

Summary Report

2012 – 2017 Reclaimed Water System Expansion Program

March 2018

Utilities Department
Naples, Florida

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This document was prepared under the responsible charge of the Professional Engineer shown below. The contents of this document represent conditions evaluated, documents reviewed and preliminary opinions prepared under the direction of the undersigned. The right is reserved to amend and/or supplement this report in the event additional information or documentation becomes available.

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Date: 03-16-2018

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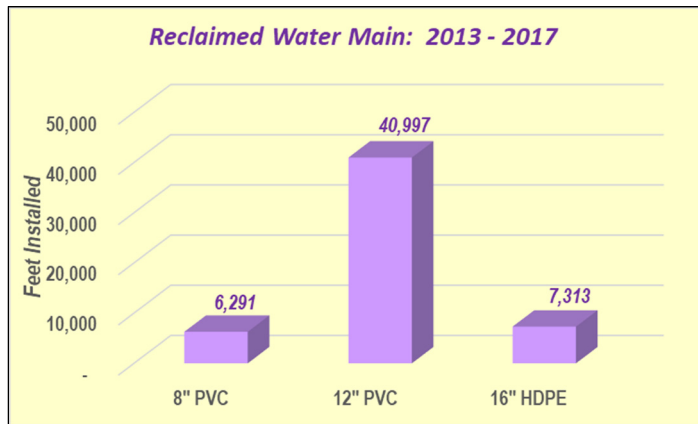
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1. EXECUTIVE SUMMARY

1.1 Overview of 2012 – 2017 Reclaimed Water Expansion Program

With a focus on reducing potable water consumption within the city-limits, the City of Naples selected Weston & Sampson Engineers, Inc. in 2012 to provide professional engineering services associated with the expansion of the City’s reclaimed water distribution system. Key components of the approach included:

- Determining “where” the largest segment of potential reclaimed water users were located within the City limits.
- As the connection to the reclaimed water system is not mandatory, determine which areas displaying large potential reclaimed customers in the City would be most likely to accept and connect if a reclaimed water system were to be installed.
- Prepare a master plan for a 5-year expansion of the existing reclaimed water system and a capital improvement plan, including the development of potable water and reclaimed water pipeline models.
- Provide design and engineering services during construction for the reclaimed water system expansion improvements.



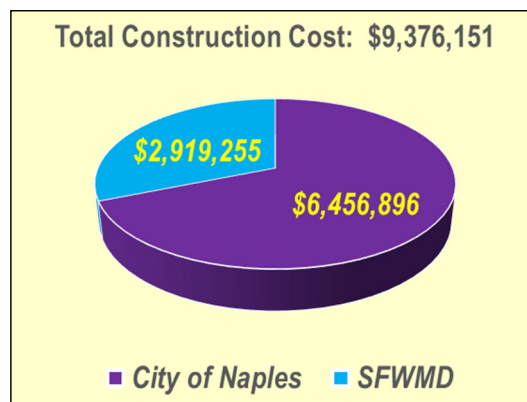
The reclaimed water expansion projects were executed in 4 phases, with construction of the initial phase beginning in 2013. The final phase was completed in 2017.

Nearly 54,600-feet of reclaimed water main (8-inch PVC, 12-inch PVC and 16-inch HDPE) was installed. Reclaimed water services were installed to nearly 535 properties during this period, as well as city-maintained medians.

Total construction cost for the reclaimed water system expansion improvements were \$9,376,151. Of that amount, the City received South Florida Water Management District Alternative Water Matching Grant funds of \$2,919,255.

The successful project outcome can be measured as follows:

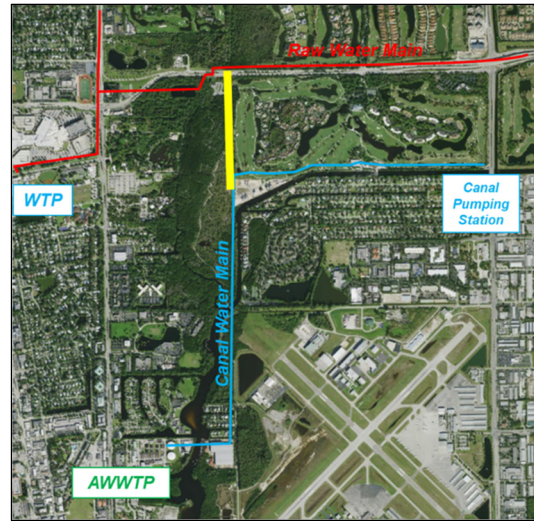
- Through February 2018, the rate of voluntary connection to the new reclaimed water system by properties abutting the project (excluding the most recently constructed phase) was 58%. Connections to the reclaimed water system continue to occur.
- The finished (potable) water production at the City’s Water Treatment Plant was reduced (on average) by approximately 14.3-million gallons per month from 2011 to 2017.



1.2 Recommendations for the Next Reclaimed Water Expansion Program

1.2.1 Secure Reclaimed Water Source Reliability

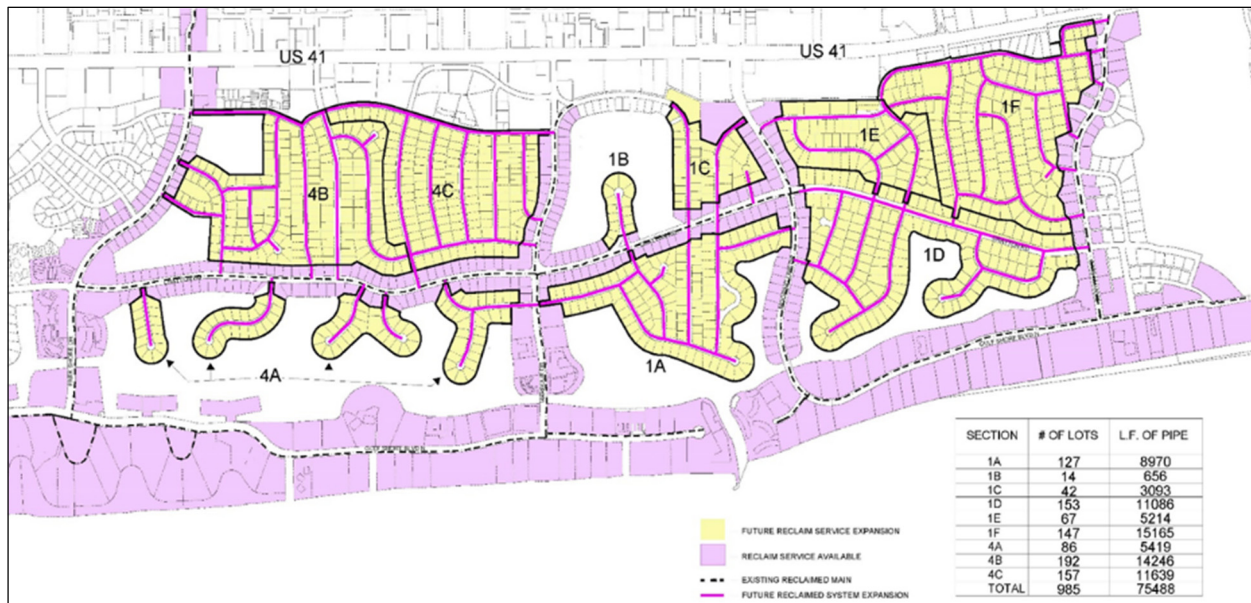
The City's reclaimed water system utilizes canal water from a pumping station located at Airport-Pulling Road and Golden Gate Canal. Due to rainfall drought conditions during Spring 2017, the City experienced a deficit of approximately 2-MGD of canal water used to supplement existing reclaimed water customers. Additionally, the ASR wells could not sustain the irrigation demand without exceeding the Council-imposed Chloride limit of 400 parts per million. The City augmented the reclaimed water system with up to 2-MGD of treated potable water for a 5 month period.



Based on a preliminary analysis, approximately 2,400 linear feet of 18-inch water main could connect the City's raw water transmission main from the well fields to the canal pumping station discharge main and provide 3-MGD of raw water to the reclaimed water system. The opinion of probable cost for this improvement, subject to regulatory agency permitting requirements, is \$1,200,000.

1.2.2 Next 5-Year Reclaimed Water Expansion Program

The previous expansion of the reclaimed water system between 2012 and 2017 was designed to be expanded into the neighborhoods along the alignment. To facilitate the next phase of reclaimed water expansion, stub-outs and valves were installed to minimize impacts to daily operations of the reclaimed water system. As presented in the graphic below, the yellow-shaded areas represent the next recommended expansion of the reclaimed water system; purple-shaded areas represent areas served by reclaimed water as a result of the previous expansion.



The expansion of unserved areas is bounded by US 41, Park Shore Drive, Gulf Shore Boulevard North and Banyan Boulevard. The expansion would serve approximately 985 properties, representing a potential of nearly 39,000,000 gallons of reclaimed water usage per billing period (650,000 gallons per day). The opinion of probable construction cost for the expansion of the reclaimed water system would be in the range of \$14,000,000 to \$19,000,000.

2. 2012 MASTER PLANNING EFFORTS

2.1 Potable Water Consumption as Indicator for Reuse Potential

2.1.1 Determination of “High Use” Potable Water Irrigation Consumers

In order to effectively and efficiently expand the reclaimed water system within the City-limits, an important consideration was the ability to identify high potable irrigation users that could be served with an alternative water source. Proposed reclaimed water main alignments were developed that would capture these potential users, switching their irrigation demands from the potable system.

Potential targets for reclaimed water usage are potable water users with:

- Separate potable water sprinkler meters
- Potable water meters with high demands that most likely include irrigation

As shown in the table, the finished water production at the City’s Water Treatment Plant was reduced by approximately 14.3-million gallons per month from 2011 to 2017.

The South Florida Water Management District (SFWMD) uses “per capita daily water use” as a guideline² to measure reasonable withdrawal requests of public water supply applicants for a general water use permit. Per capita water use includes population-related withdrawals

associated with residential, business, institutional, industrial, miscellaneous metered and unaccounted uses. Per capita daily water use greater than 200 gallons per capita per day (gpcd) must be supported with additional information explaining the rate of use.

The following is excerpted from the City’s current Water Use Permit³.

The applicant is requesting continuation of the currently authorized allocations of 6,724 million gallons (MG) per year and 685 MG per maximum month, based on a projected population 67,403 and a per capita use rate of 273 gallons per capita day (gpcd), and a maximum monthly allocation 685 MG based on a peaking ratio of 1.2. The per capita rate has historically been as high as 372 gpcd in 1984, and varied above 300 gpcd during the 1980s. The per capita use rate is high because of both a considerable seasonal population (about 35 percent increase over the permanent population) and significant domestic irrigation demands.

City of Naples - Finished Water Production		
Month	2011 Finished Water (MG) ¹	2017 Finished Water (MG) ¹
January	467.378	470.507
February	436.001	448.500
March	498.415	529.214
April	488.112	522.542
May	477.491	505.024
June	444.109	354.509
July	401.410	339.028
August	391.110	334.357
September	369.180	327.243
October	410.896	373.467
November	430.055	427.084
December	436.357	447.161
<i>Monthly Average</i>	<i>437.543</i>	<i>423.220</i>

¹ Source: City of Naples Finished Water Production records from water treatment plant.

