

FINAL REPORT

# Long-term Master Water Plan

December 2018



## Table of Contents

|                                                                                  |      |
|----------------------------------------------------------------------------------|------|
| Executive Summary.....                                                           | ES-1 |
| 1. Introduction and Overview .....                                               | 1-1  |
| 1.1 Background .....                                                             | 1-1  |
| 1.2 Review of Governing Agreements.....                                          | 1-5  |
| 1.2.1 Amended and Restated Interlocal Agreement.....                             | 1-5  |
| 1.2.2 Master Water Supply Contract .....                                         | 1-5  |
| 1.3 Objectives of Long-term Master Water Plan 2018 .....                         | 1-6  |
| 2. Existing Water Sources and Facilities Inventory.....                          | 2-1  |
| 2.1 Introduction.....                                                            | 2-1  |
| 2.2 Groundwater Sources .....                                                    | 2-3  |
| 2.3 Groundwater Treatment Facilities.....                                        | 2-4  |
| 2.3.1 Cypress Creek Operational Control Center .....                             | 2-5  |
| 2.4 Surface Water Treatment Facilities.....                                      | 2-6  |
| 2.4.1 C. W. (Bill) Young Regional Reservoir .....                                | 2-8  |
| 2.4.2 Tampa Bypass Canal and Hillsborough River Surface Water Supply .....       | 2-8  |
| 2.4.3 Alafia River Water Supply and Pump Station.....                            | 2-9  |
| 2.4.4 Regional Surface Water Treatment Plant and High Service Pump Station ..... | 2-9  |
| 2.4.5 Surface Water System Raw Water Pumping and Transmission Facilities.....    | 2-10 |
| 2.5 Seawater Desalination Facilities .....                                       | 2-12 |
| 2.6 Booster Pump Stations .....                                                  | 2-13 |
| 2.7 Potable Water Transmission Mains.....                                        | 2-15 |
| 2.8 Supply Capacity from Member Government Interconnects .....                   | 2-15 |
| 2.8.1 Tampa/Hillsborough Interconnect.....                                       | 2-15 |
| 2.8.2 U.S. 301 Interconnect .....                                                | 2-16 |
| 2.8.3 Maytum WTP Supply Interconnection .....                                    | 2-16 |
| 2.8.4 Lake Park WTP Emergency Supply Interconnection .....                       | 2-16 |
| 2.8.5 Northwest Hillsborough WTP Emergency Supply Interconnection .....          | 2-17 |
| 3. Regulatory Outlook .....                                                      | 3-1  |
| 3.1 Background.....                                                              | 3-1  |
| 3.1.1 Current Federal Regulatory Requirements .....                              | 3-1  |
| 3.1.1.1 Surface Water Treatment Rules Suite.....                                 | 3-2  |
| 3.1.1.2 Groundwater Rule .....                                                   | 3-3  |
| 3.1.1.3 Total Coliform Rule and the Revised Total Coliform Rule .....            | 3-3  |

|          |                                                                                                                    |      |
|----------|--------------------------------------------------------------------------------------------------------------------|------|
| 3.1.1.4  | Disinfection By-Product Rules.....                                                                                 | 3-4  |
| 3.1.1.5  | Lead and Copper.....                                                                                               | 3-4  |
| 3.1.1.6  | Potential Long-Term Lead and Copper Rule Revisions.....                                                            | 3-5  |
| 3.1.1.7  | Radionuclides.....                                                                                                 | 3-5  |
| 3.1.1.8  | Arsenic .....                                                                                                      | 3-5  |
| 3.1.1.9  | Filter Backwash Recycling Rule.....                                                                                | 3-5  |
| 3.2      | Future Regulatory Considerations .....                                                                             | 3-6  |
| 3.2.1    | Identifying New Contaminants: The Contaminant Candidate List and the Unregulated Contaminant Monitoring Rules..... | 3-7  |
| 3.2.2    | Health Advisories.....                                                                                             | 3-10 |
| 3.2.3    | Potential Regulation.....                                                                                          | 3-11 |
| 3.2.3.1  | Algal Toxins .....                                                                                                 | 3-11 |
| 3.2.3.2  | Strontium.....                                                                                                     | 3-11 |
| 3.2.3.3  | Perchlorate and Chlorate.....                                                                                      | 3-12 |
| 3.2.3.4  | Volatile Organic Compounds.....                                                                                    | 3-12 |
| 3.2.3.5  | Nitrosamines and Disinfection By-Products .....                                                                    | 3-13 |
| 3.2.3.6  | Manganese.....                                                                                                     | 3-13 |
| 3.2.3.7  | Chromium VI .....                                                                                                  | 3-14 |
| 3.2.3.8  | Contaminants of Emerging Concern .....                                                                             | 3-14 |
| 3.2.3.9  | Microbial Contaminants .....                                                                                       | 3-15 |
| 3.2.3.10 | Potential Long Term Lead and copper Rule Revision.....                                                             | 3-15 |
| 3.2.11   | Potable Reuse Regulation .....                                                                                     | 3-16 |
| 3.2.4    | Timeline for Future Regulations .....                                                                              | 3-17 |
| 3.2.5    | Summary.. ..                                                                                                       | 3-18 |
| 3.3      | Tampa Bay Water Current Water Use Permits Issued by the Southwest Florida Water Management District.....           | 3-19 |
| 3.4      | Tampa Bay Water Current Facility Permits Issued by the Florida Department of Environmental Protection.....         | 3-20 |
| 4.       | Existing and Projected Customers and Water Demands.....                                                            | 4-1  |
| 4.1      | Introduction.....                                                                                                  | 4-1  |
| 4.2      | Meeting Member Government Water Demands .....                                                                      | 4-3  |
| 4.2.1    | Historical Usage by Member Governments.....                                                                        | 4-4  |
| 4.2.2    | Future Customers and Future Demands .....                                                                          | 4-8  |
| 4.3      | Demand Forecasting System .....                                                                                    | 4-9  |
| 4.4      | Demand Forecasting System Results .....                                                                            | 4-10 |
| 4.5      | Estimated New Supply Need Over Planning Horizon.....                                                               | 4-12 |

|         |                                                                                                                 |      |
|---------|-----------------------------------------------------------------------------------------------------------------|------|
| 4.6     | Interlocal Agreement Requirements/Recommended Planning and Management Activities .....                          | 4-14 |
| 5.      | Water Shortage Mitigation Plan.....                                                                             | 5-1  |
| 5.1     | Background.....                                                                                                 | 5-1  |
| 5.2     | Goal and Objectives of Water Shortage Mitigation Plan .....                                                     | 5-1  |
| 5.3     | Hydrologic and Supply Shortage Trigger Identification.....                                                      | 5-2  |
| 5.4     | Determining Entry and Exit Conditions for Water Shortage Stages .....                                           | 5-4  |
| 5.4.1   | Consistency with District Declarations.....                                                                     | 5-4  |
| 5.5     | Demand and Supply Management Actions .....                                                                      | 5-5  |
| 5.6     | WSMP Recovery Actions.....                                                                                      | 5-9  |
| 5.7     | WSMP Communication Plan .....                                                                                   | 5-9  |
| 5.8     | Water Shortage Mitigation Plan Implementation .....                                                             | 5-10 |
| 5.9     | Planned Revisions.....                                                                                          | 5-10 |
| 6.      | Identification of Potential Future Water Supply Projects.....                                                   | 6-1  |
| 6.1     | Previously Identified Projects.....                                                                             | 6-1  |
| 6.1.1   | Small Footprint Reverse Osmosis .....                                                                           | 6-1  |
| 6.1.2   | Tampa Bay Seawater Desalination Plant Expansion .....                                                           | 6-2  |
| 6.1.3   | Gulf Coast Desalination Plant.....                                                                              | 6-3  |
| 6.1.4   | Additional Potable Groundwater from Existing Northern Wellfields.....                                           | 6-5  |
| 6.1.5   | Thonotosassa Wells.....                                                                                         | 6-6  |
| 6.1.6   | Surface Water Expansion .....                                                                                   | 6-6  |
| 6.1.7   | Aquifer Recharge .....                                                                                          | 6-7  |
| 6.2     | New Projects .....                                                                                              | 6-7  |
| 6.2.1   | Aquifer Recharge .....                                                                                          | 6-9  |
| 6.2.1.1 | New Groundwater Supply and Treatment Plant via Net Benefit from SHARP Program .....                             | 6-9  |
| 6.2.1.2 | New Groundwater Supply via and Treatment Plant via Net Benefit from Expanded SHARP Program .....                | 6-12 |
| 6.2.1.3 | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water in South Hillsborough County.....           | 6-13 |
| 6.2.1.4 | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP Credits) ..... | 6-14 |
| 6.2.2   | Potable Reuse .....                                                                                             | 6-17 |
| 6.2.2.1 | Purified Water to Tampa Bypass Canal.....                                                                       | 6-17 |
| 6.2.2.2 | Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site .....                       | 6-18 |
| 6.2.2.3 | Regional Surface Water Treatment Plant Expansion with Reclaimed Water .....                                     | 6-19 |
| 6.2.2.4 | Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water .....                                      | 6-20 |
| 6.3     | Recommended Projects.....                                                                                       | 6-22 |



|         |                                                                                                                                                     |      |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 7.      | South Hillsborough County Supply Options.....                                                                                                       | 7-1  |
| 7.1     | Overview of South Hillsborough County Deficits and Supply Option Concepts .....                                                                     | 7-2  |
| 7.2     | Potential Projects.....                                                                                                                             | 7-4  |
| 7.2.1   | Project Overview .....                                                                                                                              | 7-4  |
| 7.2.2   | Project Screening.....                                                                                                                              | 7-15 |
| 7.2.2.1 | Capital cost per Unit of Capacity .....                                                                                                             | 7-15 |
| 7.2.2.2 | Operation and Maintenance Cost .....                                                                                                                | 7-16 |
| 7.2.2.3 | Timeframe for Another Project .....                                                                                                                 | 7-16 |
| 7.2.2.4 | Long-term Master Water Plan Coordination .....                                                                                                      | 7-17 |
| 7.2.2.5 | Reliability and Redundancy .....                                                                                                                    | 7-18 |
| 7.2.2.6 | Constructability .....                                                                                                                              | 7-18 |
| 7.2.2.7 | Operational Complexity.....                                                                                                                         | 7-19 |
| 7.2.3   | Recommended Projected for Detailed Assessment.....                                                                                                  | 7-21 |
| 7.3     | Incorporation of Recommended Projects into Master Water Plan.....                                                                                   | 7-21 |
| 8.      | System wide Reliability and Future Needs.....                                                                                                       | 8-1  |
| 8.1     | Regional System Performance Evaluation Model .....                                                                                                  | 8-2  |
| 8.1.1   | Overview of Modeling Setup.....                                                                                                                     | 8-3  |
| 8.1.1.1 | Demand Projections and Supply Simulation .....                                                                                                      | 8-4  |
| 8.1.2   | Model Setup – Concept of Realization and Latin Hyper Cube Sampling .....                                                                            | 8-5  |
| 8.1.3   | Simulation Optimization Approach .....                                                                                                              | 8-5  |
| 8.1.4   | Methodology for Calculation Project Yield Results .....                                                                                             | 8-6  |
| 8.2     | Project Yield and Reliability Analysis.....                                                                                                         | 8-6  |
| 8.2.1   | Preliminary Analysis, Results and Adjustments.....                                                                                                  | 8-7  |
| 8.2.2   | Project Screening Runs .....                                                                                                                        | 8-8  |
| 8.2.2.1 | Tampa Augmentation Project Yield Results .....                                                                                                      | 8-10 |
| 9.      | Water Supply Concept Development.....                                                                                                               | 9-1  |
| 9.1     | Conditions for Concept Development.....                                                                                                             | 9-1  |
| 9.2     | Concepts.....                                                                                                                                       | 9-1  |
| 9.2.1   | Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant<br>Expansions with Existing Sources.....                           | 9-4  |
| 9.2.2   | New Gulf Coast Desalination Facility.....                                                                                                           | 9-4  |
| 9.2.3   | Regional Surface Water Treatment Plant Expansion with Existing Source and New<br>Groundwater Supply via Net Benefit from SHARP Program.....         | 9-4  |
| 9.2.4   | Tampa Bay Seawater Desalination Plant Expansion with Existing Source and New<br>Groundwater Supply via Net Benefit from Expanded SHARP Program..... | 9-5  |
| 9.2.5   | New Groundwater Supply via Net Benefit from SHARP Program.....                                                                                      | 9-5  |

|          |                                                                                                                                                                               |       |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 9.2.6    | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Native Groundwater Quality).....                                                 | 9-6   |
| 9.2.7    | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Impacted Groundwater Quality).....                                               | 9-6   |
| 9.2.8    | Regional Surface Water Treatment Plant Expansion with Reclaimed Water .....                                                                                                   | 9-7   |
| 9.2.9    | New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Site....                                                                                       | 9-7   |
| 9.2.10   | Regional Surface Water Treatment Plant Expansion with Existing Source and New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Facilities Site..... | 9-8   |
| 9.2.11   | Tampa Bay Seawater Desalination Plant with Existing Source and New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Site.....                       | 9-8   |
| 9.2.12   | Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water and New Groundwater Supply via Net Benefit from SHARP Program.....                                       | 9-8   |
| 9.2.13   | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water.....                                                                                                      | 9-9   |
| 9.3      | Next Steps.....                                                                                                                                                               | 9-9   |
| 10.      | Property Assessment.....                                                                                                                                                      | 10-1  |
| 10.1     | Anticipated Property Needs for Future Water Supply Options .....                                                                                                              | 10-1  |
| 10.2     | Preliminary Investigation of Property Needs .....                                                                                                                             | 10-2  |
| 10.2.1   | General Property Requirement Assumptions.....                                                                                                                                 | 10-2  |
| 10.2.2   | Property Assessment for Water Supply Options .....                                                                                                                            | 10-3  |
| 10.2.2.1 | Gulf Coast Desalination .....                                                                                                                                                 | 10-3  |
| 10.2.2.2 | New Groundwater via Net Benefit from SHARP Program .....                                                                                                                      | 10-5  |
| 10.2.2.3 | New Groundwater via Net Benefit from Expanded SHARP Program.....                                                                                                              | 10-5  |
| 10.2.2.4 | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Native or Impacted Groundwater Quality).....                                     | 10-6  |
| 10.2.2.5 | Regional Surface Water Treatment Plant Expansion with Reclaimed Water .....                                                                                                   | 10-7  |
| 10.2.2.6 | New Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending.....                                                                                      | 10-8  |
| 10.2.2.7 | Seawater Desalination Plant Expansion with Reclaimed Water.....                                                                                                               | 10-9  |
| 10.2.2.8 | Aquifer Recharge and Recovery with Treated Reclaimed Water .....                                                                                                              | 10-10 |
| 11.      | System Analysis.....                                                                                                                                                          | 11-1  |
| 11.1     | Systems Analysis Tools.....                                                                                                                                                   | 11-1  |
| 11.2     | Previous Hydraulic and Systems Analyses .....                                                                                                                                 | 11-2  |
| 11.2.1   | Surge Modeling.....                                                                                                                                                           | 11-2  |
| 11.2.2   | Hydraulic Analysis of the Regional Transmission System.....                                                                                                                   | 11-2  |
| 11.2.3   | 2035 System Hydraulic and Emergency Scenario Analysis .....                                                                                                                   | 11-3  |
| 11.3     | System Analysis for Future Water Supply Project Concepts.....                                                                                                                 | 11-3  |
| 11.3.1   | System Analysis for Future Water Supply Project Concepts .....                                                                                                                | 11-3  |
| 11.3.2   | Future System Surge Analysis.....                                                                                                                                             | 11-6  |
| 11.4     | System Reliability and Emergency Scenario Planning.....                                                                                                                       | 11-6  |

|         |                                                                                      |       |
|---------|--------------------------------------------------------------------------------------|-------|
| 12.     | Climate Variability and Coastal Hazards Vulnerability Assessment.....                | 12-1  |
| 12.1    | Background on Climate Variability and Sea Level Rise .....                           | 12-1  |
| 12.2    | Coastal Hazards Vulnerability Assessment .....                                       | 12-4  |
| 12.2.1  | Overview of Approach and Criteria .....                                              | 12-4  |
| 12.2.2  | Flood Zone Location Analysis .....                                                   | 12-5  |
| 12.2.3  | Storm Surge Analysis.....                                                            | 12-6  |
| 12.2.4  | Sea Level Rise Assessment .....                                                      | 12-8  |
| 12.2.5  | Potential for Source Water Quality Impacts from Coastal Hazards.....                 | 12-10 |
| 12.2.6  | Results of Vulnerability Assessment Scoring for Water Supply Project Components..... | 12-10 |
| 12.3    | Summary of Findings and Recommendations .....                                        | 12-13 |
| 13.     | Environmental Sustainability Assessment.....                                         | 13-1  |
| 13.1    | Overview of Envision™ Sustainability Evaluation Approach .....                       | 13-1  |
| 13.2    | Summary of Environmental sustainability Assessment Scoring .....                     | 13-3  |
| 13.3    | Summary of Findings.....                                                             | 13-4  |
| 14.     | Coarse Screening of Future Water Supply Concepts.....                                | 14-1  |
| 14.1    | Evaluation Overview .....                                                            | 14-1  |
| 14.2    | Coarse Screening Criteria .....                                                      | 14-1  |
| 14.3    | Water Supply Concept Scoring.....                                                    | 14-2  |
| 14.4    | Score Aggregation.....                                                               | 14-5  |
| 14.4.1  | Further Evaluation of Tier 2 Concepts.....                                           | 14-6  |
| 14.5    | Recommendations .....                                                                | 14-7  |
| 15.     | Configuration Development and Fine Screening.....                                    | 15-1  |
| 15.1    | Water Supply Configurations .....                                                    | 15-1  |
| 15.2    | Fine Screening Criteria.....                                                         | 15-3  |
| 15.3    | Fine Screening Evaluation .....                                                      | 15-6  |
| 15.3.1  | Ease of Permitting .....                                                             | 15-6  |
| 15.3.2  | Environmental Sustainability Index.....                                              | 15-6  |
| 15.3.3  | Public Reception .....                                                               | 15-7  |
| 15.3.4  | Life Cycle Cost .....                                                                | 15-7  |
| 15.3.5  | Ability to Phase .....                                                               | 15-8  |
| 15.3.6  | Cost Risk Factors .....                                                              | 15-8  |
| 15.3.7  | Source Water Supply Resiliency .....                                                 | 15-9  |
| 15.3.8  | Vulnerability Index .....                                                            | 15-9  |
| 15.3.9  | Regional System Operational Impacts .....                                            | 15-10 |
| 15.3.10 | Contractual Requirements.....                                                        | 15-10 |
| 15.4    | Fine Screening Results .....                                                         | 15-14 |

|          |                                                                                                                                                  |       |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 16.      | Top Ranked Water Supply Projects for Meeting Future Demands.....                                                                                 | 16-1  |
| 16.1     | Overview of Top Ranked Configurations and Associated Projects.....                                                                               | 16-1  |
| 16.2     | Individual Water Supply Projects .....                                                                                                           | 16-2  |
| 16.2.1   | New Groundwater Treatment Plant using Aquifer Recharge Credits vis Net Benefit SHARP Program 16-2                                                |       |
| 16.2.1.1 | Major Components.....                                                                                                                            | 16-2  |
| 16.2.1.2 | Cost Opinion .....                                                                                                                               | 16-3  |
| 16.2.1.3 | Special Considerations .....                                                                                                                     | 16-4  |
| 16.2.2   | Desalination Water Treatment Plant Expansion with Existing Source Water .....                                                                    | 16-5  |
| 16.2.2.1 | Major Components.....                                                                                                                            | 16-8  |
| 16.2.2.2 | Cost Opinion .....                                                                                                                               | 16-8  |
| 16.2.2.3 | Special Considerations .....                                                                                                                     | 16-11 |
| 16.2.3   | Regional Surface Water Treatment Plant Expansion with Existing Source Water.....                                                                 | 16-12 |
| 16.2.3.1 | Major Components.....                                                                                                                            | 16-14 |
| 16.2.3.2 | Cost Opinion .....                                                                                                                               | 16-14 |
| 16.2.3.3 | Special Considerations .....                                                                                                                     | 16-16 |
| 16.2.4   | Summary of Recommended Water Supply Projects.....                                                                                                | 16-19 |
| 17.      | Optimization of Existing Facilities.....                                                                                                         | 17-1  |
| 17.1     | Introduction.....                                                                                                                                | 17-1  |
| 17.2     | Regional Surface Water Treatment Plant .....                                                                                                     | 17-1  |
| 17.3     | Tampa Bay Seawater Desalination Plant .....                                                                                                      | 17-2  |
| 17.4     | 17.4 Summary of Preliminary Findings .....                                                                                                       | 17-4  |
| 18.      | Staffing.....                                                                                                                                    | 18-1  |
| 18.1     | Existing System Staffing Plan.....                                                                                                               | 18-1  |
| 18.2     | Estimated Staffing Needs for Future Supply Options.....                                                                                          | 18-2  |
| 19.      | Source Water Assessment and Protection .....                                                                                                     | 19-1  |
| 19.1     | Introduction.....                                                                                                                                | 19-1  |
| 19.2     | Source Water Assessment and Protection – Current Supplies.....                                                                                   | 19-1  |
| 19.2.1   | Source Water Monitoring and Assessment .....                                                                                                     | 19-2  |
| 19.2.2   | Current and Future Land Use Activities .....                                                                                                     | 19-3  |
| 19.2.3   | Stakeholder Interaction.....                                                                                                                     | 19-4  |
| 19.2.4   | Education and Communication .....                                                                                                                | 19-4  |
| 19.2.5   | Research and Related Activities.....                                                                                                             | 19-5  |
| 19.3     | Source Water Assessment and Protection Needs – Future Supplies .....                                                                             | 19-5  |
| 19.3.1   | New Groundwater Water Treatment Plant with South-Hillsborough Aquifer Recharge Project Net Benefit from SHARP Program (groundwater source) ..... | 19-6  |



|         |                                                                                                                              |      |
|---------|------------------------------------------------------------------------------------------------------------------------------|------|
| 19.3.2  | Surface Water Treatment Plant Expansion with Existing Sources (Tampa Bypass Canal/Hillsborough River and Alafia River) ..... | 19-6 |
| 19.3.3  | Desalination Facility Expansion with existing source (TECO Plant/Hillsborough Bay).....                                      | 19-6 |
| 20.     | Demand Management Plan.....                                                                                                  | 20-1 |
| 20.1    | Introduction.....                                                                                                            | 20-1 |
| 20.2    | Components of Tampa Bay Water’s Demand Management Plan.....                                                                  | 20-2 |
| 20.3    | Profile of Regional Water Demand.....                                                                                        | 20-2 |
| 20.4    | Evaluation of Water Efficiency Alternative (Forecast).....                                                                   | 20-3 |
| 20.4.1  | Passive Fixture and Savings Estimates.....                                                                                   | 20-3 |
| 20.4.2  | Screening and Selection of Active Efficiency Technologies/Programs.....                                                      | 20-3 |
| 20.5    | Economic Analysis of Alternative Demand Management Strategies.....                                                           | 20-5 |
| 20.6    | 2018 Evaluation of Demand Management Implementation Strategies.....                                                          | 20-5 |
| 21.     | Public Engagement Program .....                                                                                              | 21-1 |
| 21.1    | Summary of Efforts: 2015 – 2018 .....                                                                                        | 21-1 |
| 21.1.1  | 2015 Public Opinion Survey .....                                                                                             | 21-2 |
| 21.1.2  | Ad Hoc Committee .....                                                                                                       | 21-2 |
| 21.1.3  | Focus Groups .....                                                                                                           | 21-3 |
| 21.1.4  | Water Quality Campaign and Microsite (tampabayh2o.com).....                                                                  | 21-4 |
| 21.1.5  | Fact Pack and Web Content .....                                                                                              | 21-5 |
| 21.1.6  | Speakers Bureau .....                                                                                                        | 21-5 |
| 21.1.7  | Dedicated Microsite (futurewater.org) and “Have a Voice” Campaign.....                                                       | 21-6 |
| 21.1.8  | Online Survey .....                                                                                                          | 21-6 |
| 21.1.9  | Telephone Town Hall Meetings.....                                                                                            | 21-7 |
| 21.1.10 | Summary of 2018 Public Opinion Survey Findings .....                                                                         | 21-7 |
| 21.1.11 | Summary of 2018 Public Opinion Survey Findings .....                                                                         | 21-8 |
| 21.2    | Findings and Implications with Respect to Potential New Sources.....                                                         | 21-9 |
| 22.     | Implementation Plan for Recommended Future Water Supply Projects.....                                                        | 22-1 |
| 22.1    | Timing and Phasing Under Current Demand Projections.....                                                                     | 22-2 |
| 22.2    | Implications of South Hillsborough County Projects.....                                                                      | 22-3 |
| 22.3    | Implications on Timing of Other Master Plan Components .....                                                                 | 22-7 |
| 23.     | Recommendations .....                                                                                                        | 23-1 |
| 23.1    | Specific Recommendations for Each Master Plan Component.....                                                                 | 23-1 |
|         | The specific recommendations for each major LTMWP component follow:.....                                                     | 23-1 |
| 23.2    | Additional Feasibly Study Recommendations for Water Supply Projects.....                                                     | 23-4 |
| 23.3    | Next Steps for Implementation .....                                                                                          | 23-6 |

## List of Tables

|                                                                                                                                                                            |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Table 1-1: Summary of Tampa Bay Water Supply System.....                                                                                                                   | 1-1  |
| Table 1-2: Long-term Master Water Plan Project and Policy/Planning Studies Approved in 2008 .....                                                                          | 1-3  |
| Table 1-3: Long-term Master Water Plan 2018 Required Section Descriptions .....                                                                                            | 1-6  |
| Table 2-1: Tampa Bay Water Regional System Facilities Currently in Service by Source .....                                                                                 | 2-3  |
| Table 2-2: Capacity Terms for Tampa Bay Water’s Major Facilities .....                                                                                                     | 2-3  |
| Table 2-3: Rated and Sustainable Capacities of the Existing Tampa Bay Water Wellfields .....                                                                               | 2-5  |
| Table 2-4: Rated and Sustainable Capacities of the Groundwater Treatment Facilities.....                                                                                   | 2-6  |
| Table 2-5: Rated and Sustainable Capacities of the Enhanced Surface Water System .....                                                                                     | 2-9  |
| Table 2-6: Rated and Sustainable Capacities of the of the Regional Surface Water Treatment Plant,<br>Desalination Plant and the Regional High Service Pumping Station..... | 2-13 |
| Table 2-7: Rated and Sustainable Capacities of the Booster Pumping Stations .....                                                                                          | 2-15 |
| Table 2-8: Tampa Bay Water Major Potable Transmission Mains (TM) .....                                                                                                     | 2-16 |
| Table 2-9: Rated and Sustainable Capacities of the Tampa/Hillsborough Interconnect .....                                                                                   | 2-18 |
| Table 2-10: Rated and Sustainable Capacities fo the US 301 Interconnect.....                                                                                               | 2-18 |
| Table 3-1: Cyanotoxins of Interest.....                                                                                                                                    | 3-9  |
| Table 3-2: HAAs, Bromide, and TOC Required to be Sampled under UCMR 4.....                                                                                                 | 3-10 |
| Table 3-3: Additional Contaminants to be Sampled Under UCMR 4 .....                                                                                                        | 3-11 |
| Table 3-4: Potential Future Regulatory Impacts and Recommendations for Tampa Bay Water.....                                                                                | 3-18 |
| Table 3-5: Tampa Bay Water’s Water Use Permits Issued by the Southwest Florida Water Management<br>District.....                                                           | 3-19 |
| Table 3-6: Tampa Bay Water’s Facility Permits Issued by the Florida Department of Environmental<br>Protection.....                                                         | 3-20 |
| Table 4-1 Summary of Member Government Service Area4-4                                                                                                                     |      |
| Table 4-2 Historic Regional Water Demands in Tampa Bay Water Service Area .....                                                                                            | 4-5  |
| Table 4-3 Historical Water Delivery to Current Customers .....                                                                                                             | 4-5  |
| Table 4-4 Projected Water Demands for Tampa Bay Water Member Governments and Tampa Bay Water<br>Delivery .....                                                             | 4-10 |
| Table 5-1: Summary of WSMP Water Shortage Stages and Triggers 5-3                                                                                                          |      |
| Table 5-2: Summary of WSMP Stages, Triggers, and Actions.....                                                                                                              | 5-7  |
| Table 6-1: Coarse Screening Criteria for the Shortlisting of Potential Reuse Projects .....                                                                                | 6-8  |
| Table 6-2: Water Supply Project Summary.....                                                                                                                               | 6-21 |
| Table 7-1: South-central Hillsborough County Demand Projections.....                                                                                                       | 7-1  |
| Table 7-2: Existing Points of Connection in Hillsborough County to the Tampa Bay Water Regional<br>System .....                                                            | 7-2  |

|                                                                                                                                                                             |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Table 7-3: Potential Projects to Provide Supply to South Hillsborough County.....                                                                                           | 7-4   |
| Table 7-4: Project Screening Evaluation Criteria and Weighting .....                                                                                                        | 7-15  |
| Table 7-5: Capital Cost per Unit Capacity Scoring .....                                                                                                                     | 7-15  |
| Table 7-6: Operation and Maintenance Cost Scoring.....                                                                                                                      | 7-16  |
| Table 7-7: Timeframe for Another Project Scoring.....                                                                                                                       | 7-17  |
| Table 7-8: Long-term Master Water Plan Coordination Scoring.....                                                                                                            | 7-17  |
| Table 7-9: Reliability and Redundancy Scoring.....                                                                                                                          | 7-18  |
| Table 7-10: Constructability Values Weighting for Project Components.....                                                                                                   | 7-19  |
| Table 7-11: Constructability Scoring.....                                                                                                                                   | 7-19  |
| Table 7-12: Operational Complexity Values Weighting.....                                                                                                                    | 7-20  |
| Table 7-13: Operational Complexity Scoring.....                                                                                                                             | 7-20  |
| Table 7-14: Project Scoring Summary.....                                                                                                                                    | 7-21  |
| Table 8-1: Water Supply Projects from Section 6.....                                                                                                                        | 8-7   |
| Table 8-2: Project Concept Yield and Reliability Results .....                                                                                                              | 8-9   |
| Table 8-3: Potential Regional Benefits of TAP in 2040 – Median Basis (50 <sup>th</sup> Percentile).....                                                                     | 8-11  |
| Table 9-1: Summary of Water Supply Concepts to Achieve 20 mgd of Additional Yield .....                                                                                     | 9-2   |
| Table 10-2: Future Water Supply Options Property Needs                                                                                                                      | 10-1  |
| Table 11-1 Future Water Supply Project Components .....                                                                                                                     | 11-4  |
| Table 12-1: Relative Sea Level Change Scenarios for St. Petersburg, Florida in feet above Lower Mean<br>Sea Level (LMSL), base year 1992 control for national survey datum. | 12-4  |
| Table 12-2: Future Water Supply Option Facilities Located within the Flood Plain.....                                                                                       | 12-6  |
| Table 12-3: Facilities Potentially Affected by Hurricane Storm Surge.....                                                                                                   | 12-9  |
| Table 12-4: Facilities Potentially Affected by Sea Level Rise.....                                                                                                          | 12-10 |
| Table 12-5: Facilities Potentially Affected by Changes in Water Supply Source Quality & Availability                                                                        | 12-11 |
| Table 12-6: Results of Vulnerability Assessment of Components of New Water Supply Project Concepts<br>.....                                                                 | 12-15 |
| Table 13-1. Envision Categories.....                                                                                                                                        | 13-1  |
| Table 13-2. Envision Achievement Levels .....                                                                                                                               | 13-2  |
| Table 13-2. Environmental Sustainability Scores for Water Supply Project Options.....                                                                                       | 13-3  |
| Table 14-1: Criteria for Coarse Screening Evaluation of Water Supply Concepts.....                                                                                          | 14-2  |
| Table 14-2: Coarse Screening Evaluation Scores and Explanations .....                                                                                                       | 14-3  |
| Table 14-3: Coarse Screening Evaluation Aggregate Scores and Tiers .....                                                                                                    | 14-5  |
| Table 14-4: Results for Further Evaluation of Tier 2 Water Supply Concepts .....                                                                                            | 14-6  |
| Table 14-5: Recommended Water Supply Concepts for Inclusion in the Fine Screening Evaluation....                                                                            | 14-7  |
| Table 15-1: Water Supply Configurations for Fine Screening Evaluation.....                                                                                                  | 15-3  |

|                                                                                                                                                            |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Table 15-2: Criteria for Fine Screening Evaluation of Water Supply Configurations .....                                                                    | 15-5  |
| Table 15-3: Unweighted Fine Screening Scores for Individual Criteria.....                                                                                  | 15-12 |
| Table 15-4: Aggregate Unweighted Scores, Aggregate Weighted Scores, and Rankings from Fine Screening Evaluation.....                                       | 15-14 |
| Table 15-5: Top Nine Configurations and Recommendations for Further Evaluation .....                                                                       | 15-16 |
| Table 15-6: Recommended Water Supply Projects for Further Evaluation .....                                                                                 | 15-17 |
| Table 16-1: Recommended Water Supply Configurations from Fine Screening Evaluation.....                                                                    | 16-2  |
| Table 16-2: Detailed EOPCC for New Groundwater Treatment Plant using Aquifer Recharge Credits via Net Benefit from SHARP Program– 7.5 mgd Yield.....       | 16-3  |
| Table 16-3: Detailed EOPCC for Desalination Water Treatment Plant Expansion with Existing Source – 10 mgd Yield.....                                       | 16-8  |
| Table 16-4: Detailed EOPCC for Desalination Water Treatment Plant Expansion with Existing Source – 12.5 mgd Yield.....                                     | 16-9  |
| Table 16-5: Detailed EOPCC for Regional Surface Water Treatment Plant Expansion with Existing Source – 10 mgd Yield.....                                   | 16-14 |
| Table 16-6: Detailed EOPCC for Regional Surface Water Treatment Plant Expansion with Existing Source – 12.5 mgd Yield.....                                 | 16-15 |
| Table 16-7: Detailed EOPCC for Regional Pipeline from the Regional Facility Site to the Balm Area POC in South Hillsborough County – 42-inch Diameter..... | 16-17 |
| Table 16-8: Detailed EOPCC for Regional Pipeline from the Regional Facility Site to the Balm Area POC in South Hillsborough County – 36-inch Diameter..... | 16-18 |
| Table 16-9: Summary of Recommended Water Supply Projects and Costs <sup>1</sup> .....                                                                      | 16-19 |
| Table 18-1: Potential Staffing Levels.....                                                                                                                 | 18-3  |
| Table 20-1: Programs Meeting Screening Criteria .....                                                                                                      | 20-4  |
| Table 20-2: Net Present Value (NPV) of Avoided Costs.....                                                                                                  | 20-5  |
| Table 21-1: Willingness to Accept Reclaimed Water by Use Type.....                                                                                         | 21-8  |
| Table 22-1: Preliminary Project Timing of 2 <sup>nd</sup> Phase Based on Current Demand Projections .....                                                  | 22-2  |
| Table 22-2: Summary of Timing Implications for Regional Supply Projects Based on South Hillsborough County Project.....                                    | 22-6  |
| Table 22-3: Summary of Potential Timing Implications for other Master Plan Components.....                                                                 | 22-9  |
| Table 23-1: Additional Feasibility Study Recommendations for Shortlisted Projects .....                                                                    | 23-4  |

