CITY COUNCIL INFRASTRUCTURE MEETING

Pre-read Materials

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LIST OF INFRASTRUCTUE

Charlotte City Council Infrastructure Meeting

Category	Asset	General Metric	Lead Entity
Community Need	Affordable Housing	Yes/No	Private Sector
	Arts And Culture Facilities	Condition, Capacity, % Engaged	Private Sector, City
	Banks	Proximity To	Private Sector, City
	College & Universities	Enrollment, Education Level	State, Private Sector
	Daycare	Proximity To	Private Sector
	Grocery Store	Proximity To	Private Sector
	Healthy Food	Proximity To	Private Sector
	Homeless Shelter	% Capacity	Private Sector
	Homeownership Opportunities	Yes/No	Private Sector
	Hospital	Proximity To	Private Sector
	Job Opportunities	Proximity To	Private Sector
	Library	Proximity To	County
	Medical Centers	Proximity To	Private Sector
	Pharmacy	Proximity To	Private Sector
	Playground	Proximity To	Private Sector
	Public Activity Fields (Baseball, Tennis Courts, Etc)	Proximity To	County
	Public Pool	Proximity To	County
	Post Office	Proximity To	Federal
	Public Open Space	Proximity To	Private Sector
	Public Transportation	Proximity To	City
	School	Student Generation, % Capacity, Graduation Rate	CMS
Emergency Service	Firehouse	Response Time/Distance To Station	City
	Medic	Proximity To	County
	Police Station	Proximity To	City
	Response Center	Call Time, % Vacant	City

Category	Asset	General Metric	Lead Entity
Green Infrastructure	Air Quality	Air Quality Index	State
	Contamination/Brownfield	Yes/No	State
	Erosion And Sediment Control		State
	Open Space	% Of Open Space	City
	Parks/Nature Preserves	Proximity To	County
	Threatened/Endangered Species	Yes/No	State, Federal
	Trails/Greenway	Proximity To	County
	Trees	% Tree Canopy	City
	Wetlands	Yes/No	
	Wildlife		State, Federal
Operations	311 App	Efficiency	City
	Fire Staffing/Companies	Emergency Incident Saturation, Response Time	City, State
	Fleet	Quantity, Condition, % EV	City
	Maintenance Facilities	Capacity, Condition, Access	City
	Open Data	Age, Accuracy, Access	City, County
	Police Response	Response Time	City
	Solid Waste Operations		City
	Transit Operations	On-time Performance	City
Telecommunications	5G	Yes/No	3rd Party
	Cell Phone Tower	Yes/No	3rd Party
	Electrical Grid		3rd Party
	Wifi Access	Yes/No	3rd Party
Transportation Infrastructure	ADA Intersection Improvements	Meets Federal Standard Yes/No	City, State
	Amtrack / Regional Commuter Rail	Proximity To, Car Trips Diverted, Crossings	Private Sector
	Autonomous Vehicle Instructure	None	City, State
	Bike Lanes	Required Streets Map Standards	City
	Bike Parking	Yes Or No	Private Sector
	Bikeshare	Proximity To, # Served, Car Trips Diverted	Private Sector
	Bus Park & Ride	Proximity To, Existing/Planned	City
	Bus Stop	Proximity To, Existing/Planned	City
	Digital Highway Signs	Yes Or No	State
	Driveway Access/Cuts	Required CTR Standards	City, State
	Fare Platform	Access	City

Category	Asset	General Metric	Lead Entity
Transportation Infrastructure	Freight	Capacity, Condition, Access, Crossing	Private Sector
	High Frequency Transit Service	Proximity To, Existing/Planned	City
	Highway Noise Barrier	Yes Or No	State
	Intersection Improvements	Intersection Delay (Seconds) AM/PM Peak	City, State
	Mobility Hubs	Proximity To, Existing/Planned	City
	New Streets	Required UDO Standards	City
	Paratransit	Capacity	City
	New Traffic Signals	New Installation	City
	Parking	Required UDO Standards	City
	Pedestrian Crossings/Signals	New Installation	City
	Rail Park & Ride	Proximity To, Existing/Planned	City
	Rail Stop	Proximity To, Existing/Planned	City
	Real-Time Bus Tracking	Yes Or No, % Accuracy	City
	Roads	Required Streets Map Standards (ROW Protection)	City, State
	Sidewalk	Required Streets Map/UDO Standards	City
	Rail Trail	Proximity To, Existing/Planned	City
	Signal Prioritization	Yes Or No	City
	Signage	Yes Or No	City
	Street Lighting	Presence Of Lighting; Is It Upgraded To LED	City, State (Interstates Only)
Utility	Administrative Facilities	Energy Management, Sustainable Practices, Age, Condition	City
	Booster Pump Stations	Capacity, Age, Efficiency, Condition, Safety, Compatibility, Size	City
	Drainage Pipes And Culverts	Material, Age, Condition, Size	City
	Drainage Structures	Age, Condition	City
	Electric Charging	Proximity To	3rd Party, Private Sector, City

Category	Asset	General Metric	Lead Entity
Utility, cont.	Elevated Storage Tanks	Capacity, Age, Condition, Compatibility, Efficiency	City
	Fiber	Yes Or No	Private Sector, City
	Laboratory Services	Regulatory, QA/QC, Capacity, Water Quality	City
	Landfills	Capacity	County
	Open Conveyance Systems	Condition	City
	Raw Water Intakes & Pump Stations	Capacity, Age, Efficiency, Condition, Safety, Size	City
	Raw Water Pipelines	Capacity, Age, Condition	City
	Recycling Facilities	Capacity	County
	Sewer Capacity	Yes Or No	City
	Sewer Collection Pipelines	Capacity, Age, Condition, Reliability, Location	City
	Sewer Force Mains	Capacity, Age, Condition, Suitability, Condition	City
	Sewer Lift Stations	Capacity, Age, Efficiency, Resilience, Safety	City
	Wastewater Treatment Plants	Capacity, Age, Efficiency, Condition, Safety	City
	Water Capacity	Yes Or No	City
	Water Distribution Metering	Capacity, Age, Condition, Efficiency, Growth	City
	Water Distribution Pipelines	Capacity, Age, Condition, Location, Suitability	City
	Water Treatment Plants	Capacity, Age, Efficiency, Condition, Safety, Compatibility	City
	WW, WT, Booster Stations, Lift Stations	Regulatory, Reliability, Resilience, Continuity Of Operations	City
	Stormwater Drainage Pipes And Culverts	Size, Material, Age, Condition	City
	Stormwater Open Drainage Systems	Condition	City
	Stormwater Drainage Structures	Condition	City
	Stormwater Control Measures	Size, Condition	City

PLANNING FOR CHARLOTTE'S GROWTH

Charlotte City Council Infrastructure Meeting

Past Policy Efforts to Support Infrastructure and Capital Facilities Planning

In the past, the City of Charlotte Department of Planning, Design, and Development created plans to serve as policy guides and to address how parts of the community should be maintained and/or changed in the future. These plans made recommendations on land use, zoning, transportation, and infrastructure investments to realize the vision of the area. During the plan development process, community stakeholders, staff, and leaders with the City of Charlotte, Mecklenburg County (including CMS and Parks and Recreation), and regional partners shared growth projections, development data, decision-making principles, and strategies for planned and future capital investments for their respective entities. This collaborative interdepartmental, inter-jurisdictional approach is a common practice for all planning initiatives within our region and shares a common goal to implement our vision for growth and development.

Current and Future Policy Efforts to Support Infrastructure and Capital Facilities Planning

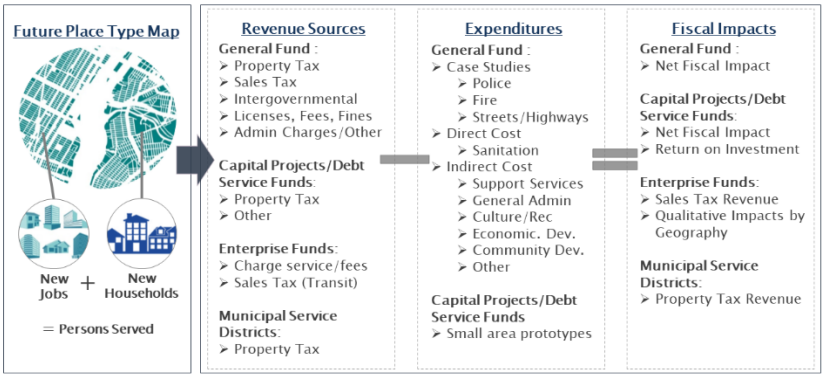
The Charlotte Future 2040 Comprehensive Plan was adopted by Council in June 2021. The Comprehensive Plan is a living document that provides a policy framework that will guide our city's decision-making and investment in both the near- and long term. The planning process was guided by a focus on equitable growth and by the residents of Charlotte coming together with staff and leaders with the City of Charlotte, Mecklenburg County, and regional partners to prioritize what is most important to our communities. Part of the Plan's Policy Framework is to provide actionable responses to the Equitable Growth Framework's priorities of improving access, better distributing the costs and benefits of growth, and creating asset-based and culturally rich places.

A Fiscal Impact Analysis (FIA) was performed throughout various phases of the project to better understand the fiscal impact of future land use and development patterns as a component of the Charlotte Future 2040 Comprehensive Plan. The report provides a summary of the fiscal impact

analysis of the desired land use pattern supported by the Comprehensive Plan. Growth forecasts for residential and commercial development in the City of Charlotte over the next 20 years were used to assess the differing impacts various land uses and Place Type designations (as outlined in the Charlotte 2040 plan) have on the City and Mecklenburg County. The analysis provides an additional layer of understanding and analyses as to what benefits various development patterns bring and what the cost to serve different patterns of growth might be. The report:

- Summarized our understanding of how new development affects the City's ongoing costs and revenues;
- Described the approach for estimating and modeling the fiscal impacts of land use changes; and
- Outlined the results of the Fiscal Impact Model and the impact of different land use and development patterns on the net fiscal impact.

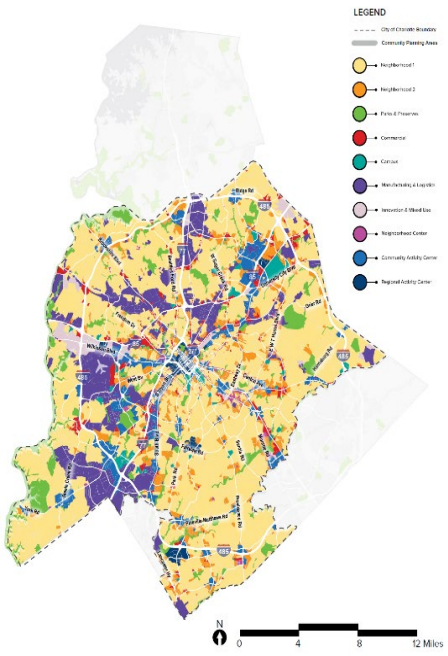
CHARLOTTE FISCAL IMPACT METHODOLOGY



Key findings included:

1. The Comprehensive Plan's growth strategy generates a more fiscally beneficial growth pattern for ongoing operations for the city;
2. Transportation and fire services are the General Fund expenditures that are most impacted by land use patterns and generate the major differences in net fiscal impact of differing growth patterns; and
3. Activity Centers designed to attract new development generate a substantial return on investment that can be leveraged to funded local area and community wide infrastructure and amenities.

CHARLOTTE FUTURE 2040 POLICY MAP



The outcome of this analysis was an understanding of the impacts and benefits of various growth patterns. This work provided guidance for the land use policy in the Comprehensive Plan and *Charlotte Future 2040 Policy Map* (Place Types) in the future for the City. Our partners in this process reviewed the Scope of Work, Data Analysis, Methodology, Findings, and Deliverables for the FIA and included departments/agencies from the City of Charlotte Strategy & Budget, Finance, Charlotte Water, Economic Development, CDOT, Housing & Neighborhood Services, Fire, Mecklenburg County, Finance, Economic Development, CMS and Park & Recreation.

The *2040 Policy Map* (Future Place Types Map) was created through the mapping of aspirational places across the community and adopted by Council in March 2022. The *2040 Policy Map* provides place-based guidance for future growth and development. The 2040 Policy Map serves as the baseline for Community Area Planning and will be refined as needed during this planning process

Community Area Plans are intended to provide a more coordinated, efficient, and effective structure for neighborhood planning and to provide detailed strategies for creating great places, transportation, infrastructure, community facilities, and amenities. The recommended approach within the Comprehensive Plan establishes an achievable method to have 100% coverage of the community, facilitate conversations between neighborhoods, and allow major barriers that often serve as neighborhood boundaries to be addressed in the planning process. During the plan development process, community stakeholders, staff, and leaders with the City of Charlotte, Mecklenburg County (including CMS and Parks and Recreation), and regional partners will share growth projections, development data, decision-making principles, and strategies for planned and future capital investments for their respective entities. Staff will continue to lead a collaborative interdepartmental, inter-jurisdictional planning process to create comprehensive strategies to address future growth and development.

REGULATORY REQUIREMENTS: UNIFIED DEVELOPMENT ORDINANCE

Charlotte City Council Infrastructure Meeting

INTRODUCTION:

While our development regulations today trigger some infrastructure requirements as a part of the development process, the adopted Unified Development Ordinance (UDO) will add to and enhance these standards with additional requirements when the ordinance is effective on June 1, 2023.

The implementation of the UDO will strengthen our ability to capture desired infrastructure, resulting in outcomes that were often limited to the conditional rezoning process. Some of the items built into the UDO were considered and incorporated based on their repeated inclusion in conditional notes on rezoning plans. Other UDO requirements help us build on the vision of the 2040 Comprehensive Plan and support implementation of plan priorities. Items such as bus stops, curb lane relocation to allow for vehicle and bike lanes, sidewalks, drainage measures and many others have all been enhanced and incorporated into the UDO so that our development outcomes better address infrastructure needs regardless of whether development occurs by-right or through the rezoning process. This will allow us to continue to build on the vision laid out in our 2040 Comprehensive Plan, better address development impacts moving forward, and continue to leverage public/private partnerships and investments that benefit our communities throughout the city. *Items identified as NEW are UDO requirements.*

MOBILITY

- **Comprehensive Transportation Review (CTR)** ***(NEW)*** – Multimodal Infrastructure Assessment
    - A CTR is required for any development project (by-right or conditional rezoning) that triggers specified trip threshold (see below). Currently only traffic impact studies
      (vehicular mitigation) occur through a conditional rezoning process when triggering trip threshold (2,500 Daily Trips)
    - Multimodal Assessment ***(NEW)***
        - Mitigation points required/assigned based on land use and intensity, points achieved by building improvements from multimodal menu (e.g. sidewalks, ADA ramps, pedestrian crossings)
    - Transportation Demand Management (TDM) Assessment ***(NEW)***
        - Mitigation points required/assigned based on land use and intensity, points achieved by building improvements from TDM menu (e.g. Bicycle facilities, transit passes, reduced parking)
    - Traffic Impact Studies (TIS) ***(New Thresholds)*** results of study determines vehicular transportation mitigation (e.g. turn lanes, new traffic signal)
        - Threshold: Low-Intensity UDO Zoning Districts - 1,500 Daily Trips (reduced from 2,500)
        - Threshold: High-Intensity UDO Zoning Districts Threshold - 2,000 Daily Trips
          (reduced from 2,500)

- **Pedestrians/Bicycles**
    - For new development, construction or improvement of sidewalks and shared-use paths along street frontage(s)
        - Increased minimum sidewalk width from current four feet to five feet ***(NEW)***
    - For new development along existing operating or future operating transit lines identified in a Council-adopted transit trail plan, construction of transit lines or land reservation for their construction ***(NEW)***
    - For new development meeting conditions, construction of connections to off-street public paths or parks ***(NEW)***
- **Transit**
    - For any development project within a Rapid Transit Corridor alignment, land reservation is required for such transit corridor ***(NEW)***
        - For reserved land in the UC and TOD Zoning Districts there is no expiration of the period for which the land is reserved ***(NEW)***
        - For all other Zoning Districts, the land reservation period is 18 months ***(NEW)***
    - New nonresidential, mixed-use, multi-family, or townhouse development along a bus route per prescribed conditions or CTR requirements will provide a new bus stop, which may include amenities such as benches and shelters ***(NEW)***
- **Streets**
    - For development and major subdivisions, local and collector streets constructed and dedicated when meeting certain size thresholds
        - Requirement expanded to include construction of single-building sites ***(NEW)***
    - For development and major subdivisions along new limited access roads and arterials as indicated on the Charlotte Streets Map, reservation of right-of-way for construction of such
        - An incentivized option to dedicate right-of-way area for construction of new limited access roads and arterials ***(NEW)***
        - New local or collector streets may be constructed in the interim in the limited access road or arterial right-of-way
    - For development meeting specified conditions, installation of new curb and gutter and the associated storm drainage where none currently exists
    - For development along street frontage(s) where the existing curb and gutter is not located at the required future back-of-curb location, relocation of existing curb and gutter to the future back-of-curb location when meeting certain conditions ***(NEW)***
    - For development, construction or improvement of amenity zones/planting strips along street frontage(s)
    - For new development meeting specified conditions, cross-access connections between sites ***(NEW)***

STORMWATER

- New approaches to control stormwater runoff that avoid site impacts from development activity such as building expansions, alteration of existing site drainage or construction of new buildings. New approaches include:
    - Site drainage plan for smaller infill development ***(NEW)***
    - Lower threshold for applicability of stormwater management standards; Applies to development of 5,000 sq ft of new impervious area. Previous threshold was 20,000 sq ft.***(NEW)***

TREES

- **Tree Preservation**
  - Preservation of existing City Street trees on public streets
  - Preservation of existing tree save
  - Tree Save/Green Area increased on-site preservation area required for residential subdivisions ***(NEW)***
  - Tree Save Land Conservation Option - for any development, land-donation/ conservation easement option to City's Tree Canopy Preservation Program (TCPP) ***(NEW)***
  - Tree Save – payment-in-lieu fee increased to align with current property tax values ***(NEW)***
  - Heritage tree protection ***(NEW)***
- **Tree Planting**
  - Street tree planting on public streets for new development
  - Street tree planting on private streets for new development ***(NEW)***
  - Street tree planting for residential infill sites. Tree must be preserved or planted in the front setback between the house and the street ***(NEW)***
  - Parking lot and internal tree planting for new development
  - Heritage tree mitigation fee and planting if heritage trees removed through development ***(NEW)***
  - Installation of tree pit infrastructure including amended soil, suspended sidewalk panels, tree grates, irrigation, and sub-drainage for urban development

OPEN SPACE

- **Open Space and Parks**
  - The option for Mecklenburg Park & Recreation to reserve land for parks through subdivision process in accordance with an adopted plan or policy document
  - Increased on-site open space for development ***(NEW)***
    - Standards require that open space be usable
    - Portions of nonresidential development open space must be accessible for use by the public
  - For new development, an option to provide fee-in-lieu to Mecklenburg County for the acquisition or development of recreation areas ***(NEW)***
  - For new development, an option to dedicate land to Mecklenburg County for the development of recreation areas ***(NEW)***
    - Land offered for dedication must meet Park and Recreation standards and be accepted by the county
  - Tree save areas may include areas dedicated to Mecklenburg County Park and Recreation for parks; Dedicated tree save areas may include passive use recreation areas and additional amenity elements ***(NEW)***
- **Greenways**
  - The option for Mecklenburg Park & Recreation to reserve land for greenways in accordance with the adopted Mecklenburg County Master Greenway Plan
    - For subdivisions
    - For other development ***(NEW)***

- Tree save areas may include areas dedicated to Mecklenburg County Park and Recreation for greenways or the City of Charlotte for the Tree Canopy Preservation Program, Urban Arboretum Trail, or other City trail projects ***(NEW)***

WATER & SEWER

Water and sanitary sewer (wastewater) facilities and service connections maintained by Charlotte Water shall meet the requirements (at minimum) of Charlotte Water Design and Construction Standards. Separately owned facilities shall meet the requirements of the appropriate permitting agency.

Charlotte Water works with development community to identify available water and sanitary sewer capacity. In the unique circumstance there is an identified limitation, required infrastructure projects may be installed through a combination of privately and publicly funded means.

SCHOOLS

The option for Charlotte-Mecklenburg Schools to reserve land for facilities through subdivision process in accordance with an adopted plan or policy document

FIRE & POLICE

The option for Charlotte Fire Department or Charlotte-Mecklenburg Police Department to reserve land for facilities through subdivision process in accordance with an adopted plan or policy document

Summary Report

Capital Transportation Programs

Infrastructure Needs & Projects

Prepared by:

Charlotte Department of Transportation

December 16, 2022

Purpose:

This document summarizes the on-going capital transportation programs and identifies long-term infrastructure needs and prioritized funded projects.

Contents:

Program Project Prioritization

Current Transportation Program Prioritization

Our current transportation project and program investment is guided by the following criteria tailored to unique metrics for each program and type of investment.

Safety – improving transportation safety and addressing safety issues

Congestion – improving and managing vehicular delay

Connectivity – increasing multi-modal connectivity and network

Leverage – capitalizing on funding and implementation partners

2040 Comprehensive Plan Prioritization

Our future transportation investment will be guided by the vison established in the Charlotte 2040 Comprehensive Plan and the supporting objectives of the Strategic Mobility Plan. The Mobility Goal adopted in the 2040 Plan is for "Safe and Equitable Mobility".

Safe and Equitable Mobility

Charlotte will provide **safe** and **equitable** mobility options for all travelers regardless of age, income, ability, race, gender, where they live, or how they choose to travel. An integrated system of transit and tree-shaded bikeways, sidewalks, shared use paths, and streets will support a **sustainable**, **connected**, **prosperous**, and **innovative** network that connects all Charlotteans to each other, jobs, housing, amenities, goods, services, and the region.

The **Strategic Mobility Plan Objectives** that will define future project identification and prioritization include:

Strategic Mobility Plan **Objectives:**

1 CIP Program: Improve Sidewalks

Goal:

Make Charlotte a more walkable city.

Projects:

Completing critical sidewalk gaps, making strategic sidewalk connections, and improving accessibility in public rights-of-way in compliance with the Americans with Disabilities Act.

Program Prioritization Criteria:

Safety

Projects that are on the High Injury Network.

Congestion

Not applied.

Connectivity

Projects that provide access to schools, parks and greenways, transit, or complete longer segments of the sidewalk network.