² Source: SFWMD *Management of Water Use Permitting Information Manual, Volume III*, Basis of Review for Water Use Permit Applications, March 18, 2010

³ Source: City of Naples Water Use Permit No. 11-00017-W, issued by the South Florida Water Management District, dated June 21, 2010

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The City of Naples water service area is approximately 12,055 acres, of which 3,368 acres is to be considered irrigable, according to the Regional Irrigation Distribution System (RIDS) study (South Florida Water Management District [SFWMD], 2002). The percentage of irrigable to total acres is 28 percent, which is double the average percentage of all other utility service areas in Lee and Collier Counties. The RIDS study estimated that outdoor irrigation use in the Naples service area was 65 percent of the total annual use of the potable water system (Naples and Marco Island service areas each had a 65 percent usage rate where all other utilities in Lee and Collier Counties were 50 percent or less).

The City of Naples reclaimed water usage data from 2011 shows an annual average daily distribution of 5.6 million gallons per day (MGD). The current use of reclaimed water is 100 percent based on production and the three lowest monthly demands. Within the duration of the water use permit, the City plans to increase the total supply of reclaimed water by 3.4 MGD, to 9 MGD, representing a decrease in the potable water per capita use rate by about 50 gpcd.

The reclaimed water use during the past 10 years has been near or in excess of the available supply. The applicant believes that increased use of reclaimed water combined with water conservation efforts will ensure the ability to meet the demands of a population increasing by more than 25 percent without requiring more water than historical use.

In consideration of the language contained in the City's current Water Use Permit, the SFWMD has recognized the City's intent to increase the use of reclaimed water within the City, corresponding to a decrease in the potable water per capita use rate of approximately 50 gpd/capita. This would reduce the potable water usage rate from 273 gpd/capita to 223 gpd/capita.

The goal of the reclaimed water expansion program is to identify potential high and very high demand users that reflect irrigation usage that have a reasonable expectation for connection.

1. The initial approach is to identify "pockets" within the City-limits that have a high density of sprinkler meters.
 - a. Existing customers with sprinkler meters have the infrastructure in-place on their private property
 - b. This would facilitate rapid and cost-effective connections to a public reclaimed water distribution system.
2. In order to interconnect these "pockets" of sprinkler meters, the distribution mains will need to be installed throughout residential neighborhoods.

Sprinkler meter customers are easily identifiable and quantifiable. The methodology below focuses on identifying high and very high potable water residential customers without separate sprinkler meters as potential candidates for reclaimed water.

In developing this approach, the following assumptions have been made:

- For residential customers, any potable water usage over 150 gpd/capita is considered as outdoor irrigation
- Most large non-residential irrigation users (golf courses, large commercial customers, public areas) have been previously identified and furnished with reclaimed water.
- Condominium Associations (and similar multi-family developments) will typically have a separate sprinkler meter for irrigation needs.

2.1.2 Methodology for Developing Reclaimed Water Expansion Zone Map

Three key elements were considered during the initial stages of the development of the zone map to guide the expansion of the reclaimed water distribution system.

- Expansion of the reclaimed water system would only occur within the city limits
- Identification of boundaries for the existing reclaimed water distribution system
- Identification of “large” potable water customers (potable water meters and sprinkler meters)

After analyzing 5-years of potable and sprinkler water meter records, a map similar to that shown (right) was developed that contains the following information:

- City boundary
- Existing reclaimed water distribution system
- Potable water consumption data per billing cycle
 - Red stars/dots: Sprinkler/potable meter consumption greater than 46,000 gallons
 - Green stars/dots: Sprinkler/potable meter consumption less than 46,000 gallons

Utilizing this data in graphical form, the intent was to develop areas (zones) that could be further evaluated and ranked as potential candidates for expansion. Initial boundaries were established based on:

- Areas or clusters having greater perceived densities of “red stars and dots” (representing areas of high potable demands that could be potential reclaimed water customers)
- Areas currently served by reclaimed water.
- Natural geographic borders (i.e. - Naples Bay, Venetian Bay, etc.)
- Major corridors (i.e. - Tamiami Trail, Park Shore Drive, etc.)



Using the above criteria, zones for further evaluation were developed. Upon establishment of these zones, using 5-years of potable water demand records:

- The potential reclaimed (irrigation) demand was determined by zone.
- Zones were ranked from 1 (highest) to 12 (lowest) for potential reclaimed water consumption.

Based on these findings, the map shown at right was prepared.

2.1.3 Projected Irrigation Demands by Zone

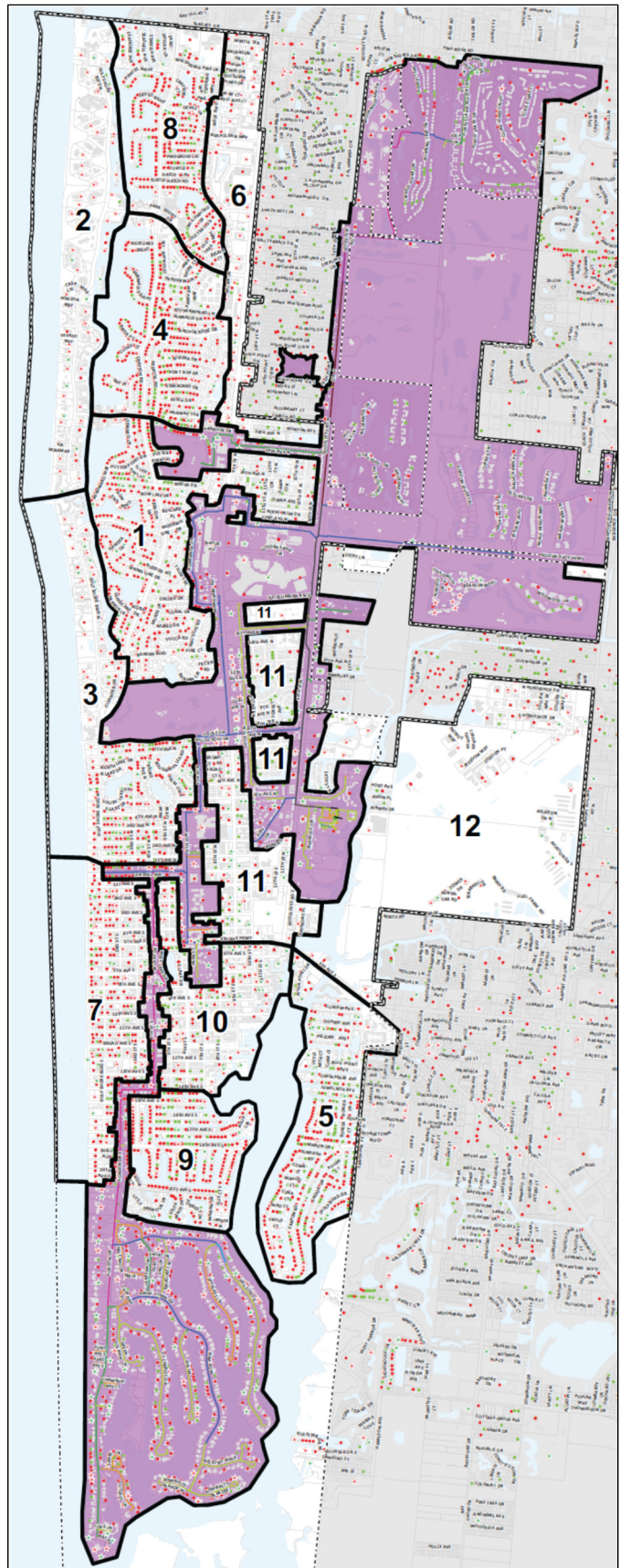
Using GIS, potable water meters and sprinkler meters were assigned to specific zones based on billing addresses.

Irrigation demands currently being met by potable water were projected as follows:

- Where a sprinkler meter did not exist, 50% of the potable meter usage was attributed to irrigation purposes
- For addresses that had both a sprinkler and potable water meter, only the sprinkler meter demand was used to determine irrigation demand.
- For each zone, total irrigation usage was calculated by taking the sum of the sprinkler meter use and the irrigation usage of the potable meter.

Potential Reclaimed Water Usage by Zones				
Subarea	Sprinkler Meter Actual Use (MG per Billing Period ¹)	Potable Meters Actual Use Where no SP meter in place (MG per Billing Period ¹)	Projected Irrigation Usage From Potable (50% of Potable Meter) (MG per Billing Period ¹)	Sprinkler Meter + Projected Irrigation Usage (MG per Billing Period ¹)
1	3.88	36.03	18.01	21.89
2	16.18	9.86	4.93	21.11
3	9.52	20.72	10.36	19.88
4	2.51	31.90	15.95	18.46
5	4.42	26.94	13.47	17.89
6	11.70	11.53	5.77	17.46
7	4.76	24.54	12.27	17.03
8	2.78	26.45	13.22	16.01
9	1.71	23.87	11.93	13.64
10	5.02	12.78	6.39	11.41
11	3.05	15.17	7.59	10.64
12	4.68	4.48	2.24	6.92
TOTAL	70.20	244.27	122.13	192.33

¹ NOTE: One billing period (cycle) represents approximately 60 days



2.1.4 Zones with Highest Reclaimed Water Potential

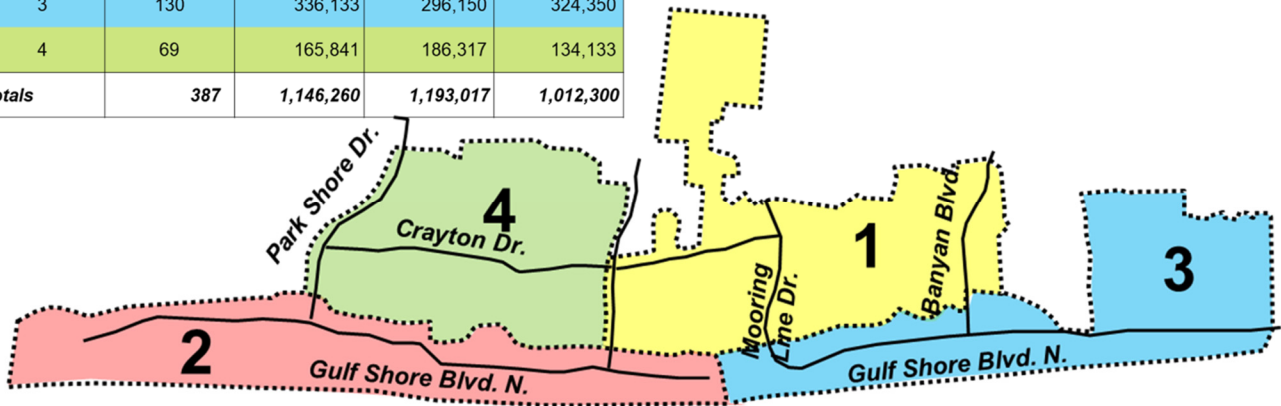
The four highest zones (1 – 4) were designated as areas having the greatest potential for using reclaimed water for irrigation, while eliminating that irrigation demand from the potable water system.

Those areas are generally described as follows:

- Zone 1: West of Tamiami Trail, north of Naples Beach and Golf Course, south of Harbor Drive
- Zone 2: Gulf Shore Boulevard, north of Doctors Pass
- Zone 3: Gulf Shore Boulevard, south of Doctors Pass, north of Central Avenue
- Zone 4: West of Tamiami Trail, north of Harbour Drive, south of Park Shore Drive

ZONE	Existing Sprinkler Meters: Average Daily Flow (Based on 60 Days per Billing Cycle)			
	No. of Existing Sprinkler Meters In Zone	Sprinkler Meter 5-year Billing Record Analysis GPD	Sprinkler Meter Spring 2011 (dry season) GPD	Sprinkler Meter Fall 2011 (wet season) GPD
1	78	101,196	85,517	93,683
2	110	543,090	625,033	460,133
3	130	336,133	296,150	324,350
4	69	165,841	186,317	134,133
Totals	387	1,146,260	1,193,017	1,012,300

Information presented on this exhibit only reflects those customers that irrigate through an installed "potable sprinkler meter".