## List of Figures

|                                                                                                                                             |      |
|---------------------------------------------------------------------------------------------------------------------------------------------|------|
| Figure 1-1: Major Components of the LTMWP.....                                                                                              | 1-2  |
| Figure 1-2: Tampa Bay Water System.....                                                                                                     | 1-4  |
| Figure 2-1: Tampa Bay Water Regional Water Supply and Delivery System .....                                                                 | 2-4  |
| Figure 2-2: Components and Flow Directions in Tampa Bay Water’s Enhanced Surface Water System .....                                         | 2-9  |
| Figure 2-3: Process Flow Diagram for the Regional Surface Water Treatment Plant.....                                                        | 2-12 |
| Figure 2-4: Process Flow Diagram for the Tampa Bay Seawater Desalination Plant.....                                                         | 2-14 |
| Figure 2-5: Tampa Bay Water Potable Transmission Mains.....                                                                                 | 2-17 |
| Figure 3-1: Regulatory Timeline and Accumulation for Drinking Water in the United States.....                                               | 3-2  |
| Figure 3-2: Timeline of Lead and Copper Rule Amendments and Revisions.....                                                                  | 3-5  |
| Figure 3-3: Federal Safe Drinking Water Act Standard Setting Process .....                                                                  | 3-9  |
| Figure 3-4: Potential Timeline for Future Regulations.....                                                                                  | 3-17 |
| Figure 4-1 - Water Demand Planning Areas .....                                                                                              | 4-2  |
| Figure 4-2 – Refined Member Government Water Demand Planning Areas.....                                                                     | 4-3  |
| Figure 4-3 Total Population by County .....                                                                                                 | 4-8  |
| Figure 4-4 Tampa Bay Water 2017 Projected Regional Water Demands.....                                                                       | 4-9  |
| Figure 4-5 Historic and Projected Regional Tampa Bay Water Delivery as Compared with Available<br>Tampa Bay Water Supplies.....             | 4-11 |
| Figure 5-1: Water Shortage Mitigation Plan Communications Structure.....                                                                    | 5-11 |
| Figure 5-2: Water Shortage Mitigation Plan Implementation Procedure.....                                                                    | 5-12 |
| Figure 6-1: Process Flow Diagram for the Gulf Coast Desalination Plant .....                                                                | 6-4  |
| Figure 6-2: Anticipated Aquifer Recharge Well Sites and Modeled Withdrawal Wellfield Sites (Appendix<br>6B) .....                           | 6-10 |
| Figure 6-3: Preliminary Layout for the Groundwater Treatment Facility.....                                                                  | 6-12 |
| Figure 6-4: Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water .....                                                       | 6-14 |
| Figure 6-5: Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending.....                                            | 6-18 |
| Figure 6-6: Treatment Process Expansions and Upgrades for the Regional Surface Water Treatment Plant<br>Expansion with Reclaimed Water..... | 6-19 |
| Figure 6-7: Treatment Process Expansions and Upgrades for the Tampa Bay Seawater Desalination Plant<br>Expansion with Reclaimed Water.....  | 6-21 |
| Figure 7-1: Projected South-central Hillsborough County Annual Average Daily Flow.....                                                      | 7-2  |
| Figure 7-2: Schematic of South Hillsborough County Supply Project 1.....                                                                    | 7-7  |
| Figure 7-3: Schematic of South Hillsborough County Supply Project 2.....                                                                    | 7-8  |
| Figure 7-4: Schematic of South Hillsborough County Supply Project 3.....                                                                    | 7-9  |
| Figure 7-5: Schematic of South Hillsborough County Supply Project 4.....                                                                    | 7-10 |



|                                                                                                                         |       |
|-------------------------------------------------------------------------------------------------------------------------|-------|
| Figure 7-6: Schematic of South Hillsborough County Supply Project 5.....                                                | 7-11  |
| Figure 7-7: Schematic of South Hillsborough County Supply Project 6.....                                                | 7-12  |
| Figure 7-8: Schematic of South Hillsborough County Supply Project 7.....                                                | 7-13  |
| Figure 7-9: Schematic of South Hillsborough County Supply Project 8.....                                                | 7-14  |
| Figure 8-1: Historic and Projected Regional Tampa Bay Water Demands as Compared with.....                               | 8-2   |
| Available Supplies .....                                                                                                | 8-2   |
| Figure 8-2: Regional Performance Evaluation Model .....                                                                 | 8-3   |
| Figure 8-3: Range of Regional 2040 Demands in Millions of Gallons per Day (mgd).....                                    | 8-4   |
| Figure 10-1: Preliminary Layout of the Gulf Coast Desalination Plant .....                                              | 10-4  |
| Figure 10-2: Preliminary Pipeline Route from Gulf Coast Desalination Plant to Regional Interconnect<br>Point .....      | 10-5  |
| Figure 10-3: Proposed via Net Benefit SHARP Program System Pipeline Routing.....                                        | 10-6  |
| Figure 10-4: Proposed via Net Benefit Expanded SHARP Program Proposed Pipeline Routing.....                             | 10-7  |
| Figure 10-5: Proposed Pipeline Route from Tampa Area Recharge Project to Regional Facilities Site .                     | 10-8  |
| Figure 10-6: Proposed Pipeline Route from H. F. Curren AWTP to the Regional Surface Water Plant                         | 10-8  |
| Figure 10-7: Preliminary Site Plan for Proposed Advanced Water Treatment Plant.....                                     | 10-9  |
| Figure 10-8: Proposed Route from H. F. Curren AWTP to the Desalination Plant .....                                      | 10-10 |
| Figure 10-9: Proposed Pipeline Routes for the Aquifer Recharge and Recovery with Treated Reclaimed<br>Water Option..... | 10-11 |
| Figure 11-1 Water Supply Project Concepts Entry Locations to the Regional System.....                                   | 11-5  |
| Figure 12-1: Tampa Bay Water System.....                                                                                | 12-3  |
| Figure 12-2: SLOSH Model Results for Category 4 Hurricane .....                                                         | 12-8  |
| Figure 12-3: SLOSH Model results for Category 5 Hurricane .....                                                         | 12-8  |
| Figure 12-4: Relative Sea Level Change Projections for the Tampa Area .....                                             | 12-10 |
| Figure 12-5: Results of Vulnerability Assessment Scoring for Water Supply Project Components.....                       | 12-13 |
| Figure 15-1: Detailed Fine Screening Results for Top Ranked Configurations .....                                        | 15-15 |
| Figure 15-2: Schematic of the Number One Ranked Configuration, Configuration 3.....                                     | 15-18 |
| Figure 15-3: Schematic of the Number Two Ranked Configuration, Configuration 4A .....                                   | 15-19 |
| Figure 15-4: Schematic of Number Three Ranked Configuration, Configuration 1 .....                                      | 15-20 |
| Figure 15-5: Schematic of the Number Four Ranked Configuration, Configuration 4B.....                                   | 15-21 |
| Figure 15-6: Schematic of the Number Five Ranked Configuration, Configuration 5A.....                                   | 15-22 |
| Figure 15-7: Schematic of the Number Six Ranked Configuration, Configuration 7B .....                                   | 15-23 |
| 15-24                                                                                                                   |       |
| Figure 15-8: Schematic of the Number Seven Ranked Configuration, Configuration 6A .....                                 | 15-24 |
| Figure 15-9: Schematic of the Number Eight Ranked Configuration, Configuration 7A.....                                  | 15-25 |

|                                                                                                                                                          |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Figure 15-10: Schematic for the Number Nine Ranked Configuration, Configuration 5B .....                                                                 | 15-26 |
| Figure 16-1: Weighted Fine Screening Scores for Recommended Configurations.....                                                                          | 16-1  |
| Figure 16-3: Preliminary Layout for the Desalination Water Treatment Plant Expansion .....                                                               | 16-6  |
| Figure 16-4: Preliminary layout for the Regional Surface Water Treatment Plant Expansion.....                                                            | 16-12 |
| Figure 18-1: Tampa Bay Water Organization Chart.....                                                                                                     | 18-1  |
| Figure 22-1: Regional Supply and Projected Demands used in the LTMWP Planning Process .....                                                              | 22-2  |
| Figure 22-2: Preliminary Schedule for Phase 1 Implementation of Regional Water Supply Project.....                                                       | 22-3  |
| Figure 22-3: South-central Hillsborough County Supply and Projected Demands used in the LTMWP<br>Planning Process .....                                  | 22-4  |
| Figure 22-4: Preliminary Schedule for Implementation of South Hillsborough County Project .....                                                          | 22-4  |
| Figure 22-5: Estimated Impact on Timing of new Regional Supply if Pipeline if Installed to Meet South<br>Hillsborough County Supply Needs.....           | 22-5  |
| Figure 22-6: Estimated Impact on Timing of new Regional Supply if new Groundwater Treatment Plant<br>to Meet South Hillsborough County Supply Needs..... | 22-6  |
| Figure 23-1: Tampa Bay Water Long-term Master Water Plan Components .....                                                                                | 23-1  |

## List of Acronyms

| Abbreviation | Definition                               |
|--------------|------------------------------------------|
| AAF          | Alkalinity Adjustment Facility           |
| Agency       | Tampa Bay Water                          |
| AOP          | Advanced Oxidation Process               |
| APT          | Aquifer Performance Test                 |
| ASR          | Aquifer Storage and Recovery             |
| AWTP         | Advanced Wastewater Treatment Plant      |
| BAC          | Biological Activated Carbon              |
| BAF          | Biologically Active Filters              |
| BAT          | Best Available Technology                |
| BCAA         | Bromochloroacetic Acid                   |
| BDCAA        | Bromodichloroacetic Acid                 |
| BDL          | Below Detection Level                    |
| BEBR         | Bureau of Economic and Business Research |
| BMP          | Best Management Practices                |
| BOCC         | Board of County Commissioners            |
| BODR         | Basis of Design Report                   |
| BSCC         | Brandon/South-Central Connection         |
| BUDW         | Brandon Urban Dispersed Wells            |
| CAD          | Computer Aided Design                    |
| CCL          | Contaminant Candidate List               |
| CDBAA        | Chlorodibromoacetic Acid                 |
| CEC          | Contaminant of Emerging Concern          |
| CFR          | Code of Federal Regulations              |
| CFS          | Cubic Feet per Second                    |
| CIP          | Capital Improvement Program              |
| CM           | Construction Management                  |

| Abbreviation | Definition                                           |
|--------------|------------------------------------------------------|
| COT          | City of Tampa                                        |
| CSAP         | Climate Science Advisory Panel                       |
| CWA          | Clean Water Act                                      |
| CWUP         | Consolidated Water Use Permit                        |
| CZM          | Coastal Zone Management                              |
| D/DBPR       | Disinfectants and Disinfection By-Products Rule      |
| DAF          | Dissolved Air Flotation                              |
| DBAA         | Dibromoacetic Acid                                   |
| DBO          | Design-Build-Operate                                 |
| DBOOT        | Design Build Own Operate and Transfer                |
| DBP          | Disinfection by-Product                              |
| DBPR         | Disinfection by-Product Rule                         |
| DCAA         | Dichloroacetic Acid                                  |
| DE           | Diatomaceous Earth (Related to Desal)                |
| DIP          | Ductile Iron Pipe                                    |
| District     | Southwest Florida Water Management District          |
| DMP          | Demand Management Plant                              |
| DOAH         | Department of Administrative Hearings                |
| DOH          | Florida Department of Health                         |
| DRI          | Development of Regional Impact                       |
| EAP          | Emergency Action Plan                                |
| EDC          | Endocrine-Disrupting Compound                        |
| EID          | Environmental Impact Document                        |
| EIS          | Environmental Impact Statement                       |
| ELAPP        | Environmental Lands Acquisition & Protection Program |
| EMP          | Environmental Management Plan                        |
| ENE          | East-Northeast                                       |

| Abbreviation | Definition                                      |
|--------------|-------------------------------------------------|
| EOPCC        | Estimate of Probable Construction Cost          |
| EPACT        | Energy Policy Act                               |
| EPC          | Engineering Procurement and Construction        |
| ERP          | Environmental Resource Permit                   |
| ESA          | Environmental Site Assessment                   |
| ESWS         | Enhanced Surface Water System                   |
| ET           | Evapotranspiration                              |
| FAA          | Federal Aviation Authority                      |
| FAC          | Florida Administrative Code                     |
| FAQ's        | Frequently Asked Questions                      |
| FBRR         | Filter Backwash Recycling Rule                  |
| FDEP         | Florida Department of Environmental Protection  |
| FDOT         | Florida Department of Transportation            |
| FEMA         | Federal Emergency Management Agency             |
| FFL          | Florida Friendly Landscaping                    |
| FFWCC        | Florida Fish & Wildlife Conservation Commission |
| FMP          | Florida Marine Patrol                           |
| FPC          | Florida Power Corporation                       |
| FPS          | Florida Parks Service                           |
| fps          | feet per second                                 |
| FRP          | Fiber Reinforced Plastic                        |
| FS           | Florida Statutes                                |
| ft           | Feet                                            |
| FWS          | US Fish and Wildlife Service                    |
| GAC          | Granular Activated Carbon                       |
| gal          | Gallon                                          |
| GIS          | Geographical Information System                 |

| Abbreviation         | Definition                                                                           |
|----------------------|--------------------------------------------------------------------------------------|
| GP                   | General Permit                                                                       |
| GPR                  | Ground Penetrating Radar                                                             |
| gpm                  | gallons per minute                                                                   |
| GPY                  | Gallons per Year                                                                     |
| GWR                  | Groundwater Rule                                                                     |
| GWTP                 | Groundwater Treatment Plant                                                          |
| GWUDI                | Groundwater Under the Direct Influence of Surface Water                              |
| H <sub>2</sub> S     | Hydrogen Sulfide                                                                     |
| HAA                  | Haloacetic Acids                                                                     |
| HAA5                 | Group of 5 Haloacetic Acids (DCAA, MCAA, TCAA, MBAA, DBAA)                           |
| HAA9                 | Group of 9 Haloacetic Acids (DCAA, MCAA, TCAA, MBAA, DBAA, BCAA, BDCAA, CDBAA, TBAA) |
| HAA6Br               | Group of 6 bromide-containing HAA's (MBAA, DBAA, BCAA, BDCAA, CDBAA, TBAA)           |
| HAL                  | Health Advisory Level                                                                |
| HCDPW                | Hillsborough County Department of Public Works                                       |
| HCWRT                | Hillsborough County Water Resource Team                                              |
| HDPE                 | High Density Polyethylene                                                            |
| HE                   | High Efficiency                                                                      |
| HFC                  | Howard F Curren Advanced Wastewater Treatment Facility                               |
| HRTBC                | Hillsborough River Tampa Bypass Canal                                                |
| HSPS                 | High Service Pumping Station                                                         |
| HVAC                 | Heating Ventilation & Air Conditioning                                               |
| IESWTR               | Interim Enhanced Surface Water Treatment Rule                                        |
| IHM                  | Integrated Hydrologic Model                                                          |
| Interlocal Agreement | Amended and Restated Interlocal Agreement executed in May 1998                       |
| IOC                  | Inorganic Contaminants                                                               |
| JD                   | Jurisdictional Determination (Wetlands)                                              |
| JPA                  | Joint Project Agreement                                                              |



| Abbreviation | Definition                                        |
|--------------|---------------------------------------------------|
| JUA          | Joint Use Agreement                               |
| kwh          | Kilowatt Hours                                    |
| LA           | License Agreement                                 |
| LCR          | Lead and Copper Rule                              |
| LDC          | Land Development Code                             |
| LF           | Linear Feet                                       |
| LMSL         | Lower Mean Sea Level                              |
| LOS          | Level of Service                                  |
| LOX          | Liquid Oxygen                                     |
| LSL          | Lead Service Line                                 |
| LT1ESWTR     | Long Term 1 Enhanced Surface Water Treatment Rule |
| LT2          | Long Term 2 Enhanced Surface Water Treatment Rule |
| LT2ESWTR     | Long Term 2 Enhanced Surface Water Treatment Rule |
| LT-LCR       | Long-term Lead and Copper Rule                    |
| LTMWP        | Long-term Master Water Plan                       |
| MBAA         | Monobromoacetic Acid                              |
| MCAA         | Monochloroacetic Acid                             |
| MCL          | Maximum Contaminant Level                         |
| MCLG         | Maximum Contaminant Level Goal                    |
| MF           | Membrane Filtration                               |
| MG           | Million Gallons                                   |
| mg/l         | Milligrams per Liter                              |
| µg/L         | Micrograms per Liter                              |
| mgd or MGD   | Million Gallons per Day                           |
| MIA          | Most Impacted Area                                |
| MIB          | Methylisoborneol                                  |
| MIEX         | Magnetic Ion Exchange                             |

| Abbreviation | Definition                                      |
|--------------|-------------------------------------------------|
| ML Lakes     | Minimum Level Highland Ridge Lakes              |
| MOT          | Maintenance of Traffic                          |
| MRDL         | Maximum Residual Disinfection Limit             |
| MSL          | Main Sea Level                                  |
| MTBE         | Methyl Tertiary Butyl Ether                     |
| MWP          | Master Water Plan                               |
| NCHI         | North-Central Hillsborough Intertie             |
| NDMA         | N-nitrosodimethylamine                          |
| NEP          | National Estuary Program                        |
| NEPA         | National Environmental Policy Act               |
| ng/L         | Nanogram per Liter                              |
| NGVD         | National Geodetic Vertical Datum                |
| NOAA         | National Oceanic and Atmospheric Administration |
| NOI          | Notice of Intent                                |
| NPDES        | National Pollutant Discharge Elimination System |
| NPDWR        | National Primary Drinking Water Regulation      |
| NPR          | New Port Richey WDPA                            |
| NR           | Non-residential                                 |
| NRP          | Natural Resources Permit                        |
| NTP          | Notice to Proceed                               |
| NTU          | Nephelometric Turbidity Units                   |
| NW           | Northwest                                       |
| NWH          | Northwest Hillsborough County WDPA              |
| O&E          | Ownership and Encumbrances                      |
| OGC          | Office of General Counsel                       |
| O&M          | Operation and Maintenance                       |
| OROP         | Optimized Regional Operations Plan              |

| Abbreviation | Definition                                   |
|--------------|----------------------------------------------|
| PAS          | Pasco County WDPA                            |
| PCCP         | Pre-stressed Concrete Cylinder Pipe          |
| PCE          | Perchloroethylene or Tetrachloroethylene     |
| pCi/L        | Picocuries per Liter                         |
| PCP          | Personal Care Product                        |
| PE           | Professional Engineer                        |
| PFC          | Perfluorinated Compounds                     |
| PFOA         | Perfluorooctanic acid                        |
| PFOS         | Perfluorooctane sulfonate                    |
| PG           | Professional Geologist                       |
| PhAC         | Pharmaceutically-Active Compound             |
| PI           | Public Information                           |
| PIN          | Pinellas County WDPA                         |
| P&ID         | Process and Instrumentation Diagram          |
| PM           | Project Management                           |
| POC          | Point of Connection                          |
| POU          | Point of Use                                 |
| Ppb          | Parts per Billion                            |
| ppm          | Parts per Million                            |
| PRC          | Potable Reuse Commission                     |
| PS           | Pump Station                                 |
| psi          | Pounds per Square Inch                       |
| psig         | Pounds per Square Inch Gauge                 |
| PVC          | Poly-Vinyl Chloride Pipe                     |
| PWS          | Public Water System                          |
| RCD          | 12-month Rolling Cumulative Deficit Rainfall |
| RCP          | Reinforced Concrete Pipe                     |

| Abbreviation | Definition                                    |
|--------------|-----------------------------------------------|
| RAI          | Request for Additional Information            |
| RFP          | Request for Proposal                          |
| RFQ          | Request for Qualifications                    |
| RMD          | 12-month Rolling Median Deficit               |
| RO           | Reverse Osmosis                               |
| ROW          | Right of Way                                  |
| RPEM         | Regional Performance Evaluation Model         |
| RSEM         | Regional System Evaluation Model              |
| RSLC         | Relative Sea Level Change                     |
| RSWTP        | Reginal Surface Water Treatment Plant         |
| RTCR         | Revised Total Coliform Rule                   |
| SCADA        | Supervisory Control and Data Acquisition      |
| SCAP         | Site Conditions Assessment Permit             |
| SCH          | South-Central Hillsborough County WDPA        |
| SCHI         | South-Central Hillsborough Intertie           |
| SDI          | Silt Density Index (Related to Desal)         |
| SDWA         | Safe Drinking Water Act                       |
| SE           | System Engineer                               |
| SF           | Single-Family                                 |
| SHARE        | South Hillsborough Aquifer Recharge Expansion |
| SHARP        | South Hillsborough Aquifer Recharge Program   |
| SLOSH        | Sea Lake and Overland Surge from Hurricanes   |
| SLR          | Sea Level Rise                                |
| SMS          | Soil Moisture Sensor                          |
| SOBAC        | Save Our Bay, Air and Canals Association      |
| SOC          | Synthetic Organic Contaminants                |
| SOQ          | Statement of Qualifications                   |

| Abbreviation | Definition                                  |
|--------------|---------------------------------------------|
| STP          | St. Petersburg WDP                          |
| SW           | Surface Water                               |
| SWFWMD       | Southwest Florida Water Management District |
| SWPPP        | Storm Water Pollution Prevention Plan       |
| SWTP         | Surface Water Treatment Plant               |
| SWTR         | Surface Water Treatment Rule                |
| SWUCA        | Southern water Use Caution Area             |
| TAC          | Technical Advisory Committee                |
| TAP          | Tampa Augmentation Project                  |
| TBAA         | Trichloroacetic Acid                        |
| TBC          | Tampa Bypass Canal                          |
| TBEP         | Tampa Bay Estuary Program                   |
| TCAA         | Trichloroacetic Acid                        |
| TCE          | Trichloroethylene                           |
| TCR          | Total Coliform Rule                         |
| TDH          | Total Dynamic Head                          |
| TECO         | Tampa Electric Company                      |
| THI          | Tampa/Hillsborough Interconnect             |
| TM           | Transmission Main                           |
| TOC          | Total Organic Carbon                        |
| TOB          | Top of Bank                                 |
| TPA          | Tampa Port Authority                        |
| TTHM         | Total Trihalomethane                        |
| TTHMFP       | Total Trihalomethane Formation Potential    |
| TV           | Television                                  |
| UCMR         | Unregulated Contaminant Monitoring Rule     |
| UIC          | Underground Injection Control               |

| Abbreviation | Definition                                            |
|--------------|-------------------------------------------------------|
| URA          | Uniform Relocation Act                                |
| USACOE       | United States Army Corps of Engineers                 |
| USCG         | United States Coast Guard                             |
| USEPA        | United States Environmental Protection Agency         |
| USFOS        | US Filter Operating Services                          |
| USFWS        | United States Fish and Wildlife Service               |
| USGS         | United States Geological Survey                       |
| USPAP        | Uniform Standards of Professional Appraisal Practices |
| UV           | Ultra Violet                                          |
| VE           | Value Engineering                                     |
| VFD          | Variable Frequency Drive                              |
| VOC          | Volatile Organic Contaminants                         |
| WDPA         | Water Demand Planning Area                            |
| WF           | Wellfield                                             |
| WHO          | World Health Organization                             |
| WOD          | Works of the District                                 |
| WQC          | Water Quality Certification                           |
| WQP          | Water Quality Parameters                              |
| WQWG         | Water Quality Work Group                              |
| WRAP         | Wetland Rapid Assessment Procedure                    |
| WSMP         | Water Shortage Mitigation Plan                        |
| WSP          | Welded Steel Pipe                                     |
| WTP          | Water Treatment Plant                                 |
| WUP          | Water Use Permit                                      |
| yrs          | Years                                                 |
| \$M          | Million dollars                                       |

## Acknowledgements

Hazen and Sawyer would like to sincerely thank the various people and organizations that have made invaluable contributions to this report:

- All the Tampa Bay Water Officers for their guidance and input throughout the Master Water Plan.
- Ms. Ivana Kajtezovic, Tampa Bay Water Planning Program Manager, for her overall oversight and guidance on the Master Water Plan.
- Ms. Alison Adams, PE, PhD, former Planning Director at Tampa Bay Water, for her overall guidance and contributions, particularly related to demand forecasting.
- Mr. Tirusew Asefa, PhD and Mr. Nisai Wanakule, PhD, at Tampa Bay Water, related to their extensive efforts on the surface water system reliability modeling.
- Many other Tampa Bay Water staff for their contributions related to the surface water system reliability modeling, demand forecasting, development of the Water Shortage Mitigation Plan, Demand Management Plan, Source Water Protection Plan, and overall input and review of the Master Water Plan.
- Black & Veatch Engineering, related to the environmental sustainability and vulnerability assessments, hydraulic analyses, cost development and overall assistance with the Master Water Plan.
- WSP related to the hydrogeological assessments.
- Juturna Consulting for the development and assessment of the south Hillsborough County solutions.
- Dialogue PR related to the development and implementation of the public engagement program.
- Florida Acquisition and Appraisal related to preliminary property assessments.



## EXECUTIVE SUMMARY

### Introduction

Tampa Bay Water is a regional water supply authority created in 1998, which provides wholesale water for its six-member governments: Hillsborough, Pasco and Pinellas counties, and the cities of New Port Richey, St. Petersburg and Tampa. Tampa Bay Water owns and operates a diversified water supply system, which includes 13 wellfields, eight groundwater treatment facilities, one surface water treatment facility, one desalination facility, 15.5-billion-gallon surface water storage reservoir, nine pump stations, several interconnects with the member governments and over 270 miles of transmission mains as shown in Figure ES-1 and further defined in Section 2.

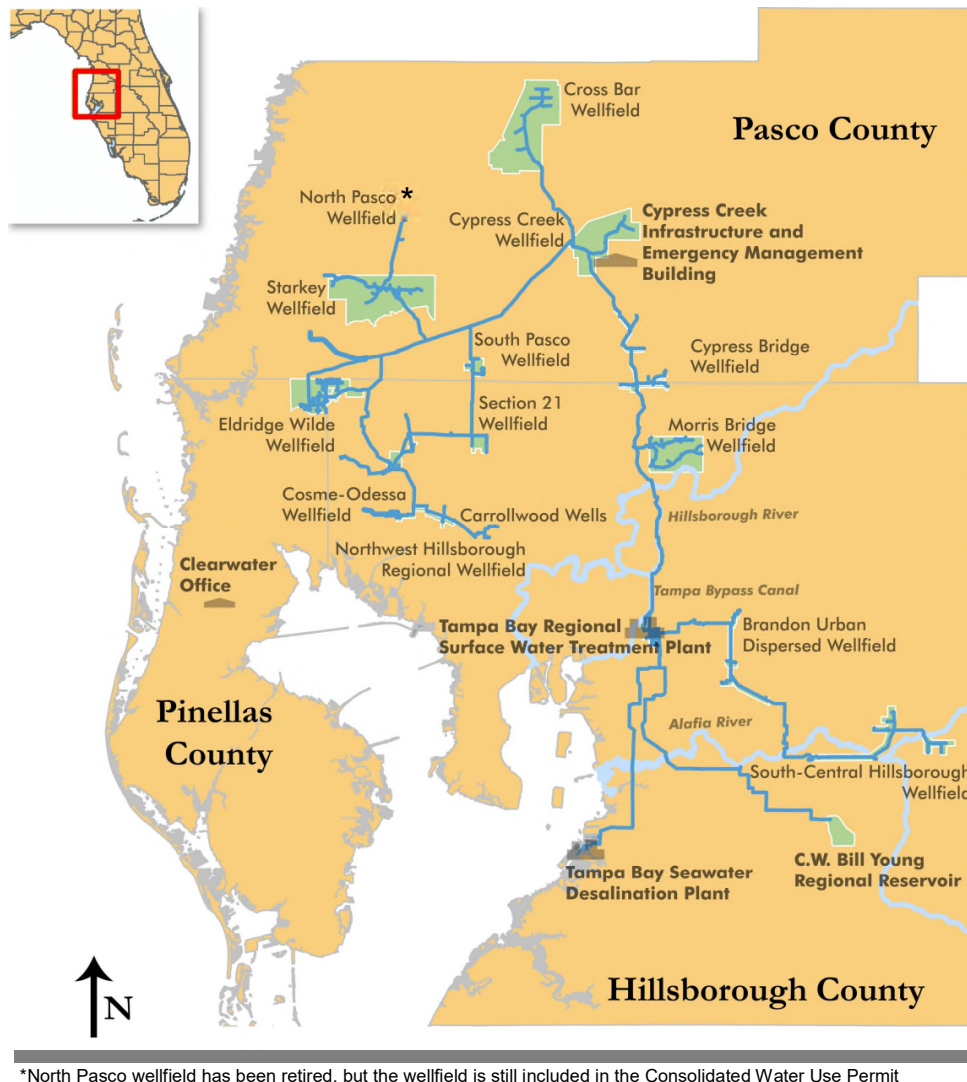


Figure ES-1: Existing Tampa Bay Water System

Tampa Bay Water’s Long-term Master Water Plan (LTMWP) documents how Tampa Bay Water meets its unequivocal obligation to provide Quality Water to the member governments now and in the long-term future as defined in the Interlocal Agreement, and includes several main components as presented in Figure ES-2. The 1998 Amended and Restated Interlocal Agreement (referred to as the Interlocal Agreement) requires the LTMWP be updated every five years which ensures that Tampa Bay Water (Agency) prepares for the provision of adequate supplies over a 20-year planning horizon. Since 1998, Tampa Bay Water has completed four revisions of its LTMWP. This document, entitled Long-term Master Water Plan 2018, is the latest update.

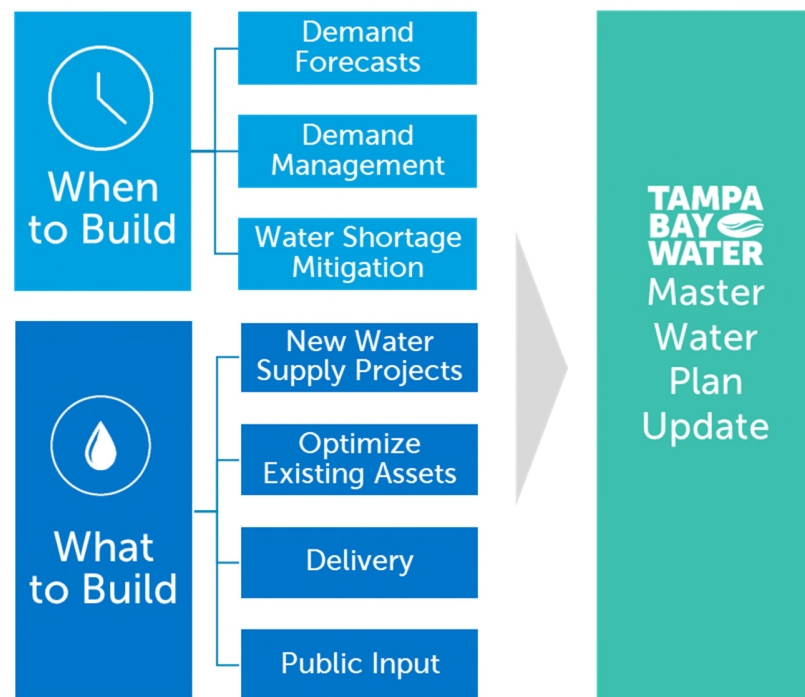


Figure ES-2: Major Components of the LTMWP

## Long-term Master Water Plan Objectives

The objectives of this Long-term Master Water Plan 2018 are to meet the requirements set forth in Section 2.09 of the Interlocal Agreement, which include:

- Identification of current customers, projects, and future customers;
- Review and general inventory of all existing Agency Water Supply Facilities;
- Identification of a capital improvement program for the Agency;
- Review of all current Tampa Bay Water environmental permits, existing regulations and projected regulations;
- Identification of all proposed new water supply facilities;
- Evaluation of Agency staffing;
- Hydraulic analysis of the Agency’s Water Supply Facilities, both existing and proposed;
- Evaluation of present and future sources of water and treatment requirements for those sources in terms of capacity, reliability and economy; and

- Update of the list of proposed Water Supply Facilities required to meet the anticipated Quality Water needs of the member governments for the next 20 years.

The above elements are included in the document as shown in Table ES-1.

