

**Technical Memorandum  
December 2012**

# **Computer Modeling of Available Fire Flows**

Potable Water System  
City of Naples, Florida

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TECHNICAL MEMORANDUM

December, 2012

COMPUTER MODELING OF AVAILABLE FIRE FLOWS

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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.

Jeffrey A. Wilson, P.E.  
Florida Registration No. 41792

Date:\_\_\_\_\_

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Fort Myers, FL 33916  
Certificate of Authorization No. 26190

## TECHNICAL MEMORANDUM

November, 2012

# COMPUTER MODELING OF AVAILABLE FIRE FLOWS

### A. EXECUTIVE SUMMARY

The new Florida Fire Prevention Code (FFPC) was adopted on December 31, 2011. The new code now includes minimum fire flow requirements for all newly constructed one and two-family dwellings. For homes having a fire flow area of 5,000 square feet or less, a minimum of 1,000 gallons per minute (GPM) fire flow for duration of two hours is required.

The goal of the City is to provide all areas within Naples City limits with a minimum fire flow of 1,500 gpm at 20 psi. Where feasible, the City desires to use the reclaimed water distribution system to supplement fire flow in areas where it is available to meet this goal.

As part of the Potable Water System Hydraulic modeling efforts, the City requested Weston & Sampson identify:

- Available fire flows of the potable and reclaimed water systems
- Improvements to these systems that would help the City to meet their fire flow requirements.

The following assumptions were included in the modeling effort:

- Potable Water: Maximum day demand of 20 million gallons per day (mgd).
- Reclaimed Water - Maximum day demand 7 mgd (10,000 gpm).

The modeling software utilized for the hydraulic analysis contains a tool that allows fire flow to be determined at each junction node. The potable system hydraulic model was utilized to identify the available fire flows in the distribution system at 20 psi. The reclaimed water system hydraulic model was analyzed to determine the available fire flows from the reclaimed water system. There is significantly more fire flow available in the reclaimed water system during the day when customers are not irrigating than at night, due to reduced pressures. It is our opinion the available fire flow in the reclaimed water system should represent worse case scenarios, which is indicative of demands during the middle of the night.

Important findings of this investigation include:

- In general, a 1,500 gpm flow is not possible through a single dead-ended 6-inch water main.
- In order to provide 1,500 gpm to these areas from the potable system alone, the City will most likely need to replace many of the 6-inch mains with 8-inch or loop these mains with others.
- Looping many of the mains in the potable system at the dead-ends, will require directional drilling under a canal.
- A scenario was calculated within the model to increase the water main size to 8-inch, which resulted in significant increases in the fire flows and alleviated many of the deficiencies throughout the City. The other alternatives to increase fire flow would be to

loop existing water mains at the dead-ends, or to utilize the reclaimed water system to provide a second source of water

- To assist with the evaluation, the city was broken into five concentrated areas for the analysis of their available fire flows. These five are all within city limits and defined as
  - Port Royal
  - Royal Harbor
  - Aqualane Shores
  - Area South of Central Avenue
  - Northern Naples (within the City-limits)
- The reclaimed water system primarily affects the total available fire flow in the Port Royal area. All other areas are currently not serviced by the reclaimed water system.

Based on the analysis, if the City were to upgrade the potable water system only to provide fire flow capacity of 1,500 gpm, the preliminary opinion of probable project costs is shown below.

<b>Summary By Neighborhood</b>	
<i>Port Royal</i>	\$ 4,670,200
<i>Aqualane Shores</i>	4,326,100
<i>South of Central Avenue</i>	7,051,100
<i>Royal Harbor</i>	6,364,900
<i>North Naples</i>	<u>18,003,000</u>
<i>Total</i>	\$ 40,415,300

As an alternative, or in addition to potable water system improvements, the City may wish to consider extending reclaimed water to areas having insufficient fire flows. With a reclaimed water system, the available supply would take into account both reclaimed water and potable water. Other benefits of extending the reclaimed water might include:

- Reduction of irrigation demand with potable water, which would positively impact the operation (flow and pressure) of the potable water distribution system

To develop efficient and effective recommendations for addressing the fire flow issues within the city limits, it is suggested the City consider:

- Cost impacts vs. benefits of providing fire flows of 1,500 gpm vs. 1,000 gpm.
- Policy of providing fire flows by potable water only vs. potable plus reclaimed water
- An optimized approach to capital expended versus benefits received utilizing both the reclaimed and potable water system.

## B. BACKGROUND:

The new Florida Fire Prevention Code (FFPC) was adopted on December 31, 2011. The new code now includes minimum fire flow requirements for all newly constructed one and two-family dwellings.



The FFPC now requires that a newly constructed one and two-family home must be built within the parameters of the fire flow capability provided to that property. These flows and durations are important to ensure that there is a sufficient water supply to extinguish a fire in the building and to keep it from spreading to nearby buildings.

The new Florida Fire Prevention Code requires a minimum of 1,000 gallons per minute (GPM) fire flow for duration of two hours for homes having a fire flow area of 5,000 square feet or less.