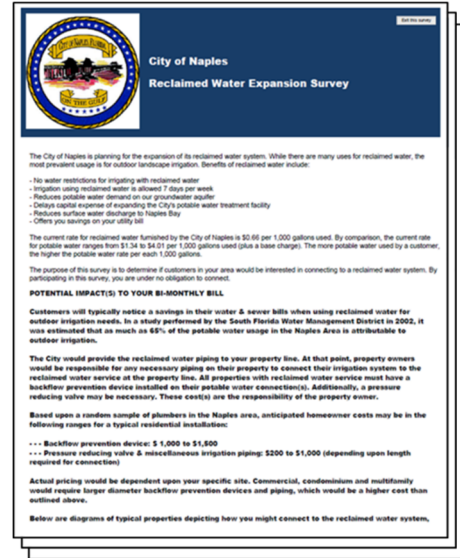
2.2 Resident Survey for Potential Reuse Connection

2.2.1 Gauging Public Acceptance

In 2012, to assist with gauging public acceptance and potential connectivity to a reclaimed water distribution system if expanded into one or more of these areas, postcards were mailed to customer billing addresses in these four zones, asking them to go to an on-line survey website (SurveyMonkey) and participate in the survey.

The survey commenced with outlining some of the benefits of using reclaimed water for irrigation purposes, which included:

- No water restrictions for irrigating with reclaimed water
- Irrigation using reclaimed water is allowed 7 days per week
- Reduces potable water demand on our groundwater aquifer
- Delays capital expense of expanding the City's potable water treatment facility
- Reduces surface water discharge to Naples Bay
- Offers savings on your utility bill



Examples of potential savings by converting from potable water to reclaimed water were demonstrated for typical residential customers, as well as multi-family complexes using a separate 2-inch potable sprinkler meter for irrigation.

EXAMPLE SAVINGS FOR RESIDENTIAL CUSTOMERS HAVING 5/8-INCH AND 3/4-INCH POTABLE WATER METERS					
Total Usage per Billing Cycle (gallons)	Total Cost Per Billing Cycle Based on Using Potable Water Only	Total Cost Per Billing Cycle Based on Using Potable & Reclaimed Water	Total Annual Utility Bill Savings	Assumed Property Owner Out-of-Pocket Cost to Connect to Reclaimed Water System	Pay-back Period (Years)
17,500	\$139.06	\$89.08	\$299.88	\$2,000	6.7
25,000	\$168.90	\$102.42	\$398.88	\$2,000	5.0
50,000	\$250.95	\$160.18	\$544.62	\$2,000	3.7
75,000	\$291.05	\$225.01	\$396.24	\$2,000	5.0



For illustration purposes, this calculation is based on 35% of total water usage for domestic purposes; 65% for outdoor irrigation purposes

**EXAMPLE SAVINGS FOR MULTI-FAMILY CUSTOMERS
USING SEPARATE 2-INCH SPRINKLER WATER METERS**

Total Irrigation Usage per Billing Cycle (gallons)	Total Cost of Potable Water for Irrigation Per Billing Cycle Based on Using Sprinkler Meter	Total Cost of Reclaimed Water for Irrigation Per Billing Cycle Based on Using Reclaimed Meter	Total Annual Irrigation Bill Savings	Assumed Property Owner Out-of-Pocket Cost to Connect to Reclaimed Water System	Pay-back Period (Years)
50,000	\$199.42	\$33.00	\$998.52	\$2,000	2.0
100,000	\$266.42	\$66.00	\$1,202.52	\$2,000	1.7
150,000	\$363.72	\$99.00	\$1,588.32	\$2,000	1.3
250,000	\$608.72	\$165.00	\$2,662.32	\$2,000	0.8



For illustration purposes, this calculation is based on 35% of total water usage for domestic purposes; 65% for outdoor irrigation purposes

The questions included in the survey are shown below.

City of Naples
RECLAIMED WATER EXPANSION SURVEY

1. As provided on the post card that you received in the mail, please select the area that you are located:

2. Should the City expand reclaimed water service into your neighborhood?

- Definitely , I want to connect
- Seems like a good idea
- Not entirely sold on the concept, but open to learning more about the expansion
- Seems like a bad idea
- Absolutely not
- Reclaimed water is currently in my neighborhood, and I received this survey by mistake

3. Please check the type of water meters that you currently have for your property (check all that apply)

- Potable Water Meter
- Sprinkler Water Meter
- I don't know

4. Do you currently have a private water well on your property for your landscape irrigation needs?

- Yes
- No
- I don't know

5. My property is a:

- Single family home
- High-rise condominium (over 3 stories)
- Condominium (up to 3 stories)
- Rental property
- Commercial property
- Other (please specify)

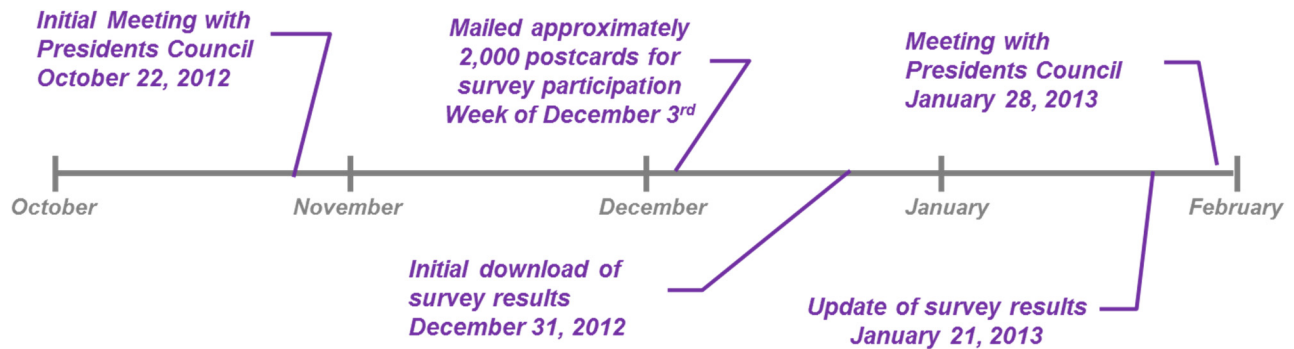
6. Please provide your Naples property information.
(If you have multiple properties, please enter the additional property address(es) in Question 7.)

- Name:
- Address:
- City:
- State:
- ZIP:
- Email Address:

7. If you have additional properties in Naples (other than the property indicated in Question 6), please provide the street address below:

During the first week of December, 2012, postcards were mailed to approximately 2,000 potable water customers in Areas 1 through 4.

Survey Timeline

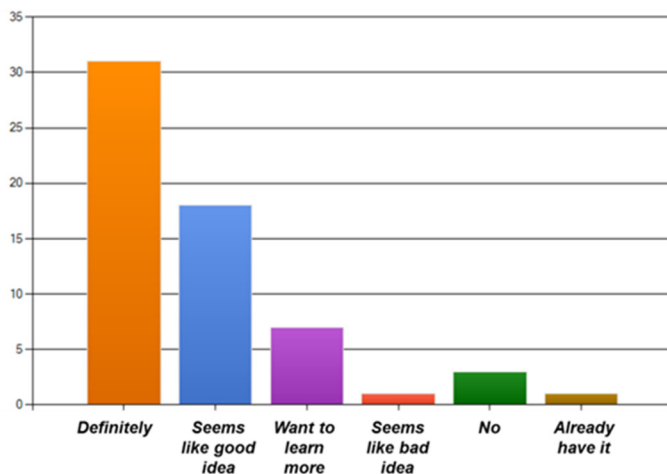


The response rates, through January 21, 2013 are tabulated below.

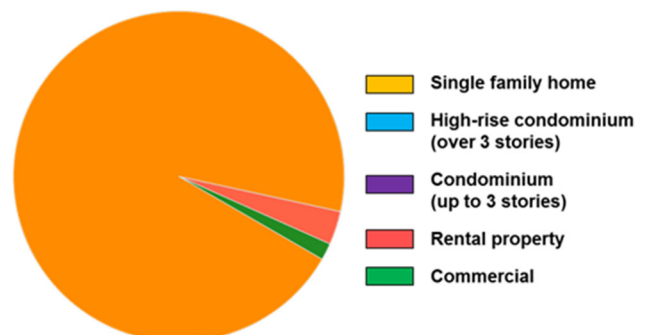
Area	Postcards Mailed	As of December 31, 2012		As of January 21, 2013	
		Survey Participants	Percentage within Area	Survey Participants	Percentage within Area
1	852	59	6.9%	61	7.2%
2	126	24	19.0%	24	19.0%
3	460	33	7.2%	36	7.8%
4	577	46	8.0%	48	8.3%
Skipped		0		3	
TOTALS	2,015	162	8.0%	172	8.5%

Responses to “should the City expand reclaimed water” into specific zones, along with the types of respondents for each zone, are presented below.

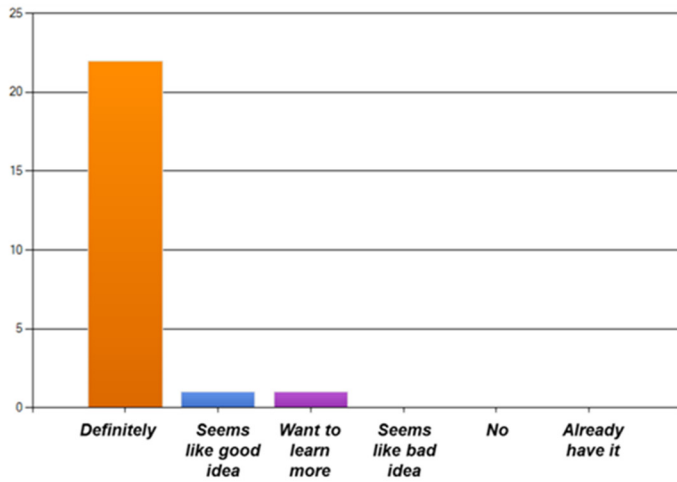
Zone 1: Should the City Expand Reclaimed Water?



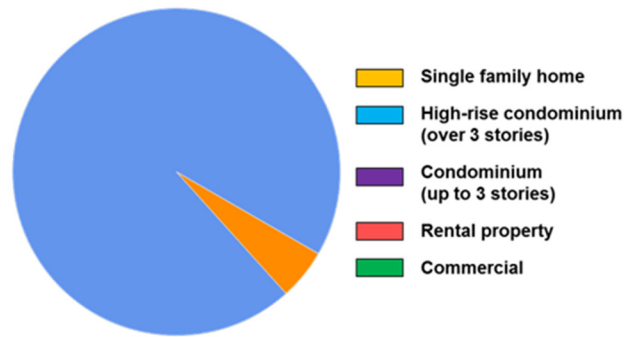
Zone 1: Survey Respondents



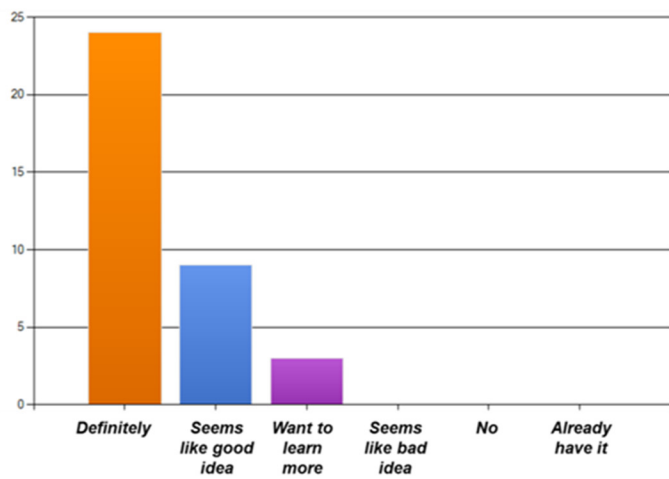
Zone 2: Should the City Expand Reclaimed Water?



