SECTION 7

Recommended Capital Improvement Program

One of the primary goals of this Master Plan is to recommend a phased capital improvement program (CIP) of water distribution system improvements that will enable the Town of Cary to correct existing deficiencies and meet future needs in the most cost-efficient manner.

This section presents information about each recommended CIP project for each of the defined planning periods of 2010, 2015, 2025 and build-out. Table 7-1 provides a detailed list of the recommended CIP projects. The location of each project is shown in Figure 6-7.

7.1 Section Format

The recommended CIP projects are presented by the following defined planning periods:

- Phase 1 – 2010
- Phase 2 – 2015
- Phase 3 – 2025
- Phase 4 – Build-out
- Undesignated Phase – Designated as "local service area" projects which may be required to satisfy site specific conditions but are not required to satisfy the design criteria adopted for this Master Plan

The proposed improvements for each planning period are subdivided into four major types of infrastructure:

- Storage
- Pumping
- Control valves
- Piping improvements

Each recommended project was given a tracking number (WPZ-x, CPZ-x, or SPZ-x) based on the pressure zone in which the project is located and was also categorized based on the purpose of the project as follows:

- ***1 – Hydraulic***: The project is hydraulically necessary to satisfy the evaluation criteria detailed in Table 5-1, such as maintaining adequate flows and pressures in the system.
- ***2 – Water Quality***: The project has anticipated benefits associated with water quality, such has removal of dead-end piping by forming loops in the system. This category is not hydraulically necessary to satisfy flow and pressure criteria.

- ***3 – Planned or Anticipated Local Service***: The project is in progress or anticipated to meet the water needs of new service areas, such as new subdivisions and new commercial parks. This project category is not hydraulically necessary to satisfy flow and pressure criteria from a system perspective, but will be necessary for local service demands.

Section 7.2 describes the cost estimating methodology used in this Master Plan.

Tables 7-2 and 7-3 present a summary of the project costs for each planning period by type of recommended infrastructure and by percent of the total CIP costs, respectively. Table 7-4 presents the project costs by pressure zone for all of the planning periods and the percent of total CIP costs.

Table 7-5 presents the recommended CIP projects for the year 2010 planning period.

Section 7-9 presents recommendations for additional analyses that would help clarify, validate, or modify future CIP items and enhance the water distribution system model developed for this Master Plan.

7.2 Cost Estimating Methodology

The cost estimates presented in this Master Plan have been prepared for guidance in project evaluation based on information available at the time of preparation. The final cost of a project will depend on actual labor and material costs, actual site conditions, construction productivity, competitive market conditions, final project scope, final project schedule and other variable factors. As a result, the final project costs will vary from the costs presented in this report. Therefore, funding will need to be carefully reviewed prior to making specific financial decisions, establishing final project budgets or prioritizing projects.

Costs for the CIP projects have been estimated primarily from unit rates developed for this Master Plan. The costs provided are a Class 4 estimate based on the Association for the Advancement of Cost Engineering (AACE) which applies a potential range of -30 percent to +50 percent to the estimate.

The total project cost estimates presented in this Master Plan include:

- Engineering
- Construction administration
- Project management
- Environmental document / permitting allowance
- Contingency for design and construction

The basis for pipeline projects is a cost per linear foot for a given diameter, with allowances made for stream and road crossing using trenchless technology.

Storage tanks have been estimated based on a cost per gallon which varies with the size of the tank. The cost of demolition of existing tanks has been estimated as a percentage of the construction cost based on historical data.

Pump installation costs at the Cary/Apex HSPS were developed using CH2M HILL's proprietary costing tool and include associated electrical, instrumentation, and control equipment.

The cost estimates presented in Table 7-1 are in March 2009 dollars, with no escalation for the anticipated year of construction. They do not include any costs associated with land, easements and right-of-way acquisition or with the condemnation of property.

7.3 Phase 1 – Year 2010 Improvements

7.3.1 Year 2010 Storage

No storage improvement projects are recommended for the 2010 planning year.

7.3.2 Year 2010 Pumping

7.3.2.1 Project WPZ-24: Installation of Third High Service Western Zone Pump (#9)

This project involves the design and installation of a 5.5 MGD vertical turbine pump in an existing unused slot (#9) at the Cary/Apex High Service Pump Station by the year 2010. The project includes new electrical and I&C equipment. Project WPZ-24 was determined necessary based on a 2007 study by HDR, Incorporated.

Category	1-Hydraulic
Diameter, Length, or Capacity	5.5 MGD at 305 ft TDH
Year Completed	2010
Total Construction Cost	$0.99 million

7.3.2.2 Project CPZ-19: Installation of Sixth High Service Central Zone Pump (#8)

This project involves the design and installation of a 9 MGD vertical turbine pump in an existing unused slot (#8) at the Cary/Apex High Service Pump Station by the year 2010.

The project includes new electrical and I&C equipment. Project CPZ-19 was determined necessary based on a 2007 study by HDR, Incorporated.

Category	1-Hydraulic
Diameter, Length, or Capacity	9 MGD at 450 ft TDH
Year Completed	2010
Total Construction Cost	$1.81 million

7.3.3 Year 2010 Control Valve

7.3.3.1 Project CPZ-9: Removal of Check Valve from Evans, Lake Crabtree, and Holiday Inn Master Meters

This project involves the removal of three check valves from existing Morrisville Master Meters. The existence of the check valve prevents the reverse flow of water through the Evans, Lake Crabtree and Holiday Inn Master Meters which eliminates the ability to re-route water during an emergency, such as a pipe break.

Category	1-Hydraulic
Year Completed	2010
Total Construction Cost	$0.15 million

7.3.3.2 Project SPZ-6: Construct Highway 1 Control Valve and 16-inch Main

This project involves the design and construction of a control valve and 16-inch main under Highway 1 from Gregson Drive to Regency Parkway. This proposed third connection from the Central PZ to the Southern PZ is necessary to satisfy projected 2010 peak demand. Project SPZ-6 also provides additional water quality benefits by delaying the need for a second elevated tank in the Southern PZ (until build-out) and increasing flow through several dead-end mains in the Central PZ in the vicinity of Highway 64 and Highway 1 where sampling data has revealed high levels of disinfection by-products. In addition, Project SPZ-6 also reduces the required flow through the existing Kildaire Farm Road and Cary Parkway OCVs and thus reduces stress on the Ridgeview ET in the Central PZ. However, the flow rate through SPZ-6 should be evaluated during detailed design so as not to cause excessive upstream pressure fluctuations, and for this reason, a flow control valve or pressure sustaining valve is preliminarily recommended. During design of SPZ-6, the operational requirements of the three control valves should be evaluated under the condition when the Plumtree Way Tank is off-line for maintenance.

Category	1-Hydraulic
Diameter, Length, or Capacity	1,890 LF of 16-inch
Year Completed	2010
Total Construction Cost	$0.51 million

7.3.4 Year 2010 Piping

7.3.4.1 Project WPZ-1 *(WT1142)*: Construct 24-inch Water Main along Wimberley Road

This project involves the design and construction of 10,530 LF of 24-inch main along Wimberley Road. This proposed water line provides an additional source of water from the high service station into the WPZ, which is necessary to provide redundancy during the I-540 highway construction project. Additionally, this main reduces head loss in the existing 30-inch main along Jenks Road.

Category	1-Hydraulic
Diameter, Length, or Capacity	10,530 LF of 24-inch
Year Completed	2010
Total Construction Cost	$8.48 million

7.3.4.2 Project WPZ-2 *(WT1129)*: Construct 24-inch Water Main along Green Level West Road

This project involves the design and construction of 5,105 LF of 24-inch main along Green Level West Road. This proposed water line is a necessary extension of WPZ-1, which provides additional supply redundancy to the WPZ.

Category	1-Hydraulic
Diameter, Length, or Capacity	5,110 LF of 24-inch
Year Completed	2010
Total Construction Cost	$4.26 million

7.3.4.3 Project WPZ-3: Construct 20-inch Water Main along Green Level Church Road

This project involves the design and construction of 3,250 LF of 20-inch main along Green Level West Road. This water line is proposed in conjunction with WPZ-1 and WPZ-2.

Category	1-Hydraulic
Diameter, Length, or Capacity	3,250 LF of 20-inch
Year Completed	2010
Total Construction Cost	$0.93 million

7.3.4.4 Project WPZ-4 *(WT1165)*: Construct 12-inch Water Main along High House Road

This project involves the design and construction of 1,380 LF of 12-inch main parallel to existing 12-ing main along High House Road. This proposed water line increases supply to high elevations in the SE portion of the WPZ which has experienced low pressures. This project eliminates a dead-end and potentially improves water quality, increases static pressure and available fire flow.

