

Pilot North Carolina Stormwater Needs Assessment:

Fiscal Years 2020-2034

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SCHOOL OF GOVERNMENT
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Executive Summary

Just like water and wastewater, stormwater is a capital-intensive service. Understanding future stormwater capital needs will help the North Carolina Department of Environmental Quality Division of Water Infrastructure and other programs that provide stormwater funding in North Carolina support stormwater management programs. This pilot needs assessment uses data collected from capital improvement plans (CIPs) from 49 North Carolina municipalities to extrapolate a 15-year estimate of stormwater capital needs for the State of North Carolina between 2020 and 2034 for municipalities with populations greater than 2,500. The process used for this assessment can inform a more comprehensive needs assessment in the future.

We estimate that there is \$2.76 billion in stormwater capital spending needs between 2020 and 2034. The total 15-year stormwater capital spending needs for the entire state is likely higher than \$2.76 billion as this estimate does not include municipalities with fewer than 2,500 people, nor does it include unincorporated county areas. Additionally, our methodology relied on estimating needs into the future for municipalities for which we have CIP data by averaging the most recent years for which we have capital improvement projections. This means we assume that needs in real dollars will not grow in the future for the municipalities for which we have CIP data. In reality, annual stormwater capital needs in North Carolina are likely to increase over time due to urbanization, regulatory drivers, and climate resiliency pressures.

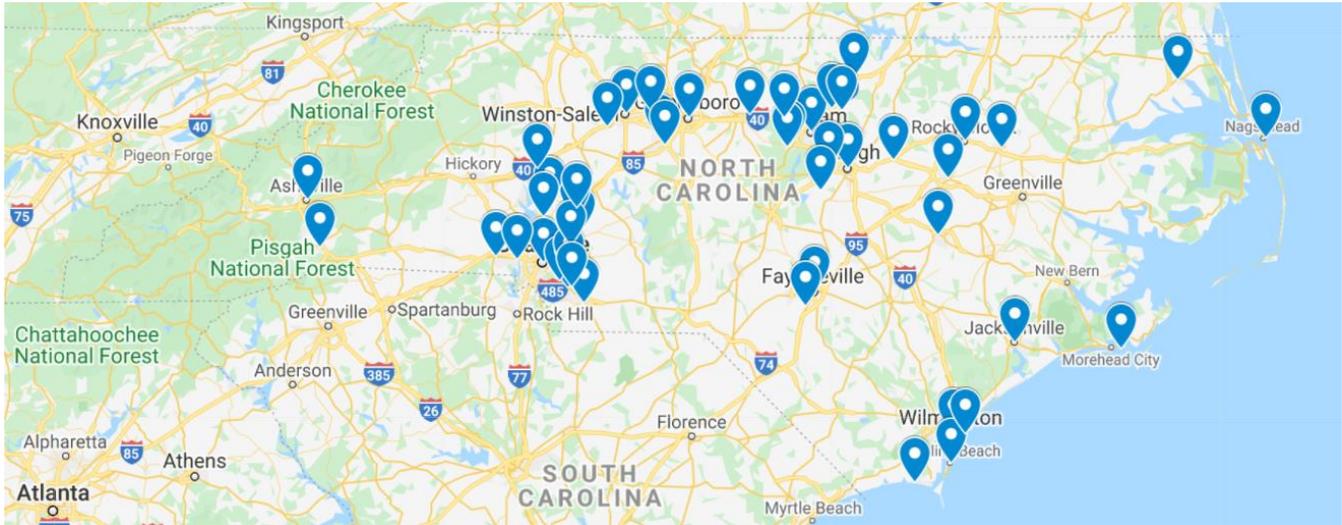
Acknowledgements

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Methods

Figure 1: Municipalities in North Carolina with Stormwater CIPs



Capital improvement plan collection

We collected 49 CIPs from municipal websites across the State that include stormwater capital spending (Figure 1). Since CIPs list projected capital costs in the nominal dollars, we adjust for inflation using expected Consumer Price Index values.¹ All dollar amounts in this assessment are presented in 2020 dollars. The 49 municipalities for which we have CIPs are the sample municipalities. All other municipalities are outside the sample.