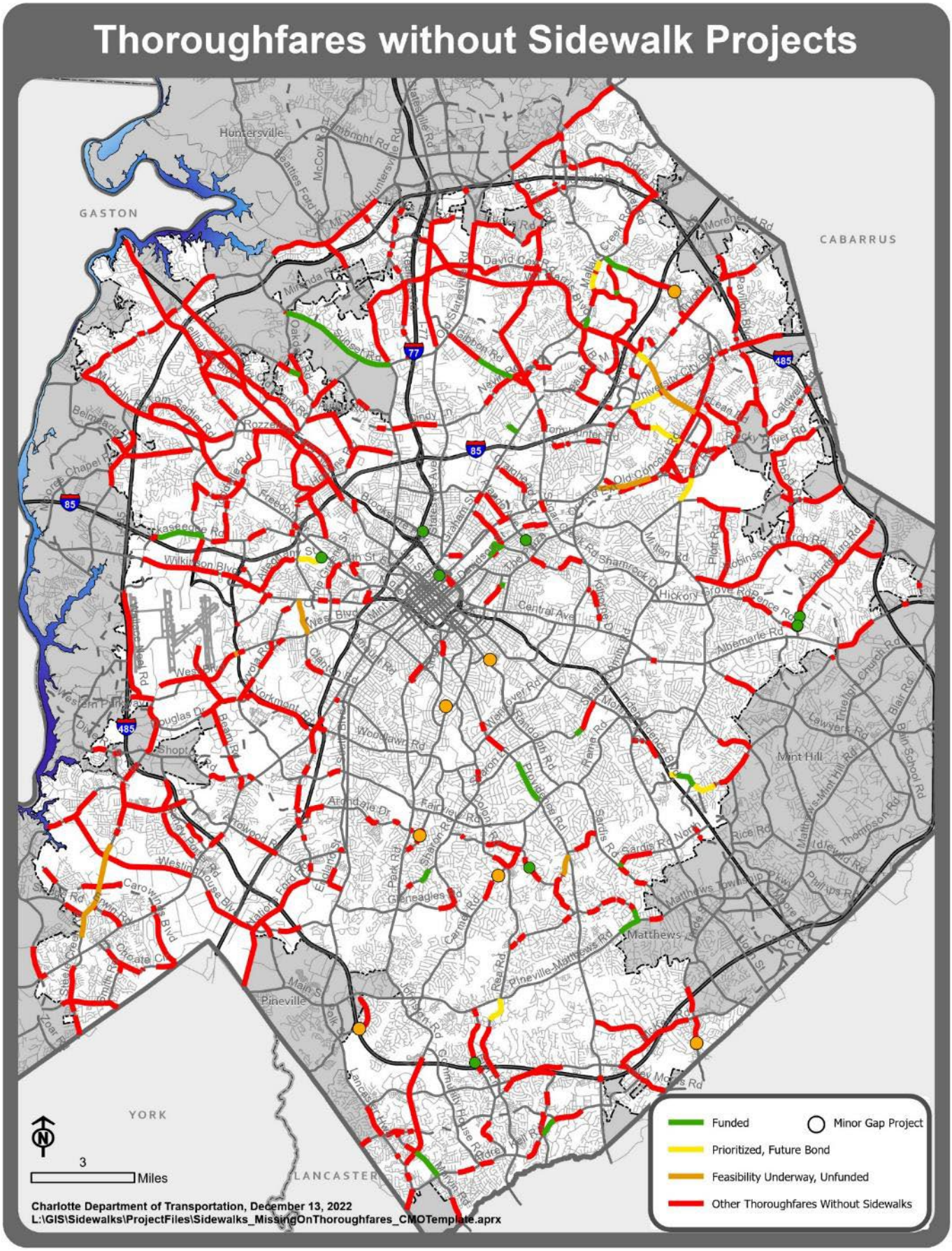
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$50 million

CIP Program: **Improve Sidewalks**



CIP Program: **Improve Sidewalks**

Sidewalk Project List

	FUNDED		
	Project Name	***Begin***	***End***
	10th St & Church St Minor Gap	NA	NA
	5212 Sharon View Rd Minor Gap	NA	NA
*	Alleghany St Minor Gap	Freedom Dr	Crisman St
	Ardrey Kell Rd Sidewalk	Tom Short Rd	Future Bryant Farms Rd Ext
*	Endhaven Ln Minor Gap	Megawood Dr	Elm Ln
	Gibbon Rd Sidewalk	Nevin Rd	Brawer Farm Rd
	Harrisburg Rd Minor Gap, Phase 1	NA	NA
	Harrisburg Rd Minor Gap, Phase 2	NA	NA
	Hornets Nest Park Access (Sunset Rd)	Day Lily Ln	Kiev Dr
	Kennon St Sidewalk	Hawthorne Ln	Thomas Ave
	Kuykendall Rd Sidewalk	McKee Rd	Drayton Hall Ln
	Margaret Wallace Rd Sidewalk	Campbell Creek	Old Gate Rd
	Marvin Rd Sidewalk	Johnston Rd	Ardrey Kell Rd
	N Sharon Amity Rd Sidewalk	Tangle Dr	Delane Ave
	Oneida Rd Sidewalk	N Graham St	Teton Trail
	Pineville-Matthews Rd Sidewalk	Echo Forest Dr	Alexander Rd
	Pleasant Grove Rd Sidewalk	Hipp Rd	Oakdale Elementary School
	Providence Rd Sidewalk	Greentree Dr	Knob Oak Ln
*	Sardis Rd North Sidewalk	Sardis Rd	Rittenhouse Cir
	Sharon Rd Sidewalk	Bramwyck Dr	Chandworth Rd
*	Spencer St Minor Gap	35th St	36th St
*	Tuckaseegee Rd Sidewalk	Little Rock Rd	Westerwood Dr
*	University Research Park Sidewalks	NA	NA
	W Mallard Creek Church Rd MUP	Mallard Creek Rd	Claude Freeman Dr
*	Whisnant St MUP Minor Gap	NA	NA
	XCLT - Davidson St to Matheson Ave	N Davidson St, 25th St, Jordan Pl, & Matheson Ave	
*	*Additional funding needed to complete project.*		

Prioritized Future Bond Projects: Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

PRIORITIZED, FUTURE BOND			
Rank	***Project Name***	***Begin***	***End***
1	WT Harris Blvd MUP	Tryon St	JW Clay Blvd
2	WT Harris Blvd MUP	The Plaza	Grier Rd
3	University City Blvd Sidewalk	N Tryon St	E WT Harris Blvd
4	Alleghany St Sidewalk	Crisman St	Ashley Rd
5	Margaret Wallace Rd Sidewalk	Old Gate Rd	Marshbrooke Rd
6	Margaret Wallace Rd Sidewalk	Independence Blvd	Campbell Creek
7	Rocky River Road Sidewalk/MUP	Rockland Dr	Old Concord Rd
8	Mallard Creek Rd Sidewalk	Alexander Rd	Driwood Ct
9	Mallard Creek Rd Sidewalk	Silver Birch Dr	Colvard Park Wy
10	Rea Rd Sidewalk/MUP	Pineville-Matthews Rd	Fairways Club Dr

MUP = Multi-Use Path

FEASIBILITY UNDERWAY, UNFUNDED			
	Project Name	***Begin***	***End***
	4017 Weddington Rd Minor Gap	NA	NA
	Carmel Rd & Moreland Farms Rd Minor Gap	NA	NA
	Donald Ross Rd Sidewalk	Wilkinson Blvd	West Blvd
	Dotger Ave & Vail Ave Minor Gap	NA	NA
	Hastings Dr & Wellesley Ave Minor Gap	NA	NA
	Mallard Creek Church Rd & Mallard Glen Dr Minor Gap	NA	NA
	Old Concord Rd Sidewalk	Orchid Bridge Rd	Donna Dr
	Old Providence Rd Sidewalk	Providence Rd	Vendue Pl
	Park Rd Minor Gap	I-485	Kingfisher Dr
	Park South Dr Minor Gap	Harper Ct	Archdale Dr
	Steele Creek Rd Sidewalk	Westinghouse Commons Dr	Settlers Trail Ct
	West Blvd Sidewalk/MUP	Jackson Dr	Billy Graham Pkwy
	WT Harris Blvd Sidewalk/MUP	University City Blvd	Old Concord Rd
	WT Harris Blvd Sidewalk/MUP	Tryon St	University City Blvd

MUP = Multi-Use Path

CIP Program:

2 Connect Bicycle Facilities

Goal:

Make Charlotte a bikeable city.

Projects:

Expansion of the bicycle network by building important new facilities and repurpose existing infrastructure to create space for cyclists.

Program Prioritization Criteria:

Safety

Projects that create a safe and comfortable bicycle network.

Congestion

Projects that provide network and mode alternatives to high volume arterials.

Connectivity

Projects that create a bicycle network that provides useful connections to destinations.

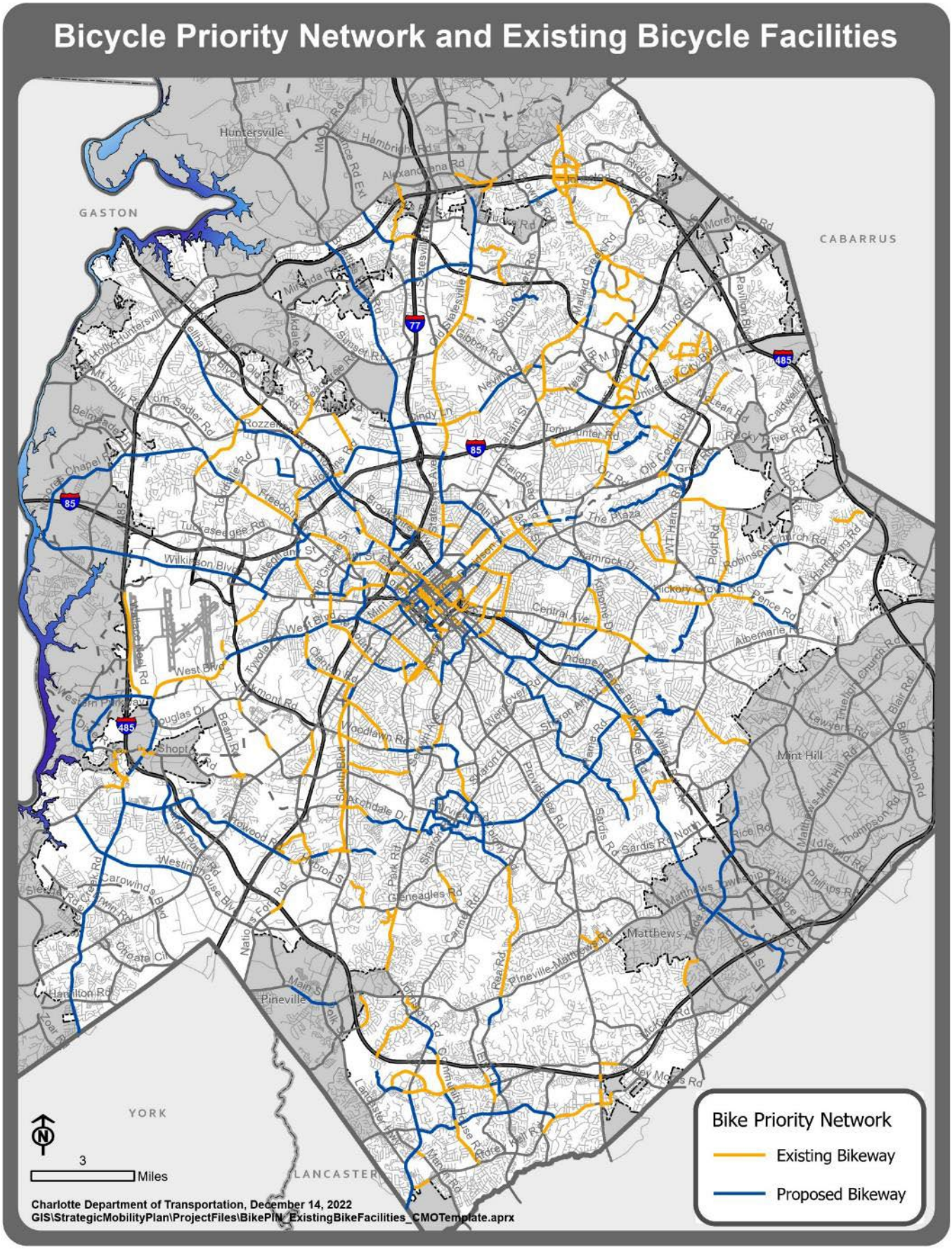
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$8 million

CIP Program: **Connect Bicycle Facilities**



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CIP Program:

Enhance Transportation Safety

Vision Zero

Goal:

Make Charlotte a safe city.

Projects:

Neighborhood traffic calming, spot safety treatments, and small infrastructure projects such as pedestrian crossings.

Program Prioritization Criteria:

Safety

Projects that directly relate to safety, primarily using data from the High Injury Network.

Congestion

Not applied.

Connectivity

Projects that create safe connections for walking and biking.

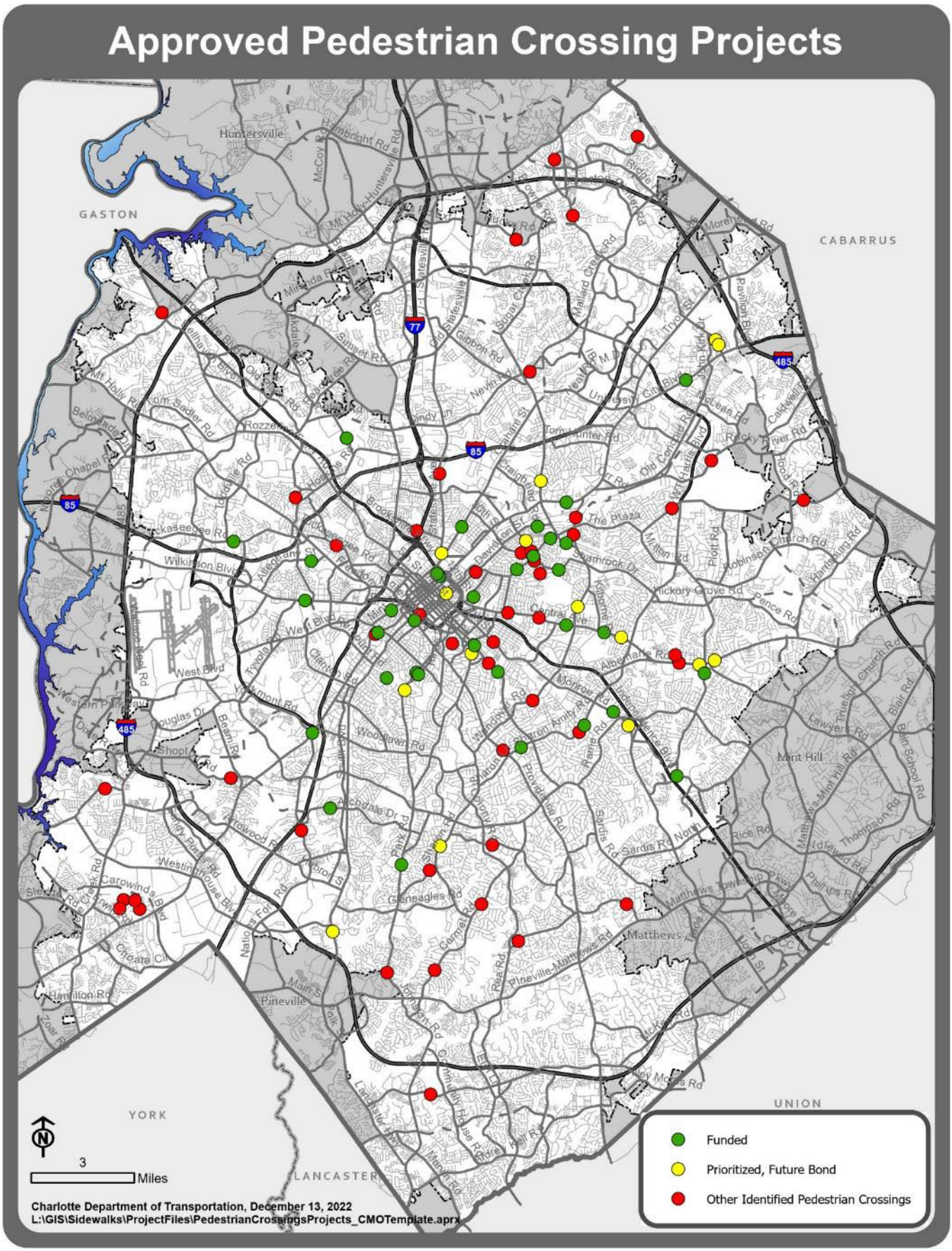
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$12.6 million

CIP Program: **Enhance Transportation Safety (Vision Zero)**



CIP Program: **Enhance Transportation Safety (Vision Zero)**

Pedestrian Crossing Project List

FUNDED	
	Project Name
*	10th St & Poplar St Intersection Improvements
	10th St & Church St Crosswalk
	1105 Otts St Speed Tables and Signage
	1335 Alleghany St Pedestrian Refuge Island
*	1437 E Sugar Creek Rd PHB
	3240 Wilkinson Blvd Intersection Traffic Signal
*	3601 Central Ave PHB
	5945 Tuckaseegee Rd & Yahtzee Ln Crosswalk
*	Archdale Dr near Cherrycrest Ln RRFB
*	Central Ave between Kilborne Dr & Progress Ln PHB
	Chesapeake Dr Crosswalk
	E WT Harris Blvd & Bonlyn Dr PHB
*	Graham St & Woodward Ave Crosswalk
	Lattimore St & Kenilworth Ave & Scott Ave RRFBs
	Mark Twain Rd & University City Blvd PHB
	Margaret Wallace Rd & Greenway Crossing RRFB
*	Mint St & Lincoln St Intersection Accessible Ramps
*	Monroe Rd & Ashmore Dr PHB
	Morehead St & Caldwell St Intersection Traffic Signal
	N Davidson & Anderson Multiway Stop with Crosswalks
*	N Tryon St & Bennett St Intersection Traffic Signal
*	Park Rd & Huntingtowne Farms Ln PHB
	Poindexter Dr & Elmhurst Rd Signage
	Randolph Rd & Colonial Ave Intersection Traffic Signal
*	Randolph Rd & Mint Museum PHB
*	S Tryon St & Yorkmont Rd/Nations Ford Rd Intersection Pedestrian Signals
*	Shamrock Dr & Anne St RRFB
*	Sharon Amity Rd & Delane Ave PHB
*	Sharon Amity Rd & Robin Rd PHB
	Sugar Creek Rd & Merlane Dr PHB
	The Plaza & Duncan Ave PHB
*	The Plaza & Sweetbriar St PHB
*	The Plaza between Matheson Ave & 36th St PHB
* *Additional funding needed to complete project.*	

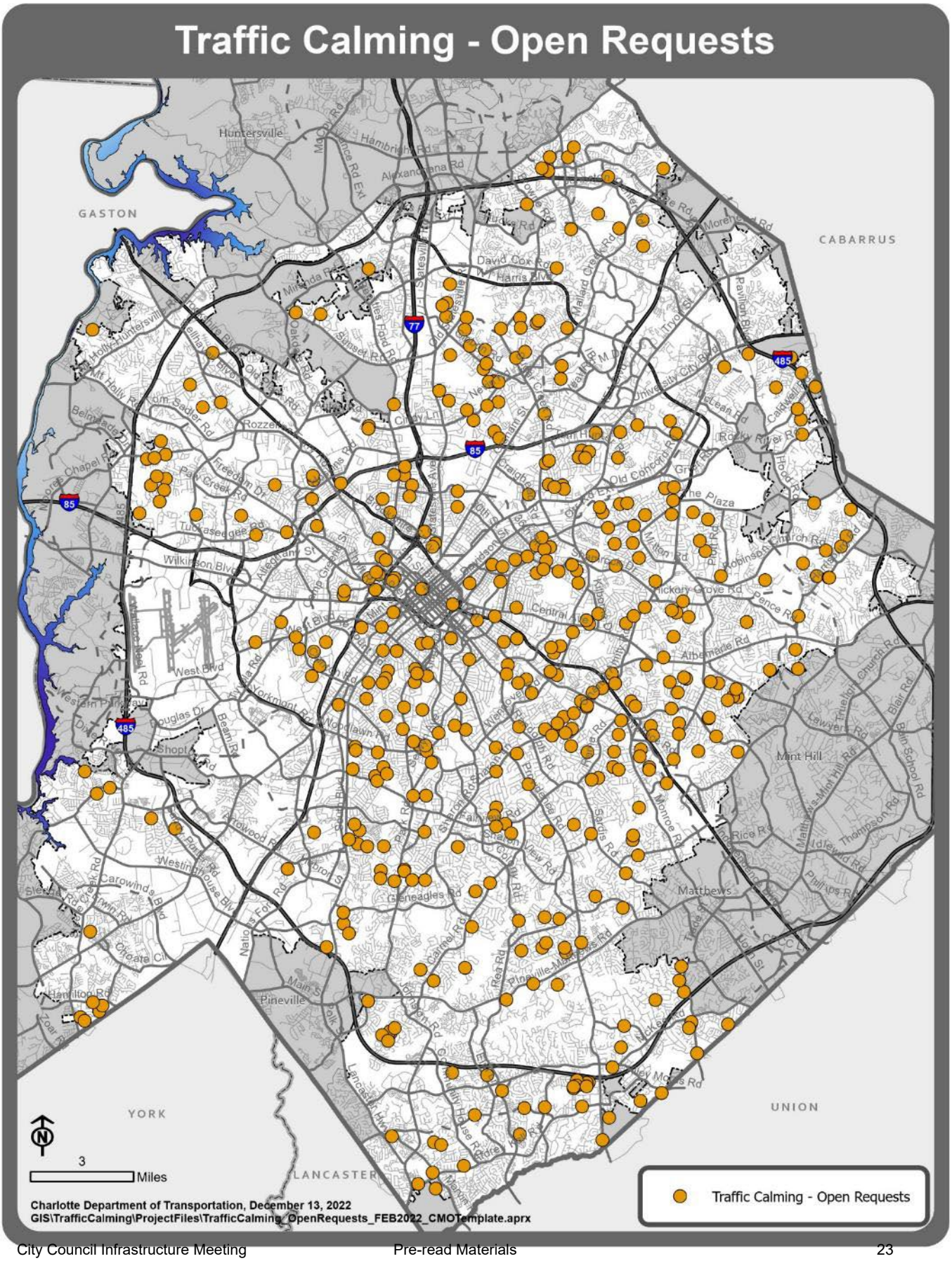
Prioritized Future Bond Projects: Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

PRIORITIZED, FUTURE BOND	
Rank	***Project Name***
1	Sugar Creek Rd & Sofley Rd PHB
2	Mallard Creek Church Rd & University Village Blvd PHB
3	Mallard Creek Church Rd & Campus Pointe Ct PHB
4	4900 Block Central Ave PHB
5	Eastway Dr & Arnold Dr PHB
6	South Blvd & Longleaf Dr PHB
7	7128 Albemarle Rd PHB
8	N Caldwell St & E 8th St Intersection Traffic Signal
9	6740 Albemarle Rd PHB
10	36th St & Spencer St RRFB
11	Sharon Rd & Sulkirk Dr PHB
12	Statesville Ave & Oliver St PHB
13	Providence Rd & Colonial Park (Dartmouth Pl) PHB
14	Park Rd & Sunset Dr PHB
15	Monroe Rd & Knickerbocker Dr Traffic Signal

PHB = Pedestrian Hybrid Beacon

RRFB = Rectangular Rapid Flashing Beacon

CIP Program: **Enhance Transportation Safety (Vision Zero)**



4

CIP Program:

Enhance Transportation Safety

Street Lighting

Goal:

Make Charlotte a safe city.

Projects:

New street lighting projects on the high-injury network and enhanced existing street lighting through LED conversion (increased visibility & environmentally sustainable).

Program Prioritization Criteria:

Safety

Projects that directly relate to safety, primarily using data from the High Injury Network.

Congestion

Not applied.

Connectivity

Projects that create safe connections for walking and biking.

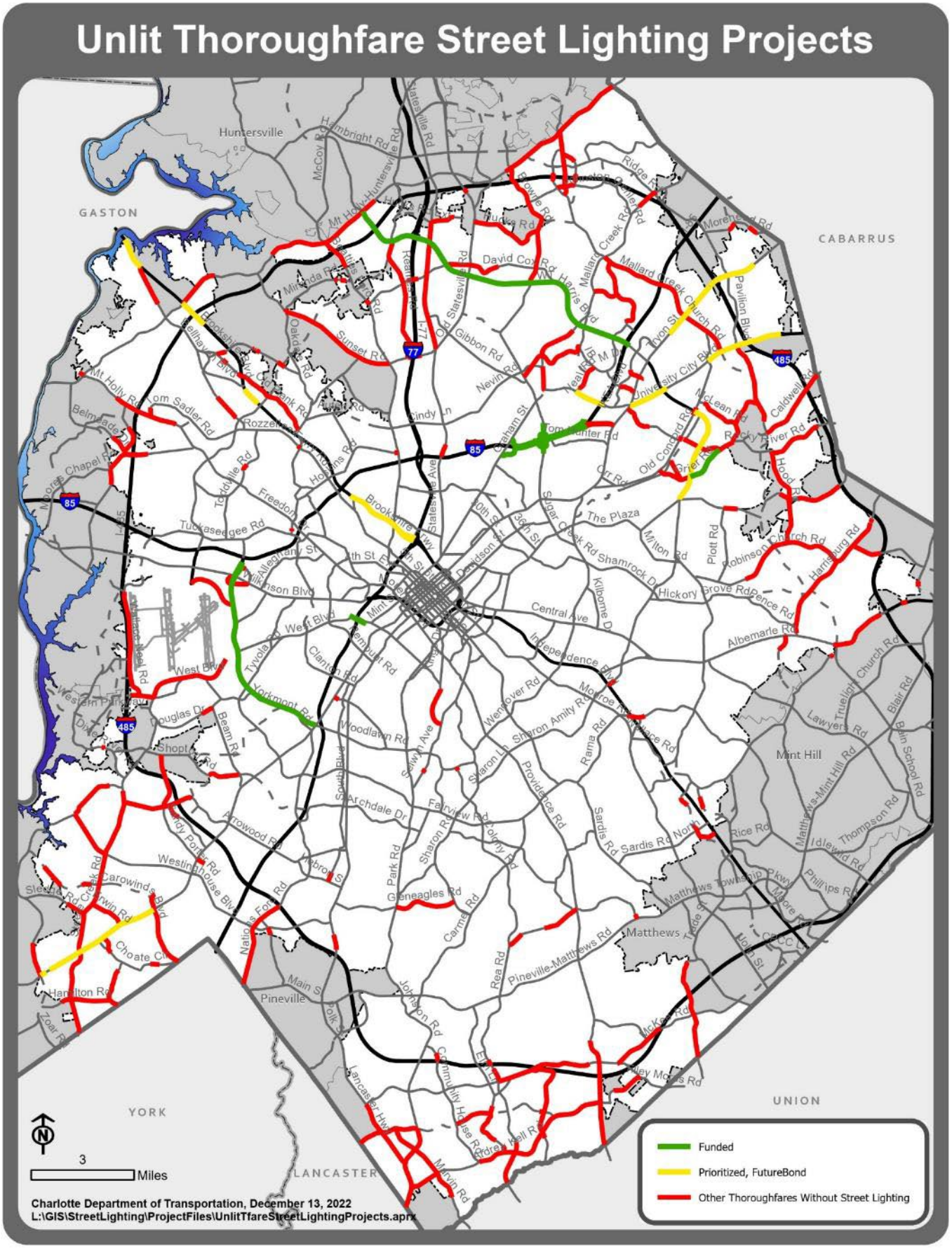
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$4.5 million

CIP Program: **Enhance Transportation Safety (Street Lighting)**



CIP Program: **Enhance Transportation Safety (Street Lighting)**

Street Lighting Project List

	FUNDED		
	Project Name	***Begin***	***End***
	Billy Graham Pkwy Street Lighting	I-85	S Tryon St
	Equipment Dr Street Lighting	N Graham St	Mineral Springs Rd
	Grier Rd Street Lighting	WT Harris Blvd	Rocky River Rd
	Reagan Dr Street Lighting	N Graham St	I-85 Connector
	W Sugar Creek Rd Street Lighting	Equipment Dr	Nevin Rd
	West Blvd & I-77 Underpass Lighting	NA	NA
	WT Harris Blvd Street Lighting	I-485	Mount Holly-Huntersville Rd
	PRIORITIZED, FUTURE BOND		
Rank	***Project Name***	***Begin***	***End***
1	S Tryon St Street Lighting	Carowinds Blvd	City Limits
2	Brookshire Blvd Street Lighting	Mount-Holly Huntersville Rd	Long Creek
3	WT Harris Blvd Street Lighting	Old Concord Rd	The Plaza
4	N Tryon St Street Lighting	Institute Cir	Wednesbury Blvd
5	University City Blvd Street Lighting	North Tryon St	WT Harris Blvd
6	University City Blvd Street Lighting	Old Concord Rd	City Limits
7	Brookshire Blvd Street Lighting	Idaho Dr	I-77
8	Brookshire Blvd Street Lighting	Rozzelles Ferry Rd	City Limits
9	Brookshire Blvd Street Lighting	Belhaven Blvd	Fred D Alexander Blvd

Prioritized Future Bond Projects:
Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

CIP Program:

5 Upgrade Traffic Control Devices

Goal:

Maintain and operate a safe and innovative transportation network.