Category	1-Hydraulic
Diameter, Length, or Capacity	1,380 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.17 million

7.3.4.5 Project WPZ-5 *(WT1160)*: Construct 12-inch Water Main along Carpenter Upchurch Road

This project involves the design and construction of 6,140 LF of 12-inch main along Carpenter Upchurch Road. This water line is proposed in conjunction with project WPZ-6 to provide local service in a high elevation area and increase redundancy and looping in the area.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	6,140 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.82 million

7.3.4.6 Project WPZ-6 *(WT1164)*: Construct 12-inch Water Main along Louis Stephens Drive

This project involves the design and construction of 4,080 LF of 12-inch main along Louis Stephens Drive. This water line is proposed in conjunction with project WPZ-5.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	4,080 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.54 million

7.3.4.7 Project WPZ-7 *(WT1164)*: Construct 12-inch Water Main along Eagle Meadow Court

This project involves the design and construction of 280 LF of 12-inch main along Eagle Meadow Court. This project connects existing 12-inch mains and eliminates dead-end piping, increases supply and improves redundancy in the southeast area of the WPZ.

Category	1-Hydraulic
Diameter, Length, or Capacity	280 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.04 million

7.3.4.8 Project WPZ-8 *(WT1124)*: Construct 16-inch Water Main along Morrisville Parkway

This project involves the design and construction of 1,070 LF of 16-inch main along Morrisville Parkway. This project connects existing 16-inch main along Morrisville Parkway at Davis Drive and works in conjunction with WPZ-7.

Category	1-Hydraulic
Diameter, Length, or Capacity	1,070 LF of 16-inch
Year Completed	2009
Total Construction Cost	$0.21 million

7.3.4.9 Project WPZ-15: Construct 16-inch Water Main along Alston Avenue at Green Level Durham Road

This project involves the design and construction of 820 LF of 16-inch main along Alston Avenue at Green Level Durham Road. This project creates a loop in the RTP portion of the WPZ, improves redundancy, static pressure, and available fire flow in this commercial area.

Category	1-Hydraulic
Diameter, Length, or Capacity	820 LF of 16-inch
Year Completed	2010
Total Construction Cost	$0.14 million

7.3.4.10 Project CPZ-1 *(CIB)*: Construct 24-inch Water Main along Jenks-Carpenter Holt Road

This project involves the design and construction of 7,710 LF of 24-inch main parallel to existing 36-inch main along Jenks-Carpenter. This project increases supply to the southern portion of the CPZ and is recommended in conjunction with CPZ-2 and CPZ-3.

Category	1-Hydraulic
Diameter, Length, or Capacity	7,710 LF of 24-inch
Year Completed	2010
Total Construction Cost	$6.22 million

7.3.4.11 Project CPZ-2 *(WT1166 & WT1143)*: Construct 24-inch Water Main along Holt Road

This project involves the design and construction of 3,780 LF of 24-inch main along Holt Road, Howell Road, and Farm Pond Road. This project is recommended in conjunction with CPZ-1 and CPZ-3.

Category	1-Hydraulic
Diameter, Length, or Capacity	3,780 LF of 24-inch
Year Completed	2009
Total Construction Cost	$3.69 million

7.3.4.12 Project CPZ-3: Construct 24-inch Water Main along West High Street

This project involves the design and construction of 1,850 LF of 24-inch main parallel to existing 12-inch main along West High Street. This project is recommended in conjunction with CPZ-1 and CPZ-2.

Category	1-Hydraulic
Diameter, Length, or Capacity	1,850 LF of 24-inch
Year Completed	2010
Total Construction Cost	$1.53 million

7.3.4.13 Project CPZ-4 *(WT1161)*: Construct 20-inch Water Main along SW Cary Parkway

This project involves the design and construction of 3,550 LF of 20-inch main parallel to existing 20-inch main along SW Cary Parkway from West High Street to Old Apex Road. This project increases supply to the southern portion of the Central PZ and is recommended in conjunction with CPZ-1, 2, and 3.

Category	1-Hydraulic
Diameter, Length, or Capacity	3,550 LF of 20-inch
Year Completed	2010
Total Construction Cost	$1.01 million

7.3.4.14 Project CPZ-8 *(CIB)*: Construct 16-inch Water Main along South Walker Street

This project involves the design and construction of 3,250 LF of 16-inch main along South Walker Street from Walnut Street to East Chatham Street. This project is designated as an existing local service area project. This project increases available fire flow and redundancy in the center of Town.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	3,250 LF of 16-inch
Year Completed	2010
Total Construction Cost	$0.68 million

7.3.4.15 Project CPZ-21 *(WT1153)*, CPZ-22 *(WT1120)*, CPZ-23 *(WT1121)*, and CPZ-24 *(WT1114):* Replacement of 6-inch water distribution mains in Maynard Loop Area)

These projects involve the replacement or installation of short 6-inch distribution mains in the Maynard Loop area of the Central PZ for a total of 2,100 LF. These projects are designated as an existing local service area projects.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	6-inch
Year Completed	2009-2010
Total Construction Cost	$0.17 million

7.3.4.16 Project SPZ-1 *(WT1054 & WT1073)*: Construction of 12-inch Water Main along Holly Springs Road and Lily Atkins Road

This project involves the design and construction of 6,510 LF of 12-inch main along Holly Springs Road and Lily Atkins Road. This project involves a series of three segments: along Holly Springs Road from SE Cary Parkway to Windstream Way, along Holly Springs Road from Swift Ridge Road to Lilly Atkins Road, and along Lily Atkins Road from Holly Springs Road to an existing 12-inch main at Maltland Drive.. This project provides an additional supply to the southeast portion of the Southern PZ and is recommended in conjunction with SPZ-5 and SPZ-6.

Category	1-Hydraulic
Diameter, Length, or Capacity	6,510 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.99 million

7.3.4.17 Project SPZ-2 *(WT1098 & WT 1089)*: Construction of 12 & 16-inch Water Main along Pierce Olive Road and Optimist Farm Road

This project involves the design and construction of 9,140 LF of 12-inch main along Pierce Olive Road and 3,120 LF of 16-inch main along Optimist Farm Road. This project creates a loop in the southern portion of the Southern PZ and will potentially improve water quality in an area where chlorine residual levels are difficult to maintain. Project will also provide redundancy and increase available fire flow.

Category	2-Water Quality
Diameter, Length, or Capacity	9,140 LF of 12-inch 3,120 LF of 16-inch
Year Completed	2010
Total Construction Cost	$1.82 million

7.3.4.18 Project SPZ-3 (*WT5006)*: Construction of 12-inch Water Main along Kingsford Drive

This project involves the design and construction of 1,920 LF of 12-inch main along Kingsford Drive. This project is an existing local service area project which provides an additional connection between Penny Road and Kildaire Farm Road.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	1,920 LF of 12-inch
Year Completed	2010
Total Construction Cost	$0.27 million

7.3.4.19 Project SPZ-4 (*WT1094)*: Construction of 12-inch Water Main along Cowley Road

This project involves the design and construction of 2,490 LF of 12-inch main along Cowley Road. This is an existing local service area project. Also, this project will require a closed valve at Tryon Road to act as a zone valve between the Central and Southern PZ.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	2,490 LF of 12-inch
Year Completed	2009
Total Construction Cost	$0.34 million

7.3.4.20 Project SPZ-5 (*WT1054)*: Construction of 16-inch Water Main along Holly Springs Road

This project involves the design and construction of 12,650 LF of 16-inch main along Holly Springs Road, Penny Road, and in a subdivision along Chelmsford Court and Birksland Drive. This project is recommended in conjunction with SPZ-1 and SPZ-6.

Category	1- Hydraulic
Diameter, Length, or Capacity	12,650 LF of 16-inch
Year Completed	2010
Total Construction Cost	$2.30 million

7.4 Phase 2 – Year 2015 Improvements

7.4.1 Year 2015 Storage

7.4.1.1 Project WPZ-17: Construct I-540 Elevated Tank

This project involves the design and construction of a 2 MG elevated tank in the vicinity of the I-540/NC55 interchange north of the existing Carpenter Elevated Tank by the year 2015. This proposed elevated tank is necessary to provide adequate storage based on 2015 projected water demands. Pipeline projects WPZ-9, WPZ-12, WPZ-13, WPZ-14, and WPZ-16 should all be evaluated when selecting a final site for the proposed I-540 ET.

Category	1-Hydraulic
Diameter, Length, or Capacity	2 MG
Year Completed	2015
Total Construction Cost	$5.56 million

7.4.2 Year 2015 Pumping

No pumping improvement projects are recommended for the 2015 planning year.

