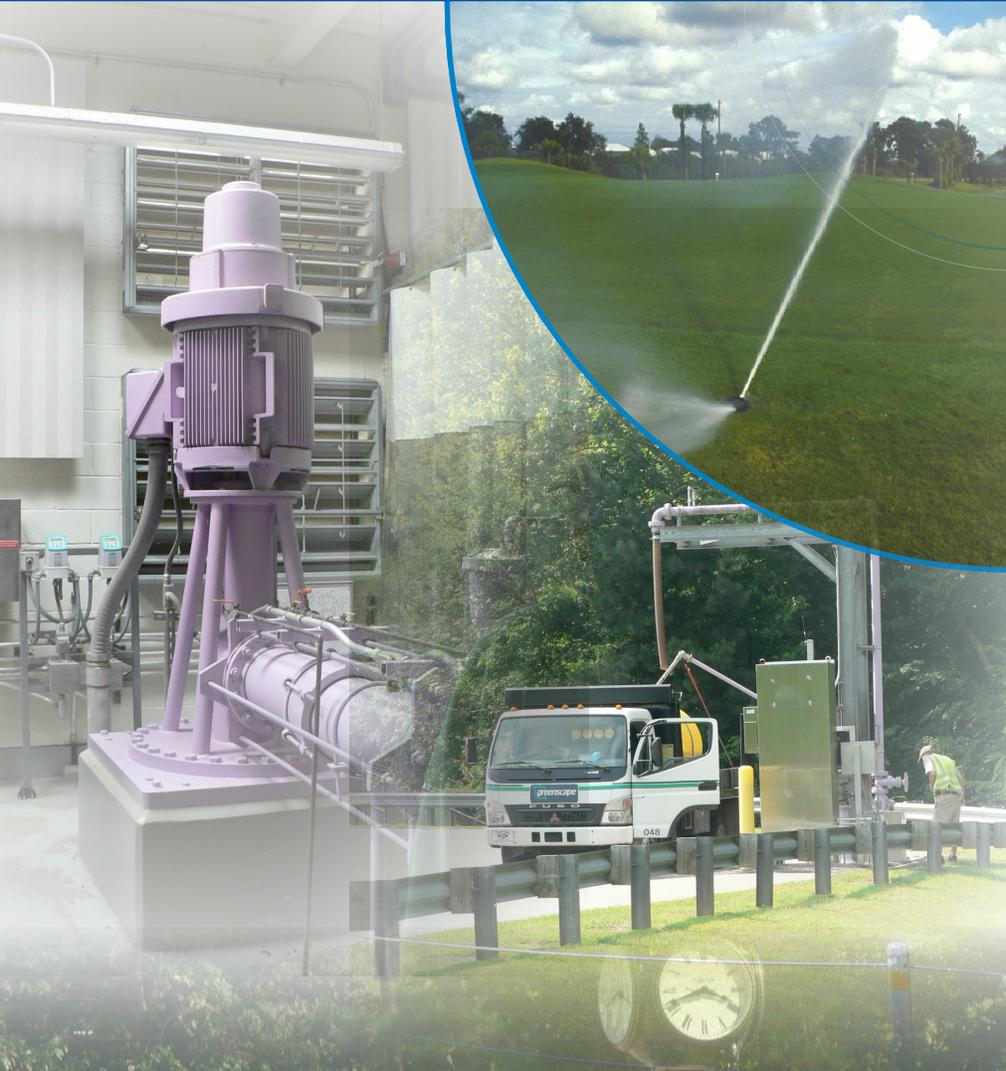


# TOWN OF CARY RECLAIMED WATER MASTER PLAN UPDATE - ADDENDUM



DECEMBER 2017

**FINAL**

**CDM  
Smith**





5400 Glenwood Avenue, Suite 400  
Raleigh, North Carolina 27612  
tel: 919 325-3500  
fax: 919 781-5730

December 28, 2017

Ms. Shuyan Tian, P.E.  
Engineering Department  
Town of Cary  
316 North Academy Street  
Cary, North Carolina 27511

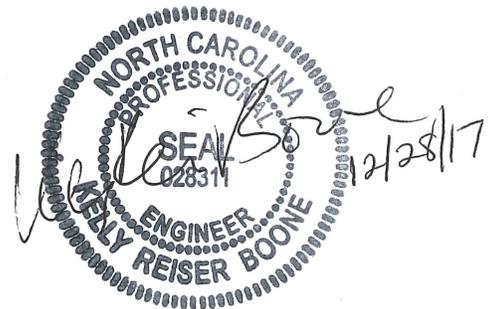
Subject: Final Reclaimed Water Master Plan Update Addendum (SW-1211)

Dear Ms. Tian:

Enclosed please find five copies of the final Town of Cary Reclaimed Water Master Plan Update Addendum technical memorandum for your review. We have also included a thumb drive with an electronic version of the memo. If you have any questions, please call me at (919) 325-3508 or email me at boonekr@cdmsmith.com. Thank you for the opportunity to work with you on this project.

Very truly yours,

Kelly R. Boone, P.E.  
CDM Smith Inc.



Enclosures: 5 copies of Addendum Memorandum  
Thumb drive with electronic version of memorandum





## Technical Memorandum

*To: Town of Cary*

*From: CDM Smith*

*Date: December 28, 2017*

*Subject: Addendum to 2013 Reclaimed Water Master Plan Update*

The Town of Cary's Reclaimed Water Master Plan Update, completed by CDM Smith in July 2013, provided a summary of the existing reclaimed water system and demands, evaluation of future reclaimed water demand scenarios and infrastructure needs, and a Capital Improvement Program (CIP) for implementing the recommended system improvements.

In 2016, the Town of Cary (Town) requested that CDM Smith update portions of the 2013 Master Plan Update with revised assumptions regarding system demands, reclaimed water supply sources, and planned infrastructure for the North and West Cary reclaimed water service areas. This addendum presents the results of the updated evaluation for the North and West Cary reclaimed water service areas. The recommendations for the South Cary reclaimed water service area remain the same as presented in the 2013 Master Plan Update.

### 1.0 Scope of Master Plan Updates

The major assumptions and objectives addressed in this addendum that differ from the 2013 Master Plan Update are listed below under the corresponding report section from the 2013 Master Plan Update report.

#### Master Plan Update Section 5 – Future Reclaimed Water Demands

- Revise assumptions to reflect the Town's plans for no retrofit of reclaimed water pipes within existing developments.
- Revise the demand projections to reflect a more realistic percentage of new residential development that would have irrigation systems utilizing reclaimed water.
- Review demand peaking factors based on recent metering data and update the modeled demands, as necessary.

#### Master Plan Update Section 8 – Future Reclaimed Water Scenario Evaluation

- Eliminate reliance on the proposed northwest connector pipeline (projects NW-2A and NW-2B in the 2013 Master Plan Update) to supply reclaimed water from the North Cary Water Reclamation Facility (NCWRF) to the West service area in the near-term.

- Evaluate near-term scenarios that maximize reclaimed water supplied from the Durham County Triangle Wastewater Treatment Plant (TWWTP) to the West service area through the end of the current interlocal agreement with Durham County.
- Eliminate the proposed elevated 'baseball' storage tank at Thomas Brooks Park (project NW-1 in the 2013 Master Plan Update). Re-evaluate the location, phasing and need for ground storage in the reclaimed water system.
- Evaluate mid-term and buildout scenarios both with and without reclaimed water supply from Durham County.
- For buildout of the combined North/West service area, evaluate options to reduce the size of the proposed single 24-inch diameter northwest connector pipeline (projects NW-2A and NW-2B) by constructing pipelines along two or more routes between the North and West service areas. The Town anticipates that sections of this pipeline will be constructed by developers as part of new development projects.
- Eliminate pipelines crossing major roadways (including NC 540 and NC Highway 55), to the extent possible.

#### Master Plan Update Section 9 – Recommended Capital Improvement Program

- Update the Capital Improvement Program (CIP) for implementing the recommended reclaimed water system improvements for the North/ West reclaimed water service area.

Other than the updates listed above, the evaluations in this addendum are based on the information presented in the 2013 Master Plan Update report and the InfoWorks WS hydraulic model developed for the 2013 Master Plan Update for Scenario 4 (preferred scenario). The evaluations in this addendum are based on the Town's current North and West service area as defined in Policy Statement 132: Effective Utilization of Reclaimed Water System, adopted in 2014.

## 2.0 Reclaimed Water Demand Projections

The reclaimed water demand projections for Scenario 4 presented in Section 5 of the 2013 Master Plan Update were revised under this addendum.

Existing reclaimed water demands for the North and West service areas were updated based on a review of reclaimed water meter data from January 2014 through August 2016. **Table 1** presents a summary of the reclaimed water customer meter data and the maximum monthly and daily peaking factors by type of use. Based on annual data from 2014 and 2015, the maximum day to average annual peaking factors for irrigation and cooling tower use are similar to those assumed for the 2013 Master Plan Update (2.5 for cooling and 3.4 for irrigation). Therefore, the maximum day peaking factors were not updated for this analysis.

**Table 1. Summary of Customer Meter Data (excluding NCWRF & Metered Blowoffs)<sup>1</sup>**

Use Type	Description <sup>2</sup>	2014 Meters	2015 Meters
<b>North Service Area</b>			
Total <sup>3</sup>	ADD (gpd)	162,000	200,000
	Max Month PF	2.0	2.1
	Max Day PF	2.8	3.2
Cooling <sup>4</sup>	% of Total ADD	26%	16%
	Max Month PF	1.4	1.4
	Max Day PF	1.9	2.1
Irrigation	% of Total ADD	74%	84%
	Max Month PF	2.2	2.3
	Max Day PF	3.3	3.4
<b>West Service Area</b>			
Total <sup>3</sup>	ADD (gpd)	101,000	126,000
	Max Month PF	2.0	2.1
	Max Day PF	3.1	2.9
Cooling	% of Total ADD	53%	50%
	Max Month PF	1.6	1.9
	Max Day PF	2.1	2.2
Irrigation	% of Total ADD	47%	50%
	Max Month PF	2.5	2.4
	Max Day PF	4.2	3.3

1) Meter data from January 2014 through August 2016 was reviewed. Since a full year of data for 2016 was not available at the time of analysis, 2016 is not included in Table 1.

2) ADD = average day demand; PF = peaking factor

3) All metered reclaimed water customer use, excluding metered NCWRF use and metered blowoffs.

4) SAS cooling use was minimal in 2015 since March, resulting in lower percent cooling use in 2015.

Future buildout reclaimed water demands for the North and West service area were revised to account for the following assumptions:

- Future irrigation demands assume 13 percent of new single-family residential and townhome developments have irrigation systems installed. This percentage is based on current trends for irrigation in new developments within the service area, and is less than the 35 to 40 percent assumed in the 2013 Master Plan Update.
- It is assumed that existing developments that do not currently have reclaimed water lines installed will not have any future reclaimed water demands. The 2013 Master Plan Update included future demands in some of these developments. However, the Town indicated that existing neighborhoods will not be retrofitted with reclaimed water pipes and therefore demands in these neighborhoods have been eliminated.

**Table 2** and **Figure 1** present the updated reclaimed water demand projections for buildout of the combined North/West reclaimed water service area. The revised average day and maximum day demands for the entire service area are 2.7 mgd and 7.1 mgd, respectively. This is approximately 30 percent less than the demands projected for buildout of Scenario 4 in the 2013 Master Plan Update.

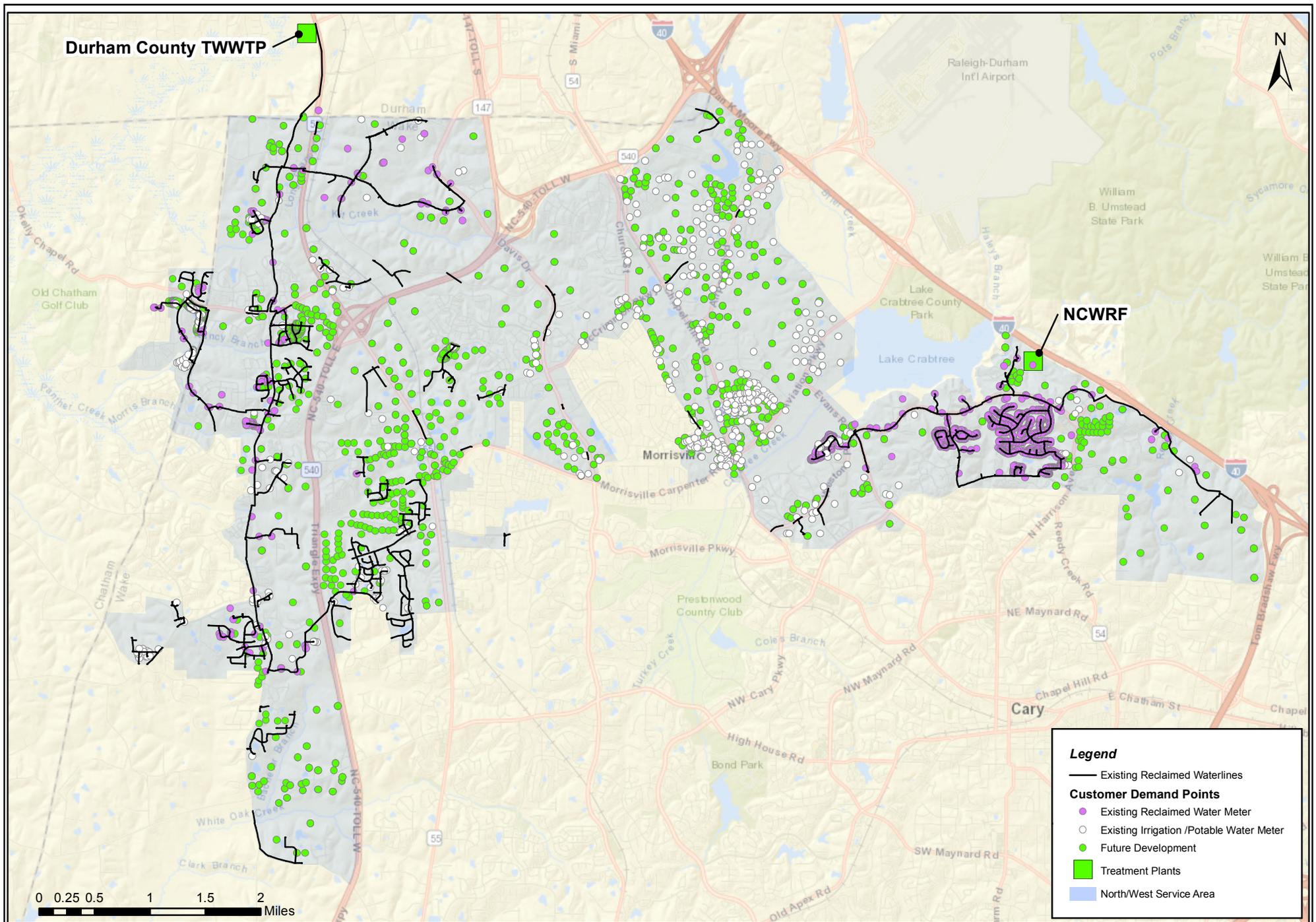
**Table 2. Updated Reclaimed Water Demand Projections for Buildout of North/West Service Area**

Meter Type	Use	Average Day Demand (mgd)	Maximum Day Demand <sup>1</sup> (mgd)
Existing RCW Meters <sup>2</sup>	Irrigation	0.28	0.95
	Cooling	0.11	0.28
	<b>Subtotal</b>	<b>0.39</b>	<b>1.23</b>
Existing Potable/Irrigation Customers <sup>3</sup>	Irrigation	0.38	1.30
Future Development	Irrigation <sup>4</sup>	0.84	2.86
	Cooling	0.31	0.78
	Toilet Flushing	0.46	0.46
	<b>Subtotal</b>	<b>1.61</b>	<b>4.10</b>
Non-Revenue	NCWRF Uses <sup>5</sup>	0.20	0.20
	Miscellaneous <sup>6</sup>	0.12	0.33
	<b>Subtotal</b>	<b>0.32</b>	<b>0.53</b>
<b>TOTAL</b>		<b>2.7</b>	<b>7.2</b>

- 1) Max day demand peaking factors: 3.4 for irrigation; 2.5 for cooling; 1.0 for toilet flushing per Master Plan Update.
- 2) Existing reclaimed water meter demands updated based on August 2015 to July 2016 meter data.
- 3) Existing potable or irrigation meters to be converted to reclaimed water. The updated demands exclude existing residential developments with no reclaimed water pipelines (assuming no retrofit).
- 4) Future irrigation demands updated to assume 13% of new single-family residential and townhome developments have irrigation systems installed. Cooling and toilet flushing assumptions remain the same as the 2013 Master Plan Update.
- 5) Estimate of reclaimed water used on-site at NCWRF is the same as assumed for the 2013 Master Plan Update.
- 6) Includes 5% for system loss, bulk water, safety factor. Calculated as 5% of off-site use (not including NCWRF).

### 3.0 Evaluation of Reclaimed Water Scenarios

Under this addendum, several additional scenarios were evaluated for the reclaimed water service area to meet the objectives listed in Section 1.0. The additional scenarios are variations of Scenario 4, as presented in Section 8 of the 2013 Master Plan Update. Hydraulic analyses were performed using the Town’s InfoWorks WS hydraulic model (developed under the Master Plan Update) to determine sizing and phasing of proposed improvements to the reclaimed water system.



