Water System Comprehensive Plan

for

Town of Nags Head, N.C.

Service Contract Purchase Order #1702250

April, 2018
Revised September 5, 2018
R&A Project No. 2017052

Rivers & Associates, Inc.

ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS

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Prepared by:

RIVERS AND ASSOCIATES, INC.

Greenville, North Carolina

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PREFACE

The Water System Comprehensive Plan, including the Hydraulic Analysis, the Asset Condition and Criticality Assessment, and the Capital Improvements Plan, are not static documents. The Town's water system, like any utility infrastructure, is constantly changing based on age, condition, maintenance, changing system demands, etc. As such, re-evaluation is recommended and periodically required in order for the documents to remain useful in coming years.

It is recommended that the WSCP be reviewed and updated at a minimum of five (5) year intervals. Rivers & Associates, Inc. stands ready to assist the Town of Nags Head with that effort, as well as any interim needs that the Town may identify as a priority. Our firm appreciates the opportunity to have prepared this plan, and to continue working with the staff, elected officials, and citizens of the Town of Nags Head.

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION/BACKGROUND

The Town of Nags Head, North Carolina contracted with Rivers & Associates, Inc. (Rivers) to prepare a Water System Comprehensive Plan (WSCP) that consists of three (3) components: (1) Hydraulic Model and Analysis, (2) Inspection and Assessment of System Components, and (3) a Capital Improvements Plan (CIP) for the water system.

The primary purposes of the Comprehensive Plan are to identify deficiencies with the Town's water distribution system, prioritize and recommend improvements, and provide preliminary cost opinions for the recommended work. Deficiencies and improvements to the water system were identified and evaluated by inspection, discussions with Town staff, and use of a hydraulic model created to simulate the response of the water system to varying parameters.

The Hydraulic Model was created using Bentley's WaterGEMS software. The Town supplied Graphical Information System (GIS) data, water billing/purchase records, pump models and/or curves, control data, and land use information; all of which was imported into the software to construct the model. Extended period simulations were created within the model, which include pump curves, pump controls, and a diurnal curve to simulate varying demand, tank levels and system pressures throughout the simulation period (72 hours) for max day-peak hour demand conditions.

A steady increase in both permanent residential water customers and seasonal population during summer vacation months is anticipated over the next 5 – 10 years. The modeled system demand was set for 2016 based on actual water consumption data from the Town. Those demand figures were then increased by 15% to conservatively simulate conditions in year 2028 which is ten years from completion of the WSCP.

Specific system improvements were modeled to improve pressure issues experienced by the Town during maximum demand conditions, both current and in the future. Additional improvements were modeled in an effort to attain a fire flow of 1,000 gallons per minute (gpm) while maintaining a residual pressure of 20 pounds per square inch (psi) at all hydrants under their jurisdiction. Other recommendations are included for improvement based on inspection and assessment of the condition and criticality of the existing infrastructure. Cost estimates were prepared for all recommended improvements, and are included in the Capital Improvements Plan for the Town's water system.

This report summarizes the findings, recommendations, and preliminary cost opinions associated with all components of the work.

1.2 FINDINGS

Results from the hydraulic analysis depict frequent and widespread occurrences of high pressures based on the Town's current distribution system arrangement, pump control set, and tank levels. High pressures are frequently realized in the 90+ psi range and at times over 100 psi. Public Works and Water Department staff have concurred with these findings. Typically, when the Eighth Street Elevated Tank is full, its altitude valve is closed, and a single Eighth Street pump continues to operate to fill the South Tower in order to meet demand in the south, high pressures are generated. Complaints regarding high system pressures have been registered and received from Town Hall and The Outer Banks Hospital previously. Water Department staff acknowledges that they sometimes manually shut off a high service pump before the tank fills in order to reduce high pressures. These circumstances primarily affect the areas of Town located north of Jockey's Ridge (30% +/- of total system demand) and from Jockey's Ridge to Pond Island (50% +/- of total system demand). As such, high pressures affect approximately 80% of the Town's customer base.

Low pressure issues are more isolated. Three predominant areas in Town exhibit periodic, instantaneous low pressure dips during peak demand hours. These locations are characterized by high ground elevations which prevent the elevated tanks from supplying the necessary pressure during peak demand hours when water levels in the tanks are low. These low pressure areas are Villa Dunes, Old Nags Head Cove (ONHC), and The Village at Nags Head (Golf Course). Rivers & Associates staff visited these areas to confirm the accuracy of the general topographic representation. At one time, a smaller 300,000 gallon elevated storage tank was located near the center of Town that likely provided more stability during peak hours for ONHC and the Golf Course. In the case of Villa Dunes, however, Town Staff suggests that low pressure issues were present from inception, and previous attempts have been made to improve pressure in that area. Villa Dunes is located at the dead end of a road at a high elevation that borders the north side of Jockey's Ridge State Park.

Fire flow analyses were conducted to evaluate firefighting capability at all 500 +/- hydrants included in the Town's GIS data system. The Fire Department has indicated their desire for each hydrant to have the capability to produce 1,000 gpm of available fire flow at 20 psi minimum residual pressure. Eight areas in the distribution system were identified as problematic. Some of these areas have been previously identified by other hydraulic studies, and are areas in which the Fire Department is already familiar. Some of the fire flow issues coincide with low pressure areas due to topographic constraints. The fire flow recommendations by themselves, however, do not resolve the low pressures issues.

1.3 OPTIONS

Specific recommendations are intended to support the following broader objectives and priorities:

Short-Term Needs: Install improvements as needed to address immediate system deficiencies.

Intermediate Needs: Install improvements to address impending needs or deficiencies of increasing consequence.

Long-Term Needs: Construct improvements to address anticipated system deficiencies in advance of their occurrence.

1.4 RECOMMENDATIONS

On the basis of the results of the Hydraulic Model and Analysis, Inspection, and Asset Condition/Criticality Assessment, as well as input received from Town Officials and Staff, the following improvements are recommended. System Improvements Maps depicting the locations of the various recommended improvements are attached as Appendix A.

Short-Term Needs:

1. Rehabilitate each of the Elevated Storage Tanks to protect against corrosion and degradation, and to extend their useful service lives.

   Estimated Cost = $274,450 (Eighth Street Water Plant)
   = $274,450 (Gull Street Pump Station)
   = $548,900 (Total)

2. Install new 12-inch water main on U.S. Hwy 158 from W. Danube Street to Diamond Street to complete the connection of existing 12-inch lines to the north and south of this area.

   Estimated Cost = $235,000

3. Replace the existing manual transfer switch for emergency standby generator operation at the Eighth Street Water Plant with an automatic transfer switch.

   Estimated Cost = $25,000

4. Install new fire hydrants at various underserved locations throughout the distribution system based on the recommendation of the fire department.

   Estimated Cost = $18,600

5. Replace 6-inch AC Water Main on Barnes Street from the Beach Road to the entrance of Vista Colony, extending beneath U.S. Hwy 158 (Bypass Road).

   Estimated Cost = $235,000

Intermediate Needs:

1. Install a Dual 12-inch Water Main along South Croatan Hwy around Jockey's Ridge to parallel the existing 12-inch main located on the Beach Road. This improvement will provide redundancy in the event of a 12-inch main break on the Beach Road such that the current level of service can be maintained. In addition, it provides some improvements to low and high system pressures.

   Estimated Cost = $625,000

2. Install an additional High Service Pump at Gull Street Pump Station to reduce the number of low pressure areas in the central part of the system while significantly decreasing high pressures.

   Estimated Cost = $276,000

3. Upgrade Electrical Motor Control Center and Variable Frequency Drives at Gull Street Pump Station to replace aging equipment, and improve pumping control, system pressures, and recognize energy savings.

   Estimated Cost = $600,000

4. Replace Emergency Standby Generator and Auto-transfer Switch at Gull Street Pump Station to replace aging equipment, and improve emergency standby capability.

   Estimated Cost = $365,000

5. Replace Asbestos Cement Pipelines throughout Town – Systematically replace all AC pipelines in the older areas and neighborhoods in Town. This includes all of the Wrightsville Avenue and Memorial Avenue area, Vista Colony, and Nags Head Cove. In addition, 8-inch AC Pipeline is installed on portions of the east side of Old Oregon Inlet Road (OOIR) from 9600 OOIR to McCall Court. Field verification of pipe location and material will be necessary.

   Estimated Cost = $2,548,000 (Wrightsville Ave and Memorial Ave area)
   = $ 936,000 (Vista Colony area)
   = $1,934,000 (Old Nags Head Cove area)
   = $ 735,000 (Old Oregon Inlet Road)
   = $6,153,000 (Total)

6. Install new fire hydrants at various underserved locations throughout the distribution system based on the recommendation of the fire department.

   Estimated Cost = $20,000

7. Replace the existing gas chlorine disinfection systems at the Eighth Street Water Plant and Gull Street Pump Station with liquid sodium hypochlorite feed systems.

   Estimated Cost = $108,000 (Eighth Street Water Plant)
   = $108,000 (Gull Street Pump Station)
   = $216,000 (Total)

8. Rehabilitate each of the Elevated Storage Tanks to protect against corrosion and degradation, and to extend their useful service lives.

   Estimated Cost = $274,450 (Eighth Street Water Plant)
   = $274,450 (Gull Street Pump Station)
   = $548,900 (Total)

9. Update the 2018 Water System Comprehensive Plan including the hydraulic analysis, asset condition and criticality assessment, and Water System Capital Improvements Plan. This effort should be undertaken on a five year interval to account for system changes.

   Estimated Cost = $60,000

10. Update System Development Fee Study to establish and document revisions to the system development fee schedule to fund capital expenses associated with new development in Town. State statutes require this effort to be undertaken every five years.

    Estimated Cost = $13,200

Long-Term Needs:

1. Install an additional 500,000 gallon elevated storage tank and altitude valve in the central portion of the water system (near Town Hall) to provide a long term, stable solution for meeting present and future demands while increasing low pressures in the central portion of the system and reducing high pressures to a more typical and acceptable range.

   Estimated Cost = $2,920,000

2.0 INTRODUCTION

2.1 PURPOSE AND SCOPE

This document has been prepared for the Town of Nags Head, NC based on the September 20, 2017 Engineering Services Agreement between the Town and Rivers & Associates, Inc. (Rivers) to provide an updated Water System Comprehensive Plan (WSCP). The WSCP consists of three (3) components: (1) Inspection and Assessment of System Components, (2) Hydraulic Model and Analysis, and (3) a Capital Improvements Plan (CIP) for the water system. The primary purposes of the Comprehensive Plan are to identify deficiencies with the Town's water distribution system, prioritize and recommend improvements, and provide preliminary cost opinions for the recommended work.

Deficiencies and improvements to the water system were identified and evaluated by inspection, discussions with Town staff, and use of a hydraulic model created to simulate the response of the water system to varying parameters.

2.2 BACKGROUND

2.2.1 GENERAL INFORMATION

The Town of Nags Head is an oceanfront community located in Dare County, North Carolina with a year-round population of approximately 3,000 residents and peak seasonal population of approximately 40,000 during summer vacation months.

Tourism is the primary revenue source for the Town as both Nags Head itself and its neighbors have a variety of attractions; the major attractions are all within roughly a 20 to 30 mile range. Nags Head contains Jockey's Ridge State Park. Jockey's Ridge is the tallest active sand dune system in the Eastern United States.

To the north, in order from south to north are Kill Devil Hills, home to the famous Wright Brothers Memorial, Kitty Hawk, Southern Shores, and Duck. Just north of Duck, the Outer Banks fall under the jurisdiction of Currituck County continuing to the North Carolina border with the Commonwealth of Virginia. Located to the south of Nags Head are the Cape Hatteras National Seashore, Bodie Island Lighthouse, and Oregon Inlet Fishing Center.

North Carolina extends out into the Atlantic Ocean to the east, where the Gulf Stream from the south and the Labrador Current from the north converge. This makes the Oregon Inlet Fishing Center a popular charter fishing marina. Across a small stretch of the Roanoke Sound, to the west is the Town of Manteo. Manteo is also home to several attractions such as The Lost Colony, the North Carolina Aquarium at Roanoke Island, and the Roanoke Maritime Museum.

U.S. Highway 64 is the major highway serving both Nags Head and Dare County in an east-west direction, this is the main artery for people visiting from North Carolina. The other major route is U.S. Hwy 158 coming from the northwest over the sound from Currituck County. Farther north, U.S. Hwy 158 meets N.C. Hwy 168 that extends to Norfolk, VA about 75 miles away. South of Nags Head is N.C. Hwy 12 that extends down the Outer Banks barrier islands towards Buxton, NC, home of the Cape Hatteras Lighthouse, which is roughly 40 miles away.

2.2.2 WATER SYSTEM

The Town's potable water is supplied in bulk according to the terms of their agreement with the Dare County Water Department. The water system is a long linear system that generally conforms to the shape of the coastal barrier island. Seasonal population variability, the source of water supply, and the system layout present an interesting dynamic in regards to water operations. Water issues vary based upon seasonal demand, water quality supplied, and transmission and storage capability.

When the water system was first established in 1963, the Town supplied its own water. The primary water source was a natural, freshwater pond located behind the Eighth Street Water Plant. The Eighth Street Plant produced potable drinking water for distribution to Nags Head customers until 1980 when the Town shut it down. The plant was reactivated in 1985, and operated until June, 2009 when it was deactivated due to increasing system demand and the associated cost of production.

The Town of Nags Head entered into an agreement with Dare County and Kill Devil Hills on June 30, 1996 to formalize their mutual understandings concerning the production, allocation, pricing and supply of water among the parties. A subsequent amendment dated February 4, 2009 removed the Eighth Street Water Plant as a mandatory water production facility, but allows Nags Head to maintain it as desired for a backup water source. Since June, 2009, Nags Head has purchased all of its potable water from Dare County.

Dare County water supply to Nags Head is furnished by two water treatment plants. The Skyco Water Plant lies between Manteo and Wanchese, NC on Roanoke Island. The source water for the Skyco Plant is freshwater wells. The plant utilizes ion exchange and nanofiltration treatment to produce a blended potable water supply. The North Reverse Osmosis (NRO) Plant is located in Kill Devil Hills just south of the Wright Brothers Memorial. As the name suggests, this treatment facility utilizes reverse osmosis treatment in order to treat a brackish water supply from deep wells in the Yorktown Aquifer. Water is transmitted to the Town of Nags Head's two ground storage tanks

(GSTs) from Dare County via a 24-inch transmission main that extends from the Skyco Plant east along U.S. Hwy 64 and north along S. Croatan Hwy (U.S. Hwy 158), sometimes referred to as the "Bypass" road.

In addition to its residents and businesses, the Town of Nags Head supplies water to two parks. Jockey's Ridge State Park is the tallest active sand dune system in the Eastern United States. The sand dune acts as a barrier located within the Town's water system as it extends practically from the beach to the sound. The Town of Nags Head only has one transmission main (12-inch) that extends around the park by following the beach road. The only other means of water transmission around the dune is the previously mentioned 24-inch line owned by Dare County that follows the Bypass road.

Cape Hatteras National Seashore is a federal park under the jurisdiction of the United States Department of the Interior, National Parks Service. The park preserves over 70 miles of unspoiled barrier islands along the Atlantic Ocean that extend from Bodie Island to Ocracoke Island. The Town has an agreement with the National Park Service (NPS) to provide potable water, water quality testing, and infrastructure repair work up to the NPS water meters. The NPS is served via an 8-inch water main from the south end of Nags Head extending to the Coast Guard Station & Oregon Inlet Fishing Center. The Bodie Island Lighthouse is served by a 6-inch main that branches off the aforementioned 8-inch line.

The topography in Nags Head consists of mainly flat areas close to the beach with some hilly terrain extending westward from the beach closer to the sound. Older aerial photographs illustrate the sand dunes extending northward and southward of Jockey's Ridge State Park. Those areas were subsequently cleared for development, but the terrain still exhibits significant elevation change over rather short distances. Appendix B depicts the variation in elevations across the Town.

The Town has previously commissioned Water System Management Plans, including the following:

- Water System Master Plan, 1986 by Black and Veatch,
- Water System Master Plan Update, May, 2004 by Cavanaugh and Associates,
- Water Utility Master Plan Update, March, 2011 by Diehl and Phillips, P.A.

2.3 ACKNOWLEDGEMENTS

The Town of Nags Head hydraulic model includes two ground storage tanks, five high service pumps, two elevated tanks, transmission and distribution mains, and roughly 5,000 user accounts. GIS data, pump curves and controls, billing data, demand data, etc. was provided through the assistance of various individuals from the Town's staff. Many thanks for their time, efforts and patience is extended to all those who assisted, and particularly to:

Public Works:	Ralph Barille
	Nancy Carawan
Administrative Services:	Amy Miller
	Kim Blankenburg
Planning and Development:	Andy Garman
	Kelly Wyatt
	Holly White
Administration:	Cliff Ogburn

2.4 REFERENCES

- Nags Head Local Water Supply Plan – 2014, 2015, 2016
- Town of Nags Head Comprehensive Plan – 2010, 2017
- U.S. Census Data
- Cavanaugh and Associates, WSMP Update – 2004
- Diehl and Phillips, WSMP Update – 2011
- Construction Plans for 8th Street Water Plant and Ground Storage Tank, William F. Freeman, Inc. – 1963
- Construction Plans for 8th Street Water Plant and Ground Storage Tank Improvements, Moore, Gardner & Associates, Inc. – 1970
- Construction Plans for Gull Street Pump Station and Ground Storage Tank, Williams & Works – 1981
- Construction Plans for South Tower and associated 12-inch main, Black and Veatch – 1988
- Construction Plans for the 8th Street Elevated Tank and water line connection at South Tower, Cavanaugh & Associates – 2004
- Construction Plans for the National Park Service Utility Improvements, Phase 1, Team Henry Enterprises, LLC – 2011
- Construction Plans for the National Park Service Utility Improvements, Phase 2, Team Henry Enterprises, LLC – 2011
- Construction Plans for Gull Street Pump Station Pipe/Mixing Improvements, MacConnell and Associates – 2012

3.0 POPULATION

The permanent population served by the Town of Nags Head water system as reported in the 2016 Local Water Supply Plan (LWSP) is 3,125 people. The seasonal population is reported in the 2016 LWSP as being only 22,000. However, based on its own internal resources, the Town has consistently estimated its seasonal population at approximately 40,000. The Town of Nags Head 2017 Land Use Plan (LUP) estimated 40,534 potential persons at peak population.

Rivers explored several sources of information and concluded that the Town of Nags Head 2017 LUP contains the most relevant population projections based on historical census data, commercial season visitor estimates, commercial and residential development records, and a host of other factors.

In order to predict where the water system will be stressed in the future, it is necessary to project population estimates to determine the magnitude of additional demands that may be experienced. Two methodologies were used to project the population out ten years to 2028. This was performed for the months with seasonal extremes, February and July. One method used the local permanent population estimate as a base which was then escalated by a ratio of peak seasonal population versus the local permanent population. The second method used the 2017 LUP's figure for the 2005 potential persons estimated at the peak of tourist season as a base figure which was then increased using a historical growth rate multiplied by the number of years into the future.

The two methods yielded 14% and 9% increases respectively for calendar year 2028. Therefore, an estimate of 15% was used for conservativism. Appendix C includes the spreadsheet calculations utilized to project future population figures and their associated water system demands.

4.0 ASSET MANAGEMENT AND CONDITION ASSESSMENT

The Town of Nags Head water system is comprised of numerous assets, some that are buried and some that are visible. These are the physical components of the system and include: pipe, valves, tanks, pumps, chemical treatment, building facilities, and any other components that make up the system. The assets that make up a water system generally depreciate over time as the system ages and deteriorates. As system components deteriorate, operations, transmission and delivery of the expected level of service can become more difficult, or in the worst case, be impeded. The costs of operation and maintenance can be expected to increase as the assets age. Increased costs for operations then have to be weighed against the cost of replacement or upgrade.

The goal of asset management is to meet a required level of service in the most cost-effective manner through the creation, acquisition, operation, maintenance, rehabilitation, and disposal of assets to provide for the needs of present and future customers. Utility owners should be interested in managing its assets in a cost-effective manner for a number of reasons: 1) water infrastructure assets represent a major public investment; 2) well-run infrastructure is important in economic development; 3) proper operation and maintenance of a utility is essential for public health and safety; 4) utility assets provide an essential customer service; and 5) asset management promotes efficiency and innovation in the operation of the system.

The intent of asset management is to ensure the long-term sustainability of the water utility. By assisting management to make informed decisions on when to repair, replace, or rehabilitate particular assets and by developing a long-term funding strategy, the utility can ensure its ability to deliver the required level of service perpetually.

The first four steps of the following basic asset management approach have been applied in evaluating the Town's water infrastructure components. The fifth component of work was excluded from the current scope of the WSCP effort, but should be evaluated in light of the capital improvement recommendations included in this report.

1. Inventory Assets – Catalog the tanks, pumps and pipes.
2. Assess Condition of Assets – Determine which assets need repair, rehabilitation, or replacement.
3. Rank & Prioritize Needs – Assess the 'criticality' of the assets and the consequences of failure.
4. Capital Improvement Plan – Establish an infrastructure repair, replacement, and upgrade schedule.
5. User Rate Impact – Review and adjust water rates/revenues to establish appropriate reserves. Revenues should cover debt service, operations/maintenance, and reserves.

4.1 DOCUMENTS REVIEW

As part of this evaluation, Rivers prepared several written document requests to obtain applicable records related to the water distribution system assets. The documents provided were reviewed to gain insight into the construction of the system and to develop an understanding of current water supply and distribution system operations. A comprehensive list of supplied documents is not incorporated herein; however, many of the documents are referenced in Paragraph 2.4 above or subsequently within the WSCP.

4.2 SITE VISITS

Members of Rivers' staff visited the Town on Thursday and Friday, October 19 – 20, 2017 in order to meet and interview stakeholders, as well as to inspect and assess the condition and criticality of existing water system infrastructure components. Included among the stakeholders were representatives of the following Town Departments: Administration, Administrative Services, Planning and Development, and Public Works, including Water Operations and Distribution. Also, representatives of the Dare County Water Department were interviewed.

4.3 EXISTING WATER SYSTEM INFRASTRUCTURE

The relative condition and remaining service life of infrastructure assets are often estimated based on the materials of manufacture, the environment that it serves and the maintenance that it receives. The following Tables 1 and 2 are useful life matrices with information derived from various sources including EPA and CFR 40 Part 35. Such information is often used to estimate the remaining useful life for planning and cost estimating purposes, and was considered in the assessment of assets for the Nags Head water system.

Table 1 - Useful Life Matrix: Drinking Water Infrastructure	
Reservoirs and Dams	80 – 100 years
Treatment Plant – Concrete Structures	60 – 70 years
Treatment Plant – Mechanical & Electrical	15 – 25 years
Trunk Mains	65 – 95 years
Pumping Stations – Concrete Structures	60 –70 years
Pumping Stations – Mechanical & Electrical	25 years
Distribution	65 – 95 years

Table 2 - Useful Life Matrix: Clean Water Infrastructure	
Collections	80 – 100 years
Treatment Plant – Concrete Structures	50 years
Treatment Plant – Mechanical & Electrical	15 – 25 years
Force Mains	25 years
Pumping Stations – Concrete Structures	50 years
Pumping Stations – Mechanical & Electrical	15 years
Interceptors	90 –100 years

4.3.1 WATER SUPPLY

The Town's potable water is supplied in bulk according to the terms of their agreement with the Dare County Water Department. The Town operates and maintains its own water storage and distribution infrastructure, however; it purchases all of its water supply from Dare County.

The Dare County water supply to Nags Head consists of two water treatment plants. The Skyco Water Plant lies between Manteo and Wanchese, NC on Roanoke Island. The source water for the Skyco Plant is freshwater wells. The plant utilizes ion exchange and nanofiltration treatment to produce a blended potable water supply. The North Reverse Osmosis (NRO) Plant is located in Kill Devil Hills just south of the Wright Brothers Memorial. As the name suggests, this treatment facility utilizes reverse osmosis treatment in order to treat a brackish water supply from deep wells in the Yorktown Aquifer.

Water is transmitted to the Town of Nags Head's two ground storage tanks from Dare County via a 24-inch transmission main that extends from the Skyco Plant east along U.S. Hwy 64 and north along S. Croatan Hwy (U.S. Hwy 158).

The Town of Nags Head has five (5) additional interconnects with Dare County for emergency use only. These interconnects are located as follows:

- Eighth Street
- Hollowell Street
- Soundside Road
- Danube Street
- Lakeside Drive

An additional emergency interconnect is also in place with the Kill Devil Hills water system near the Eighth Street Water Plant.

The Town is under a long-term contract with Dare County, and is not permitted per the terms of the contract to use water from sources not controlled by Dare County. The contract expiration date is 2036.

4.3.1.1 WATER QUANTITY

Dare County is currently obligated to supply 3.5 MGD to Nags Head, 3.0 MGD to Kill Devil Hills, and 1.0 MGD to Manteo. In the event the Dare County system is producing at 90% of its capacity on two consecutive days in a twelve month period, then Dare County is obligated to begin work to expand the production system by an increment of no less than 1.0 MGD. In addition, if either Nags Head or Kill Devil Hills exceeds their respective allocated amounts in any two consecutive days, then they shall pay Dare

County all costs and expenses associated with a required expansion of the Dare County Water Plant at no less than a 1.0 MGD increment.

The normal production capacity of the Dare County Skyco and NRO Water Treatment Plants is 10.0 MGD (5.0 MGD respectively). Each WTP can potentially produce an additional 1.0 MGD +/- of capacity via bypass water from the Skyco facility and by increasing the flux rate of the NRO membranes for a total production capacity of 12.0 MGD. Furthermore, Dare County maintains approximately 10 Mgal in storage at the NRO facility to assist during periods of high demand. The two-day maximum daily demand (MDD) reported by Dare County in 2017 was 9.2 MGD which is approximately 92% of normal treatment capacity, but only 77% of potential treatment capacity. Appendix D includes a graphical depiction of the Dare County WTP normal, potential, and 90% of potential capacity values vs historical single maximum day demand. Single maximum day demand will always be equal or exceed the two consecutive day demand. Overall demand for Dare County water supply has generally declined since 2011. At this juncture in time, the County appears to have sufficient capacity to comfortably meet customer needs. At present, Dare County does not report any plans to expand production facilities.

Current water supply allocated by agreement from Dare County to Nags Head is 3.5 MGD. The two-day MDD for Nags Head in 2016 was approximately 2.334 MGD which is approximately 67% of the allocated capacity. A graph is included in Appendix D to depict the historical relationship of allocated supply and 90% of allocated supply (3.15 MGD) to demand.

As noted earlier, the Water Agreement requires Nags Head to pay Dare County the cost for a minimal 1.0 MGD incremental WTP expansion when Nags Head exceeds its 3.5 MGD allocated capacity. Over the next ten years, Nags Head water consumption is estimated to increase no more than 15 percent which would equate to a two-consecutive day MDD of approximately 2.68 MGD. This still represents only 77% of obligated capacity.

At this juncture, and for the immediate foreseeable future, the quantity of potable water supply available to the Town of Nags Head appears sufficient. Nags Head currently has a 1.0 MGD Reverse Osmosis WTP expansion at an estimated cost of approximately $5,000,000 included as a 2018-19 CIP request with expenditures beginning in 2023. Part of the project justification compares the 2008 MDD of 2.805 MGD to 90% of the 3.5 MGD allocated capacity or 3.15 MGD. The Water Agreement suggests that the two-day MDD should be compared to the full 3.5 MGD allocation. Current data suggests that the cost for the 1.0 MGD WTP expansion may not need to be expended during the next ten-year period.

4.3.1.2 WATER QUALITY

Until recently, the water quality received by the Town from Dare County was of concern relative to formation of Disinfection Byproducts (DBPs), and the ability for Nags Head to maintain sufficient chlorine residual in the distal portions of the distribution system. Finished water quality from Dare County in general is very good with both WTPs routinely meeting primary and secondary water quality standards. As one might expect, water quality from the NRO WTP is excellent as reverse osmosis membranes not only remove chlorides and hardness from the brackish groundwater, but provide the added benefit of removing DBP precursors and other dissolved solids.

Water quality at the Skyco WTP, however, was limited by the capability of the ion exchange treatment process. That process was not capable of removing elevated bromides which were primarily responsible for formation of the brominated trihalomethane (THM) species. In May 2017, Dare County completed the Skyco WTP upgrade which added nano-filtration treatment for removal of the elevated bromide concentrations. With this addition, Skyco is able to produce a blended water with a much lower DBP formation potential. Subsequent water quality sample results have confirmed much lower concentrations of THMs in the water supply. The Nags Head Public Works staff have subsequently confirmed a dramatic decrease in DBPs at the extremities of the distribution system, as well as much lower chlorine demand in the water supply.

By all indications, the major problems that the Town has previously experienced relative to water quality have been rectified by the recent Dare County treatment upgrades.

4.3.1.3 TRANSMISSION

As noted previously, Dare County supplies water to Nags Head via an existing 24” diameter transmission main. The transmission main was installed approximately forty years ago (1978–1979) which suggests the main may have 20 – 60 years of useful service life remaining. The Town would be most vulnerable due to a pipe failure where the transmission main crosses beneath the Albemarle Sound at the Virginia Dare Memorial Bridge and Washington Baum Bridge. However, the Town benefits by its location between the Skyco and NRO WTPs. Being located between two sources of supply, the Town is able to receive water from either direction in the event of a supply or transmission issue near either WTP or beneath the Roanoke Sound. Furthermore, the five (5) low pressure emergency interconnects with Dare County and one (1) higher pressure emergency interconnect with Kill Devil Hills allow multiple points of service in the event of a service disruption at the Gull Street Pump Station or the Eighth Street Water Plant and their respective ground storage tanks.

4.3.2 WATER STORAGE

NCDEQ Rules Governing Public Water Systems require a minimum volume of water in storage to equal or exceed one-half day's supply based on the average annual daily demand (ADD). Nags Heads' annual ADD for 2016 was approximately 1.125 MGD. The Town has 2.0 MG in storage, including 1.0 MG in the GSTs and 1.0 MG in the ESTs. At present, the Town maintains approximately 1.75 days of water storage based on ADD.

For a coastal community with increased seasonal demand, it is not unreasonable that the minimum storage volume be based on peak season average day demand. For Nags Head, ADD in the June – August timeframe is approximately 1.865 MGD. As such, the Town maintains approximately 22 hours of storage during peak season. In December – February the average daily demand drops to approximately 0.625 MGD which equates to approximately three days of storage.

At present, the Town appears to have ample water storage volume to handle peak hourly flows during maximum day demand conditions as well as to meet minimum fire flow capacity requirements. Subsequent discussion relative to the results of the hydraulic analysis deal with the capability of the existing transmission system to deliver water to the customers at reasonable pressures.

4.3.2.1 GROUND STORAGE

The Town of Nags Head water system includes two (2) pre-stressed concrete, 500,000 gallon ground storage tanks which serve as storage reservoirs receiving potable water from Dare County, and providing suction supply to the high service pumps. One of the GSTs is located at the Eighth Street Water Plant and the other at the Gull Street Pump Station. Refer to Appendix B for specific locations.

The Eighth Street GST was originally constructed in 1964 with the Eighth Street WTP (Appendix E – Photo #5). In 2016, the tank was rehabilitated to repair and seal degraded concrete. Interior tank inspections were performed by MacConnell & Associates. The inspections revealed the workmanship to be excellent, and the tank was found to be in good condition overall.

Overall, the Eighth Street GST appears to be in good service and good working order. Pre-stressed concrete tanks can be expected to have a useful service life of approximately 60 – 80 years with routine and proper maintenance. Based on the recent repairs, the Eighth Street GST should be in good working order for the next five – ten year period. If reasonable maintenance is provided, the Eighth Street GST may provide another 10 – 25 years of service.

The Gull Street GST was initially constructed in 1982 (Appendix E – Photo #10). In May 2012, the tank was retrofitted/rehabilitated to incorporate additional piping and a mixer. The mixer was intended to prevent short-circuiting and assist to reduce water age and water quality concerns. An interior tank inspection was performed by MacConnell & Associates in March, 2017. The inspection revealed the tank to be in good condition overall. However, isolated pitting on the floor was observed in several locations which did not exceed 10% of the floor area, nor 1/8" in depth. Three small locations of concern were observed on the ceiling, but the Contractor was to repair the ceiling defects prior to disinfecting and returning the tank to service.

Overall, the Gull Street GST also appears to be in good service and good working order. The tank is expected to remain in good working order for the next five – ten year period. Should reasonable maintenance be provided, the Gull Street GST may provide another 25 – 45 years of service.

The submersible mixer manufacturer indicates that maintenance of the submersible mixer is minimal, and suggests that it be run to failure before replacing the motor. The mixer motor is anticipated to have a remaining useful operational service life of five to ten years.

4.3.2.2 ELEVATED STORAGE

The Town's water system includes two (2) 500,000 gallon welded steel, elevated storage tanks (ESTs) which serve as storage reservoirs to supply potable water to Nags Head customers and provide pressure across the distribution system. One of the ESTs is located at the Eighth Street Water Plant while the South Tower is located near the south end of Town on S. Old Oregon Inlet Road.

The South Tower was originally constructed in 1988, and was most recently repainted in 2013 (Appendix E - Photo #17). In 2013, a submersible mixer was installed to minimize short-circuiting and to assist in reducing water age to help improve water quality. In 2013, the tank was washed, the surface was prepared and two coats of Series 700 Hydroflon advanced fluoropolymer paint was applied. Hydroflon is a superior paint system supplied by Tnemec Company, Inc. Typically, this paint system can be expected to hold up for 12 – 15 years or more. In harsh coastal environments such as that found in Nags Head, the coating system will likely exhibit a 30% +/- reduction in useful life.

The South Tower appears to generally be in good condition although some surface corrosion has begun to re-form at bolted connections, welded seems and other irregular surfaces. Welded steel elevated storage tanks can be expected to have a useful service life of as much as 100 years with routine and proper maintenance. However, coastal environments with the corrosive effects of wind-borne salt is particularly difficult on such structures. Given this, the expected service life is likely on the order of 60 – 70 years. Based on its current condition, the South Tower should be cleaned, repaired, and recoated very soon. With routine maintenance, the South Tower may provide another 30 – 40 or more years of service.

It is critical to provide proper maintenance to a steel EST in order to maximize the life of the structure. It is advisable to wash and disinfect the tank interior approximately every three years. This helps to keep the interior clean, reduce residue and improve water quality. It is also critical to perform cleaning, surface preparation and recoating prior to complete system failure. Recoating of a tank located in this coastal environment should be performed in five year internals, roughly. If the coating is allowed to degrade to failure, the cost for recoating increases dramatically as containment, sandblasting and additional surface preparation can add $150,000 or more to the cost of a typical exterior overcoat and interior rehabilitation project.

The Eighth Street Elevated Tank was initially constructed in 2005 (Appendix E – Photo #7). In January, 2015 the tank was rehabilitated and repainted, and a submersible mixer was installed to minimize short-circuiting and reduce water age to improve water quality. Tank inspection was performed by MacConnell & Associates. The inspection revealed the workmanship to be of good condition overall.

Similar to the South Tower, the Eighth Street EST also received the Tnemec Series 700 Hydroflon coating system. The EST appears to be in good working order although it also displays minor surface corrosion at some of the welded connections. Based on the recent repairs and re-coating, the Eighth Street EST should be in good working order for the next few years, but should be rehabilitated within a five year window. With routine maintenance, the Eighth Street EST may provide another 40 – 50 or more years of service.

Information relative to each of the water storage tanks is summarized in Table 3 below.

Table 3 – Water Storage Facilities

Name	Location	Year of Construction	Storage Capacity (Gallons)	Overflow Elevation (HGL)
8th Street Elevated Tank	8th Street / Pond Street	2005/Repainted 2015	500,000	145
South Tower (Elevated)	S. Old Oregon Inlet Road	1988/Repainted 2013	500,000	145
Ground Storage Tank	8th Street / Pond Street	1964/Rehabilitated 2016	500,000	22.5
Ground Storage Tank	Gull Street	1982/Rehabilitated 2017	500,000	24.5
Total			**2,000,000**	

4.3.3 HIGH SERVICE PUMPS

The Town operates two high service pumping stations. One is located at the Eighth Street Water Plant (Appendix E – Photo #1). The other is the Gull Street Pump Station (Appendix E – Photo #10).

4.3.3.1 EIGHTH STREET WATER PLANT

The Eighth Street Water Plant includes three (3) vertical turbine can pumps that pull water from the Eighth Street Ground Storage Tank (Appendix E – Photo #2). The original 1964 water plant included only two pumps, but they have been serviced, replaced, or supplemented as demand and operations have required. All three pumps include 100 HP motors; however, Pumps #1 and #3 are rated at 1,500 gpm, while Pump #2 is rated for 1,000 gpm. The Eighth Street Pump #1 was replaced in 1998. Pump #2 is believed to be the original constructed in 1964, but the pump and the motor were rebuilt in 2008. Pump #3 was installed in 2001, and its motor was later replaced in 2017. Vertical turbine pumping equipment of this type is commonly used and still specified in modern water infrastructure projects. Fairbanks Morse is the manufacturer of the 1,500 gpm pumps, and they still produce pumping equipment of this type. As such, service and replacement parts for Pumps #1 and #3 should still be available. Byron Jackson is the manufacturer of the 1,000 gpm pump. Some Byron Jackson legacy pumps are now sold and/or serviced by Flowserve; however, the Nags Head Byron Jackson HSP model is no longer manufactured. As such, the Town can expect that this pump will have to be replaced in the future when it can no longer be serviced. Many similar manufacturers of vertical turbine can-pumps are available including Fairbanks Morse, Flowserve, or others. The original motor control center and pump starters were replaced in 2009 with new soft starters and controls (Appendix E – Photo #3).

At present, the Eighth Street high service pumps, motors and electrical gear appear to be in good operating condition. Continued maintenance and routine monitoring of pumping capacity are recommended such that repairs can be affected in a timely manner to ensure primary and standby pumping capability, particularly in advance of the summer peak season demand.

Electrical starter/controls technology has improved immensely in the past fifty years with equipment that is able to deliver improved pump control and substantive energy savings. The electrical soft starters installed in 2009 are able to reduce inrush current and limit starting torque which reduces motor heat and wear, reduces the effect of water surge/ hammer on the distribution system, and reduces energy consumption. Variable Frequency Drives (VFDs) have become much more prevalent in recent years, and although expensive, their cost continues to decline. VFDs not only control the speed of the motor and the flowrate of the pump during the start and stop cycle, but also throughout the pumping cycle. As such VFDs can provide similar benefits as the soft starters, but also can assist in better controlling system pressures by gradually increasing or decreasing speed and flow based on elevated tank levels and/or system pressures.

Given the fairly recent replacement of the electrical equipment at Eighth Street, it is likely not worthwhile to replace the soft starters with VFDs at this juncture in time. However, in the future as the electrical equipment approaches the end of its service life, consideration might be given to upgrading with VFDs.

4.3.3.2 GULL STREET PUMP STATION

The Gull Street Pump Station includes two (2) horizontal split case pumps that pull water from the Gull Street Ground Storage Tank (Appendix E – Photo #11). Both pumps include 125 HP motors and are rated at 2,000 gpm. Space exists for the addition of a third pump of similar style and capacity.

The Gull Street pumps and electrical equipment are original to the installation of the Gull Street Pump Station which was constructed in 1982. Soft starters were installed to operate the two 125 HP HSPs in 2005. Horizontal split case pumps are commonly used today in water transmission projects, and although the Worthington brand has been bought out by Flowserve, the Nags Head pump model is currently manufactured with service and parts still available. The Motor Control Center (Appendix E – Photo #12), Emergency Standby Generator/Auto-transfer Switch (Appendix E – Photo #13) and associated electrical equipment at Gull Street is approximately 36 years old. This equipment will soon be a candidate for replacement, and installation of variable frequency drives (VFDs) may be worth considering as a means to reap benefits associated with more flexible pumping control, improved system pressures and energy savings.

The Town's high service pump inventory are summarized in Table 4 below.

Table 4 – High Service Pumps

Name	Hydraulic Model Pump Reference	Type	Pump Manufacturer	GPM*	Head*	RPM*
8th Street Pump No. 1	#1	Vertical Turbine	Fairbanks Morse	1,500	211'	1,800
8th Street Pump No. 2	#2	Vertical Turbine	Byron Jackson	1,000	230'	1,775
8th Street Pump No. 3	#3	Vertical Turbine	Fairbanks Morse	1,500	211'	1,800
Gull Street Pump No. 1	#4	Horizontal Split Case Flooded Suction	Worthington	2,000	175'	1,780
Gull Street Pump No. 2	#5	Horizontal Split Case Flooded Suction	Worthington	2,000	175'	1,780

* Information provided by the Town of Nags Head.

4.3.3.3 PUMP CONTROLS

The Town's water system has a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides automated monitoring, control, alarm notification and data logging for various system components and processes. The SCADA system continuously monitors water levels in all tanks, and provides automatic control of the high service pumps based on water level set point established for each of the two elevated tanks. Water System Operators have the ability to adjust level set points to modify pump operations, and they can activate additional pumps as deemed necessary for system conditions.

The Town typically operates only three (3) of their five (5) high service pumps on a normal basis. The Eighth Street (lead) Pump No. 1 cuts on first, followed by Gull Street (lead) Pump No. 1 and then Gull Street (lag) Pump No. 2. As the South Tower fills, the Eighth Street Pump No. 1 cuts off first, followed by Gull Street Pumps No. 1 & 2 together. All pumps monitor the South Tower for their activation levels, but Town Staff still retain the option to turn on and off any pump at any time. Pumps at both stations are alternated to balance run times, although Eighth Street Pump No. 2 is seldom operated. Table 5 below shows the current pump control level setpoints relative to the tank elevations.

Table 5 – South Tower Control Elevations & Setpoints

Condition or Action	Elevation (ft MSL)*
Top of Tank Elevation	150.0
High Water Level	145.0
Stop All Gull St. Pumps	139.0
Stop 8th Street Pump	138.0
Call 8th Street Pump	129.0
Call Lead Gull St. Pump	128.0
Call Lag Gull St. Pump	127.0
Low Level Alarm	123.0
Low Water Level	109.0
Bottom of Bowl	107.5
Base of Tank Elevation	10.5

*Levels based on SCADA setpoint levels and construction plans for the elevated tanks provided by the Town.

4.3.4 DISTRIBUTION SYSTEM

The Town's water system is comprised of approximately 101 miles of 2" – 14" water mains based on the 2017 Local Water Supply Plan (Appendix F). Approximately 8% of the mains reportedly consist of Asbestos Cement Pipeline (ACP). The AC water mains are generally in the 3" – 8" diameter with the vast majority being 6" diameter. Most of the AC pipelines were installed beginning in the 1960's, and are located in older areas and neighborhoods of the Town, including all of the Wrightsville Avenue and Memorial Avenue area, Vista Colony, and Nags Head Cove. In addition, it is believed that the 8" Pipeline installed on Old Oregon Inlet Road (OOIR) from 9600 OOIR to McCall Court includes portions of ACP. The useful service life of ACP is generally considered to be 70 years, but actual service life depends on the pipe condition and working environment. The AC pipelines within the Nags Head water system are approaching 60 years of age; however, the Town has not reported a significant failure rate to this point in time. Other eastern N.C. municipal water systems of similarly aged AC piping have begun to experience increased failure rates, and in many cases have initiated or completed the steps to replace such pipes. The Town of Nags Head also experiences significantly high pressures based on system characteristics as discussed subsequently in Section 5.0 Hydraulic Analysis. Significant pressure swings are likely to contribute to ACP failure as its useful life is expended. The Town should begin financial preparations for replacement of the AC pipelines in the near future.

Cast iron and ductile iron pipelines account for approximately 45% of the town's water mains. These pipes range in size from 6" – 14" in diameter. The most significant of these mains is the 12" DIP transmission main that extends from Eighth Street southward along Virginia Dare Trail to Whalebone Junction. The 12" DIP extends from Whalebone to 9600 OOIR. At that location, the 12" DIP main crosses to the west side of OOIR, and extends to the South Tower. In addition, an 8" DIP main extends along the west side of OOIR from Whalebone to 9600 OOIR.

The remainder of the water system is primarily comprised of PVC pipelines, including newer developments and lateral mains extending from the DIP transmission mains. A portion of the 8" main that extends along the east side of OOIR from 9600 OOIR to McCall Court is comprised of Class 160 PVC.

4.3.4.1 WATER QUALITY

Until recently, the water quality received by the Town of Nags Head from Dare County was of concern due to formation of Disinfection Byproducts (DBPs) in the distribution system. Additionally, the Town experienced difficulty in maintaining sufficient chlorine residual in the distribution system.

Raw water quality and the associated treatment process employed at the Dare County Skyco WTP appears to have been a contributor to the DBP concerns. The groundwater supply to Skyco is water drawn from the Principal Aquifer located beneath Roanoke Island. The Principal Aquifer is fresh beneath most of Roanoke Island; however, it is vulnerable to saltwater intrusion from the Surficial Aquifer where the confining layer is thin or absent. Saltwater intrusion has been previously identified in areas of poor aquifer confinement and/or poor residential well construction where the confining layer was breached.

Until recently, the Skyco WTP relied on ion exchange to soften the hard groundwater prior to disinfection and transmission to Nags Head and other bulk or retail customers. Ion exchange, however, will not remove the elevated concentration of bromides associated with the groundwater from the Principal Aquifer.

Both Dare County and Nags Head utilize chlorine as their primary and residual disinfectant. In the presence of bromides, chlorine will begin forming DBP compounds such as the brominated species of THMs. Other dissolved or suspended organic materials in the water will also consume chlorine. Formation of DBPs is a function of several variables, including raw water chemistry, chlorine dose, temperature, pH, water age, etc. Water age is also a significant contributing factor in the Nags Head system.

The Town boosts disinfectant residual by the addition of gas chlorine at the Gull Street Pump Station and Eighth Street Water Plant. Prior to the Skyco WTP Upgrade, the Town experienced difficulty in sustaining a chlorine residual in the potable water, particularly at the south end of the distribution system. Dare County has recently completed an upgrade to the Skyco WTP which includes the addition of 3.0 MGD nano-filtration treatment train. The nano-filtration treatment system has the capability to remove bromides from the raw water. A blended water is now distributed to Dare County's customers which is less susceptible to the formation of DBPs and exhibits reduced chlorine demand and improved chlorine residual. Both Dare County and Nags Head have observed a significant reduction in DBP formation and chlorine usage as a result of improved source water quality.

By all indications, the problems that the Town has previously experienced relative to DBP and chlorine residual water quality have improved considerably by upgrades implemented to the source water treatment by the Dare County Water Department.

4.3.4.2 WATER AGE

As indicated above, water age is a significant contributor to DBP or other water quality issues. The Town of Nags Head water system is characterized by extensive water age in the off peak season particularly in the southern part of the system below Whalebone Junction. This is not uncharacteristic of coastal resort communities where seasonal population and associated consumptive demand varies widely.

Water age varies substantially among public water systems. Generally, water age is lower in large systems and higher in smaller systems. There is no specific maximum water age for a public water system although AWWA recommends a water age of less than seven (7) days. A reasonable water age depends on many factors including raw water quality, type of treatment provided, size of the system, etc.

In addition to the water treatment improvements made by Dare County, a number of additional improvements have been previously made by Nags Head in efforts to improve water quality within the system. They are as follows:

- Submersible mixers have been installed in the Gull Street GST, the Eighth Street EST, and the South Tower EST in order to encourage water turnover within the tanks,

- Automatic flushing devices have been installed in six (6) locations where customer demand is low and water age is high in order to reduce water age and maintain chlorine residuals at the extents of the system. Automatic flushing devices are located at Pond Island, the Causeway, 10435 Old Oregon Inlet Road near McCall Court, south of Coquina Beach, the Oregon Inlet Campground, and the Oregon Inlet Marina.

- A 12” water main was installed at the South Tower EST to encourage water movement between the parallel 8” and 12” diameter mains on Old Oregon Inlet Road.

As previously noted, the Nags Head distribution system supports both domestic water consumption and fire suppression. The storage tanks are intended to provide for operational storage, equalization, and fire suppression storage. Excess water in the storage and distribution system during times of low consumption provide greater opportunity for DBP formation, and compounds the difficulty of maintaining sufficient chlorine residuals in the distribution system.

The hydraulic analysis described subsequently in this report includes an evaluation of water age during peak season and off peak season. During peak season when demand is high, water age throughout the system appears to be very reasonable. However, during the off-peak season, demand diminishes drastically, and water age similarly increases as a result. In the areas north of Whalebone Junction, water age appears acceptable; however, locations south of Whalebone appear particularly high.

The Town currently forces water turnover in the GSTs weekly during the winter months by closing the inlet valves from Dare County and pumping the tanks down. These actions are not required during the summer season. Additional improvements options that the Town could consider are: (1) lower pump settings in the Elevated Tanks to reduce the amount of water in storage during the off-peak season, and (2) request Dare County to lower the pump settings associated with the Ground Storage Tanks such that less water is stored during the period of low demand.

4.3.4.3 FIRE FLOW CAPABILITY

The Town of Nags Head water system provides water transmission from storage via the distribution system for fire suppression purposes. The Town's water system includes approximately 500 fire hydrants located throughout the community. As with most communities, the availability of a robust fire protection service not only provides increased assurance of satisfactory response during a fire emergency, but also provides benefits to community residents and business owners of improved insurance ratings and lower insurance premiums.

Fire flow is defined as the flow rate that is available at a given point in the distribution system when the residual water system pressure equals a minimum of 20 psi. Previous hydraulic studies have identified isolated areas within the Town in which the available fire flow is less than that desired by the Fire Department. Some previous infrastructure improvements have been installed in an effort to improve fire flow capability in specific areas. In addition, the Town has previously installed additional fire hydrants at specific locations to improve firefighting capability and accessibility

The following hydraulic analysis includes a fire flow evaluation component in order to identify areas of the water system in which available fire flow is less than desired. Recommendations and associated cost estimates are provided for each of the identified improvements. In addition, an estimate is also provided for installation of additional fire hydrants at various locations recommended by the Nags Head Fire Department.

5.0 HYDRAULIC ANALYSIS

5.1 MODEL DEVELOPMENT

A hydraulic model was developed for the Town of Nags Head's water system using WaterGEMS version V8i SELECT Series 3 by Bentley Systems, Inc. WaterGEMS is a sophisticated hydraulics modeling software package that is one of the most popular hydraulics modeling tools within the Water Works industry. The software consists of a graphical interface, database and analytical tools for construction and analysis of hydraulic systems. It is able to interface with AutoCAD, ArcGIS and other common Geospatial database tools.

Hydraulic analyses and evaluation were utilized to identify deficiencies in the distribution network and to establish improvements required to meet the required demands.

5.1.1 CONSTRUCTION

Development of the hydraulic model consists of construction of the physical model, assignment of demands, and calibration to ensure the results sufficiently represent actual system response. The physical model is represented by a series of pipe segments, junction nodes, pumps, tanks, etc. Demand varies based on the location of water customers, the season, and the time of day. Calibration consists of a series of runs to compare the results from the model against known results from field testing with associated adjustments to the model as required.

Geographic Information System (GIS) data related to the Town's existing water system was obtained from Mr. Andy Garmin, Planning and Development Director. The data includes shapefiles that represent existing pipe locations and sizes, hydrant locations, etc. The GIS data was imported into WaterGEMS where the GIS lines were converted to individual pipe segments and junction nodes. These pipes and junction nodes each are separately labeled for identification, and serve as the basic piping network representing the Town's water system. In addition, topographic information was obtained from the Dare County GIS system indirectly through NCOneMap and is represented on the schematic drawings included in Appendix B, this topographic information set the baseline for the ground elevations assigned to all junction nodes.

A copy of the WaterGEMS digital files has been burned to a compact disk (CD) and attached to this report for use by The Town of Nags Head. A drawing is attached in Appendix G that graphically illustrates the piping network. However, the easiest method for locating a specific entity in the model is from within the software application.

Additional data that was secured from the Town of Nags Head staff during development of the model includes:

- Pump curves, impeller diameters, and bowl settings for each pump at their respective pump station and water plant sites
- Dimension, capacity, and elevation of Elevated Storage Tanks
- Dimension, capacity, and elevation of Ground Storage Tanks
- Records for Water Purchased from Dare County in Calendar Year 2016
- Records for Water Billed to Town of Nags Head customers in Calendar Year 2016
- 2017 Comprehensive Land Use Plan
- Water Plant SCADA control levels
- General feedback from Town Staff regarding pipe age and material

Information regarding additional pipe segments which were not reflected in the GIS data received were based on information provided by Public Works staff. These additional segments were manually added to the pipe network within the hydraulic model.

Distribution elements are represented by symbols within the hydraulic model. Junction nodes, labeled for instance as "J10", represent a change in pipe diameter size, a termination of a pipe, and/or a connection of two or more pipes. These junction nodes also serve as the location where customer water demands are assigned. Elevated storage tanks are represented by a static node symbol, such as "T1". All mains contain a pipe number that appears approximately midway of the pipe segment. Pipe diameters are indicated by the color of the pipe segment which is coordinated with the pipe legend. The pipe numbers and diameters are useful in reviewing the hydraulic results. The existing Ground Storage Tanks are modeled as a reservoir of unlimited supply. The high service pumps are modeled with pump curves to closely represent the operating conditions based on the existing pump models and setpoint control conditions.

5.1.2 DEMAND ALLOCATION

System demand was allocated at the junction nodes within the model to reflect consumption within the system. In order to allocate demand, calendar year 2016 water billing and water purchase records were obtained from the Town. Calendar year 2016 was utilized since it provided a complete year of data immediately prior to the time the evaluation began. Demand was allocated on the basis of the total water purchased from Dare County. Volumetric differences between purchase and sales records can be attributed to system losses, meter calibration, etc. By utilizing water purchased, these volumetric differences are included in the total demand imposed on the water system.

Water Loss

Data for water purchased from Dare County and water billed to Nags Head customers were compared to evaluate system losses experienced within the Town's system. The total volume of water purchased in 2016 was 413,717,860 gallons. The total volume of water billed to customers was 350,835,200 gallons. As such, water billed is approximately 85% of that purchased, yielding approximately a 15% loss. The 2016 Local Water Supply Plan includes an estimated volume of 25,411,000 gallons of water used for system processes which accounts for approximately 6.1% of the overall demand leaving approximately 9% of overall demand as unaccounted losses. Unaccounted losses are often attributable to water leaks, fire hydrant use, meter inaccuracies, non-metered connections, main breaks, street cleaning, etc. A water audit provides an accounting of all types of water use, metered and non-metered; however, a water loss audit is beyond the scope of services included with this Comprehensive Plan. The N.C. State Water Supply Plan (January 2001, Section 5.2.2 Water Loss Reduction and Leak Detection) and the American Water Works Association (AWWA) state that unaccounted-for water between 10 – 15% or less of the average daily use is generally acceptable. Given this, losses within the Town of Nags Head water system appear to fall within a normal range.

Current Demand

Current demand is typically assigned based upon evaluation of four demand conditions: Average Day Flow, Maximum Day Flow, Minimum Day Flow and Peak Hour Flow. They are defined as follows:

- Average Day Flow = Average flow per day over 12 consecutive months, MGD
- Max Day Flow = Largest one-day flow during 12 consecutive months, MGD
- Min Day Flow = Lowest one-day flow during 12 consecutive months, MGD
- Peak Hour Flow = Largest one-hour flow during the Max Day, MGD

The Max Day and Peak Hour demands are the most critical for analyzing the existing water system and recommending improvements. Water supply from the Town's pump station and water plant should be capable of providing Max Day demand without a net loss of water in storage although water in storage can be used to meet the Peak Hour demand. System pressures outside of an acceptable range are not desirable during Average Day, Max Day or Peak Hour conditions.

Average Day Demand

Based on the 2016 Local Water Supply Plan, Nags Head water customers consumed an annual average of 1.125 MGD. The customer base consisted of 4,493 residential connections, 377 commercial connections, and 2 institutional connections.

Maximum Day Demand

The maximum day water delivered to customers for 2016 was 2.334 MGD on July 27, 2016 according to the Local Water Supply Plan. This was a max day/average day ratio of:

$$\frac{2.334 \text{ MGD}}{1.125 \text{ MGD}} = 2.075$$

This is much higher than a typical municipal water system ratio of approximately 1.5. Since the Town of Nags Head experiences substantial swings in water use due to its seasonal tourism industry, average day flow (ADF) is not representative of the conditions for which the hydraulic evaluation should be based. Instead, maximum month/maximum day and minimum month/minimum day scenarios were evaluated. MDF may represent maximum day flow or minimum day flow depending on the scenario evaluated.

Peak Hour Demand

The ratio of peak hour to maximum day is rarely computed, consequently the typical ratio of 2.5 will be used to adjust the demands at each node from maximum day to peak hour utilizing a diurnal curve applied to all runs. A graphic illustration of the diurnal curve utilized in this model is included in Appendix H. The peak hour multiplier is equal to 2.5.

$$\frac{\text{Peak Hour}}{\text{Max Day}} = 2.5$$

Maximum and Minimum Day Demand Computation

Since average day flow is not representative of the conditions for which the hydraulic evaluation should focus, maximum month/maximum day and minimum month/minimum day scenarios were computed. February and July demands were targeted since they represent the maximum and minimum demand months, respectively.

Data provided by the Town for each customer account included the parcel number and water volume billed for each billing period of 2016. A billing period actually represents two months of water consumption (Jan-Feb, Mar-Apr, etc.) as the water meters are read every other month. The two-month billing figures were prorated into monthly demands using a ratio of the respective days in each month. The percentage of total water billed for each month was applied to the total water purchased from Dare County. Final figures were converted into gallons per minute to derive an average daily flow baseline for the given month per individual customer as illustrated in Table 6 below.

Table 6 – Maximum and Minimum Daily Demand Conditions

Month, Year	Total Water Purchased (gallons)*	No. Days in Month	Average Day Purchased for the Month (gal/day)	Max or Min Day Purchased (gallons) *	Max or Min / Average (Ratio)
Feb, 2016	16,879,392	29	582,048	357,581 (Feb 7)	0.61435
July, 2016	62,888,832	31	2,028,672	2,312,057 (July 27)	1.13969

Month, Year	Average Day Purchased for the Month (gal/day)	Minutes/day	Average Day Demand (gpm)
Feb, 2016	582,048	1,440	404.2
July, 2016	2,028,672	1,440	1,408.8

Month, Year	Average Day Demand (gpm)	Max or Min / Average (Ratio)	Max or Min Day Demand Conditions (Total gpm)
Feb, 2016	404.2	x 0.61435	248.3 (Min. Day)
July, 2016	1408.8	x 1.13969	1,605.6 (Max. Day)

*Data within this table reflects minimum day water purchased for February and maximum day water purchased for July. Purchase includes water losses, billing adjustments or other unaccounted-for water.

The Nags Head parcel and average daily demand data was compared and merged with those of Dare County GIS system in an effort to provide a complete geospatial reference location for each customer demand. The resulting demand shapefile was then uploaded into WaterGEMS, and allocated to specific junction nodes based on the closest proximity of each parcel demand to a model node. Some parcel numbers were missing, however, and others did not match despite having identical street addresses. Therefore, demands for missing properties that could be readily identified, as well as other missing demands over 1.0 gpm were added individually by the modeler to its closest node. In addition, some demands were removed from the full parcel list as they represented anomalies for billing offsets, leaks, faulty meters, etc.

Maximum daily demand was allocated within the model by globally multiplying the average daily demand in July for each junction node by the ratio of Max Day/ADF depicted in Table 6 above. Likewise, the minimum daily demand was spatially allocated by globally multiplying the ADD in February for each node by the ratio of Min Day/ADF as indicated in Table 6 above. The diurnal curve depicted in Appendix H was applied to reflect hourly variation in demand during the extended period simulation runs. Peak Hour demands are represented from 6:30 – 7:30 PM when the peaking factor equals 2.5. The precise timeframe that peak hour is modeled is not as consequential as the magnitude of the demand, and the assurance that peak hour is actually represented during the course of the day.

Future Demand

The Nags Head Comprehensive Plan was reviewed to obtain information relative to historical and projected permanent and peak population estimates from Calendar Year 2000 to Calendar Year 2030. On the basis of these projections, the percentage increase in peak population was estimated for the next ten (10) year period. Calendar year 2028 was utilized for the 10-year projection since this Water System Comprehensive Plan was compiled in 2018.

Calculations summarizing the population projections and associated water demand projections are included in Appendix C.

The calculations make use of historical populations and growth rates to correlate peak population to the local permanent population. Two methods were used to estimate the percentage increase in peak population from 2016 to 2028. The estimates depicted an expected growth rate of 9 – 14%. For conservatism, 15% was used as a reasonable estimate of the increased peak population in Calendar Year (CY) 2028.

2016 water demands were globally escalated by 15% for CY 2028 in order to account for the projected increase. The results are summarized in Table 7 below:

Table 7 – Existing and Future Flow Projections Summary		
Demand Condition	Calculation	Demand
Minimum Day Demand (February 7, 2016)		248 gpm
Minimum Day Demand (February 7, 2028)	248 gpm x 115% =	285 gpm
Average Day Minimum Month Demand (February 2016)		404 gpm
Average Day Minimum Month Demand (February 2028)	404 gpm x 115%	465 gpm
Average Day Maximum Month Demand (July 2016)		1,409 gpm
Average Day Maximum Month Demand (July 2028)	1,409 gpm x 115% =	1,620 gpm
Maximum Day Demand (July 27, 2016)		1,606 gpm
Maximum Day Demand (July 27, 2028)	1,606 gpm x 115% =	1,847 gpm

5.1.3 FIELD TESTING & CALIBRATION

Field fire hydrant flow and pressure tests were conducted to observe the performance of the existing system and to calibrate the computer model as required. The resulting flow demand was applied to the corresponding junction and the residual pressure was compared to the flow test residual pressure reading.

A series of twenty (20) flow tests were conducted by Rivers and Nags Head staff. The test sites were scattered throughout the water system at ten (10) locations. One test was later deemed non-representative, leaving nineteen (19) good data points to calibrate the model. The tests were performed on December 12, 2017 with assistance of Ms. Nancy Carawan and Mr. David Perry of the Nags Head Water Department. Each flow test was conducted using two hydrants in reasonably close proximity to one another. One hydrant was selected to induce flow from the distribution system while the other hydrant was used to record residual pressure in the supply main. Several key measurements were recorded. The first measurement is the static pressure of the system prior to inducing flow from the hydrant. The second measurement is the actual flow and associated residual pressure at the supply main as water is discharged from the flowing hydrant. In parallel with these local measurements, elevated tank levels and high service pump operation were recorded. In some cases, the test was conducted with a single pump activated at the Eighth Street Water Plant. In other cases, one pump was operated at the Eighth Street Water Plant while another pump was active at the Gull Street Pump Station. Appendix I depicts the location and results from each of the field tests.

In order to test the validity of the model, analyses were run in an effort to simulate the conditions of the water system at the time that the flow tests were conducted. First, the static pressure of the model is compared to the static pressure recorded in the system. Secondly, a local demand equivalent to that measured during the flow test was placed at the location of the flow hydrant in the model. The resulting residual pressure was then compared to that recorded in the actual flow test. The flow testing was conducted in December, 2016. As such, a local demand equivalent was generated by globally multiplying the February 2016 demand to increase the average daily flow to approximate the demand for December 2017. The customer count and demand distribution are comparable in the winter months.

Normally, Hazen-Williams C-values (pipe roughness coefficients) are adjusted in an effort for the model pressures to correspond more closely to the fire flow residual pressures. This procedure involves some judgment on the part of the modeler since numerous variable conditions can impact the results. When required, adjustments are made to pipe roughness coefficients, tank levels, etc. to reasonably replicate field results. A majority of the field test results were within an acceptable range or have a rational explanation for why field results vary from modeled results. The model is considered to be a reasonable representation of the actual water system.

A meeting was conducted with Town staff on January 16, 2018 to solicit feedback relative to operation and observations garnered from the hydraulic model. The model indicated high and low pressure areas that appear to be consistent with those that staff have observed with current distribution system operations. In addition, fire flow concerns appear to overlap areas that previous models have identified and that the Nags Head Fire Department recognize to be an area of concern.

5.2 SUMMARY OF HYDRAULIC MODEL RUNS

Extended Period Simulations for 72 hours were performed for the following demand conditions both currently and in the future:

- Maximum Day Demand with Peak Hour
- Minimum Day Demand with Peak Hour

Fire Flow Analyses were also conducted for the following demand conditions both currently and in the future:

- Maximum Day Demand

For the Extended Period Simulation model runs, the tanks have been assumed to be roughly three quarters full and the pumps were set to be initially running.

5.2.1 EXISTING (2016) WATER SYSTEM DEMAND SCENARIOS

The computer model uses scenarios or "runs" to simulate various demands and potential improvements to determine and evaluate system response. These scenarios can be used with a variety of combinations. Demand and fire flow runs are configured differently.

Demand runs utilize Extended Period Simulation (EPS) calculation method. These runs were set for seventy two (72) hours, which simulate three consecutive days of similar demand. EPS scenarios make use of the diurnal curve, which increase or reduce the demand for each given hour of the day. For instance, times such as 11:00 AM and 6:00 PM are increased for lunch and dinner, whereas the middle of the night will be less. The highest period of demand over the course of a day is referred to as "peak hour." For the diurnal curve depicted in Appendix H, peak hour is set for 6:30 -7:30 PM with a peaking factor of two and a half (2.5). It is not unusual, particularly in coastal communities, several close-to-maximum days of demand can occur sequentially. By running the simulation over a 72-hour period, potential issues of concern may be identified that otherwise may be overlooked when operating over a single 24-hour period.

Numerous hydraulic model scenarios were conducted during the course of this evaluation. It is not the intent of this report to discuss all scenarios, but rather to focus on scenarios that identify system needs or deficiencies and/or support or justify the reasoning for the recommended improvements contained herein. Schematic diagrams and graphs are referenced as applicable for each scenario to illustrate minimum and maximum system pressures, tank levels/tank cycling, high service pump operation, and pressure fluctuations for a selection of junction nodes from throughout the distribution system. Appendix J identifies junction locations which are referenced in the graphs to demonstrate system pressures.

The following discussion is a summary of the results and conclusions from various hydraulic runs that were conducted for existing demand condition followed by similar analyses conducted for the future demand condition. Various improvements were evaluated to determine whether a positive impact was observed on system operations.

5.2.1.1 Scenario 1: July 2016 MDF – Existing Controls

Settings: This scenario simulates the Town's maximum daily demand in July 2016 with existing pump control settings and existing pipe network. Operation of all pumps is controlled by water level settings at the South Tower. The existing pump control settings are summarized in Table 8 below:

Table 8 - Existing Controls					
	Automatic				Manual
	On		Off		
Pump	Eighth	South	Eighth	South	
1		129.00		138.00	
2					X
3					X
4		128.00		139.00	
5		127.00		139.00	

This scenario serves as a baseline for the peak demand during the summer tourism season months.

Results: Instantaneous pressures dip below the 30 psi threshold in three areas, Villa Dunes, Old Nags Head Cove, and The Village at Nags Head. These brief instances of low pressure are somewhat consistent throughout most operational scenarios due to the higher ground elevations of these areas relative to the elevated tank levels. The low pressures occur coincident to the beginning of peak hour demand when both elevated tanks drop to low levels and Pumps 1 and 4 are called to run. High pressures occur when the Eighth Street Elevated Tank is full, its altitude valve is closed, and Pumps 1 and 4 are actively working to fill the South Tower. Areas from Eighth Street to Jockey's Ridge experience pressures that exceed 100 psi while areas from Jockey's Ridge to Pond Island observe pressures in the 90 - 100 psi range. Results are tabulated and depicted in Appendix K.

Conclusions: Instantaneous minimum pressures are experienced twice during the 72-hour run during the peak demand hour. The high pressures are higher than desired, and are not recommended especially in the north end of the system which contains significant quantities of Asbestos Cement Pipe (ACP). Typically, a maximum pressure of 80 psi is desirable. Town Staff has stated that pressures in the 90 – 100+ psi range are not uncommon, but to this point in time the Town has not experienced major infrastructure failures. The age and condition of the ACP, in concert with the high system pressures, is not a tenable situation. Modifications are recommended to reduce the high system pressures while replacing the aging ACP water mains with contemporary piping materials.

5.2.1.2 Scenario 2: July 2016 MDF – Revised Controls 1

Settings: This scenario simulates the Town's existing distribution system during maximum daily demand of July 2016 with the following variation to the existing pump control settings.

Table 9 - Revised Controls 1					
	Automatic				Manual
	On		Off		
Pump	Eighth	South	Eighth	South	
1	128.00		139.00		
2					X
3	127.00		139.00		
4		128.00		139.00	
5		128.00		139.00	

The pump controls are reconfigured where the Eighth Street pumps are controlled by the Eighth Street Elevated Tank water levels, while the Gull Street pumps are controlled by the levels in the South Tower. In addition, both pumps at Gull Street operate in tandem, which will require the installation of one additional standby pump at the Gull Street Pump Station. Operation of Pumps 4 and 5 would be slightly staggered via SCADA and soft start control to reduce inrush current and minimize the effects of water hammer. This control set is referred to as Revised Controls 1.

Results: Switching to the Revised Controls 1 set reduces the number of low pressure areas and decreases maximum pressures over a broad area from Eighth Street to Pond Island. High pressures with the existing control set range from the 90 – 100+ psi range. The proposed control set reduces these figures to the 60 – 90 psi range. Results are tabulated and depicted in Appendix L.

Conclusions: This is a recommended option that can be utilized for improved low and high pressures in the short or intermediate timeframe. In subsequent scenarios, the Revised Controls 1 set modification can be used as well in conjunction with other recommended improvements.

5.2.1.3 Scenario 14: July 2016 MDF, 12-inch Main Break – Revised Controls 1

Settings: This scenario simulates the Town's existing distribution system during maximum daily demand using the Revised Controls 1 set, but with a failure in the single 12-inch transmission main that extends past Jockey's Ridge State Park. This is a very real risk in a coastal community where high winds, waves, tides and storm surge can create massive erosion with loss of above and below ground utilities. This main break scenario with the Revised Controls 1 modifications was chosen as the best representation of several controls scenarios that were considered and simulated.

In the Revised Controls 1 set (Table 9 above), the Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels and the Gull Street Pumps are controlled by the levels South Tower. Both pumps at Gull Street operate in tandem albeit with a controlled stagger. This scenario serves as a baseline for a main break because in such an event, the Operators would reconfigure the Eighth Street Pumps to operate from the Eighth Street Elevated Tank water level settings instead of the South Tower. This is consistent with the proposed control logic.

Results: During a main break as described above, the north and south ends of the distribution system are isolated from each other. For practical purposes the Nags Head water system becomes two individual systems until such time as the 12-inch connecting main is restored. The north and south systems each would have a ground storage tank, high service pumps, an elevated tank, distribution mains and customer base. The Eighth Street Pumps will operate based on water level in the Eighth Street Elevated Tank only. The north end of the water system appears to function well as an independent system with low pressures in the 30 – 40 psi range around Villa Dunes while remaining areas are in the 40 – 60 psi range. In addition, high pressures do not exceed 60 psi. Results are summarized in Appendix M.

The major issue of concern during this main break scenario is unacceptably low pressures in the middle of the system from Jockey's Ridge to Pond Island and extending down to roughly 9600 OOIR. The south system has both Pumps 4 and 5 at Gull Street operating based on water levels in the South Tower. The pressures, however, in the middle of the system fall below 0 psi during peak demand hours. Even during non-peak hours, pressures range unacceptably from 0-30 psi. Operating by itself, the south system is not able to generate and transmit sufficient water to support the middle of the system based on the infrastructure assets that are currently in place. Any customer not located in the general area of South Tower can expect severe low pressure issues during maximum day demand conditions. In addition, operating both Gull Street pumps together during the main break condition causes pressure spikes over 100 psi each time they are activated.

Conclusions: Should the 12-inch main along the beach road break in the area of Jockey's Ridge, the middle of the system will be severely underserved with no existing capability to resolve the issue short of repairing the break.

5.2.1.4 Scenario 22: July 2016 MDF, Dual 12-inch Main – Revised Controls 1

Settings: This scenario simulates the Town's maximum daily demand with the Revised Controls 1 set and the addition of a 12-inch main extending around Jockey's Ridge along the bypass road. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels and Gull Street Pumps are controlled by the levels in the South Tower. In addition, both pumps at Gull Street turn on and off in tandem.

Results: When compared to the existing system with existing controls, this scenario shows some reduction in the number of low pressure areas and measurable reductions to the high pressures. Some of the instantaneous low pressure areas at the Village at Nags Head improve slightly to exceed the minimum required pressure of 30 psi. High pressures for the area north of Jockey's Ridge are reduced from 100+ psi to a maximum of 93 psi. Results are tabulated and depicted in Appendix N.

Conclusions: This is a recommended option that can be utilized in the short or intermediate timeframe for improved low and high pressures. In addition, it provides a redundant transmission main extending across Jockeys Ridge State Park to serve as a backup to the single main that currently exists on the beach road. In the event that the existing transmission main is compromised, the parallel main will maintain service at its current level.

5.2.1.5 Scenario 23: July 2016 MDF, New Tank – Revised Controls 1

Settings: This scenario simulated the Town's maximum daily demand in July of 2016 with the Revised Controls 1 set and the addition of a new 500,000 gallon elevated storage tank located near Town Hall. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels, and Gull Street Pumps are controlled by the South Tower water level. In addition, both pumps at Gull Street turn on and off in tandem. This scenario was created to see if the addition of an elevated tank in the center of the distribution would substantially improve existing conditions.

Results: This scenario yielded much improved pressure results. The three primary low pressure areas hold at or above 35 psi for the full 3-day run. High pressures only spike to 85 psi when the new central tank happens to be full while the Gull Street pumps continue to fill South Tower which is for less than a 30 minute period. Normal high pressures are approximately 75 psi. Results are tabulated and depicted in Appendix O.

Conclusions: Based on the results of the current demand scenario, the addition of a centralized tank is a good option for stabilizing system pressures throughout the system. Due to cost, the Town may wish to consider this as a longer term solution as demands escalate in the future.

5.2.1.6 Scenario 24: July 2016 MDF, New Tank – Revised Controls 2

Settings: This scenario simulated the Town's maximum daily demand in July of 2016 with a Revised Controls 2 set and the addition of the new 500,000 gallon elevated storage tank located near Town Hall. Revised Controls 2 are depicted in Table 10 below. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels, and Gull Street Pumps are controlled by the South Tower water level. The Gull Street pumps are set for staggered starting based on separate pump on levels as opposed to the tandem operation of the previous Revised Controls set 1. This scenario was created to see if single operation of a Gull Street pump coupled with the additional elevated tank in the center of the distribution system would substantially improve system pressures.