Fire flows (GPM) for homes with a fire flow area exceeding 5,000 square feet shall not be less than that specified in the Florida Fire Prevention Code, NFPA 1, Chapter 18, Table 18.4.5.1.2. (provided on the following page)

As part of the Potable Water System Hydraulic modeling efforts, the City requested Weston & Sampson identify:

- Available fire flows of the potable and reclaimed water systems
- Improvements to these systems that would help the City to meet their fire flow requirements.

## C. CITY GOALS:

The goal of the City is to provide all areas within Naples City limits with a minimum fire flow of 1,500 gpm at 20 psi. Where feasible, the City desires to use the reclaimed water distribution system to supplement fire flow in areas where it is available to meet this goal.

**Table 18.4.5.1.2 Minimum Required Fire Flow and Flow Duration for Buildings**

See FFPC 1-18.4 for information regarding flow credits for fully sprinkled buildings.					Fire Flow gpm† (× 3.785 for L/min)	Flow Duration (hours)
Fire Area ft <sup>2</sup> (×0.0929 for m <sup>2</sup> )						
I(443),I(332), II(222)*	II(111), III(211)*	IV(2HH), V(111)*	II(000), III(200)*	V(000)*		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	2
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	3
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	4
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
Greater than 295,900	Greater than 166,500	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
		115,801–125,500	83,701–90,600	51,501–55,700	6,250	
		125,501–135,500	90,601–97,900	55,701–60,200	6,500	
		135,501–145,800	97,901–106,800	60,201–64,800	6,750	
		145,801–156,700	106,801–113,200	64,801–69,600	7,000	
		156,701–167,900	113,201–121,300	69,601–74,600	7,250	
		167,901–179,400	121,301–129,600	74,601–79,800	7,500	
		179,401–191,400	129,601–138,300	79,801–85,100	7,750	
		Greater than 191,400	Greater than 138,300	Greater than 85,100	8000	

\*Types of construction are based on NFPA 220.

† Measured at 20 psi (139.9 kPa).

**D. ASSUMPTIONS:**

The following assumptions were included in the modeling effort:

- Potable Water
  - The potable water system maximum day demand was calculated based on a three-month average (December, January and February) from the historical billing consumption data from the city.
    - Maximum day demand of 20 million gallons per day (mgd).
  - This demand set was used for modeling all available fire flows in the system.
- Reclaimed Water
  - The water demands in the reclaimed system differ from the potable system demands significantly. The reclaimed system does not experience a typical diurnal curve because the water is solely used for irrigation purposes. There are a half dozen large using customers that fill their irrigation ponds from the reclaimed water system during the day, but the majority of reclaimed water is used between the hours of 10 pm and 7 am.
  - The maximum day reclaimed demand occurs in the late fall or early spring and is consistently observed as high as 7 mgd. The average daily demand for April 2012 was approximately 7 mgd which is what was utilized in the model as a starting point for assessing demands.

- 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 lake dump customers 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 is being 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.
- Computer Model
    - The modeling software creates junction nodes at each end of a pipe with pipes connecting at junction nodes.
    - The software contains an analysis tool that allows fire flow to be determined at each junction node. This is an excellent tool for determining water main / distribution system available fire flow capacity system-wide.
      - Because this analysis is done on junction nodes, it does not account for head-loss of flow through a fire hydrant and lateral main and can result in an overestimate of what the fire department indicates can be achieved compared with their hydrant capacity test.

## E. APPROACH:



The potable system hydraulic model was utilized with the maximum day demands to identify the available fire flows in the distribution system at 20 psi (Figure 3).

The reclaimed water system hydraulic model was run in order to determine the impact of the reclaimed water system on available fire flows. Where reclaimed water distribution mains have been installed, the available fire flow would be a combination of both potable water and reclaimed water.

There is significantly more fire flow available in the reclaimed water system during the day when customers are not irrigating than at night, due to reduced pressures. It is our opinion the available fire flow in the reclaimed water system should represent worse case scenarios, which is indicative of demands during the middle of the night.

## F. MODELING RESULTS:

Figure 1 shows the available fire flows in the potable water model during maximum day demands. The City has indicated that they wish to provide a minimum of 1500 gpm at 20 psi to all hydrants in the City.

This flow is not possible through a single dead-ended 6-inch water main. There are many instances where a dead-end 6-inch main is connected to a 12-inch water main with greater than 3,000 gpm and cannot pass 1,500 gpm through it to the end.

In order to provide 1,500 gpm to these areas from the potable system alone, the City will need to replace many of the 6-inch mains with 8-inch or loop these mains with others.