**Table ES-1: Long-term Master Water Plan 2018 Required Section Descriptions**

| Requirement                                                                                                                                              | Report Section     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Identify current customers, projects, and future customers                                                                                               | Section 4          |
| Review and generally inventory all existing Agency Water Supply Facilities                                                                               | Section 2          |
| Identify a capital improvement program for the Agency                                                                                                    | Section 16         |
| Review all current Tampa Bay Water environmental permits, existing regulations and projected regulations                                                 | Section 3          |
| Identify all proposed new water supply facilities                                                                                                        | Sections 6 and 9   |
| Evaluate Agency staffing                                                                                                                                 | Section 18         |
| Provide for hydraulic analysis of the Agency's Water Supply Facilities, both existing and proposed                                                       | Section 11         |
| Evaluate present and future sources of Water and treatment requirements for those sources in terms of capacity, reliability and economy                  | Section 8          |
| Update the list of proposed Water Supply Facilities required to meet the anticipated Quality Water needs of the member governments for the next 20 years | Sections 16 and 23 |

Additionally, the following sections relevant to the long-term water supply needs have been added to this LTMWP 2018 to produce a more comprehensive report, which incorporates other relevant areas since the 2013 Master Plan:

- Section 7: South Hillsborough County Supply Options
- Section 8: System-wide Reliability and Future Needs
- Section 9: Water Supply Concept Development
- Section 10: Property Assessment
- Section 12: Climate Variability and Coast Hazards Vulnerability Assessment
- Section 13: Environmental Sustainability Assessments
- Section 14: Coarse Screening of Future Water Supply Concepts
- Section 15: Configuration Development and Fine Screening
- Section 17: Optimization of Existing Facilities
- Section 19: Source Water Assessment and Protection
- Section 20: Demand Management Plan
- Section 21: Public Engagement Program
- Section 22: Implementation Plan for Recommended Future Water Supply Projects
- Section 23: Recommendations

## Projected Water Demands

Tampa Bay Water and the member governments provide water to more than 2.5 million people. Based on an analysis of sustainable system capacity, drought supply capacities and projected demands of all the member governments through the year 2040, Tampa Bay Water has determined that:

- Approximately 20 million gallons per day (mgd) of new supplies need to be developed during this planning horizon (Figure ES-3), and
- Approximately 10 mgd of this 20 mgd will need to be brought online by 2028.

The exact timing of when new supplies need to be online will continue to be evaluated during the next several years as demand forecasts are updated and supply feasibility projects completed. Additional information regarding projected water demands can be found in Section 4.

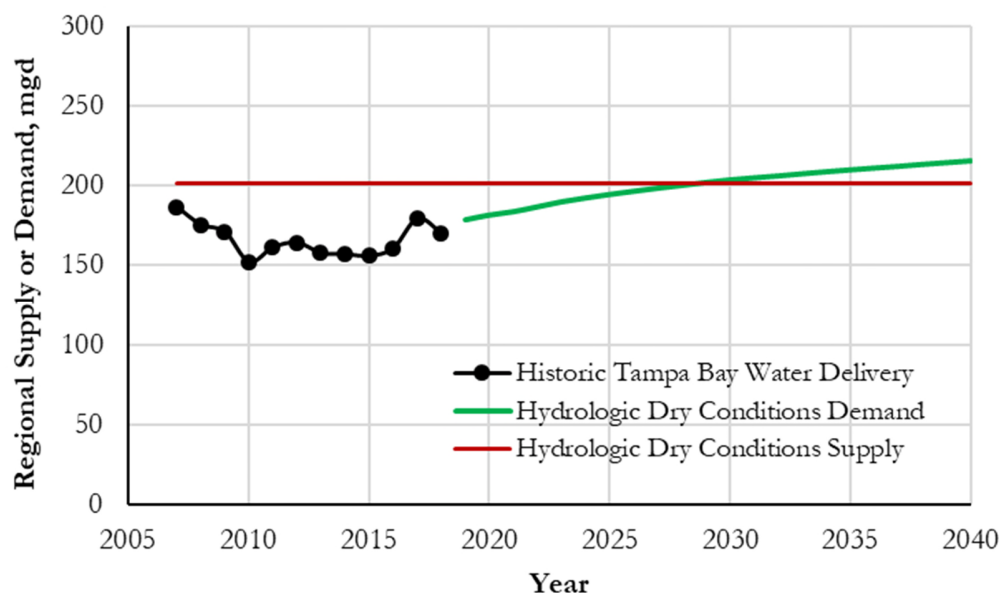


**Figure ES-3: Historic and Projected Regional Tampa Bay Water Delivery as Compared with Available Tampa Bay Water Supplies**

## Potential Future Regional Water Supply Projects

As discussed in Section 6, during the last Long-term Master Water Plan update, the Tampa Bay Water Board approved seven projects for further evaluation:

- Small Footprint Reverse Osmosis
- Tampa Bay Seawater Desalination Plant Expansion
- Gulf Coast Desalination Plant
- Additional Potable Groundwater from Existing Northern Wellfields
- Thonotosassa Wells
- Surface Water Expansion

- Aquifer Recharge

During the current Plan update, three of these projects were not evaluated in depth due to minimal potential for additional supply and/or timeline constraints, as further explained in Section 6:

- Small Footprint Reverse Osmosis Projects
- Additional Potable Groundwater from existing Northern Wellfields.
- Thonotosassa Well Supply

In 2014, the Tampa Bay Water Board of Directors directed the Agency staff to consider potable reuse projects in addition to the potential water supply projects identified in the 2013 Long-term Master Water Plan. A Member Government Working Group was developed in 2014 and met regularly through 2017 to provide input on potential reuse projects, share information on local projects, provide input on screening criteria, public engagement and cost assumptions. The identified reuse projects were narrowed down to a list of approximately 130 projects, which were evaluated and compared as part of a potable reuse-specific coarse screening process.

Based on the results of the coarse screening process, several potable reuse projects were prioritized for further consideration, ultimately leading to two reuse concepts for inclusion in the 2018 Long-term Master Water Plan evaluation and ranking process: Aquifer recharge, and Indirect potable reuse via the Tampa Bay Bypass Canal. The new projects that were developed with respect to these two prioritized reuse concepts and evaluated as part of the current Plan update include the following, as further explained in Section 6:

- New Groundwater Treatment Plant via Net Benefit from South Hillsborough Aquifer Recharge Program (SHARP)
- New Groundwater Treatment Plant via Net Benefit from Expanded SHARP
- Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water in South Hillsborough County
- Purified Water to the Tampa Bypass Canal
- Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Tampa Augmentation Program Credits)
- Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site
- Regional Surface Water Treatment Plant Expansion with Reclaimed Water
- Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water

Based on the 2013 Long-term Master Water Plan, board direction, and the coarse screening of identified reuse projects, several water potable reuse projects were added to this Plan update for more detailed assessment as potential strategies for meeting future water supply needs in the Tampa Bay Water region as summarized in Table ES-2.

**Table ES-2: Water Supply Project Summary**

| Category                              | Potential Water Sources                                                                           | Recommended for Detailed Assessment? |
|---------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Previously Identified Projects</b> | Small Footprint Reverse Osmosis Projects                                                          | No                                   |
|                                       | Tampa Bay Seawater Desalination Plant Expansion                                                   | Yes                                  |
|                                       | Gulf Coast Desalination Plant                                                                     | Yes                                  |
|                                       | Additional Potable Groundwater from Existing Northern Wellfields                                  | No                                   |
|                                       | Thonotosassa Wells                                                                                | No                                   |
|                                       | Surface Water Expansion                                                                           | Yes                                  |
|                                       | Aquifer Recharge                                                                                  | Yes                                  |
| <b>New Projects</b>                   | New Groundwater Treatment Plant via Net Benefit from SHARP Program                                | Yes                                  |
|                                       | New Groundwater Treatment Plant via Net Benefit from Expanded SHARP Program                       | Yes                                  |
|                                       | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                               | Yes                                  |
|                                       | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP) | Yes                                  |
|                                       | Purified Water to Tampa Bypass Canal                                                              | No                                   |
|                                       | Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site               | Yes                                  |
|                                       | Regional Surface Water Treatment Plant Expansion with Reclaimed Water                             | Yes                                  |
|                                       | Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water                              | Yes                                  |

## Potential South Hillsborough County Water Supply Projects

South Hillsborough County is projected to experience significant growth, which will exceed Tampa Bay Water's available delivery capacity in South Hillsborough County by 2025 as shown in Figure ES-4 and further discussed in Section 7.

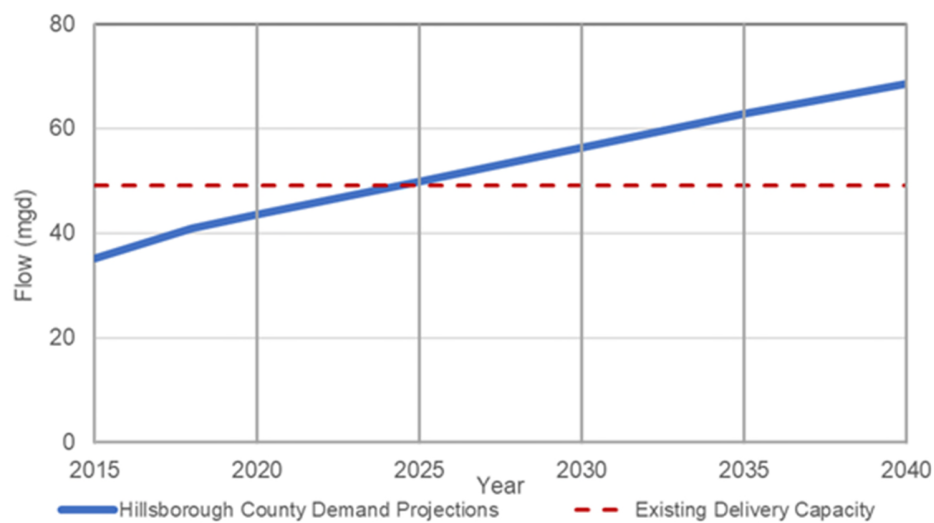


**Figure ES-4: Projected Tampa Bay Water Delivery to Hillsborough County as Compared with Available Tampa Bay Water Supplies**

Tampa Bay Water has adequate regional supply to meet South Hillsborough County’s projected demands by 2025; however, the Agency’s ability to meet the projected demand is constrained by existing regional infrastructure and permitted capacity of the South-Central Hillsborough Regional and Brandon Urban Dispersed wellfields. Tampa Bay Water will need to either expand an existing Hillsborough County’s point of connection or install a new point of connection to meet projected needs in 2025 and beyond.

Potential infrastructure improvement concepts and associated capacity increases were identified and evaluated as part of the LTMWP based on several factors, including capital costs, operations and maintenance costs, reliability and redundancy, constructability, and operational complexity. Details of the various concepts are included in Section 7. Two projects were shortlisted for further evaluation: New regional feed pipeline to Balm area (Project 5) and New Groundwater Treatment Plant via net benefit from SHARP (Project 8). Project 5 includes the delivery of existing regional supply to a new Point of Connection in the Balm area via approximately 20 miles of 42-inch transmission main from the Tampa Bay Water Regional Facilities Site to the Balm area, which could supply up to 25 mgd. Project 8 includes the early implementation of the groundwater treatment plant via net benefit from SHARP, the first phase of which could provide an estimated 7.5 mgd of new supply to the south Hillsborough County area.

## System Wide Source Reliability and Future Needs

To evaluate the reliability, resiliency and yields of the various regional supply projects, Tampa Bay Water modeled the entire regional water supply and delivery system, as further described in Section 8. The results of these analyses were used to select projects that would either provide the required 20 mgd of new supply as a standalone project or would meet the 20 mgd yield requirement in combination with another project. The modeling indicated that each water supply concept can provide approximately 10 – 20 mgd and keep the regional reservoir at approximately 80% of capacity. The result of this analysis was a listing of projects that were further analyzed, as well as the combining of projects into concepts to achieve the 20 mgd of additional supply needs.



## Water Supply Concept Development and Coarse Screening

Based on the modeling and yield analyses, 13 water supply concepts were developed for consideration as pathways for supplying the Tampa Bay Water service area with an additional 20 mgd of water supply (Section 9). Developed water supply projects could provide 20 mgd as sole supply or they were combined with other water supply projects. In addition to being able to provide the required regional water supply yield, the environmental impacts, costs, property requirements, ability to integrate into the existing infrastructure, and vulnerability of each water supply concept were also considered. To determine if any of the water supply concepts could be eliminated before conducting a more detailed evaluation, the concepts were subjected to a coarse screening evaluation. The coarse screening involved the use of five decision-making criteria, all of which have been used in previous Tampa Bay Water Master Water Plans. The five criteria capture potential impacts of a new water supply concept with respect to cost, yield reliability, the environment, source water protection, implementation, feasibility, risk, regulations, contracts, and public reception. Based on the coarse screening process, the water supply concepts that were considered for further evaluation are summarized in Table ES-3.

**Table ES-3: Recommended Water Supply Concepts for Inclusion in the Fine Screening Evaluation**

| Water Supply Concepts                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------|
| Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant Expansions with Existing Sources                            |
| New Gulf Coast Desalination Facility                                                                                                         |
| Regional Surface Water Treatment Plant Expansion with Existing Source and New Groundwater Treatment Plant via Net Benefit from SHARP Program |
| Tampa Bay Seawater Desalination Plant Expansion with Existing Source and New Groundwater Treatment Plant via Net Benefit from SHARP Program  |
| New Groundwater Treatment Plant via Net Benefit from Expanded SHARP Program                                                                  |
| Regional Surface Water Treatment Plant Expansion with New Groundwater via Tampa Credits (Native Groundwater Quality)                         |
| Regional Surface Water Treatment Plant Expansion with Existing Source and New Advanced Water Treatment Plant for Reclaimed Water             |
| Tampa Bay Seawater Desalination Plant Expansion with Existing Source and New Advanced Water Treatment Plant for Reclaimed Water              |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                                                                          |

## Configuration Development and Fine Screening

The shortlisted project concepts were combined with the project solutions for meeting the South Hillsborough County demands in 2025 to develop a list of potential project configurations. These configurations were then further evaluated through a more detailed screening and evaluation processes. A detailed description of that process and those configurations can be found in Sections 15. The top ranked configurations included three unique water supply projects (Table ES-4)**Error! Reference source not found.**, which are recommended for additional feasibility study:



- Expansion of the Regional Surface Water Treatment Plant with existing source water (included in Configurations 1 and 3);
- Expansion of the Tampa Bay Seawater Desalination Plant with existing source water (included in Configurations 1 and 4A); and
- New groundwater treatment plant with withdrawals enabled by net benefit from SHARP program (included in Configurations 3, 4A, and 5A).

**Table ES-4: Recommended Water Supply Projects for Further Evaluation**

| Project                                            | Source                         | Additional Yield |
|----------------------------------------------------|--------------------------------|------------------|
| SWTP Expansion with Existing Source                | Existing surface water sources | 10 – 12.5 mgd    |
| Desalination WTP Expansion with Existing Source    | Existing seawater source       | 10 – 12.5 mgd    |
| New Groundwater via Net Benefit from SHARP program | Groundwater                    | 7.5 mgd          |

In addition, two of the recommended four configurations include the construction of a new regional pipeline from the Regional Facilities Site to a new Balm Point of Connection to address water supply limitations in south Hillsborough County (included in Configurations 1 and 3) Please refer to table ES-12.

## Top Ranked Water Supply Projects for Meeting Future Demands

Following is a brief description of the recommended top-ranked projects. Details including an overall description, major components, costs, and special considerations, are discussed in Section 16. The descriptions and costs for each project assume that it is being implemented as a first phase project as both a regional and south Hillsborough County supply because the actual phasing of these projects is unknown at this time.

### Project 1 - New Groundwater Treatment Plant via Net Benefit from South Hillsborough Aquifer Recharge Project (SHARP)

The 7.5 mgd water supply project includes three major components:

- Groundwater withdrawal wellfield;
- Groundwater treatment plant; and
- Finished water transmission from the new groundwater treatment plant to the regional system.

The estimated construction costs for this project is provided in Table ES-5. No cost is included for the transferral of groundwater credits from Hillsborough County to Tampa Bay Water, nor reclaimed water from a member government to Tampa Bay Water.

**Table ES-5: Summary of estimated construction costs for New Groundwater Treatment Plant via Net Benefit from SHARP – 7.5 mgd Yield**

| SUMMARY                                                                |               |
|------------------------------------------------------------------------|---------------|
| Capital Cost <sup>1</sup>                                              | \$116 million |
| Annual Operation and Maintenance Cost <sup>2</sup>                     | \$1.1 million |
| Capital Cost per 1,000 gallons <sup>1,3</sup>                          | \$3.11        |
| Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup> | \$0.38        |
| Total Unit Cost per 1,000 gallons <sup>1,2,3</sup>                     | \$3.49        |

<sup>1</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>2</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor; no inclusion of costs related to the transfer of groundwater credits from Hillsborough County to Tampa Bay Water

<sup>3</sup> Assumes a 30-year bond term and 6% interest rate

### Project 2 – Tampa Bay Seawater Desalination Plant Expansion with Existing Source Water

This water supply project involves expanding the existing desalination facility to provide an additional 10 – 12.5 mgd of water (depending on the specific configuration) within the existing site constraints and with increased use of the existing source water. Expansion of the existing desalination plant includes the following major components:

- Seawater supply line and pump station improvements;
- Pretreatment process upgrades;
- Reverse osmosis, post-treatment, and residuals management process expansions;
- Finished water pump station expansion.

The EOPCC for the Desalination Plant expansion is summarized in Table ES-6. **Error! Reference source not found..**

**Table ES-6: Summary of EOPCC for Tampa Bay Seawater Desalination Plant Expansion with Existing Source – 10 mgd and 12.5 mgd Yield**

| SUMMARY                                                                |               |                |
|------------------------------------------------------------------------|---------------|----------------|
| Category                                                               | 10 mgd Yield  | 12.5 mgd Yield |
| Capital Cost <sup>1</sup>                                              | \$244 million | \$244 million  |
| Annual Operation and Maintenance Cost <sup>2</sup>                     | \$6.2 million | \$7.7 million  |
| Capital Cost per 1,000 gallons <sup>1,3</sup>                          | \$4.88        | \$3.89         |
| Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup> | \$1.70        | \$1.69         |
| Total Unit Cost per 1,000 gallons <sup>1,2,3</sup>                     | \$6.58        | \$5.58         |

<sup>1</sup> It was assumed that the existing pretreatment process will be replaced with a dissolved air flotation (DAF)/membrane filtration (MF) system to address the overall reliability of the facility; capital cost includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>2</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor; no inclusion of costs related to the transfer of groundwater credits from Hillsborough County to Tampa Bay Water

<sup>3</sup> Assumes a 30-year bond term and 6% interest rate

### Project 3 - Regional Surface Water Treatment Plant Expansion with Existing Source Water

This water supply project involves expanding the existing Regional Surface Water Treatment Plant to provide an additional 10 – 12.5 mgd of yield (depending on the specific configuration) within the existing site constraints and with increased use of the existing source waters. Expansion of the existing Regional Surface Water Treatment Plant includes the following major components:

- Influent piping system improvements;
- Process and support system expansions for the ACTIFLO®, ozone, biofiltration, chlorination, and residuals unit processes; and
- Increased chemical storage.

The EOPCC for the Regional Surface Water Treatment Plant expansion is summarized in Table ES-7.

**Table ES-7: Summary of EOPCC for Regional Surface Water Treatment Plant Expansion with Existing Source – 10 mgd and 12.5 mgd Yield**

| SUMMARY                                                                |               |                |
|------------------------------------------------------------------------|---------------|----------------|
| Category                                                               | 10 mgd Yield  | 12.5 mgd Yield |
| Capital Cost <sup>1</sup>                                              | \$88 million  | \$88 million   |
| Annual Operation and Maintenance Cost <sup>2</sup>                     | \$1.4 million | \$1.6 million  |
| Capital Cost per 1,000 gallons <sup>1,3</sup>                          | \$1.78        | \$1.42         |
| Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup> | \$0.38        | \$0.36         |
| Total Unit Cost per 1,000 gallons <sup>1,2,3</sup>                     | \$2.16        | \$1.78         |

<sup>1</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>2</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor; no inclusion of costs related to the transfer of groundwater credits from Hillsborough County to Tampa Bay Water

<sup>3</sup> Assumes a 30-year bond term and 6% interest rate

The Regional Surface Water Treatment Plant Expansion and possibly the Seawater Desalination Plant Expansion would require a new regional pipeline to be constructed from the Regional Facilities Site to south Hillsborough County (Balm Point of Connection) in order to meet south Hillsborough County's growing water needs by 2025. The new Groundwater Treatment Plant via net benefit from SHARP can supply the needs of South Hillsborough County by 2025 if implemented. The required capacity of the pipeline depends on the anticipated second phase supply project and could require a 42-inch or a 36-inch pipeline.

A summary of the estimated costs for both the 42-inch and 36-inch diameter regional pipeline, assuming that the capital cost of the pipeline would be split between Tampa Bay Water and Hillsborough County, is presented in Table ES-8.

**Table ES-8: Summary of EOPCC for Regional Pipeline from the Regional Facilities Site to the Balm Area POC in South Hillsborough County – 42-inch and 36-inch Diameter**

| SUMMARY                                                                |                  |                  |
|------------------------------------------------------------------------|------------------|------------------|
| Category – 10 mgd Yield                                                | 42-inch Diameter | 36-inch Diameter |
| Capital Cost <sup>1</sup>                                              | \$96.7 million   | \$75.9 million   |
| Annual Operation and Maintenance Cost <sup>2</sup>                     | \$1.1 million    | \$0.7 million    |
| Capital Cost per 1,000 gallons <sup>1,3</sup>                          | \$1.95           | \$1.53           |
| Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup> | \$0.29           | \$0.19           |
| Total Unit Cost per 1,000 gallons <sup>1,2,3</sup>                     | \$2.23           | \$1.73           |
| Category – 12.5 mgd Yield                                              | 42-inch Diameter | 36-inch Diameter |
| Capital Cost <sup>1</sup>                                              | \$96.7 million   | \$75.9 million   |
| Annual Operation and Maintenance Cost <sup>2</sup>                     | \$1.1 million    | \$0.7 million    |
| Capital Cost per 1,000 gallons <sup>1,3</sup>                          | \$1.56           | \$1.23           |
| Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup> | \$0.23           | \$0.16           |
| Total Unit Cost per 1,000 gallons <sup>1,2,3</sup>                     | \$1.79           | \$1.38           |

<sup>1</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>2</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor; no inclusion of costs related to the transfer of groundwater credits from Hillsborough County to Tampa Bay Water

<sup>3</sup> Assumes a 30-year bond term and 6% interest rate

## Optimization of Existing Facilities

Two of the top-ranked water supply projects for meeting future demands, the Regional Surface Water Treatment Plant and the Tampa Bay Seawater Desalination Plant Expansions, involve the expansion of existing treatment facilities. To implement these expansions cost-effectively, existing assets should first be leveraged to the greatest extent possible to maximize the reliability and yield of existing infrastructure, as well as to inform any additional feasibility and design work associated with the expansion. Tampa Bay Water has the potential to increase the annual average (sustainable) yields from both the existing Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant by approximately 5 mgd for each facility, which has the potential to delay the timing for future water supply projects by optimizing the existing assets. Further analysis is required at both sites to confirm the potential improvements and estimated costs.

## Demand Management Plan

The 2018 Demand Management Plan update consists of a comprehensive evaluation of benefits and costs of integrated water demand management as a quantifiable, complementary alternative to conventional water supply sources. The update reflects improvements in the state of water use efficiency occurring since 1995 when the first Demand Management Plan was adopted. The plan also includes implementation of demand management projects as a beneficial tool for long-term water supply planning. Results define how water efficiency activities may delay the need to build new supplies as part of Tampa Bay Water’s long-term water supply planning process.

The demand management evaluation effort includes an analysis of water savings (past and future) and an analysis of avoided supply costs related to improved water use efficiency. The “avoided supply cost” analysis considers increments of conserved water versus (a) cost to operate existing water supply sources and (b) total cost (capital and operating costs) to develop new water supply. Consideration of cost savings

and water supply benefits permits a consistent “apples to apples” comparison of demand management options relative to other water supply alternatives.

Consistent with Board direction, various demand management implementation strategies were evaluated to determine how demand management could be implemented to secure savings within identified time frames. Tampa Bay Water is working with its member governments to develop water efficiency programs that will help reduce projected demands by up to 11 mgd by 2030 if ultimately adopted by the Board, which could delay the future implementation of regional water supply projects.

## **Public Engagement Program**

For the LTMWP 2018, the purpose of the education and outreach effort was to:

- Inform residents on the planning and decision-making processes,
- Educate residents about the potential projects and sources under consideration, and
- Ensure stakeholders’ priorities and concerns are included and considered in project ranking and selection.

Because a new source of supply (reclaimed water) was being considered in this update of the LTMWP, water quality education became an important component of the public engagement process.

Tampa Bay Water began public information and outreach for the LTMWP 2018 in 2014. Efforts completed since that time include establishing and meeting regularly with a Member Government Working Group to obtain feedback on potable reuse options; conducting two statistically valid public opinion surveys; ad hoc committee discussions; two focus groups; water quality campaign and microsite; speakers bureau presentations; online survey; three telephone town hall meeting and public information and education efforts. All public engagement efforts are highlighted in Section 21 along with the key findings from the public education and outreach efforts.

The LTMWP summarizes all input received during the planning period to help inform Tampa Bay Water’s board of directors as it selects projects for further evaluation and possible implementation. The input was also factored into the project scoring with existing sources ranked higher from a public acceptance perspective than new alternative sources. Key findings include:

- Water quality remains a priority among residents. Less than 60% of survey respondents currently drink their tap water. Waning confidence in the current water supply will complicate public acceptance of an alternative supply that has more complex water quality concerns than the existing sources.
- Protecting the Floridan Aquifer is a priority for residents. Residents expressed concern about any activity that could harm the aquifer, including fracking, aquifer recharge and excessive groundwater pumping that would allow saltwater intrusion.
- Government trust plays a role in public acceptance. Residents are keenly aware of water crises that have occurred across the country (e.g. Flint, Michigan) and are also attuned to problems that have occurred statewide and locally (surface water problems, tap water quality concerns, wastewater overflows, etc.).

- Given the concern for water quality and the mistrust of government, it is not surprising that residents favor existing sources (groundwater, river water and desalinated seawater) over reclaimed water. Health and safety are the top concerns for reclaimed water cited by residents.
- Conservation and growth are also factors that residents cite when discussing the need for new water supplies. Reducing demand and eliminating waste is important to residents. Residents want to know that the resource is being used wisely and efficiently and see conservation as an important step before new supplies are built.

All of the public input received over the past three years will be used to tailor project-specific public information and outreach programs for projects short-listed by the Board in December 2018. Input will be used to develop key messages, educational elements, outreach programs and more to ensure residents are fully informed and engaged as the selected projects move through final design. Input gathered in the next phase will be presented to Tampa Bay Water's board of directors to inform its decision in selecting the next water supply for the Tampa Bay region.

## **Implementation Plan for Recommended Future Water Supply Projects**

The shortlisted projects for additional feasibility study to meet the initial phase of the regional water supply needs are:

- New Groundwater Treatment Plant via Net Benefit from the SHARP Program
- Tampa Bay Seawater Desalination Plant Expansion with Existing Source Water
- Regional Surface Water Treatment Plant Expansion with Existing Source Water

The goal of additional feasibility studies is to select one of the above projects for implementation to meet the initial regional water supply needs by 2028. Either of the remaining projects or another one of the highly ranked projects from the 2018 Plan update can then be coupled with the selected project to meet the long-term regional supply needs within the 2040 planning period. The required implementation timing of these projects depends on the selected project to meet south Hillsborough County needs, and the implementation of the Tampa Augmentation Program and/or other projects that could affect the need for new supplies. The projects shortlisted for further evaluation to meet the short-term needs of south Hillsborough County are:

- New Groundwater Wellfield and Treatment Plant via Net Benefit from South Hillsborough Aquifer Recharge Program
- Pipeline from the Regional Facilities Site to the Balm area of south Hillsborough County.

## **Implications of South Hillsborough County Projects**

The water supply projections for south Hillsborough County are presented in Figure ES-5.

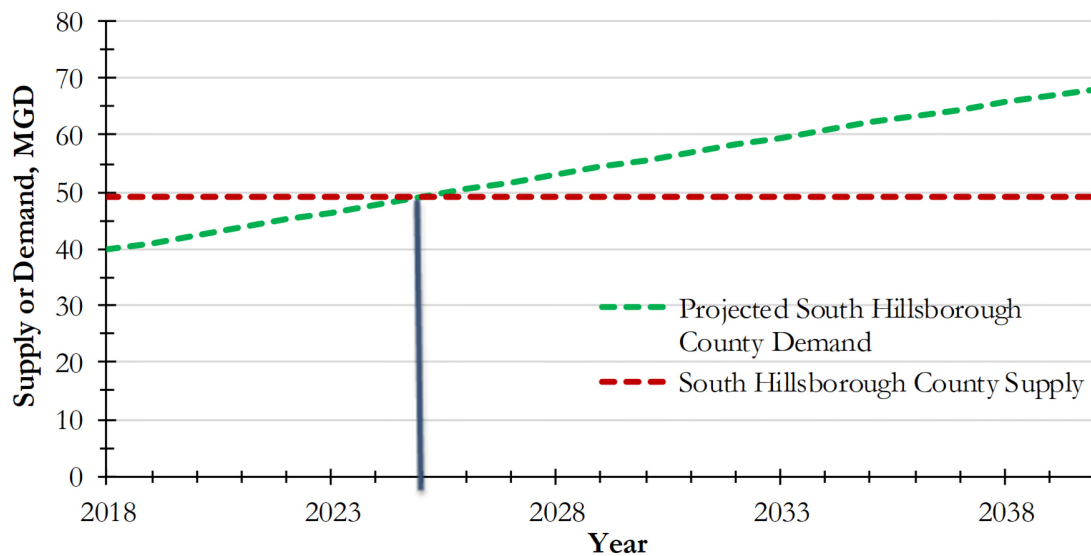


**Figure ES-5: South Hillsborough County Supply and Projected Demands used in the LTMWP Planning Process**

Based on these projections and the existing available supplies to south Hillsborough County, additional water supply is required in that region by 2025. To meet these growing demands, a south Hillsborough County project should be selected in February 2020, to complete the project by 2025.

If the regional pipeline project to a new Balm area point of connection is selected as the project to meet the needs in south Hillsborough County by 2025, the timing of the regional water supply projects will not be impacted. A new regional supply will still be required by 2028 because the new pipeline does not bring new supplies into the region but only provides a pipeline to convey existing water to south Hillsborough County. The new pipeline would carry as much as 25 mgd of regional supply to the south Hillsborough County area, delaying the need for additional supply to the south Hillsborough County area until after 2040 as shown in Figure ES-6.



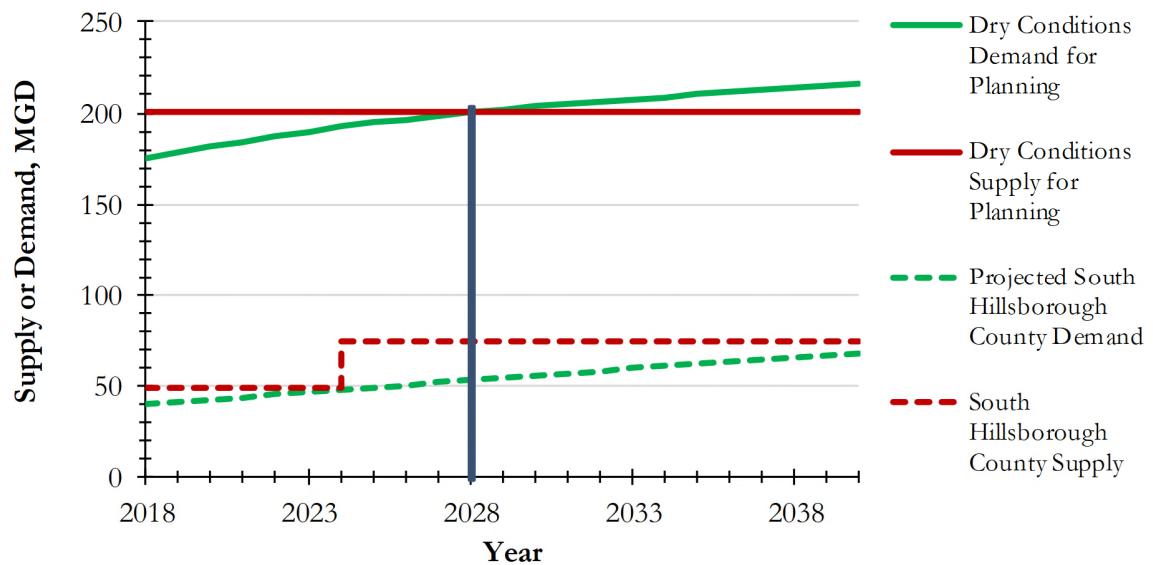


**Figure ES-6: Estimated Impact on Timing of New Regional Supply if Pipeline is Installed to Meet South Hillsborough County Supply Needs**

If the new Groundwater Treatment Plant project is selected as the solution for South Hillsborough County supply needs, the timing of Phase 1 of the regional supply project could be delayed until 2033 as presented in Figure ES-7.

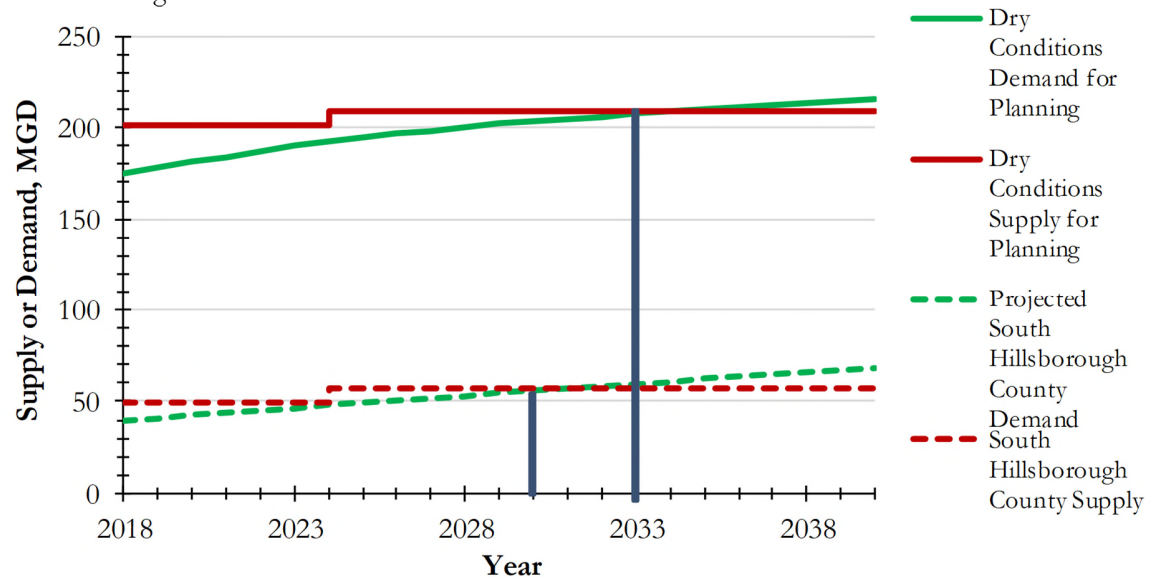


**Figure ES-7: Estimated Impact on Timing of New Regional Supply if New Groundwater Treatment Plant is Installed to Meet South Hillsborough County Supply Needs**

The new Groundwater Treatment Plant provides up to 7.5 mgd of additional supply to both south Hillsborough County and the region. Based on this additional supply, the next regional project could be



delayed until 2033. However, under this scenario, south Hillsborough County will need additional supply by 2030.