Projects:

Maintenance and replacement of outdated traffic control equipment, such as traffic signals, pedestrian signals, detection devices, and signs.

Program Prioritization Criteria:

Safety

Projects that replace failed or end-of-life traffic signal equipment or increase safety.

Congestion

Projects that aid in reducing congestion by facilitating more efficient operation of traffic signals.

Connectivity

Projects that aid transit, schools, pedestrians, bicyclists and neighborhoods.

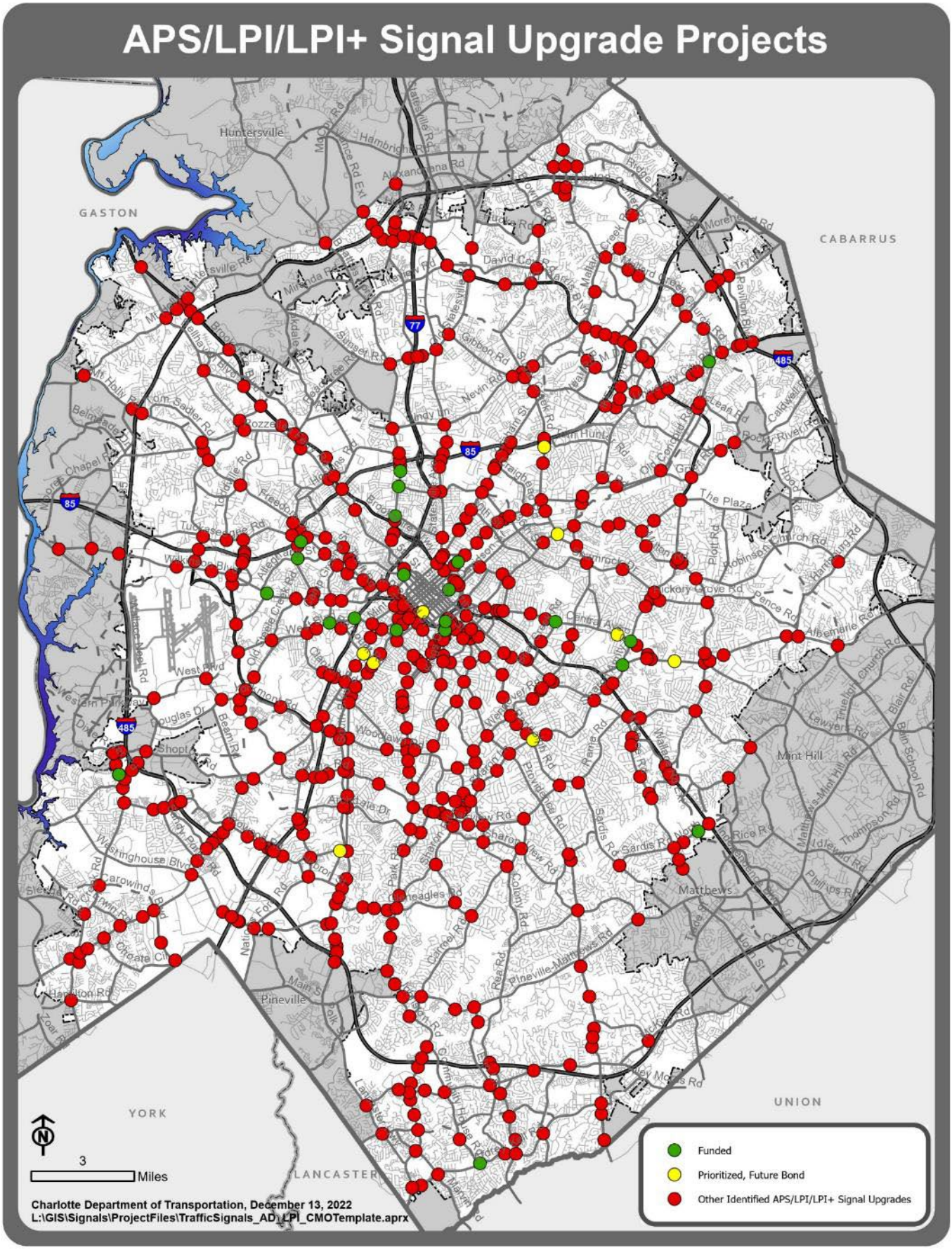
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$4.5 million

CIP Program: **Upgrade Traffic Control Devices**



CIP Program: **Upgrade Traffic Control Devices**

Signal Upgrade Project List

(Accessible Pedestrian Signals & Leading Pedestrian Intervals)

FUNDED	
	Project Name
	16th St & Tryon St Intersection Pedestrian Signal Improvements
	3rd St & I-277 OL Ramp Intersection Pedestrian Signal Improvements
	4th St & Johnson and Wales Way Intersection Pedestrian Signal Improvements
	9th St & Caldwell St Intersection Pedestrian Signal Improvements
	Albemarle Rd & Sharon Amity Rd Intersection Pedestrian Signal Improvements
	Alleghany St & Ashley Rd Intersection Pedestrian Signal Improvements
	Ardrey Kell Rd & Community House Rd Intersection Pedestrian Signal Improvements
	Ashley Rd & Tuckaseegee Rd Intersection Pedestrian Signal Improvements
	Beatties Ford Rd & Booker Ave & Oaklawn Ave Intersection Improvements
	Beatties Ford Rd & Gilbert St & Montana Dr Intersection Pedestrian Signal Improvements
	Beatties Ford Rd & Lasalle St Intersection Improvements
	Central Ave & Briar Creek Rd Intersection Pedestrian Signal Improvements
	Central Ave & Sharon Amity Rd Intersection Pedestrian Signal Improvements
	Charlottetowne Ave & Metropolitan Ave Intersection Pedestrian Signal Improvements
	Crownpoint Executive Dr & Krefeld Dr & Sardis Rd North Intersection Pedestrian Signal Improvements
	Dixie River Rd & Trojan Dr Intersection Pedestrian Signal Improvements
	John Kirk Dr & University City Blvd Intersection
	Park Ave & South Blvd Intersection Pedestrian Signal Improvements
	West Blvd & Barringer Dr & I-77 SB Ramp Intersection Improvements
	West Blvd & Remount Rd Intersection Improvements
	Wilkinson Blvd & Morris Field Intersection Pedestrian Signal Improvements
PRIORITIZED, FUTURE BOND	
Rank	***Project Name***
1	Central Ave & Rosehaven Dr Intersection
2	Sugar Creek Rd & Reagan Dr Intersection
3	Caldwell St & Stonewall St Intersection
4	Arrowood Rd & England St & Old Pineville Rd Intersection
5	Sugar Creek Rd & The Plaza Intersection
6	Albemarle Rd & Farm Pond Ln Intersection
7	Randolph Rd & Sharon Amity Rd Intersection
8	South Blvd & Remount Rd & Ideal Way Intersection
9	Remount Rd & Tryon St Intersection Pedestrian Signal Improvements

Prioritized Future Bond Projects:
Projects prioritized for funding with available
2022 Bonds and/or future approved bonds

CIP Program:

6 Maintain Intelligent Transportation Systems

Goal:

Maintain and operate a safe and innovative transportation network.

Projects:

New signal installations, fiberoptic cable and real-time traffic management cameras, and maintenance and replacement of outdated equipment.

Program Prioritization Criteria:

Safety

Projects that replace failed or end-of-life traffic signal equipment or increase safety.

Congestion

Projects that aid in reducing congestion by facilitating more efficient operation of traffic signals.

Connectivity

Projects that aid transit, schools, pedestrians, bicyclists and neighborhoods.

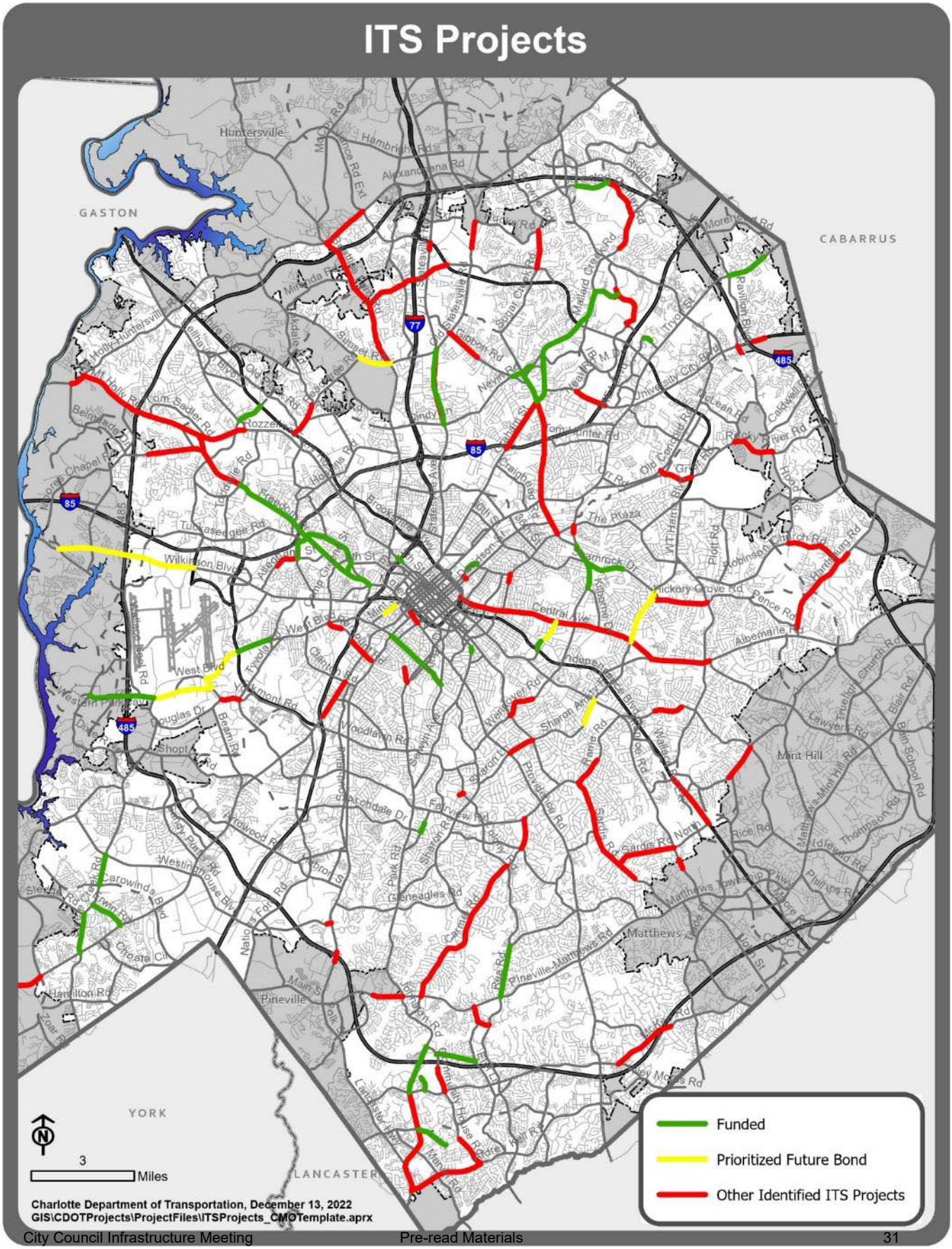
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$4 million

CIP Program: **Maintain Intelligent Transportation Systems**



CIP Program: **Maintain Intelligent Transportation Systems**

Intelligent Transportation Systems Project List

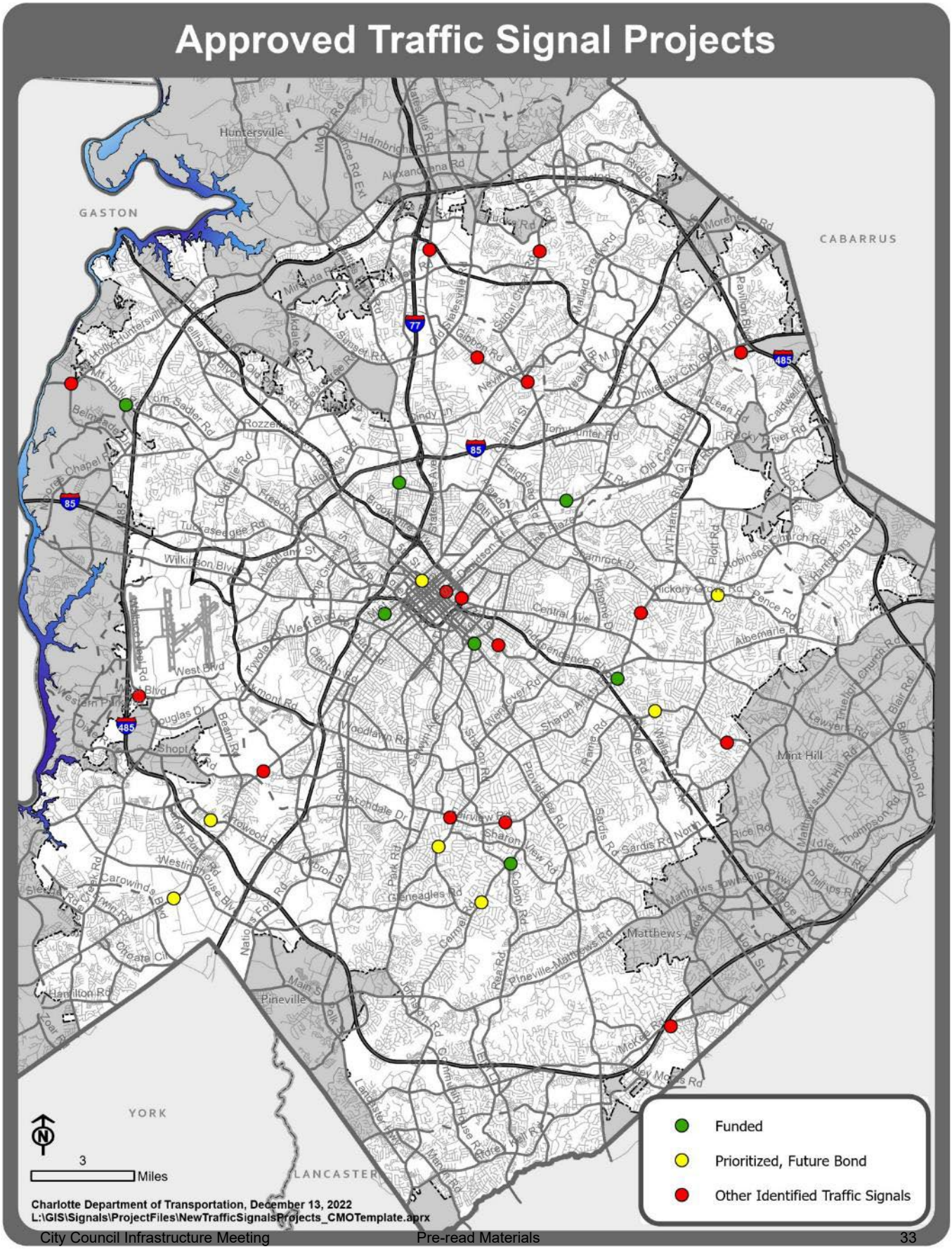
(Fiber-Optic Cable & Real-Time Traffic Management Cameras)

FUNDED			
	Project Name	***Begin***	***End***
	Arrowood Rd ITS	South Blvd	S Tryon St
	Ashley Rd ITS	Freedom Dr	Alleghany St
	Ballantyne Corporate Pl ITS	Ballantyne Commons Pkwy	Upper Ave
	Carmel Rd ITS	Pineville-Matthews Rd	Carmel Commons Blvd
	East Blvd ITS	South Blvd	Kings Dr
	Eastway Dr ITS	E Sugar Creek Rd	Kilborne Dr
	Endhaven Ln ITS	Johnston Rd	Elm Ln
	Erwin Rd ITS	S Tryon St	Steele Creek Rd
	Fred D Alexander Blvd ITS	Brookshire Blvd	Valleydale Rd
	Freedom Dr ITS	Morehead St	Bradford Dr
	Freedom Dr Phase 2 ITS	Bradford Dr	Toddville Rd
	Governor Hunt Rd ITS	Mallard Creek Rd	David Taylor Dr
	Graham St Ext/Mallard Creek Rd ITS	Sugar Creek Rd	Harris Blvd
	Johnston Oehler Rd ITS Upgrades, Phase 1	Prosperity Ridge Rd	High School Pedestrian Beacon
	Johnston Rd ITS Upgrades, Phase 1	N Community House Rd	Ballantyne Commons Pkwy
	JW Clay Blvd ITS	N Tryon St	Doug Mayes Pl
	Mallard Creek Rd ITS	Harris Blvd	Governor Hunt Rd
	N Tryon St ITS	Pavilion Blvd	Caprington Ave
	Nevin Rd ITS	Gibbon Rd	Mallard Creek Rd
	Parkwood Ave ITS	16th St	Caldwell St
	Providence Rd West ITS	Johnston Rd	Old Ardrey Kell Rd
	Rea Rd ITS	Colony Rd	Highway 51
	Shamrock Dr ITS	Eastway Dr	Tipperary Pl
	Steele Creek Rd ITS	S Tryon St	Sledge Rd
	Steele Creek Rd ITS	Sam Neely Rd	Westinghouse Blvd
	Sugar Creek Rd ITS	Graham St	Nevin Rd
	Tuckaseegee Rd ITS	Ashley Rd	Freedom Dr
	West Blvd Ext ITS	Steele Creek Rd	I-485 Outer
	West Blvd Ext ITS	I-485 Outer	Dixie River Rd
	West Blvd ITS Upgrades	Billy Graham Pkwy	Old Steele Creek Rd
PRIORITIZED, FUTURE BOND			
Rank	***Project Name***	***Begin***	***End***
1	N Sharon Amity Rd ITS	Central Ave	Hickory Grove Rd
2	Sharon Amity Rd ITS	Monroe Rd	Delane Ave
3	Briar Creek Rd ITS	Commonwealth Ave	Central Ave
4	Wilkinson Blvd Phase 2 ITS	Josh Birmingham Pkwy	I-485
5	Byrum Dr/Yorkmont Rd/West Blvd ITS	Steele Creek Rd	Billy Graham Pkwy
6	Last Mile N Sharon Amity Rd ITS	Hickory Grove Rd	Shamrock Dr
7	Last Mile S Mint St ITS	W Palmer St	W Summit Ave
8	Wilkinson Blvd Phase 3 ITS	I-485	Old Dowd Rd
9	Sunset Rd ITS	Beatties Ford Rd	Peachtree Rd

ITS= Intelligent Transportation Systems

Prioritized Future Bond Projects:
Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

CIP Program: **Maintain Intelligent Transportation Systems**



CIP Program: **Maintain Intelligent Transportation Systems**

New Traffic Signal Project List

FUNDED	
	Project Name
	Amity Pl & Pierson Dr & Sharon Amity Rd Intersection Traffic Signal
	Beatties Ford Rd & Catherine Simmons Ave Intersection Traffic Signal
	Camila Dr & Carmel Rd Intersection Traffic Signal
	Mint St & Summit Ave Intersection Traffic Signal
	Mt Holly Rd & Rhyne Rd Intersection Traffic Signal
	Randolph Rd & Colonial Ave Intersection Traffic Signal
	Sardis Ln & Sardis Rd Intersection Traffic Signal
	Wilkinson Blvd & Walmart Driveway Intersection Traffic Half-Signal
	N Tryon St & Bennett St Intersection Traffic Signal
PRIORITIZED, FUTURE BOND	
Rank	***Project Name***
1	Arrowood Rd & Whitehall Commons Center Dr Intersection Traffic Signal
2	General Dr & S Tryon St & York Center Dr Intersection Traffic Signal
3	Citiside Dr & Eastway Dr Intersection Traffic Signal
4	Carmel Rd & Hillingdon Rd Intersection Traffic Signal
5	Hickory Grove Rd & Highland Ave & Pence Rd Intersection Traffic Signal
6	Chancellor Park Dr & Harris Blvd Intersection Traffic Half-Signal
7	5th St & Pine St Intersection Traffic Signal
8	Cedarwild Rd & Idlewild Rd Intersection Traffic Signal
9	Sharon Rd & Sulkirk Dr Intersection Traffic Signal
10	Grier Rd & Orr Rd Intersection Traffic Signal

Prioritized Future Bond Projects:
Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

7 CIP Program: Mitigate Congestion

Goal:

Manage congestion and traffic flow in targeted high growth suburban areas.

Projects:

Targeted, small-scale, and quick capacity projects (new/extended intersection lanes, new road connections) in the South Charlotte, Steele Creek, and University City areas.

Program Prioritization Criteria:

Safety

Projects that are on the High Injury Network and/or improve safety (e.g. new signal)

Congestion

Projects that aid in reducing congestion and/or are identified on the High Congestion Intersection list.

Connectivity

Projects that add new streets and/or expand connectivity or access.

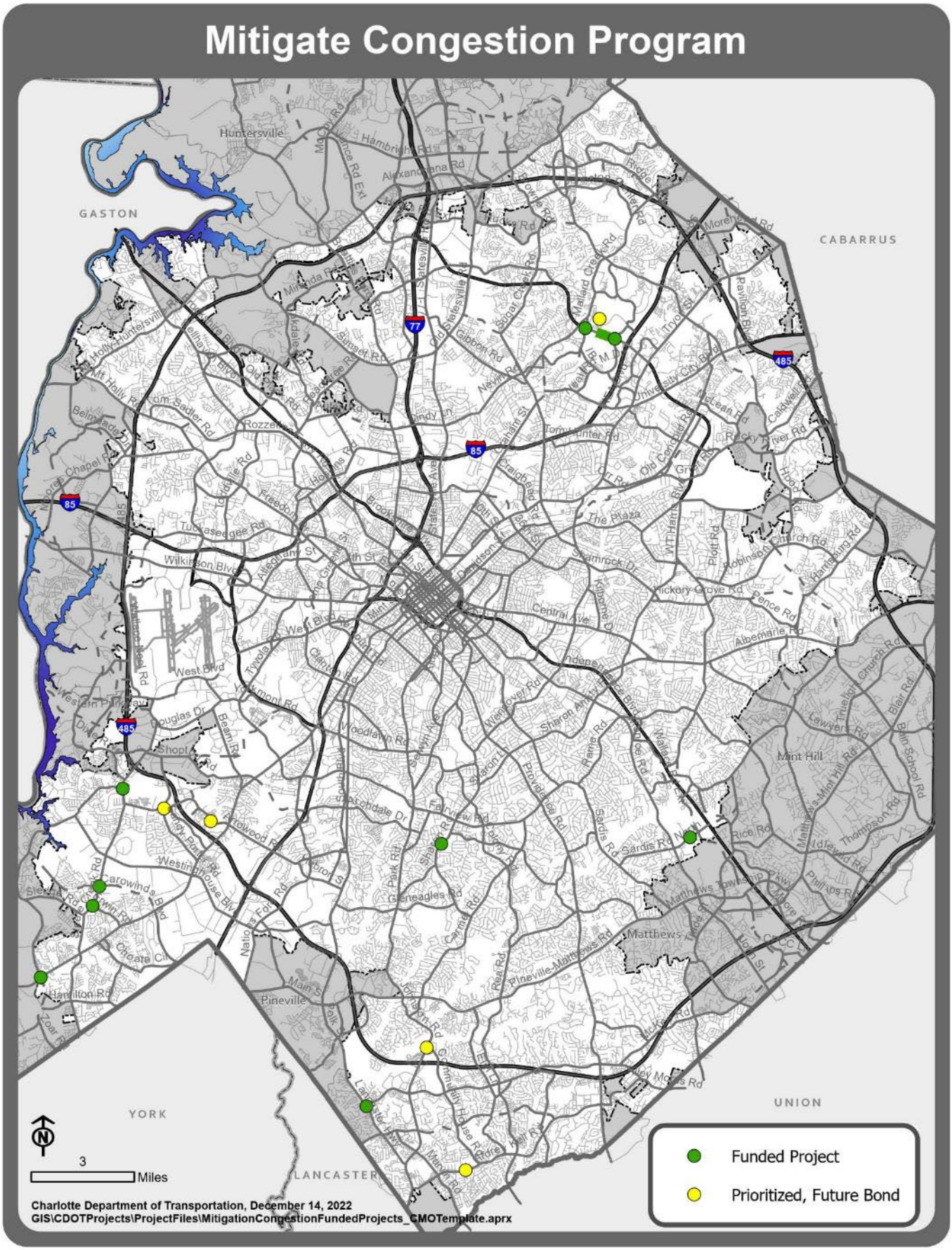
Leverage

Projects with other funding partners such as developers, State or other programs.