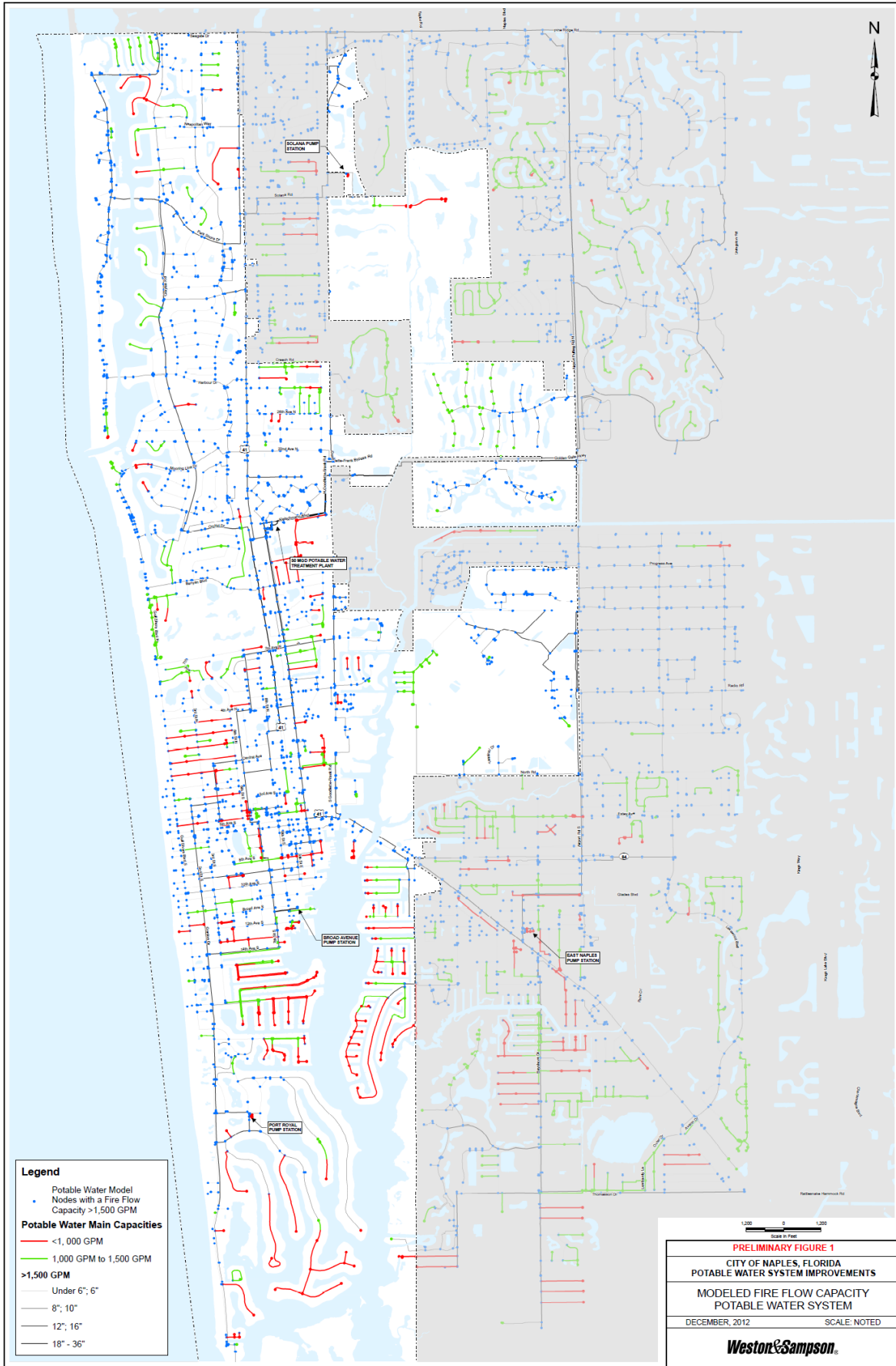
Looping many of the mains in the potable system at the dead-ends, will require directional drilling under a canal.

A scenario was calculated within the model to increase the water main size to 8-inch, which resulted in significant increases in the fire flows and alleviated many of the deficiencies throughout the City. The other alternatives to increase fire flow would be to loop existing water mains at the dead-ends, or to utilize the reclaimed water system to provide a second source of water.

Figure 2 provides a graphic display of fire flow capacities available from the reclaimed water system, while Figure 3 provides fire flow capacities available from combination potable water and reclaimed water systems.







