APPENDIX E
WRF and Collection System Descriptions

APPENDIX E

WRF AND COLLECTION SYSTEM DESCRIPTIONS

E.1 EXISTING COLLECTION SYSTEMS

E.1.1 Town of Apex

The Town of Apex wastewater collection system consists of over 116 miles of gravity sewers, 27 miles of force mains, and 21 pump stations. All of Apex's wastewater is treated at the Middle Creek Wastewater Treatment Plant (WWTP). The Middle Creek WWTP treated approximately 2.3 million gallons per day (mgd) of wastewater in Fiscal Year 2003. Figure 3-1 in Section 3.0 shows the Town of Apex's existing wastewater collection system, including pump stations and their associated force mains, and the location of the Middle Creek WWTP.

Table E-1 lists gravity pipeline sizes and their corresponding lengths for the Apex wastewater collection system. The main gravity interceptors for the Town of Apex collection system are the Beaver Creek Outfall and the James Street Outfall. The Beaver Creek Outfall collects wastewater along Beaver Creek and discharges to the Kelly Road Pump Station. The Kelly Road Pump Station and Highway 55 Pump Station force mains meet south of downtown Apex, where they transition to gravity and are conveyed by the 36-inch gravity sewer (James Street Outfall) to the Middle Creek WWTP. The collection system for the Town of Apex includes approximately 1,045 inch-miles of gravity sewers and interceptors.

Apex's 21 pump stations are used to convey wastewater to gravity lines in areas where gravity flow is not possible. Information on the existing pump stations in the Town of Apex collection system including the number of pumps, firm pumping capacity, year the pump station was put on-line, and the pump station condition is presented in Table E-2. All of the pumping stations are equipped with supervisory control and data acquisition (SCADA) equipment for remote monitoring.

During Fiscal Year 2003 the Town of Apex reported two sanitary sewer overflows (SSOs). The first overflow occurred on February 4, 2003 at the intersection of Hillcrest and Cash Streets. Approximately 150 gallons of overflow occurred due to a blockage in the main line caused by rags and roots. The second overflow occurred on April 23, 2003 behind Kelly Road Park. Approximately 2,500 gallons

of overflow occurred due to a contractor's flow-through manhole plug that dislodged and clogged a manhole.

TABLE E-1
Apex Wastewater Collection System – Gravity Lines

Pipe Diameter (inches)	Length (Miles)
4	0.05
8	104.21
10	2.40
12	5.20
14	0.00
15	0.92
16	0.02
18	0.80
20	0.00
21	0.00
24	1.81
27	0.00
30	0.32
36	1.21
TOTAL	116.94

TABLE E-2
Pump Stations in Apex Wastewater Collection System

Pump Station	No. of Pumps	Firm Pumping Capacity (gpm)	Year Put On-line	Condition
Feltonsville	2	180	1981	Fair
Perry Farms	2	180	1995	Fair
Elem. School	2	100	Unknown	Fair
Schieffelin Rd	2	220	1996	Good
Kelly Road	2	2150	1994	Fair
Hwy 55	2	2433	1994	Good
Green Level	2	450	1997	Good
Laura Village	2	150	1992	Fair
Parkway Point	2	100	1994	Good
Waterford 1	2	400	1988	Fair
Whoops	2	100	1994	Good
Shepherds Vineyard	2	1400	1997	Good
Buckingham	2	110	1985	Fair
Waterford 2	2	78 to 100	1994	Fair
Avalon Peaks	2	225	1997	Good
Summit Lakes	2	188	1997	Good
Sunset Hills	2	350 to 460	2000	Good
Holland Crossing	2	580	1997	Good
Homestead	2	380 to 500	1997	Good
Abbington	2	100	1998	Good
Pinnacle Park	2	400	1998	Good

Source: Town of Apex

There are 280 homes with water connections in the Town of Apex service area that do not have sewer service. However, there are no problems associated with this area or the homes.

E.1.2 Town of Cary

The Town of Cary provides wastewater collection and treatment for the Town of Cary, as well as for the Town of Morrisville, Raleigh-Durham (RDU) International Airport, and the Wake County portion of Research Triangle Park (RTP South). The Town of Cary wastewater collection system consists of approximately 625 miles of interceptors and force mains, over 15,000 manholes, and 29 wastewater pumping stations. The Town operates two water reclamation facilities (WRFs), the North Cary WRF and the South Cary WRF. Together, the two WRFs treated approximately 12.3 million gallons per day (mgd) of wastewater in Fiscal Year 2003. Figure 3-2 in Section 3.0 shows the Town of Cary's existing wastewater collection system, including pump stations and their associated force mains. The location of the two water reclamation facilities and RDU International Airport, RTP South and Town of Morrisville boundaries are also shown on Figure 3-2.

The Town of Cary wastewater collection system is currently divided into three basins, the North Basin, the South Basin and the West Basin. The West Basin includes areas that drain to the Cape Fear River Basin. Wastewater from these areas is currently pumped to the North Basin for treatment at the North Cary WRF, which is in the Neuse River Basin. The dividing line between the North and South Basins closely follows the natural east-west ridge that crosses the Town of Cary, as shown on Figure 3-2.

The main gravity interceptor to the North Cary WRF is the Crabtree Creek Interceptor. The North Cary System contains 15 pump stations, including four pump stations in the West Basin for which flows are currently pumped to the North Cary WRF. Bond Park Pump Station is a small manhole pump station with submersible sump pumps. The I-40 Pump Station is the only pump station utilizing a wet well/dry well arrangement; the other pump stations utilize a wet well only, with submersible pumps. Kit Creek Pump Station employs two duty and one standby pump.

The main gravity interceptor to the South Cary WRF is the Camp Branch Interceptor. The South Cary System contains 14 pump stations. All 14 pump

stations utilize a wet well only, with submersible pumps. Swift Creek and Walnut Creek Pump Stations employ two duty pumps and one standby pump; the remaining pump stations utilize one duty and one standby pump. Table E-3 lists pipeline sizes and corresponding lengths for the gravity lines and force mains for the combined North and South Basins.

The combined North and South collection systems for the Town of Cary include approximately 5,800 inch-miles of gravity sewers and interceptors. A list of major interceptors and the years in which they were constructed is included in Table E-4. The main interceptors for the Town of Cary include the Crabtree Creek Interceptor, which conveys wastewater flow to the North Cary WRF; the Walnut Creek Interceptor, which conveys flow to the Walnut Creek Pump Station; the Swift Creek Interceptor, which conveys flow to the Swift Creek Pump Station; and the Camp Branch Interceptor, which conveys flow to the South Cary WRF.

TABLE E-3
Cary Wastewater Collection System Gravity Lines and Force Mains

	Length (Miles)	
Pipe Diameter (inches)	**Gravity Lines**	**Force Mains**
1	—	0.16
2	—	2.70
3	—	1.42
4	0.07	4.20
6	2.70	4.11
8	484.58	3.99
9	0.12	—
10	8.06	8.15
12	20.29	0.75
14	1.53	3.31
15	7.30	1.75
16	2.60	3.23
18	10.05	2.99
20	0.52	3.98
21	3.53	—
24	13.01	2.83
27	0.51	—
30	10.53	—
36	3.28	4.38
40	0.66	—
42	4.16	—
48	3.03	—
54	0.57	—
TOTAL	577.11	47.94

TABLE E-4
Construction Dates for Major Cary Interceptors

Interceptor	Basin	Year Constructed	Comments
Crabtree Creek	North	1986	
Black Creek	North	1982	
Coles Branch	North	1987	From old Dixon Ave. plant site to Crabtree Creek Interceptor
Walnut Creek	South	1964	
Upper Swift Creek	South	1982	From north of U.S. 1/64 to vicinity of Regency
Upper Swift Creek	South	1985	From MacGregor Downs to north of U.S. 1/64
Long Branch	South	1989	
Lynns Branch	South	1989	Except for major repair sections around east side of Lochmere Lake (1998)
Speight Branch	South	1991	From Spring Hollow Lane to Swift Creek Interceptor
Swift Creek	South	1988	From vicinity of Regency to pump station
Camp Branch	South	1989	

The collection system pump stations convey wastewater to gravity lines in areas where gravity flow is not possible. The oldest pump station in the Town of Cary system is approximately 27 years old. Information on the existing pump stations in the Town of Cary collection system is presented in Table E-5. Note that the Walnut Creek Pump Station can send flow to either the North Cary WRF or the South Cary WRF and is currently configured to go to the South Cary WRF. Twenty-four of the pumping stations are equipped with supervisory control and data acquisition (SCADA) equipment.

TABLE E-5
Existing Cary Wastewater Pump Stations

Pump Station	Number of Pumps	Firm Pumping Capacity (gpm)[1]	Year Put On-Line	Condition
Blanche Drive	2	303	1984	Excellent
Bond Park	2	N/A	N/A	Excellent
Brooks Park	2	N/A	2001	Excellent
Cary Park	2	1,145	1998	New
Carystone	2	171	1980	Excellent
Crossroads	2	362	1992	Excellent
Fairfield Inn	2	61	1978	Good
Fieldstone	2	552	1994	Good
Gateway Center	2	507	1985	Good
Glenmitt Stone[3]	2	105	1999	Excellent
Glenridge	2	462	1998	Excellent
Holly Brook	2	145	1997	Excellent
I-40	2	675	1982	Good
Jones Franklin Road	2	624	1987	Good
Kensington	2	160	2001	Excellent
Kit Creek	3	2,757	1991	Excellent
MacGregor Park[3]	2	179	1979	Good
Medfield	2	745	1984	Excellent
Nelson Road	2	1,016	1990	Good
RDU Center	2	228	1985	Excellent

TABLE E-5
Existing Cary Wastewater Pump Stations

Pump Station	Number of Pumps	Firm Pumping Capacity (gpm)[1]	Year Put On-Line	Condition
Reedy Creek	2	33	1984	Good
Rocky Branch	2	247	1998	Excellent
Ronaldsby Drive[3]	2	178	1981	Excellent
Swift Creek[2]	3	10,319	1988	Good
Talloway Drive	2	142	1980	Excellent
Thresher Court	2	142	1984	Good
Walnut Creek	3	4,668	1989	Good
Westwood Park	2	50	2000	Excellent
White Oak	2	1,135	1991	Good

[1] Based on pump drawdown tests conducted for the Town of Cary Wastewater Collection System Master Plan, June 2003.
[2] A fourth pump is available for standby use. The fourth pump has a capacity of approximately 6,275 gpm based on drawdown tests.
[3] Pump capacity based on data provided by the Town of Cary.