2022 Bond:

$10 million

CIP Program: **Mitigate Congestion**



CIP Program: **Mitigate Congestion**

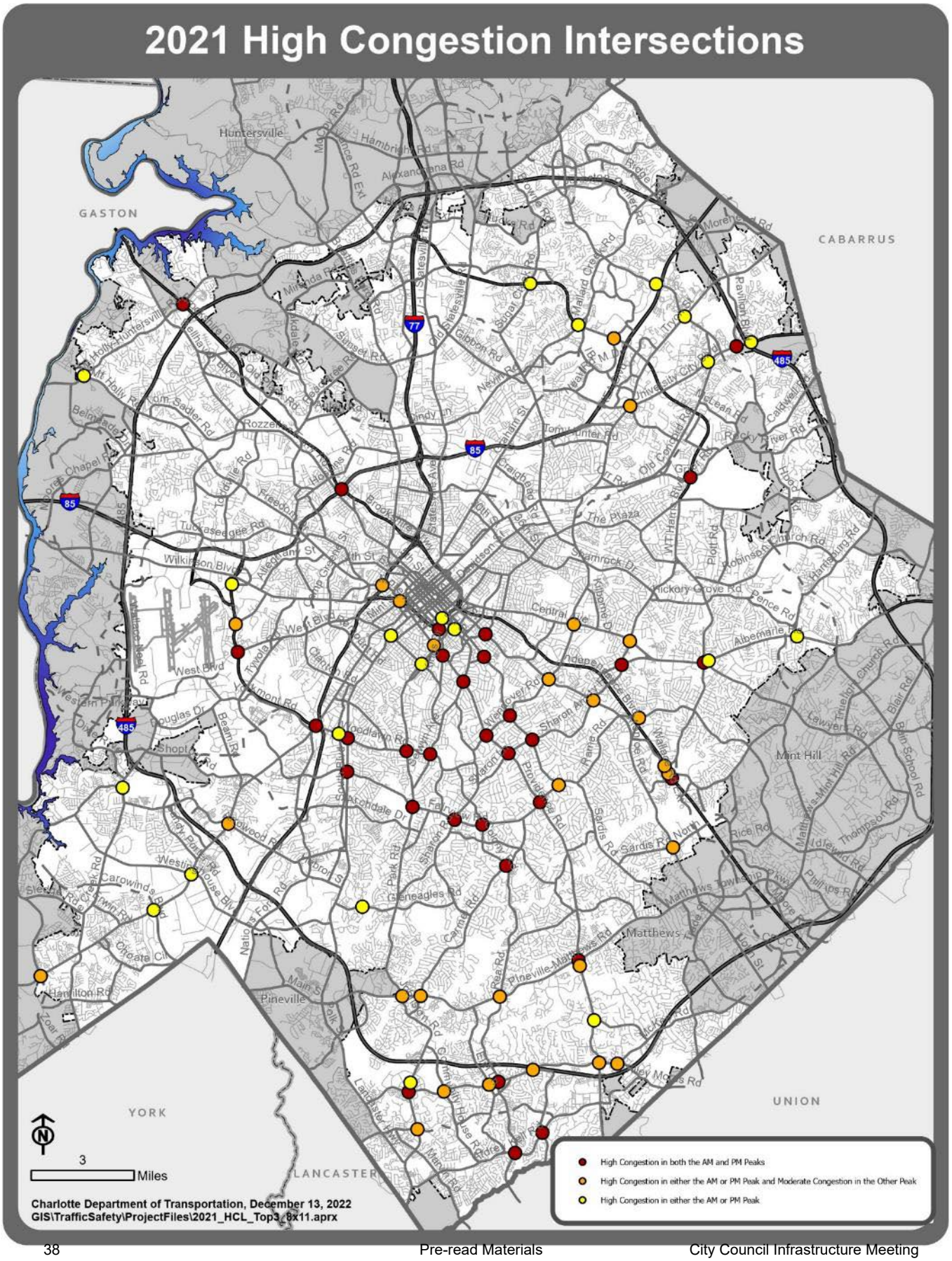
Mitigate Congestion Project List

FUNDED
Project Name
Graham St & WT Harris Blvd & Mallard Creek Rd A. WT Harris Blvd Widening B. WT Harris Blvd & Medical Plaza Dr Intersection C. WT Harris Blvd & IBM Dr Intersection **NCDOT Partnership*
Lancaster Hwy & Ballantyne Commons Pkwy Intersection **Developer Partnership*
Sardis Rd N & Coronation Blvd Intersection
Sharon Rd & Eastburn Rd Intersection
Steele Creek & Erwin Rd Intersection **Developer Partnership*
Steele Creek Rd & Sam Neely Rd Intersection
Steele Creek Rd & Shopton Rd West Intersection
Sterling Dr Street Connection
S Tryon St & Shopton Rd West Intersection **Developer Partnership*

PRIORITIZED, 2022 FUTURE BOND
Project Name
Ardrey Kell Rd & Beau Riley Rd Intersection **Developer/CMS Partnership*
Arrowood Rd & Whitehall Commons Dr Intersection
Ben Craig Dr
Brown-Grier Rd & Sandy Porter Rd Intersection
Johnston Rd & Community House Rd Intersection **Developer/CMS Partnership*

Prioritized Future Bond Projects:
Projects prioritized for funding with available 2022 Bonds and/or future approved bonds

CIP Program: **Mitigate Congestion**



8 CIP Program: Repair & Replace Bridges

Goal:

Maintain a safe bridge system and connected road network.

Projects:

Inspection, repair, and replacement of bridges as identified through the city's biennial inspection program required by the North Carolina Department of Transportation.

Program Prioritization Criteria:

Safety

Bridges are inspected every 2 years and maintained accordingly and replaced when they become in poor condition.

Congestion

Bridges are maintained to keep them in safe condition and riding surface suitable for comfortable travel.

Connectivity

Projects that aid access to transit, schools and neighborhoods.

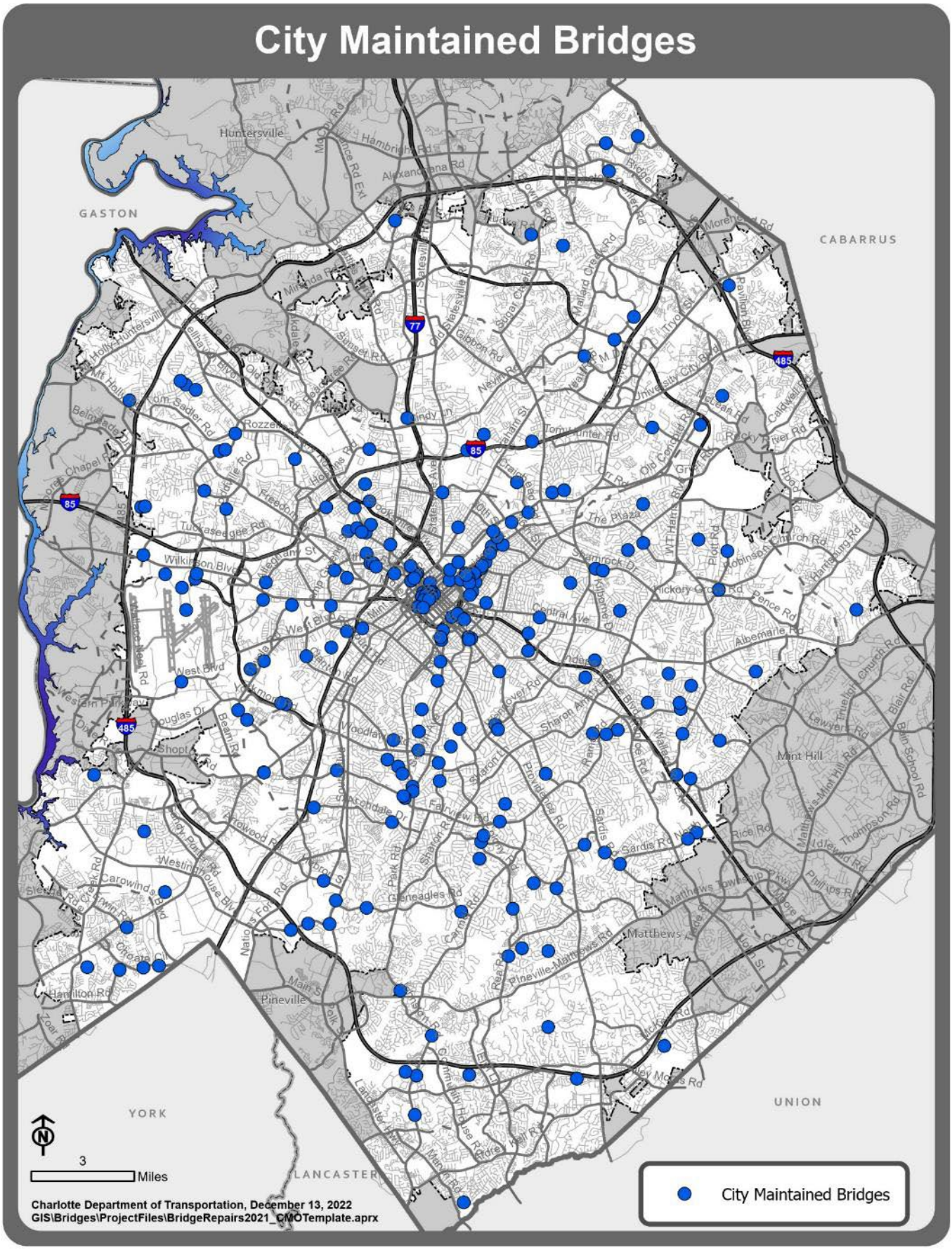
Leverage

Bridges that are greater than 21 feet in length receive federal participation up to 80% of the inspection and the replacement cost.

2022 Bond:

$5 million

CIP Program: **Repair & Replace Bridges**



9 CIP Program: Resurfacing Streets

Goal:

Maintain a safe and sustainable road infrastructure

Projects:

Scheduled street resurfacing and maintenance, this program provides additional funding beyond the city's State Powell Bill funding.

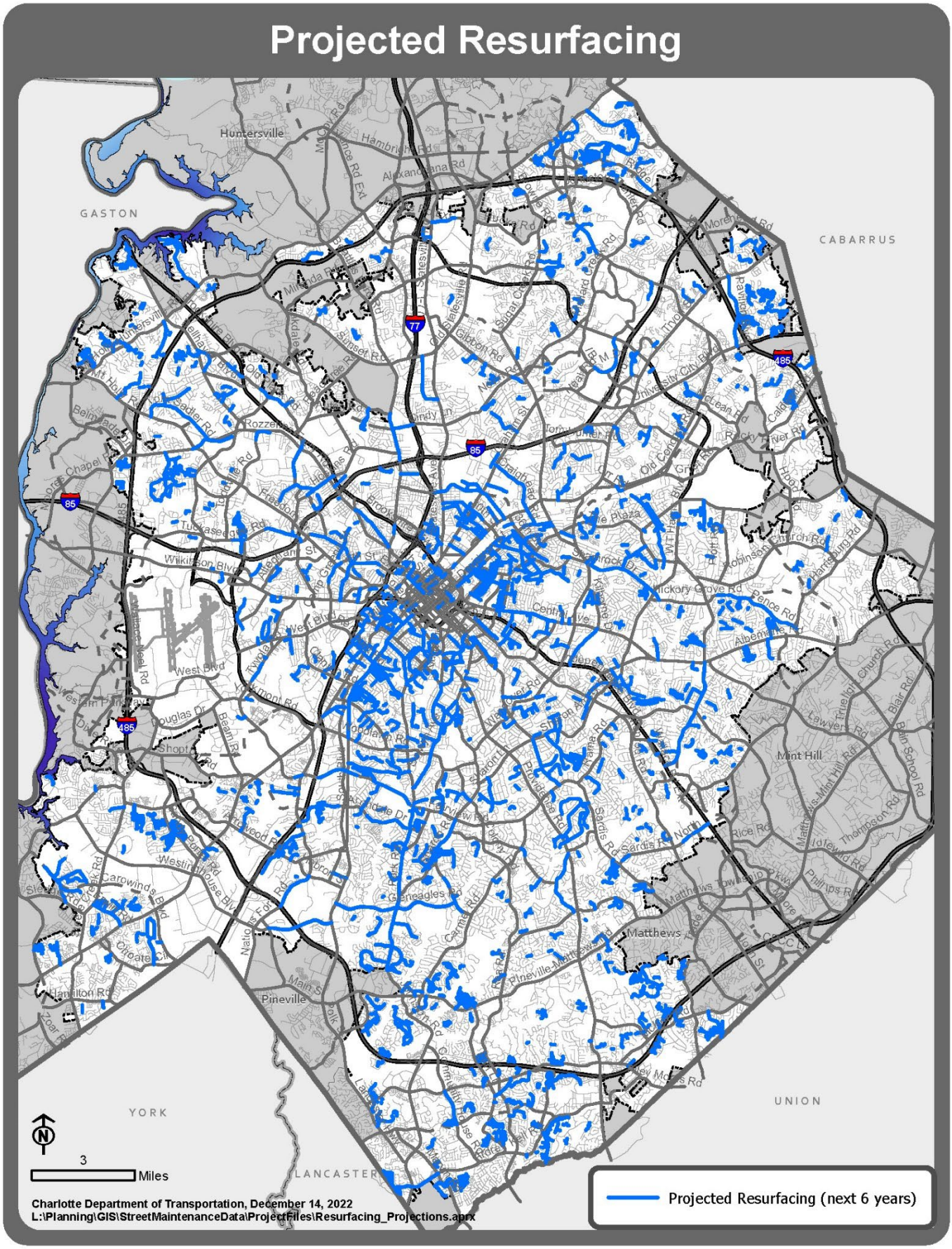
Program Prioritization Criteria:

Streets are prioritized for resurfacing based on condition and schedule of prior paving.

2022 Bond:

$21.6 million

CIP Program: **Resurfacing Streets**



CHARLOTTE FIRE DEPARTMENT

HOW DOES CFD IDENTIFY THE NEED FOR A NEW FIREHOUSE OR FIRE COMPANY?

1. CFD follows a nationally adopted and scientifically proven standard, National Fire Protection Association (NFPA) 1710 Standard.
2. CFD establishes benchmarks for quality control based on industry standard.
3. CFD analyzes response data using a team of trained analysts to ensure the department meets its benchmarks and makes data-fueled recommendations for changes or enhancements to its service delivery.
4. CFD has industry peers review its performance and self-evaluation through the Center for Public Safety Excellence accreditation process and Insurance Services Office (ISO) review.

THE MINIMUM STANDARD

NFPA 1710 provides the minimum requirements relating to the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments. It outlines minimum staffing, response times, and the effective firefighting force (EFF) required to successfully mitigate emergency incidents. CFD measures its performance against NFPA 1710 standards which are backed by decades of research on the best ways to prevent loss of life and property. Compliance with NFPA 1710 affects CFD's Accreditation and the city's ISO rating. To meet the new NFPA 1710 requirements, the department will need to consider increasing staffing in its most densely populated areas.

RESPONSE TIMES

An inability to provide timely emergency response is CFD's primary trigger for requesting additional firehouses or fire companies

A graphic explaining response time benchmarks is at Appendix A: CFD Response Time Performance Evaluation (page 6). Response times are evaluated at the 90th percentile and are broken into different segments – call processing, turnout, and travel - that are each evaluated separately, and together as a whole under the umbrella of Total Response Time (TRT).

For new firehouses and fire companies, most analyses focus on travel time instead of TRT because travel time is the only part of incident response affected by adding either; changes to call processing and turnout times are driven by other factors that also affect TRT. The table below shows CFD's FY22 travel time and TRT performance in comparison with NFPA 1710 Standards; CFD does not currently meet NFPA 1710 standards in 3 of the 4 categories below (in red), and CFD's 1st-unit times continue to trend higher since FY19.

CFD FY22 Response Times with NFPA 1710 Standard				
	1st Unit Travel	1st Unit TRT	4th Unit Travel	4th Unit TRT
NFPA 1710 Standard	*<= 4:00*	*<= 6:00*	*<= 8:00*	*<= 10:20*
FY22 Actual	5:34	6:53	7:55	10:24

The FY22 Excessive 1st-Unit Response Map (Appendix B, page 7) shows areas of Charlotte where TRT exceeded 6 minutes. Areas with many excessive responses warrant analysis to determine the best approach for improving

response times. Sometimes this is achievable by adding a new fire company at the closest existing firehouse, while other times a new infill firehouse is needed.

Note: CFD needs to expand its methodology for evaluating response times against new requirements in the 2020 edition of NFPA 1710. The 2020 edition expanded the way fire departments should evaluate EFF and response times, requiring additional firefighters and different response time standards for medium- and high-risk buildings like apartments, commercial buildings, and high-rises. See NFPA 1710 Summary 2020 (Appendix C, page 8) for more information.

WHAT FACTORS CAUSE INCREASING TRAVEL TIMES?

Related to city growth, Charlotte's increasing density and annexations are both driving up response times. Annexations drive up travel time as more incidents are further from CFD's firehouses. Travel time also increases when CFD lacks the fire companies to accommodate incident growth in developing areas, especially those with increasing density from high rises and apartments; there are more overlapping calls in high-density areas which means fire companies from other firehouses respond from further away, often with excessive response times. Other factors that impact travel time include road connectivity, traffic calming initiatives, and traffic congestion.

FIRE COMPANY WORKLOAD (UNIT UTILIZATION)

Unit call volume is a secondary trigger for new firehouses and fire companies. For engines, ladders, rescues, and towers, call volume over 3,500 calls/year should trigger consideration of additional units.

At this level of call volume, a unit usually misses calls in their own response area because they're already on another call. When that happens, other units respond from farther away which creates more excessive responses. CFD has 15 units currently exceeding 3,500 calls per year, with additional units very close to exceeding this mark. They are listed in Appendix D: CFD Companies with Over or Near 3,500 Calls (page 9).

Note: In FY23, CFD Planning is also starting a Unit Utilization Study to quantify firefighters' time on duties that are necessary and required to maintain emergency readiness. This includes duties like training, facility and apparatus maintenance, physical conditioning, building preplans, hydrant testing, etc. This study will allow CFD to develop thresholds for when units are too busy to complete all required incident and non-incident work.

HOW DOES CFD EVALUATE AND PRIORITIZE FUTURE FIREHOUSES AND COMPANIES?

EVALUATION

CFD Planning uses predictive emergency response modeling software to simulate and analyze changes to CFD Operations such as opening new firehouses, adding new companies, or relocating existing firehouses and units. These analyses enable CFD to understand impacts of changes before making those changes in the field.

The accuracy of the software is validated on an annual basis and simulation outputs include (but are not limited to) data on response times, unit workloads, and maps. CFD has used the software extensively for new firehouse analyses, COVID-related analyses, and unit-type studies, and the department has made 3 changes based on recommendations from these analyses including adding Station 43 and relocating two units. After those changes were made, Planning evaluated the real-world impacts against the estimated impacts from simulations and found the simulations to be highly reliable for predicting what would happen.

HOW DOES CFD PREDICT INCIDENTS FOR FUTURE ANNEXATIONS AND REDEVELOPMENTS?

The simplest metric for predicting incident growth is that CFD responds to about 2 incidents for every 5 households (0.38 incidents per household).

In 2018, an external consultant also found variations in incident volume for multi-family developments based on housing cost; annually, high-cost multi-family housing generates 55 incidents per 1,000 households, mid-cost

housing generates 92 calls per 1,000 households, and low-cost multi-family housing generates 598 incidents per 1,000 households. For more complex impact analyses that show impacts to response times and workloads, CFD Planning uses predictive modeling software to simulate additional calls in developing areas.

PRIORITIZATION

After simulating new firehouses or companies, CFD analyzes the impacts of those changes and prioritizes new firehouses and companies based on the factors in the table on the right.

New Resource Prioritization Factors	
1	Response time impacts
2	Unit workload impacts
3	Predicted development and growth
4	Land availability
5	Budget limitations

In 2019, CFD completed a Facilities Master Plan (FMP) document that analyzed and ranked the current conditions of all CFD facilities. As of 2022, there are 13 CFD firehouses over 50 years old, and the 2019 edition of the FMP has identified that at least nine firehouses require replacement. Even more firehouses need substantial renovations to bring them into compliance with Equity, ADA, and OSHA. With external requirements driving the need for renovations, CFD cannot deprioritize renovations in favor of projects that maintain the department's service delivery.

Charlotte Fire has identified several locations where it currently needs new firehouses to keep up with city expansion and redevelopment, decrease response times, and help manage high call volume areas, including Hidden Valley (construction will start Q1 2023), River District (advanced planning started), Gateway Village, Ballantyne West, and Miranda Road. A Map of Firehouse Locations with FY22 Excessive Response Density Map is in Appendix F (page 11).

HOW DOES CFD DETERMINE WHAT TYPE OF COMPANY IS NEEDED?

UNIT-TYPE STUDIES

Using predictive modeling software, CFD Planning has run four major studies to evaluate the performance of specific types of companies on the call types that require those companies. These studies enabled CFD to:

1. **identify existing gaps in those resources' capabilities,**
2. **ensure existing companies are in optimal locations for the types of calls they respond to, and**
3. **recommend new companies where remaining gaps cannot be filled by moving current resources.**

This includes the 2018 Ladder Study, 2019 Rescue Study, 2021 Airport Study, and 2022 Battalion Chief Study. Based on the outcomes of those studies, CFD moved two companies and has already optimized the locations of the existing 16 ladders and 2 rescues. After relocating those companies, CFD analysts evaluated the real-world impacts and the studies nearly perfectly predicted what happened in the real world. For example, moving Rescue 03 to Station 11 (R11) improved Rescue TRT by over two minutes and balanced the workload between CFD's two Rescue companies to nearly 50/50 split, whereas before R10 call volume more than doubled R03's.

ENGINES VS. LADDERS

Engines and ladders are the most common companies within CFD. Though, historically, Charlotte Fire's new firehouses were first staffed with a single engine, and then later with a ladder, the department has had to start looking at adding ladder companies first due to a shortage of ladders citywide.

Engines and ladders serve many of the same functions and can often be substituted for one another on calls requiring only one unit, such as medical calls or vehicle crashes. However, ladders are a necessary and specialized piece of equipment required on all building fires, especially fires in taller buildings. As Charlotte continues to grow vertically, so too will the reliance on ladders and the need to expand ladder coverage.

HOW DOES CFD DETERMINE THE SIZE OF A FIREHOUSE?

The size of a firehouse is driven by a few factors:

1. **How many and what types of trucks will be assigned now? In the future?**
2. **How many FFs will the firehouse need to accommodate now? In the future?**
3. **What support functions or apparatus might the firehouse be needed for?**

To accommodate future growth and changes without incurring renovation and/or addition costs or interrupting firehouse functions, all future CFD firehouses should include at least 3-4 garage bays and capacity for 10-15 personnel per shift depending on the needs CFD determines for that particular facility.

HOW DOES CFD DETERMINE THE NEED AND PRIORITY FOR SUPPORT FACILITIES?

It is difficult for CFD to place priority on any support facilities when competing against the need for firehouses and fire companies. However, the reality is, as the city and department continue to grow and age, so does the need to repair, replace, and expand support facilities. Currently, several of the department's support facilities have CIP needs and a brief description of the top two are below.

Urban Search and Rescue (USAR) Building – CFD's Emergency Management, Special Operations Division, and USAR Team currently co-locate in a leased 18,338 square foot warehouse space at 3410 Yorkmont Rd. Due to the ever evolving and expanding needs and service delivery of the program, CFD is requesting CIP funding to build a warehouse to ensure adequate space for the specialized equipment of these divisions.

Training Academy - Commercial Burn Building & Drill Tower - Although most large municipal departments have commercial burn buildings, CFD does not and relies on a burn building at Gaston College for firefighter training. Commercial burn buildings are an invaluable tool to firefighter safety because it mimics the fire, heat, and smoke of a commercial building fire in a controlled environment. An existing 6-story drill tower is heavily used for high rise training for new recruits and active firefighters. The tower was identified in a 2018 Training Academy Master Plan as needing significant renovation or replacement so that it may continue to serve the City of Charlotte. With the increasing number of high rise buildings in the city, CFD needs to train in an environment that simulates fires in such structures.

WHAT THE CHARLOTTE FIRE DEPARTMENT NEEDS MOVING FORWARD

Aggressive land acquisition - CFD often identifies needs well in advance of development and CIP funding. Being able to purchase land as quickly as possible after identifying and validating a need not only helps save money on the purchase but would reduce staff time for both CFD and Real Estate.

Co-location with other city departments when appropriate - Occasionally, other city departments have similar land or building needs as CFD. The department struggles to identify opportunities for collocation or shared land. For example, both CFD and CMPD need warehouse space for Emergency Management and Special Operations.

Public/private partnerships when appropriate – Land and building costs are higher than ever before. If a public safety need is identified in a high value area, opportunities to collocate a firehouse with a public project could be a worthwhile solution, especially in master planned neighborhoods like the River District. There are several examples of recent projects in Arlington, VA, Washington, DC, and Alexandria, VA.

How does CFD evaluate performance?