**Legend**

- Potable Water Model Nodes with a Fire Flow Capacity >1,500 GPM

**Potable Water Main Capacities**

- <1,000 GPM
- 1,000 GPM to 1,500 GPM
- >1,500 GPM

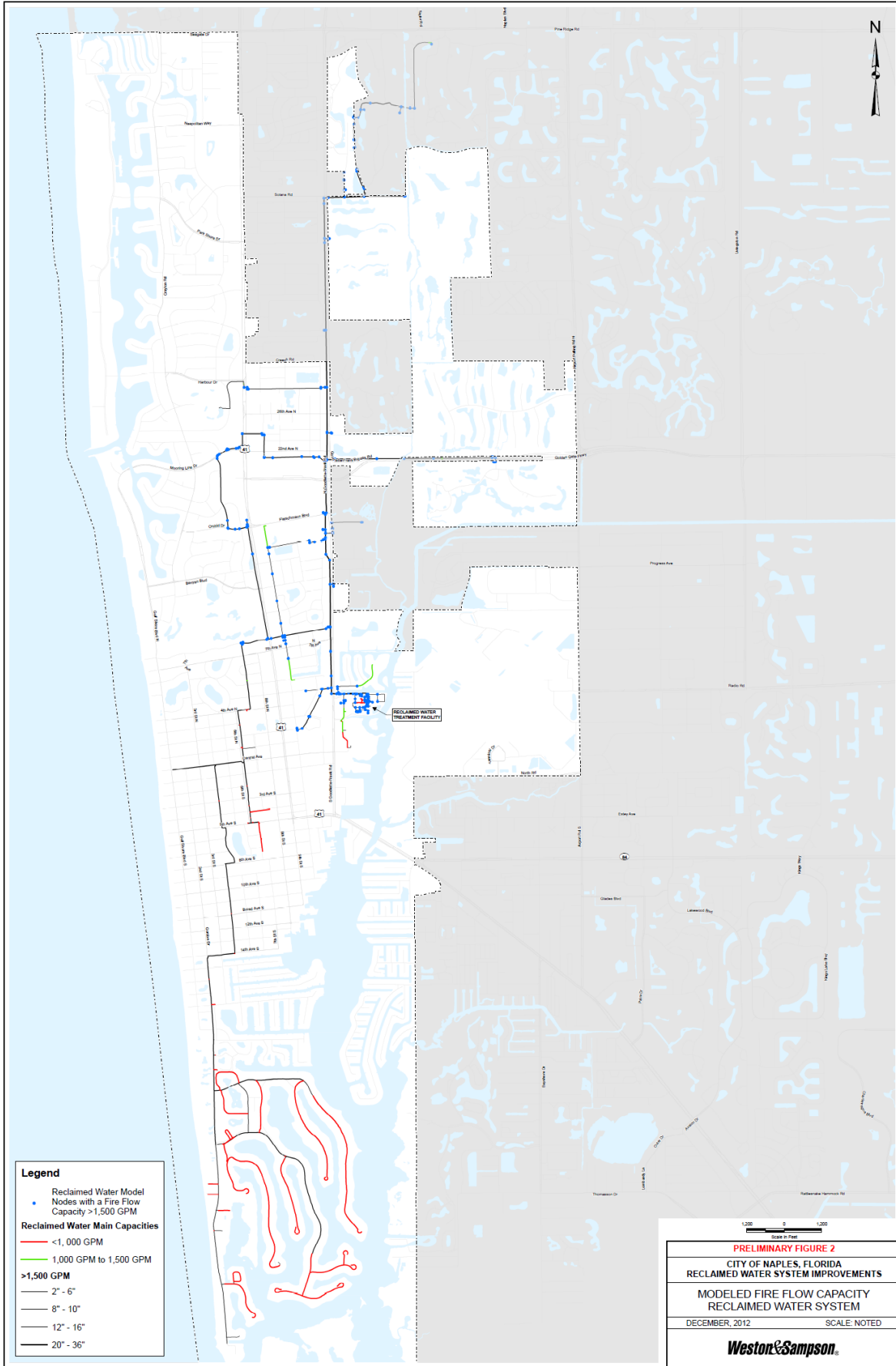
**Pipe Diameters**

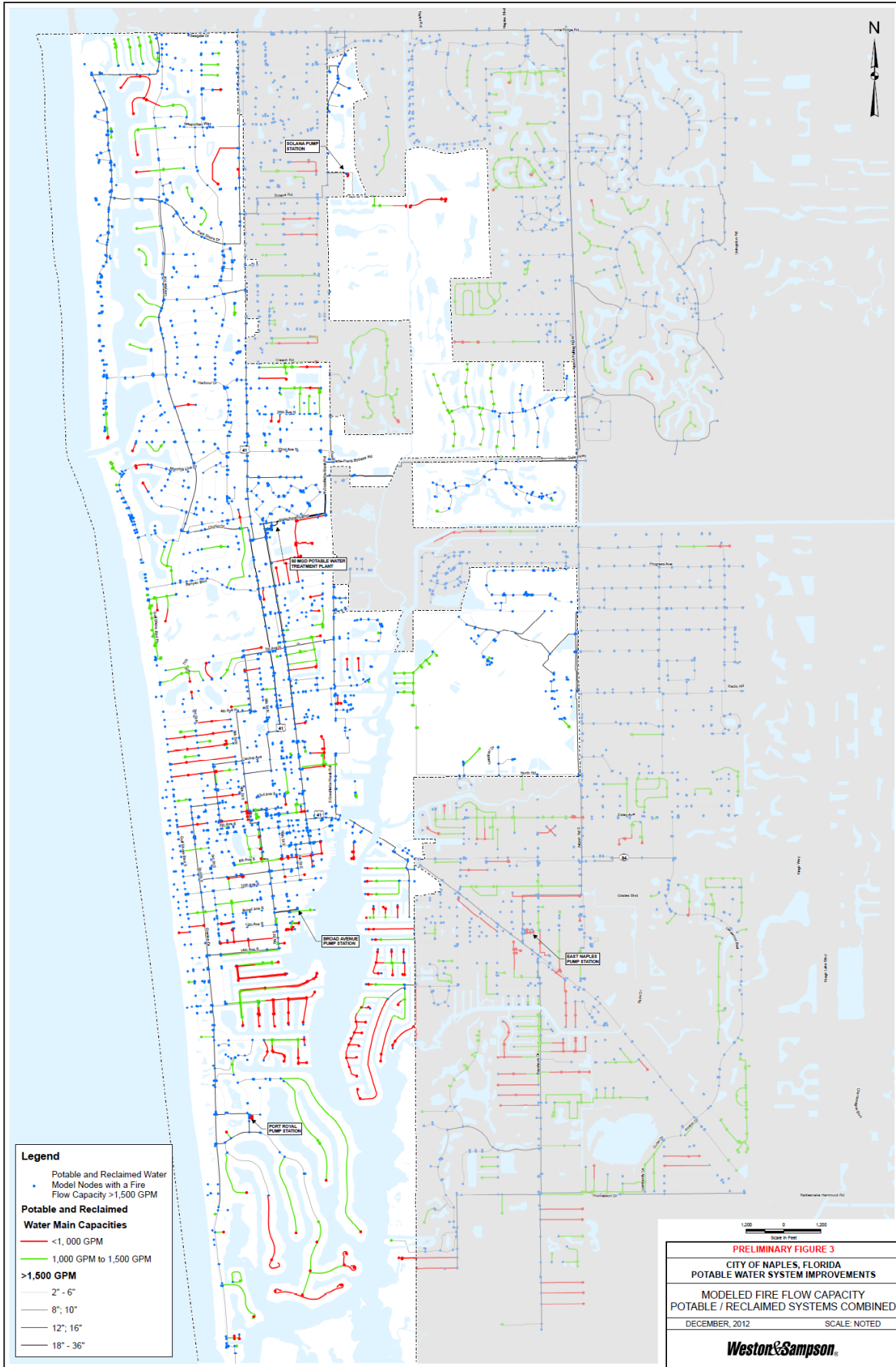
- Under 6", 6"
- 8", 10"
- 12", 16"
- 18" - 36"