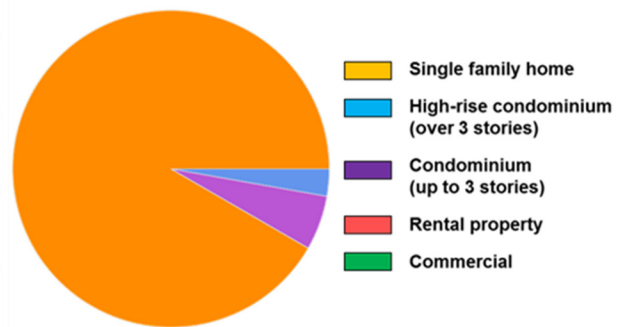
Zone 2: Survey Respondents



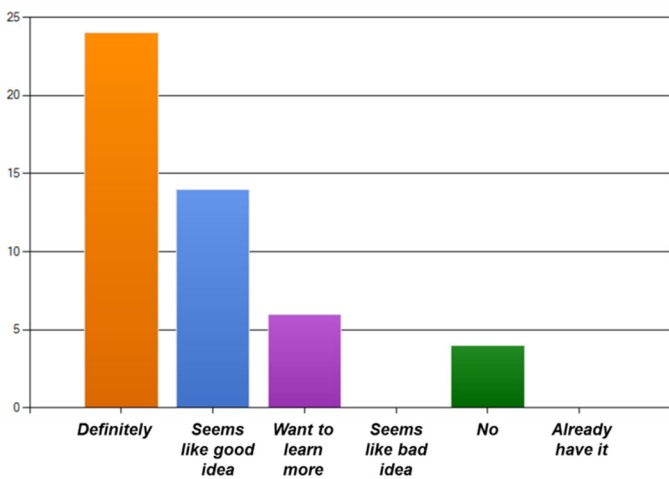
Zone 3: Should the City Expand Reclaimed Water?



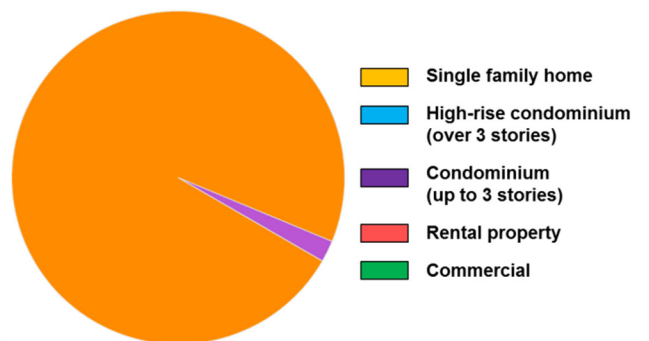
Zone 3: Survey Respondents



Zone 4: Should the City Expand Reclaimed Water?

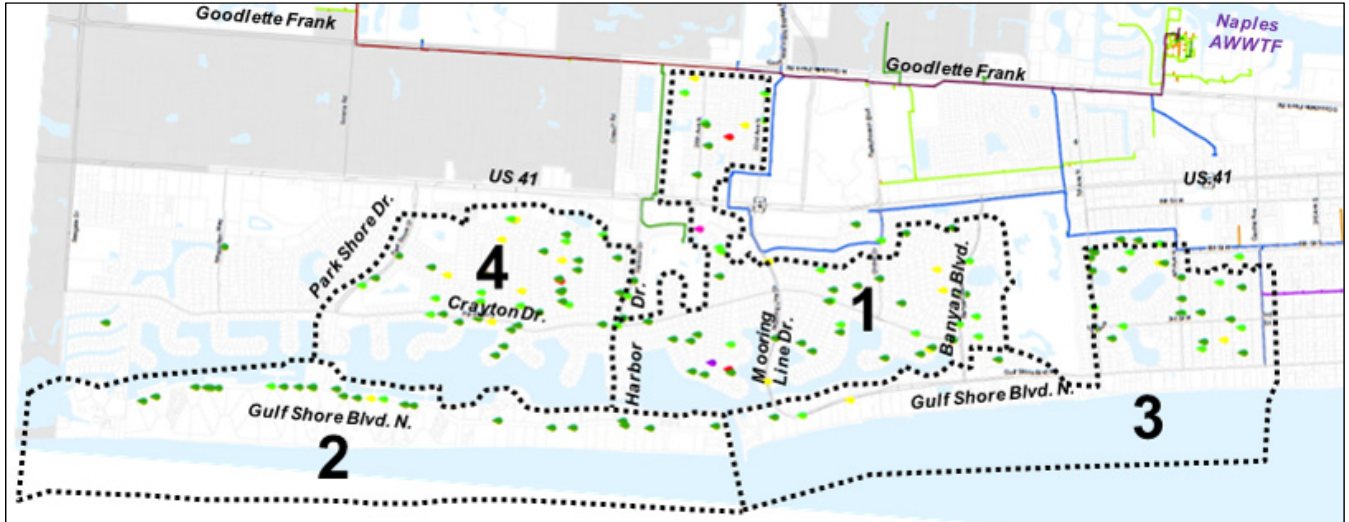


Zone 4: Survey Respondents



2.2.2 Resident Survey Summary

Utilizing results obtained from the survey conducted in Zones 1 through 4, a map was generated that presents the respondents views on whether the City should expand the reclaimed water into their neighborhood.



Responses were classified as:

-  Definitely Connect
-  Seems Like Good Idea
-  Want to Learn More
-  Seems Like Bad Idea
-  Absolutely Not
-  Already Have Service

As shown by the exhibit, Zone 2 presents a linear alignment of respondents that would “definitely connect” or “seems like a good idea”.

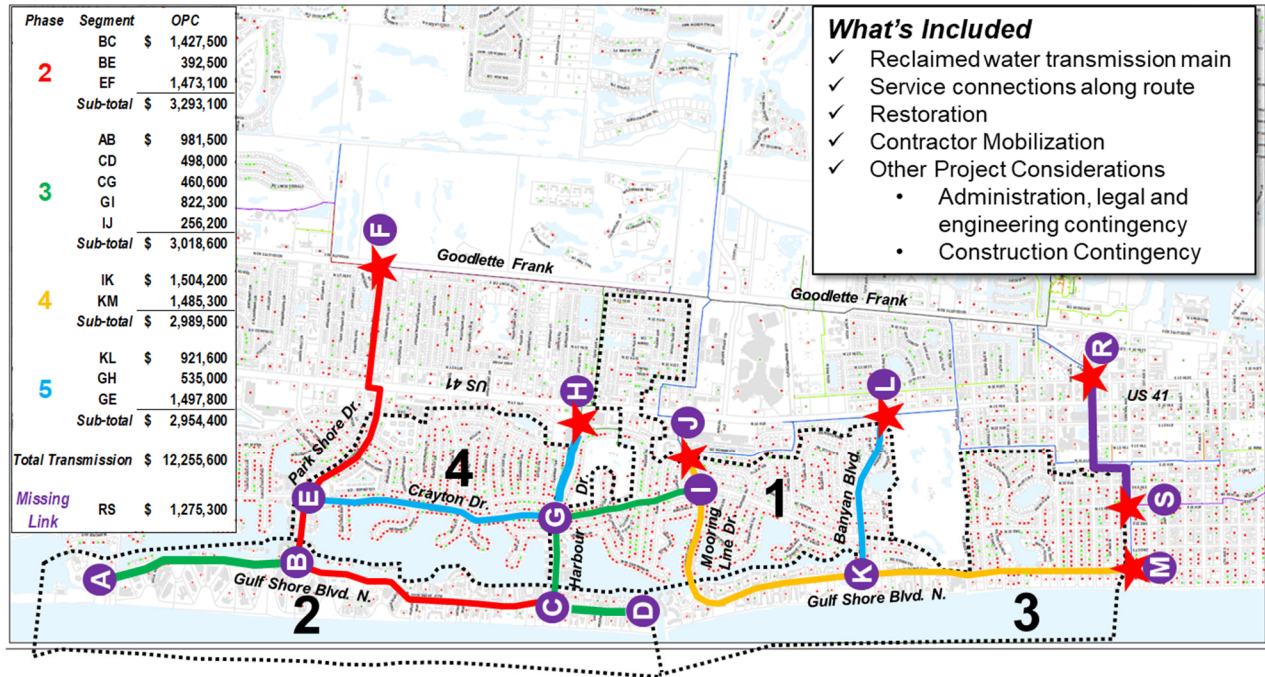
Previously in this document, this zone was identified as a potentially high usage of reclaimed water. Analysis of past billing records has indicated *Sprinkler Meter Actual Usage* to be 16.18 million gallons per billing period. Sprinkler meters represent existing users that could be easily converted to reclaimed water without additional, extensive expense by the property owner.

As such, Zone 2 was selected for the expansion of the reclaimed water system. Primary reasons included:

- Highest survey positive rate of response
- Significant potential users of reclaimed water
- Single street alignment within Zone 2, with services from the transmission main.

2.3 Proposed 5-Year Capital Improvement Plan

The reclaimed water expansion master planning for transmission pipelines was developed, based on a five-year fiscal year capital improvements program for years 2013 through year 2018. Phases 1 through 5 represent manageable segments of transmission pipelines that have been combined based on estimated construction costs. A summary of the opinion of probable construction costs (by phases and locations) is shown below.



An updated rate study was conducted to ensure funds were available for the expansion of the reclaimed water system. Supplemental funds have been provided by SFWMD grants.

2.4 Execution and Final Costs of the Master Plan Efforts

2.4.1 Phase 1 (Port Royal Expansion)

- This reclaimed water expansion was previously completed in 2008.

2.4.2 Phase 2 (Option T-7)

- 12-inch reclaimed water pipeline connecting at the existing reclaimed water main on Goodlette Frank Road going west to 14th Street North, south on Cypress Woods Drive, west to Park Shore Drive, and south on Gulf Shore Blvd. to Harbour Drive.

2.4.3 Phase 3 (Option T-2)

This project was divided in two parts for construction.

- Part 1: 12-inch reclaimed water pipeline on Gulf Shore Blvd. connecting at Park Shore Drive, then heading north on Gulf Shore Blvd., and connecting at Harbour Drive and Gulf Shore Blvd. and heading south.
- Part 2 (a.k.a. T-2 Extension): 12-inch reclaimed water pipeline from the connection at Gulf Shore Blvd. and Harbour Drive, east on Harbour Drive to Crayton Road, south on Crayton Road to Mooring Line Drive, and east on Mooring Line Drive to connect to the existing reclaimed water system on Alamanda Drive.

2.4.4 Phase 4 (Option T-1)

This project was divided in two parts for construction.

- Part 1: 12-inch reclaimed water pipeline from connection to existing RWM at Mooring Line Drive and Crayton Road west along Mooring Line Drive to Gulf Shore Blvd.
- Part 2: 12-inch reclaimed water pipeline south along Gulf Shore Blvd. to connect to the existing reclaimed water system at Central Avenue and Gulf Shore Blvd.

2.4.5 Phase 5 (Option T-4)

This project was divided in two parts for construction.

- Part 1: 8-inch reclaimed water pipeline on Banyan Blvd. connecting existing systems on Gulf Shore Blvd. to the west and US 41 to the east.
- Part 2: 12-inch reclaimed water pipeline connecting the existing reclaimed water system at Park Shore Blvd. and Crayton Road, going south on Crayton Road, east on Harbour Drive, and connecting to the existing reclaimed water system on Wedge Drive.