First extrapolation: Extrapolation of needs to 2034 for municipalities within the sample

Most of the CIPs do not project stormwater capital costs out to 2034. Therefore, we average annual stormwater capital expenditures for each municipality for the available years and use those annual averages for the remaining years between 2020 and 2034 from which there was not projected capital needs. For example, for a municipality with a 5-year CIP from 2020 to 2024 with \$500,000 total capital needs, we apply the \$100,000 annual average to each of the rest of the years 2025–2034, to get a total 15-year estimate for the municipality. This means we extrapolated capital costs for each municipality for years that fall outside the scope of the CIP. This is the first extrapolation in this methodology.

¹ An alternative approach is to use Construction Cost Index (CCI). Since 2002, CCI has been higher than CPI, but CCI is much more variable.

Second extrapolation: Extrapolation of needs to municipalities outside the sample

We then used a stratified statistical sampling methodology. In this context, stratified sampling means dividing the population of stormwater systems into separate groups (i.e., strata) based on population size, such that the stormwater systems within each stratum are like the other systems in the stratum. We assume that the systems within each stratum for which we have CIP data are sufficiently like the systems in the stratum for which we do not have CIP data and thus must estimate stormwater needs. For this method, we split the municipalities into three strata based on population size: large (>100,000), medium (10,000-99,999), and small (2,500-9,999) (Table 1).

Table 1: Number of municipalities inside and outside the sample of CIPs by population stratum

Stratum	Municipalities In Sample	Municipalities Outside Sample
Large (>100,000)	7	0
Medium (10,000-100,000)	27	50
Small (<10,000)	13	131

We have CIP data for all nine North Carolina municipalities with populations over 100,000, meaning we do not have to extrapolate needs to other municipalities for this stratum. However, we must still extrapolate needs out to 2034 within the “large” stratum. We have CIPs for 27 “medium” municipalities and 13 “small” municipalities. Since we do not have any CIPs for municipalities smaller than 2,500 people, we do not include needs estimates for these municipalities as part of our calculations. There are 320 municipalities of fewer the 2,500 people, accounting for 265,262 North Carolinians. We also do not have a CIP from any counties, so we cannot include stormwater needs for unincorporated county areas in our assessment. In total, our final needs estimates cover stormwater needs for municipalities whose populations account for 54 percent of North Carolina’s population.²

We then calculated estimated 15-year stormwater needs per person for each municipality by dividing 15-year stormwater capital needs estimates by population to get a needs per capita estimate in the sample. We then calculated the median 15-year stormwater needs per capita for each population stratum. The median needs per

² Based on 2019 American Community Survey (ACS) estimates. 2020 ACS data was not available at the time of this analysis.

capita are \$220.58 for large municipalities, \$300.32 for medium municipalities, and \$462.63 for small municipalities. We then used these values to extrapolate stormwater capital needs to the medium and small municipalities outside the sample. For all other municipalities within each group, we multiply the population by the calculated median 15-year needs per capita for the respective group to achieve a total 15-year needs estimate for each municipality. This is the second extrapolation in this methodology.

Summing estimated stormwater capital needs

Finally, we summed the municipal 15-year needs estimates for the municipalities inside and outside the sample to get a total needs estimate for municipalities with greater than 2,500 people. Total estimated 15-year needs are the needs identified within the CIPs in the sample, the results of the first extrapolation within the sample, and the results of the second extrapolation to municipalities outside the sample.