1:200 0 1:200  
SCALE IN FEET

**PRELIMINARY FIGURE 1**  
**CITY OF NAPLES, FLORIDA**  
**POTABLE WATER SYSTEM IMPROVEMENTS**  
**MODELED FIRE FLOW CAPACITY**  
**POTABLE WATER SYSTEM**  
 DECEMBER, 2012 SCALE NOTED

**Weston&Sampson®**





## G. DISCUSSION:

To assist with the evaluation, the city was broken into five concentrated areas for the analysis of their available fire flows. These five are all within city limits and defined as

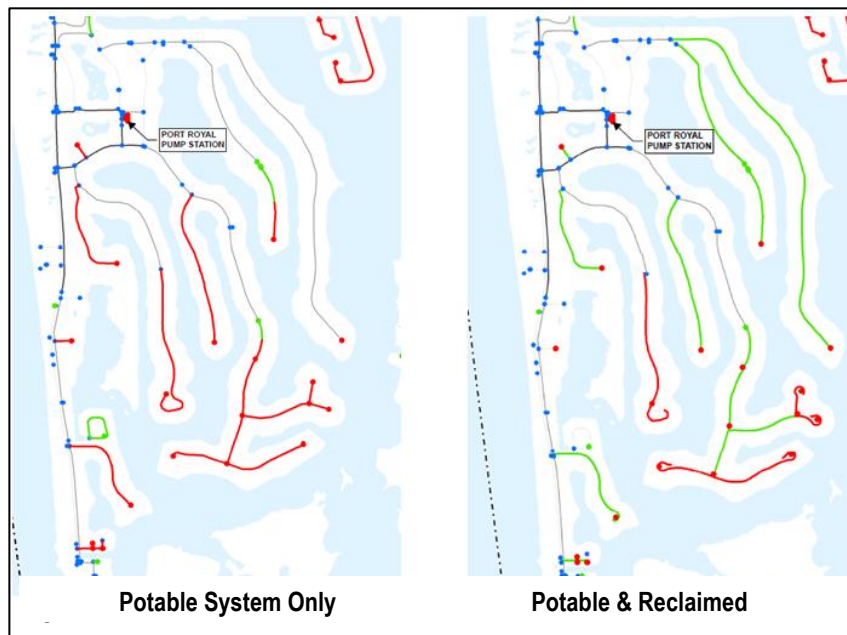
- Port Royal
- Royal Harbor
- Aqualane Shores
- Area South of Central Avenue
- Northern Naples (within the City-limits)

The reclaimed water system primarily affects the total available fire flow in the Port Royal area. All other areas are currently not serviced by the reclaimed water system.

### Port Royal Area

The Reclaimed water system has been expanded in the Port Royal area and does work to improve the fire flows in this area. The amount that the reclaimed system improves the fire flows depends on the time of day and whether customers are irrigating or not.