### 3.1 Planning Periods

Instead of scaling the demand projections through 2060 and defining the planning periods by year, as was done for the 2013 Master Plan Update, the planning periods for this evaluation are defined by portions of the service area or quantity of demand that can be met with a given supply source/infrastructure. This allows the Town to more easily adjust the timing of future reclaimed water infrastructure projects to match the amount of development that has occurred within the system. The existing, near-term, mid-term, and buildout planning periods are defined in the following paragraphs.

#### 3.1.1 Existing

The existing scenario reflects the reclaimed water demands and pipes in service as of 2016. The existing scenario was evaluated for the West service area only, since it is currently supplied from Durham County through an interlocal agreement with the Town and is the focus of the near-term evaluations under this addendum.

#### 3.1.2 Near-Term

Near-term scenarios were evaluated for the West service area only. Near-term is defined by the maximum reclaimed water demand that can be met with supply from the Durham County Triangle WWTP under the current interlocal agreement. The interlocal agreement is effective through June 30, 2021 and stipulates that Durham County provide the Town with a peak hour of up to 3.6 mgd (150,000 gallons per hour). An annual average capacity of 0.7 mgd is assumed to be available to the Town through 2021.

#### 3.1.3 Mid-Term

By mid-term, the North and West reclaimed water service areas are assumed to be connected via the northwest connector pipeline. Once connected, two pressure zones will be established for the reclaimed water system, corresponding to the central pressure zone (CPZ) and west pressure zone (WPZ) for the potable water system. Mid-term is defined by the maximum reclaimed water demand that can be met with a single pipeline connecting the North and West service areas without additional reclaimed water storage in the CPZ.

#### 3.1.4 Buildout

Buildout is defined by the total future demand projected within the combined North/West service area. The buildout average day demand is 2.7 mgd and maximum day demand is 7.2 mgd, as given in Table 2.

### 3.2 Scenarios

**Table 3** lists the scenarios that were evaluated for existing, near-term, mid-term, and buildout planning periods. The average day and maximum day reclaimed water demand of the system for each scenario is also listed. The following sections provide additional details and results of the hydraulic modeling for each scenario.

**Table 3. Summary of Reclaimed Water Scenarios**

Scenario	Planning Period	Service Area	Reclaimed Water Supply Source	Storage Tank Location(s)	Avg Day Demand (mgd)	Max Day Demand (mgd)
A	Existing	West	Durham County	none	0.2	0.6
B	Near-Term	West	Durham County	none	0.5	1.5
C	Near-Term	West	Durham County	Thomas Brooks Park	0.7	2.0
D	Mid-Term	North/West	NCWRF	Thomas Brooks Park	1.6	4.2
E	Buildout	North/West	NCWRF	Thomas Brooks Park & Highway 54	2.7	7.2
F	Mid-Term	North/West	NCWRF & Durham County	Thomas Brooks Park	2.0	5.3
G	Buildout	North/West	NCWRF & Durham County	Thomas Brooks Park & Highway 54	2.7	7.2
H	Buildout	North/West	NCWRF	McCrimmon Pkwy	2.7	7.2
I	Buildout	North/West	NCWRF & Durham County	McCrimmon Pkwy	2.7	7.2

### 3.2.1 Scenario A (Existing)

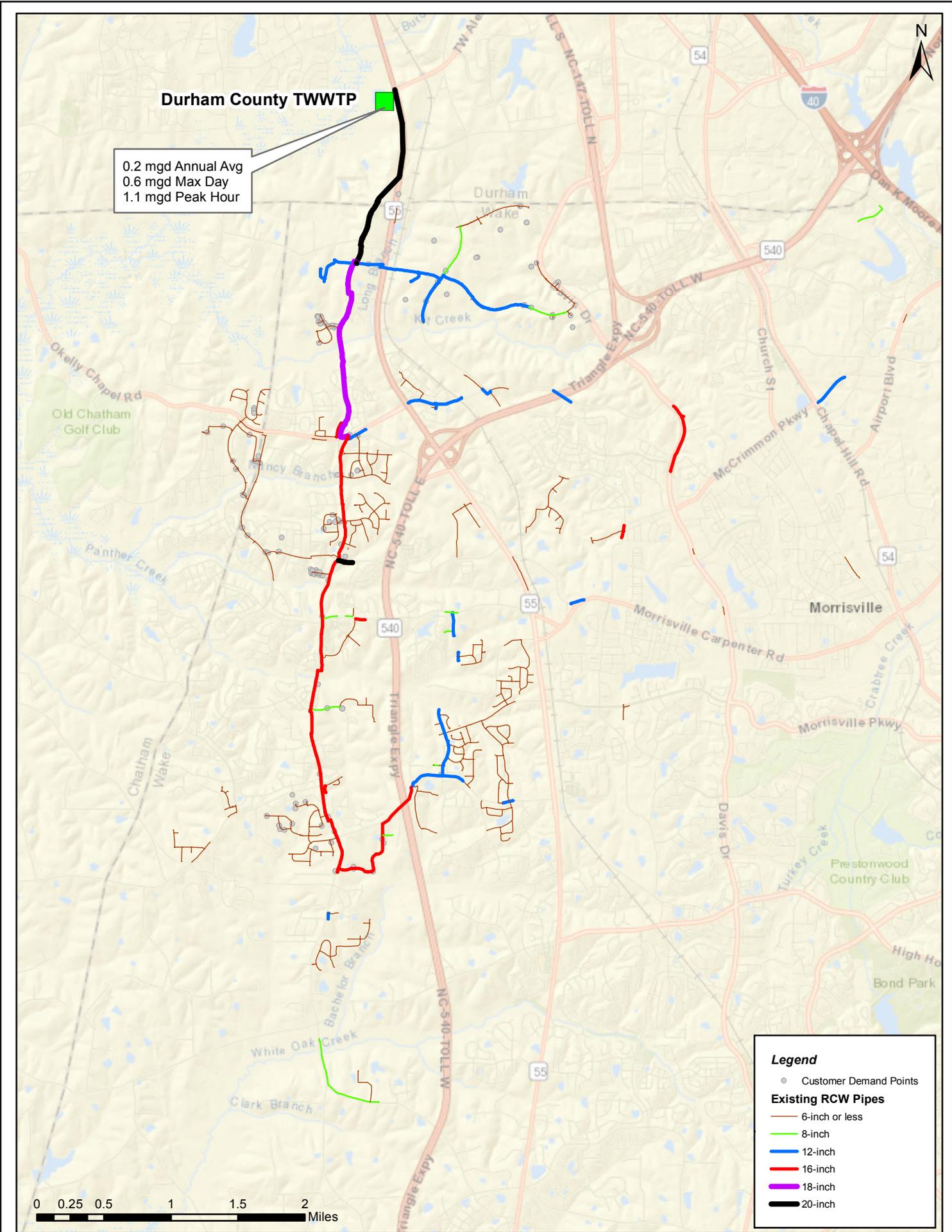
Scenario A, presented in **Figure 2**, represents the existing reclaimed water system in the West service area. The service area is supplied with reclaimed water from the Durham County Triangle WWTP. Delivery pressure at the Durham County connection is approximately 90 psi, which is equivalent to a hydraulic grade line (HGL) elevation of approximately 560 feet. This is slightly higher than the Town’s potable water HGL elevation in the west pressure zone (WPZ) of 541 feet.

As shown in Figure 2, there are several areas where reclaimed water lines have been installed with new developments, but not yet connected to the reclaimed water system. These lines remain connected to the potable water system (or inactive) until the reclaimed water system is built out to those areas and the service is switched to reclaimed water.

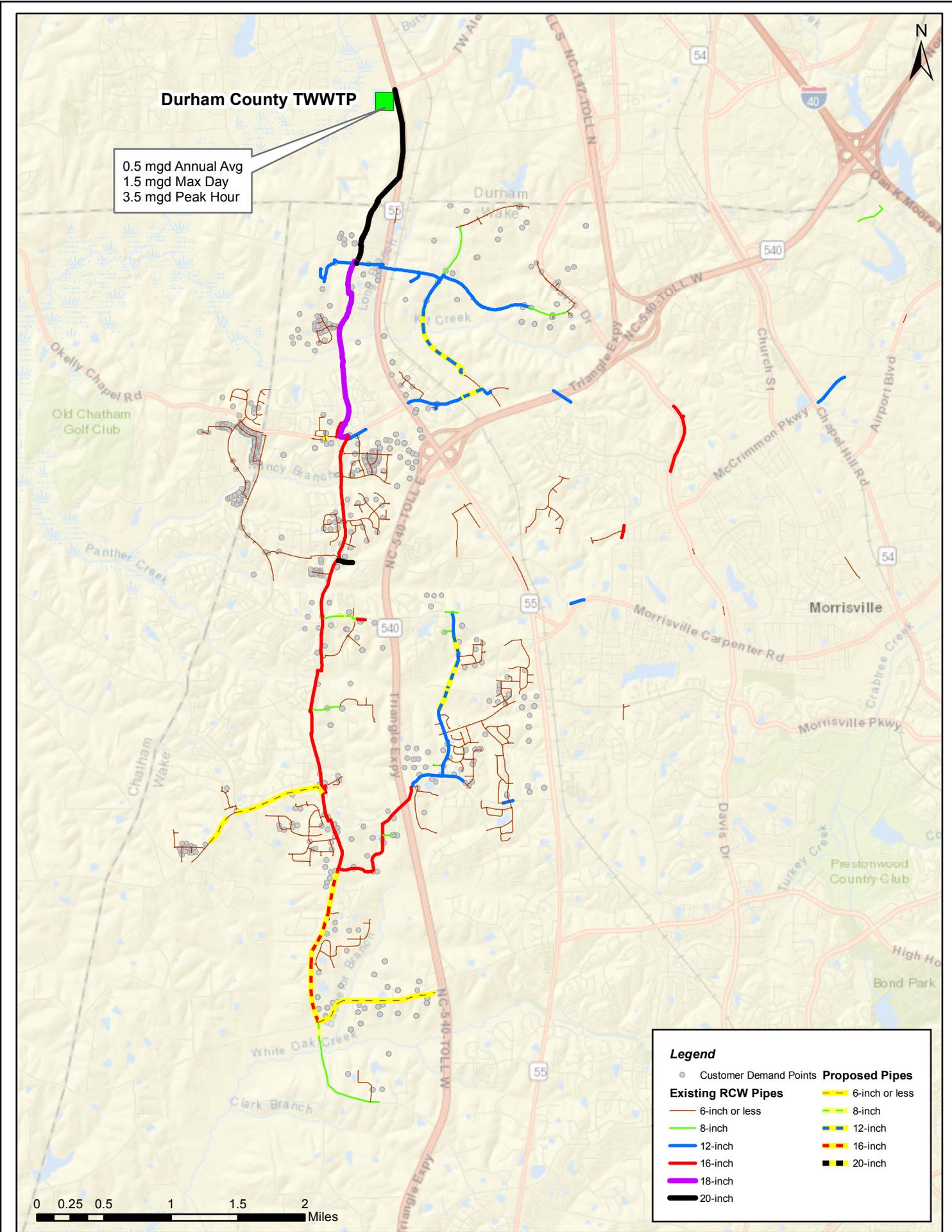
The reclaimed water transmission and supply capacity in the West service area is adequate for existing demand conditions. The average day and peak hour demands (based on the hydraulic model) are 0.2 mgd and 1.1 mgd, respectively, which are well below the maximum contracted supply from Durham County. The maximum day demand is 0.6 mgd.

### 3.2.2 Scenario B (Near-Term)

Near-term Scenario B, presented in **Figure 3**, represents the maximum expansion of the West service area that can be supplied from Durham County without additional reclaimed water storage for peak demands. This scenario is limited by the contracted peak hour supply from



**Figure 2**  
**Scenario A - Existing West Service Area**



**Figure 3**  
**Scenario B - Near-Term; No Storage**



Durham County (3.6 mgd). It is assumed that delivery pressure from Durham County will remain similar to existing (90 psi).

Scenario B includes 5.2 miles of new 6-inch through 16-inch inch diameter pipe to connect existing reclaimed water lines in the following general areas:

- Research Triangle Park (RTP) South
- Southern portion of the service area along Green Level Church and Green Level West Roads
- Morrisville Parkway west of Green Level Church Road
- East of NC 540 between Morrisville Parkway and Carpenter Fire Station Road.

Based on input from Town staff, these areas are likely to develop first. The average day, maximum day, and peak hour demands for Scenario B are 0.5 mgd, 1.5 mgd, and 3.5 mgd, respectively.

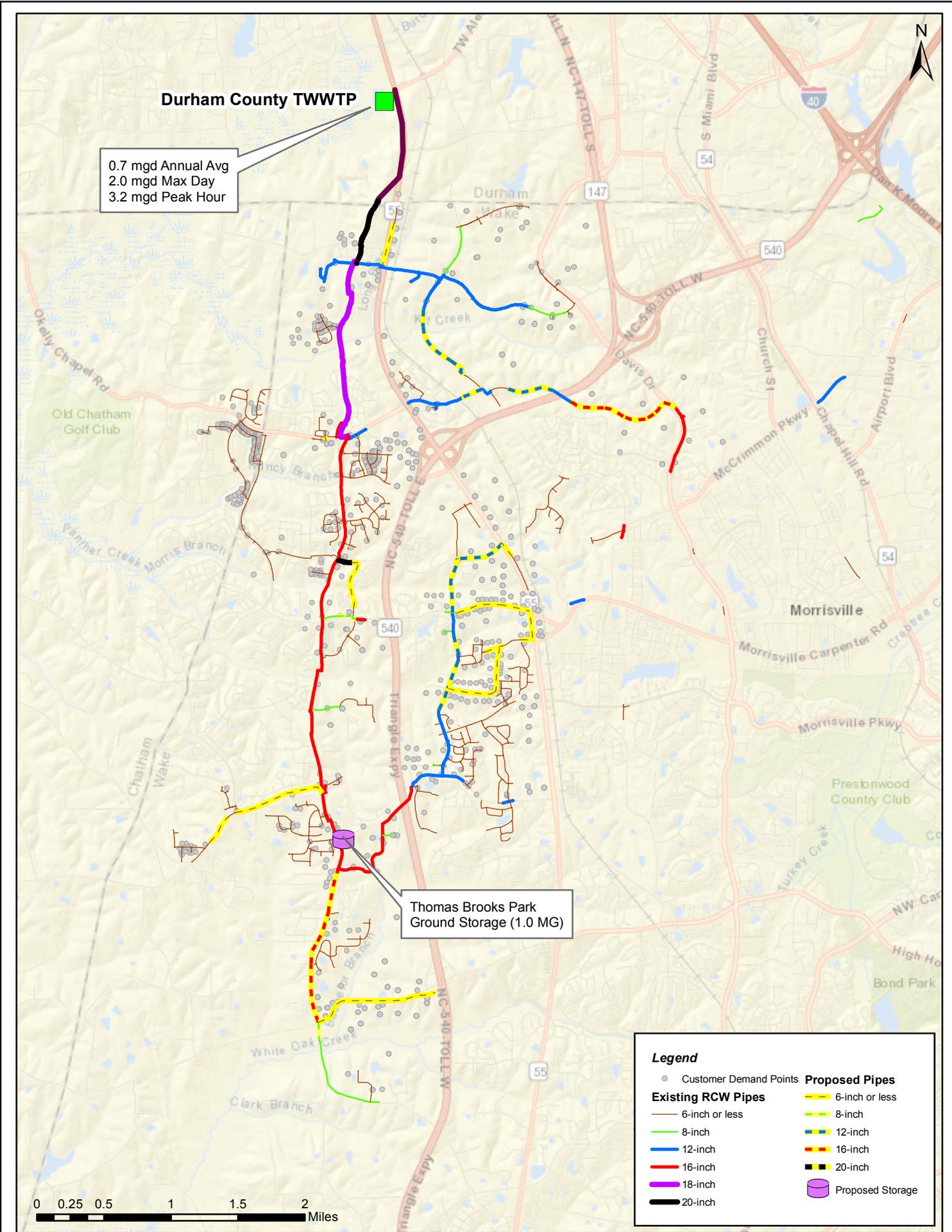
### **3.2.3 Scenario C (Near-Term)**

Near-term Scenario C, presented in **Figure 4**, represents the maximum expansion of the West service area that can be supplied from Durham County if a storage tank is constructed to provide equalization for peak demands. Since the storage tank provides additional supply for peak demands, this scenario is limited by the contracted average day supply from Durham County (0.7 mgd). It is assumed that delivery pressure from Durham County will remain similar to existing (90 psi).

Scenario C includes the same new pipes as described for Scenario B plus an additional 5.5 miles of new 6-inch and 12-inch diameter pipe to serve additional properties in the following general areas:

- Along NC Highway 55 near the Durham County line
- Along Little Drive to Davis Drive
- Along Cary Glen Boulevard
- Area bounded by McCrimmon Parkway, NC Highway 55, Good Hope School Road, and NC 540.