7.4.3 Year 2015 Control Valve

No control valve improvement projects are recommended for the 2015 planning year.

7.4.4 Year 2015 Piping

7.4.4.1 Project WPZ-9 *(WT1097)*: Construction of 16-inch Water Main along NC 55

This project involves the design and construction of 4,610 LF of 16-inch main parallel to the existing 16-inch main along NC-55. This project is necessary as part of the proposed I-540 Elevated Tank (WPZ-17).

Category	1- Hydraulic
Diameter, Length, or Capacity	4,610 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.84 million

7.4.4.2 Project WPZ-11: Construction of 12-inch Water Main along Green Level to Durham Road at Dennison Lane

This project involves the design and construction of 790 LF of 12-inch main along Green Level to Durham. The proposed water main connects two segments of 12-inch mains along Green Level to Durham; thereby eliminating two dead-ends.

Category	1- Hydraulic
Diameter, Length, or Capacity	790 LF of 12-inch
Year Completed	2015
Total Construction Cost	$0.12 million

7.4.4.3 Project WPZ-12: Construction of 20-inch Water Main along Alston Avenue

This project involves the design and construction of 5,000 LF of 20-inch main along Alston Avenue from NC-55 to O'Kelly Chapel Hill Road. This project is necessary as part of the proposed I-540 Elevated Tank (WPZ-17).

Category	1- Hydraulic
Diameter, Length, or Capacity	5,000 LF of 20-inch
Year Completed	2015
Total Construction Cost	$1.43 million

7.4.4.4 Project WPZ-16: Construction of 16-inch Water Main along Carpenter Fire Station Road

This project involves the design and construction of 6 LF of 16-inch main along Carpenter Fire Station Road. The project connects two segments of 16-inch main along Carpenter Fire Station Road; thereby, eliminating two dead-ends.

Category	1- Hydraulic
Diameter, Length, or Capacity	600 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.10 million

7.4.4.5 Project WPZ-22: Construction of 12-inch Water Main along Roberts Road

This project involves the design and construction of 5,400 LF of 12-inch main along Roberts Road continuing on Green Level Church Road to Green Level West Road. This project is recommended in conjunction with WPZ-23 and reduces stress on the existing 30-inch main on NC-55. Pipeline diameters proposed in WPZ-22 and WPZ-23 may need to be upsized based on detailed design of the proposed Western PZ boundary expansion into Morrisville. However, the Town may elect to rely on the Davis Drive PRV to accommodate additional demands which may eliminate the need to upsize these mains or delay them until the planning year 2025.

Category	1- Hydraulic
Diameter, Length, or Capacity	5,400 LF of 12-inch
Year Completed	2015
Total Construction Cost	$0.71 million

7.4.4.6 Project WPZ-23: Construction of 12-inch Water Main along Green Level West Road

This project involves the design and construction of 10,430 LF of 12-inch main along Green Level West Road from Green Level Church Road to NC-55. This project is recommended in conjunction with WPZ-22.

Category	1- Hydraulic
Diameter, Length, or Capacity	10,430 LF of 12-inch
Year Completed	2015
Total Construction Cost	$1.43 million

7.4.4.7 Project CPZ-5: Construction of 16-inch Water Main along Old Apex Road

This project involves the design and construction of 8,140 LF of 16-inch water main parallel to an existing 12-inch main along Old Apex Road from Cary Parkway to Maynard Road. This project will allow the Old Apex BPS to pump from the ground storage tank and for the tank to be filled without significantly impacting the system hydraulic grade line and thus affecting the Cary/Apex WTP HSPS flow rate. Modeling conducted during this study indicates that the existing pumps may be operating at run-out conditions after the 16-inch main is installed. For this reason, new pumps may be required or the existing pumps may need to be modified to operate on a more efficient part of their pump curve.

Category	1-Hydraulic
Diameter, Length, or Capacity	8,140 LF of 16-inch
Year Completed	2015
Total Construction Cost	$1.50 million

7.4.4.8 Project CPZ-6 *(CIB)*: Construction of 12-inch Water Main along Maynard Road

This project involves the design and construction of 2,950 LF of 12-inch main along Maynard Road which provides additional supply the southern portion of the Central PZ

Category	1- Hydraulic
Diameter, Length, or Capacity	2,950 LF of 12-inch
Year Completed	2015
Total Construction Cost	$0.44 million

7.4.4.9 Project CPZ-7 *(WT1154)*: Construction of 12-inch Water Main along Walnut Street

This project involves the design and construction of 4,680 LF of 12-inch main along Walnut Street. This is an existing local service area project, which provides redundancy and looping in the Maynard Loop area.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	4,680 LF of 12-inch
Year Completed	2015
Total Construction Cost	$0.66 million

7.4.4.10 Project CPZ-10: Construction of 16-inch Water Main from Highway 54 to Cary Parkway

This project involves the design and construction of 100 LF of 16-inch main connecting existing 24-inch main along Cary Parkway to existing 16-inch main along Highway 54. A

connection does not currently exist due to previous district boundaries between Morrisville and the Town of Cary. This provides additional supply to the Morrisville and RDU Airport areas and to the central area of the Central PZ. After this connection, flow direction through the Highway 54 Master Meter (magnetic meter) will change predominately to west-to-east from the current flow direction of east-to-west.

Category	1- Hydraulic
Diameter, Length, or Capacity	100 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.15 million

7.4.4.11 Project CPZ-12: Construction of 16-inch Water Main along SW Cary Parkway

This project involves the design and construction of 4,940 LF of 16-inch main parallel to an existing 16-inch main along SW Cary Parkway. This project allows for additional flows and reduced stress on the Ridgeview elevated tank and assists with supplying the proposed US-1 control valve.

Category	1- Hydraulic
Diameter, Length, or Capacity	4,940 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.96 million

7.4.4.12 Project CPZ-13: Construction of 16-inch Water Main along SE Cary Parkway

This project involves the design and construction of 1,110 LF of 16-inch main parallel to existing 16-inch main along SE Cary from Kildaire Farm Road to Ridge Drive. This proposed line provides a strong connection for the Ridgeview and Maynard elevated tanks and reduces stresses on the existing 16-inch main.

Category	1- Hydraulic
Diameter, Length, or Capacity	1,110 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.25 million

7.4.4.13 Project CPZ-16: Construction of 16-inch Water Main along SW and NW Maynard Road

This project involves the design and construction of 7,630 LF of 16-inch main parallel to the existing 12-inch main along SW and NW Maynard Road from Old Apex Road to Kildaire Farm Road. This proposed line provides additional flows and reduces stresses for Ridgeview and Maynard elevated tanks.

Category	1- Hydraulic
Diameter, Length, or Capacity	7,630 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.22 million

7.4.4.14 Project CPZ-17: Construction of 16-inch Water Main along Kildaire Farm Road

This project involves the design and construction of 4,980 LF of 16-inch main parallel to the existing 12-inch main along Kildaire Farm Road from Maynard Road to Cary Parkway. This

main is proposed in conjunction with CPZ-18 to provide additional supply between Maynard and Ridgeview elevated tanks.

Category	1- Hydraulic
Diameter, Length, or Capacity	4,980 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.91 million

7.4.4.15 Project CPZ-18: Construction of 16-inch Water Main along SE Maynard Road

This project involves the design and construction of 6,220 LF of 16-inch main parallel to the existing 12-inch main along Maynard Road from Kildaire Farm Road to Maynard elevated tank. This main is proposed in conjunction with CPZ-17.

Category	1- Hydraulic
Diameter, Length, or Capacity	6,220 LF of 16-inch
Year Completed	2015
Total Construction Cost	$1.15 million

7.5 Phase 3 – Year 2025 Improvements

7.5.1 Year 2025 Storage

No storage improvement projects are recommended for the 2025 planning year.

7.5.2 Year 2025 Pumping

7.5.2.1 Project WPZ-25: Installation of Fourth High Service Western Zone Pump (#10)

This project involves the design and installation of a 5.5 MGD vertical turbine pump in an existing slot (#9) at the Cary/Apex High Service Pump Station by the year 2025. This project is necessary to meet MDD demands in the Western PZ. The project includes new electrical and I&C equipment.

Category	1-Hydraulic
Diameter, Length, or Capacity	5.5 MGD at 305 ft TDH
Year Completed	2025
Total Construction Cost	$0.99 million

7.5.3 Year 2025 Control Valve

No control valve improvement projects are recommended for the 2025 planning year.

