EXECUTIVE SUMMARY

Background

The previous master plan for the Town of Cary's wastewater collection system was completed in 2003 by Hazen and Sawyer, P.C. Subsequently, several significant changes, which posed additional challenges for the Town of Cary, have taken place in the system. First in 2005, the Town of Cary took over the ownership of the Town of Morrisville's utilities assets including its wastewater collection system. Second, the plans for the future Western Wake Regional Water Reclamation Facility (WWRWRF), the third water reclamation facility (WRF) in the Town, are progressing smoothly under the leadership of the Town of Cary and other joint partners. Third, both the Towns of Cary and Morrisville continue to undergo robust population growth. The scope for the previous master plan did not adequately address the integration of Morrisville's wastewater collection system in association with anticipated rapid population growth, nor of the new water reclamation facility in any significant detail. Therefore, the Town of Cary retained Hazen and Sawyer, P.C. to update its Wastewater Master Plan, focusing on these changes and other challenges encountered by the Town in its wastewater collection system. This document is developed to be largely based on the Town of Cary's year 2010 baseline data due to the time required for compiling data, creating and validating the existing sewer model. Naturally, there is a time lag between the timing of this report and the timing of the baseline data on which to be based. The Town has implemented many capital projects between 2010 and 2012 to address flow issues. For instance, The Town of Cary is in the process of completing Speight Branch parallel sewer, which would allow the flows from Walnut Creek Pump Station to be conveyed through Speight Branch instead of Lynn's Branch, thus relieving the surcharge condition experienced at Lynn's Branch. The NW Cary Force Main memo (Appendix A) is based on more recent year 2011 baseline data, primarily serving the construction of WWRWRF.

In addition to serving its own residents, the Town of Cary provides wastewater collection, conveyance and treatment services for the Town of Morrisville, Raleigh-Durham (RDU) International Airport, and the Wake County portion of Research Triangle Park (RTP South). The study area can be found in Figure ES-1. The Town's topography is made up of numerous drainage basins sloping away from the central part of the Town. For this reason, the wastewater collection system in the Town is divided into three service areas: the North Service Area, the South Service Area and the West Service Area, each of which is discharging into the North Cary Water Reclamation Facility (WRF), the South Cary WRF and Durham County's Triangle Wastewater Treatment Plant (WWTP), respectively. The Town of Cary currently operates and maintains nearly 873 miles of collection system (789 miles of gravity sewers and 84 miles of force mains), more than forty wastewater pumping stations, and nearly 23,000 manholes and safely treated roughly 13 million gallons of wastewater on an average daily basis in 2010. The Town has actively pursued the abandonment of pump stations when new sewers or pump stations downstream of the existing pump stations have made this abandonment possible. This is a sound policy for the Town to continue pursuing, and will result in fewer small stations and larger, regional pumping stations. However, due to the unalterable consequences of the area's topography, physical obstructions (such as I-40), and political boundaries, the Town of Cary will always have at least fifteen to twenty pumping stations to maintain, even at build-out of the study area.

North Cary Water Reclamation Facility - 12 MGD treatment capacity, permitted discharge to Crabtree Creek 12 MGD

South Cary Water Reclamation Facility - 12.8 MGD treatment capacity, permitted discharge to Middle Creek 16 MGD

The Town currently has a Wastewater Treatment Service Agreement in place with Durham County to pump wastewater from its western basins to Durham County's Triangle Wastewater Treatment Plant via the Kit Creek Pump Station. The WWRWRF is currently under design and will receive all wastewater flows from the western portion of the service area, including the flows currently going to the Triangle WWTP.

Project Objectives

This report presents a wastewater collection system master plan that encompasses a long-term strategy for implementing system improvements to meet the projected wastewater flows for the collection system for the immediate (2010), 5-year (2015), 15-year (2025) and build-out periods. Our recommendations for this master plan were developed based on hydraulic simulations conducted using a computer model of the collection system (InfoWorks CS™). System improvements were devised to minimize potential surcharges and overflows in the collection system. A capital improvement program was developed to incorporate those improvement projects in a phased manner.