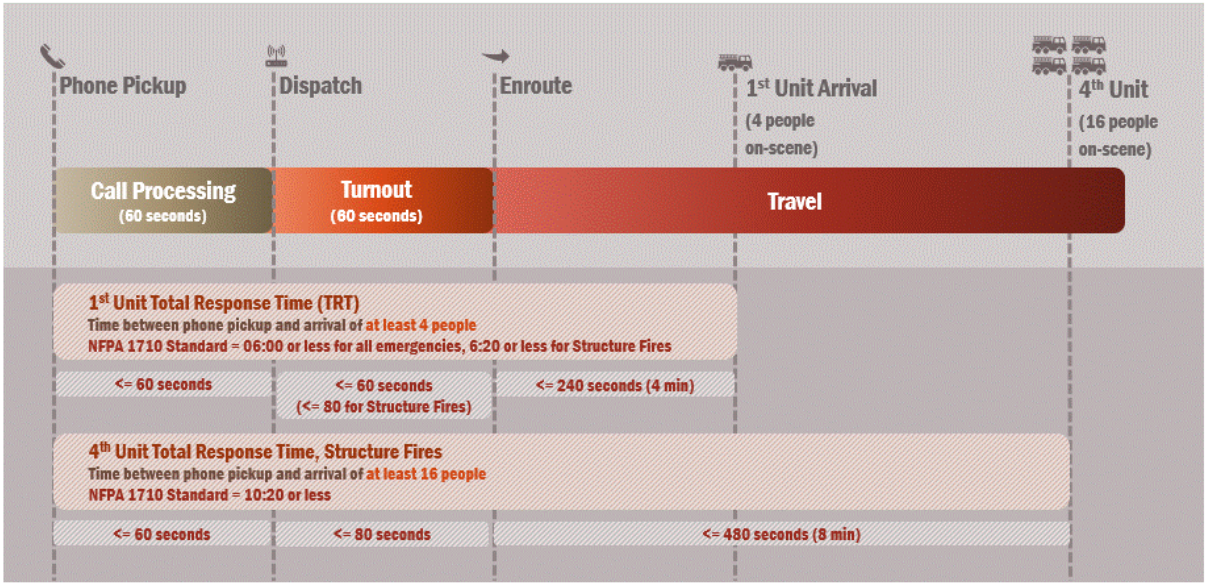
Response Time Performance Evaluation

CFD evaluates response times at the 90th percentile.

This is based on industry-wide standards from the National Fire Protection Association (NFPA) that are backed by decades of research on the best ways to prevent loss of life and property.

Travel, turnout, and call processing times are evaluated individually and as a whole, under the umbrella of Total Response Time (TRT). Each of these categories has different benchmarks, and travel time benchmarks vary by unit arrival order, so the expected travel times for 1st and 4th units are different.

The seconds shown for each time segment to the right indicate the 90th percentile benchmark. Another way to say this is that no more than 10% of emergencies should exceed the times specified for any category.



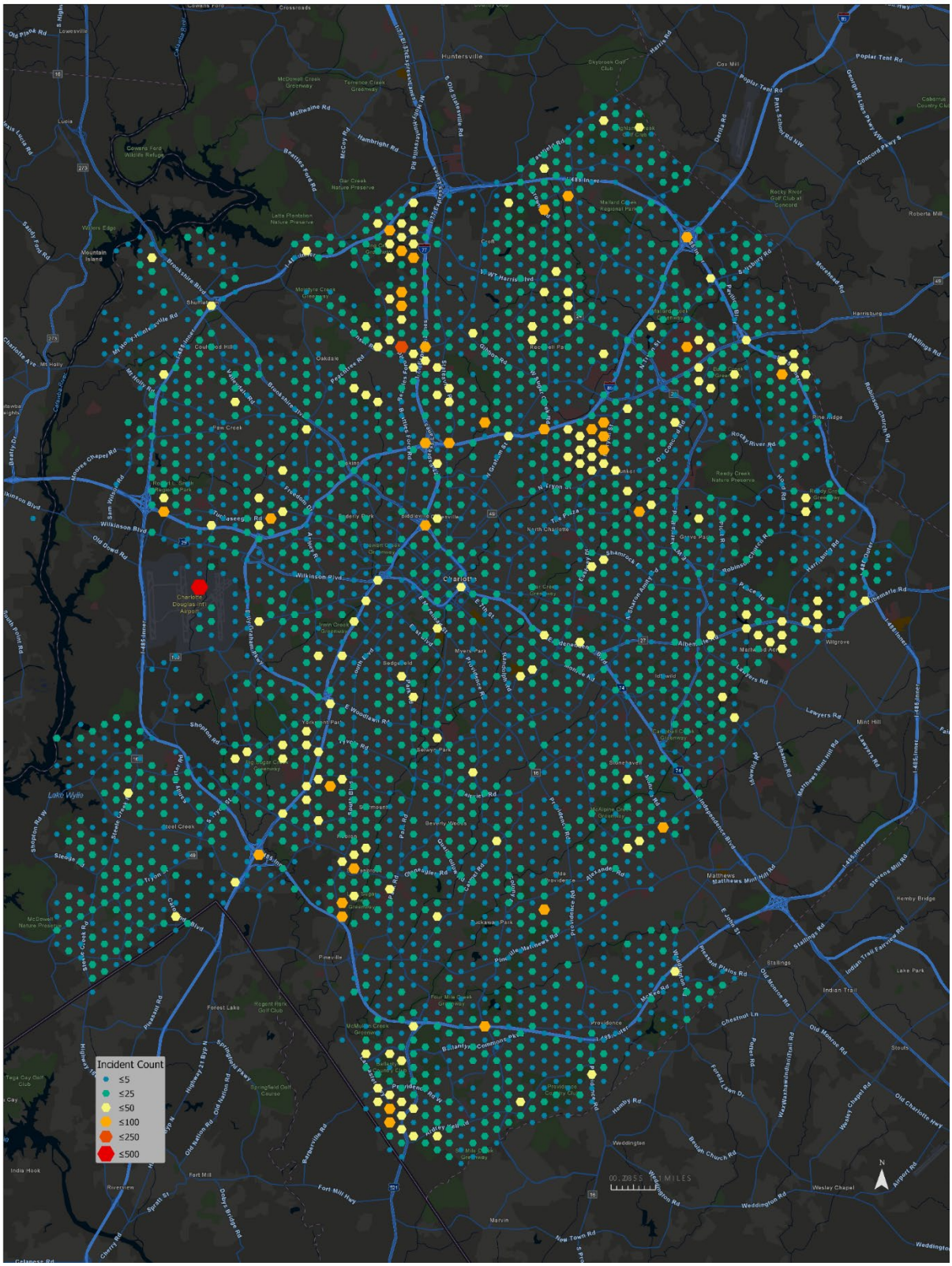
For example, the 90th percentile 1st-unit TRT should be under 6 minutes, and within that 6-minute TRT the travel time for CFD's 1st –arriving unit should be under 240 seconds 90% of the time. Turnout and call processing times should also be under 60 seconds, 90% of the time.

For structure fires, firefighters are allowed an extra 20 seconds to put on firefighting PPE during turnout.

5

B. FY22 EXCESSIVE RESPONSE MAP (1ST UNIT TRT)

The map below shows emergencies within CFD's jurisdiction where Total Response Time was greater than 6 minutes.



NFPA® Standard 1710, 2020 Edition

Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments

Fire Suppression and Special Operations Provisions

- **Career fire department** is defined as a department that uses full-time or full-time-equivalent (FTE) station-based personnel immediately available to comprise at least 50% of an initial full alarm assignment

- **Company** is defined as:
  - A group of members under direct supervision
  - Trained and equipped to perform assigned tasks
  - Organized and identified as engine, ladder, rescue, squad or multi-functional companies
  - Arrive on the scene in an apparatus

- EXCEPTION to company arriving on one apparatus:
  - Multiple apparatuses are assigned, dispatched and arrive together
  - Continuously operate together
  - Managed by a single company officer

- An initial alarm is personnel, equipment and resources originally dispatched upon notification of a structure fire

- Company Staffing (Crew Size)
  - Engine = minimum four on duty
    - High volume/geographic restrictions = five minimum on duty
    - Tactical hazards/dense urban area = six minimum on duty
  - Truck = minimum four on duty
    - High volume/geographic restrictions = five minimum on duty
    - Tactical hazards/dense urban area = six minimum on duty

- Initial Alarm Deployment (number of fire fighters, including officers)
  - Low hazard = 17 fire fighters
  - Medium hazard = 28 fire fighters
  - High hazard = 43 fire fighters

- Initial Alarm Deployment (number of fire fighters, including officers)
  - Low hazard = 17 fire fighters
  - Medium hazard = 28 fire fighters
  - High hazard = 43 fire fighters

- Key Performance Objectives for **Fire** Response
  - Turnout time ≤ 80 seconds
  - First engine arrive on scene ≤ 240 seconds (four minutes)
  - Second company arrive on scene ≤ 360 seconds (six minutes)
  - Low and medium hazard: Initial full alarm on scene ≤ 480 sec (eight minutes)
  - High hazard/high-rise: Initial full alarm ≤ 610 sec (10 minutes, 10 seconds)

- Fire departments shall set forth criteria for various types of incidents to which they are required/expected to respond. These types of incidents should include the following:
  - Natural disaster
  - Airport rescue and firefighting
  - Acts of terrorism
  - Marine rescue and firefighting
  - Weapons of Mass Destruction
  - Wildland fire sppression services
  - Large-scale mass casualty
  - Mutual and auto-aid

EMS Provisions

- The Authority Having Jurisdiction (AHJ) shall determine if the fire department will provide BLS and/or ALS first response and/or transport.

- Patient treatment associated with each level of EMS should be determined by the AHJ based on requirements and licensing within each state/province

- Staffing (Crew Size)
  - On-duty EMS units shall be staffed with the minimum members necessary for emergency medical care relative to the level of EMS provided by the fire department
  - Personnel deployed to ALS emergency responses include:
    - A minimum of two members trained at the paramedic level
    - **AND** two members trained at the Basic level arriving on scene within the established travel time.

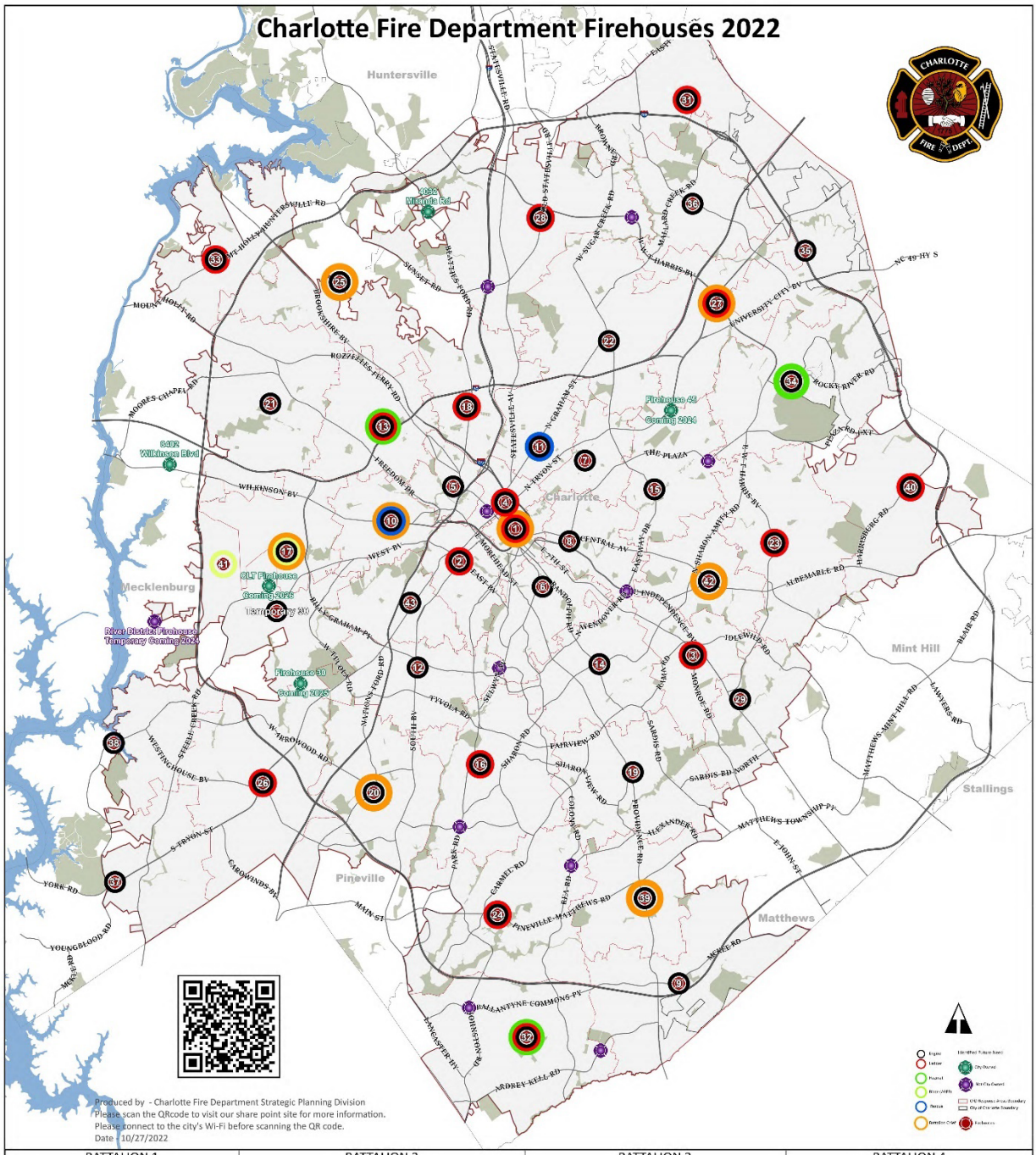
- Key Performance Objectives for **EMS** Response
  - Turnout time ≤ 60 seconds
  - First responder arrives with an AED or higher capability ≤ 240 seconds (four minutes)
  - ALS unit arrives ≤ 480 sec (eight minutes)
    - The eight-minute benchmark for ALS units assumes that a first responder, minimally equipped with an AED, arrived in four minutes

- The fire department shall clearly document its role, responsibilities, functions and objectives for the delivery of EMS. EMS operations shall be organized to ensure the fire department's capability and includes members, equipment and resources to deploy the initial arriving company and additional alarm assignments

D. CFD COMPANIES OVER OR NEAR 3500 CALLS PER YEAR

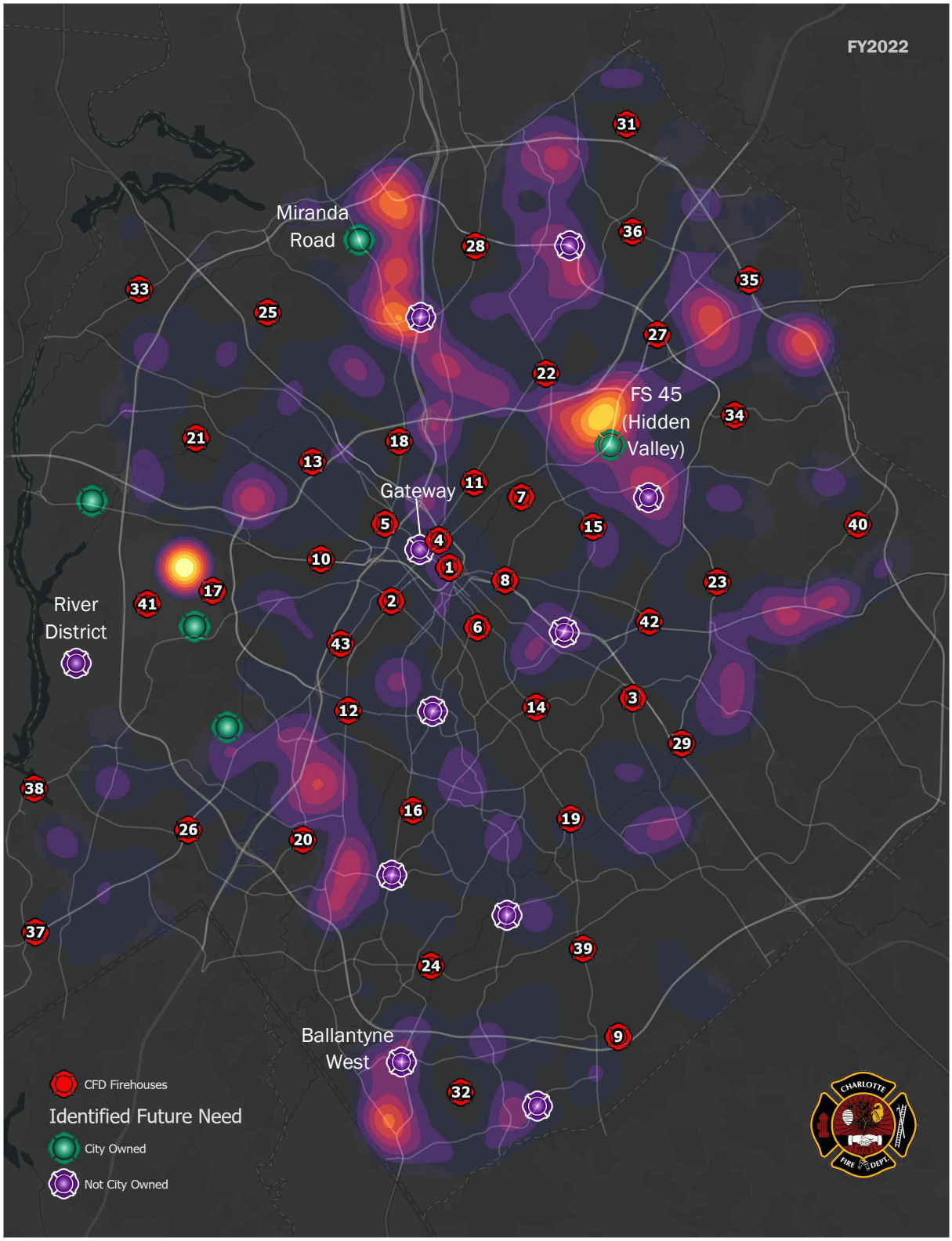
CFD Companies with 3,500 calls or more (FY22) (bold unit name indicates call volume over 3,500/year)				
Unit	**Total**	**Area**	**Impacted by... (Future Stations)**	**Future Firehouse/Company Estimated Date**
Engine 22	5516	NE/University	Station 45	Summer 2024
Engine 12	5251	South Charlotte	Station 30 Relocation	Summer 2025
Engine 15	4809	NE/University	Station 45	Summer 2024
Engine 20	4708	South Charlotte	Station 30 Relocation	Summer 2025
Ladder 27	4216	NE/University	Station 45	Summer 2024
Ladder 04	4022	Center City	Gateway Station	n/a
Ladder 01	3993	Center City	Gateway Station	n/a
Engine 04	3791	Center City	Gateway Station	n/a
Engine 28	3771	Northwest	Miranda Rd Station	n/a
Ladder 28	3728	Northwest	Miranda Rd Station	n/a
Engine 10	3634	West Charlotte	Station 30 Relocation, Gateway Station	Station 30: Summer 2025 Gateway: n/a
Engine 27	3627	NE/University	Station 45	Summer 2024
Engine 06	3589	Eastover	Selwyn & Colony Station	n/a
Engine 18	3522	NW/West Charlotte	Miranda Rd Station	n/a
Ladder 13	3499	West Charlotte	Airport Ladder (L17)	n/a
Engine 43	3490	South Charlotte	Station 30 Relocation	Summer 2025
Ladder 23	3452	East Charlotte	n/a	n/a
Engine 01	3448	Center City	Gateway Station	n/a
Ladder 02	3422	Center City	Gateway Station	n/a
Ladder 26	3402	South Charlotte	Station 30 Relocation	Summer 2025

E. CFD CURRENT FIREHOUSES

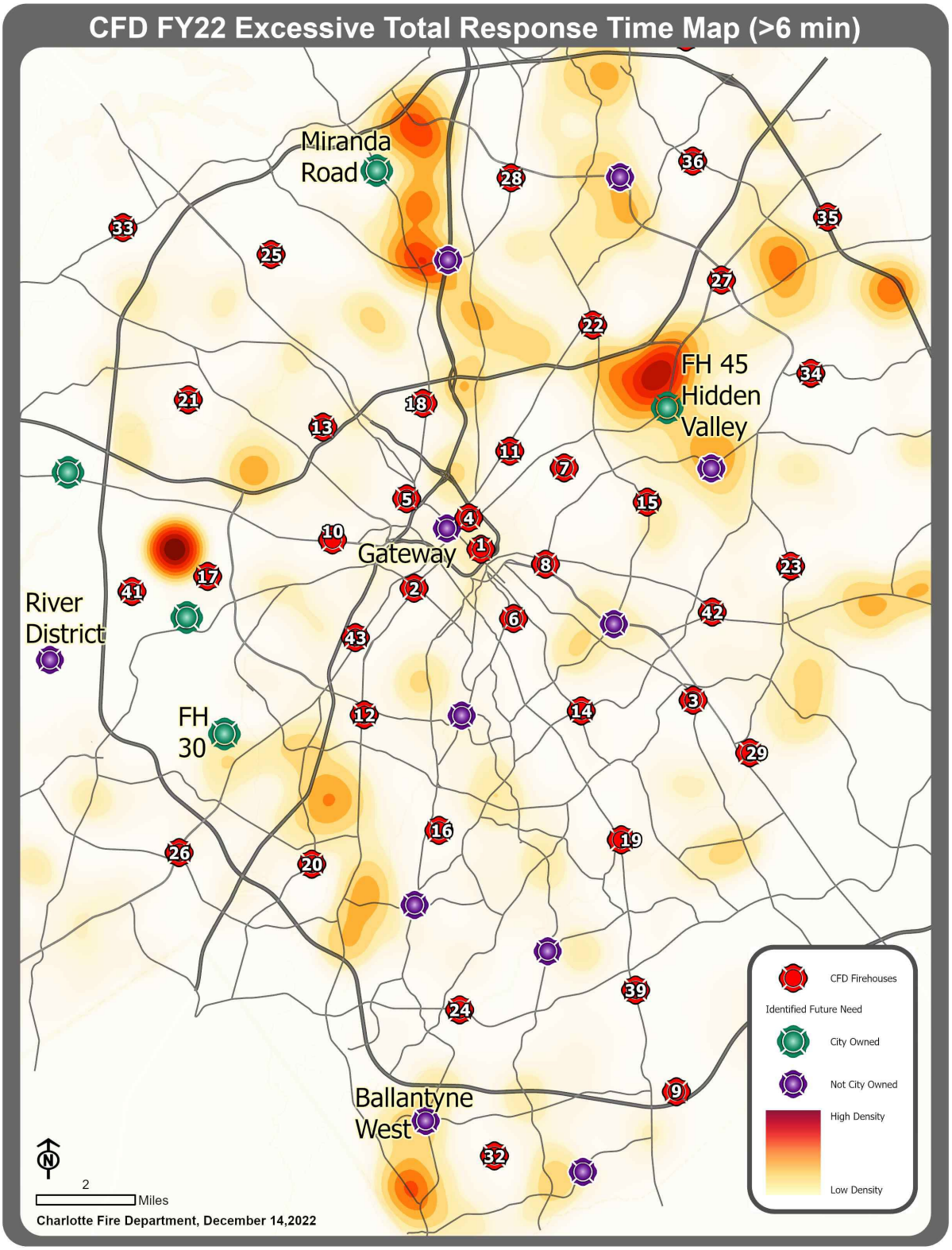


BATTALION 1		BATTALION 2		BATTALION 3		BATTALION 4	
FIREHOUSE 01	221 N Myers St	FIREHOUSE 27	111 Ken Hoffman Dr	FIREHOUSE 10	2810 Wilkinson Bv	FIREHOUSE 42	5620 Central Av
FIREHOUSE 04	525 N Church St	FIREHOUSE 22	1917 W Sugar Creek Rd	FIREHOUSE 02	1817 South Bv	FIREHOUSE 03	6512 Monroe Rd
FIREHOUSE 06	249 S Laurel Av	FIREHOUSE 34	2824 Rocky River Rd	FIREHOUSE 05	224 Wesley Heights Wy	FIREHOUSE 15	3617 Frontenac Av
FIREHOUSE 07	3210 N Davidson St	FIREHOUSE 35	1120 Pavilion Bv	FIREHOUSE 13	4337 Glenwood Dr	FIREHOUSE 23	7400 E W T Harris Bv
FIREHOUSE 08	1201 The Plaza	FIREHOUSE 36	2325 W Mallard Creek Church Rd	FIREHOUSE 21	1023 Little Rock Rd	FIREHOUSE 29	2121 Margaret Wallace Rd
FIREHOUSE 11	620 W 28th St	FIREHOUSE 40	9720 Harrisburg Rd	FIREHOUSE 43	421 Clanton Rd		
BATTALION 5		BATTALION 6		BATTALION 7		BATTALION 8	
FIREHOUSE 20	9400 Nations Ford Rd	FIREHOUSE 25	6741 Pleasant Grove Rd	FIREHOUSE 39	8325 Providence Rd	FIREHOUSE 17	5308 Morris Field Dr
FIREHOUSE 12	420 Inwood Dr	FIREHOUSE 18	2337 Dr Webber Av	FIREHOUSE 09	4529 McKee Rd	FIREHOUSE 30	4707 Belle-Oaks Dr
FIREHOUSE 16	6623 Park South Dr	FIREHOUSE 28	8031 Old Statesville Rd	FIREHOUSE 14	114 N Sharon Amity Rd	FIREHOUSE 41	5740 West Bv
FIREHOUSE 26	9231 S Tryon St	FIREHOUSE 31	3820 Ridge Rd	FIREHOUSE 19	1016 Sardis Ln		
FIREHOUSE 37	13828 S Tryon St	FIREHOUSE 33	2001 Mt Holly-Huntersville Rd	FIREHOUSE 24	7132 Pineville-Matthews Rd		
FIREHOUSE 38	12100 Shopton Rd West			FIREHOUSE 32	9225 Bryant Farms Rd		