## **Effects of Other Long-term Master Water Plan Components on Project Timing**

The implications of the following aspects of the Long-term Master Water Plan on project timing were also considered:

- Optimization of existing facilities
- Implementation of Demand Management Program
- Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19%
- Water Shortage Mitigation Plan
- Implementation of Tampa Augmentation Program (TAP)

These components and others described further below, mainly affect the timing of the regional water supply projects but may have some effect on the later phases of the supply projects required to serve south Hillsborough County. Because of the uncertainty of the exact benefit of each component, the potential timing effects are described below as independent impacts; however, they could be coupled together to have even greater impacts as described under the TAP scenario.

### **Optimization of Existing Facilities**

Tampa Bay Water has the opportunity to optimize its existing Regional Surface Water Treatment Plant and Seawater Desalination Plant, which has the potential to increase the available regional supplies by up to 10 mgd, approximately 5 mgd from each facility. If both facilities are successfully optimized before 2028, Phase 1 of regional supply projects could be delayed until approximately 2035. Additional supply from the optimized Desalination Plant could also be directly supplied to south Hillsborough County, which has the potential to delay the second phase of a supply project to south Hillsborough County until approximately 2034 assuming a new groundwater treatment plant (7.5 mgd) is constructed initially to meet the south Hillsborough County needs.

### **Implementation of Demand Management**

Implementation of the Demand Management Program can reduce the annual average demands within the region by up to 11 mgd within the 2040 planning period, which maximizes the availability of the existing supplies. This program likely will not affect the timing of Phase 1 for either the regional supply or south Hillsborough County supply because water savings may take several years to consistently observe, but demand management could delay Phase 2 by at least 5 to 10 years for the regional supply project. The impact of demand management on the long-term supply needs in south Hillsborough County is uncertain.

### **Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19%**

Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19% will potentially increase the yield of the Regional Surface Water Treatment Plant Facility by approximately 2 mgd based on the modeling discussed in Section 8. This could result in a delay of the Phase 1 regional supply project by approximately two years and a delay of the Phase 2 regional supply project by three years.

## **Water Shortage Mitigation Plan**

The purpose of the Water Shortage Mitigation Plan is to provide Tampa Bay Water and its member governments with a strategy for identifying and responding to water supply shortages caused by extended hydrologic drought conditions. The Water Shortage Mitigation Plan does not affect long-term demand, nor is it likely to impact the timing of Phase 1 or Phase 2 projects, but rather is a plan for Tampa Bay Water to meet member government water needs during extended hydrologic droughts with its existing regional system in an environmentally sustainable manner. Implementation of this plan would potentially allow the Agency to meet demands during infrequent but extended drought events, avoiding infrastructure investment specifically for these events that would seldom be used. Thus, the Water Shortage Mitigation Plan allows the Long-term Master Water Plan to focus on long-term water supply needs for the future.

## **Tampa Augmentation Program**

Tampa Augmentation Program is a City of Tampa potable reuse project which evaluates the feasibility of using reclaimed water to supplement the City's drinking water supply. On-going feasibility work is being conducted by the City of Tampa to confirm the potential yields of this project. The estimated completion date for the project is currently 2027. If successful, the City of Tampa will be able to self-supply by that date, thus eliminating the City's need for raw surface water augmentation from the Tampa Bypass Canal via the Harney Canal, which will make available approximately 1.8 mgd of additional source water on an annual average basis.<sup>1</sup> This project also has the potential to reduce the City of Tampa's dependence on Tampa Bay Water, which allows Tampa Bay Water to reallocate 6 mgd of regional supply that is currently budgeted to the City on an annual average basis, as well as that which is projected to be needed by the City over the 2040 planning horizon (up to 22 mgd, including the annual budgeted allocation of 6 mgd).

Based on the reduced demands and potential increase in available supplies, the implementation of Tampa Augmentation Project has the potential to delay the future water supply projects. However, the timing depends on which project is implemented as the south Hillsborough County solution and if other water supply improvements are implemented such, as optimization of the existing facilities or increasing the permitted withdrawals of Alafia River. Ultimately, the quantity of water that can be made available from these permits for regional use by Tampa Bay Water will be determined through the permitting process with the Southwest Florida Water Management District.

Although the City of Tampa estimates TAP to be implemented by 2027, up to 3 years operational data from TAP may be required before Tampa Bay Water can realize the benefits from TAP and depend on TAP to offset future supplies because of the uncertainty associated with construction delays, permitting, actual yields, and observed water quality. This may push off the potential date of when regional benefits may be observed from TAP beyond 2027, details of which can be found in Section 22.

## **Summary**

Table ES-9 summarizes the timing implications of the other Master Water Plan components on both the regional and south Hillsborough County projects.

---

<sup>1</sup> Refer to descriptions of Runs 108 and 109 in Appendix 8B

**Table ES-9: Summary of Potential Timing Implications for other Master Plan Components**

| Condition No. and Description |                                                                         | Selected South Hillsborough County Supply Option <sup>(1)</sup> | Schedule of South Hillsborough County Supply Project |             | Schedule of Regional Supply Project |                                 |
|-------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------|-------------|-------------------------------------|---------------------------------|
|                               |                                                                         |                                                                 | Phase 1                                              | Phase 2     | Phase 1                             | Phase 2                         |
| 1                             | Current regional demand projections (Baseline Schedule)                 | N/A                                                             | NA                                                   | NA          | 2028                                | 2033-2038 <sup>(2)</sup>        |
| 2                             | Current regional demand with south Hillsborough County Projects         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | 2033-2038 <sup>(2)</sup>        |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2033                                | Beyond 2040                     |
| 3                             | If SWTP and Desalination Plant optimized by 2028 <sup>(3)</sup>         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2035                                | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2034        | Beyond 2040                         | Beyond 2040                     |
| 4                             | If full Demand Management Program is implemented by 2030 <sup>(4)</sup> | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | Beyond 2040                         | Beyond 2040                     |
| 5                             | If Alafia withdrawal permit is increased to 19% by 2028 <sup>(5)</sup>  | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2030                                | 2036-Beyond 2040 <sup>(2)</sup> |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2036                                | Beyond 2040                     |
| 6                             | If Water Shortage Mitigation Plan is implemented <sup>(6)</sup>         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | 2033-2038 <sup>(2)</sup>        |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2033                                | Beyond 2040                     |
| 7                             | If Tampa Augmentation Project is implemented by 2027 <sup>(7)</sup>     | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028-Beyond 2040 <sup>(8)</sup>     | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | Beyond 2040                         | Beyond 2040                     |

<sup>1</sup> Assuming the pipeline to south Hillsborough County has a capacity of 20 mgd or more, and the groundwater treatment plant provides 7.5 mgd to the region and to south Hillsborough County through the use of SHARP credits

<sup>2</sup> Depends on which project is implemented in Phase 1; Phase 1 projects may range from 7.5 mgd to 12.5 mgd of yield

<sup>3</sup> Assumes a total of 10 mgd to the region, including 5 mgd from the Desal WTP to south Hillsborough County

<sup>4</sup> Assumes demand management activities increase available supply up to 11 mgd by 2030; impact of demand management on south Hillsborough County demand projections is uncertain

<sup>5</sup> Assumes an increase in the yield of the Regional Surface Water Treatment Plant up to 2 mgd

<sup>6</sup> Assumes the Water Shortage Mitigation Plan does not impact long-term supply needs

<sup>7</sup> Assumes 6 mgd is no longer needed by City of Tampa on an annual average basis, long-term City demands are met with self-supply, and up to 1.8 mgd annual average of additional surface water after full TAP implementation

<sup>8</sup> Timing could be shifted beyond 2028 if another water supply project is implemented in the near-term, such as optimization of existing facilities, to provide additional time to realize the benefits of TAP before implementing a major Phase 1 project.

## 2018 Long-term Master Water Plan Recommendations

The specific recommendations for each major Long-term Master Water Plan component follow:

### Demand Forecast

- Continue to implement and enhance Tampa Bay Water's planning and management activities to address both seasonal and severe drought events and long-term future water supply needs,

all of which enables continued monitoring and assessment of existing and future water supply reliability.

- Continue to participate in state water policy and regulatory discussions to further an understanding by policy-makers of the complexities associated with developing and operating surface water supply systems.
- Understand any beneficial initiatives, such as conjunctive use approaches, that may be proposed State-wide that could also assist the agency with its planning efforts.
- Coordinate demand projections with Hillsborough County to determine potential impacts on the required timing of the selected south Hillsborough County supply project.

### **Demand Management**

- Proceed with the Demand Management Implementation Plan as approved at the Tampa Bay Water August 2018 Tampa Bay Water Board of Directors meeting.
- Apply for financial support of the Demand Management Implementation Plan from the Southwest Florida Water Management District (District) through the Cooperative Funding Initiative.
- Develop an implementation strategy by April 2019 that can be implemented in a timely manner to realize proposed savings, working closely with the member governments.

### **Water Shortage Mitigation Plan**

- Continue to regularly update the Agency's Water Shortage Mitigation Plan to allow Tampa Bay Water to meet demands with the existing and future regional water supply system during drought events, thus allowing the 2018 Plan to focus on long-term water supply needs of the member governments.
- Continue working with the District for the implementation of the Water Shortage Mitigation Plan through the renewal of the Consolidated Water Use Permit to address short term, drought-related supply needs.

### **New Water Supply Projects**

- Proceed with additional feasibility study of the three shortlisted water supply projects as detailed in Section 23. Confirm by December 2022 which regional supply project to move forward for implementation to meet the Phase 1 timeline of new supply by 2028:
  - New Groundwater Wellfield and Treatment Plant via Net Benefit from the South Hillsborough Aquifer Recharge Program
  - Desalination Water Treatment Plant Expansion with Existing Source Water
  - Regional Surface Water Treatment Plant Expansion with Existing Source Water
- Proceed with the additional feasibility and preliminary investigation work associated with the two south Hillsborough County options to select by February 2020 which project to move forward for implementation to meet the south Hillsborough County supply needs by 2025:
  - New Groundwater Wellfield and Treatment Plant via Net Benefit from the SHARP Program
  - New Pipeline from Tampa Bay Water's Regional Facilities Site to the Balm area of south Hillsborough County

- Finalize the Memorandum of Understanding and cost for aquifer recharge credits associated with the south Hillsborough County project options.
- Continue to monitor the Tampa Augmentation Program and its feasibility to determine the potential effects on the timing of future water supply projects.
- Continue to monitor potable reuse regulatory framework discussion and rulemaking.
- Continue to refine the new water supply implementation timing strategy by taking into consideration all LTMWP components. This will include a development of indicators (sign posts) and trigger mechanism for bringing in new water supply sources informed by continued annual update of demand forecast as well as demand management implementation.

### **Optimize Existing Assets**

- Proceed with additional feasibility of the existing Regional Surface Water Treatment Plant and the existing Desalination Plant to optimize the existing facilities and increase potential sustainable yields for each facility.
- Continue to evaluate opportunities for optimizing and enhancing Tampa Bay Water's existing water supply systems.

### **Delivery**

- Continue to perform hydraulic and other system analyses of Tampa Bay Water's regional transmission system to optimize current operations and refine plans for the projected future operating conditions and integration of new supply sources.
- Update the surge analysis in the future to account for any major changes to the system once a future project is selected, including plans for new transmission system infrastructure associated with future water supply sources.
- Confirm the hydraulics associated with integrating the selected future long-term water supply options in the coming five-year planning period once a specific project is selected. feasibility work for the recommended supply options.

### **Public Information**

- Develop and implement project-specific public information and outreach programs for the three short-listed projects and the two south Hillsborough County projects to ensure residents are fully informed and engaged as the projects move toward Board selection and final design.

## **Additional Feasibility Study Recommendations for Water Supply Projects**

Based on the above recommendations, additional feasibility studies will be required on the three shortlisted water supply projects and the two south Hillsborough County projects to confirm the yields, permissibility, property requirements, and project costs as detailed in Section 23.

## Next Steps for Implementation

To facilitate the implementation of the master plan, several important next steps are required over the next 2 to 3 years to ensure decisions are made in a timely manner. These next steps are summarized in Table ES-10.

**Table ES-10: Next Steps for Master Plan Implementation Over Next 2 to 3 Years**

| Activity No. | Description                                                                                                                                 | Completion Date |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1            | Approve Long-term Master Water Plan Update                                                                                                  | December 2018   |
| 2            | Finalize MOU between Tampa Bay Water and Hillsborough County for south Hillsborough County projects, including cost for groundwater credits | February 2019   |
| 3            | Finalize SWFWMD co-funding applications for additional feasibility studies of shortlisted projects                                          | April 2019      |
| 4            | Develop demand management implementation strategies                                                                                         | April 2019      |
| 5            | Procure engineering services for additional feasibility studies of shortlisted projects                                                     | June 2019       |
| 6            | Obtain SWFWMD decision for co-funding of demand management and additional feasibility projects                                              | October 2019    |
| 7            | Finalize route study for south Hillsborough County projects                                                                                 | December 2019   |
| 8            | Update demand forecasts                                                                                                                     | December 2019   |
| 9            | Confirm decision for south Hillsborough County projects                                                                                     | February 2020   |
| 10           | Update timing of regional projects based on south Hillsborough County project decision                                                      | February 2020   |
| 11           | Finalize additional feasibility studies of shortlisted projects                                                                             | December 2021   |
| 12           | Confirm feasibility of TAP and impact on future water supply projects                                                                       | December 2021   |

Tampa Bay Water will continue to monitor the above dates over the next few years and the impacts on the timing and prioritization of future water supply projects for the region.

## 1. Introduction and Overview

### 1.1 Background

Tampa Bay Water is a regional water supply authority created in 1998, which provides wholesale water for its six-member governments: Hillsborough, Pasco and Pinellas counties, and the cities of New Port Richey, St. Petersburg and Tampa. Tampa Bay Water owns and operates a diversified water supply system that is summarized in Table 1-1.

**Table 1-1: Summary of Tampa Bay Water Supply System**

| Groundwater Facilities                                                                                                                                                                    | Surface Water Facilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Transmission and Distribution                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>13 wellfields</li> <li>164 wells</li> <li>6 groundwater treatment facilities</li> <li>2 groundwater hydrogen sulfide removal facilities</li> </ul> | <p>Freshwater Facilities</p> <ul style="list-style-type: none"> <li>2 river withdrawal pump stations</li> <li>1 re-pump station</li> <li>1 15.5 billion-gallon surface water storage reservoir</li> <li>1 surface water treatment plant</li> <li>1 booster pump station</li> <li>1 reservoir pump station</li> <li>1 augmentation pump station (Harney Canal)</li> </ul> <p>Desalination Facilities</p> <ul style="list-style-type: none"> <li>1 desalination intake and discharge</li> <li>1 seawater desalination plant</li> </ul> | <ul style="list-style-type: none"> <li>3 booster pumping stations</li> <li>19 points of connection subject to member government expectations for Exhibit C and D</li> <li>2 points of connection for emergency conditions</li> <li>~115 miles of raw water pipeline</li> <li>~156 miles of finished water pipeline</li> <li>1 alkalinity adjustment facility at the Regional Facilities Site</li> <li>5 interconnections where Tampa Bay Water can purchase water from its Members</li> </ul> |

Tampa Bay Water's Long-term Master Water Plan (LTMWP) documents how Tampa Bay Water meets its unequivocal obligation to provide Quality Water to the member governments now and in the long-term future and includes several main components as presented in Figure 1-1. The Amended and Restated Interlocal Agreement (referred to as the Interlocal Agreement) requires the Master Water Plan be updated every five years. Thus, the LTMWP ensures that Tampa Bay Water (Agency) prepares for the provision of adequate supplies over a 20-year planning horizon. Since 1998, Tampa Bay Water has completed four revisions of its LTMWP. This document, entitled Long-term Master Water Plan 2018, is the latest update.



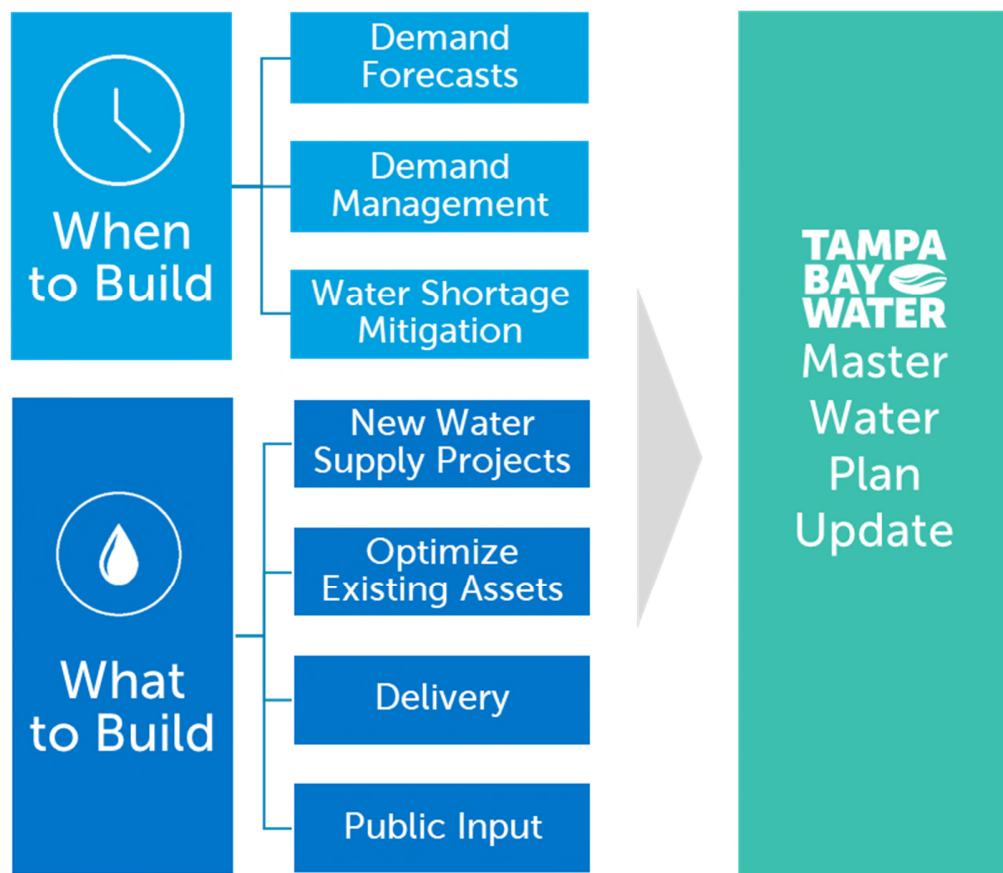


**Figure 1-1: Major Components of the LTMWP**

Each year, the Agency updates the regional water demand forecast, which is used in estimating the quantity and timing of its members future water supply needs. Taking into consideration hydrologic variability and uncertainty, droughts, and El Niño/La Niña phenomena, the Agency carefully evaluates the demand/supply relationship each year. Every five years, potential new water supply sources are evaluated as part of the LTMWP and depending on the needs analysis, the Agency performs feasibility studies on different potential water supply projects that could meet the region's future potable water demands. The timing of new water supply implementation is crucial because Section 3.03 of the Amended and Restated Interlocal Agreement requires that the Agency initiate preparation of water use permits once the regional demand reaches 75% of available permitted supply.

The original Master Water Plan included a phased approach to developing new water supplies in four separate configurations over a 20-year horizon. In 1998, the Tampa Bay Water Board of Directors approved System Configuration I water supply projects for implementation. This configuration was driven by the agreement between Tampa Bay Water, its member governments and the Southwest Florida Water Management District (the District) to reduce groundwater pumping at 11 regional wellfields by developing 91 million gallons per day (mgd) of new water supplies. The \$680 million System Configuration I, which included two surface water intakes, a surface water treatment plant, a seawater desalination facility, a 15.5-billion-gallon reservoir and several large diameter pipelines, was completed in 2005. The District provided \$183 million in co-funding for eligible projects. In 2007, Tampa Bay Water's



Board of Directors approved Configuration II of the Master Water Plan, which added 17 mgd to the system by expanding the Regional Surface Water Treatment plant and adding pumping capacity and transmission capability enhancement of the Tampa Bay Water's C.W. Bill Young Regional Reservoir. The \$226 million System Configuration II program was completed in December 2011. The program received \$122 million in funding from the State of Florida and the District. The existing Tampa Bay Water system is presented in Figure 1-2.

Tampa Bay Water has accomplished major facility and operational improvements since its creation in 1998, when its water supply was 100% dependent on groundwater. The completion of Configurations I and II resulted in a diversified water supply portfolio that is drought resistant and responsive to climate and the environment. This interconnected system consists of groundwater, surface water and desalinated water, with facilities as shown in Table 1-1 and Figure 1-2

During the 2008 LTMWP update, the comprehensive project list was updated and approximately 300 potential water supply projects were evaluated based on public input and with the advice of a Planning Advisory Committee. Out of the comprehensive list, the Tampa Bay Water Board approved seven Master Water Plan projects for additional study in December 2008. The Board directed that the feasibility of the seven Master Water Plan projects and three policy/planning areas be further studied as part of the 2013 Master Water Plan process (Table 1-2). The three policy/planning studies were completed during the 2013 Master Water Planning cycle and were included in the 2013 LTMWP. Due to lower demands during 2007-2009, the feasibility studies of the seven projects were put on hold as additional supplies were not needed. Since 2013, water demands in the region have started to increase, and the feasibility phase of work on the supply projects was moved into this 2018 Master Water Planning process.

**Table 1-2: Long-term Master Water Plan Project and Policy/Planning Studies Approved in 2008**

| Master Water Plan Projects                                                                                                                                                                                                                                                                                                                                                                            | Policy/Planning Studies                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Small Footprint Reverse Osmosis –Pinellas County</li> <li>• Gulf Coast Seawater Desalination Plant</li> <li>• Tampa Bay Seawater Desalination Plant Expansion</li> <li>• Thonotosassa Wells</li> <li>• Additional Potable Groundwater from Existing Northern Wells</li> <li>• Surface Water Expansion Project</li> <li>• Aquifer Recharge Project</li> </ul> | <ul style="list-style-type: none"> <li>• Source Water Protection Program</li> <li>• Regional Reclaimed Water Planning Assistance</li> <li>• Demand Management and Water Use Efficiency</li> </ul> |

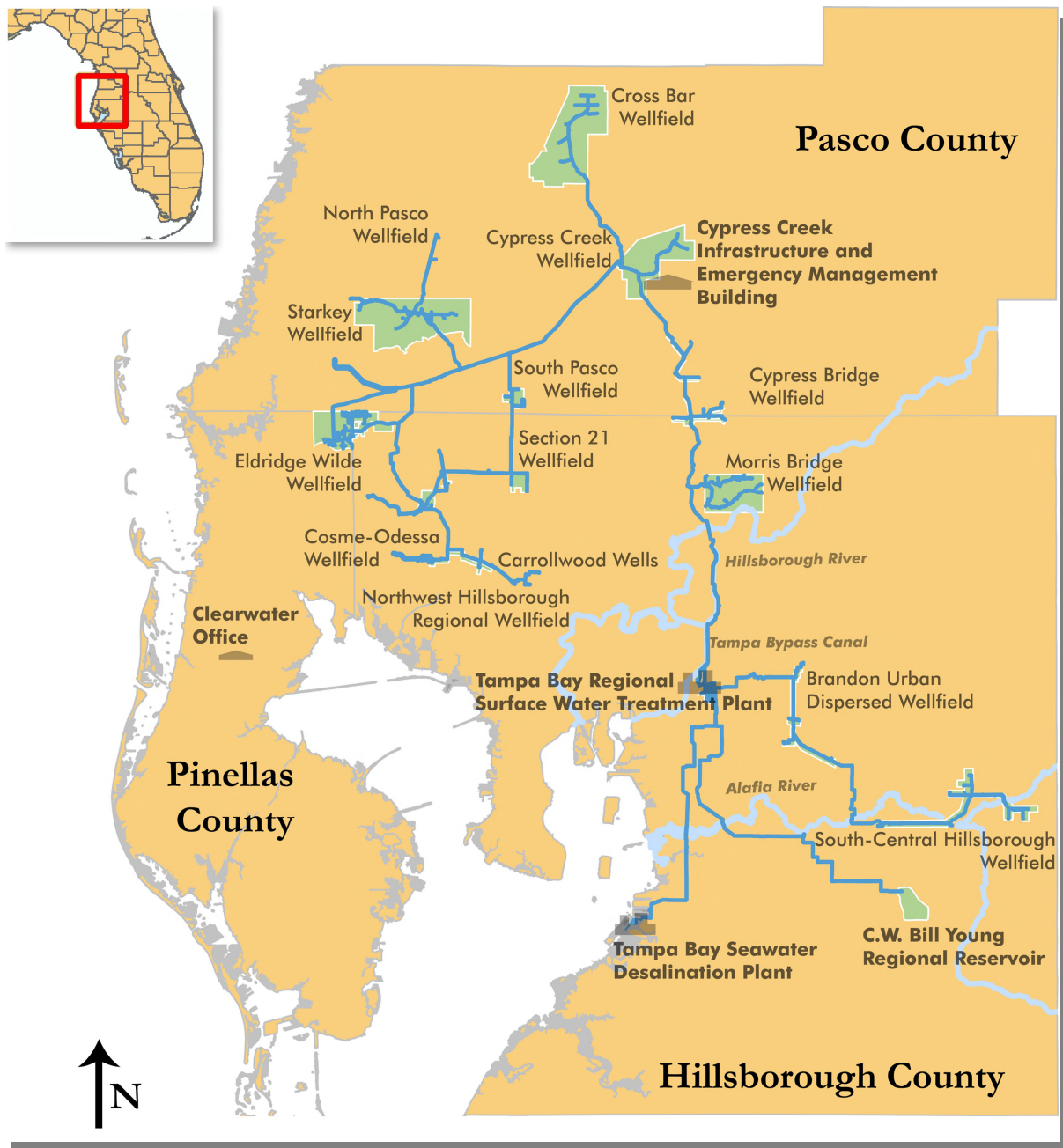


Figure 1-2: Existing Tampa Bay Water System (*NOTE: North Pasco Wells have been abandoned, but wellfield is still included in the CWUP permit*)

## 1.2 Review of Governing Agreements

Two agreements were established in 1998 to direct the governance and operations of Tampa Bay Water: the Amended and Restated Interlocal Agreement and the Master Water Supply Contract. Tampa Bay Water follows the requirements established by these agreements in meeting its commitments to the member governments.

### 1.2.1 Amended and Restated Interlocal Agreement

The Amended and Restated Interlocal Agreement, executed in May 1998, outlines critical production requirements for Tampa Bay Water, such as the following:

- “If the actual delivery of Quality Water by the Authority to the Member Governments during any twelve-month period exceeds 75 percent of the aggregate permitted capacity of the Authority’s production facilities, the General Manager shall report to the Board and recommend that the Authority initiate preparation of Primary Environmental Permit applications necessary to ensure an adequate supply. The Authority shall initiate any such applications expeditiously.” (Section 3.03 C.1)
- “If the actual delivery of Quality Water by the Authority to the Member Governments during any twelve-month period exceeds 85 percent of the aggregate permitted capacity of the Authority’s production facilities, the General Manager shall report to the Board and recommend that the Authority file Primary Environmental Permit applications to ensure adequate supply. The Authority shall file any such applications expeditiously.” Section 3.03 C.2)

Quality Water is defined as water meeting the Water Quality Standards required for delivery to member governments as defined in “Exhibit D”. Meeting these production requirements is essential in Tampa Bay Water’s decision-making process, while planning for its future water supplies. Tampa Bay Water annually updates its Long-term Demand Forecasting models which estimate the future demand across seven Water Demand Planning Regions of Tampa Bay Water’s six member governments. The forecasting model uses specific weather and socioeconomic models that generate separate demand projections for each of the planning regions. The model accounts for events of extreme drought, as well as normal hydrological events. The results of the modeling show that Tampa Bay Water’s existing supply should meet the region’s demands until approximately 2028. The projects in the 2018 Master Water Plan have more than sufficient capacity to meet the member government’s long-term 20-year needs. For planning purposes, choosing a future project(s) and beginning the preparation of water use permits should be based on the supply capacity under average hydrologic conditions since these projects are developed to meet long-term water supply needs and not seasonal drought events or rare significant drought years. The projects recommended to the Board for this Long-Term Master Water Plan 2018 can be further developed following Plan approval to assist the Board in choosing the next project or projects to implement.

### 1.2.2 Master Water Supply Contract

The Master Water Supply Contract outlines Tampa Bay Water’s obligations to supply Quality Water to the member governments. Section 8 states that Tampa Bay Water:

- “shall sell and deliver sufficient Quality Water to the member governments to meet their need for Quality Water.”
- “shall be in default hereunder should it fail to provide each member government a supply of Quality Water sufficient to meet its needs, except where the Authority’s failure to supply the Quality Water needs of each government is due to force majeure.”

The Master Water Supply Contract also describes specific details of water delivery which must be met by Tampa Bay Water including:

- Points of connection to each member government (“Exhibit C”).
- Water quality standards for water delivered to member governments (“Exhibit D”).
- Procedures for developing new or modified points of connection.

### 1.3 Objectives of Long-term Master Water Plan 2018

The objectives of this Long-term Master Water Plan 2018 are to meet the requirements set forth in Section 2.09 of the 1998 Amended and Restated Interlocal Agreement, which include:

- Identification of current customers, projects, and future customers;
- Review and general inventory of all existing Agency Water Supply Facilities;
- Identification of a capital improvement program for the Agency;
- Review of all current Tampa Bay Water environmental permits, existing regulations and projected regulations;
- Identification of all proposed new water supply facilities;
- Evaluation of Agency staffing;
- Hydraulic analysis of the Agency’s Water Supply Facilities, both existing and proposed;
- Evaluation of present and future sources of water and treatment requirements for those sources in terms of capacity, reliability and economy; and
- Update of the list of proposed Water Supply Facilities required to meet the anticipated Quality Water needs of the member governments for the next 20 years.

The above elements are included in this document as shown in Table 1-3.

**Table 1-3: Long-term Master Water Plan 2018 Required Section Descriptions**

| Requirement                                                                                                                                               | Report Section                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Identify current customers, projects, and future customers;                                                                                               | Section 4                     |
| Review and generally inventory all existing Agency Water Supply Facilities;                                                                               | Section 2                     |
| Identify a capital improvement program for the Agency;                                                                                                    | Section 16                    |
| Review all current Tampa Bay Water environmental permits, existing regulations and projected regulations;                                                 | Section 3                     |
| Identify all proposed new water supply facilities;                                                                                                        | Sections 6, 9, 14, 15, and 16 |
| Evaluate Agency staffing;                                                                                                                                 | Section 18                    |
| Provide for hydraulic analysis of the Agency's Water Supply Facilities, both existing and proposed;                                                       | Section 11                    |
| Evaluate present and future sources of Water and treatment requirements for those sources in terms of capacity, reliability and economy                   | Section 8                     |
| Update the list of proposed Water Supply Facilities required to meet the anticipated Quality Water needs of the member governments for the next 20 years. | Sections 16 and 23            |

Additionally, the following sections relevant to the long-term water supply needs have been added to this LTMWP 2018 to produce a more comprehensive report, which incorporates other relevant areas since the 2013 Master Plan. This LTMWP does not evaluate the water quality impacts of blending new supply options into the distribution system and associated impacts at individual points of connection, although distribution system dynamics and resulting water quality impacts at points of connections should be considered in future feasibility studies and LTMWPs.

- Section 7: South Hillsborough County Supply Options
- Section 8: System-wide Reliability and Future Needs
- Section 9: Water Supply Concept Development
- Section 10: Property Assessment
- Section 12: Climate Variability and Coast Hazards Vulnerability Assessment
- Section 13: Environmental Sustainability Assessments
- Section 14: Coarse Screening of Future Water Supply Concepts
- Section 15: Configuration Development and Fine Screening
- Section 17: Optimization of Existing Facilities
- Section 19: Source Water Assessment and Protection
- Section 20: Demand Management Plan
- Section 21: Public Engagement Program
- Section 22: Implementation Plan for Recommended Future Water Supply Projects

- Section 23: Recommendations

The LTMWP frames Tampa Bay Water's intent to implement the necessary activities to address seasonal and severe drought events and long-term future water supply needs to meet the requirements of the Interlocal Agreement and its member governments in addition to the following:

- Refinement of Agency's Water Shortage Mitigation Plan
- Water Use Efficiency activities approved by the Board in its Demand Management Plan resolution
- Future Needs Analyses on a routine basis
- Operational enhancements, both administrative and capital, that could add facility operational capacity within existing permit limits
- Energy optimization

These activities will be conducted in parallel along with the implementation of projects in the Master Water Plan to ensure that Tampa Bay Water continues to meet its unequivocal obligation to provide quality water to the member governments.

## 2. Existing Water Sources and Facilities Inventory

### 2.1 Introduction

Tampa Bay Water has constructed a regional water delivery system that is comprised of groundwater sources, surface water sources, an off-stream surface water storage reservoir, a seawater desalination facility and pumping and piping to distribute Quality Water. The regional system facilities that are currently in service are summarized below in Table 2-1. The location of these facilities is shown on **Figure 2-1**. This section provides an overview of the major system facilities throughout Tampa Bay Water's System.