Approximately 0.5 million gallons (MG) of storage is needed for the near-term; however, the ground storage tank is sized for buildout as a 1.0- MG ground storage and re-pump facility near the Thomas Brooks Park. Until demands on the system increase, it is recommended that only a portion of the ground tank volume is utilized. In addition, storage is not needed during the winter season due to lower reclaimed water demands. Therefore, the storage tank could be taken off-line during lower demand periods to minimize water age and water quality deterioration. Alternate locations for storage (including near the Durham County delivery point)



**Durham County TWWTP**

0.7 mgd Annual Avg  
2.0 mgd Max Day  
3.2 mgd Peak Hour

**Thomas Brooks Park  
Ground Storage (1.0 MG)**

**Legend**

- Customer Demand Points
- Existing RCW Pipes**
  - 6-inch or less
  - 8-inch
  - 12-inch
  - 16-inch
  - 18-inch
  - 20-inch
- Proposed Pipes**
  - 6-inch or less
  - 8-inch
  - 12-inch
  - 16-inch
  - 20-inch
- Proposed Storage

0 0.25 0.5 1 1.5 2 Miles



**Figure 4  
Scenario C - Near-Term with Storage**

could be considered. Scenarios H and I discuss an alternate storage location for buildout of the reclaimed water system.

The modeled average day, maximum day, and peak hour flows from Durham County for Scenario C are 0.7 mgd, 2.0 mgd, and 3.2 mgd, respectively.

### **3.2.4 Scenario D (Mid-Term)**

Scenario D, presented in **Figure 5**, assumes that the Durham County reclaimed water supply will no longer be available after the end of the current agreement (2021). Therefore, this scenario represents the maximum extent of the system that can be served from the NCWRF with a single 16-inch diameter northwest connector pipe routed along Evans Road, the future McCrimmon Parkway extension, and McCrimmon Parkway to the West service area. The sizing of the northwest connector was determined based on buildout demands (Scenario E).

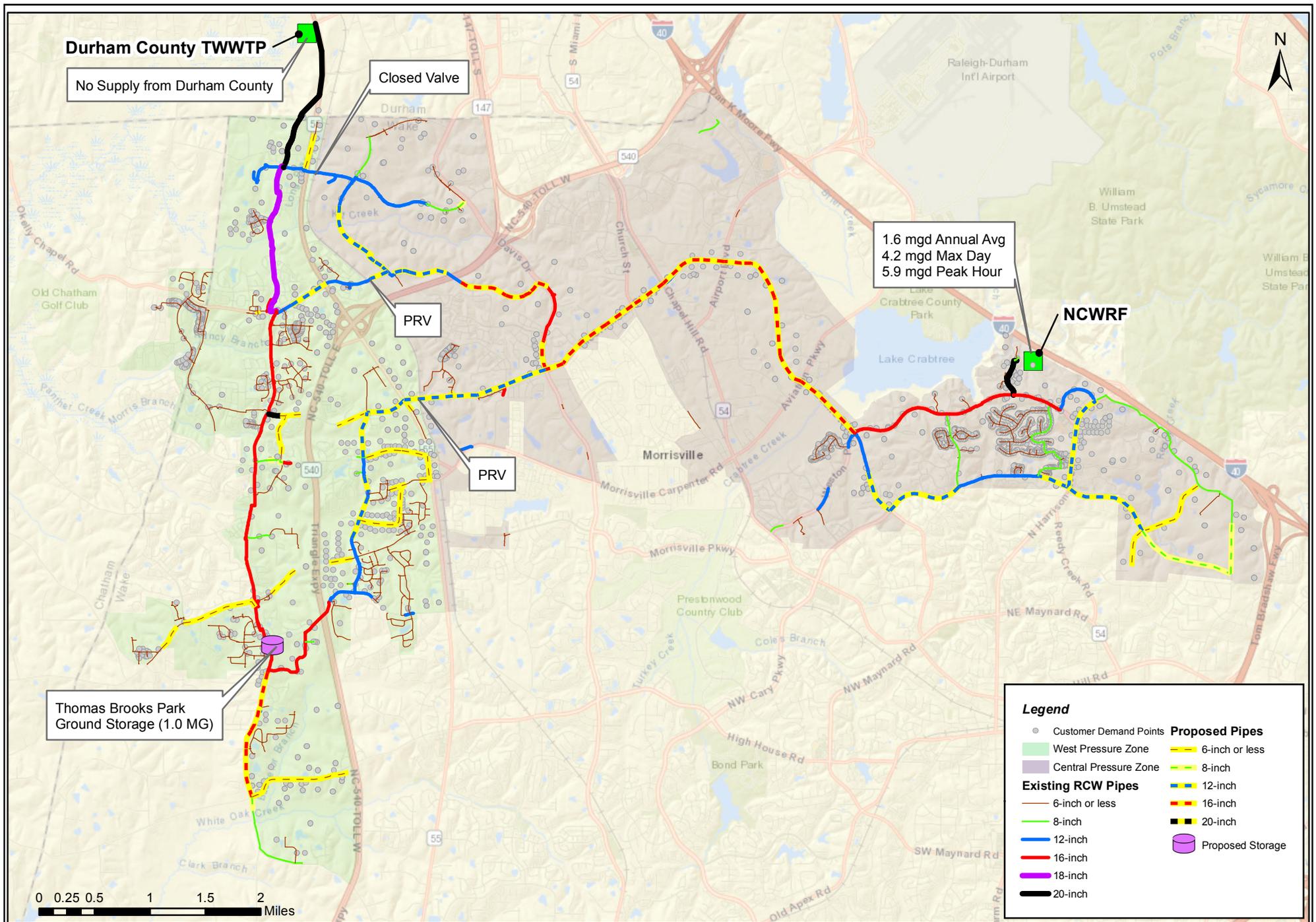
Once the northwest connector pipeline is in service, two pressure zones will be established for the combined North/West service area. The pressure zones correspond to the potable water Central pressure zone (CPZ) (641 feet HGL) and WPZ (540 feet HGL), with the boundary along NC Highway 55 and the railroad tracks as shown in Figure 5. Based on the typical discharge pressure at the NCWRF reclaimed water pumps, the reclaimed water CPZ operates at an HGL elevation of approximately 620 feet, which is slightly lower than the potable water system. Pressure reducing valves (PRVs) are proposed at O'Kelly Chapel Road and McCrimmon Parkway to establish the reclaimed water WPZ. It should be noted that during peak hour model simulations, the HGL elevation upstream of the PRVs is already less than 540 feet due to headloss through the single transmission main. Therefore, the valves are operating fully open. Figure A-1 included in Appendix A at the end of this memo shows the modeled HGL profile from the NCWRF to the reclaimed water tank in the WPZ for Scenario D.

No additional storage beyond the 1.0-MG storage re-pump facility in the WPZ (see Scenario C) is proposed for mid-term in the CPZ. The WPZ storage is not needed during the winter season due to lower reclaimed water demands. Therefore, the storage tank could be taken off-line during lower demand periods to minimize water age and water quality deterioration.

Scenario D includes the same new pipes as described for Scenario C plus an additional 14 miles of new 6-inch through 16-inch diameter pipe to connect the North and West service areas, provide looping and serve demands along Harrison Avenue, Cary Parkway, and Evans Road, and serve additional demands near SAS Campus Drive and in the WPZ. The average day and maximum day demands for Scenario D are 1.6 mgd and 4.2 mgd, respectively. The peak hour flow from the NCWRF based on the hydraulic modeling for Scenario C is 5.9 mgd, which is less than the capacity of the existing reclaimed water pumps.

### **3.2.5 Scenario E (Buildout)**

Scenario E, presented in **Figure 6**, assumes that the Durham County reclaimed supply will no longer be available after the end of the current agreement (2021). This scenario presents the infrastructure needed to meet the buildout reclaimed water demands for the entire service area from the NCWRF.



**Durham County TWWTP**  
No Supply from Durham County

Closed Valve

PRV

PRV

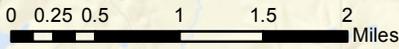
1.6 mgd Annual Avg  
4.2 mgd Max Day  
5.9 mgd Peak Hour

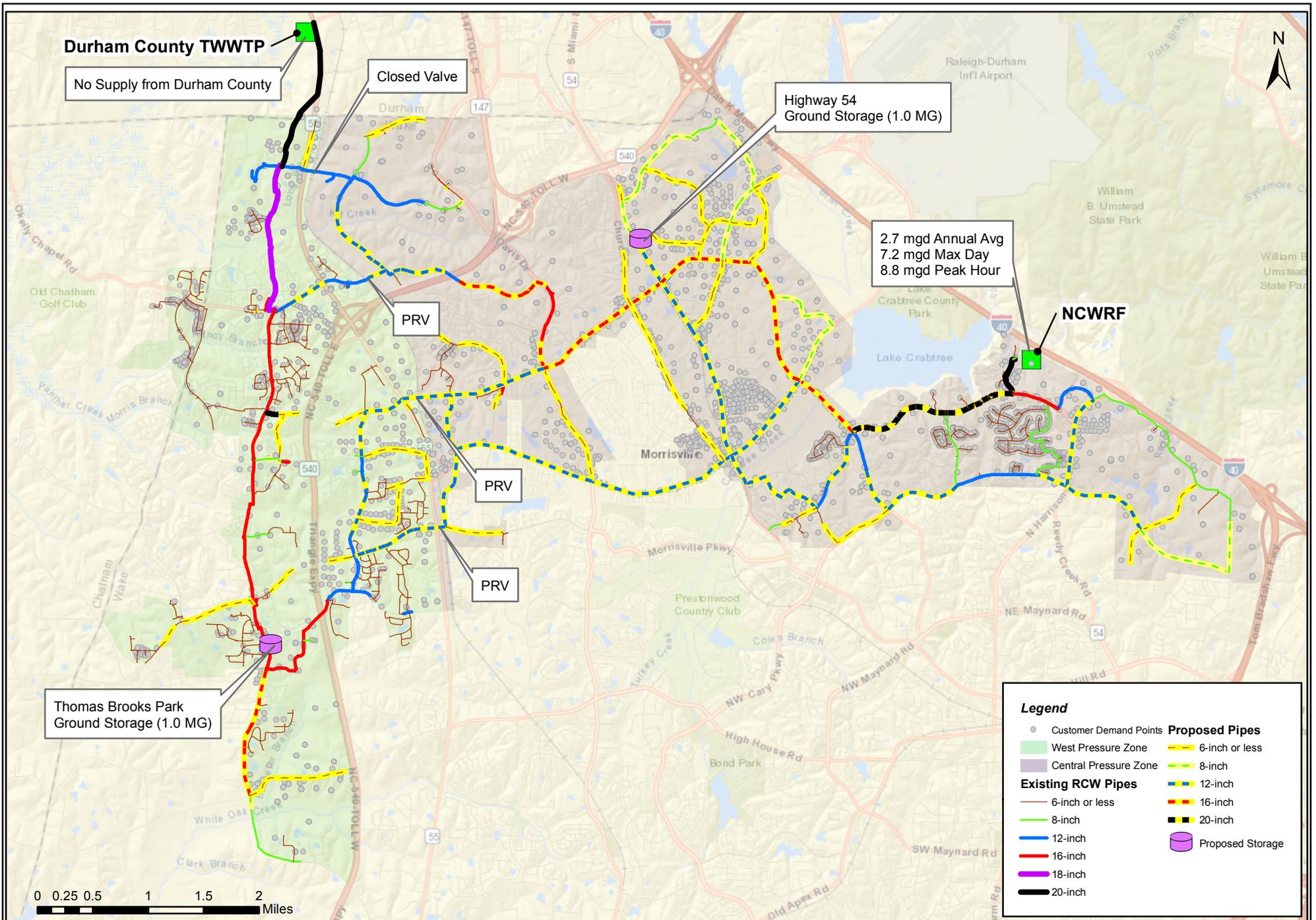
**NCWRF**

Thomas Brooks Park  
Ground Storage (1.0 MG)

**Legend**

- Customer Demand Points
- West Pressure Zone
- Central Pressure Zone
- Existing RCW Pipes
  - 6-inch or less
  - 8-inch
  - 12-inch
  - 16-inch
  - 18-inch
  - 20-inch
- Proposed Pipes
  - 6-inch or less
  - 8-inch
  - 12-inch
  - 16-inch
  - 20-inch
- Proposed Storage





In addition to the northwest connector pipe in Scenario D, a second 12-inch diameter transmission pipe connecting the NCWRF and WPZ is needed along Morrisville Carpenter Road, with a PRV to the WPZ at NC Highway 55. Additional transmission capacity is also needed from the NCWRF along Weston Parkway. An improvement to upsize the existing 16-inch diameter pipe to 20-inch diameter along Weston Parkway is recommended by buildout.

By buildout, reclaimed water storage is recommended for the CPZ to meet peak hour demands. In addition to the 1.0-MG storage in the WPZ at Thomas Brooks Park, a 1.0-MG ground storage and re-pump facility is modeled near NC Highway 54 and McCrimmon Parkway for Scenario E. Scenario H presents a possible alternate storage location for buildout of the reclaimed water system. Similar to mid-term, the WPZ storage is not needed during the winter season due to lower reclaimed water demands. Therefore, the Thomas Brooks Park storage tank could be taken off-line during lower demand periods to minimize water age and water quality deterioration, while the Highway 54 storage remains in service.

Figure A-2 attached to the end of this memo shows the modeled HGL profile from the NCWRF to the reclaimed water tank in the WPZ for Scenario E. During maximum day and peak hour demand model simulations, the HGL elevation on the upstream side of the PRVs is already less than 540 feet due to headloss through the single transmission main; hence, the valves are operating fully open.

Scenario E includes the same new pipes as described for Scenario D plus an additional 27 miles of new 6-inch through 20-inch diameter pipe, primarily to improve transmission from the NCWRF to the WPZ and serve areas in Morrisville. The average day and maximum day demands for buildout are 2.7 mgd and 7.2 mgd, respectively. The peak hour flow from the NCWRF (based on the hydraulic model) at buildout is 8.8 mgd. Since the capacity of the NCWRF reclaimed water pump station is 8.5 mgd (with one large pump out of service), pump upgrades are needed for Scenario E.

### **3.2.6 Scenario F (Mid-Term)**

Scenario F, presented in **Figure 7**, is similar to Scenario D, but assumes that reclaimed water supply will be available from Durham County through mid-term (peak hour of up to 3.6 mgd and average annual supply of 0.7 mgd). It is assumed that delivery pressure from Durham County will remain similar to existing (90 psi).

Since the RTP South area is close to the Durham County supply, the pressure zone boundary for Scenario F is slightly different from Scenario D. RTP South is included in the WPZ, and the CPZ boundary is located on the east side of Louis Stephens Drive and Little Drive. The section of pipe along Little Drive between NC 540 and Davis Drive that is proposed to serve additional customers in near-term Scenario C is not hydraulically necessary for mid-term. If construction of this section is delayed until closer to buildout, the PRV shown on Figure 7 at Louis Stephens Drive and Little Drive is not necessary in the mid-term. The proposed PRV at McCrimmon Parkway reduces the HGL elevation to 560 feet to match the supply pressure from Durham County.

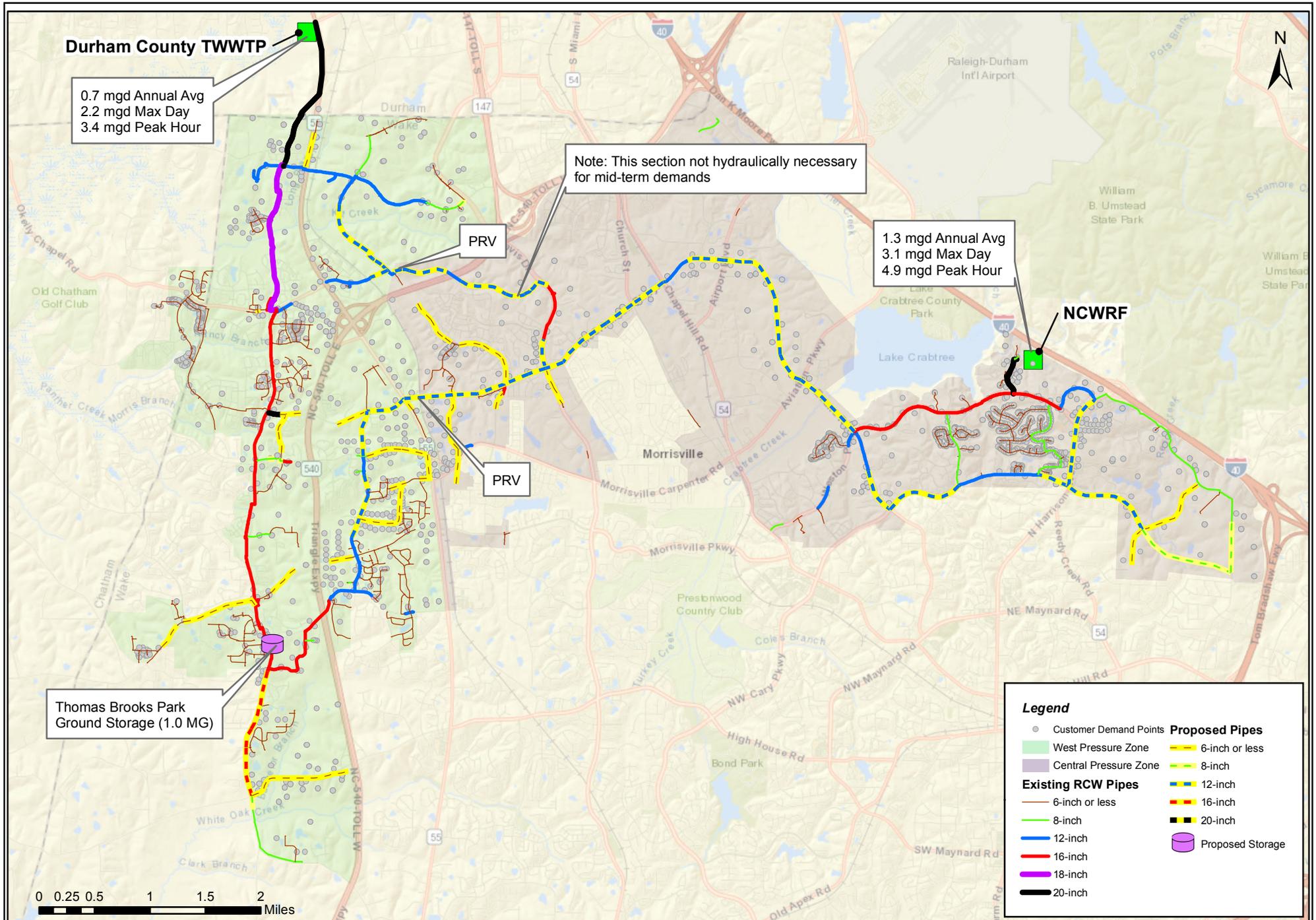


Figure A-3 attached to the end of this memo shows the modeled HGL profile from the NCWRF to the reclaimed water tank in the WPZ for Scenario E. During peak hour demand model simulations, the HGL elevation on the upstream side of the PRV is already less than 560 feet due to headloss through the single transmission main. Therefore, the valve is operating fully open.