According to the Town of Cary's Sanitary Sewer Overflow Summary for Fiscal Year 2003, there were 17 sanitary sewer overflows (SSOs) during that fiscal year, as noted in Table E-6. The overflows ranged from less than 1 gallon to 18,850 gallons. The majority of the overflows were caused by grease or a combination of grease and roots.

TABLE E-6
Reported Cary SSOs For the Fiscal Year 2003

Date	Total gallons	Location	Cause
September 16, 2002	360	515 Potomac Grove Place	Grease and Debris
October 11, 2002	6,480	1100 Buck Jones Road	Surcharge due to rain
October 11, 2002	2,930	110 W. Circle Drive	Surcharge due to rain
October 11, 2002	0	Kit Creek Pump Station	
October 15, 2002	1,000-2,500	130 Evans Road	Unknown
November 29, 2002	420	1016 Plantation Drive	Grease
December 5, 2002	5,850	411 Baker Road	Power loss due to storm
January 26, 2003	3,546	111 Shady Creek Trail	Grease
January 28, 2003	4,812	116 Gregory Drive	Partial collapse outside manhole, clay pipe broke away
February 2, 2003	3,546	111 Shady Creek Trail	Roots
February 17, 2003	1,626	106 Turquoise Creek Drive	Grease
February 22, 2003	1,500 – 1,800	1100 Buck Jones Road	Pump tripped at breaker panel
March 5, 2003	297	317 Arrundale Drive	Roots and Grease
March 6, 2003	18,850	4139 Mitt Glen Lane	Grease
April 15, 2003	346	Golf Course at Annandale Drive	Roots and Grease
May 2, 2003	600	Intersection of Sudbury & Maynard	Rocks and paper towels
May 13, 2003	6,040	Behind 132 Luxon Place	Grease
TOTALS	58,203 – 60,003		

There are a significant number of unsewered areas that are entirely surrounded by the Town of Cary service area but are not within the Town limits. The

estimated population of these areas is approximately 12,500 persons. Those areas that qualify for annexation are continually being considered for annexation and all of the current unsewered population is projected to be within the service area by around 2013.

E.1.3 Town of Holly Springs

The Town of Holly Springs wastewater collection system consists of approximately 94 miles of gravity sewer, 16 miles of force mains, and 21 pump stations. All of the wastewater is treated at the Utley Creek WWTP. The Utley Creek WWTP treated approximately 0.9 million gallons per day (mgd) of wastewater in Fiscal Year 2003. Figure 3-3 in Section 3.0 shows the Town of Holly Springs existing wastewater collection system, including gravity lines, and pump stations and their associated force mains, and the location of the Utley Creek WWTP.

Table E-7 lists gravity pipeline sizes and their corresponding lengths for the Holly Springs wastewater collection system. The collection system for the Town of Holly Springs includes approximately 786 inch-miles of gravity sewers and interceptors. A list of major interceptors, the years in which they were constructed, and their condition are included in Table E-8. The main gravity interceptors to the Utley Creek WWTP are the parallel Utley Creek WWTP interceptors. The first interceptor was a 12-inch-diameter constructed in 1990 and is in poor condition. A parallel 16-inch-diameter interceptor was constructed in 1998 and is in good condition.

TABLE E-7
Holly Springs Wastewater Collection System – Gravity Lines

Pipe Diameter (inches)	Length (Miles)
Unknown[1]	0.269
8	88.346
12	2.510
16	0.864
18	0.581
20	0.013
21	1.083
24	0.003
TOTAL	93.669

[1]Unknown sewer diameter sizes were assumed to be 8-inch-diameter.

TABLE E-8
Construction Dates for Major Holly Springs Interceptors

Interceptor	Year Constructed	Condition
Warp Tech Pump Station	1990	Poor
Utley Creek WWTP (old)	1990	Poor
Utley Creek WWTP (new)	1998	Good
Oak Hall Pump Station	1995	Fair
Middle Creek	1995	Good
Basal Creek	1998	Good
Fair Share	2001	New

The collection system pump stations convey wastewater to gravity lines in areas where gravity flow is not possible. All pumping stations are equipped with an emergency generator. The house stations are located in personal residences and vary in pumping rate from 50 to 80 gpm. Information on the existing pump stations in the Town of Holly Springs collection system, including the number of pumps, pumping capacity, year the pump station was put on-line, and the pump station condition, is presented in Table E-9. Seven of the 21 pumping stations are equipped with a telemetry dialer, and one (Middle Creek) is equipped with a cell phone.

Holly Springs reported three sanitary sewer overflows for Fiscal Year 2003. The first overflow occurred on November 4, 2002, at the Oakhall PUD Pump Station, where approximately 5,000 gallons overflowed as a result of vandalism. The second overflow occurred on November 5, 2002, at 512 Bass Lake Road where approximately 1,500 gallons escaped when a contractor broke a force main. The third overflow occurred on March 8, 2003 at the outfall adjacent to Highway 55. Approximately 4500 gallons overflowed due to paper and mud blocking the manhole discharge.

TABLE E-9
Pump Stations in Holly Springs Wastewater Collection System

Pump Station	Number of Pumps	Pumping Capacity[3] (gpm)	Year Put On-Line	Condition
Sunset Ridge[1]	2	2400	2003	Good
Bass Lake[1]	2	1400	2000	Good
Oakhall PUD[1]	2	800	1994	Fair
Somerset Farms[1]	2	600	1997	Fair
Maple Street[1]	2	120	1984	Fair
Easton Acres	2	120	1987	Poor
NC 55	2	200	1987	Poor
New Hill Road	2	220	1987	Poor
Warp Tech.	2	700	2000	Fair
Braxton Village[1]	2	1200	1997	Fair
Sunset Lake Village	2	200	2003	Good
Middle Creek[2]	2	1200	2003	Good

TABLE E-9
Pump Stations in Holly Springs Wastewater Collection System

Pump Station	Number of Pumps	Pumping Capacity[3] (gpm)	Year Put On-Line	Condition
Turner Road[1]	2	300	2003	Good
Autumn Trace	2	250	2002	Good
House Station [1]	-	75	1984	Fair
House Station 2	-	75	1984	Fair
House Station 3	-	75	1984	Fair
House Station 4	-	75	1984	Fair
House Station 5	-	75	1984	Fair
House Station 6		50	1984	Very Poor
House Station 9	-	80	1984	Poor

Source: Town of Holly Springs
[1]Equipped with telemetry dialer
[2]Equipped with cell phone
[3]Both pumps operating

E.1.4 Town of Morrisville

The Town of Morrisville's wastewater collection system consists of over 70 miles of gravity sewers, and 11 pump stations with their respective force mains. Except for four developments in Morrisville that discharge wastewater directly to the Cary system, the wastewater flow in Morrisville is collected and routed through a series of interceptors to the State Road (Aviation Parkway) Pump Station and the Perimeter Park Pump Station. From these pumping stations, the wastewater is pumped to interceptors owned by Cary that convey the wastewater to the North Cary WRF. Figure 3-4 in Section 3.0 shows the Town of Morrisville's existing wastewater collection system, including gravity lines, pump stations and their associated force mains.

Table E-10 lists gravity pipeline sizes and their corresponding lengths for the Morrisville wastewater collection system. The collection system for the Town of Morrisville includes approximately 647 inch-miles of gravity sewers and interceptors.

The collection system pump stations convey wastewater to gravity lines in areas where gravity flow is not possible. All of the pump stations utilize a wet well with vacuum-primed non-clog pumps. Information on the existing pump stations in the Town of Morrisville's collection system, including the number of pumps, design flow, and the year the pump station was put on-line is presented in Table E-11. All pumping stations are equipped with SCADA equipment.

The Morrisville wastewater collection system experienced three sanitary sewer overflows in 2000 and 2001, the largest of which was approximately

63,150 gallons, while the other two were 50 gallons and between 3,000 and 5,000 gallons, respectively.

TABLE E-10
Morrisville Wastewater Collection System – Gravity Lines

Pipe Diameter (inches)	Length (Miles)
2	0.41
4	1.64
6	1.05
8	29.33
10	2.23
12	2.56
15	1.96
16	2.02
18	1.52
20	0.11
24	1.63
48	0.16
Unverified[1]	25.91
TOTAL	70.53

[1]Unknown sewer diameter sizes were assumed to be 8-inch-diameter.

TABLE E-11
Pump Stations in Morrisville Wastewater Collection System

Pump Station	No. of Pumps	Design Flow (gpm)	Year Put On-Line
State Road (Aviation Parkway)	2	3,500	1996
Perimeter Park	2	3,500	1996
Lake Crabtree	2	98	
Paramount Center	2	400	1999
Barbee Road	2	85	
Hamlet	2	92	2002
Alta Seasons	2	351	2000
Lower Breckenridge	2	747	2000
Upper Breckenridge	2	250	2000
Terrace II	2	120	2002
Wexford	2	189	2003

Source: Town of Morrisville

E.2 EXISTING TREATMENT SYSTEMS

E.2.1 Town of Apex

Wastewater from the Town of Apex is treated at the Middle Creek WWTP, which has a design capacity of 3.6 mgd. A summary of the Middle Creek WWTP design

data is provided in Table E-12. Description of the process units at the Middle Creek WWTP are provided in the following sections.