7.5.4 Year 2025 Piping

7.5.4.1 Project SPZ-8: Construction of 12-inch Water Main along Lochmere Road

This project involves the design and construction of 1,650 LF of 12-inch main parallel to the existing 8-inch distribution main along Lochmere Road near Kildaire Farm Road. This proposed main is recommended in conjunction with SPZ-9 to delay the need to construct an

elevated tank in the Southern PZ until build-out. However, the GIS data provide some uncertainty whether the diameter of the 8-inch distribution main should is actually 12-inches. Should the existing line actually be a 12-inch main then this project is unnecessary.

Category	1- Hydraulic
Diameter, Length, or Capacity	1,650 LF of 12-inch
Year Completed	2025
Total Construction Cost	$0.23 million

7.5.4.2 Project SPZ-9: Construction of 16-inch Water Main along Ten Ten Road

This project involves the design and construction of 3,890 LF of 16-inch main along Ten Ten Road. Additionally, this project involves the design and construction of a short segment of 16- main parallel to an existing 8-inch distribution main along the Ten Ten Road connection to Penny Road. However, the GIS data provides some uncertainty at the location where a short section of 8-inch main is located. Should the existing 8-inch main actually be a 16-inch main then the short section of 16-inch is unnecessary. This project is necessary to meet peak demand and provides additional supply to the southern portion of the Southern PZ.

Category	1- Hydraulic
Diameter, Length, or Capacity	3,890 LF of 16-inch
Year Completed	2015
Total Construction Cost	$0.66 million

7.6 Phase 4 – Build-out Improvements

7.6.1 Build-out Storage

7.6.1.1 Project CPZ-25: Replace Existing Maynard Elevated Tank

This project involves the replacement of the existing Maynard elevated tank with a tank of similar volume and location. This project is proposed as a placeholder for aging infrastructure replacement.

Category	1-Hydraulic
Diameter, Length, or Capacity	0.5 MG
Year Completed	Build-out
Total Construction Cost	$1.84 million

7.6.1.2 Project CPZ-26: Replace Existing Harrison Elevated Tank

This project involves the replacement of the existing Harrison elevated tank with a tank of similar volume and location. This project is proposed as a placeholder for aging infrastructure replacement.

Category	1-Hydraulic
Diameter, Length, or Capacity	1 MG
Year Completed	Build-out
Total Construction Cost	$3.34 million

7.6.1.3 Project SPZ-15: Construct New Holly Springs Elevated Tank and Water Line

This project involves the design and construction of a 1 MG elevated tank in the vicinity of the Holly Springs Road and Ten Ten Road interchange by build-out. This proposed elevated tank is necessary to provide adequate storage based on build-out projected water demands.

Category	1-Hydraulic
Diameter, Length, or Capacity	1 MG
Year Completed	Build-out
Total Construction Cost	$3.4 million

7.6.2 Build-out Pumping

7.6.2.1 Project CPZ-20: Replacement of High Service Central Zone Pumps (#3, 4, 5, 6, 7, and 8)

This project involves the replacement of six high service pumps with new 10 MGD vertical turbine pumps in slots #3, 4, 5, 6, 7 and 8 at the Cary/Apex HSPS by the build-out planning year. The project includes new electrical and I&C equipment.

Category	1-Hydraulic
Diameter, Length, or Capacity	10 MGD at 485 ft TDH
Year Completed	Build-out
Total Construction Cost	$7.0 million

7.6.3 Build-out Control Valve

7.6.3.1 Project SPZ-7: Construct Holly Springs Control Valve and Water Main

This project involves the design and construction of a control valve and associated 16-inch water main from Tryon Road along Holly Springs Road. This project would provide a fourth supply from the Central PZ to the Southern PZ and would increase supply and redundancy in the SPZ and potentially improve water quality in the Crossroads area of the Central PZ.

Category	1- Hydraulic
Diameter, Length, or Capacity	3,220 LF of 16-inch
Year Completed	Build-out
Total Construction Cost	$0.70 million

7.6.4 Build-out Piping

7.6.4.1 Project WPZ-18 Construction of 12-inch Water Main along White Oak Church Road

This project involves the design and construction of 9,070 LF of 12-inch main along White Oak Church Road from Green Level West Road to Green Level Church Road. A section of project WPZ-19 runs parallel to an existing 12-inch main along Green Level Church Road. This project is necessary to provide a connection for the addition feeds to the eastern portion of WPZ. Under potential WPZ expansion (into the Morrisville area) this project may require larger diameter and built earlier with additional segments on Green Level Church Road.

Category	1- Hydraulic
Diameter, Length, or Capacity	9,070 LF of 12-inch
Year Completed	Build-out
Total Construction Cost	$1.33 million

7.6.4.2 Project WPZ-19 Construction of 16-inch Water Main along Green Level Church Road at Green School Hope Road

This project involves the design and construction of 4,480 LF of 16-inch main parallel to an existing 16-inch main along Green Level Church Road. This project is necessary to provide additional supply to the Western PZ. This project may need to be expedited based on final design of the proposed Western PZ boundary expansion.

Category	1- Hydraulic
Diameter, Length, or Capacity	4,480 LF of 16-inch
Year Completed	Build-out
Total Construction Cost	$0.76 million

7.7 Undesignated Phase

The Town of Cary tracks ongoing developer projects designated as "proposed" in the Town's water system geodatabase. These projects were not a CIB or Assigned capital project by the Town. These proposed projects are listed below as "undesignated."

7.7.1 Undesignated Storage

No improvement projects for undesignated storage.

7.7.2 Undesignated Pumping

No improvement projects for undesignated pumping.

7.7.3 Undesignated Control Valve

7.7.3.1 Project WPZ-26: Davis Drive PRV Flow Metering

This project involves the design and construction of modifications to the Davis Drive PRV station so that flow from the Central PZ to the Western PZ can be remotely monitored via SCADA. This project may include the installation of a 12-inch or smaller flow meter in the existing vault or in a new vault upstream of the existing vault. Due to space constraints in the existing vault and the expense of constructing a second underground vault, an alternative is to retrofit or replace the existing 12-inch Golden Anderson PRV with a valve that has flow measurement capabilities. Some control valve manufacturers provide a module that interpolates flow from the measured differential pressure using the valve Cv curve.

Category	3 - Existing or Anticipated Local Service
Diameter, Length, or Capacity	Flow Span – To Be Determined
Year Completed	Undesignated
Total Construction Cost	$0.08 million

7.7.4 Undesignated Piping

7.7.4.1 Project WPZ-10 *(WT1144)*: Construction of 12-inch Water Main along Hawles Road

This project involves the design and construction of 1,270 LF of 12-inch main along Hawles Road. This project is an existing local service area project extending a service for development.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	1,270 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$0.23 million

7.7.4.2 Project WPZ-13 Construction of 16-inch Water Main along NC-540

This project involves the design and construction of 9,500 LF of 16-inch main along Alston Avenue and NC-540 continuing on Old Maynard Road to Redwood Park Drive. This project provides a connection from the proposed new I-540 elevated tank (WPZ-17) to the eastern portion of the Western PZ and may be necessary under the expanded Western PZ into Morrisville and RDU area. Under existing PZ boundaries this proposed pipe is not necessary.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	9,490 LF of 16-inch
Year Completed	Undesignated
Total Construction Cost	$1.83 million

7.7.4.3 Project WPZ-14 Construction of 12-inch Water Main along McCrimmon Parkway

This project involves the design and construction of 4,150 LF of 12-inch main along McCrimmon Parkway and is designated as an anticipated local service project.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	4,150 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$0.64 million

7.7.4.4 Project WPZ-20 Construction of 12/16-inch Water Main along Morrisville Parkway at Louis Stephens Road

This project involves the design and construction of 820 LF of 12-inch and 1,210 LF of 16-inch main along Morrisville Parkway at Louis Stephens Road. This is an anticipated local service area project which will provide redundancy and looping in the area.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	820 LF of 12-inch 1,210 LF if 16-inch
Year Completed	Undesignated
Total Construction Cost	$0.37 million

7.7.4.5 Project CPZ-14 Construction of 12-inch Water Main from Harrison to Trenton Road

This project involves the design and construction of 10,660 LF of 12-inch main runs cross-country northwest from Harrison Road to Trenton Road. This project is an anticipated local service area project which provides looping in the northeast portion of CPZ just South of I-40.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	10,630 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$1.68 million

7.7.4.6 Project CPZ-15 Construction of 12-inch Water Main along Trenton Road

This project involves the design and construction of 3,730 LF of 12-inch main along Trinity Road and Trenton Road. This is an anticipated local service area project which will provide looping in the area.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	3,730 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$0.49 million