With the Durham County supply, the required size of the northwest connector pipe is reduced from 16-inch to 12-inch diameter. In addition, 2.8 miles of new 6-inch diameter pipe is proposed to expand reclaimed water service between NC Highway 55 and Davis Drive. Otherwise the reclaimed water pipes, storage, and PRVs are the same as those presented in mid-term Scenario D.

With a single northwest connector pipeline, the combined Durham County and NCWRF sources can supply up to a total average day demand of 2.0 mgd and maximum day demand of 5.3 mgd. The modeled peak hour flows from Durham County and the NCWRF of 3.4 mgd and 4.9 mgd, respectively, can be adequately provided by the reclaimed water pumps at both facilities based on their existing capacities.

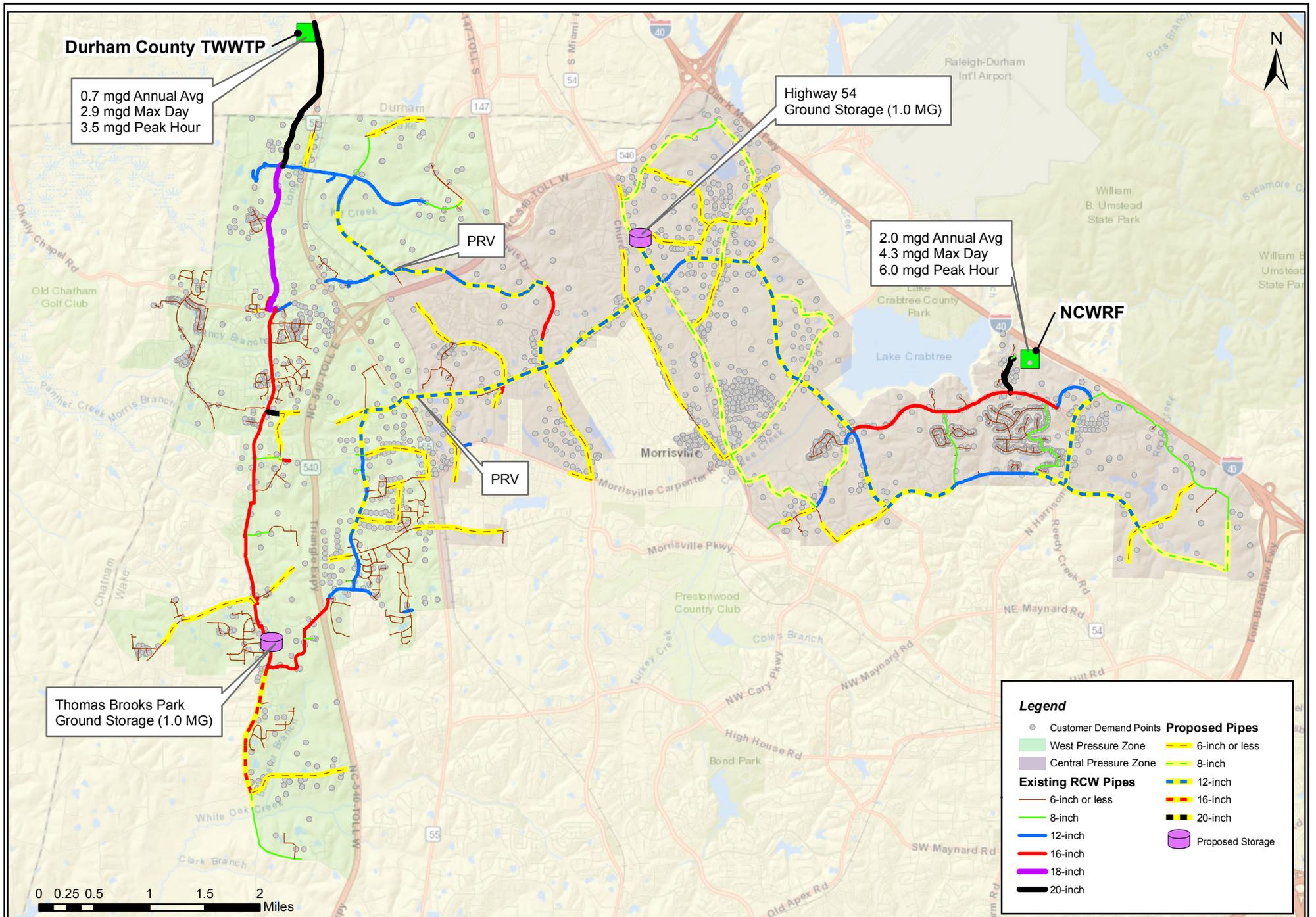
### **3.2.6 Scenario G (Buildout)**

Scenario G, presented in **Figure 8**, is similar to Scenario E, but assumes that reclaimed water supply will be available from Durham County through mid-term (peak hour of up to 3.6 mgd and average annual supply of 0.7 mgd). It is assumed that delivery pressure from Durham County will remain similar to existing (90 psi).

In addition to the mid-term improvements (Scenario F), 19 miles of new 6-inch through 12-inch diameter pipe is included for buildout, primarily to serve areas in Morrisville. A 1.0-MG ground storage and re-pump facility is also proposed near NC Highway 54 and McCrimmon Parkway. Scenario I presents a possible alternate storage location for buildout of the reclaimed water system with Durham County supply. Figure A-4 attached to the end of this memo shows the modeled HGL profile from the NCWRF to the reclaimed water tank in the WPZ for Scenario G.

As compared to buildout with supply from NCWRF alone (Scenario E), Scenario G eliminates the need for a second transmission pipe connecting the NCWRF with the WPZ, eliminates the need to upsize the existing pipeline along Weston Parkway, and eliminates highway crossings of NC Highway 55 at O'Kelly Chapel Road and Morrisville Parkway.

The average day and maximum day demands for buildout are 2.7 mgd and 7.2 mgd, respectively. The modeled peak hour flows from Durham County and the NCWRF at buildout of 3.5 mgd and 6.0 mgd, respectively, can be adequately provided by the existing reclaimed water pumps at both facilities based on their existing capacities. Therefore, pump upgrades are not needed for Scenario G.



### 3.2.7 Scenario H (Buildout)

Scenario H, presented in **Figure 9**, corresponds with Scenario E (buildout with NCWRF supply only), but evaluates an alternative reclaimed water storage tank location. Instead of the ground tank located at Thomas Brooks Park to provide storage for the WPZ, the tank is modeled just downstream of the PRV on McCrimmon Parkway near Highcroft Drive (see Figure 9). The ground tank is pumped to the WPZ at an HGL elevation of 540 feet. An additional set of pumps could potentially be added to pump back to the CPZ, although that was not modeled as part of this evaluation.

The reclaimed water pipes and PRV locations are the same as for Scenario E, however, Scenario H includes a new 16-inch diameter pipe along McCrimmon Parkway that crosses NC 540. This pipe is necessary to improve transmission from the tank to the existing 16-inch reclaimed water line along Green Level Church Road. Figure A-5 attached to the end of this memo shows the modeled HGL profile from the NCWRF to Green Level Church Road in the WPZ for Scenario H.

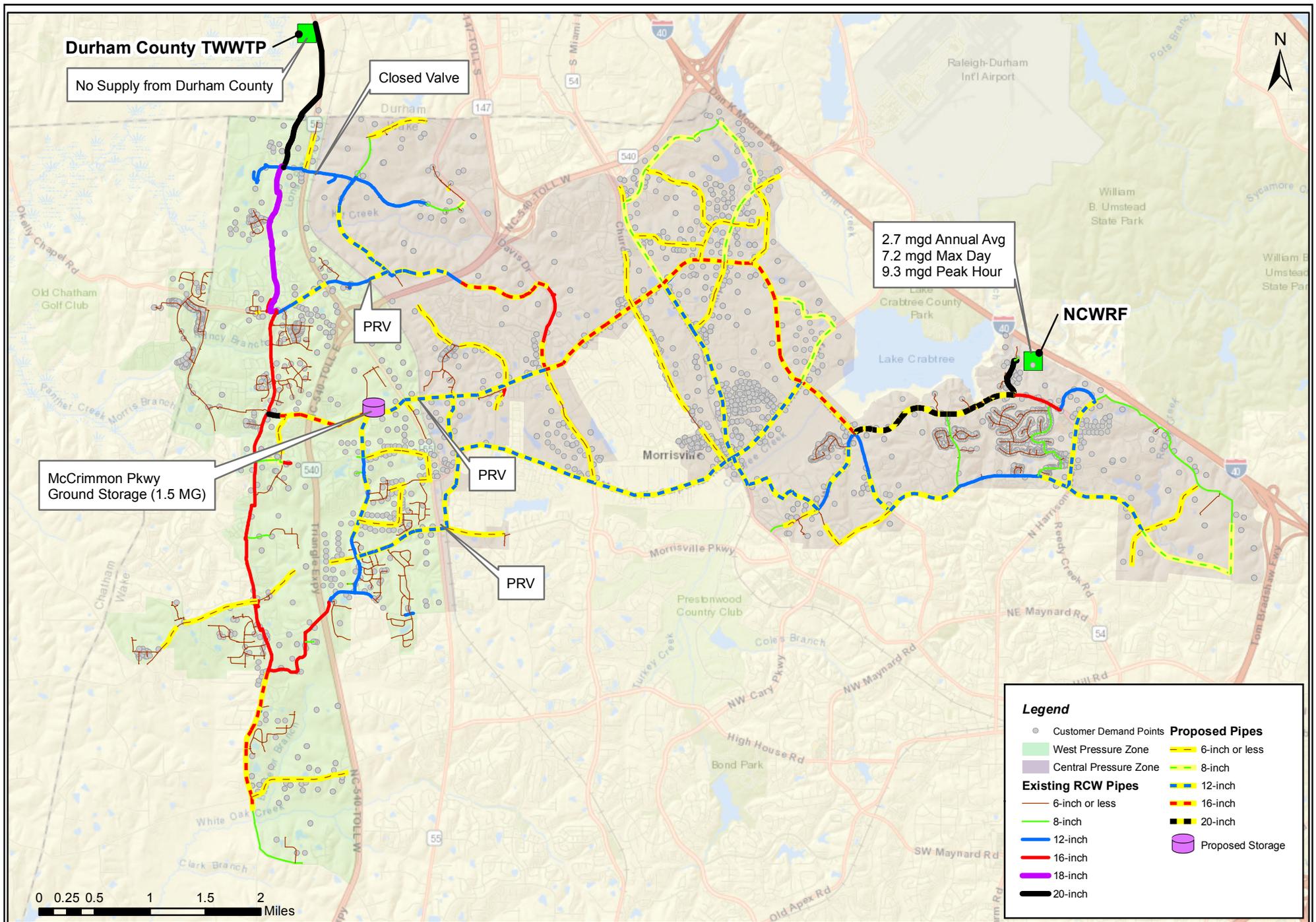
Since the alternate tank location is closer to the NCWRF, the Highway 54 ground tank recommended in Scenario E for the CPZ could be eliminated. However, without CPZ storage, the proposed WPZ tank volume increases to 1.5 MG (as compared with 1.0 MG at the Thomas Brooks Park site) and the booster pump station increases to 5.0 mgd (as compared with 4.0 mgd at the Thomas Brooks Park site) to meet peak demands. In addition, the modeled peak flow from the NCWRF is 9.3 mgd, which exceeds the current reclaimed water pump station capacity of 8.5 mgd (with one large pump out of service). Therefore, pump upgrades at the NCWRF are needed for Scenario H.

### 3.2.8 Scenario I (Buildout)

Scenario I, presented in **Figure 10**, corresponds with Scenario G (buildout with NCWRF and Durham County supply), but evaluates the same alternative reclaimed water storage tank location as discussed for Scenario H. The ground tank downstream of the PRV on McCrimmon Parkway near Highcroft Drive (see Figure 10) is pumped to the WPZ at an HGL elevation of 540 feet. An additional set of pumps could potentially be added to pump back to the CPZ, although that was not modeled as part of this evaluation. Since the alternate tank location is closer to the NCWRF, the Highway 54 ground tank recommended in Scenario G for the CPZ could be eliminated.

The reclaimed water pipes and PRV locations are the same as for Scenario G, however, Scenario I includes a new 16-inch diameter pipe along McCrimmon Parkway that crosses NC 540. This pipe is necessary to improve transmission from the tank to the existing 16-inch reclaimed water line along Green Level Church Road. Without storage in the CPZ, the required size of the northwest connector pipe is increased to 16-inch diameter between Weston Parkway and Davis Drive. Figure A-6 attached to the end of this memo shows the modeled HGL profile from the NCWRF to Green Level Church Road in the WPZ for Scenario I.

The modeled peak hour flows from Durham County and the NCWRF at buildout with the single alternate tank location are 3.5 mgd and 7.8 mgd, respectively. These flows can be adequately provided by the existing reclaimed water pumps at both facilities based on their existing capacities. Therefore, pump upgrades are not needed for Scenario I.



**Figure 9**  
Scenario H - Buildout; Supply from NCWRF Only; Alternate Tank Location

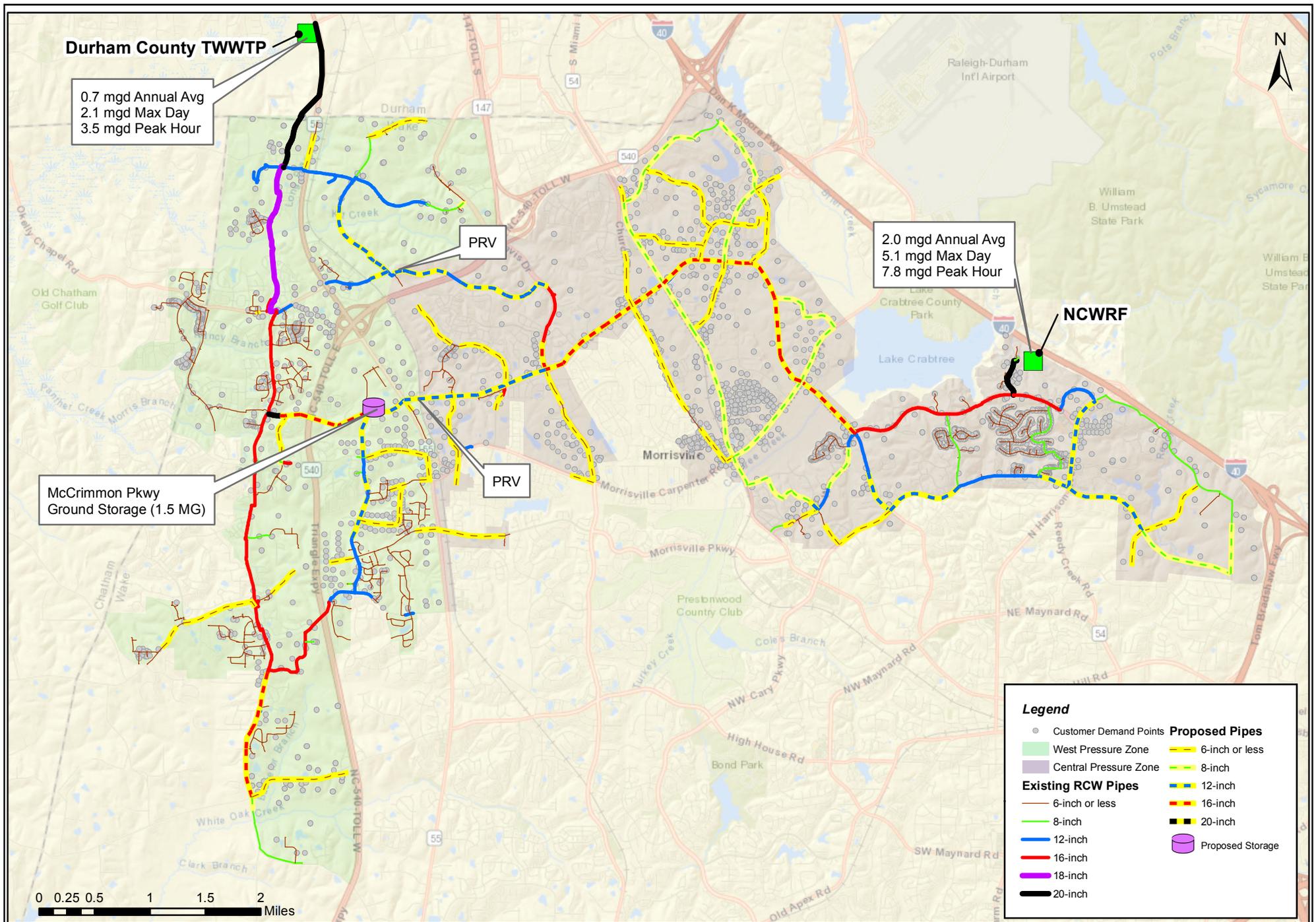


Figure 10  
 Scenario I - Buildout with Supply from Durham County; Alternate Tank Location

## 4.0 Capital Improvement Program

The CIP presented in Table 9-4 of the 2013 Master Plan Update was updated under this addendum to include the proposed projects for Scenario H. Scenario H was selected as the preferred alternative since it is a conservative estimate of the infrastructure required to build out the reclaimed water system. Scenario H assumes only the NCWRF is available as a reclaimed water supply source at buildout. However, by eliminating the second ground storage tank in the CPZ, Scenario H is lower cost than Scenario E.