2.4.6 The “Missing Link” (Option T-8)

- This option was added due to modeling results which indicated additional flow was necessary to support the Port Royal area. It includes installation of a 16-inch HDPE transmission pipe via horizontal directional bore to connect from the existing reclaimed water system on Central Avenue and 4th Street North to 2nd Avenue North and 10th Street North via 6th Street North.

Final construction costs for expanding the reclaimed water system are summarized below.

Year	Reclaimed Water Phase	Contractor	Final Construction Cost	SFWMD Alternative Water Matching Grant
2006 - 2008	1	<i>Port Royal Expansion was completed prior to this expansion program.</i>		
2013 – 2014	2	Danella Utility Construction - Boynton Beach, FL	\$ 2,439,313.36	\$ 750,000
2014 - 2015	3	Kyle Construction - Naples, FL	2,404,758.72	1,000,000
2014	“Missing Link”	Andrew Site Work - Fort Myers, FL	818,537.39	0
2015 - 2016	4	D.N. Higgins - Naples, FL	1,990,921.47	738,600
2016 - 2017	5	Kyle Construction - Naples, FL	1,722,620.00	430,655
TOTALS			\$ 9,376,151	\$ \$2,919,255

4. CITY COUNCIL INPUT, LEADERSHIP AND DIRECTION

4.1 Chronology of Events

Actions undertaken by the City Council between October 2008 and September 2016 in support of the expansion of the reclaimed water system is presented on the following pages.

Date	Item Agenda No.	Description
10/1/2008	6d	<p>Presentation of the Integrated Water Resources Plan to provide a sustainable water supply source for a 20-year planning period</p> <p>Description of Activities and/or Actions Taken: MOTION by Sorey to APPROVE RESOLUTION 08-12204 amended as follows:</p> <p>Section 1: "...Plan dated May 29, July 2008 is..."; Section 3: "...in the future and summarized in the attached Exhibit 'A'. deleting Section 4; and renumbering the remaining sections.</p> <p>This motion was seconded by Willkomm and carried 5-2, all members present and voting (Taylor-yes, Willkomm-yes, Sorey-yes, Sulick-yes, Heitmann-no, Price-no, Barnett-yes).</p>
5/18/2009	6	<p>City staff summarizes activities to date, provided a longer term business plan, summarized action plan to obtain and deliver alternative water supply to irrigation customers</p> <p>Description of Activities and/or Actions Taken: Workshop - informational only.</p>
6/13/2011	4	<p>Discussion of 5-year utilities capital improvement plan</p> <p>Description of Activities and/or Actions Taken: Workshop - It was noted that the Integrated Water Resources Plan (IWRP) had no CIP proposals for the subject year although the out years reflected funds for the ASR wellfield and the distribution system expansion. Vice Mayor Sorey recommended that \$900,000 be moved forward to FY 2011-12 for distribution system design with regard to the IWRP as a placeholder; Council concurred. Mr. Sorey then requested that Council consider his recommendation that the City's priority for Big Cypress Basin grant funding be presented as the IWRP projects, asking that Council Members opine during that week's upcoming regular meeting. In response to Council Member Price, Mr. Sorey asked that staff provide its list of priorities to Council for review prior to that week's regular meeting, keeping in mind that the anticipated funding will be at least 30% less than the prior year.</p>
5/16/2012	11	<p>Execute Professional Services Agreement with Weston & Sampson for master planning and design of reclaimed water system expansion</p> <p>Description of Activities and/or Actions Taken: MOTION by Barnett to APPROVE ITEM 11-a amended as follows: Article 3.1: "...2013 2012." This motion was seconded by Saad and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Price-yes, Saad-yes, Sulick-yes, Sorey-yes).</p>
12/17/2012	10	<p>Presentation of Potable Water System Fire Flow Hydraulic Model Report (consideration of using reclaimed water to supplement fire flow requirements)</p> <p>Description of Activities and/or Actions Taken: Workshop - Information purposes</p>

<i>Date</i>	<i>Item Agenda No.</i>	<i>Description</i>
2/19/2013	10	Presentation of the reclaimed water distribution system expansion plan
		<p><u>Description of Activities and/or Actions Taken:</u> Consensus for proceeding with the design and bidding of Transmission Option 7; staff to return with construction contract.</p> <p>Staff also directed to provide additional detail on Transmission Option 5, assumptions needed to generate rate study, and information relative to impacts of potential development within Collier County on the City's system.</p>
4/17/2013	8	SFWM Alternative Water Supply grant agreement 4600002841 to provide \$750,000 for the construction the Option T-7 reclaimed water system expansion along Park Shore Drive and Gulf Shore Boulevard North.
		<p><u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE CONSENT AGENDA as submitted; seconded by Price and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Price-yes, Saad-yes, Sulick-yes, Sorey-yes).</p>
6/5/2013	27ab	<p>a) Execute construction contract with Danella Utility Construction to construct Option T-7.</p> <p>b) Execute Amendment No. 1 with Weston & Sampson to provide construction administration services.</p>
		<p><u>Description of Activities and/or Actions Taken:</u> a) MOTION by Barnett to APPROVE THIS ITEM as submitted; seconded by Saad and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Price-yes, Saad-yes, Sulick-yes, Sorey-yes). b) MOTION by Barnett to APPROVE THIS ITEM as submitted; seconded by Saad and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Price-yes, Saad-yes, Sulick-yes, Sorey-yes).</p>
9/18/2013	6e	Resolution to approve South Florida Water Management District 2013-2014 Alternative Water Supply Funding Program Agreement No. 4600002928, to provide matching grant funds in the amount of \$1,000,000 for the construction of Phase III of the reclaimed water distribution system.
		<p><u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE CONSENT AGENDA as submitted except Item 6-f; seconded by Finlay and carried 6-0 (Barnett-yes, Finlay-yes, Heitmann-yes, Price-absent, Saad-yes, Sulick-yes, Sorey-yes).</p>
12/16/2013	8	Discussion of the 2013 Water & Sewer Rate Study, which included an analysis and recommendation regarding the Water & Sewer System Development Charges
		<p><u>Description of Activities and/or Actions Taken:</u> Workshop - After reviewing the details of the presentation with the consultant, the Council expressed concurrence with the recommendation to reduce system development charges to reflect current cost of capacity and to update the financial management plan periodically. Council however supported retaining the current water and sewer tiered rate structure for commercial accounts, and requested additional analysis and proposals with regard to the cost recovery for reclaimed water expansion.</p>

<i>Date</i>	<i>Item Agenda No.</i>	<i>Description</i>
1/13/2014	6	Discussion of the 2013 Water & Sewer Rate Study Supplement-Reclaimed Water Rates
		<u>Description of Activities and/or Actions Taken:</u> Consensus to authorize an analysis of the financial impacts of reducing the golf course discount from 40% to 20% in 5% increments or alternatively, 5% per year for the next 5 years (Barnett dissenting). Consensus to proceed with advertising water and sewer rates based on the consultant's recommendations.
1/13/2014	7	Discussion of 10-Year Reclaimed Water Expansion Plan
		<u>Description of Activities and/or Actions Taken:</u> Consensus to proceed with the expansion plan for the first three years and to direct staff to prepare an amendment to the Code of Ordinances with respect to requiring new residential construction to install two meters.
2/19/2014	8	Discussion of the 2013 Water & Sewer Rate Study, 2nd Supplement-Reclaimed Water Rates
		<u>Description of Activities and/or Actions Taken:</u> Consensus to consider amendment of the bulk rate differential / 6-1 (Barnett dissenting). Consensus to obtain analysis of current bulk rate discount to be included in the March 19, 2014 Regular Meeting consideration of the three options presented / 6-1 (Barnett dissenting).
2/19/2014	9 A-D	Public Hearing to consider structural changes to the water and sewer rates. Following the hearing, adoption of Resolution No. 14-13409 (system development charges)
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE RESOLUTION 14-13408 as submitted; seconded by Sulick and unanimously carried, all members present and voting (Finlay-yes, Heitmann-yes, Saad-yes, Barnett-yes, Penniman-yes, Sulick-yes, Sorey-yes). MOTION by Saad to APPROVE RESOLUTION 14-13409 as submitted; seconded by Sulick and carried 5-2, all members present and voting (Heitmann-no, Finlay-no, Penniman-yes, Barnett-yes, Sulick-yes, Saad-yes, Sorey-yes). 9-c. First Reading declared; Second Reading scheduled for March 5, 2014. 9-d. First Reading declared; Second Reading scheduled for March 5, 2014.
3/19/2014	15	Reconsider action taken at February 19, 2014 meeting pertaining to system development charge methodology.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Finlay to APPROVE ITEM 15-a as submitted, reconsideration to be scheduled concurrently with Second Reading of Item 15-b; seconded by Barnett and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes.)
3/19/2014	16	Discussion of the 2013 Water & Sewer Rate Study, 3rd Supplement-Reclaimed Water Rates
		<u>Description of Activities and/or Actions Taken:</u> <ul style="list-style-type: none"> • Consensus supporting separate rate structure for bulk users with and without on-site storage; • recalculation of allocation of City's storage costs to bulk users with on-site storage; "availability fee" shall be amended to "base facility fee"; • City's landscape medians shall be exempt from the base facility fee; • 25% surcharge to non-City reclaimed water customers (unless prohibited by pending state legislation); • rates shall be effective for three years and no annual rate adjustment to offset receipt of grant funding under the projected \$900,000 (annually); • and support of the recommended rate differential between bulk and retail rates / 7-0.

<i>Date</i>	<i>Item Agenda No.</i>	<i>Description</i>
4/16/2014	18	Execute construction contract with Kyle Construction to construct Option T-2.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Finlay to APPROVE THIS ITEM amended pursuant to City Attorney direction; seconded by Barnett and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).
4/16/2014	19	Execute construction contract with Andrew Site Work to construct Option T-8.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE THIS ITEM as submitted; seconded by Sulick and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).
6/4/2014	6c2	Resolution approving the First Amendment to the South Florida Water Management District Alternative Water Supply Funding Program Agreement No. 4600002841 amending the term of the agreement by extending the expiration date four months to September 30, 2014 for the T-7 reclaimed water system expansion.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE CONSENT AGENDA as submitted except Item 6-f; seconded by Finlay and carried 6-0 (Barnett-yes, Finlay-yes, Heitmann-yes, Price-absent, Saad-yes, Sulick-yes, Sorey-yes).
2/4/2015	12	Resolution to approve Amendment No. 1 to South Florida Water Management District Alternative Water Supply Funding Agreement No. 4600002928.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Sulick to APPROVE RESOLUTION 15-13592 as submitted; seconded by Penniman and carried 6-1, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-no, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).
3/18/2015	6c2	Resolution approving the Second Amendment to the South Florida Water Management District Alternative Water Supply Funding Program Agreement No. 4600002841 amending the Scope of Work in Exhibits "A2" and "B2" for Option T-7 reclaimed water system expansion.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE CONSENT AGENDA except Item 6-e; seconded by Sulick and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).
9/16/2015	6d	Resolution to approve a South Florida Water Management District 2015-2016 Alternative Water Supply Funding Program agreement for \$680,000 in grant funding.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Barnett to APPROVE RESOLUTION 15-13692 as submitted; seconded by Sulick and carried 6-1, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-no, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).
10/21/2015	11	Execute construction contract with D.N. Higgins to construct Option T-1.
		<u>Description of Activities and/or Actions Taken:</u> MOTION by Sulick to APPROVE THIS ITEM as submitted; seconded by Barnett and unanimously carried, all members present and voting (Barnett-yes, Finlay-yes, Heitmann-yes, Penniman-yes, Saad-yes, Sulick-yes, Sorey-yes).