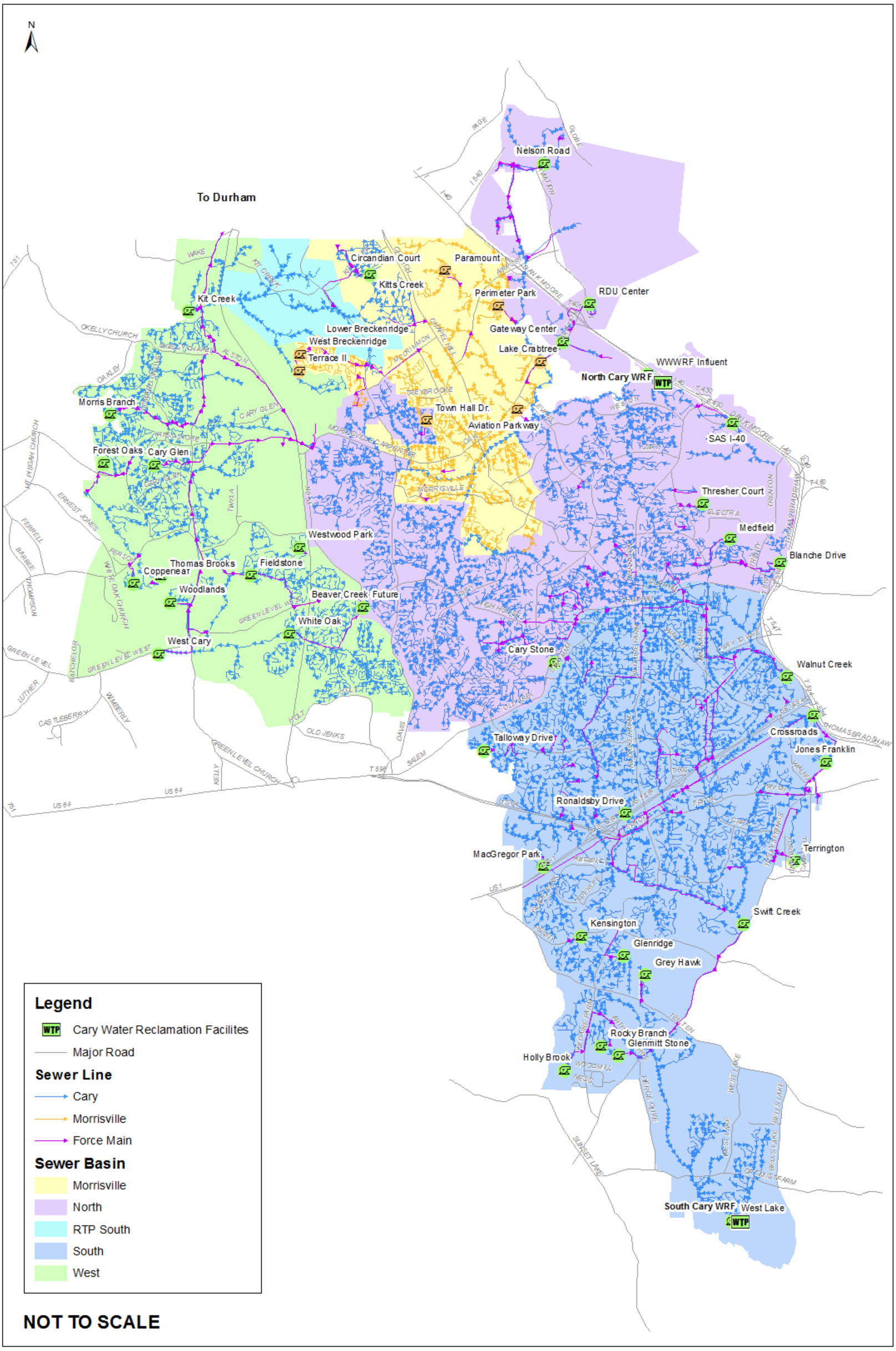
This study serves multiple objectives for the Town of Cary, which include,