Table 10 - Revised Controls 2					
	Automatic				Manual
	On		Off		
Pump	Eighth	South	Eighth	South	
1	128.00		139.00		
2					X
3	127.00		139.00		
4		128.00		139.00	
5		127.00		139.00	

Results: This scenario yielded excellent pressure results. The three primary low pressure areas hold at or above 35 psi for the full 3-day run. High pressures do not exceed 65 psi. Gull Street Pump 4, however, is shown to run for an extended period of time in an effort to fill the South Tower and New Tank. As such, having availability of a third pump will allow alternation and equipment backup in the event of a pump failure, and will allow the tanks to be filled more quickly. Results are tabulated and depicted in Appendix P.

Conclusions: This is a recommended controls option to further improve system pressures following installation of a new centralized elevated storage tank.

5.2.2 FUTURE (2028) WATER SYSTEM DEMAND SCENARIOS

The following discussion summarizes the results and conclusions from future demand scenarios. Various improvements were evaluated to determine whether a positive impact was observed on future system operations.

5.2.2.1 Scenario 4: July 2028 MDF - Existing Controls

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with the existing pump control set and existing pipe network, and with no other improvements. Operation of all pumps is controlled by water level settings at the South Tower as depicted in Table 8 above.

Results: Instantaneous low pressures in this scenario are much more pronounced than under current demand conditions. If no piping or control improvements are initiated, the central portion of the distribution system will be poorly served as minimum pressures drop below 30 psi from Jockey's Ridge to Pond Island and even further south. High pressures can be observed between 100 – 110 psi from Eighth Street to Pond Island when the Eighth Street Tank is full and Pumps 1, 4 and 5 are called to run. Results are tabulated and depicted in Appendix Q.

Conclusions: This is a baseline scenario to show what would happen if no improvements were made in ten years with a projected increase in demand from future seasonal population.

5.2.2.2 Scenario 13: July 2028 MDF, Revised Controls 3

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with Revised Controls 3 set for the existing pipe network with no additions or improvements. Revised Controls 3 are summarized in Table 11 below. In this control scenario, the Eighth Street Pumps are activated based on low water level setpoint in the Eighth Street Elevated Tank, and deactivated based on high water level setpoint in the Eighth Street Tank and South Tower. As such the Eighth Street Pumps are engaged until the South Tower is filled. The Gull Street Pumps are activated by a low water level setpoint in the South Tower, and deactivated by a high water level setpoint in the Eighth Street Tank and South Towers. All pumps remain on once engaged until both tanks are filled. The pump-on levels at each station are left staggered and not in tandem.

Table 11 - Revised Controls 3

	Automatic				Manual
	On		Off		
Pump	Eighth	South	Eighth	South	
1	128.00		139.00	139.00	
2					X
3	127.00		139.00	139.00	
4		128.00	139.00	139.00	
5		127.00	139.00	139.00	

Results: The result of this scenario is that one Eighth Street pump operates for a longer period to support the Gull Street Pumps in filling South Tower. As such, the Eighth Street Elevated Tank levels are never in jeopardy as the Eighth Street Pump is keeping it full while trying to fill South Tower. The results of this run are very similar to the Town's current configuration. The Eighth Street Elevated Tank is kept full which stabilizes the north and middle parts of the distribution system while South Tower is being filled to sustain the southern part of the system. Minimum instantaneous pressures dip below 30 psi only around Old Nags Head Cove. The downside, however, is that maximum pressures exceed 100 psi from Eighth Street to Whalebone approximately once daily.

Practically speaking, this scenario represents a minimal controls adjustment in an effort to address future system demands if the Town does not proceed with other improvements options. Results are tabulated and depicted in Appendix R.

Conclusions: This is an option to reduce low pressures in the future by simply changing the control set. However, with extremely high pressures experienced on a daily basis, this is not recommended. Other scenarios yielded results that were even worse. As such, while not the desired results, this control set provides the best results in the absence of physical system improvements.

5.2.2.3 Scenario 18: July 2028 MDF, Dual 12-inch Main – Revised Controls 1

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with the Revised Controls 1 set and the addition of a 12-inch main extending around Jockey's Ridge along the bypass road. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels, and Gull Street Pumps are controlled by the South Tower water level. In addition, both pumps at Gull Street turn on and off in tandem.

Results: This scenario indicates substantially improved operations to meet the future demand. When compared to the existing system with existing controls and future demands, this scenario shows significant reduction in the number of low pressure areas and broad reductions to the high pressures. A few instantaneous low pressure areas are still evident at Villa Dunes, Old Nags Head Cove, and the Village at Nags Head. However, high pressures from Eighth Street to Whalebone Junction are reduced from 100+ psi to a maximum of approximately 85 - 90 psi. Results are tabulated and depicted in Appendix S.

Conclusions: This is a recommended option that can be beneficial in the short-term and long-term for improved low and high pressures. In addition, it provides a redundant transmission main extending across Jockeys Ridge State Park to serve as a backup to the single main that currently exists on the Beach Road. In the event that the existing transmission main is compromised, the parallel main will maintain service at its current level.

5.2.2.4 Scenario 8: July 2028 MDF, Parallel 12-inch – Revised Controls 1

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with the Revised Controls 1 set and the addition of a longer 12-inch parallel water main extending around Jockey's Ridge along the bypass road to the Eighth Street Elevated Tank. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank water levels, and Gull Street Pumps are controlled by the South Tower water levels. Both pumps at Gull Street turn on and off in tandem. This scenario was created to determine if substantive hydraulic improvements were achieved by installation of a longer parallel 12-inch line located between the pump station and the water plant.

Results: This scenario yielded results that are very similar to Scenario 18 with the shorter 12-inch dual main connection. High and low pressures were essentially the same, and the results are tabulated and depicted in Appendix T.

Conclusions: The longer parallel 12-inch main is not a recommended option as the shorter 12-inch dual connection appears to produce similar results, and would be less expensive to construct. No worthwhile advantages were observed to justify installing the longer, more expensive 12-inch transmission main.

5.2.2.5 Scenario 21: July 2028 MDF, New Tank – Revised Controls 1

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with the Revised Controls 1 set and the addition of a new 500,000 gallon elevated storage tank located near Town Hall. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels, and the Gull Street Pumps are controlled by the South Tower water levels. Both pumps at Gull Street turn on and off in tandem. This scenario was created to determine if the addition of an elevated tank in the center of the distribution system would substantially improve operations under the future demand conditions.

Results: This scenario yielded significantly improved pressure results. The three primary low pressure areas hold at or above 35 psi for the full 3-day run. High pressures approach 85 psi for only a short period of time when the new central tank is filled while the Gull Street pumps continue to fill South Tower. Normal high pressures are around 75 psi. Results are tabulated and depicted in Appendix U.

Conclusions: Based on the results of the future demand scenario, the addition of a centralized tank is a good option for stabilizing system pressures throughout the system. This is a recommended option to resolve pressure issues in the future.

5.2.2.6 Scenario 25: July 2028 MDF, New Tank – Revised Controls 4

Settings: This scenario simulates the Town's maximum daily demand in July of 2028 with the Revised Controls 4 set and the addition of a new 500,000 gallon elevated storage tank located near Town Hall. The Revised Controls 4 set is depicted in Table 12 below. The Eighth Street Pumps are controlled by the Eighth Street Elevated Tank levels, and the Gull Street Pumps are controlled by the New EST water levels. The pumps at Gull Street include a staggered start based on tank level. The controls are as indicated below:

Table 12 - Revised Controls 4					
	Automatic				Manual
	On		Off		
Pump	Eighth	New	Eighth	New	
1	128.00		139.00		
2					X
3	127.00		139.00		
4		128.00		139.00	
5		127.00		139.00	

Results: This scenario yielded excellent pressure results. The three primary low pressure areas hold at or above 35 psi for the full 3-day run. High pressures approach 75 psi for only a short period of time when the new central tank is filled while the Gull Street pumps continue to fill South Tower. Normal high pressures are around 60 – 65 psi. Gull Street Pump 4 is shown to run for an extended period of time. As such, having availability of a third pump will allow alternation and equipment backup in the event of a pump failure. Results are tabulated and depicted in Appendix V.

Conclusions: As demand increases in the future, this is a recommended controls option to further improve system pressures following installation of a new centralized elevated storage tank.

5.2.3 FIRE FLOW MODEL SCENARIOS

Fire flow analysis operates differently than EPS runs. They are not simulated for an extended period; they operate as a "steady-state" simulation. Similarly, they use the pumps and the tank levels set in the model, but only for a "snapshot" in time, without an extended time frame. WaterGEMS tests every individual hydrant multiple times to determine the maximum flow available at a given residual pressure. Pursuant to Public Water Supply requirements the residual pressure is set at a minimum of 20 psi. Test iterations continue for each individual hydrant until the residual pressure fails to meet the specified minimum criteria, resulting in the "fire flow available" for the set conditions.

The fire flow scenarios were created to identify possible fire flow deficiencies and the need for potential improvements. Separate runs were conducted for 2016 and 2028 demand conditions. Similar areas were identified as deficient based on criteria previously provided by the Town of Nags Head Fire Department. As expected, available fire flow is slightly less in 2028 than current based on increased future consumptive demand.

Appendix W includes a 2011 letter from the Nags Head Fire Department documenting their desire for an available fire flow of 1,000 gpm at each fire hydrant located within the distribution system. As such, a fire flow demand of 1,000 gpm was assigned for testing of all 500 +/- hydrants in the Town's GIS data set and three (3) within the National Park Service. This fire demand is imposed on top of the existing maximum day domestic demand for the applicable year of service. In addition, a minimum required residual pressure of 20 psi was assigned to restrict the available fire flow for each hydrant and to comply with Public Water Supply requirements.

Appendix W also includes schematic representations of the fire flow test results for the existing system, as well as with potential system improvements. Junction nodes depicted by the color red failed to produce the desired 1,000 gpm fire flow demand at 20 psi residual system pressure. The available fire flow at minimum residual pressure is listed in black adjacent to the junction node. All of the junction nodes depicted by the color green passed the fire flow test, and were able to produce at least 1,000 gpm fire flow at 20 psi residual pressure. A few green colored junction nodes include an associated flow value. These junction nodes exhibit fire flows that oscillate above or below 1,000 gpm depending on the specific scenario run. The available fire flow figures were retained for reference.

The following piping modifications were identified as potential system improvements to increase available fire flow in deficient areas. In some cases, the improvement will attain the desired 1,000 gpm fire flow based on 2016 demand. In other cases, 1,000 gpm cannot be readily attained, but available fire flow is increased by installation of the improvement. In either case, the Town will need to decide whether the improved fire flow capability is justified by the associated improvements cost.

A. **W. Carolinian Circle –** Extension of approximately 600 LF of new 6-inch diameter water line on W. Carolinian Circle to complete a looped connection. Available fire flow increases from approximately 830 gpm to approximately 1,070 gpm under existing MDF conditions.

B. **Villa Dunes –** Replace the existing 6-inch diameter water line with approximately 5,570 LF of new 8-inch diameter water line from S. Croatan Hwy (U.S. Hwy 158) to the end of Villa Dunes Drive. In addition, replace approximately 1,320 LF of 6-inch diameter water line with 8-inch diameter water line extending westward from Villa Dunes Drive along S. Old Nags Head Wood Road. Available fire flow increases from a range of approximately 635 – 900 gpm to a range of approximately 1,080 – 1,400 gpm.

C. **Soundside & Baracuda –** Extend 450 LF across private property to connect a new 6-inch diameter water line between the existing water mains located on W. Soundside Rd. and W. Baracuda Rd. to improve the Old Nags Head Cove Area. Available fire flow increases from a range of approximately 790 – 990 gpm to a range of approximately 880 – 1,410 gpm.

D. **Cobia Way Area –** Replace approximately 4,450 LF existing 6-inch diameter Asbestos Cement (AC) water line with new 8-inch diameter water line from U.S. Hwy 158 along W. Old Cove Rd, Cobia Way, W. Sandpiper Terrace, S. Roanoke Way, and the 6-inch connection to S. Links Drive across the golf course. Available fire flow increases from a range of approximately 790 – 930 gpm to a range of approximately 880 – 1,060 gpm.

E. **Ocean Watch Court Area –** Replace approximately 400 LF of existing 2-inch diameter water main that serves E. Baymeadow Drive with new 6-inch diameter water main located on the east side of S. Virginia Dare Trail directly across from Ocean Watch Court. Available fire flow increases from a range of approximately 850 – 995 gpm to a range of approximately 1,400 – 1,900 gpm.

F. **Lone Cedar Court –** Extend approximately 1,400 LF of new 8-inch diameter water main and replace existing 6-inch diameter water line on Lone Cedar Court. New 8-inch diameter water main will extend from the Virginia Dare Trail Causeway into Lone Cedar Court. Available fire flow increases from a range of approximately 730 – 845 gpm to a range of approximately 955 – 1,015 gpm. These results depend on the installation of the Pond Island extension discussed below.

G. **Pond Island –** Extend approximately 8,400 LF of new 8-inch diameter water line to W. Marina Drive at Pond Island to create an 8-inch loop. New 8-inch diameter water main will extend from the existing 12-inch diameter main on U.S. Hwy 158 near E. Gray Eagle Street along the Virginia Dare Trail Causeway to W. Marina Drive. Available fire flow increases from a range of approximately 555 – 955 to a range of approximately 855 – 1525 gpm.

H. **S. Colony South Drive –** Replace approximately 4,300 LF of existing 6-inch diameter water main loop with new 8-inch diameter water main along portions of the north and south ends of S. Colony South Drive off S. Old Oregon Inlet Road. Available fire flow increases from a range of approximately 860 – 990 to a range of approximately 900 – 1,100 gpm.

I. **Miscellaneous Fire Hydrant Installations** – Install new fire hydrants at various underserved locations throughout the distribution system based on the recommendation of the Nags Head Fire Department.

5.2.4 WATER AGE MODEL SCENARIOS

Water age is the time spent by a discrete water particle in the distribution network. Water age simulation serves as a simple, non-specific measure of the overall quality of delivered drinking water. Extensive water age can be a significant contributor to water quality issues and concerns. There is no specific maximum water age for a public water system although the American Water Works Association (AWWA) recommends a water age of less than seven (7) days. A reasonable water age depends on many factors including raw water quality, type of treatment provided, size of the system, etc.

Water age in the Nags Head distribution system was evaluated as a reflection of potential water quality concerns. Water age scenarios were created for periods of low and high demand in Calendar Year 2016. The results of these scenarios are included in Appendix X.

In these water age analyses, all water age is assumed equal to zero at the start of simulation as water enters the distribution system through the high service pumps. In the case of the Nags Head water system, the water has already aged some as it is produced by Dare County, travels through the Dare County transmission mains, and resides in the Ground Storage Tanks for a period of time. As time progresses and water is transported throughout the piping network, a balance is achieved between newer water coming in and older water being consumed. Flushing operations are not taken into consideration as the effort is to identify the problematic areas within the system that may or may not be near a routinely flushed area.

During the summer vacation months, water age is a non-issue. The modeled scenario for maximum day flow conditions in July 2016 indicates the oldest water age to be near the south end of Town (4 days) and even further south towards the Oregon Inlet Fishing Center (9 days) where there is very little water demand. The north and middle sections of Town see ages anywhere from less than one day to two days. Water age in July 2028 is slightly less as the consumptive demand increases in the future.

Similar trends were apparent when analyzing results for minimum day flow conditions in February 2016. However, increased water ages result as off-season demand is significantly reduced. The water age in the north and the middle portions of the system stabilize at approximately 9 days maximum. Water age in the Pond Island area reaches 18 days. The south end of the system suffers from significantly high water age issues. There is simply not enough demand at the south end of the system to turn the water over in the South Tower within a reasonable time. Under current conditions, water age at the south end exceeds 45 days. Again, in February 2028, water age is proportionally less as demand has increased.

A few interim improvements were simulated to determine if simple changes in pump controls or tank levels could improve water age conditions. First, it was established that only one pump is necessary to operate in February with the low demand, so the Town is able to select which station to operate, either the Eighth Street Water Plant or the Gull Street Pump Station. Based on the goal of minimizing water age, it is better to operate the Eighth Street high service pump. Due to its location on the northern extremity, it transmits the newer water southward through the entire distribution system. Since the Gull Street Station is located in the middle of the distribution system, it transmits water in two different directions which promotes increased water age to the north and the south as older water is stored in both elevated tanks.

Additional scenarios were conducted to review the impact of an additional centralized elevated storage tank on water age. As one might expect, the additional volume of water in storage increases overall water age when the demand is constant. In the existing and future demand scenarios, water age increases in the central part of Town in the vicinity of the new tank while water age in the southern portion of the system decreases. In this scenario, water is stored more uniformly across the system to meet the demands in the immediate vicinity of each tank thereby reducing water age. As before, water age is reduced proportionally in the future as the demand for water increases. In addition, the impact of the new tank on water age is more pronounced in February than in July. In February 2016, water age increases from approximately 9 days to 14 days in the center of Town while decreasing from 43 days to 34 days at the south end of Town. In February 2028, water age is reduced to approximately 12 and 32 days, respectively.

In another scenario, the maximum water level in the elevated tanks was lowered by five (5) feet to determine the impact to water age. If the Gull Street Pump Station is maintained as the primary off-season pump station, no positive impacts were observed. However, if the Eighth Street Water Plant is selected as the primary, maximum water age for the south end of Town is curbed slightly. It does not resolve the water age issue, but it is an improvement over doing nothing.

The water age at the Oregon Inlet Fishing Center and U.S. Coast Guard Station is quite large (> 90 days). These facilities are served from the most remote southern end of the Nags Head water system. High water age can be attributed to the lengthy distance and pipe sizes required to serve a very small consumptive demand resulting in very slow water movement. The figures in Appendix X have an age cap of 45 days because that was the specified extent of the simulation. Additional scenarios were performed for a 90 day run, in which the ages for the National Park Service area continued to reach the maximum age the simulation would allow.

The linear arrangement and seasonal operational characteristics of the Nags Head water system limit the options that are available to reduce water age as a means to improve water quality. Certainly, the following efforts would be beneficial if they can be practically accomplished:

- reduce the volume of water stored in the off-season by reducing water levels in the ground storage tanks and/or elevated tanks,
- pump primarily from the Eighth Street Water Plant during the off-season while pumping just enough from the Gull Street station to promote water turnover,
- continue to promote mixing and water turnover by use of the tank mixers,
- continue to flush dead end lines to minimize stagnation and promote water turnover.

6.0 CRITICALITY ASSESSMENT

A criticality assessment is the process by which key assets and infrastructure are identified that support the purposes and capabilities of the Nags Head Public Works Department's Water Operations and Water Distribution Divisions. The criticality assessment evaluates the potential impact that loss of a particular water system asset has on system performance and customer service capability. It is a qualitative measure of how crucial and essential the asset is to continued provision of potable water service within the community.

The criticality assessment considers (1) the risk of system component failure versus and (2) the consequence of such a failure. A rating system is utilized to assign a weight to each factor that contributes to total risk or total consequence. Total risk and total consequence are the sum of the individual ratings for each applicable factor as described below. For this assessment, a total risk of failure scale was assigned a range of 0 – 23, while the total consequence of failure was assigned a range of 0 – 9. Greater risk and greater consequence are each represented by the higher numerical magnitude.

The composite criticality rating is derived by multiplying the total risk of failure by the total consequence of failure. As such, the criticality rating could range from 0 – 207 (0 x 0 = 0, 23 x 9 = 207). This can be represented graphically by a matrix where higher values represent greater criticality and lower values represent lesser criticality. The assignment of threshold values from low to extreme is subjective, and intended only to reflect increasing criticality as the magnitude increases.

Risk of Failure --->	Consequence of Failure ---->									
	0	1	2	3	4	5	6	7	8	9
23	0	23	46	69	92	115	138	161	184	207
22	0	22	44	66	88	110	132	154	176	198
21	0	21	42	63	84	105	126	147	168	189
20	0	20	40	60	80	100	120	140	160	180
19	0	19	38	57	76	95	114	133	152	171
18	0	18	36	54	72	90	108	126	144	162
17	0	17	34	51	68	85	102	119	136	153
16	0	16	32	48	64	80	96	112	128	144
15	0	15	30	45	60	75	90	105	120	135
14	0	14	28	42	56	70	84	98	112	126
13	0	13	26	39	52	65	78	91	104	117
12	0	12	24	36	48	60	72	84	96	108
11	0	11	22	33	44	55	66	77	88	99
10	0	10	20	30	40	50	60	70	80	90
9	0	9	18	27	36	45	54	63	72	81
8	0	8	16	24	32	40	48	56	64	72
7	0	7	14	21	28	35	42	49	56	63
6	0	6	12	18	24	30	36	42	48	54
5	0	5	10	15	20	25	30	35	40	45
4	0	4	8	12	16	20	24	28	32	36
3	0	3	6	9	12	15	18	21	24	27
2	0	2	4	6	8	10	12	14	16	18
1	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0

LOW	MEDIUM	HIGH	EXTREME

Figure 1 – Criticality Rating Matrix

6.1 CONDITION/RISK ASSESSMENT

The risk associated with system component failure is a function of several factors related to condition of the asset. The factors utilized for this water system condition assessment include (1A) Condition Rating, (1B) Capacity Rating, (1C) Service Life Consumed, and (1D) Level of Redundancy.

Condition assessment and rating are important parts of the process as they provide the basis for determining needed repairs, rehabilitation, and replacement decisions. This condition assessment provides information on the current status of equipment, piping, etc, as well as the expected future performance. Condition assessment techniques included visual inspection, discussions with the Operators, review of the maintenance history and manufacturer's data. The opinions and judgment of operations and maintenance staff are key as they are the most knowledgeable about the water system equipment and facilities.

"Condition Rating" takes into account the extent of defects and needed repairs. Table 13 lists the rating score range from zero for the asset performing like new to five for the asset being unserviceable.

Table 13 – (1A) CONDITION RATING

Condition Rating	Condition / Description	Maintenance Required
0	New	Normal
1	Excellent Condition	Normal
2	Minor Defects	Minor
3	Significant Maintenance Required	Significant
4	Requires Major Renewal	Renew
5	Almost Unserviceable	Replace

"Capacity Rating" evaluates whether the asset is of sufficient capacity to meet current and future needs. Table 14 lists the rating score range from zero for the asset being undersized for the required capacity to five for the asset being sized for future requirements.

Table 14 – (1B) CAPACITY RATING

Rating	Capacity	Description
0	Oversized	Meets future requirements
2	Full sized	Meets current requirements
5	Undersized	Cannot meet current requirements

"Service Life Consumed" is also estimated. The remaining useful life of an asset depends upon its expected term of service, current condition, environmental conditions, maintenance history, and extent of needed service. This rating is important as it relates to the probability of asset failure. Table 15 lists the rating score range from zero representing full service life to ten meaning no service life remains.

Table 15 – (1C) SERVICE LIFE CONSUMED

Rating	Percent of Service Life Consumed
0	0
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	100

A final factor that affects the risk of component failure is the "Level of Redundancy". This factor accounts for the availability of backup equipment, piping, etc. that are available or in service in the event of a failure. Table 16 lists the rating score range from zero for 200% redundancy to three for no redundancy.

Table 16 – (1D) LEVEL OF REDUNDANCY

Probability of Failure Reduction (%)	Level of Redundancy / Description
0	200% Backup / Capacity
1	100% Backup / Capacity
2	50% Backup / Capacity
3	No Backup / Capacity

6.2 CONSEQUENCE OF FAILURE CRITERIA

The consequences associated with system component failure can be significant. Part of the mission of all N.C. public water system owners and N.C. certified water treatment operators is to protect the public investment in their water treatment and distribution facilities, and to ensure that safe, potable water is available in adequate quantities to residents and visitors by assuring that the systems are properly operated and maintained. The factors utilized to evaluate the consequences of component failure include (2A) Water Deliver Capability, (2B) Health and Safety, and (2C) Environmental Implications.

"Water Delivery Capability" relates to the number of people impacted by the failure or how critical is the nature of the water service customer, i.e. hospital, etc. Table 17 lists the rating score range from zero which indicates no impact to three for total system failure.

Table 17 – IMPACT OF FAILURE – (2A) Water Delivery Capability	
Impact Rating	**Description**
0	No Impact – Serves no critical customers and low percent of customer base
1	Minor System Failure – Serves no critical customers but medium percent of customer base
2	Major System Failure – Serves critical customers or high percent of customer base
3	Total System Failure – Serves critical customers and high percent of customer base

When clean potable water is unavailable, the "Health and Safety" of the public can be jeopardized. For this factor, Table 18 lists a score range of zero to represent no impact while a score of three suggests significant health and safety impact.

Table 18 – IMPACT OF FAILURE – (2B) Health & Safety	
Impact Rating	**Description**
0	No Impact to health or safety of customers
1	Failure creates minimal impact to customer health or safety or to low percent of customers
2	Failure creates intermediate impact to customer health or safety or to medium percent of customer base
3	Failure significantly jeopardizes health and safety or to large percent of customer base

"Environmental" impacts can also be observed when utility infrastructure failures occur. In this case, Table 19 lists a rating of zero to represent no impact while a rating of three is a high environmental impact.

Table 19 – IMPACT OF FAILURE – (2C) Environmental	
Impact Rating	**Description**
0	No Impact
1	Permit Violation
2	Low Environmental Impact
3	High Environmental Impact

6.3 WATER SYSTEM ASSET ASSESSMENT

Appendix Y includes the Water System Asset Condition and Criticality Assessment spreadsheets. Within these spreadsheets each substantive water system component is evaluated by rating each contributing factor which results in a composite criticality score. Based on the magnitude of the criticality score each asset is ranked as a higher or lower priority in terms of needed response. An asset with a high criticality ranking is considered essential and in greater need of attention. Highly critical assets that fail may cause significant interruptions to normal water delivery which can lead to serious public health, safety and environmental concerns. On the other hand, an asset with a low criticality ranking is less prone to cause consequential negative impacts in the short term.

For distribution piping systems, large transmission pipes frequently are ranked as a higher priority due to their greater capacity to serve than smaller distribution pipes. However, in some cases the larger transmission mains may not be in imminent danger of failure. As such, water main improvement recommendations are not necessarily offered simply due to final criticality rating; rather, additional factors such as the results of the hydraulic analysis influence the recommendations offered.

Asset management, including condition assessment and criticality assessment, are not static measures, rather the risk and consequences of failure continue to evolve as the assets age. As such, asset management should be revisited every five (5) years to reassess changes to the assets and associated priorities that are expected at a later point in time.

7.0 RECOMMENDATIONS AND COST ESTIMATES

On the basis of the results of the Hydraulic Model and Analysis, Inspection, and Condition/Criticality Assessment, the following improvements are recommended. Cost estimates for each individual infrastructure improvement are included in Appendix Z.

7.1 WATER STORAGE

7.1.1 Elevated Storage Tank Rehabilitation – Periodic rehabilitation of steel elevated storage tanks are required in order to protect from the corrosive coastal environment, and to extend the useful service life of the structure. Delaying rehabilitation to the point that coating adhesion failure occurs will significantly increase rehabilitation costs. The South Tower should be rehabilitated immediately followed by Eighth Street EST 2-3 years later.

The total estimated project costs are as follows:

Estimated Cost = $274,450 (South Tower EST)
Estimated Cost = $274,450 (Eighth Street EST)

7.1.2 New Elevated Tank near Town Hall – Installation of a new elevated storage tank in the central portion of the water system (near Town Hall) provides the best long term, stable solution for meeting present and future demands while increasing low pressures in the central portion of the system and reducing high pressures to a more typical and acceptable range. An altitude valve and pressure transducer would be installed to provide proper water level monitoring and control of the high service pumps with the new tank in service.

The total estimated project cost is $2,920,000.

7.2 EIGHTH STREET WATER PLANT

7.2.1 Install Auto-Transfer Switch for Emergency Generator – The existing manual transfer switch at the Eighth Street Water Plant does not meet National Electric Code requirements. An automatic transfer switch is required for a permanently mounted emergency generator to automatically start and supply backup power during a power outage without service disruption.

The total estimated project cost is $25,000.

7.2.2 Replace Gas Chlorine Disinfection System – Install liquid sodium hypochlorite feed systems to replace the existing gas chlorine system. Although the existing gas chlorine disinfection systems is functional, chlorine gas is a safety hazard that can be extremely harmful to operators or the public if a leak were to occur. Liquid sodium hypochlorite is much safer to handle and store.

The total estimated project cost is $108,000.

7.3 GULL STREET PUMPING STATION

7.3.1 New High Service Pump at Gull Street Pump Station – Installation of an additional high service pump at the Gull Street Pump Station along with minor controls modifications is recommended to provide greater pumping capacity toward the south end of Nags Head in the short or intermediate timeframe. These improvements reduce the number of low pressure areas in the central part of the system while significantly decreasing high pressures between Eighth Street and Pond Island. These improvements also work well in the future as demand increases and a new central elevated tank is installed.

The total estimated project cost is $276,000.

7.3.2 Upgrade Electrical Equipment at Gull Street Pump Station – Installation of a new high service pump at the Gull Street Pump Station provides an excellent opportunity to also upgrade the electrical equipment. The electrical equipment at Gull Street is approximately 36 years old.

Motor Control Center/Variable Frequency Drives – Replace Electrical Motor Control Center and install Variable Frequency Drives at Gull Street Pump Station to replace aging equipment, improve pumping control, and recognize energy savings.

The total estimated project cost is $600,000.

Emergency Generator/Auto-transfer Switch – Replace Emergency Standby Generator and Auto-transfer Switch at Gull Street Pump Station to replace aging equipment, and improve emergency standby capability and safety.

The total estimated project cost is $365,000.

7.3.3 Replace Gas Chlorine Disinfection System – Install liquid sodium hypochlorite feed systems to replace the existing gas chlorine system. Although the existing gas chlorine disinfection systems is functional, chlorine gas is a safety hazard that can be extremely harmful to operators or the public if a leak were to occur. Liquid sodium hypochlorite is much safer to handle and store.

The total estimated project cost is $108,000.

7.4 WATER DISTRIBUTION

7.4.1 Install 12-inch Water Main on U.S. Hwy 158 from W. Danube Street to Diamond Street – Installation of new 12-inch water main along U.S. Hwy 158 will connect two existing 12-inch water mains located to the north and south. This will provide a level of redundancy should the existing 12-inch on the Beach Road break, as the existing 8-inch and new 12-inch mains will still be available for provision of service.

The total estimated project cost is $235,000.

7.4.2 Replace 6-inch AC Water Main on Barnes Street beneath Bypass Road – This location has been identified by the Town as an area of concern and the Town plans to take the necessary steps for its implementation in the coming years. The proposed work is comprised of replacing the 6-inch AC pipeline along Barnes Street from the Beach Road to the entrance of Vista Colony, extending beneath U.S. Hwy 158 (Bypass Road).

The total estimated project cost is $235,000.

7.4.3 Install Dual 12-inch Water Main on South Croatan Hwy around Jockey's Ridge – Installation of a dual 12-inch water main around Jockey's Ridge will improve an inherent weakness of the existing distribution system. Not only does the dual main provide redundancy in the event of a main break, but it reduces the number of low pressure areas, and reduces the magnitude of high pressures experienced within the system.

The total estimated project cost is $625,000.

7.4.4 Replace Asbestos Cement Pipelines throughout Town – AC pipelines are thought to have a lifespan of approximately 70 years, but actual service life depends on the pipe condition and working environment. The majority of the Town's AC pipelines were installed in the 1960's and are located in the older areas and neighborhoods in Town. This includes all of the Wrightsville Avenue and Memorial Avenue area, Vista Colony, and Nags Head Cove. In addition, 8" AC pipeline is installed on portions of the east side of Old Oregon Inlet Road (OOIR) from 9600 OOIR to McCall Court. The pipelines are approaching 60 years of age, and must sustain higher than normal pressures. Systematic replacement of all AC pipelines will be required in the coming years. Please note that the aforementioned replacement of 6-inch AC on Barnes Street is a portion of the Wrightsville Ave. and Memorial Ave. area.

The total estimated project cost is as follows:

Estimated Cost = $2,548,000 (Wrightsville Ave and Memorial Ave area)
= $ 936,000 (Vista Colony area)
= $1,934,000 (Old Nags Head Cove area)
= $ 735,000 (Old Oregon Inlet Road)
= $6,153,000 (Total)

7.4.5 2018 WSCP Update – Update the 2018 Water System Comprehensive Plan including the hydraulic analysis, asset condition and criticality assessment, and Water System Capital Improvements Plan. This effort should be undertaken on a five year interval to account for changes impacting the water system.

The total estimated project cost is $60,000

7.4.6 System Development Fee Study – Update System Development Fee Study to establish and document revisions to the system development fee schedule to fund capital expenses associated with new development activities in Town. State statutes require this effort to be undertaken every five years.

The total estimated project cost is $13,200

7.4.7 Fire Flow Improvements – The following piping modifications will increase available fire flow in deficient areas. In some cases, the improvement will attain the desired 1,000 gpm fire flow. In other cases, available fire flow is increased but not to the Fire Department's desired level of service. The improvements and associated costs are as follows:

W. Carolinian Circle – Extension of approximately 600 LF of new 6-inch diameter water line on W. Carolinian Court to complete a looped connection. Available fire flow increases from approximately 830 gpm to approximately 1,070 gpm under existing MDF conditions.

The total estimated project cost is $54,000.

Villa Dunes – Replace the existing 6-inch diameter water line with approximately 5,570 LF of new 8-inch diameter water line from S. Croatan Hwy (U.S. Hwy 158) to the end of Villa Dunes Drive. In addition, replace approximately 1,320 LF of 6-inch diameter water line with 8-inch diameter water line extending westward from Villa Dunes Drive along S. Old Nags Head Wood Road. Available fire flow increases from a range of approximately 635 – 900 gpm to a range of approximately 1,080 – 1,400 gpm.

The total estimated project cost is $590,000.

Soundside & Baracuda – Extend 450 LF across private property to connect a new 6-inch diameter water line between the existing water mains located on W. Soundside Rd. and W. Baracuda Rd. to improve the Old Nags Head Cove Area. Available fire flow increases from a range of approximately 790 – 990 gpm to a range of approximately 880 – 1,410 gpm.

The total estimated project cost is $64,000.

Cobia Way Area – Replace approximately 4,450 LF existing 6-inch diameter Asbestos Cement (AC) water line with new 8-inch diameter water line from U.S. Hwy 158 along W. Old Cove Rd, Cobia Way, W. Sandpiper Terrace, S. Roanoke Way, and the 6-inch connection to S. Links Drive around the golf course. Available fire flow increases from a range of approximately 790 – 930 gpm to a range of approximately 880 – 1,060 gpm.

The total estimated project cost is $505,000.

Ocean Watch Court Area – Replace approximately 400 LF of existing 2-inch diameter water main that serves E. Baymeadow Drive with new 6-inch diameter water main located on the east side of S. Virginia Dare Trail directly across from Ocean Watch Court. Available fire flow increases from a range of approximately 850 – 995 gpm to a range of approximately 1,400 – 1,900 gpm.

The total estimated project cost is $87,000.

Lone Cedar Court – Extend approximately 1,400 LF of new 8-inch diameter water main and replace existing 6-inch diameter water line on Lone Cedar Court. New 8-inch diameter water main will extend from the existing 12” diameter main on U.S. Hwy 158 near E. Gray Eagle Street along the Virginia Dare Trail Causeway into Lone Cedar Court. Available fire flow increases from a range of approximately 730 – 845 gpm to a range of approximately 955 – 1,015 gpm.

The total estimated project cost is $175,000.

Pond Island – Extend approximately 8,400 LF of new 8-inch diameter water line to W. Marina Drive at Pond Island to create an 8-inch loop. New 8-inch diameter water main will extend from the existing 12" diameter main on U.S. Hwy 158 near E. Gray Eagle Street along the Virginia Dare Trail Causeway to W. Marina Drive. Available fire flow increases from a range of approximately 555 – 955 to a range of approximately 855 – 1525 gpm.

The total estimated project cost is $825,000.

S. Colony South Drive – Replace approximately 4,300 LF of existing 6-inch diameter water main loop with new 8-inch diameter water main along portions of the north and south ends of S. Colony South Drive off S. Old Oregon Inlet Road. Available fire flow increases from a range of approximately 860 – 990 to a range of approximately 900 – 1,100 gpm.

The total estimated project cost is $587,000.

Miscellaneous Fire Hydrant Installations – Install new fire hydrants at various underserved locations throughout the distribution system based on the recommendation of the fire department.

The total estimated project cost is as follows:

Estimated Cost = $18,600 (Buccaneer/Windjammer and Windjammer/Lookout
= $20,000 (Sandpiper Terrace/Roanoke and Chippers Court #1)
= <u>$20,000</u> (Chippers Court #2 and Old Oregon Inlet/Westside)
= $58,600

8.0 CAPITAL IMPROVEMENTS PLAN

The Town of Nags Head routinely maintains a 5-year Capital Improvements Plan (CIP) to disclose costs or expenditures associated with anticipated capital improvements; identify probable sources of financing; evaluate, prioritize and schedule projects or acquisitions; and estimate the potential impact to the operating budget.

In order to facilitate long-term water system planning and to provide sound recommendations for the most critical water infrastructure needs and infrastructure projects, a 10-year CIP (in accordance with State guidance) has been prepared and included as part of this Water System Comprehensive Plan.

The needs, recommendations and associated costs for high priority assets have been established as part of the preparation of this Water System Comprehensive Plan. A review meeting was conducted with Town Officials and Staff on April 25, 2018 to discuss the preliminary findings of the hydraulic analysis and system assessment. Based on additional input received from the Town, final recommendations were prioritized as short-term, intermediate, and long-term within the proposed CIP. Each of the items that are considered of sufficient criticality to address within the next ten years have been reduced to individual CIP requests and included in Appendix AA. Each year as the Town begins preparation of the annual budget, the CIP should be re-evaluated and recommendations for water system improvements considered relative to current operations and condition. Should circumstances support submittal of the CIP request, then the individual sheets can be utilized with adjustments as required to support the individual requests.

9.0 WSCP UPDATE

The Water System Comprehensive Plan, including the Hydraulic Analysis, the Asset Condition and Criticality Assessment, and the Capital Improvements Plan, are not static documents. The Town's water system, like any utility infrastructure, is constantly changing based on age, condition, maintenance, changing system demands, etc. As such, re-evaluation is recommended and periodically required in order for the documents to remain useful in coming years.

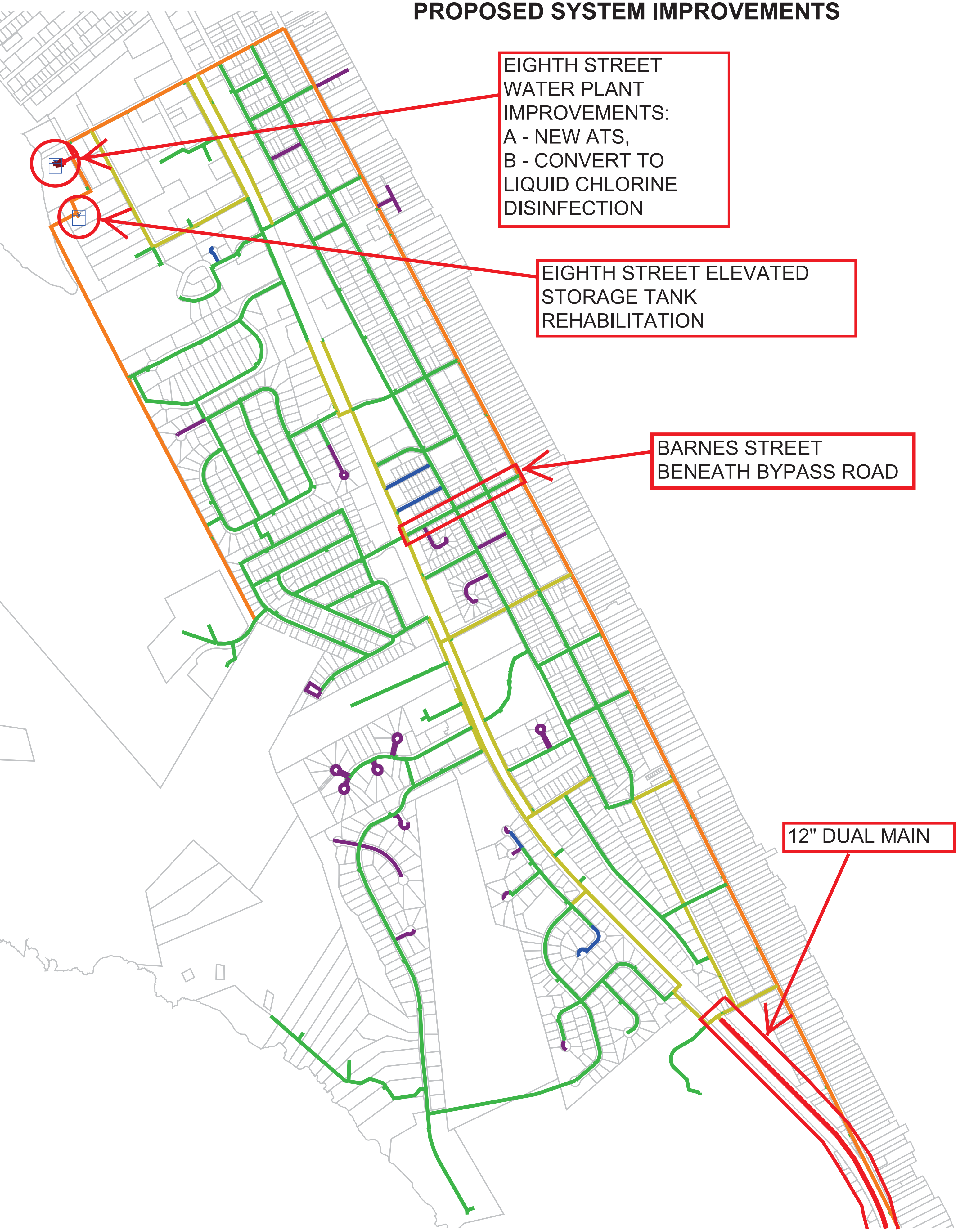
It is recommended that the WSCP be reviewed and updated at a minimum of five (5) year intervals.

APPENDIX

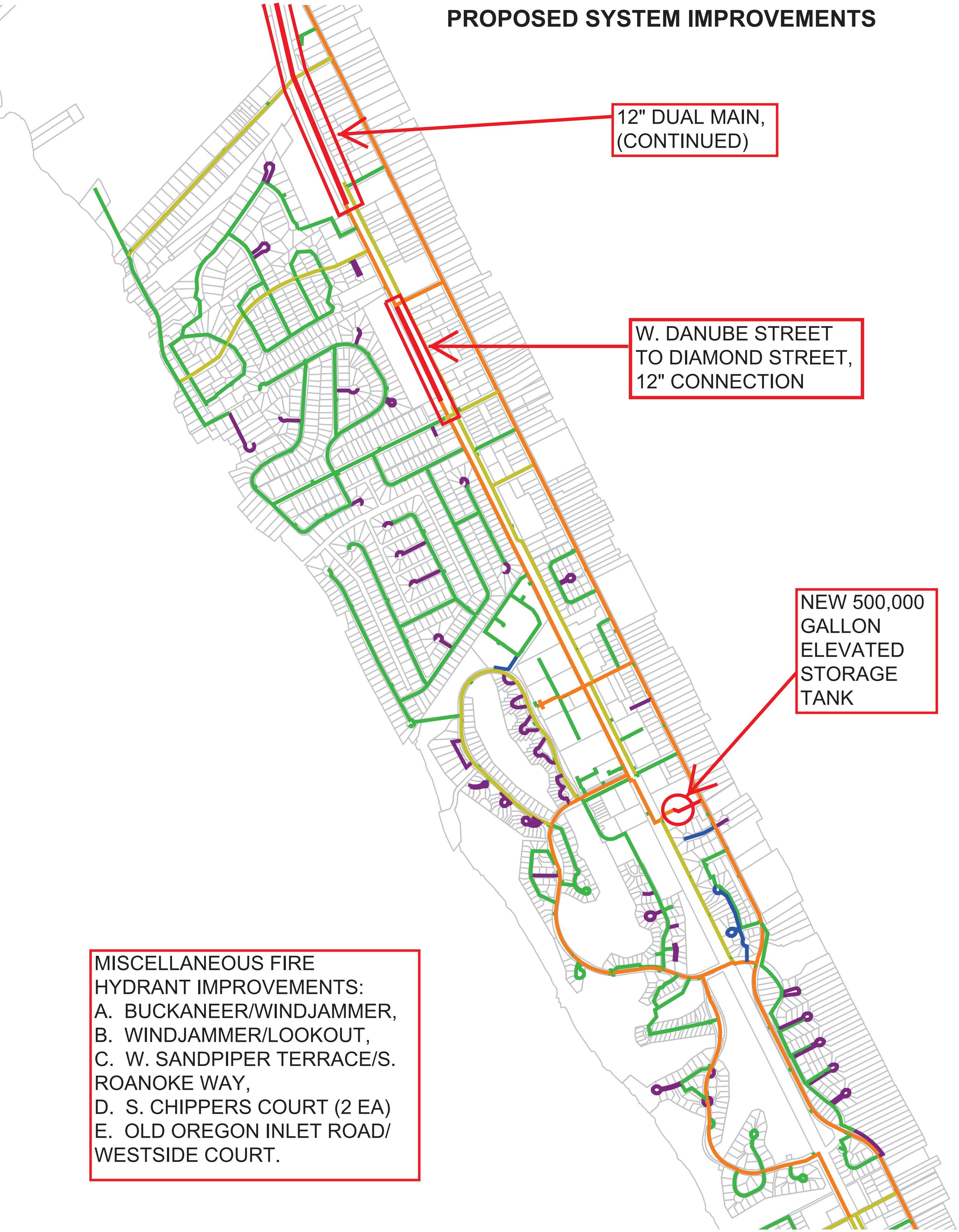
A

Water System Improvements Maps

PROPOSED SYSTEM IMPROVEMENTS



PROPOSED SYSTEM IMPROVEMENTS



PROPOSED SYSTEM IMPROVEMENTS

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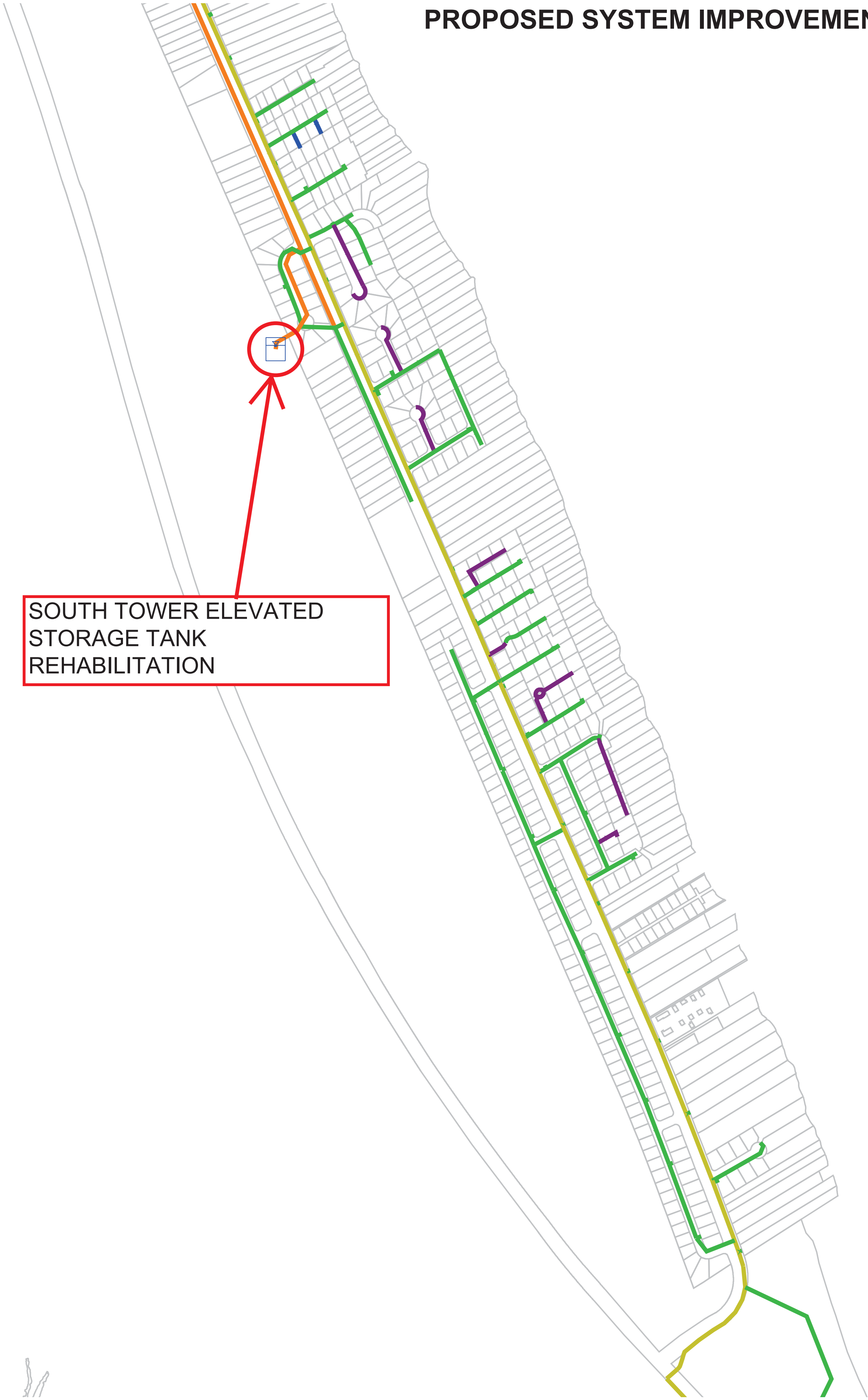
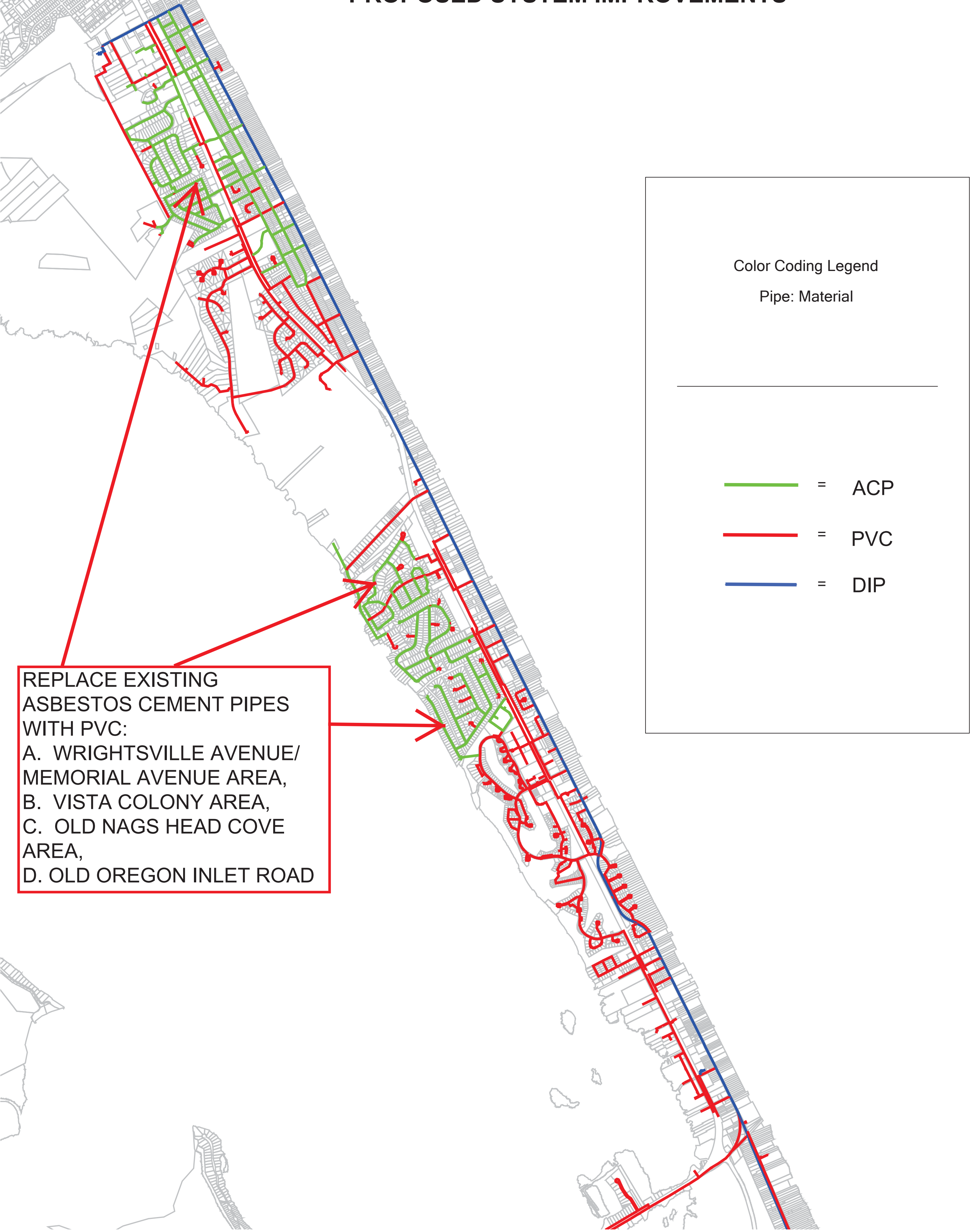


PROPOSED SYSTEM IMPROVEMENTS



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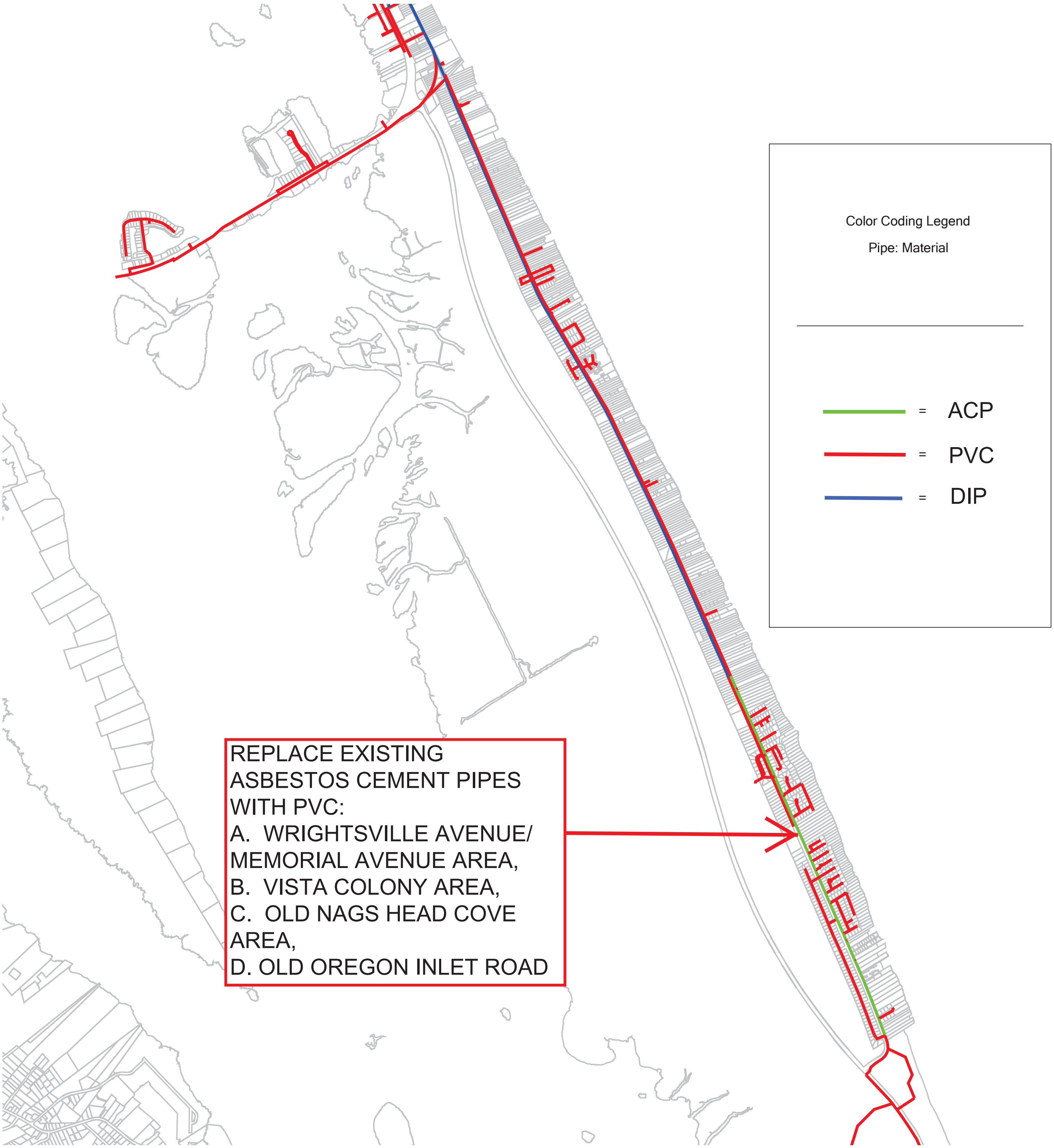
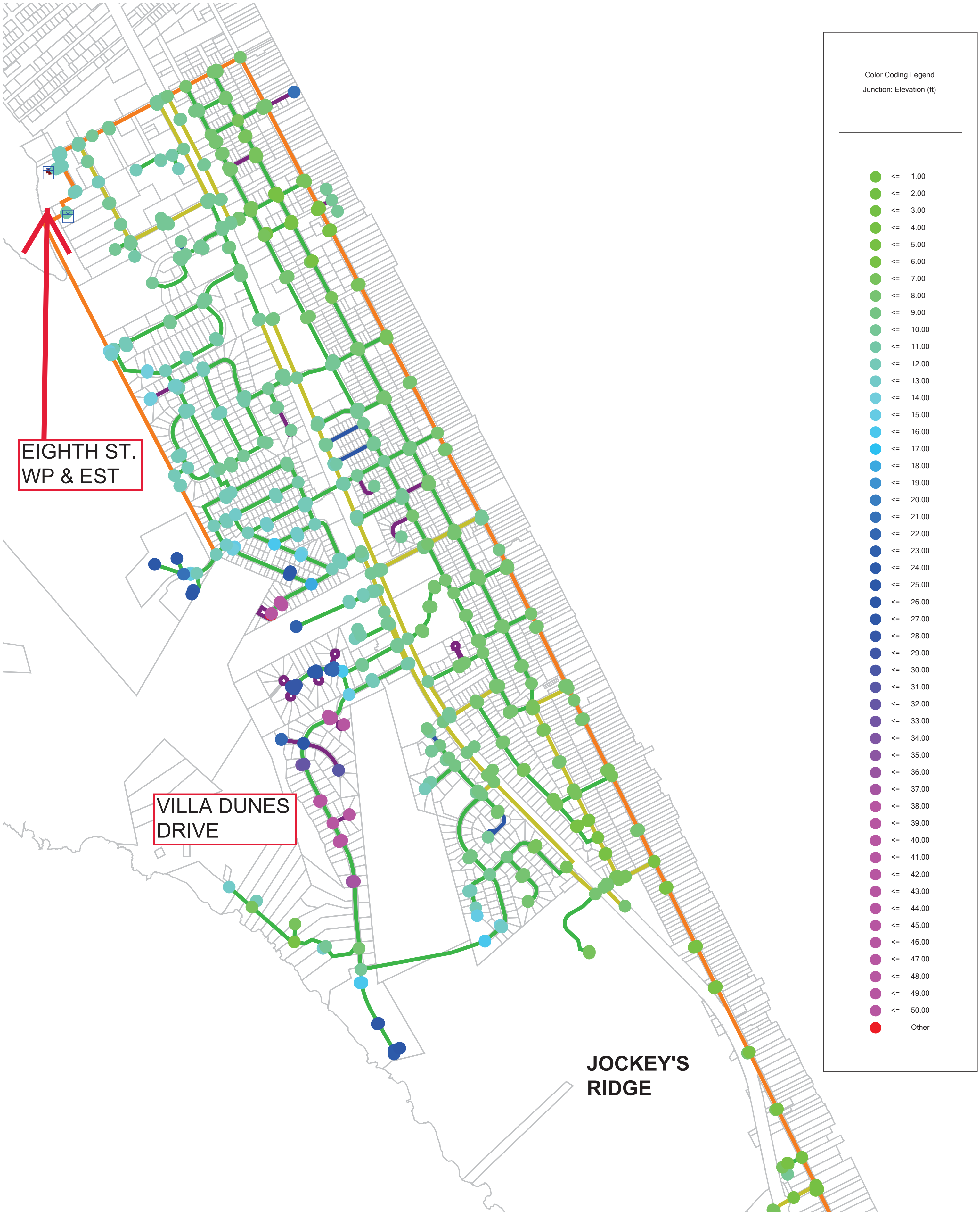


APPENDIX

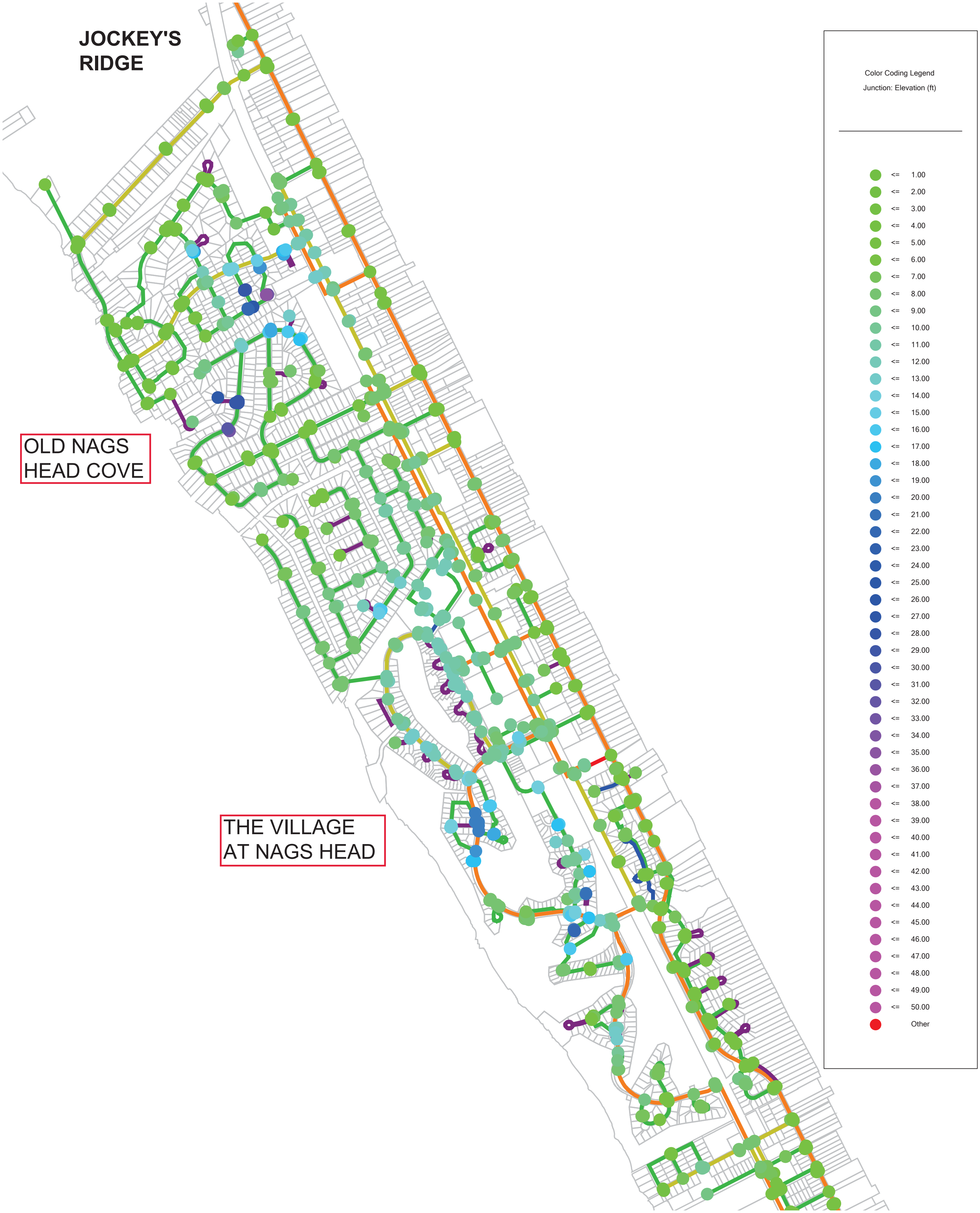
B

Topographic Elevations

TOPOGRAPHIC ELEVATIONS



TOPOGRAPHIC ELEVATIONS



TOPOGRAPHIC ELEVATIONS

TOPOGRAPHIC ELEVATIONS

APPENDIX

C

Population Projections and Water System Demands

ESTIMATE POPULATION/DEMAND PROJECTIONS FOR 2028 (10 YEARS IN THE FUTURE):

Use Local Permanent Population Data for Minimum Month (February) Water System Projections.
Use Potential Peak Population Data for Maximum Month (July) Water System Projections.

1. Local Permanent Population Projections

	Local Permanent Population[1]		
Year	Comprehensive Plan Known Value	Comprehensive Plan Estimated Value	Hydraulic Analysis Estimated Value
2000	2,700		
2005			2,729
2010	2,757		
2015		2,825	
2016			2,887
2017			2,950
2020		3,137	
2025		3,244	
2028			3,290
2030		3,320	

[1]Data from Nags Head Comprehensive Plan dated July 5, 2017, Figures 1-2, Pages 1-22 and 1-23

2. Percentage Increase in Local Permanent Population from 2016 to 2028

$$\frac{\text{2028 Local Permanent Population Estimate}}{\text{2016 Local Permanent Population Estimate}} = \frac{3,290}{2,887} \times 100 = 114\%$$

For conservatism, use 115% Increase in Local Permanent Population from 2016 to 2028 for Minimum Month Water System Projections.

3. Housing Stock and Potential Peak Population Projections

Potential Persons at Peak Population, 2017[2]	=	40,534
Difference in Potential Persons at Peak Population between 2005-2017[2]	=	(3,708)
Potential Persons at Peak Population, 2005	=	36,826

[2]Data from Nags Head Comprehensive Plan based on Housing Stock, Tables 1.2.1.D and 1.2.1.D.1, Page 1-25

4. Historical Growth Rate - Potential Persons at Peak Population (Persons/Year)

$$GR_1 = \frac{40,534 - 36,826}{2017 - 2005} = 309 \ \frac{\text{persons}}{\text{year}}$$

5. Historical Growth Rate - Local Permanent Population (Persons/Year)

$$GR_2 = \frac{2,950 - 2,729}{2017 - 2005} = 18.42 \ \frac{\text{persons}}{\text{year}}$$

6. Growth Rates Ratio of Peak Population to Local Permanent Population

$$R_1 = \frac{GR_1}{GR_2} = \frac{309}{18.42} = 16.78 \ \frac{\text{peak population}}{\text{local population}}$$

7. Ratio of Peak Population to Local Permanent Population

$$R_{2005} = \frac{36,826}{2,729} = 13.49 \ \frac{\text{peak population}}{\text{local population}}$$

$$R_{2017} = \frac{40{,}534}{2{,}950} = 13.74 \; \frac{\text{peak population}}{\text{local population}}$$

For conservatism, use R_{2017} = 13.74 for Ratio of Peak Population to Local Permanent Population for Projections.

8. 2016 Peak Population Projections

Option A: [2016 Local Permanent Population Estimate] x [Ratio of Peak Population to Local Permanent Population]

[2,887] x [R_{2017}] = [2,887] x [13.74] = 39,667 peak population

Option B: [2005 Potential Persons at Peak Population] + [(Historical Growth Rate per Year) x (No. Years)]

[36,826] + [(GR_1) x (2016-2005)] = [36,826] + [(309 x 11)] = 40,225 peak population

9. 2028 Peak Population Projections

Option A: [2028 Local Permanent Population Estimate] x [Ratio of Peak Population to Local Permanent Population]

[3,290] x [R_{2017}] = [3,290] x [13.74] = 45,205 peak population

Option B: [2005 Potential Persons at Peak Population] + [(Historical Growth Rate per Year) x (No. Years)]

[36,826] + [(GR_1) x (2028-2005)] = [36,826] + [(309 x 23)] = 43,933 peak population

10. Percentage Increase in Peak Population from 2016 to 2028

Option 1: $\frac{\text{2028 Option A Estimate}}{\text{2016 Option A Estimate}} = \frac{45{,}205}{39{,}667} \times 100 = 114\%$

Option 2: $\frac{\text{2028 Option B Estimate}}{\text{2016 Option B Estimate}} = \frac{43{,}933}{40{,}225} \times 100 = 109\%$

For conservatism, use 115% Increase in Potential Persons at Peak Population from 2016 to 2028 for Maximum Month Water System Projections.

11. 2028 Water Demand Projections

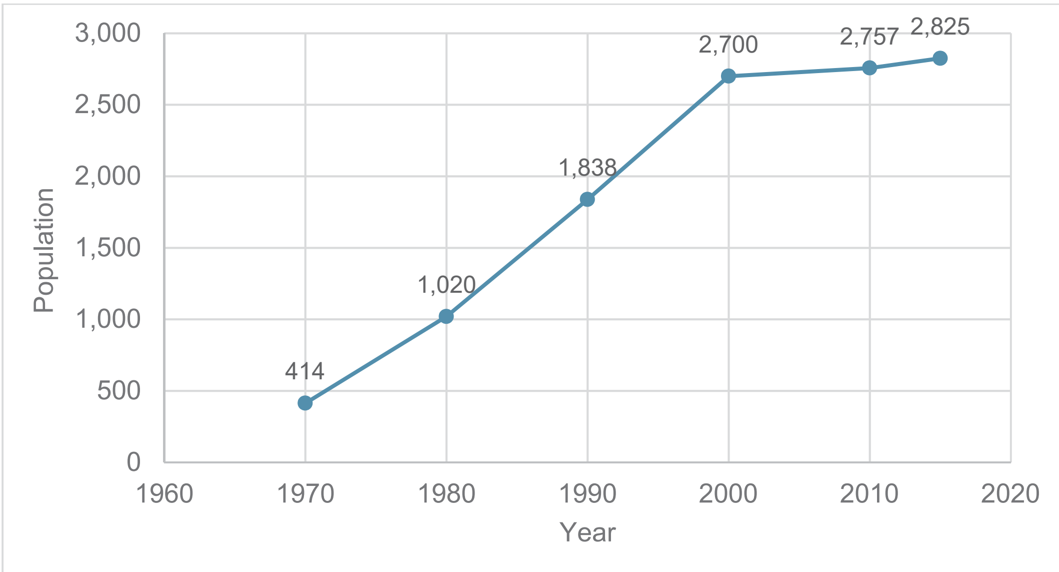
Minimum Day System Demand (February 7, 2016[3]) =		248 GPM
Projected Minimum Day System Demand (February 7, 2028) =	**248 x 115% =**	**285 GPM**
Average Day Minimum Month System Demand (February, 2016[3]) =		404 GPM
Projected Average Day Minimum Month System Demand (February, 2028) =	**404 x 115% =**	**465 GPM**
Average Day Maximum Month System Demand (July, 2016[3]) =		1,409 GPM
Projected Average Day Maximum Month System Demand (July, 2028) =	**1,409 x 115% =**	**1,620 GPM**
Maximum Day System Demand (July 27, 2016[3]) =		1,606 GPM
Projected Maximum Day System Demand (July 4, 2028) =	**1,606 x 115% =**	**1,847 GPM**

[3]Data from Master Parcel and Demand List Spreadsheet

B. Population Trends

In 2015, the permanent population of Nags Head was estimated at 2,825 people. Figure 2 shows the population of Nags Head since it was first designated as a Census Place in the 1970 Decennial Census.

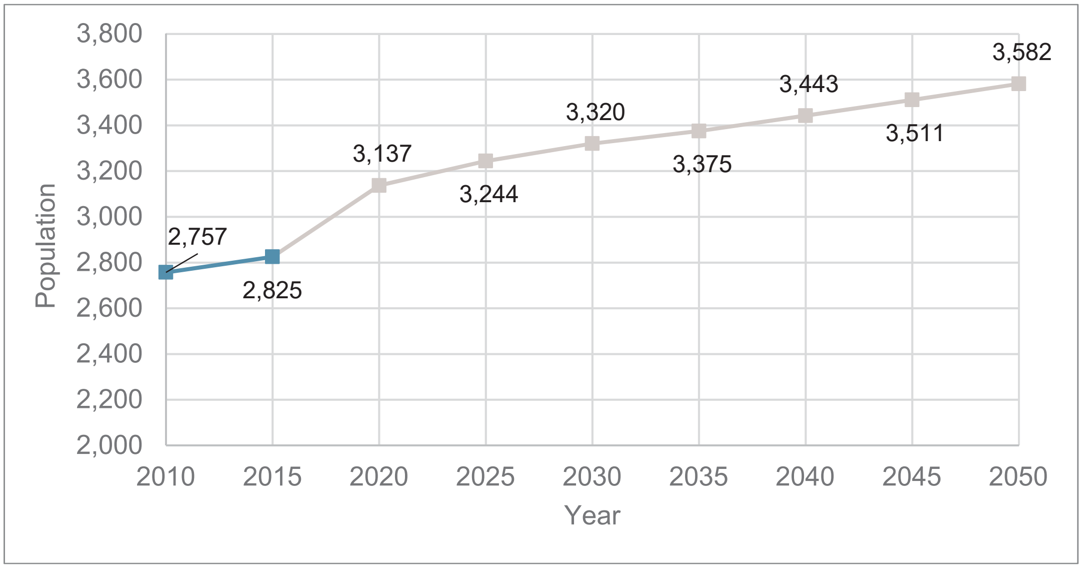
Figure 2: Nags Head Population, 1970-2015



The town experienced a population boom from 1970 to 2000. Between 1970 and 1980, the town experienced a dramatic 146% growth in its population, which reflects both the low population (only 414 residents) in 1970 and the rapid development occurring in the town. While slower in the next decade, the population still grew by 80% between 1980 and 1990. The growth rate post-2000 is notably slower. Between 2000 and 2010, the town only saw 2% population increase, a low but healthy rate for a community that is mostly built-out and facing natural hazards and environmental challenges that come with Nags Head's coastal location.