Liquid Treatment Train

Bar Screens

Raw wastewater enters the bar screen structure from a 36-inch gravity sewer. Two mechanically cleaned screens, one mesh-type and one climber-type, each with a clear opening of ¼ inch, are provided. The mesh screen has a capacity of 3.6 mgd and the climber screen has a capacity of 4.5 mgd. A single screw-type screenings compactor is provided to dewater and convey the screenings to a dumpster. The screenings are disposed of in a landfill.

Grit Collectors

Two stirred vortex grit collectors are provided after the bar screens. A grit pump is provided for each grit collector to convey the grit to a single screw-type grit classifier, which removes the excess water and deposits the dewatered grit in a dumpster. The dewatered grit is disposed of in a landfill.

Influent Pump Station

Screened and degritted raw wastewater is conveyed by gravity to the influent pump station wet well. Four variable speed submersible pumps are provided in the wet well to lift the raw wastewater to an elevation sufficient so that it can be conveyed by gravity through the remainder of the plant. Each pump has a capacity of 1,834 gpm, and the firm capacity of the pump station is 7.9 mgd. A magmeter is provided on the pump discharge header to measure the plant raw wastewater flow rate.

TABLE E-12
Apex Middle Creek Wastewater Treatment Plant Design Data

Plant Influent Characteristics		
Design average daily flow	3.6 mgd	
Design maximum instantaneous flow	7.91 mgd	
Average day influent BOD_5	250 mg/L	
3-month maximum influent BOD_5	314 mg/L	
Average day influent TSS	270 mg/L	
3-month maximum influent TSS	346 mg/L	
Average day influent NH_3-N	18.5 mg/L	
3-month maximum influent NH_3-N	22.8 mg/L	
Average day influent Total N	40 mg/L	
3-month maximum influent Total N	-	
Average day influent Total P	5 mg/L	
3-month maximum influent Total P	5.1 mg/L	
Bar Screens		
Number of mechanically-cleaned screens	2	
	Screen No. 1	Screen No. 2
Type	Mesh	Climber
Clear opening between bars	1/4 in.	
Maximum capacity of each screen, mgd	3.6	4.5
Horsepower	0.5	1.0
Number of screenings compactors	1	
Type of screenings compactor	Screw	
Number of manually-cleaned screens	1	
Method of screenings disposal	Landfill (by contract)	
Grit Collectors		
Number	2	
Type	Stirred vortex	
Diameter		
Capacity, each	7.91 mgd	
Motor horsepower	¾	
Grit Pumps		
Number per grit collector	1	
Capacity, each		
Horsepower	5	
Grit Classifier		
Number	1	
Type	Screw	
Method of grit disposal	Landfill (by contract)	
Influent Pump Station		
Number of pumps	4	
Type of pump	Submersible	
Maximum capacity of each pump	1,834 gpm	
Firm capacity	7.9 mgd	
Total dynamic head	32 ft.	
Horsepower	25	
Type of drive	Variable speed	
Influent Flow Measurement		
Number	1	
Type	Magmeter, ultrasonic	
Size	12 in.	

TABLE E-12
Apex Middle Creek Wastewater Treatment Plant Design Data

Aeration Tanks		
Number	3 (Including one anoxic and two aerobic tanks)	
Type	Oxidation ditch	
Dimensions		
Length	ft.	
Width	ft.	
Depth	14 ft.	
Volume, each tank	900,000 gal.	
Volume, total	2.7 mil. gal.	
Detention time at design flow	18.0 hr.	
Aeration System		
Type	Brush aerators	
	Ditches 1 & 2	Ditch 3
Number of brushes per tank	3	2
Horsepower	40/20.67	50
Type of drive	Two-speed	Variable speed
Mixed Liquor Recycle Pumps		
Number	3	
Type	Submersible	
Capacity, each	7,443 gpm	
Total dynamic head	12 ft.	
Firm capacity	21.4 mgd	
Horsepower	90	
Drive type	Variable speed (2), constant speed (1)	
Secondary Clarifiers		
Number	4	
Type	Center feed	
Diameter	55 ft.	
Sidewater depth	12 ft.	
Surface area, each	2,376 $ft.^2$	
Total surface area	9,500 $ft.^2$	
Surface overflow rate at design flow	380 $gpd/ft.^2$	
Type of solids removal	Suction	
Type of scum removal	Skimmer arm and scum beach	
Scum Pump Station		
Number of pumps	2	
Type	Submersible	
Capacity, each	214 gpm	
Total dynamic head	17.2 ft.	
Horsepower	3	
Return Activated Sludge (RAS) Pump Stations		
Number of stations	2	
Number of pumps per station	2 (plus one spare pump for each)	
Type	Submersible	
Capacity, each	630 gpm	
Total dynamic head	22.3 ft.	
Firm capacity	3.6 mgd	
Horsepower	7.5	
Drive type	Variable speed	

TABLE E-12
Apex Middle Creek Wastewater Treatment Plant Design Data

Chemical Feed Facilities		
	Caustic	**Alum**
Storage Tanks		
Number	1	1
Type	Aboveground	
Volume		7,500 gal.
Feed Pumps		
Number	2	2
Type	Metering	
Capacity, each		
Horsepower		1/2
Drive type		

Tertiary Filters		
Number	4	
Type	Traveling bridge	
	Filters 1 & 2	Filters 3 & 4
Dimensions		
Length, ft.	28	32
Width, ft.	12.5	12.5
Surface area, each, $ft.^2$	350	400
Total surface area	1,500 $ft.^2$	
Hydraulic loading rate at design flow	1.7 $gpm/ft.^2$	
Media type	Sand	
Media depth, in.	11	
Backwash Pumps		
Number per filter	2 (Including washwater pump)	1
Type	Submersible	
Capacity, each, gpm	150	
Horsepower	3	5
Drive type	Constant speed	
Backwash supply	Filter effluent	
Scum Pumps		
Number per filter	1	-
Type		-

Ultraviolet (UV) Disinfection Facilities	
Number of channels	1
Dimensions	
Length	
Width	
Water depth	
Maximum flow rate	8 mgd
Type of lamps	Medium pressure (Trojan UV 4000)
Number of lamp banks	2
Number of lamps per lamp bank	12
Total number of lamps	24

TABLE E-12
Apex Middle Creek Wastewater Treatment Plant Design Data

Effluent Flow Measurement			
Number	1		
Type	Parshall flume		
Throat width	18 inches		
Capacity	12 mgd		
Post Aeration			
Number	2		
Type	Cascade		
Number of steps	8		
Total fall, ft.	9.5		
Aerobic Digesters/Holding Tanks			
Number	3		
	Digester No. 1	Digester No. 2	Digester No. 3
Diameter, ft.	50	70	105
Sidewater depth, ft.	17	16	14
Volume, each, gal.	250,000	500,000	1,000,000
Total volume	1.75 mil. gal.		
Detention time at design sludge production	days		
Type of aeration/mixing systems	Mechanical, surface		
Number of aerators per digester	1	1	1
Aerator horsepower			
Number of mixers per digester	-	-	3
Decant/Transfer/Truck Loading Pumps			
	Digesters 1 & 2	Digester 3	
Number	2	2	
Type	Self-priming	Self-priming	
Capacity, each, gpm	500	500	
NPW Pumps			
Number	2		
Type	Vertical turbine		
Horsepower	10		
Emergency Generators			
Number	3		
Type	Diesel		
Rating	1 @ 200, 1 @ 400, 1 @ 500 kW		

Aeration Tanks

Three oxidation ditches are provided for biological nutrient removal (BNR). The three tanks provide a combined detention time of 18.0 hours at the design flow. The first tank (Ditch 3) is an anoxic ditch, and is provided with two brushes, each powered by a variable speed motor which allows the operator to reduce the brush speed to maintain a low DO to provide anoxic conditions. In the anoxic phase, the microorganisms remove nitrogen by converting the nitrates to nitrogen gas, which is then released to the atmosphere. The second and third tanks (Ditches 1 and 2) are aerobic ditches and are provided with three two-speed brushes per tank. The brushes introduce oxygen to the mixed liquor to maintain aerated conditions. In the aerobic phase in the presence of dissolved oxygen (DO), the microorganisms oxidize influent BOD and convert ammonia to nitrate. Three submersible mixed liquor recycle pumps are provided to return nitrates from the second and third ditches to the anoxic ditch. The pumps have a firm capacity of 21.4 mgd. Two of the pumps are variable speed pumps and the third is a constant speed pump.

Secondary Clarifiers

The aeration tank effluent is conveyed to four secondary clarifiers. The secondary clarifiers provide a settled activated sludge to return to the oxidation ditches, and a clarified effluent which is conveyed to the tertiary filters. The secondary clarifiers provide a surface overflow rate of 380 gpd/ft^2 at the plant design flow rate.

RAS Pump Stations

Two RAS pump stations are provided to convey settled return activated sludge from the secondary clarifiers to the oxidation ditches and waste activated sludge to the aerobic digesters. Each RAS pump station is dedicated to two of the secondary clarifiers. Three submersible pumps (two duty and one spare) are provided for each pump station. The firm pumping capacity of the two pump stations is 3.6 mgd.

Scum Pump Station

A scum pump station is provided to convey the scum and grease removed by the skimmer arms of the secondary clarifiers to the aerobic digesters/holding tanks. Two submersible scum pumps are provided.

Tertiary Filters

Four traveling bridge sand filters are provided to remove additional solids from the secondary clarifier effluent. The filters have a total surface area of 1,500 $ft.^2$, for a hydraulic loading rate at design flow conditions of approximately 1.7 $gpm/ft.^2$. Filter backwash is returned to the head of the plant for treatment with the influent wastewater.

Ultraviolet (UV) Disinfection Facilities

The filtered effluent flows to the ultraviolet disinfection facilities, which use ultraviolet (UV) radiation to accomplish disinfection. One UV disinfection channel is provided, with two banks of medium pressure UV lamps in the channel. The UV channel has a maximum capacity of 8 mgd. The disinfected effluent flows through a Parshall flume for effluent flow measurement prior to the cascade aerators.