- Develop wastewater flow projections for the Cary service area, based on parcel level data furnished by the Town of Cary, for 5-year (2015), 15-year (2025) and build-out conditions
- Summarize and evaluate the current operation of the existing system
- Perform an infiltration/inflow (I/I) analysis and prioritize sub-basins with respect to I/I for more detailed study
- Prepare a computer model that includes gravity sewer lines greater than or equal to 10 inches in diameter and reflects system improvements that have been implemented or will be completed in the short term
- Conduct field pump station inspection and testing to collect pump station field performance data, including noise characteristics
- Catalog system-wide permanent flow metering data and utilize them to calibrate the InfoWorks™ computer model
- Identify sewer segments that have insufficient hydraulic capacity to convey system flows or areas of the system that appear to be at risk for sewer overflows and prioritize improvements that would correct those deficiencies
- Identify system improvements that would serve future development and growth within the service areas
- Develop a detailed capital improvement plan with phased budget allocation for each proposed improvement project on a system-wide basis.

- Evaluate regulatory considerations and odor control issues with regard to the collection system
- Evaluate collection system telemetry and SCADA issues, particularly in relation to Western Wake Regional Water Reclamation Facility start-up

Flow Projection

In this wastewater master plan project, wastewater flow projections were developed for near-term, 5-year (2015), and 15-year (2025) planning periods, as well as build-out conditions. The wastewater flow projections were based on the existing wastewater flow (including both the average day sewer flow and groundwater infiltration components) as well as the incremental wastewater flow increase resulting from anticipated water demand increase in each of the planning period on a parcel-level basis, as presented in the Town of Cary Water System Master Plan, dated June 2009. In the 2009 Water System Master Plan, CH2M HILL collaborated extensively with the Town of Cary staff to identify projected future water demand increases in each parcel within the service area. This parcel level future water demand dataset provided a very detailed roadmap that depicted the possible increase in future wastewater flow spatially as well as taking into consideration the future contribution of groundwater infiltration. The relationship between the total water demand and average base flow (the sum of average day sewer flow and groundwater inflow) can be examined by correlating the two parameters for the existing service areas. Table ES-1 summarizes the itemized flow contribution from each component of average base flow for all three existing service areas in the Towns of Cary and Morrisville. For the north and south service areas, the sewer average base flow exceeds the total upstream water demand by approximately 20% on annual average basis due to the high groundwater table in the service area and the proximity of a subset of the collection system to adjoining water bodies such as lakes and creeks.



Town of Cary
North Carolina

Figure ES-1: Illustration of the Existing Sewer Collection System Owned and Serviced by the Town of Cary

Table ES-1: Summary of Total Water Demand vs. Average Base Flow Comparison

Plant	Total Water Demand upstream, non-irrigation (MGD)	Average Base Flow (MGD)	ABF/Total Water Demand upstream Ratio
North Cary WRF	4.57	6.35	1.39
South Cary WRF	4.33	4.82	1.11
Durham County Triangle WWTP	2.16	2.11	0.98
Average			1.23

Based on the 2009 Water System Master Plan by CH2M HILL, the incremental water demand increase from 2007 for the same service area is shown in Table ES-2. Therefore, the total wastewater flows for future planning periods can be projected by adding the existing wastewater flow to the future water demand increase multiplied by a ratio for each service area. The results can be found in Table ES-3.