7.7.4.7 Project SPZ-10 Construction of 16-inch Water Main along Holly Springs Road South of Ten Ten Road

This project involves the design and construction of 1,410 LF of 16-inch water main along Holly Springs Road. This project is an anticipated local service area project which provides looping in the SW portion of SPZ just South of Ten Ten Road.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	1,410 LF of 16-inch
Year Completed	Undesignated
Total Construction Cost	$0.24 million

7.7.4.8 Project SPZ-11 Construction of 12-inch Water Main along Arthur Pierce Road

This project involves the design and construction of 3,420 LF of 12-inch main along Arthur Pierce Road. This project is an anticipated local service area project which provides looping between Kildaire Farm Road and Holly Springs Road.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	3,420 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$0.43 million

7.7.4.9 Project SPZ-12 Construction of 12-inch Water Main along Kildaire Farm Road and Holly Springs Road Loop

This project involves the design and construction of 9,230 LF of 12-inch main along Arthur Pierce Road. This project is an anticipated local service area project which provides looping between Kildaire Farm Road and Holly Springs Road.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	9,230 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$1.26 million

7.7.4.10 Project SPZ-13 Construction of 12-inch Water Main along Bells Lake Road

This project involves the design and construction of 13,920 LF of 12-inch main along Bells Lake Road. This project is an anticipated local service area project which provides looping in the southeast portion of SPZ from Ten Ten Road to Optimist Farm Road.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	13,920 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$1.85 million

7.7.4.11 Project SPZ-14 Construction of 12-inch Water Main along Holly Springs Road North of Penny Road

This project involves the design and construction of 3,720 LF of 12-inch main along Holly Springs Road north of Penny Road. This project is an anticipated local service area project which provides looping in the Southern PZ.

Category	3- Existing or Anticipated Local Service Project
Diameter, Length, or Capacity	3,720 LF of 12-inch
Year Completed	Undesignated
Total Construction Cost	$0.49 million

TABLE 7-1
CIP Project Costs in 2009 Dollars with no Escalation for Year of Construction

Project No.	Assigned or CIB No.	CIP Category	Approx. Year	Project Name	Length (ft)	Diameter (in)	Location / Description	Cost in 2009 Dollars with no Escalation for Year of Construction					
								2009	2010	2015	2025	Build-out	Undesignated
WPZ-1	WT1142	1	2010	Wimberly Road WL	10,530	24	10,530 LF of 24" from Plant along Wimberly Road and Green Level West Road to White Oak Church Road.	$0	$8,475,600	$0	$0	$0	$0
WPZ-2	WT1129	1	2010	Green Level West Road WLE Ph. 1	5,110	24	5,110 LF of 24" from White Oak Church Rd. along Green Level West Road to Green Level Church Road	$0	$4,261,300	$0	$0	$0	$0
WPZ-3	WT1128	1	2010	Green Level Church Road WLE Ph.1	3,250	20	3,250 LF of 20" from Green Level West Road along Green Level Church Road to Mills Road.	$0	$930,700	$0	$0	$0	$0
WPZ-4	WT1165	1	2009	High House Road WPZ WL	1,380	12	1,380 LF of 12" along High House Road crossing CPZ	$173,800	$0	$0	$0	$0	$0
WPZ-5	WT1160	3	2009	Carpenter Upchurch WL	6,140	12	6,140 LF of 12" along Carpenter Upchurch Road from Green Hope School Road to High House Road	$821,400	$0	$0	$0	$0	$0
WPZ-6	WT1168	3	2009	Louis Stevens Drive WL	4,080	12	4,080 LF of 12" along Louis Stevens Drive from Carpenter Upchurch Road.	$538,200	$0	$0	$0	$0	$0
WPZ-7	WT1164	1	2009	Eagle Meadow Ct. WLE	280	12	280 LF of 12" along Heritage Pines Drive from Louis Stevens Drive to Preston Village Way	$35,600	$0	$0	$0	$0	$0
WPZ-8	WT1124	1	2009	Morrisville Pkwy. WL	1,070	16	1,070 LF of 16" along Morrisville Pkwy at Davis Drive	$212,700	$0	$0	$0	$0	$0
WPZ-9	WT1097	1	2015	NC 55 WL Extension	4,610	16	4,610 LF of 16" along Hwy 55 (dead-end)	$0	$0	$843,600	$0	$0	$0
WPZ-10	WT1144	3	Undesignated	Hawles WL	1,270	12	1,270 LF of 12" along Hawles Road (dead-end)	$0	$0	$0	$0	$0	$232,100
WPZ-11	-	1	2015	Green Level to Durham Road at Dennison Lane WL	790	12	790 LF of 12" along Green Level to Durham Road between Dennison Lane and Courtland View Lane.	$0	$0	$123,100	$0	$0	$0
WPZ-12	-	1	2015	Alston Avenue WL	5,000	20	5,000 LF of 20" along Alston Avenue	$0	$0	$1,426,000	$0	$0	$0
WPZ-13	-	3	Undesignated	NC 540 WL	9,490	16	9,490 LF of 16" along Alston Avenue and NC-540 continuing on Old Maynard Road to Redword Park Drive	$0	$0	$0	$0	$0	$1,830,300
WPZ-14	-	3	Undesignated	McCrimmon Parkway WL	4,150	12	4,150 LF of 12" along McCrimmon Parkway	$0	$0	$0	$0	$0	$642,400
WPZ-15	-	1	2010	Alston Avenue at Green Level Durham Road WL	820	16	820 LF of 16" along Alston Avenue from Green Level Durham Road	$0	$137,800	$0	$0	$0	$0
WPZ-16	-	1	2015	Carpenter Fire Station Road WL	600	16	600 LF of 16" along Carpenter Fire Station Road from Green Level to Durham Road	$0	$0	$101,000	$0	$0	$0
WPZ-17	-	1	2015	New I-540 Tank and WL	350	20	New 2MG tank located on Petty Farm Road. 350 LF of 20" from Petty Farm Road to New 540 Tank	$0	$0	$5,556,800	$0	$0	$0
WPZ-18	-	1	Build-out	White Oak Church Road WL	9,070	12	9,070 LF of 12" from Green Level West Road along White Oak Church Road continuing along Green Level Church to Yates Store Road	$0	$0	$0	$0	$ 1,334,200	$0

TABLE 7-1
CIP Project Costs in 2009 Dollars with no Escalation for Year of Construction

Project No.	Assigned or CIB No.	CIP Category	Approx. Year	Project Name	Length (ft)	Diameter (in)	Location / Description	Cost in 2009 Dollars with no Escalation for Year of Construction					
								2009	2010	2015	2025	Build-out	Undesignated
WPZ-19	-	1	Build-out	Green Level Church Road at Green Hope School Road WL	4,480	16	4,480 LF of 16" from Mills Road along Green Level Church Road to Green Hope School Road.	$0	$0	$0	$0	$756,700	$0
WPZ-20	-	3	Undesignated	Morrisville Parkway at Louis Stephens Road WL	1,210	16	1,210 LF of 16" along Morrisville Parkway from Louis Stephens Road	$0	$0	$0	$0	$0	$268,700
WPZ-20	-	3	Undesignated	Morrisville Parkway at Louis Stephens Road WL	820	12	820 LF of 12" along Louis Stephens Road to Morrisvile Parkway	$0	$0	$0	$0	$0	$103,800
WPZ-21	-	-	-	-	-	-	Project number not used	-	-	-	-	-	-
WPZ-22	-	1	2015	Roberts WL	5,400	12	5,400 LF of 12" along Roberts Road from Green Level Church Road	$0	$0	$704,800	$0	$0	$0
WPZ-23	-	1	2015	Green Level West Road near Beaver Dam Road WL	10,430	12	10,430 LF of 12" along Green Level West Road from Green Level Church Road to NC 55	$0	$0	$1,434,400	$0	$0	$0
WPZ-24	-	1	2010	New High Service Pump WPZ 2010 (#9)	-	-	Addition of new HS pump with a design of 5.5 MGD and TDH of 305	$0	$990,000	$0	$0	$0	$0
WPZ-25	-	1	2025	New High Service Pump WPZ 2025 (#10)	-	-	Addition of new HS pump with a design of 5.5 MGD and TDH of 305	$0	$0	$0	$990,000	$0	$0
WPZ-26	-	3	Undesignated	Davis Drive PRV Flow Metering	-	-	Addition of new flow meter and/or I&C modifications to be able to monitor flow at the Davis Drive PRV through SCADA	$0	$0	$0	$0	$0	$80,000
CPZ-1	CIB	1	2010	Jenks-Carpenter Holt Road WL Reinforcement	7,710	24	7,710 LF of 24” parallel to existing 36” along Holt Road from Hwy 55 to Jenks Carpenter Road	$0	$6,220,600	$0	$0	$0	$0
CPZ-2	WT1166 WT1143	1	2009	Holt Road to Davis Drive WL	3,780	24	3,780 LF of 24” along Holt, Powell, and Farm Pond Road	$3,694,400	$0	$0	$0	$0	$0
CPZ-3	-	1	2010	West High Street WL	1,850	24	1,850 LF of 24” parallel to existing 12” along W. High St. from Moravian Lane to Cary Parkway	$0	$1,534,600	$0	$0	$0	$0
CPZ-4	WT1161	1	2010	Cary Parkway SW WL Reinforcement	3,550	20	3,550 LF of 20” parallel to existing 20"/16” along Cary Parkway from W. High Street to Old Apex Road.	$0	$1,007,800	$0	$0	$0	$0
CPZ-5	WT1172	1	2015	Old Apex Road WL Reinforcement	8,140	16	8,140 LF of 16” parallel to existing 12” along Old Apex Road from Cary Parkway to Maynard Road	$0	$0	$1,504,600	$0	$0	$0
CPZ-6	CIB	1	2015	Maynard Road WL Reinforcement Ph. 1	2,950	12	2,950 LF of 12” parallel to existing 12” along Maynard Road from High House to Old Apex Road	$0	$0	$443,800	$0	$0	$0
CPZ-7	WT1154	3	2015	Walnut Street WL Reinforcement	4,680	12	4,680 LF of 12” parallel to existing 6” along Walnut Street from Maynard Road Loop to Kildaire Farm Road	$0	$0	$661,900	$0	$0	$0
CPZ-8	CIB	3	2010	TCAP Waterline Upgrade	3,250	16	3,250 LF of 16” along S. Walker Street from Walnut Street to E. Chatham Street	$0	$678,900	$0	$0	$0	$0