A key step in planning for a community's future is estimating the population growth that will occur over the next decades. This information is vital in order to plan for infrastructure, service, and amenity expansion, budgeting, hazard mitigation planning, and land use allocation. While it is impossible to predict exactly what will happen in the future, current population trends in the town and in Dare County can be extrapolated to make an estimation. Figure 3 shows a population projection for Nags Head through 2050. The relatively large growth projected for 2015-2020 comes from projections that Dare County will experience high growth as recovery from the Great Recession continues, then even back out to approximately 2% population growth into the next few decades. It is important to note that this projection is made for the purposes of planning only. The methodology assumes that employment opportunities, the broader economy, housing costs and availability, and birth, death, and migration rates in Nags Head will remain constant. A major shift in one or more of these variables would change the projected population.

Figure 3: Nags Head Population Projections, 2020 - 2050



Points shown in blue are known data points.
Points shown in grey are projections.

C. Resident Demographics

The median age in Nags Head is 45 years, slightly older than the statewide median of 38 years. Figure 4 is a population pyramid for Nags Head as of 2015 and provides additional detail on the age structure in the town. It shows the number of males and females in each five-year age group. Viewing the population pyramid, it becomes apparent why the median age in Nags Head is older than most communities in North Carolina. A "typical" community's chart is shaped like a pyramid: More young people on the bottom for a wider "base" of the pyramid, and fewer older people toward the top. While the distribution in Nags Head is not completely "top-heavy," like the inverted pyramid one might expect in a retirement community, there are large numbers of adults age 60 and older and many fewer people under age 20 than in an average community.

number of transient lodging and smaller single-family homes since 2005. For a detailed discussion of the implications of these changes, see Section 3.2.5, Housing and Accommodations.

Table1.2.1.D: Housing Stock by Type and Potential Peak Population, 2017					
Property Type	**Total # Properties**	**Total # Rooms / Bedrooms**	**% of Total Bedrooms**	**Persons Per Unit/ Bedroom**	**Potential Persons at Peak Population**
Single Family					
1-2 bedrooms	220	424	2.2%	2	848
3-5 bedrooms	3,497	12,985	66.1%	2	25,970
6-7 bedrooms	300	1,901	9.7%	2	3,802
8+ bedrooms	234	1,961	10.0%	2	3,922
Single Family Subtotal	4,251	17,271	87.9%	2	34,542
Multi-Family					
Multi-Family Subtotal	558	1,547	7.9%	2	3,094
Transient					
Hotel	15	627	3.2%	3.5	2,195
Cottage Court	13	201	1.0%	3.5	704
Transient Subtotal	28	828	4.2%	3.5	2,898
TOTAL					40,534

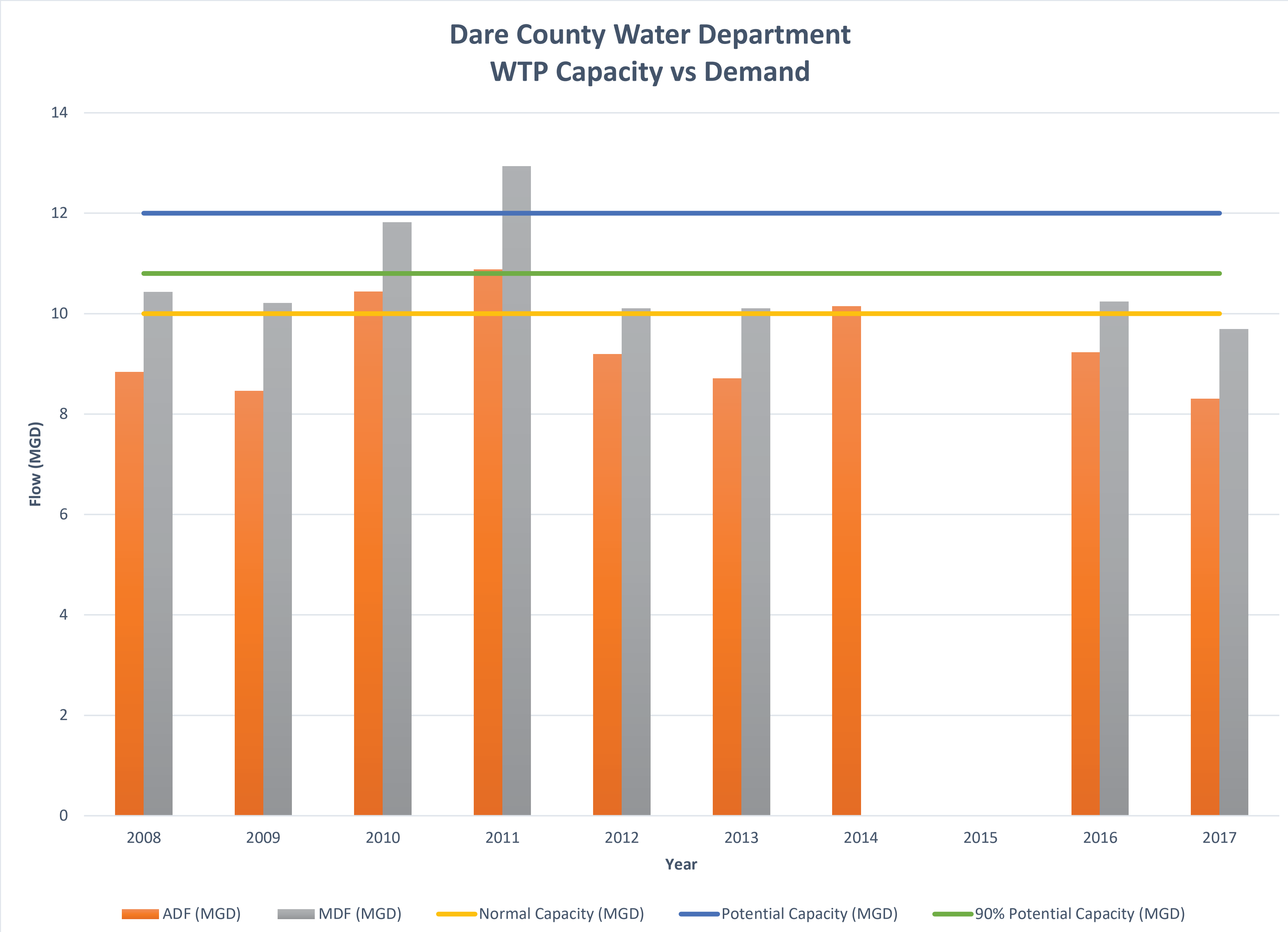
Table1.2.1.D.1: Change in Housing Stock, 2005-2017			
Property Type	**Change in Total # Properties**	**Change in Total # Rooms / Bedrooms**	**Change in Potential Persons at Peak Population**
Single Family			
1-2 bedrooms	- 48	- 98	- 196
3-5 bedrooms	+ 103	+ 567	+ 1,134
6-7 bedrooms	+ 113	+ 715	+ 1,430
8+ bedrooms	+ 84	+ 863	+ 1,726
Single Family Subtotal	+ 252	+ 2,047	+ 4,094
Multi-Family			
Multi-Family Subtotal	+ 53	+ 143	+ 3,094
Transient			
Hotel	- 4	- 180	- 631
Cottage Court	- 2	- 12	- 673
Transient Subtotal	- 6	- 192	- 673
TOTAL	+ 299	+ 1,998	+ 3,708

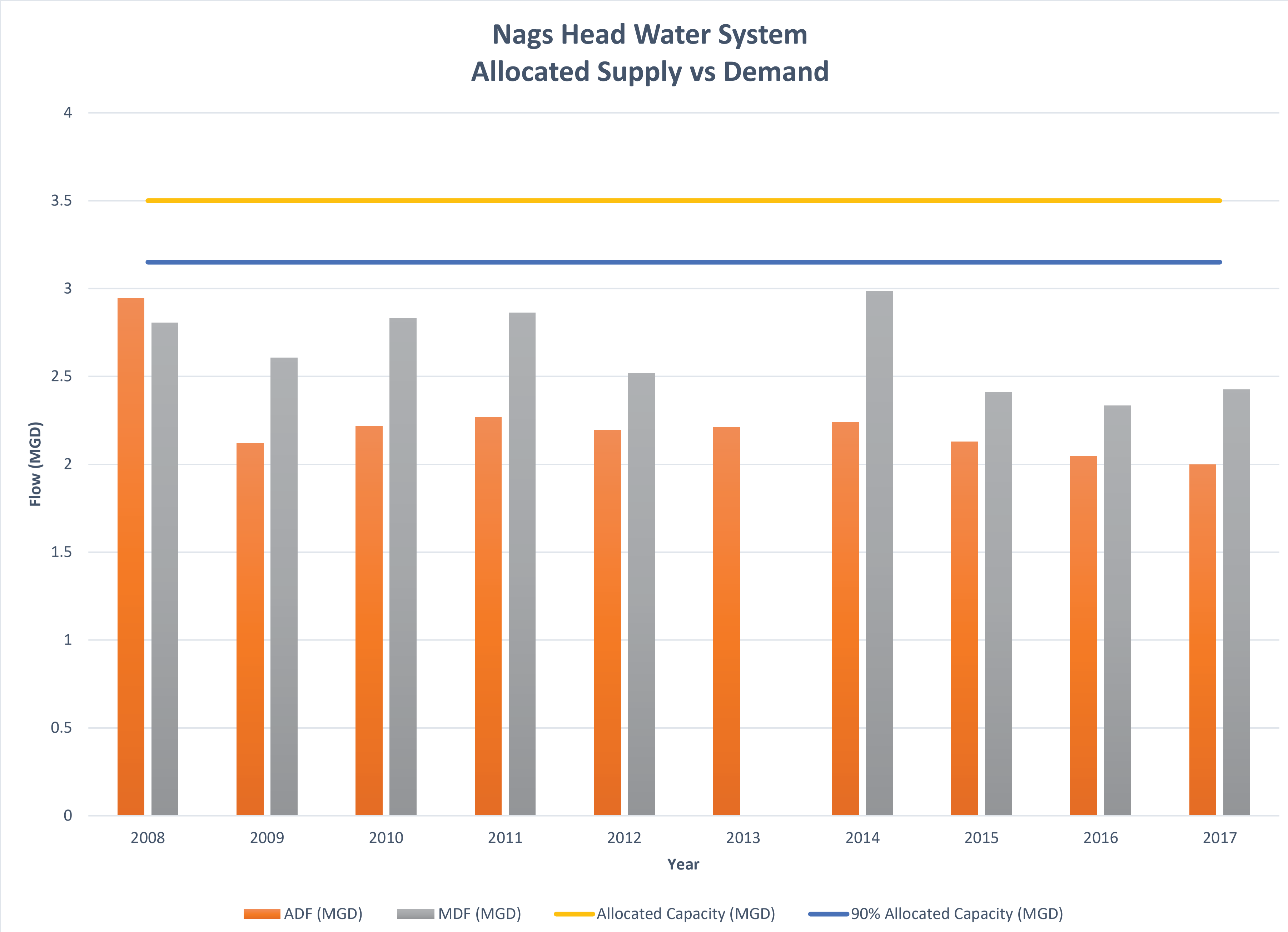
APPENDIX

D

Water Supply vs Water Demand

- **Dare County**
- **Town of Nags Head**


Dare County Water Department
WTP Capacity vs Demand
14
12
10
8
6
4
2
0
Flow (MGD)
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
ADF (MGD)
MDF (MGD)
Normal Capacity (MGD)
Potential Capacity (MGD)
90% Potential Capacity (MGD)


Nags Head Water System
Allocated Supply vs Demand
4
3.5
3
2.5
2
1.5
1
0.5
0
Flow (MGD)
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
ADF (MGD)
MDF (MGD)
Allocated Capacity (MGD)
90% Allocated Capacity (MGD)

APPENDIX

E

Photograph Log

Photo #1 – Eighth Street Pump Station

Photo #2 – Eighth Street PS Vertical Turbine High Service Pumps

Photo #3 – Eight Street PS Motor Control Center with Soft Starters

Photo #4 – Gas Chlorine Feed System

Photo #5 – Eighth Street PS Ground Storage Tank

Photo #6 – Eighth Street Standby Emergency Generator

Photo #7 – 500,000 Gallon Eighth Street Elevated Storage Tank

Photo #8 – Eighth Street Altitude Valve & Vault

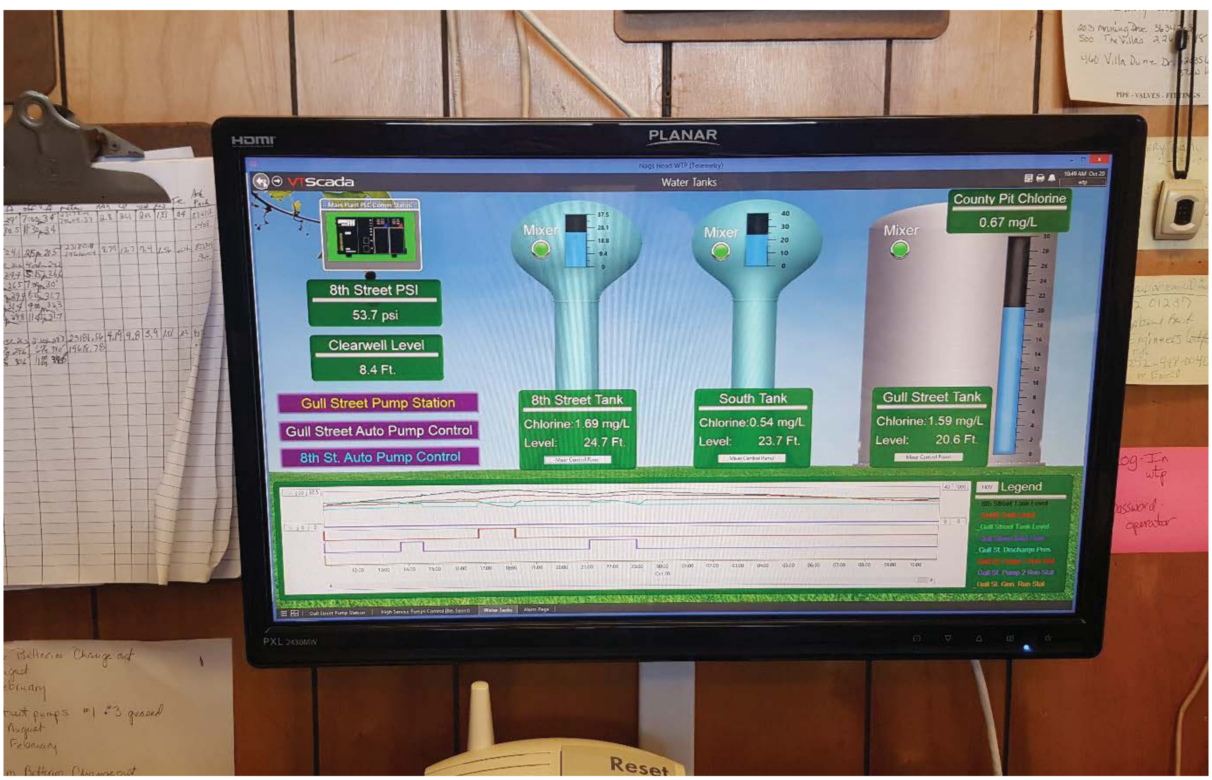


Photo #9 – Eighth Street PS SCADA Human Machine Interface

Photo #10 – Gull Street Pump Station and Ground Storage Tank

Photo #11 – Gull Street PS Horizontal Split Case High Service Pumps

Photo # 12 – Gull Street PS Motor Control Center

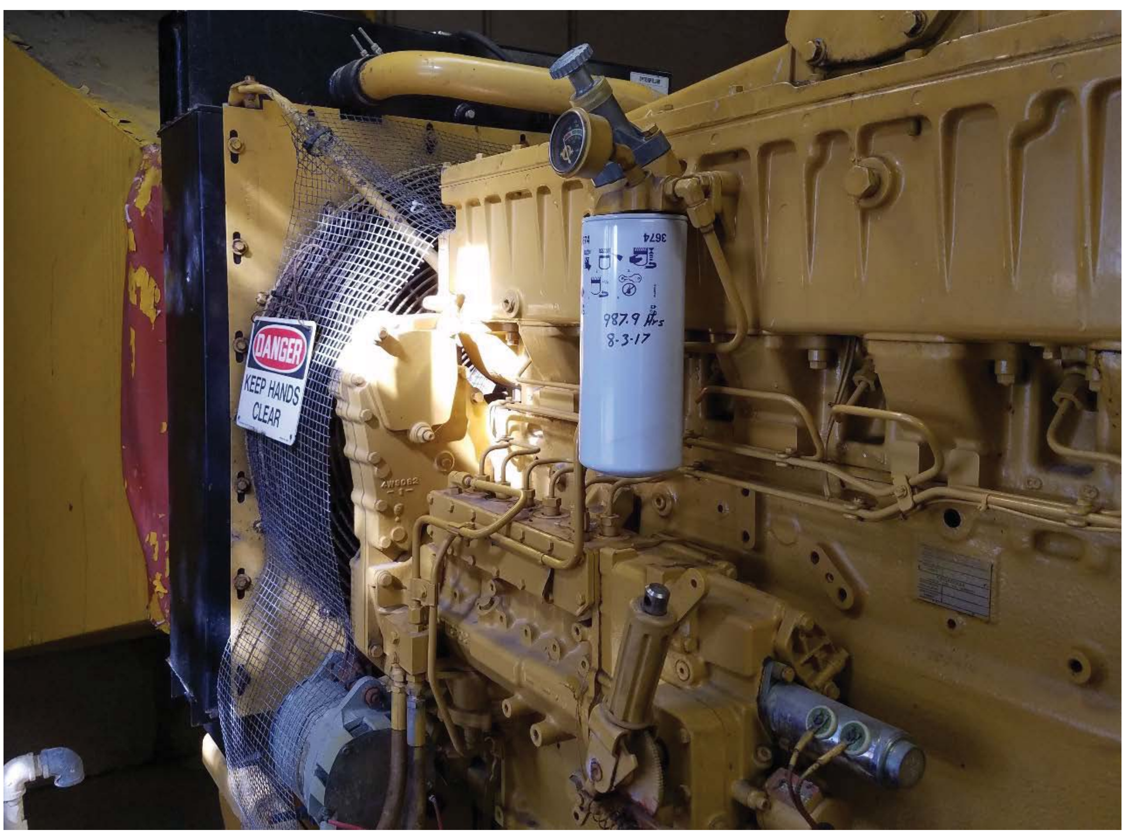


Photo #13 – Gull Street PS Emergency Standby Generator

Photo # 14 – Gull Street PS Gas Chlorine Feed System

Photo #15 – Gull Street PS Remote Terminal Unit

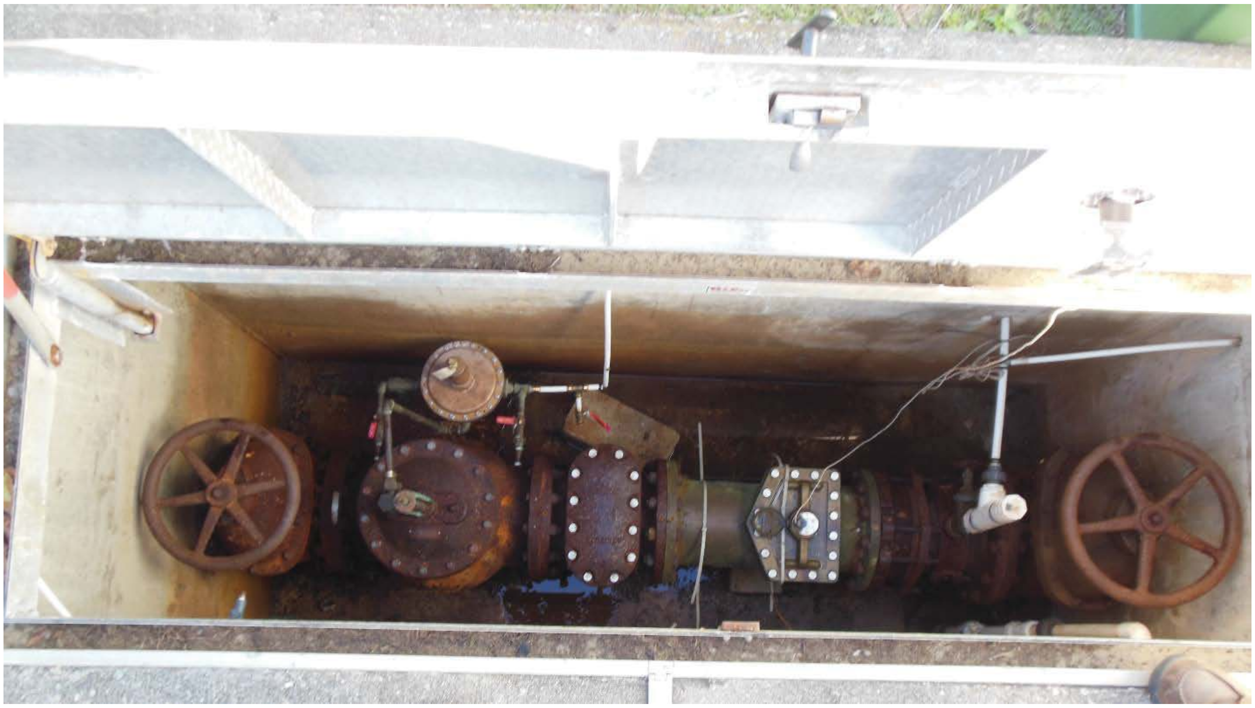


Photo #16 – Gull Street GST Altitude Valve & Vault

Photo #17 – South Tower Elevated Storage Tank

APPENDIX

F

Local Water Supply Plans

- **2017**
- **2016**

Nags Head

2017 ▾

The Division of Water Resources (DWR) provides the data contained within this Local Water Supply Plan (LWSP) as a courtesy and service to our customers. DWR staff does not field verify data. Neither DWR, nor any other party involved in the preparation of this LWSP attests that the data is completely free of errors and omissions. Furthermore, data users are cautioned that LWSPs labeled **PROVISIONAL** have yet to be reviewed by DWR staff. Subsequent review may result in significant revision. Questions regarding the accuracy or limitations of usage of this data should be directed to the water system and/or DWR.

1. System Information

Contact Information

Provisional

Water System Name: Nags Head
Mailing Address: P.O. Box 99
Nags Head, NC 27959

PWSID: 04-28-010
Ownership: Municipality

Contact Person: Nancy Roop Carawan
Phone: 252-449-4210

Title: Water Supt.
Fax: 252-480-1560

Secondary Contact: Ralph Barile
Mailing Address: PO Box 99
Nags Head, NC 27959

Phone: 252-449-4205
Fax: 252-441-3350

Distribution System

Line Type	Size Range (Inches)	Estimated % of lines
Asbestos Cement	3-8	8.00 %
Cast Iron	6-12	25.00 %
Ductile Iron	6-14	20.00 %
Polyvinyl Chloride	2-12	47.00 %

What are the estimated total miles of distribution system lines? 101 Miles
How many feet of distribution lines were replaced during 2017? 1,485 Feet
How many feet of new water mains were added during 2017? 502 Feet
How many meters were replaced in 2017? 54
How old are the oldest meters in this system? 15 Year(s)
How many meters for outdoor water use, such as irrigation, are not billed for sewer services? 0
What is this system's finished water storage capacity? 2.000 Million Gallons
Has water pressure been inadequate in any part of the system since last update? No

NOTE 320' of 2" line installed in Elliott Estates. 181' of 6" line installed connecting Morning View to Baltic. 1485' of 6" line was installed down Morning View and Becker Street replacing 4" A/C pipe.
Installed 8 hydrants. Locations: 115 E. Sea Gull,10229 Bodie Island Court,117 Moring View,118 Barnes,2438 Memorial Ave,2220 VDT,113 Bergen Court, E. Lakeside Dr. and E. side of 158 bypass.

Programs

Does this system have a program to work or flush hydrants? Yes, Annually
Does this system have a valve exercise program? Yes, Annually
Does this system have a cross-connection program? Yes
Does this system have a program to replace meters? Yes
Does this system have a plumbing retrofit program? Yes
Does this system have an active water conservation public education program? No
Does this system have a leak detection program? Yes

NOTE We have a Cross Connection program. Back check valve are installed on any meter (up to 2") that is found without one.(Plumbing retrofit program). Water mains, service lines and meters are checked for leaks while doing monthly meter reading. NC Rural Water personnel has used their leak detection equipment to detect leaks in our water system

Water Conservation

What type of rate structure is used? Increasing Block
How much reclaimed water does this system use? 0.000 MGD For how many connections? 0
Does this system have an interconnection with another system capable of providing water in an emergency? Yes

NOTE The Town of Nags Head has 5 inter connections with Dare County for emergency use only. West side of US 158 bypass: Hollowell Street, Soundside Rd.,Danube Street and Lakeside Drive. Eastside of US 158: 8th Street. The Town has 1 interconnection with the Town of Kill Devil Hills for emergency use only, located at the NE corner of 8th Street/US 158 Bypass intersection

2. Water Use Information

Service Area

Sub-Basin(s)	% of Service Population
Albemarle Sound (12-1)	100 %

County(s)	% of Service Population
Dare	100 %

What was the year-round population served in 2017? 3,125

What was the seasonal population and months served in 2017? (if applicable) 22,415 (Jun Jul Aug)

Has this system acquired another system since last report? No

Water Use by Type

Type of Use	Metered Connections	Metered Average Use (MGD)	Non-Metered Connections	Non-Metered Estimated Use (MGD)
Residential	4,517	0.687	0	0.000
Commercial	325	0.228	0	0.000
Industrial	0	0.000	0	0.000
Institutional	2	0.018	0	0.000

How much water was used for system processes (backwash, line cleaning, flushing, etc.)? 0.071 MGD

NOTE OBX hospital=Institutional Annual System flushing= 8.4 MG; Cl2 analyzers=est..2 MG; 6 Automatic flushers=15.154 MG OI hydrant=1.440 MG Fire Dept. training=est..7MG Station 16=.120 MG Total=26.014 MG

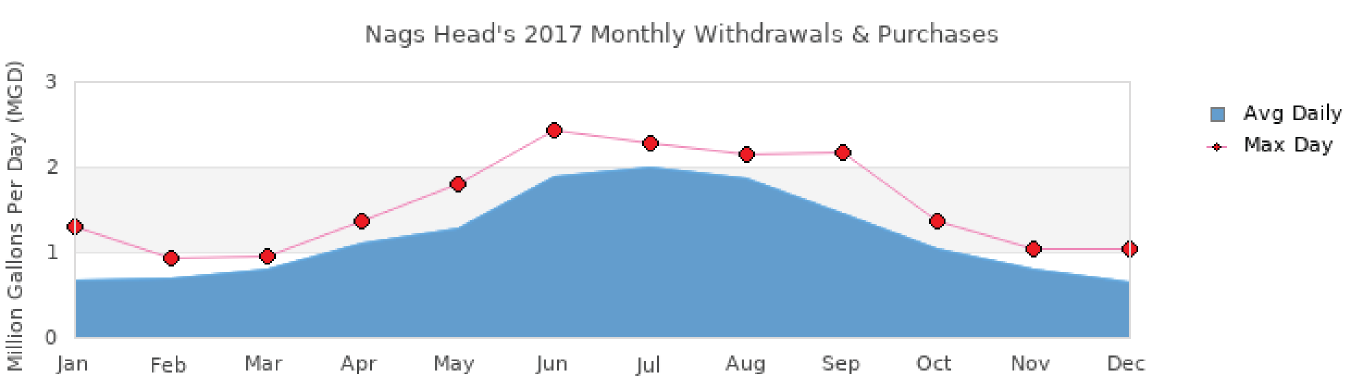
Water Sales

Purchaser	PWSID	Average Daily Sold (MGD)	Days Used	Contract			Required to comply with water use restrictions?	Pipe Size(s) (Inches)	Use Type
				MGD	Expiration	Recurring			
Town of Kill Devil Hills	04-28-015	0.000	0	0.000		No	No	16/24	Emergency

3. Water Supply Sources

Monthly Withdrawals & Purchases

	Average Daily Use (MGD)	Max Day Use (MGD)		Average Daily Use (MGD)	Max Day Use (MGD)		Average Daily Use (MGD)	Max Day Use (MGD)
Jan	0.672	1.302	May	1.284	1.807	Sep	1.444	2.164
Feb	0.685	0.931	Jun	1.877	2.425	Oct	1.031	1.368
Mar	0.786	0.952	Jul	1.999	2.270	Nov	0.791	1.040
Apr	1.103	1.363	Aug	1.866	2.143	Dec	0.649	1.041



Water Purchases From Other Systems

Seller	PWSID	Average	Days	Contract	Required to	Pipe Size(s)	Use

		Daily Purchased (MGD)	Used	MGD	Expiration	Recurring	comply with water use restrictions?	(Inches)	Type
Dare Co Regional	04-28-030	1.182	365	3.500	2036	Yes	Yes	24	Regular
Town of Kill Devl Hills	04-28-015	0.000	0			No	Yes	16/24	Emergency

4. Wastewater Information

Monthly Discharges

	Average Daily Discharge (MGD)		Average Daily Discharge (MGD)		Average Daily Discharge (MGD)
Jan	0.000	May	0.000	Sep	0.000
Feb	0.000	Jun	0.000	Oct	0.000
Mar	0.000	Jul	0.000	Nov	0.000
Apr	0.000	Aug	0.000	Dec	0.000

How many sewer connections does this system have? 0

How many water service connections with septic systems does this system have? 4,241

Are there plans to build or expand wastewater treatment facilities in the next 10 years? No

5. Planning

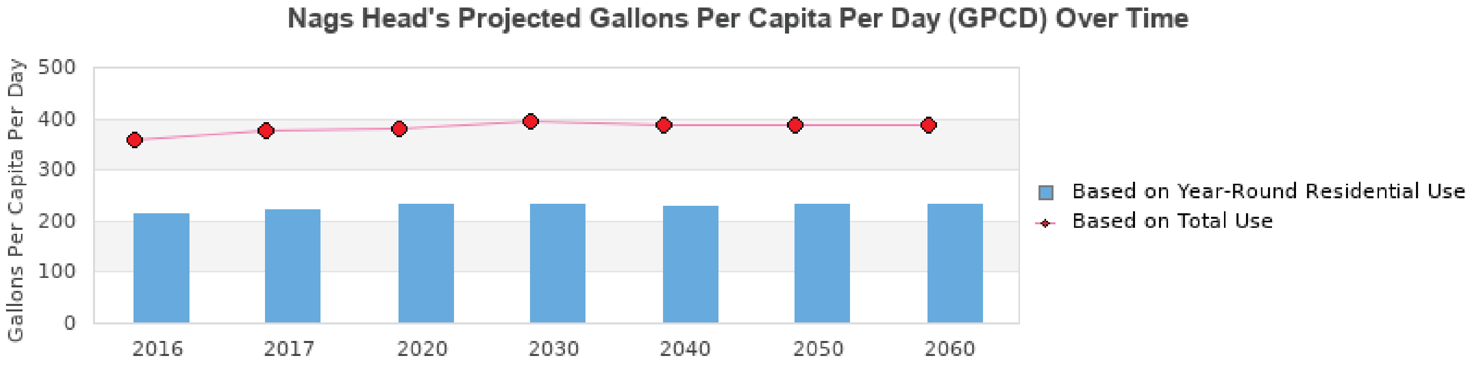
Projections

	2017	2020	2030	2040	2050	2060
Year-Round Population	3,125	3,869	4,353	4,853	5,271	5,705
Seasonal Population	22,415	25,148	28,294	31,440	34,261	37,082
Residential	0.687	0.890	1.001	1.113	1.212	1.312
Commercial	0.228	0.288	0.401	0.445	0.486	0.526
Industrial	0.000	0.000	0.000	0.000	0.000	0.000
Institutional	0.018	0.015	0.015	0.015	0.015	0.015
System Process	0.071	0.132	0.132	0.132	0.132	0.132
Unaccounted-for	0.178	0.144	0.168	0.185	0.201	0.216

Demand v/s Percent of Supply

	2017	2020	2030	2040	2050	2060
Surface Water Supply	0.000	0.000	0.000	0.000	0.000	0.000
Ground Water Supply	0.000	0.000	0.000	0.000	0.000	0.000
Purchases	3.500	3.500	3.500	3.500	3.500	3.500
Future Supplies		0.000	0.000	0.000	0.000	0.000
Total Available Supply (MGD)	3.500	3.500	3.500	3.500	3.500	3.500
Service Area Demand	1.182	1.469	1.717	1.890	2.046	2.201
Sales	0.000	0.000	0.000	0.000	0.000	0.000
Future Sales		0.000	0.000	0.000	0.000	0.000

Total Demand (MGD)	1.182	1.469	1.717	1.890	2.046	2.201
Demand as Percent of Supply	34%	42%	49%	54%	58%	63%



The purpose of the above chart is to show a general indication of how the long-term per capita water demand changes over time. The per capita water demand may actually be different than indicated due to seasonal populations and the accuracy of data submitted. Water systems that have calculated long-term per capita water demand based on a methodology that produces different results may submit their information in the notes field.

Your long-term water demand is 220 gallons per capita per day. What demand management practices do you plan to implement to reduce the per capita water demand (i.e. conduct regular water audits, implement a plumbing retrofit program, employ practices such as rainwater harvesting or reclaimed water)? If these practices are covered elsewhere in your plan, indicate where the practices are discussed here.

Are there other demand management practices you will implement to reduce your future supply needs? The town has a meter replacement program, retro plumbing program, does leak detection on water mains, and provides water conservation information in the annual Consumer Confidence Report. The long term water demand in per capita per day needs to be figured NON SEASONAL and SEASONAL. Formula=# of metered gallons divided by the # of days divided by the year round population.

What supplies other than the ones listed in future supplies are being considered to meet your future supply needs? There is a 1MGD reverse osmosis train in our Capital Improvement Plan to be installed at the Dare county North RO plant if we exceed a percentage of our 3.5 MGD allotment. It is in the 2022 budget year if needed.

How does the water system intend to implement the demand management and supply planning components above? We have a Water Master Plan that updated every 5-10 years. We will work with the guidance of NC Rural Water Association.

Additional Information

Has this system participated in regional water supply or water use planning? Yes, Yes, we have a 40 year contract with Dare County Regional Water System that expires in 2036. We have in house and engineering studies and reports.

What major water supply reports or studies were used for planning? Town of Nags Head Water Master Plan, Nags Head Annual Report, Nags Head Needs Assessment and the 2017 Comprehensive Plan.

Please describe any other needs or issues regarding your water supply sources, any water system deficiencies or needed improvements (storage, treatment, etc.) or your ability to meet present and future water needs. Include both quantity and quality considerations, as well as financial, technical, managerial, permitting, and compliance issues:

Nags Head

2016 ▾

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1. System Information

Contact Information

Complete

Water System Name: Nags Head
Mailing Address: P.O. Box 99
Nags Head, NC 27959

PWSID: 04-28-010
Ownership: Municipality

Contact Person: Nancy Roop Carawan
Phone: 252-449-4210

Title: Water Supt.
Fax: 252-480-1560

Secondary Contact: Ralph Barile
Mailing Address: PO Box 99
Nags Head, NC 27959

Phone: 252-449-4205
Fax: 252-441-3350

Distribution System

Line Type	Size Range (Inches)	Estimated % of lines
Asbestos Cement	3-8	8.00 %
Cast Iron	6-12	25.00 %
Ductile Iron	6-14	20.00 %
Polyvinyl Chloride	2-12	47.00 %

What are the estimated total miles of distribution system lines? 101 Miles
How many feet of distribution lines were replaced during 2016? 290 Feet
How many feet of new water mains were added during 2016? 2,409 Feet
How many meters were replaced in 2016? 63
How old are the oldest meters in this system? 15 Year(s)
How many meters for outdoor water use, such as irrigation, are not billed for sewer services? 0
What is this system's finished water storage capacity? 2.000 Million Gallons
Has water pressure been inadequate in any part of the system since last update? No

Bonnett St. to Baltic St 1630' of 8" line on By pass- added 2 hydrants at Becker and Morning View; Fire Line at Millers 400' of 6" line ; Carolinian Circle 225' of 6" line, replaced 290' of 2" line with 6" line at Carolinian Circle; Oneto Lane 154' of 2" line

Programs

Does this system have a program to work or flush hydrants? Yes, Annually
Does this system have a valve exercise program? Yes, Annually
Does this system have a cross-connection program? Yes
Does this system have a program to replace meters? Yes
Does this system have a plumbing retrofit program? Yes
Does this system have an active water conservation public education program? No
Does this system have a leak detection program? Yes

We have a Cross Connection program. Back check valves are installed on any meter (up to 2") that is found without. (Plumbing retrofit program). Water mains, services and meters are checked for leaks while doing monthly meter reading. NC Rural Water personnel use their leak detection equipment to detect leaks in our water mains.

Water Conservation

What type of rate structure is used? Increasing Block
How much reclaimed water does this system use? 0.000 MGD For how many connections? 0
Does this system have an interconnection with another system capable of providing water in an emergency? Yes

The Town of Nags Head has 5 interconnections with Dare County for emergency use only. West side of US 158 by pass. Hollowell Street,Soundside Road, Danube Street and Lakeside Drive. East side of US 158 : 8th Street. The Town has 1 interconnection with the Town of Kill Devil Hills for emergency use only, located at the 8th Street/US 158 Bypass intersection.

2. Water Use Information

Service Area

Sub-Basin(s)	% of Service Population	County(s)	% of Service Population
Albemarle Sound (12-1)	100 %	Dare	100 %

What was the year-round population served in 2016? 3,125

What was the seasonal population and months served in 2016? (if applicable) 22,415 (Jun Jul Aug)

Has this system acquired another system since last report? No

Water Use by Type

Type of Use	Metered Connections	Metered Average Use (MGD)	Non-Metered Connections	Non-Metered Estimated Use (MGD)
Residential	4,493	0.668	0	0.000
Commercial	377	0.255	0	0.000
Industrial	0	0.000	0	0.000
Institutional	2	0.019	0	0.000

How much water was used for system processes (backwash, line cleaning, flushing, etc.)? 0.070 MGD

OBX hospital=Institutional Annual system flushing= est. 8.4 MG Cl2 analyzers= est..2 MG 6 automatic flushers= 16.111 MG Fire Dept. training and fires= est. .7 MG = Total 25.411 MGD

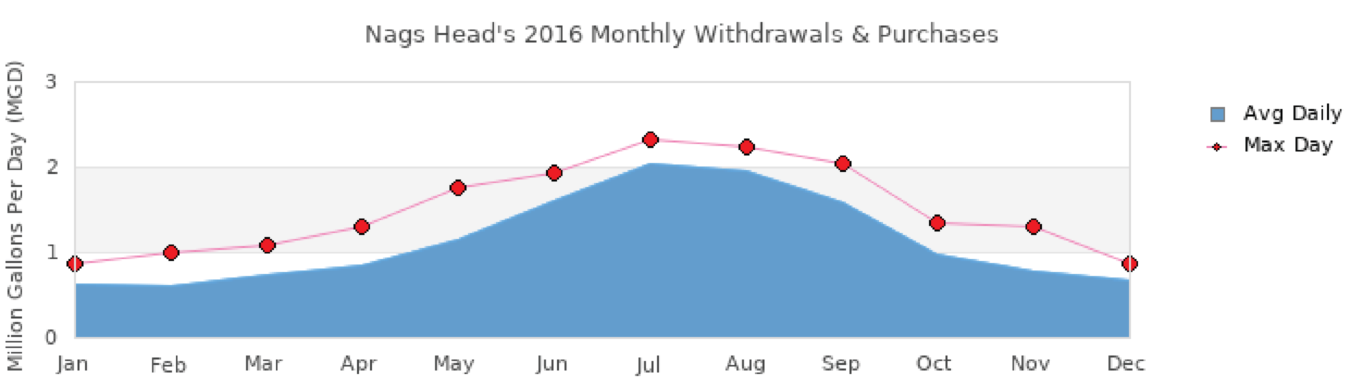
Water Sales

Purchaser	PWSID	Average Daily Sold (MGD)	Days Used	Contract MGD	Contract Expiration	Contract Recurring	Required to comply with water use restrictions?	Pipe Size(s) (Inches)	Use Type
Town of Kill Devil Hills	04-28-015	0.000	0	0.000		No	No	16/24	Emergency

3. Water Supply Sources

Monthly Withdrawals & Purchases

	Average Daily Use (MGD)	Max Day Use (MGD)		Average Daily Use (MGD)	Max Day Use (MGD)		Average Daily Use (MGD)	Max Day Use (MGD)
Jan	0.615	0.869	May	1.135	1.762	Sep	1.572	2.032
Feb	0.591	1.001	Jun	1.606	1.934	Oct	0.978	1.349
Mar	0.738	1.085	Jul	2.046	2.334	Nov	0.777	1.297
Apr	0.833	1.297	Aug	1.943	2.231	Dec	0.667	0.852



Water Purchases From Other Systems

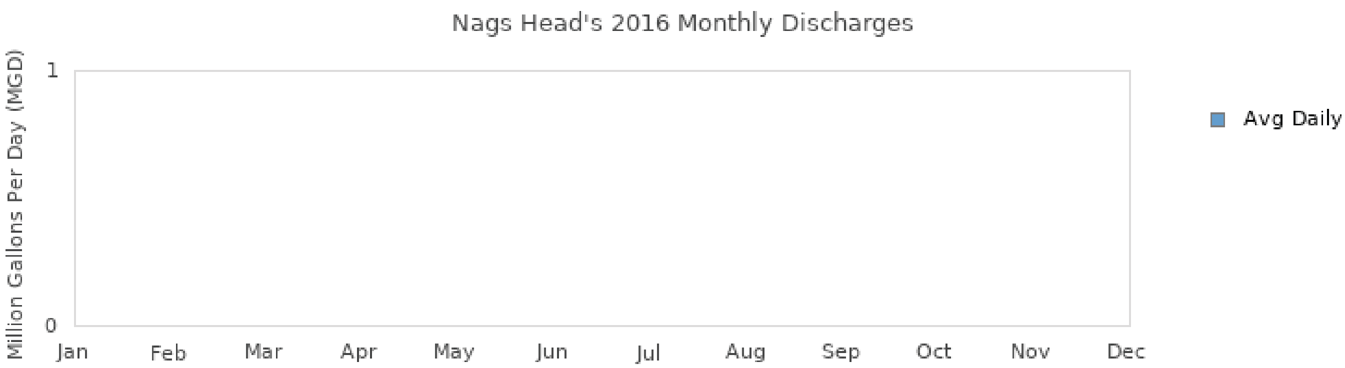
Seller	PWSID	Average	Days	Contract	Required to	Pipe Size(s)	Use

		Daily Purchased (MGD)	Used	MGD	Expiration	Recurring	comply with water use restrictions?	(Inches)	Type
Dare Co Regional	04-28-030	1.125	365	3.500	2036	Yes	Yes	24	Regular
Town of Kill Devl Hills	04-25-015	0.000	0			No	Yes	16/24	Emergency

4. Wastewater Information

Monthly Discharges

	Average Daily Discharge (MGD)		Average Daily Discharge (MGD)		Average Daily Discharge (MGD)
Jan	0.000	May	0.000	Sep	0.000
Feb	0.000	Jun	0.000	Oct	0.000
Mar	0.000	Jul	0.000	Nov	0.000
Apr	0.000	Aug	0.000	Dec	0.000



How many sewer connections does this system have? 0

How many water service connections with septic systems does this system have? 4,139

Are there plans to build or expand wastewater treatment facilities in the next 10 years? No

5. Planning

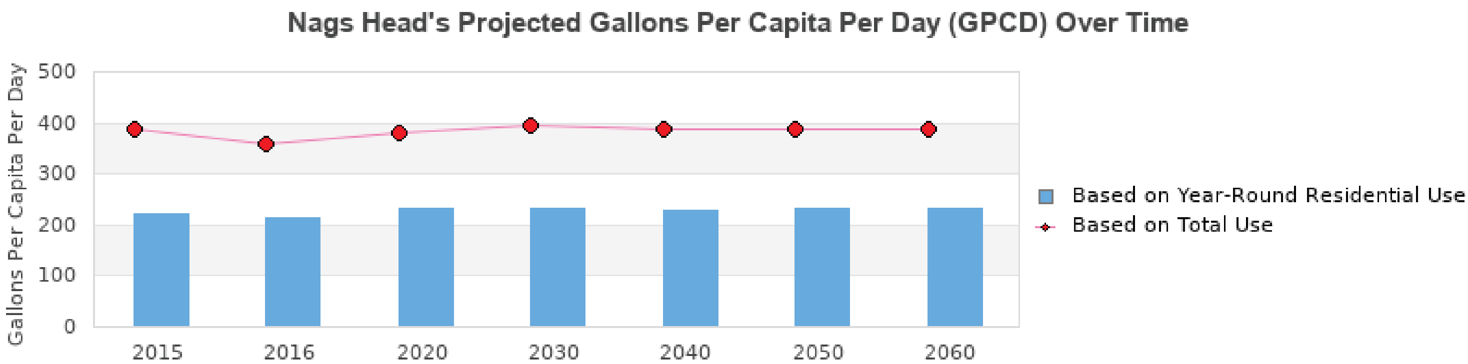
Projections

	2016	2020	2030	2040	2050	2060
Year-Round Population	3,125	3,869	4,353	4,853	5,271	5,705
Seasonal Population	22,415	25,148	28,294	31,440	34,261	37,082
Residential	0.668	0.890	1.001	1.113	1.212	1.312
Commercial	0.255	0.288	0.401	0.445	0.486	0.526
Industrial	0.000	0.000	0.000	0.000	0.000	0.000
Institutional	0.019	0.015	0.015	0.015	0.015	0.015
System Process	0.070	0.132	0.132	0.132	0.132	0.132
Unaccounted-for	0.110	0.144	0.168	0.185	0.201	0.216

Demand v/s Percent of Supply

	2016	2020	2030	2040	2050	2060
Surface Water Supply	0.000	0.000	0.000	0.000	0.000	0.000
Ground Water Supply	0.000	0.000	0.000	0.000	0.000	0.000
Purchases	3.500	3.500	3.500	3.500	3.500	3.500
Future Supplies		0.000	0.000	0.000	0.000	0.000
Total Available Supply (MGD)	3.500	3.500	3.500	3.500	3.500	3.500
Service Area Demand	1.122	1.469	1.717	1.890	2.046	2.201
Sales	0.000	0.000	0.000	0.000	0.000	0.000
Future Sales		0.000	0.000	0.000	0.000	0.000

Total Demand (MGD)	1.122	1.469	1.717	1.890	2.046	2.201
Demand as Percent of Supply	32%	42%	49%	54%	58%	63%



The purpose of the above chart is to show a general indication of how the long-term per capita water demand changes over time. The per capita water demand may actually be different than indicated due to seasonal populations and the accuracy of data submitted. Water systems that have calculated long-term per capita water demand based on a methodology that produces different results may submit their information in the notes field.

Your long-term water demand is 214 gallons per capita per day. What demand management practices do you plan to implement to reduce the per capita water demand (i.e. conduct regular water audits, implement a plumbing retrofit program, employ practices such as rainwater harvesting or reclaimed water)? If these practices are covered elsewhere in your plan, indicate where the practices are discussed here.

Are there other demand management practices you will implement to reduce your future supply needs? The town has a meter replacement program, retro plumbing program, does leak detection on water mains, and provides water conservation information in the annual Consumer Confidence Report.
The long term water demand in per capita per day needs to be figured NON SEASONAL and SEASONAL. Formula = # of metered gallons divided by the # of days divided by the year round population.

What supplies other than the ones listed in future supplies are being considered to meet your future supply needs? There is a 1 MGD reverse osmosis train in our Capital Improvement Plan to be installed at the Dare County North Reverse Osmosis plant if we exceed a percentage of our 3.5 MGD allotment. It is in the 2021 budget year if needed.

How does the water system intend to implement the demand management and supply planning components above? The Town will work with the guidance of NC Rural Water Association

Additional Information

Has this system participated in regional water supply or water use planning? Yes, We have a 40 year contract with Dare County Regional System that will expire in 2036. we have in house and engineering studies and reports.

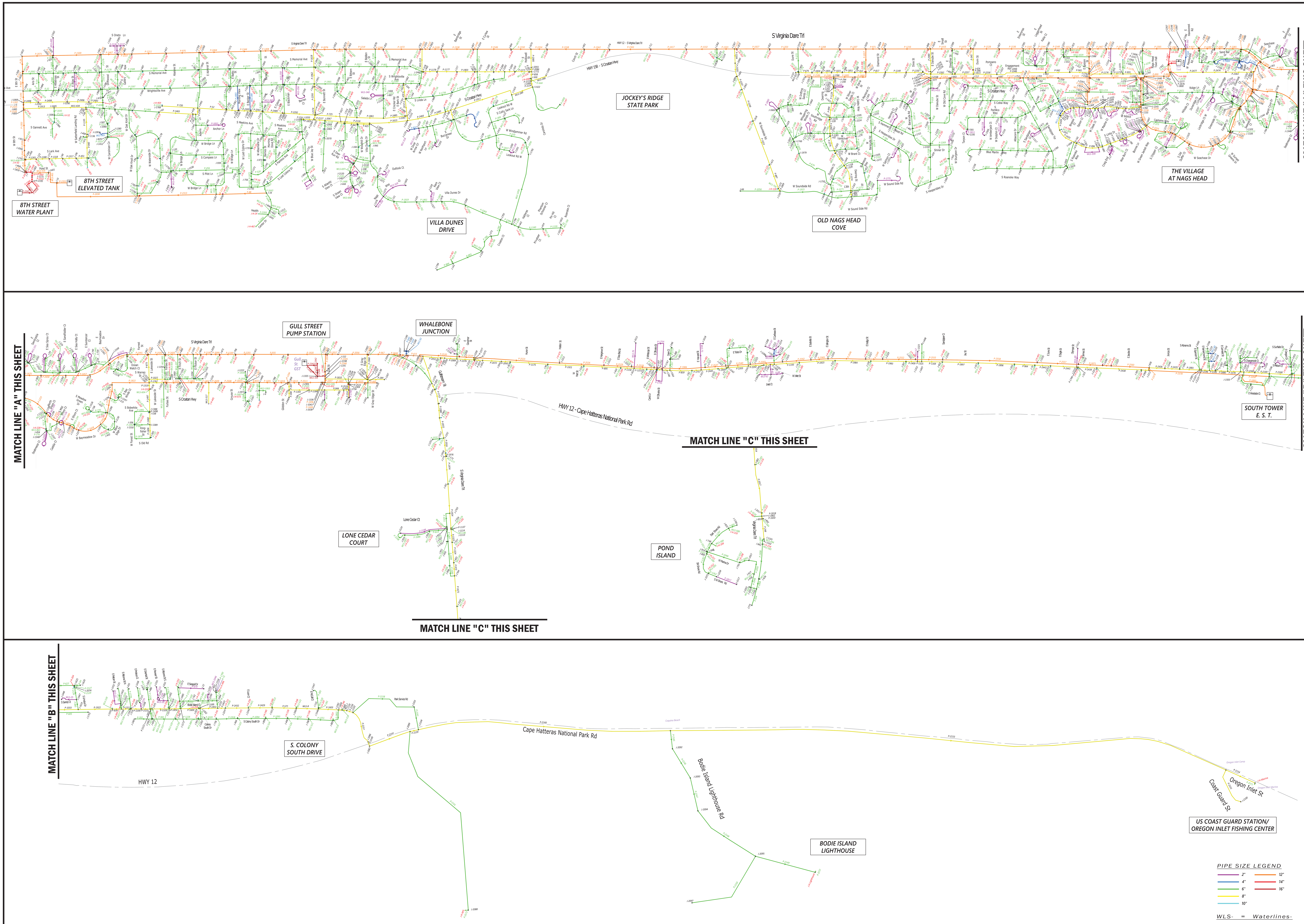
What major water supply reports or studies were used for planning? Town of Nags Head Water Master Plan, Nags Head Annual Report, Nags Head Needs Assessment and the 2010 Land Use Plan.

Please describe any other needs or issues regarding your water supply sources, any water system deficiencies or needed improvements (storage, treatment, etc.) or your ability to meet present and future water needs. Include both quantity and quality considerations, as well as financial, technical, managerial, permitting, and compliance issues:

APPENDIX

G

Hydraulic Model Network Map



SURVEY		DRAFT: JIM	
DESIGN		CHECK	
PROJECT No.	2017052		
DRAWING No.	E-343		
SCALE:	1" - 600 ft		
SHEET No.	1 OF 1		

APRIL 13, 2018

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Landscape Architects

HYDRAULIC MODEL NETWORK
WATER SYSTEM COMPREHENSIVE PLAN
TOWN OF NAGS HEAD
DARE COUNTY NORTH CAROLINA

THE TOWN OF NAGS HEAD 1961

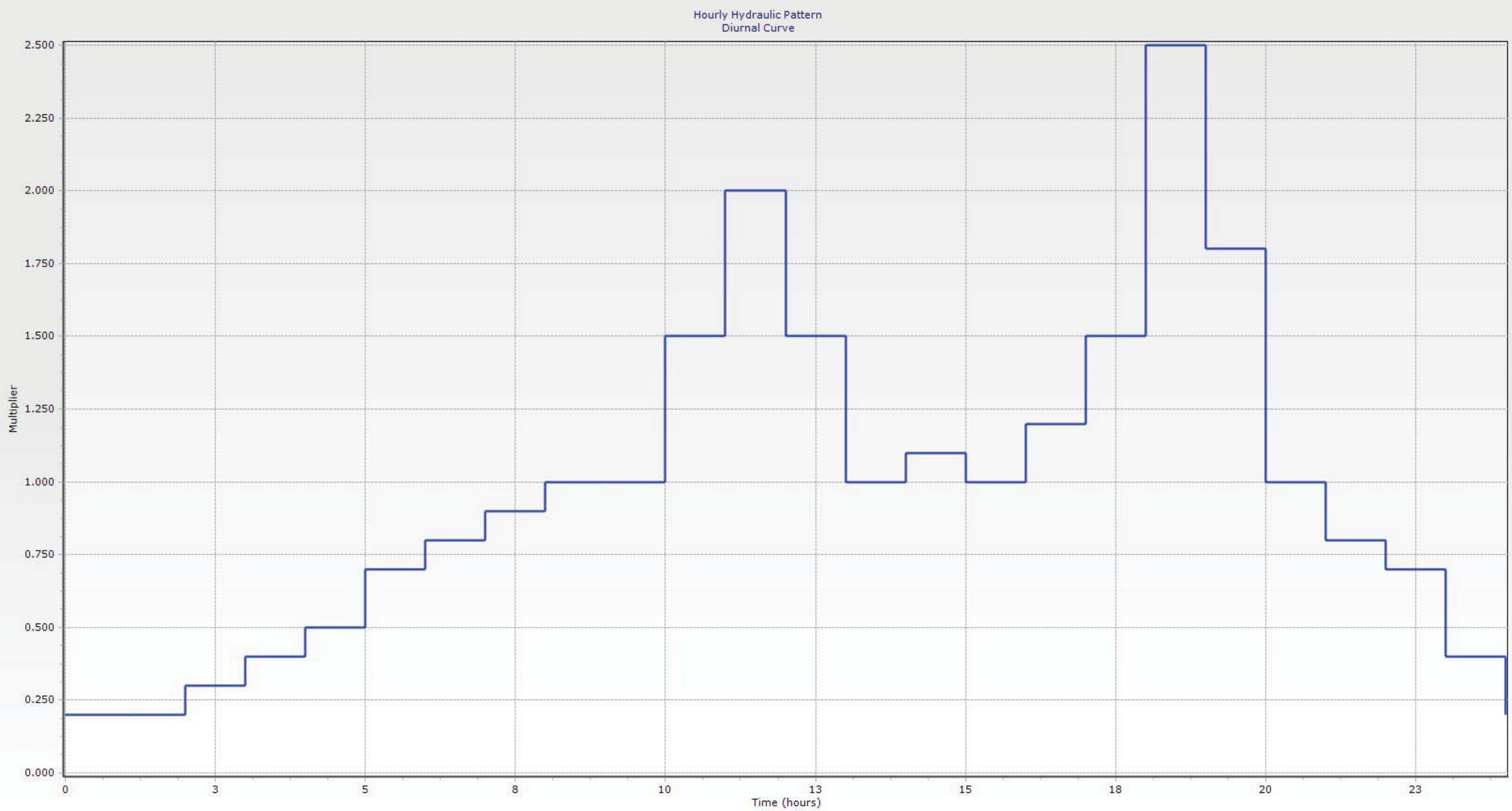
REVISIONS:

REV.	DESCRIPTION	DATE	APP'D

APPENDIX

H

Diurnal Curve

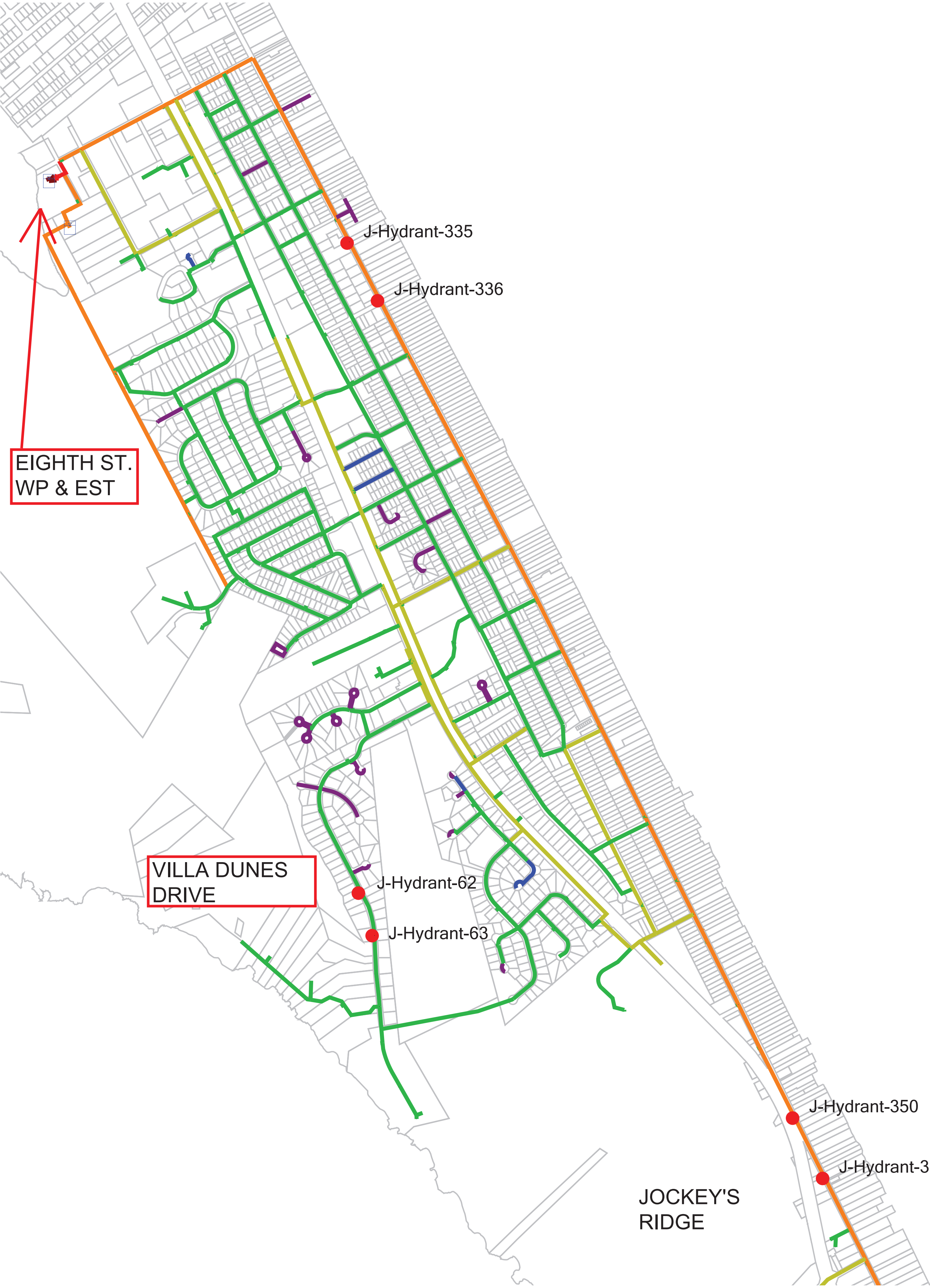

Hourly Hydraulic Pattern
Diurnal Curve
Multiplier
2.500
2.250
2.000
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
0
3
5
8
10
13
15
18
20
23
Time (hours)

APPENDIX

I

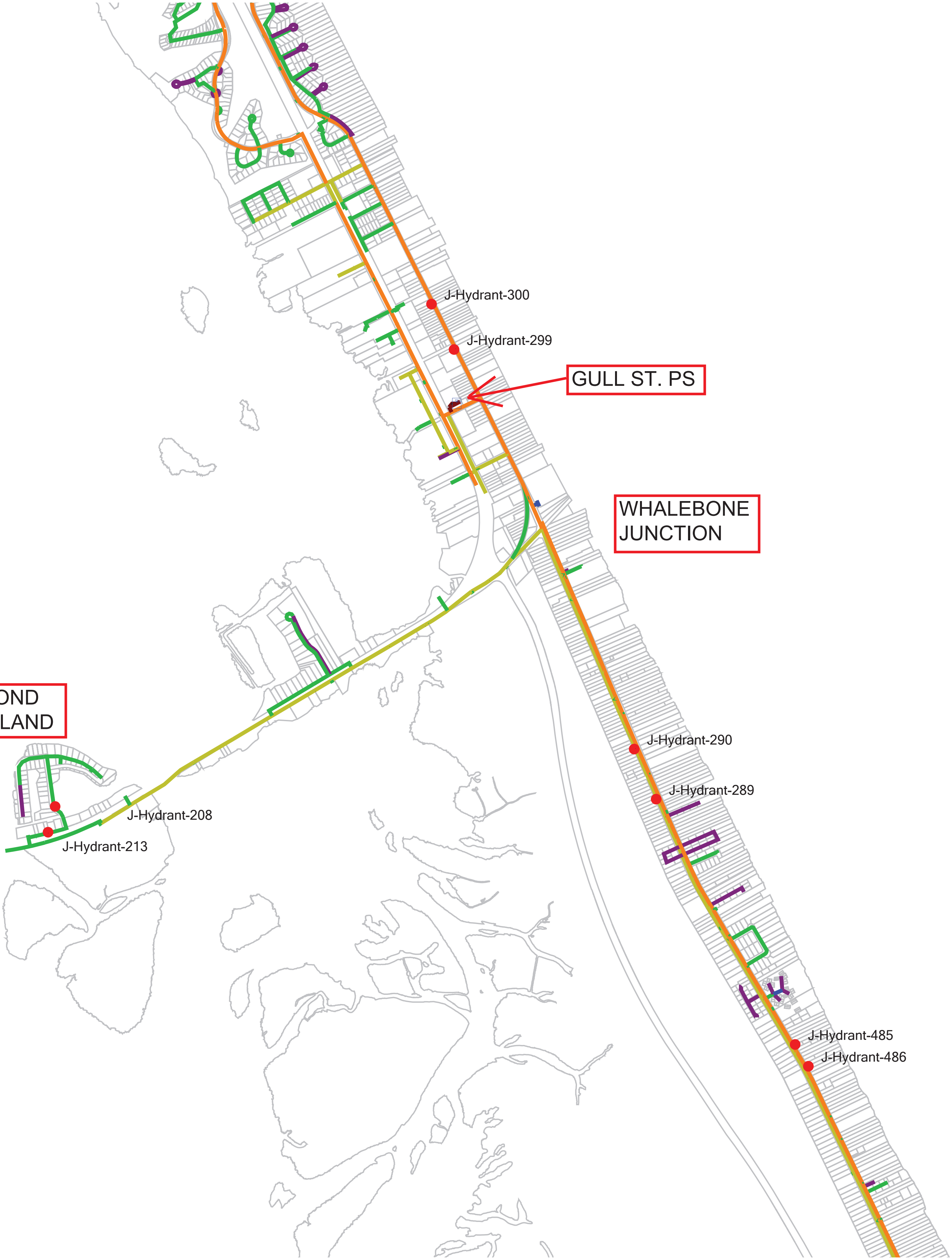
Field Calibration Hydrant Test Locations and Data

HYDRANT FIELD CALIBRATION TEST LOCATIONS

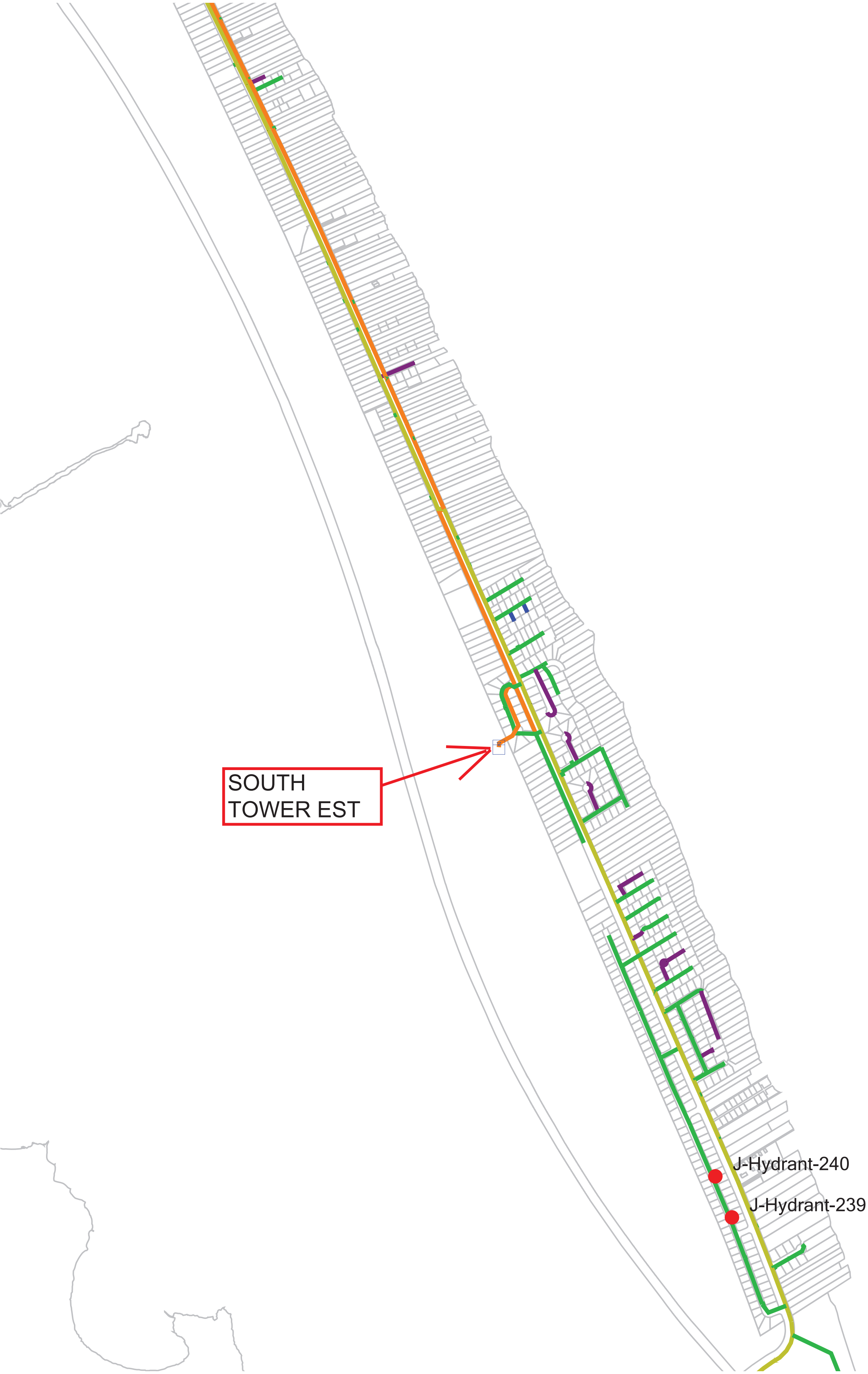


HYDRANT FIELD CALIBRATION TEST LOCATIONS

HYDRANT FIELD CALIBRATION TEST LOCATIONS



HYDRANT FIELD CALIBRATION TEST LOCATIONS



Nags Head Flow Testing (12-12-2017)

Test #	Hydrant # (Up/Down)	Location (Description)	Time	Upstream Hydrant Static Pressure (psi)	Upstream Hydrant Residual Pressure (psi)	Downstream Test Hydrant Flow (GPM)	High Service Pump Running (Y or N)	Pump ID# if Running	High Service Pump Flow (GPM)	8th St. GST Level / HG	8th St. Elev. Tank Level / HG	Gull St. GST Level / HG	South Tower Tank Level / HG
1	335/336 J-946/656	Surfin Spoon / Red Drum Grill, 12" line	9:47	53	46	1010 (55 psi)	N	N/A	N/A	9.9	28.7	21	28.6
										20.9	136.2	27.5	136.1
2	62/63 J-878/2199	408 Villa Dunes, 6" line	10:08	37	22	720 (25 psi)	N	N/A	N/A	9.9	27.9	21	28.5
										20.9	135.4	27.5	136
3	62/63 J-878/2199	408 Villa Dunes, 6" line	10:20	42	25	750 (27 psi)	Y	8th Street Pump #3	1800	9.9	29	21	28.6
										20.9	136.5	27.5	136.1
4	62/63 J-878/2199	408 Villa Dunes, 6" line	10:25	48	31	790 (30 psi)	Y	8th Street Pump #3 & Gull St. Pump #1	–	9.5	31.4	20.6	29.1
										20.5	138.9	27.1	136.6
5	350/351 J-710/718	Jockey's Ridge, Beach Road, 12" line	10:46	52	43	850 (36 psi)	N	N/A	N/A	9.4	28.6	29.1	20.2
										20.4	136.1	35.6	127.7

Nags Head Flow Testing (12-12-2017)

Test #	Hydrant # (Up/Down)	Location (Description)	Time	Upstream Hydrant Static Pressure (psi)	Upstream Hydrant Residual Pressure (psi)	Downstream Test Hydrant Flow (GPM)	High Service Pump Running (Y or N)	Pump ID# if Running	High Service Pump Flow (GPM)	8th St. GST Level	8th St. Elev. Tank Level	Gull St. GST Level	South Tower Tank Level
6	148/149 J-976/932	West Danube, 6" line	11:03	52	48	790 (30 psi)	N	N/A	N/A	9.5	28.3	20.2	28.8
										20.5	135.8	26.7	136.3
7	148/149 J-976/932	West Danube, 6" line	11:08	62	53	850 (36 psi)	Y	8th Street Pump #3	1800	9.3	29.9	20.2	28.8
										20.3	137.4	26.7	136.3
8	148/149 J-976/932	West Danube, 6" line	11:15	71	57	935 (45 psi)	Y	8th Street Pump #3 & Gull St. Pump #2	8th St. cut down to 1550 from 1800 when Gull cut on	9.1	31	19.9	29.4
										20.1	138.5	26.4	136.9
9	385/386 J-2201/1978	Seachase & S. Croatan Hwy Intersection, 8" line	11:40	53	49	890 (40 psi)	N	N/A	N/A	9	28.7	19.7	29
										20	136.2	26.2	136.5
10	299/300 J-793/830	Beach Road near Gull St. Pump Station, Glidden St. & Grouse St., 12" line	11:56	52	40	825 (33 psi)	N	N/A	N/A	9	28.3	19.7	28.8
										20	135.8	26.2	136.3

Nags Head Flow Testing (12-12-2017)

Test #	Hydrant # (Up/Down)	Location (Description)	Time	Upstream Hydrant Static Pressure (psi)	Upstream Hydrant Residual Pressure (psi)	Downstream Test Hydrant Flow (GPM)	High Service Pump Running (Y or N)	Pump ID# if Running	High Service Pump Flow (GPM)	8th St. GST Level	8th St. Elev. Tank Level	Gull St. GST Level	South Tower Tank Level
11	299/300 J-793/830	Beach Road near Gull St. Pump Station, Glidden St. & Grouse St., 12" line	12:03	65	41	850 (36 psi)	Y	8th Street Pump #3	–	8.9	29.7	19.7	29
										19.9	137.2	26.2	136.5
12	299/300 J-793/830	Beach Road near Gull St. Pump Station, Glidden St. & Grouse St., 12" line	12:08	89	59	1000 (54 psi)	Y	8th Street Pump #3 & Gull St. Pump #1	–	8.8	30.8	19.4	29.4
										19.8	138.3	25.9	136.9
13	213/208 J-457/749	Pond Island, parking lot by old Crab Shack, 6" line	12:24	55	17	500 (13 psi)	N	N/A	N/A	8.6	28.7	19.3	29.1
										19.6	136.2	25.8	136.6
14	213/208 J-457/749	Pond Island, parking lot by old Crab Shack, 6" line	12:30	56	18	500 (13 psi)	Y	8th Street Pump #3	–	8.5	29.8	19.3	29.5
										19.5	137.3	25.8	137
15	213/208 J-457/749	Pond Island, parking lot by old Crab Shack, 6" line	12:35	74	23	600 (17 psi)	Y	8th Street Pump #3 & Gull St. Pump #2	–	8.3	31.6	19	29.6
										19.3	139.1	25.5	137.1

Nags Head Flow Testing (12-12-2017)