F. FIREHOUSE LOCATIONS WITH FY22 EXCESSIVE RESPONSE DENSITY MAP

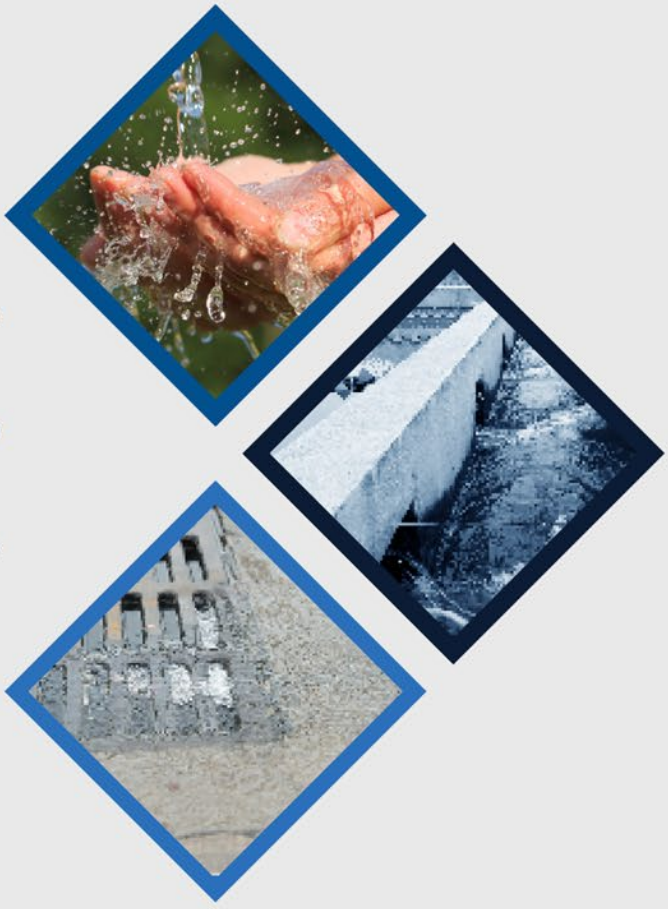


G. FIREHOUSE LOCATIONS WITH FY22 EXCESSIVE RESPONSE DENSITY MAP



One Water

2022 State of Infrastructure Report



Water

Stormwater

Wastewater

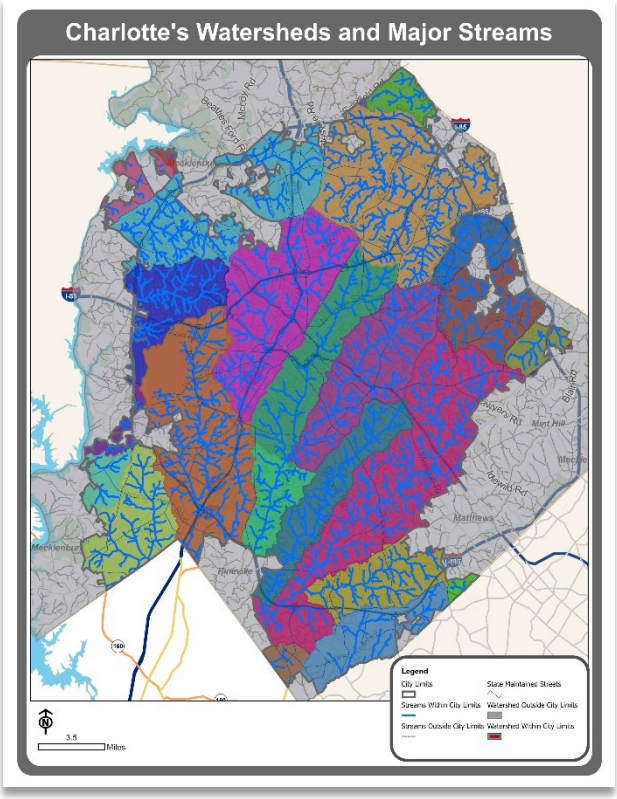
CITY OF CHARLOTTE

December 2022

I) Overview

This report provides an overview of the key considerations in assessing the impacts of development on the city's drainage infrastructure. When considering these impacts, Storm Water Services is primarily concerned with the following drivers:

1. Mitigating the direct impacts to downstream properties of new impervious area, which increases the amount of runoff from rain events, and provide for the conveyance of drainage for future development.
2. Ensuring the overall drainage system is well-maintained and sized appropriately to convey rainwater during design storm events.



Charlotte's Drainage Plan

The "system plan" for Storm Water Services is created by nature. Charlotte has 18 watersheds that collect rainwater and drain to a network of streams within those watersheds. As development occurs, many natural drainage channels and small creeks are replaced by pipes. Today that network includes approximately 2,100 miles of privately owned pipe and 1,400 miles of publicly owned pipes. Storm Water Services is charged with maintaining the public portion of the system and for ensuring compliance with Federal Clean Water Act requirements. Individual property owners are responsible for maintenance of the private system that is on their property. The impacts of the increased runoff from development tend to be localized within the watershed. All rainwater in Charlotte eventually collects in a FEMA-regulated stream before joining with either the Catawba or Rocky River.

Capacity versus Risk Management

Unlike many other categories of city infrastructure, urban drainage systems do not have a maximum capacity at the system-wide level. For example, whereas traffic volumes on streets follow relatively stable daily patterns, the demands on drainage facilities vary dramatically based on unpredictable weather events. A drainage facility may work well every day for decades and then be overwhelmed by an isolated 15-minute storm. Storm Water Services concerns itself with considering the risk of different types of events and ensuring those risks are reasonably managed.

To manage flood risk as Charlotte continues to grow, Storm Water Services seeks to ensure adequate drainage infrastructure by 1) regulating development to mitigate immediate downstream impacts, and 2) adequately maintaining the public drainage system to safely convey rainwater and minimize flooding. Taken together, these represent both the private and public investment in the drainage system.

II) Development Regulation (Private Investment in the Drainage System)

The key infrastructure driver for Storm Water Services in regulating new development is to mitigate the direct impacts to downstream properties while ensuring rainwater from future upstream development is also adequately conveyed. Broadly speaking, Charlotte's development regulations were well suited to meet these goals for larger format development and greenfield development. In recent years, development has trended towards infill development, which those same regulations do not adequately regulate. The Unified Development Ordinance, set to become effective in June of 2023, adds tools to allow for better regulation of these conditions. See Appendix for an illustration of the types of issues that arise with infill conditions that the UDO will address.

Below is a table that lists the existing and UDO-related provisions affecting storm drainage.

Provisions	Existing Ordinances	UDO
On-Site detention to slow the release of runoff into the drainage system and improve surface water quality	20,000 square feet or greater	5,000 square feet or greater
Drainage design and construction in accordance with prescribed standards	Commercial, multi-family, and subdivision	Commercial, multi-family, subdivision, and infill development
Temporary measures required on-site to reduce sediment from leaving site during construction	1 acre of disturbed area triggers compliance	No change
Option to pay fee-in lieu of creating stormwater control measures on-site.	Allowed under Prescribed conditions	Control measures must be provided on-site instead of fee-in-lieu
New or improved structures must be built above a prescribed flood elevation	100-year storm elevation +1'	100-year storm elevation +2'

Rights and Responsibilities of Homeowners Related to Drainage

A common misconception about drainage regulation concerns the rights and responsibilities of neighboring property owners when new development occurs. By law, all properties must receive the runoff from uphill properties. This principle often violates property owner's expectations who believe it is not their responsibility to accommodate the runoff. However, this is an important principle for the overall drainage system because all rainwater is on a journey downhill to the stream within its watershed and to impede its flow would be to effectively dam against the water's natural drainage and risking upstream flooding. Although this is the correct way to manage drainage, and even though the impacted property owner enjoys the same benefits to drain their rainwater onto downhill properties, it nevertheless gives rise to a perception of inadequate regulation. Charlotte's regulations do significantly mitigate the impacts, primarily using storm water control measures to slow the release of water. These storm water control measures also significantly mitigate the cumulative impact of new development.

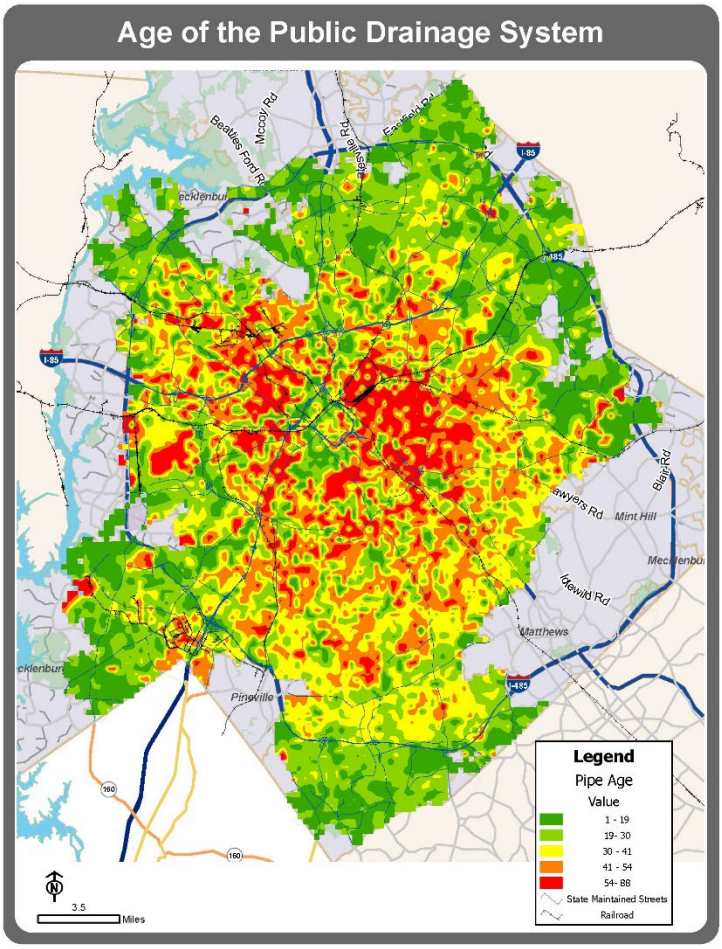
Cumulative Impacts to Floodplain

While most impacts of development are localized, the cumulative effects of increased impervious surface area do impact the FEMA-regulated floodplains. Mecklenburg County Storm Water Services administers FEMA related development requirements. This is done in part by modeling for anticipated future development conditions to predict how high floodwaters might rise in a 100-year storm. The City's Floodplain Ordinance establishes requirements on new development and improvements to existing structures within the regulated floodplains.

III) Public Investment in the Drainage System

The key driver for addressing the impacts of growth on drainage infrastructure through public investment is ensuring the proper maintenance and function of the public drainage system. Generally speaking, the greatest threat to the proper functioning of the system is time. Charlotte's system was installed concurrently with the city's growth over decades and much of it is at or approaching its end of useful life. Storm Water Services has a $538M capital program over the next five years that heavily invests in replacing these aging assets, among other system improvements.

This heat map shows the age of the public drainage system; green areas are newer infrastructure, red areas are older infrastructure



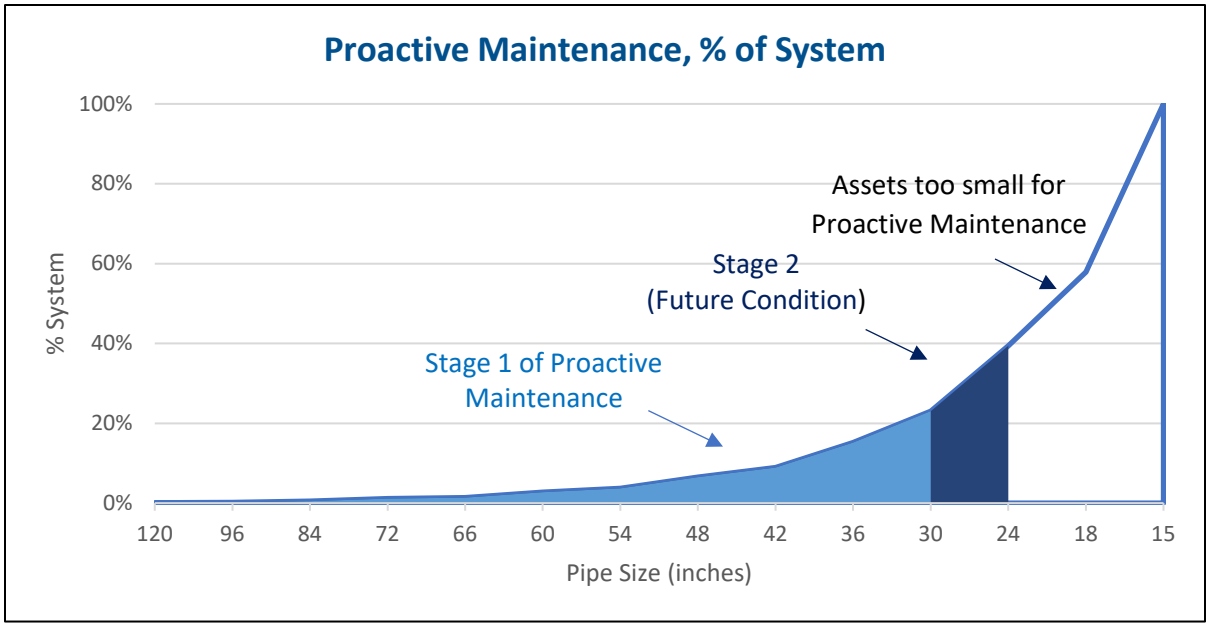
At a system-wide scale, the amount of impervious area has increased at an approximate rate of 1.3% per year, and the size of the public drainage system has grown along with it.

Using an Asset Management Approach

To keep up with the rate of aging infrastructure, Storm Water Services continues to shift towards an asset management-based approach. This approach seeks to use data about the condition of the system to help make better decisions on planning for new projects and for conducting proactive maintenance that can extend the life of an infrastructure asset.

The public drainage system includes an array of small pipes (15” diameter) up to very large pipes and culverts (120” in diameter). Taking an asset management-based approach tends to prioritize preventative maintenance of larger assets. There is a size, below which, it is not financially beneficial to conduct preventative measures to extend the life of the asset. Storm Water Services is in the process of developing a program that, in its first stage, would inspect and proactively maintain assets 30” in diameter and larger. Storm Water Services envisions a potential future Stage 2 that could add in pipes ranging down to 24” in diameter. Pipes smaller than 24” would not be subject to proactive maintenance and simply be replaced at their end of life. The chart below shows the makeup of the public drainage system from largest to smallest pipe size, and the percentage of the system that would be subject to proactive maintenance in the first and second stages of an asset management program.

Since Storm Water Services has only recently begun to systematically evaluate the condition of the drainage system, the data set is not yet complete for all assets intended for proactive maintenance. However, the data that is available is already being used to prioritize projects. The prioritization is based on a criticality assessment, which combines the risk of failure and the consequence of failure for a given asset. The types of factors used in this process are listed below.



STW's Staged Approach to Asset Management Based on Pipe Size

Types of Factors Used in Project Prioritization

Likelihood of Failure	Consequence of Failure
Age of Asset	Impact to emergency response
Asset material	Impact to mobility
Flood risk	Impact to property
Presence of defects	Impact to vulnerable populations

These criteria are also evaluated with respect to constructability factors that include the opportunity to partner with other departments to lower project costs and minimize community disruption, and complicating factors like required approvals from property owners, utilities, or agencies known to create barriers to project implementation. Storm Water Services is also evaluating options for incorporating impacts to and benefits for vulnerable populations into the project prioritization process. The full asset management-based project prioritization methodology is shown in the Appendix.

IV) Summary

Although the additional impervious area created by new development can create direct drainage impacts on nearby properties and incrementally raise flood elevations within regulated floodplains, these are not the greatest infrastructure challenges for Storm Water Services. The drivers for providing adequate drainage infrastructure are ensuring adequate development regulation on a site-by-site basis and ensuring the public drainage system is well-maintained through public investments from the Storm Water fee.

CHARLOTTE WATER

Summary of Charlotte Water
(Water and Wastewater)

Charlotte Water provides safe, reliable, high-quality water, wastewater, and stormwater services, to more than 1.1 million customers in the greater Charlotte region. We perform this vital work to the community through the hard work and dedication of our more than 1,200 (water, wastewater, and stormwater) valued employees, strategic capital infrastructure planning, highly rated financial stability, and award-winning environmental stewardship.

Charlotte Water's mission is to:

- plan **infrastructure** for the future that supports growth, mobility, accessibility, and reliability
- promote **sustainability** through regulatory compliance that protects residents and waterways; and,
- practice **equity and inclusion**, by providing services equitably for the benefit of all.

Charlotte Water Infrastructure

Every day, Charlotte Water treats an average of **117.5 MG (million gallons) of water** and **79.8 MG of wastewater**.

Operations are performed at:

- 3 drinking water treatment plants
- 7 wastewater treatment plants
- 5 administrative field operation and lab facilities
- 17 staffed worksites
- 2 water supply intakes
- 13 water towers/treated water storage tanks
- 78 wastewater lift stations

Assets include:

- Approx. 10,000 miles of water and sewer pipe
- 319 water quality monitoring stations
- 320,000+ water meters
- 88,295 valves
- 115,518 manholes
- 18,000+ fire hydrants

Economic Revenue

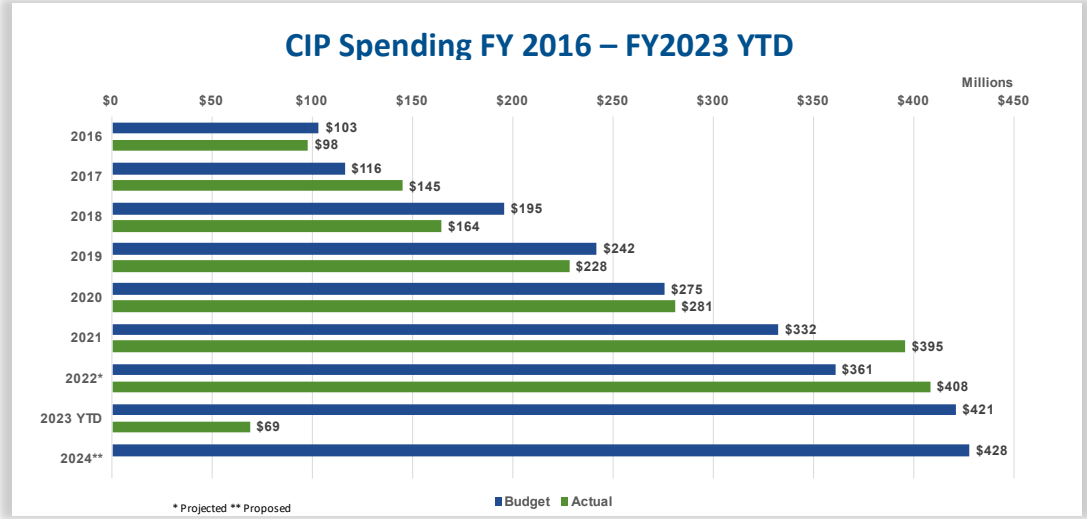
64% of Charlotte Water's annual budget supports the ***Capital Investment Program (CIP).*** There are currently **123** CIP projects planned between 2023-2027. These projects are selected for their ability to:

- satisfy **regulatory requirements**
- support current **growth** projects
- meet continuous **rehabilitation and replacement** needs
- overall necessary water system expansion to continue to meet **public projects & utility operations** commitments

Metric:
Maintain optimal bond rating agency status to maximize rate-payer investment

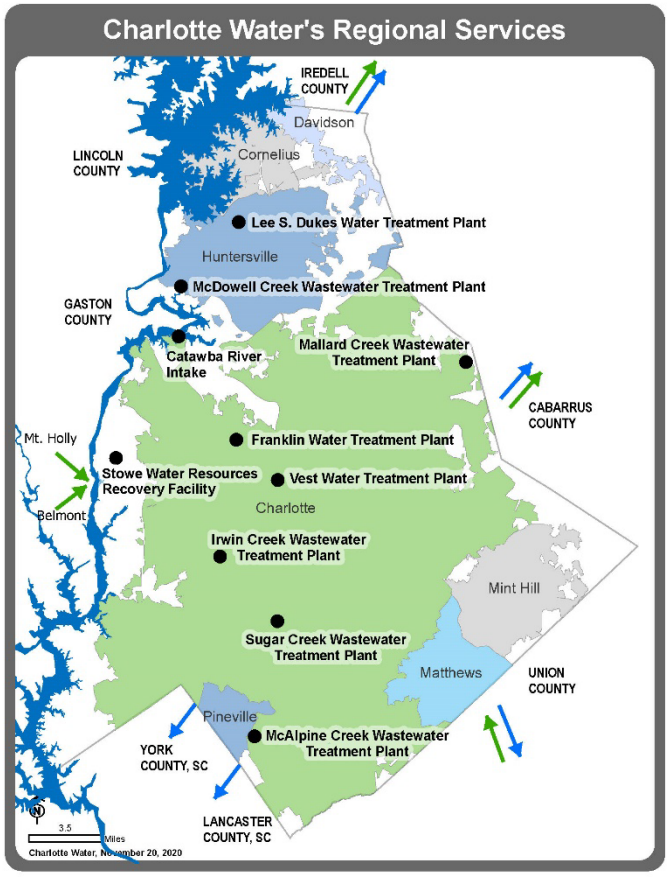
Status:
Charlotte Water is **AAA Rated by Moody's Investors Service, Fitch, and Standard & Poor's Financial Services**, which allows us to successfully manage a $2.64B *Capital Investment Program (CIP)* budget each year

FY 2023 – FY 2027 Adopted CIP
Five-year CIP Budget = $2.65 Billion



Regionalism

In addition to serving customers within Mecklenburg County, CLTWater meets with different municipalities, jurisdictions and planning entities in the multiple cities and towns of our six-county region. Each has a unique need and vision for their communities, which requires close collaboration and the ability to meet the individual need while promoting the regional vision.



The **Stowe Regional Water Resource Recovery Facility** is just one example of Charlotte Water's commitment to meeting the growing wastewater needs of a fast-expanding region. In partnership with the cities of Belmont and Mount Holly, this project will update aging infrastructure, add capacity to support future growth and reduce the current pumping distance and travel time.

The project, expected to go online in 2026, includes building two pumping stations at the Belmont and Mount Holly sites and will connect the two county's systems to each other by boring and installing pipes under the Catawba River.

Planning for Growth

Growth in the region directly impacts not only strategic long-term planning, but Charlotte Water's daily operations**. Each month, 792** new **residential and commercial new water and sewer service connections for customers are added.**

Since 2018, CLTWater has grown its water and sanitary sewer system by 226 and 253 miles, respectively. For the past six years (2017 – 2023), annual requests for system capacity have averaged 5.5 million gallons per day (MGD). This calendar year, the requested capacity is anticipated to be 6.7 MGD

Metric:
Meet the needs of the development community through prompt plan review and capacity availability

Status:
All plans reviewed within 20 days and calendar year requested capacity is estimated at 6.7 MGD

Development and redevelopment projects also create changes in water use. To accommodate for the population growth in the city, the city's zoning decisions direct and concentrate density, which affects Charlotte Water's capacity planning, rehabilitation concerns in aging infrastructure areas, service provisions, maintenance, operation costs, resources, and staff.

Charlotte Water's Capacity Assurance Program (CAP).

Developers are encouraged to apply for a sanitary sewer capacity reservation through the CAP. Staff will review designer plans during a request for building permits or rezoning and analyze hydraulic models, past spills in the area and other field data to verify adequate capacity in the pipes downstream. Some reviews lead to the identification of capital pipeline projects to improve the service level to current customers and accommodate projected development.

Wastewater Capacity Projects Completed in 2022

Belmont and Optimist Park Wastewater Pipe Replacement Project
Approximately 6,327 Linear Feet (LF) of pipe was upsized to serve the growing area around Belmont and Optimist Park neighborhoods. The project is an investment of $12.3 million.

Stevens Creek Lift Station, Force Main & Gravity Sewer Project
Now serves the Goose Creek and Stevens Creek drainage basins, which includes the Town of Mint Hill. Provided public sewer service to an area that is predominantly on septic systems. The project is an investment of $20.4 million. Phase 2 added 4,600 linear feet of pipe at an additional investment of $1.5 million.

Upper Taggart Creek Wastewater Pipe Replacement Project.
Approximately 10,200 linear feet of pipe was upsized to serve the growing area. The project was an investment of $20 million.

Regulatory Compliance

Every year, CLTWater sends every customer our Annual Drinking Water Quality Report, a snapshot of the previous year's water quality. **During 2021, we received zero drinking water violations.** Last year, Charlotte Water performed **170,000 laboratory analyses.**

All seven wastewater treatment plants earned Peak Performance Awards from the National Association of Clean Water Agencies (NACWA) for the calendar year 2021. NACWA Peak Performance Awards recognize wastewater treatment professionals nationwide for protecting the environment and public health through outstanding treatment and discharge regulatory compliance.

Metric:
100% compliance with applicable requirements for the Safe Drinking Water Act and Clean Water Act

Status:
100% compliance with applicable requirements for the Safe Drinking Water Act and Clean Water Act in FY22

Metric:
Test 315 samples of the distribution system per month

Status:
100% compliance with sampling of the distribution system

Metric:
Maintain wastewater treatment plant capacity below 80% of treated capacity through master planning implementation

Status:
Completed wastewater treatment master plan October 2022. Capacity status of wastewater treatment plants: Mallard: 79%, McDowell 46%, Irwin 86%, Sugar 80%, McAlpine 63%

Sustainability Initiative: Biosolids Program

Biosolids, a product of the wastewater treatment process, is a highly treated, nutrient-rich product used to enhance soil quality. Currently, CLTWater produces biosolids as a Class B product, meaning it can be used safely on agricultural land through our partnership with local farmers.