TABLE 7-1
CIP Project Costs in 2009 Dollars with no Escalation for Year of Construction

Project No.	Assigned or CIB No.	CIP Category	Approx. Year	Project Name	Length (ft)	Diameter (in)	Location / Description	Cost in 2009 Dollars with no Escalation for Year of Construction					
								2009	2010	2015	2025	Build-out	Undesignated
CPZ-9	-	1	2010	Evans MM Check Valve Removal	-	16	Removal of 16" check valve and replacement with short pipe at Evans MM	$0	$50,000	$0	$0	$0	$0
CPZ-9	-	1	2010	Lake Crabtree MM Check Valve Removal	-	16	Removal of 16" check valve and replacement with short pipe at Lake Crabtree MM	$0	$50,000	$0	$0	$0	$0
CPZ-9	-	1	2010	Holiday Inn MM Check Valve Removal	-	16	Removal of 16" check valve and replacement with short pipe at Holiday Inn MM	$0	$50,000	$0	$0	$0	$0
CPZ-10	-	1	2015	Highway 54 Cary Parkway WL Connection	100	16	100 LF of 16" along Chapel Hill Road at NW Cary Parkway	$0	$0	$145,700	$0	$0	$0
CPZ-12	-	1	2015	SW Cary Parkway Reinforcement WL	4,940	16	4,940 LF of 20" parallel to existing 16" along SW Cary Parkway from Old Apex Road to Lake Pine Drive	$0	$0	$964,200	$0	$0	$0
CPZ-13	-	1	2015	Ridgeview Tank Reinforcement WL	1,110	16	1,110 LF of 16" parallel to existing 16" along SE Cary Parkway from Kildaire Farm Road to Ridge Drive	$0	$0	$252,000	$0	$0	$0
CPZ-14	-	3	Undesignated	Harrison to Trenton Road WL	10,630	12	9,070 LF of 12" running cross country (NW) from Harrison to Trenton Road. 1,560 LF of 12" along Trinity Road to Trenton Road	$0	$0	$0	$0	$0	$1,677,900
CPZ-15	-	3	Undesignated	Trenton WL	3,730	12	3,730 LF of 12" along Trenton Road	$0	$0	$0	$0	$0	$493,800
CPZ-16	-	1	2015	NW Maynard Road Reinforcement WL	1,110	16	7,630 LF of 16" parallel to existing 12" along SE Maynard Road from Old Apex Road to Kildaire Farm Road	$0	$0	$215,700	$0	$0	$0
CPZ-17	-	1	2015	Kildaire Farm Road Reinforcement WL	4,980	16	4,980 LF of 16" parallel to existing 12" along Kildaire Farm Road from SE Cary Parkway to SW Maynard Road	$0	$0	$906,900	$0	$0	$0
CPZ-18	-	1	2015	SE Maynard Road Reinforcement WL	6,220	16	6,220 LF of 16" parallel to existing 12" along SE Maynard Road from Kildaire Farm Road to Maynard Tank	$0	$0	$1,147,800	$0	$0	$0
CPZ-19	-	1	2010	New High Service Pump CPZ 2010 (#8)	-	-	Addition of new HS pump with a design of 9 MGD and TDH of 450	$0	$1,810,000	$0	$0	$0	$0
CPZ-20	-	1	Build-out	New High Service Pump CPZ Build-out (#3, 4, 5, 6, 7, & 8)	-	-	Replace 6 existing HS pumps with new HS pumps with design of 10 MGD and 485' TDH	$0	$0	$0	$0	$7,000,000	$0
CPZ-21	WT1153	2	2009	Waterline Upgrades 08	250	6	250 LF of 6" along Hunter Street from East Park to Webster Street	$20,000	$0	$0	$0	$0	$0
CPZ-22	WT1120	2	2010	Town Center WL – Waldo Street	250	6	250 LF of 6" along Waldo Street	$0	$20,000	$0	$0	$0	$0
CPZ-23	WT1121	2	2010	Upgrade WL – FY06	900	6	900 LF of 6" along Hillsboro Street	$0	$71,800	$0	$0	$0	$0
CPZ-24	WT1114	2	2010	Upgrade WL – FY05	700	6	700 LF of 6" along Sorrell Street	$0	$55,900	$0	$0	$0	$0
CPZ-25	-	3	Build-out	Replace 0.5 MG Maynard Tank	-	-	New 0.5 MG tank to replace existing Maynard Tank at same location	$0	$0	$0	$0	$1,836,500	$0

TABLE 7-1
CIP Project Costs in 2009 Dollars with no Escalation for Year of Construction

Project No.	Assigned or CIB No.	CIP Category	Approx. Year	Project Name	Length (ft)	Diameter (in)	Location / Description	Cost in 2009 Dollars with no Escalation for Year of Construction					
								2009	2010	2015	2025	Build-out	Undesignated
CPZ-26	-	3	Build-out	Replace 1 MG Harrison Tank	-	-	New 1MG tank to replace existing Harrison Tank at same location	$0	$0	$0	$0	$3,339,000	$0
SPZ-1	WT1054 WT1073	1	2009	Holly Springs Road WL Ph. 1 and Lilly Atkins Road WL	6,510	12	6,510 LF along Holly Springs Road continuing onto Lily Atkins Road	$988,700	$0	$0	$0	$0	$0
SPZ-2	WT1098 and WT 1089	2	2010	Pierce Olive Road WL and Optimist Farm Road WL	9,140	12	9,140 LF of 12" from Holly Springs Road along SR1389 to Optimist Farm Road	$0	$1,295,400	$0	$0	$0	$0
SPZ-2	WT1098 and WT 1089	2	2010	Pierce Olive Road WL and Optimist Farm Road WL	3,120	16	3,120 LF of 16" along Optimist Farm Road from SR 1389	$0	$526,900	$0	$0	$0	$0
SPZ-3	WT5006	3	2010	Windsor Oaks WL	1,920	12	1,920 LF of 12" along Kingsford Drive	$0	$265,500	$0	$0	$0	$0
SPZ-4	WT1094	3	2009	Pink Acres WL	2,490	12	2,490 LF of 12" along Cowley Road	$337,800	$0	$0	$0	$0	$0
SPZ-5	WT1054	1	2010	Holly Springs Road WL Phase 2	12,650	16	12,650 LF of 16" from Birkhaven Drive South along Holly Springs Road to Ten Ten Road.	$0	$2,298,900	$0	$0	$0	$0
SPZ-6	-	1	2010	SPZ Highway 1 Control Valve and WL	1,890	16	1,890 LF of 16" from Gregson Drive crossing US 1 to Regency Parkway plus SPZ Highway 1 control valve.	$0	$541,300	$0	$0	$0	$0
SPZ-7	-	2	Build-out	SPZ Holly Springs Control Valve and WL	3,220	16	3,220 LF of 16" along Holly Springs Road from Tryon Road. Holly Springs control valve.	$0	$0	$0	$0	$702,700	$0
SPZ-8	-	1	2025	Lochmere Road WL	1,650	12	1,650 LF of 12" along Lochmere Road	$0	$0	$0	$231,600	$0	$0
SPZ-9	-	1	2025	Ten Ten Road WL	3,890	16	3,890 LF of 16" along Ten Ten Road	$0	$0	$0	$657,300	$0	$0
SPZ-10	-	3	Undesignated	Holly Springs Road S of Ten Ten Road WL	1,410	16	1,410 LF of 16" along Holly Springs Road south of Ten Ten Road	$0	$0	$0	$0	$0	$238,900
SPZ-11	-	3	Undesignated	Arthur Pierce Road WL	3,420	12	3,420 LF of 12" along Arthur Pierce Road	$0	$0	$0	$0	$0	$430,700
SPZ-12	-	3	Undesignated	Kildaire Farm Road/Holly Springs Road Loop WL	9,230	12	9,230 LF of 12" along Kildaire Farm Road across to Holly Run Road continuing along Holly Springs Road	$0	$0	$0	$0	$0	$1,258,400
SPZ-13	-	3	Undesignated	Bells Lake Road WL	13,920	12	13,920 LF of 12" along Ten Ten continuing along Bells Lake Road and Optimist Farm Road	$0	$0	$0	$0	$0	$1,850,100
SPZ-14	-	3	Undesignated	Holly Springs Road N of Penny Road WL	3,720	12	3,720 LF of 12" along Holly Springs Road North of Penny Road	$0	$0	$0	$0	$0	$492,500
SPZ-15	-	1	Build-out	New Holly Springs Tank and WL	300	20	New 1MG elevated tank located at Holly Springs and Ten Ten Road. 300 LF of 20" to New Holly Springs Tank	$0	$0	$0	$0	$3,339,000	$0
TOTAL								**$6,822,600**	**$31,273,000**	**$16,432,300**	**$1,878,900**	**$18,308,100**	**$9,599,600**