Cascade Aeration

Two cascade aerators are provided to increase the effluent DO to meet the plant effluent DO limit of 5.0 mg/L. Each cascade aerator has 8 steps for a total fall of 9.5 feet. After the cascade aerators, the plant effluent is discharged to Middle Creek.

Solids Handling Facilities

Aerobic Digesters/Holding Tanks

Waste activated sludge is pumped from the RAS pump stations to three aerobic digesters/holding tanks for sludge stabilization and storage prior to land application. The digesters have a total volume of 1.75 million gallons. The total storage time at annual average flow conditions is 77 days. Each digester is provided with a single mechanical surface aerator. The aeration system for the aerobic digesters is periodically stopped to promote sludge thickening through gravity settling. The biosolids in the aerobic digesters/holding tanks is typically thickened to a solids concentration of approximately 2.5 percent before hauling.

Decant/Transfer/Truck Loading Pumps

Two pump stations are provided to convey supernatant and digested biosolids from the aerobic digesters. One pump station is dedicated to Digesters 1 and 2, and contains two pumps. The other pump station is dedicated to Digester 3, and also contains two pumps. The pumps are used to return supernatant to the head of the WWTP for treatment in the liquid process train, and to transfer the

stabilized, thickened digested sludge (biosolids) to tanker trucks. The tanker trucks convey the sludge to privately-owned agricultural land for land application by a biosolids management contractor. Compliance with Class B requirements of the federal 40 CFR Part 503 sewage sludge regulations is monitored prior to land application by testing for fecal coliforms for pathogen reduction and specific oxygen uptake rate (SOUR) for stabilization (vector attraction reduction).

E.2.2 Town of Cary

Wastewater generated in the Town of Cary is treated at the North Cary WRF and the South Cary WRF, which have design capacities of 10 and 12.8 mgd, respectively. A summary of design data for the North Cary WRF is provided in Table E-13. Descriptions of the process units at the North Cary WRF are provided in the following sections.

Liquid Treatment Train

Coarse Bar Screen

Raw wastewater enters the coarse bar screen structure from the Crabtree Creek and Harrison Oaks Interceptors. One mechanically-cleaned screen is provided, with a clear opening between bars of 1.0 inch and a flow capacity of 30 mgd. A manual bypass screen is provided for use when the mechanical screen is out of service.

Influent Pump Stations

Screened wastewater enters the two influent pump stations. Influent Pump Station No. 1 consists of two wet wells and four influent pumps in a dry well. The pumps are variable speed and each pump has a capacity of 3,500 gpm. Influent Pump Station No. 2 consists of two wet wells, with two submersible pumps in one wet well and one submersible pump in the other wet well. The second wet well includes space for a future pump. The pumps in Influent Pump Station No. 2 are also variable speed pumps and each has a capacity of 3,500 gpm. The firm capacity of the two influent pump stations is 30.2 mgd. The influent pump stations lift the influent wastewater to a level at which it can flow by gravity through the remainder of the plant.

Fine Bar Screens

Raw wastewater from the influent pump stations passes through a Parshall flume for influent flow measurement before entering the second set of bar screens at the main plant site. Two mechanically-cleaned fine screens are provided, each

TABLE E-13
North Cary WRF Existing Facilities Design Data

Influent Wastewater Characteristics		
Design average daily flow, mgd	10	
Design peak daily flow, mgd	20	
Design influent BOD5, mg/L	250	
Design influent TSS, mg/L	300	
Design influent NH3-N, mg/L	24	
Design influent TKN, mg/L	35	
Design influent Total P, mg/L	7	
Coarse Bar Screen		
Number	1	
Type	Mechanically-cleaned	
Channel width, ft.	4.75	
Clear opening between bars, inches	1.0	
Capacity, mgd	30	
Number of manual bypass screens	1	
Method of screenings disposal	Landfill (by contract)	
Influent Pump Stations		
Number of pump stations	2	
	Influent Pump Station No. 1	Influent Pump Station No. 2
Number of pumps	4	3
Type	Centrifugal	Submersible, non-clog
Capacity, each, gpm	3,500	
Total dynamic head, ft.	150	
Firm capacity, mgd	30.2	
Horsepower	200	
Type of drive	Variable speed	
Influent Flow Measurement		
Number	1	
Type	Parshall flume	
Throat width, ft.	3.0	
Fine Bar Screens		
Number	2	
Type	Mechanically-cleaned	
Channel width, ft.	4.0	
Clear opening between bars, inches	1/2	
Number of manually-cleaned screens	1	
Method of screenings disposal	Landfill (by contract)	
Grit and Grease Basins		
Number	2	
Type	Aerated	
Dimensions at water surface for grit chambers		
Length, ft.	52	
Width, ft.	9.5	

TABLE E-13
North Cary WRF Existing Facilities Design Data

Grease section width, ft.	8.0
Maximum depth, ft.	12.5
Volume (grit section), each basin, gal.	41,035
Total volume (grit section), gal.	82,070
Detention time at 10 mgd, min.	11.8
Design peak daily flow, each basin, mgd	13.5
Grit Pumps	
Number	2
Type	Vortex
Capacity, each, gpm	150
Horsepower	3
Grit Classifer	
Number	1
Type	Screw
Grit Basin Blowers	
Number	3
Type	Vortex
Capacity, each, cfm	100
Horsepower	6.4
Method of grit disposal	Landfill (by contract)
Method of grease disposal	Composting (by contract)
Aeration Basins	
Number	2
Dimensions	
Length, ft.	169.83
Width, ft.	141.33
Depth (oxidation ditch), ft.	18.0
Volume, each basin, mil. gal.	3.82
Total volume, mil. gal.	7.63
Detention time at 10 mgd, hours	18.3
Anaerobic Zone	
Number of stages per basin	4
Volume, each stage, mil. gal.	0.093
Total volume, both basins, mil. gal.	0.744
Detention time at 10 mgd, hours	1.8
Aerobic Zone/Oxidation Ditch	
Number of ditches per basin	2
Volume, each ditch, mil. gal.	1.5
Total volume, both basins, mil. gal.	6.0
Detention time at 10 mgd, hours	14.4
Anoxic Zone	
Number of stages per basin	3
Volume, each stage, mil. gal.	0.111
Total volume, both basins, mil. gal.	0.666
Detention time at 10 mgd, hours	1.6
Reaeration Zone	
Number of stages per basin	1
Volume, each basin, mil. gal.	0.111
Total volume, both basins, mil. gal.	0.222

TABLE E-13
North Cary WRF Existing Facilities Design Data

Detention time at 10 mgd, hours	0.5
Anaerobic Zone Mixing System	
Number of mixers per stage	1
Type	Submersible, propeller
Horsepower	4.9
Aerobic Zone Aeration System	
Number of aerators per ditch	4
Type	Brush rotor
Horsepower	60
Aerobic Zone Mixing System	
Number of mixers per ditch	2
Type	Submersible, propeller
Horsepower	9.0
Anoxic Zone Mixing System	
Number of mixers per stage	1
Type	Submersible, propeller
Horsepower	6.5
Reaeration Zone Aeration System	
Type	Diffused air
Type of diffusers	Coarse bubble
Number of diffusers per basin	66
Reaeration Zone Blowers	
Number	2
Type	Positive displacement
Capacity, each, scfm	245
Horsepower	20
Secondary Clarifiers	
Number	2
Diameter, ft.	130
Sidewater depth, ft.	14
Surface area, each, $ft.^2$	13,270
Total surface area, $ft.^2$	26,540
Overflow rate at 10 mgd, $gpd/ft.^2$	380
RAS/WAS Pump Station	
RAS Pumps	
Number of pumps	4
Type	Submersible
Capacity, each, gpm	3,500
Firm capacity, mgd	15.1
Horsepower	40
Drive type	Variable speed
WAS Pumps	
Number	2
Type	Submersible
Capacity, each, gpm	500-700 (pump to digesters or to gravity belt thickeners)
Horsepower	20
Drive type	Variable speed

TABLE E-13
North Cary WRF Existing Facilities Design Data

Tertiary Filters	
Number	12
Type	Continuous backwash, upflow, four-cell
Dimensions	
Length, ft.	14.17
Width, ft.	14.17
Surface area, each, $ft.^2$	200
Total surface area, $ft.^2$	2,400
Hydraulic loading rate at 10 mgd, $gpm/ft.^2$	2.88
Media type	Sand
Media depth, ft.	11.0
Backwash type	Compressed air
Design airflow per filter cell, scfh	120
Air Compressors	
Number	2
Type	Scroll
Capacity, each, scfm	230
Horsepower	60
Drive type	Constant speed
Effluent Flow Measurement	
Number	1
Type	Parshall flume
Throat width, ft.	2.5
UV Disinfection Facilities	
Number of UV disinfection channels	1
Type of lamps	Medium pressure (Trojan UV 4000)
Number of lamps banks per channel	2
Number of lamps per bank	30
Total number of lamps	60
Post Aeration	
Number	1
Type	Cascade
Number of steps	7
Total vertical fall, ft.	7.6
Gravity Belt Thickeners	
Number	2
Belt width, meters	2.0
Design hydraulic loading rate, each, gpm	500
Aerobic Digesters	
Number	3

TABLE E-13
North Cary WRF Existing Facilities Design Data

Dimensions	Digesters No. 1 and 2	Digester No. 3
Diameter, ft.	81	146
Sidewater depth, ft.	16.0	16.2
Volume, each, gal.	616,700	2,030,000
Total volume, gal.	3,263,400	
Aeration System		
Type	Diffused air	
Diffuser type	Fine bubble membrane	
Number of diffusers per digester	1,238	2,400

Aerobic Digester Blowers		
Number	2	1
Type	Multi-stage, centrifugal	
Capacity, each, scfm	4,200	5,800
Firm capacity, scfm	4,200	—
Discharge pressure, psig	9.54	9.54
Horsepower	200	300

Emergency Generators	
Number	4
Type	Diesel
Capacity, each, kW	2 @ 600, 1 @ 1,000, 1 @ 1,500

of which has a clear opening between bars of 1/2 inches. A manual bypass screen is also provided at the bar screen structure. The screenings are disposed of a landfill.