By implementing Thermal Hydrolysis Process (THP) at its McAlpine Creek Wastewater Management Facility, CLTWater will be able to create a Class A product. Class A biosolids can also safely be used on lawns, gardens, and agricultural lands. This aligns with Charlotte Water's and the City's greenhouse gas emissions goals while advancing Charlotte Water's vision for a long-term, sustainable biosolids management program for our customers and the Charlotte community by:

1. reduce overall biosolids volume generated, improve the biosolids quality,
2. reduce the overall carbon footprint and greenhouse gas emissions,
3. create opportunities for additional market collaboration,
4. achieve cost efficiencies, and
5. further advances the City's circular economy goals by turning wastewater treatment byproducts into more diversified commodities.

Aging Infrastructure

CLTWater manages **4,526 miles** of water mains and **4,526** miles of sewer mains. Nearly 75% of Charlotte Water pipes were built after 1980 and most have a 30–50-year lifespan**.** Aging infrastructure contributes not only to customer disruptions of water service but also to sanitary sewer overflows if unaddressed. **The renewal of aging water pipeline infrastructure is necessary to maintain water quality standards, system pressures needed for fire protection, and system operation for customer demands.** In CY22, Charlotte Water experienced 8.9 main breaks per 100 miles of water distribution system. (The industry standard is 15 breaks per 100 miles.)

Metric:
Rehabilitate or replace greater than 44,000 linear feet of aging water pipe in FY23

Status:
23,276 Feet of water pipe rehabilitated or replaced in FY22

Metric:
Three or less sanitary sewer overflows per 100 miles of pipe in FY23

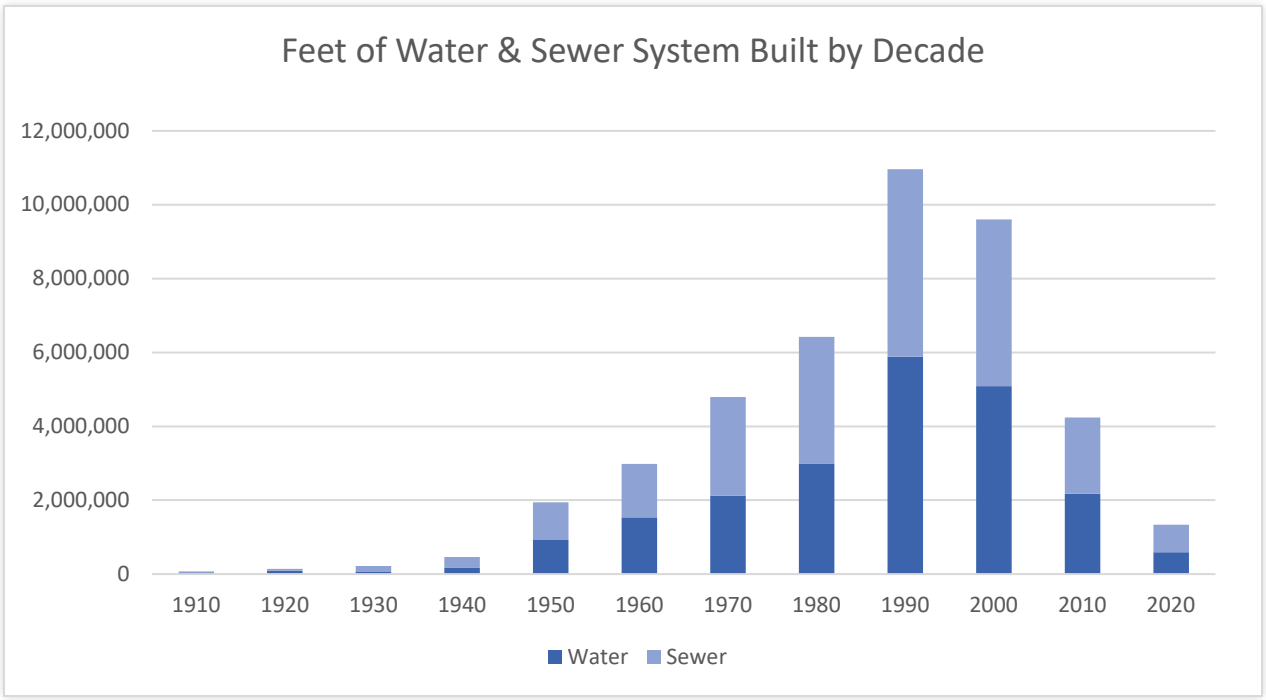
Status:
3.6 Sanitary sewer overflows per 100 miles of pipe in FY22

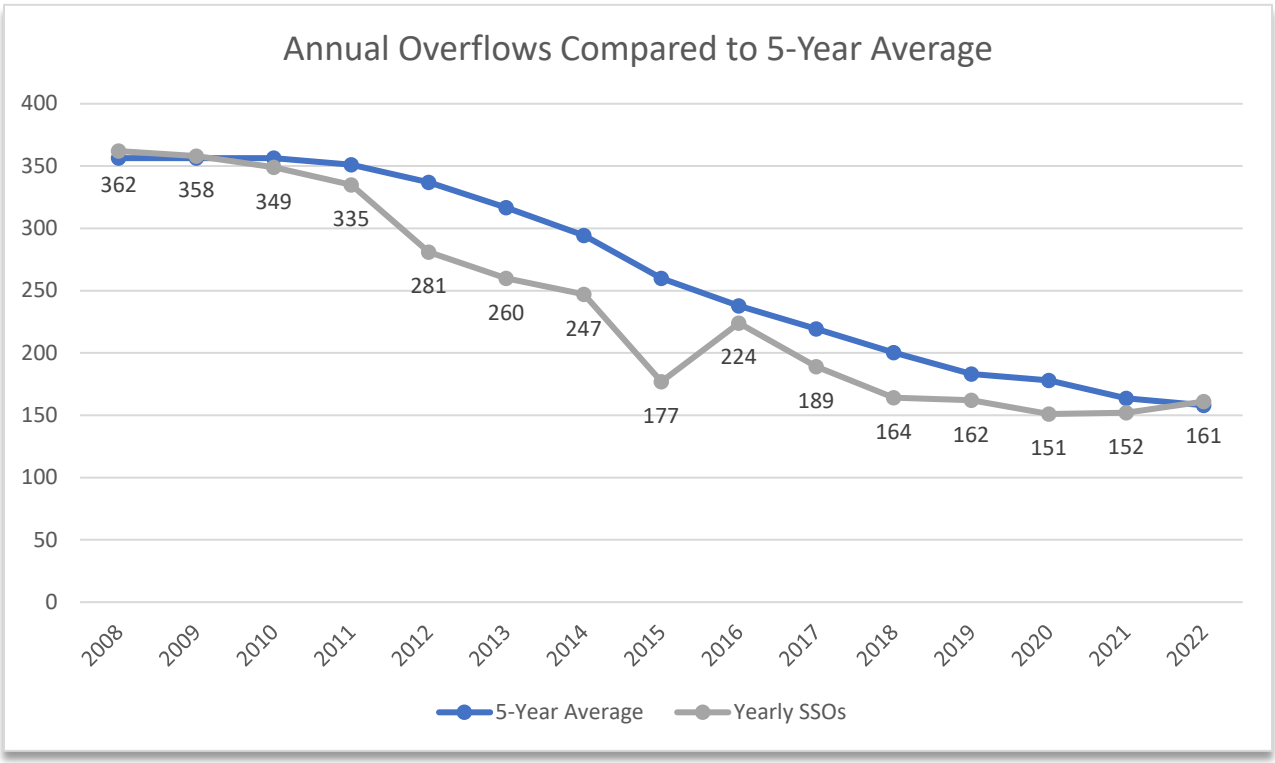
Metric:
Clean a minimum of 10% footage of total wastewater pipe per year

Status:
15.6% (691.4 miles or 3,650,592 ft) cleaned in FY22

Metric:
Rapid response crews respond to emergency service requests within 2 hours

Status:
Average response time for rapid response crews is 31 minutes

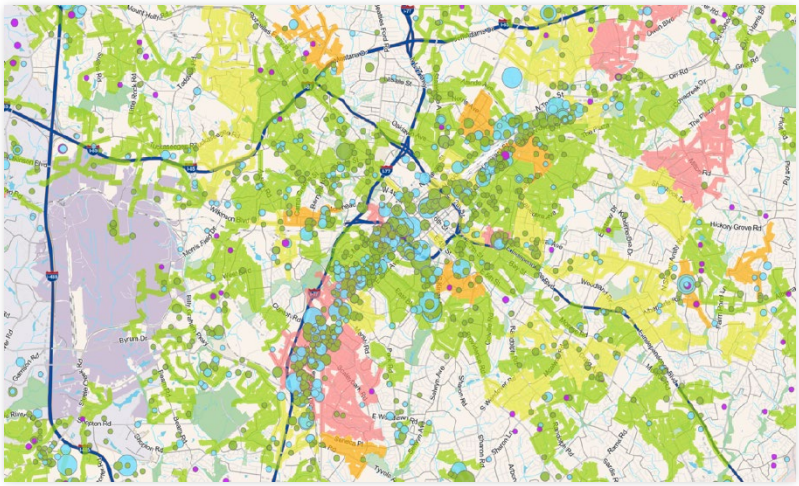

Feet of Water & Sewer System Built by Decade
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Water
Sewer


Annual Overflows Compared to 5-Year Average
400
350
300
250
200
150
100
50
0
362
358
349
335
281
260
247
177
224
189
164
162
151
152
161
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
5-Year Average
Yearly SSOs

TOD and High-Density Growth

Our community is constantly changing and expanding. One of the defining projects impacting CLTWater is the CATS LYNX Blue Line. While the physical project elevated commuter transport, growth, and development, it also changed the landscape by implementing **Transit Oriented Development (TOD).** This allowed dwelling units to increase to a maximum of 369 dwelling units per acre. Since 2017, the Capacity Assurance Program has approved over 100 applications requesting a total of 2.99 MGD of flow (all within a concentrated area along the LYNX Blue Line route).

CAP Apps – Size Relative to Flow Request



This growth along the LYNX Blue Line corridor has triggered over **$275 Million in water and sanitary sewer pipeline projects**. This includes a massive investment in the Mallard Creek Basin (UNCC area) with major sanitary sewer pipeline improvements and roughly a 4 MGD increase in treatment capacity at the Mallard WWTP facility (another $300 Million investment.)

Lead & Copper Rule Revision Program

In 2021, the Environmental Protection Agency (EPA) updated the Lead and Copper Rule (LCRR), modifying water service provider regulations for lead reduction. **Charlotte Water has monitored for lead since 1991 and continuously met all requirements, while conducting a range of corrosion control measures**. CLTWater is actively developing a Lead Reduction Program to address new requirements.

Metric:
No more than 10% of samples taken to measure lead in drinking water detect lead above the 15 parts per million action level

Status: No samples tested detected lead above 15 ppm in 2022

This program will:

- establish a lead service line inventory for public and private service lines
- increase testing in schools and childcare facilities.
- mitigate public health risks associated with old service lines that may contain lead or galvanized iron.
- ensure CLTWater can meet its new testing requirements and has adequate resources for service line replacement needs.

Economic Output and Workforce Development

Every dollar CLTWater invests into the region creates thousands of jobs, supports various job industries, and generates millions for the region.

- **81 jobs created for every $1 million dollars** spent by Charlotte Water
- **$17.7 million in regional economic growth for every $1 million dollars** spent by Charlotte Water

Charlotte Water's objectives are to create jobs, promote upward mobility, and advance equitable employment opportunities with the department, City and industry through apprenticeship and pipeline academy programs.

Metric:
Conduct a regional economic development analysis

Status:
Completed in FY22

Metric: Greater than fifteen apprentices hired in FY23

Status:
1 Apprentice hired in FY22

Metric:
Greater than ten pipeline academy graduates hired in FY23

Status:
8 Graduates hired in FY22

Customer Satisfaction

Charlotte Water serves more than 1.1 million people every day. High satisfaction is a top priority for the utility. Customers expect fast, efficient and reliable service. In 2020, Charlotte Water established the Charlotte Water Cares program to better meet customers' needs.

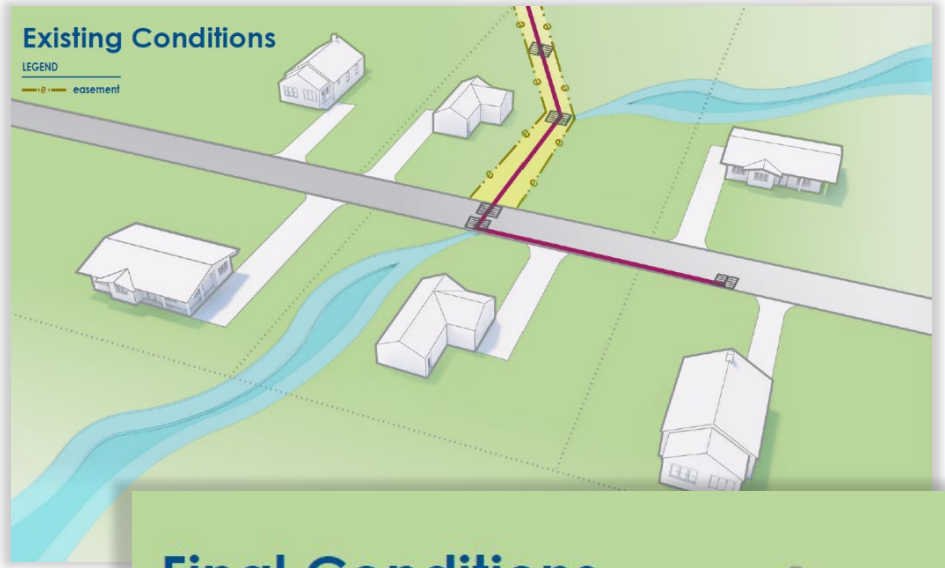
When service disruptions occur, Charlotte Water quickly dispatches 24/7 rapid response crews to assess and conduct emergency repairs. Other lower-priority repairs not causing damages or disruptions are addressed as quickly as possible.

Metric:
Greater than 96.7% of requests for service such as turn-ons and move-ins that meet the customer's desired time frame in FY23

Status:
99.06% of requests for service such as turn-ons and move-ins met the customers desired time frame in FY22

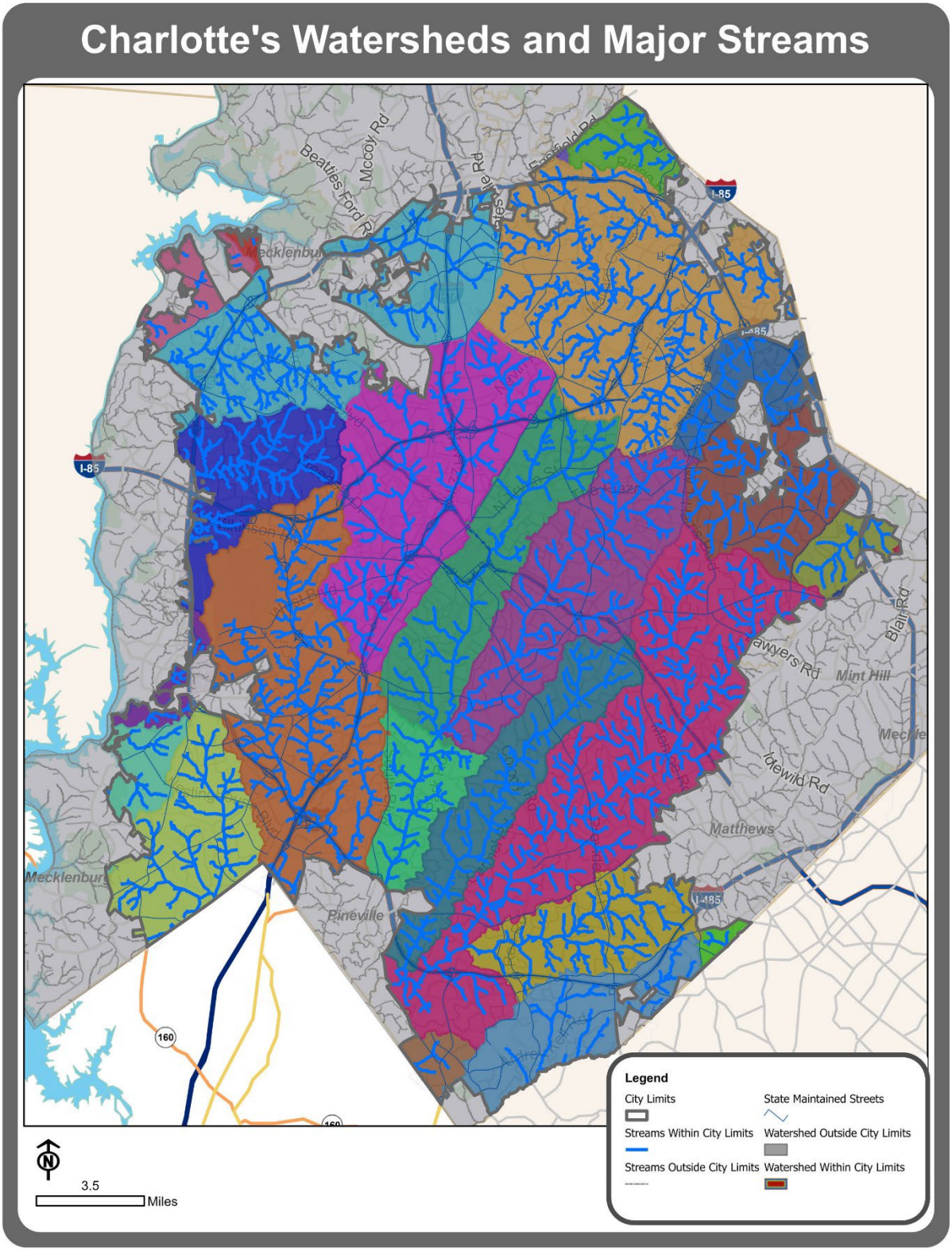
Metric:
Repair all water main breaks within 28-days of being reported

Status:
84% success of all breaks repaired within 28 days; current average repair timeframe on non-emergency repairs is 31 days

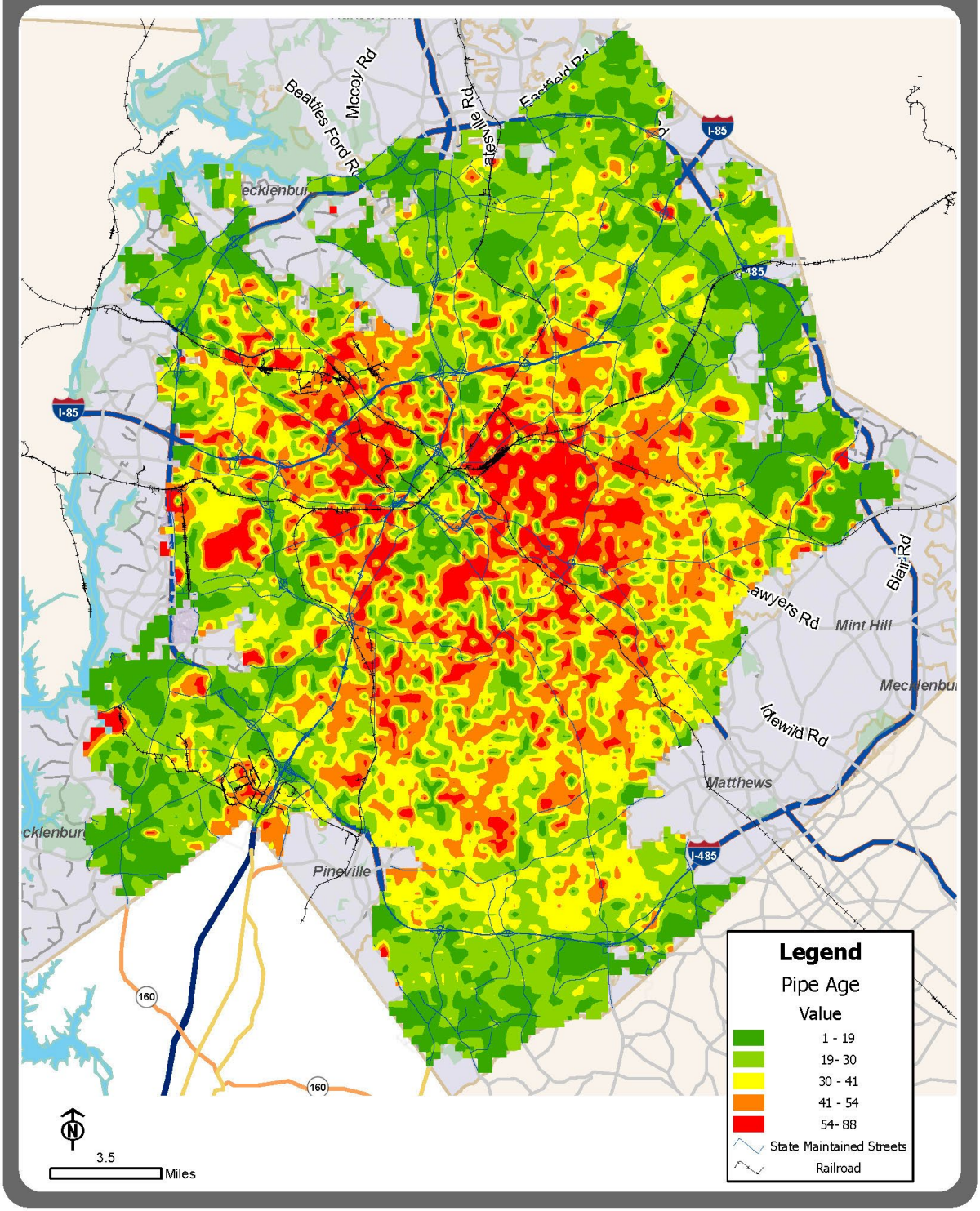


Storm Water Appendix

The example to the left and below shows how incremental infill development can introduce drainage problems and impact existing property owners. Current ordinances do not allow for these issues to be prevented during plan review. The UDO, once effective, will enable staff to better regulate the drainage impacts of infill development.