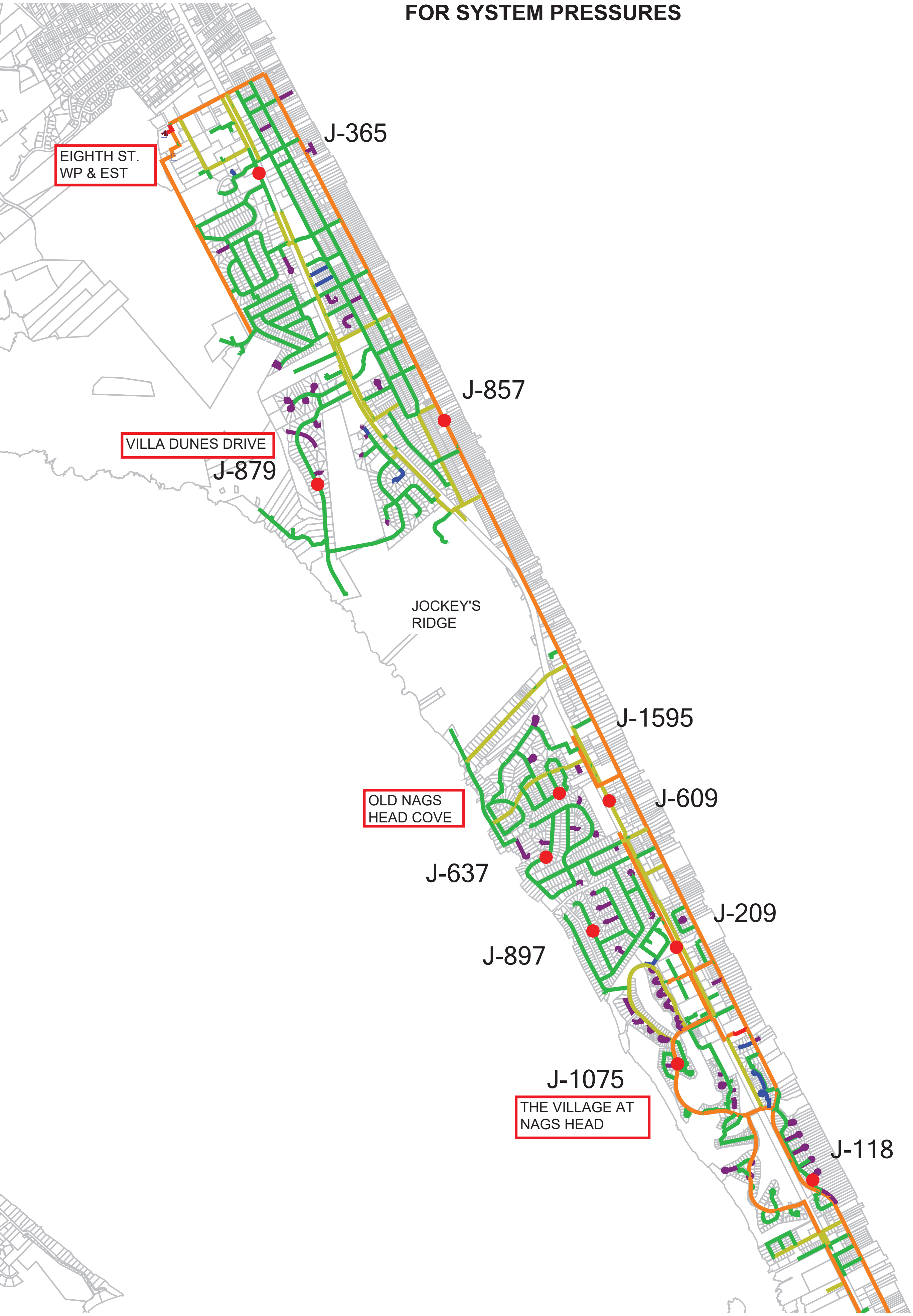
Test #	Hydrant # (Up/Down)	Location (Description)	Time	Upstream Hydrant Static Pressure (psi)	Upstream Hydrant Residual Pressure (psi)	Downstream Test Hydrant Flow (GPM)	High Service Pump Running (Y or N)	Pump ID# if Running	High Service Pump Flow (GPM)	8th St. GST Level	8th St. Elev. Tank Level	Gull St. GST Level	South Tower Tank Level
16	289/290 J-449/517	Hardgrove Beach Access, 8" line	12:56	55	44	890 (40 psi)	Y	8th Street Pump #3, incidental, automatic	–	8.2	31.1	20.3	29.9
										19.2	138.6	26.8	137.4
17	486/485 J-2204/2206	Beach Access next to Fire Dept, 12" line	1:08	45	38	935 (45 psi)	N	N/A	N/A	8.8	29.9	20.4	30.3
										19.8	137.4	26.9	137.8
18	240/239 J-898/445	S. South Colony Drive, 6" line	1:38	52	31	790 (30 psi)	N	N/A	N/A	9.8	29.6	20.4	29.5
										20.8	137.1	26.9	137
~~19~~	~~240/239 J-898/445~~	~~S. South Colony Drive, 6" line~~	~~1:44~~	~~52~~	~~31~~	~~7910 (30 psi)~~	~~Y~~	~~8th Street Pump #3~~	–	~~9.8~~	~~29.6~~	~~20.4~~	~~29.5~~
										~~20.8~~	~~137.1~~	~~26.9~~	~~137~~
20	240/239 J-898/445	S. South Colony Drive, 6" line	1:49	55	33	810 (32 psi)	Y	8th Street Pump #3 & Gull St. Pump #1	–	9.5	33	20.1	30
										20.5	140.5	26.6	137.5

APPENDIX

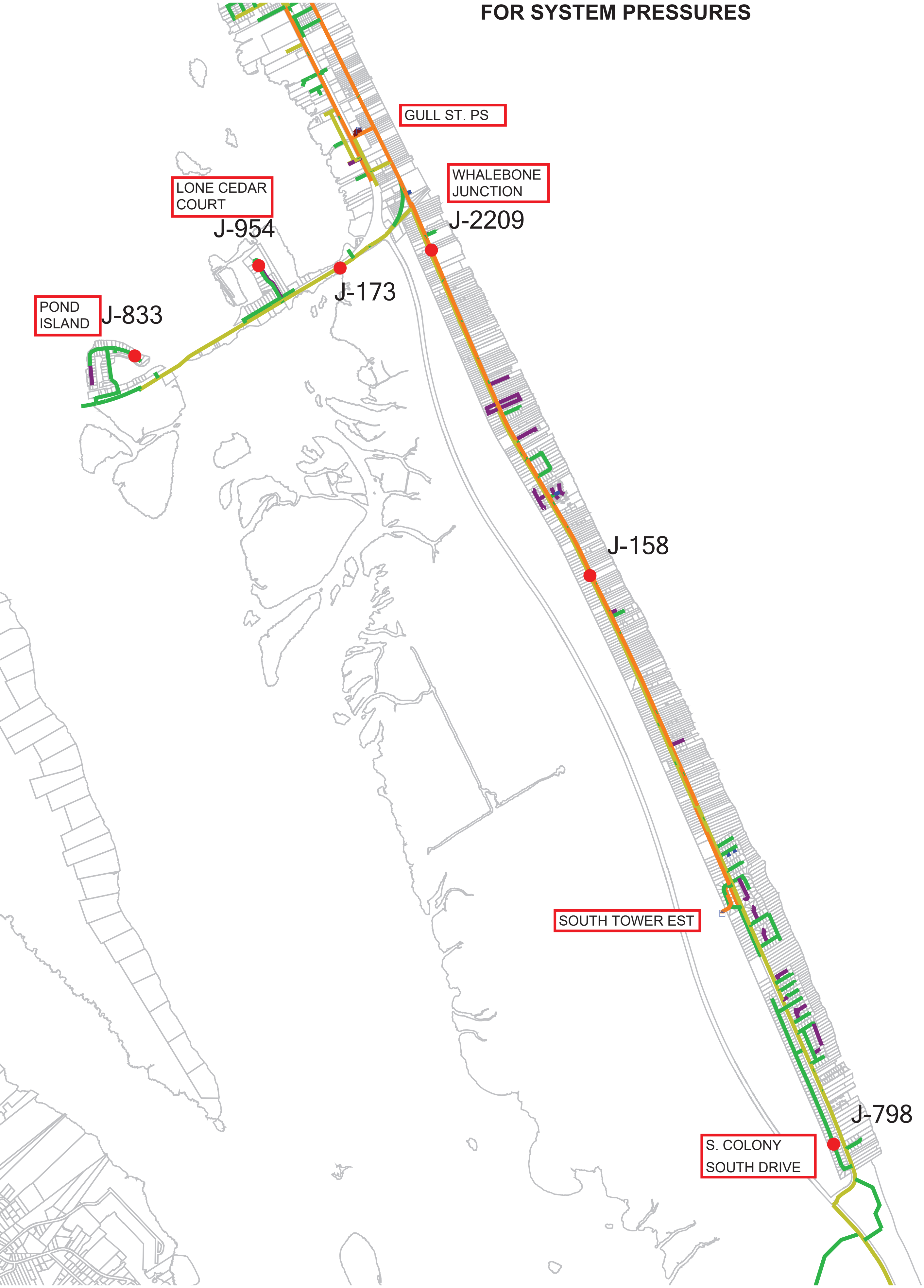
J

Junction Node Reference Locations for System Pressures

JUNCTION NODE REFERENCES FOR SYSTEM PRESSURES



JUNCTION NODE REFERENCES FOR SYSTEM PRESSURES

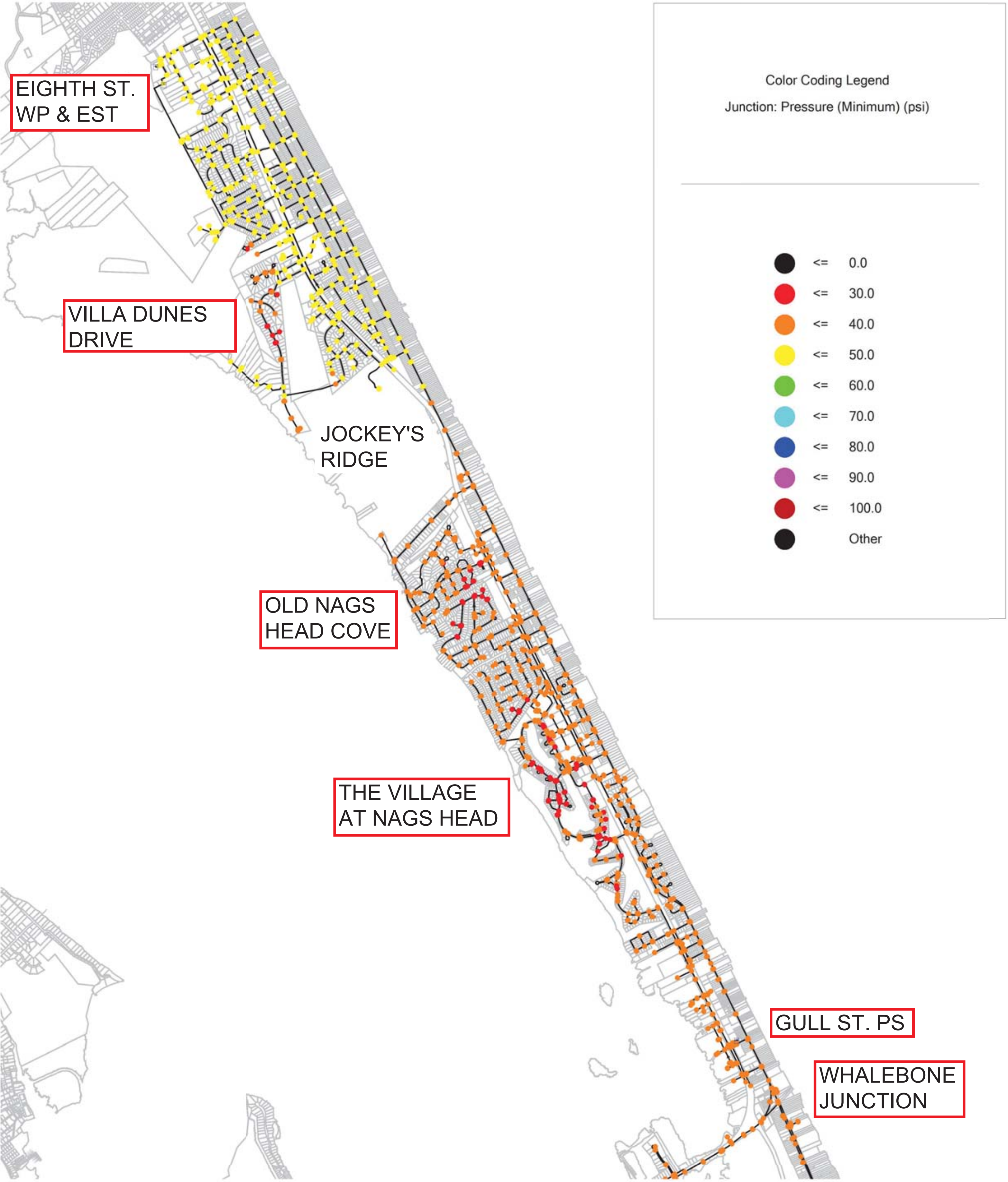


APPENDIX

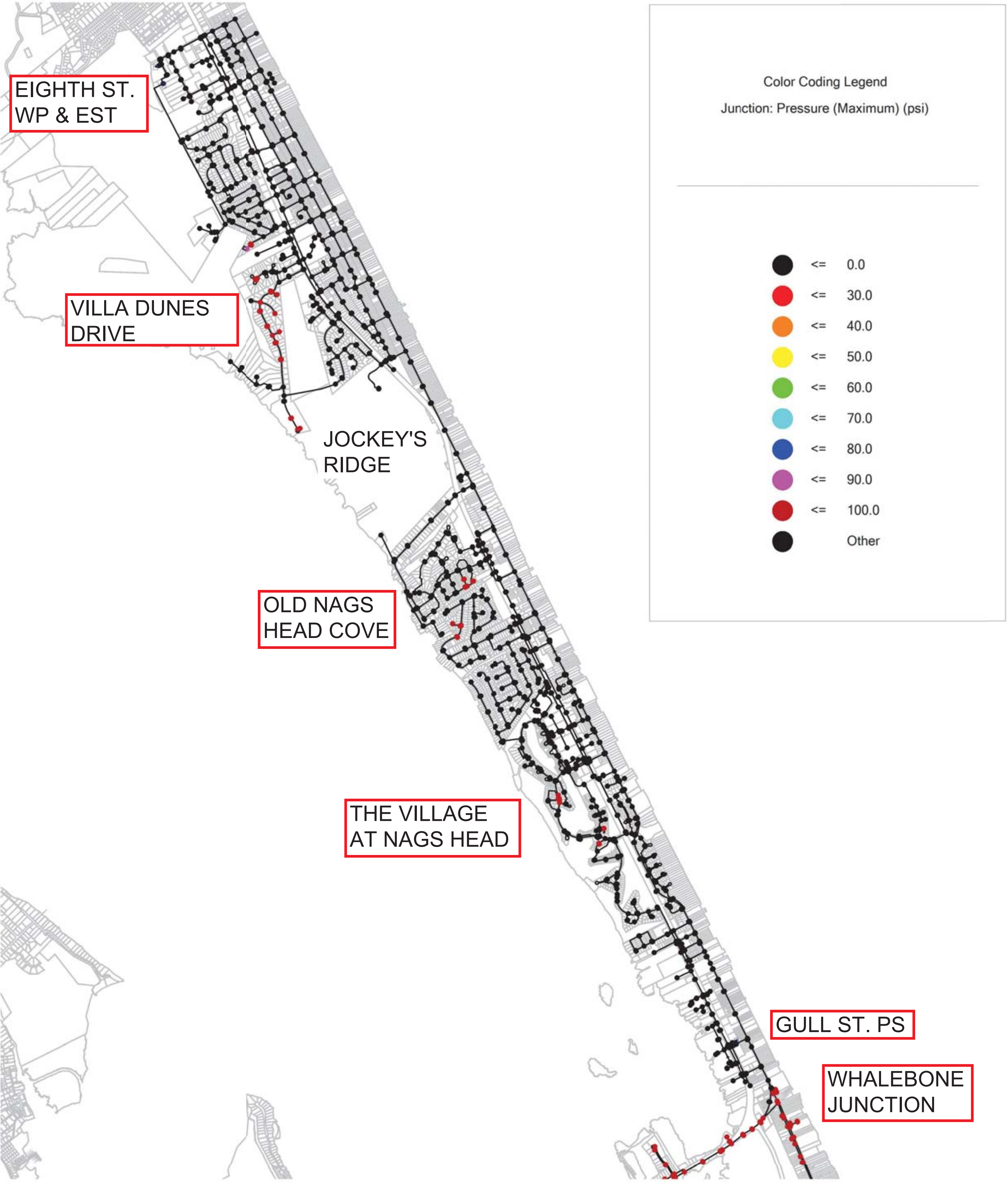
K

Scenario 1
July 2016 Maximum Day Flow
Existing Controls

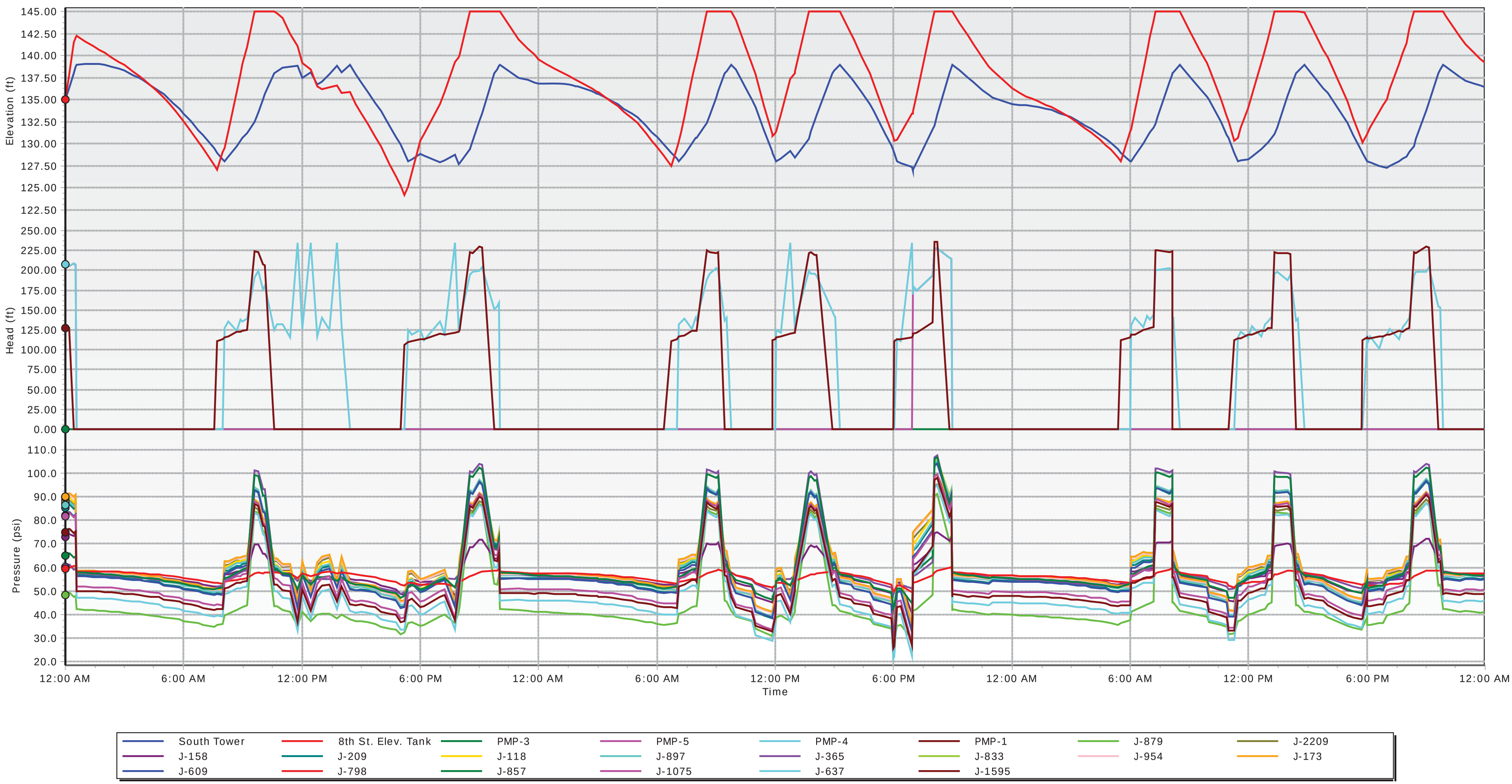
SCENARIO 1 - JULY 2016 MAXIMUM DAY FLOW
EXISTING CONTROLS
MINIMUM PRESSURES



SCENARIO 1 - JULY 2016 MAXIMUM DAY FLOW
EXISTING CONTROLS
MAXIMUM PRESSURES



SCENARIO 1 - JULY 2016 MAXIMUM DAY FLOW
EXISTING CONTROLS

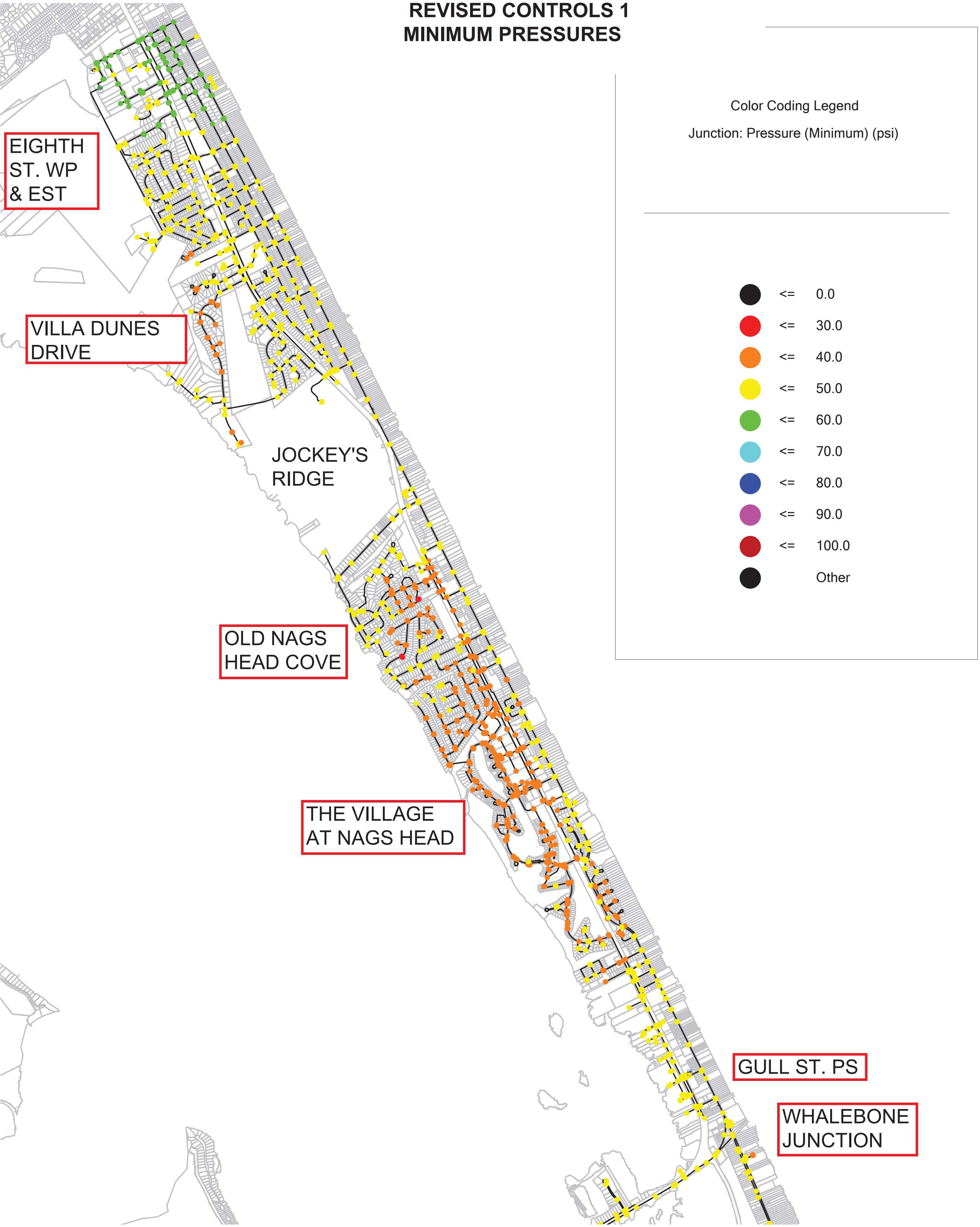


APPENDIX

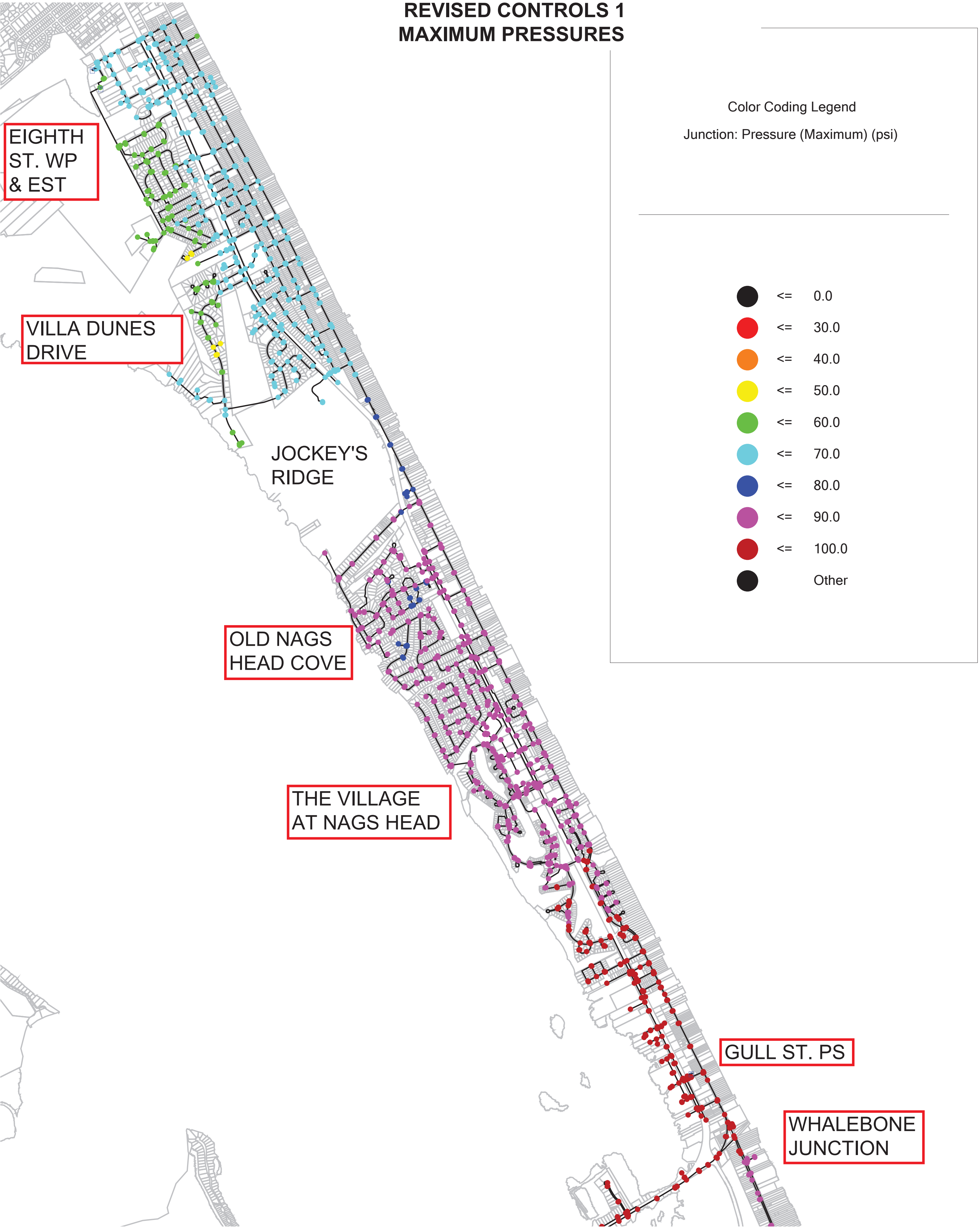
L

Scenario 2
July 2016 Maximum Day Flow
Revised Controls 1

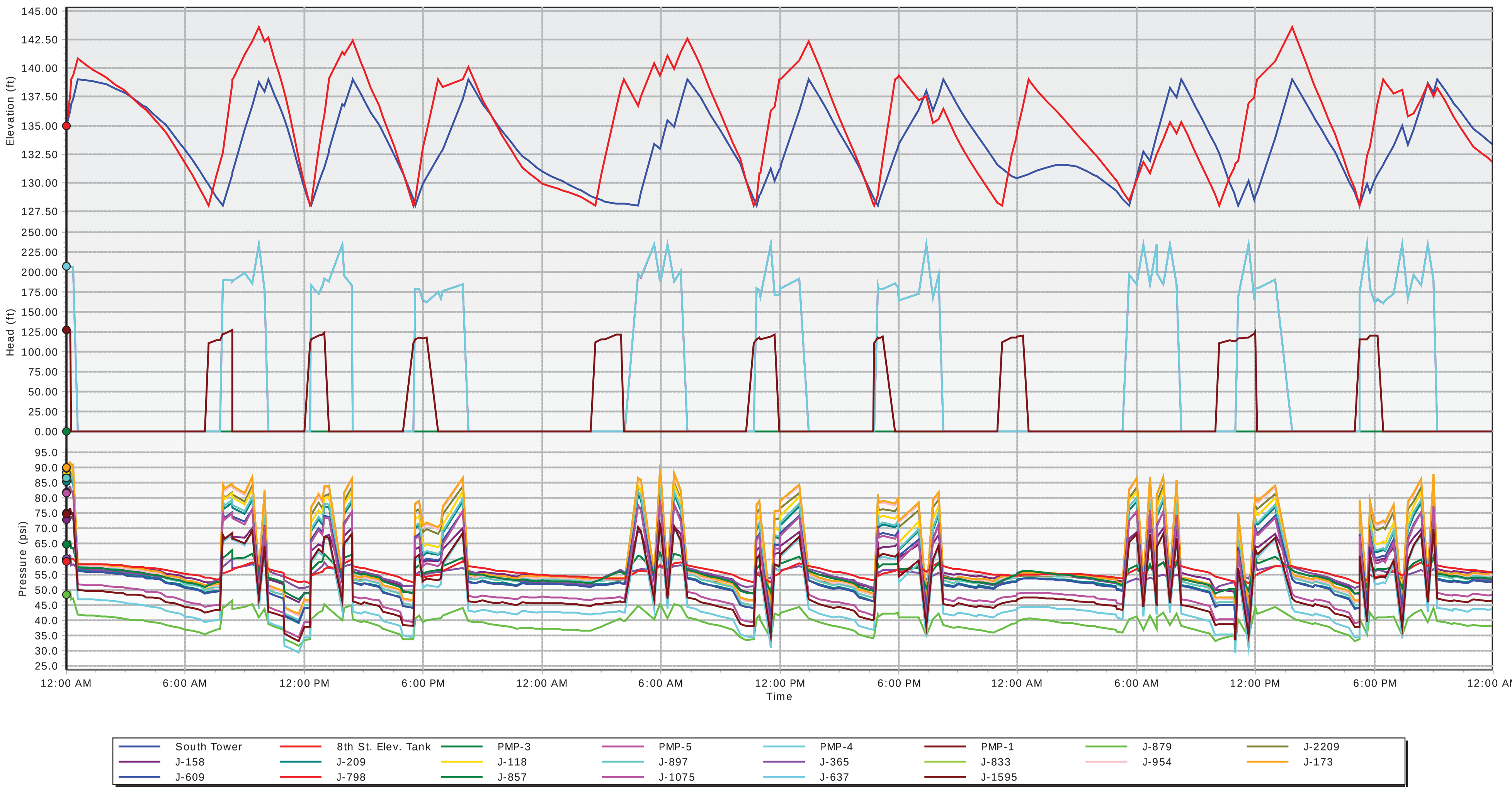
SCENARIO 2 - JULY 2016 MAXIMUM DAY FLOW
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 2 - JULY 2016 MAXIMUM DAY FLOW
REVISED CONTROLS 1
MAXIMUM PRESSURES



SCENARIO 2 - JULY 2016 MAXIMUM DAY FLOW
REVISED CONTROLS 1



APPENDIX

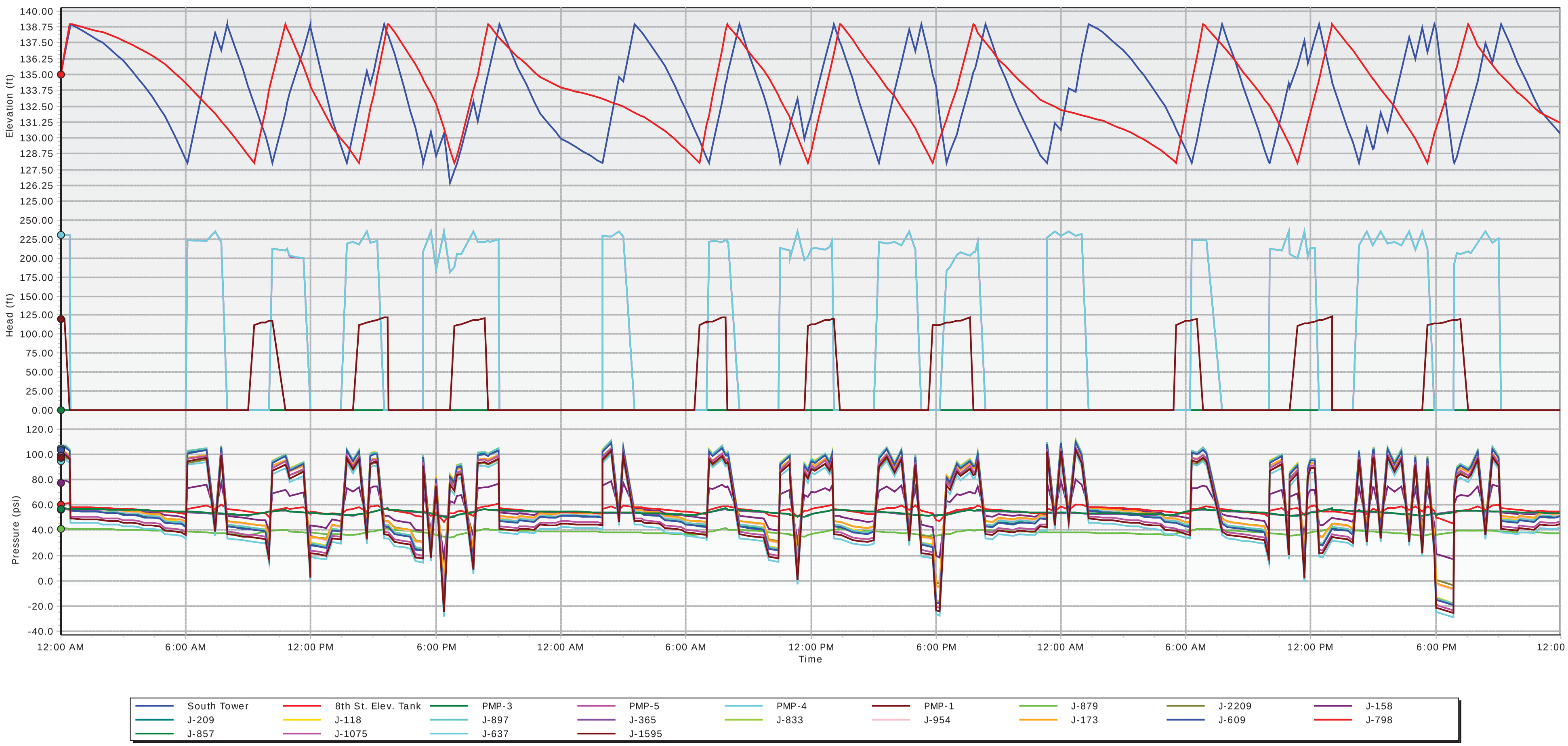
M

Scenario 14
July 2016 Maximum Day Flow
Main Break
Revised Controls 1

SCENARIO 14 - JULY 2016 MAXIMUM DAY FLOW
MAIN BREAK
REVISED CONTROLS 1
MINIMUM PRESSURES

SCENARIO 14 - JULY 2016 MAXIMUM DAY FLOW
MAIN BREAK
REVISED CONTROLS 1
MAXIMUM PRESSURES

SCENARIO 14 - JULY 2016 MAXIMUM DAY FLOW
MAIN BREAK
REVISED CONTROLS 1

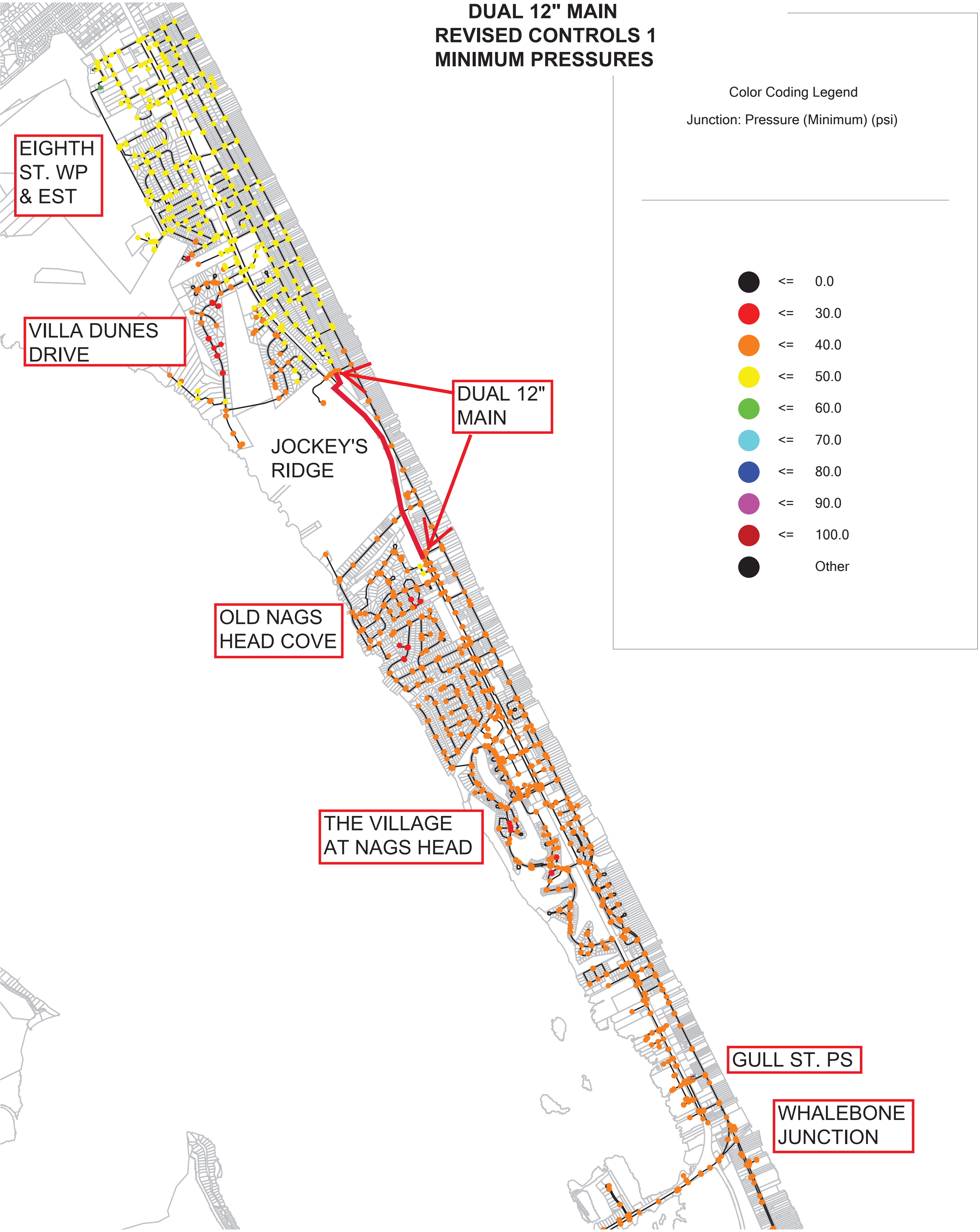


APPENDIX

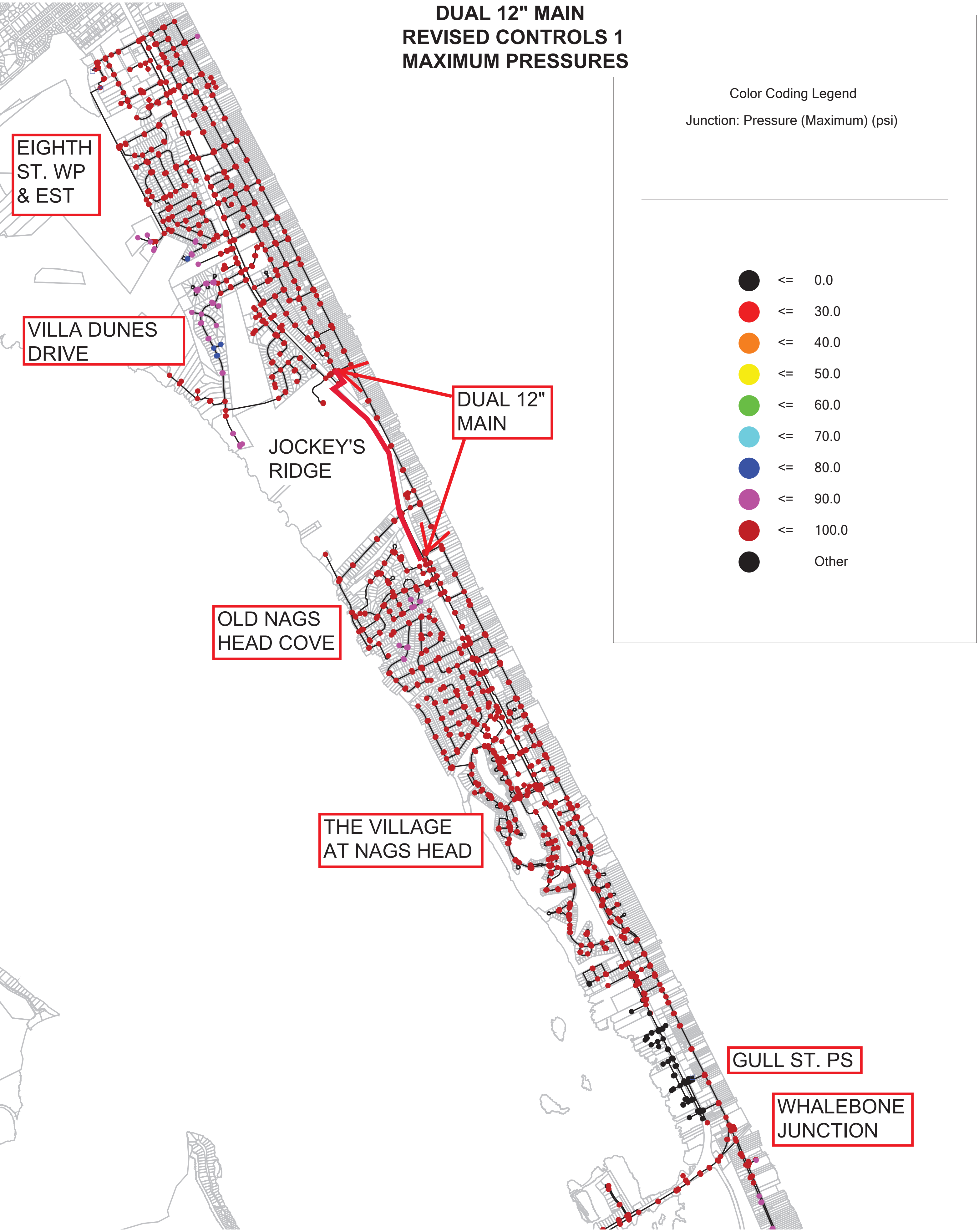
N

Scenario 22
July 2016 Maximum Day Flow
Dual 12-inch Main
Revised Controls 1

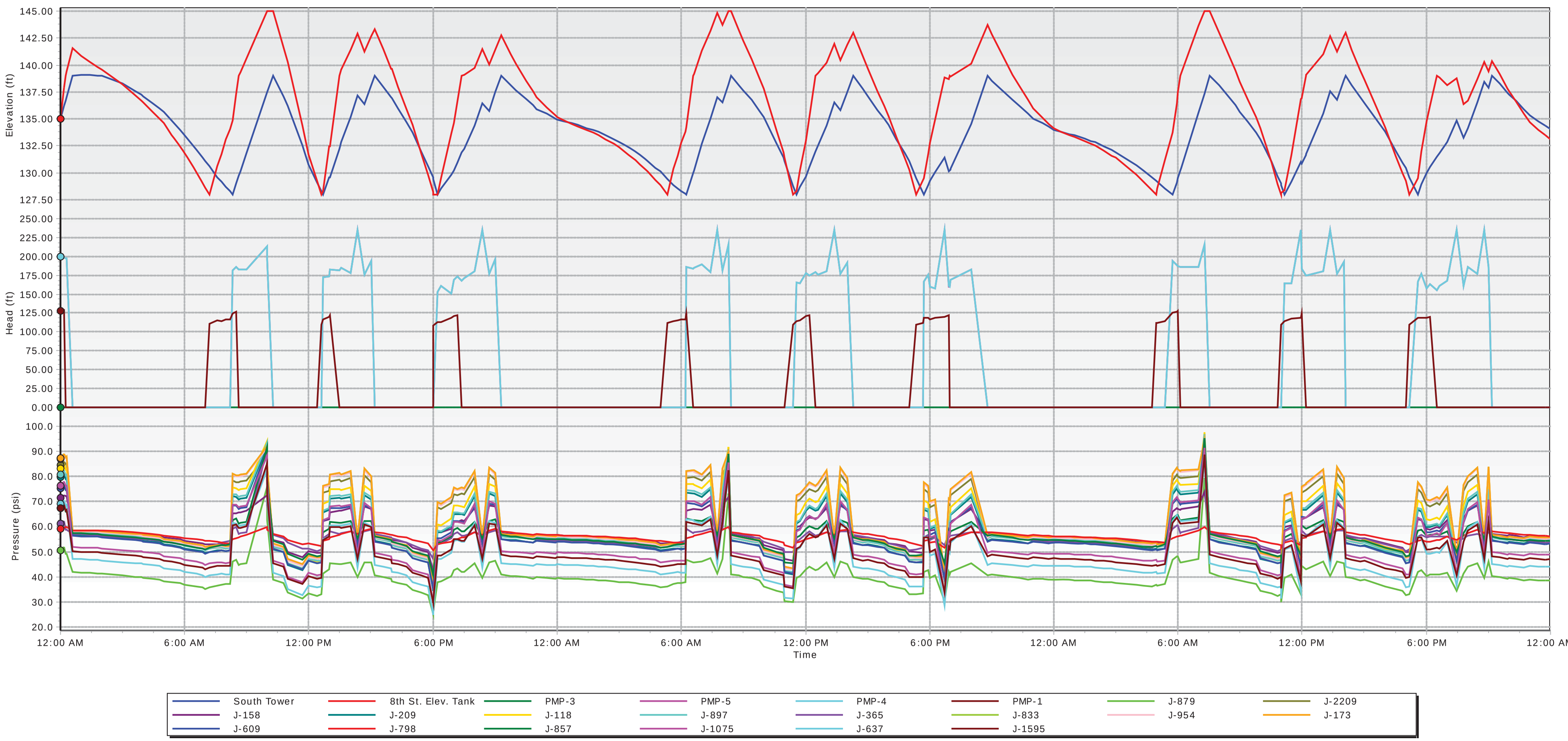
SCENARIO 22 - JULY 2016 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 22 - JULY 2016 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1
MAXIMUM PRESSURES



SCENARIO 22 - JULY 2016 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1

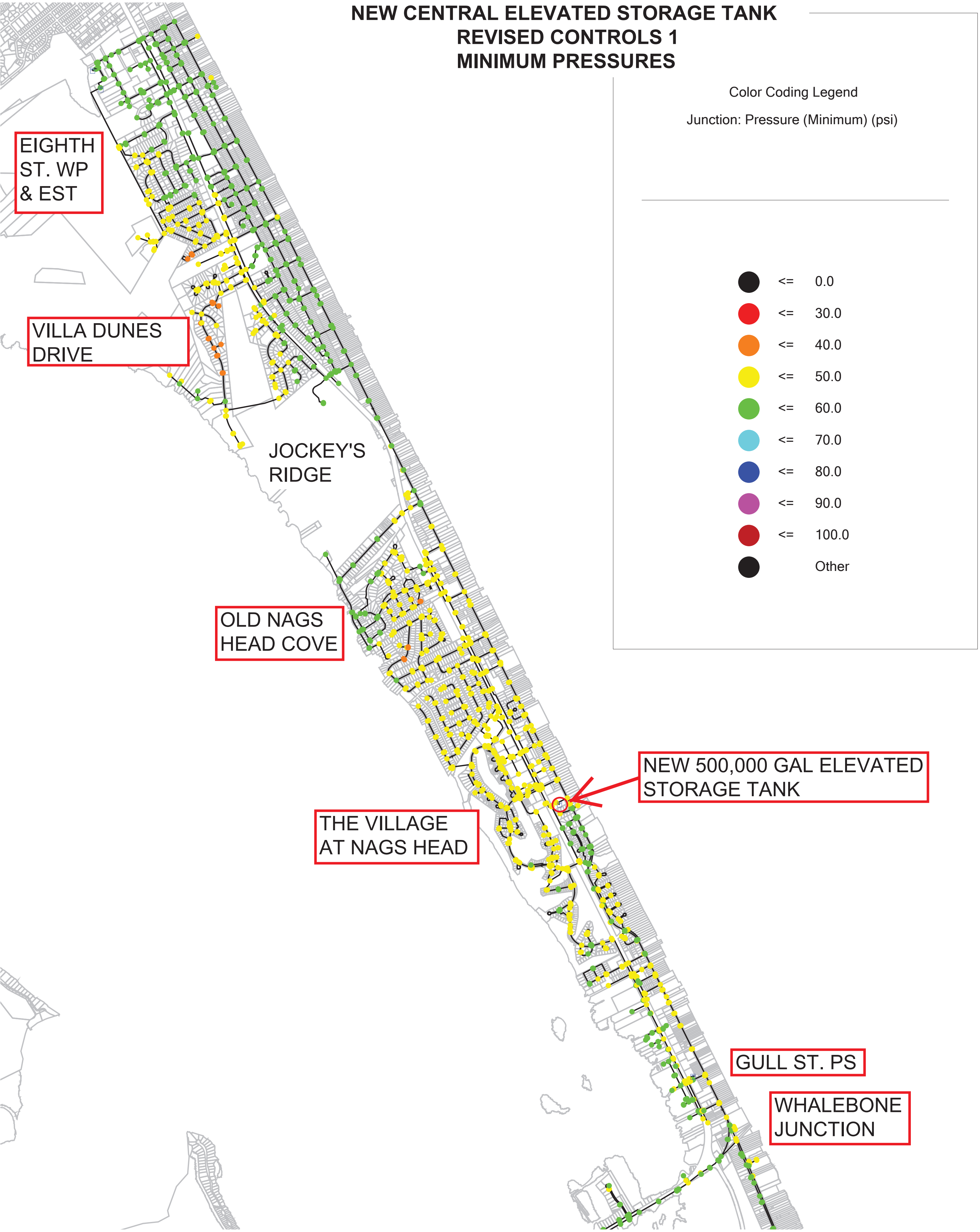


APPENDIX

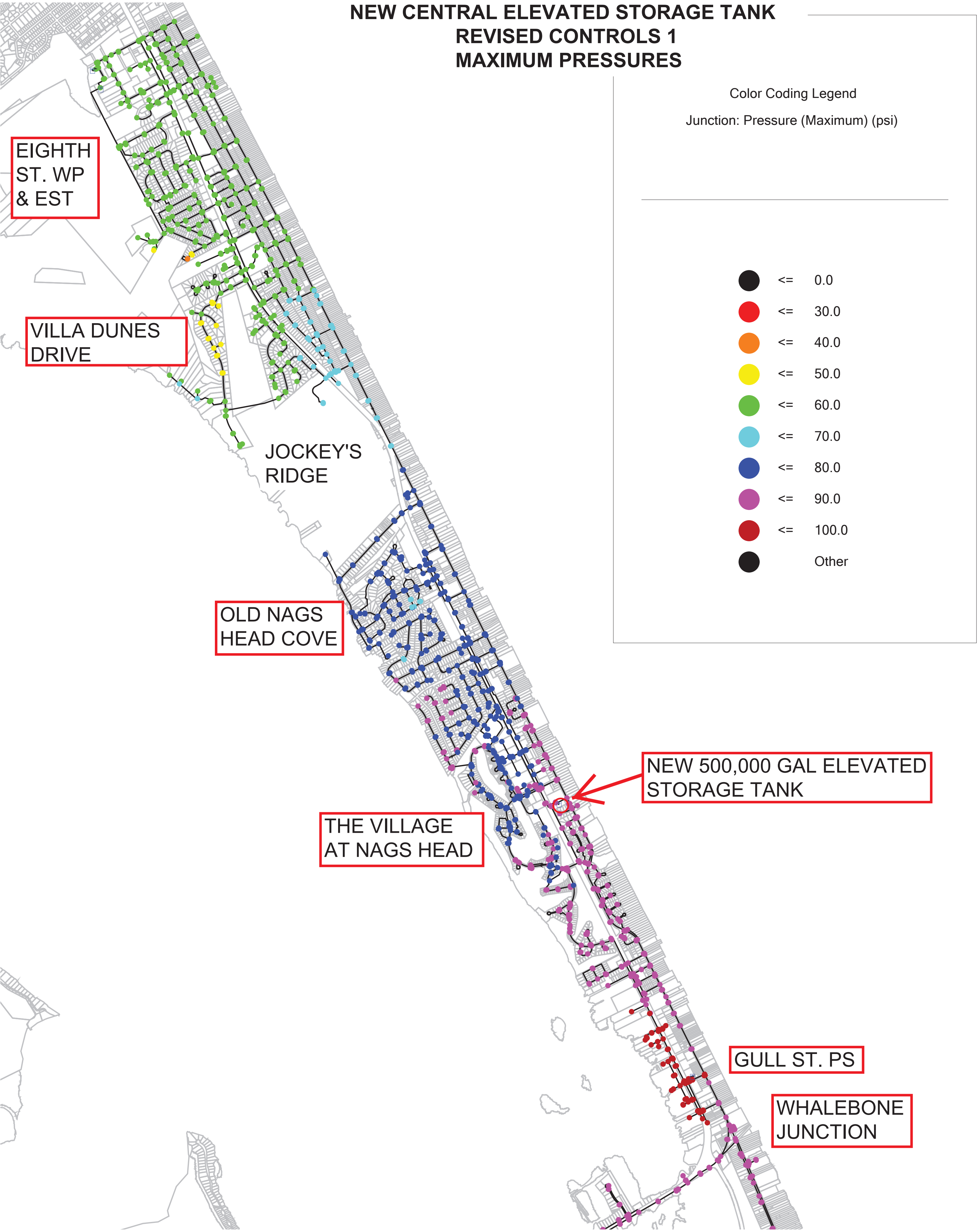
O

Scenario 23
July 2016 Maximum Day Flow
New Tank
Revised Controls 1

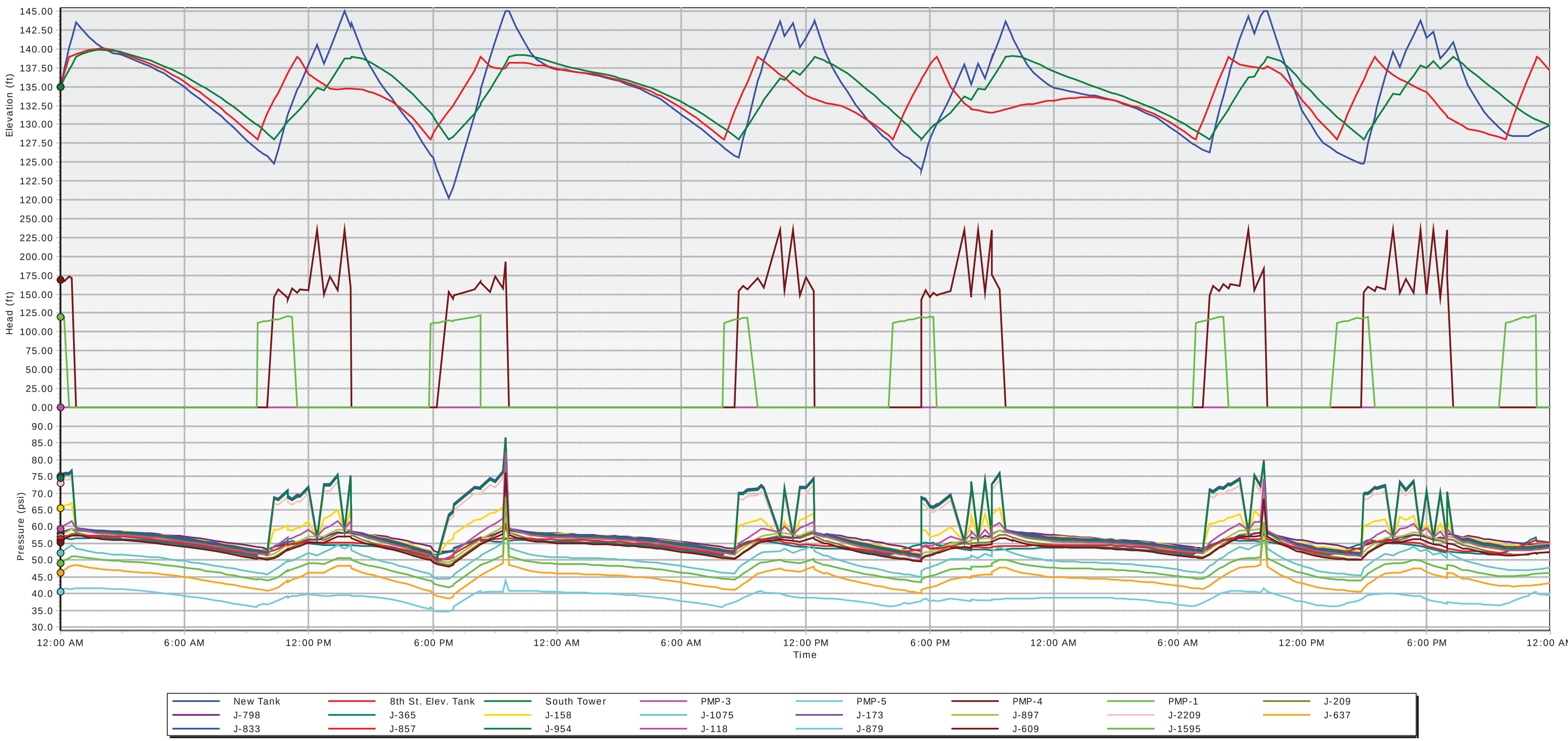
SCENARIO 23 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 23 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1
MAXIMUM PRESSURES



SCENARIO 23 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1

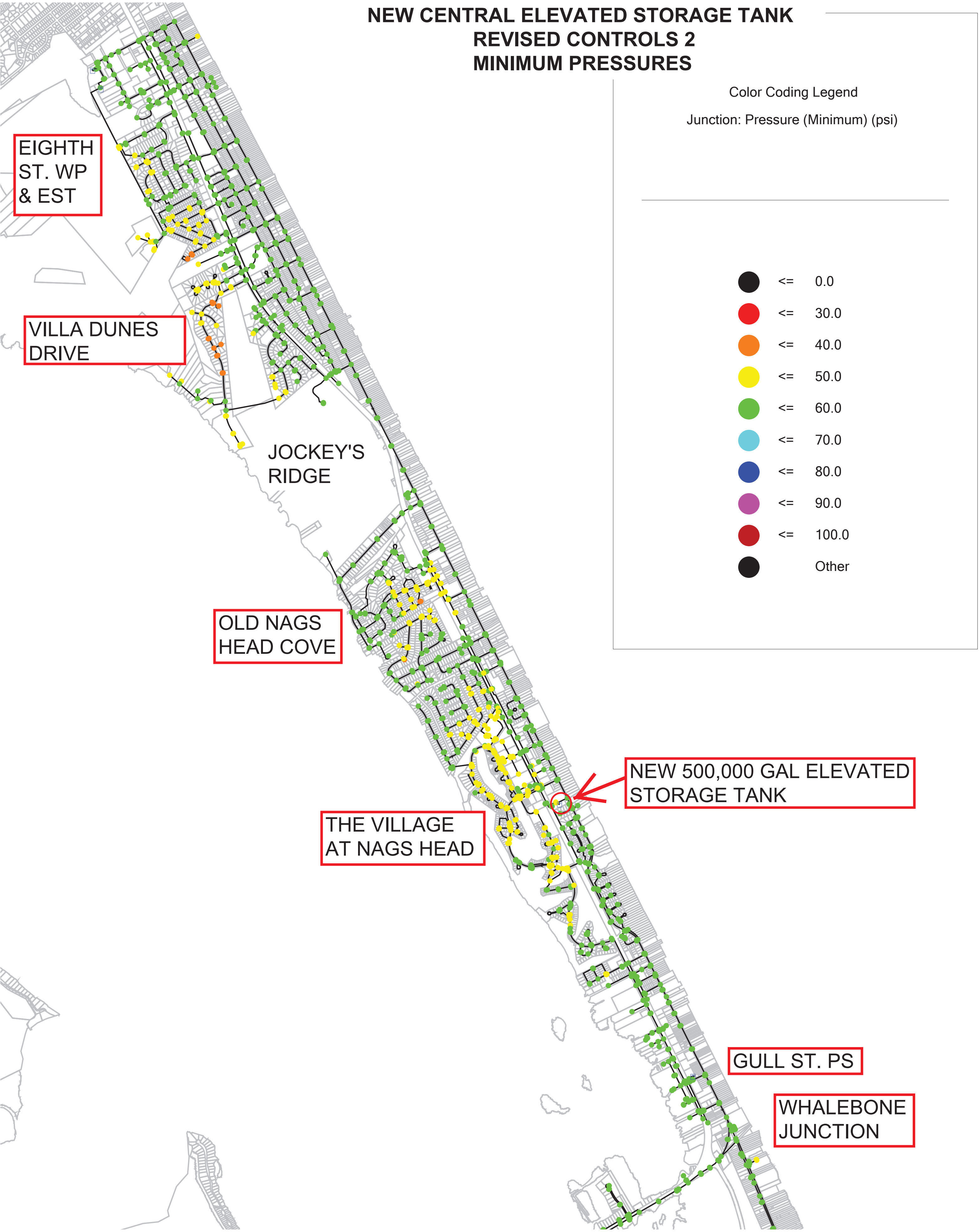


APPENDIX

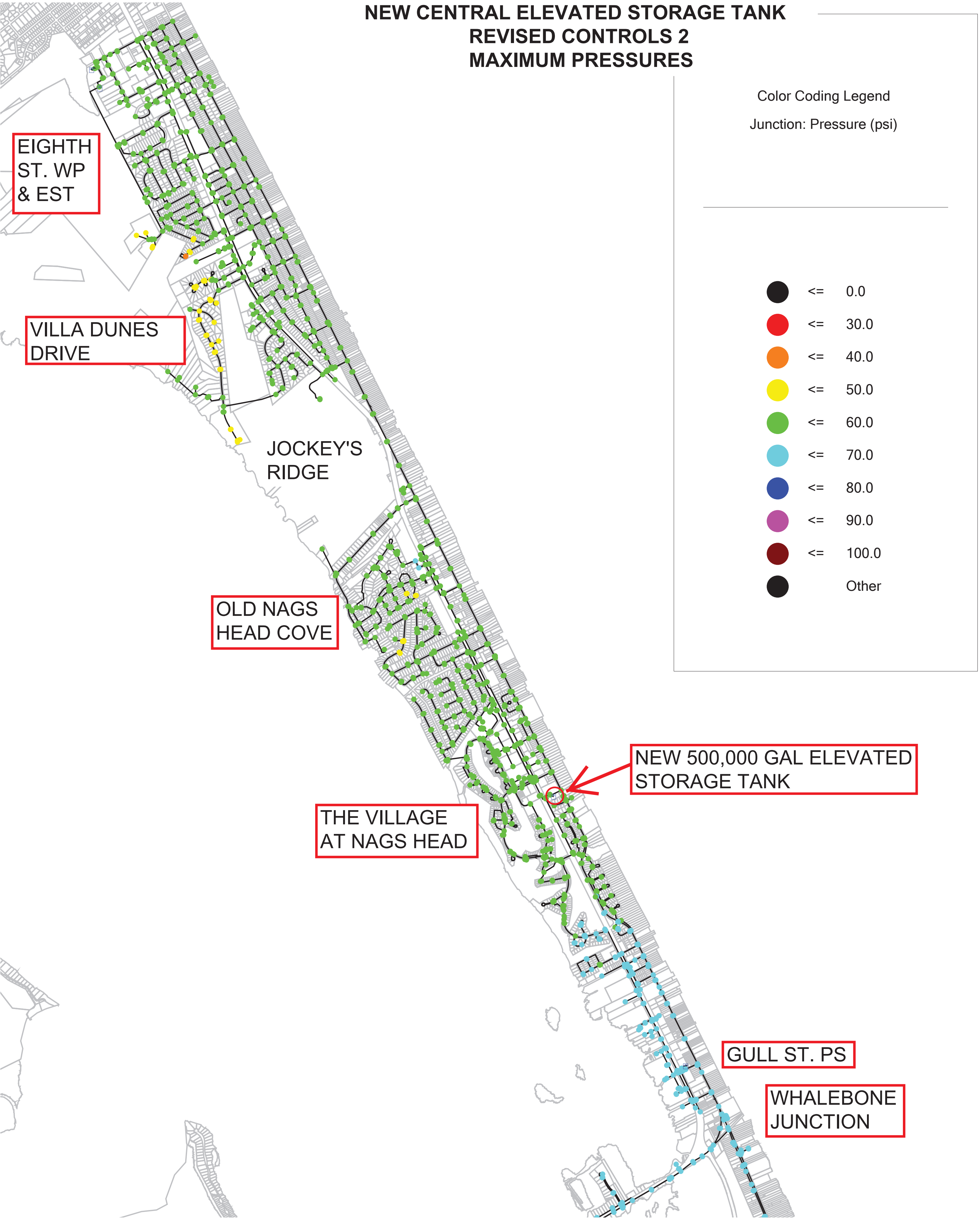
P

Scenario 24
July 2016 Maximum Day Flow
New Tank
Revised Controls 2

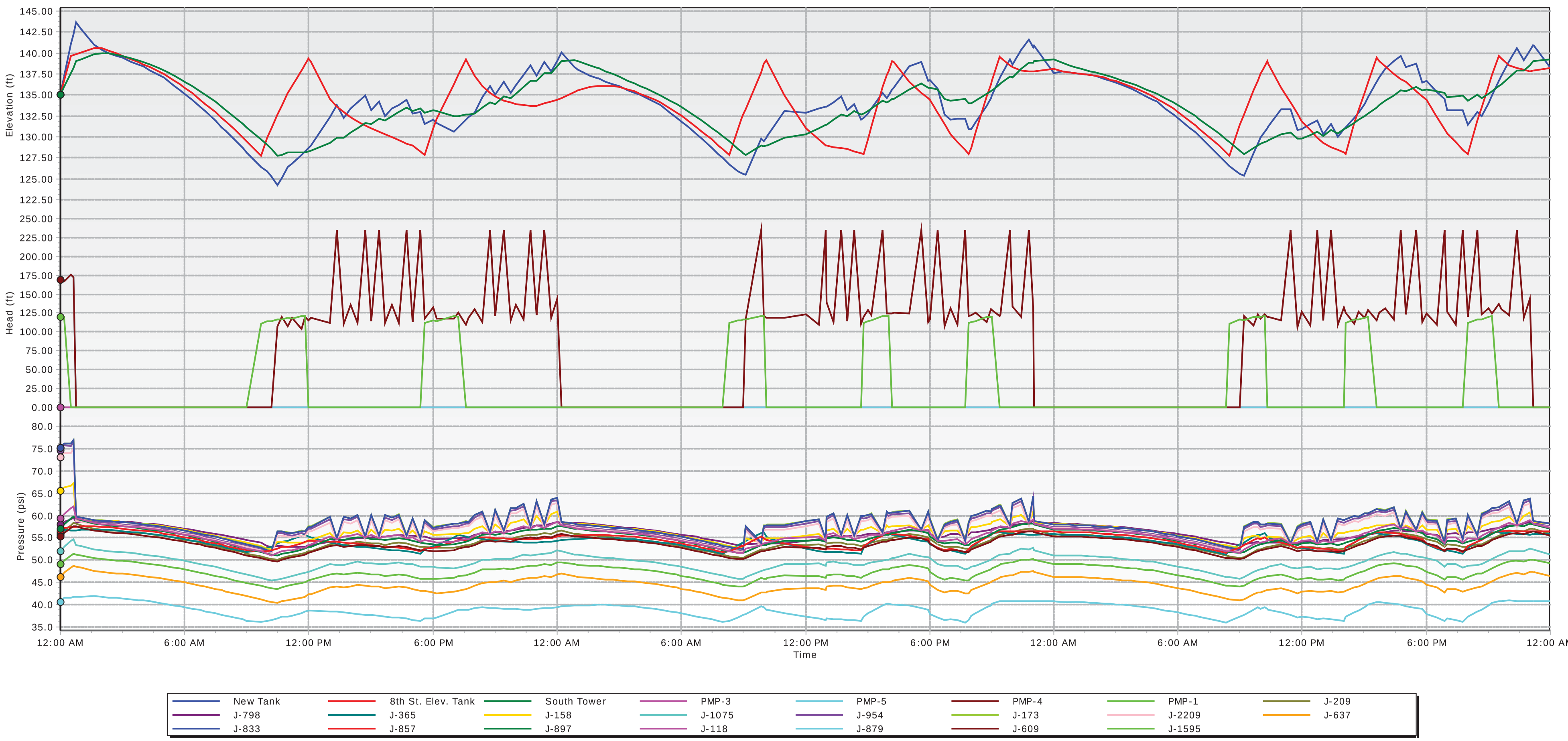
SCENARIO 24 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 2
MINIMUM PRESSURES



SCENARIO 24 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 2
MAXIMUM PRESSURES