Grit and Grease Basins

Two aerated grit and grease basins are provided after the fine bar screens. The collected grit is pumped to a screw-type grit classifier which removes the excess water and deposits the dewatered grit in a dumpster. Grease is skimmed from the top surface of the grit collectors and deposited in a collection box. The skimmed grease is composted by a contractor. The dewatered grit is disposed of in a landfill.

Aeration Basins

Two aeration basins provide biological nutrient removal (BNR) for the screened and degritted influent wastewater. Each BNR aeration basin includes five stages to provide biological removal of phosphorus and nitrogen, as well as carbonaceous BOD removal. These include a four-stage anaerobic selector; two oxidation ditches designed for a series flow pattern and alternating aerobic and anoxic conditions; a three-stage secondary anoxic zone; and a single-stage reaeration zone. Raw wastewater enters the four-stage anaerobic selector and remains in each cell for approximately 30 minutes, for a total anaerobic detention time of approximately 2 hours. Low velocity submersible mixers maintain solids in suspension and minimize turbulence. Return activated sludge (RAS) is introduced in the first anaerobic stage prior to mixing with the influent wastewater in the second anaerobic stage. Anaerobic conditioning of the mixed liquor promotes the growth of the microorganisms necessary for phosphorus removal in the later stages.

After leaving the anaerobic selector, the mixed liquor flows into the phased isolation oxidation ditches for BOD removal and biological nitrogen and phosphorus removal. Conditions in the ditches alternate between aerobic and anoxic in order to achieve nitrification and denitrification without internal recycle pumping. Aerobic conditions are maintained by brush rotor surface aerators. In the aerobic phase in the presence of dissolved oxygen (DO), the microorganisms convert ammonia to nitrate. In the anoxic phase, the microorganisms convert nitrates to nitrogen gas, which is then released to the atmosphere.

After the wastewater leaves the oxidation ditches, the total nitrogen concentration is further reduced in the three-stage anoxic reactor. Following this anoxic zone,

the wastewater passes through a reaeration zone before entering the secondary clarifiers.

Secondary Clarifiers

The aeration basin effluent is conveyed to two secondary clarifiers. The secondary clarifiers provide a settled activated sludge for return to the anaerobic selector and a clarified effluent, which is conveyed to the effluent filters. The two secondary clarifiers provide a surface overflow rate of approximately 380 gpd/ft.^{2} at the plant design flow rate.

RAS/WAS Pump Station

The RAS/WAS Pump Station conveys settled activated sludge from the secondary clarifiers to the anaerobic selector and to the gravity belt thickeners or aerobic digesters. Four submersible RAS pumps are provided, each with a capacity of 3,500 gpm. The firm capacity for RAS pumping is approximately 15.1 mgd. Two submersible WAS pumps, each of which has a maximum capacity of 700 gpm, are provided for pumping settled solids to the gravity belt thickeners.

Effluent Filters

Twelve continuously backwashing, upflow sand filters are provided to remove additional solids from the secondary clarifier effluent. Internal airlift and washer sections use filtrate to continuously clean the dirty sand. Each filter has four cells and has a surface area of 200 ft.^{2}, for a total surface area of 2,400 ft.^{2}. The hydraulic loading rate at design flow conditions is approximately 2.9 gpm/ft.^{2}. The filter backwash water is returned to the head of the plant for treatment with the influent wastewater. The filter effluent passes through a Parshall flume for effluent flow measurement prior to disinfection.

Ultraviolet Disinfection Facilities

Disinfection is accomplished by ultraviolet (UV) irradiation in one UV disinfection channel. The UV channel contains two banks of medium pressure UV lamps, with 30 lamps in each UV lamp bank, for a total of 60 lamps.

Cascade Aeration

One cascade aerator is provided to increase the effluent DO to meet the DO limit of 5.0 mg/L in the plant NPDES Permit. The cascade aerator has seven steps, for a total fall of approximately 7.6 feet. After the cascade aerator, the plant effluent is discharged to Crabtree Creek.

Solids Handling Facilities

Gravity Belt Thickeners

Two gravity belt thickeners (GBTs) are provided in thicken the waste activated sludge from the secondary clarifiers prior to stabilization in the aerobic digesters. The GBTs thicken the solids from approximately 0.5 percent solids to approximately 2.5 percent solids. Each gravity belt thickener has a belt width of 2.0 meters, and has a maximum hydraulic loading rate of 500 gpm. The filtrate from the GBTs in returned to the head of the plant for treatment in the liquid treatment process.

Aerobic Digesters

Three aerobic digesters are provided for stabilization and storage of waste activated sludge prior to beneficial use. The aerobic digesters provide solids stabilization and volume reduction by destruction of volatile solids.

Thickened waste activated sludge is pumped from the GBTs to the aerobic digesters. Digesters No. 1 and 2 each have a volume of approximately 616,700 gallons. Digester No. 3 has a volume of approximately 2.03 million gallons. The digesters are aerated and mixed by a fine bubble diffused air aeration system. Air is supplied by three blowers, two of which have a capacity of 4,200 scfm, and one of which has a capacity of 5,800 scfm.

Solids Disposal

Digested biosolids are hauled by truck to permitted land application sites for beneficial use as a fertilizer and soil conditioner on agricultural pasture and cropland. The digested biosolids meet the EPA Part 503 sewage sludge regulations for Class B biosolids using laboratory bench-scale testing for volatile solids reduction and testing for fecal coliforms. Digested biosolids can also be dewatered using a portable belt filter press and hauled by truck for off-site composting.

A summary of design data for the South Cary WRF is provided in Table E-14. Descriptions of the process units at the South Cary WRF are provided in the following sections.

TABLE E-14
South Cary WRF Design Data

Influent Wastewater Characteristics		
Design average daily flow, mgd	12.8	
Design instantaneous peak flow, mgd	32.0	
Design average influent BOD_5, mg/L	200	
Design maximum influent BOD_5, mg/L	350	
Design average influent TSS, mg/L	250	
Design maximum influent TSS, mg/L	700	
Design average influent NH_3-N, mg/L	23	
Design average influent TKN, mg/L	50	
Design average influent P, mg/L	6	
Bar Screens		
Number	2	
Type	Mechanically-cleaned	
	Bar Screen No. 1	Bar Screen No. 2
Type of screen	Chain and rake	Traveling mesh
Channel width, ft.	5.0	5.5
Clear opening between bars, inches	1/2	1/4
Capacity, each screen, mgd	16	32
Number of manually-cleaned screens	1	
Screenings Compactor		
Number	1 (for Bar Screen No. 2 only)	
Type	Screw	
Method of screenings disposal	Landfill (by contract)	
Influent Flow Measurement		
Number	1	
Type	Parshall flume	
Throat width, ft.	2.0	
Grit Collectors		
Number	2	
Type	Aerated	
Dimensions at water surface		
Length, ft.	27	
Width, ft.	27	
Sidewater depth, ft.	14.0	
Volume, each, gal.	86,150	
Total volume, gal.	172,300	
Detention time at 12.8 mgd, min.	19.4	
Design maximum flow, each grit collector, mgd	16	
Grit Classifiers		
Number	2	
Type	Screw	
Blowers (for air diffusion and airlift pumping)		
Number	2	
Type	Regenerative	

TABLE E-14
South Cary WRF Design Data

Capacity, each, cfm	200	
Discharge pressure, psig	6.0	
Method of grit disposal	Landfill (by contract)	
Aeration Basins		
Number	3	
Dimensions		
Outer diameter, ft.	165	
Inner diameter, ft.	77.5	
Depth, ft.	20	
Volume, each basin, mil. gal.	3.2	
Total volume, mil. gal.	9.6	
Mainstream Anoxic Zone (Cell 1)		
Number of cells per basin	1	
Volume, each basin, mil. gal.	0.71	
Total volume, mil. gal.	2.13	
Detention time @ 12.8 mgd, hours	4.0	
Mainstream Aerobic Zone (Cells 9-14)		
Number of cells per basin	6	
Volume, each basin, mil. gal.	1.60	
Total volume, mil. gal.	4.80	
Detention time at 12.8 mgd, hours	9.0	
Mainstream Second Anoxic Zone (Cell 15)		
Number of cells per basin	1	
Volume, each basin, mil. gal.	0.18	
Total volume, mil. gal.	0.53	
Detention time at 12.8 mgd, hours	1.0	
Mainstream Reaeration Zone (Cell 16)		
Number of cells per basin	1	
Volume, each basin, mil. gal.	0.09	
Total volume, mil. gal.	0.27	
Detention time @ 12.8 mgd, hours	0.5	
Phosphorus Sidestream Anaerobic Zone (Cells 2, 3 & 6)		
Number of cells per basin	3	
Volume, each basin, mil. gal.	0.27	
Total volume, mil. gal.	0.80	
Phosphorus Sidestream Anoxic Zone (Cells 4 & 5)		
Number of cells per basin	2	
Volume, each basin, mil. gal.	0.18	
Total volume, mil. gal.	0.53	
Fermentation Sidestream Zone (Cells 7 & 8)		
Number of cells per basin	2	
Volume, each basin, mil. gal.	0.18	
Total volume, mil. gal.	0.53	
Anaerobic/Anoxic Zone Mixing Systems		
	Cell 1	Cells 2-8
Number of mixers per basin	2	1
Type	Submersible propeller	

TABLE E-14
South Cary WRF Design Data

Horsepower	7.5		4	
Aerobic/Anoxic Zone Mixing/Aeration Systems				
	Cells 9 &10	Cells 11, 14 &15	Cells 12 & 13	Cell 16
Type		Jet aeration		Diffused air
Number of jet nozzles per cell	10	12	36	-
Number of diffusers per basin	-	-	-	10