Table ES-2: Incremental Water Demand Increase from Water System Master Plan

Basin	2015 Future Demand Increase (MGD)	2025 Future Demand Increase (MGD)	Build-out Future Demand Increase (MGD)
North	2.20	2.80	4.87
South	0.73	1.09	2.87
West	3.54	4.46	6.20
Total	6.47	8.35	13.95

Table ES-3: Long-Term Wastewater Flow Projections

	2015 WW Flows (MGD)	2025 WW Flows (MGD)	Build-out WW Flows (MGD)
North	9.40	10.24	13.11
South	5.63	6.02	8.00
West	5.57	6.48	8.18
Total	20.6	22.7	29.29

Pump Station Flow Tests

The scope of this project included inspection of all sewer pump stations and testing of 25 key pump stations in the Town of Cary service area. Table ES-4 lists all pump stations, including those that were chosen by the Town for drawdown testing as part of this project, as well as those tested and inspected in the previous master plan project. The coverage of general inspection included:

- Structural, mechanical, electrical, and HVAC evaluation of the building
- Dry-well, associated piping, equipment and the surrounding property
- An operational evaluation of the pumps
- Collection of pump station operating sequence data
- Odor and noise levels
- Current and design pump station flows

Table ES-4: Pump Station Test Results

ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Year Tested
			1	2	3	Firm Capacity (MGD)	
001	Swift Creek	5	6,231	6,227	5,459	14.706*	2010
002	Walnut Creek	3	1,788	2,437	2,065	3.847	2010
003	Kit Creek	3	3,905	4,136	4,110	7.568	2010
004	White Oak	2				1.634	2001
005	Nelson Road	2				1.463	2001
006	Crossroads	2	180	158		0.228	2010
007	Glenmitt Stone	2				0.036	2001
008	Fieldstone	2				0.794	2001
009	SAS I-40	2	555	671		0.798	2010
010	Glenridge	2	324	378		0.467	2010
011	Jones Franklin	2	791	732		1.054	2010
012	Medfield	2	776	762		1.097	2010
013	Blanche Drive	2	215	186		0.268	2010
014	Talloway Drive	2				0.204	2001
015	Gateway Center	2	482	482		0.693	2010
016	RDU Center	2	321	336		0.463	2010

Table ES-4: Pump Station Test Results (Continued)

ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Year Tested
			1	2	3	Firm Capacity (MGD)	
017	MacGregor Park	2				0.273	2001
018	Ronaldsby Drive	2				0.150	2001
019	Morris Branch	2	2,886		2,897	4.156	2010
020	Carystone	2				0.247	2001
021	Thresher Court	2				0.204	2001
023	Town Hall Dr.	2				0.199	
024	Holly Brook	2				0.209	2001
025	Rocky Branch	2	224	202		0.292	2010
026	Westwood Park	2				0.073	2001
027	Kensington	2				0.231	2001
028	Cary Glen	2				0.834	
029	Thomas Brooks	2				0.229	
030	Grey Hawk	2	185	182		0.262	2010
031	Terrington	2				0.334	
032	Park at West Lake	2				0.180	
033	Forest Oaks	2	558	546		0.787	2010
034	Copperleaf	2	286	281		0.405	2010

Table ES-4: Pump Station Test Results (Continued)

ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Year Tested
			1	2	3	Firm Capacity (MGD)	
035	West Cary	3	1,126	1,154	1,124	2.293	2010
038	Lower Breckenridge	2	802	797		1.147	2010
039	Terrace II	2				0.135	
040	West Breckenridge	2	267	291		0.385	2010
041	Woodlands	2	377	370		0.532	2010
042	Aviation Parkway	2	3,125	3,137		4.500	2010
043	Circandian Court	2	114	101		0.146	2010
044	Paramount	2	537	496		0.714	2010
046	Perimeter Park	2				3.123	
047	Lake Crabtree	2	137	139		0.198	2010
048	Kitts Creek	2	1,090	1,118		1.570	2010
049	Palaver (Copperleaf II)	2				0.226	
050	Somer (Aventon)	2				0.442	
	* Pump 4 and Pump 6 had flow rates of 2,132 and 2,964 gpm, respectively.						

Inflow and Infiltration Analysis

An inflow and infiltration analysis was conducted for this master plan to identify sub-basins within the collection system with a high level of inflow and infiltration problems. For this analysis, the flow data for a total of 23 permanent flow meters for the period from 2006 to 2010 were thoroughly examined. The significant rainfall event on 6/14/2006 (Hurricane Alberto) and 6/16/2009 were specifically targeted and analyzed for system wet weather performance.