SCENARIO 24 - JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 2

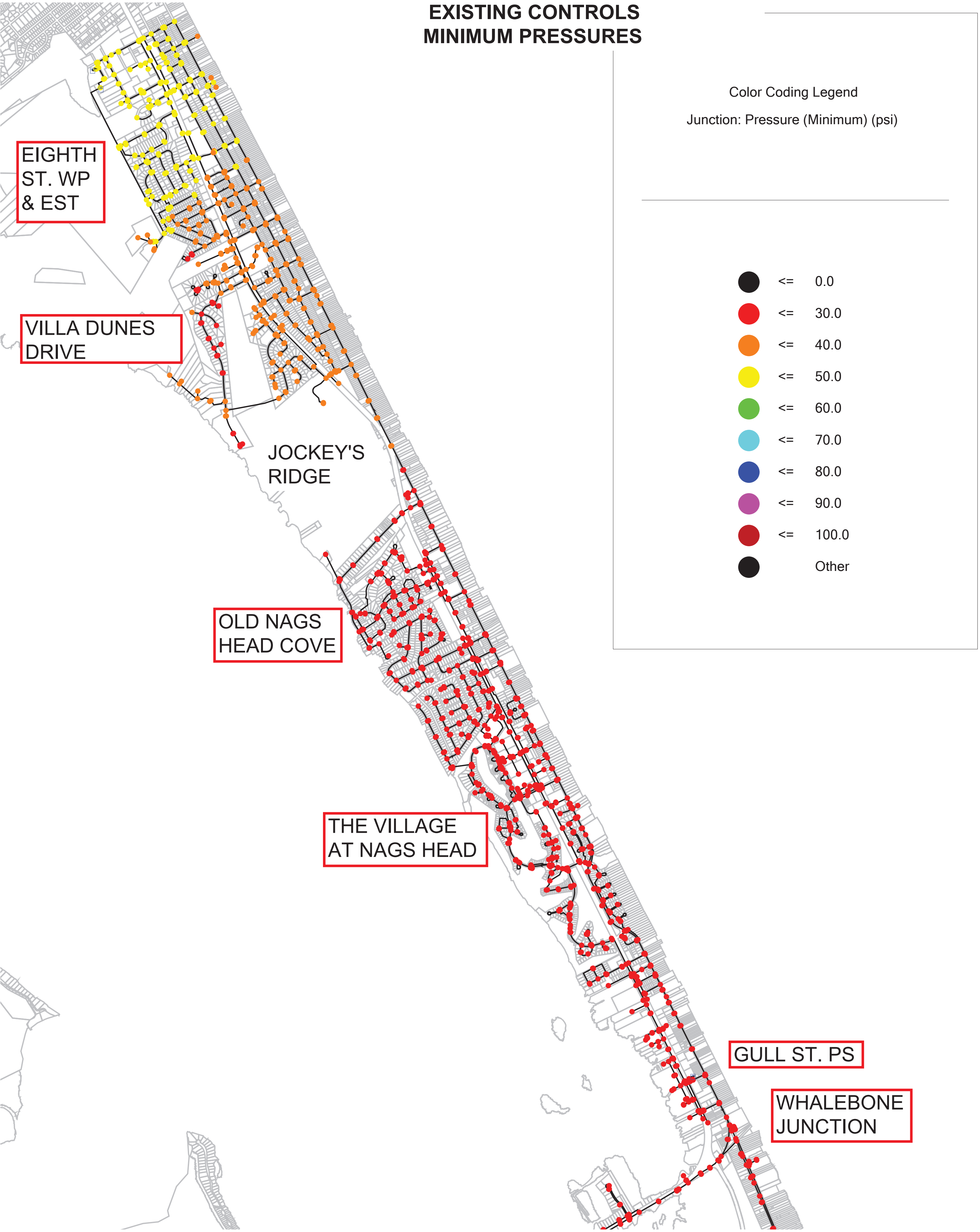


APPENDIX

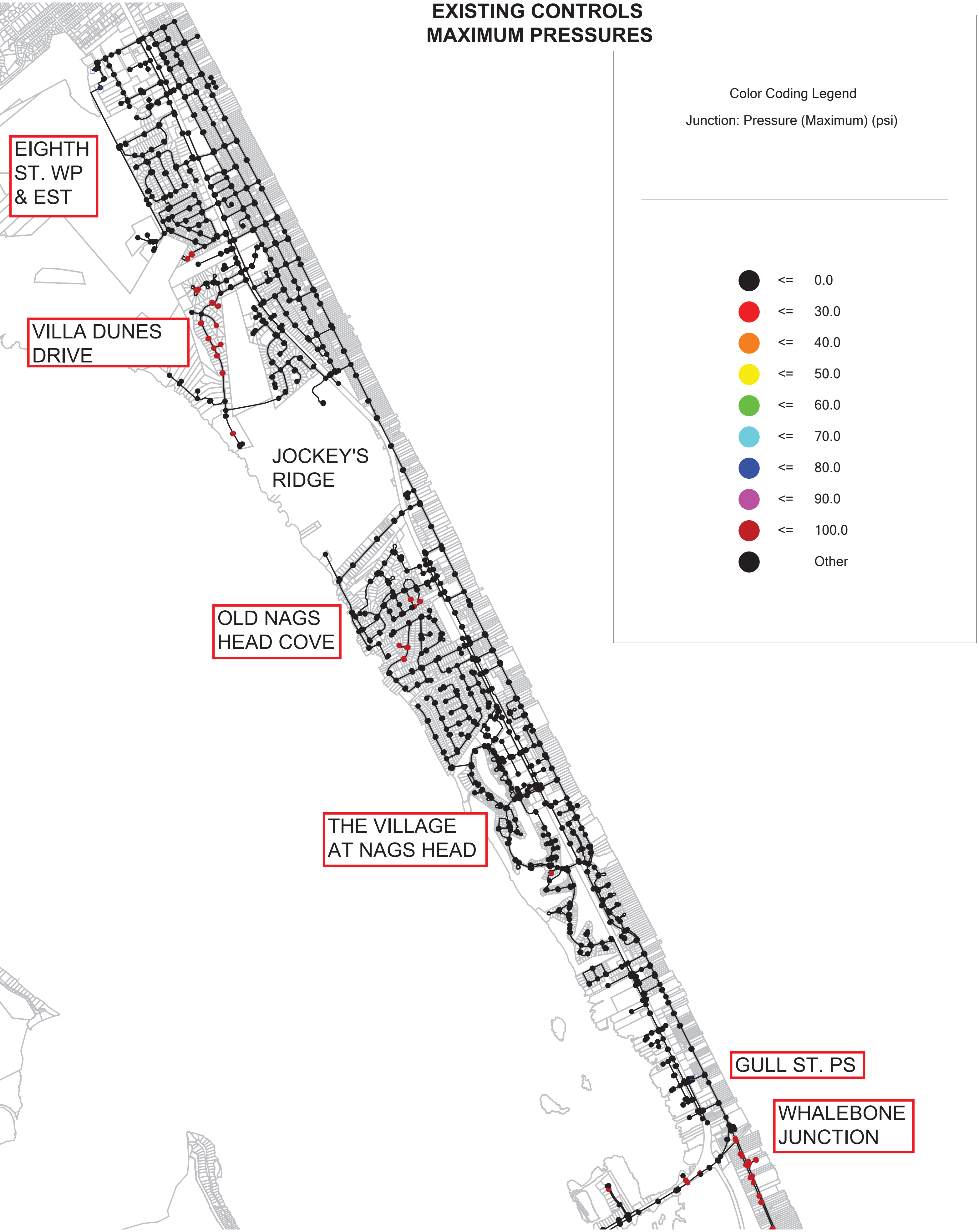
Q

Scenario 4
July 2028 Maximum Day Flow
Existing Controls

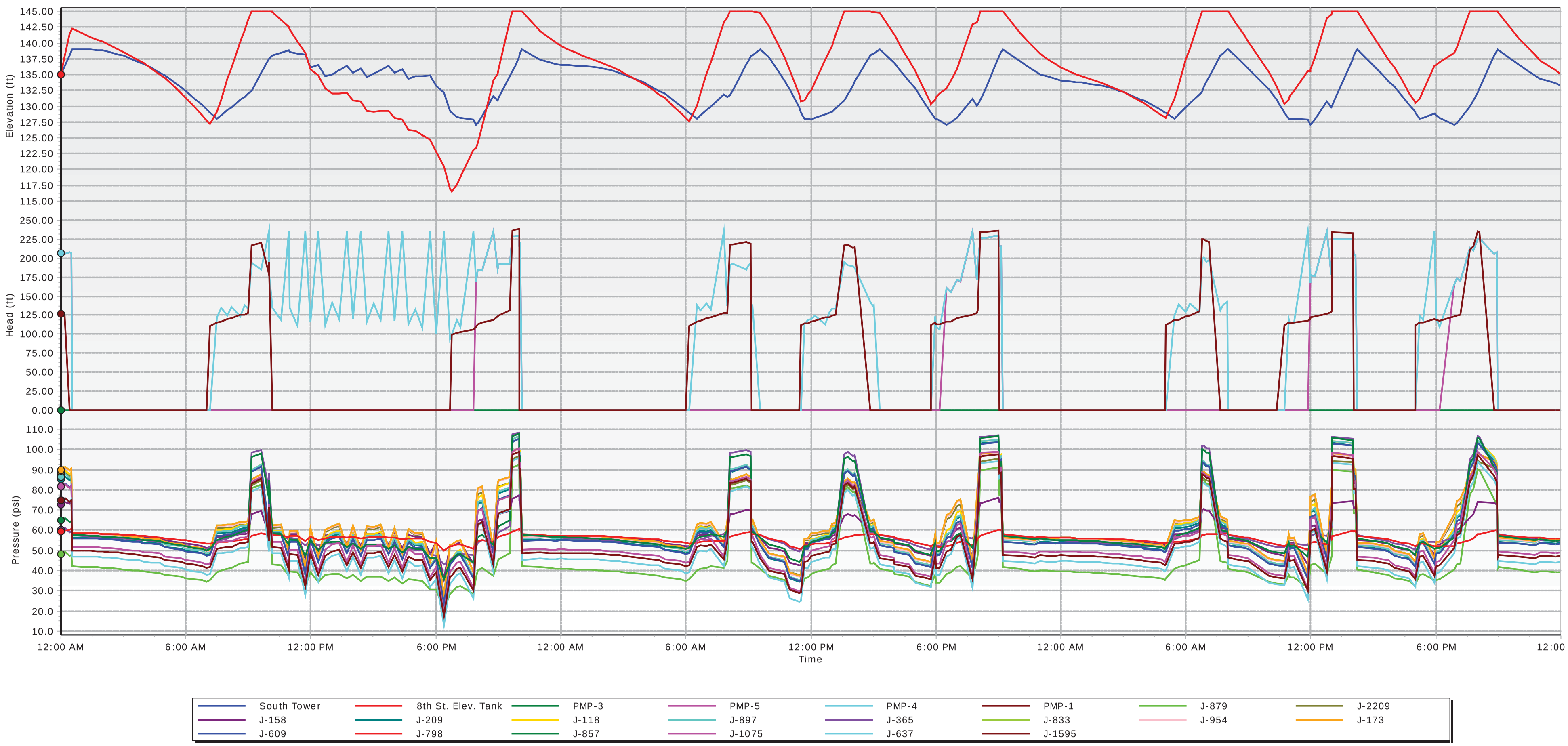
SCENARIO 4 - JULY 2028 MAXIMUM DAY FLOW
EXISTING CONTROLS
MINIMUM PRESSURES



SCENARIO 4 - JULY 2028 MAXIMUM DAY FLOW
EXISTING CONTROLS
MAXIMUM PRESSURES



SCENARIO 4 - JULY 2028 MAXIMUM DAY FLOW
EXISTING CONTROLS

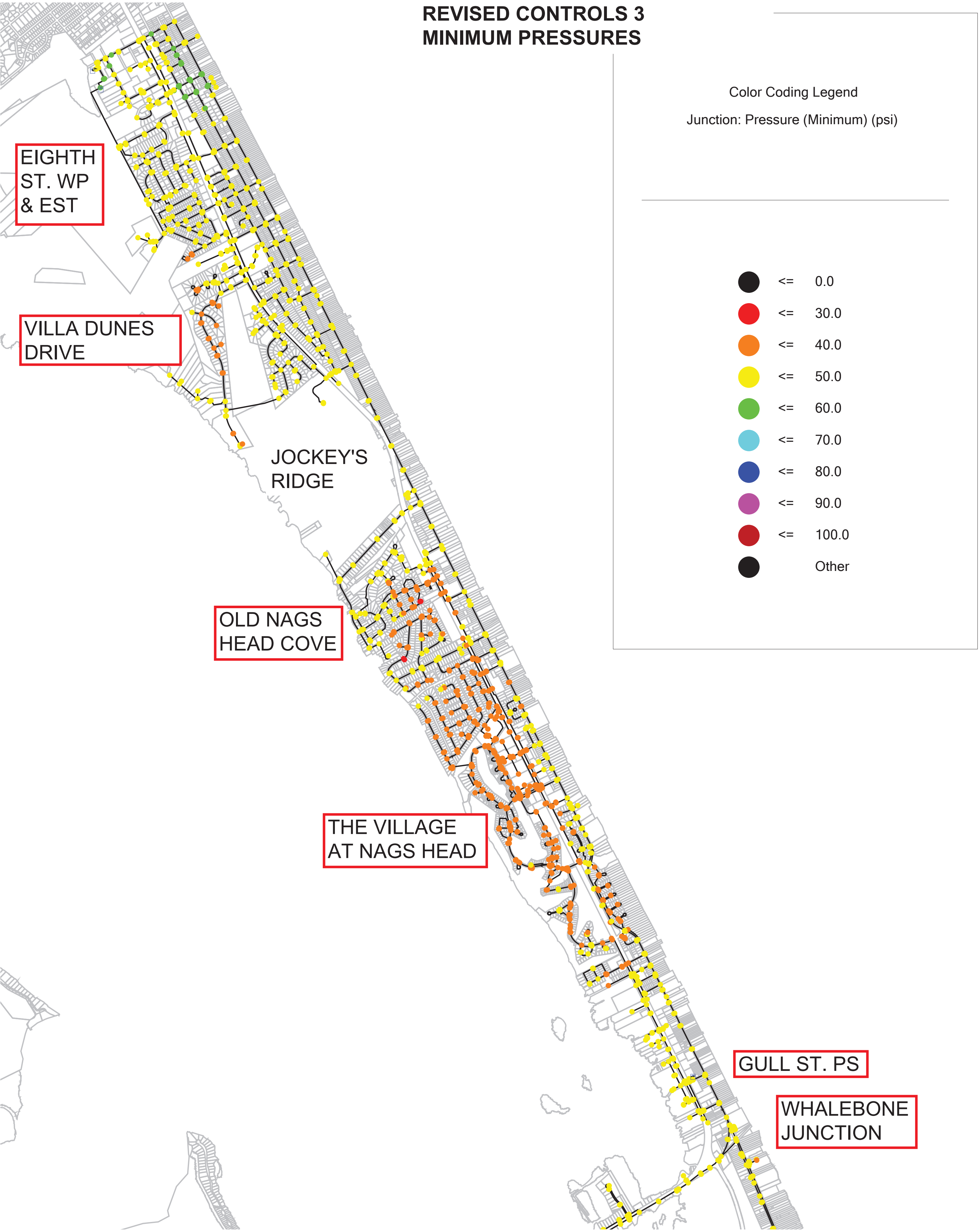


APPENDIX

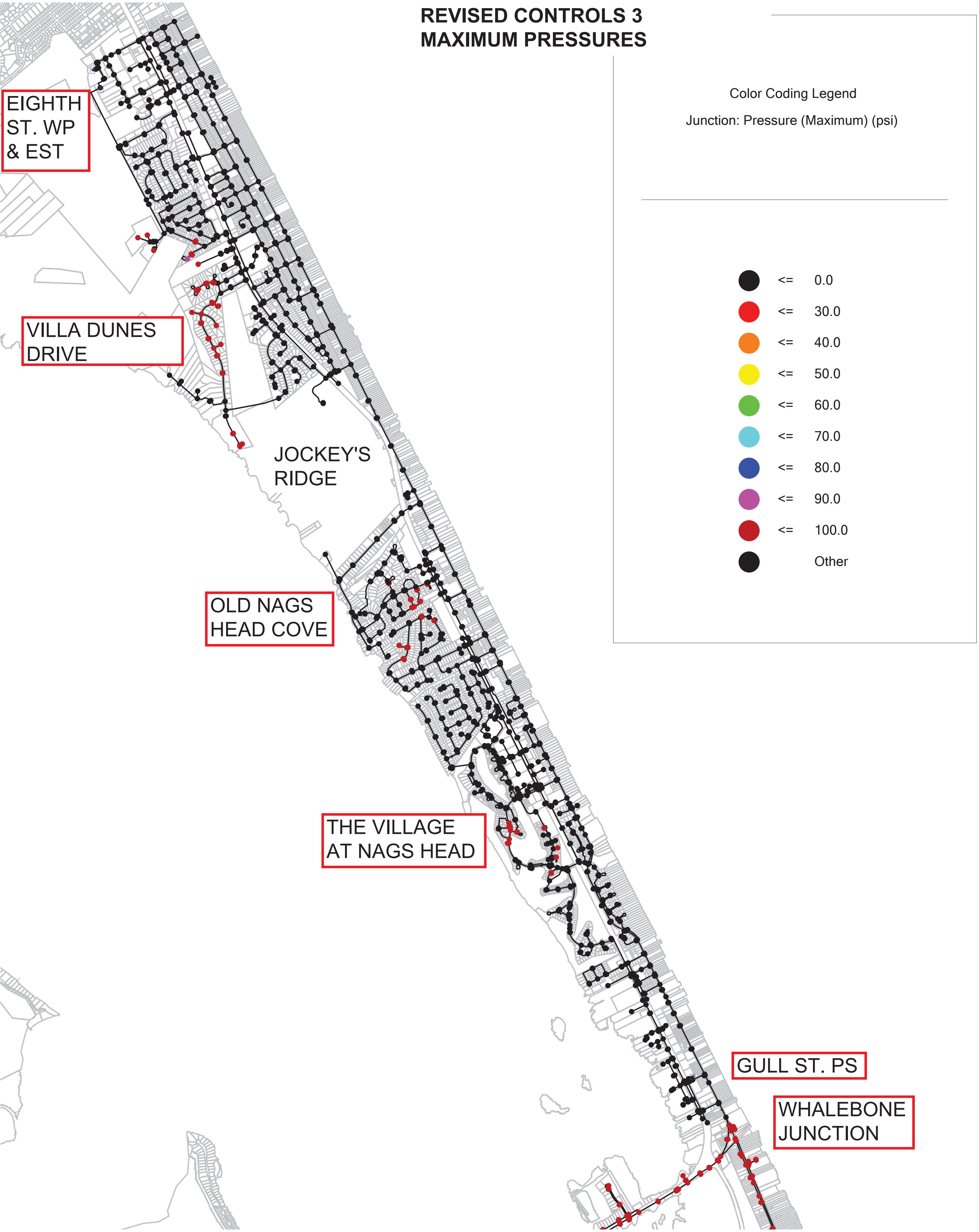
R

Scenario 13
July 2028 Maximum Day Flow
Revised Controls 3

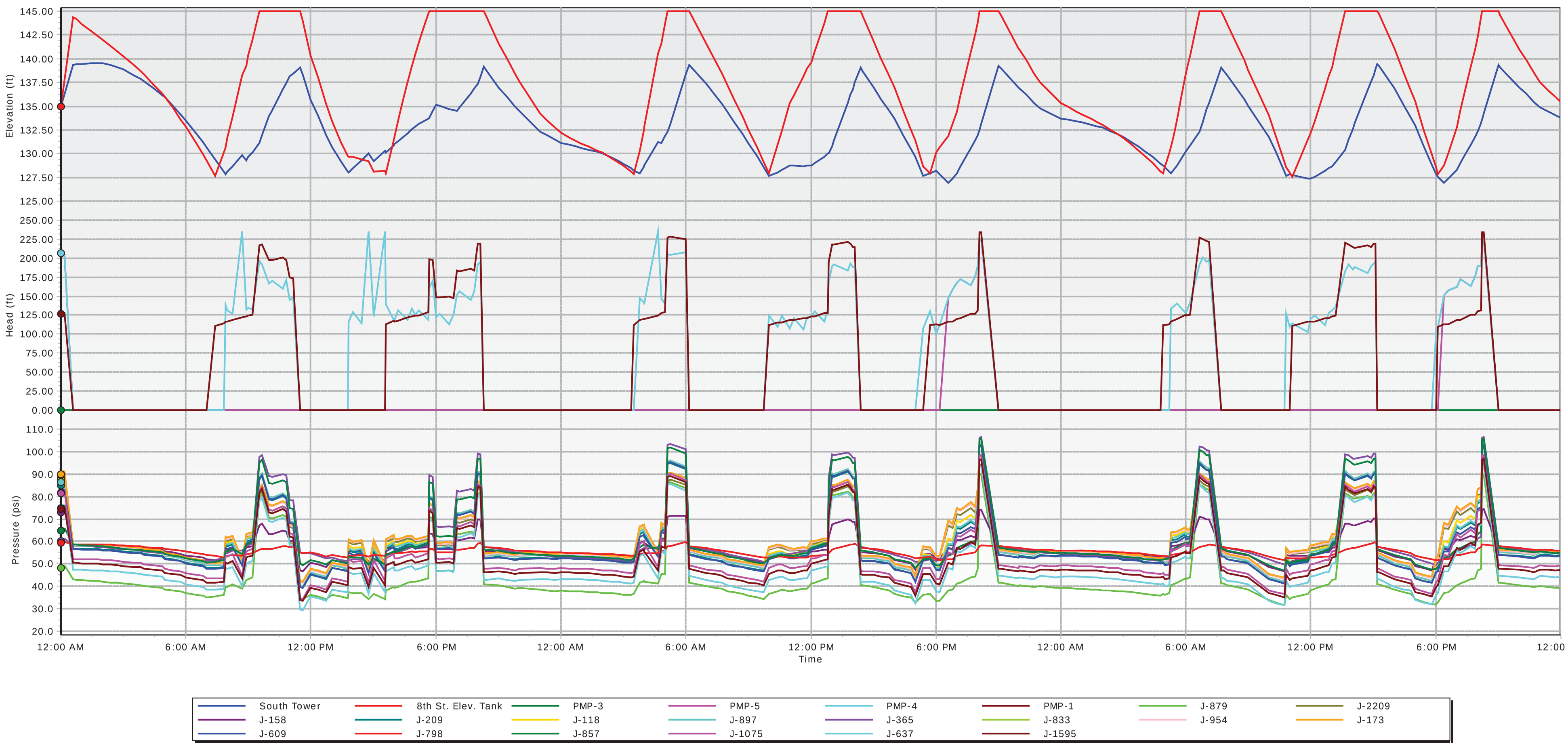
SCENARIO 13 - JULY 2028 MAXIMUM DAY FLOW
REVISED CONTROLS 3
MINIMUM PRESSURES



SCENARIO 13 - JULY 2028 MAXIMUM DAY FLOW
REVISED CONTROLS 3
MAXIMUM PRESSURES



SCENARIO 13 - JULY 2028 MAXIMUM DAY FLOW
REVISED CONTROLS 3

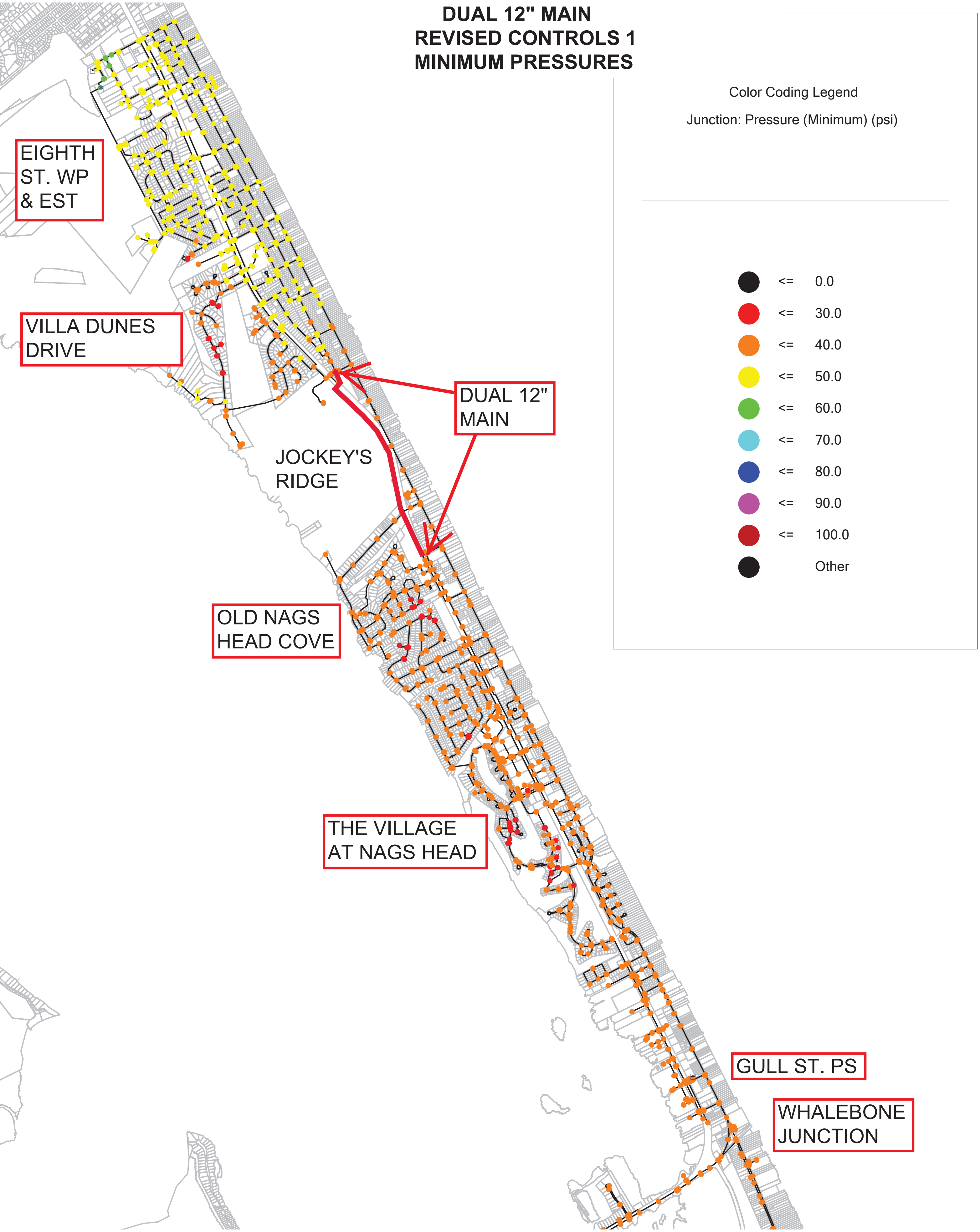


APPENDIX

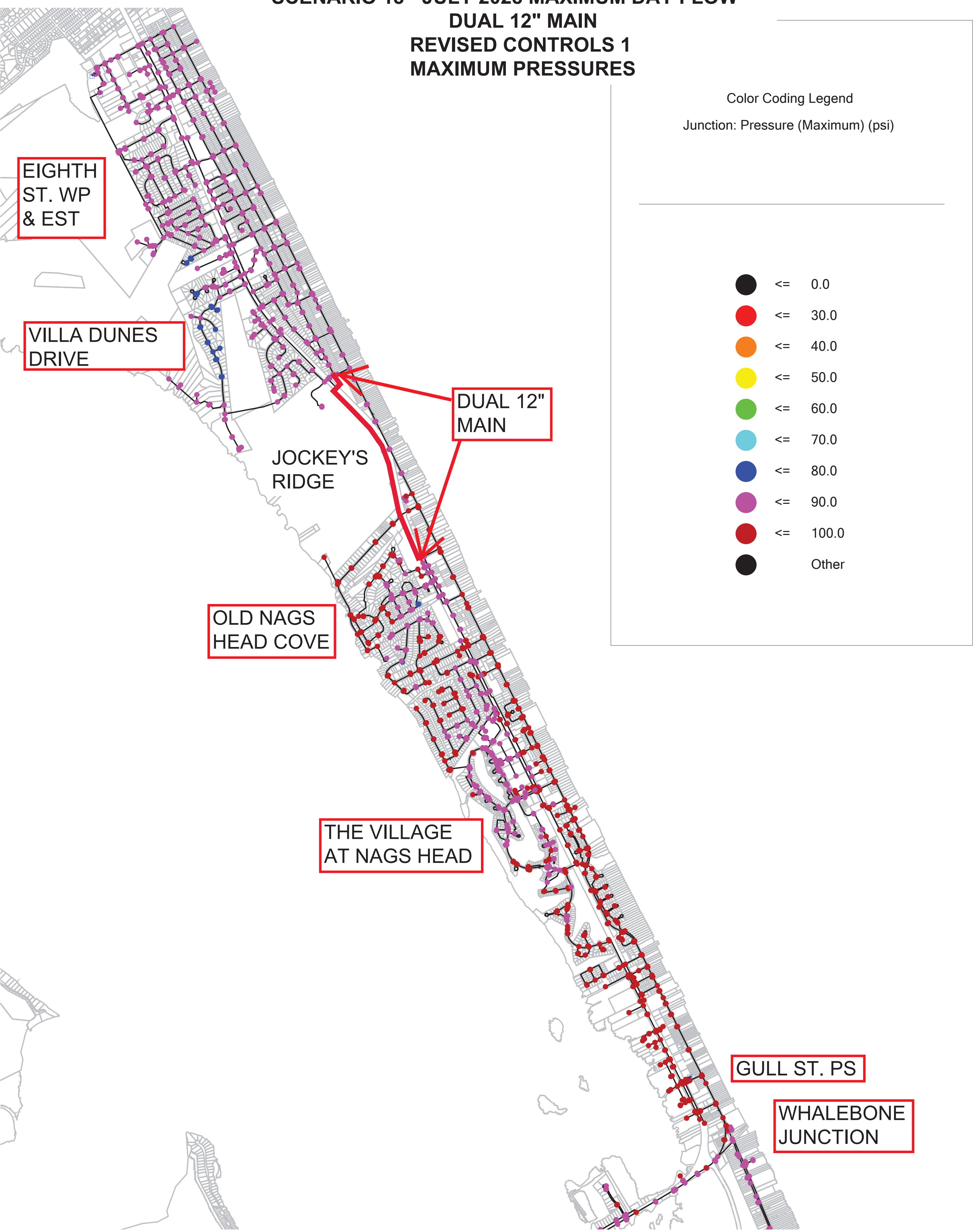
S

Scenario 18
July 2028 Maximum Day Flow
Dual 12-inch Main
Revised Controls 1

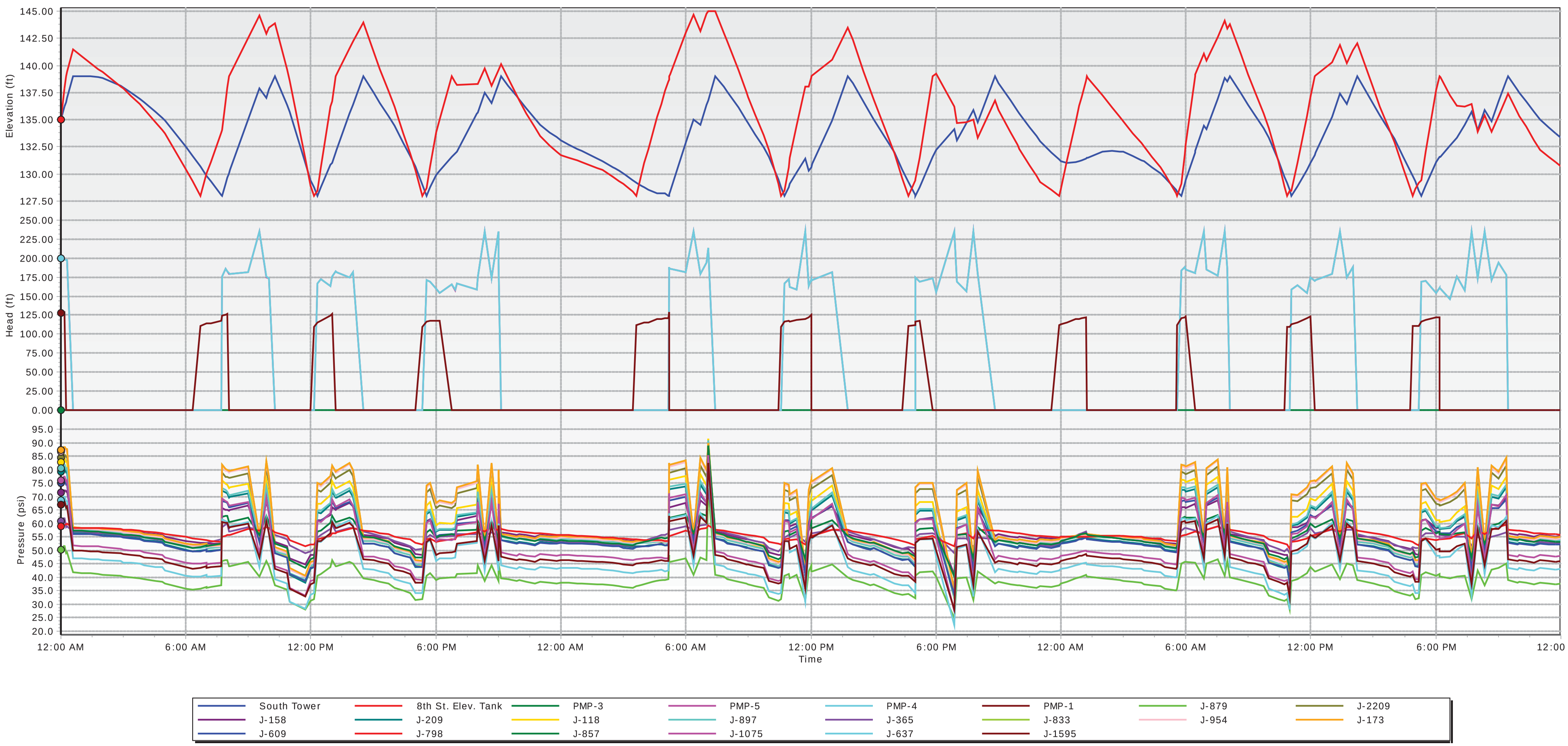
SCENARIO 18 - JULY 2028 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 18 - JULY 2028 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1
MAXIMUM PRESSURES



SCENARIO 18 - JULY 2028 MAXIMUM DAY FLOW
DUAL 12" MAIN
REVISED CONTROLS 1

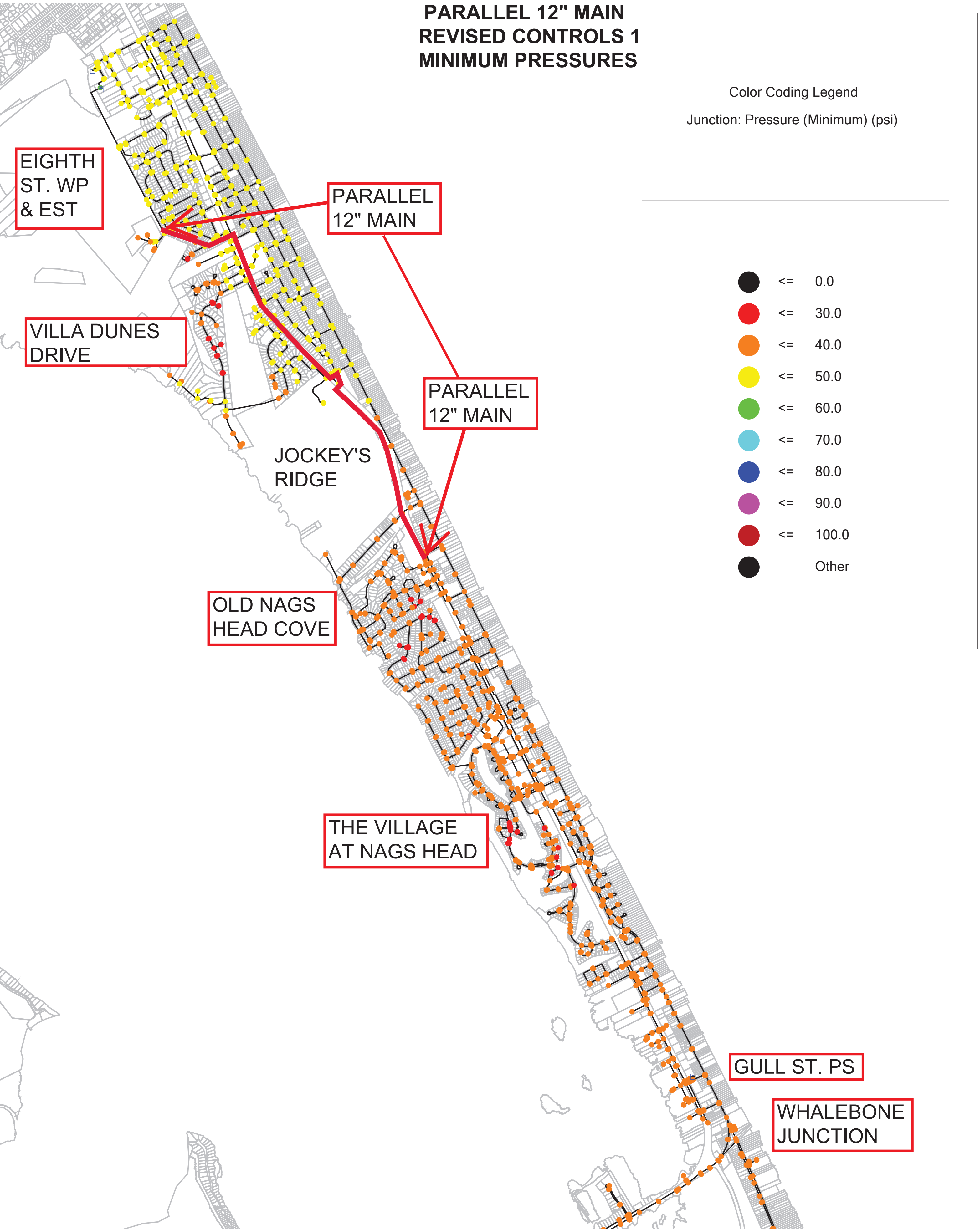


APPENDIX

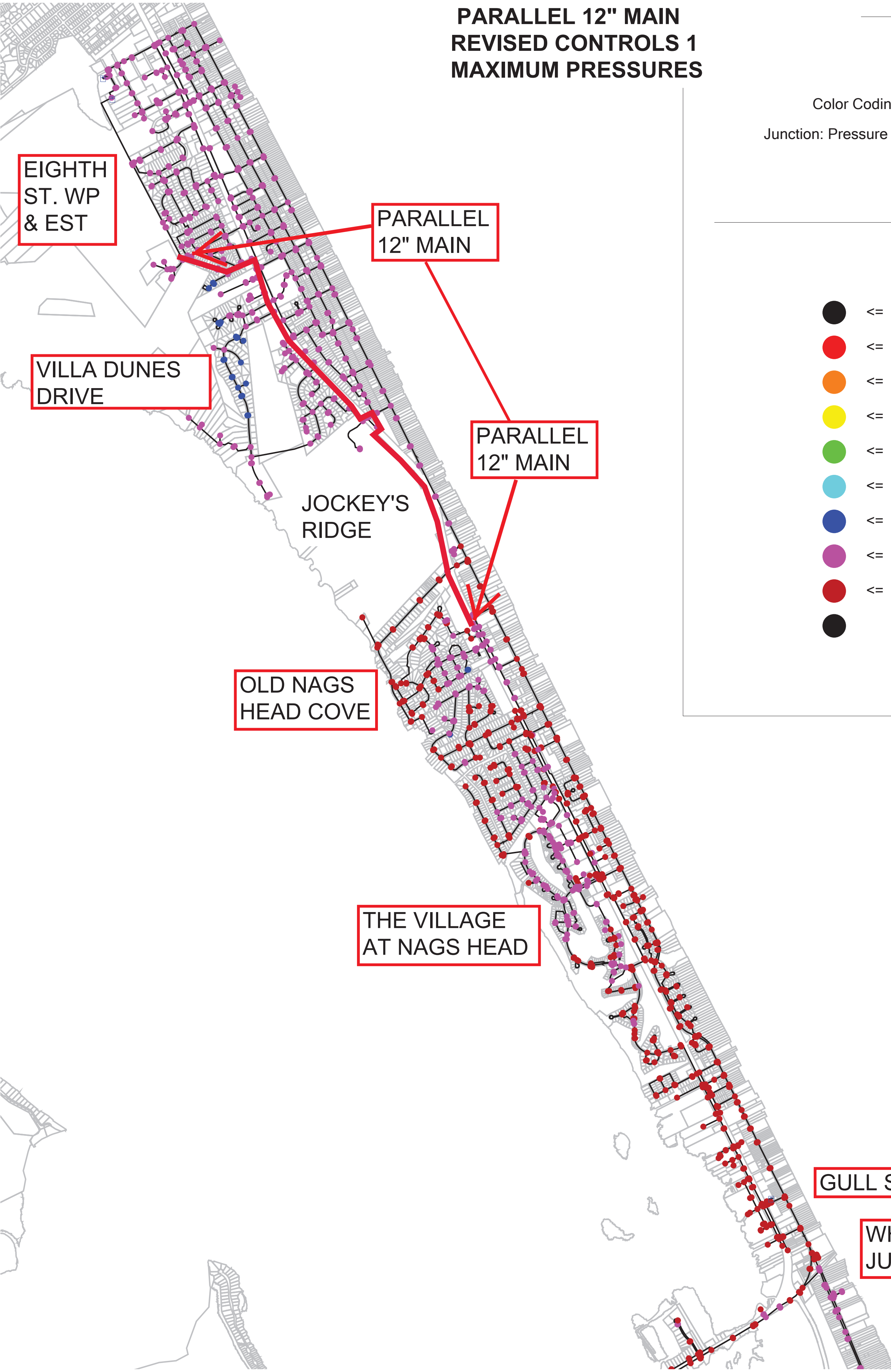
T

Scenario 8
July 2028 Maximum Day Flow
Parallel 12-inch Main
Revised Controls 1

SCENARIO 8 - JULY 2028 MAXIMUM DAY FLOW
PARALLEL 12" MAIN
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 8 - JULY 2028 MAXIMUM DAY FLOW
PARALLEL 12" MAIN
REVISED CONTROLS 1
MAXIMUM PRESSURES

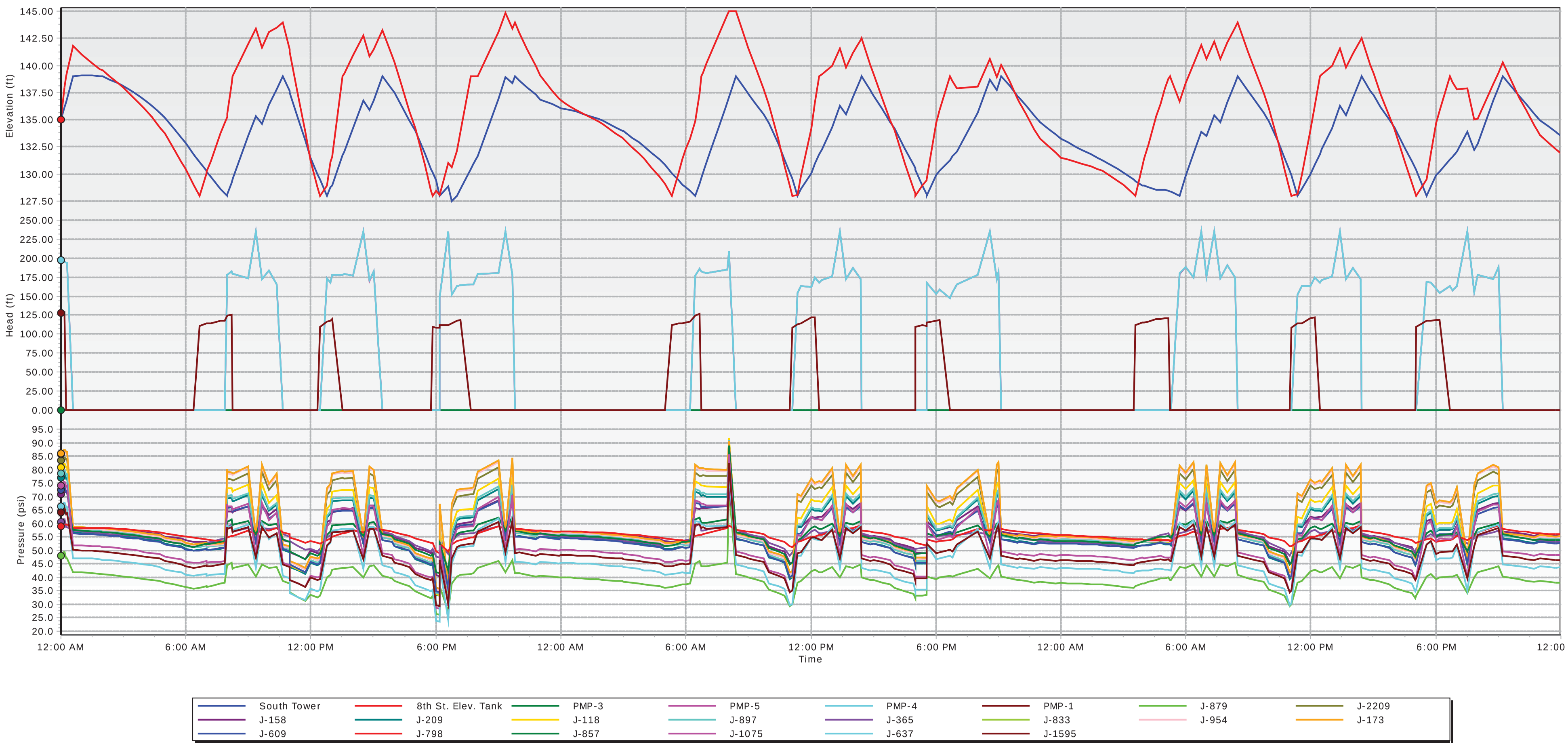


Color Coding Legend

Junction: Pressure (Maximum) (psi)

<=	0.0
<=	30.0
<=	40.0
<=	50.0
<=	60.0
<=	70.0
<=	80.0
<=	90.0
<=	100.0
	Other

SCENARIO 8 - JULY 2028 MAXIMUM DAY FLOW
PARALLEL 12" MAIN
REVISED CONTROLS 1

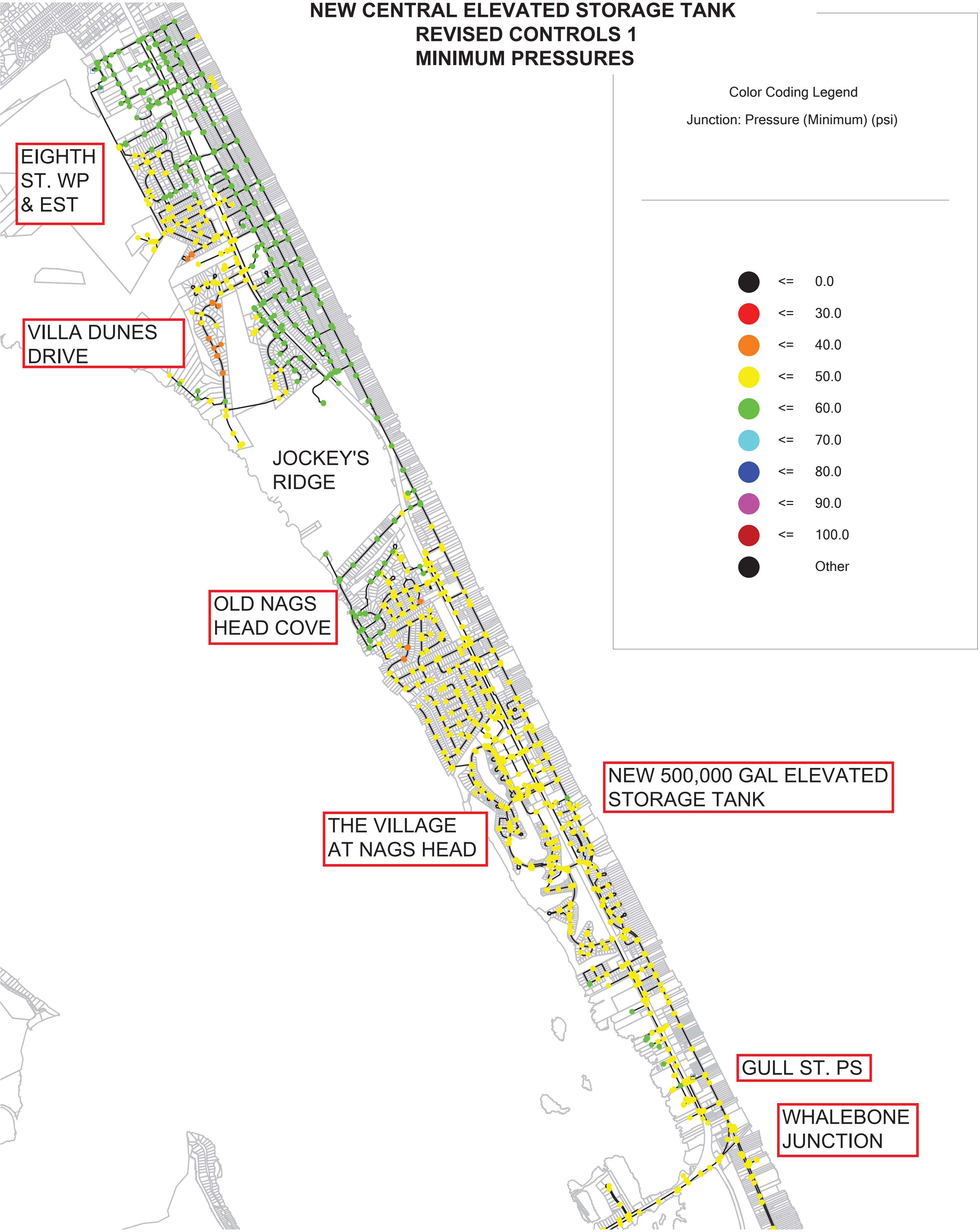


APPENDIX

U

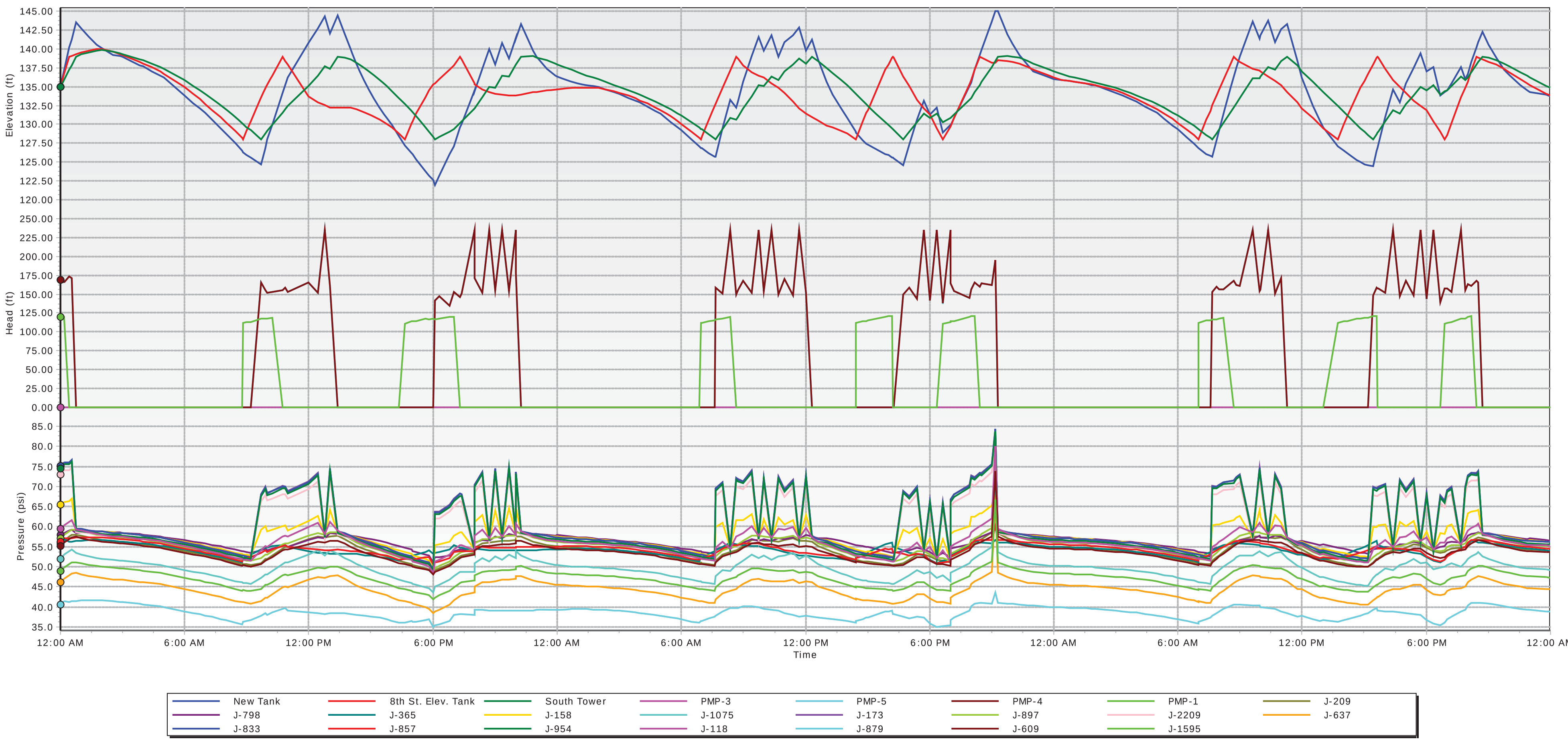
Scenario 21
July 2028 Maximum Day Flow
New Tank
Revised Controls 1

SCENARIO 21 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1
MINIMUM PRESSURES



SCENARIO 21 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1
MAXIMUM PRESSURES

SCENARIO 21 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 1

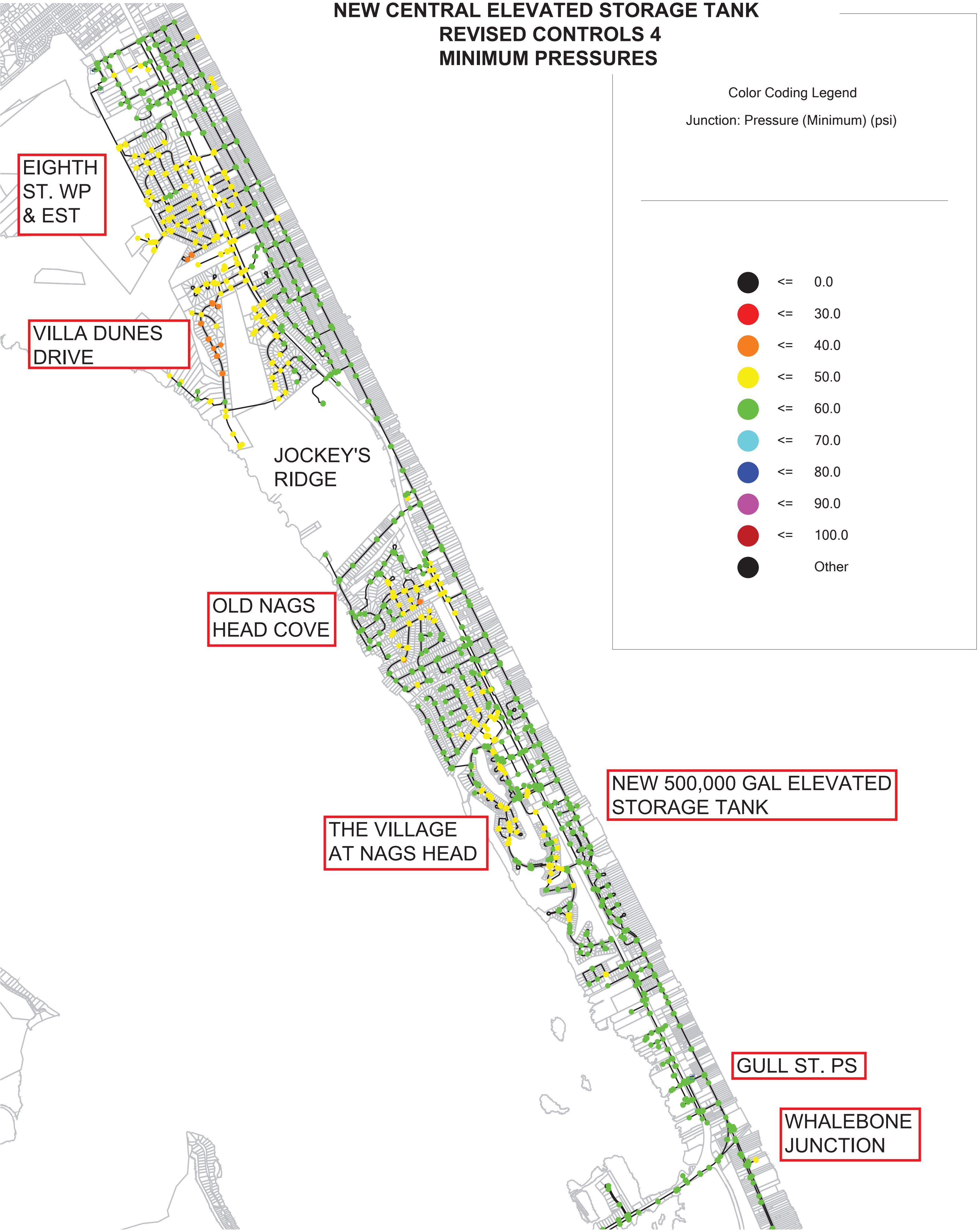


APPENDIX

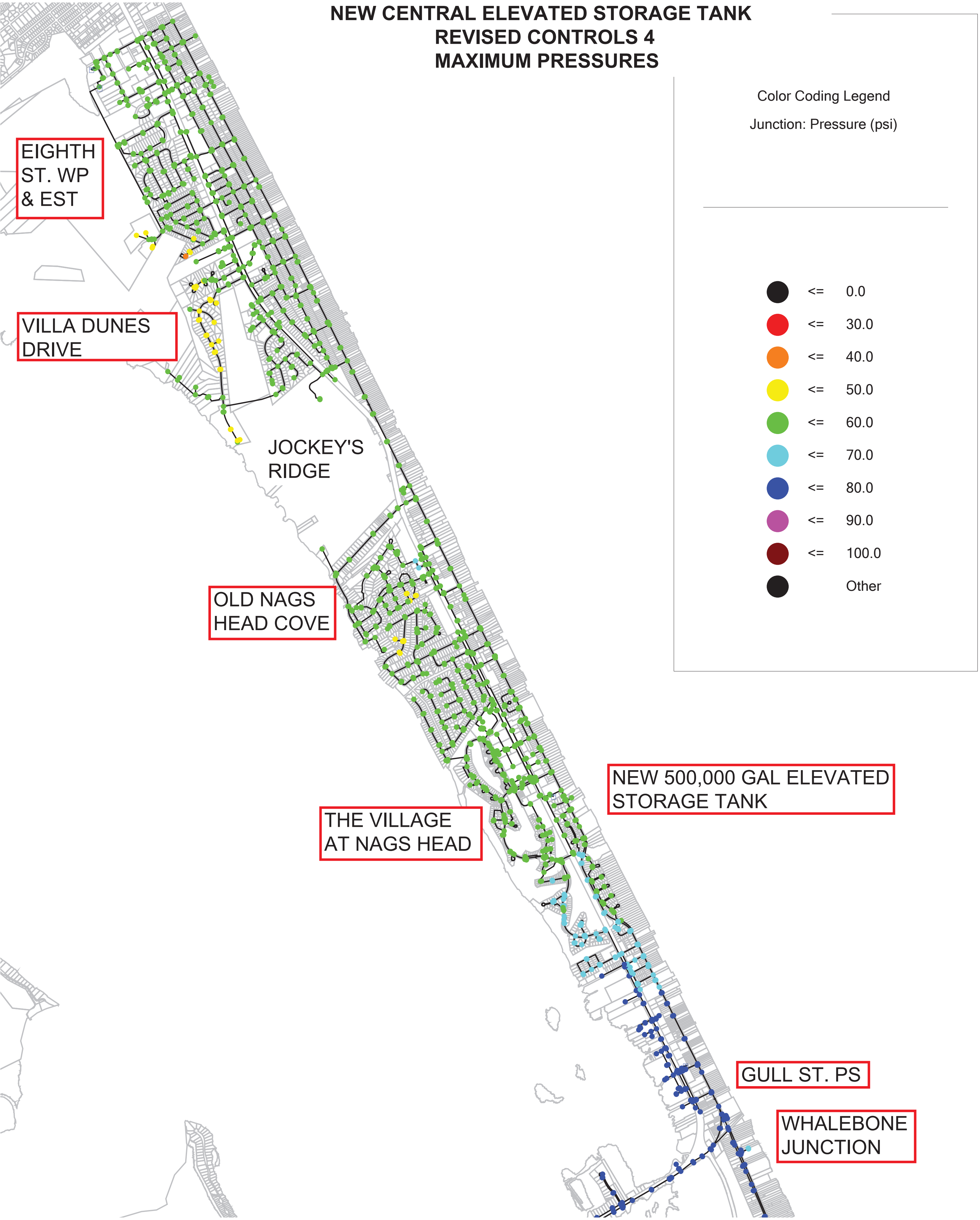
V

Scenario 25
July 2028 Maximum Day Flow
New Tank
Revised Controls 4

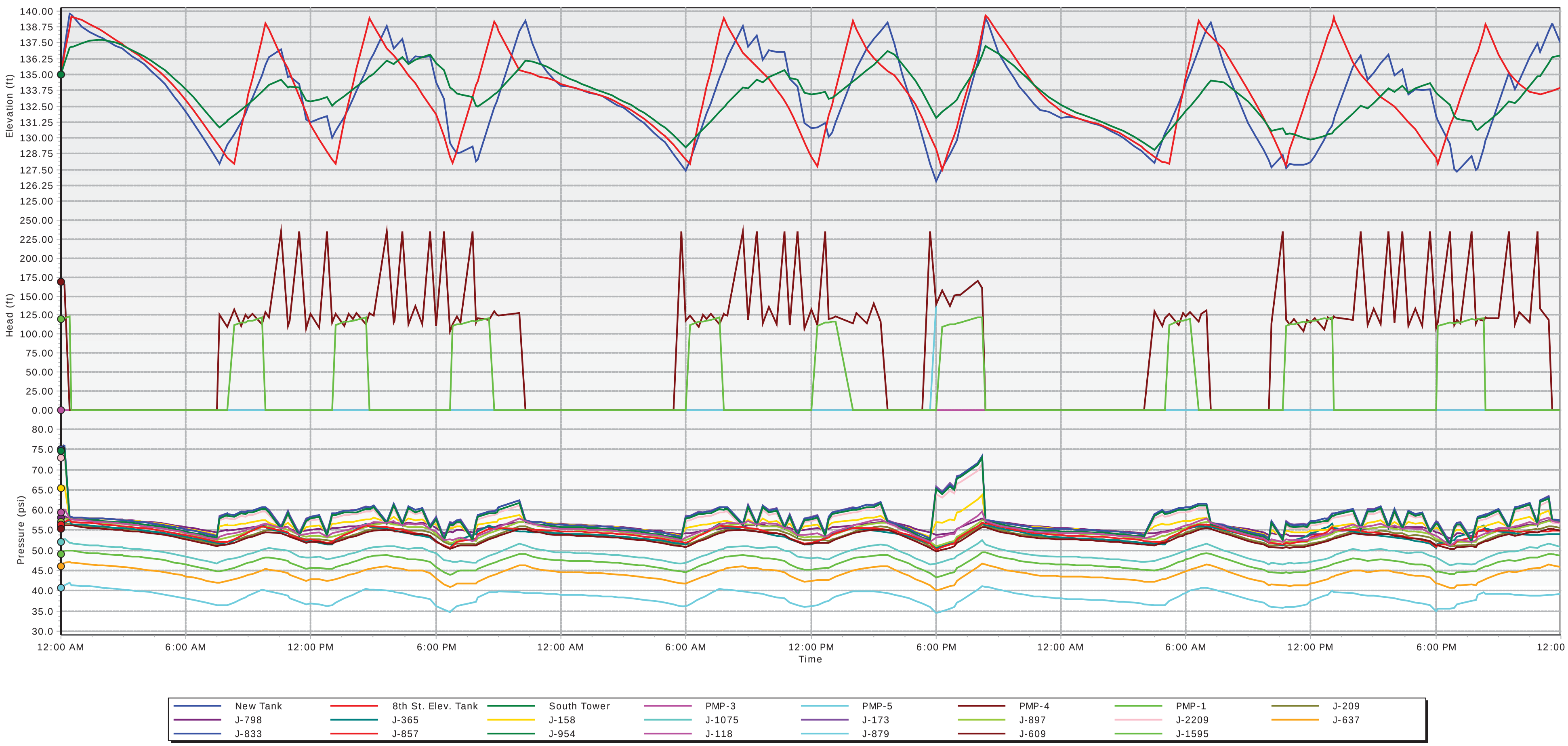
SCENARIO 25 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 4
MINIMUM PRESSURES



SCENARIO 25 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 4
MAXIMUM PRESSURES



SCENARIO 25 - JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK
REVISED CONTROLS 4



APPENDIX

W

Fire Flow Analysis

From: Steve Kovacs
Sent: Wednesday, January 26, 2011 1:23 AM
To: Nancy Carawan; Kevin Zorc
Subject: RE: Areas of concern

Nancy,

There are three main areas of concern for water flow. These include Nags Head Woods, Villa Dunes Drive, along the Causeway especially Pond Island, and then of course the National Park Service. There may be a few other areas but these are the ones that come to mind quickly. I know that towards the end of Villa Dunes and NH Woods Road we may only get 400-500 gallons per minute from those hydrants and we would not be able to flow multiple hydrants back there without robbing water from others causing serious issues. Pond Island and the park this would also occur. When we do fire flow testing we base the figures on residual/flow pressures of 20 psi. This is the minimum that we pump any hydrant, anything lower we would start pulling a vacuum on the system and cause damage.

Minimum fire flow requirements based on NC Fire Code Appendix B calls for a minimum fire flow of 1,000 gallons a minute for a residential structure of not exceeding 3,600 square feet; this is being used as a reference point. Anything above 3,600 sq ft would require additional flow, but not necessarily from one hydrant; with that said though we don't need to rob water from one hydrant when we open one upstream. This happen to me when operating at a fire on Oak Knoll prior to that being looped. Luckily we didn't have anyone doing interior operations at the time when that occurred.

It would be nice to be able to obtain a flow of 1,000 gpm @ 20 psi in all of our hydrants. I feel that our biggest issue is Villa Dunes (especially the Condos) and along Nags Head Woods Road where the needed fire flows will not be meet by the current system; any improvement would be great. One thing is that when we operate two of our small handlines which is what we primarily use on residential structures we are flowing nearly 360 gpm to start. This is not much less then some of the hydrants in these areas.

Hope this answered your questions. If you need me to clarify this or if you have additional question give me a call 202-5684.

Captain Steven R. Kovacs

Nags Head Fire & Rescue Division

252-441-5909

To: Nancy Carawan; Kevin Zorc
Subject: New Hydrants

Nancy,

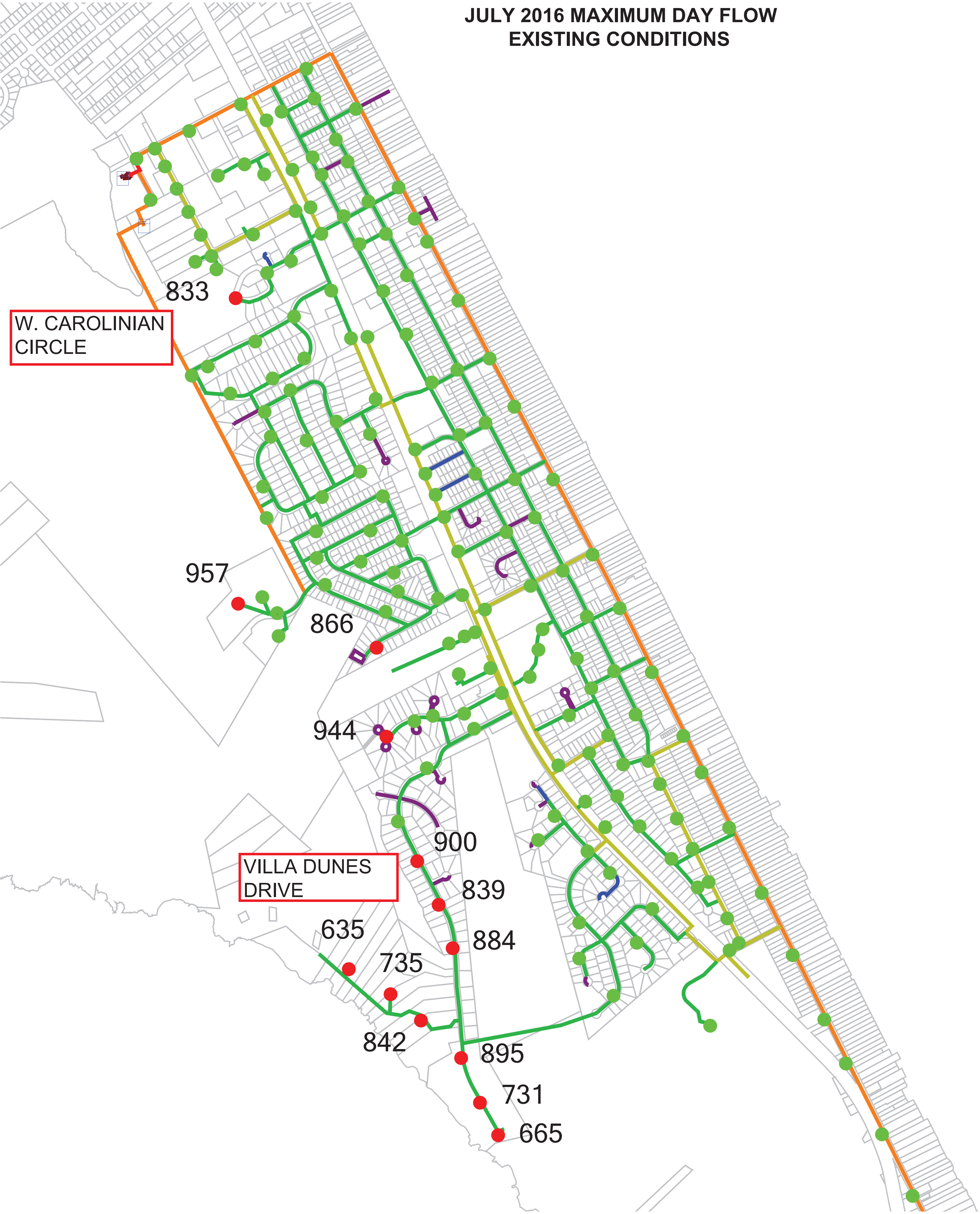
I looked over the hydrant map after our conversation today and do have several suggestions on additional fire hydrants. Ray Schoonmaker says that some of this may already be planned but I want to ask in case they have not.

South Virginia Dare trail – Between Albatross and Driftwood – DONE
East Abalone and Memorial – DONE
East Barnes and Wrightsville – DONE
Bergen Court and Wrightsville – DONE
Between Buccaneer and the current hydrant on Windjammer
Windjammer and Lookout
SVDT-Behind Kitty Hawk Kites near the Sprinkler connection
West Sandpiper Terrace and S. Roanoke Way- South end
Each end of S.Chippers Court
East Lakeside and South Croatan Hwy. DONE
West side of Old Oregon Inlet Road- North of Westside court
Across from East Oregon on the West side of SOOIR- There is no hydrant for the homes on the loop road
E Limulus and SOOIR-
Bodie Island Court + Sea Gull – DONE

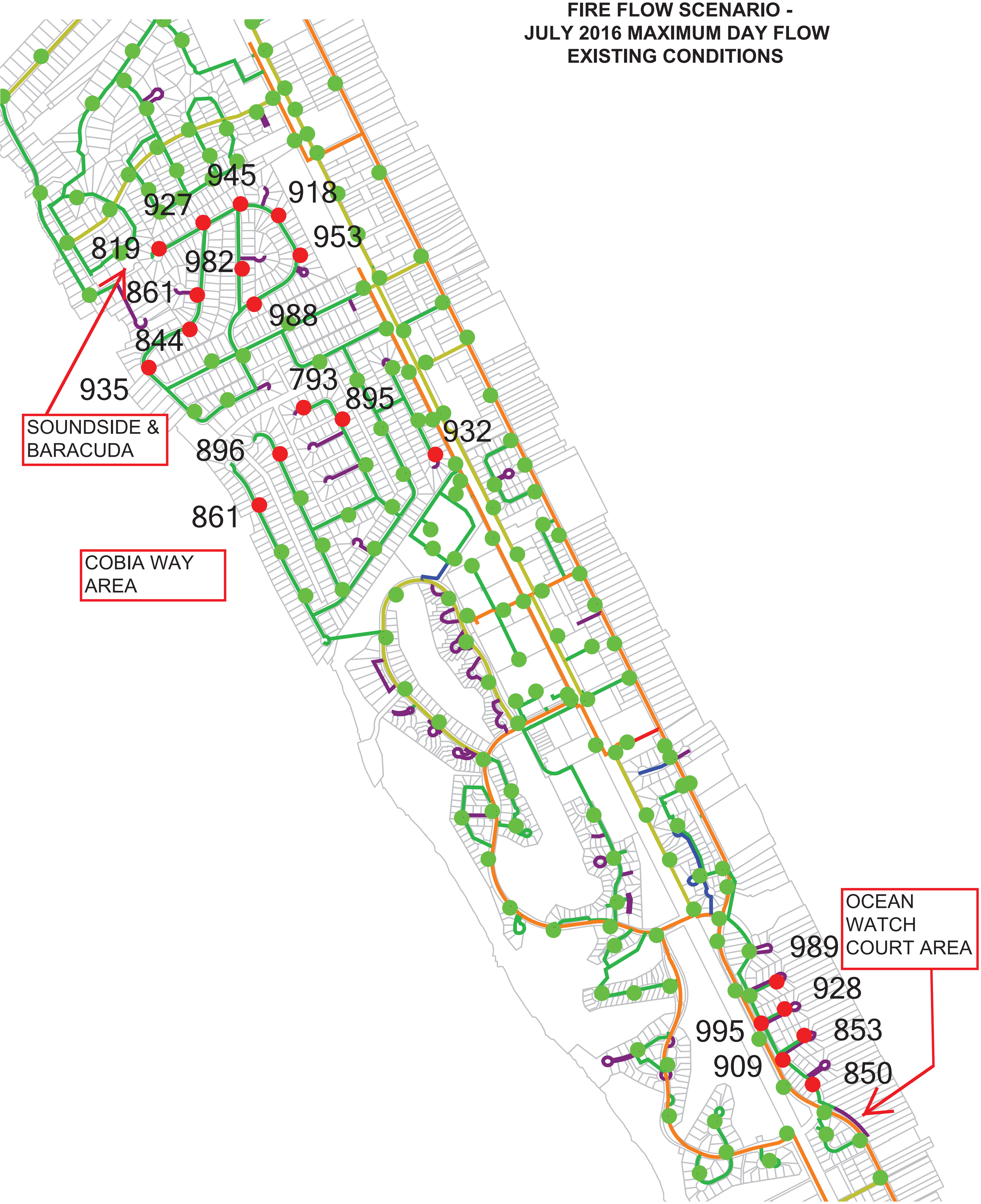
I can explain on the map why these are important. Some of these areas would require long hose lays or blocking the roadway after the supply hose is stretched.