<i>Date</i>	<i>Item Agenda No.</i>	<i>Description</i>
9/07/2016	6 b	Resolution to approve South Florida Water Management District 2015-2016 Alternative Water Supply Funding Program Agreement No. 4600003469 to provide matching grant funds for construction of the Phase 5 expansion of the Reclaimed Water System. <i>Description of Activities and/or Actions Taken:</i> MOTION by Saad to APPROVE CONSENT AGENDA except Item 6-c; seconded by Buxton and unanimously carried, all members present and voting (Buxton-yes, Finlay-yes, McLeod-yes, Penniman-yes, Saad-yes, Seigel-yes, Barnett-yes).
9/07/2016	12	Execute construction contract with Kyle Construction to construct OPTION T-4 <i>Description of Activities and/or Actions Taken:</i> MOTION by Saad to APPROVE THIS ITEM as submitted; seconded by Buxton and unanimously carried, all members present and voting (McLeodyes, Finlay-yes, Penniman-yes, Buxton-yes, Seigel-yes, Saad-yes, Barnett-yes).

5. RECLAIMED WATER MODELING

The City of Naples reclaimed water distribution system hydraulic model was developed to investigate the ability of the system to meet water demands during the period of peak consumption. A computer-aided hydraulic analysis was performed of the distribution systems using the hydraulic model.

5.1 Hydraulic Analysis by Computer Modeling

The distribution system analysis utilized the computerized hydraulic analysis program WaterCAD®. WaterCAD® V8i is a product developed by Bentley Systems, Inc.

The City of Naples currently manages their own GIS database. This GIS database was imported into WaterCAD®, where minor revisions were made based on the City's review of the existing system. The reclaimed water distribution system has approximately 30 miles of distribution main.

The WaterCAD® program output includes: a summary of input data (headloss, flow, flow direction, and velocity for each pipe segment) demand, pressure, and hydraulic gradient at each node. This output data can be shown graphically using functions in WaterCAD® that will build pressure, hydraulic grade line, and elevation contours onto the WaterCAD® hydraulic map.

To initiate the analysis process, the system was built using the model builder tool in WaterCAD®. By using this, data from the City's GIS including the pipes and their respective diameters along with the nodes and their elevations were imported. Fixed grade reservoirs were used to represent the Water and Wastewater Treatment Plants respectively for the potable and reclaimed water distribution systems. Pumps and tanks for the model were imported and modified from the previous engineer's model that was created in 2004.

5.1.1 Advanced Wastewater Treatment Plant

The Advanced Wastewater Treatment Plant (WWTP) is a 10 MGD plant that supplies approximately 30 miles of reclaimed water distribution main. In the model the plant was set as a fixed grade reservoir which varies outputs pressures ranging from 100-110 psi depending on the time of day.

5.1.2 Reclaimed Water System Demands

When calculating the average day demand for the reclaimed system, an average of the usage for the reclaimed meters was taken from the last 6 billing periods (1 year). The average day demands were peaked to a maximum day in April, representing when the plant produces 7.5 MGD.

5.1.3 C-Value Assignment

C-values were assigned for each pipe segment based on the size, material, and age of pipe from information received from the City's GIS. Construction of the reclaimed water system began in 1988, confirming that all pipes are ductile iron cement lined, high density polyethylene, and polyvinyl chloride.

Pipe Description	C-Value
Cement Lined Galvanized Steel	80
Cement Lined Cast Iron	100
Cement Lined Ductile Iron	120
Asbestos Cement Lined	130
Polyvinyl Chloride	130
High Density Polyethylene	130

5.2 Calibration of the Hydraulic Model

The majority of water use is for irrigation, meaning that the majority of customers use water between 10PM and 6AM.

- Residential Demand Pattern: Representing residential irrigation usage, this pattern peaks throughout the night between 10PM and 6AM while the majority of accounts are irrigating, with limited usage throughout the day.
- Bulk User (golf course lake) Demand Patterns: The City currently has 6 bulk users (golf course lakes) which represent some of the top users in the City on the reclaimed system. The City allows them to use reclaimed water, although only during off peak hours (6 AM-12 PM). During these hours, they fill ponds within the golf course that they then pump out of to irrigate. These users would cripple the system if they were allowed to pull during peak use hours because of the vast amount of water they use. Six different demand patterns were created because all the bulk users utilize water in different patterns.

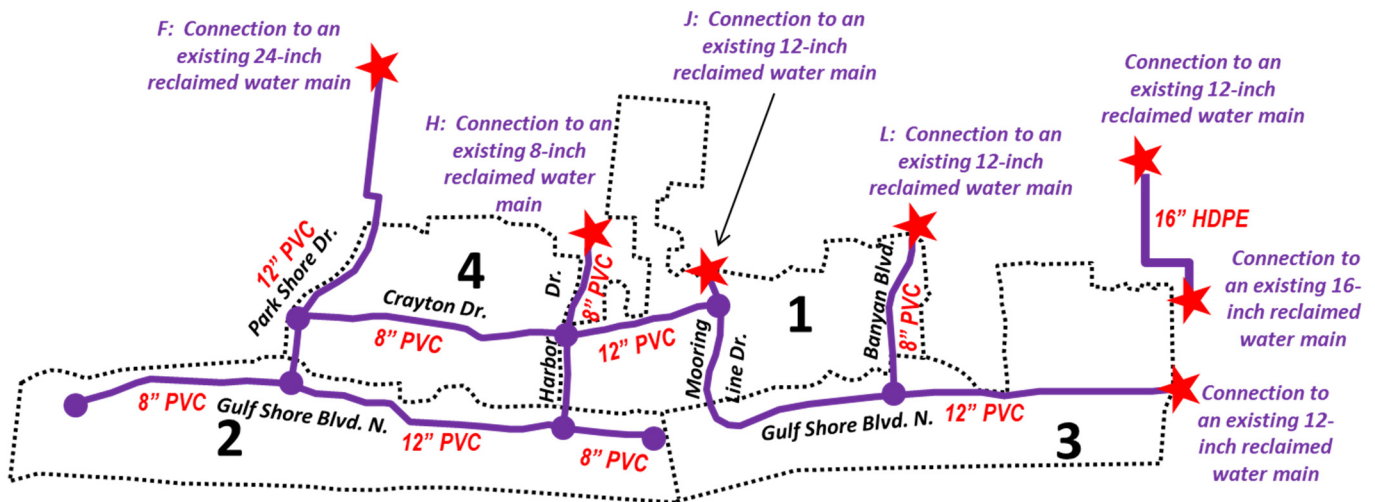
5.3 Assumptions

The following assumptions were included in the modeling effort:

- In order to assess what is available for fire flows in the reclaimed water system, we modeled under the worse-case demand scenario at night, while people are irrigating.
- The actual current usage of 12 of the largest reclaimed customers was applied to the model in the appropriate node with an appropriate diurnal pattern. This data was provided by the City through the actual meter data. The bulk users were not assumed to be using water during the hours of 10 pm and 7 am and were therefore not included in the fire flow scenarios. The remainder of the reclaimed water use was averaged over a nine hour period.
- The reclaimed water system hydraulic model was analyzed for available fire flows with a nighttime demand of approximately 10,000 gpm. This was verified with flow meter data out of the wastewater plant and is commensurate with typical maximum day flows.

5.4 Modeling Results

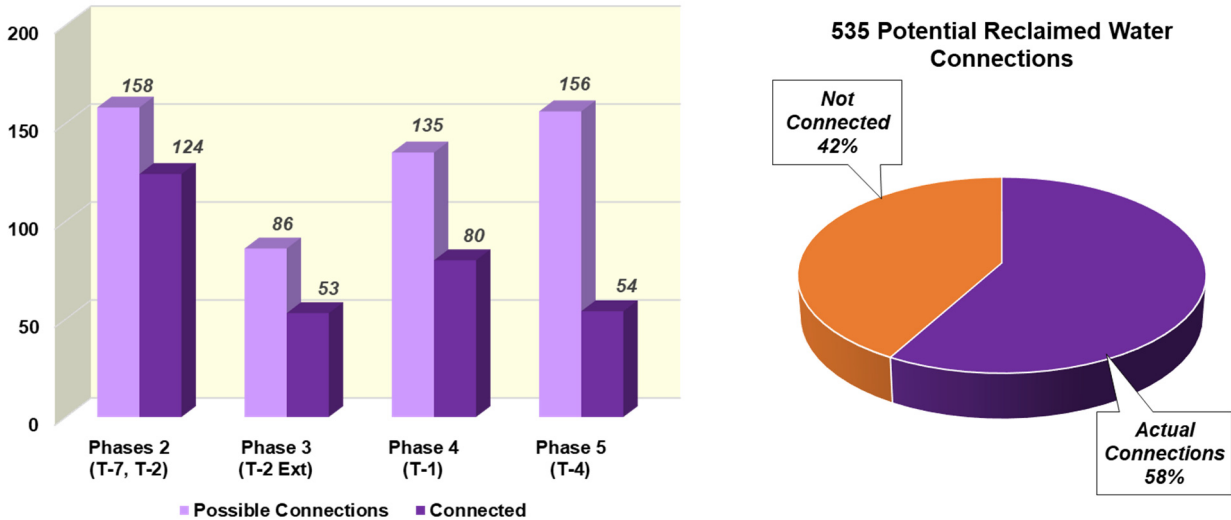
The proposed transmission main sizing results from the modeling efforts are shown in the graphic below.



6. 2017 PRELIMINARY MASTER PLANNING EFFORTS

6.1 Successes of the Recent Reclaimed Water Expansion Program

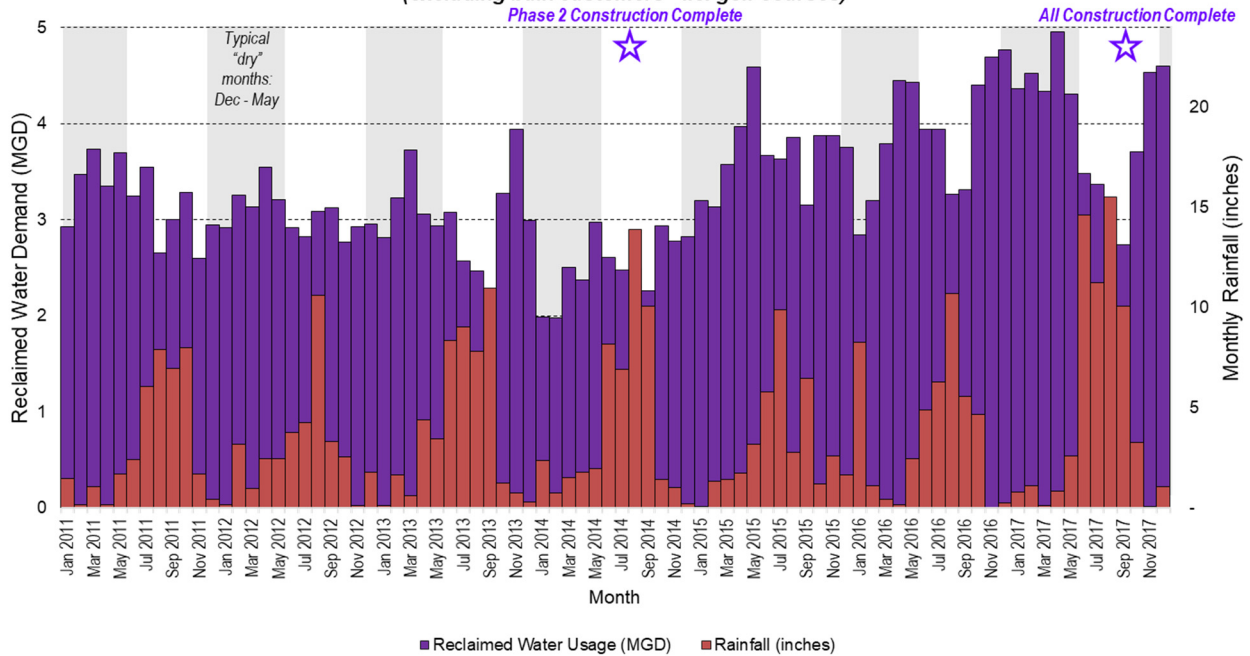
The City of Naples instituted a voluntary connection policy to the City's reclaimed water system. The recent expansion program, which was completed in October 2017, yielded 535 potential new reclaimed water connections (customers). Through February 2018, 58% of the potential customers have connected to the reclaimed water system.