The estimated ground water infiltration (GWI) rate for each meter was computed as seen in Table ES-5. Meters 2, 3, 5, 6, 12, 14, 15, and 16 were found to have a comparatively high degree of GWI.

GWI/ABF ratio is also an important parameter to observe the degree to which the Average Base Flow (ABF) of each meter is affected by the contribution of its GWI component. The above listed meters, have GWI/ABF ratio more than 50 percent. This is a good indication of high groundwater table and possible proximity of aquatic environment such as major creeks and lakes in the service area. All meters in the West Cary service area have relatively low GWI/ABF, GWI/area and GWI/inch-mile ratios, partially as a result of being new parts of collection system in the Towns of Cary and Morrisville. Both North and South Cary service area have the same number of meters with high GWI/ABF, GWI/area and GWI/inch-mile ratios and merit our further attention in subsequent analysis. The meters in the West Cary service area perform the best in this regard, perhaps due to the fact that the sewer system there is relatively new.

Table ES-5: GWI for Flow Meters

Meter	Meter-Basin Service Area (Acres)	Inch-Miles (in-mi)	Service Region	ABF (MGD)	GWI (MGD)	GWI/ ABF	GWI/Area (GPD/Acre)	GWI/Inch-Mile (GPD/in-mile)
M1	993	216	North	0.4	0.28	0.70	282	1296
M2	357	94	South	1.33	0.75	0.56	2101	7979
M3	1345	276	North	4	2.19	0.55	1628	7935
M4	1480	373	South	0.68	0.43	0.63	291	1153
M5	1318	296	South	1.38	0.82	0.59	622	2770
M6	2609	592	South	2.55	1.4	0.55	537	2365
M7	1473	336	South	1.02	0.67	0.66	455	1994
M8	1344	367	North	0.64	0.46	0.72	342	1253

Table ES-5: GWI for Flow Meters (Continued)

Meter	Meter-Basin Service Area (Acres)	Inch-Miles (in-mi)	Service Region	ABF (MGD)	GWI (MGD)	GWI/ ABF	GWI/Area (GPD/Acre)	GWI/Inch-Mile (GPD/in-mile)
M9	619	120	South	0.16	0.11	0.69	178	917
M10	690	145	South	0.41	0.27	0.66	391	1862
M11	1953	517	North	1.28	0.71	0.55	364	1373
M12	1274	312	North	1.33	0.68	0.51	534	2179
M13	754	183	North	0.27	0.18	0.67	239	984
M14	478	155	West	1.73	1.06	0.61	2218	6839
M15	1373	404	South	4.98	2.71	0.54	1974	6708
M16	1627	469	North	3.05	2.04	0.67	1254	4350
M17	942	231	South	0.59	0.43	0.73	456	1861
M18	1265	354	West	0.68	0.41	0.60	324	1158
M22	345	106	North	0.16	0.11	0.69	319	1038
M23	1175	291	North	0.63	0.37	0.59	315	1271
M24	308	43	North	0.05	0.04	0.80	130	930
M25	1357	303	North	1.24	0.57	0.46	420	1881
M26	1972	572	West	1.4	0.96	0.69	487	1678

Rainfall dependent inflow and infiltration (RDI/I) is the extraneous water that enters the sewer system in direct response to intensive rainfall events. The objective is to identify the basins with highest potential for RDI/I by compiling flow/volume statistics for all flow meters during specific events during which the sewer system configurations are close to the existing system conditions as of late 2009 and early 2010.

The numbers of times that each flow meter experiences surcharge condition for the period from Jan, 2008 to April, 2010 were investigated as a surrogate for the degree of potential RDI/I problems. Meters 22 and 23 are showing six and four months of surcharge, respectively. Both meters are located near the downtown Morrisville area serving the Indian Creek Interceptor and York Interceptor, where many segments of the system were laid prior to 1980's. Inadequate capacity in the York interceptor or in the Aviation Parkway Pump Station may render both meters more susceptible to surcharge conditions.