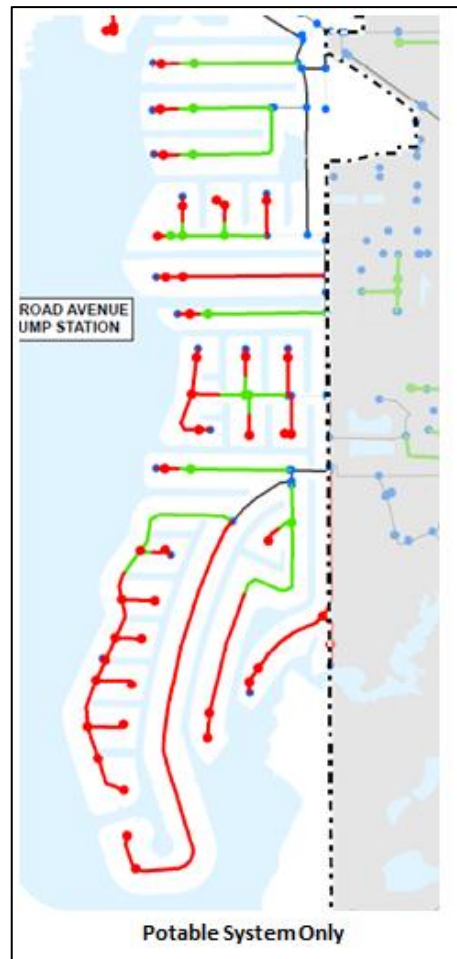
- The model indicates that typically when customers are irrigating the hydraulic grade line is reduced significantly and the system provides between 150 and 300 gpm supplemental flows.
- During the day when customers are not irrigating the reclaimed system provides between 600 and 900 gpm additional fire flows.
- We will evaluate using one of the potable water tanks on the reclaimed system to help stabilize the grade line when customers are irrigating.
- The model demonstrates that the fire flows in the potable system are improved approximately 100 gpm when both the Port Royal pumps are operating.
- Combining the potable and reclaimed system flows with some operational changes, the available fire flows in the majority of streets in the Port Royal area are meet the minimum requirement of 1500 gpm at 20 psi.



### Royal Harbor

The reclaimed water system currently does not service the Royal Harbor area. Because of this the available fire flows are solely from the potable system.

- The existing potable water system provides fire flows of less than 1,000 gpm.
- We utilized the model to identify if operational changes to the East Naples Pump Station could be made to improve the available fire flows in this area.
- For the city to reach their minimum requirement of 1,500 gpm at 20 psi, the 6-inch mains in the Royal Harbor area would need to be replaced with 8-inch, or looping would be required at the dead end streets.

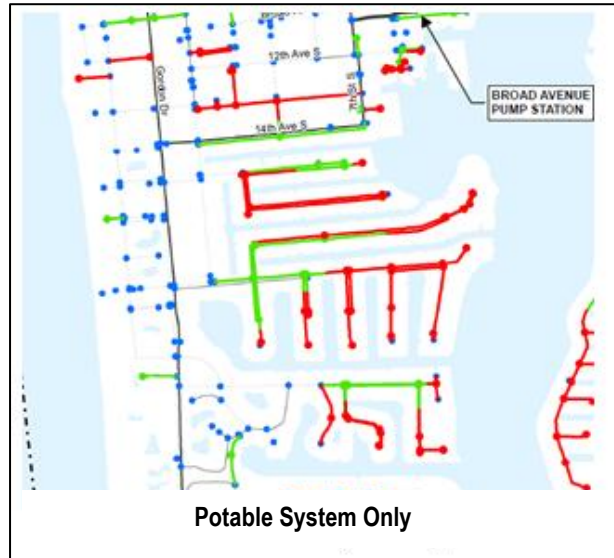


### Aqualane Shores

The Aqualane Shores is serviced only by the potable water system.

- The existing potable water system provides fire flows of less than 1,000 gpm to the dead-end peninsula streets.
- Operational changes / improvements are limited for this area because is located between the Broad Street Pump Station and the Port Royal Pump Station.

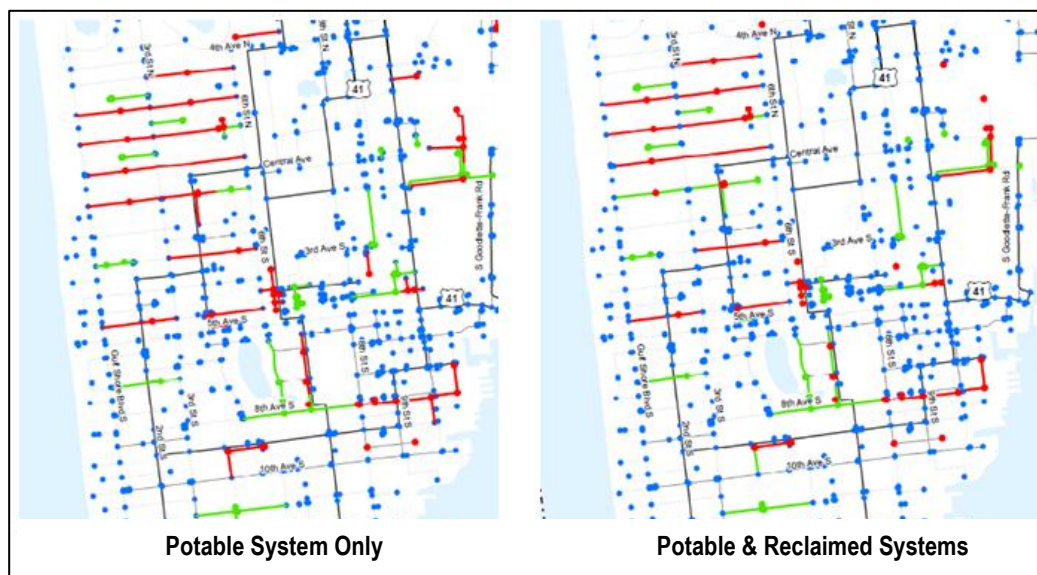
- To satisfy the minimum requirement of 1,500 gpm at 20 psi, the 6-inch mains would need to be replaced with 8-inch, or looping would be required at the ends of the potable system (under the canals) or the reclaimed system would need to be expanded into these streets.