Shane L. Hite
Deputy Fire Chief
Town Safety Officer
Town of Nags Head
Shane.hite@nagsheadnc.gov
252-441-5909
252-202-1576 cell

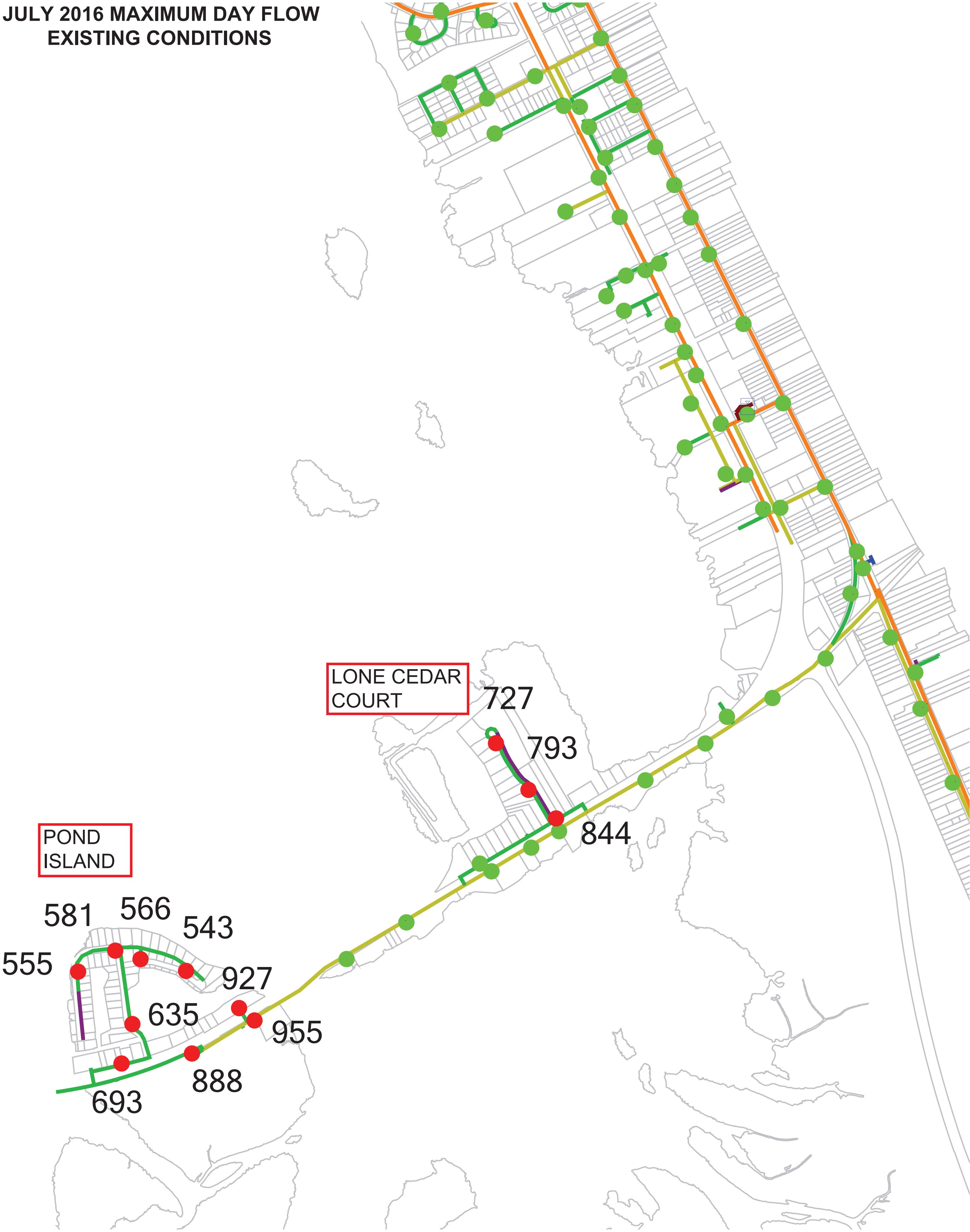
FIRE FLOW SCENARIO -
JULY 2016 MAXIMUM DAY FLOW
EXISTING CONDITIONS



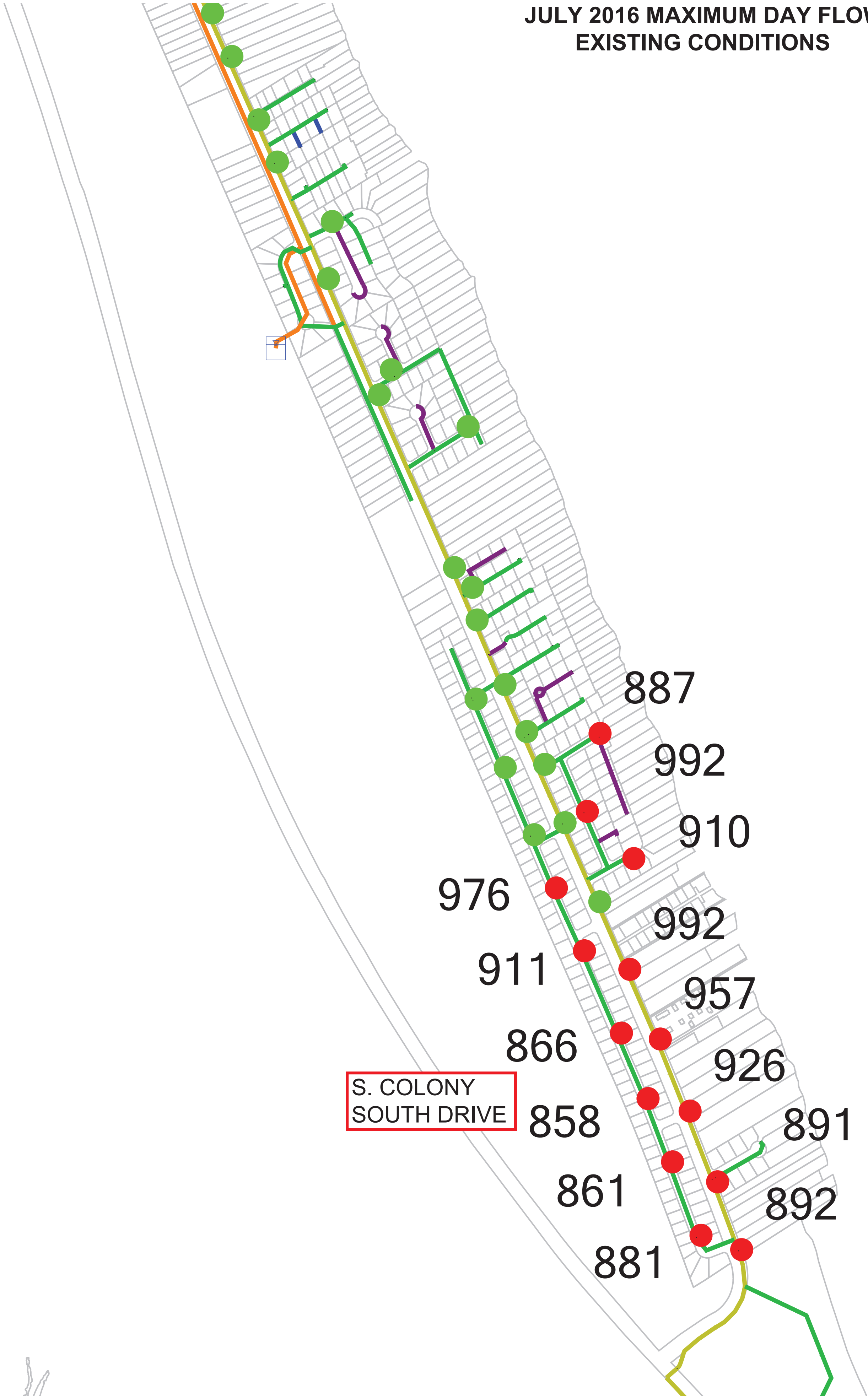
FIRE FLOW SCENARIO - JULY 2016 MAXIMUM DAY FLOW EXISTING CONDITIONS



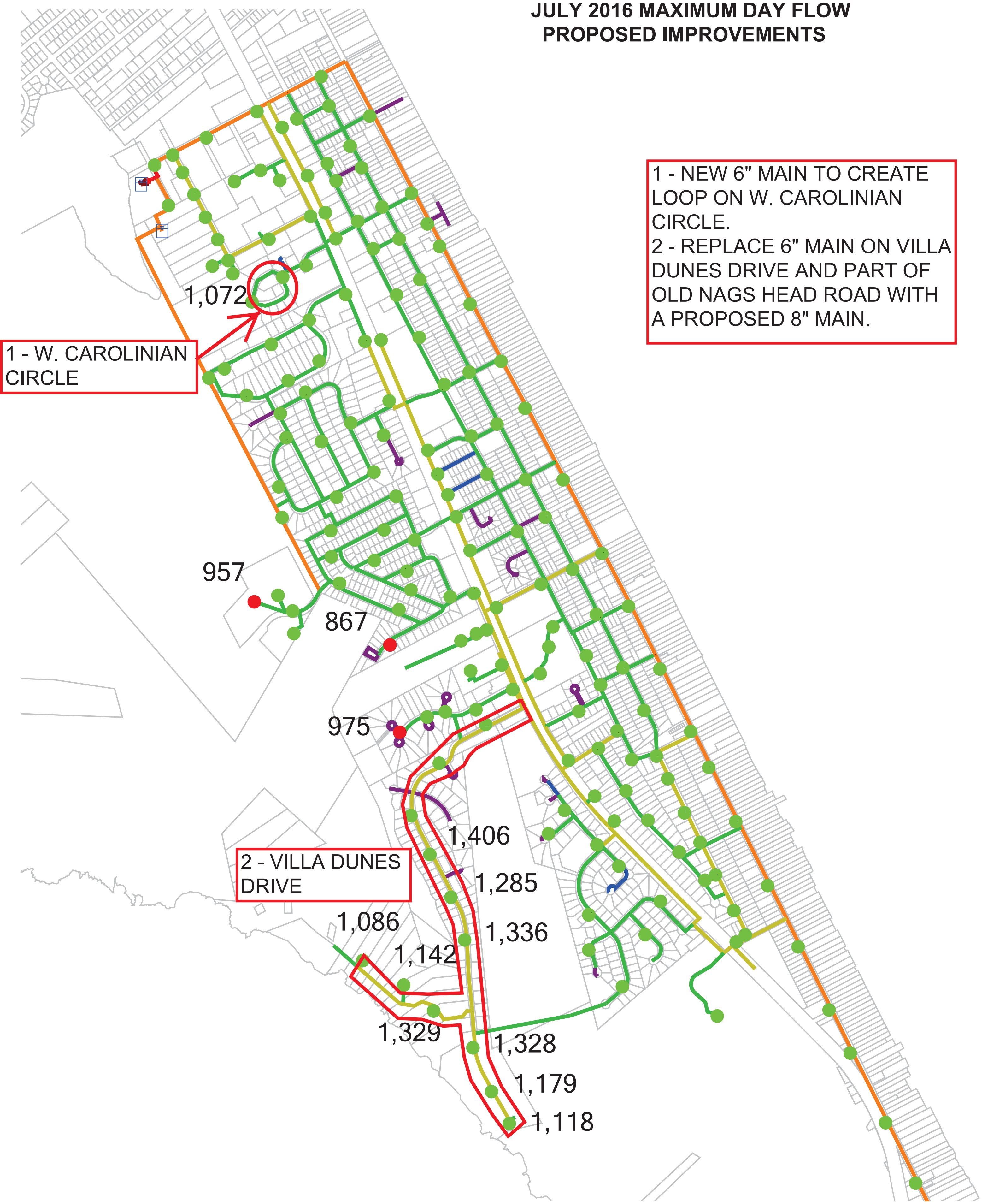
FIRE FLOW SCENARIO - JULY 2016 MAXIMUM DAY FLOW EXISTING CONDITIONS



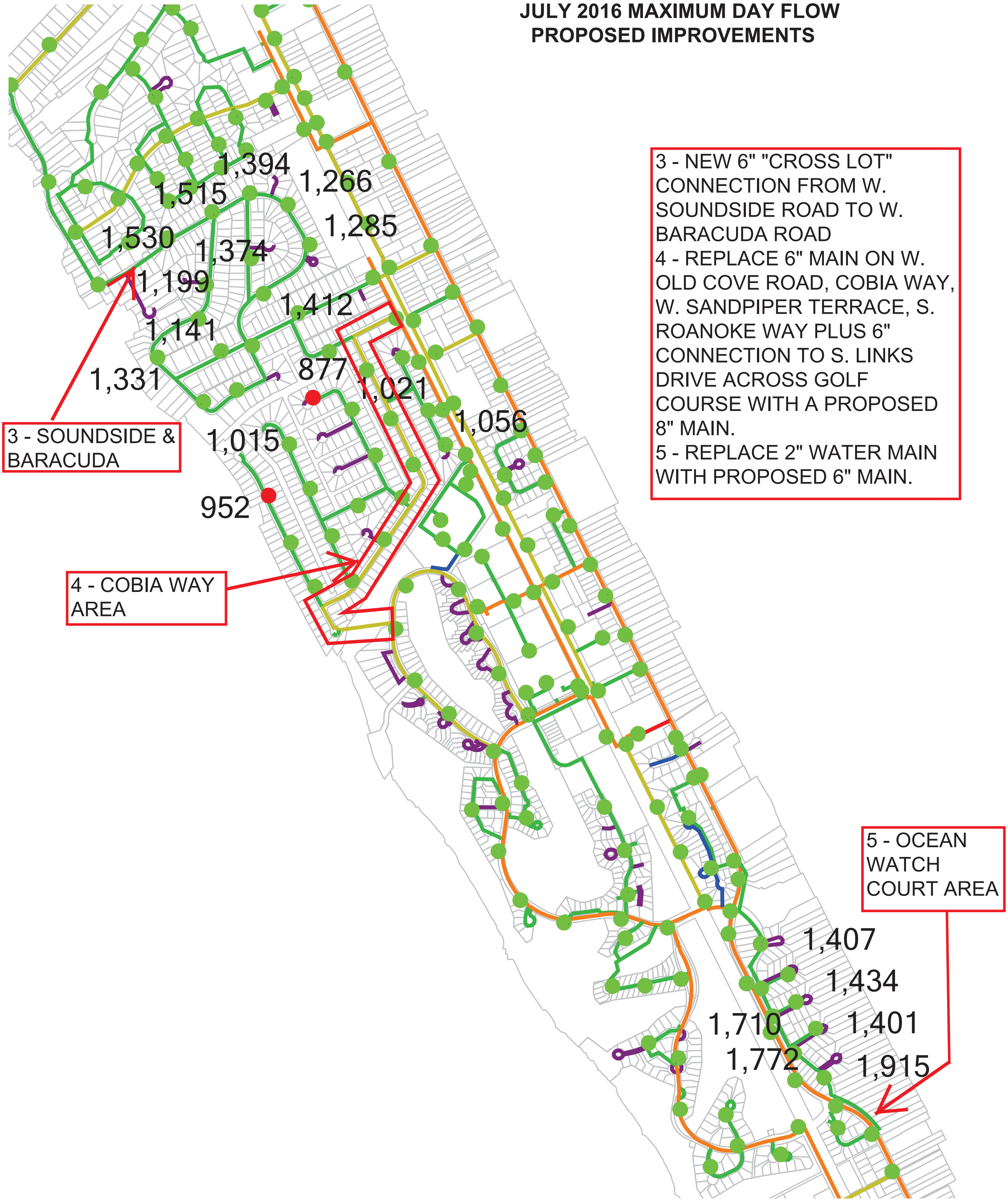
FIRE FLOW SCENARIO -
JULY 2016 MAXIMUM DAY FLOW
EXISTING CONDITIONS



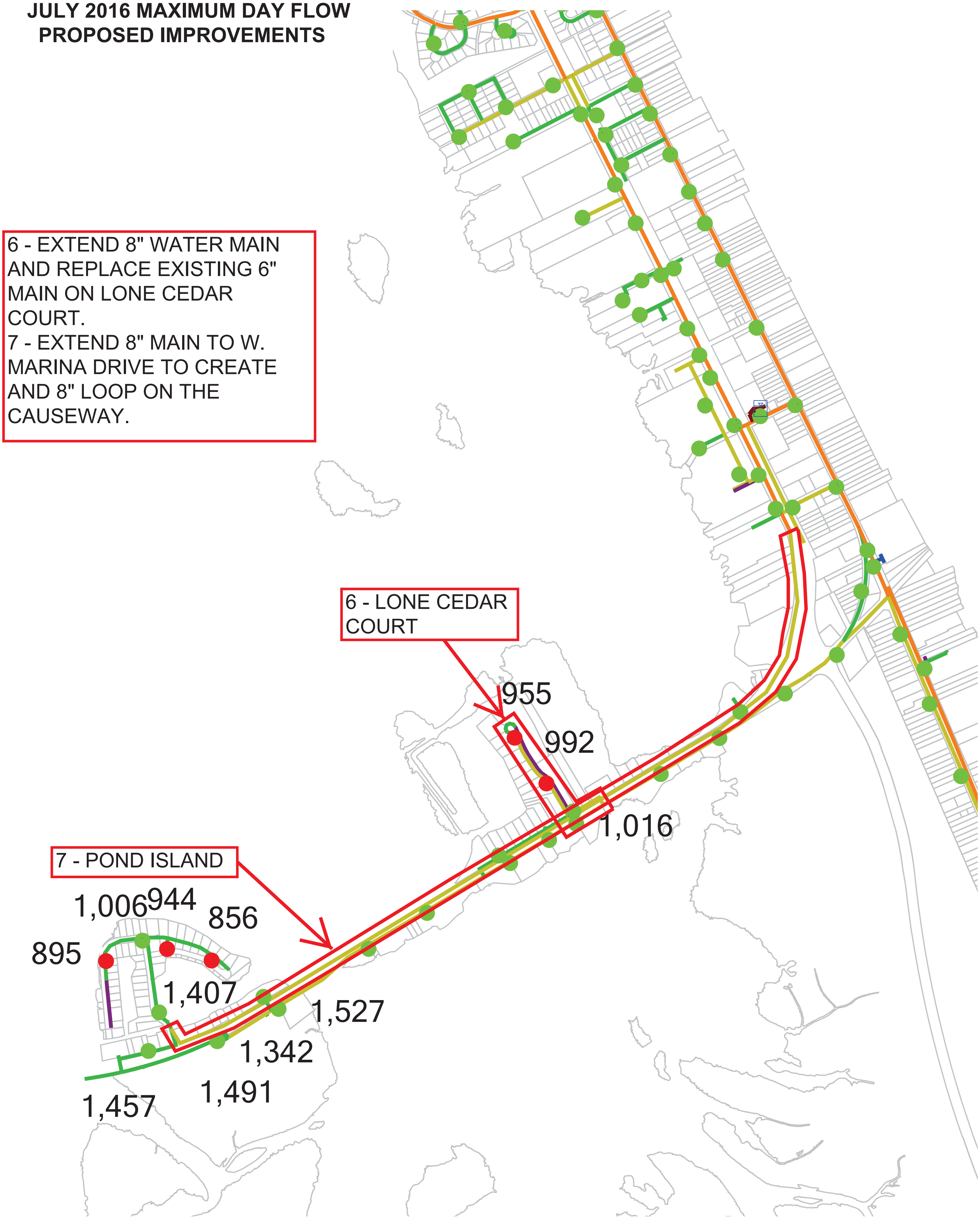
FIRE FLOW SCENARIO - JULY 2016 MAXIMUM DAY FLOW PROPOSED IMPROVEMENTS



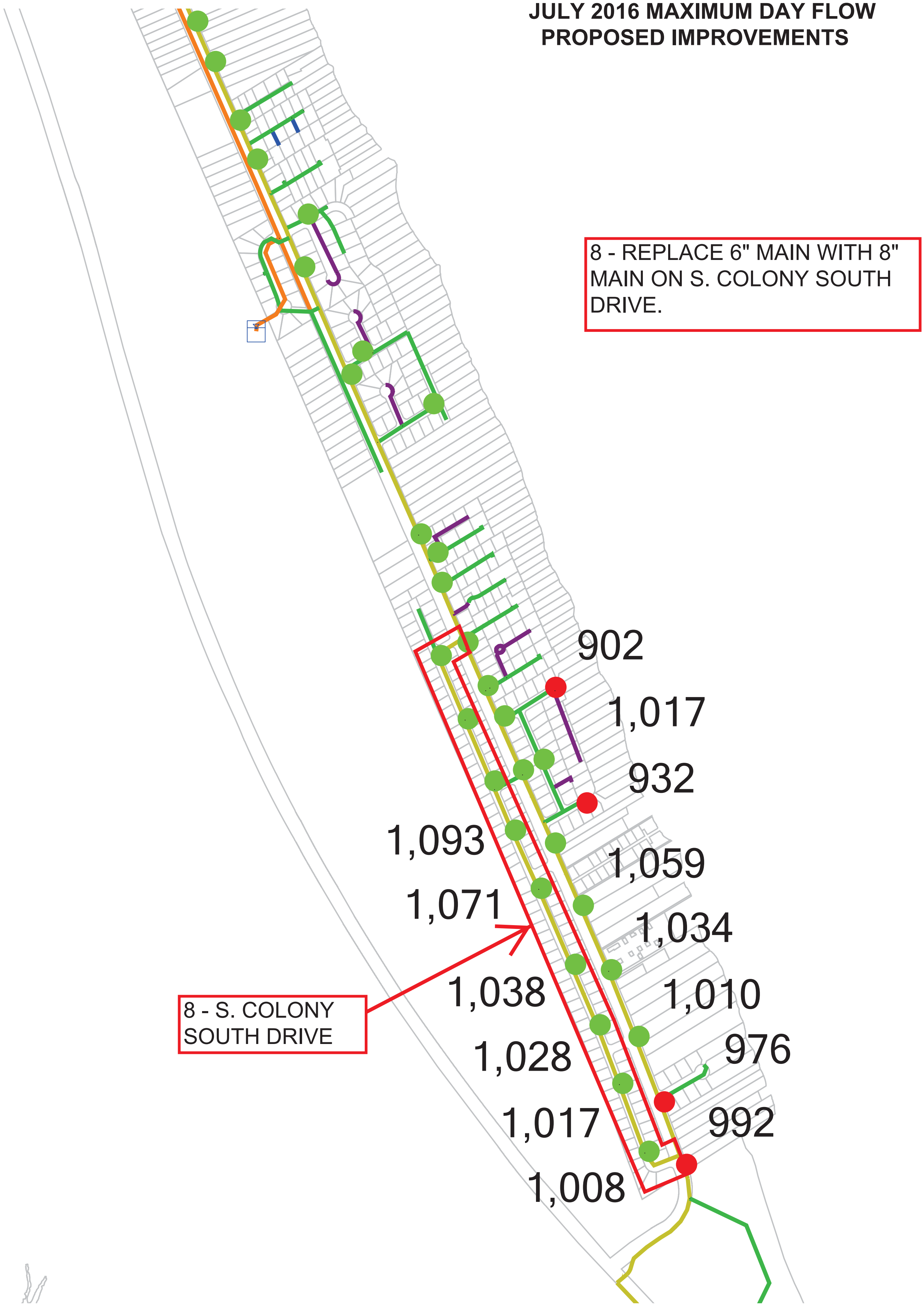
FIRE FLOW SCENARIO - JULY 2016 MAXIMUM DAY FLOW PROPOSED IMPROVEMENTS



FIRE FLOW SCENARIO -
JULY 2016 MAXIMUM DAY FLOW
PROPOSED IMPROVEMENTS



FIRE FLOW SCENARIO - JULY 2016 MAXIMUM DAY FLOW PROPOSED IMPROVEMENTS

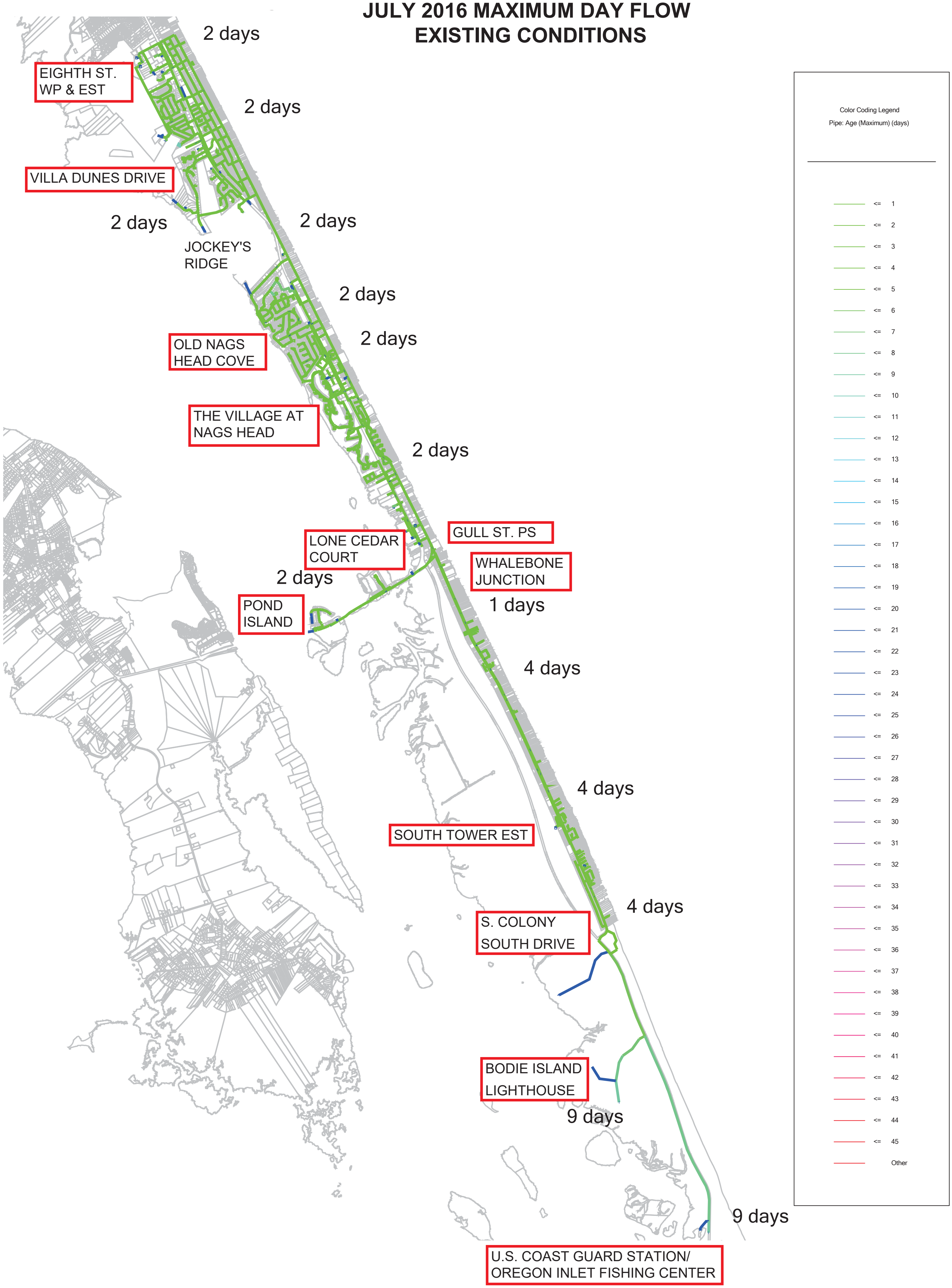


APPENDIX

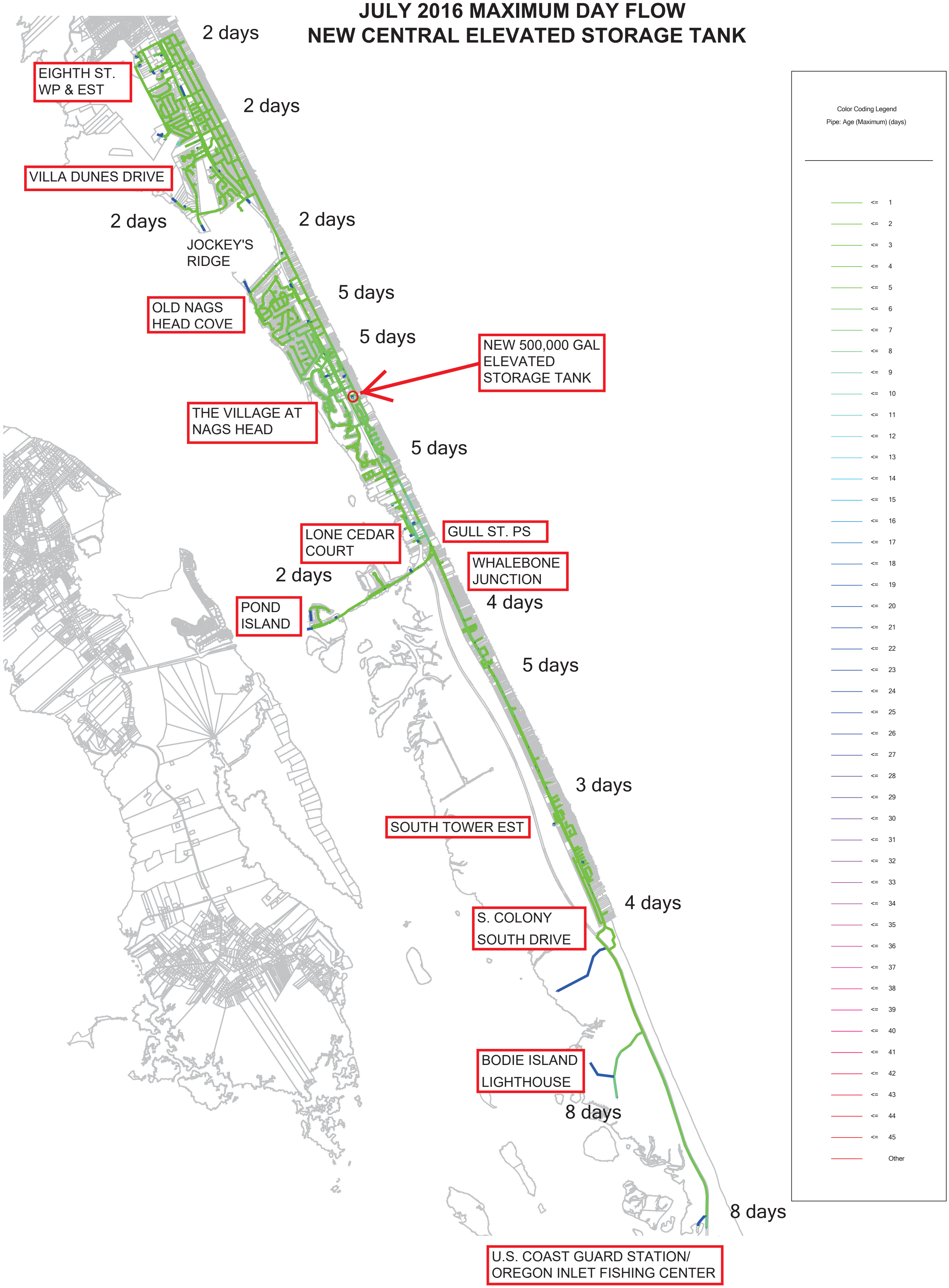
X

Water Age Analysis

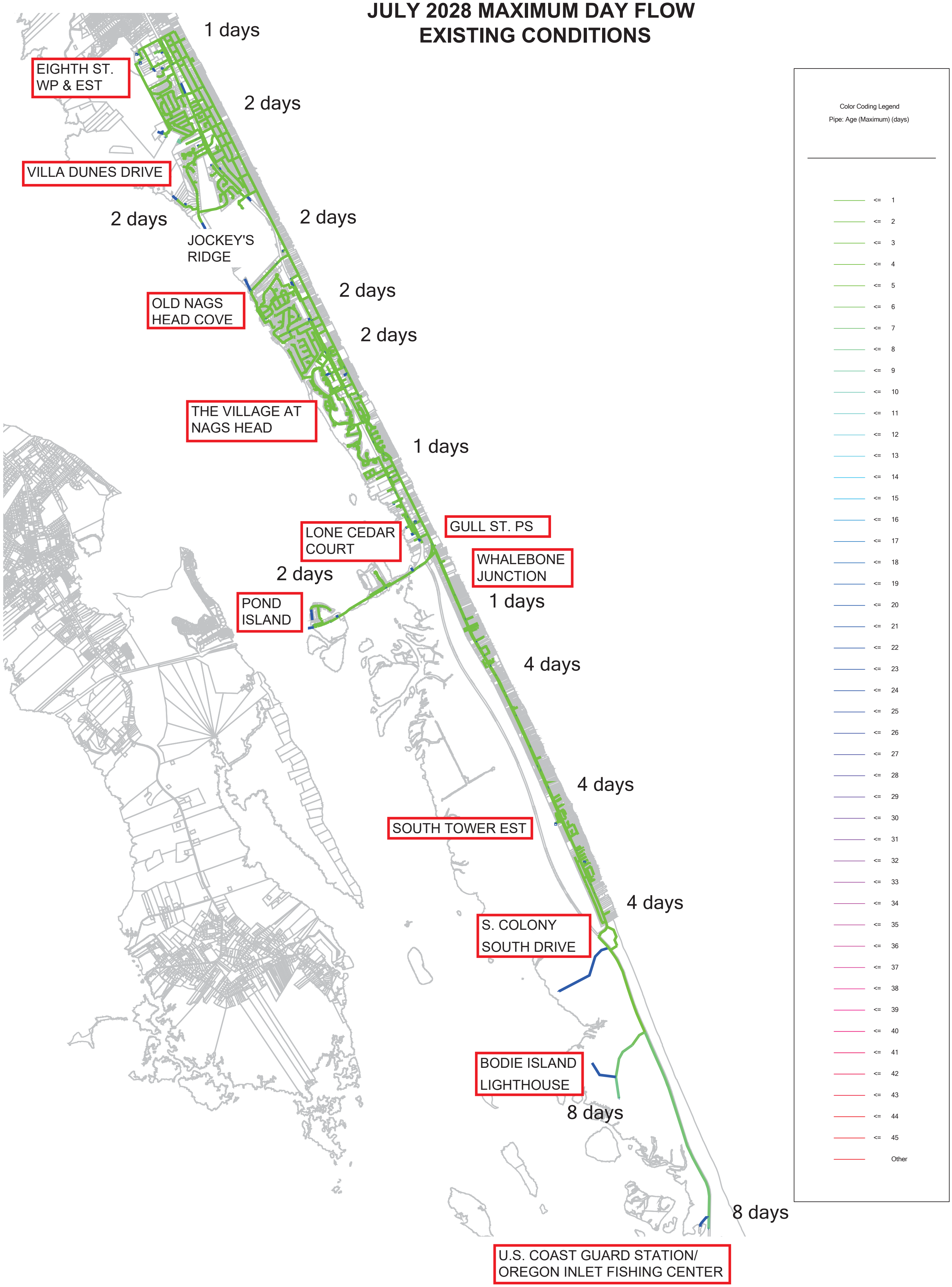
WATER AGE SCENARIO
JULY 2016 MAXIMUM DAY FLOW
EXISTING CONDITIONS



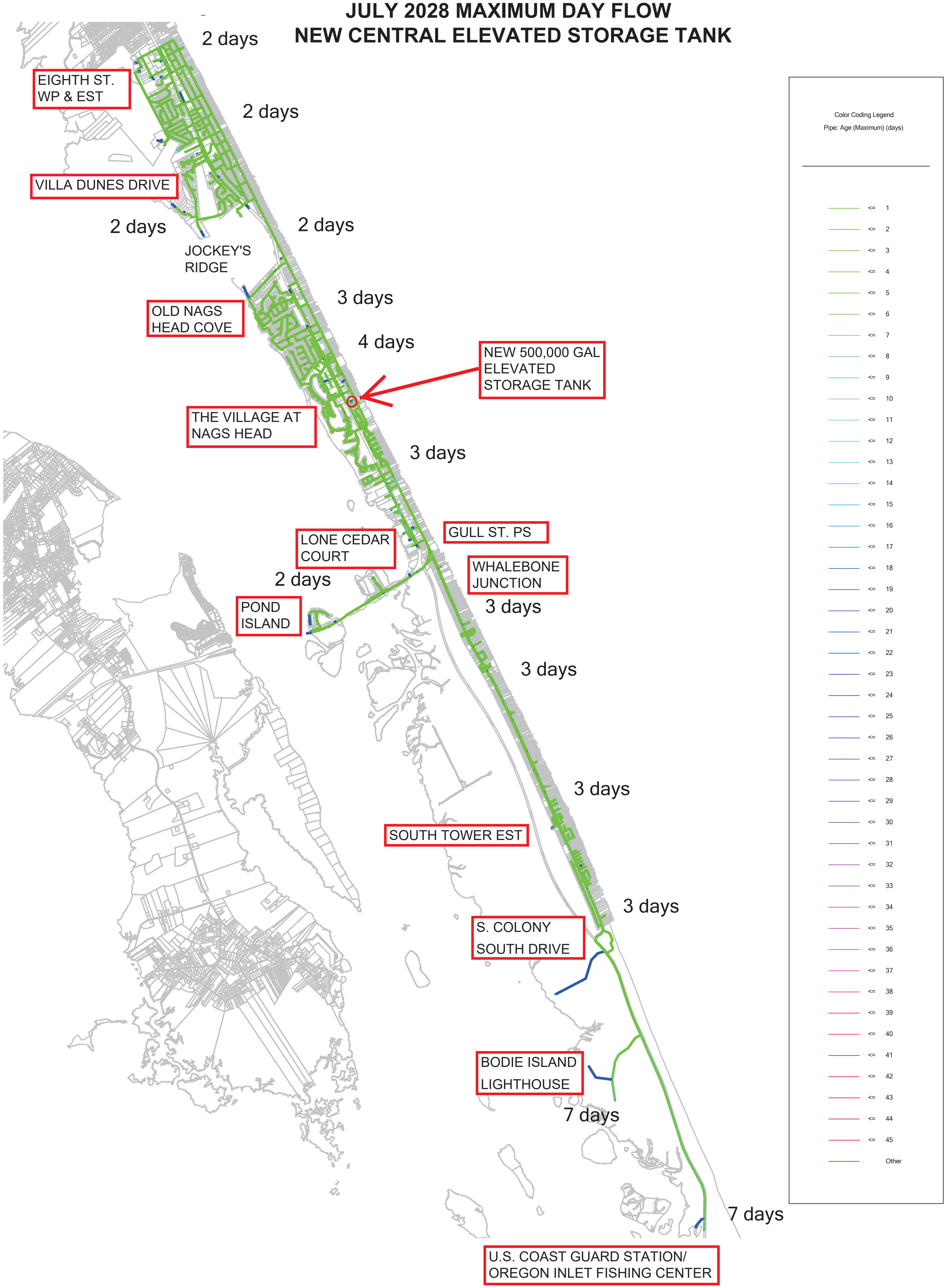
WATER AGE SCENARIO
JULY 2016 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK



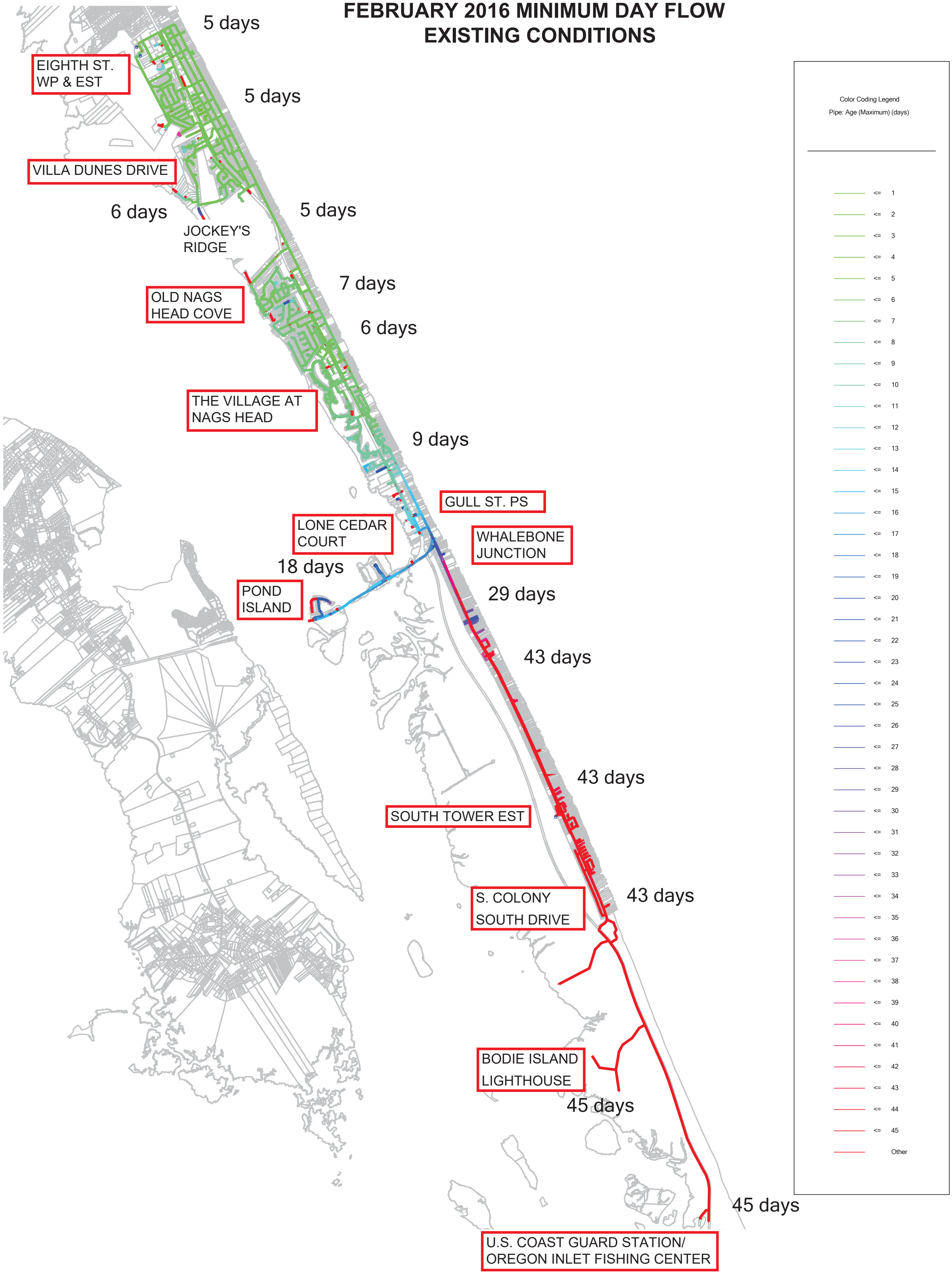
WATER AGE SCENARIO
JULY 2028 MAXIMUM DAY FLOW
EXISTING CONDITIONS



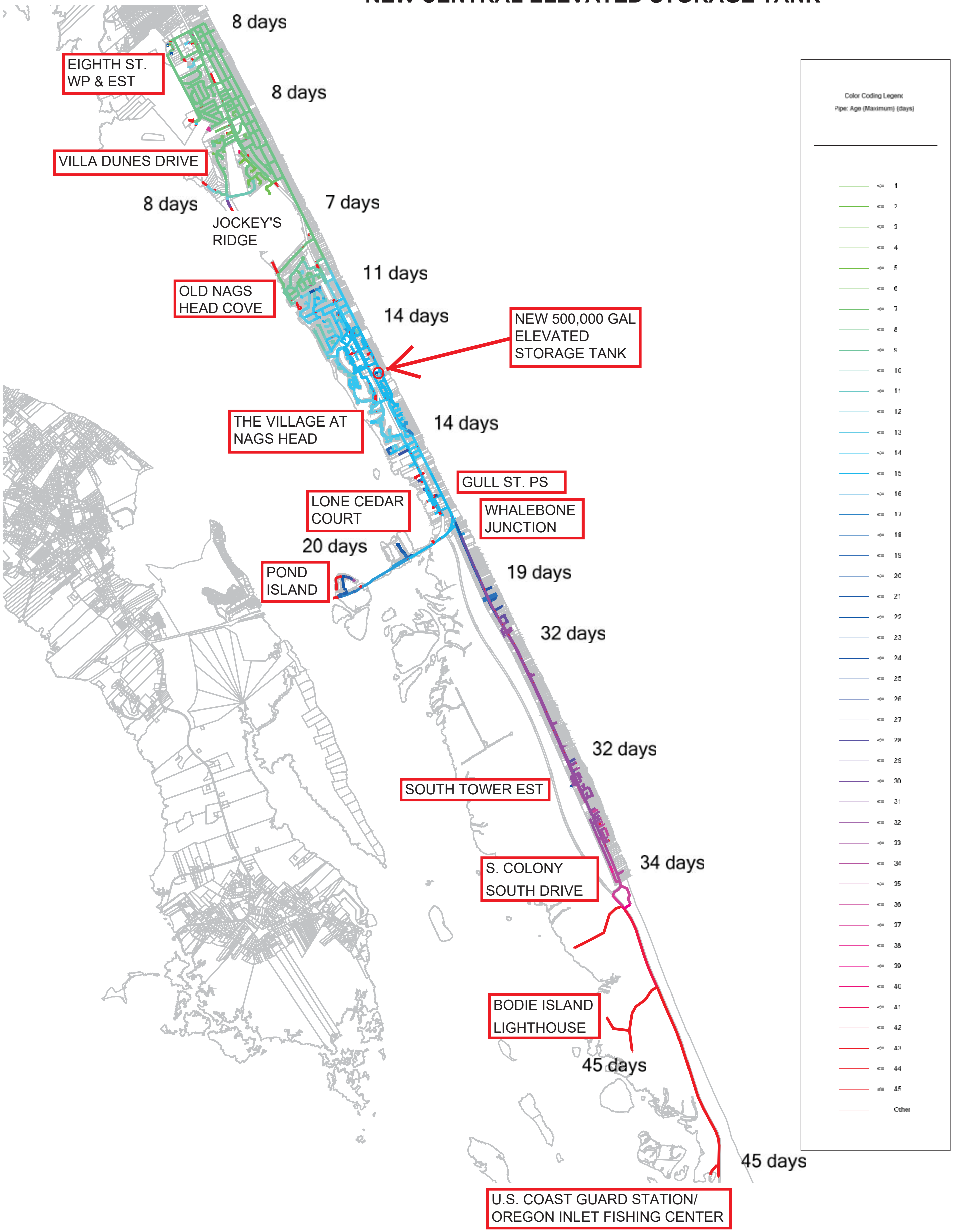
WATER AGE SCENARIO
JULY 2028 MAXIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK



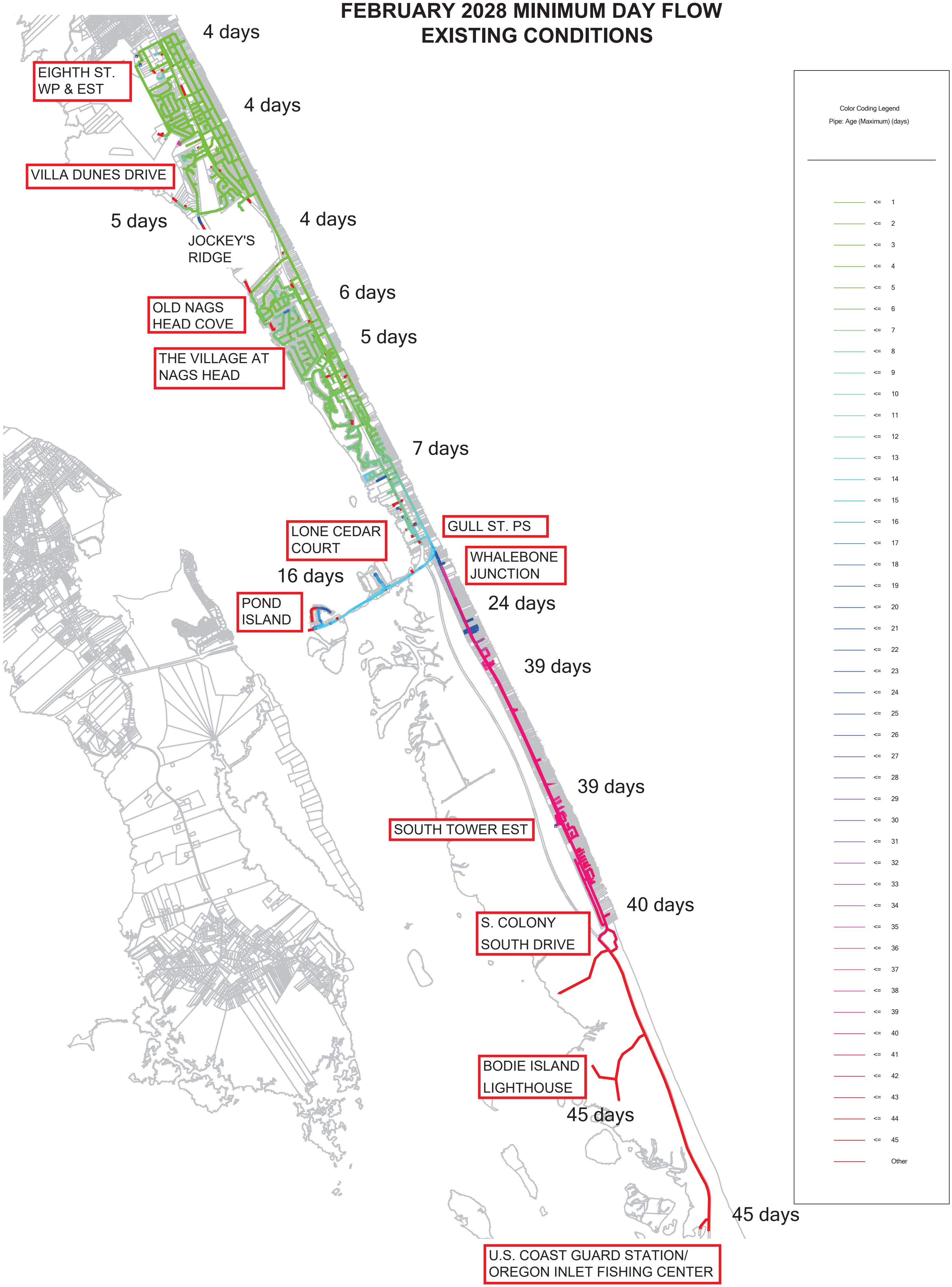
WATER AGE SCENARIO
FEBRUARY 2016 MINIMUM DAY FLOW
EXISTING CONDITIONS



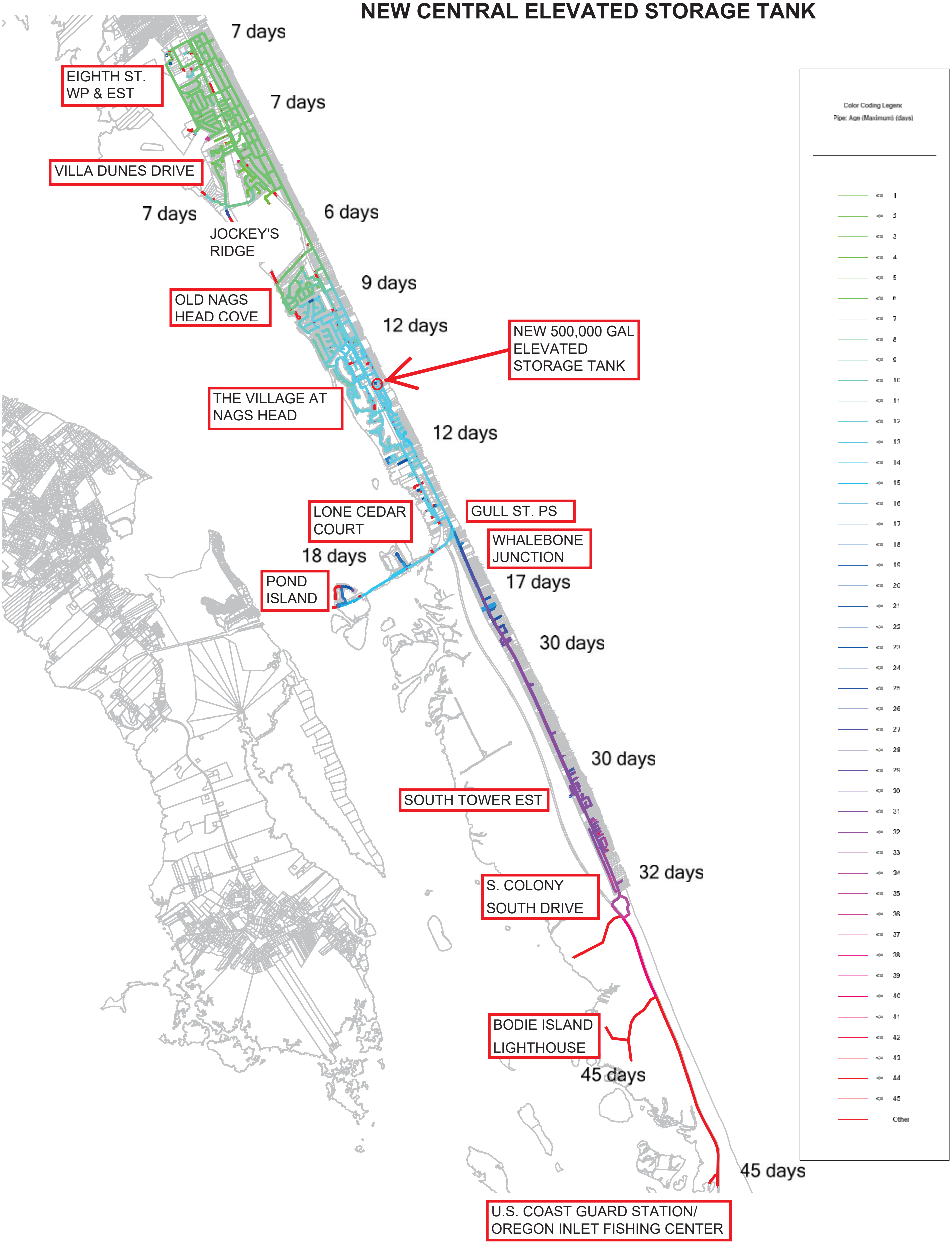
WATER AGE SCENARIO
FEBRUARY 2016 MINIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK



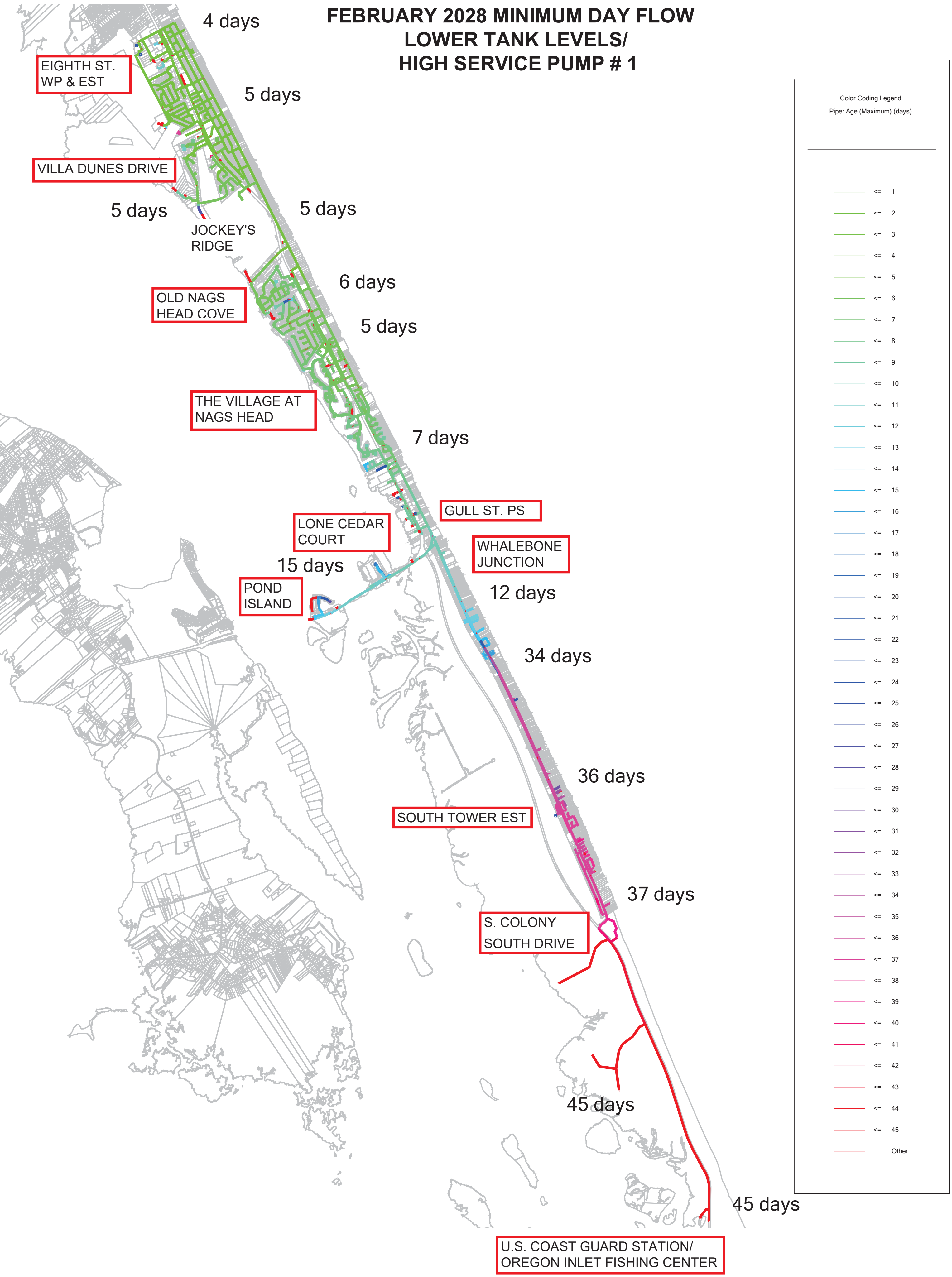
WATER AGE SCENARIO
FEBRUARY 2028 MINIMUM DAY FLOW
EXISTING CONDITIONS



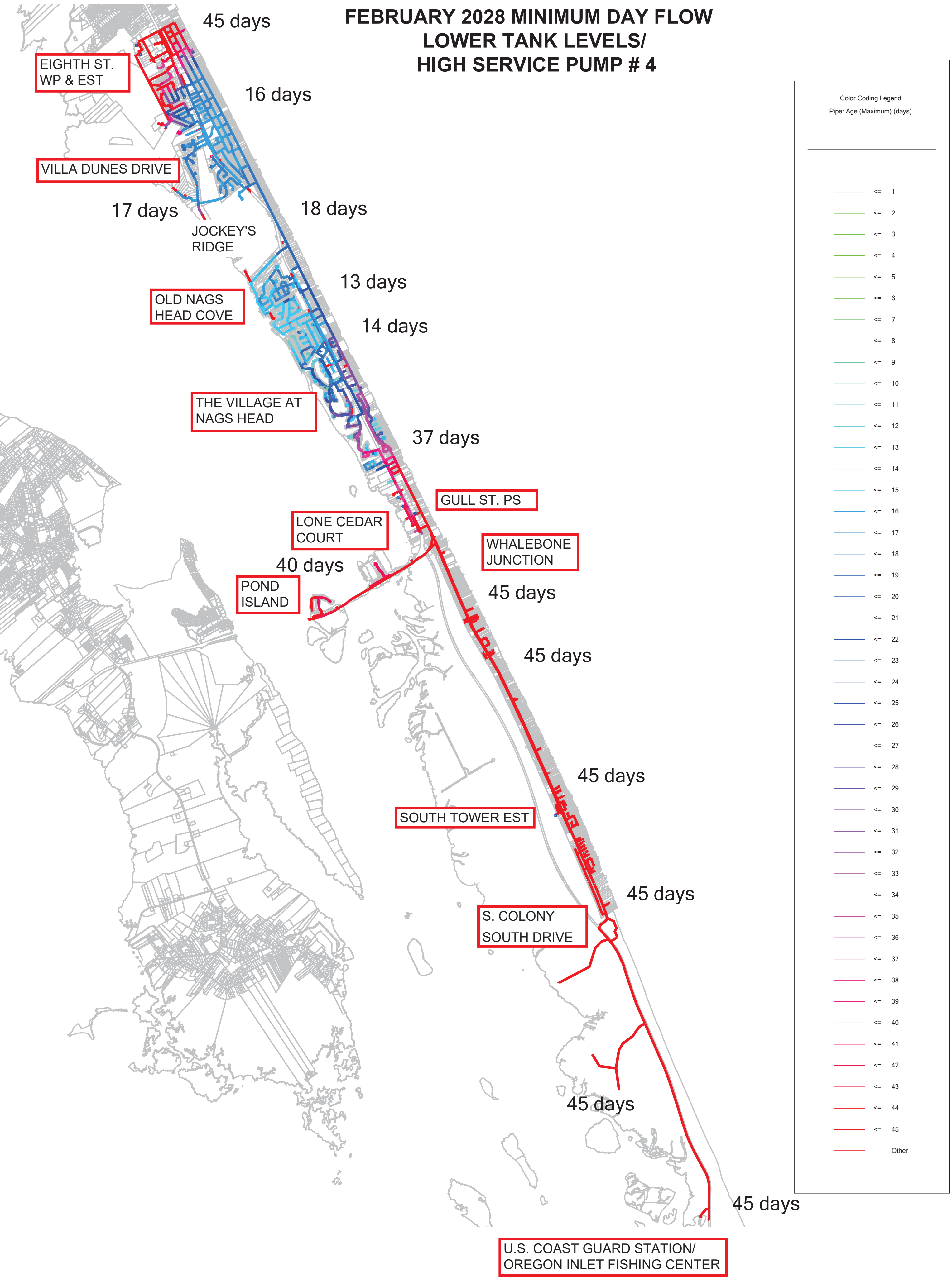
WATER AGE SCENARIO
FEBRUARY 2028 MINIMUM DAY FLOW
NEW CENTRAL ELEVATED STORAGE TANK



WATER AGE SCENARIO
FEBRUARY 2028 MINIMUM DAY FLOW
LOWER TANK LEVELS/
HIGH SERVICE PUMP # 1



WATER AGE SCENARIO
FEBRUARY 2028 MINIMUM DAY FLOW
LOWER TANK LEVELS/
HIGH SERVICE PUMP # 4



APPENDIX

Y

Water System Condition and Criticality Analysis

Appendix Y
Water System Asset Condition and Criticality Assessment (Score Sheet)
Town of Nags Head, NC

Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2B +	2C +	SUM 2	Criticality Rating SUM 1 x SUM 2 =	Criticality Ranking
Scoring Range	0 - 5	0- 5	0 - 10	0 - 3	0 - 23	0 - 3	0 -3	0 -3	0 -9	0 - 207	
Water System Component	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Numerical Rank
Eighth Street Chlorine Feed	2	2	7	1	**12**	3	3	3	**9**	**108**	**1**
Gull Street Chlorine Feed	2	2	7	1	**12**	3	3	3	**9**	**108**	**1**
Gull Street Emergency Generator/ATS	4	2	8	1	**15**	2	2	1	**5**	**75**	**2**
South Tower EST/Coating	1	2	5	2	**10**	3	3	1	**7**	**70**	**3**
Gull Street MCC/Electrical	2	2	8	1	**13**	2	2	1	**5**	**65**	**4**
Gull Street HSP #4	2	5	5	3	**15**	2	2	0	**4**	**60**	**5**
Gull Street HSP #5	2	5	5	3	**15**	2	2	0	**4**	**60**	**5**
Eighth Street EST/Coating	1	2	4	2	**9**	3	2	1	**6**	**54**	**6**
Eighth Street Emergency Generator/ATS	2	2	4	2	**10**	2	2	1	**5**	**50**	**7**
Eighth Street GST	2	2	6	2	**12**	2	1	1	**4**	**48**	**8**
Gull Street GST	2	2	5	2	**11**	2	1	1	**4**	**44**	**9**
Gull Street SCADA	3	2	7	1	**13**	2	1	0	**3**	**39**	**10**
Eighth Street MCC/Electrical	1	2	3	1	**7**	2	2	1	**5**	**35**	**11**
Eighth Street SCADA	2	2	5	1	**10**	2	1	0	**3**	**30**	**12**
Eighth Street Pump Station Building	3	2	6	3	**14**	1	1	0	**2**	**28**	**13**
Eighth Street HSP #1	3	2	7	1	**13**	1	1	0	**2**	**26**	**14**
Eighth Street HSP #2	3	2	7	1	**13**	1	1	0	**2**	**26**	**14**
Eighth Street HSP #3	3	2	7	1	**13**	1	1	0	**2**	**26**	**14**
Eighth Street EST Submersible Mixer	1	2	4	3	**10**	0	1	1	**2**	**20**	**15**
South Tower EST Submersible Mixer	1	2	4	3	**10**	0	1	1	**2**	**20**	**15**
Gull Street GST Submersible Mixer	1	2	2	3	**8**	0	1	1	**2**	**16**	**16**
Gull Street Pump Station Building	2	0	4	2	**8**	1	1	0	**2**	**16**	**16**

Appendix Y
Water System Asset Condition and Criticality Assessment (Score Sheet)
Town of Nags Head, NC