**Table 2-1: Tampa Bay Water Regional System Facilities Currently in Service by Source**

| Groundwater Facilities                                                                                                                                                                           | Freshwater Facilities                                                                                                                                                                                                                                                                                                                       | Seawater and Ancillary Facilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>13 wellfields with a total of 164 wells</li> <li>6 groundwater treatment facilities</li> <li>2 groundwater hydrogen sulfide removal facilities</li> </ul> | <ul style="list-style-type: none"> <li>2 river withdrawal pump stations</li> <li>1 re-pump station</li> <li>1 15.5-billion gallon surface water storage reservoir</li> <li>1 surface water treatment plant</li> <li>1 booster pump station</li> <li>1 reservoir pump station</li> <li>1 augmentation pump station (Harney Canal)</li> </ul> | <ul style="list-style-type: none"> <li>1 seawater intake system</li> <li>1 seawater desalination plant</li> <li>3 booster pumping stations</li> <li>19 points of connection subject to member government expectations for Exhibit C and D</li> <li>2 points of connection for emergency conditions</li> <li>~115 miles of raw water pipeline</li> <li>~156 miles of finished water pipeline</li> <li>2 alkalinity adjustment facilities</li> <li>5 interconnection where Agency can purchase finished water from member governments</li> </ul> |

Tampa Bay Water has defined appropriate capacities for major facilities within the current regional system. The facility capacity terms are defined in Table 2-2.

**Table 2-2: Capacity Terms for Tampa Bay Water's Major Facilities**

| Capacity Term                  | Definition                                                                                                                      |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Rated Capacity                 | Design or permitted capacity of a facility                                                                                      |
| Minimum Capacity               | Minimum capacity facility can be operated at                                                                                    |
| Sustainable Operating Capacity | Continuous sustainable operating capacity of a facility, also includes peak day and greater than five days operational capacity |



Rated capacity, a term used by regulatory agencies in the issuance of drinking water permits, is based on the design treatment capacity of the facility and successful completion of performance testing to verify the capabilities of the facility. The term “permitted capacity” refers to a water use permit limit on source withdrawal. The term “Rated Capacity” used in this evaluation uses either the design or permitted capacity to determine the maximum amount of water the facility can produce.

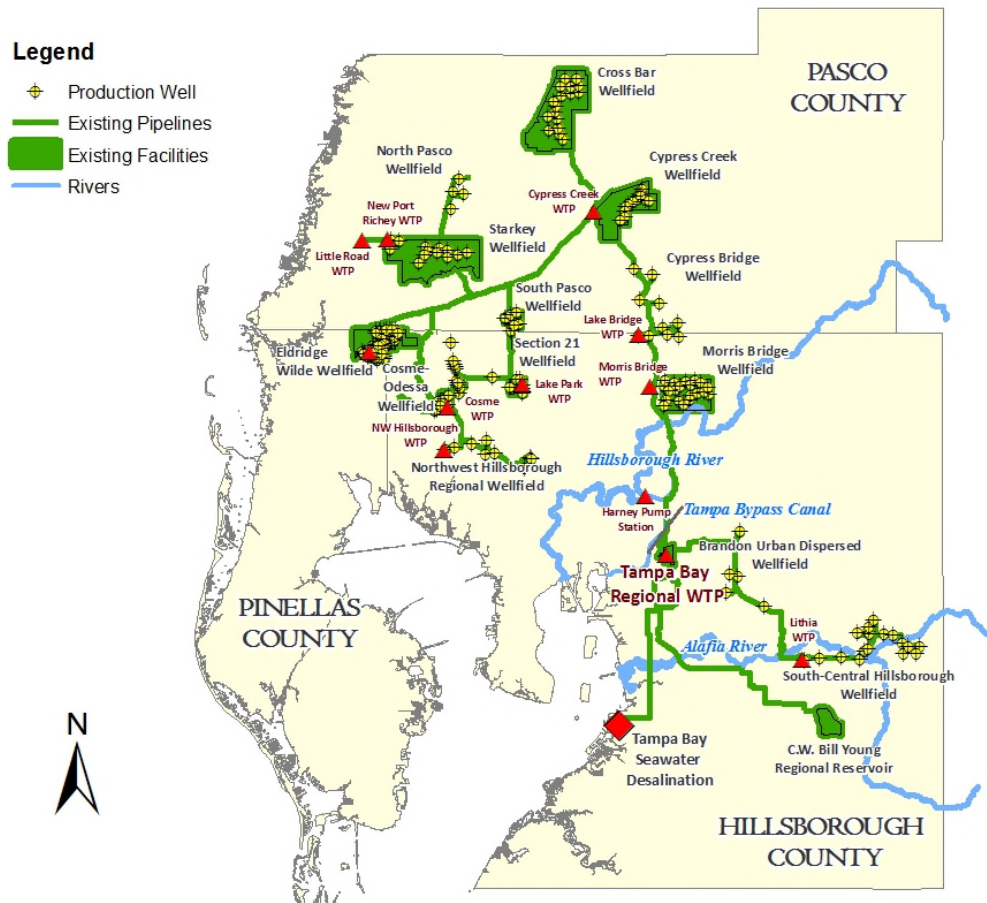


**Figure 2-1: Tampa Bay Water Regional Water Supply and Delivery System** (Note: North Pasco wells have been abandoned, but wellfield is still included in the CWUP)

The minimum operational capacity is the lowest amount of water that a facility can pump or treat during a 24-hour period. When there is insufficient source water to meet the minimum operational flow requirements or the need for the water reduces below the minimum operational capacity, the facility is taken out of service. The facility is returned to service when either the demand increases or sufficient source water returns to maintain production at or above operational minimum rates. Operational minimum capacities are determined based on design, hydraulic limitations, and operational limitations.

For the system- wide reliability analysis (see Section 8), the five-day sustainable operating capacity generally represents the amount of water that can move through a facility dependably and meet demands



at the daily time scale at that flow rate. Sustainable operating capacity is based on performance and operational experience. Factors considered in determining sustainable capacity include: chemical feed systems, facility hydraulics, normal maintenance activities, source water quality, and industry standards.

The following sub-sections describe Tampa Bay Water's existing water sources and facilities by water source and/or facility type.

## 2.2 Groundwater Sources

Currently, groundwater sources account for approximately half of the total sustainable supply permitted for Tampa Bay Water. Figure 2-1 shows the locations and well configurations of the existing Tampa Bay Water wellfields. Table 2-3 shows the rated (i.e., permitted or design), minimum and sustainable capacities for these wellfields. In general, each of Tampa Bay Water's existing wellfields includes a number of water supply wells equipped with vertical turbine well pumps, discharge piping and valves, instrumentation and controls, and raw water mains to carry the supply to a treatment facility. The quality of the untreated groundwater pumped directly from the wellfields meets most state and federal primary and secondary drinking water standards. Generally, the water requires only disinfection and stabilization (to control corrosivity) prior to distribution to customers. In some cases, Tampa Bay Water treats the groundwater and blends it with other regional water supplies prior to delivery to a Member Government point of connection. In other cases, raw groundwater is delivered to member government treatment facilities where it is treated for local distribution. Selected wellfields include auxiliary generators. Most of the wellfields are connected to the regional system through their nearby water treatment plants.

Tampa Bay Water groundwater sources include thirteen wellfields, two of which consist of individual well systems (Carrollwood and BUDW). Eleven wellfields are managed under the Consolidated Water Use Permit (WUP), although the North Pasco wellfield has been removed from service. The South-Central Hillsborough Regional Wellfield, Brandon Urban Dispersed Wells, and Carrollwood Wells have individual water use permits. All groundwater sources are managed to meet Tampa Bay Water delivery requirements for regional demands. The Optimized Regional Operations Plan (OROP), initiated in 1999, is a custom-built application which incorporates an optimization model and utilizes output from various surface and ground water models, current hydrologic and pumpage data, and a set of operating constraints to manage production from the 11 wellfields under the Consolidated Permit, the Brandon Urban Dispersed Wells (BUDW), and the Carrollwood Wells through the development of weekly well rotation schedules. Appendix A includes additional details of each of the wellfields in Table 2-3.

**Table 2-3: Rated and Sustainable Capacities of the Existing Tampa Bay Water Wellfields**

| Wellfield                     | Rated Capacity |        |         | Sustainable Capacity |         |
|-------------------------------|----------------|--------|---------|----------------------|---------|
|                               | WUP            | Design | Minimum | Peak Day             | >5 Days |
|                               | mgd            | mgd    | mgd     | mgd                  | mgd     |
| Brandon Urban Dispersed Wells | 6.0            | 9.3    | 1.5     | 6.0                  | 4.0     |
| Carrollwood Wells             | 0.82           | 2.9    | 0.6     | 1.2                  | 0.8     |

| Wellfield          | Rated Capacity    |        |         | Sustainable Capacity |         |
|--------------------|-------------------|--------|---------|----------------------|---------|
|                    | WUP               | Design | Minimum | Peak Day             | >5 Days |
|                    | mgd               | mgd    | mgd     | mgd                  | mgd     |
| SC Hillsborough WF | 24.1              | 45.0   | 8.0     | 45.0                 | 35.0    |
| Cosme/Odessa WF    | CWUP <sup>1</sup> | 22.0   | 3.0     | 20.0                 | 17.5    |
| Cross Bar WF       | CWUP              | 45.0   | 6.5     | 43.0                 | 38.5    |
| Cypress Bridge WF  | CWUP              | 30.0   | 4.5     | 20.0                 | 17.5    |
| Cypress Creek WF   | CWUP              | 38.0   | 5.0     | 35.0                 | 30.0    |
| Eldridge Wilde WF  | CWUP              | 45.0   | 5.0     | 36.0                 | 30.0    |
| Morris Bridge WF   | CWUP              | 40.0   | 5.0     | 20.0                 | 17.5    |
| NW Hillsborough WF | CWUP              | 18.0   | 1.5     | 16.5                 | 15.0    |
| Section 21 WF      | CWUP              | 23.0   | 4.0     | 21.0                 | 18.5    |
| South Pasco WF     | CWUP              | 28.0   | 3.5     | 26.5                 | 12.0    |
| Starkey WF         | CWUP              | 23.5   | 1.5     | 19.5                 | 8.0     |

<sup>1</sup> CWUP = consolidated water use permit, this is the average water use permitted from Tampa Bay Water's consolidated wellfields, which is currently set at 90 mgd as a 12 month rolling average.

## 2.3 Groundwater Treatment Facilities

Tampa Bay Water operates six groundwater treatment plants (WTP): Morris Bridge WTP, Lake Bridge WTP, Cypress Creek WTP, South Pasco WTP, Brandon Urban Dispersed Well Site 5 WTP, and Well Site 7 WTP. The groundwater treatment plants provide chemical treatment and disinfection of raw groundwater. In addition, the Agency operates two hydrogen sulfide removal facilities: an ozone facility at the South-Central Hillsborough Wellfield and packed tower aeration system at Eldridge-Wilde Wellfield. The treated groundwater is either delivered to a member government or blended with regional water for delivery to downstream points of connection. Table 2-4 shows the rated (i.e., permitted or design), minimum and sustainable capacities for these facilities. Additional details of each of these treatment facilities can be found in Appendix A.

**Table 2-4: Rated and Sustainable Capacities of the Groundwater Treatment Facilities**

| Facility                                                     | Rated Capacity     |        |         | Sustainable Capacity |         |
|--------------------------------------------------------------|--------------------|--------|---------|----------------------|---------|
|                                                              | Permitted Capacity | Design | Minimum | Peak Day             | >5 Days |
|                                                              | mgd                | mgd    | mgd     | mgd                  | mgd     |
| Cypress Creek Water Treatment Plant and Pump Station         | 83.0               | 83.0   | 11.0    | 78.0                 | 68.5    |
| Lake Bridge Water Treatment Plant                            | 44.9               | 30.0   | 4.5     | 20.0                 | 17.5    |
| Morris Bridge Water Treatment Plant and Booster Pump Station | 30.0               | 40.0   | 5.0     | 20.0                 | 17.5    |
| South Pasco Water Treatment Plant                            | 30.0               | 30.0   | 3.5     | 26.5                 | 12.0    |
| Brandon Urban Dispersed Well 5 Water Treatment Plant         | 6.2                | 6.2    | 1.0     | 5.0                  | 3.0     |
| Brandon Urban Dispersed Well 7 Water Treatment Plant         | 3.0                | 3.1    | 0.5     | 1.0                  | 1.0     |
| Keller Hydrogen Sulfide Removal Plant                        | 45.0               | 45.0   | 10.0    | 30.0                 | 25.0    |
| Lithia Ozone Hydrogen Sulfide Removal Plant                  | 45.0               | 45.0   | 8.0     | 40.0                 | 35.0    |

### 2.3.1 Cypress Creek Operational Control Center

The Cypress Creek Facility is the operational control center of Tampa Bay Water's Regional System; however, the system can also be operated from the regional High Service Pump Station (HSPS) for redundancy. The Cypress Creek center is located in central Pasco County in the western portion of the Cypress Creek Wellfield property. The major components of the Cypress Creek Facility include:

- Treatment building for chemical feed and storage;
- Three 5-million gallon pre-stressed concrete ground storage tanks;
- High service pump station;
- Emergency generators;
- Operations building;
- Laboratory building;
- Storage/maintenance/warehouse buildings; and
- Infrastructure and Emergency Management building.

The Infrastructure and Emergency Management building houses staff offices for operations, maintenance, instrumentation and controls, engineering and construction groups. The building was designed and constructed with a Hurricane Category 5 rating and serves as a command center during emergency events.

As mentioned, Tampa Bay Water's entire Supervisory Control and Data Acquisition (SCADA) system can be remotely monitored and controlled at the operations center at the Cypress Creek Facility as well as the Regional High Service Pumping Station. Tampa Bay Water's SCADA system consists of remote terminal units located at metering sites, well pump stations, water treatment facilities, booster pumping stations, and storage tanks. Communication between the remote terminal units and the SCADA system is through leased telephone lines, as well as Tampa Bay Water-owned copper wire and fiber optic cables. The SCADA system-host computers can access any remote terminal unit to monitor and historically archive 'real-time' operating conditions, as well as implement control strategies to start and/or stop pumps, change local operating limits, or respond to alarm events.

The SCADA system has been expanded to include monitoring of Tampa Bay Water's regional facilities, and data collection from chloramine and pH monitoring sites located throughout the water transmission system. The system is also interconnected with Tampa Bay Water's data management network. This allows data collection for use in predictive system modeling and water resource allocation efforts within Tampa Bay Water.

## **2.4 Surface Water Treatment Facilities**

Tampa Bay Water's surface water facilities are collectively known as the Enhanced Surface Water System (ESWS). These facilities consist of a pump station on the Tampa Bypass Canal, a pump station on the Alafia River, the regional surface water treatment plant (RSWTP), a re-pump station, the South-central Intertie Booster pump station, the Regional Reservoir pump station, the C.W. Bill Young Regional Reservoir and associated transmission mains (Figure 2-2). The Regional Surface Water Treatment Plant is located at the Regional Facilities Site along with the Regional High Service Pump Station (HSPS) and Alkalinity Adjustment Facility (AAF). The original ESWS facilities were placed into service in late 2002 and early 2003, with the exception of the Regional Reservoir. The Regional Reservoir was completed and placed into service in 2005. Expansion of the ESWS began in 2007 and was completed in 2011. The Regional Reservoir was taken out of service for renovation in 2013 and returned to service in 2014. Table 2-5 shows the rated (i.e., permitted or design), minimum and sustainable capacities for the ESWS facilities. Additional details of Tampa Bay Water's surface water facilities can be found in Appendix A.

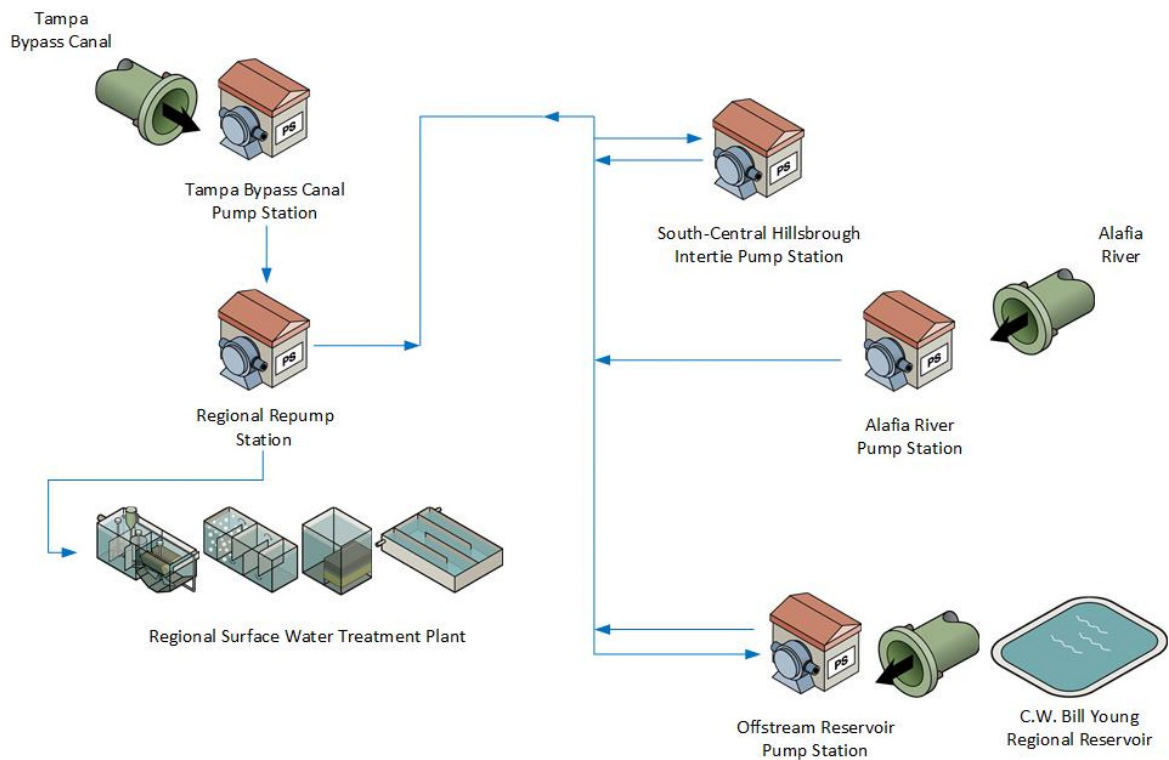


Figure 2-2: Components and Flow Directions in Tampa Bay Water's Enhanced Surface Water System

Table 2-5: Rated and Sustainable Capacities of the Enhanced Surface Water System

| Facility                             | Operating Conditions     | Rated Capacity |        |           | Sustainable Capacity |         |
|--------------------------------------|--------------------------|----------------|--------|-----------|----------------------|---------|
|                                      |                          | WUP            | Design | Minimum   | Peak Day             | >5 Days |
|                                      |                          | mgd            | mgd    | mgd       | mgd                  | mgd     |
| Offstream Reservoir Pump Station     | Influent                 |                | 212.0  | 7.50      | 212.0                | 198.5   |
|                                      | Effluent/Gravity Limit   |                | 120.0  | 40.0/20.0 | 100.0                | 100.0   |
|                                      | Effluent Alafia @ 52 mgd |                | 62.0   | 20.0      | 62.0                 | 46.0    |
|                                      | Effluent Alafia off      |                | 100.0  | 20.0      | 100.0                | 85.0    |
| Tampa Bypass Canal Pump Station      | High Head                | 258.0          | 257.0  | 15.0      | 257.0                | 240.0   |
|                                      | Low Head                 | 258.0          | 282.0  | 15.0      | 258.0                | 250.0   |
| Alafia Pump Station                  | all                      | 60.0           | 60.0   | 4.0       | 60.0                 | 43.0    |
| Surface Water Treatment Plant (SWTP) |                          | 120            | 120    | 20        | 120                  | 90      |

| Facility                                            | Operating Conditions    | Rated Capacity |        |         | Sustainable Capacity |         |
|-----------------------------------------------------|-------------------------|----------------|--------|---------|----------------------|---------|
|                                                     |                         | WUP            | Design | Minimum | Peak Day             | >5 Days |
|                                                     |                         | mgd            | mgd    | mgd     | mgd                  | mgd     |
| Re-pump Station                                     | Alafia on @ 52 mgd      |                | 135.0  | 25.0    | 135.0                | 127.0   |
|                                                     | High Head Alafia Off    |                | 145.0  | 25.0    | 145.0                | 137.0   |
|                                                     | Low Head Alafia Off     |                | 160.0  | 25.0    | 160.0                | 153.0   |
|                                                     | SCH Pump Station On     |                | 182.0  | 25.0    | 182.0                | 171.0   |
| High Service Pump Station (HSPS)                    |                         |                | 159    | 20      | 159                  | 128     |
| South-Central Hillsborough Intertie Booster Station | To Reservoir            |                | 182.0  | 110.0   | 182.0                | 145.0   |
|                                                     | From Reservoir (PS off) |                | 130.0  | 75.0    | 120.0                | 90.0    |
| Harney Pump Station                                 | all                     | 40.0           | 55.0   | 18.00   | 38.0                 | 36.5    |

#### 2.4.1 C. W. (Bill) Young Regional Reservoir

The C.W. Bill Young Regional Reservoir is located on 5,200 acres in southeastern Hillsborough County. The reservoir is an approximately 1100 acre surface, off-stream earthen embankment with an average height of 48 feet above natural grade. It impounds approximately 15.5-billion gallons (47,500 acre-feet) of raw water from the Hillsborough and Alafia rivers and Tampa Bypass Canal. The circumference at the top of the reservoir berm is approximately five miles.

The off-stream reservoir is an integral part of Tampa Bay Water's ESWS. It stores captured surface water from the Tampa Bypass Canal, the Alafia River, and the Hillsborough River during high flow periods in accordance with water use permit withdrawal rules. The reservoir is connected to the South-Central Hillsborough Intertie via the 8-mile long, 84-inch diameter, bi-directional Reservoir Transmission Main. Previously, raw water from the reservoir was piped to the Regional Surface Water Treatment Plant for treatment by gravity. In 2011, Tampa Bay Water completed construction of the off-stream reservoir pump station to allow increased drawdown capacity from the reservoir to the treatment plant.

#### 2.4.2 Tampa Bypass Canal and Hillsborough River Surface Water Supply

The Tampa Bypass Canal withdrawal facilities were part of System Configuration I in the original Master Water Plan. Tampa Bypass Canal Structure S-161 is utilized to divert a percentage of high flows from the Hillsborough River to the Tampa Bypass Canal. This diverted river flow, as well as flow originating from the Tampa Bypass Canal itself, is withdrawn from the middle and/or lower pool of the Tampa Bypass Canal at a single pumping facility located on the east side of the Tampa Bypass Canal (adjacent to flood control structure S-162).

The pump station delivers raw water from the middle pool and lower pool of the Tampa Bypass Canal through 2 miles of 84-inch diameter pipeline to raw water storage tanks at the Regional Facilities Site.

Raw water is either sent to the RSWTP for treatment or pumped to the Regional Reservoir via the re-pump station for storage. Withdrawal of water from the Tampa Bypass Canal and diversions from the Hillsborough River Reservoir are in accordance with the Tampa Bypass Canal water use permit. The permitted maximum day withdrawal is 258 mgd.

#### **2.4.3 Alafia River Water Supply and Pump Station**

The Alafia River Project was another System Configuration I project completed as part of the original Master Water Plan. The Alafia River Pump Station is located near the Bell Shoals Road bridge over the Alafia River. The pump station delivers raw water to the RSWTP through the 72-inch diameter South-Central Hillsborough Intertie or to the Regional Reservoir through its transmission main. The permitted maximum daily withdrawal from the Alafia River is 60.0 mgd and is dependent on daily river flows.

#### **2.4.4 Regional Surface Water Treatment Plant and High Service Pump Station**

The Tampa Bay Regional Surface Water Treatment Plant is located in central Hillsborough County near Columbus Drive Extension and U.S. Highway 301. The plant treats surface water from the Tampa Bypass Canal, Alafia River, Hillsborough River and the C.W. Bill Young Regional Reservoir. The finished water is pumped to three 7.5-million gallon ground storage tanks for storage and blending with desalinated water. Tampa Bay Water completed an expansion of this plant in 2011 to an FDEP-rated capacity of 120 mgd, which Tampa Bay Water equates to a sustainable capacity is 90 mgd assuming one treatment train is out of service.

Treatment at the surface water facilities includes (see Figure 2-3):

- pH adjustment;
- High-rate ballasted sedimentation process, sulfuric acid and ferric sulfate for enhanced coagulation, flocculation and sedimentation;
- Ozone for primary disinfection;
- Biologically active filtration for turbidity reduction (particle removal), taste and odor control, and removal of biodegradable organic carbon;
- Chlorination (followed by ammonia addition after blending with desalinated water) for secondary disinfection; and
- Carbon dioxide or sodium hydroxide addition in the finished water for pH and alkalinity adjustment.



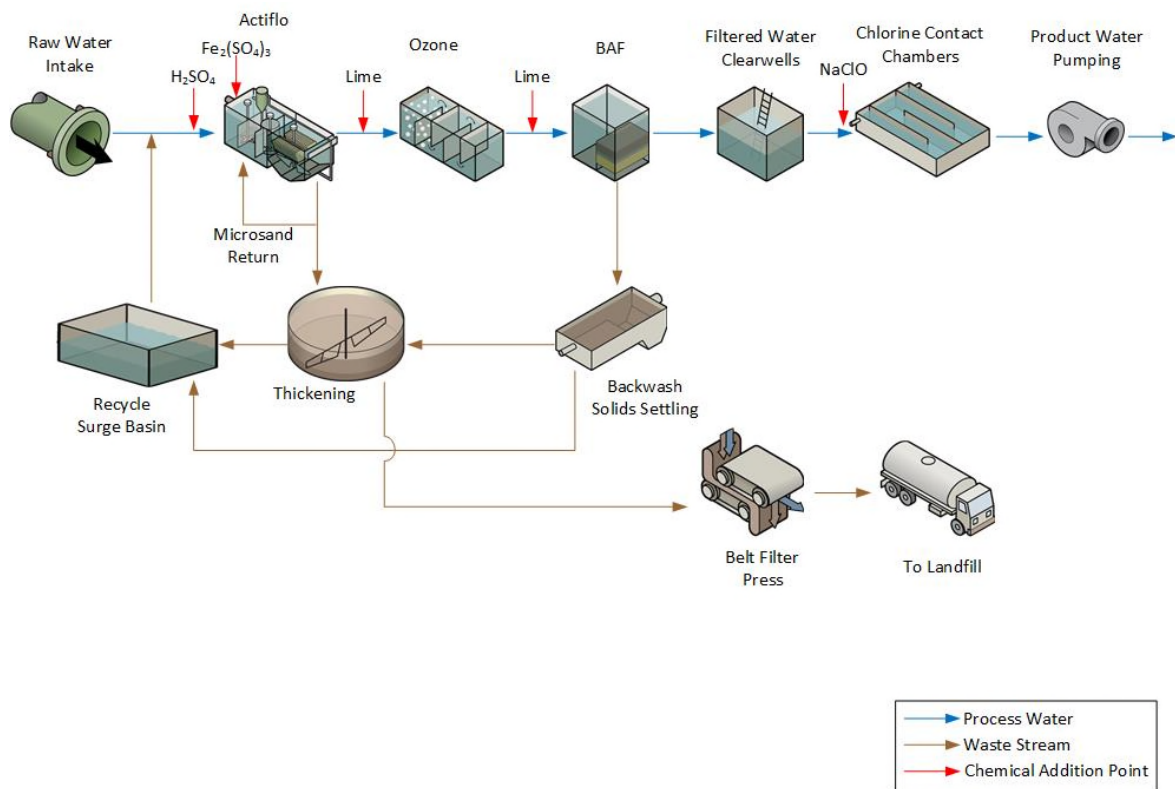


**Figure 2-3: Process Flow Diagram for the Regional Surface Water Treatment Plant**

Potable water from the Tampa Bay Regional Surface Water Treatment Plant is blended with finished water from the Tampa Bay Seawater Desalination Plant in ground storage tanks at the Regional Facility Site. Chloramination of the blended treated supplies occurs at the Regional Facilities Site prior to pumping the treated water into the regional distribution system.

The Regional High Service Pump Station delivers this blended Quality Water from the ground storage tanks into the regional transmission system. The High Service Pump Station currently has six high service pumps with a total design capacity of 159 mgd, and a sustainable operating capacity of 110 mgd. Following initial evaluations for this update to the Long-term Master Water Plan, Tampa Bay Water identified the option of adding a seventh high service pump to increase the sustainable operating capacity of the station to approximately 132 mgd.

#### 2.4.5 Surface Water System Raw Water Pumping and Transmission Facilities

Tampa Bay Water's ESWS includes a number of pumping and transmission facilities, which are summarized in this section.

**South-Central Hillsborough Intertie:** The South-Central Hillsborough Intertie is a bi-directional, 72-inch diameter pipeline that delivers raw water from the Alafia River Pump Station and the Regional Reservoir to the Tampa Bay Regional Surface Water Treatment Plant for treatment. It can also convey raw water

from the Tampa Bypass Canal and Hillsborough River sources to the Regional Reservoir for storage through the connection to the Reservoir Transmission Main.

Regional Reservoir Transmission Main: The Regional Reservoir Transmission Main is a bi-directional, 84-inch, pipeline that connects the Regional Reservoir to the Alafia River Intake and pump station and the South-Central Hillsborough Intertie. This pipeline conveys raw surface water from the Tampa Bypass and Alafia River pump stations to the Regional Reservoir for storage and conveys stored regional reservoir water to the Regional Surface Water Treatment Plant via the South-Central Hillsborough Intertie.

Re-pump Station: Tampa Bay Water's re-pump station is located at the Regional Facility Site and allows water from the Tampa Bypass Canal to be pumped to the Regional Reservoir through the South-Central Hillsborough Intertie/Reservoir Transmission Main. Under System Configuration II, the pumping capacity was expanded to 182 mgd with the addition of two new pumps and associated electrical equipment and yard piping.

South-Central Hillsborough Intertie (SCHI) Booster Pump Station: This facility is located along the South-Central Hillsborough Intertie. The SCHI Booster Pump station increases the pumping capacity of raw water from the Re-pump Station to the Regional Reservoir. In addition, the booster pump station can flow in the opposite direction increasing the flow of raw water from the Regional Reservoir to the Surface Water Treatment Plant. The facility has a design pumping capacity of 182 mgd.

Off-stream Reservoir Pump Station: In 2011, Tampa Bay Water completed construction of the Off-stream Reservoir Pump Station. The function of the Off-stream Reservoir Pump Station is to pump raw water from the Regional Reservoir to the Tampa Bay Water Surface Water Treatment Plant when higher flows than could be delivered by gravity are required. The facility has a design pumping capacity of 120 mgd.

Harney Pump Station: Tampa Bay Water's Harney Pump Station (also known as the Tampa Bypass Canal at Harney Road Pump Station) is utilized only to augment the City of Tampa's raw water supply by pumping water from the Tampa Bypass Canal middle pool to the Hillsborough River Reservoir at Structure S-161. Water is only pumped from the Tampa Bypass Canal when necessary to augment river flow into the City's reservoir. Tampa Bay Water has a water use permit with the SWFWMD which sets forth the criteria for when augmentation is allowed. The station is located in central Hillsborough County along the Tampa Bypass Canal at Harney Road.

**Table 2-6: Rated and Sustainable Capacities of the of the Regional Surface Water Treatment Plant, Desalination Plant and the Regional High Service Pumping Station**

| Facility                                  | Operating Conditions            | Rated Capacity |        |         | Sustainable Capacity |         |
|-------------------------------------------|---------------------------------|----------------|--------|---------|----------------------|---------|
|                                           |                                 | PWS            | Design | Minimum | Peak Day             | >5 Days |
|                                           |                                 | mgd            | mgd    | mgd     | mgd                  | mgd     |
| Regional Surface Water Treatment Facility |                                 | 120.00         | 120.00 | 20.00   | 120.00               | 90.00   |
| Desalination Facility                     | Intake water temp >90 degrees F | 28.75          | 28.75  | 8.00    | 20.0                 | 20.0    |
|                                           | Intake water temp <90 degrees F | 28.75          | 28.75  | 8.00    | 18.0                 | 18.0    |
| Regional High Service Pumping Station     | Cypress Creek at 70 psi         |                | 159.0  | 20.0    | 133.0                | 110.0   |

## 2.5 Seawater Desalination Facilities

The Tampa Bay Seawater Desalination Plant, located adjacent to Tampa Electric Company's Big Bend Power Station on Tampa Bay, is designed to produce potable water and convey it to the Tampa Bay Water Regional Facilities Site. The facility utilizes reverse osmosis (RO) technology to treat seawater drawn from the condenser cooling water discharge of TECO's power station. Table 2-6 shows the rated (i.e., permitted or design), minimum and sustainable capacities for this facility and Figure 2-4 is a process flow diagram.