Area South of Central Avenue

This area south of Central Avenue is currently experiencing significant growth. It is the oldest part of the potable distribution system containing a significant amount of small diameter water main.

- This area is also poorly gridded due to the pressure constraints caused by the Broad Street Pump Station.
- The model demonstrates that the transmission network in this area is performing well, but that the smaller mains are causing the fire flows to be less than 1,500 gpm.



### Northern Naples

The North Naples area is considered for this report to be the area north of South Central Avenue. Only accounts within the City limits have been considered. The majority of North Naples is currently only serviced by the potable water system. A limited amount of area is currently serviced by the reclaimed water system, due to the path the system takes towards the Port Royal area.

- The model shows that the majority of the North Naples area is performing well due to the somewhat gridded system. Areas that are currently not receiving 1,500 gpm fire flows are located on dead end roads bordering the canal.
- To satisfy the minimum requirement of 1,500 gpm at 20 psi, the 6-inch mains would need to be replaced with 8-inch mains, or looping would be required at the ends of the potable system (under the canals).
- Another way to satisfy this requirement would be to extend the reclaimed water system to these areas. North Naples currently uses the most water from the potable system, making it preliminarily the top priority to extend re-use water to.



## H. PRELIMINARY OPINIONS OF PROBABLE PROJECT COSTS

Figure 3 represents the improvements required to replace the 6-inch water main with 8-inch potable water main and improve the fire flows to 1,500 gpm throughout the city.

Table 1 provides a summary of planning-level opinions or probable project costs for each of the five areas. Complete preliminary opinions of probable project costs are provided on the following pages.

Table 1

### ***Preliminary Opinion of Probable Project Cost - Master Planning Level*** **Summary of Potable Water Main Improvements**

*December 2012*

Item No.	Item Description	Qty.	Unit	Unit Cost	Price
1	8-inch watermain, PVC <sup>1</sup>	159,600	LF	80	12,768,000
2	Service connections	3,900	EA	1,750	6,825,000
3	Restoration	1	LS	45%	5,745,600
4	Contractor Mobilization	1	LS	10%	2,533,900
Sub-total Construction (rounded to nearest \$100)					\$ 27,872,500

#### **Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 5,574,500
<i>Construction Contingency</i>	25%	6,968,400

<b>Summary of Potable Water Main Improvements</b>
<b><i>Preliminary Opinion of Probable Project Cost (Master Planning Level)</i></b>
<b>\$ 40,415,300</b>

<sup>1</sup> Includes fittings, valves, fire hydrants, air release valves

<b>Summary By Neighborhood</b>	
<i>Port Royal</i>	\$ 4,670,200
<i>Aqualane Shores</i>	4,326,100
<i>South of Central Avenue</i>	7,051,100
<i>Royal Harbor</i>	6,364,900
<i>North Naples</i>	<u>18,003,000</u>
<i>Total</i>	<b>\$ 40,415,300</b>



## I. CONCLUSIONS AND RECOMMENDATIONS:

The new Florida Fire Prevention Code (FFPC) was adopted on December 31, 2011. The new code now includes minimum fire flow requirements for all newly constructed one and two-family dwellings.

The FFPC now requires that a newly constructed one and two-family home must be built within the parameters of the fire flow capability provided to that property. These flows and durations are important to ensure that there is a sufficient water supply to extinguish a fire in the building and to keep it from spreading to nearby buildings.

The new Florida Fire Prevention Code requires a minimum of 1,000 gallons per minute (GPM) fire flow for duration of two hours for homes having a fire flow area of 5,000 square feet or less. Fire flows for homes with a fire flow area exceeding 5,000 square feet shall not be less than that specified in the Florida Fire Prevention Code, NFPA 1, Chapter 18, Table 18.4.5.1.2.

The City should consider:

- The cost impacts of providing fire flows of 1,500 gpm city-wide vs. 1,000 gpm.
- If the desire is to provide 1,500 gpm city-wide, items would include
  - o Replacing small diameter water main in the potable water system with 8-inch mains.
  - o Providing "looping" in the potable water system

The preliminary opinion of probable project costs for upgrading the potable water system is shown below.

