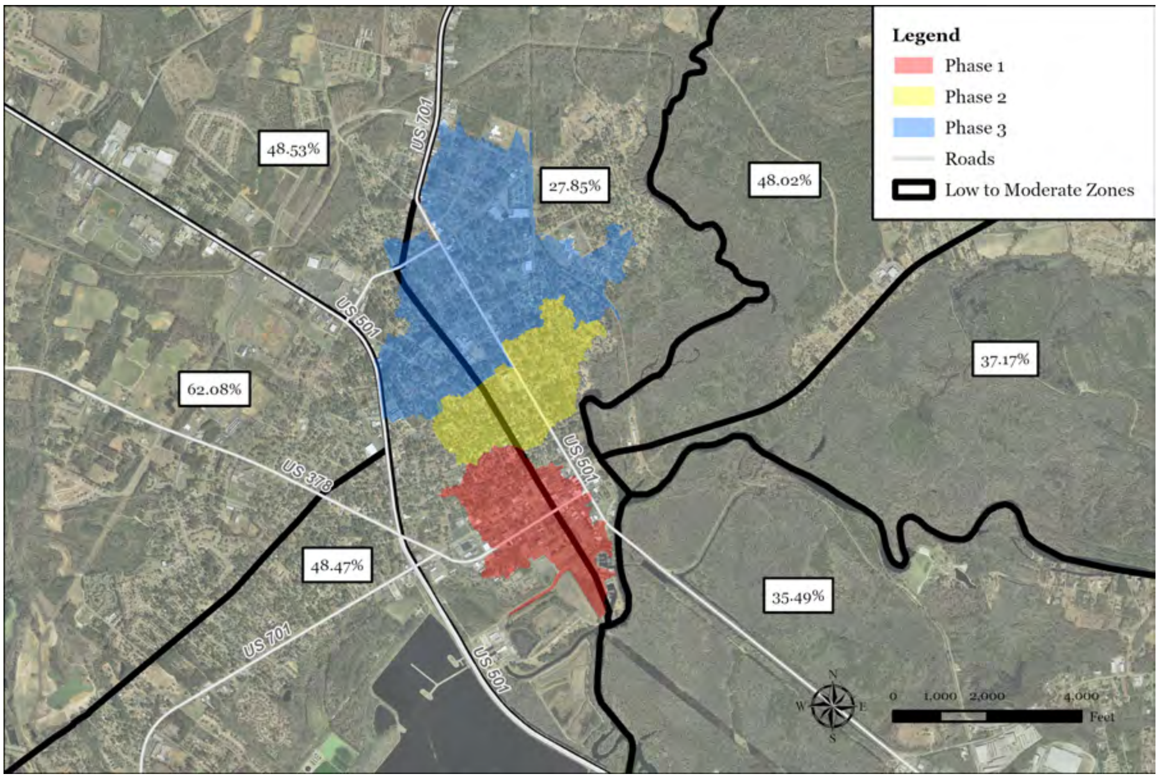

Figure 15 – The low to moderate income percentages of census tracks within Phase 1, 2, and 3 Study Areas.

8.0 –Environmental Review

Davis & Floyd conducted an Environmental Review of the proposed project Study Areas in the City of Conway. The report notes hazardous material or petroleum facilities which may affect the proposed improvement areas, existing and potential historic sites, potential wetland areas, and listed federally threatened and/or endangered species that may be present within the Study Area. D|F conducted a desktop review of the three Phased project Study Areas. A site reconnaissance of the Study Areas was not performed for the limited environmental review. A copy of the Limited Environmental Review is included in **Appendix F**.

8.1– Environmental Approach Summary

D|F contracted Environmental Data Resources, Inc. (EDR) to perform a search of standard Federal and State databases required by ASTM E 1527-21. The EDR report also contains a review of additional databases not required by this ASTM standard. One EDR Report was ordered for each Study Area. A copy of each EDR Radius MapTM Reports is attached to the Limited Environmental Review report.

D|F reviewed the US Fish and Wildlife National Wetland Inventory (NWI) Mapper and USGS Topographic Maps for the potential presence of wetlands with the project Study Areas.

D|F reviewed the South Carolina State Historic Preservation Office (SC SHPO) ArcSite for the presence of currently catalogued national register points and polygons, historic structures, and historic areas.

D|F conducted a review of the U.S. Fish and Wildlife's Environmental Conservation Online System (ECOS) along with NatureServe Explorer to determine the threatened and endangered species located on or near the Study Areas.

8.2 – Threatened and Endangered Species Summary

There are seven at-risk species, six federally threatened species, four federally endangered species, one candidate species, and one species protected under the Bald & Golden Eagle Protection Act listed within Horry County. There are also 13 federally threatened species and 20 federally endangered species that are known species in South Carolina in addition to those listed within Horry County. These species can be further detailed on the U.S. Fish and Wildlife's ECOS online system.