Meters 2, 4 and 5 are the second block of meters that draw our attention. The RDI/I volume contribution from the incremental service area of Meter 5 itself is very minor. As such, the majority of RDI/I observed at Meter 5 and Meter 2 are the direct result of RDI/I at Meter 4 upstream of Walnut Creek Pump Station. A lower volume and flow rate were recorded at Meter 2 than Meter 5, the difference of which cannot be explained readily. The firm capacity and total capacity of the Walnut Creek Pump Station are below the peak flow recorded at Meter 4. We believe that the Walnut Creek Pump Station may need upsizing in the future to accommodate the high RDI/I flow generated from the Meter 4 sub-basin.

Both Meter 3 and Meter 16 are showing substantial flow increase and surcharge. During the event of 6/16/2009, the RDI/I volume identified at Meter 16 (3.97 MG) dominates the RDI/I volume recorded at Meter 3 (4.07 MG). It shows a higher and earlier peak than Meter 3, a typical characteristic of damping in the collection system.

The sub-basins for Meters 22, 23 and 4 are identified as the ones with highest level of RDI/I and therefore should be targeted for further investigation and possible rehabilitation in the future. We would recommend a more detailed study to further ascertain the cause of surcharges. The objectives of the study should evaluate the degree of surcharging that can be ascribed to local blockages, the impacts of the spiral wound pipe employed at the downstream segment of the Crabtree Creek Interceptor, and the effects of the influent pump station operation at the North Cary WRF.

Hydraulic Capacity Analysis

As an integral part of this wastewater master plan, a dynamic hydraulic model was used to evaluate the hydraulic capacity of the collection system for the existing and future flow conditions. The model was built using the InfoWorks CS™ proprietary model devised by Innovyze (formerly MWH Soft). The physical data on which to base the model was supplied by the Town of Cary's GIS department. The model included all pump stations and all sewer lines 10 inches and larger in diameter. The model was calibrated using the most current flow metering data in 2010 including all 23 flow meters. The calibration was performed both on a dry weather flow and wet weather flow basis.

To determine the adequacy of the existing system to convey current and projected wastewater flows through the build-out period, the flow projections were simulated through the calibrated hydraulic model and their effects on the system were evaluated. Unlike previous master plans, a varying peaking factor method was adopted to account for the varying severity of inflow and infiltration problems as discussed in detail in Section 5. New gravity lines were designed to flow 2/3 full, while pump station capacity was determined based on upstream peak wastewater flows. When build-out size was determined, the model was rerun for 2015 and 2025 flows to determine infrastructure needed for each planning period.

The existing system is limited in capacity to convey future (2015, and 2025 and build-out) projected peak wet-weather flows. The main interceptors in the York, Crabtree and Swift Creek sub-basins have inadequate capacity to convey projected future wet weather flows.

Capital Improvement Program

A Capital Improvement Program (CIP) was developed for implementing the recommended system improvements. The CIP prioritized improvements into phases in accordance with the Town's financial planning schedule. A series of hydraulic model simulations were performed to help phase improvements.

A summary of the CIP for projects recommended in this study is presented in Table ES-6. The table contains the capital costs for each project. The capital cost includes construction costs; a 25 percent construction contingency, and 10 percent for engineering, legal, and administration fees. A detailed discussion of the cost calculations is provided in Section 7 of this report. The total capital cost for Phase I is $90 million.