Mixed Liquor Recycle Pumps

Number per basin	1
Type	Submersible, propeller
Capacity, each, mgd	17.0
Horsepower	40
Drive type	Constant speed

Seed Pumps

Number per basin	1
Type	Submersible
Capacity, each, gpm	150
Horsepower	0.5
Drive type	Constant speed

Aeration Tank Blowers

Number	4
Type	Multi-stage, centrifugal
Capacity, each, scfm	5,500
Firm capacity, scfm	16,500
Horsepower	300

Secondary Clarifiers

Number	4
Diameter, ft.	100
Sidewater depth, ft.	14
Surface area, each, $ft.^2$	7,850
Total surface area, $ft.^2$	31,420
Overflow rate at 12.8 mgd, $gpd/ft.^2$	410
Type of sludge removal	Suction

RAS Pump Station

Number of pumps	6 (including two on standby)
Type	Submersible
Capacity, each, gpm	3,500
Firm capacity, mgd	20.2
Horsepower	30
Type of drive	Variable speed

WAS Pump Station

Number of pumps	2
Type	Submersible

TABLE E-14
South Cary WRF Design Data

Capacity, each, gpm	Approx. 1,200
Firm capacity, gpm	Approx. 1,200
Horsepower	35
Type of drive	Variable speed

Effluent Filters

Number	7
Type	Deep bed
Dimensions	
Length, ft.	58.0
Width, ft.	9.5
Surface area, each, $ft.^2$	550
Total surface area, $ft.^2$	3,860
Hydraulic loading rate at 12.8 mgd	2.3 $gpm/ft.^2$
Media type	Sand
Media depth, ft.	6.0
Backwash Pumps	
Number	2
Type	Vertical turbine
Capacity, each, gpm	3,310
Horsepower	40
Drive type	Constant speed
Mudwell Pumps	
Number	2
Type	Submersible
Capacity, each, gpm	2,200
Horsepower	35
Drive type	Constant speed
Air Scour Blowers	
Number	3
Type	Positive displacement
Capacity, each, scfm	2,400
Horsepower	100
Drive type	Constant speed

Ultraviolet (UV) Disinfection Facilities

Number of UV disinfection channels	1
Design peak flow, mgd	32
Type of lamps	Medium pressure
Number of lamp banks	2
Number of lamps per bank	42
Total number of lamps	84

Effluent Flow Measurement

Number	1
Type	Weir
Weir length, ft.	10.0

TABLE E-14
South Cary WRF Design Data

Post Aeration	
Number	1
Type	Cascade
Number of steps	3
Total height of free fall, ft.	5.0
Gravity Belt Thickeners	
Number	2
Belt width, meters	2.0
Hydraulic loading rate per thickener, gpm	600
Aerobic Digesters	
Number	3
Dimensions	
Length, ft.	120
Width, ft.	60
Sidewater depth, ft.	16.6
Volume, each, gal.	895,000
Total volume, gal.	2,685,000
Aeration System	
Type	Diffused air
Diffuser type	Fine bubble, membrane
Number of diffusers per digester	1,500
Mixing System	
Number of mixers per digester	3
Type	Submersible propeller
Blowers	
Number	3
Type	Multi-stage, centrifugal
Capacity, each, scfm	4,000
Firm capacity, scfm	8,000
Discharge pressure, psig	8.5
Horsepower	250
Truck Loading/Sludge Transfer Pumps	
Number	2
Type	Screw centrifugal
Capacity, each, gpm	1,000
Horsepower	25
Drive type	Constant speed
Emergency Generators	
Number	3
Type	Diesel
Capacity, each, kW	1 @ 750, 2 @ 1,000

Liquid Treatment Facilities

Bar Screens

Raw wastewater enters the bar screen structure from the Camp Branch Interceptor. Two mechanically-cleaned screens are provided, with a clear opening between bars of 1/4 inch and a flow capacity of 32 mgd for the normal duty screen. The screenings are disposed of in a landfill. A manually-cleaned screen is provided for use when the mechanically-cleaned screens are out of service. A Parshall flume is provided for influent flow measurement of the screened effluent.

Grit Collectors

Bar screen effluent is conveyed to two aerated grit collectors. Each grit collector has a volume of 86,150 gallons, for a total detention time at design flow of approximately 19 minutes. The collected grit is pumped to two screw-type grit classifiers which remove the excess water and deposit the dewatered grit into dumpsters. The dewatered grit is disposed of in a landfill.

Aeration Basins

Three aeration basins provide biological nutrient removal (BNR) for the screened and degritted influent wastewater. Each BNR aeration basin includes four stages to provide biological removal of nitrogen and carbonaceous BOD. The stages include an anoxic zone, an aerobic zone, a second anoxic zone and a final aerobic zone. Influent wastewater enters the anoxic zone, which has a detention time of approximately 4 hours. Fermented return activated sludge which has passed through anoxic and anaerobic zones is mixed with the influent wastewater in the first anoxic zone. Submersible mixers maintain the solids in suspension in the anaerobic and anoxic zones. The anaerobic conditioning of the return activated sludge promotes the growth of microorganisms responsible for biological phosphorus removal by phosphorus uptake in the aerobic zone.

The first anoxic zone allows nitrogen removal by conversion of recycled nitrates from the aerobic zone to nitrogen gas. A submersible recycle pump in each aeration basin provides mixed liquor recycle to the first anoxic zone.

From the first anoxic zone, the mixed liquor flows to the aerobic zone, where carbonaceous BOD removal and nitrification take place. Aeration in the aerobic cells is provided by jet nozzle aerators in all but the last cell, which is aerated using diffused air. After the aerobic zone, the mixed liquor is conveyed to the

second anoxic zone for additional denitrification, the final aeration zone to increase the mixed liquor DO, and then to the secondary clarifiers.

Secondary Clarifiers

The aeration basin effluent is conveyed to four secondary clarifiers. The secondary clarifiers provide a settled activated sludge for return to the aeration basins and a clarified effluent, which is conveyed to the effluent filters. The four secondary clarifiers have a total surface area of approximately 31,420 $ft.^2$, for a surface overflow rate of approximately 410 $gpd/ft.^2$ at the plant design flow rate. Scum from the secondary clarifiers is conveyed to a scum digester and from there it is returned to the liquid treatment facilities.

RAS Pump Station

The RAS Pump Station returns settled activated sludge from the secondary clarifiers to the aeration basins. Six submersible pumps are provided, each with a capacity of 3,500 gpm. The firm RAS pumping capacity is approximately 20.2 mgd.

Effluent Filters

Seven deep bed sand filters are provided to remove additional solids from the secondary clarifier effluent. Each filter has a surface area of 550 $ft.^2$. The total surface area is 3,860 $ft.^2$, for a hydraulic loading rate at design flow conditions of approximately 2.3 $gpm/ft.^2$. Filter backwash is returned to the head of the plant for treatment with the influent wastewater.

UV Disinfection Facilities

The filtered effluent flows to the ultraviolet disinfection facilities, which use ultraviolet (UV) irradiation to accomplish disinfection. One UV disinfection channel is provided, with two banks of medium pressure UV lamps in the channel. The UV disinfection system has a design peak flow capacity of 32 mgd. The filtered effluent flows over a weir for effluent flow measurement prior to cascade aeration.

Cascade Aerator

One cascade aerator is provided to increase the effluent DO to meet the plant effluent DO limit of 5.0 mg/L. The cascade aerator has three steps, for a total fall of 5.0 feet. After the cascade aerator, the plant effluent is discharged to Middle Creek.

Solids Handling Facilities

WAS Pump Station

The WAS Pump Station has two submersible pumps, which convey waste activated sludge to the gravity belt thickeners. Each of the WAS pumps has a capacity of approximately 1,200 gpm.

Gravity Belt Thickeners

Two gravity belt thickeners (GBTs) are provided to thicken the waste activate sludge and scum from the secondary clarifiers prior to stabilization in the aerobic digesters. The GBTs thicken the solids from approximately 0.5 percent solids to approximately 4 percent solids. Each gravity belt thickener has a belt width of 2.0 meters, and a maximum hydraulic loading rate of 600 gpm. The filtrate from the GBTs is returned to the head of the plant for treatment in the liquid treatment process.

Aerobic Digesters

Three aerobic digesters are provided for stabilization and storage of waste activated sludge prior to beneficial use. The aerobic digesters provide solids stabilization and volume reduction by destruction of volatile solids.

Thickened waste activated sludge is pumped from the GBTs to the aerobic digesters. The digesters each have a volume of approximately 900,000 gallons. The digesters are aerated and mixed by fine bubble membrane diffused air aeration systems. Air is supplied by three blowers, each of which has a capacity of 4,000 scfm.

Solids Disposal

Digested biosolids are hauled by truck to permitted land application sites for beneficial use as a fertilizer and soil conditioner on agricultural pasture and cropland. The digested biosolids meet the EPA Part 503 sewage sludge regulations for Class B biosolids using laboratory bench-scale testing for volatile solids reduction and testing for fecal coliforms. Dewatering and thermal drying facilities are currently under construction at the South Cary WRF.

E.2.3 Town of Holly Springs

Wastewater from the Town of Holly Springs is treated at the Utley Creek WWTP, which has a design capacity of 1.5 mgd. A summary of design data for the Utley

Creek WWTP is provided in Table E-15. Descriptions of the process units at the Utley Creek WWTP are provided in the following sections.

Liquid Treatment Train

Influent Flow Measurement

Raw wastewater enters the Utley Creek WWTP through an 18-inch-diameter gravity sewer, and passes through a Parshall flume for influent flow measurement before it is conveyed by gravity to the bar screen.