<b>Summary By Neighborhood</b>	
<i>Port Royal</i>	\$ 4,670,200
<i>Aqualane Shores</i>	4,326,100
<i>South of Central Avenue</i>	7,051,100
<i>Royal Harbor</i>	6,364,900
<i>North Naples</i>	<u>18,003,000</u>
<i>Total</i>	\$ 40,415,300

As an alternative, or in addition to potable water system improvements, the City may wish to consider extending reclaimed water to areas having insufficient fire flows. With a reclaimed water system, the available supply would take into account both reclaimed water and potable water. Other benefits of extending the reclaimed water might include:

- Reduction of irrigation demand using potable water, which would positively impact the operation (flow and pressure) of the potable water distribution system

**J. APPENDIX A: SUPPORTING DOCUMENTATION – COST TABLES**

*City of Naples, Florida*

***Preliminary Opinion of Probable Project Cost - Master Planning Level  
Port Royal***

*December 2012*

<b>Item No.</b>	<b>Item Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Price</b>
1	8-inch watermain, PVC <sup>1</sup>	18,000	LF	80	1,440,000
2	Service connections	480	EA	1,750	840,000
3	Restoration	1	LS	45%	648,000
4	Contractor Mobilization	1	LS	10%	292,800
Sub-total Construction (rounded to nearest \$100)					\$ 3,220,800

**Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 644,200
<i>Construction Contingency</i>	25%	805,200

<b>Port Royal</b>
<b><i>Preliminary Opinion of Probable Project Cost (Master Planning Level)</i></b> <span style="float: right;"><b>\$ 4,670,200</b></span>

<sup>1</sup> *Includes fittings, valves, fire hydrants, air release valves*

**City of Naples, Florida**

**Preliminary Opinion of Probable Project Cost - Master Planning Level  
Royal Harbor**

*December 2012*

<b>Item No.</b>	<b>Item Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Price</b>
1	8-inch watermain, PVC <sup>1</sup>	25,500	LF	80	\$ 2,040,000
2	Service connections	590	EA	1,750	1,032,500
3	Restoration	1	LS	45%	918,000
4	Contractor Mobilization	1	LS	10%	399,100
Sub-total Construction (rounded to nearest \$100)					\$ 4,389,600

**Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 877,900
<i>Construction Contingency</i>	25%	1,097,400

<b>Royal Harbor</b>	
<b><i>Preliminary Opinion of Probable Project Cost (Master Planning Level)</i></b>	<b>\$ 6,364,900</b>

<sup>1</sup> Includes fittings, valves, fire hydrants, air release valves

**City of Naples, Florida**

**Preliminary Opinion of Probable Project Cost - Master Planning Level  
Aqualane Shores**

*December 2012*

<b>Item No.</b>	<b>Item Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Price</b>
1	8-inch watermain, PVC <sup>1</sup>	17,800	LF	80	1,424,000
2	Service connections	370	EA	1,750	647,500
3	Restoration	1	LS	45%	640,800
4	Contractor Mobilization	1	LS	10%	271,200
Sub-total Construction (rounded to nearest \$100)					<b>\$ 2,983,500</b>

**Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 596,700
<i>Construction Contingency</i>	25%	745,900

<b>Aqualane Shores</b>
<b>Preliminary Opinion of Probable Project Cost (Master Planning Level)      \$ 4,326,100</b>

<sup>1</sup> Includes fittings, valves, fire hydrants, air release valves

**City of Naples, Florida**

**Preliminary Opinion of Probable Project Cost - Master Planning Level  
South of Central Avenue**

*December 2012*

<b>Item No.</b>	<b>Item Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Price</b>
1	8-inch watermain, PVC <sup>1</sup>	27,700	LF	80	2,216,000
2	Service connections	690	EA	1,750	1,207,500
3	Restoration	1	LS	45%	997,200
4	Contractor Mobilization	1	LS	10%	442,100
Sub-total Construction (rounded to nearest \$100)					\$ 4,862,800

**Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 972,600
<i>Construction Contingency</i>	25%	1,215,700

<b>South of Central Avenue</b>	
<b><i>Preliminary Opinion of Probable Project Cost (Master Planning Level)</i></b>	<b>\$ 7,051,100</b>

<sup>1</sup> Includes fittings, valves, fire hydrants, air release valves

**City of Naples, Florida**

**Preliminary Opinion of Probable Project Cost - Master Planning Level  
North Naples**

*December 2012*

<b>Item No.</b>	<b>Item Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Price</b>
1	8-inch watermain, PVC <sup>1</sup>	70,600	LF	80	5,648,000
2	Service connections	1,770	EA	1,750	3,097,500
3	Restoration	1	LS	45%	2,541,600
4	Contractor Mobilization	1	LS	10%	1,128,700
Sub-total Construction (rounded to nearest \$100)					\$12,415,800

**Other Project Considerations**

<i>Administration, legal and engineering contingency</i>	20%	\$ 2,483,200
<i>Construction Contingency</i>	25%	3,104,000

<p><b>North Naples</b>  <b>Preliminary Opinion of Probable Project Cost (Master Planning Level)</b> <span style="float: right;"><b>\$18,003,000</b></span></p>
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<sup>1</sup> Includes fittings, valves, fire hydrants, air release valves