Charlotte's Watersheds and Major Streams
I-85
I-485
160
Mint Hill
Matthews
Pineville
Blair Rd
Idlewild Rd
Legend
City Limits
State Maintained Streets
Streams Within City Limits
Watershed Outside City Limits
Streams Outside City Limits
Watershed Within City Limits
3.5
Miles

Age of the Public Drainage System



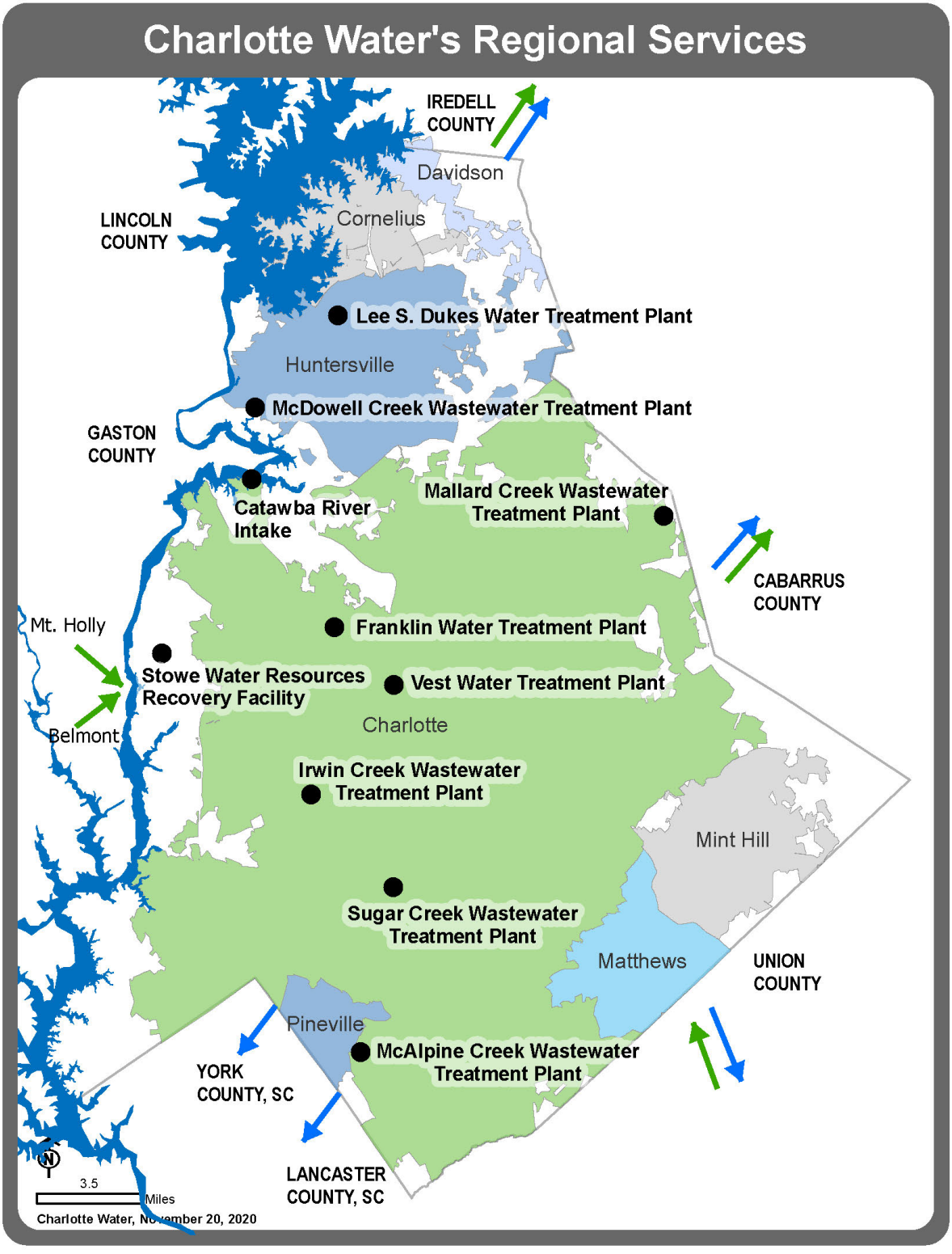
Infrastructure Scoring Methodology

Scores, Weights & Schema

	Label	Schema	Weight	Score
	Clogging/Flooding Risk:		***40%***	
	Condition Risk:		***60%***	
Likelihood of Falure (LOF) (Clogging/Flooding)	**Clogging:**		**35%**	
	· Less than 25%	less_than_25%		0
	· Between 25% to 50%	between_25%_to_50%		5
	· Between 50% to 75%	between_50%_to_75%		7
	· Greater than 75%	greater_than_75%		10
	· Did not inspect	did_not_inspect		0
	· [Blank]	0		0
	· Clogging-Related Flooding	yes		10
	· No Clogging related flooding	no		
	Flooding Design Standards:		**65%**	
	· Meets CDS	meets_cds		0
	· Fails CDS, meets Retrofit	fails_cds_meets_retrofit		3
	· Fails Retrofit	fails_retrofit		8
	· Culvert failing Retrofit	culvert_failing_retrofit		10
	· Unknown	unknown		2
	· [Blank]	0		2
Likelihood of Falure (LOF) (Condition)	**Material:**		**20%**	
	· Metal or Steel (CMP/DIP)	metal_or_steel_cmp_dip_		10
	· Concrete	concrete		3
	· Clay (VCP)	clay_vcp_		7
	· Plastic (HDPE/PVC/PP)	plastic_hdpe_pvc_pp_		7
	· Brick (CMUs, Brick)	brick_cmus_brick_		7
	· Stone	stone		7
	· Other	other		5
	· [Blank]	0		5
	Defect Severity:		**80%**	
	· In Progress/Complete	in_progress_complete		9
	· Severe	severe		7
	· Significant	significant		5
	· Moderate	moderate		3
	· Nominal	nominal		1
	· [Blank]	0		0
	Extensiveness Adjustment:			
	· Limited			0
	· Extensive			1

	Label	Schema	Weight	Score
Consequences of Failure (COF) (Clogging/Flooding)	**Consequence Location (Clogging/Flooding):**		**45%**	
	· N/A	n_a		0
	· Emergency Route	emergency_route		10
	· Critical Facility	critical_facility		10
	· Thoroughfare	thoroughfare		10
	· Collector	collector_		8
	· Local Limited	local_limited		8
	· FFE Principal Structure	ffe_principal_structure		8
	· Local	local		6
	· Sidewalk	sidewalk		4
	· Driveway / Private Drive	driveway_private_drive		4
	· Attached Garage	attached_garage		3
	· Crawl Space	crawl_space		3
	· Detached Garage/shed > 150 sq.ft.	Det.garage_shed_>_150_sq_f		3
	· HVAC	hvac		3
	· [Blank]	0		0
Consequences of Failure (COF) (Condition)	**equence Location (Condition):**		**45%**	
	horoughfare	thoroughfare		8
	· Collector	collector		6
	· Local Limited	local_limited		6
	· Local	local_		4
	· Principal Structure	principal_structure		6
	· Sidewalk	sidewalk		4
	· Driveway	driveway		4
	· Accessory Structure	accessory_structure		2
	· Open Space/ Lawn	open_space_lawn		0
	· Right-of-Way	right_of_way		2
	· Non-City	non_city		0
	· [Blank]	0		0
	Consequence Location ZoI:			
	· Problem directly under Consequence Location	problem_directly_under_defect_l		2
	· Problem within ZoI of Consequence Location	problem_within_zoi_of_defect_lo		0
Consequences of Failure (COF) (All Failure Modes)	**Span/Rise:**		**20%**	
	· 1.00 (12)	1_00_12_	1	1
	· 1.25 (15)	1_25_15_	1.25	1
	· 1.50 (18)	1_50_18_	1.5	1
	· 2.00 (24)	2_00_24_	2	1
	· 2.50 (30)	2_50_30_	2.5	4
	· 3.00 (36)	3_00_36_	3	4

Label	Schema	Weight	Score
· 3.50 (42)	3_50_42_	3.5	4
· 4.00 (48)	4_00_48_	4	7
· 4.50 (54)	4_50_54_	4.5	7
· 5.00 (60)	5_00_60_	5	7
· 5.50 (66)	5_50_66_	5.5	7
· 6.00 (72)	6_00_72_	6	7
· N/A	n_a	0	0
· Other	other	0	0
· [Blank]	0	0	0
· [Greater than 6']		10	10
Depth:		**10%**	
· >12'	12		10
· >8' to 12'	8	12	5
· 8' or less	0	8	1
Service Eligibility:		**15%**	
· City RoW	city_row		10
· Private Property with SDE	private_property_with_sde		10
· Private Property with system benefit but no SDE	private_property_with_system_be		5
· Private Property with no SDE and no system benefit	private_property_with_no_sde_an		0
· [Blank]	0		0
Public Interest:		**10%**	
· Greater Public Interest			10
· Resident Complaint			5
· No Resident Complaint			0
Does asset convey runoff from a City-Maintained street?:			
· Yes	yes		
· No	no		0

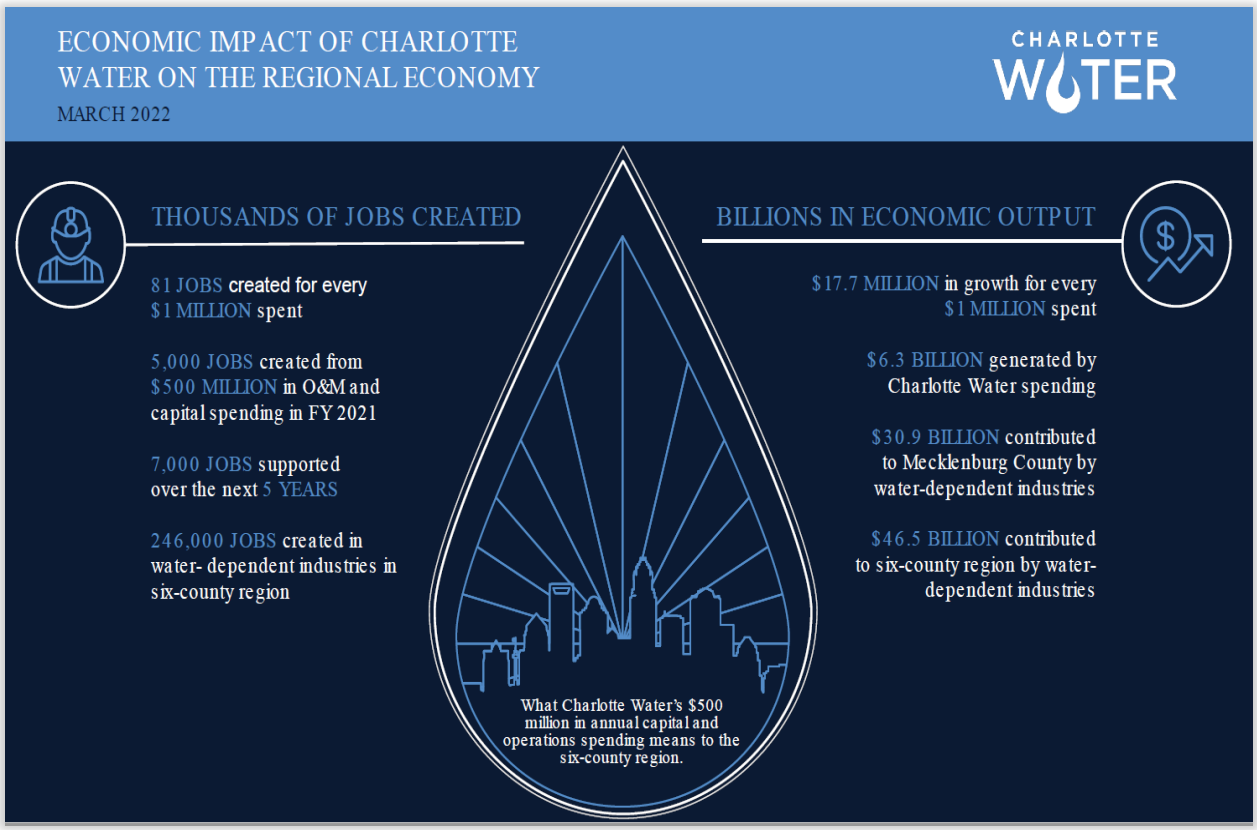

Charlotte Water's Regional Services
IREDELL COUNTY
Davidson
Cornelius
LINCOLN COUNTY
Lee S. Dukes Water Treatment Plant
Huntersville
McDowell Creek Wastewater Treatment Plant
GASTON COUNTY
Catawba River Intake
Mallard Creek Wastewater Treatment Plant
CABARRUS COUNTY
Mt. Holly
Franklin Water Treatment Plant
Stowe Water Resources Recovery Facility
Vest Water Treatment Plant
Belmont
Charlotte
Irwin Creek Wastewater Treatment Plant
Mint Hill
Sugar Creek Wastewater Treatment Plant
Matthews
UNION COUNTY
Pineville
McAlpine Creek Wastewater Treatment Plant
YORK COUNTY, SC
LANCASTER COUNTY, SC
N
3.5
Miles
Charlotte Water, November 20, 2020

Project Prioritization

Development happens across Charlotte in continuous spurts. At any time, hundreds of pipes may need to be added, replaced, upgraded, or installed at various projects, neighborhoods, and shopping centers. Charlotte Water uses a weighted scorecard to plan which and when projects are scheduled.

CIP Prioritization Criteria & Weighting:

- Compliance – 23%
- Reliable Infrastructure – 22%
- Customer Level of Service – 18%
- Operational Efficiency – 15%
- Capacity Enhancement – 15%
- Environmental Enhancements – 7%



Wastewater Capacity Needs

Charlotte Water's Wastewater System Master Plan (WWSMP) is a comprehensive planning effort to evaluate system-wide needs. This planning effort will provide a guiding framework and vision for system performance, as well as a capital expenditure roadmap to ensure priorities are addressed in a cost-effective manner.

Example: In 2007, a study of the McAlpine, Irwin and Sugar Creek basins was completed to help identify future wastewater treatment capacity needs through 2030. To address these:

- Projects at the Irwin Creek and Sugar Creek WWTPs were completed recently, bringing the reliable treatment capacity up.
- Significant flow and load reduction at the McAlpine WWTP will be accomplished by converting the Long Creek Lift Station into the Stowe Regional WRRF
- Projects planned expansion of the Mallard Creek Water Reclamation Facility (WRF)

COVID-19 and Global Issues Impacting Charlotte Water's CIP

Like many businesses across industries, Covid has created new challenges for Charlotte Water to address. Some of these direct issues include:

- Supply chain issues
- Access to service and construction contractors
- Staffing and the ability to fill vacancies
- Cost escalations for services, labor, and materials

In some areas, Charlotte Water can augment these needs by working with the private sector through our contractors. **This allows us to have minimal impacts on our project timelines and schedules.**

Customers likely see the effect of vacancies in the longer than normal response time to **non-emergency leaks.**

The normal volume of leaks received, combined with staff and labor shortages and supply chain delays, weather and impacts caused by external contractors such as fiber companies, all contribute to the time it takes to fix a leak.

Charlotte Water staff continue to respond to, evaluate and repair leaks based on a system that prioritizes resources based on leak significance and impact.

Inter-Agency Collaboration

Intra-agency collaboration is another way to ensure the steps Charlotte Water is taking align with the City's plans. This close collaboration with Charlotte Water and other City departments benefits Charlotte Water customers and residents.

Charlotte Planning, Design & Development: to understand zoning changes, proposals, and trends.

Charlotte Area Transit System (CATS) on capital infrastructure projects as they plan for growth along transit corridors.

Charlotte Department of Transportation (CDOT) to ensure safe relocation and replacement of infrastructure before road enhancements and during capital projects.

Housing & Neighborhood Services: From utilizing the city's 311 call center to help address customer calls, to partnering on Housing and Neighborhood Services' Citizen Leadership Academy and Training on Demand Program, this partnership is one of the most direct ways we serve our community

Charlotte Water directly serves the towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville. Indirectly, through regional water and wastewater services agreements, Charlotte Water also services areas of Harrisburg, York County (SC), Lancaster County (SC), Concord and Union County (NC).

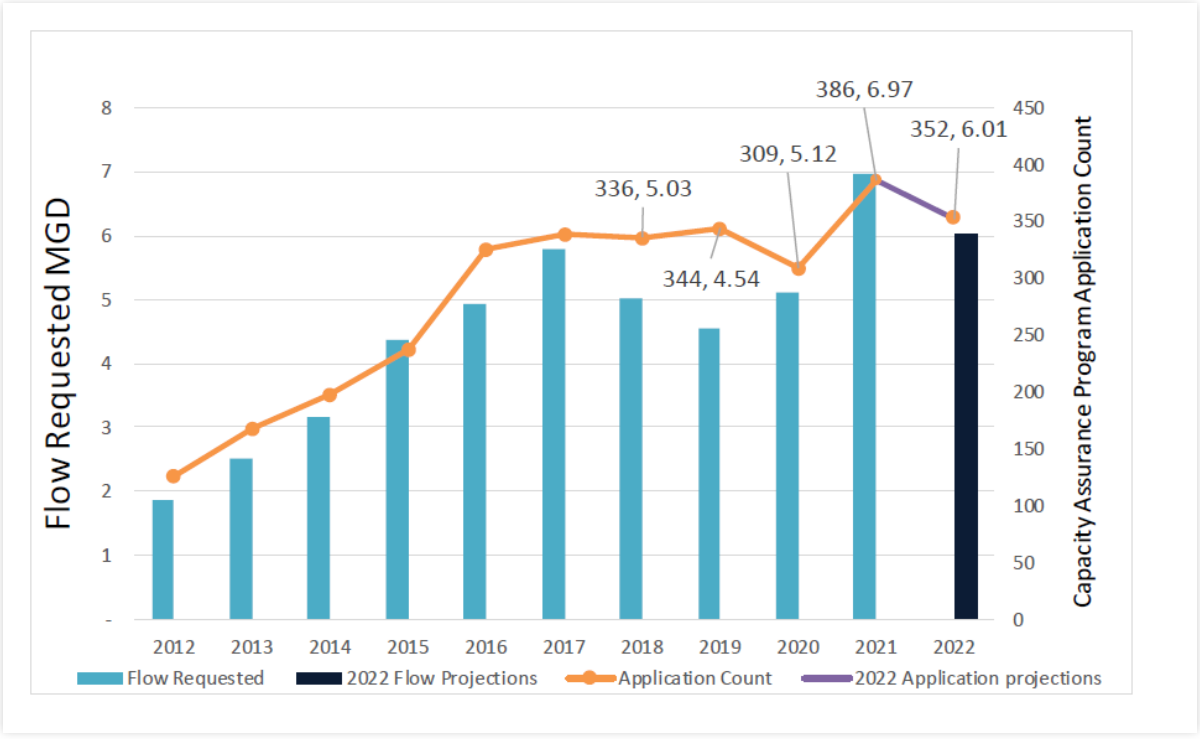
The Catawba-Wateree River Basin is the sole water source of the region. Charlotte Water is a member of the **Catawba-Wateree Water Management Group,** which works to develop projects that help preserve, extend, and enhance the capabilities of the basin. Regional partnerships are limited by inter-basin transfers (IBT).

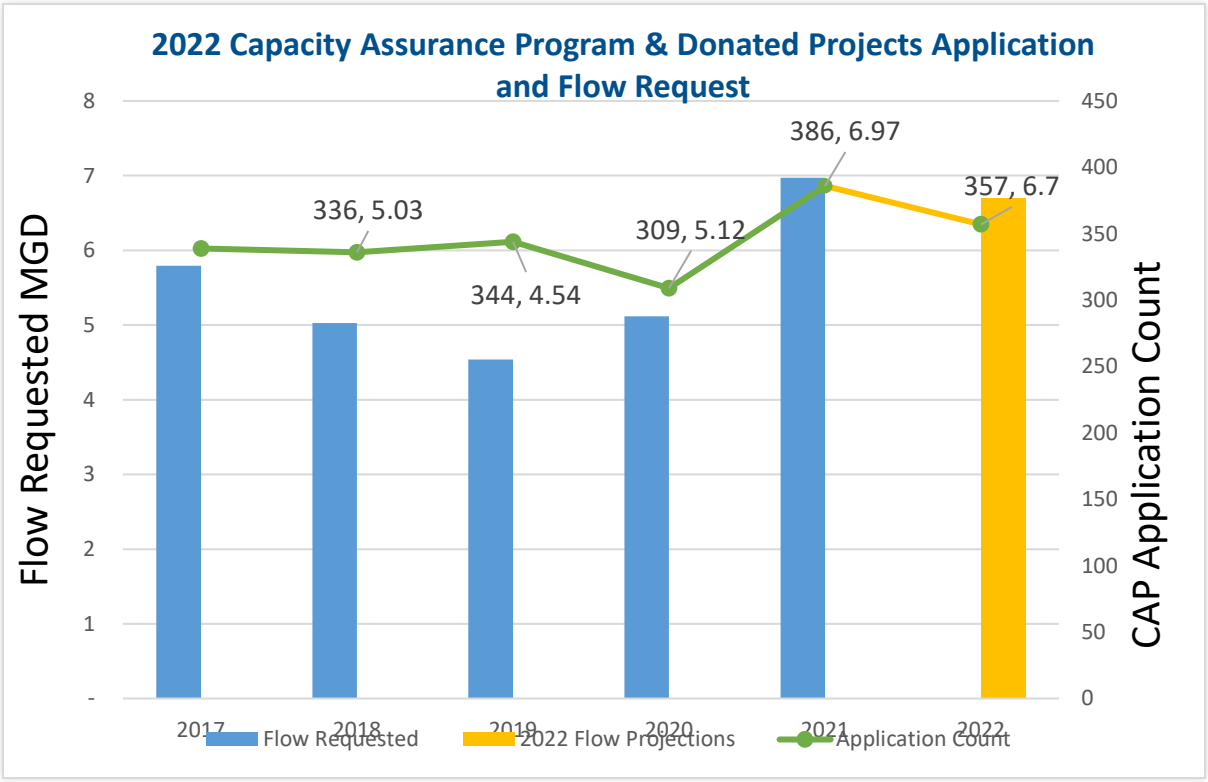
Capacity Assurance Program

Instituted in 2009 as a response to an EPA Administrative Order addressing the Clean Water Act and sanitary sewer overflows. The AO provided specific compliance requirements for the sanitary sewer collection system: update and implement their management, operations, and maintenance programs, develop a capacity assurance program, and continue to complete specific capital improvement projects.

The Capacity Assurance Program uses various modeling and monitoring techniques to determine the capacity of pipes from the point of connection by a development to the wastewater treatment facility. Certain parameters associated with the assessment were approved with the EPA AO and defined by NC DEQ Administrative Code.

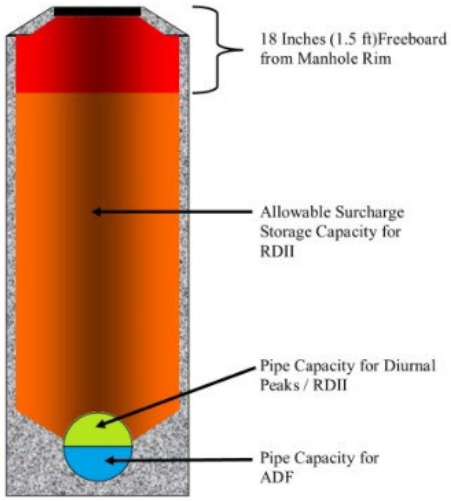
2022 Capacity Assurance Program & Donated Projects Application and Flow Request





Collection System Capacity

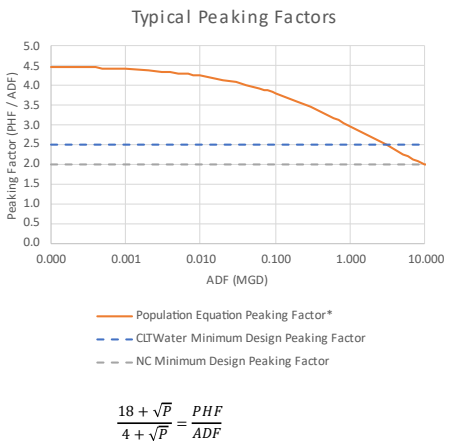
- **Capacity to Accommodate a Peak Hourly Wastewater Flow during a 2-Year Rain Event**
- **Gravity Sewers**
  - Max. Allowable Surcharge 1.5 feet below Manhole rim
- **Lift Stations**
  - Firm Pumping Capacity
  - High Water Alarm / Sanitary Sewer Overflows (spills)
- **Treatment Plants**
  - Annual Maximum Monthly Average Flow
  - Overflows
  - Permit Violations
  - Contaminant Loads



Modeling Factor Used

Factor	Value	Requirement
Dry-Weather Peaking Factor	2.5	Charlotte Water Design Manual (IV.A 4. a) (State = 2.0 - 15A NCAC 2T .0114)
Minimum Manhole Freeboard (2 Year Storm Event)	18 inches	2008 EPA Approved CAP Guidance Documentation (TM 13)
Flow Factors for Existing Charlotte Water Treatment Facilities		
Single-Family DU	190 gpd/du	1995 NC DEQ Flow Reduction Approval Letter
Multi-Family Du	135 gpd/du	1995 NC DEQ Flow Reduction Approval Letter
Flow Factors for WSACC Treatment Facilities		
Residential DU	65gpd/bedroom, min 2 bedrooms or 130 gpd/du	2021 NC DEQ Flow Reduction Approval Letter

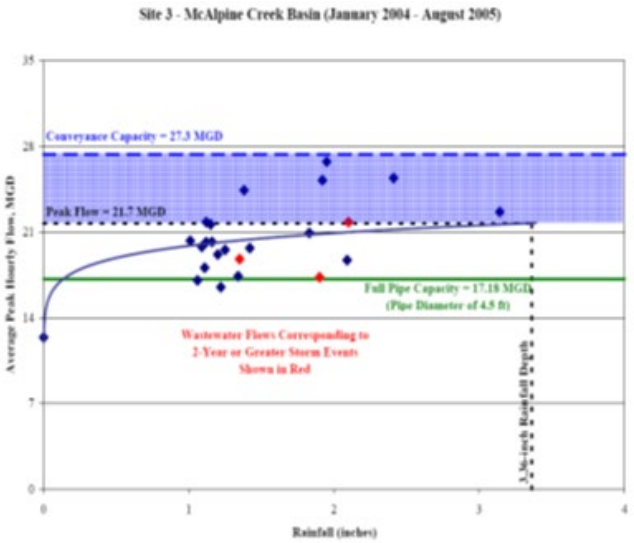
Peak Hour and Wet Weather Flows



$$\frac{18+\sqrt{P}}{4+\sqrt{P}}=\frac{PHF}{ADF}$$

P is Population in Thousands.

***Assumed 100 gpd per person.**



Engineering Staffing Positions by Fiscal Year

Count of Position	Section				
Fiscal Year	703010	703015	703035	705040	Grand Total
2020	85	11	21	20	137
2021	88	11	24	21	144
2022	88	11	24	21	144
2023	92	11	26	21	150
2024	98	11	27	26	162

Sewer, water and treatment plant projects required to serve development along Blue Line/TOD corridor

Project Name	Est. Total Cost
Toby Creek Basin Sewer Improvements	$ 30,500,000
Doby Creek Sanitary Sewer Improvements	$ 20,033,867
Little Sugar Creek Tributary to CBD Sewer	$ 34,000,000
Irwin Creek Tributaries to Dewitt Ln and Yeoman Rd Sanitary Sewer	$ 35,605,100
Wilmore Drive to I-77 Sanitary Sewer Improvements	$ 8,908,906
Little Hope Creek Basin Sanitary Sewer Improvements	$ 57,000,000
N Tryon Sanitary Sewer Improvements	$ 14,809,906
Mallard Trib/Marlynn (by CW D&C)	$ 1,800,000
Fieldcrest/Lower Barringer/Scaleybark (by CW Rehab)	$ 1,400,000
Rocky River Rd (w/ CDOT)	$ 1,540,000
Hidden Valley Trunk Sewer Replacement	$ 6,262,950
Irwin Basin Tributary to Remount Rd	$ 33,868,500
South Blvd 24-inch Water Main Phase 1 (2006)	$ 5,000,000
Various water main improvements during Blue Line Phase 1 (2005/2006)	$ 10,000,000
South Blvd 24-inch Water Main from Worthington Avenue to Clanton Rd (2022)	$ 18,500,000
Mallard Creek Basin Sanitary Sewer Improvements (Trunkline)	$ 76,792,000
Mallard WWTP Expansion (Phase 1A, 1, and 2)	$ 219,877,000
Total	**$ 575,898,228**

Annual report to regulators indicating Inter Basin Transfer in million gallons per day

Table 1: Actual IBT Summary

Calendar Year	Avg. Annual IBT (mgd)	Max. Day IBT (mgd)
2002	6.74	11.97
2003	6.91	9.82
2004	7.79	12.56
2005	8.66	13.79
2006	9.56	14.35
2007	9.96	17.22
2008	11.39	17.42
2009	12.04	16.00
2010	13.33	18.33
2011	13.11	18.82
2012	12.18	17.67
2013	12.99	16.80
2014	15.02	21.44
2015	16.59	24.19
2016	17.32	22.39
2017	16.27	21.97
2018	19.13	25.81
2019	18.06	25.26
2020	17.74	23.66
2021	20.28	25.57