8.3 - Regulated Facilities Summary

The Project Environmental Review identified regulated facilities within the project Study Areas. Additional investigation is recommended at eleven regulated facilities in the Phase 1 Study Area, one regulated facility in the Phase 2 Study Area, and sixteen regulated facilities in the Phase 3 Study Area. Additional assessment is recommended to be performed by a professional archaeologist for the presence or absence of historic features within the Study Areas for Phases / sub-projects as conceptual design is advanced. For design advancement in areas which include potential for construction activities to disturb potential wetland locations, a wetland delineation should be performed to survey the limits of wetlands within the associated Phase / sub-project footprint.

8.4 –Environmental Summary

8.4.1– Phase 1

Phase 1 Study Area is approximately 140-acres and begins at the southernmost portion of Elm Street, then extends North to 6th Avenue, East to N Main Street, and West to Powell Street . The Environmental Database Review identified 18 underground storage tank (UST) facilities, 15 leaking underground storage tank (LUST) facilities, 13 EDR historical automotive facilities, 21 FINDS facilities, five EDR historical dry cleaner facilities, four EPA Enforcement and Compliance History Online (ECHO) facilities, and one state hazardous waste site (SHWS) facility to be located within the Phase 1 Study Area. The SC SHPO ArcGIS Review identified 11 facilities that were listed as historic preservation sites within the Phase I Study Area. The NWI Mapper identified approximately 5.24-acres of wetland area within the Phase I Study Area and 3.47-acres on the southeast border of the Phase I Study Area. These findings are discussed in further detail in Section 2.0 of the Limited Environmental Review Report. Please note that wetland acreage obtained from NWI differs from information included in the 2019 NLCD presented in Section 6 of this report.

8.4.2 – Phase 2

Phase 2 Study Area is approximately 140-acres and begins at the intersection of 6th Avenue and Burroughs Street, then extends North to 9th Avenue, East to the Waccamaw River, and West to Currie Street. The Environmental Database Review identified one UST, LUST facility, one EDR historical automotive facility, nine FINDS facilities, and one ECHO facility to be located within the Phase 2 Study Area. The SC SHPO ArcGIS Review identified six facilities that were listed as historic preservation sites within the Phase 2 Study Area. The NWI Mapper identified approximately 2.77-acres of wetland area within the Phase 2 Study Area. These findings are discussed in further detail in Section 3.0 of the Limited Environmental Review Report. Please note that wetland acreage obtained from NWI differs from information included in the 2019 NLCD presented in Section 6 of this report.

8.4.3 – Phase 3

Phase 3 Study Area is approximately 430-acres and begins at the intersection of N Main Street and 9th Avenue, then extends North to Sherwood Drive, East to Lakeland Drive, and West to Church Street . The Environmental Database Review noted there were 14 UST facilities, 13 LUST facilities, one aboveground storage tank (AST) facility, three EDR historical automotive facilities, 18 FINDS facilities, and two EDR Historical Cleaner facilities, one dry cleaning facility, and one SHWS facility within the Phase 3 Study Area. The SC SHPO ArcGIS Review identified one facility that was listed as a historic preservation site within the Phase 3 Study Area. The NWI Mapper identified approximately 4.39-acres of wetland area within the Phase 3 Study Area. The NWI Mapper identified a stormwater drainage channel that is classified as wetland area that spans from Oak Street to Sherwood Drive within the Phase 3 Study Area. These findings are discussed in further detail in Section 4.0 of the Limited Environmental Review Report. Please note that wetland acreage obtained from NWI differs from information included in the 2019 NLCD presented in Section 6 of this report.

9.0 – Conclusion

Assessment of the City's drainage infrastructure in the City of Conway was completed to analyze and assess the capacity and condition of drainage infrastructure within the study limits (see **Figure 2**). Existing drainage performance was evaluated under two climate conditions using varying rainfall to develop a holistic assessment of existing system capabilities. Existing conditions, represented by present day design rainfall and collected riverine stage data, was used as the basis of conceptual design recommendations for the initial evaluation of drainage improvements. Future conditions, represented by forecasted increases in rainfall depth and rainfall intensity were used to identify areas that may be prone to flooding in the future. In total, 3 Phases, which collectively include 41 drainage improvement sub- projects, were recommended across the City of Conway with an estimated combined project cost around $82 million.

The recommendations provided in this Master Plan report are conceptual in nature and the level of detail of design concepts and estimations have been prepared to support the City's planning and programming purposes. The information provided in this report is recommended to be re-evaluated during advancement of design for the respective Phase or sub-project. Cost estimates provided for the recommended conceptual Phases and associated sub-projects are representative of 2022 dollars and have been estimated based upon a conceptual design, use of historic data, and engineering judgment and are not suitable to represent exact costs of a particular Phase and / or sub-project. Furthermore, recommendations are based on synthetic design rainfall events and recommended to be reviewed and further assessed as a recommended project or project(s) are advanced in design and / or as additional documented historic rainfall events occur within the Study Area / the scientific accuracy of climate change predictions and technical guidance are advanced.

10.0 – References

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