The CIP prioritizes Scenario H improvements into the following phases for planning purposes, as summarized in **Table 4**:

- Phase 1A – Near-term prior to addition of storage in the West service area (corresponds to Scenario B)
- Phase 1B – Near-term with addition of storage in the West service area (corresponds to Scenario C; alternate tank location)
- Phase 2 – Mid-term (corresponds to Scenario D; alternate tank location)
- Phase 3 – Buildout (corresponds to Scenario H)

**Table 4. Summary of CIP Phasing**

Phase	Planning Period	Reclaimed Water Supply from Durham County	Storage Tank	Avg Day Demand (mgd)	Max Day Demand (mgd)	Corresponding Scenario (see Section 3)
1A	Near-Term	Yes	none	0.5	1.5	Scenario B
1B	Near-Term	Yes	McCrimmon Pkwy Tank	0.7	2.0	Scenario C (with alternate tank location)
2	Mid-Term	No	McCrimmon Pkwy Tank	1.6	4.2	Scenario D (with alternate tank location)
3	Buildout	No	McCrimmon Pkwy Tank	2.7	7.2	Scenario H

A description of how the cost estimates were developed is provided in Section 9.1 of the 2013 Master Plan Update. Unit costs presented in the 2013 Master Plan report have been updated based on recent estimates for similar projects, historical data from comparable work, and estimating guides and equipment costs. All costs are in 2017 dollars and reference an August 2017 ENR construction cost index of 10841.

The updated CIP is presented in **Table 5**. Projects for the South Cary reclaimed water service area are also included in Table 5. The recommendations for the South Cary service area have not been updated since the 2013 Master Plan Update. However, for consistency, the South Cary

reclaimed water project costs have been updated to 2017 dollars (ENR construction cost index of 10841) using the same updated unit costs as the North/ West Cary reclaimed water service area projects.

A description of the recommended improvements for the North/West Cary reclaimed water service area is provided by phase in the following sections. The new reclaimed water pipelines are generally located along existing or proposed transportation thoroughfares identified in the *2009 Morrisville Transportation Plan* or *2008 Town of Cary Comprehensive Transportation Plan Update* as used for the 2013 Master Plan Update.

The location of each project is shown color coded by diameter on **Figure 11** and color coded by phase on **Figure 12**. A description and mapping of the South Cary reclaimed water service area projects can be found in Section 9.2 of the 2013 Master Plan Update report.

#### **4.1 Phase 1A (Near-Term)**

##### **Project NW-1: RTP Phase 2**

Construct approximately 4,300 LF of 12-inch diameter pipeline along Louis Stephens Drive and Little Drive. Project extends from existing reclaimed water line in RTP on Louis Stephens Drive and connects to the existing reclaimed water line on Little Drive. This project extends reclaimed water service to additional areas of RTP.

Engineer's Opinion of Probable Cost: \$800,000

##### **Project NW-2: Green Level Church Road Force Main Conversion**

Convert approximately 6,800 LF of existing 16-inch diameter wastewater force main along Green Level Church Road to reclaimed water line between the existing reclaimed water lines near Brooks Park Lane and Green Level West Road. This project extends reclaimed water service to new development south of Thomas Brooks Park. A placeholder of \$50,000 is included for condition assessment of the force main.

Engineer's Opinion of Probable Cost: \$50,000

##### **Project NW-3: Green Level West Road Extension**

Construct approximately 5,000 LF of 6-inch diameter pipeline along Green Level West Road between Green Level Church Road and NC 540. This project extends reclaimed water service to new development in the vicinity of Green Level West Road.

Engineer's Opinion of Probable Cost: \$500,000

##### **Project NW-4: Morrisville Parkway West Extension**

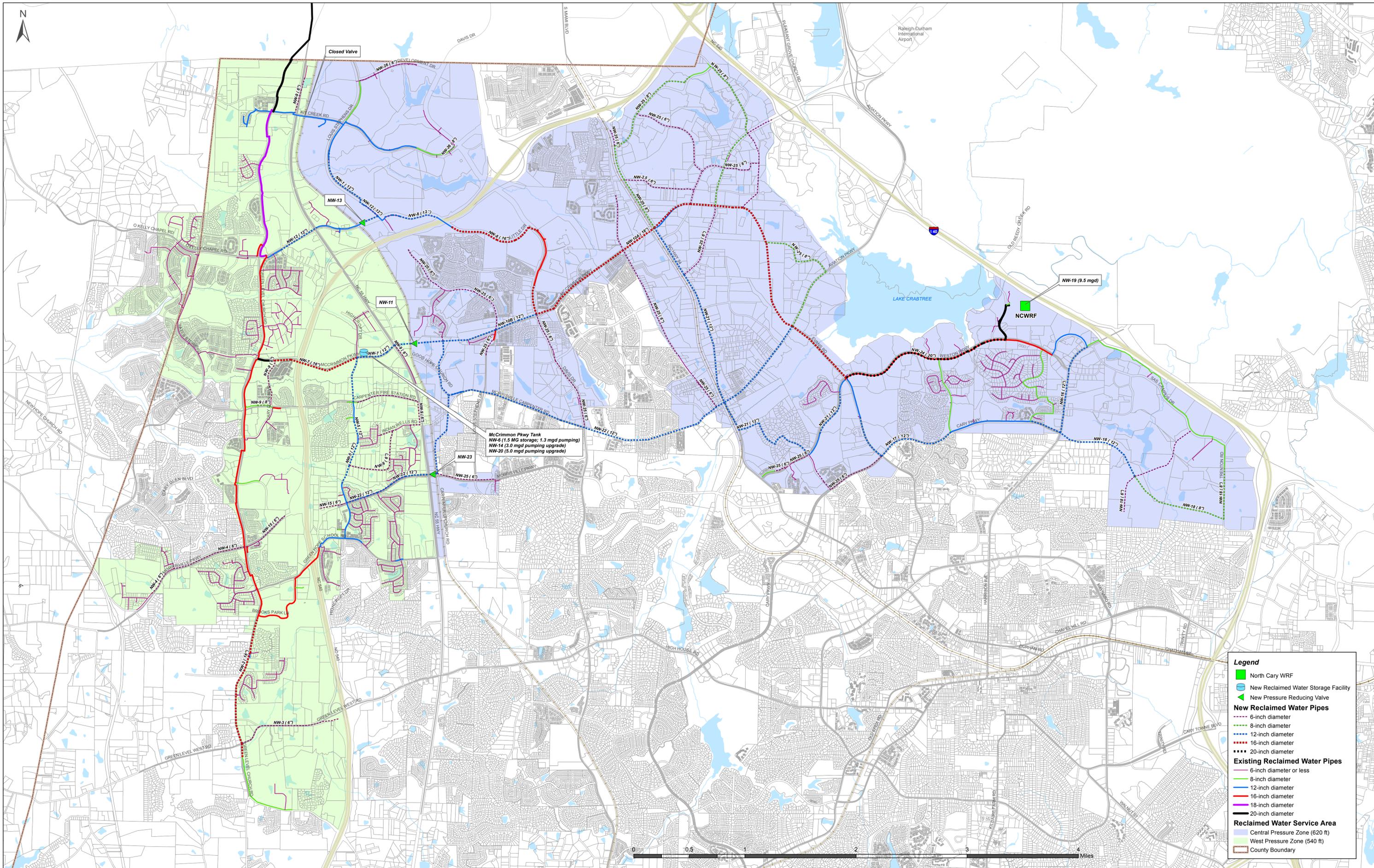
Construct approximately 5,000 LF of 6-inch diameter pipeline along Morrisville Parkway west of Green Level Church Road and NC 540 to Stratford Ridge Lane. This project extends reclaimed water service to the Weldon Ridge neighborhood, Copperleaf neighborhood, and other nearby new developments.

Engineer's Opinion of Probable Cost: \$500,000

**Table 5. Town of Cary Reclaimed Water System Capital Improvements Program**

Project No.	Project Name	Phase	Location/Description	Diameter (in)	Total Length (LF)	Total Capital Cost (in 2017 Dollars) <sup>1</sup>
<b>North/ West Cary Service Area</b>						
NW-1	RTP Phase 2 <sup>2</sup>	1A	New connecting pipeline on Louis Stephens Dr and Little Dr	12	4,300	\$800,000
NW-2	Green Level Church Rd Force Main Conversion <sup>3</sup>	1A	Convert existing wastewater force main along Green Level Church Rd to reclaimed water	16	6,800	\$50,000
NW-3	Green level West Rd Extension <sup>2</sup>	1A	New distribution pipelines along Green Level West Rd and Green Level Church Rd	6	5,000	\$500,000
NW-4	Morrisville Parkway West Extension <sup>2</sup>	1A	New pipeline extension along Morrisville Pkwy from Green Level Church Rd to Stratford Ridge Ln	6	5,000	\$500,000
NW-5	Indian Wells Extension <sup>2</sup>	1A	New connecting pipeline along proposed connector road between Morrisville Pkwy and Carpenter Fire Station Rd	12	2,800	\$500,000
<b>Phase 1A Subtotal</b>					<b>23,900</b>	<b>\$2,350,000</b>
NW-6	McCrimmon Pkwy Ground Storage Re-Pump Facility <sup>4</sup>	1B	1.5 MG Ground Storage Tank and 1.3 mgd booster pump station	-	-	\$4,100,000
NW-7	McCrimmon Pkwy Tank Loop <sup>2</sup>	1B	New pipeline from McCrimmon ground storage tank to Green Level Church Rd and Carpenter Fire Station Rd	12 16	8,500	\$2,000,000
NW-8	Little Dr Pipeline <sup>2</sup>	1B	New connecting pipeline on Little Dr	12 16	6,400	\$1,600,000
NW-9	Miscellaneous West Service Area Looping/ Extensions <sup>2</sup>	1B	New pipelines to complete looping and extend service to various areas in the West service area.	6 8	14,000	\$1,500,000
<b>Phase 1B Subtotal</b>					<b>28,900</b>	<b>\$9,200,000</b>
NW-10A	Northwest Connector Phase A <sup>2</sup>	2	New pipeline from Weston Pkwy to Davis Dr	16	23,100	\$6,500,000
NW-10B	Northwest Connector Phase B <sup>2</sup>	2	New pipeline from Davis Dr to Highway 55	12	7,000	\$1,300,000
NW-11	McCrimmon Pkwy PRV	2	Pressure reducing valve for West Pressure Zone at Hwy 55 & McCrimmon Pkwy	-	-	\$50,000
NW-12	O'Kelly Chapel Rd/Little Dr Loop <sup>2</sup>	2	Upsize existing pipes and new pipeline to complete loop from Little Dr to Green Level Church Rd	12	3,700	\$700,000
NW-13	O'Kelly Chapel Rd PRV	2	Pressure reducing valve for West Pressure Zone at Railroad & O'Kelly Chapel Rd	-	-	\$50,000
NW-14	Pump Upgrade at McCrimmon Rd Storage Facility	2	Upgrade booster pump station to 3.0 mgd	-	-	\$2,100,000
NW-15	Morrisville Pkwy Extensions <sup>2</sup>	2	New pipeline extensions along Morrisville Pkwy east and west of Highway 55	6	2,700	\$300,000
NW-16	Harrison Ave Pipe Loop <sup>2</sup>	2	New pipe loop along Harrison Ave and NW Cary Pkwy	12	6,000	\$1,200,000
NW-17	Evans Dr & NW Cary Pkwy Loop <sup>2</sup>	2	New pipe loop to serve Weston Pointe neighborhood	12	6,000	\$1,200,000
NW-18	SAS Area Loop <sup>2</sup>	2	Extend RCW pipeline along SAS Campus Dr, Trenton Road and future Cary Pkwy extension	6 8 12	17,300	\$2,400,000
<b>Phase 2 Subtotal</b>					<b>65,800</b>	<b>\$15,800,000</b>
NW-19	NCWRF Pump Upgrade	3	Replace one existing 150-hp pump with one new 300-hp pump	-	-	\$800,000
NW-20	Pump Upgrade at McCrimmon Rd Storage Facility	3	Upgrade booster pump station to 5.0 mgd	-	-	\$2,400,000
NW-21	Highway 54 Transmission Loop <sup>2</sup>	3	New pipe loop to improve transmission from Weston Pkwy to McCrimmon Pkwy	12	17,300	\$3,300,000
NW-22	Northwest Connector Phase 3 <sup>2</sup>	3	New pipeline along Aviation Rd, Morrisville Carpenter Rd, and Morrisville Pkwy to WPZ	12	30,200	\$5,800,000
NW-23	Morrisville Parkway PRV	3	Pressure reducing valve for West Pressure Zone at NC Highway 55 & Morrisville Pkwy	-	-	\$50,000
NW-24	Weston Pkwy Transmission Improvement <sup>2</sup>	3	Upsize existing transmission pipe along Weston Pkwy from Old Reedy Creek Rd to Evans Rd	20	8,300	\$3,700,000
NW-25	Morrisville Area Distribution Line Extensions <sup>2</sup>	3	New distribution pipelines along existing & planned thoroughfares in Morrisville area to serve additional RCW customers	6 8	79,900	\$9,100,000
NW-26	RTP South Pipe Upgrades <sup>2</sup>	3	Upsize pipes in the RTP South area	6 8	3,400	\$400,000
<b>Phase 3 Subtotal</b>					<b>139,100</b>	<b>\$25,550,000</b>
<b>North/West Service Area SUBTOTAL</b>					<b>257,700</b>	<b>\$52,900,000</b>
<b>South Cary Service Area</b>						
S-1	SCWRF Pump Upgrade	2	Replace existing high service pump station with new 2.0 mgd pump station	-	-	\$2,400,000
S-2	Pierce Olive Rd Loop	2	Loop between existing pipes on Optimist Farm Road and West Lake Road extending South service area to the west	8	14,800	\$2,000,000
S-3	Heritage and Woodlands Loop	2	New pipe loop along Serene Forest Drive and Glade Hill Drive	6	6,300	\$600,000
<b>Phase 2 Subtotal</b>					<b>21,100</b>	<b>\$5,000,000</b>
S-4	West Lake Rd Transmission Improvement	3	Upsize existing pipe from SCWRF along West Lake Road and Optimist Farm Road	12 16	7,800	\$2,100,000
S-5	Bells Lake Rd Loop	3	Loop along Optimist Farm Rd, Bells Lake Rd and Oxford Green	8 12	13,600	\$1,900,000
S-6	Bells Lake Rd Pipeline South	3	Bells Lake Rd pipe extension to the south	6	5,700	\$600,000
S-7	Bells Lake Rd Pipeline North	3	Bells Lake Rd pipe extension to the north	6	1,800	\$200,000
S-8	West Lake Rd Pipeline North	3	New pipeline from Hwy 540 corridor to Ten Ten Rd	12	4,400	\$900,000
S-9	West Lake Elevated Storage Tank	3	0.5 MG Elevated Tank near West Lake Road and Floresta Drive	-	-	\$3,100,000
S-10	Ten Ten Road Pipeline	3	New pipeline along Ten Ten Road	6 8	9,000	\$1,100,000
S-11	Distribution Line Extensions	3	New distribution pipelines along roads in the northern portion of the service area	6	21,000	\$2,200,000
<b>Phase 3 Subtotal</b>					<b>63,300</b>	<b>\$12,100,000</b>
<b>South Service Area SUBTOTAL</b>					<b>84,400</b>	<b>\$17,100,000</b>
<b>TOTAL</b>					<b>342,100</b>	<b>\$70,000,000</b>

- The cost estimates for this study were prepared using previous estimates for similar projects, historical data from comparable work, and estimating guides and equipment costs. Capital costs include estimated land acquisition costs assuming one-half the length of the project will require additional easements 20 feet wide at a cost of \$20,000 per acre. Capital costs include 30% for construction contingencies and 25% for engineering, legal, and administration fees.
- Pipeline construction costs are estimated based on unit costs per linear foot including fittings, gate valves, air release valves, and blow-offs. C900/C905 PVC pipe is assumed for 6-inch through 16-inch diameter. Ductile iron pipe is assumed for 20-inch diameter. Costs assume minimum dewatering and 10% of the pipeline length will require rock excavation. Costs for trenchless road and stream crossings assume horizontal directional drill.
- Cost of \$50,000 is included as a placeholder for force main condition assessment.
- Ground storage costs assume a prestressed concrete ground storage tank with standard dimensions.