Results

The final estimate is \$2.76 billion in total stormwater capital needs for the 15-year period 2020–2034 for municipalities with a population over 2,500.³ This total can be further broken down by stratum, where the nine large municipalities account for \$1.67 billion of the total, the 77 medium municipalities have estimated needs of \$667 million, and the 144 small municipalities have estimated needs of \$432.3 million. See Table 2 for a breakdown of needs identified in the CIPs, extrapolated needs, and total needs by stratum.

We used population in our stratified statistical sampling methodology to extrapolate stormwater capital needs to municipalities outside the sample. However, there are other variables that may influence a municipality’s stormwater capital needs. These include NPDES MS4 permit status, population density, propensity to flooding, and stakeholder demands. Due to the nature of this analysis as a pilot assessment, we did not explore these variables. A more comprehensive needs assessment would explore these variables for inclusion within the stratified statistical sampling methodology.

Table 2: Needs identified in CIPs, needs extrapolated within sample (first extrapolation), needs extrapolated to municipalities outside sample (second extrapolation), and total estimated 15-year needs

Strata	Needs Identified in CIPs	First Extrapolation	Second Extrapolation	Total Estimated 15-year Needs
Large	\$317 million	\$1.35 billion	\$0	\$1.67 billion
Medium	\$72 million	\$243 million	\$352 million	\$667 million
Small	\$34 million	\$102 million	\$296 million	\$432 million
Statewide Total	\$423 million	\$1.69 billion	\$648 million	\$2.76 billion

³ Using CCI instead of CIP, the 15-year stormwater capital needs for NC are \$2.742 billion.

Table 3: Municipalities in sample by stratum and years for which CIP data was available

Municipality	Population	Stratum	Years in CIP
Charlotte	885,708	Large	2018-2021
Raleigh	474,069	Large	2021-2025
Greensboro	296,710	Large	2021-2025
Durham	278,993	Large	2019-2024
Winston-Salem	247,945	Large	2021-2026
Fayetteville	211,657	Large	2020-2025
Cary	170,282	Large	2021-2025
Wilmington	123,744	Large	2022-2023
High Point	112,791	Large	2020-2022
Concord	96,341	Medium	2020-2024
Asheville	92,870	Medium	2017-2020
Gastonia	77,273	Medium	2015-2020
Jacksonville	72,436	Medium	2020-2021
Chapel Hill	64,051	Medium	2021-2025
Rocky Mount	53,922	Medium	2019-2024
Kannapolis	50,841	Medium	2021-2028
Wilson	49,459	Medium	2022-2026
Indian Trail	40,252	Medium	2021
Mooresville	39,132	Medium	2020-2024
Holly Springs	37,812	Medium	2021-2025
Monroe	35,540	Medium	2021-2026
Goldsboro	34,186	Medium	2020-2021
Matthews	33,138	Medium	2019-2021
Mint Hill	27,617	Medium	2021
Statesville	27,528	Medium	2021-2026
Kernersville	24,660	Medium	2022-2026
Carrboro	21,190	Medium	2021-2026
Clemmons	20,867	Medium	2019-2021
Elizabeth City	17,751	Medium	2018-2021
Harrisburg	16,576	Medium	2021-2030
Hope Mills	15,849	Medium	2020-2024
Hendersonville	14,157	Medium	2021-2030
Davidson	13,054	Medium	2023-2025
Belmont	12,558	Medium	2021-2025
Archdale	11,513	Medium	2020-2021
Tarboro	10,715	Medium	2021-2026
Oxford	8,886	Small	2022-2026
Oak Island	8,386	Small	2019-2021
Butner	7,859	Small	2021
Hillsborough	7,161	Small	2019-2021
Carolina Beach	6,399	Small	2019-2021
Zebulon	5,917	Small	2021-2025
Creedmoor	4,612	Small	2020-2021
Beaufort	4,452	Small	2021-2025
Lake Park	3,909	Small	2021
Landis	3,138	Small	2021
Nags Head	2,975	Small	2022-2025
Wrightsville Beach	2,556	Small	2020-2021
Haw River	2,535	Small	2020-2021



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