7.8 Summary of Recommended CIP Projects

The total cost of the recommended CIP projects presented in Table 7-1 is $84.3 million. However the projects that comprise the recommended CIP are distributed spatially throughout the service area and also temporally by defined planning period. Tables 7-2 and 7-3 present a summary of the project costs for each planning period by type of recommended infrastructure and the percentage of total CIP costs, respectively. Table 7-4 presents the project costs by pressure zone for all of the planning periods and the percentage of total CIP costs.

TABLE 7-2
CIP Project Costs by Planning Period and Type of Recommended Infrastructure
(Costs in 2009 Dollars with no Escalation for Year of Construction)

Type of Recommended Infrastructure	2009	2010	2015	2025	Build-out	Undesignated	Total by Infrastructure Type
Storage	$ -	$ -	$5,556,800	$ -	$8,514,500	$ -	$14,071,300
Pumping	$ -	$2,800,000	$ -	$990,000	$7,000,000	$ -	$10,790,000
Control Valve	$ -	$691,300	$ -	$ -	$702,700	$80,000	$1,474,000
Piping	$6,822,600	$27,781,700	$10,875,500	$888,900	$2,090,900	$9,519,600	$57,979,200
Total by Planning Period	$6,822,600	$31,273,000	$16,432,300	$1,878,900	$18,308,100	$9,599,600	$84,314,500

TABLE 7-3
CIP Project Costs by Planning Period and Type of Recommended Infrastructure (units in percent of Total CIP cost of $84.3 million)

Type of Recommended Infrastructure	2009	2010	2015	2025	Build-out	Undesignated	Total by Infrastructure Type
Storage	0%	0%	7%	0%	10%	0%	**17%**
Pumping	0%	3%	0%	1%	8%	0%	**12%**
Control Valve	0%	1%	0%	0%	1%	0%	**2%**
Piping	8%	33%	13%	1%	2%	11%	**68%**
Percent of Total CIP by Planning Period	**8%**	**37%**	**20%**	**2%**	**21%**	**11%**	

Note: Numbers may not add exactly to 100% due to rounding.

TABLE 7-4
CIP Project Costs by Pressure Zone for all Planning Periods and Percentage of Total CIP Cost of $84.3 million
(Costs in 2009 Dollars with no Escalation for Year of Construction)

Western (WPZ)	Central (CPZ)	Southern (SPZ)
$33,005,000	$35,853,800	$15,455,700
39% of Total CIP Cost	43% of Total CIP Cost	18% of Total CIP Cost

The first phase of the recommended CIP is the year 2010 planning period. Sixteen projects totaling approximately $31.3 million are recommended for the first phase as presented in Table 7-5. Many of these projects were previously identified in the 2000 Master Plan. CH2M HILL re-evaluated each previously recommended project using the updated 2010, 2015, 2025, and build-out demand projections and included in this Master Plan only the projects that were verified as needed. These previously recommended projects are highlighted in yellow in the table below. They comprise nine of the sixteen projects and total $25.1 million of the proposed $31.3 million in projects recommended for the 2010 planning period.

TABLE 7-5
CIP Projects and Costs for Year 2010 Planning Period
(Costs in 2009 Dollars with no Escalation for Year of Construction)

Project No./ Assigned or CIB No.	Project Name	Opinion of Probable Cost	Notes
WPZ-1 WT1142	Wimberly Road 24-inch water line	$8,475,600	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
WPZ-2 WT1129	Green Level West 24-inch water line	$4,261,300	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
WPZ-3 WT1128	Green Level Church Road 20-inch water line	$930,700	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
WPZ-15	Alston Ave. at Green Level Durham Road 16-inch water line	$137,800	Project identified in this Master Plan
WPZ-24	New High Service Pump for Western PZ	$990,000	Project identified in this Master Plan
CPZ-1 CIB	Jenks-Carpenter Holt Road 24-inch water line	$6,220,600	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
CPZ-3	West High Street 24-inch water line to parallel 12-inch water line	$1,534,600	Project identified in this Master Plan

TABLE 7-5
CIP Projects and Costs for Year 2010 Planning Period
(Costs in 2009 Dollars with no Escalation for Year of Construction)

Project No./ Assigned or CIB No.	Project Name	Opinion of Probable Cost	Notes
CPZ-4 WT1161	Cary Parkway 20-inch water line to parallel 20-inch water line	$1,007,800	Project identified in this Master Plan
CPZ-8 CIB	TCAP Waterline Upgrade	$678,900	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
CPZ-9	Check Valve Removal at Evans MM; Lake Crabtree MM; Holiday Inn MM	$150,000	Project identified in this Master Plan
CPZ-19	New High Service Pump for Central PZ	$1,810,000	Project identified in this Master Plan
CPZ-22; CPZ-23; CPZ-24 WT1120; WT1121; WT1114	Various 6-inch water line upgrades	$147,700	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
SPZ-2 WT1098 and WT1089	Pierce Olive Road and Optimist Farm Road 12-inch and 16-inch water lines	$1,822,300	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
SPZ-3 WT5006	Windsor Oaks 12-inch water line	$265,500	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
SPZ-5 WT1054	Holly Springs Road Phase 2; 16-inch water line	$2,298,900	Recommended in previous Master Plan; Verified by CH2M HILL in this Master Plan
SPZ-6	Southern PZ Highway 1 Control Valve	$541,300	Project identified in this Master Plan
	Total	**$31,273,000**	

Note: Highlighted projects were previously recommended in the 2000 Master Plan and re-evaluated by CH2M HILL using the updated 2010, 2015, 2025, and build-out demand projections. Only the projects verified as needed are included in this Master Plan. Verified previously recommended projects total $25.1 million.

7.9 Recommendations for Further Study

Throughout this Master Plan, additional analyses that may impact the sizing, timing or need for recommended CIP projects were briefly discussed and are summarized in this section.

CH2M HILL recommends that the Town of Cary consider the following suggestions for further studies that may help clarify, validate, or modify future CIP items and enhance the water distribution system model developed for this Master Plan.

7.9.1 Field Verification Recommendations

As referenced in Section 4.3, hydrant flow test data was collected during the field testing phase to help calibrate the hydraulic model using a steady state approach. For tests that produced marginal steady state calibration results, the following recommendations were noted. Performing some of the tests recommended below has been included in the contract amendment described in Section 1.2.