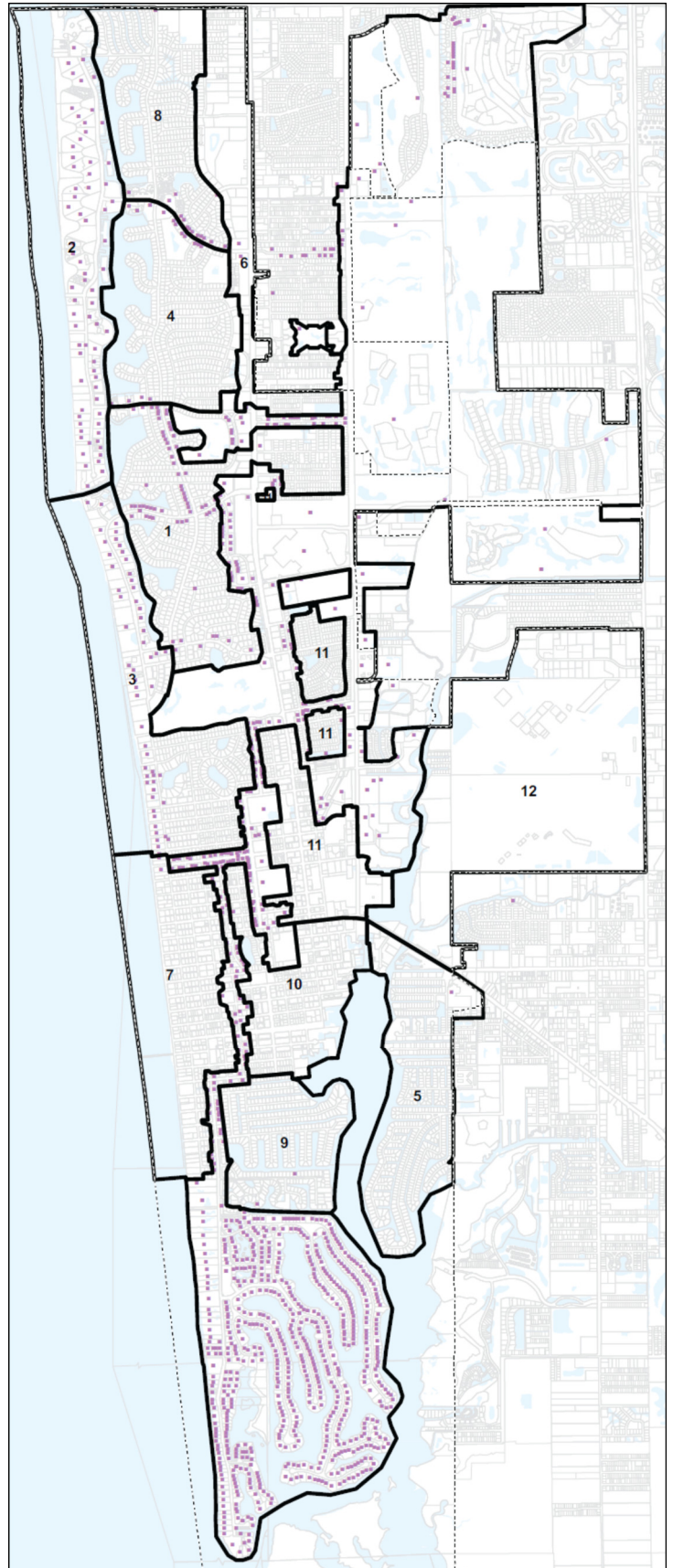
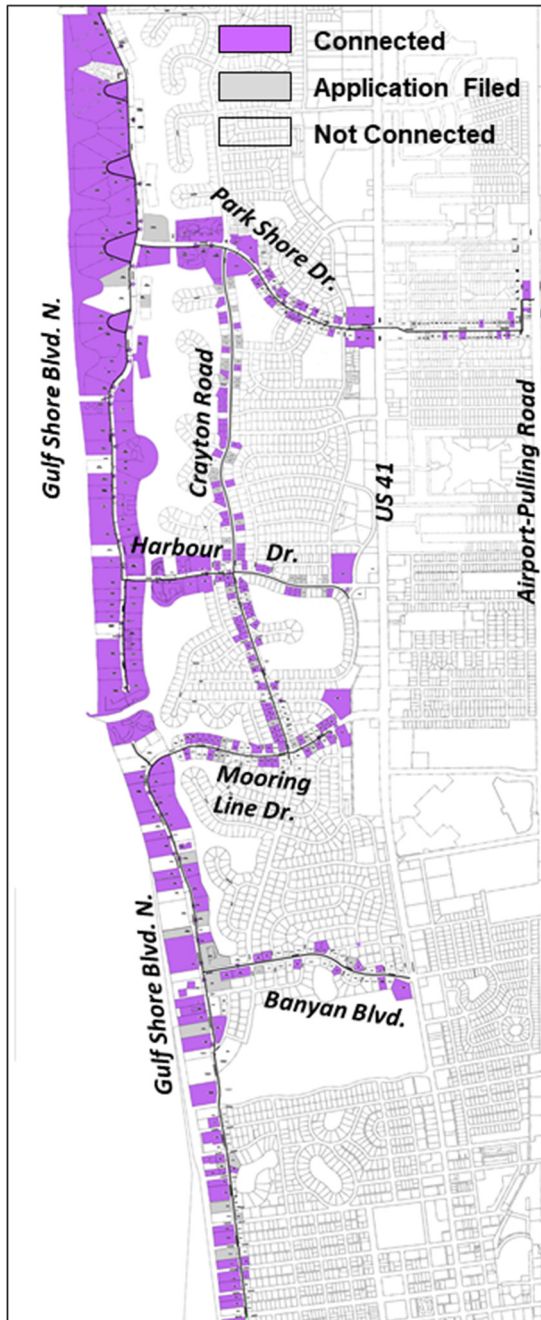
The "dry season" (December through May) is the period when the City realizes the heaviest demands on the reclaimed water system. A noticeable increase in the reclaimed water demand has been observed since completion of the Phase 2 project in July 2014.

System-wide Reclaimed Water Usage vs. Rain

(excluding bulk customers - i.e. golf courses)



The intent of the master planning conducted in 2012 was to focus on installing transmission mains that could be expanded in a subsequent expansion program for installing reclaimed water distribution mains throughout neighborhoods and unserved city streets. As of February 2018, shown at right is a graphic of properties within the City of Naples that have installed reclaimed water meters; shown below is a graphic of the properties that have connected during the most recent reclaimed water expansion project.



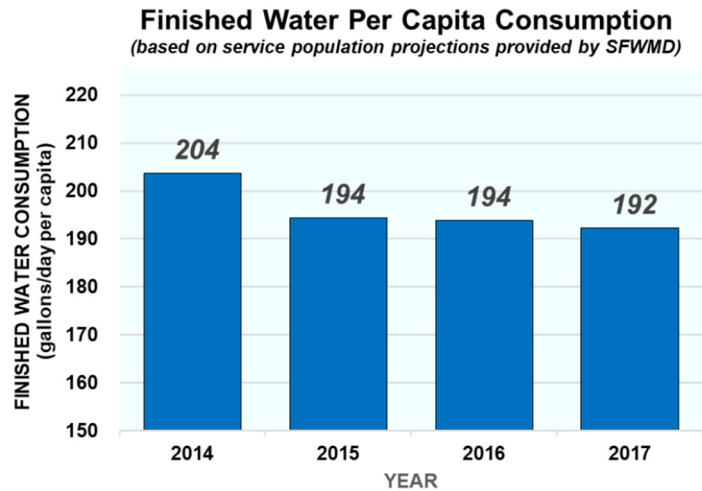
As a result of increased utilization of reclaimed water for outdoor irrigation demands, the City has also seen a reduction in the per capita demand for potable water. Excerpts from the City's water use permit, issued by the South Florida Water Management District on June 10, 2010 (page 4/13) states:

*"...projected population 67,403 and a per capita use rate of 273 gallons per capita day (gpcd),
The per capita rate has historically been as high as 372 gpcd in 1984, and varied above 300 gpcd during the 1980s"*

Using SFWMD population projections (provided to the City), coupled with the increased usage of reclaimed water for irrigation purposes, the City has observed a reduction in potable water per capita consumption.

South Florida Water Management District Population Projections (Provided to City)

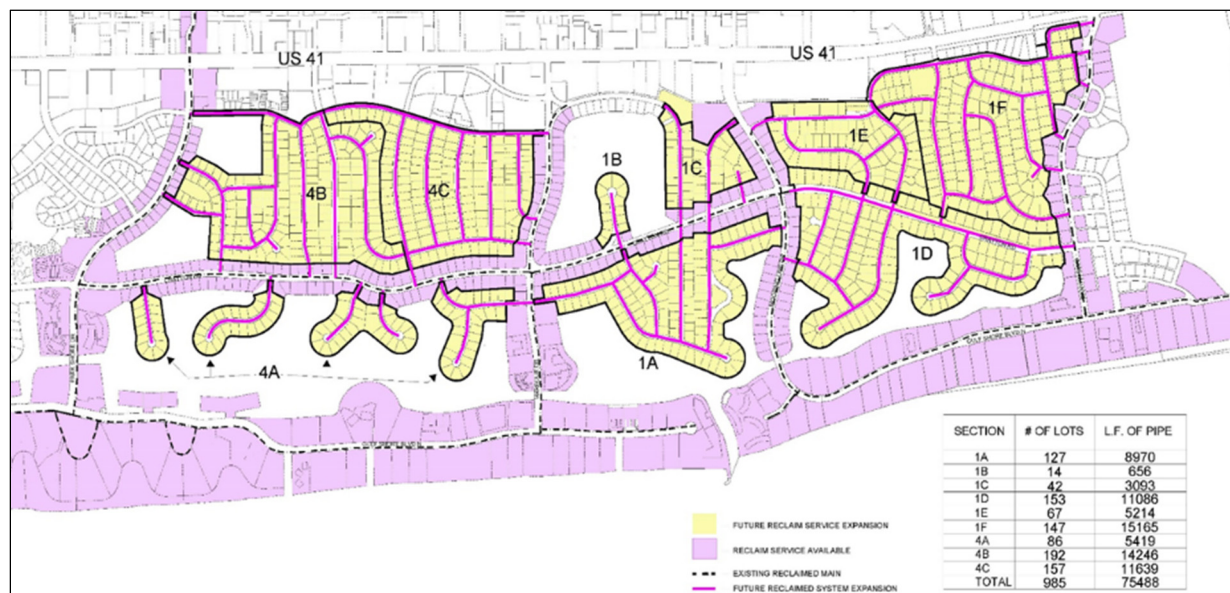
- 2014: 69,397
- 2015: 70,385
- 2016: 71,372
- 2017: 72,360



6.2 Suggested Alternative for the Next Expansion of the Reclaimed Water System

Building on the City's efforts from 2012, shown below is a graphic of suggested expansion of reclaimed water distribution mains for the next five-year period.