										Risk of Failure					Consequence of Failure				Criticality Rating	
									Scoring Reference	1A +	1B +	1C +	1D =	SUM 1	2A +	2D +	3D =	SUM 2	SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5545	P-1331	J-1567	J-1362	12	367	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
5546	P-1332	J-1362	J-719	12	639	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
5631	P-1417	J-719	J-711	12	746	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
5768	P-1554	J-784	J-1675	12	339	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	Install 12" Dual Water Main around Jockey's Ridge
5772	P-1558	J-901	J-784	12	777	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
5775	P-1561	J-711	J-774	12	863	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
5776	P-1562	J-774	J-901	12	529	DIP	Beach Road	1960s	Good/Fair	3	2	5	3	13	3	2	1	6	78	
2159	waterlines-101	J-1335	J-2198	16	78	DIP	Gull St. Pump Station	1982	Good/Fair	3	5	4	2	14	2	2	1	5	70	
6937	P-2344	PMP-4	J-1335	16	65	DIP	Gull St. Pump Station	1982	Good/Fair	3	5	4	2	14	2	2	1	5	70	Gull Street PS Discharge Mains
6943	P-2348	PMP-5	J-1335	16	58	DIP	Gull St. Pump Station	1982	Good/Fair	3	5	4	2	14	2	2	1	5	70	
4457	P-243	J-7	J-1816	14	39	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
4878	P-664	J-1483	J-1171	14	52	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
6261	P-1938	J-7	J-1483	14	135	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
6910	P-2330	PMP-3	J-2195	14	37	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	Eighth Street PS Discharge Mains
6913	P-2332	J-2195	J-1171	14	31	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
6915	P-2334	PMP-2	J-2195	14	20	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
6929	P-2340	PMP-1	J-2195	14	36	DIP	8th St. Pump Station	1964	Good/Fair	3	2.8	5	2	12.8	2	2	1	5	64	
4231	P-19	J-464	J-1816	12	29	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
4233	P-21	J-1767	J-464	12	245	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
4236	P-24	J-1815	J-569	12	318	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
4627	P-413	J-569	J-1835	12	48	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
4629	P-415	J-1480	J-623	12	243	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
4682	P-468	J-911	J-1824	12	124	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5018	P-804	J-1501	J-873	12	16	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5043	P-829	J-863	J-1637	12	34	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5091	P-877	J-639	J-1778	12	35	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5115	P-901	J-754	J-1579	12	106	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5149	P-935	J-794	J-831	12	717	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5181	P-967	J-1654	J-764	12	432	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5183	P-969	J-1835	J-1834	12	363	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5185	P-971	J-1824	J-1635	12	281	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5189	P-975	J-1759	J-657	12	685	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5191	P-977	J-873	J-1067	12	268	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	12" DIP Beach Road
5237	P-1023	J-623	J-1183	12	36	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5323	P-1109	J-1797	J-867	12	26	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5367	P-1153	J-877	J-1567	12	52	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5400	P-1186	J-875	J-1501	12	316	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5405	P-1191	J-1834	J-1069	12	243	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5415	P-1201	J-831	J-796	12	380	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5417	P-1203	J-1579	J-822	12	593	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5421	P-1207	J-1635	J-669	12	545	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5422	P-1208	J-669	J-754	12	771	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5425	P-1211	J-657	J-947	12	722	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5428	P-1214	J-1676	J-963	12	608	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5430	P-1216	J-808	J-911	12	896	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5471	P-1257	J-963	J-1673	12	29	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5477	P-1263	J-764	J-1602	12	24	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5550	P-1336	J-1624	J-808	12	50	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5551	P-1337	J-947	J-865	12	283	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5553	P-1339	J-796	J-871	12	334	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5558	P-1344	J-1773	J-571	12	678	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5560	P-1346	J-855	J-1676	12	168	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5568	P-1354	J-1467	J-544	12	405	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5607	P-1393	J-865	J-1333	12	23	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5611	P-1397	J-1069	J-5	12	49	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5621	P-1407	J-1778	J-548	12	885	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5622	P-1408	J-548	J-1773	12	217	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5630	P-1416	J-1589	J-1624	12	454	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5653	P-1439	J-1549	J-530	12	291	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5654	P-1440	J-530	J-1680	12	169	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5655	P-1441	J-867	J-1467	12	425	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5678	P-1464	J-1593	J-800	12	272	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5681	P-1467	J-1333	J-1738	12	334	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5684	P-1470	J-695	J-1589	12	387	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5686	P-1472	J-921	J-855	12	770	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5687	P-1473	J-800	J-1591	12	55	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5713	P-1499	J-1738	J-941	12	25	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5714	P-1500	J-941	J-1503	12	972	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5715	P-1501	J-683	J-651	12	630	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5718	P-1504	J-1555	J-921	12	41	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5720	P-1506	J-1610	J-695	12	50	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5734	P-1520	J-869	J-1593	12	157	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5742	P-1528	J-827	J-1610	12	546	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5750	P-1536	J-1581	J-827	12	503	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5752	P-1538	J-847	J-857	12	669	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5754	P-1540	J-1554	J-847	12	83	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5756	P-1542	J-917	J-1581	12	240	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5758	P-1544	J-1580	J-917	12	252	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5760	P-1546	J-804	J-1554	12	707	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5762	P-1548	J-1257	J-1580	12	345	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5764	P-1550	J-1675	J-804	12	416	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5766	P-1552	J-923	J-1257	12	149	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5770	P-1556	J-1703	J-923	12	390	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
5779	P-1565	J-1399	J-1607	12	578	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6198	P-1875	J-969	J-361	12	497	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6243	P-1920	J-1637	J-794	12	784	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6249	P-1926	J-1383	J-1797	12	333	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6250	P-1927	J-822	J-877	12	683	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6356	P-1999	J-361	J-1975	12	210	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6357	P-2000	J-1975	J-1549	12	28	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6462	P-2039	J-651	J-2040	12	218	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	12" DIP Beach Road
6463	P-2040	J-2040	J-1767	12	183	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6479	P-2053	J-1649	J-1480	12	70	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6483	P-2056	J-1602	J-2044	12	608	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6484	P-2057	J-2044	J-863	12	230	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6503	P-2070	J-1503	J-2050	12	18	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6504	P-2071	J-2050	J-1815	12	639	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6510	P-2075	J-1673	J-2052	12	206	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6511	P-2076	J-2052	J-639	12	419	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6520	P-2083	J-2054	J-875	12	206	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6541	P-2099	J-871	J-2059	12	174	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6542	P-2100	J-2059	J-869	12	219	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6555	P-2109	J-857	J-2063	12	244	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6556	P-2110	J-2063	J-1555	12	158	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6774	P-2244	J-1067	J-2146	12	40	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6792	P-2255	J-2153	J-814	12	94	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6900	P-2325	J-5	J-845	12	75	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
6901	P-2326	J-845	J-683	12	30	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7247	P-2380	J-1680	J-1359	12	22	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7248	P-2381	J-1359	J-2054	12	343	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7533	P-2447	J-1183	J-2257	12	128	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7534	P-2448	J-2257	J-1654	12	234	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7538	P-2450	J-1591	J-2259	12	253	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7539	P-2451	J-2259	J-1383	12	24	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7543	P-2453	J-544	J-2261	12	44	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7544	P-2454	J-2261	J-792	12	448	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7550	P-2457	J-792	J-2264	12	507	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7551	P-2458	J-2264	J-969	12	517	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7557	P-2461	J-2146	J-2267	12	117	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7558	P-2462	J-2267	J-1399	12	171	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7562	P-2464	J-571	J-2269	12	587	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7563	P-2465	J-2269	J-1759	12	30	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7567	P-2467	J-814	J-2271	12	332	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	**Pipe #**	**Start Node Junction #**	**Stop Node Junction #**	**Size (in.)**	**Length (ft.)**	**Material**	**Grouping Name**	**Age (years)**	**Assumed Condition**	**Condition Rating**	**Capacity Rating**	**Service Life Rating**	**Level of Redundancy**	**Total Risk Score**	**Water Delivery Capability**	**Health & Safety**	**Environmental**	**Total Consequence Score**	**Product of Risk x Consequence**	**Comment**
7568	P-2468	J-2271	J-1703	12	28	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	12" DIP Beach Road
7572	P-2470	J-1607	J-2273	12	342	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
7573	P-2471	J-2273	J-2153	12	323	DIP	Beach Road	1960s	Good/Fair	3	2	5	2	12	2	2	1	5	60	
205	waterlines-771	J-Hydrant-124	J-52	6	18	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
214	waterlines-772	J-Hydrant-120	J-58	6	19	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
241	waterlines-690	J-Hydrant-101	J-76	6	17	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
247	waterlines-643	J-Hydrant-1	J-80	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
253	waterlines-645	J-Hydrant-2	J-84	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
265	waterlines-763	J-Hydrant-121	J-92	6	8	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
274	waterlines-654	J-Hydrant-7	J-98	6	19	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
307	waterlines-649	J-Hydrant-12	J-120	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
382	waterlines-764	J-Hydrant-122	J-170	6	10	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
394	waterlines-646	J-Hydrant-4	J-178	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
429	waterlines-769	J-Hydrant-106	J-201	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
438	waterlines-642	J-Hydrant-418	J-207	6	16	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
444	waterlines-770	J-Hydrant-125	J-211	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
462	waterlines-758	J-Hydrant-116	J-223	6	19	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
627	waterlines-631	J-Hydrant-86	J-333	6	13	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
633	waterlines-795	J-Hydrant-169	J-337	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
639	waterlines-757	J-Hydrant-127	J-341	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
660	waterlines-686	J-Hydrant-96	J-355	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
675	waterlines-641	J-364	J-365	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
681	waterlines-678	J-Hydrant-26	J-369	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
693	waterlines-679	J-Hydrant-31	J-377	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
717	waterlines-648	J-Hydrant-6	J-393	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
740	waterlines-614	J-Hydrant-51	J-408	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
758	waterlines-619	J-Hydrant-76	J-420	6	45	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
779	waterlines-971	J-Hydrant-427	J-434	6	78	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
800	waterlines-682	J-Hydrant-411	J-448	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
833	waterlines-785	J-Hydrant-164	J-470	6	28	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
836	waterlines-675	J-Hydrant-29	J-472	6	37	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
839	waterlines-660	J-Hydrant-13	J-474	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
842	waterlines-762	J-Hydrant-118	J-476	6	18	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
845	waterlines-638	J-477	J-478	6	18	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
851	waterlines-777	J-Hydrant-160	J-482	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
872	waterlines-668	J-Hydrant-95	J-496	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
884	waterlines-693	J-Hydrant-99	J-504	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
893	waterlines-803	J-Hydrant-177	J-510	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
898	waterlines-798	J-Hydrant-171	J-512	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
910	waterlines-666	J-Hydrant-104	J-1608	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
916	waterlines-776	J-Hydrant-158	J-524	6	29	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
931	waterlines-628	J-Hydrant-80	J-534	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
934	waterlines-670	J-Hydrant-17	J-536	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
975	waterlines-691	J-Hydrant-98	J-1983	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
981	waterlines-613	J-Hydrant-49	J-2188	6	16	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
996	waterlines-808	J-Hydrant-172	J-577	6	41	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1002	waterlines-810	J-Hydrant-174	J-581	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1005	waterlines-644	J-Hydrant-3	J-583	6	40	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1011	waterlines-639	J-Hydrant-56	J-587	6	43	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1014	waterlines-630	J-Hydrant-93	J-589	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1017	waterlines-688	J-Hydrant-97	J-591	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1020	waterlines-624	J-Hydrant-82	J-593	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1023	waterlines-625	J-Hydrant-81	J-595	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1038	waterlines-667	J-Hydrant-94	J-605	6	19	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1041	waterlines-809	J-Hydrant-173	J-607	6	38	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1068	waterlines-915	J-Hydrant-111	J-625	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1074	waterlines-943	J-Hydrant-113	J-629	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1077	waterlines-792	J-Hydrant-165	J-631	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1086	waterlines-778	J-Hydrant-153	J-637	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1092	waterlines-661	J-Hydrant-413	J-641	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1122	waterlines-942	J-Hydrant-166	J-661	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1125	waterlines-796	J-Hydrant-167	J-663	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1128	waterlines-677	J-Hydrant-23	J-665	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1137	waterlines-799	J-Hydrant-183	J-671	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
1140	waterlines-676	J-672	J-Hydrant-30	6	39	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1158	waterlines-969	J-684	J-Hydrant-429	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1161	waterlines-637	J-Hydrant-92	J-687	6	29	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1176	waterlines-797	J-Hydrant-170	J-697	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1179	waterlines-917	J-Hydrant-110	J-699	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1188	waterlines-662	J-Hydrant-412	J-705	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1194	waterlines-680	J-Hydrant-27	J-709	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1203	waterlines-626	J-Hydrant-78	J-715	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1217	waterlines-621	J-Hydrant-83	J-724	6	21	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1226	waterlines-779	J-Hydrant-161	J-730	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1250	waterlines-886	J-Hydrant-178	J-746	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1265	waterlines-671	J-Hydrant-19	J-756	6	34	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1268	waterlines-623	J-757	J-758	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1274	waterlines-655	J-Hydrant-11	J-762	6	45	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1286	waterlines-672	J-Hydrant-20	J-770	6	37	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1295	waterlines-647	J-Hydrant-5	J-776	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1301	waterlines-653	J-Hydrant-91	J-780	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1316	waterlines-656	J-Hydrant-8	J-790	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1369	waterlines-780	J-Hydrant-154	J-825	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1375	waterlines-640	J-Hydrant-57	J-829	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1384	waterlines-802	J-Hydrant-182	J-835	6	29	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1390	waterlines-782	J-Hydrant-151	J-839	6	44	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1396	waterlines-783	J-Hydrant-152	J-843	6	35	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1405	waterlines-627	J-Hydrant-79	J-849	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1411	waterlines-760	J-Hydrant-119	J-853	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1423	waterlines-972	J-Hydrant-428	J-861	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1477	waterlines-887	J-Hydrant-176	J-897	6	34	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1492	waterlines-725	J-Hydrant-139	J-907	6	34	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1495	waterlines-801	J-Hydrant-180	J-909	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1519	waterlines-622	J-Hydrant-332	J-925	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1522	waterlines-918	J-Hydrant-109	J-927	6	17	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1531	waterlines-781	J-Hydrant-149	J-933	6	37	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1534	waterlines-784	J-Hydrant-163	J-935	6	35	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1540	waterlines-658	J-Hydrant-10	J-939	6	40	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1582	waterlines-775	J-Hydrant-156	J-1787	6	34	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1591	waterlines-674	J-Hydrant-22	J-973	6	29	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
1597	waterlines-786	J-Hydrant-148	J-977	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1624	waterlines-673	J-Hydrant-21	J-995	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1627	waterlines-692	J-Hydrant-100	J-997	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1630	waterlines-681	J-Hydrant-28	J-999	6	38	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1645	waterlines-652	J-Hydrant-88	J-1009	6	36	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1648	waterlines-663	J-Hydrant-89	J-1011	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1654	waterlines-974	J-1014	J-1015	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1663	waterlines-800	J-Hydrant-179	J-1021	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1693	waterlines-657	J-Hydrant-9	J-1041	6	46	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1699	waterlines-636	J-Hydrant-85	J-1045	6	36	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1729	waterlines-975	J-Hydrant-162	J-1065	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1792	waterlines-659	J-Hydrant-14	J-1106	6	47	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1807	waterlines-669	J-Hydrant-103	J-1116	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1825	waterlines-635	J-Hydrant-87	J-1128	6	40	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
1828	waterlines-914	J-1129	J-1130	6	54	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2003	waterlines-970	J-Hydrant-430	J-1240	6	156	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2048	waterlines-1020	J-1266	J-1267	6	182	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2124	waterlines-373	J-904	J-1313	6	243	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2127	waterlines-401	J-1314	J-1315	6	207	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2297	waterlines-268	J-1420	J-1421	6	706	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2335	waterlines-378	J-1443	J-1444	6	378	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2362	waterlines-1025	J-1459	J-1460	6	262	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2418	waterlines-1018	J-1493	J-1494	6	433	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2674	waterlines-357	J-1650	J-1651	6	602	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2711	waterlines-342	J-1766	J-1673	6	363	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4224	P-12	J-1728	J-512	6	114	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4225	P-13	J-512	J-1670	6	171	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4226	P-14	J-1670	J-577	6	326	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
4227	P-15	J-1515	J-1508	6	350	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4228	P-16	J-1515	J-577	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4241	P-29	J-925	J-2050	6	43	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4242	P-30	J-1834	J-420	6	305	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4243	P-31	J-420	J-1484	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4246	P-32	J-1484	J-1678	6	311	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4253	P-39	J-1950	J-Hydrant-468	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4268	P-54	J-1484	J-1485	6	356	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4271	P-57	J-567	J-Hydrant-462	6	200	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4280	P-66	J-32	J-31	6	10	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4291	P-77	J-1656	J-1405	6	304	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4320	P-106	J-393	J-1746	6	549	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4324	P-110	J-1616	J-1385	6	47	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4351	P-137	J-1306	J-Hydrant-52	6	177	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4371	P-157	J-1789	J-1021	6	62	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4412	P-198	J-790	J-1538	6	45	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4422	P-208	J-839	J-1752	6	509	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4441	P-227	J-1631	J-80	6	555	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4442	P-228	J-80	J-1632	6	49	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4460	P-246	J-705	J-1702	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4469	P-255	J-1495	J-333	6	37	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4470	P-256	J-333	J-1496	6	326	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4481	P-267	J-1341	J-641	6	247	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4485	P-271	J-1721	J-730	6	412	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4494	P-280	J-1736	J-1314	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4511	P-297	J-1206	J-997	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4512	P-298	J-563	J-1676	6	364	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4543	P-329	J-1693	J-1645	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4553	P-339	J-1560	J-470	6	265	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4554	P-340	J-470	J-1639	6	571	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4581	P-367	J-1644	J-853	6	599	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4582	P-368	J-853	J-1669	6	349	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
4622	P-408	J-933	J-1639	6	95	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4636	P-422	J-973	J-1745	6	243	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4638	P-424	J-1791	J-1739	6	124	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4670	P-456	J-1538	J-1737	6	781	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4734	P-520	J-1745	J-1371	6	281	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4806	P-592	J-Hydrant-123	J-317	6	13	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4808	P-594	J-76	J-462	6	298	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4852	P-638	J-Hydrant-112	J-490	6	18	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4860	P-646	J-Hydrant-181	J-498	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4862	P-648	J-1341	J-1630	6	319	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4868	P-654	J-758	J-1678	6	105	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4873	P-659	J-1691	J-1011	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4888	P-674	J-1979	J-1750	6	1042	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4949	P-735	J-1663	J-1140	6	50	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4950	P-736	J-1140	J-625	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4951	P-737	J-625	J-1130	6	195	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4961	P-747	J-1118	J-1117	6	49	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4966	P-752	J-927	J-1118	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4967	P-753	J-1338	J-1695	6	264	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4968	P-754	J-1695	J-1727	6	137	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4980	P-766	J-607	J-581	6	459	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4981	P-767	J-730	J-1360	6	101	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4982	P-768	J-1360	J-1722	6	486	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4987	P-773	J-1652	J-587	6	327	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4997	P-783	J-825	J-1352	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4998	P-784	J-1352	J-1787	6	646	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5023	P-809	J-1766	J-591	6	52	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5024	P-810	J-591	J-355	6	562	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5033	P-819	J-583	J-84	6	580	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5034	P-820	J-84	J-1632	6	447	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5035	P-821	J-1695	J-377	6	49	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5036	P-822	J-377	J-1723	6	570	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5069	P-855	J-1727	J-709	6	402	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5070	P-856	J-709	J-1696	6	337	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5075	P-861	J-1723	J-369	6	237	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5076	P-862	J-369	J-1696	6	292	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5085	P-871	J-1584	J-1608	6	233	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5086	P-872	J-1608	J-520	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5108	P-894	J-478	J-1791	6	106	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5113	P-899	J-909	J-498	6	480	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5127	P-913	J-1674	J-317	6	262	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5132	P-918	J-1243	J-933	6	623	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5133	P-919	J-1394	J-1116	6	241	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5135	P-921	J-1734	J-770	6	307	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5136	P-922	J-770	J-1371	6	523	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5148	P-934	J-1343	J-448	6	185	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5159	P-945	J-907	J-1682	6	333	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5166	P-952	J-1739	J-1726	6	357	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5179	P-965	J-504	J-563	6	502	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5197	P-983	J-1630	J-474	6	45	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5199	P-985	J-1632	J-178	6	536	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5206	P-992	J-935	J-1209	6	291	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5214	P-1000	J-637	J-825	6	342	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5217	P-1003	J-1701	J-1691	6	372	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5218	P-1004	J-1691	J-705	6	495	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5221	P-1007	J-1727	J-1725	6	316	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5227	P-1013	J-1677	J-666	6	245	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5230	P-1016	J-1459	J-504	6	236	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5239	P-1025	J-829	J-1412	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5243	P-1029	J-861	J-434	6	694	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5244	P-1030	J-434	J-1415	6	140	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5253	P-1039	J-1683	J-1749	6	15	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5254	P-1040	J-1749	J-1647	6	62	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
5270	P-1056	J-1187	J-66	6	834	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5274	P-1060	J-1669	J-1694	6	36	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5283	P-1069	J-1736	J-98	6	44	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5284	P-1070	J-98	J-1538	6	290	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5285	P-1071	J-1371	J-756	6	131	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5286	P-1072	J-756	J-1735	6	158	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5305	P-1091	J-1130	J-490	6	62	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5306	P-1092	J-490	J-1664	6	363	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5311	P-1097	J-1117	J-699	6	269	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5312	P-1098	J-699	J-1647	6	78	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5317	P-1103	J-476	J-1708	6	529	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5318	P-1104	J-1708	J-341	6	581	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5319	P-1105	J-1015	J-684	6	55	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5322	P-1108	J-170	J-1674	6	61	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5325	P-1111	J-1116	J-1650	6	22	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5328	P-1114	J-1280	J-829	6	71	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5333	P-1119	J-1721	J-482	6	158	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5354	P-1140	J-1595	J-211	6	241	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5362	P-1148	J-1732	J-939	6	178	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5377	P-1163	J-1647	J-629	6	301	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5378	P-1164	J-629	J-1663	6	391	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5379	P-1165	J-897	J-510	6	468	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5396	P-1182	J-1240	J-1015	6	379	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5412	P-1198	J-1584	J-1343	6	356	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5414	P-1200	J-1671	J-897	6	321	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5420	P-1206	J-365	J-1652	6	223	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5435	P-1221	J-666	J-667	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5447	P-1233	J-1752	J-843	6	273	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5448	P-1234	J-843	J-637	6	642	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5450	P-1236	J-979	J-978	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5453	P-1239	J-1735	J-1641	6	273	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5456	P-1242	J-1605	J-1616	6	47	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5467	P-1253	J-1752	J-1065	6	342	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5468	P-1254	J-1065	J-935	6	434	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5470	P-1256	J-1474	J-1845	6	447	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5503	P-1289	J-1650	J-1473	6	17	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5504	P-1290	J-1473	J-1584	6	444	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5529	P-1315	J-1021	J-746	6	474	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5530	P-1316	J-746	J-1671	6	175	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5536	P-1322	J-605	J-1584	6	326	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5548	P-1334	J-1631	J-365	6	291	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5561	P-1347	J-1630	J-1106	6	529	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5562	P-1348	J-1106	J-1732	6	293	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5590	P-1376	J-496	J-1474	6	41	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5594	P-1380	J-1787	J-1722	6	357	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5614	P-1400	J-207	J-1631	6	70	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5664	P-1450	J-92	J-170	6	253	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5680	P-1466	J-64	J-207	6	559	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5737	P-1523	J-58	J-92	6	251	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5791	P-1577	J-1845	J-1701	6	642	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5792	P-1578	J-1846	J-Hydrant-90	6	26	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5795	P-1581	J-563	J-997	6	327	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5797	P-1583	J-1496	J-589	6	23	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5798	P-1584	J-589	J-687	6	504	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5799	P-1585	J-687	J-129	6	487	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5800	P-1586	J-129	J-780	6	671	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5801	P-1587	J-780	J-1830	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5803	P-1589	J-1009	J-1830	6	332	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5804	P-1590	J-1830	J-1759	6	358	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5808	P-1594	J-1488	J-715	6	33	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5809	P-1595	J-715	J-849	6	507	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5811	P-1597	J-1495	J-1045	6	558	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5820	P-1606	J-1652	J-1739	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5842	P-1620	J-355	J-1843	6	40	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5843	P-1621	J-1843	J-496	6	613	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
5845	P-1622	J-1773	J-1845	6	357	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5846	P-1623	J-1845	J-605	6	29	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5848	P-1624	J-1830	J-1846	6	627	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5849	P-1625	J-1846	J-1701	6	28	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5876	P-1641	J-665	J-904	6	74	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5879	P-1643	J-16	J-1641	6	165	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5880	P-1644	J-16	J-904	6	329	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5883	P-1645	J-1445	J-1306	6	153	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5886	P-1647	J-1444	J-1266	6	404	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5887	P-1648	J-1266	J-1041	6	174	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5902	P-1658	J-1128	J-1045	6	533	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5908	P-1661	J-1732	J-762	6	576	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5909	P-1662	J-762	J-1733	6	537	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5914	P-1664	J-665	J-1642	6	82	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5934	P-1676	J-999	J-32	6	167	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5942	P-1678	J-995	J-973	6	500	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5952	P-1685	J-977	J-1243	6	165	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5983	P-1705	J-178	J-776	6	417	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5992	P-1711	J-1725	J-672	6	283	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5993	P-1712	J-672	J-472	6	729	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5995	P-1713	J-1405	J-661	6	251	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6002	P-1718	J-595	J-1489	6	37	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6005	P-1719	J-1489	J-593	6	235	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6011	P-1723	J-1734	J-536	6	294	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6012	P-1724	J-536	J-1443	6	737	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6015	P-1726	J-534	J-595	6	488	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6020	P-1729	J-1304	J-524	6	169	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6066	P-1758	J-64	J-Hydrant-419	6	17	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6137	P-1814	J-835	J-1236	6	492	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6139	P-1816	J-661	J-663	6	366	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6142	P-1819	J-510	J-1270	6	372	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6161	P-1838	J-1696	J-1745	6	340	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6165	P-1842	J-1805	J-909	6	197	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6169	P-1846	J-1725	J-999	6	426	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6186	P-1863	J-1508	J-607	6	115	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6192	P-1869	J-498	J-835	6	497	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6196	P-1873	J-1041	J-790	6	583	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6213	P-1890	J-1540	J-927	6	261	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6217	P-1894	J-1766	J-462	6	345	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6230	P-1907	J-472	J-1641	6	92	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6233	P-1910	J-978	J-482	6	514	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6238	P-1915	J-341	J-1187	6	934	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6254	P-1931	J-76	J-1206	6	326	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6256	P-1933	J-894	J-971	6	90	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6281	P-1953	J-1750	J-1645	6	155	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6283	P-1954	J-1644	J-223	6	382	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6284	P-1955	J-223	J-1750	6	131	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6286	P-1956	J-Hydrant-469	J-1948	6	28	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6287	P-1957	J-1948	J-1972	6	302	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6289	P-1958	J-1698	J-1950	6	156	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6290	P-1959	J-1950	J-1948	6	248	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6293	P-1961	J-1698	J-462	6	196	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6298	P-1964	J-1394	J-1951	6	378	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6299	P-1965	J-1951	J-1698	6	473	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6301	P-1966	J-211	J-201	6	362	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6302	P-1967	J-201	J-1421	6	89	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6332	P-1985	J-474	J-120	6	799	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6335	P-1987	J-120	J-1733	6	11	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6336	P-1988	J-1733	J-1736	6	365	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6344	P-1993	J-1595	J-52	6	221	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6345	P-1994	J-52	J-1420	6	290	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6349	P-1995	J-Hydrant-470	J-1972	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6350	P-1996	J-1972	J-1699	6	190	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6366	P-2005	J-1749	J-1979	6	272	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6370	P-2007	J-1979	J-Hydrant-471	6	12	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
6375	P-2010	J-563	J-1983	6	24	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6376	P-2011	J-1983	J-1766	6	609	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6378	P-2012	J-1306	J-1984	6	147	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6379	P-2013	J-1984	J-Hydrant-54	6	334	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6381	P-2014	J-1984	J-Hydrant-53	6	16	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6444	P-2029	J-1460	J-907	6	263	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6449	P-2032	J-1751	J-1746	6	59	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6450	P-2033	J-1746	J-583	6	155	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6458	P-2037	J-776	J-1315	6	294	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6459	P-2038	J-1315	J-393	6	222	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6489	P-2061	J-724	J-1485	6	17	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6490	P-2062	J-1485	J-1835	6	332	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6492	P-2063	J-1488	J-2046	6	181	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6493	P-2064	J-2046	J-758	6	154	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6495	P-2065	J-2046	J-Hydrant-77	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6497	P-2066	J-593	J-2048	6	206	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6498	P-2067	J-2048	J-724	6	295	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6500	P-2068	J-1678	J-2048	6	359	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6501	P-2069	J-2048	J-925	6	327	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6562	P-2113	J-587	J-2066	6	27	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6563	P-2114	J-2066	J-1280	6	182	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6650	P-2162	J-1272	J-2105	6	138	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6653	P-2164	J-2105	J-Hydrant-155	6	25	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6666	P-2173	J-1405	J-2110	6	309	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6669	P-2175	J-2110	J-Hydrant-168	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6671	P-2176	J-1738	J-2112	6	367	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6674	P-2178	J-1496	J-2112	6	332	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6675	P-2179	J-2112	J-534	6	44	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6682	P-2183	J-1494	J-1009	6	42	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6684	P-2184	J-1011	J-1494	6	606	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6685	P-2185	J-1494	J-1128	6	625	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6688	P-2187	J-1813	J-1341	6	228	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6785	P-2250	J-684	J-1294	6	195	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6786	P-2251	J-1294	J-861	6	66	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6788	P-2252	J-1414	J-1415	6	298	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6789	P-2253	J-1415	J-1240	6	311	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6812	P-2268	J-2160	J-839	6	253	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6815	P-2269	J-1209	J-2160	6	390	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6816	P-2270	J-2160	J-1721	6	444	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6818	P-2271	J-1645	J-2163	6	396	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6819	P-2272	J-2163	J-1669	6	342	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6827	P-2277	J-1540	J-2165	6	493	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6828	P-2278	J-2165	J-58	6	233	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6830	P-2279	J-317	J-2167	6	275	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6831	P-2280	J-2167	J-1540	6	123	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6846	P-2289	J-1682	J-1677	6	431	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6847	P-2290	J-1677	J-1206	6	161	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6855	P-2295	J-448	J-2176	6	20	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6861	P-2299	J-2176	J-2178	6	478	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6862	P-2300	J-2178	J-995	6	30	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6864	P-2301	J-1723	J-2178	6	271	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6865	P-2302	J-2178	J-1734	6	262	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6874	P-2308	J-1691	J-2182	6	149	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6875	P-2309	J-2182	J-520	6	253	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Replace ACP Water Mains
6879	P-2311	J-939	J-1737	6	141	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6880	P-2312	J-1737	J-1444	6	64	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6885	P-2315	J-849	J-2186	6	35	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6886	P-2316	J-2186	J-1495	6	327	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6888	P-2317	J-2112	J-2186	6	361	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6889	P-2318	J-2186	J-478	6	169	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6891	P-2319	J-567	J-2188	6	31	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6892	P-2320	J-2188	J-Hydrant-463	6	185	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7434	P-2389	J-1443	J-2216	6	80	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7435	P-2390	J-2216	J-1735	6	537	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7451	P-2398	J-1674	J-2224	6	283	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7452	P-2399	J-2224	J-1595	6	64	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7456	P-2401	J-667	J-2226	6	58	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7457	P-2402	J-2226	J-1477	6	407	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7463	P-2405	J-1639	J-2229	6	436	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7464	P-2406	J-2229	J-2160	6	36	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7468	P-2408	J-1722	J-2231	6	32	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7469	P-2409	J-2231	J-1304	6	201	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7473	P-2411	J-524	J-2233	6	420	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7474	P-2412	J-2233	J-979	6	108	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7478	P-2414	J-1670	J-2235	6	320	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
7479	P-2415	J-2235	J-1671	6	378	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6267	P-1944	J-1528	J-476	6	321	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Low Fire Flow Results - W. Soundside & Baracuda
6651	P-2163	J-2105	J-1787	6	493	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2528	waterlines-237	J-1560	J-1561	6	471	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2600	waterlines-200	J-1604	J-1605	6	525	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
4392	P-178	J-631	J-1560	6	345	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5089	P-875	J-1728	J-697	6	470	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5174	P-960	J-671	J-1728	6	393	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5331	P-1117	J-337	J-1656	6	161	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	Low Fire Flow Results - Cobia Way Area
5332	P-1118	J-1656	J-631	6	357	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5358	P-1144	J-1316	J-671	6	47	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5455	P-1241	J-1805	J-1605	6	286	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5569	P-1355	J-1805	J-1789	6	356	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
5570	P-1356	J-1789	J-1316	6	498	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
6225	P-1902	J-697	J-337	6	487	ACP	System Wide	1960s	Poor	5	0.7	8	2	15.7	1	1	1	3	47.1	
2606	waterlines-380	J-520	J-1609	4	535	ACP	System Wide	1960s	Poor	5	0.3	8	2	15.3	1	1	1	3	45.9	
6206	P-1883	J-2182	J-9	4	516	ACP	System Wide	1960s	Poor	5	0.3	8	2	15.3	1	1	1	3	45.9	Replace ACP Water Mains
2787	waterlines-8	J-1546	J-1063	8	463	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
4785	P-571	J-1063	J-1013	8	507	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	**Pipe #**	**Start Node Junction #**	**Stop Node Junction #**	**Size (in.)**	**Length (ft.)**	**Material**	**Grouping Name**	**Age (years)**	**Assumed Condition**	**Condition Rating**	**Capacity Rating**	**Service Life Rating**	**Level of Redundancy**	**Total Risk Score**	**Water Delivery Capability**	**Health & Safety**	**Environmental**	**Total Consequence Score**	**Product of Risk x Consequence**	**Comment**
5053	P-839	J-1568	J-1035	8	192	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5247	P-1033	J-1619	J-1622	8	559	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5359	P-1145	J-1007	J-1597	8	121	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5525	P-1311	J-1563	J-1568	8	181	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5542	P-1328	J-1574	J-975	8	361	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5667	P-1453	J-1533	J-1302	8	369	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5668	P-1454	J-1573	J-1574	8	242	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5782	P-1568	J-1019	J-1110	8	230	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5783	P-1569	J-1110	J-1505	8	69	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5784	P-1570	J-1505	J-1557	8	269	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5813	P-1599	J-1302	J-929	8	29	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5814	P-1600	J-929	J-1573	8	374	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5817	P-1603	J-1546	J-1292	8	416	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6203	P-1880	J-1557	J-1007	8	258	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	Replace ACP Water Mains
6204	P-1881	J-1081	J-1092	8	413	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6245	P-1922	J-1035	J-1619	8	713	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6576	P-2122	J-975	J-2072	8	39	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6577	P-2123	J-2072	J-1268	8	185	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6659	P-2168	J-1622	J-2108	8	472	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6660	P-2169	J-2108	J-1019	8	305	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6703	P-2196	J-1597	J-2123	8	178	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6704	P-2197	J-2123	J-1081	8	36	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6710	P-2200	J-1268	J-516	8	213	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
6711	P-2201	J-516	J-1563	8	21	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
7503	P-2429	J-1013	J-2245	8	497	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
7508	P-2432	J-2245	J-2247	8	480	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
7509	P-2433	J-2247	J-1533	8	162	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
7513	P-2435	J-1092	J-2249	8	309	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
7514	P-2436	J-2249	J-836	8	330	ACP	9600 OOIR to McCall Court	1960s	Poor	5	1.3	8	0	14.3	1	1	1	3	42.9	
5272	P-1058	J-1576	J-1657	12	562	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
6194	P-1871	J-1090	J-1919	12	507	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
6215	P-1892	South Tower	J-1657	12	829	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
6229	P-1906	J-1717	J-1923	12	1069	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7211	P-2369	J-2203	J-2205	12	359	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7241	P-2378	J-1657	J-2211	12	1958	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7242	P-2379	J-2211	J-836	12	58	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7657	P-2519	J-2209	J-2309	12	306	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7658	P-2520	J-2309	J-1480	12	861	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7663	P-2523	J-2311	J-2209	12	1795	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7668	P-2526	J-2313	J-2311	12	931	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	PVC Water Mains
7672	P-2528	J-1923	J-2315	12	474	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7673	P-2529	J-2315	J-2313	12	578	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7687	P-2537	J-2321	J-1717	12	433	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7692	P-2540	J-2323	J-2321	12	515	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7696	P-2542	J-2205	J-2325	12	596	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7697	P-2543	J-2325	J-2323	12	676	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7702	P-2546	J-2327	J-2203	12	787	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7707	P-2549	J-2329	J-2327	12	356	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7712	P-2552	J-2331	J-2329	12	687	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7717	P-2555	J-2333	J-2331	12	568	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7721	P-2557	J-1919	J-2335	12	862	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7722	P-2558	J-2335	J-2333	12	1981	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7726	P-2560	J-836	J-2337	12	795	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
7727	P-2561	J-2337	J-1090	12	180	PVC	Whalebone to South Tower	1988	Good	1	2	3	2	8	2	2	1	5	40	
5073	P-859	J-62	J-1564	8	462	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5109	P-895	J-450	J-518	8	773	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5178	P-964	J-70	J-203	8	427	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5339	P-1125	J-1542	J-72	8	32	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5371	P-1157	J-410	J-1614	8	263	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	DIP Water Mains
5372	P-1158	J-1614	J-450	8	282	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5383	P-1169	J-402	J-1497	8	432	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5389	P-1175	J-96	J-367	8	788	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5407	P-1193	J-74	J-1287	8	524	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5523	P-1309	J-1287	J-1461	8	83	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5539	P-1325	J-1497	J-1322	8	89	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5609	P-1395	J-1461	J-144	8	137	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
5623	P-1409	J-1322	J-347	8	239	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6036	P-1740	J-323	J-1510	8	31	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6046	P-1746	J-1564	J-38	8	159	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6047	P-1747	J-38	J-397	8	106	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6055	P-1752	J-397	J-1924	8	16	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6056	P-1753	J-1924	J-410	8	204	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6065	P-1757	J-1617	J-62	8	193	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6219	P-1896	J-203	J-357	8	756	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6220	P-1897	J-357	J-402	8	753	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6231	P-1908	J-836	J-381	8	200	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6244	P-1921	J-518	J-96	8	755	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6246	P-1923	J-315	J-74	8	751	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6329	P-1983	J-347	J-158	8	736	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	DIP Water Mains
6330	P-1984	J-158	J-315	8	747	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6468	P-2043	J-367	J-2042	8	184	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6478	P-2052	J-782	J-1649	8	374	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6506	P-2072	J-2042	J-2051	8	394	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6507	P-2073	J-2051	J-321	8	168	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6528	P-2089	J-1457	J-2056	8	258	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6529	P-2090	J-2056	J-782	8	83	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6713	P-2202	J-144	J-1541	8	323	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
6714	P-2203	J-1541	J-1542	8	428	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7237	P-2375	J-321	J-2210	8	16	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7238	P-2376	J-2210	J-1457	8	355	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7239	P-2377	J-2209	J-2210	8	46	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7518	P-2438	J-381	J-2251	8	932	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7519	P-2439	J-2251	J-323	8	392	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7523	P-2441	J-1510	J-2253	8	545	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7524	P-2442	J-2253	J-70	8	330	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7528	P-2444	J-72	J-2255	8	177	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
7529	P-2445	J-2255	J-1617	8	355	DIP	Whalebone to 9600 OOIR	1960s	Good/Fair	3	1.3	5	0	9.3	1	2	1	4	37.2	
4657	P-443	J-1810	J-1162	12	188	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	Low Fire Flow Results - Pond Island
1501	waterlines-212	J-913	J-912	12	31	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
4261	P-47	J-1811	J-1643	12	86	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
4609	P-395	J-1637	J-152	12	368	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
4699	P-485	J-1643	J-1801	12	376	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
4954	P-740	J-542	J-1800	12	169	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
4986	P-772	J-1296	J-1390	12	310	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5020	P-806	J-1731	J-1742	12	37	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5029	P-815	J-643	J-1561	12	32	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5047	P-833	J-1490	J-772	12	249	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5079	P-865	J-1628	J-1817	12	48	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5095	P-881	J-1162	J-919	12	63	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5103	P-889	J-1800	J-859	12	204	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5104	P-890	J-859	J-1640	12	407	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5231	P-1017	J-1635	J-887	12	475	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5232	P-1018	J-887	J-1417	12	20	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5250	P-1036	J-732	J-734	12	280	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	PVC Water Mains
5301	P-1087	J-1811	J-1543	12	357	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5302	P-1088	J-1543	J-1372	12	171	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5341	P-1127	J-752	J-647	12	477	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5393	P-1179	J-1817	J-1289	12	98	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5437	P-1223	J-1198	J-1578	12	558	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5438	P-1224	J-1578	J-1811	12	425	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5485	P-1271	J-1801	J-1514	12	160	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5486	P-1272	J-1514	J-1549	12	110	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5492	P-1278	J-1103	J-1125	12	26	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5508	P-1294	J-468	J-1439	12	29	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5510	P-1296	J-1414	J-752	12	65	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5511	P-1297	J-647	J-717	12	510	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5512	P-1298	J-717	J-643	12	468	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5521	P-1307	J-772	J-1158	12	29	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5555	P-1341	J-1289	J-88	12	961	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5571	P-1357	J-1643	J-891	12	40	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5600	P-1386	J-313	J-1731	12	71	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5606	P-1392	J-1525	J-1284	12	241	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5616	P-1402	J-1535	J-1031	12	148	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5641	P-1427	J-1390	J-1391	12	287	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5642	P-1428	J-1391	J-225	12	500	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5649	P-1435	J-891	J-1299	12	98	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5670	P-1456	J-1697	J-1155	12	310	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5697	P-1483	J-1125	J-585	12	13	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5700	P-1486	J-1196	J-1175	12	158	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5703	P-1489	J-1175	J-1174	12	81	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5710	P-1496	J-1043	J-1336	12	34	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5724	P-1510	J-965	J-1525	12	115	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5731	P-1517	J-225	J-1197	12	108	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5732	P-1518	J-1197	J-1196	12	93	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5735	P-1521	J-1174	J-713	12	53	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5805	P-1591	J-1490	J-788	12	315	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5821	P-1607	J-1134	J-1638	12	492	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5822	P-1608	J-1638	J-1043	12	44	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5824	P-1610	J-1134	J-919	12	341	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5865	P-1635	J-1215	J-1852	12	57	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5866	P-1636	J-1852	J-1216	12	54	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5873	P-1639	J-1369	J-1852	12	55	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5874	P-1640	J-1852	J-912	12	208	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5895	P-1653	J-713	J-1199	12	187	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5896	P-1654	J-1199	J-1198	12	94	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5898	P-1655	J-1158	J-1523	12	15	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5917	P-1666	J-1057	J-1757	12	130	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
5949	P-1683	J-983	J-1788	12	443	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6145	P-1822	J-1160	J-1094	12	826	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6146	P-1823	J-1094	J-1296	12	283	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	PVC Water Mains
6180	P-1857	J-1931	J-732	12	64	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6212	P-1889	J-1417	J-983	12	320	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6218	P-1895	J-734	J-1031	12	455	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6239	P-1916	J-1439	J-788	12	275	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6240	P-1917	J-209	J-703	12	450	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6720	P-2207	J-1191	J-1638	12	74	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6726	P-2211	J-1078	J-701	12	29	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6727	P-2212	J-701	J-1103	12	485	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6728	P-2213	J-1078	J-1372	12	43	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6731	P-2215	J-494	J-965	12	501	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6734	P-2217	J-1038	J-494	12	99	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6736	P-2218	J-585	J-1039	12	328	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6737	P-2219	J-1039	J-1038	12	35	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6742	P-2222	J-1284	J-1452	12	64	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6743	P-2223	J-1452	J-1075	12	40	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6745	P-2224	J-1075	J-1274	12	113	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6746	P-2225	J-1274	J-1697	12	424	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6751	P-2228	J-1545	J-1165	12	55	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6754	P-2230	J-1165	J-1119	12	231	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6757	P-2232	J-1119	J-383	12	251	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6758	P-2233	J-383	J-1817	12	27	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6759	P-2234	J-1640	J-1628	12	60	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6765	P-2238	J-1155	J-1782	12	102	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6766	P-2239	J-1782	J-1545	12	46	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6779	P-2246	J-1703	J-1586	12	167	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6780	P-2247	J-1586	J-313	12	253	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6805	P-2263	J-1561	J-2158	12	387	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6806	P-2264	J-2158	J-1826	12	221	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6894	P-2321	J-88	J-2189	12	24	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6895	P-2322	J-2189	J-209	12	648	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6897	P-2323	J-1742	J-2189	12	80	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6940	P-2345	J-152	J-2198	12	85	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6941	P-2346	J-2198	J-1191	12	62	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7624	P-2501	J-703	J-2294	12	180	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7625	P-2502	J-2294	J-1414	12	99	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7631	P-2505	J-2189	J-2297	12	225	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7632	P-2506	J-2297	J-913	12	70	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7636	P-2508	J-1523	J-2299	12	500	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7637	P-2509	J-2299	J-1535	12	265	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7641	P-2511	J-1336	J-2301	12	470	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7642	P-2512	J-2301	J-468	12	207	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7811	P-2577	J-1772	J-681	12	4565	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
7812	P-2578	J-681	J-1757	12	1431	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
8082	P-2585	J-1788	J-2346	12	282	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
8083	P-2586	J-2346	J-1057	12	179	PVC	System Wide	1980s +	Good/Fair	3	2	4	2	11	1	1	1	3	33	
6170	P-1847	J-1399	J-542	14	350	DIP	Old 300,000 Gal Tank	1960s	Good/Fair	3	2.8	5	0	10.8	1	1	1	3	32.4	
1856	waterlines-921	J-1147	J-1148	8	63	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
1875	waterlines-7	J-889	J-1159	8	98	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
1879	waterlines-98	J-1161	J-1162	8	71	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2136	waterlines-322	J-1320	J-1321	8	207	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2225	waterlines-1061	J-9	J-1702	8	241	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2300	waterlines-289	J-1422	J-1423	8	465	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2427	waterlines-288	J-1499	J-1500	8	358	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2487	waterlines-517	J-1535	J-Hydrant-445	8	444	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2520	waterlines-313	J-1555	J-1460	8	468	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2877	waterlines-434	J-1726	J-1445	8	666	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4266	P-52	J-1493	J-1702	8	604	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4438	P-224	J-1033	J-1338	8	48	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4440	P-226	J-1729	J-1649	8	603	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4462	P-248	J-893	J-1101	8	425	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4467	P-253	J-1708	J-400	8	91	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4498	P-284	J-1161	J-1507	8	346	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4521	P-307	J-468	J-1755	8	153	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4522	P-308	J-1755	J-1440	8	156	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4526	P-312	J-488	J-1417	8	230	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4528	P-314	J-1756	J-1450	8	161	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	PVC Water Mains
4533	P-319	J-1813	J-418	8	59	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4548	P-334	J-597	J-1682	8	35	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4559	P-345	J-1610	J-424	8	439	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4560	P-346	J-424	J-1611	8	88	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4577	P-363	J-1772	J-221	8	47	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4592	P-378	J-440	J-1460	8	34	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4599	P-385	J-1726	J-68	8	39	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4639	P-425	J-1665	J-1770	8	257	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4664	P-450	J-985	J-1756	8	102	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4665	P-451	J-567	J-196	8	228	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4889	P-675	J-1148	J-649	8	280	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4934	P-720	J-1768	J-1493	8	747	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4939	P-725	J-1945	J-1699	8	866	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4959	P-745	J-675	J-1604	8	59	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
4994	P-780	J-1321	J-1181	8	111	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5008	P-794	J-194	J-1788	8	35	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5031	P-817	J-1417	J-609	8	411	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5051	P-837	J-1247	J-786	8	70	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5055	P-841	J-1770	J-1518	8	255	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5072	P-858	J-1772	J-500	8	143	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5081	P-867	J-809	J-1023	8	56	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5087	P-873	J-1797	J-1519	8	520	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5101	P-887	J-573	J-621	8	530	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5138	P-924	J-1743	J-597	8	292	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5154	P-940	J-971	J-567	8	435	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5155	P-941	J-1731	J-959	8	406	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5156	P-942	J-959	J-363	8	503	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5158	P-944	J-1318	J-985	8	400	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5169	P-955	J-1061	J-1373	8	343	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =		SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3		0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental		Total Consequence Score	Product of Risk x Consequence	Comment
5187	P-973	J-601	J-1764	8	275	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5201	P-987	J-1697	J-1017	8	32	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5208	P-994	J-1420	J-1421	8	297	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5210	P-996	J-1364	J-1365	8	260	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5235	P-1021	J-484	J-486	8	227	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5241	P-1027	J-1519	J-1351	8	332	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5252	P-1038	J-1603	J-1161	8	19	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5343	P-1129	J-1421	J-386	8	320	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5347	P-1133	J-786	J-1248	8	69	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5349	P-1135	J-68	J-408	8	528	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5350	P-1136	J-408	J-971	8	56	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5351	P-1137	J-559	J-1113	8	28	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5363	P-1149	J-609	J-611	8	435	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5364	P-1150	J-611	J-613	8	347	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5385	P-1171	J-221	J-359	8	297	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5387	P-1173	J-1373	J-603	8	244	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5388	P-1174	J-603	J-1742	8	465	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5391	P-1177	J-217	J-502	8	419	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5392	P-1178	J-502	J-440	8	281	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5397	P-1183	J-1755	J-728	8	418	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5398	P-1184	J-728	J-1318	8	325	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5402	P-1188	J-172	J-112	8	274	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5439	P-1225	J-1017	J-1097	8	181	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5440	P-1226	J-1097	J-1247	8	300	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5460	P-1246	J-885	J-1364	8	88	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5479	P-1265	J-112	J-456	8	221	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5480	P-1266	J-456	J-1767	8	20	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5502	P-1288	J-689	J-1782	8	37	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5505	P-1291	J-386	J-725	8	20	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5517	P-1303	J-1248	J-1143	8	209	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5531	P-1317	J-196	J-90	8	282	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5532	P-1318	J-90	J-172	8	281	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5533	P-1319	J-1160	J-Hydrant-233	8	134	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	PVC Water Mains
5537	P-1323	J-1113	J-557	8	271	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5538	P-1324	J-557	J-601	8	427	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5588	P-1374	J-128	J-1420	8	49	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5595	P-1381	J-1519	J-1160	8	72	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5601	P-1387	J-725	J-726	8	24	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5602	P-1388	J-726	J-194	8	155	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5620	P-1406	J-1389	J-565	8	266	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5627	P-1413	J-621	J-818	8	980	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5639	P-1425	J-1604	J-1051	8	406	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5640	P-1426	J-1051	J-823	8	309	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5646	P-1432	J-1261	J-339	8	70	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5674	P-1460	J-538	J-1389	8	257	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5679	P-1465	J-418	J-64	8	710	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5693	P-1479	J-823	J-1260	8	116	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5694	P-1480	J-1260	J-1261	8	147	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5695	P-1481	J-760	J-1424	8	44	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5711	P-1497	J-Hydrant-233	J-1388	8	466	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5712	P-1498	J-1388	J-538	8	22	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5726	P-1512	J-1233	J-1290	8	95	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5729	P-1515	J-1424	J-1366	8	149	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5730	P-1516	J-1366	J-689	8	280	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5743	P-1529	J-1291	J-1425	8	133	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5744	P-1530	J-1425	J-760	8	257	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5745	P-1531	J-1290	J-1049	8	105	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5746	P-1532	J-1049	J-1291	8	70	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5747	P-1533	J-339	J-1234	8	118	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5748	P-1534	J-1234	J-1233	8	126	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5818	P-1604	J-1292	J-889	8	78	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5829	P-1613	J-1208	J-1804	8	798	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5831	P-1615	J-1665	J-1804	8	28	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	
5839	P-1618	J-1778	J-1843	8	364	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1		3	30.9	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5851	P-1626	J-514	J-1518	8	21	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5852	P-1627	J-514	J-1666	8	138	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5890	P-1650	J-1862	J-893	8	59	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5927	P-1671	J-1764	J-1025	8	640	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
5998	P-1715	J-1084	J-645	8	307	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6018	P-1728	J-528	J-1644	8	65	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6074	P-1762	J-1160	J-1931	8	302	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6132	P-1809	J-1187	J-573	8	64	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6133	P-1810	J-1191	J-1603	8	877	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6152	P-1829	J-1193	J-1033	8	233	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6157	P-1834	J-649	J-438	8	202	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6158	P-1835	J-438	J-484	8	205	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6174	P-1851	J-486	J-488	8	261	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6184	P-1861	J-1477	J-1699	8	556	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6208	P-1885	J-1143	J-885	8	179	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6209	P-1886	J-1365	J-675	8	214	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6214	P-1891	J-1084	J-1729	8	138	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6224	P-1901	J-1644	J-371	8	312	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6226	P-1903	J-186	J-217	8	369	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6234	P-1911	J-1423	J-1321	8	1411	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6236	P-1913	J-1445	J-845	8	639	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6237	P-1914	J-1025	J-881	8	648	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6247	P-1924	J-391	J-559	8	924	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6269	P-1946	J-363	J-1037	8	1037	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6295	P-1962	J-1843	J-1951	8	351	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6296	P-1963	J-1951	J-540	8	61	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6304	P-1968	J-1602	J-1954	8	476	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6305	P-1969	J-1954	J-1603	8	49	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6313	P-1974	J-174	J-391	8	583	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6316	P-1976	J-1958	J-174	8	67	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6323	P-1980	J-645	J-1961	8	298	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	PVC Water Mains
6413	P-2015	J-1961	J-1252	8	431	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6414	P-2016	J-1252	J-1958	8	316	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6416	P-2017	J-881	J-2017	8	1024	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6417	P-2018	J-2017	J-1862	8	65	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6523	P-2085	J-1675	J-2055	8	383	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6524	P-2086	J-2055	J-1772	8	87	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6546	P-2103	J-681	J-2060	8	281	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6547	P-2104	J-2060	J-1567	8	299	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6550	P-2106	J-818	J-2061	8	697	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6551	P-2107	J-2061	J-681	8	294	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6566	P-2116	J-1804	J-2067	8	935	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6567	P-2117	J-2067	J-1193	8	212	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6593	P-2131	J-1208	J-1553	8	99	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6594	P-2132	J-1553	J-1743	8	355	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6598	P-2133	J-500	J-1499	8	55	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6599	P-2134	J-1499	J-1422	8	127	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6610	P-2140	J-2086	J-2087	8	93	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6614	P-2142	J-2087	J-2089	8	901	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6637	P-2153	Coquina Beach	Oregon Inlet Camp	8	11772	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6638	P-2154	Oregon Inlet Camp	Oregon Inlet Marina	8	669	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6639	P-2155	J-2100	Oregon Inlet Camp	8	832	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6641	P-2156	J-1159	J-2102	8	137	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6642	P-2157	J-2102	J-2086	8	720	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6646	P-2159	J-2089	J-2104	8	179	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6647	P-2160	J-2104	Coquina Beach	8	5296	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6687	P-2186	J-1493	J-1813	8	171	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6716	P-2204	J-1134	J-2128	8	24	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6763	P-2237	J-1606	J-1061	8	65	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6796	P-2257	J-1023	J-1611	8	384	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6797	P-2258	J-1611	J-1037	8	492	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6802	P-2261	J-613	J-2156	8	173	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6803	P-2262	J-2156	J-809	8	453	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6808	P-2265	J-977	J-2158	8	44	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6809	P-2266	J-2158	J-2156	8	87	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6821	P-2273	J-400	J-2163	8	40	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6822	P-2274	J-2163	J-528	8	495	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6824	P-2275	J-371	J-2165	8	61	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6825	P-2276	J-2165	J-82	8	317	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6833	P-2281	J-82	J-2167	8	53	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6834	P-2282	J-2167	J-128	8	290	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6836	P-2283	J-359	J-1263	8	213	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6837	P-2284	J-1263	J-160	8	229	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6839	P-2285	J-160	J-2170	8	346	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6840	P-2286	J-2170	J-186	8	53	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6849	P-2291	J-1945	J-2174	8	19	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6850	P-2292	J-2174	J-1651	8	634	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6852	P-2293	J-540	J-2174	8	590	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6853	P-2294	J-2174	J-1193	8	101	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6870	P-2305	J-1609	J-2181	8	235	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
6871	P-2306	J-2181	J-9	8	19	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7192	P-2363	J-1977	J-2202	8	526	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7193	P-2364	J-2202	J-1801	8	57	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7578	P-2474	J-2275	J-1977	8	481	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7582	P-2476	J-1800	J-2277	8	27	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7583	P-2477	J-2277	J-2275	8	668	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7587	P-2479	J-2156	J-2279	8	51	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7588	P-2480	J-2279	J-1624	8	475	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	PVC Water Mains
7592	P-2482	J-1181	J-2281	8	359	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7593	P-2483	J-2281	J-1208	8	460	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7597	P-2485	J-1477	J-2283	8	453	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7598	P-2486	J-2283	J-1553	8	43	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7602	P-2488	J-1651	J-2285	8	41	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7603	P-2489	J-2285	J-2176	8	423	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7608	P-2492	J-2287	J-1791	8	290	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7615	P-2496	J-2290	J-2287	8	454	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7619	P-2498	J-1069	J-2292	8	312	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7620	P-2499	J-2292	J-2290	8	604	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7648	P-2515	J-2128	J-2304	8	16	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7649	P-2516	J-2304	J-1756	8	117	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7731	P-2563	J-2176	J-2339	8	237	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
7732	P-2564	J-2339	J-1609	8	18	PVC	System Wide	1980s +	Good/Fair	3	1.3	4	2	10.3	1	1	1	3	30.9	
2266	waterlines-901	J-1401	J-15	12	381	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
2401	waterlines-416	J-1401	J-1483	12	341	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
4302	P-88	J-2030	J-16	12	913	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
6446	P-2030	J-15	J-1751	12	1970	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
6452	P-2034	J-1751	J-2036	12	47	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
6882	P-2313	J-2036	J-1267	12	1605	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
6883	P-2314	J-1267	J-2030	12	138	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
7095	P-2355	8th St. Elev. Tank	J-15	12	49	C900	8th St. EST	2004	Good	1	2	1	2	6	2	2	1	5	30	
6168	P-1845	J-1412	J-Hydrant-497	6	666	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	Low Fire Flow Results - W. Carolinian Circle
6533	P-2093	J-2057	J-750	6	200	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	Low Fire Flow Results - Pond Island
4827	P-613	J-1705	J-956	6	374	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5049	P-835	J-1707	J-1705	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5225	P-1011	J-1763	J-952	6	358	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	Low Fire Flow Results - Lone Cedar Court
5226	P-1012	J-952	J-1707	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5954	P-1686	J-956	J-954	6	528	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4415	P-201	J-693	J-1662	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5196	P-982	J-744	J-693	6	481	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5234	P-1020	J-736	J-1303	6	322	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5307	P-1093	J-446	J-899	6	458	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5308	P-1094	J-899	J-466	6	587	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5441	P-1227	J-1303	J-561	6	55	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	Low Fire Flow Results - S. Colony South Drive
5442	P-1228	J-561	J-744	6	475	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5465	P-1251	J-883	J-798	6	513	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5466	P-1252	J-798	J-446	6	440	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6125	P-1802	J-883	J-1292	6	303	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6241	P-1918	J-466	J-736	6	445	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6701	P-2195	J-2072	J-1662	6	212	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1672	waterlines-709	J-Hydrant-66	J-1027	6	41	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4999	P-785	J-1793	J-373	6	488	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5000	P-786	J-373	J-1100	6	406	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5097	P-883	J-1100	J-142	6	651	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5119	P-905	J-1404	J-945	6	321	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5373	P-1159	J-1027	J-414	6	367	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5374	P-1160	J-414	J-442	6	523	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5563	P-1349	J-721	J-1375	6	248	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5564	P-1350	J-1375	J-1071	6	444	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5583	P-1369	J-1071	J-1278	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	Low Fire Flow Results - Villa Dunes
5584	P-1370	J-1278	J-1404	6	353	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5597	P-1383	J-442	J-1796	6	154	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5598	P-1384	J-1796	J-1793	6	250	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5617	P-1403	J-879	J-1327	6	228	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5675	P-1461	J-1327	J-635	6	299	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6242	P-1919	J-635	J-721	6	474	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7179	P-2360	J-1793	J-2200	6	788	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7180	P-2361	J-2200	J-879	6	511	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5120	P-906	J-945	J-1665	6	447	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
208	waterlines-855	J-Hydrant-322	J-54	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
220	waterlines-562	J-Hydrant-286	J-62	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
229	waterlines-615	J-Hydrant-55	J-68	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
232	waterlines-549	J-Hydrant-273	J-70	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
235	waterlines-560	J-Hydrant-282	J-72	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
238	waterlines-556	J-Hydrant-280	J-74	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
244	waterlines-722	J-Hydrant-145	J-78	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
250	waterlines-767	J-Hydrant-108	J-82	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
259	waterlines-896	J-Hydrant-439	J-88	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
262	waterlines-611	J-Hydrant-47	J-90	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
271	waterlines-568	J-Hydrant-291	J-96	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
277	waterlines-698	J-Hydrant-40	J-100	6	47	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
283	waterlines-559	J-Hydrant-284	J-104	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
286	waterlines-885	J-Hydrant-235	J-106	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
289	waterlines-696	J-Hydrant-38	J-2118	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
292	waterlines-520	J-Hydrant-247	J-110	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
295	waterlines-609	J-Hydrant-50	J-112	6	9	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
298	waterlines-858	J-Hydrant-311	J-114	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
304	waterlines-861	J-Hydrant-310	J-118	6	10	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
310	waterlines-884	J-121	J-122	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
313	waterlines-851	J-Hydrant-320	J-124	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
337	waterlines-697	J-Hydrant-39	J-2120	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
340	waterlines-704	J-Hydrant-461	J-142	6	90	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
343	waterlines-558	J-Hydrant-281	J-144	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
346	waterlines-891	J-Hydrant-36	J-146	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
355	waterlines-878	J-Hydrant-380	J-152	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
361	waterlines-859	J-Hydrant-312	J-156	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
364	waterlines-554	J-Hydrant-278	J-158	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
367	waterlines-723	J-Hydrant-134	J-160	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
373	waterlines-729	J-Hydrant-141	J-164	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
376	waterlines-890	J-Hydrant-37	J-166	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
379	waterlines-833	J-Hydrant-370	J-168	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
385	waterlines-610	J-Hydrant-46	J-172	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
388	waterlines-577	J-173	J-174	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
391	waterlines-846	J-Hydrant-325	J-176	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
397	waterlines-844	J-Hydrant-324	J-180	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
406	waterlines-738	J-Hydrant-135	J-186	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
409	waterlines-845	J-Hydrant-326	J-188	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
418	waterlines-773	J-Hydrant-421	J-194	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
421	waterlines-612	J-Hydrant-48	J-196	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
432	waterlines-550	J-Hydrant-274	J-203	6	30	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
435	waterlines-837	J-204	J-205	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

										Risk of Failure					Consequence of Failure				Criticality Rating	
									Scoring Reference	1A +	1B +	1C +	1D =	SUM 1	2A +	2D +	3D =	SUM 2	SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
441	waterlines-815	J-Hydrant-432	J-209	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
447	waterlines-991	J-Hydrant-383	J-213	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
450	waterlines-871	J-Hydrant-232	J-215	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
453	waterlines-733	J-Hydrant-136	J-217	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
456	waterlines-602	J-Hydrant-448	J-219	6	88	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
459	waterlines-720	J-Hydrant-132	J-221	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
465	waterlines-865	J-Hydrant-228	J-225	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
471	waterlines-856	J-Hydrant-314	J-229	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
597	waterlines-817	J-Hydrant-373	J-313	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
600	waterlines-555	J-Hydrant-279	J-315	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
606	waterlines-737	J-Hydrant-144	J-319	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
609	waterlines-570	J-Hydrant-293	J-321	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
612	waterlines-548	J-Hydrant-271	J-323	6	30	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
618	waterlines-828	J-Hydrant-193	J-327	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
621	waterlines-561	J-Hydrant-283	J-329	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
624	waterlines-732	J-Hydrant-143	J-331	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
630	waterlines-541	J-Hydrant-262	J-335	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
636	waterlines-807	J-Hydrant-187	J-339	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
648	waterlines-553	J-Hydrant-277	J-347	6	38	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
651	waterlines-788	J-Hydrant-358	J-349	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
654	waterlines-843	J-350	J-351	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
663	waterlines-551	J-Hydrant-275	J-357	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
666	waterlines-721	J-Hydrant-133	J-359	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
669	waterlines-850	J-Hydrant-318	J-361	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
672	waterlines-951	J-Hydrant-391	J-363	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
678	waterlines-569	J-Hydrant-292	J-367	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
684	waterlines-766	J-Hydrant-114	J-371	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
687	waterlines-706	J-Hydrant-459	J-373	6	38	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
699	waterlines-547	J-Hydrant-268	J-381	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
702	waterlines-835	J-Hydrant-441	J-383	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
708	waterlines-270	J-386	J-Hydrant-105	6	40	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
711	waterlines-563	J-388	J-389	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
714	waterlines-578	J-Hydrant-376	J-391	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
723	waterlines-565	J-Hydrant-287	J-397	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
728	waterlines-761	J-Hydrant-117	J-400	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
731	waterlines-552	J-Hydrant-276	J-402	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
743	waterlines-564	J-Hydrant-288	J-410	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
749	waterlines-708	J-Hydrant-65	J-414	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
755	waterlines-651	J-Hydrant-420	J-418	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
761	waterlines-711	J-Hydrant-68	J-422	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
764	waterlines-791	J-Hydrant-393	J-424	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
767	waterlines-826	J-Hydrant-196	J-426	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
773	waterlines-713	J-Hydrant-75	J-430	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
776	waterlines-866	J-Hydrant-229	J-432	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
785	waterlines-926	J-437	J-438	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
788	waterlines-726	J-Hydrant-138	J-440	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
791	waterlines-707	J-Hydrant-64	J-442	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
797	waterlines-526	J-Hydrant-239	J-446	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
803	waterlines-566	J-Hydrant-289	J-450	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
806	waterlines-824	J-Hydrant-192	J-452	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
809	waterlines-863	J-Hydrant-226	J-454	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
812	waterlines-608	J-Hydrant-43	J-456	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
815	waterlines-587	J-Hydrant-213	J-458	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
824	waterlines-607	J-Hydrant-44	J-464	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
827	waterlines-525	J-Hydrant-241	J-466	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
830	waterlines-596	J-Hydrant-450	J-1439	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
848	waterlines-535	J-479	J-480	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
854	waterlines-927	J-Hydrant-401	J-484	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
857	waterlines-929	J-Hydrant-400	J-486	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
860	waterlines-928	J-Hydrant-399	J-488	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
866	waterlines-849	J-Hydrant-201	J-492	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
869	waterlines-830	J-Hydrant-198	J-494	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
881	waterlines-734	J-Hydrant-137	J-502	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
887	waterlines-872	J-Hydrant-308	J-506	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
901	waterlines-695	J-Hydrant-15	J-514	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
904	waterlines-536	J-Hydrant-258	J-1563	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
907	waterlines-567	J-Hydrant-290	J-518	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
913	waterlines-717	J-Hydrant-73	J-522	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
922	waterlines-759	J-Hydrant-115	J-528	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
925	waterlines-847	J-Hydrant-323	J-530	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
937	waterlines-875	J-Hydrant-234	J-538	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
940	waterlines-684	J-Hydrant-102	J-540	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
949	waterlines-949	J-Hydrant-365	J-546	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
952	waterlines-683	J-Hydrant-339	J-548	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
955	waterlines-529	J-Hydrant-255	J-550	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
961	waterlines-946	J-553	J-551	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
963	waterlines-813	J-Hydrant-363	J-555	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
966	waterlines-580	J-Hydrant-219	J-557	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
969	waterlines-579	J-Hydrant-220	J-559	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
972	waterlines-880	J-Hydrant-243	J-561	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
984	waterlines-620	J-Hydrant-84	J-569	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
987	waterlines-664	J-Hydrant-338	J-571	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
990	waterlines-756	J-Hydrant-128	J-573	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
999	waterlines-955	J-Hydrant-440	J-579	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1008	waterlines-831	J-Hydrant-199	J-585	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1026	waterlines-735	J-Hydrant-140	J-597	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1029	waterlines-605	J-Hydrant-384	J-599	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1032	waterlines-581	J-Hydrant-218	J-601	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1035	waterlines-819	J-Hydrant-372	J-603	6	49	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1044	waterlines-933	J-Hydrant-396	J-609	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1047	waterlines-932	J-Hydrant-397	J-611	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1050	waterlines-931	J-612	J-613	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1053	waterlines-990	J-Hydrant-382	J-615	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
1056	waterlines-979	J-Hydrant-327	J-617	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1059	waterlines-531	J-Hydrant-256	J-619	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1062	waterlines-755	J-Hydrant-131	J-621	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1065	waterlines-573	J-Hydrant-295	J-623	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1071	waterlines-586	J-626	J-627	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1083	waterlines-702	J-Hydrant-61	J-635	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1089	waterlines-687	J-Hydrant-340	J-639	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1095	waterlines-937	J-Hydrant-423	J-643	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1098	waterlines-576	J-644	J-645	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1101	waterlines-939	J-Hydrant-425	J-647	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1104	waterlines-945	J-Hydrant-402	J-649	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1107	waterlines-616	J-Hydrant-42	J-651	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1113	waterlines-867	J-Hydrant-230	J-655	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1116	waterlines-634	J-Hydrant-336	J-657	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1134	waterlines-750	J-Hydrant-355	J-669	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1143	waterlines-805	J-Hydrant-189	J-675	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1146	waterlines-571	J-676	J-677	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1149	waterlines-604	J-678	J-Hydrant-233	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1152	waterlines-753	J-680	J-681	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1155	waterlines-617	J-Hydrant-41	J-683	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1164	waterlines-838	J-Hydrant-184	J-689	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1170	waterlines-533	J-Hydrant-245	J-693	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1173	waterlines-790	J-Hydrant-359	J-695	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1182	waterlines-832	J-700	J-701	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1185	waterlines-941	J-702	J-703	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1191	waterlines-710	J-Hydrant-67	J-707	6	41	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1197	waterlines-744	J-Hydrant-350	J-711	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1200	waterlines-864	J-Hydrant-227	J-713	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1206	waterlines-938	J-Hydrant-424	J-717	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1209	waterlines-745	J-Hydrant-351	J-719	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1212	waterlines-701	J-Hydrant-60	J-721	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1223	waterlines-594	J-Hydrant-454	J-728	6	42	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1229	waterlines-993	J-Hydrant-443	J-732	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1232	waterlines-982	J-733	J-734	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1235	waterlines-527	J-Hydrant-242	J-736	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
1238	waterlines-868	J-Hydrant-231	J-738	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1244	waterlines-882	J-Hydrant-252	J-742	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1247	waterlines-530	J-Hydrant-244	J-744	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1253	waterlines-589	J-Hydrant-209	J-748	6	104	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1256	waterlines-1012	J-Hydrant-208	J-750	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1262	waterlines-748	J-Hydrant-354	J-754	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1271	waterlines-823	J-Hydrant-185	J-760	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1277	waterlines-592	J-Hydrant-297	J-764	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1280	waterlines-853	J-Hydrant-206	J-766	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1289	waterlines-600	J-Hydrant-447	J-772	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1292	waterlines-743	J-Hydrant-349	J-774	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1298	waterlines-715	J-Hydrant-71	J-778	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1304	waterlines-572	J-Hydrant-294	J-782	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1307	waterlines-740	J-Hydrant-347	J-784	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1310	waterlines-821	J-Hydrant-191	J-786	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1313	waterlines-599	J-Hydrant-449	J-788	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1319	waterlines-860	J-Hydrant-315	J-792	6	42	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1322	waterlines-597	J-Hydrant-299	J-794	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1325	waterlines-877	J-Hydrant-301	J-796	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1328	waterlines-521	J-Hydrant-238	J-798	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1331	waterlines-603	J-Hydrant-304	J-800	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1337	waterlines-724	J-Hydrant-346	J-804	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1340	waterlines-590	J-Hydrant-211	J-806	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1343	waterlines-787	J-Hydrant-357	J-808	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1349	waterlines-718	J-Hydrant-74	J-812	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1352	waterlines-818	J-Hydrant-368	J-814	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1355	waterlines-1011	J-815	J-816	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1358	waterlines-754	J-Hydrant-129	J-818	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1361	waterlines-716	J-Hydrant-72	J-820	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1364	waterlines-747	J-Hydrant-353	J-822	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1372	waterlines-793	J-Hydrant-360	J-827	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1378	waterlines-598	J-Hydrant-300	J-831	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1381	waterlines-588	J-Hydrant-210	J-833	6	46	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
1393	waterlines-585	J-Hydrant-214	J-841	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1402	waterlines-739	J-Hydrant-345	J-847	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1408	waterlines-574	J-Hydrant-374	J-851	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1414	waterlines-694	J-Hydrant-342	J-855	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1417	waterlines-728	J-Hydrant-344	J-857	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1420	waterlines-834	J-Hydrant-442	J-859	6	44	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1429	waterlines-632	J-Hydrant-334	J-865	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1432	waterlines-874	J-Hydrant-306	J-867	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1438	waterlines-876	J-Hydrant-302	J-871	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1441	waterlines-841	J-Hydrant-328	J-873	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1444	waterlines-842	J-874	J-875	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1447	waterlines-746	J-Hydrant-352	J-877	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1450	waterlines-703	J-Hydrant-62	J-879	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1453	waterlines-583	J-Hydrant-216	J-881	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1456	waterlines-519	J-Hydrant-237	J-883	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1459	waterlines-820	J-Hydrant-190	J-885	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1462	waterlines-889	J-Hydrant-398	J-887	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1465	waterlines-518	J-Hydrant-246	J-889	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1468	waterlines-848	J-Hydrant-205	J-891	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1471	waterlines-584	J-892	J-893	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1480	waterlines-524	J-Hydrant-240	J-899	6	30	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1483	waterlines-742	J-Hydrant-348	J-901	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1486	waterlines-920	J-Hydrant-403	J-903	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1498	waterlines-751	J-Hydrant-356	J-911	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1507	waterlines-811	J-Hydrant-364	J-917	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1510	waterlines-591	J-Hydrant-456	J-919	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1513	waterlines-727	J-Hydrant-343	J-921	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1516	waterlines-816	J-Hydrant-366	J-923	6	37	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1525	waterlines-881	J-Hydrant-254	J-929	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1537	waterlines-712	J-Hydrant-69	J-937	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1543	waterlines-629	J-Hydrant-333	J-941	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
1546	waterlines-540	J-Hydrant-263	J-943	6	49	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1549	waterlines-700	J-Hydrant-58	J-945	6	30	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1552	waterlines-633	J-Hydrant-335	J-947	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1555	waterlines-1008	J-948	J-Hydrant-224	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1558	waterlines-1005	J-950	J-951	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1561	waterlines-1004	J-952	J-Hydrant-221	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1564	waterlines-1007	J-954	J-Hydrant-223	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1567	waterlines-1006	J-956	J-Hydrant-222	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1570	waterlines-952	J-Hydrant-390	J-959	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1576	waterlines-689	J-Hydrant-341	J-963	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1579	waterlines-829	J-Hydrant-197	J-965	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1585	waterlines-854	J-Hydrant-317	J-969	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1594	waterlines-534	J-Hydrant-257	J-975	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1606	waterlines-888	J-Hydrant-422	J-983	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1609	waterlines-593	J-Hydrant-455	J-985	6	43	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1615	waterlines-736	J-Hydrant-142	J-989	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1621	waterlines-814	J-Hydrant-361	J-993	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1636	waterlines-542	J-1002	J-1003	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1639	waterlines-852	J-Hydrant-225	J-1005	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1642	waterlines-544	J-Hydrant-265	J-1007	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1651	waterlines-523	J-Hydrant-249	J-1013	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1657	waterlines-825	J-Hydrant-194	J-1017	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1660	waterlines-883	J-Hydrant-261	J-1019	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1666	waterlines-789	J-Hydrant-394	J-1023	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1669	waterlines-582	J-Hydrant-217	J-1025	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1675	waterlines-978	J-1028	J-1029	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1678	waterlines-601	J-Hydrant-444	J-1031	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1681	waterlines-354	J-Hydrant-32	J-1033	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1684	waterlines-539	J-Hydrant-259	J-1035	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1687	waterlines-794	J-Hydrant-392	J-1037	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1690	waterlines-897	J-1038	J-1039	6	451	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
1696	waterlines-595	J-Hydrant-452	J-1043	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1705	waterlines-822	J-Hydrant-186	J-1049	6	40	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1708	waterlines-806	J-Hydrant-188	J-1051	6	43	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1714	waterlines-500	J-1054	J-1055	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1717	waterlines-272	J-1056	J-1057	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1723	waterlines-836	J-1060	J-1061	6	37	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1726	waterlines-522	J-Hydrant-248	J-1063	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1732	waterlines-840	J-Hydrant-329	J-2146	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1739	waterlines-699	J-Hydrant-59	J-1071	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1742	waterlines-505	J-1072	J-Hydrant-212	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1745	waterlines-827	J-Hydrant-195	J-1075	6	38	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1751	waterlines-160	J-1078	J-Hydrant-200	6	40	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1759	waterlines-575	J-Hydrant-375	J-1084	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1768	waterlines-1013	J-Hydrant-269	J-1090	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1771	waterlines-546	J-Hydrant-266	J-1092	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1774	waterlines-870	J-Hydrant-458	J-1094	6	41	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1783	waterlines-705	J-Hydrant-460	J-1100	6	211	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1786	waterlines-496	J-1101	J-1102	6	45	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1789	waterlines-177	J-1103	J-1104	6	45	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1801	waterlines-862	J-1111	J-1112	6	49	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1804	waterlines-86	J-1113	J-1114	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1813	waterlines-209	J-1119	J-1120	6	57	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1819	waterlines-907	J-1123	J-1124	6	75	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1822	waterlines-176	J-1125	J-1126	6	52	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1837	waterlines-714	J-Hydrant-70	J-1136	6	42	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1849	waterlines-192	J-1143	J-1144	6	57	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1909	waterlines-869	J-1178	J-1179	6	84	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1912	waterlines-731	J-Hydrant-405	J-1181	6	86	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1924	waterlines-167	J-1188	J-1189	6	90	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1936	waterlines-134	J-1196	J-1197	6	153	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1975	waterlines-180	J-1211	J-1221	6	115	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1979	waterlines-281	J-1223	J-1224	6	116	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2019	waterlines-1063	J-3	J-4	6	169	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
2081	waterlines-63	J-1287	J-150	6	167	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2106	waterlines-14	J-1302	J-1303	6	222	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2133	waterlines-512	J-1318	J-1319	6	207	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2184	waterlines-1032	J-1350	J-1351	6	246	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2190	waterlines-168	J-1354	J-1231	6	251	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2222	waterlines-950	J-1373	J-Hydrant-371	6	298	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2238	waterlines-983	J-1383	J-1350	6	272	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2269	waterlines-338	J-1403	J-1404	6	288	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2333	waterlines-1034	J-1162	J-1442	6	312	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2381	waterlines-1038	J-1471	J-1472	6	348	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2424	waterlines-56	J-1497	J-1498	6	367	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2568	waterlines-1029	J-551	J-1586	6	527	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2578	waterlines-107	J-1591	J-1592	6	509	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2581	waterlines-987	J-1593	J-1594	6	509	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2702	waterlines-1031	J-1931	J-Hydrant-472	6	705	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2798	waterlines-215	J-Hydrant-435	J-913	6	503	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
2942	waterlines-1056	J-1795	J-1796	6	1504	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4249	P-35	J-1211	J-1253	6	222	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4258	P-44	J-1054	J-1530	6	125	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4274	P-60	J-1550	J-1389	6	325	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4278	P-64	J-1625	J-1620	6	126	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4286	P-72	J-Hydrant-496	J-802	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4288	P-74	J-Hydrant-494	J-2123	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4295	P-81	J-1833	J-1027	6	72	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4303	P-89	J-1523	J-1973	6	212	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4307	P-93	J-1198	J-1112	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4314	P-100	J-1588	J-1107	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4321	P-107	J-1296	J-215	6	214	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4322	P-108	J-215	J-1297	6	229	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4341	P-127	J-1684	J-1249	6	181	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4386	P-172	J-738	J-1526	6	284	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4388	P-174	J-219	J-1167	6	37	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4390	P-176	J-546	J-1257	6	126	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
4401	P-187	J-1711	J-1136	6	857	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4402	P-188	J-1136	J-1413	6	309	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4409	P-195	J-1229	J-1431	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4416	P-202	J-1662	J-1487	6	349	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4420	P-206	J-579	J-1289	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4449	P-235	J-1467	J-506	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4455	P-241	J-1501	J-617	6	45	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4464	P-250	J-993	J-1581	6	46	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4473	P-259	J-1362	J-1223	6	181	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4474	P-260	J-1223	J-1363	6	73	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4475	P-261	J-1541	J-104	6	280	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4477	P-263	J-1505	J-335	6	190	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4478	P-264	J-335	J-1471	6	86	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4487	P-273	J-1579	J-903	6	473	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4488	P-274	J-903	J-1148	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4495	P-281	J-1546	J-110	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4496	P-282	J-110	J-1547	6	411	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4500	P-286	J-349	J-1589	6	40	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4503	P-289	J-1606	J-168	6	483	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4504	P-290	J-168	J-1607	6	42	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4517	P-303	J-1574	J-619	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4519	P-305	J-1545	J-1627	6	50	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4540	P-326	J-164	J-1743	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4556	P-342	J-1081	J-1600	6	463	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4571	P-357	J-1564	J-389	6	231	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4580	P-366	J-1219	J-1598	6	101	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4585	P-371	J-1423	J-812	6	540	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4587	P-373	J-1697	J-452	6	418	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4593	P-379	J-1572	J-1685	6	292	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4603	P-389	J-1633	J-522	6	285	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4604	P-390	J-522	J-1634	6	420	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
4605	P-391	J-1627	J-205	6	216	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4606	P-392	J-205	J-1628	6	349	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4688	P-474	J-1741	J-Hydrant-389	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4713	P-499	J-1588	J-188	6	546	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4718	P-504	J-1530	J-1775	6	356	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4727	P-513	J-Hydrant-45	J-1401	6	30	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4735	P-521	J-1413	J-778	6	310	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4740	P-526	J-432	J-1391	6	201	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4741	P-527	J-1729	J-851	6	509	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4742	P-528	J-851	J-1654	6	622	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4773	P-559	J-1413	J-820	6	669	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4819	P-605	J-1753	J-1576	6	1235	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4832	P-618	J-1124	J-Hydrant-16	6	78	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4840	P-626	J-Hydrant-426	J-752	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4841	P-627	J-1625	J-1621	6	550	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4858	P-644	J-500	J-Hydrant-408	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4866	P-652	J-Hydrant-303	J-869	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4883	P-669	J-Hydrant-253	J-1572	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4886	P-672	J-Hydrant-331	J-542	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4895	P-681	J-1700	J-833	6	186	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4897	P-683	J-1490	J-3	6	171	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4898	P-684	J-3	J-Hydrant-500	6	200	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4909	P-695	J-Hydrant-298	J-863	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4921	P-707	J-Hydrant-362	J-575	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4924	P-710	J-128	J-Hydrant-107	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4936	P-722	J-Hydrant-236	J-565	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4943	P-729	J-1944	J-1179	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4945	P-731	J-1052	J-124	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4956	P-742	J-1407	J-1426	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4969	P-755	J-1578	J-1005	6	93	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
4977	P-763	J-1229	J-54	6	290	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4983	P-769	J-1390	J-655	6	37	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4984	P-770	J-655	J-738	6	314	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4989	P-775	J-1112	J-454	6	326	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4990	P-776	J-454	J-1348	6	40	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4995	P-781	J-1594	J-615	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
4996	P-782	J-615	J-1330	6	158	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5001	P-787	J-617	J-1029	6	298	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5009	P-795	J-1580	J-555	6	55	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5015	P-801	J-766	J-1544	6	311	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5021	P-807	J-619	J-1301	6	140	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5027	P-813	J-1457	J-1145	6	103	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5028	P-814	J-1145	J-677	6	212	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5038	P-824	J-1476	J-707	6	116	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5063	P-849	J-1597	J-1227	6	194	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5064	P-850	J-1227	J-1219	6	165	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5098	P-884	J-142	J-1794	6	359	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5099	P-885	J-1619	J-1447	6	211	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5111	P-897	J-812	J-1633	6	394	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5112	P-898	J-1633	J-1413	6	292	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5143	P-929	J-1249	J-742	6	210	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5144	P-930	J-742	J-1685	6	386	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5193	P-979	J-452	J-327	6	375	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5211	P-997	J-188	J-1149	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5220	P-1006	J-426	J-1453	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5242	P-1028	J-1351	J-599	6	109	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5245	P-1031	J-815	J-806	6	45	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5257	P-1043	J-229	J-1740	6	245	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5260	P-1046	J-750	J-815	6	716	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5262	P-1048	J-458	J-1054	6	288	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5268	P-1054	J-Hydrant-381	J-1849	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5275	P-1061	J-1469	J-1592	6	47	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5276	P-1062	J-1592	J-213	6	38	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5282	P-1068	J-627	J-1530	6	216	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
5287	P-1073	J-1770	J-146	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5288	P-1074	J-146	J-166	6	467	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5293	P-1079	J-1372	J-1377	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5295	P-1081	J-1354	J-492	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5296	P-1082	J-492	J-20	6	110	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5299	P-1085	J-124	J-1053	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5304	P-1090	J-114	J-1407	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5335	P-1121	J-937	J-1320	6	51	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5365	P-1151	J-555	J-575	6	488	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5473	P-1259	J-78	J-1382	6	346	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5474	P-1260	J-1382	J-319	6	72	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5475	P-1261	J-806	J-1072	6	476	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5476	P-1262	J-1072	J-1258	6	181	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5481	P-1267	J-1705	J-950	6	246	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5483	P-1269	J-166	J-1403	6	249	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5489	P-1275	J-1377	J-1188	6	166	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5490	P-1276	J-1188	J-1354	6	42	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5497	P-1283	J-1320	J-1711	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5498	P-1284	J-1711	J-430	6	270	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5499	P-1285	J-575	J-415	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5577	P-1363	J-960	J-100	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5578	P-1364	J-100	J-991	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5580	P-1366	J-444	J-960	6	257	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5603	P-1389	J-415	J-416	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5604	P-1390	J-416	J-993	6	519	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5643	P-1429	J-108	J-353	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5659	P-1445	J-739	J-740	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5660	P-1446	J-740	J-114	6	279	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5702	P-1488	J-140	J-444	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5785	P-1571	J-1471	J-1506	6	57	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
5862	P-1633	J-Hydrant-436	J-1349	6	63	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5863	P-1634	J-1349	J-47	6	86	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5891	P-1651	J-2017	J-Hydrant-215	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5930	P-1673	J-1557	J-1003	6	126	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5946	P-1681	J-989	J-164	6	558	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5957	P-1688	J-950	J-948	6	509	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5958	P-1689	J-948	J-1764	6	303	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5960	P-1690	J-1621	J-1455	6	285	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5971	P-1697	J-1101	J-841	6	135	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5972	P-1698	J-841	J-627	6	732	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5975	P-1700	J-802	J-1534	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5977	P-1701	J-1533	J-1684	6	156	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5978	P-1702	J-1684	J-802	6	178	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5986	P-1707	J-833	J-748	6	481	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
5987	P-1708	J-748	J-815	6	196	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6008	P-1721	J-1685	J-550	6	108	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6009	P-1722	J-550	J-1573	6	54	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6023	P-1731	J-1661	J-480	6	43	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6030	P-1736	J-331	J-989	6	410	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6032	P-1737	J-104	J-329	6	464	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6033	P-1738	J-329	J-1542	6	446	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6038	P-1741	J-Hydrant-492	J-1919	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6053	P-1751	J-Hydrant-478	J-1923	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6072	P-1761	J-Hydrant-433	J-912	6	469	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6092	P-1769	J-1349	J-Hydrant-437	6	279	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6096	P-1773	J-246	J-389	6	260	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6100	P-1777	J-1165	J-47	6	89	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6101	P-1778	J-435	J-516	6	446	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6105	P-1782	J-525	J-1433	6	337	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6106	P-1783	J-1179	J-544	6	247	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6107	P-1784	J-551	J-546	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6108	P-1785	J-632	J-1301	6	296	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6109	P-1786	J-658	J-1003	6	311	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6110	P-1787	J-809	J-349	6	487	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
6116	P-1793	J-1076	J-579	6	176	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6120	P-1797	J-122	J-1110	6	426	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6124	P-1801	J-1149	J-1029	6	292	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6131	P-1808	J-1518	J-1124	6	402	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6135	P-1812	J-1476	J-422	6	394	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6136	P-1813	J-1431	J-1052	6	417	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6141	P-1818	J-1263	J-78	6	360	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6144	P-1821	J-1453	J-1274	6	608	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6147	P-1824	J-1544	J-1299	6	503	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6149	P-1826	J-506	J-1944	6	492	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6150	P-1827	J-1576	J-122	6	497	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6151	P-1828	J-213	J-1594	6	289	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6159	P-1836	J-820	J-1795	6	256	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6160	P-1837	J-778	J-1200	6	210	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6162	P-1839	J-1377	J-1125	6	614	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6166	P-1843	J-1627	J-351	6	681	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6172	P-1849	J-156	J-1426	6	315	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6181	P-1858	J-707	J-1225	6	177	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6183	P-1860	J-1525	J-426	6	429	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6189	P-1866	J-1476	J-937	6	402	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6199	P-1876	J-565	J-1550	6	632	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6228	P-1905	J-319	J-331	6	494	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6253	P-1930	J-1849	J-1158	6	123	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6257	P-1934	J-1222	J-1849	6	145	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6262	P-1939	J-327	J-1284	6	613	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6263	P-1940	ɔckey's Ridge State Pai	J-1422	6	997	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6266	P-1943	J-1740	J-1229	6	314	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6275	P-1949	J-1944	J-Hydrant-307	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6277	P-1950	J-Hydrant-409	J-1945	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6307	P-1970	J-1954	J-Hydrant-379	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6309	P-1971	J-1359	J-180	6	48	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
6310	P-1972	J-180	J-1588	6	184	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6318	P-1977	J-1958	J-Hydrant-377	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6327	P-1982	J-1961	J-Hydrant-378	6	38	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6339	P-1990	J-118	J-739	6	69	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6341	P-1991	J-1388	J-106	6	586	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6342	P-1992	J-106	J-1550	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6352	P-1997	J-Hydrant-473	J-1973	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6353	P-1998	J-1973	J-219	6	223	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6359	P-2001	J-1975	J-Hydrant-319	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6364	P-2004	J-1977	J-Hydrant-386	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6424	P-2019	J-1568	J-2023	6	80	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6425	P-2020	J-2023	J-1433	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6428	P-2021	J-2023	J-Hydrant-495	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6431	P-2023	J-2026	J-1622	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6433	P-2024	J-2026	J-Hydrant-260	6	51	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6435	P-2025	J-1455	J-943	6	59	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6436	P-2026	J-943	J-2026	6	138	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6441	P-2027	J-2181	J-Hydrant-498	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6455	P-2036	J-Hydrant-466	J-2036	6	10	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6532	P-2092	J-458	J-2057	6	428	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6537	P-2096	J-1053	J-2058	6	246	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6538	P-2097	J-2058	J-1680	6	633	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6553	P-2108	J-2061	J-Hydrant-130	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6569	P-2118	J-2067	J-2068	6	58	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6571	P-2119	J-2068	J-2069	6	120	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6573	P-2120	J-2069	J-2070	6	185	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6574	P-2121	J-2070	J-2071	6	691	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6583	P-2126	J-1447	J-2074	6	267	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6584	P-2127	J-2074	J-1625	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6589	P-2129	J-2074	J-Hydrant-264	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6591	P-2130	J-1223	J-Hydrant-404	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6613	P-2141	J-2088	J-2089	6	4197	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6620	P-2145	Coquina Beach	J-2092	6	381	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	**Pipe #**	**Start Node Junction #**	**Stop Node Junction #**	**Size (in.)**	**Length (ft.)**	**Material**	**Grouping Name**	**Age (years)**	**Assumed Condition**	**Condition Rating**	**Capacity Rating**	**Service Life Rating**	**Level of Redundancy**	**Total Risk Score**	**Water Delivery Capability**	**Health & Safety**	**Environmental**	**Total Consequence Score**	**Product of Risk x Consequence**	**Comment**
6622	P-2146	J-2092	J-2093	6	716	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6624	P-2147	J-2093	J-2094	6	705	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6626	P-2148	J-2094	J-2095	6	1554	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6628	P-2149	J-2095	Bodie Island Lighthouse	6	1293	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6630	P-2150	J-2095	J-2097	6	1824	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6644	P-2158	J-2102	J-2103	6	1467	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6648	P-2161	J-2103	J-2104	6	483	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6656	P-2166	J-2107	J-1174	6	366	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6657	P-2167	J-2107	J-1348	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6661	P-2170	J-1576	J-2108	6	63	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6664	P-2172	J-2109	J-118	6	337	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6678	P-2180	J-1426	J-1427	6	316	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6679	P-2181	J-1427	J-1740	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6690	P-2188	J-1403	J-2118	6	107	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6691	P-2189	J-2118	J-108	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6694	P-2190	J-353	J-2120	6	172	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6695	P-2191	J-2120	J-140	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6697	P-2192	J-1438	J-2121	6	319	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6700	P-2194	J-480	J-2072	6	411	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6706	P-2198	J-954	J-2124	6	280	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6722	P-2208	J-1390	J-2130	6	272	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6723	P-2209	J-2130	J-432	6	269	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6724	P-2210	J-1550	J-2130	6	421	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6762	P-2236	J-1741	J-1606	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6842	P-2287	J-1554	J-2170	6	472	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6843	P-2288	J-2170	J-1382	6	254	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
6877	P-2310	J-1768	J-Hydrant-464	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7181	P-2362	J-Hydrant-63	J-2200	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7194	P-2365	J-Hydrant-385	J-2202	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
7209	P-2368	J-2203	J-Hydrant-486	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7214	P-2371	J-2205	J-Hydrant-485	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7437	P-2391	J-2216	J-Hydrant-18	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7439	P-2392	J-1313	J-Hydrant-25	6	48	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7441	P-2393	J-1642	J-Hydrant-24	6	203	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7443	P-2394	J-1642	J-Hydrant-467	6	361	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7445	P-2395	J-2068	J-Hydrant-33	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7447	P-2396	J-2069	J-Hydrant-34	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7449	P-2397	J-2070	J-Hydrant-35	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7454	P-2400	J-2224	J-Hydrant-126	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7459	P-2403	J-2226	J-Hydrant-146	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7461	P-2404	ockey's Ridge State Pa	J-Hydrant-147	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7466	P-2407	J-2229	J-Hydrant-150	6	46	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7471	P-2410	J-2231	J-Hydrant-157	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7476	P-2413	J-2233	J-Hydrant-159	6	39	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7481	P-2416	J-2235	J-Hydrant-175	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7483	P-2417	J-1231	J-2237	6	179	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7484	P-2418	J-2237	J-1211	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7486	P-2419	J-2237	J-Hydrant-202	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7488	P-2420	J-1253	J-2239	6	217	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7489	P-2421	J-2239	J-351	6	530	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7491	P-2422	J-2239	J-Hydrant-203	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7493	P-2423	J-1543	J-2241	6	228	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7494	P-2424	J-2241	J-1544	6	275	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7496	P-2425	J-2241	J-Hydrant-204	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7498	P-2426	J-1005	J-2243	6	351	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7499	P-2427	J-2243	J-766	6	364	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7501	P-2428	J-2243	J-Hydrant-207	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7506	P-2431	J-2245	J-Hydrant-250	6	22	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7511	P-2434	J-2247	J-Hydrant-251	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7516	P-2437	J-2249	J-Hydrant-267	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7521	P-2440	J-2251	J-Hydrant-270	6	31	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7526	P-2443	J-2253	J-Hydrant-272	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7531	P-2446	J-2255	J-Hydrant-285	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7536	P-2449	J-2257	J-Hydrant-296	6	11	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
7541	P-2452	J-2259	J-Hydrant-305	6	26	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7546	P-2455	J-2261	J-Hydrant-309	6	24	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7548	P-2456	J-1740	J-Hydrant-313	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7553	P-2459	J-2264	J-Hydrant-316	6	35	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7555	P-2460	J-1229	J-Hydrant-321	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7560	P-2463	J-2267	J-Hydrant-330	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7565	P-2466	J-2269	J-Hydrant-337	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7570	P-2469	J-2271	J-Hydrant-367	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7575	P-2472	J-2273	J-Hydrant-369	6	23	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7580	P-2475	J-2275	J-Hydrant-387	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7585	P-2478	J-2277	J-Hydrant-388	6	15	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7590	P-2481	J-2279	J-Hydrant-395	6	45	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7595	P-2484	J-2281	J-Hydrant-406	6	111	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7600	P-2487	J-2283	J-Hydrant-407	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7605	P-2490	J-2285	J-Hydrant-410	6	17	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7610	P-2493	J-2287	J-Hydrant-414	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7612	P-2494	J-1791	J-Hydrant-415	6	18	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7617	P-2497	J-2290	J-Hydrant-416	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7622	P-2500	J-2292	J-Hydrant-417	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7627	P-2503	J-2294	J-Hydrant-431	6	43	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7629	P-2504	J-Hydrant-434	J-1369	6	62	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7634	P-2507	J-2297	J-Hydrant-438	6	14	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7639	P-2510	J-2299	J-Hydrant-446	6	19	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7644	P-2513	J-2301	J-Hydrant-451	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7646	P-2514	J-1319	J-Hydrant-453	6	67	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7651	P-2517	J-2304	J-Hydrant-457	6	16	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7655	P-2518	J-2030	J-Hydrant-465	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7660	P-2521	J-2309	J-Hydrant-474	6	12	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7665	P-2524	J-2311	J-Hydrant-475	6	29	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7670	P-2527	J-2313	J-Hydrant-476	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	PVC Water Mains
7675	P-2530	J-2315	J-Hydrant-477	6	34	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7677	P-2531	J-1251	J-2317	6	148	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7678	P-2532	J-2317	J-1252	6	87	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7680	P-2533	J-2317	J-Hydrant-479	6	13	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7682	P-2534	J-1862	J-Hydrant-480	6	150	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7684	P-2535	J-1717	J-Hydrant-481	6	60	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7689	P-2538	J-2321	J-Hydrant-482	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7694	P-2541	J-2323	J-Hydrant-483	6	33	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7699	P-2544	J-2325	J-Hydrant-484	6	32	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7704	P-2547	J-2327	J-Hydrant-487	6	28	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7709	P-2550	J-2329	J-Hydrant-488	6	25	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7714	P-2553	J-2331	J-Hydrant-489	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7719	P-2556	J-2333	J-Hydrant-490	6	36	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7724	P-2559	J-2335	J-Hydrant-491	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7729	P-2562	J-2337	J-Hydrant-493	6	20	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7734	P-2565	J-2339	J-Hydrant-499	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7738	P-2566	J-Hydrant-66	J-66	6	3802	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7739	P-2567	J-1528	J-1272	6	426	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7740	P-2568	J-1412	J-Hydrant-497	6	531	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7743	P-2570	J-1810	J-2057	6	8207	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7780	P-2571	J-Hydrant-Marina	Oregon Inlet Marina	6	27	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7782	P-2572	Bodie Island Lighthous	J-Hydrant-Lighthouse	6	21	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7784	P-2573	J-Hydrant-NPS	J-2088	6	60	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7855	P-2582	J-1177	J-637	6	425	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
7914	P-2583	J-542	New Tank	6	125	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
8050	P-2584	J-1417	J-1826	6	1184	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
8085	P-2587	J-2346	J-2347	6	206	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
8087	P-2588	J-2347	J-2348	6	218	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
8088	P-2589	J-2348	J-1664	6	370	PVC	System Wide	1980s +	Good/Fair	3	0.7	4	2	9.7	1	1	1	3	29.1	
1367	waterlines-207	J-823	J-1	4	26	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
1915	waterlines-92	J-1182	J-1183	4	86	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
1948	waterlines-973	J-1	J-2	4	104	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
1972	waterlines-40	J-1219	J-1220	4	112	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
1985	waterlines-39	J-1227	J-1228	4	119	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =	SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	Pipe #	Start Node Junction #	Stop Node Junction #	Size (in.)	Length (ft.)	Material	Grouping Name	Age (years)	Assumed Condition	Condition Rating	Capacity Rating	Service Life Rating	Level of Redundancy	Total Risk Score	Water Delivery Capability	Health & Safety	Environmental	Total Consequence Score	Product of Risk x Consequence	Comment
2070	waterlines-905	J-1280	J-1281	4	195	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
4311	P-97	J-1107	J-176	4	25	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
4406	P-192	J-150	J-1213	4	137	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
4549	P-335	J-2	J-1294	4	234	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
4853	P-639	J-1184	J-1182	4	44	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
4854	P-640	J-1182	J-1185	4	45	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	PVC Water Mains
4882	P-668	J-1067	J-1504	4	373	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
5046	P-832	J-1225	J-1131	4	198	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
6119	P-1796	J-176	J-1514	4	707	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
6179	P-1856	J-430	J-1437	4	470	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
6207	P-1884	J-1149	J-1107	4	605	PVC	System Wide	1980s +	Good/Fair	3	0.3	4	2	9.3	1	1	1	3	27.9	
6663	P-2171	J-1467	J-2109	2	457	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	Low Fire Flow Results - Ocean Watch Court Area
157	waterlines-178	J-19	J-20	2	359	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
175	waterlines-363	J-31	J-32	2	408	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
752	waterlines-217	J-415	J-416	2	440	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1131	waterlines-340	J-666	J-667	2	590	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1241	waterlines-121	J-739	J-740	2	550	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1600	waterlines-251	J-978	J-979	2	297	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1711	waterlines-151	J-1052	J-1053	2	436	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1810	waterlines-912	J-1117	J-1118	2	502	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1831	waterlines-318	J-1131	J-1132	2	81	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1852	waterlines-82	J-1145	J-1146	2	58	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1901	waterlines-136	J-1174	J-1175	2	140	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1904	waterlines-135	J-1174	J-1175	2	140	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1939	waterlines-144	J-1198	J-1199	2	158	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1942	waterlines-298	J-1200	J-1201	2	113	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1957	waterlines-242	J-1209	J-1210	2	183	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1960	waterlines-170	J-1211	J-1212	2	403	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1963	waterlines-68	J-1213	J-1214	2	110	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1982	waterlines-317	J-1225	J-1226	2	118	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1991	waterlines-179	J-1231	J-1232	2	121	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
1994	waterlines-204	J-1233	J-1234	2	381	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2009	waterlines-453	J-1243	J-1244	2	136	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2012	waterlines-64	J-150	J-1246	2	136	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2016	waterlines-191	J-1247	J-1248	2	400	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2020	waterlines-1046	J-1249	J-1250	2	173	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2026	waterlines-181	J-1253	J-1254	2	145	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2038	waterlines-205	J-1260	J-1261	2	229	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	PVC Water Mains
2067	waterlines-332	J-1278	J-1279	2	285	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2078	waterlines-162	J-1067	J-1286	2	167	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2083	waterlines-65	J-150	J-1288	2	168	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2087	waterlines-203	J-1290	J-1291	2	475	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2103	waterlines-20	J-1300	J-1301	2	192	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2109	waterlines-252	J-1304	J-1305	2	217	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2117	waterlines-67	J-1213	J-1308	2	200	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2130	waterlines-229	J-1316	J-1317	2	310	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2139	waterlines-57	J-1322	J-1323	2	208	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2147	waterlines-310	J-1327	J-1328	2	235	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2172	waterlines-360	J-1343	J-1344	2	416	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2187	waterlines-248	J-1352	J-1353	2	269	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2200	waterlines-247	J-1360	J-1361	2	285	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2207	waterlines-199	J-1364	J-1365	2	526	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2212	waterlines-62	J-1367	J-1368	2	263	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2226	waterlines-328	J-1375	J-1376	2	267	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2255	waterlines-356	J-1394	J-1395	2	483	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2303	waterlines-202	J-1424	J-1425	2	521	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2311	waterlines-892	J-1314	J-1429	2	304	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2316	waterlines-22	J-1432	J-1433	2	399	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2341	waterlines-25	J-1447	J-1448	2	341	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2351	waterlines-188	J-1452	J-1453	2	321	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2356	waterlines-28	J-1455	J-1456	2	352	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2384	waterlines-358	J-1473	J-1474	2	350	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2410	waterlines-430	J-1488	J-1489	2	360	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	