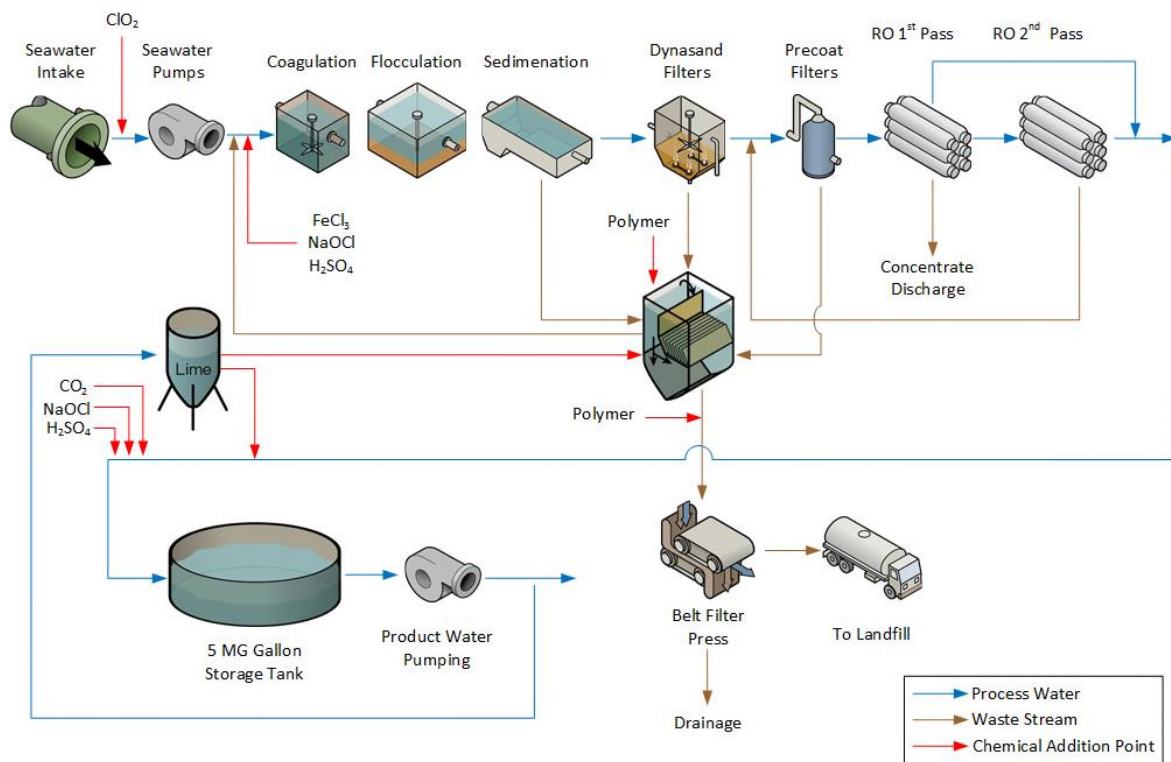


**Figure 2-4: Process Flow Diagram for the Tampa Bay Seawater Desalination Plant**

The reverse osmosis system has seven independent trains, each comprised of a transfer pump, cartridge filter, associated high pressure pump, an energy recovery turbine and reverse osmosis membranes. The facility has an additional second pass train to re-treat the back permeate from four trains of the initial seven trains. The second pass was expanded to re-treat the back permeate from six trains. Facilities at the Tampa Bay Seawater Desalination Plant include:

- Intake/discharge facilities – intake pumps, cooling water pumps, concentrate discharge;
- Pretreatment facilities – initial intake oxidation treatment, traveling screens, chemical mixing, coagulation, flocculation, sedimentation, upflow sand filters, diatomaceous earth filters, and micron filtration (cartridge filters);
- Reverse osmosis facilities – semi-permeable membranes (first pass);
- Second Pass – nanofiltration (10 percent of first pass)
- Post-treatment facilities – lime addition and carbon dioxide addition as needed for stabilization, and chlorination; and
- Storage/finished water transmission – storage, transfer pumping, transmission pipeline.

## 2.6 Booster Pump Stations

Tampa Bay Water operates treated water booster pump stations located throughout the transmission system. These include the U.S. 41 Booster Pump Station, the Odessa Booster Pump Station, and the

Lake Bridge Booster Pump Station. Table 2-7 shows the permitted, design, minimum and sustainable capacities for these facilities.

**Table 2-7: Rated and Sustainable Capacities of the Booster Pumping Stations**

| Facility                         | Table Categories |        |         | Sustainable Capacity |         |
|----------------------------------|------------------|--------|---------|----------------------|---------|
|                                  | PWS              | Design | Minimum | Peak Day             | >5 Days |
|                                  | mgd              | mgd    | mgd     | mgd                  | mgd     |
| Odessa Booster Pump Station      | 17.0             | 26.4   | 1.5     | 17.0                 | 17.0    |
| U.S. 41 Booster Pump Station     | 18.0             | 24.6   | 1.2     | 18.0                 | 18.0    |
| Lake Bridge Booster Pump Station | 17.5             | 25.2   | 2.5     | 17.5                 | 17.5    |

These booster pump stations provide finished water to Pasco County at these three points of connection.

## 2.7 Potable Water Transmission Mains

Tampa Bay Water's distribution system includes several major potable water transmission mains that deliver treated water supplies to Member Government points of connection. These major transmission pipelines are shown on Figure 2-5 and are summarized in Table 2-8. Descriptions of each major potable transmission main are also presented in Appendix A. In addition to the major transmission mains listed in Table 2-8, there are raw water collection mains within each wellfield to collect water from the individual wells and convey the water to a Tampa Bay Water or member government treatment facility. The raw water collection mains are also described in Appendix A (Groundwater Sources).

**Table 2-8: Tampa Bay Water Major Potable Transmission Mains (TM)**

| Transmission Main                   | Diameter (inches) | Material                                                   | Length (miles) | Location/Function                                                             |
|-------------------------------------|-------------------|------------------------------------------------------------|----------------|-------------------------------------------------------------------------------|
| North-Central Hillsborough Intertie | 84                | Steel                                                      | 13.6           | Potable water from Regional Surface Water Treatment Plant to Morris Bridge TM |
| Brandon Transmission Main           | 30 and 36         | Ductile Iron                                               | 16.8           | Potable water from Regional Facility Site to Brandon/South-Central Connector  |
| Brandon/South-Central Connector     | 30                | Ductile Iron                                               | 6.3            | Potable water from Brandon TM to Lithia WTP                                   |
| Morris Bridge Transmission Main     | 64                | Ductile Iron                                               | 3.9            | Potable water from NCHI to Cypress Bridge TM                                  |
| Cypress Bridge Phase A              | 66                | Steel/                                                     | 5.7            | Potable water from Morris Bridge TM to Cypress Creek TM                       |
| Phase B                             | 64                | Ductile Iron                                               | 4.4            |                                                                               |
| Cypress Creek Transmission Main     | 84 and 66         | Pre-stressed concrete cylinder pipe / Steel / Ductile Iron | 17.6           | Potable water from Cypress Creek WTP to Keller Connector                      |
| Keller Connector                    | 66                | Steel                                                      | 1.5            | Potable water from Cypress Creek TM to Keller WTP                             |

| Transmission Main                        | Diameter (inches) | Material                                                                     | Length (miles) | Location/Function                                                            |
|------------------------------------------|-------------------|------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------|
| South Pasco Transmission Main            | 42                | Prestressed concrete cylinder pipe / Reinforced concrete pipe / Ductile Iron | 13.9           | Potable water from Cypress Creek TM to Lake Park and Cosme WTP               |
| West Pasco Transmission Main             | 36 and 42         | Ductile Iron / Steel                                                         | 7.8            | Potable water from Cypress Creek TM to Little Road and Maytum WTPs           |
| Cosme Transmission Main                  | 64                | Steel                                                                        | 8.4            | Potable water from Cypress Creek TM to Cosme WTP                             |
| Northwest Hillsborough Transmission Main | 36                | Ductile Iron                                                                 | 2.3            | Potable water from Cosme TM to Northwest Hillsborough WTP                    |
| Seawater Desalination Transmission Main  | 42                | Ductile Iron                                                                 | 14.5           | Potable water from Tampa Bay Desalination Facility to Regional Facility Site |

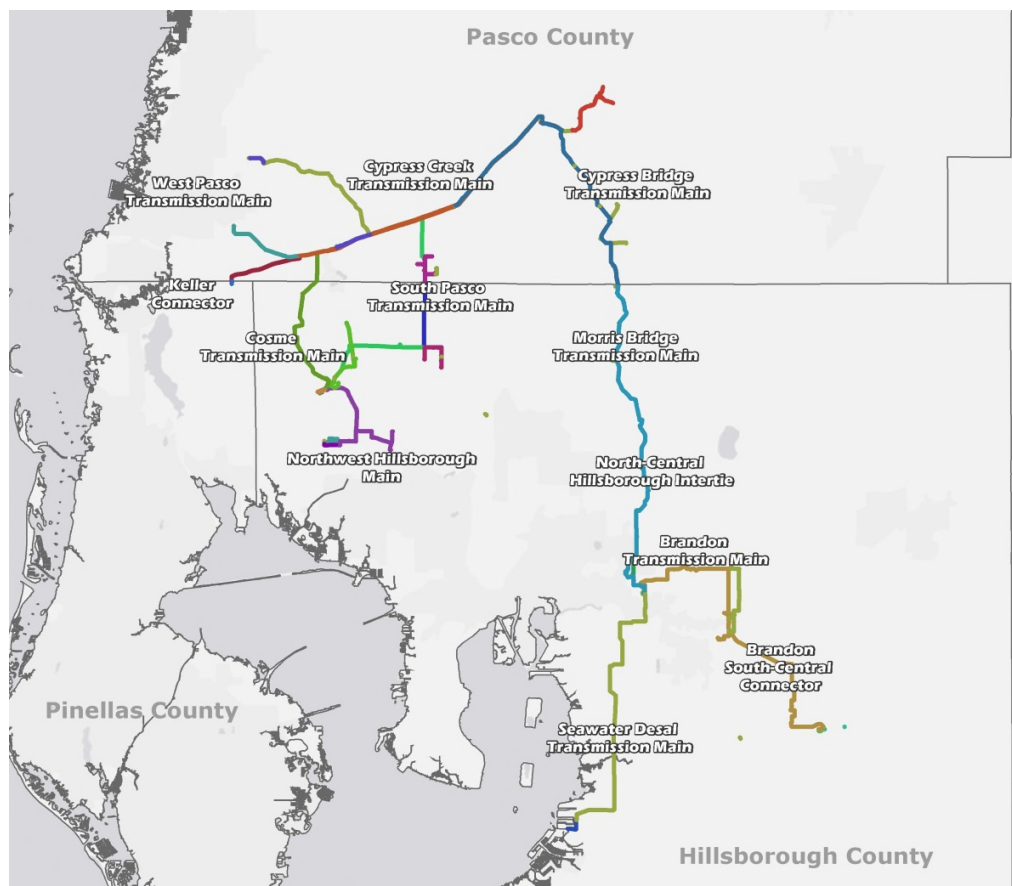


Figure 2-5: Tampa Bay Water Potable Transmission Mains

## 2.8 Supply Capacity from Member Government Interconnects

The regional supply system includes five interconnects where Tampa Bay Water can purchase finished water from member governments. These are described below.

### 2.8.1 Tampa/Hillsborough Interconnect

The Tampa/Hillsborough Interconnect (THI) is a metered connection that allows surplus treated water from the City of Tampa to be purchased by Tampa Bay Water and delivered into Hillsborough County's Northwest County distribution system. The Tampa/Hillsborough Interconnect can deliver up to 15 mgd. Tampa Bay Water owns the pump station while Hillsborough County controls the daily pumpage to meet Tampa Bay Water's request. This pump station is used to increase the pressure of the City of Tampa supply, enabling it to be delivered through the interconnect piping into Hillsborough County's water distribution system. Table 2-9 shows the rated (permitted and design), minimum and sustainable capacities for this facility.

**Table 2-9: Rated and Sustainable Capacities of the Tampa/Hillsborough Interconnect**

| Rated Capacity |        |         | Sustainable Capacity |         |
|----------------|--------|---------|----------------------|---------|
| PWS            | Design | Minimum | Peak Day             | >5 Days |
| mgd            | mgd    | mgd     | mgd                  | mgd     |
| 15.0           | 15.0   | 0.50    | 10.0                 | 7.5     |

### 2.8.2 U.S. 301 Interconnect

In 2002, the City of Tampa constructed a 36-inch diameter interconnect (U.S. 301 Interconnect) in order to sell surplus treated water to Tampa Bay Water. Tampa Bay Water subsequently made improvements at the U.S. 301 interconnect that also allows Tampa Bay Water to provide emergency water to the City of Tampa, per Section 3.08B of the Amended and Restated Interlocal Agreement. In 2011, the pipeline was extended to allow the chloraminated supply from the City of Tampa's system to be delivered to the storage tanks at the Regional High Service Pump Station. Tampa Bay Water owns and operates the facilities. Table 2-10 shows the rated design, minimum and sustainable capacities for this facility.

**Table 2-10: Rated and Sustainable Capacities for the US 301 Interconnect**

| Facility                | Rated Capacity |        | Sustainable Capacity |          |
|-------------------------|----------------|--------|----------------------|----------|
|                         | Minimum        | Design | Peak Day             | > 5 Days |
|                         | mgd            | mgd    | mgd                  | mgd      |
| Emergency Flow to Tampa | 3.0            | 30.0   | 30.0                 | 30.0     |
| Flow to Tampa Bay Water | 2.0            | 15.0   | 5.0                  | 5.0      |

### 2.8.3 Maytum WTP Supply Interconnection

Tampa Bay Water and the City of New Port Richey entered into a surplus finished water agreement in 2007 as a part of the West Pasco Infrastructure Project. This project provided a pipeline connection that delivers finished water from the regional system to the Maytum and Little Road WTPs. Additionally,



Tampa Bay Water provided piping modifications and a new pumping station at the Maytum WTP to allow the purchase of excess treated groundwater from New Port Richey and pumping to the Pasco County Little Road WTP. Previous system planning efforts identified several scenarios where surplus water from the Maytum WTP could be pumped to Pasco County's Little Road WTP. The Maytum surplus water pump station has a capacity of approximately 7.5 mgd.

#### **2.8.4 Lake Park WTP Emergency Supply Interconnection**

Tampa Bay Water and Hillsborough County entered into an emergency surplus water agreement in 2010. As a part of this agreement, Tampa Bay Water completed piping improvements at the Lake Park WTP to allow the ability for Hillsborough County to deliver surplus finished water supply back into the Tampa Bay Water Regional Transmission System. Previous system analyses identified several scenarios where surplus water from the Lake Park WTP could be sent to the Cosme WTP; which in turn could be used to supplement the delivery of potable water supply to the City of St. Petersburg (and to Pinellas County via existing emergency interconnects with St. Petersburg). Hillsborough County staff at the Lake Park WTP control and set the flow rate to meet Tampa Bay Water's request. The metered capacity at this connection is 15 mgd.

#### **2.8.5 Northwest Hillsborough WTP Emergency Supply Interconnection**

Tampa Bay Water and Hillsborough County entered into an emergency surplus water agreement in 2010. As a part of this agreement, Tampa Bay Water completed piping improvements at the Northwest Hillsborough WTP to allow the ability for Hillsborough County to deliver surplus finished water supply back into the Tampa Bay Water Regional Transmission System. Previous system analyses identified several scenarios where surplus water from the Northwest Hillsborough WTP which in turn could be used to supplement the delivery of potable water supply to the City of St. Petersburg (and to Pinellas County via existing emergency interconnects with St. Petersburg). Hillsborough County staff at the Northwest Hillsborough WTP control and set the flow rate to meet Tampa Bay Water's request. The metered capacity at this connection is 15 mgd.



**THIS PAGE INTENTIONALLY LEFT BLANK**

### **3. Regulatory Outlook for Drinking Water Supplies**

#### **3.1 Background**

The Safe Drinking Water Act (SDWA) was enacted in 1974 to regulate the nation's public drinking water supplies and protect public health. It was amended in 1986 and 1996 to improve protection of drinking water quality as well as include coverage for sources of drinking water: rivers, lakes, springs, and groundwater. The current SDWA mandate includes source water protection, water treatment, finished water distribution, and public information.

Under the SDWA, the United States Environmental Protection Agency (USEPA) is authorized to establish enforceable standards for drinking water which include natural and man-made constituents and minimal treatment requirements. These regulations establish health-based maximum contaminant levels (MCLs) for specific drinking water constituents and identify the approved testing methods for each contaminant. "Primacy" is the authority that allows a state to implement and enforce the SDWA within the jurisdiction of that state. The USEPA can delegate primacy to a state if the state provides assurance that it will adopt drinking water standards at least as stringent as the federal standards and can appropriately enforce those standards. In Florida, the Florida Department of Environmental Protection has primacy authority to enforce the SDWA. This section summarizes the pertinent regulations that may affect Tampa Bay Water's existing and future water supplies.

##### **3.1.1 Current Federal Regulatory Requirements**

Drinking water rules are designated as either primary or secondary standards. Primary standards target public health issues and are enforceable; they apply to all public water systems. Regulated constituents are classified as follows: microorganisms, disinfectants, disinfection by-products, radionuclides, organic and inorganic chemicals. Secondary standards are related to aesthetic qualities such as color, taste, and odor and are not enforced by the federal government. However, states may choose to adopt them as enforceable standards; Florida enforces compliance with the secondary MCLs.

Under the authority of the SDWA, the USEPA has promulgated regulations that are applicable to public water systems. They include:

- Amendments to the SDWA (National Primary Drinking Water Regulations), 1986 and 1996
- Surface Water Treatment Rule (SWTR), 1989
- Total Coliform Rule (TCR), 1989
- Lead and Copper Rule (LCR), 1991
- Interim Enhanced Surface Water Treatment Rule (IESWTR), 1998
- Stage 1 Disinfectants and Disinfection By-Products Rule (Stage 1 D/DBPR), 1998
- Radionuclides Rule, 2000
- Arsenic Rule, 2001
- Filter Backwash Recycling Rule (FBRR), 2001
- Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), 2002
- Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), 2006

- Stage 2 Disinfectants and Disinfection By-Products Rule (Stage 2 D/DBPR), 2006
- Groundwater Rule (GWR), 2006
- Revised Total Coliform Rule (RTCR), 2013

The progress of regulatory development is episodic; initially in the 1970s and 80s, activity under the SDWA was quite rapid. In recent years, the development and implementation of regulations has been more methodical and frequently managed through the Negotiated Regulation approach. Figure 3-1 illustrates the cumulative nature of the regulation of drinking water constituents in the United States.

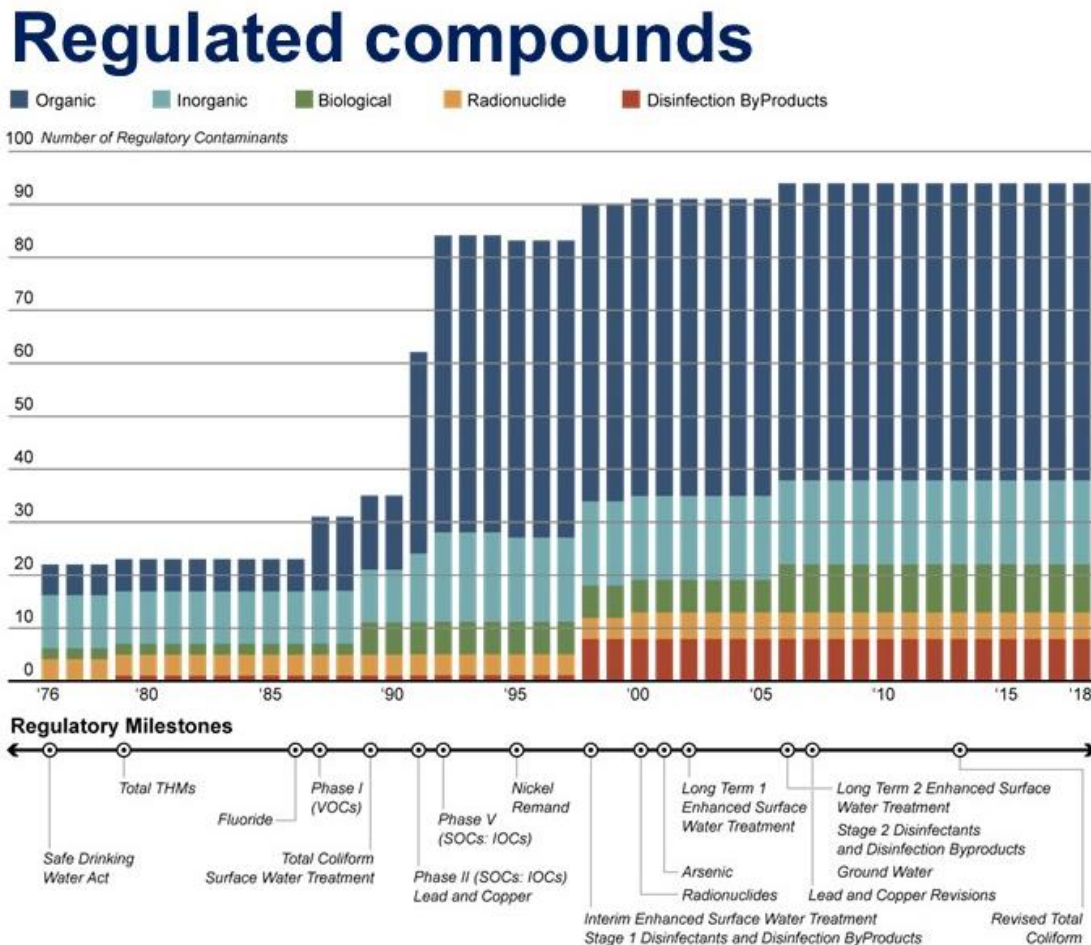


Figure 3-1: Regulatory Timeline for Drinking Water Rules and Constituents in the United States

### 3.1.1.1 Surface Water Treatment Rules Suite

The suite of Surface Water Treatment Rules (SWTR, IESWTR, LT1ESWTR, and LT2ESWTR) provides a minimum level of treatment for drinking water production from surface water supplies. Surface water is at a higher risk for contamination from runoff and other pollution sources. The treatment requirements for surface water supplies are specific to protect against waterborne diseases caused by

viruses, such as *Giardia lamblia*, *Cryptosporidium*, and *Legionella*. The initial SWTR required the disinfection of surface waters and the maintenance of a minimum residual disinfectant in the distribution system, as well as a 3-log (99.9%) removal/inactivation of *Giardia* and 4-log (99.99%) removal/inactivation of viruses. The SWTR also required combined filtered water turbidity monitoring (less than or equal to 0.5 NTU) to demonstrate the adequacy of the filtration process.

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was an incremental step to further control of microbial pathogens, particularly *Cryptosporidium*, in systems that serve 10,000 persons or more. It required these systems to calculate levels of microbial inactivation to understand the risk trade-offs with disinfection byproducts (i.e., the microbial disinfection backstop). The Stage 1 D/DBPR was published concurrent to the 1998 IESWTR which lowered the total trihalomethane (TTHM) MCL to 0.080 mg/L and added five haloacetic acids (HAA5), chlorite and bromate to the regulation. It also set Maximum Residual Disinfectant Levels (MRDL) for chlorine, chloramine, and chlorine dioxide.

The IESWTR tightened individual and combined filter effluent turbidity standards and individual filter turbidity provisions; it required a 2-log reduction in *Cryptosporidium* and individual and combined filtered water turbidity be less than 0.3 NTU in 95% of samples and never exceed 1 NTU. Finally, it required covers on all new finished water storage facilities and sanitary surveys for all surface water systems regardless of size.

The Long Term 1 ESWTR (LT1ESWTR) extended the provisions and protection of the IESWTR which applied to systems larger than 10,000 persons to systems less than 10,000 persons.

The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) was promulgated to further enhance public protection against illness caused by microbial pathogens, including *Cryptosporidium*, in drinking water beyond what was required by the IESWTR, as well as assess the tradeoffs associated with the control of disinfection by-products. The LT2ESWTR rule implemented a risk-based approach to *Cryptosporidium*, requiring additional removal based on source water protozoan monitoring. The rule included a “microbial toolbox,” which provided a suite of treatment options that can be used to meet the rule required combination of inactivation and removal.

#### 3.1.1.2 Groundwater Rule

The intent of the 2006 Groundwater Rule was to reduce the incidence of illness caused by microbial contamination in public systems that utilize groundwater sources. Under this rule, groundwater systems must undergo sanitary surveys at least once every three years and take corrective actions for any significant deficiencies identified. A groundwater system must provide a minimum of 4 log virus inactivation/removal or be subject to triggered source water monitoring in the event of a total coliform positive observation in the distribution system. Triggered source water sampling includes at least one sample from each source that was in use at the time of the positive total coliform result. The triggered source water samples must be analyzed for the presence of fecal indicators also.

#### 3.1.1.3 Total Coliform Rule and the Revised Total Coliform Rule

The 1989 Total Coliform Rule (TCR) was substantially revised in 2014; the intent of both the original rule and revisions were to ensure the microbial quality of water in the distribution system. Coliform

bacteria are used as indicator organisms that may signal the presence of contamination and overall microbial quality. *E. coli*, a specific subgroup of coliforms that are usually human pathogens, are the specific indicator of potential fecal contamination. All total coliform samples must be further analyzed for *E. coli*, and additional “recollect” samples must be taken from sites specifically related to the initial positive sample.

The 2014 revisions set a non-enforceable maximum contaminant level goal (MCLG) for total coliforms as zero and an enforceable MCL of zero for *E. coli*. Any observation of *E. coli* in distribution system water is an acute MCL violation that would trigger a boil water order. The revised rule also established a performance metric for total coliform observations; if 5% of the monthly samples taken in the distribution system are total coliform positive, a system must conduct a Level 1 Assessment. A Level 1 Assessment is a detailed review of system operational practices and may be conducted by the utility staff. The rule also established a Level 2 Assessment that must be performed if the system has a second exceedance of the 5% total coliform threshold in a rolling 12-month period, or if *E. coli* is detected in the distribution system. The Level 2 Assessment is conducted by the state or a third party designated by the state.

#### 3.1.1.4 *Disinfection By-Product Rules*

The 1979 TTHM Rule was the first endeavor by the USEPA to regulate a group of constituents. It established the maximum allowable level of four disinfection byproducts (chloroform, bromoform, dichlorobromomethane and dibromochloromethane) to 0.100 mg/L and was based on an estimate of total population exposure. The Stage 1 D/DBPR was published concurrent to the 1998 IESWTR; it lowered the TTHM MCL to 0.080 mg/L and added five haloacetic acids (HAA5), chlorite and bromate to the regulation. It also set the Maximum Residual Disinfectant Levels (MRDL) for chlorine, chloramines, and chlorine dioxide. The Stage 1 D/DBPR required systems using chlorine or chloramines to monitor total organic carbon (TOC), alkalinity, TTHM, and HAA5 and demonstrate adequate TOC removal based on source water quality.

The 2006 Stage 2 D/DBPR was promulgated in tandem with the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) to further reduce the health risks associated with disinfection by-product formation in drinking water. The second provision of the Stage 2 D/DBPR modified the method of calculating compliance with the TTHM and HAA5 maximum levels. This change represented a shift from a total population exposure estimate (a system-wide running annual average) to a locational running annual average for TTHM and HAA5. The MCL values remained equal to the Stage 1 D/DBPR levels of 0.080 mg/L and 0.060 mg/L for TTHM and HAA5, but the locational running average is now used to determine compliance at each individual sampling location. This approach intended to reduce exposure to high disinfection by-product concentrations in pockets of a distribution system. Each monitoring site must comply with the running annual average for each disinfection by-product group.

#### 3.1.1.5 *Lead and Copper*

In June 1991, the Lead and Copper Rule (LCR) was issued to protect public health by minimizing lead and copper levels in drinking water. The rule specified a unique compliance approach: action levels. The exceedance of an action level is not a violation; it signals the need to re-evaluate the existing corrosion

control strategy and adjust. Remedial actions may include a new corrosion control treatment, source water monitoring, public education, and/or lead service line replacement. The LCR was revised in October 2007 to clarify monitoring, treatment, customer awareness, lead service line replacement, and compliance with public education requirements. Long-term revisions to the LCR were scheduled to be released in 2017 but have been delayed; revisions are expected to be proposed in 2019. The long-term revisions are expected to address five topics: sample site selection, lead sampling protocol, public education for copper exceedances, lead service line replacement requirements, and identify measures to ensure optimal corrosion control treatment. Previous and ongoing revisions to the LCR are further discussed as future regulatory considerations (Section 3.2.3.10).

#### *3.1.1.6 Radionuclides*

In December 2000, the Radionuclides Rule was published as a revision of the original 1977 regulation. The standards included a combined radium 226/228 of 5 picocuries (pCi)/L, a gross alpha standard for all alpha emitters of 15 pCi/L, a combined standard of 4 millirems/year for beta emitters, and a new MCL of 30 µg/L for uranium. USEPA has considered regulating radon in drinking water, announcing its intention to evaluate in 1999, but no additional advances have been made in more than a decade.

#### *3.1.1.7 Arsenic*

In January 2001, the Arsenic Rule was published which reduced the arsenic drinking water MCL from 50 µg/L to 10 µg/L. A “stealth” MCL of 5 ug/L exists in the Consumer Confidence Report (CCR) Rule; if a system observes arsenic at greater than 5 ug/L but less than 10 ug/L, it must be reported in the CCR.

#### *3.1.1.8 Filter Backwash Recycling Rule*

The Filter Backwash Recycling Rule (FBRR) was published in June 2001 and requires recycled filter backwash water, thickener supernatant, and liquids from dewatering processes be routed to allow full treatment by the facility conventional processes. The intent was to reduce the loading of pathogens present in recycling processes which could possibly impact finished water quality.

#### *3.1.1.9 The Water Infrastructure Act of 2018*

The Water Infrastructure Act of 2018 was signed into law on October 24, 2018. While most of the bill detail focuses on traditional water projects carried out by the Army Corps of Engineers (ACOE), some provisions may directly impact water utilities. It should be noted that this bill only authorizes a number of water related programs and activities; it does not identify funding sources. Funding will need to be secured through separate legislation after which the ACOE and the USEPA may move into rulemaking. The Water Infrastructure Act of 2018 was signed into law on October 24, 2018. While most of the bill detail focuses on traditional water projects carried out by the Army Corps of Engineers (ACOE), some provisions may directly impact water utilities. It should be noted that this bill only authorizes a number of water related programs and activities; it does not identify funding sources. Funding will need to be secured through separate legislation after which the ACOE and the USEPA may move into rulemaking.

The relevant sections of this bill that may have an impact on Tampa Bay Water include:

- Making the Consumer Confidence Reports (CCRs) more clear, understandable and usable,
- Requiring the issuance of CCRs twice per year for utilities serving 10,000 persons or more,
- Encouraging the development of utility asset management plans, and
- Developing a plan to improve the accuracy and availability of compliance monitoring data from the states.

The USEPA will have to engage in rulemaking to codify these provisions before any of these impacts will be seen in drinking water utilities.

### **3.2 Future Regulatory Considerations**

To become a regulated compound under the SDWA, a number of criteria must be met. The criteria include:

- The contaminant may, or is likely to, have an adverse effect on human health;
- The contaminant is known to occur in drinking water at a frequency and in high enough concentrations to be of public health concern; and
- In the sole judgment of the USEPA Administrator, the regulation of the contaminant presents a meaningful opportunity for health risk reduction for persons served by public water systems.

This regulatory framework is slow and intentionally deliberate; the process allows the drinking water community to gather enough data to understand occurrence, health effects and treatability. It also allows for the development of cost-benefit analyses to determine the costs for achieving reduced health risks.

There are disadvantages to “slow and deliberate”; it can lead to public frustration, and a missed opportunity for some portion of the public health benefit and uncertainly.

The USEPA has several programs to identify the potential regulation opportunity of compounds and microorganisms that are not currently subject to proposed or promulgated National Primary Drinking Water Rules (NPDWRs). Currently, there are over 150,000,000 registered chemical substances in the Chemical Abstracts Service, with millions added each year. Selecting target constituents for future regulation is a formidable challenge.

The Drinking Water Contaminant Candidate List (CCL) and the Unregulated Contaminant Monitoring Rule (UCMR) programs are the two primary tools that the USEPA uses to identify candidates for regulation. Constituents that may be the subject of near-term regulations or an increase in stringency include perchlorate, chlorate, select volatile organic compounds (VOCs), chromium VI, nitrosamines, and emerging constituents such as algal toxins, personal care products and endocrine disruptors. Finally, new regulations can also be proposed through political action which may accelerates the SDWA process for developing national drinking water standards.



### **3.2.1 Identifying New Constituents: The Unregulated Contaminant Monitoring Rule and the Contaminant Candidate List**

As a means for the USEPA to consistently inform the regulatory process about constituents not presently regulated under the SDWA, the Unregulated Contaminant Monitoring Rule (UCMR) was promulgated through the 1996 SDWA amendments. The CCL program identifies the universe of constituents that may occur in public water systems which may be targeted for future regulatory action. The SDWA requires that the CCL be updated every five years. For each cycle, the USEPA must decide whether to regulate at least five of the constituents using a specific regulatory determination process which is summarized in Figure 3-2.

The goal of the UCMR was threefold: it generates national occurrence data on five-year cycles for up to 30 selected constituents per cycle, provides a platform for testing more recently developed sampling methods and analytical procedures for constituents, and screens constituents using new or specialized analytical methods. The constituents that have been investigated in each cycle of the UCMR are selected from the CCL in the same cycle (see Figure 3-2). The 1996 SDWA Amendments require that the USEPA review the data collected under the UCMR program and announce whether they will or will not move forward to rule making for at least five of the constituents; a positive determination means the constituent will move forward into rule making while a negative determination indicates that no additional rule work will proceed on the constituent at that time.

The UCMR CCL process has gone through three full cycles. The most recent regulatory determination arose from CCL3, which was finalized on January 4, 2016 and identified strontium as a candidate for future regulation development. CCL4 was finalized on November 17, 2016 and the microbial and chemical constituents on the list can be found at <https://www.epa.gov/ccl/chemical-constituents-ccl-4> and <https://www.epa.gov/ccl/microbial-constituents-ccl-4>.

Following CCL4, the USEPA published the UCMR4 in December 2016 and it contained 30 constituents. Monitoring under UCMR4 will take place from 2018 to 2020. The UCMR4 parameters are wide ranging and include pesticides, algal toxins, metals, additional haloacetic acids, alcohols, and semi-volatiles. The compounds are divided into two groups: 10 cyanotoxins and 20 additional constituents. All surface water (SW) systems and groundwater under the direct influence of surface water (GWUDI) systems serving more than 10,000 people are required to monitor all 30 constituents

Table 3-1 through Table 3-3 summarize the parameters that surface water utilities must sample for under UCMR4.