The suggested expansion focuses on "in-fill of reclaimed water distribution mains" in Zone 1 and Zone 4 where reclaimed water transmission mains were installed between 2013 and 2017.



The Opinion of Probable Construction Cost for the 5-Year Program ranges between \$14.3M and \$19.1M, plus engineering costs. This expansion would serve slightly under 1,000 lots, representing a potential of nearly 39,000,000 gallons of reclaimed water usage per billing period (650,000 gallons per day). Additional detail is provided in the table on the following page.

This is a PDF copy of an original document filed with the City of Naples, FL Utilities Department on March 19, 2018

**Reclaimed Water Distribution Expansion
Proposed 5-Year Capital Improvement Program**

Item Description	No. of Lots	Qty.	Unit	OPINION OF PROBABLE CONSTRUCTION COSTS				Survey & Engineering Contingency @ 15% (based on average cost of construction)	Sprinkler Meter + Projected Irrigation Usage	
				Unit Cost ^{1,2,3}	Unit Cost ^{1,2,3}	Price	Price		(Gallons per Billing Period) Per Lot	Per Zone
				Lower Range (\$ per linear feet of street)	Upper Range (\$ per linear feet of street)	Lower Range	Upper Range			
YEAR 1										
Zone 1A	127	9,000	LF						39,800	5,055,000
Zone 4A	86	5,400	LF						39,300	3,380,000
Subtotal - Year 1	213	14,400	LF	\$ 189	\$ 253	\$ 2,728,100	\$ 3,637,400	\$ 477,400		8,435,000
YEAR 2										
Zone 4B	192	14,300	LF						39,300	7,546,000
Subtotal - Year 2	192	14,300	LF	\$ 189	\$ 253	\$ 2,709,100	\$ 3,612,100	\$ 499,400		7,546,000
YEAR 3										
Zone 1B	14	700	LF						39,800	557,000
Zone 1C	42	3,100	LF						39,800	1,672,000
Zone 4C	157	11,600	LF						39,300	6,170,000
Subtotal - Year 3	213	15,400	LF	\$ 189	\$ 253	\$ 2,917,500	\$ 3,890,000	\$ 510,600		8,399,000
YEAR 4										
Zone 1D	153	11,100	LF						39,800	6,089,000
Zone 1E	67	5,200	LF						39,800	2,667,000
Subtotal - Year 4	220	16,300	LF	\$ 189	\$ 253	\$ 3,088,000	\$ 4,117,300	\$ 540,400		8,756,000
YEAR 5										
Zone 1F	147	15,200	LF						39,800	5,851,000
Subtotal - Year 5	147	15,200	LF	\$ 189	\$ 253	\$ 2,879,700	\$ 3,839,400	\$ 503,900		5,851,000
Grand Total - 5 Years	985	75,600	LF	<i>Sub-total (rounded to nearest \$100)</i>		\$14,322,400	\$19,096,200	\$ 2,531,700		38,987,000

¹ Size of main subject to model evaluation of system. Unit cost based on 8-inch main.

² Includes fittings, valves, fire hydrants

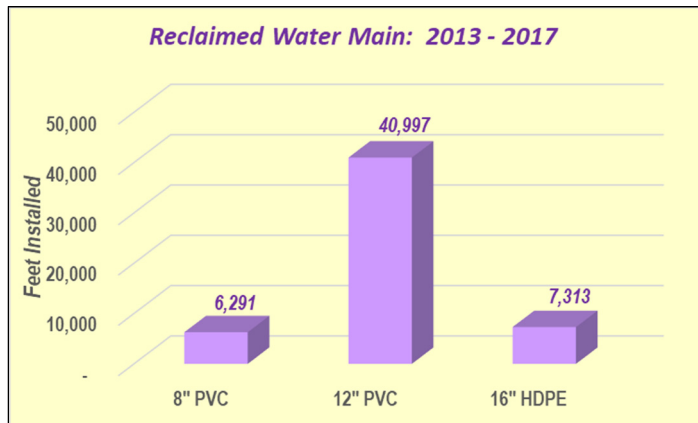
³ Includes contingencies for Construction (25%)

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

With a focus on reducing potable water consumption within the city-limits, the City of Naples selected Weston & Sampson Engineers, Inc. in 2012 to provide professional engineering services associated with the expansion of the City's reclaimed water distribution system. Key components of the approach included:

- Determining "where" the largest segment of potential reclaimed water users were located within the City limits.
- As the connection to the reclaimed water system is not mandatory, determine which areas displaying large potential reclaimed customers in the City would be most likely to accept and connect if a reclaimed water system were to be installed.
- Prepare a master plan for a 5-year expansion of the existing reclaimed water system and a capital improvement plan, including the development of potable water and reclaimed water pipeline models.
- Provide design and engineering services during construction for the reclaimed water system expansion improvements.



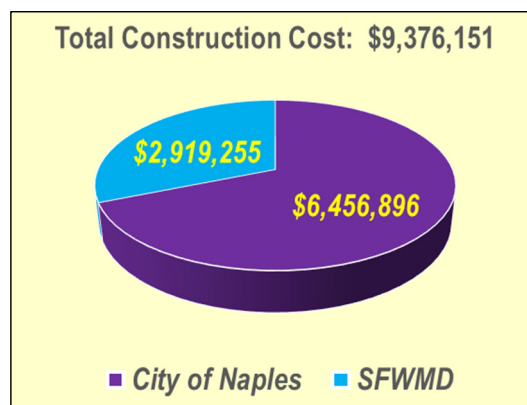
The reclaimed water expansion projects were executed in 4 phases, with construction of the initial phase beginning in 2013. The final phase was completed in 2017.

Nearly 54,600-feet of reclaimed water main (8-inch PVC, 12-inch PVC and 16-inch HDPE) was installed. Reclaimed water services were installed to nearly 535 properties during this period, as well as city-maintained medians.

Total construction cost for the reclaimed water system expansion improvements were \$9,376,151. Of that amount, the City received South Florida Water Management District Alternative Water Matching Grant funds of \$2,919,255.

The successful project outcome can be measured as follows:

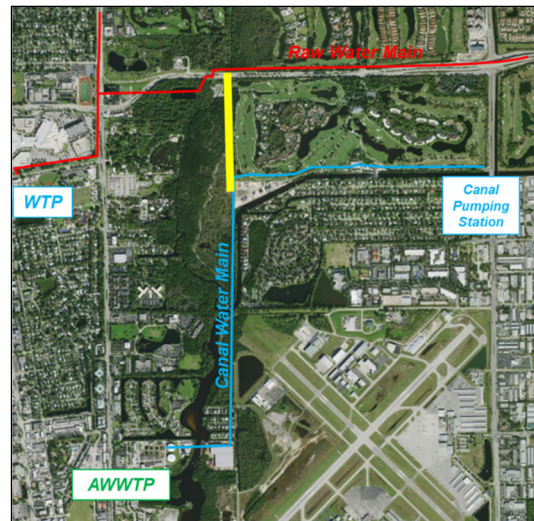
- Through February 2018, the rate of voluntary connection to the new reclaimed water system by properties abutting the project (excluding the most recently constructed phase) was 58%. Connections to the reclaimed water system continue to occur.
- The finished (potable) water production at the City's Water Treatment Plant was reduced (on average) by approximately 14.3-million gallons per month from 2011 to 2017.



7.2 Recommendations

7.2.1 Secure Reclaimed Water Source Reliability

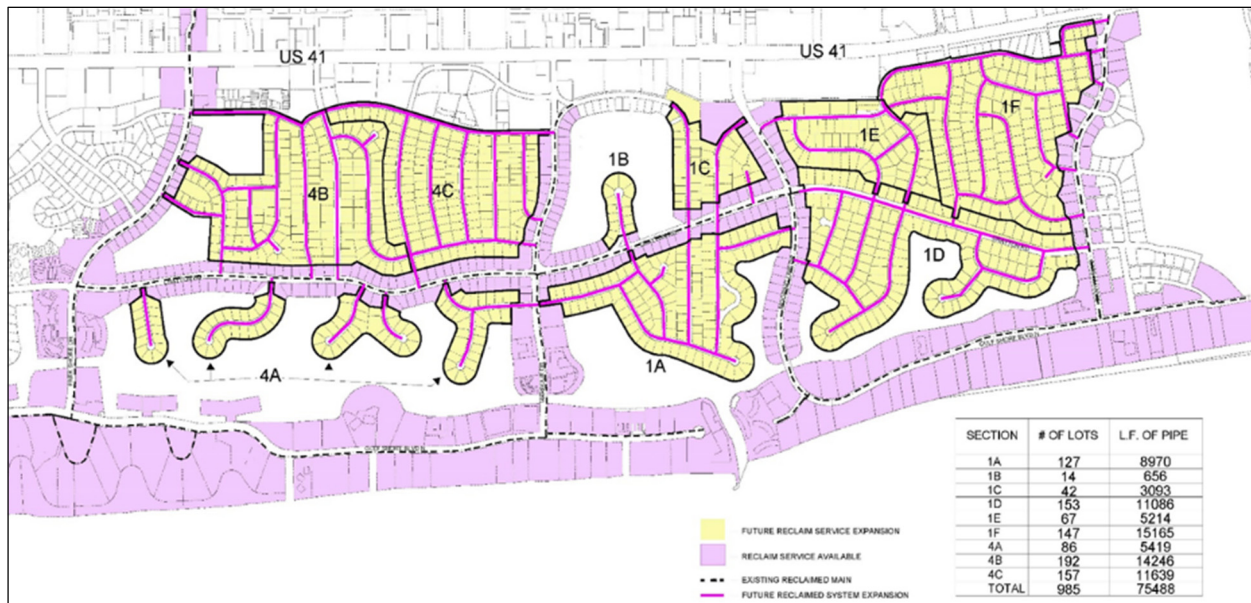
The City's reclaimed water system utilizes canal water from a pumping station located at Airport-Pulling Road and Golden Gate Canal. Due to rainfall drought conditions during Spring 2017, the City experienced a deficit of approximately 2-MGD of canal water used to supplement existing reclaimed water customers. Additionally, the ASR wells could not sustain the irrigation demand without exceeding the Council-imposed Chloride limit of 400 parts per million. The City augmented the reclaimed water system with up to 2-MGD of treated potable water for a 5 month period.



Based on a preliminary analysis, approximately 2,400 linear feet of 18-inch water main could connect the City's raw water transmission main from the well fields to the canal pumping station discharge main and provide 3-MGD of raw water to the reclaimed water system. The opinion of probable cost for this improvement, subject to regulatory agency permitting requirements, is \$1,200,000.

7.2.2 Next 5-Year Reclaimed Water Expansion Program

The previous expansion of the reclaimed water system between 2012 and 2017 was designed to be expanded into the neighborhoods along the alignment. To facilitate the next phase of reclaimed water expansion, stub-outs and valves were installed to minimize impacts to daily operations of the reclaimed water system. As presented in the graphic below, the yellow-shaded areas represent the next recommended expansion of the reclaimed water system; purple-shaded areas represent areas served by reclaimed water as a result of the previous expansion.



The expansion of unserved areas is bounded by US 41, Park Shore Drive, Gulf Shore Boulevard North and Banyan Boulevard. The expansion would serve approximately 985 properties, representing a potential of nearly 39,000,000 gallons of reclaimed water usage per billing period (650,000 gallons per day). The opinion of probable construction cost for the expansion of the reclaimed water system would be in the range of \$14,000,000 to \$19,000,000.