Additional description and maps of each project are presented in Section 7 of the report. To begin implementation of the proposed system improvements, it is recommended that the Town proceed with implementation of the Phase I CIP projects as listed below:

- Proceed with the preliminary design, final design, and construction of the Phase 1 projects associated with the WWRWRF
- Proceed with preliminary design, final design, and construction of projects associated with the new Reedy Creek Regional Pump Station
- Proceed with the preliminary design and final design of the projects associated with the Rocky Branch Interceptor and Dutchman's Branch/Pump Station
- Proceed with the investigation and design/construction related to the integration of the Morrisville system into the North Cary system. Special attention should be directed to increasing the delivery capacity in the York Interceptor and at the Aviation Parkway Pump Station. The Town has a capital improvement project planned for the Aviation Parkway Pump Station. We would recommend that the firm capacity of the pump station be increased to 8 MGD. Further details can be found in Table 6-5.
- Proceed with the investigation of the surcharge in the Crabtree Creek Interceptor
- Add or relocate more flow meters to the West Service Area and quantify the flow entries to the Kit Creek, Morris Branch and West Cary Regional Pump Stations

Table ES-6: Capital Improvement Program

Name	Phase 1 (2010-2015)	Phase 2 (2015-2025)	Phase 3 (2025 - Build Out)	Project Total
Crabtree Creek A	$7,285,000			$7,285,000
Crabtree Creek B	$3,825,000			$3,825,000
Long Branch	$2,079,000			$2,079,000
Lynn's Branch	$2,979,000			$2,979,000
Nancy Branch	$1,399,000			$1,399,000
Speight Branch	$ 824,000			$824,000
Upper Crabtree Creek	$ 840,000			$840,000
York Interceptor	$1,936,000			$1,936,000
Harrison Oaks	$1,812,000			$1,812,000
Dutchman's Branch	$1,790,000			$1,790,000
Glenmitt Stone	$559,000			$559,000
Green Level B	$7,268,000			$7,268,000
Holly Brook Branch	$463,000			$463,000
Reedy Creek A	$764,000			$764,000
Reedy Creek B	$783,000			$783,000
Reedy Creek C	$680,000			$680,000
Reedy Creek Extension	$430,000			$430,000
Rocky Branch	$776,000			$776,000
Thresher Court Extension A	$525,000			$525,000
Thresher Court Extension B	$301,000			$301,000
Paramount Gravity Sewer	$703,000			$703,000
Green Level Force Main	$1,464,000			$1,464,000
Alston Force Main	$1,191,000			$1,191,000
Holly Brook Force Main	$434,000			$434,000
Rocky Branch Force Main	$747,000			$747,000
Reedy Creek Regional PS Force Main	$841,000			$841,000
Dutchman's Branch Force Main	$101,000			$101,000
Kit Creek Pump Station Expansion	$3,530,000		$224,000	$3,754,000
Medfield Pump Station Abandonment	$138,000			$138,000
Morris Branch Pump Station Expansion	$1,745,000		$326,000	$2,071,000
Paramount Pump Station Abandonment	$1,238,000			$1,238,000
New rocky Branch Pump Station (1 MGD)	$1,100,000			$1,100,000
I-40 Pump Station Expansion to Reedy Creek Regional Pump Station (to 5.6 MGD)	$4,125,000			$4,125,000
Walnut Creek Pump Station Expansion (to 5.5 MGD)	$1,650,000			$1,650,000
Glenridge Pump Station Abandonment	$138,000			$138,000
Glenmitt Stone Pump Station Abandonment	$138,000			$138,000
Thresher Pump Station Abandonment	$138,000			$138,000
Holly Brook Station Expansion (to 0.80 MGD)	$1,100,000			$1,100,000
New Dutchman's Branch Pump Station (0.6 MGD)	$1,100,000			$1,100,000
Aviation Parkway Pump Station Expansion	$2,750,000			$2,750,000
Blanche Pump Station Expansion (0.75 MGD)	$1,169,000			$1,169,000
Cross Roads Pump Station Expansion (0.45 MGD)	$1,169,000			$1,169,000
Westwood One Pump Station Abandonment	$688,000			$688,000
Swift Creek A		$1,654,000		$1,654,000
Swift Creek B		$1,376,000		$1,376,000
Swift Creek C		$941,000		$941,000
Swift Creek D		$569,000		$569,000
Upper Kit Creek		$335,000		$335,000
Circadian Court Pump Station Expansion to 0.30 MGD		$963,000		$963,000
Green Level A Force Main		$1,765,000		$1,765,000