Bar Screen

Raw wastewater from the Parshall flume is directed to a single traveling mesh-type bar screen. The bar screen has a clear opening of ¼-inch between bars, and a capacity of 3.75 mgd. Screenings are compacted to remove excess water by a single ram-type compactor, then disposed of by contract in a landfill.

Grit Collector

Bar screen effluent is directed to a single aerated grit collector, with a detention time at the design flow of 16.9 minutes. The collected grit is pumped to a screw-type grit classifier which removes the excess water and deposits the grit into a dumpster. The dewatered grit is disposed of by contract in a landfill.

Phosphorus Removal/Flow Equalization Tank

Degritted wastewater flows by gravity to the Phosphorus Removal/Flow Equalization Tank. The tank has a detention time of 2.6 hours at the design flow. Two mechanical floating mixers are provided for mixing. The tank can be operated in either the phosphorus removal or flow equalization mode. In the phosphorus removal mode, return activated sludge (RAS) is returned to the tank for anaerobic/aerobic cycling for biological phosphorus removal.

Influent Pump Station

Raw wastewater from the Phosphorus Removal/Flow Equalization Tank is lifted to a sufficient elevation so that it can be conveyed by gravity to the remainder of the treatment plant. The pump station consists of a single wet well with three variable speed pumps. The firm pumping capacity of the influent pump station is 5.3 mgd.

TABLE E–15
Holly Springs Utley Creek WWTP Design Data

Plant Influent Characteristics	
Design average daily flow	
Design maximum month flow	1.5 mgd
Design maximum instantaneous flow	3.75 mgd
Design average day influent BOD5	300 mg/L
Design maximum month influent BOD5	
Design average day influent TSS	300 mg/L
Design maximum month influent TSS	
Design average day influent TKN	35 mg/L
Design maximum day influent TKN	
Design average day influent P	
Design maximum month influent Total P	
Influent Flow Measurement	
Number	1
Type	Parshall flume
Throat width	18 in.
Maximum capacity	15.5 mgd
Bar Screen	
No. of mechanically-cleaned screens	1
Type	Traveling mesh
Clear opening between bars	1/4 in.
Maximum capacity of screen	3.75 mgd
Horsepower	0.5
Number of screenings compactors	1
Type of screenings compactor	Ram
Screenings compactor horsepower	2
Number of manually-cleaned screens	0
Method of screenings disposal	Landfill (By contract)
Grit Collector	
Number	1
Type	Aerated
Dimensions	
Length	14 ft.
Width	14 ft.
Depth	12 ft.
Volume	17,590 gal.
Detention time at design flow	16.9 min.
Grit Pump	
Number	1
Type	Self-priming
Capacity	200 gpm
Horsepower	5

TABLE E–15
Holly Springs Utley Creek WWTP Design Data

Grit Classifier		
Number	1	
Type	Screw	
Blowers		
Number	2	
Type	Positive displacement	
Capacity, each	60 scfm	
Horsepower	5	
Method of grit disposal	Landfill (by contract)	
Phosphorus Removal/Flow Equalization Tank		
Number	1	
Dimensions		
Length	90 ft.	
Width	24 ft.	
Depth	10 ft.	
Volume	161,570 gal.	
Detention time at design flow	2.6 hr.	
Mixing System		
Number of mixers	2	
Type	Mechanical, floating	
Horsepower	3	
Influent Pump Station		
Number of pumps	3	
Type of pump	Submersible	
Maximum capacity of each pump	1,825 gpm	
Firm capacity	5.3 mgd	
Total dynamic head	31.8 ft.	
Horsepower	30	
Type of drive	Variable speed	
Anoxic Tank		
Number	1	
Design flow	1.5 mgd	
Volume	216,770 gal.	
Detention time at design flow	3.5 hr.	
Mixing System		
Number	1	
Type	Fixed, platform-mounted	
Horsepower	10	
Drive type	Constant speed	
Aeration Tanks		
Number	3	
	Aeration Tanks No. 1 & 2	Aeration Tank No. 3
Type	Package plant	Carrousel
Design flow, mgd	0.5	1.0 (1.5)

TABLE E–15
Holly Springs Utley Creek WWTP Design Data

Dimensions	Aeration Tanks No. 1 & 2	Aeration Tank No. 3
Length, ft.		
Width, ft.		
Depth, ft.		
Volume, each tank, mil. gal.	0.314	1.14
Total volume, mil. gal.	0.628	1.14
Detention time at design flow, hr.	30.1	27.4 (18.2)
Aeration System		
Type	Coarse bubble diffused air	Fixed, platform-mounted, surface aerators
Number of aerators	-	2
Horsepower	-	75/56
Drive type	-	Two-speed
Blowers	See Digesters No. 4 & 5	-
Nitrified Recycle Facilities		
Type	-	Diverter gate

Secondary Clarifiers

Number	3	
	Clarifiers No. 1 & 2	Clarifier No. 3
Type	Package plant	Center feed
Design flow, mgd	0.5	1.0 (1.5)
Diameter, ft.	-	70.0
Sidewater depth, ft.	16.0	14.85
Surface area, each, $ft.^2$	540	3,850
Total surface area, $ft.^2$	1,080	3,850
Surface overflow rate at design flow, $gpd/ft.^2$	460	260 (390)
Type of solids removal	Suction	Scraper
Type of scum removal	Scum cups	Skimmer arm and scum beach

Return Activated Sludge (RAS) Pumps

Number		-
Type	Airlift	Gravity to Phosphorus Removal/Flow Equalization Tank
Capacity, each		-
Firm capacity		-

Tertiary Filters

Number	2	
	Filter No. 1	Filter No. 2
Type	Traveling bridge	
Dimensions		
Length, ft.	22.21	40.0
Width, ft.	7.96	9.0
Surface area, each, $ft.^2$	173	360
Total surface area	533 $ft.^2$	
Hydraulic loading rate at design flow	2.0 $gpm/ft.^2$	
Media type	Sand	

TABLE E–15
Holly Springs Utley Creek WWTP Design Data

Media depth, in.		
Backwash Pumps	Filter No. 1	Filter No. 2
Number	1	1
Type	Self-priming	Submersible
Capacity, each, gpm	120	25
Horsepower	2	3
Drive type	Constant speed	
Backwash supply	Filter effluent	
Washwater Pumps		
Number	1	1
Type	Self-priming	
Capacity, each, gpm		25
Horsepower		3
Skimmer Pump		
Number	-	1
Type	-	
Capacity, gpm	-	50
Total dynamic head, ft.	-	15
Horsepower	-	0.5
Surface Wash Pump		
Number	1	-
Type	Submersible	-
Capacity, gpm	12	-
Horsepower	1.5	-

Ultraviolet (UV) Disinfection Facilities	
Number of channels	1 (plus one future)
Dimensions	
Length	
Width	2.5 ft.
Water depth	2.0 ft.
Type of lamps	Low pressure (Trojan UV 3000)
Number of lamp banks per channel	2
Number of modules per lamp bank	10
Number of lamps per module	8
Number of lamps per lamp bank	80
Total number of lamps	160

Effluent Flow Measurement	
Number	1
Type	Weir
Weir length	2.0 ft.

Post Aeration	
Number	1
Type	Cascade
Number of steps	6
Total vertical fall	12.0 ft.

TABLE E–15
Holly Springs Utley Creek WWTP Design Data

Aerobic Digester/Sludge Holding Tanks				
Number	5			
	Digesters 1&2	Digester 3	Digester 4	Digester 5
Type	Rectangular	Rectangular	Circular, package plant	Package plant
Dimensions				
Length, ft.	15	90	-	-
Width, ft.	24	24	-	-
Diameter, ft.	-	-		-
Sidewater depth, ft.	10	10		
Volume, each, gal.	26,930	161,570	100,000	73,000
Total volume	388,430 gal.			
Detention time at design sludge production				
Type of aeration system	Coarse bubble, diffused air			
Design airflow capacity				
Aerobic Digester Blowers				
	Digesters 1, 2 & 3 (0.25-mgd package plant)		Digesters 4 & 5 (0.5-mgd package plant)	
Number	3		3	
Type	Multi-stage, centrifugal			
Capacity, each, scfm				
Firm capacity, scfm				
Horsepower	50		125	
Emergency Generators				
Number	2			
Type	Diesel			
Rating	1 @ 400 kW, 1 @ 500 kW			

Anoxic Tank and Aeration Tanks

The influent pump station discharge is sent to the anoxic tank. The anoxic tank has a 3.5-hour detention time at the design flow. Following the anoxic tank, the flow is split, with 1/3 of the flow going to a package plant with two aeration tanks, and 2/3 to a Carrousel-type aeration tank. The two package plant aeration tanks provide a detention time at design flow (0.5 mgd) of 30.1 hours. Multi-stage centrifugal blowers provide air to the two tanks and distribute it using coarse bubble diffusers.

The Carrousel aeration tank provides a detention time at design flow (1.0 mgd) of 27.4 hours. The tank is aerated using fixed, platform-mounted surface aerators. A nitrified recycle (NRCY) stream is provided for this tank by means of a diverter gate.

Secondary Clarifiers

The aeration tank effluent for the package plant is delivered to two secondary clarifiers that are part of the package plant. These two clarifiers are rectangular and provide a surface overflow rate at the design flow (0.5 mgd) of 460 gpd/ft.^{2}. Settled activated sludge for return to the aeration tanks is transferred by an airlift/suction pump. Clarified effluent is conveyed to the tertiary filters and scum is conveyed by gravity to the aerobic digesters.

The effluent from the Carrousel aeration tank is delivered to a separate secondary clarifier that provides a surface overflow rate of 260 gpd/ft.^{2} at design flow (1.0 mgd). A scraper removes the settled activated sludge and it is conveyed by gravity to the Phosphorus Removal/Flow Equalization Tank. Scum is removed by a skimmer arm and beach and is delivered to the aerobic digesters. Clarified effluent is conveyed to the tertiary filters.

Tertiary Filters

Secondary effluent is delivered to two traveling bridge sand filters for additional solids removal. The filters provide a hydraulic loading rate at the design flow of 2.0 gpm/ft.^{2}.