Closed Valve

NW-19 (9.5 mgd)

NCWRF

McCrimmon Pkwy Tank  
 NW-6 (1.5 MG storage; 1.3 mgd pumping)  
 NW-14 (3.0 mgd pumping upgrade)  
 NW-20 (5.0 mgd pumping upgrade)

**Legend**

- North Cary WRF
- New Reclaimed Water Storage Facility
- ▲ New Pressure Reducing Valve
- New Reclaimed Water Pipes**
  - 6-inch diameter
  - 8-inch diameter
  - 12-inch diameter
  - 16-inch diameter
  - 20-inch diameter
- Existing Reclaimed Water Pipes**
  - 6-inch diameter or less
  - 8-inch diameter
  - 12-inch diameter
  - 16-inch diameter
  - 18-inch diameter
  - 20-inch diameter
- Reclaimed Water Service Area**
  - Central Pressure Zone (620 ft)
  - West Pressure Zone (540 ft)
  - County Boundary

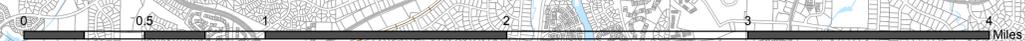
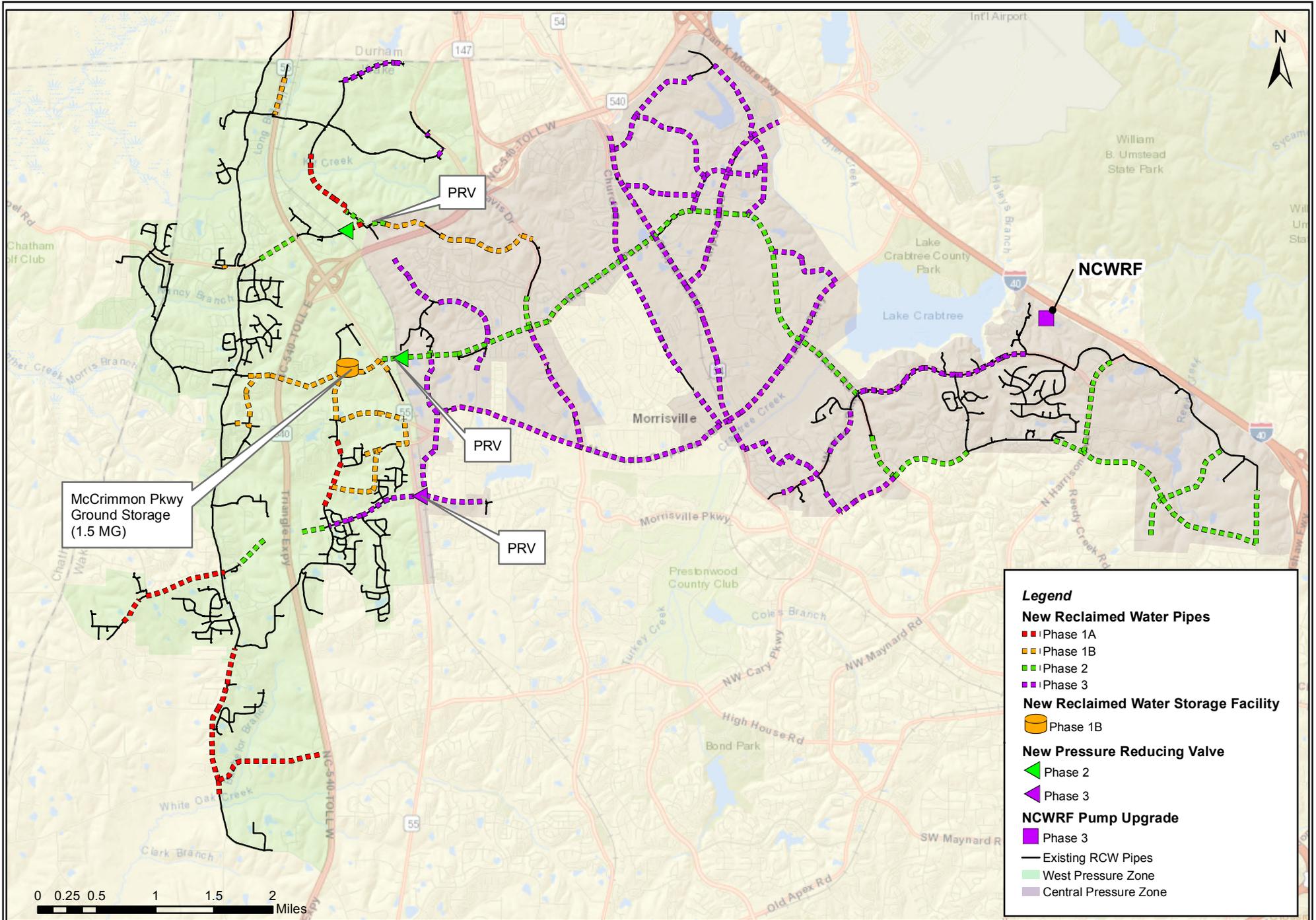


Figure 11  
 Recommended Capital Improvement Projects by Diameter



**Figure 12**  
Recommended Capital Improvement Projects by Phase

**Project NW-5: Indian Wells Extension**

Construct approximately 2,800 LF of 12-inch diameter pipeline along proposed new connector road between Morrisville Parkway and Carpenter Fire Station Road. This project extends reclaimed water service to the Indian Wells neighborhood and surrounding areas.

Engineer's Opinion of Probable Cost: \$500,000

**4.2 Phase 1B (Near-Term)**

**Project NW-6: McCrimmon Parkway Ground Storage Re-Pump Facility**

Construct new 1.5 MG ground storage tank and 1.3 mgd booster pump station near McCrimmon Parkway and Highcroft Drive to provide reclaimed water system storage in the West pressure zone. Pump station should be designed to be expanded to 5.0 mgd in future phases per projects NW-14 and NW-20.

Engineer's Opinion of Probable Cost: \$4,100,000

**Project NW-7: McCrimmon Parkway Tank Loop**

Construct approximately 4,400 LF of 16-inch diameter pipeline along McCrimmon Parkway from the ground storage tank (Project NW-6) to Green Level Church Road, including crossing under NC 540. Construct approximately 4,100 LF of 12-inch diameter pipeline along McCrimmon Parkway from NC Highway 55 to the ground storage tank (Project NW-6), including crossing under NC 55 and along Highcroft Drive from McCrimmon Parkway to the existing reclaimed water pipe at Carpenter Fire Station Road. This project allows transmission of reclaimed water in the West service area between the ground storage tank and transmission main on Green Level Church Road.

Engineer's Opinion of Probable Cost: \$2,000,000

**Project NW-8: Little Drive Pipeline**

Construct approximately 1,800 LF of 12-inch diameter pipeline along Little Drive west of the existing 12-inch diameter pipeline installed under NC 540. Construct approximately 4,600 LF of 16-inch diameter pipeline along Little Drive east of the existing pipeline installed under NC 540. This project connects existing sections of reclaimed water pipeline to extend reclaimed water service to Davis Drive.

Engineer's Opinion of Probable Cost: \$1,600,000

**Project NW-9: Miscellaneous West Service Area Looping/Extensions**

Construct approximately 9,000 LF of 6-inch diameter pipeline to complete a loop along Carpenter Fire Station Road, NC 55, Indian Wells Road, and Wackena Road. Construct approximately 700 of 6-inch diameter pipeline along NC 55 from McCrimmon Parkway to the existing reclaimed water pipe near Good Hope Church Road. Construct approximately 1,900 LF of 6-inch diameter pipeline and 600 LF of 8-inch diameter pipeline to complete a loop along Cary Glen Boulevard and Carpenter Fire Station Road. Construct approximately 1,700 LF of 6-inch diameter pipeline along NC 55 north of Louis Stephens Drive. Construct approximately 100

LF of 6-inch pipe crossing O’Kelly Chapel Road near Stone Croft Lane. These projects extend reclaimed water service in the West service area.

Engineer’s Opinion of Probable Cost: \$1,500,000

#### **4.3 Phase 2 (Mid-Term)**

##### **Project NW-10A: Northwest Connector Phase A**

Construct approximately 23,100 LF of 16-inch diameter pipeline along Evans Road, the proposed McCrimmon Parkway extension, and McCrimmon Parkway from Weston Parkway to the existing 16-inch reclaimed water pipe on Davis Drive. The purpose of the NW Connector is to convey water from the NCWRF into the West Cary service area.

Engineer’s Opinion of Probable Cost: \$6,500,000

##### **Project NW-10B: Northwest Connector Phase B**

Construct approximately 7,000 LF of 12-inch diameter pipeline along existing and proposed McCrimmon Parkway corridor from Project NW-10A to NC Highway 55. The purpose of the NW Connector is to convey water from the NCWRF into the West Cary service area.

Engineer’s Opinion of Probable Cost: \$1,300,000

##### **Project NW-11: McCrimmon Parkway Pressure Reducing Valve**

Install pressure reducing valve on 12-inch reclaimed water pipeline (Project NW-7) at NC Highway 55 and McCrimmon Parkway. This valve is required to establish a West pressure zone (HGL = 540 ft) within the reclaimed water system along Highway 55 to correspond with the potable water system pressure zone boundary.

Engineer’s Opinion of Probable Cost: \$50,000

##### **Project NW-12: O’Kelly Chapel Road/ Little Drive Loop**

Construct approximately 2,000 LF of 12-inch diameter pipeline along O’Kelly Chapel Road between existing reclaimed water pipe sections east of Green Level Church Road, including crossing under NC Highway 55. Upsize approximately 1,700 LF of existing 6-inch diameter reclaimed water pipes near the intersection of Louis Stephens Drive and Little Drive to 12-inch diameter. Completion of the project will create a loop allowing for transmission of reclaimed water from the NCWRF to the existing West Cary service area.

Engineer’s Opinion of Probable Cost: \$700,000

##### **Project NW-13: O’Kelly Chapel Road Pressure Reducing Valve**

Install pressure reducing valve on 12-inch reclaimed water pipeline (Project NW-12) at the railroad tracks and O’Kelly Chapel Road. This valve is required to establish a West pressure zone (HGL = 540 ft) within the reclaimed water system to correspond with the potable water system pressure zone boundary.

Engineer’s Opinion of Probable Cost: \$50,000

**Project NW-14: Pump Station Upgrade at McCrimmon Parkway Storage Facility**

Increase booster pump station capacity from 1.3 mgd to 3.0 mgd.

Engineer's Opinion of Probable Cost: \$2,100,000

**Project NW-15: Morrisville Parkway Extensions**

Construct approximately 2,700 LF of 6-inch diameter pipeline along Morrisville Parkway east and west of NC Highway 55 (no highway crossing) to serve new development in this area.

Engineer's Opinion of Probable Cost: \$300,000

**Project NW-16: Harrison Avenue Pipe Loop**

Construct approximately 5,600 LF of 12-inch diameter pipeline along NW Cary Parkway and Harrison Avenue between the existing sections of pipe on NW Cary Parkway and Harrison Avenue to complete pipe loop.

Engineer's Opinion of Probable Cost: \$1,200,000

**Project NW-17: Evans Drive & NW Cary Parkway Loop**

Construct approximately 5,800 LF of 12-inch diameter pipeline along NW Cary Parkway and Evans Road to complete a loop between the existing pipeline sections on NW Cary Parkway and Evans Road.

Engineer's Opinion of Probable Cost: \$1,200,000

**Project NW-18: SAS Area**

Construct approximately 17,300 LF of 6-inch, 8-inch, and 12-inch diameter pipelines along Trenton Road, the future Cary Parkway extension, and a proposed future thoroughfare. Individual projects should be broken out as dictated by future growth.

Engineer's Opinion of Probable Cost: \$2,400,000

**4.4 Phase 3 (Buildout)**

**Project NW-19: NCWRF Pump Upgrade**

Replace the existing 150-hp pump at the NCWRF reclaimed water pump station with a new 300-hp pump.

Engineer's Opinion of Probable Cost: \$800,000

**Project NW-20: Pump Station Upgrade at McCrimmon Parkway Storage Facility**

Increase booster pump station capacity from 3.0 mgd to 5.0 mgd.

Engineer's Opinion of Probable Cost: \$2,400,000

**Project NW-21: Highway 54 Transmission Loop**

Construct approximately 17,300 LF of 12-inch diameter transmission pipeline along Weston Parkway and Highway 54 between Evans Road and McCrimmon Parkway to improve transmission to the central portion of the service area.

Engineer's Opinion of Probable Cost: \$3,300,000

**Project NW-22: Northwest Connector Phase 3**

Construct approximately 30,200 LF of 12-inch diameter transmission pipeline along Aviation Parkway, Morrisville Carpenter Road, Carpenter Upchurch Road, and Morrisville Parkway. This project improves transmission capacity from the NCWRF into the WPZ.

Engineer's Opinion of Probable Cost: \$5,800,000

**Project NW-23: Morrisville Parkway Pressure Reducing Valve**

Install pressure reducing valve on 12-inch reclaimed water pipeline (Project NW-22) at NC Highway 55 and Morrisville Parkway. This valve is required to establish a West pressure zone (HGL = 540 ft) within the reclaimed water system to correspond with the potable water system pressure zone boundary.

Engineer's Opinion of Probable Cost: \$50,000

**Project NW-24: Weston Parkway Transmission Improvement**

Upsize approximately 8,200 LF of existing 16-inch diameter transmission pipeline to 20-inch diameter along Weston Parkway between Old Reedy Creek Road and Evans Road.

Engineer's Opinion of Probable Cost: \$3,700,000

**Project NW-25: Morrisville Distribution Line Extensions**

Construct approximately 79,900 LF of 6-inch and 8-inch diameter pipelines along existing and planned thoroughfares in Morrisville and the CPZ to provide reclaimed water service throughout this area. Individual projects should be broken out as dictated by future growth.

Engineer's Opinion of Probable Cost: \$9,100,000

**Project NW-26: RTP South Pipe Upgrades**

Upsize approximately 400 LF of existing 6-inch diameter reclaimed water pipe to 8-inch diameter along Davis Drive. Upsize approximately 3,000 LF of existing 4-inch diameter reclaimed water pipe to 6-inch diameter along Development Drive. This project addresses capacity limitations in the RTP area as demands increase by buildout.

Engineer's Opinion of Probable Cost: \$400,000

#### 4.5 Summary

The total cost of updated CIP projects for the North/West reclaimed water service area presented in Table 5 is \$52.9 million. A summary of the CIP costs by project type and year is presented in **Table 6**. The previously recommended projects for the North/West service area presented in Table 9-4 of the 2013 Master Plan Update totaled \$69.2 million (in 2013 dollars). The reduction of CIP cost with this addendum is due to lower demands which allow for smaller pipe sizes and the elimination of an elevated storage tank at Thomas Brooks Park.

**Table 6. Summary of North/West Service Area CIP Project Costs by Type and Phase (in millions of dollars)<sup>1,2</sup>**

Project Type	Near-Term Phase 1A	Near-Term Phase 1B	Mid-Term Phase 2	Buildout Phase 3	Total
Storage	-	\$4.10	-	-	\$4.10
Pipelines	\$2.35	\$5.10	\$13.60	\$22.30	\$43.35
Pumping	-	-	\$2.10	\$3.20	\$5.30
Control Valves	-	-	\$0.10	\$0.05	\$0.15
<b>Total</b>	<b>\$2.35</b>	<b>\$9.20</b>	<b>\$15.80</b>	<b>\$25.55</b>	<b>\$52.90</b>

1) Capital costs include 30% for construction contingencies and 25% for engineering, legal, and administration fees.  
 2) All cost estimates are based on 2017 dollars without escalation with an ENR construction cost index of 10841.

#### 5.0 Operational Considerations

As discussed in Section 3, storage sizing recommendations are based on maximum day demand conditions. However, due to the nature of the peaking factors associated with the reclaimed water system, the recommended storage volume is large in comparison with the average annual demand or summer seasonal demands. To maintain water quality and decrease water age in the storage facility, particularly during summer seasonal and average annual demand conditions prior to buildout of the system, the ground storage tank should be operated with a lesser volume (i.e. do not fill the entire tank volume), as dictated by system demand conditions. The tank may be removed from service in the winter when demands are minimal. The tanks should be re-disinfected prior to return to service. Design of the ground storage tank should take into account the planned operations with a half full tank and empty tank for portions of the year and, as well as the potential need for mixing in the tank.

Additionally, the recommended pipelines are sized to meet minimum design criteria for build-out peak hour demands. In the intermediate phases and during periods of lower demand, blowoffs may be required in some areas to maintain water quality.

In 2013 the Town performed a Blowoff Optimization and Chlorine Boosting Feasibility Study. The study concluded that the Town should implement some operational modifications, but the construction of chlorine boosting stations was not recommended at that time. Once the northwest connector is constructed and water from the NCWRF is transmitted to the WPZ, the Town should re-evaluate disinfection residuals in the service area and determine the need for booster disinfection. It is recommended that the conclusions of the 2013 feasibility study be

revisited, and the need for booster chlorine facilities be evaluated in more detail as part of the next reclaimed water master plan update.

In recent years the Town has experienced some corrosion issues in the reclaimed water distribution system, particularly at the service connections to the main. It is recommended that these issues, and their impacts to system operations and standards for materials of construction, be studied in more detail as part of the next reclaimed water master plan update.

Finally, as shown in the figures included in Appendix A to this memo, there are some areas of the CPZ that will experience high pressures in the reclaimed water system (greater than 80 psi). Consideration should be given if pressure reducing valves are needed to be installed on irrigation systems that receive reclaimed water in these areas.