									Scoring Reference	Risk of Failure 1A +	1B +	1C +	1D =	SUM 1	Consequence of Failure 2A +	2D +	3D =		SUM 2	Criticality Rating SUM 1 x SUM 2	
									Scoring Range	0 - 5	0 - 5	0 - 10	0 - 3	0 - 23	0 - 3	0 - 3	0 - 3	0 - 9	0 - 207	
Hydraulic Model ID #	**Pipe #**	**Start Node Junction #**	**Stop Node Junction #**	**Size (in.)**	**Length (ft.)**	**Material**	**Grouping Name**	**Age (years)**	**Assumed Condition**	**Condition Rating**	**Capacity Rating**	**Service Life Rating**	**Level of Redundancy**	**Total Risk Score**	**Water Delivery Capability**	**Health & Safety**	**Environmental**	**Total Consequence Score**	**Product of Risk x Consequence**	**Comment**
2432	waterlines-449	J-1502	J-1503	2	372	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2442	waterlines-228	J-1508	J-1509	2	418	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2445	waterlines-49	J-1510	J-1511	2	392	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2454	waterlines-227	J-1515	J-1516	2	408	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2594	waterlines-329	J-1375	J-1601	2	550	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2616	waterlines-76	J-1614	J-1615	2	532	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
2622	waterlines-71	J-1617	J-1618	2	618	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4276	P-62	J-20	J-19	2	7	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4293	P-79	J-17	J-1144	2	222	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4294	P-80	J-1144	J-17	2	210	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4297	P-83	J-1461	J-1367	2	207	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4298	P-84	J-1367	J-1462	2	260	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4356	P-142	J-663	J-1256	2	167	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4377	P-163	J-960	J-100	2	461	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4418	P-204	J-108	J-353	2	534	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4434	P-220	J-725	J-726	2	415	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4706	P-492	J-422	J-1203	2	98	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4730	P-516	J-1429	J-1441	2	21	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4747	P-533	J-1331	J-1300	2	320	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4748	P-534	J-1300	J-1332	2	66	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4751	P-537	J-1407	J-156	2	514	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4872	P-658	J-140	J-444	2	378	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
4884	P-670	J-1572	J-12	2	534	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
5786	P-1572	J-335	J-1204	2	437	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	PVC Water Mains
5787	P-1573	J-1204	J-1559	2	162	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6058	P-1754	J-37	J-1924	2	1223	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6059	P-1755	J-1924	J-38	2	594	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6098	P-1775	J-1528	J-1177	2	612	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6115	P-1792	J-100	J-991	2	370	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6121	P-1798	J-1406	J-2128	2	309	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6123	P-1800	J-1663	J-1140	2	492	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6126	P-1803	J-1366	J-1155	2	464	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6134	P-1811	J-581	J-1195	2	129	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6140	P-1817	J-1258	J-1517	2	450	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6155	P-1832	J-641	J-1454	2	473	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6176	P-1853	J-1427	J-229	2	581	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6177	P-1854	J-54	J-1431	2	535	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6601	P-2135	J-1333	J-2083	2	174	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6602	P-2136	J-2083	J-1334	2	146	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6604	P-2137	J-2083	J-2084	2	149	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6655	P-2165	J-1348	J-2107	2	708	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6667	P-2174	J-2110	J-1169	2	188	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6698	P-2193	J-2121	J-1268	2	140	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6707	P-2199	J-2124	J-1707	2	984	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6769	P-2241	J-2144	J-1098	2	499	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6771	P-2242	J-1097	J-1098	2	54	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6772	P-2243	J-1098	J-2144	2	6	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	
6794	P-2256	J-2153	J-2154	2	261	PVC	System Wide	1980s +	Good/Fair	3	0.1	4	2	9.1	1	1	1	3	27.3	

APPENDIX

Z

Preliminary Opinion of Probable Project Cost

TOWN OF NAGS HEAD, N.C.
SOUTH TOWER EST REHABILITATION (500,000 GALLON)
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION		UNIT PRICE		COST
1.	1	LS	Mobilization	$	5,500.00	$	5,500.00
2.	9,000	SF	Clean, Surface Preparation, and Interior Recoat (Wet Area)	$	7.00	$	63,000.00
3.	5,500	SF	Clean, Surface Preparation and Interior Recoat (Dry Area)	$	5.00	$	27,500.00
4.	12,750	SF	Clean, Surface Preparation and Exterior Recoat	$	7.50	$	95,625.00
5.	1	LS	Cleanup and Demobilization	$	5,500.00	$	5,500.00
			SUBTOTAL - CONSTRUCTION			**$**	**197,125.00**
			CONTINGENCY @ 10%+/-			**$**	**19,250.00**
			TOTAL ESTIMATED CONSTRUCTION COST			**$**	**216,375.00**
			TECHNICAL SERVICES @ 25% +/-			**$**	**53,075.00**
			LEGAL & ADMINISTRATIVE			**$**	**5,000.00**
			TOTAL ESTIMATED PROJECT COST			**$**	**274,450.00**

* If existing coating degrades to point of adhesion failure, estimated cost can be expected to increase by approximately $150,000 for cost of containment and sandblasting.

TOWN OF NAGS HEAD, N.C.
12" WATER MAIN INSTALLATION - W. DANUBE STREET TO DIAMOND STREET
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install approximately 1,350 feet of water line from Danube Street to Diamond Street on the west side of U.S. Hwy 158.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1,350	LF	12" PVC (C-900)	$ 65.00	$ 87,750.00
2.	2	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 6,600.00
3.	3,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 15,000.00
4.	3	EA	NEW FIRE HYDRANT & VALVE ASSEMBLY	$ 4,600.00	$ 13,800.00
5.	2	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 1,500.00
6.	2	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 2,000.00
7.	50	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 3,000.00
8.	100	CY	SELECT BACKFILL	$ 20.00	$ 2,000.00
9.	50	TN	STABILIZATION STONE	$ 30.00	$ 1,500.00
10.	10	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 1,000.00
11.	200	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 1,000.00
12.	200	LF	SILT FENCE	$ 5.00	$ 1,000.00
13.	1	LS	TRAFFIC CONTROL	$ 25,000.00	$ 25,000.00
14.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 164,150.00**
			CONTINGENCY @ 10%+/-		**$ 18,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 182,150.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 47,850.00**
			LEGAL & ADMINISTRATIVE		**$ 5,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 235,000.00**

TOWN OF NAGS HEAD, N.C.
EIGHTH STREET WATER PLANT - GENERATOR TRANSFER SWITCH REPLACEMENT
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **An automatic transfer switch is required for use with a permanently mounted emergency generator such as that located at the Eighth Street Water Plant. With an auto-transfer switch, the generator will automatically start and supply emergency backup power during a power outage without service disruption.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	800 Amp Autotransfer Switch Installed	$ 20,000.00	$ 20,000.00
			SUBTOTAL - CONSTRUCTION		**$ 20,000.00**
			CONTINGENCY @ 10%+/-		**$ 2,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 22,000.00**
			TECHNICAL SERVICES @ 15% +/-		**$ 3,000.00**
			LEGAL & ADMINISTRATIVE		**$ -**
			TOTAL ESTIMATED PROJECT COST		**$ 25,000.00**

TOWN OF NAGS HEAD, N.C.
FIRE HYDRANT INSTALLATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install new Fire Hydrants at underserved locations within the distribution system:**
(1) Corner of Buckaneer Drive / Windjammer Road
(2) Corner of Windjammer Road / Lookout Road

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	2	EA	6" x 6" Tapping Sleeve and Valve	$ 2,800.00	$ 5,600.00
2.	2	EA	Fire Hydrant Assemblies	$ 3,800.00	$ 7,600.00
			SUBTOTAL - CONSTRUCTION		**$ 13,200.00**
			CONTINGENCY @ 10%+/-		**$ 5,400.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 18,600.00**

TOWN OF NAGS HEAD, N.C.
6" ACP WATER MAIN REPLACEMENT - BARNES STREET BENEATH BYPASS ROAD
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace existing 6" ACP on Barnes Street from the Beach Road to the Vista Colony entrance beneath the Bypass Road**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1,280	LF	6" PVC (C-900)	$ 22.00	$ 28,160.00
2.	3	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 7,800.00
3.	1	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 2,800.00
4.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
5.	2,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 10,000.00
6.	2	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 7,000.00
7.	8	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 8,800.00
8.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
9.	4	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 4,000.00
10.	120	LF	6" RJDIP WATER MAIN	$ 53.00	$ 6,360.00
11.	120	LF	16" STEEL CASING (BORE AND JACK)	$ 240.00	$ 28,800.00
12.	17	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 10,200.00
13.	140	LF	3/4" SERVICE TUBING	$ 6.00	$ 840.00
14.	400	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 8,000.00
15.	175	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 20,125.00
16.	250	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 15,000.00
17.	100	CY	SELECT BACKFILL	$ 20.00	$ 2,000.00
18.	50	TN	STABILIZATION STONE	$ 30.00	$ 1,500.00
19.	8	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 800.00
20.	200	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 1,000.00
21.	200	LF	SILT FENCE	$ 5.00	$ 1,000.00
22.	1	LS	TESTING ALLOWANCE		$ 1,000.00
			SUBTOTAL - CONSTRUCTION		**$ 169,235.00**
			CONTINGENCY @ 10%+/-		**$ 17,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 186,235.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 46,765.00**
			LEGAL & ADMINISTRATIVE		**$ 2,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 235,000.00**

TOWN OF NAGS HEAD, N.C.
EIGHTH STREET EST REHABILITATION (500,000 GALLON)
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION		UNIT PRICE		COST
1.	1	LS	Mobilization	$	5,500.00	$	5,500.00
2.	9,000	SF	Clean, Surface Preparation, and Interior Recoat (Wet Area)	$	7.00	$	63,000.00
3.	5,500	SF	Clean, Surface Preparation and Interior Recoat (Dry Area)	$	5.00	$	27,500.00
4.	12,750	SF	Clean, Surface Preparation and Exterior Recoat	$	7.50	$	95,625.00
5.	1	LS	Cleanup and Demobilization	$	5,500.00	$	5,500.00
			SUBTOTAL - CONSTRUCTION			**$**	**197,125.00**
			CONTINGENCY @ 10%+/-			**$**	**19,250.00**
			TOTAL ESTIMATED CONSTRUCTION COST			**$**	**216,375.00**
			TECHNICAL SERVICES @ 25% +/-			**$**	**53,075.00**
			LEGAL & ADMINISTRATIVE			**$**	**5,000.00**
			TOTAL ESTIMATED PROJECT COST			**$**	**274,450.00**

* If existing coating degrades to point of adhesion failure, estimated cost can be expected to increase by approximately $150,000 for cost of containment and sandblasting.

TOWN OF NAGS HEAD, N.C.
DUAL 12" MAIN AROUND JOCKEY'S RIDGE
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Extend 12" transmission main from the south to the north sides of Jockey's Ridge State Park to improve hydraulic capacity and system redundancy. Extend 12" main from the existing termination on the west side of South Croatan Hwy to the existing 8" looped main at E. Hollowell Street.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	6,000	LF	12" PVC (C-900)	$ 55.00	$ 330,000.00
2.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
3.	2	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 5,600.00
4.	4,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 20,000.00
5.	120	LF	24" Steel Casing (Jack & Bore)	$ 420.00	$ 50,400.00
6.	2	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 1,500.00
7.	2	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 2,000.00
8.	120	LF	CONCRETE WALKWAY RESTORATION	$ 115.00	$ 13,800.00
9.	80	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 4,800.00
10.	30	LF	STONE DRIVEWAY RESTORATION	$ 10.00	$ 300.00
11.	100	CY	SELECT BACKFILL	$ 20.00	$ 2,000.00
12.	100	TN	STABILIZATION STONE	$ 30.00	$ 3,000.00
13.	30	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 3,000.00
14.	500	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,500.00
15.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
16.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 447,700.00**
			CONTINGENCY @ 10%+/-		**$ 44,300.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 492,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 123,000.00**
			LEGAL & ADMINISTRATIVE		**$ 10,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 625,000.00**

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TOWN OF NAGS HEAD, N.C.
NEW HIGH SERVICE PUMP @ GULL STREET PUMP STATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **The 2018 Water System Comprehensive Plan recommends addition of a third high service pump with controls modifications to improve system performance and provide more stable system pressures.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION		UNIT PRICE		COST
1.	1	LS	125 HP Horizontal Split Case Pump Installed	$	100,000.00	$	100,000.00
2.	1	LS	Piping and Valve Additions	$	40,000.00	$	40,000.00
3.	1	LS	SCADA Hardware and Programming Modifications	$	20,000.00	$	20,000.00
4.	1	LS	Electrical Modifications	$	40,000.00	$	40,000.00
			SUBTOTAL - CONSTRUCTION			**$**	**200,000.00**
			CONTINGENCY @ 10%+/-			**$**	**20,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST			**$**	**220,000.00**
			TECHNICAL SERVICES @ 25% +/-			**$**	**55,000.00**
			LEGAL & ADMINISTRATIVE			**$**	**1,000.00**
			TOTAL ESTIMATED PROJECT COST			**$**	**276,000.00**

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TOWN OF NAGS HEAD, N.C.
UPGRADE ELECTRICAL @ GULL STREET PUMP STATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace Electrical Motor Control Center and install Variable Frequency Drives at Gull Street Pump Station to replace aging equipment, improve pumping control, and recognize energy savings.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	New 800 Amp 277/480 VAC Motor Control Center with Variable Frequency Drives for three (3) 125 HP High Service Pumps - Installed	$ 300,000.00	$ 300,000.00
2.	1	LS	800 Amp Main Breaker	$ 25,000.00	$ 25,000.00
3.	1	LS	SPD Surge Protection Device	$ 10,000.00	$ 10,000.00
4.	1	LS	Low Voltage Transformer	$ 10,000.00	$ 10,000.00
5.	1	LS	Low Voltage Panels	$ 5,000.00	$ 5,000.00
6.	1	LS	Conduit and Wire	$ 35,000.00	$ 35,000.00
7.	1	LS	Ductless Split Air Conditioning	$ 10,000.00	$ 10,000.00
8.	1	LS	SCADA Hardware and Programming Modifications	$ 20,000.00	$ 20,000.00
9.	1	LS	Miscellaneous	$ 20,000.00	$ 20,000.00
			SUBTOTAL - CONSTRUCTION		**$ 435,000.00**
			CONTINGENCY @ 10%+/-		**$ 44,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 479,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 120,000.00**
			LEGAL & ADMINISTRATIVE		**$ 1,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 600,000.00**

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TOWN OF NAGS HEAD, N.C.
REPLACE EMERGENCY GENERATOR @ GULL STREET PUMP STATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace Emergency Standby Generator and Auto-transfer Switch at Gull Street Pump Station to replace aging equipment, and improve emergency standby capability and safety.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	New Sound Attenuated 400 KW Generator with Enclosure and Sub-base Fuel Tank	$ 200,000.00	$ 200,000.00
2.	1	LS	800 Amp Autotransfer Switch	$ 40,000.00	$ 40,000.00
3.	1	LS	Conduit and Wire	$ 10,000.00	$ 10,000.00
4.	1	LS	SCADA Programming Modifications	$ 5,000.00	$ 5,000.00
5.	1	LS	Miscellaneous	$ 10,000.00	$ 10,000.00
			SUBTOTAL - CONSTRUCTION		**$ 265,000.00**
			CONTINGENCY @ 10%+/-		**$ 26,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 291,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 73,000.00**
			LEGAL & ADMINISTRATIVE		**$ 1,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 365,000.00**

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TOWN OF NAGS HEAD, N.C.
REPLACE ASBESTOS CEMENT PIPELINES
WRIGHTSVILLE AVENUE AND MEMORIAL AVENUE AREA
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace aging Asbestos Cement Pipe in the Wrightsville Avenue and Memorial Avenue area as part of a systematic ACP replacement throughout Town.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	27,220	LF	6" PVC (C-900)	$ 20.00	$ 544,400.00
2.	2	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 5,200.00
3.	11	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 30,800.00
4.	8	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 26,400.00
5.	4,800	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 24,000.00
6.	37	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 129,500.00
7.	5	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 7,500.00
8.	17	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 18,700.00
9.	18	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 13,500.00
10.	18	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 18,000.00
11.	407	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 244,200.00
12.	4,740	LF	3/4" SERVICE TUBING	$ 6.00	$ 28,440.00
13.	6,800	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 136,000.00
14.	7	EA	1" WATER SERVICE CHANGE-OVER	$ 600.00	$ 4,200.00
15.	20	LF	1" SERVICE TUBING	$ 7.00	$ 140.00
16.	240	LF	1" SERVICE TUBING W/ MOLE	$ 25.00	$ 6,000.00
17.	5	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 5,000.00
18.	100	LF	2" WATER SERVICE	$ 25.00	$ 2,500.00
19.	3,750	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 431,250.00
20.	1,140	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 68,400.00
21.	1,000	CY	SELECT BACKFILL	$ 20.00	$ 20,000.00
22.	500	TN	STABILIZATION STONE	$ 30.00	$ 15,000.00
23.	140	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 14,000.00
24.	1,000	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 5,000.00
25.	5,000	LF	SILT FENCE	$ 5.00	$ 25,000.00
26.	1	LS	TESTING ALLOWANCE		$ 15,000.00
			SUBTOTAL - CONSTRUCTION		**$ 1,838,130.00**
			CONTINGENCY @ 10%+/-		**$ 184,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 2,022,130.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 505,870.00**
			LEGAL & ADMINISTRATIVE		**$ 20,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 2,548,000.00**

TOWN OF NAGS HEAD, N.C.
REPLACE ASBESTOS CEMENT PIPELINES
VISTA COLONY
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace aging Asbestos Cement Pipe in the Vista Colony area as part of a systematic ACP replacement throughout Town.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	11,250	LF	6" PVC (C-900)	$ 20.00	$ 225,000.00
2.	1	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 2,600.00
3.	2	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 5,600.00
4.	3,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 15,000.00
5.	14	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 49,000.00
6.	3	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 3,300.00
7.	8	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 6,000.00
8.	8	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 8,000.00
9.	155	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 93,000.00
10.	1,540	LF	3/4" SERVICE TUBING	$ 6.00	$ 9,240.00
11.	3,120	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 62,400.00
12.	1	EA	1" WATER SERVICE CHANGE-OVER	$ 700.00	$ 700.00
13.	20	LF	1" SERVICE TUBING	$ 8.00	$ 160.00
14.	1	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 1,000.00
15.	20	LF	2" WATER SERVICE	$ 25.00	$ 500.00
16.	1,155	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 132,825.00
17.	300	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 18,000.00
18.	400	CY	SELECT BACKFILL	$ 20.00	$ 8,000.00
19.	200	TN	STABILIZATION STONE	$ 30.00	$ 6,000.00
20.	50	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 5,000.00
21.	700	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 3,500.00
22.	2,500	LF	SILT FENCE	$ 5.00	$ 12,500.00
23.	1	LS	TESTING ALLOWANCE		$ 6,000.00
			SUBTOTAL - CONSTRUCTION		**$ 673,325.00**
			CONTINGENCY @ 10%+/-		**$ 67,675.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 741,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 185,000.00**
			LEGAL & ADMINISTRATIVE		**$ 10,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 936,000.00**

TOWN OF NAGS HEAD, N.C.
REPLACE ASBESTOS CEMENT PIPELINES
OLD NAGS HEAD COVE
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace aging Asbestos Cement Pipe in the Old Nags Head Cove area as part of a systematic ACP replacement throughout Town.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	19,280	LF	6" PVC (C-900)	$ 20.00	$ 385,600.00
2.	6	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 15,600.00
3.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
4.	4,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 20,000.00
5.	31	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 108,500.00
6.	9	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 9,900.00
7.	8	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 6,000.00
8.	8	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 8,000.00
9.	379	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 227,400.00
10.	3,800	LF	3/4" SERVICE TUBING	$ 6.00	$ 22,800.00
11.	7,560	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 151,200.00
12.	14	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 14,000.00
13.	280	LF	2" WATER SERVICE	$ 25.00	$ 7,000.00
14.	2,850	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 327,750.00
15.	510	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 30,600.00
16.	500	CY	SELECT BACKFILL	$ 20.00	$ 10,000.00
17.	300	TN	STABILIZATION STONE	$ 30.00	$ 9,000.00
18.	100	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 10,000.00
19.	700	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 3,500.00
20.	3,000	LF	SILT FENCE	$ 5.00	$ 15,000.00
21.	1	LS	TESTING ALLOWANCE		$ 10,000.00
			SUBTOTAL - CONSTRUCTION		**$ 1,395,150.00**
			CONTINGENCY @ 10%+/-		**$ 139,850.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 1,535,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 384,000.00**
			LEGAL & ADMINISTRATIVE		**$ 15,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 1,934,000.00**

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TOWN OF NAGS HEAD, N.C.
REPLACE ASBESTOS CEMENT PIPELINES
OLD OREGON INLET ROAD
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace aging 8" Asbestos Cement Pipe along Old Oregon Inlet Road as part of a systematic ACP replacement throughout Town.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	9,000	LF	8" PVC (C-900)	$ 30.00	$ 270,000.00
2.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
3.	5,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 25,000.00
4.	10	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 35,000.00
5.	3	EA	8" GATE VALVE & BOX	$ 1,100.00	$ 3,300.00
6.	4	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 3,000.00
7.	4	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 4,000.00
8.	53	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 31,800.00
9.	680	LF	3/4" SERVICE TUBING	$ 6.00	$ 4,080.00
10.	760	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 15,200.00
11.	740	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 85,100.00
12.	480	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 28,800.00
13.	200	CY	SELECT BACKFILL	$ 20.00	$ 4,000.00
14.	100	TN	STABILIZATION STONE	$ 30.00	$ 3,000.00
15.	50	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 5,000.00
16.	500	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,500.00
17.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
18.	1	LS	TESTING ALLOWANCE		$ 5,000.00
			SUBTOTAL - CONSTRUCTION		**$ 530,580.00**
			CONTINGENCY @ 10%+/-		**$ 53,420.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 584,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 146,000.00**
			LEGAL & ADMINISTRATIVE		**$ 5,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 735,000.00**

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TOWN OF NAGS HEAD, N.C.
FIRE HYDRANT INSTALLATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install new Fire Hydrants at underserved locations within the distribution system:**
(1) Corner of W. Sandpiper Terrace and Roanoke Way
(2) South Chipper's Court #1

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	2	EA	6" x 6" Tapping Sleeve and Valve	$ 3,100.00	$ 6,200.00
2.	2	EA	Fire Hydrant Assemblies	$ 4,200.00	$ 8,400.00
			SUBTOTAL - CONSTRUCTION		**$ 14,600.00**
			CONTINGENCY @ 10%+/-		**$ 5,400.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 20,000.00**

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TOWN OF NAGS HEAD, N.C.
FIRE HYDRANT INSTALLATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install new Fire Hydrants at underserved locations within the distribution system:**
(1) South Chipper's Court #2
(2) Corner of Old Oregon Inlet Road and Westside Court

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	2	EA	6" x 6" Tapping Sleeve and Valve	$ 3,100.00	$ 6,200.00
2.	2	EA	Fire Hydrant Assemblies	$ 4,200.00	$ 8,400.00
			SUBTOTAL - CONSTRUCTION		**$ 14,600.00**
			CONTINGENCY @ 10%+/-		**$ 5,400.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 20,000.00**

TOWN OF NAGS HEAD, N.C.
LIQUID SODIUM HYPOCHLORITE CHEMICAL FEED CONVERSION
EIGHTH STREET WATER PLANT
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install liquid sodium hypochlorite feed systems to replace the existing gas chlorine system.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	Mobilization/Demolition	$ 3,000.00	$ 3,000.00
2.	2	EA	Peristaltic Chlorine Feed Pumps Installed	$ 10,000.00	$ 20,000.00
3.	2	EA	Double Walled Sodium Hypochlorite Storage Tank	$ 5,000.00	$ 10,000.00
4.	1	LS	Piping/Venting Modifications/Installation	$ 5,000.00	$ 5,000.00
5.	1	LS	Ductless Split Air Conditioning	$ 10,000.00	$ 10,000.00
6.	1	LS	SCADA/Controls Modifications	$ 15,000.00	$ 15,000.00
7.	1	LS	Electrical/Ventilation Modifications	$ 15,000.00	$ 15,000.00
			SUBTOTAL - CONSTRUCTION		**$ 78,000.00**
			CONTINGENCY @ 10%+/-		**$ 8,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 86,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 22,000.00**
			LEGAL & ADMINISTRATIVE		**$ -**
			TOTAL ESTIMATED PROJECT COST		**$ 108,000.00**

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TOWN OF NAGS HEAD, N.C.
LIQUID SODIUM HYPOCHLORITE CHEMICAL FEED CONVERSION
GULL STREET PUMP STATION
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Install liquid sodium hypochlorite feed systems to replace the existing gas chlorine system.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	Mobilization/Demolition	$ 3,000.00	$ 3,000.00
2.	2	EA	Peristaltic Chlorine Feed Pumps Installed	$ 10,000.00	$ 20,000.00
3.	2	EA	Double Walled Sodium Hypochlorite Storage Tank	$ 5,000.00	$ 10,000.00
4.	1	LS	Piping/Venting Modifications/Installation	$ 5,000.00	$ 5,000.00
5.	1	LS	Ductless Split Air Conditioning	$ 10,000.00	$ 10,000.00
6.	1	LS	SCADA/Controls Modifications	$ 15,000.00	$ 15,000.00
7.	1	LS	Electrical/Ventilation Modifications	$ 15,000.00	$ 15,000.00
			SUBTOTAL - CONSTRUCTION		**$ 78,000.00**
			CONTINGENCY @ 10%+/-		**$ 8,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 86,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 22,000.00**
			LEGAL & ADMINISTRATIVE		**$ -**
			TOTAL ESTIMATED PROJECT COST		**$ 108,000.00**

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TOWN OF NAGS HEAD, N.C.
WATER SYSTEM COMPREHENSIVE PLAN UPDATE &
SYSTEM DEVELOPMENT FEE STUDY
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Update the 2018 Water System Comprehensive Plan including the hydraulic analysis, asset condition and criticality assessment, and Water System Capital Improvements Plan. Obtain and evaluate financial information, extract pertinent data for System Development Fee calculations, prepare summaries and report, and review with the Owner to meet state statutory requirements.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	Reconaissance, Discovery, Asset Condition Assessment	$ 8,000.00	$ 8,000.00
2.	1	LS	Update Hydraulic Model and Analysis	$ 30,000.00	$ 30,000.00
3.	1	LS	Prepare Cost Estimates, CIP Sheets and WSCP Report	$ 22,000.00	$ 22,000.00
4.	1	LS	Water System Development Fee Study	$ 13,200.00	$ 13,200.00
			TOTAL ESTIMATED PROJECT COST		**$ 73,200.00**

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TOWN OF NAGS HEAD, N.C.
500,000 GALLON ELEVATED WATER STORAGE TANK
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Installation of a new elevated storage tank in the central portion of the water system (near Town Hall) provides the best long term, stable solution for meeting present and future demands while increasing low pressures in the central portion of the system and reducing high pressures to a more typical and acceptable range. An altitude valve and pressure transducer would be installed to provide proper water level monitoring and control of the high service pumps with the new tank in service.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1	LS	Piling Installation	$ 50,000.00	$ 50,000.00
2.	1	LS	Foundation	$ 150,000.00	$ 150,000.00
3.	1	LS	Tank Fabrication and Erection	$ 1,550,000.00	$ 1,550,000.00
4.	1	LS	Site Piping/Grading	$ 75,000.00	$ 75,000.00
5.	1	LS	Altitude Valve & Vault	$ 50,000.00	$ 50,000.00
6.	1	LS	Field Painting	$ 350,000.00	$ 350,000.00
7.	1	LS	SCADA RTU & Electrical	$ 50,000.00	$ 50,000.00
8.	1	LS	Testing Allowance	$ 25,000.00	$ 25,000.00
			SUBTOTAL - CONSTRUCTION		**$ 2,300,000.00**
			CONTINGENCY @ 10%+/-		**$ 230,000.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 2,530,000.00**
			TECHNICAL SERVICES @ 15% +/-		**$ 380,000.00**
			LEGAL & ADMINISTRATIVE		**$ 10,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 2,920,000.00**

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TOWN OF NAGS HEAD, N.C.
W. CAROLINIAN CIRCLE
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Extend new 6" diameter water main on W. Carolinian Court to complete a looped connection for improved fire flow availability.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION		UNIT PRICE		COST
1.	600	LF	6" PVC (C-900)	$	20.00	$	12,000.00
2.	2	EA	TIE INTO EXISTING 6" PIPELINE	$	2,600.00	$	5,200.00
3.	200	LB	MISC. DUCTILE IRON FITTINGS	$	5.00	$	1,000.00
4.	1	EA	NEW FIRE HYDRANT & VALVE ASSEMBLY	$	4,600.00	$	4,600.00
5.	2	EA	6" GATE VALVE & BOX	$	1,100.00	$	2,200.00
6.	1	EA	1" MANUAL AIR RELEASE VALVE	$	750.00	$	750.00
7.	2	EA	3/4" WATER SERVICE CHANGE-OVER	$	600.00	$	1,200.00
8.	40	LF	3/4" SERVICE TUBING	$	6.00	$	240.00
9.	45	LF	CONCRETE DRIVEWAY RESTORATION	$	115.00	$	5,175.00
10.	30	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$	60.00	$	1,800.00
11.	20	CY	SELECT BACKFILL	$	20.00	$	400.00
12.	20	TN	STABILIZATION STONE	$	30.00	$	600.00
13.	4	EA	STRAW WATTLE CHECK DAM	$	100.00	$	400.00
14.	100	SY	MATTING FOR EROSION CONTROL	$	5.00	$	500.00
15.	100	LF	SILT FENCE	$	5.00	$	500.00
16.	1	LS	TESTING ALLOWANCE			$	1,000.00
			SUBTOTAL - CONSTRUCTION			**$**	**37,565.00**
			CONTINGENCY @ 10%+/-			**$**	**3,935.00**
			TOTAL ESTIMATED CONSTRUCTION COST			**$**	**41,500.00**
			TECHNICAL SERVICES @ 25% +/-			**$**	**10,500.00**
			LEGAL & ADMINISTRATIVE			**$**	**2,000.00**
			TOTAL ESTIMATED PROJECT COST			**$**	**54,000.00**

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TOWN OF NAGS HEAD, N.C.
VILLA DUNES DRIVE AND S. OLD NAGS HEAD ROAD
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace existing 6"water main with 8" main from S. Croatan Hwy to the end of Villa Dunes Drive. Replace a portion of 6" water main with 8" from Villa Dunes Drive along S. Old Nags Head Wood Road to improve available fire flow.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	7,000	LF	8" PVC (C-900)	$ 30.00	$ 210,000.00
2.	1	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 2,800.00
3.	1	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 2,600.00
4.	6	EA	TIE INTO EXISTING 4" PIPELINE	$ 2,000.00	$ 12,000.00
5.	1,000	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 5,000.00
6.	12	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 42,000.00
7.	2	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 3,000.00
8.	1	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 1,100.00
9.	2	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 1,500.00
10.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
11.	36	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 21,600.00
12.	400	LF	3/4" SERVICE TUBING	$ 6.00	$ 2,400.00
13.	640	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 12,800.00
14.	1	EA	1" WATER SERVICE CHANGE-OVER	$ 600.00	$ 600.00
15.	40	LF	1" SERVICE TUBING W/ MOLE	$ 25.00	$ 1,000.00
16.	4	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 4,000.00
17.	40	LF	2" SERVICE TUBING W/ MOLE	$ 25.00	$ 1,000.00
18.	140	LF	2" WATER SERVICE	$ 25.00	$ 3,500.00
19.	345	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 39,675.00
20.	720	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 43,200.00
21.	60	LF	STONE DRIVEWAY RESTORATION	$ 10.00	$ 600.00
22.	100	CY	SELECT BACKFILL	$ 20.00	$ 2,000.00
23.	60	TN	STABILIZATION STONE	$ 30.00	$ 1,800.00
24.	30	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 3,000.00
25.	500	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,500.00
26.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
27.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 426,175.00**
			CONTINGENCY @ 10%+/-		**$ 42,325.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 468,500.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 116,500.00**
			LEGAL & ADMINISTRATIVE		**$ 5,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 590,000.00**

TOWN OF NAGS HEAD, N.C.
W. SOUNDSIDE ROAD AND W. BARACUDA ROAD
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Extend "cross lot" connection of new 6" water main between the water mains located on W. Soundside Road and W. Baracuda Road to improve available fire flow in the Old Nags Head Cove area.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	600	LF	6" PVC (C-900)	$ 20.00	$ 12,000.00
2.	2	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 5,200.00
3.	300	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 1,500.00
4.	1	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 3,500.00
5.	2	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 2,200.00
6.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
7.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
8.	100	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 6,000.00
9.	20	CY	SELECT BACKFILL	$ 20.00	$ 400.00
10.	20	TN	STABILIZATION STONE	$ 30.00	$ 600.00
11.	4	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 400.00
12.	0.20	AC	CLEARING & GRUBBING	$ 10,000.00	$ 2,000.00
13.	100	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 500.00
14.	100	LF	SILT FENCE	$ 5.00	$ 500.00
15.	1	LS	TESTING ALLOWANCE		$ 1,000.00
			SUBTOTAL - CONSTRUCTION		**$ 37,550.00**
			CONTINGENCY @ 10%+/-		**$ 3,950.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 41,500.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 10,500.00**
			LEGAL & ADMINISTRATIVE (EASEMENT)		**$ 12,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 64,000.00**

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TOWN OF NAGS HEAD, N.C.
COBIA WAY, W. OLD COVE ROAD, W. SANDPIPER TERRACE & S. ROANOKE WAY
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace existing 6" Asbestos Cement water main with new 8" main from Hwy 158 along W. Old Cove Road, Cobia Way, W. Sandpiper Terrace, S. Roanoke Way, and install a 6" connection to S. Links Drive to increase available fire flow.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	4,500	LF	8" PVC (C-900)	$ 30.00	$ 135,000.00
2.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
3.	1	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 2,800.00
4.	1	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 2,600.00
5.	800	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 4,000.00
6.	4	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 14,000.00
7.	2	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 3,000.00
8.	1	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 1,100.00
9.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
10.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
11.	77	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 46,200.00
12.	680	LF	3/4" SERVICE TUBING	$ 6.00	$ 4,080.00
13.	1,720	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 34,400.00
14.	1	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 1,000.00
15.	20	LF	2" WATER SERVICE	$ 25.00	$ 500.00
16.	555	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 63,825.00
17.	210	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 12,600.00
18.	1,200	SY	GOLF COURSE RESTORATION	$ 15.00	$ 18,000.00
19.	100	CY	SELECT BACKFILL	$ 20.00	$ 2,000.00
20.	60	TN	STABILIZATION STONE	$ 30.00	$ 1,800.00
21.	30	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 3,000.00
22.	0.10	AC	CLEARING & GRUBBING	$ 10,000.00	$ 1,000.00
23.	500	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,500.00
24.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
25.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 363,955.00**
			CONTINGENCY @ 10%+/-		**$ 36,045.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 400,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 100,000.00**
			LEGAL & ADMINISTRATIVE		**$ 5,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 505,000.00**

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TOWN OF NAGS HEAD, N.C.
OCEAN WATCH COURT TO E. BAYMEADOW DRIVE
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace existing 2" water main that serves E. Baymeadow Drive with 6" water main. Install casing from Ocean Watch Court to east side of S. Virginia Dare Trail to increase available fire flow.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	450	LF	6" PVC (C-900)	$ 20.00	$ 9,000.00
2.	100	LF	6" RJDIP	$ 53.00	$ 5,300.00
3.	2	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 6,600.00
4.	2	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 5,200.00
5.	200	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 1,000.00
6.	2	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 2,200.00
7.	70	LF	12" STEEL CASING (JACK & BORE)	$ 180.00	$ 12,600.00
8.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
9.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
10.	6	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 3,600.00
11.	120	LF	3/4" SERVICE TUBING	$ 6.00	$ 720.00
12.	90	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 10,350.00
13.	20	CY	SELECT BACKFILL	$ 20.00	$ 400.00
14.	20	TN	STABILIZATION STONE	$ 30.00	$ 600.00
15.	4	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 400.00
16.	100	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 500.00
17.	100	LF	SILT FENCE	$ 5.00	$ 500.00
18.	1	LS	TESTING ALLOWANCE		$ 1,000.00
			SUBTOTAL - CONSTRUCTION		**$ 61,720.00**
			CONTINGENCY @ 10%+/-		**$ 6,280.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 68,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 17,000.00**
			LEGAL & ADMINISTRATIVE		**$ 2,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 87,000.00**

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TOWN OF NAGS HEAD, N.C.
LONE CEDAR COURT, VIRGINIA DARE CAUSEWAY
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Extend new 8" water main and replace 6" main on Lone Cedar Court. New 8" main to extend from existing 12" main on US Hwy 158 near E. Gray Eagle Street along Virginia Dare Trail Causeway into Lone Cedar Court to increase available fire flow.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	1,400	LF	8" PVC (C-900)	$ 30.00	$ 42,000.00
2.	1	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 2,800.00
3.	1	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 2,600.00
4.	500	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 2,500.00
5.	2	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 7,000.00
6.	1	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 1,500.00
7.	1	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 1,100.00
8.	100	LF	16" STEEL CASING (BORE & JACK)	$ 240.00	$ 24,000.00
9.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
10.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
11.	9	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 5,400.00
12.	140	LF	3/4" SERVICE TUBING	$ 6.00	$ 840.00
13.	80	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 1,600.00
14.	1	EA	2" WATER SERVICE CONNECTION	$ 1,000.00	$ 1,000.00
15.	20	LF	2" WATER SERVICE	$ 25.00	$ 500.00
16.	90	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 10,350.00
17.	90	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 5,400.00
18.	15	LF	STONE DRIVEWAY RESTORATION	$ 10.00	$ 150.00
19.	200	CY	SELECT BACKFILL	$ 20.00	$ 4,000.00
20.	60	TN	STABILIZATION STONE	$ 30.00	$ 1,800.00
21.	16	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 1,600.00
22.	300	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 1,500.00
23.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
24.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 124,890.00**
			CONTINGENCY @ 10%+/-		**$ 12,610.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 137,500.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 34,500.00**
			LEGAL & ADMINISTRATIVE		**$ 3,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 175,000.00**

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TOWN OF NAGS HEAD, N.C.
POND ISLAND
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Extend new 8" water main to W. Marina Drive at Pond Island to create and 8" loop for improved fire flow availability. New 8" main will extend from the existing 12" main on US Hwy 158 near E. Gray Eagle Street along Virginia Dare Trail Causeway to W. Marina Drive.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	7,800	LF	8" PVC (C-900)	$ 30.00	$ 234,000.00
2.	200	LF	8" RJDIP	$ 70.00	$ 14,000.00
3.	1,300	LF	10" HDPE DIRECTIONAL BORE	$ 120.00	$ 156,000.00
4.	1	EA	TIE INTO EXISTING 12" PIPELINE	$ 3,300.00	$ 3,300.00
5.	1	EA	TIE INTO EXISTING 6" PIPELINE	$ 2,600.00	$ 2,600.00
6.	1,500	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 7,500.00
7.	2	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 3,000.00
8.	200	LF	16" STEEL CASING (JACK & BORE)	$ 240.00	$ 48,000.00
9.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
10.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
11.	90	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 10,350.00
12.	450	LF	LATTICE CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 51,750.00
13.	740	LF	ASPHALT ROADWAY/DRIVEWAY REPAIR	$ 60.00	$ 44,400.00
14.	75	LF	STONE DRIVEWAY RESTORATION	$ 10.00	$ 750.00
15.	200	CY	SELECT BACKFILL	$ 20.00	$ 4,000.00
16.	60	TN	STABILIZATION STONE	$ 30.00	$ 1,800.00
17.	30	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 3,000.00
18.	500	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,500.00
19.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
20.	1	LS	TESTING ALLOWANCE		$ 5,000.00
			SUBTOTAL - CONSTRUCTION		**$ 596,200.00**
			CONTINGENCY @ 10%+/-		**$ 59,800.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 656,000.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 164,000.00**
			LEGAL & ADMINISTRATIVE		**$ 5,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 825,000.00**

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TOWN OF NAGS HEAD, N.C.
S. COLONY SOUTH DRIVE
FIRE FLOW IMPROVEMENTS
PRELIMINARY OPINION OF PROBABLE PROJECT COST
APRIL, 2018

Description: **Replace 6" water main loop with 8" water main along portions of the north and south ends of S. Colony South Drive off Old Oregon Inlet Drive in order to improve available fire flow.**

CONSTRUCTION:

ITEM NO.	QTY.	UNIT	DESCRIPTION	UNIT PRICE	COST
1.	4,300	LF	8" PVC (C-900)	$ 30.00	$ 129,000.00
2.	160	LF	8" RJDIP	$ 70.00	$ 11,200.00
3.	2	EA	TIE INTO EXISTING 8" PIPELINE	$ 2,800.00	$ 5,600.00
4.	1,200	LB	MISC. DUCTILE IRON FITTINGS	$ 5.00	$ 6,000.00
5.	9	EA	6" FIRE HYDRANT CONNECTION	$ 3,500.00	$ 31,500.00
6.	2	EA	8" GATE VALVE & BOX	$ 1,500.00	$ 3,000.00
7.	1	EA	6" GATE VALVE & BOX	$ 1,100.00	$ 1,100.00
8.	160	LF	16" STEEL CASING (JACK & BORE)	$ 240.00	$ 38,400.00
9.	1	EA	1" MANUAL AIR RELEASE VALVE	$ 750.00	$ 750.00
10.	1	EA	2" TEMPORARY BLOW-OFF ASSEMBLY	$ 1,000.00	$ 1,000.00
11.	94	EA	3/4" WATER SERVICE CHANGE-OVER	$ 600.00	$ 56,400.00
12.	960	LF	3/4" SERVICE TUBING	$ 6.00	$ 5,760.00
13.	1,840	LF	3/4" SERVICE TUBING W/ MOLE	$ 20.00	$ 36,800.00
14.	720	LF	CONCRETE DRIVEWAY RESTORATION	$ 115.00	$ 82,800.00
15.	200	CY	SELECT BACKFILL	$ 20.00	$ 4,000.00
16.	60	TN	STABILIZATION STONE	$ 30.00	$ 1,800.00
17.	24	EA	STRAW WATTLE CHECK DAM	$ 100.00	$ 2,400.00
18.	400	SY	MATTING FOR EROSION CONTROL	$ 5.00	$ 2,000.00
19.	500	LF	SILT FENCE	$ 5.00	$ 2,500.00
20.	1	LS	TESTING ALLOWANCE		$ 3,000.00
			SUBTOTAL - CONSTRUCTION		**$ 425,010.00**
			CONTINGENCY @ 10%+/-		**$ 42,490.00**
			TOTAL ESTIMATED CONSTRUCTION COST		**$ 467,500.00**
			TECHNICAL SERVICES @ 25% +/-		**$ 116,500.00**
			LEGAL & ADMINISTRATIVE		**$ 3,000.00**
			TOTAL ESTIMATED PROJECT COST		**$ 587,000.00**

APPENDIX

AA

Town of Nags Head, NC
Water System
Capital Improvements Plan

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	South Tower Elevated Storage Tank Rehabilitation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to clean, repair and repaint the South Tower Elevated Storage Tank.

5. Type of Project or Acquisition

- ☐ Replacement
- ☐ New
- ☑ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The South Tower EST was constructed in 1988, and was most recently painted in 2013. The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service. With timely and proper maintenance, the useful service life of a steel water storage tanks can be greatly extended. Should rehabilitation be delayed such that coating adhesion failure occurs, the cost for repair will increase substantially due to the requirements associated with containment and sandblasting.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:		$274,450			$274,450
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:	$274,450											$274,450
Grants:												
Financing:												
Other:												
Other:												
Totals:	$274,450											$274,450

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	12" Water Main Installation - W. Danube Street to Diamond Street	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This request is to install approximately 1,350 feet of water line from Diamond Street to Danube Street on the west side of U.S. Hwy 158.

5. Type of Project or Acquisition

- ☐ Replacement
- ☑ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

Complete the 12" main extension on the west side of US 158 from the Douglas A. Remaley Fire Station 16 to Deering Street. This project will provide a redundant water main to that provided by the 12" transmission main on the Beach Road, and will provide an additional source of water to South Ridge and Nags Head Cove.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:		$235,000			$235,000
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:	$235,000											$235,000
Grants:												
Financing:												
Other:												
Other:												
Totals:	$235,000											$235,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Eighth Street Water Plant - Generator Transfer Switch Replacement	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to replace the existing manual transfer switch for emergency generator operations with an auto-transfer switch at the Eighth Street Water Plant.

5. Type of Project or Acquisition

☑	Replacement	☐	New
☐	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

The existing generator at the Eighth Street Pumping Station is a manual transfer switch which does not meet National Electric Code requirements. An automatic transfer switch is required for use with a permanently mounted emergency generator such as that located at the Eighth Street Water Plant. With an auto-transfer switch, the generator will automatically start and supply emergency backup power during a power outage without service disruption. This offers a greater amount of protection for pumping and other motorized equipment, as well as safety for employees as they will no longer be required to manually switch power to the generator.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:		$25,000			$25,000
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:	$25,000											$25,000
Grants:												
Financing:												
Other:												
Other:												
Totals:	$25,000											$25,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Fire Hydrant Installation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes the addtion of two (2) new hydrants within the Town's water system: (1) Corner of Buccaneer Drive and Windjammer Road, (2) Corner of Windjammer Road and Lookout Road

5. Type of Project or Acquisition

☐	Replacement	☑	New
☐	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

Installation of new fire hydrants as necessary to serve the community as the system expands.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:		$18,600			$18,600
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:	$18,600											$18,600
Grants:												
Financing:												
Other:												
Other:												
Totals:	$18,600											$18,600

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	6" ACP Water Main Replacement - Barnes Street beneath Bypass Road	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

Replace segment of 6" ACP under the Bypass Road that serves the Vista Colony area.

5. Type of Project or Acquisition

☑	Replacement	☐	New
☐	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

The proposed project will replace approximately 1,400 LF of 6" ACP from the Beach Road and extending west under U.S. Hwy 158 to the Vista Colony entrance. This project will replace aging Asbestos Cement Pipe in an area of high demand that is susceptible to recurring high pressures on a routine basis.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:		$235,000			$235,000
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:		$235,000										$235,000
Grants:												
Financing:												
Other:												
Other:												
Totals:		$235,000										$235,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Eighth Street Elevated Storage Tank Rehabilitation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to clean, repair and repaint the Eighth Street Elevated Storage Tank.

5. Type of Project or Acquisition

☐	Replacement	☐	New
☑	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

The Eighth Street EST was constructed in 2005, and was most recently painted in 2013. The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service. With timely and proper maintenance, the useful service life of a steel water storage tanks can be greatly extended. Should rehabilitation be delayed such that coating adhesion failure occurs, the cost for repair will increase substantially due to the requirements associated with containment and sandblasting.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:		$274,450			$274,450
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:			$274,450									$274,450
Grants:												
Financing:												
Other:												
Other:												
Totals:			$274,450									$274,450

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	12" Dual Water Main around Jockey's Ridge	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes extension of approximately 6,000 LF of 12" water main on U.S. Hwy 158 from the south to the north side of Jockey's Ridge State Park.

5. Type of Project or Acquisition

- ☐ Replacement
- ☑ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The 2018 Water System Comprehensive Plan included a hydraulic evaluation of the Town's water system. The project described above is a high priority water distribution extension required to help stabilize system pressures and to provide redundancy to the critical 12" transmission main located on S. Virginia Dare Trail.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:		$60,000			$60,000
FY 2022:		$565,000			$565,000
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:												
Grants:												
Financing:			$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$154,114	$770,570
Other:												
Other:												
Totals:			$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$154,114	$770,570

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Gull Street Pump Station Improvements	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

Project consists of three recommended improvements: (1) installation of an additional high service pump, (2) replacement of the existing Motor Control Center and Soft Starters, and (3) replacement of the existing emergency standby generator and auto-transfer switch at the Gull Street Pumping Station.

5. Type of Project or Acquisition

- ☑ Replacement
- ☐ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The 2018 Water System Comprehensive Plan recommends addition of a third high service pump with controls modifications to improve system performance and provide more stable system pressures. The existing electrical equipment is 36 years old, and quickly approaching the end of its useful service life. The Motor Control Center and soft starters are critical items of equipment for operation of the high service pumps. The Motor Control Center can be outfitted with variable frequency drives to control operations of each high service pump to reduce heat and motor wear, reduce the effects of water surge/hammer, assist with pressure control, and reduce energy consumption. The emergency generator and automatic transfer switch are critical to provide uninterrupted water supply during a power outage. The standby equipment provides automatic standby operation and continued pumping from the Gull Street Ground Storage Tank to the distribution system and South Tower Elevated Storage Tank during a power loss event. Each of the recommended improvements incorporate electrical components within the Gull Street pumping facility. As such, a single project is warranted to include each component.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:		$125,000			$125,000
FY 2022:		$1,116,000			$1,116,000
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:												
Grants:												
Financing:			$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$306,008	$1,530,040
Other:												
Other:												
Totals:			$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$306,008	$1,530,040

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Miscellaneous ACP Water Main Replacement	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes the replacement of existing asbestos cement pipe in older ares of the Town's water system.

5. Type of Project or Acquisition

- [x] Replacement
- [ ] New
- [ ] Renovation
- [ ] Expansion
- [ ] Equipment
- [ ] Land

6. Project Justification

The Town routinely experiences high pressures due primarily to the long, linear system configuration. High pressures in combination with aging asbestos cement pipes that are approaching the end of their useful service lives yields significant potential for pipe failure. The primary areas of focus are the Wrightsville and Memorial Avenue area, Vista Colony, Old Nags Head Cove, and Old Oregon Inlet Road.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:		$300,000			$300,000
FY 2022:		$300,000			$300,000
FY 2023:		$300,000			$300,000
FY 2024:		$300,000			$300,000
FY 2025:		$300,000			$300,000
FY 2026:		$300,000			$300,000
FY 2027:		$300,000			$300,000
FY 2028:		$300,000			$300,000
Beyond FY 2028:		$300,000			$300,000

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:			$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$2,700,000
Grants:												
Financing:												
Other:												
Other:												
Totals:			$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$2,700,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Fire Hydrant Installation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes the addtion of four (4) new hydrants within the Town's water system: (1) Corner of W. Sandpiper Terrace and Roanoke Way, (2) Two hydrants at S. Chipper's Court, and (3) Corner of Old Oregon Inlet Road and Westside Court

5. Type of Project or Acquisition

☑	Replacement	☑	New
☐	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

Installation of new fire hydrants as necessary to serve the community as the system expands.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:		$20,000			$20,000
FY 2021:		$20,000			$20,000
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:		$20,000	$20,000									$40,000
Grants:												
Financing:												
Other:												
Other:												
Totals:		$20,000	$20,000									$40,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Liquid Chlorine Conversion at Eighth Street and Gull Street Pump Stations	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes design, permitting and construction associated with conversion of the existing gas chlorine feed systems to liquid sodium hypochlorite feed systems.

5. Type of Project or Acquisition

- ☑ Replacement
- ☐ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

Although the gas chlorine feed systems at both pump station sites are functional, chlorine gas is a deadly hazard. Chlorine gas is shipped and stored under pressure as a liquid typicaly in 100 lb cylinders. If a chlorine leak occurs, the liquid turns to gas which appears as a yellow-green color. Because the gas is heavier than air, it spreads rapidly across the ground exhibiting a pungent irritating odor like bleach. Chlorine exposure can lead to blurred vision, painful skin irritation, burning in the nose, throat and eyes, difficulty breathing, fluid in the lungs, nausea, vomiting, and possibly death. Many utilities across the nation have actively been converting to liquid sodium hypochlorite which is much safer for storage and handling.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:		$44,000			$44,000
FY 2025:		$172,000			$172,000
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:						$44,000	$172,000					$216,000
Grants:												
Financing:												
Other:												
Other:												
Totals:						$44,000	$172,000					$216,000

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	South Tower EST Replace w/ Rehabilitation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to clean, repair and repaint the South Tower Elevated Storage Tank.

5. Type of Project or Acquisition

☐	Replacement	☐	New
☑	Renovation	☐	Expansion
☐	Equipment	☐	Land

6. Project Justification

The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service. With timely and proper maintenance, the useful service life of a steel water storage tanks can be greatly extended. Should rehabilitation be delayed such that coating adhesion failure occurs, the cost for repair will increase substantially due to the requirements associated with containment and sandblasting.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:		$274,450			$274,450
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:						$274,450						$274,450
Grants:												
Financing:												
Other:												
Other:												
Totals:						$274,450						$274,450

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Eighth Street Elevated Storage Tank Rehabilitation	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to clean, repair and repaint the South Tower Elevated Storage Tank.

5. Type of Project or Acquisition

- ☐ Replacement
- ☐ New
- ☑ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The EST requires rehabilitation to protect the steel surfaces from the corrosive effects of the coastal environment, and to extend the service life of the Tank via cleaning, repair, surface preparation and repainting. Following rehabilitation, the tank will be disinfected prior to its return to service. With timely and proper maintenance, the useful service life of a steel water storage tanks can be greatly extended. Should rehabilitation be delayed such that coating adhesion failure occurs, the cost for repair will increase substantially due to the requirements associated with containment and sandblasting.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:		$274,450			$274,450
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:								$274,450				$274,450
Grants:												
Financing:												
Other:												
Other:												
Totals:								$274,450				$274,450

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	Water System Comprehensive Plan Update and System Development Fee Study	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project includes updating the 2018 Water System Comprehensive Plan including the Hydraulic Analysis, Asset Condition and Criticality Assessment, and Water System Capital Improvements Plan. Also included is preparation of a System Development Fee Study.

5. Type of Project or Acquisition

- ☑ Replacement
- ☐ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The 2018 Water System Comprehensive Plan, including the hydraulic analysis, asset management component, and resulting capital improvements plan are not static measures. As such, the WSCP should be revisited every five (5) years to reassess changes and the impacts on the Town's financial planning. In addition, state statute requires the System Development Fee Study to be evaluated every five years. Each of these professional services is an integral part of CIP planning, and an economy of scale can be provided if they are provided congruently by the same engineering firm.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:		$73,200			$73,200
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:					$73,200							$73,200
Grants:												
Financing:												
Other:												
Other:												
Totals:					$73,200							$73,200

Town of Nags Head Capital Improvement Program Request Fiscal Years 2018-2019 through 2027-2028

1. Project	New Elevated Storage Tank Erection	2. Department	Public Works Water Operations	3. Rank (Completed by TM)	

4. Project Description

This project is to construct a new centrally located 500,000 gallon elevated storage tank and altitude valve near the vicinity of Town Hall in order to stabilize water system pressures within a more typical operating range.

5. Type of Project or Acquisition

- ☐ Replacement
- ☑ New
- ☐ Renovation
- ☐ Expansion
- ☐ Equipment
- ☐ Land

6. Project Justification

The 2018 Water System Comprehensive Plan included a hydraulic model and analysis of the Town's water system. Of the options evaluated, erection of the new, centrally located, elevated tank provided the best long-term, stable solution for meeting present and future water demands while improving low pressures in the central portion of the distribution system and reducing high pressures to a typical and acceptable range. The addition of the elevated tank increases the overall hydraulic grade in the area of Town that exhibits the greatest demand, and improves water age by locating a storage facility in closer proximity to the demand.

7. Implementation/Acquisition Schedule

Project Category	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:
Planning and Design	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Land and Land Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Construction	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Equipment Acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Miscellaneous	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

8. Operating Budget Impact

	Personnel:	Capital/One Time Costs:	Maintenance/Operating Costs:	Other:	Total:
FY 2019:					
FY 2020:					
FY 2021:					
FY 2022:					
FY 2023:					
FY 2024:					
FY 2025:					
FY 2026:					
FY 2027:					
FY 2028:					
Beyond FY 2028:					

9. Additional or Alternate Funding Sources

	FY 2019:	FY 2020:	FY 2021:	FY 2022:	FY 2023:	FY 2024:	FY 2025:	FY 2026:	FY 2027:	FY 2028:	Beyond FY 2028:	Total
Reserve:												
Grants:												
Financing:												
Other:												
Other:												
Totals:												

TOWN OF NAGS HEAD CAPITAL IMPROVEMENT PROGRAM REQUEST FISCAL YEARS 2018-19 THROUGH 2027-28
SUMMARY TABLE

Priority:	Project:	Implementation/Acquisition Schedule											Funding
		FY 2019	FY 2020	FY 2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	>FY2028	
Short-Term	South Tower Elevated Storage Tank Rehabilitation	$274,450											Reserve
Short-Term	12" Water Main Installation - W. Danube Street to Diamond Street	$235,000											Reserve
Short-Term	Eighth Street Water Plant - Generator Transfer Switch Replacement	$25,000											Reserve
Short-Term	Fire Hydrant Installation	$18,600											Reserve
Short-Term	6" ACP Water Main Replacement - Barnes Street Beneath Bypass Road		$235,000										Reserve
Short-Term	Eighth Street Elevated Storage Tank Rehabilitation			$274,450									Reserve
Intermediate	12" Dual Water Main around Jockey's Ridge			$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$77,057	$154,114	10-yr Loan
Intermediate	Gull Street Pump Station Improvements			$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$153,004	$306,008	10-yr Loan
Intermediate	Miscellaneous ACP Water Main Replacement			$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$300,000	$3,753,000	Reserve
Intermediate	Fire Hydrant Installation		$20,000	$20,000									Reserve
Intermediate	Liquid Chlorine Conversion at Eighth Street and Gull Street Pump Stations						$44,000	$172,000					Reserve
Intermediate	South Tower Elevated Storage Tank Rehabilitation						$274,450						Reserve
Intermediate	Eighth Street Elevated Storage Tank Rehabilitation								$274,450				Reserve
Intermediate	Water System Comprehensive Plan Update and System Development Fee Study					$73,200							Reserve
Long-Term	New Central EST												
	Totals:	$553,050	$255,000	$824,511	$530,061	$603,261	$848,511	$702,061	$804,511	$530,061	$530,061	$4,213,122	