Ultraviolet (UV) Disinfection Facilities

Disinfection of the filter effluent is accomplished by ultraviolet (UV) irradiation in one UV disinfection channel with two banks of low pressure UV lamps. The UV effluent passes over a weir for effluent flow measurement prior to post aeration at the cascade aerator.

Cascade Aeration

One cascade aerator with six steps and a total fall of 12.0 ft. is provided to increase the effluent DO to meet the plant effluent limit of 6.0 mg/L prior to discharge to Utley Creek.

Solids Handling Facilities

Aerobic Digesters/Sludge Holding Tanks

Five aerobic digesters are provided for stabilization and storage of waste activated sludge prior to beneficial use. The aerobic digesters provide solids stabilization and volume reduction by destruction of volatile solids. The total volume of the five digesters is 388,430 gallons. Air is provided to the digesters by multi-stage centrifugal blowers and distributed through coarse bubble diffusers. The biosolids in the aerobic digesters/sludge holding tanks is typically thickened to a solids concentration of 3.5 to 4.0 percent before hauling.

Solids Disposal

Digested biosolids are hauled by truck to permitted land application sites. The Town of Holly Springs contracts with a private biosolids management contractor for biosolids disposal. The private contractor adds lime to the biosolids prior to land application to meet the 40 CFR Part 503 regulations.

E.3 HISTORICAL WASTEWATER FLOWS AND I/I ANALYSIS

E.3.1 Town of Apex

Existing wastewater flows in the Town of Apex service area for Fiscal Year 2003 are summarized in Table E-16. The flows for the Town of Apex include infiltration and inflow, as well as residential, commercial and industrial flows. Expected residential, commercial, and industrial wastewater flows are based on water usage from water billing data times 0.9. The estimated infiltration and inflow rate is based on subtraction of the expected wastewater flow from the treatment plant flow. Plant effluent flow records were used to determine the total treatment plant flow.

TABLE E-16
Apex Wastewater Service Area Fiscal Year 2003 Wastewater Flows

Total Residential Served Population	26,844
Wastewater Flows, mgd*	
Residential	1.304
Commercial	0.401
Industrial	0.005

Subtotal	1.710
Annual Average Infiltration/Inflow	0.596
Annual Average WWTP Flow	2.306

* Wastewater flows estimated based on 0.9 times water consumption.

Existing infiltration and inflow (I/I) rates for the Town of Apex were estimated using the State Revolving Fund (SRF) criteria for loan funding. The existing infiltration rate was determined based on the wettest three-month period, which occurred in February through April 2003. Estimated infiltration rates for Apex are summarized in Table E-17. Based on a maximum value of 3,000 gpd/in-mile for non-excessive infiltration, the infiltration for the Town of Apex wastewater collection system is not considered excessive.

Existing inflow rates for the Town of Apex collection system were determined based on the estimated non-industrial instantaneous peak flow for a 1-inch rain event that occurred on November 12, 2004. The estimated inflow for a 1-inch rain event is also summarized in Table E-17. The non-excessive inflow amount based on the SRF criteria is 275 gpcd or less. Based on the inflow estimate in Table E-17, inflow is not considered excessive in the Town of Apex collection system.

The Town of Apex presently budgets $100,000 a year on I/I reduction programs.

TABLE E-17
Apex Infiltration/Inflow Evaluation

Infiltration	
Wet weather flow, mgd*	2.705
Water sold, mgd*	1.834
Estimated Water returned to sewer, mgd	1.651
Infiltration, mgd	1.054
Inch-miles of gravity sewers	1045
Estimated Infiltration, gpd/in-mile	1009
Excessive Infiltration?	No
Inflow	
Estimated non-industrial instantaneous peak flow, 1" rainfall event, mgd**	5.1
Population served (FY 2003)	26,844
Estimated non-industrial instantaneous peak flow, gpcd**	190
Excessive inflow?	No

* Based on the three wettest months from February through April 2003

** Based on a 1" rainfall event on November 12, 2004

E.3.2 Town of Cary

Existing wastewater flows in the Town of Cary service area for Fiscal Year 2003 are summarized in Table E-18. The flows for the Town of Cary and its customers include infiltration and inflow, as well as residential and non-residential flows. Expected residential and non-residential wastewater flows for Cary are based on billed water usage times 0.9. The estimated infiltration and inflow rate is based on subtraction of the expected wastewater flow from the treatment plant flows. Plant effluent flow records for the North Cary WRF and South Cary WRF were used to determine the total treatment plant flow.

TABLE E-18
Cary Fiscal Year 2003 Wastewater Flows

Total Residential Served Population	105,950
Wastewater Flows, mgd*	
Residential	4.901
Non-residential	3.216
Subtotal (Cary only)	8.117
Morrisville	1.019
RDU	0.148
RTP South	0.280
Total Wastewater Flow	9.563
Annual Average Infiltration/Inflow	2.731
Annual Average WRF Flow	12.294

*Wastewater flows estimated based on 0.9 times water consumption.

Existing infiltration and inflow (I/I) rates for the Town of Cary are combined with the Town of Morrisville because the Town of Cary treats all of Morrisville's flow. The I/I rates were estimated using the State Revolving Fund (SRF) criteria for loan funding. The existing infiltration rate was determined based on the wettest three-month period, which occurred in February through April 2003. Estimated infiltration rates for Cary and Morrisville are summarized in Table E-19. Based on a maximum value of 3,000 gpd/in-mile for non-excessive infiltration, the infiltration for the Towns of Cary and Morrisville's wastewater collection systems is not considered excessive.

Exisiting inflow rates for the Town of Cary collection system, including Morrisville, RDU, and RTP South, were determined based on estimated instantaneous non-industrial peak flows for three 1-inch rain events from February 2002 to July 2003. The estimated inflow for a 1-inch rain event is also summarized in Table E-19. The non-excessive inflow amount based on the SRF criteria is 275 gpcd or less. Based on the inflow estimate in Table E-19, inflow is not considered excessive in the Town of Cary collection system.

TABLE E-19
Cary/Morrisville Infiltration/Inflow Evaluation

Infiltration	Total Cary System*
Wet weather flow, mgd**	14.650
Water sold, mgd*	9.666
Estimated Water returned to sewer, mgd	8.699
Estimated Infiltration, mgd	5.951
Inch-miles of gravity sewers	6,441
Estimated Infiltration, gpd/in-mile	924
Excessive Infiltration?	No
Inflow	Total Cary System*
Estimated non-industrial instantaneous peak flow, 1" rainfall event, mgd***	20.39
Population served (FY 2003)	112,240
Estimated non-industrial instantaneous peak flow, gpcd***	182
Excessive inflow?	No

* Includes the Town of Morrisville, RTP South and RDU.

** Based on the three wettest months (February through April 2003).

*** Based on three 1" rainfall events from February 2002 to July 2003.

E.3.3 Town of Holly Springs

Existing wastewater flows in the Town of Holly Springs service area for Fiscal Year 2003 are summarized in Table E-20. The flows for the Town of Holly Springs include infiltration and inflow, as well as residential, commercial and industrial flows. Expected residential, commercial, and industrial wastewater flows are based on water usage from water billing data times 0.9. The estimated infiltration and inflow rate is based on subtraction of the expected wastewater flow from the treatment plant flow. Plant effluent flow records were used to determine the total treatment plant flow.

TABLE E-20
Holly Springs Fiscal Year 2003 Wastewater Flows

Total Residential Served Population	12,036
Wastewater Flows, mgd*	
Residential	0.630
Commercial	0.047
Industrial	0.007
Other	0.005
Subtotal	0.689
Annual Average Infiltration/Inflow	0.206
Annual Average WWTP Flow	0.896

* Wastewater flows estimated based on 0.9 times water consumption.

Existing infiltration and inflow (I/I) rates for the Town of Holly Springs were estimated using the State Revolving Fund (SRF) criteria for loan funding. The existing infiltration rate was determined based on the wettest three-month period,

which occurred in February through April 2003. Estimated infiltration rates for Holly Springs are summarized in Table E-21. Based on a maximum value of 3,000 gpd/in-mile for non-excessive infiltration, the infiltration for the Town of Holly Springs wastewater collection system is not considered excessive.

Exisiting inflow rates for the Town of Holly Springs collection system were determined based on estimated non-industrial instantaneous peak flows for three 1-inch rain events from February 2002 to July 2003. The estimated inflow for a 1-inch rain event is also summarized in Table E-21. The non-excessive inflow amount based on the SRF criteria is 275 gpcd or less. Based on the inflow estimate in Table E-21, inflow is not considered excessive in the Town of Holly Springs collection system.

TABLE E-21
Holly Springs Infiltration/Inflow Evaluation

Infiltration	
Wet weather flow, mgd*	1.056
Water sold, mgd*	0.727
Estimated water returned to sewer, mgd	0.654
Estimated infiltration, mgd	0.402
Inch-miles of gravity sewers	786
Estimated infiltration, gpd/in-mile	511
Excessive Infiltration?	No
Inflow	
Estimated non-industrial instantaneous peak flow, 1" rainfall event, mgd**	2.04
Population served (FY 2003)	12,036
Estimated non-industrial peak flow, gpcd**	169
Excessive inflow?	No

* Based on the three wettest months (February through April 2003) not including irrigation.

** Based on three 1" rainfall events from February 2002 to July 2003.

Holly Springs has an active I/I reduction program. The Town's crews perform smoke testing and manhole repairs.

E.3.4 Town of Morrisville

All of Morrisville's wastewater flows are conveyed to the North Cary WRF for treatment and disposal. The infiltration/inflow evaluation for the Morrisville collection system is included in the evaluation for Cary in Section E.3.2.

The Town of Morrisville performs some smoke testing for the Town's I/I reduction program. The Town has assigned two individuals to the I/I program to perform smoke testing with assistance from other Public Works staff.