# Appendix A

## Hydraulic Modeling – HGL Profiles

Figure A-1. Scenario D Mid-Term Without Durham County Supply

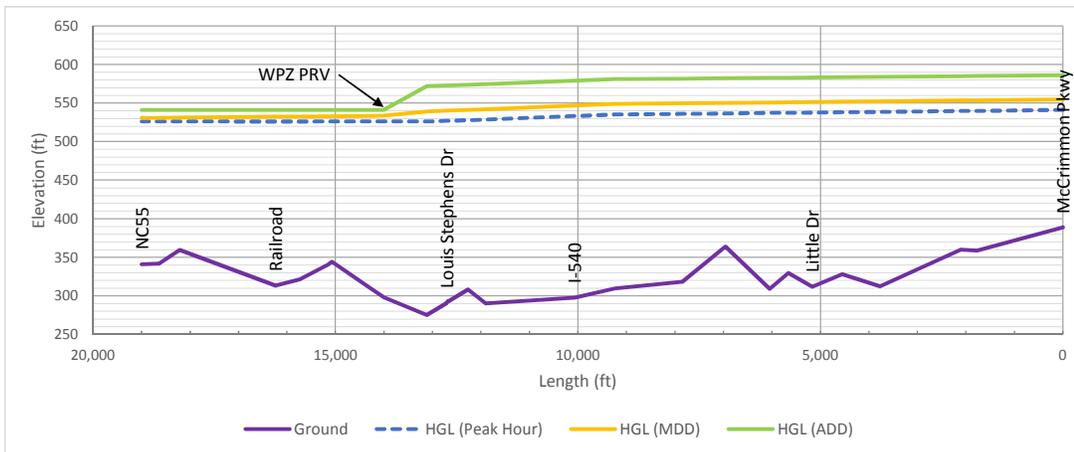
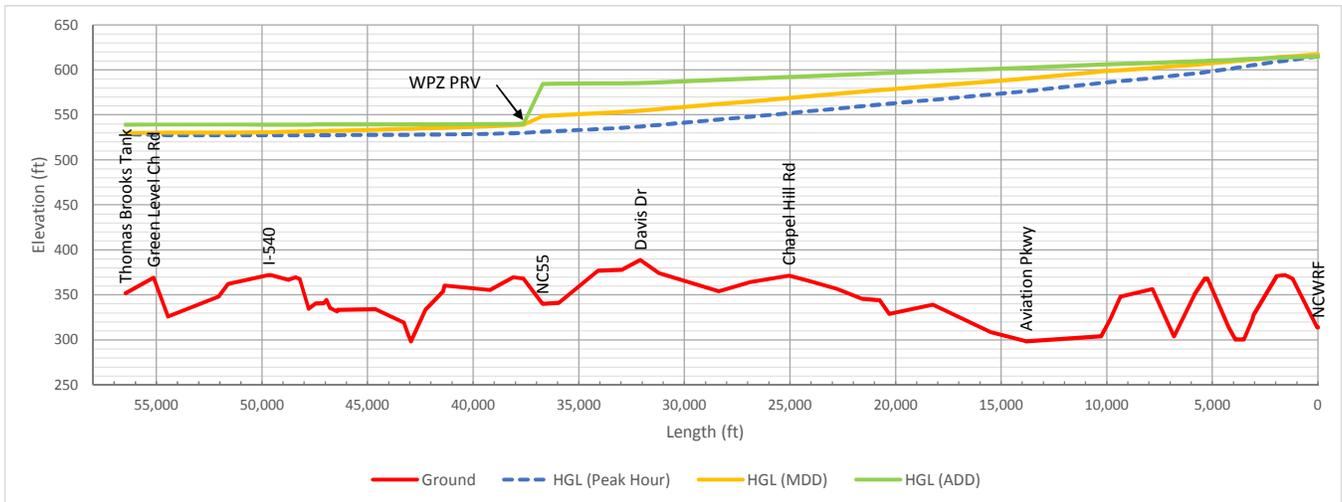
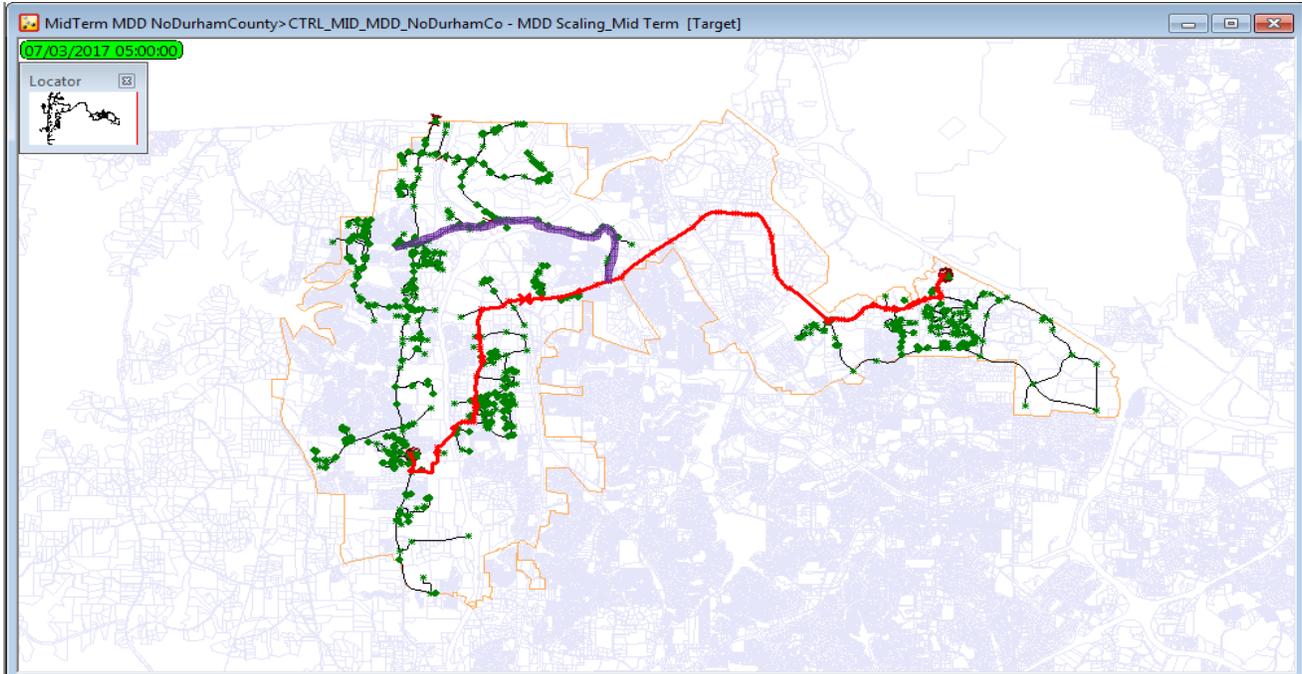


Figure A-2. Scenario E Buildout Without Durham County Supply

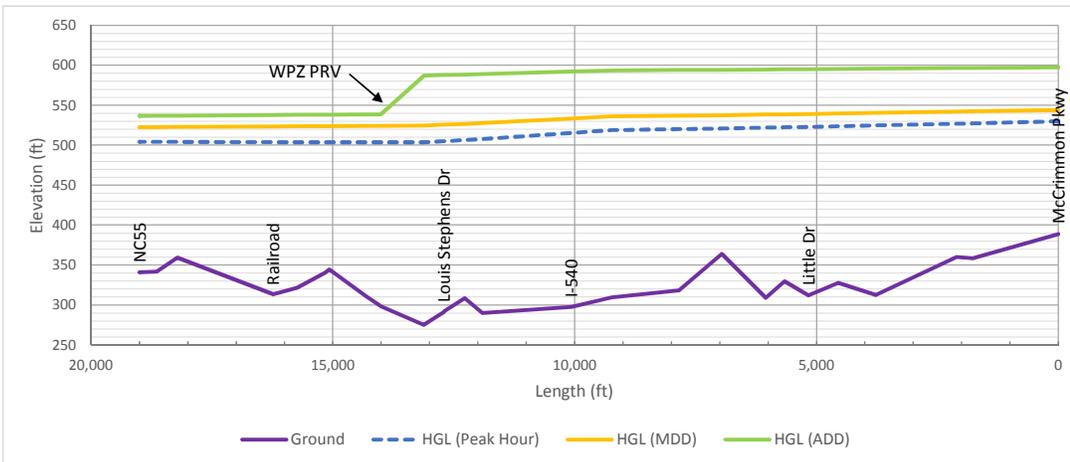
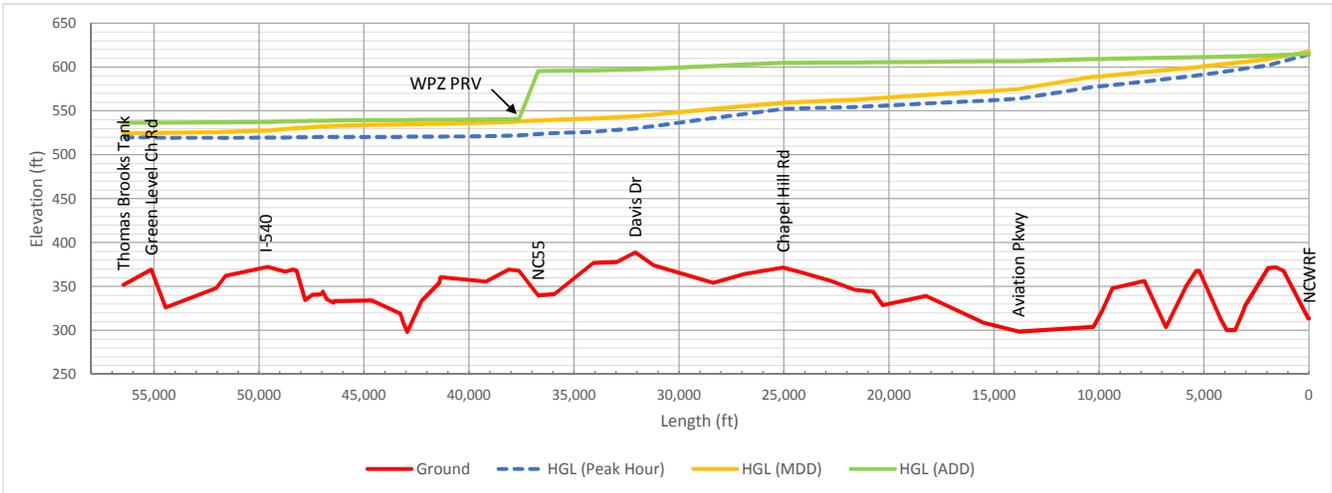
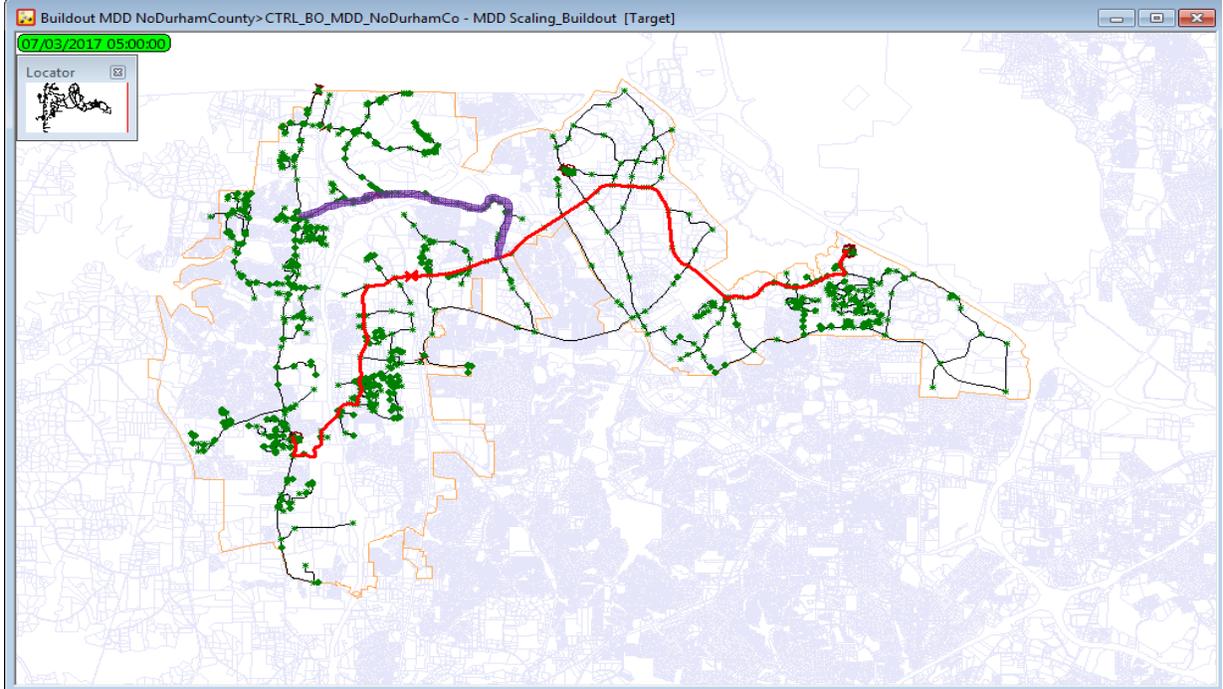


Figure A-3. Scenario F Mid-Term With Durham County Supply

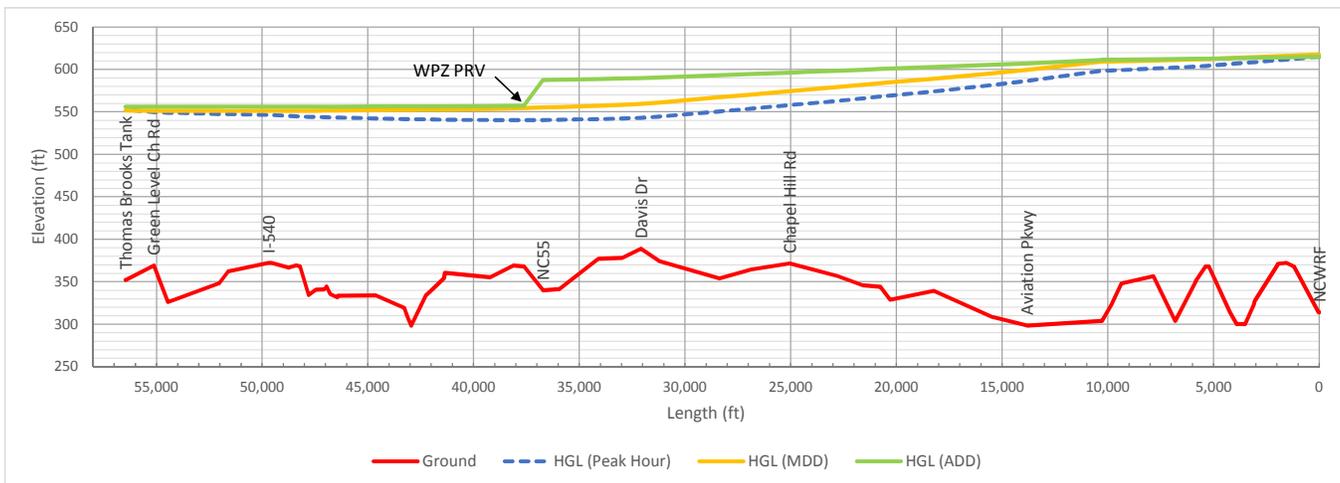
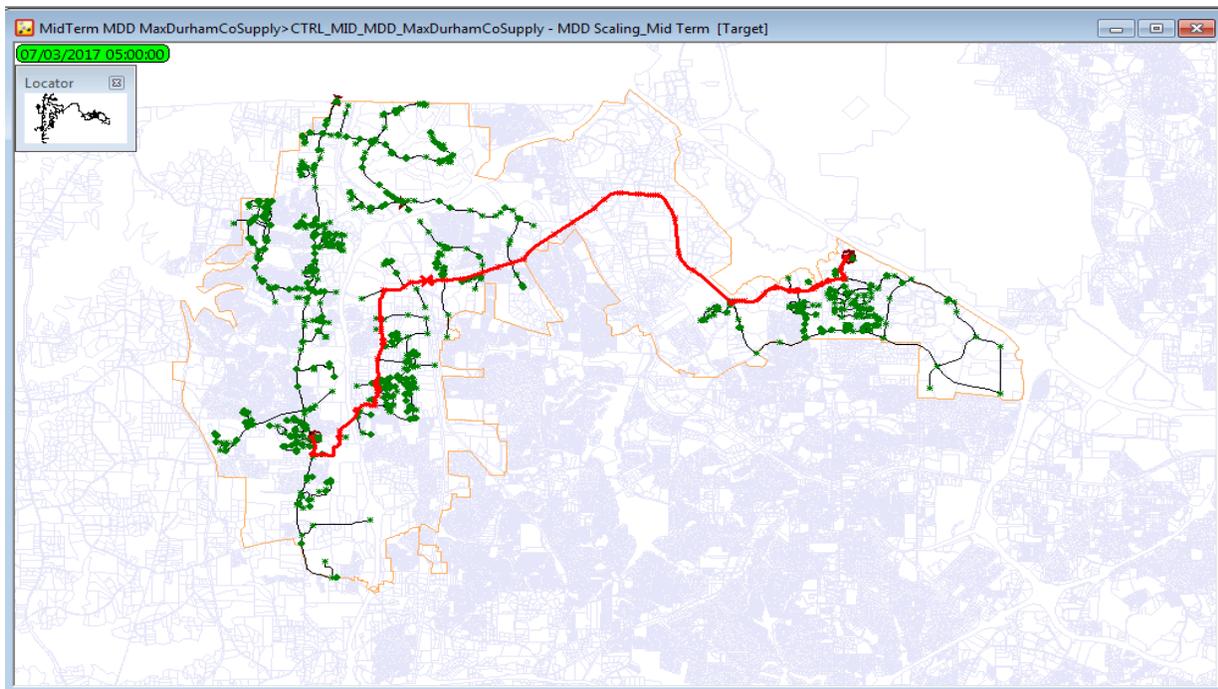