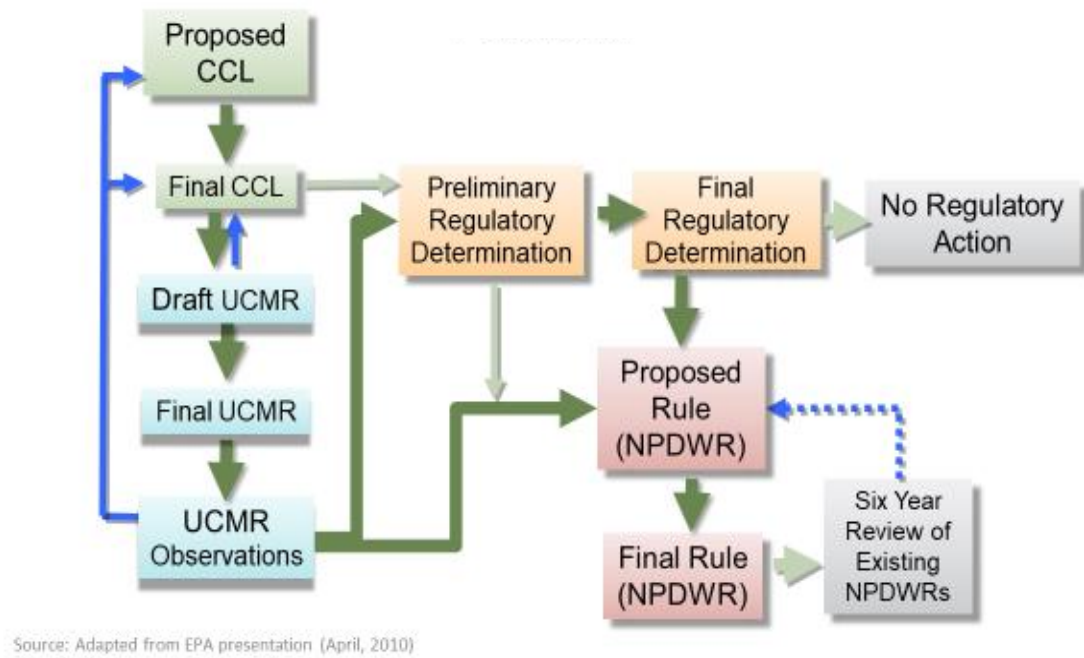


Figure 3-2: Federal Safe Drinking Water Act Standard Setting Process

Table 3-1: Cyanotoxins to be sampled under UCMR4

| Analyte            | CAS Registry Number | EPA Method Number | Minimum Reporting Level (µg/L) |
|--------------------|---------------------|-------------------|--------------------------------|
| total microcystins | N/A                 | 546               | 0.300                          |
| microcystin-LA     | 96180-79-9          | 544               | 0.008                          |
| microcystin-LF     | 154037-70-4         | 544               | 0.006                          |
| microcystin-LR     | 101043-37-2         | 544               | 0.020                          |
| microcystin-LY     | 123304-10-9         | 544               | 0.009                          |
| microcystin-RR     | 111755-37-4         | 544               | 0.006                          |
| microcystin-YR     | 101064-48-6         | 544               | 0.020                          |
| nodularin          | 118399-22-7         | 544               | 0.005                          |
| anatoxin-a         | 64285-06-9          | 545               | 0.030                          |
| cylindrospermopsin | 143545-90-8         | 545               | 0.090                          |

**Table 3-2: HAAs, Bromide, and TOC Required to be Sampled under UCMR 4**

| Analyte                    |        |  |                                  | CAS Registry Number | Analytical Method | Minimum Reporting Level (µg/L) | Maximum Contaminant Level Goals* (µg/L) |
|----------------------------|--------|--|----------------------------------|---------------------|-------------------|--------------------------------|-----------------------------------------|
| HAA9                       | HAA5   |  | dichloroacetic acid (DCAA)       | 79-43-6             | EPA 552.3         | 0.2                            | 0                                       |
|                            |        |  | monochloroacetic acid (MCAA)     | 79-11-8             | EPA 552.3         | 2.0                            | 70                                      |
|                            |        |  | trichloroacetic acid (TCAA)      | 76-03-9             | EPA 552.3         | 0.5                            | 20                                      |
|                            | HAA6Br |  | monobromoacetic acid (MBAA)      | 79-08-3             | EPA 552.3         | 0.3                            | N/A                                     |
|                            |        |  | dibromoacetic acid (DBAA)        | 631-64-1            | EPA 552.3         | 0.3                            | N/A                                     |
|                            |        |  | bromochloroacetic acid (BCAA)    | 5589-96-8           | EPA 552.3         | 0.3                            | N/A                                     |
|                            |        |  | bromodichloroacetic acid (BDCAA) | 71133-14-7          | EPA 552.3         | 0.5                            | N/A                                     |
|                            |        |  | chlorodibromoacetic acid (CDBAA) | 5278-95-5           | EPA 552.3         | 0.3                            | N/A                                     |
|                            |        |  | tribromoacetic acid (TBAA)       | 75-96-7             | EPA 552.3         | 2.0                            | N/A                                     |
| Total Organic Carbon (TOC) |        |  |                                  | 7440-44-0           | SM 5310C          | 0.3 mg/L                       | N/A                                     |
| Bromide                    |        |  |                                  | 24959-67-9          | EPA 300.0         | 5                              | N/A                                     |

**Table 3-3: Additional Constituents to be Sampled Under UCMR 4**

| Analyte                                | CAS Registry Number | EPA Method Number | Minimum Reporting Level (µg/L) |
|----------------------------------------|---------------------|-------------------|--------------------------------|
| <b>Metals</b>                          |                     |                   |                                |
| germanium                              | 7440-56-4           | 200.8             | 0.30                           |
| manganese                              | 7439-96-5           | 200.8             | 0.40                           |
| <b>Pesticides</b>                      |                     |                   |                                |
| alpha-hexachlorocyclohexane            | 319-84-6            | 525.3             | 0.01                           |
| chlorpyrifos                           | 2921-88-2           | 525.3             | 0.03                           |
| dimethipin                             | 55290-64-7          | 525.3             | 0.20                           |
| ethoprop                               | 13194-48-4          | 525.3             | 0.03                           |
| oxyfluorfen                            | 42874-03-3          | 525.3             | 0.05                           |
| profenofos                             | 41198-08-7          | 525.3             | 0.30                           |
| tebuconazole                           | 107534-96-3         | 525.3             | 0.20                           |
| total permethrin (cis- & trans-)       | 52645-53-1          | 525.3             | 0.04                           |
| tribufos                               | 78-48-8             | 525.3             | 0.07                           |
| <b>Alcohols</b>                        |                     |                   |                                |
| 1-butanol                              | 71-36-3             | 541               | 2.00                           |
| 2-propen-1-ol                          | 107-18-6            | 541               | 0.50                           |
| 2-methoxyethanol                       | 109-86-4            | 541               | 0.40                           |
| <b>Semi-volatile Organic Chemicals</b> |                     |                   |                                |
| butylated hydroxyanisole               | 25013-16-5          | 530               | 0.03                           |
| o-toluidine                            | 95-53-4             | 530               | 0.007                          |
| quinoline                              | 91-22-5             | 530               | 0.02                           |

Following the conclusion of the national sampling and reporting for UCMR4, the USEPA will proceed to making regulatory determinations (both positive and negative) for at least five of the parameters on these lists. A regulatory determination is a formal decision on whether the USEPA should initiate a process to develop a national primary drinking water regulation for a specific contaminant.

### 3.2.2 Health Advisories

In addition to the primary and secondary drinking water standards, the CCL and the UCMR processes, the SDWA authorizes the USEPA to develop HALs (HALs), which are guidance for unregulated drinking water constituents. Drinking water HALs are based on non-cancer health effects for varying sub-populations (i.e. infants, children, the elderly and immunocompromised persons). Because the traditional rulemaking process is lengthy, and some constituents do not meet the criteria for NPDWRs, setting HALs allows USEPA to move quickly to address potential threats to public health. Although HALs are non-enforceable, the recommended drinking water concentrations in a health advisory level are likely to be interpreted by states and the public as the equivalent of a regulation. HALs are based solely on the USEPA's assessment of peer-reviewed science with the goal to provide the public with a margin of protection from long-term exposure to drinking water constituents taking the most sensitive populations into account. The drawback to using HALs widely is that, because USEPA cannot pre-

release potential HALs, they do not undergo public review and comment. Since a health advisory level is not a primary drinking water standard, it is also possible that states will adopt varying HALs. It is expected that HALs will be an increasingly important tool for the USEPA.

Tampa Bay Water closely monitors the state and federal issuances of HALs and alerts Member Governments. Member Government staff and their Board members historically have relied on agency staff to address concerns, provide occurrence information and treatability assessments.

### 3.2.3 Potential Regulation

#### 3.2.3.1 *Algal Toxins*

A group of constituents that are likely to be regulated are cyanotoxins. Cyanobacteria, also known as blue-green algae, produce cyanotoxins which are a concern for water utilities worldwide. Their presence in water supplies cause numerous problems for water treatment plants but are most notorious for the metabolites they produce: taste and odor compounds and toxins. Taste and odor compounds such as 2-methyl isoborneol (MIB) and geosmin are indirectly regulated through the secondary standard for odor. The primary modes of toxicity for algal toxins fall into three categories: (1) hepatotoxins that adversely affect the liver; (2) neurotoxins that affect the nervous system; and (3) dermatotoxins which cause skin and mucous irritations.

Algal toxins are not currently regulated by the USEPA; however, the agency issued HALs for two cyanotoxins in June 2015. The health advisory level covered 10-day health advisories for microcystins and cylindrospermopsin. The USEPA has the health advisories set at or below 0.3 µg/L for microcystins and 0.7 µg/L for cylindrospermopsin in drinking water for children pre-school age and younger. For school-age children through adults, the USEPA recommends less than 1.6 µg/L for microcystins and 3.0 µg/L for cylindrospermopsin. The World Health Organization (WHO) has a chronic exposure guideline value of 1 µg/L for microcystin and a maximum tolerable daily intake of 6 µg/L for an adult (WHO 2011). The WHO guideline assumes microcystin is an adequate surrogate for any other algal toxins that may also be present.

Three algal toxins were included on the CCL3. The CCL4 expands investigation and includes 10 algal toxins including variants of microcystin. CCL4 has the advantage of improved analytical methods. With new analytical methods, the list includes individual measurements of six specific microcystins, nodularin, anatoxin-a, and cylindrospermopsin. Following the conclusion of UCMR4 monitoring, it is highly likely that rulemaking will ensue for a group of algal toxins. In the interim, states and local governments have issued their own standards, advisories and warnings regarding algal toxins.

#### 3.2.3.2 *Strontium*

It is likely that the USEPA will regulate strontium in drinking water. The element was included on the CCL3 list and the earlier National Inorganics and Radionuclides Survey (NIRS). A health reference level of 1.5 mg/L was set for strontium as part of the CCL3 regulatory determination process. Strontium is released into fresh water from geologic weathering associated with sedimentary rocks such as gypsum, anhydrite, rock salt, limestone, and dolomite. Anthropomorphic sources of strontium include air

contamination from milling processes, coal burning, and phosphate fertilizers. The air constituents are eventually deposited on land and soil. Strontium can accumulate in plants and organisms through uptake and bioaccumulation, thus entering the human food chain. The major health effect associated with the stable form of strontium is skeletal deformation in children. Although some isotopes of strontium are radioactive, this potential regulation is focused on the stable form of the element because the radioactive isotopes are covered under the existing radionuclides rule.

#### *3.2.3.3 Perchlorate and Chlorate*

The USEPA has announced its intent to issue a perchlorate regulation by December 2019. A notice of proposed rule is expected in November 2018. Several states have already established a perchlorate MCL including California (6 µg/L) and Massachusetts (2 µg/L). Nevada has an action level of 18 µg/L. Sources of perchlorate include munitions, rocket fuel, industrial sites, and hypochlorite. Perchlorate interferes with the ability of the thyroid to produce hormones needed for normal growth and development.

In addition to perchlorate, chlorate ( $\text{ClO}_3^-$ ) is another constituent that occurs in drinking water facilities that use bulk hypochlorite or onsite-generated hypochlorite. In hypochlorite solutions, chlorate may form during manufacture, transport, or storage, and increases in concentration correlate with the increase of time and/or temperature. Chlorate was on the CCL3 list and the USEPA has announced a chlorate health reference level of 210 µg/L. For comparison, the World Health Organization and Health Canada have proposed chlorate criteria of 700 and 100 µg/L, respectively. Chlorate is likely to be regulated in the future and it may be included in the six-year review of the Stage 2 DBP Rule which would shorten the time to final determination and regulation for chlorate.

#### *3.2.3.4 Volatile Organic Compounds*

Volatile organic compounds (VOCs) are a group of constituents for which USEPA decided in 2011 to increase regulation stringency. Some VOCs have been found to cause liver, kidney, central nervous system damage in addition to eye, nose, and throat irritation. Some VOCs are also suspected or known human carcinogens. There are currently eight regulated VOCs. USEPA planned to regulate eight additional compounds and revise the regulations for the currently regulated VOCs under the auspices of what the Agency has called the Carcinogenic VOC Rule (cVOC). Trichloroethylene (TCE) and tetrachloroethylene (PCE) are currently regulated and would likely be subject to more stringent regulations. The following eight VOCs were proposed to be regulated as part of USEPA's contaminant grouping strategy (in addition to the eight VOCs that are currently regulated): aniline, benzyl chloride, 1,3-butadiene, 1,1-dichloroethane, nitrobenzene, oxirane methyl, 1,2,3-trichloropropane, and urethane.

VOCs are typically associated with known industrial contamination sites that impact a utility's source water. The most common contamination occurs in groundwater. However, surface water supplies are vulnerable and an understanding of potential industrial sites in the watershed will help drive decision making regarding potential VOC presence in the source water. The anticipated date for a draft final cVOC rule was May 2019 but is now likely delayed.

### 3.2.3.5 *Nitrosamines and Emerging Disinfection By-Products*

Emerging DBPs consist of myriad compounds that are produced because of reactions between disinfectants and natural organic matter. These by-products include trihalomethanes, haloacetic acids, chloral hydrate, bromochloroacetic acid and an entire category of unknown organic halogens. More than 700 organic halogens have been identified. Due to the uncertainty in their abundance, occurrence and toxicity, there is much debate regarding potential public health relevance. One primary concern is the comparison of DBPs that are formed using chlorine disinfection with those that are formed using chloramine disinfection. There is no evidence that chloraminated water poses any different cancer risk than that of chlorinated water, yet speculation persists. The use of chloramines does reduce the overall exposure to regulated DBPs relative to free chlorine.

The Safe Drinking Water Act requires that USEPA review drinking water regulations at least once every six years and make appropriate revisions. The USEPA looked closely at nitrosamines in their review of the microbial and disinfection byproduct rules in the third six-year review cycle which concluded in January 2017. In September 2018, the USEPA opened comment to initiate the fourth six-year review and will certainly include nitrosamines and emerging disinfection by-products in that analysis.

If the USEPA incorporates rule making for new disinfection byproducts as part of the fourth six-year review of the DBP regulations, the approval and implementation process may be shorter in time than the more traditional positive regulatory determination pathway and new rule development. Based on the expected rule revisions and compliance cycles, regulatory compliance for nitrosamines could be required by 2022.

The popularity of chloramines for secondary disinfection purposes has also brought increased awareness of nitrosamines in drinking water, in particular N-nitrosodimethylamine (NDMA). Nitrosamines are DBPs that form from the oxidation of precursors in chlorinated and chloraminated waters. Nitrosamines have been found to strongly correlate with chloramine use, the use of certain polymers (e.g., POLYDADMAC) and ion exchange resins (e.g., MIEX). Health effect research indicates that nitrosamines are likely carcinogenic and may be linked to other diseases such as Alzheimer's, Parkinson's, and Type 2 diabetes.

Nitrosamines are not yet regulated with a standard MCL; five nitrosamines were on the CCL3. USEPA is considering a specific nitrosamine rule but it has not currently published a regulatory plan. California has established a 10 nanogram per liter (ng/L) notification level and Massachusetts has established a regulatory limit of 10 ng/L for drinking water. USEPA's regulatory limit may be as low as 10 ng/L with an MCL goal (MCLG) of zero since nitrosamines are considered likely carcinogenic compounds.

### 3.2.3.6 *Manganese*

Manganese is a naturally-occurring element found in air, soil, and water. It currently has a secondary standard of 0.05 mg/L. High exposure to manganese can result in various health effects depending on the route and duration of exposure. At this time, the potential regulatory horizon for manganese is uncertain.

Two states, Massachusetts and Minnesota, requested that manganese be included on the CCL4. Manganese was on the CCL3 and at its conclusion, it was deemed unnecessary to regulate it in drinking



water. Recent toxicity studies suggest that ingestion of manganese may be related to neurological effects in children and are the new driver for manganese inclusion in the final version of CCL4. More than 10 percent of the groundwaters in the US have manganese levels higher than the current health advisory level (0.05 mg/L) which increases the likelihood that some regulation will be developed.

#### 3.2.3.7 *Chromium VI*

Studies and publications of the Environmental Working Group (<https://www.ewg.org>) have renewed interest in chromium VI. Chromium VI, previously thought to be only a contact hazard causing allergic dermatitis at high concentration, has recently been implicated in cancer occurrence. Chromium is a naturally occurring metal in rocks, plants, humans, soil and volcanic dust, and animals. It is mostly present as chromium III, chromium VI, and the metal form of chromium, the latter two of which are produced in industrial processes. Major sources of chromium include steel and pulp mills and natural deposit erosion.

Currently the USEPA regulates the total concentration of chromium in drinking water with an MCL of 0.1 mg/L. California regulates the total chromium concentration at 10 µg/L as of July 1, 2014. Due to emerging research, the USEPA has proposed that chronic chromium VI exposure be classified as a probable carcinogen and so is likely to be considered for regulatory development in the future.

#### 3.2.3.8 *Constituents of Emerging Concern*

Another group of constituents that may be regulated in the future are constituents of emerging concern (CECs), also known as microconstituents, micropollutants, or trace organics. These constituents include pharmaceutically-active compounds (PhACs), personal care products (PCPs), endocrine-disrupting compounds (EDCs), and other organic compounds. Sources of endocrine-disrupting compounds as well as other emerging constituents include domestic waste, agricultural runoff, industrial sources, and solid waste. There are currently no federal or state regulations that specifically address PhACs, PCPs or EDCs. The UCMR3 included seven steroid hormones considered endocrine disrupting compounds. Based on the low frequency of occurrence as well as the low levels observed, it is unlikely that USEPA will regulate these emerging constituents which are readily oxidized by free chlorine.

Many personal care products fit within the CEC category, though the ones of current regulatory concern are the perfluorinated compounds (PFCs), which can be found in non-stick and water repellent chemicals. In May 2016, the USEPA issued health advisories for two of the PFCs (PFOS and PFOA) which are based on the agency assessment of the latest peer-reviewed science. The health advisory is a non-regulatory guideline recommending that if PFOA and PFOS is detected in drinking water at individual or combined concentrations greater than 70 ng/L, water systems should perform additional sampling to determine the source of the contamination and terminate it, if possible. USEPA also suggests that drinking water systems provide their customers with information about the levels of PFOS and PFOA in their water as well as the risks associated with exposure.

In Spring and Summer of 2018, the USEPA held a series of public meetings including the PFC National Leadership Summit as well as regional community meetings to gather stakeholder input for their PFC efforts which will result in an USEPA PFC Management Plan. This management plan is expected to be released in Fall 2018. Other activities undertaken by the USEPA include: updating the USEPA

Treatability Database, testing and approving improved laboratory methods, release of the Provisional Peer Reviewed Toxicity Values for PFCs, catalogue of scientific literature on PFC toxicity and the creation of a PFC Stewardship Program. The PFC Stewardship Plan will facilitate the phasing out of perfluorinated chemical manufacturing. The USEPA is also developing public communication tools and webinars for utility use.

#### 3.2.3.9 *Microbial Constituents*

Microbial constituents are pathogenic organisms that include bacteria, viruses, and protozoa. Microbial constituents associated with drinking water may cause acute illness. Microorganisms, such as *Cryptosporidium* or *Giardia lamblia*, cause gastrointestinal illness, or in the case of *Legionella*, cause a type of pneumonia, Legionnaire's Disease. Enteroviruses and noroviruses were on the UCMR3 due to concern regarding their presence in groundwater supply systems. No microbial pathogens are included in the UCMR4. Pathogens in biofilms, such as *Legionella* and *Naegleria fowleri*, are also microbial constituents of concern as they can thrive in building plumbing systems, such as hospitals, hotels, schools, homes, and factories. It is not expected that new regulations for specific microbes will be promulgated in the near term.

#### 3.2.3.10 *Potential Long-Term Lead and Copper Rule Revisions*

After being promulgated in 1991, the Lead and Copper Rule (LCR) went through a series of technical amendments and more extensive revisions in January 2000 and October 2007 (**Error! Reference source not found.**). The goal of the January 2000 revisions was to streamline requirements and promote consistent implementation of effective corrosion control throughout the nation. The goal of the 2007 Short Term Revisions was to enhance the implementation of the LCR in five main categories: treatment, monitoring, consumer awareness, public education, and lead service line (LSL) replacement. Since the promulgation of the 2007 Short Term Revisions, the USEPA has identified a number of issues and concerns regarding the LCR. This effort is referred to as the USEPA Long Term Revisions and will serve to improve the effectiveness of corrosion control, thus reducing exposure to lead and copper. The USEPA assembled a working group to assist the National Drinking Water Advisory Council (NDWAC). This NDWAC Working Group was asked to:

- Propose ways to reduce the complexity of the rule;
- Identify the level of discretion that should be allowed with respect to optimal corrosion control treatment practices;
- Identify best practices for compliance sampling;
- Focus on key areas of concern, such as schools and childcare facilities and recommend options.

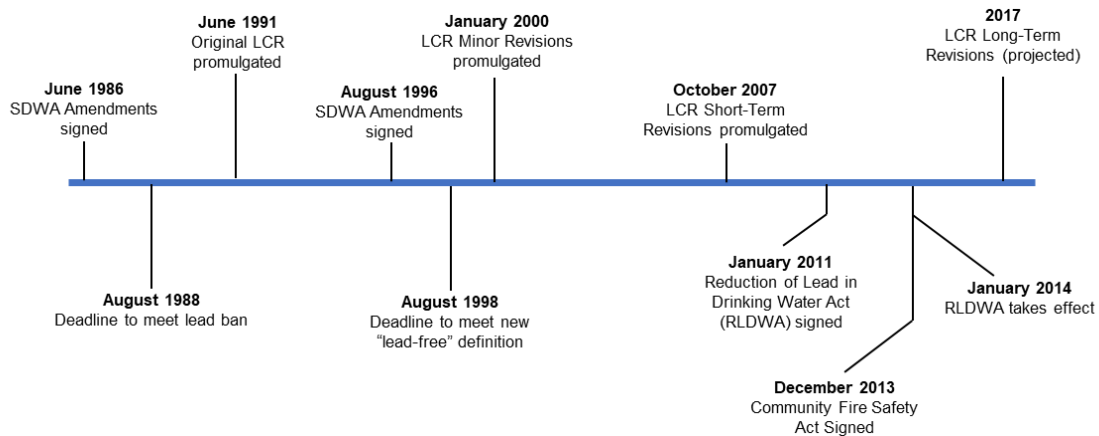


**Figure 3-3: Timeline of Lead and Copper Rule Amendments and Revisions**

The USEPA has identified the following items for development in the Lead and Copper Rule Long Term Revisions (LCR LTR):

- Lead service line (LSL) replacement;
- Improve optimal corrosion control treatment requirements;
- Incorporation of health-based benchmarks;
- Use of point of use (POU) filters;
- Clarify sampling requirements;
- Increase transparency and information sharing with the public;
- Develop more specific public education requirements; and
- Revise the copper requirements.

### 3.2.3.11 Potable Reuse Regulations

While potable reuse is gaining viability as a potential source of water supply in Florida, there is still a need for a regulatory framework to permit new facilities that would treat and deliver the supply. Tampa Bay Water recognizes the importance of reuse as a water supply option and has been working with the Florida Department of Environmental Protection since 2015 on this issue. Staff have met with FDEP staff in Tallahassee on four occasions and have been actively engaged in state wide meetings and presentations. Table 3-4 summarizes the existing regulations related to water reuse, aquifer recharge and indirect potable reuse. For direct potable reuse to be implemented successfully, requirements for pilot testing, monitoring, reporting, and operator licensing will need to be set.

The State is actively engaged in developing a framework for potable reuse implementation. To this end, the FDEP and the Water Management Districts are actively promoting and funding an initiative, the Potable Reuse Commission (PRC). The PRC is a consensus panel of eleven water resource, industry, agricultural and health professionals which will develop a framework for potable reuse implementation in Florida. The framework is intended to advise elected officials and regulatory agencies on legislation, rule development and incentives. The commission is also working with the Water Research Foundation to produce the framework guidance document for the 2019 legislative session, along with fact sheets and public education materials that can be used by utilities state wide. Tampa Bay Water is supportive of

these efforts and will benefit greatly from guidance provided by the PRC if a potable reuse option is chosen for the next supply.

**Table 3-4: Florida Administrative Code Chapter 62 Regulatory Summary**

| Section | Title                                                 | Description                                                                                                                                                                                                                                                                                                     |
|---------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 520     | Groundwater Classes, Standards, and Exemptions        | Classifies groundwater and dictates the dimensions of zones of discharge for each class of groundwater. Provides regulatory information on water quality criteria exemption for discharges to groundwater.                                                                                                      |
| 524     | New Potable Water Well Permitting in Delineated Areas | Regulates well construction, water quality testing, permit requirements, and inspections for areas within which ground water contamination is known to exist or which encompasses vulnerable areas or areas where a subsidy for restoration or replacement of contaminated drinking water supplies is provided. |
| 528     | Underground Injection Control                         | This includes all injection wells defined in subsection 62-528.300(1), F.A.C., as Class I, III, IV or V wells. Class II wells are regulated by the Florida Geological Survey under Chapter 377, F.S., and Chapters 62C-26 through 62C-30, F.A.C.                                                                |
| 610     | Reuse of Reclaimed Water and Land Application         | Provides design and Operations and Maintenance criteria for land application systems that may discharge to Class G-I, G-II, and F-I ground waters, and requirements for Ground Water Recharge and Indirect Potable Reuse.                                                                                       |

#### 3.2.4 Timeline for Future Regulations

A plethora of issues are poised which will continue to delay most of the major drinking water regulations that are anticipated to be released by USEPA's Office of Groundwater and Drinking Water (OGWDW). Regulations for the constituents highlighted above, as well as other drinking water regulations, have been significantly delayed over the past several years (Figure 3-4). Constituents that are likely to be regulated in the next 5 to 8 years include perchlorate, chlorate, volatile organic compounds, nitrosamines, and manganese. In addition, the USEPA is re-evaluating the MCL for chromium III and may add an MCL for chromium VI. Considered holistically, the USEPA currently has a full schedule with the largest numbers of potential constituents since 1996. As a result, many of these regulatory deadlines may be pushed out several years into the future. Thus, many of the constituents on CCL4 may not receive a positive or negative regulatory determination until the 2020 – 2025 timeframe. In the interim, water systems recognize the likely possibility that the USEPA will move towards using non-regulatory health advisories levels as compared to the MCLs that have been promulgated in the past.

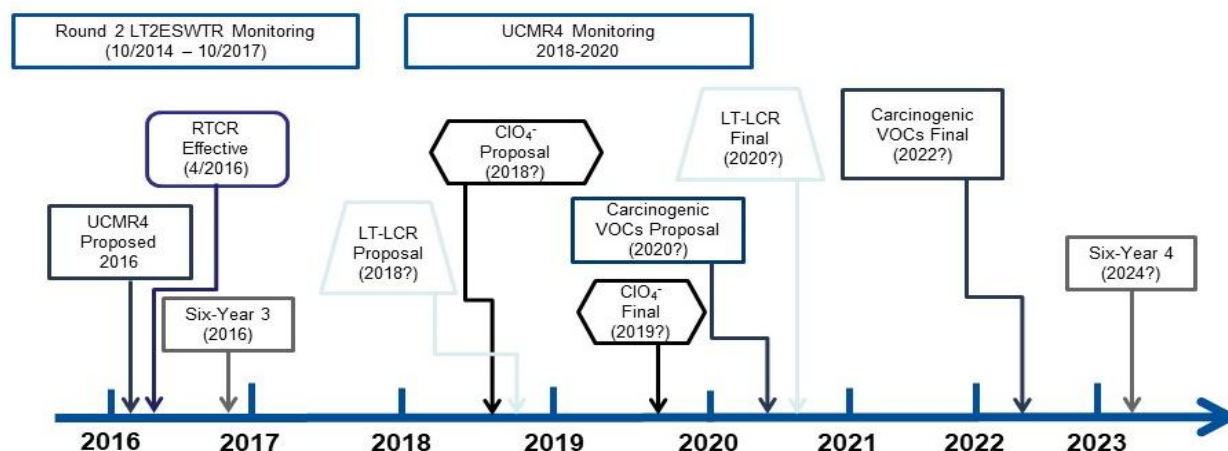


Figure 3-4: Potential Timeline for Future Regulations

### 3.2.5 Summary

Constituents that are likely to be regulated in the next 5 to 8 years include perchlorate, chlorate, volatile organic carbons, nitrosamines, emerging disinfection by-products, and some other UCMR3 compounds, including the perfluorinated compounds. Strontium received a positive regulatory determination in October 2014 but is not expected to impact surface water utilities because it tends to be a groundwater-specific contaminant. USEPA is re-evaluating the MCL for chromium III and may be adding an MCL for chromium VI. These anticipated regulatory changes represent the largest increase in potentially-regulated constituents seen since 1996; however, final regulations will not be issued for several more years into the future. Many of the proposed constituents may not receive a regulatory determination until the 2020 to 2025 timeframe. The most likely exceptions are perchlorate, nitrosamines and chlorate, which may have draft regulations before 2020. Table 3-5 identifies potential regulations and considerations for future water supplies as part of this Long-term Master Water Plan. Many of these should be monitored over the next 5 years to evaluate potential impacts on existing and future supplies.

**Table 3-5: Potential Future Regulatory Impacts and Recommendations for Tampa Bay Water**

| Parameter                  | Regulatory Outlook          | Notes                                                                                                                                          |
|----------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Algal Toxins               | Likely; next 5 to 8 years   | No expected treatment impacts; may increase reliance on ozone and biologically active filters; monitoring requirements likely in near future   |
| Strontium                  | Possible; next 5 to 8 years | Observed in member systems; typically, a groundwater issue                                                                                     |
| Perchlorate and Chlorate   | Likely; next 5 to 8 years   | No expected treatment impacts; evaluate hypochlorite specifications and handling procedures                                                    |
| Volatile Organic Compounds | Likely; next 5 to 8 years   | No expected treatment impacts; monitor and assess periodically                                                                                 |
| Nitrosamines and DBPs      | Likely; next 5 to 8 years   | Long term impacts uncertain; monitor and assess routinely; review results of UCMR4 monitoring for Agency and member governments                |
| Manganese                  | Likely; next 5 to 8 years   | May impact ozone and biologically active filters; long term impacts uncertain but should be manageable                                         |
| Chromium VI                | Likely; next 5 to 8 years   | Current water quality data indicate no expected treatment impacts; recommend speciation of chromium results and monitor periodically           |
| Emerging Constituents      | Likely; next 5 to 8 years   | Long term impacts uncertain; monitor UCMR4 results for Agency and member governments                                                           |
| Microbial Constituents     | Likely; next 5 to 8 years   | Long term impacts uncertain; monitor <i>Legionella</i> control plans and recommendations for MGs and their customers (hospitals, hotels, etc.) |
| Lead and Copper Revisions  | Certain; next 2 to 3 years  | No expected treatment impacts; coordinate corrosion control approaches with member governments                                                 |
| Perfluorinated Compounds   | Likely; next 3 to 5 years   | Long term impacts uncertain; recommend assess occurrence in Agency and member governments systems; monitor state and federal actions           |

### 3.3 Tampa Bay Water Current Water Use Permits Issued by the Southwest Florida Water Management District

The waters of the State of Florida are considered among its most important natural resources and are intended to be managed for the full beneficial use of the resource. To that end, the State recognizes the importance of water through the Water Resources Act, Chapter 373, Florida Statutes. The goal of the Water Resources Act is that enough water be available for all existing and future reasonable beneficial uses and natural systems while avoiding the adverse effects of competition for supplies. The Act created the water management districts and authorized the Districts to require and issue permits for the consumptive use of water. The consumptive uses of both surface water and groundwater are required to have permits and are based on threshold use. Water Use Permits (WUPs) in the Tampa Bay region are issued by the Southwest Florida Water Management District (SWFWMD). Tampa Bay Water holds eight WUPs for its groundwater resources and surface water supplies. The facilities, quantities, permit numbers and renewal cycles are provided in Table 3-6. The renewal and maintenance of the quantities and conditions in these WUPs are key components of the regional water supply plan.

**Table 3-6: Tampa Bay Water's Water Use Permits Issued by the Southwest Florida Water Management District**

| Facility                                      | Permitted or Design Capacity (MGD)      | Current Water Use Permit                                                                                                                    |
|-----------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Cosme-Odesa Wellfield                         | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Cross Bar Ranch Wellfield                     | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Cypress Bridge Wellfield                      | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Cypress Creek Wellfield                       | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Morris Bridge Wellfield                       | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Eldridge-Wilde Wellfield                      | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Northwest Hillsborough Regional Wellfield     | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Section 21 Wellfield                          | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| South Pasco Wellfield                         | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| Starkey Wellfield                             | Consolidated Wellfield Permit at 90 MGD | WUP 20011771.001 Issued January 25, 2011.<br>Expires January 25, 2021.                                                                      |
| South-Central Hillsborough Regional Wellfield | 24.1                                    | WUP 2004352.006 issued November 26, 2007 with letter modification (WUP 20004352.007) issued February 7, 2011.<br>Expires December 31, 2020. |
| Brandon Urban Dispersed Wells                 | 6                                       | WUP 20011732.003 issued November 20, 2009 with later modification (WUP 20011732.004) issued July 24, 2015.<br>Expires November 20, 2019.    |
| Eagles Wells                                  | 0.198                                   | WUP 2006312.003 issued September 3, 1993, extended July 1998.<br>Expires September 3, 2017.                                                 |
| Carrollwood Wells                             | 0.82                                    | WUP 2005886.004 issued October 11, 2010.<br>Expires October 11, 2030.                                                                       |
| Tampa Bypass Canal @Harney Road Pump Station  | 20                                      | WUP 2006675.006 issued May 26, 2011.<br>Expires May 26, 2031.                                                                               |
| Tampa Bypass Canal Water Supply               | 258                                     | WUP 20011796.002 issued August 28, 2007.<br>Expires December 31, 2030.                                                                      |
| Alafia River Pump Station                     | 60                                      | WUP 20011794.002 issued November 27, 2012.<br>Expires November 27, 2032.                                                                    |

### 3.4 Tampa Bay Water Current Facility Permits Issued by the Florida Department of Environmental Protection

The Florida Department of Environmental Protection (FDEP) was created by the Florida Environmental Reorganization Act of 1993 to protect, conserve, and manage Florida's natural resources and enforce the state's environmental laws. Its primary responsibility is to preserve the environmental integrity of Florida's physical environment, especially water and includes oversight of the water management districts, water pollution, public drinking water supplies, and the administration of the federal Safe Drinking Water



Act in Florida. Water treatment facilities, booster pump stations and related structures in the Tampa Bay region are permitted by the Southwest District of the FDEP. Typically, FDEP water facility permits are renewed on an annual basis by fee. The agency facilities permitted by FDEP, the current permitted capacities and permit numbers are provided in Table 3-7 below.