- HGL D: The remote southern end of the Southern PZ undergoes regular flushing at a rate of 300 gpm. The flushing demand should be assigned to more accurately calibrate to the location of gauging point 16.
- FF Test 3: Gauging point 3 was located within a new subdivision currently under construction. To achieve a calibration match, an existing pipe in the development was closed and the 12-inch main along Yates Store Road was closed. It is recommended that a future fire flow profile test be conducted along Yates Store Road with closer spacing of digital pressure recorders in order to determine the location of a potential closed valve.
- FF Test 4 and 6: The small area within the Western PZ east of NC-55 and south of Morrisville-Carpenter Road exhibited the need for diurnal demand pattern adjustments. It is recommended that this area be re-tested near gauging points 4 and 6 after more refined diurnal demand patterns are developed for this area.
- FF Test 7: Gauging point 7 was located in the Research Triangle Park area which consists of many commercial developments. Developing more accurate diurnal demand patterns for this area of the WPZ is recommended.
- FF Tests 8-14: Tests 8 through 14 were located within the Morrisville and RDU Airport Area of the Central PZ. It was observed in the modeling process that there is a need for more accurate diurnal demand patterns in the Morrisville and RDU Airport area to more accurately calibrate the model.
- FF Tests 15 and 16: Gauging points 15 and 16 were located just south of Morrisville and exhibited the need for diurnal demand pattern adjustments. There is a need for a more individualized diurnal demand pattern near the Weston Master Meter.
- FF Test 19c: Gauging point 19c revealed some potential piping connectivity errors between existing 8-inch and 16-inch pipes along Old Apex Road in the vicinity of Murphy Drive and Falcon Parkway. It is recommended this area be visited to determine pipe connectivity in the area.

- FF Test 20a: Gauging point 20a was located within the Maynard Loop area and it was thought that a potential closed valve or partially closed valve in the vicinity of Gage 20a may exist. Since there is an upcoming pipe replacement project in the area, it is recommended that this area be investigated for valve closures.
- FF Test 24: The Kildaire Farm Road OCV pressure was not matched well during calibration. Additional investigation is needed to achieve a closer match of the Kildaire Farm Road OCV resulting in a more accurate calibration of Test 24.

7.9.2 Verification of Western PZ High Service Pump Curves

As noted in Section 4.4.2.1, a small difference between the model and SCADA data was observed for the Cary/Apex WTP HSPS Western PZ header flow and pressure. For this reason, the Western PZ pump curve was slightly de-rated to provide a better match between the model and SCADA data. It is recommended that the Town perform a desktop analysis of the Western PZ high service pump curves by downloading at least one year of hourly SCADA data for the following points: Western PZ discharge header pressure, Western PZ discharge header flow, and clearwell level. Using the elevations for the bottom of clearwell and the discharge header pressure indicator transmitter, the hourly pump head could be plotted which will define the actual profiles of the two Western PZ high service pumps.

7.9.3 Verification of Central PZ Tank Data

As noted in Section 4.4.2.2, a difference in SCADA tank head and model tank head values were noted. Further refinement of the district diurnal curves and verifying the bottom of bowl elevation for the Maynard Elevated Tank is recommended.

7.9.4 Refinement of System Diurnal Demands

A chlorine residual-based water quality model is currently underway as an addendum to this Master Plan. To complete the water quality model, it is recommended that diurnal demands be refined by conducting a series of district measurements to help provide a detailed characterization. Performing these district measurements has been included in the contract amendment described in Section 1.2. Upon collecting the field data, the new diurnal demands will be added to the model to further refine the hydraulic model calibration.

The district measurement data can be used to analyze the diurnal demand variations by areas within the distribution system. It is recommended that an analysis of this data be conducted to evaluate the effectiveness of water conservation measures (i.e. watering restrictions) that reduce water demand during the peak hours of the day. Ultimately, a reduction of peak hour demands may allow the Town to delay or eliminate certain capital projects and reduce capital expenditures.

7.9.5 Town of Apex Water Distribution System Model and Analysis

Since the Town of Apex's water distribution system demands are supplied through connections with the Town of Cary system at Green Level and Jenks Road, the Town of Cary's system pressure and flows can be impacted by fluctuations in Apex's demands. To study the potential impacts in more detail, it is recommended that the Town of Apex's distribution system be included as part of the Town of Cary's distribution system hydraulic

model developed for this Master Plan. The resulting model would be used to evaluate the supply requirements from the Cary/Apex Water Treatment Plant and the significant capital expenditure required by the Town of Cary to increase supply to the southern portions of the Central PZ and Southern PZ, areas which are currently at design capacity as described in Section 6.1.2. This analysis would address the following primary issues:

- Town of Apex Future Diurnal Demands and Available Storage – A detailed diurnal demand and storage analysis should be conducted for the Apex water distribution system to determine in detail the manner in which it impacts the Town of Cary's distribution system. This analysis was not included in the scope of work for this Master Plan. Apex projects a significant increase in future demands and it is possible that the Town of Apex has insufficient system storage under future demand conditions which may require flows in excess of maximum day demand to be supplied by the Green Level and Jenks Road master meters.
- Town of Cary Southern Pressure Zone Capacity Limitations – Recommendations for increasing supply to the Ridgeview Elevated Tank, the Maynard Elevated Tank and the Southern PZ are provided in this Master Plan. However, these improvements will require significant capital expenditures. To offset or delay these costs, it is recommended that the Town of Cary and Apex evaluate the potential to utilize the Lake Pine Drive and Penny Road supply points to supplement peak hour demands to the Southern PZ.

7.9.6 Characterization of Residential Consumption Data for Further Evaluation of Lateral Line Sizing and Evaluation of Low Pressure Areas

Section 5.2.1 presented the findings of a residential lateral line sizing evaluation. However, to conduct a more detailed analysis, it is recommended that the Town install several digital flow recorders on select residential meters to obtain hourly consumption data. Collecting this data would provide information on the current customers' water use habits and peak instantaneous water demand at the larger residences. The residential service connections from the meter to the residence could then be modeled and a number of alternatives could be analyzed based on different fixtures in the residence being operated.

In conjunction with this recommendation, Section 5.2.3 describes an option to create low pressure (or high elevation) "special service area" districts which could require new development to increase the lateral service line size beyond the adopted standards to further minimize pressure loss. This approach would strategically focus on the low pressure areas while not imposing additional constraints on areas with adequate pressure.

7.9.7 Pipe Criticality Analysis

Based on the findings of the emergency conditions evaluation described in Section 5.6, it is recommended that the Town of Cary conduct a modeling analysis to simulate the loss of the 42-inch transmission main during maximum month demand conditions and develop an operations plan for this scenario.

It is also recommended that the Town perform a future pipe criticality analysis to develop operating scenarios that could be included as part of an emergency operations plan. A

criticality analysis would allow the Town to evaluate system performance while modeling a series of possible main breaks to identify weak areas within the water distribution system. The Wallingford InfoWorks WS hydraulic modeling software provides an automated function to support a pipe criticality analysis.

7.9.8 Detailed Design Study for Possible Western PZ Expansion

Expanding the Western PZ to accommodate the Morrisville area was discussed in Section 6.2. During this Master Plan, the primary goal of this analysis was to develop pressure zone boundary alternatives which focused more on providing industry standard capacity and pressure to the Morrisville area rather than satisfying existing sprinkler system design rates. Based on this evaluation, a phased approach incorporating the concepts presented in Alternatives 1 (small WPZ expansion) and 2 (medium WPZ expansion) is recommended. A detailed design study is recommended for this phased expansion of the Western PZ including a detailed investigation of the Low Pressure Zone area to establish a specific zone boundary based on the location of existing PRVs, boundary valves, and connectivity of critical Central PZ mains.

7.9.9 Additional Analysis of Proposed Highway 1 Control Valve

Section 6.5.2.3 contains a recommendation for a third connection and control valve at Highway 1 to improve supply to the Southern PZ. It is recommended that the Town conduct additional modeling analysis of the Kildaire Farm Road, Cary Parkway, and proposed Highway 1 control valves under various operating conditions during detailed design of the proposed Highway 1 control valve. The modeling analysis should evaluate how to best operate the control valves when the Plumtree Way Elevated Tank is taken out of service for maintenance and also when a primary supply main to the Southern PZ may be broken or taken out of service.

This analysis would help determine if the Kildaire Farm Road and Cary Parkway OCVs could be converted to a different operating strategy after the Highway 1 control valve is brought in service in 2010.

7.9.10 Old Apex Pump Station Pump and Tank Evaluation

As described in Section 6.5.3.2, the 16-inch water line along Old Apex Road (CPZ-5) that is recommended by 2015 will significantly affect the system hydraulics for the Old Apex Pump Station. Model simulations with CPZ-5 on-line revealed that the pumps may approach run-out conditions. During detailed design of CPZ-5, it is recommended that a detailed evaluation be conducted for the Old Apex PS pumps to determine if they should be modified or replaced to operate on a better portion of the pump curve. During this analysis, the "usable" volume of the Old Apex Ground Storage Tank could be determined based on the proposed pump net positive suction head requirement.