Figure A-4. Scenario G Buildout With Durham County Supply

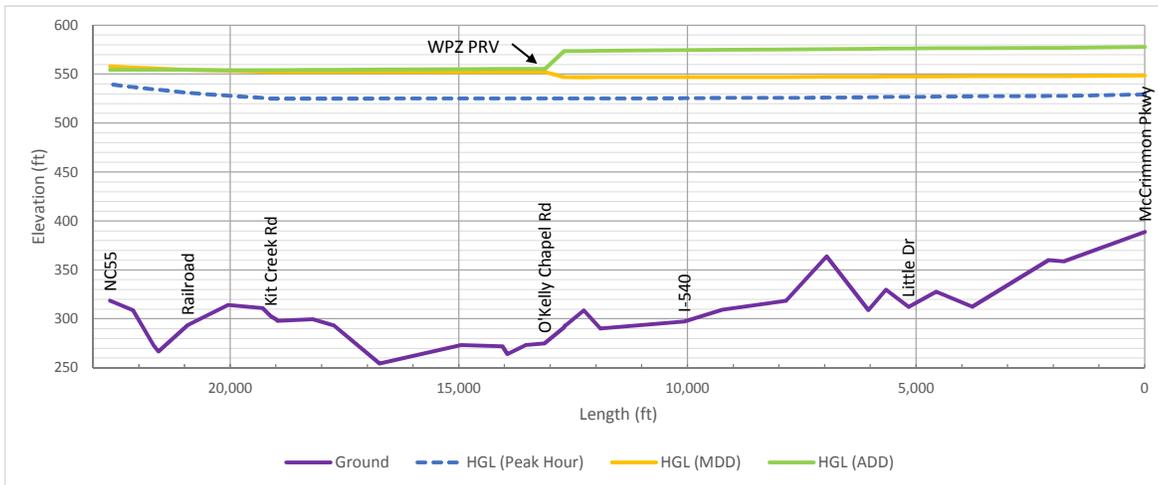
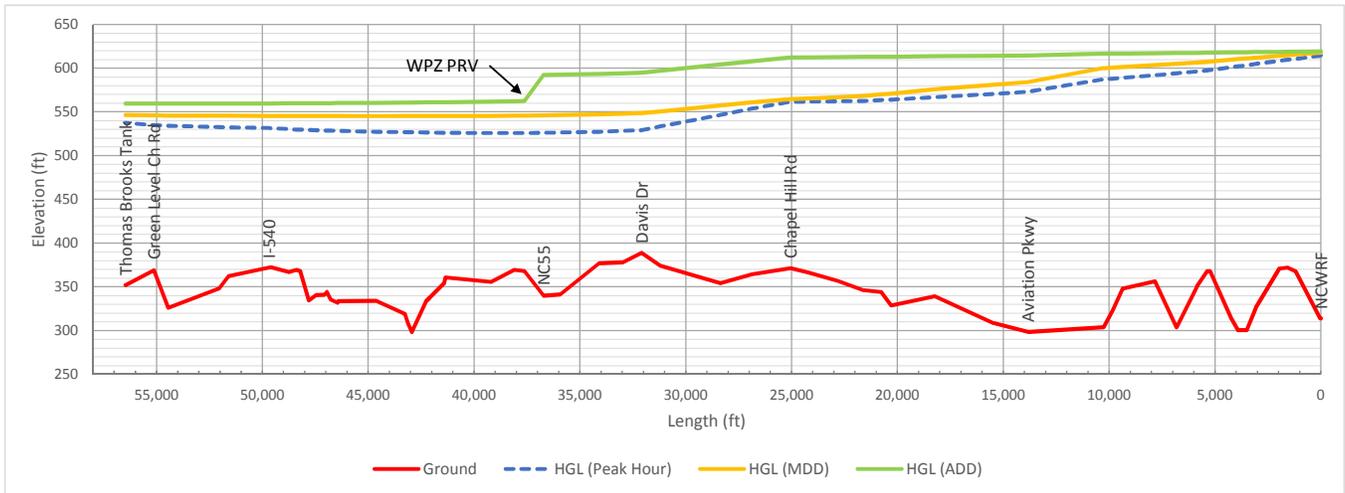
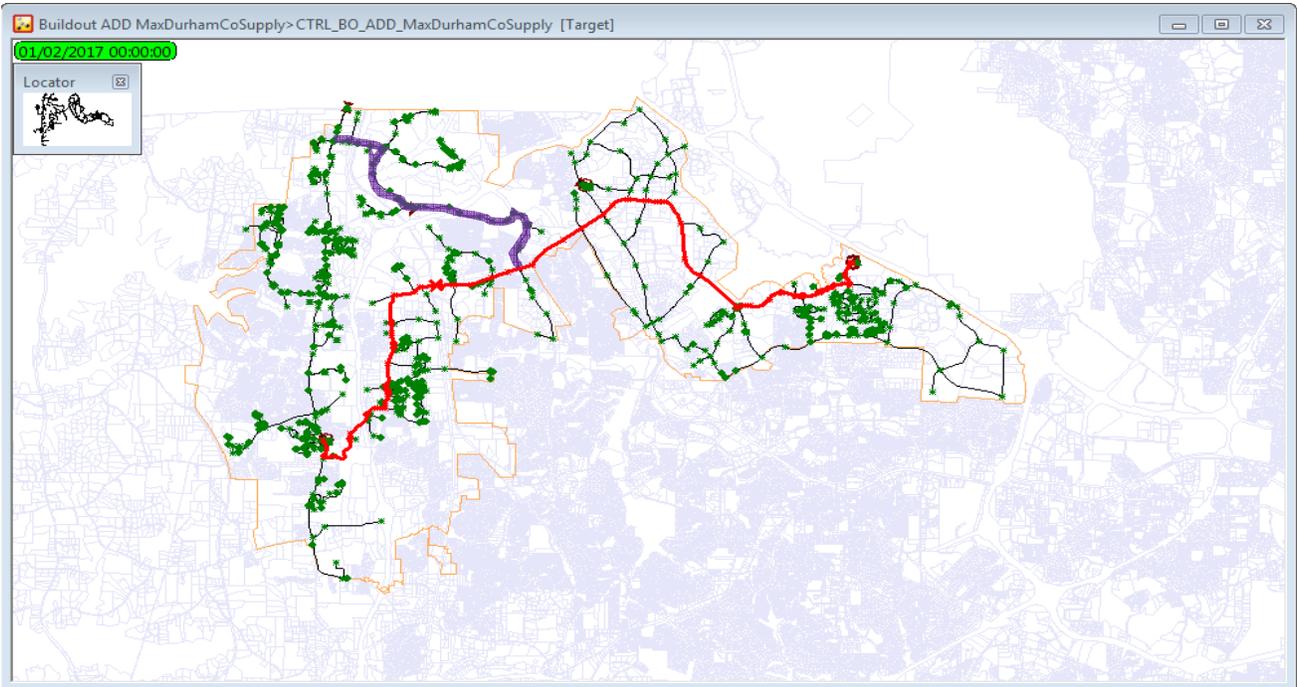


Figure A-5. Scenario H Buildout Without Durham County Supply - Alternate Tank Location

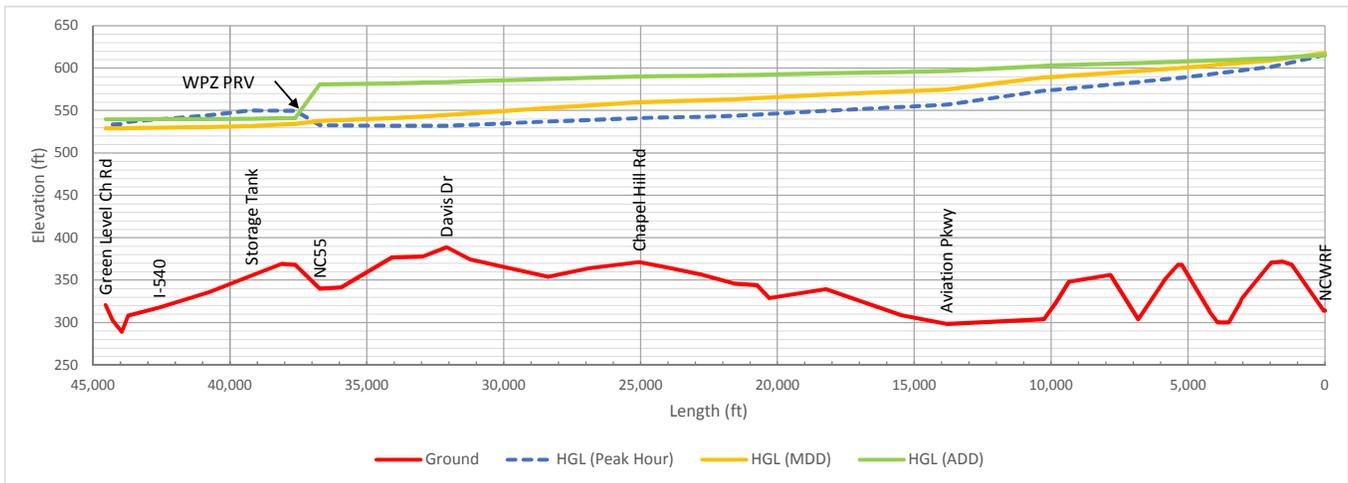
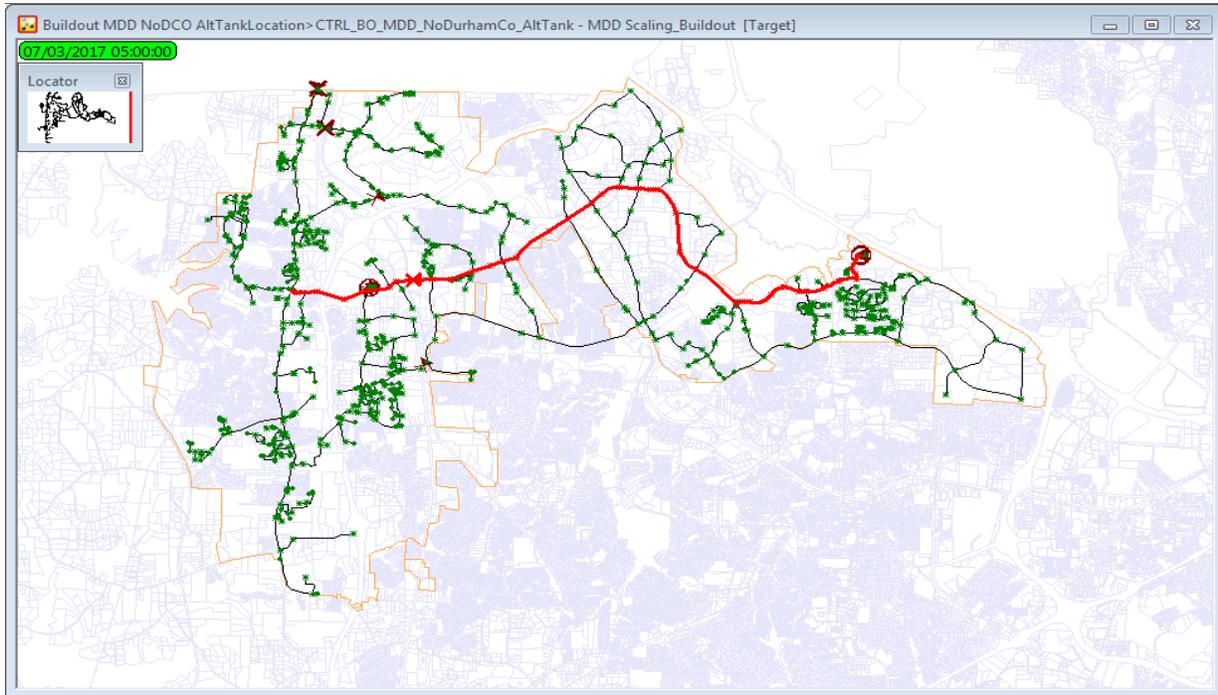
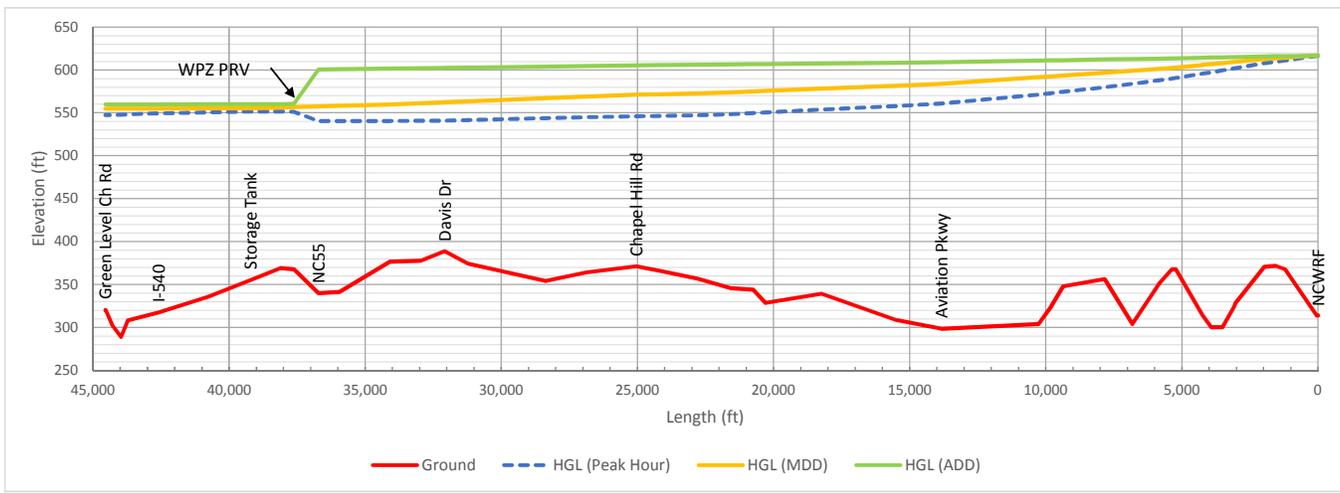
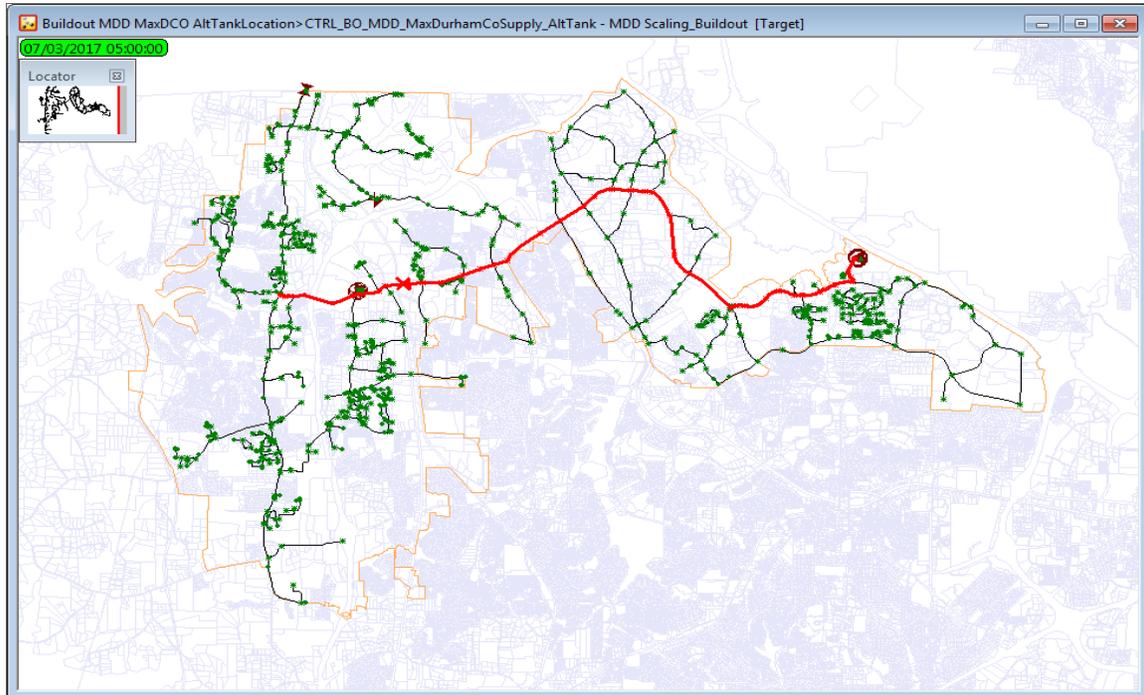


Figure A-6. Scenario I Buildout With Durham County Supply - Alternate Tank Location





**CDM  
Smith**  
[cdmsmith.com](http://cdmsmith.com)