Table ES-6: Capital Improvement Program (Continued)

Name	Phase1 (2010-2015)	Phase2 (2015-2025)	Phase3 (2025-BuildOut)	Project Total
New Dutchman's Branch Pump Station (0.6 MGD)	$1,100,000			$1,100,000
Aviation Parkway Pump Station Expansion	$2,750,000			$2,750,000
Blanche Pump Station Expansion (0.75 MGD)	$1,169,000			$1,169,000
Cross Road Pump Station Expansion (0.45 MGD)	$1,169,000			$1,169,000
Westwood One Pump Station Abandonment	$688,000			$688,000
Swift Creek A		$1,654,000		$1,654,000
Swift Creek B		$1,376,000		$1,376,000
Swift Creek C		$941,000		$941,000
Swift Creek D		$569,000		$569,000
Upper Kit Creek		$335,000		$335,000
Circadian Court Pump Station Expansion to 0.30 MGD		$963,000		$963,000
Green Level A Force Main		$1,765,000		$1,765,000
Campbell Branch			$654,000	$654,000
The Reserve			$743,000	$743,000
Upper Swift Creek			$434,000	$434,000
New Pump Station 01 Force Main			$648,000	$648,000
New Pump Station 02 Force Main			$1,430,000	$1,430,000
New Pump Station 03 Force Main			$1,014,000	$1,014,000
Upper Crabtree Pump Station Force Main			$13,822,000	$13,822,000
Terrington Pump Station Expansion to 0.80 MGD			$1,306,000	$1,306,000
New Upper Crabtree Pump Station (6.6 MGD)			$7,563,000	$7,563,000
New Pump Station 01			$1,375,000	$1,375,000
New Pump Station 02			$1,375,000	$1,375,000
New Pump Station 03			$1,375,000	$1,375,000
Kit Creek Pump Station Expansion			$224,000	$224,000
Morris Branch Pump Station Expansion			$326,000	$326,000
	$63,986,000	$7,603,000	$32,289,000	$103,878,000

Conclusions and Recommendations

The Town of Cary is embracing many challenges and opportunities in its sewer collection system in the next five years. The reshaping of the system has substantial fiscal and operational impacts for its future. The Town is committed, along with other partners, in completing the Western Wake Regional Water Reclamation Facility (WWRWRF) in the timeframe of 2013 to 2014.

The inflow and infiltration problems in the Town's collection system are relatively minor, as indicated in Section 5. Sewer pipe upgrades through open trench construction or trenchless techniques may prove to be more cost-effective in addressing those capacity deficiencies. However, the Town should continue to maintain and expand the existing sewer rehabilitation program to forestall the decay of the sewer collection system.

Two sewer sub-basins, the sub-basin upstream of Meter 23 in the downtown Morrisville area and the sub-basin upstream of the Walnut Creek Pump Station in the downtown of Cary, were identified as the basins with a high infiltration, high RDI/I per linear foot of sewer and high peak wet weather to dry weather flow ratios. Sewer pipe upgrade projects are proposed to address the surcharge and possible overflows at the downstream system at those locations in this study. However, those projects should be implemented in accordance to the future flow directions planned for those sewer basins.

Robust population and corresponding wastewater flow growth are anticipated for the Town's sewer service areas, in particular for the West Cary service area. The average base flows are expected to almost double at build-out, which implies an annual growth rate of around 2%. However, the wastewater generation on per capita basis has declined in the past decade. More attention should be directed at monitoring the per capita average base flow rate to avoid potential over-investment prior to the materialization of the capacity needs.

The existing system has adequate capacity to convey existing dry weather wastewater flows; however, capacity is very limited in terms of delivering the existing wet weather wastewater flows in parts of existing system, such as Crabtree Creek interceptor and Swift Creek interceptor.

A comprehensive capital improvement program has been developed using the hydraulic simulation results. The total capital outlay is projected to be $104 million (year 2010 dollars).