**Table 3-7: Tampa Bay Water's Facility Permits Issued by the Florida Department of Environmental Protection**

| Facility                                                  | Current Permitted Capacity (MGD) | Permit   |
|-----------------------------------------------------------|----------------------------------|----------|
| Cypress Creek Pump Station                                | 165                              |          |
| Cypress Creek Water Treatment Facility                    | 110                              | 651-2230 |
| Morris Bridge Booster Station                             | 30                               | 629-6177 |
| South-Central Hillsborough Intertie Booster Station       | 108                              |          |
| Off-stream Reservoir Pump Station                         | 120                              |          |
| Regional Surface Water Treatment Plant                    | 120                              | 629-6139 |
| Regional High Service Pump Station                        | 108                              |          |
| Lake Bridge Water Treatment Facility                      | 6.9                              | 651-5234 |
| South Pasco Water Treatment Facility                      | 28                               | 651-5275 |
| Eldridge-Wilde Hydrogen Sulfide Removal Facility          | 45                               |          |
| Tampa/Hillsborough Interconnect Pump Station              | 15                               | 629-0327 |
| Brandon Urban Dispersed 2, 4, 5R Water Treatment Facility | 9.24                             | 629-6320 |
| Brandon Urban Dispersed 7 Water Treatment Facility        | 3.5                              | 629-6319 |
| Tampa Bay Desalination Plant                              | 28.75                            | 629-6153 |
| C. W. Bill Young Regional Reservoir                       | 15.5 BG                          |          |
| Lithia Hydrogen Sulfide Treatment Facility                | 44.6                             |          |

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 4. Existing and Projected Customers and Water Demands

### 4.1 Introduction

Tampa Bay Water has the absolute and unequivocal obligation to meet the drinking water demands of its six-member governments which include Hillsborough, Pasco and Pinellas counties and the cities of New Port Richey, St. Petersburg and Tampa. This relationship was established in accordance with the Master Water Supply Contract and per Chapter 373.1962 of the Florida Statutes which states that:

*“...regional water supply authorities may be created for the purpose of developing, recovering, storing, and supplying water for county or municipal purposes in such a manner as will give priority to reducing environmental effects of excessive or improper withdrawals of water from concentrated areas.”*

A major component in developing new supplies of potable water is the ability to accurately determine future demands so that new projects can be implemented in an appropriate demand-based sequence while minimizing inherent risks associated with under- or over-estimation, as well as supply reliability. As stated by the American Water Works Association’s *Manual of Water Supply Practices M50* (Third edition, 2017), a sound water demand forecast allows utilities and regional suppliers to provide the following:

- Adequacy of supply
- Optimum facility location and size
- Sound transmission and distribution system design

Tampa Bay Water provides regional water demand forecasts for its six member governments specifically to project the amount of water supply needed within Tampa Bay Water’s service area. The regional demand forecasts include the total water demand for each member, including the City of Tampa, which self-supplies most of its water from the Hillsborough River. The Agency’s Long-term Demand Forecasting models are designed primarily for the purpose of longer-term planning and forecasting over 20-30-year time horizons. The models provide monthly and annual water demand forecasts for the seven water demand planning areas (WDPAs) of the six member governments through the 2040 planning horizon. The seven WDPAs, shown in Figure 4-1, reflect the current service area boundaries for the six member governments. Separating the regional system into demand planning areas assists Tampa Bay Water by identifying siting and capacity requirements of future supply development projects which ensures that adequate supply will be made available to member governments in the areas of future growth.

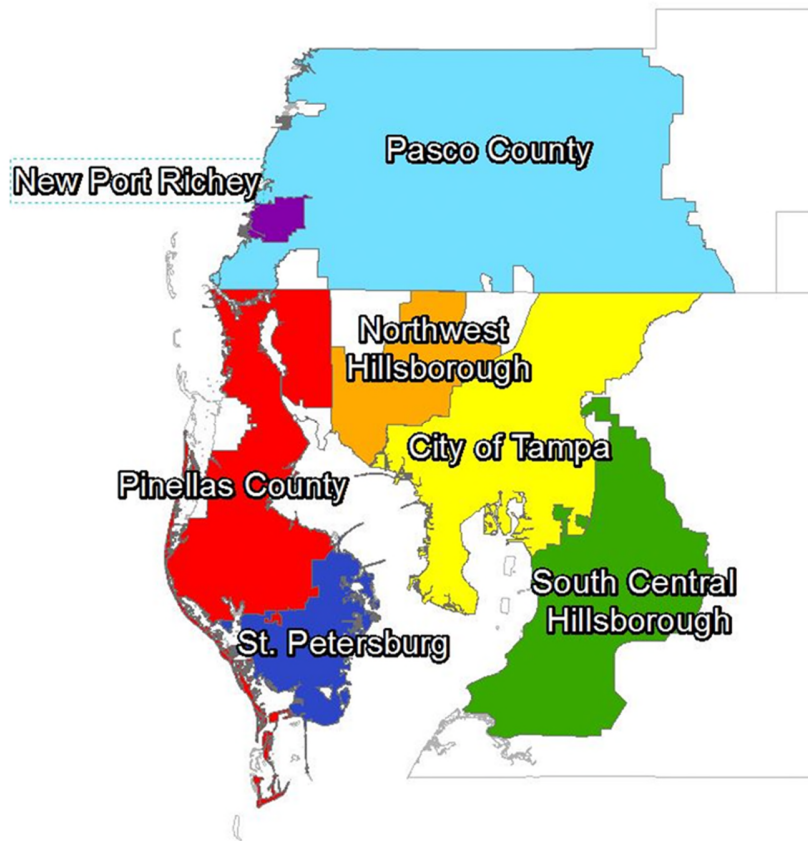


**Figure 4-1: Water Demand Planning Areas**

A more refined breakdown of the member government water services in these demand planning areas is provided in Figure 4-2. Some of the refinements include identifying where member governments provide water to wholesale customers.

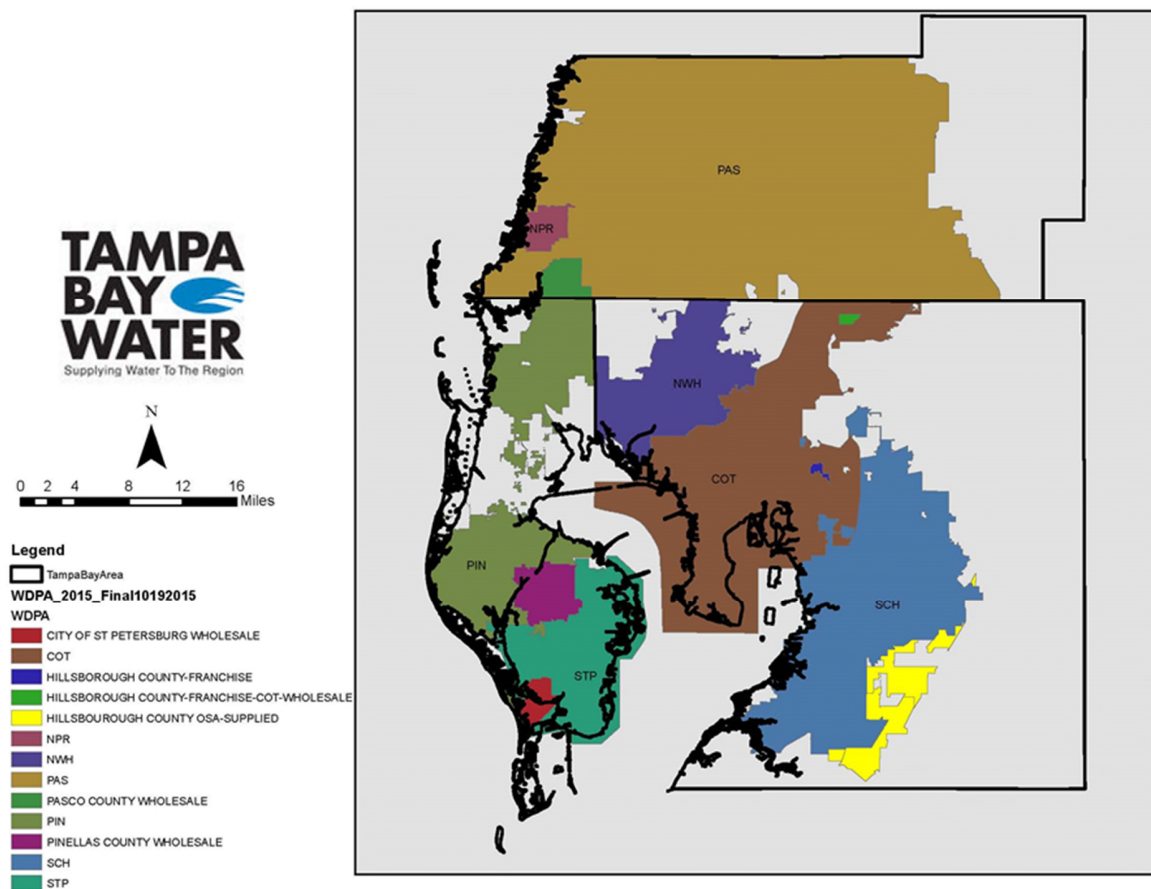


**Figure 4-2: Refined Member Government Water Demand Planning Areas**

This section of the Long-term Master Water Plan provides an overview of the customer base of the member governments, member governments' projected long-term water demands, and Tampa Bay Water delivered-water projections to identify the additional demand required for this 2018 Long-term Master Water Plan. Information provided in this section meets the requirements set forth in Section 2.09 of the Amended and Restated Interlocal Agreement to identify current and future customers.

## 4.2 Meeting Member Government Water Demands

Tampa Bay Water and the member governments provide water to more than 2.5 million people. Member government service area coverage is summarized in Table 4-1 and shown in Figure 4-2. Potable water is supplied by Tampa Bay Water's regional system which includes groundwater, surface water, and seawater sources. In addition, some members have self-supply sources.

Tampa Bay Water ensures that short-term and long-term demands are met through utilization of its Optimized Regional Operations Plan, Regional System Performance Evaluation Model, Source Rotation and Operational Planning models, and the Demand Forecasting System, respectively. Forecasted surface water flows, current groundwater levels, rainfall data and current demands are input into a customized computer model used to generate information to update the Optimized Regional Operations Plan on a

weekly basis. Through use of the Optimized Regional Operations Plan, supply sources can be utilized in a manner which meets real time demands, minimizes environmental impacts to regional water resources and meets the requirements set forth in the Consolidated Water Use Permit. Long-term demand forecasting is performed using the Demand Forecasting System to predict expected future demand on a spatial and temporal basis. The Regional System Performance Evaluation Model (see Section 8 and Appendix 8A) combines long-term probabilistic demand forecasts with supply uncertainty and operational protocols to determine the sustainable supply through 2040, the current planning horizon. The model is also used to quantify the system performance in meeting demands through the forecast horizon and in determining yield and reliability of potential water supply projects.

**Table 4-1: Summary of Member Government Service Area**

| <b>Member Government</b> | <b>Service Area Summary</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hillsborough County      | Hillsborough County supplies water to unincorporated area residents that are outside the service areas of the cities of Tampa, Temple Terrace and Plant City. The County has no wholesale customers.                                                                                                                                                                                                                                             |
| City of New Port Richey  | The City of New Port Richey supplies retail water to residents within its corporate limits and a portion of unincorporated Pasco County. The city also supplies wholesale water to a private utility (Lindrick Service Corporation) and the City of Port Richey.                                                                                                                                                                                 |
| Pasco County             | The Pasco County Water System supplies retail water to residents throughout the unincorporated areas of the county, as well as wholesale water to several private utilities, including Forest Hills, Orchid Lake, Virginia City, Southern State Utilities, and Jasmine Lakes Utilities Corporation.                                                                                                                                              |
| Pinellas County          | The Pinellas County Water System provides retail water to unincorporated Pinellas County, including some municipalities, and approximately 6 wholesale customers within the county. These customers include Belleair, Clearwater, Oldsmar, Pinellas Park, Safety Harbor and Tarpon Springs.                                                                                                                                                      |
| City of St. Petersburg   | The City of St. Petersburg Water Demand Planning Area includes the City of St. Petersburg, Gulfport, and South Pasadena Water System (wholesale customers), as well as some unincorporated areas within Pinellas County including Bear Creek, Lealman, Gandy and Bay Pines.                                                                                                                                                                      |
| City of Tampa            | The Tampa Water Department provides water to a service area of over 211 square miles, including the City of Tampa and some unincorporated areas of Hillsborough County. The City of Tampa self-serves from the Hillsborough River and Sulfur Springs. The Tampa Bypass Canal (middle pool) is also used to augment the Hillsborough River during low flow periods. Tampa Bay Water provides water to the City during low flow periods as needed. |

#### 4.2.1 Historical Usage by Member Governments

Table 4-2 identifies the historic total demand for each of Tampa Bay Water's member governments and Table 4-3 identifies the quantity of water provided to member governments by Tampa Bay Water each water year since Tampa Bay Water was formed in 1998. The years listed are Water Years, which begin in October of the previous calendar year and end on September 30th of the indicated year.

As shown on Table 4-2 and Table 4-3 and Figure 4-3 and Figure 4-4, water demands in the Tampa Bay Water service area declined substantially from 2008 through 2010 and remained relatively flat through 2015. This reduction in water demand coincides with the economic recession which occurred across the region, state and country during this time. Since 2016 water demands have been steadily increased. Regional water demands increased for Water Year 2017 due to regional drought conditions as well as an increase in new accounts resulting in growth in demand. The south-central Hillsborough County Water Demand planning area is experiencing significant increases in new accounts, and water demands in this area have increased about 20% over the past three years. Total water delivered to Hillsborough County by Tampa Bay Water now exceeds the amount of water delivered to Pinellas County.

**Table 4-2: Historic Regional Water Demands in Tampa Bay Water Service Area**

| Water Year | Pinellas County (mgd) | City of St. Petersburg (mgd) | Hillsborough County (mgd) | City of New Port Richey (mgd) | City of Tampa (mgd) | Pasco County (mgd) | Regional Total (mgd) |
|------------|-----------------------|------------------------------|---------------------------|-------------------------------|---------------------|--------------------|----------------------|
| 1998       | 69.6                  | 36.9                         | 33.2                      | 3.6                           | 70.0                | 14.2               | 227.5                |
| 1999       | 73.0                  | 37.5                         | 38.0                      | 4.4                           | 74.5                | 19.4               | 246.8                |
| 2000       | 71.8                  | 35.9                         | 39.7                      | 4.0                           | 72.0                | 17.7               | 241.0                |
| 2001       | 69.7                  | 32.6                         | 40.4                      | 3.6                           | 70.8                | 17.5               | 234.5                |
| 2002       | 69.8                  | 32.3                         | 41.2                      | 3.5                           | 70.7                | 17.8               | 235.3                |
| 2003       | 64.8                  | 30.3                         | 38.3                      | 3.2                           | 68.0                | 17.8               | 222.5                |
| 2004       | 66.6                  | 30.8                         | 43.7                      | 3.3                           | 75.3                | 21.1               | 240.7                |
| 2005       | 65.9                  | 31.7                         | 46.7                      | 3.3                           | 78.9                | 23.0               | 249.5                |
| 2006       | 65.7                  | 32.1                         | 51.7                      | 3.4                           | 81.7                | 27.3               | 261.9                |
| 2007       | 64.8                  | 30.5                         | 52.6                      | 3.3                           | 81.1                | 28.7               | 260.9                |
| 2008       | 62.0                  | 29.0                         | 49.5                      | 3.1                           | 76.4                | 27.5               | 247.4                |
| 2009       | 57.6                  | 27.9                         | 47.1                      | 2.8                           | 69.0                | 25.1               | 229.6                |
| 2010       | 54.4                  | 27.1                         | 46.6                      | 2.7                           | 67.9                | 23.6               | 222.4                |
| 2011       | 53.9                  | 27.5                         | 50.6                      | 2.9                           | 71.2                | 25.5               | 231.5                |
| 2012       | 53.8                  | 28.7                         | 50.0                      | 2.9                           | 70.9                | 26.5               | 232.8                |
| 2013       | 52.1                  | 28.3                         | 49.3                      | 3.1                           | 67.8                | 26.9               | 227.7                |
| 2014       | 50.9                  | 27.7                         | 51.0                      | 3.3                           | 67.6                | 26.3               | 226.8                |
| 2015       | 49.3                  | 28.2                         | 51.9                      | 3.3                           | 68.2                | 25.6               | 226.5                |
| 2016       | 48.2                  | 28.5                         | 55.0                      | 3.6                           | 72.0                | 28.5               | 235.8                |
| 2017       | 50.9                  | 29.3                         | 59.8                      | 3.5                           | 79.1                | 31.3               | 253.7                |
| 2018       | 48.8                  | 28.5                         | 61.0                      | 3.4                           | 76.7                | 29.5               | 247.8                |



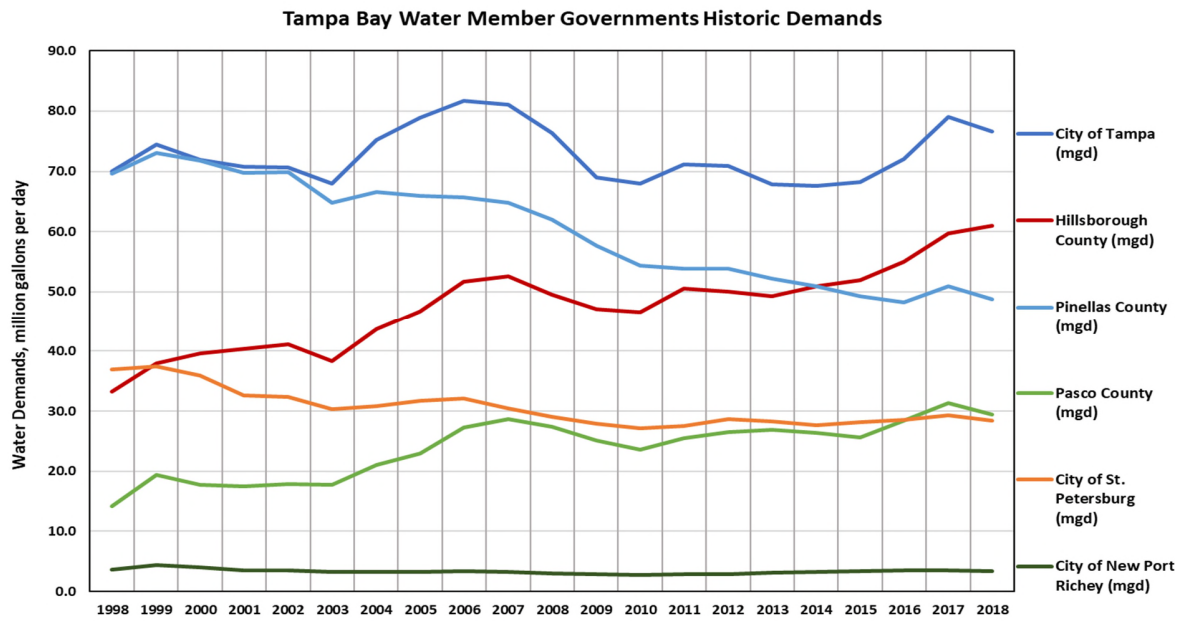


Figure 4-3: Tampa Bay Water Member Governments Historic Demands

**Table 4-3: Historical Water Delivery to Current Customers**

| Water Year | Pinellas<br>County<br>(mgd) | City of St.<br>Petersburg<br>(mgd) | Hillsborough<br>County<br>(mgd) | City of New<br>Port Richey<br>(mgd) | City of<br>Tampa<br>(mgd) | Pasco<br>County<br>(mgd) | Total<br>Delivery<br>(mgd) |
|------------|-----------------------------|------------------------------------|---------------------------------|-------------------------------------|---------------------------|--------------------------|----------------------------|
| 1998       | 69.6                        | 36.9                               | 33.2                            | 2.9                                 | 5.9                       | 14.0                     | 162.6                      |
| 1999       | 73.0                        | 37.5                               | 38.0                            | 3.8                                 | 6.0                       | 18.8                     | 177.0                      |
| 2000       | 71.8                        | 35.9                               | 39.7                            | 3.4                                 | 12.7                      | 17.3                     | 180.7                      |
| 2001       | 69.7                        | 32.6                               | 40.4                            | 2.9                                 | 16.1                      | 16.5                     | 178.2                      |
| 2002       | 69.8                        | 32.3                               | 41.2                            | 2.9                                 | 3.3                       | 16.3                     | 165.8                      |
| 2003       | 64.8                        | 30.3                               | 38.3                            | 2.7                                 | 0.1                       | 15.6                     | 151.8                      |
| 2004       | 66.6                        | 30.8                               | 43.7                            | 2.8                                 | 0.1                       | 18.6                     | 162.6                      |
| 2005       | 65.9                        | 31.7                               | 46.7                            | 2.8                                 | 0.0                       | 21.7                     | 168.8                      |
| 2006       | 65.7                        | 32.1                               | 51.7                            | 3.0                                 | 4.8                       | 25.3                     | 182.6                      |
| 2007       | 64.8                        | 30.5                               | 52.6                            | 2.9                                 | 9.4                       | 26.5                     | 186.6                      |
| 2008       | 62.0                        | 29.0                               | 49.5                            | 2.6                                 | 6.2                       | 26.1                     | 175.5                      |
| 2009       | 57.6                        | 27.9                               | 47.1                            | 2.4                                 | 12.9                      | 23.2                     | 171.1                      |
| 2010       | 54.4                        | 27.1                               | 46.6                            | 2.4                                 | 0.0                       | 21.9                     | 152.3                      |
| 2011       | 53.9                        | 27.5                               | 50.6                            | 2.4                                 | 3.5                       | 23.5                     | 161.4                      |
| 2012       | 53.8                        | 28.7                               | 50.0                            | 2.4                                 | 4.7                       | 24.7                     | 164.3                      |
| 2013       | 52.1                        | 28.3                               | 49.3                            | 2.7                                 | 0.0                       | 25.3                     | 157.8                      |
| 2014       | 50.9                        | 27.7                               | 51.0                            | 2.9                                 | 0.0                       | 24.5                     | 157.1                      |
| 2015       | 49.3                        | 28.2                               | 51.9                            | 2.9                                 | 0.0                       | 23.8                     | 156.1                      |
| 2016       | 48.2                        | 28.5                               | 55.0                            | 3.1                                 | 0.0                       | 25.9                     | 160.8                      |
| 2017       | 50.9                        | 29.3                               | 59.8                            | 3.0                                 | 6.2                       | 30.1                     | 179.3                      |
| 2018       | 48.8                        | 28.5                               | 61.0                            | 2.9                                 | 0.0                       | 28.5                     | 169.6                      |

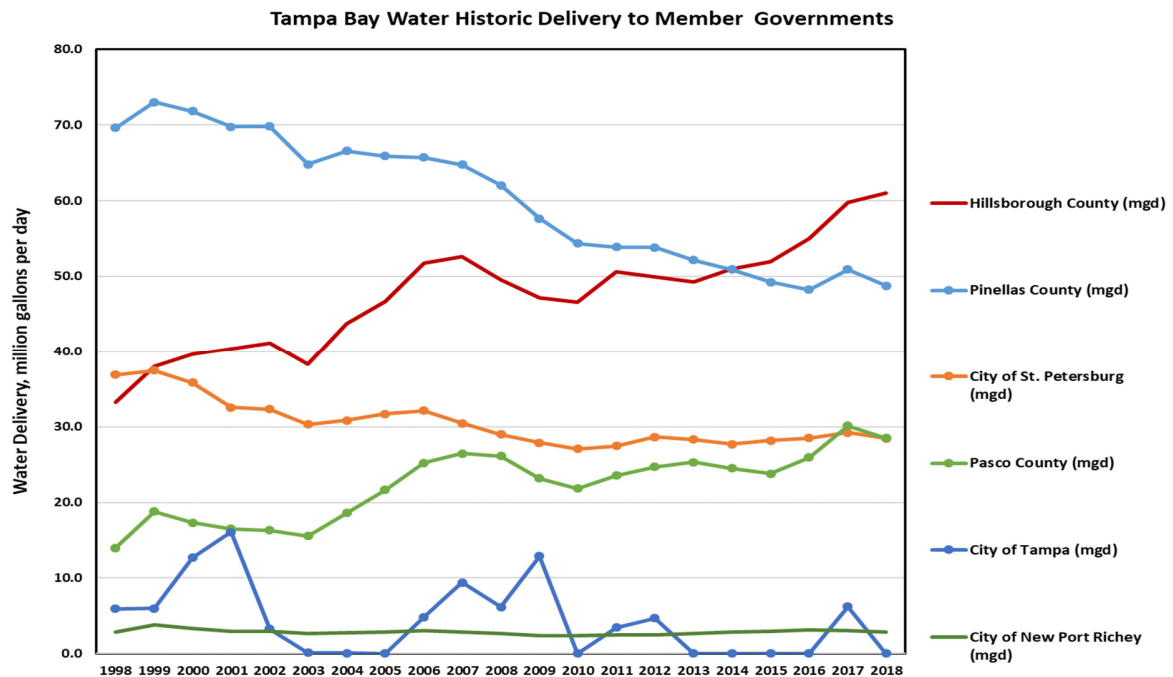


**Figure 4-4: Tampa Bay Water Historic Delivery to Member Governments**

The difference in amount of water delivered by Tampa Bay Water to its members Table 4-3 and the total water demand in the Tampa Bay Water service area Table 4-2 is because several members provide some portion of their total demands. For example, the City of Tampa can currently self-supply up to about 82 mgd annual average demands unless the region is experiencing drought conditions. In those cases, (e.g. 1998-2001, 2006-2009, 2017), Tampa Bay Water supplies various amounts of potable water to the City of Tampa. Pasco County and the City of New Port Richey also self-supply a much smaller portion of their demands. In general, Tampa Bay Water provides about 70% of the water needed to meet the water demands of its member governments.

#### 4.2.2 Future Customers and Future Demands

There are no plans to expand Tampa Bay Water's customer base. Water demand projections presented in this section are based on meeting the future needs of the six member governments. As a wholesale water utility, Tampa Bay Water supplies the daily water demands of its member governments. Meeting peak hour and fire flow demands are a local distribution issue, and the member governments must develop and operate sufficient storage, pumping, and distribution facilities to meet their peak hour and fire flow demands.

The Master Water Supply Contract between Tampa Bay Water and the member governments specifies the points of connection at which water is to be supplied to each member government's system as well as the pressure requirement at each point of connection. The specific quantity of water to be provided to each member government is not specifically identified in the contract. The quantity of water to be supplied is determined by the projected needs of the member governments.

### 4.3 Demand Forecasting System

The Demand Forecasting System was commissioned in December 2001 to quantify how socioeconomic, meteorological, and policy conditions influence potable water demand. Tampa Bay Water updated its Long-term Demand Forecasting models in 2008 and subsequently developed two long-term water demand forecasts to 2035, using 2008 as the base year and most recently using Water Year 2009 as the base year (Hazen and Sawyer, 2010a). The models provide monthly water demand forecasts for the seven water demand planning areas (WDPAs) of the six member governments through the 2040 planning horizon. These water demand projections are updated annually.

As described in the Long-term Demand Forecasting Model documentation (Hazen and Sawyer, 2010a), retail demand is modelled using three sector specific econometric models, single-family, multi-family and non-residential. Non-residential include all commercial and light industrial water customers for each member government. This sector includes hotels, restaurants, schools, office complexes for example. Each model generates demand forecasts based on WDPA, specific weather, and socioeconomic projections. Sector specific models therefore satisfy the need for modelling retail demand on a member by member basis. From these results, sector specific results can be aggregated as needed into various time periods and geographic delineations.

The forecasting methodology employs a “rate of use times driver” approach for calculating sectoral demands. Each sector specific model calculates average monthly demand, or rate of use per water consuming entity, or driver unit. A different driver unit is defined for each sector (e.g., single-family (SF), multi-family (MF) and non-residential (NR)). The SF sectoral model calculates retail demand per single family household, with single family households serving as a driver unit. Likewise, the MF sectoral model calculates retail demand per multifamily dwelling unit, with the number of multifamily dwelling units serving as a driver unit. The NR sectoral model calculates retail demand per employee, with number of employees serving as a driver unit. A forecast of demand for any given sector is a simple product of predicted rate of use and the predicted number of driver units.

Each sectoral model has a set of variables that explains the rate of water use by sector, WDPA, and month. Examples of explanatory variables include income, real marginal price, persons per household, and density. Coefficients for each explanatory variable, which measure the relationship between the variable and the per unit sector water use by WDPA and month, were determined by performing regression analyses on historic water use, weather, and socioeconomic data.

Tampa Bay Water engaged the services of Hazen and Sawyer to complete a probabilistic regional demand forecast for the seven water demand planning areas, which is used for the forecasting effort. Documentation of this work is provided in Hazen and Sawyer (2012). Probabilistic demand forecasting is performed to assess the potential variation in predictions of actual future demand from the point forecast given the point-projected (“expected”) future values of socioeconomic conditions and the observed historical variability in these conditions from year to year. The resulting probabilistic forecast therefore reflects a superposition of historical year-to-year variability in explanatory and driver variables, and resulting demand, on the point forecast. The probabilistic demand forecast was produced using probabilistic socioeconomic and weather projection ensembles. For this update to the Long-term Master Water Plan, the probabilistic demand forecasts were used in the System-wide Performance Evaluation Model to develop the baseline sustainable yield of the current regional water delivery system and to

evaluate project yield and reliability of the various project concepts under evaluation. This model links the long-term demand projections with surface water availability simulations through common simulations of weather. See Chapter 8 and Appendix 8A for more detailed discussion on the use of the probabilistic demand projections.

#### 4.4 Demand Forecasting System Results

The Bureau of Economic and Business Research's (BEBR) estimate of total population in Hillsborough, Pasco, and Pinellas counties for 2016 was 2.80 million people. The total population served by Tampa Bay Water and the member governments is approximately 2.5 million people, about 88% of the total population. The regional population growth rate through the year 2040 based on BEBR projections is approximately 1.0% per year. As shown on Figure 4-5, population in Pinellas County is projected to remain relatively constant through the forecast period of 2040, population for Hillsborough County is projected to increase through the forecast period at a higher rate, while population in Pasco County is projected to increase, but at a slower rate.

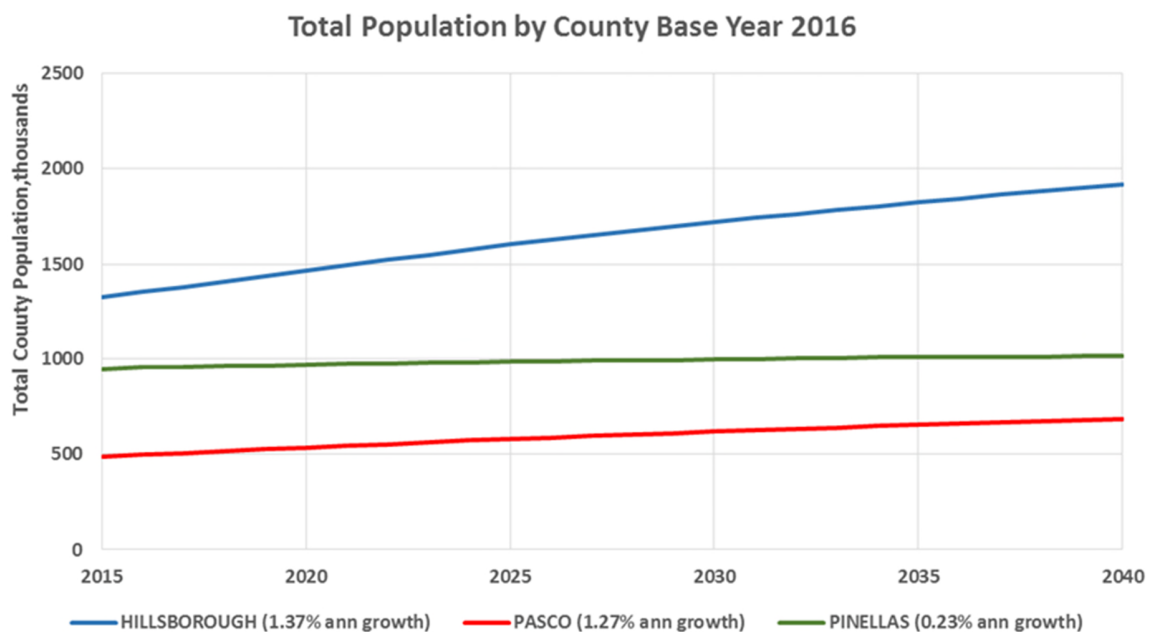


**Figure 4-5: Total Population by County**

The demand forecasts presented in this Master Water Plan update are based on the current model and results presented to Tampa Bay Water's Board of Directors in December 2017 as the update for 2018 is not yet available. Since Tampa Bay Water updates its long-term demand forecasts annually, the timing of any new water supply projects will be updated annually to ensure that Tampa Bay Water meets the member government demands during this planning horizon.

Tampa Bay Water service area demand projections for the planning horizon 2020-2040 presented in this section are based on deterministic demand modelling using the existing long-term demand forecasting models. The projected member government water demands for this planning horizon are shown in

Figure 4-6 and Table 4-4. The amount of water projected for Tampa Bay Water to deliver on an average annual basis through the planning horizon is also shown on Table 4-4.

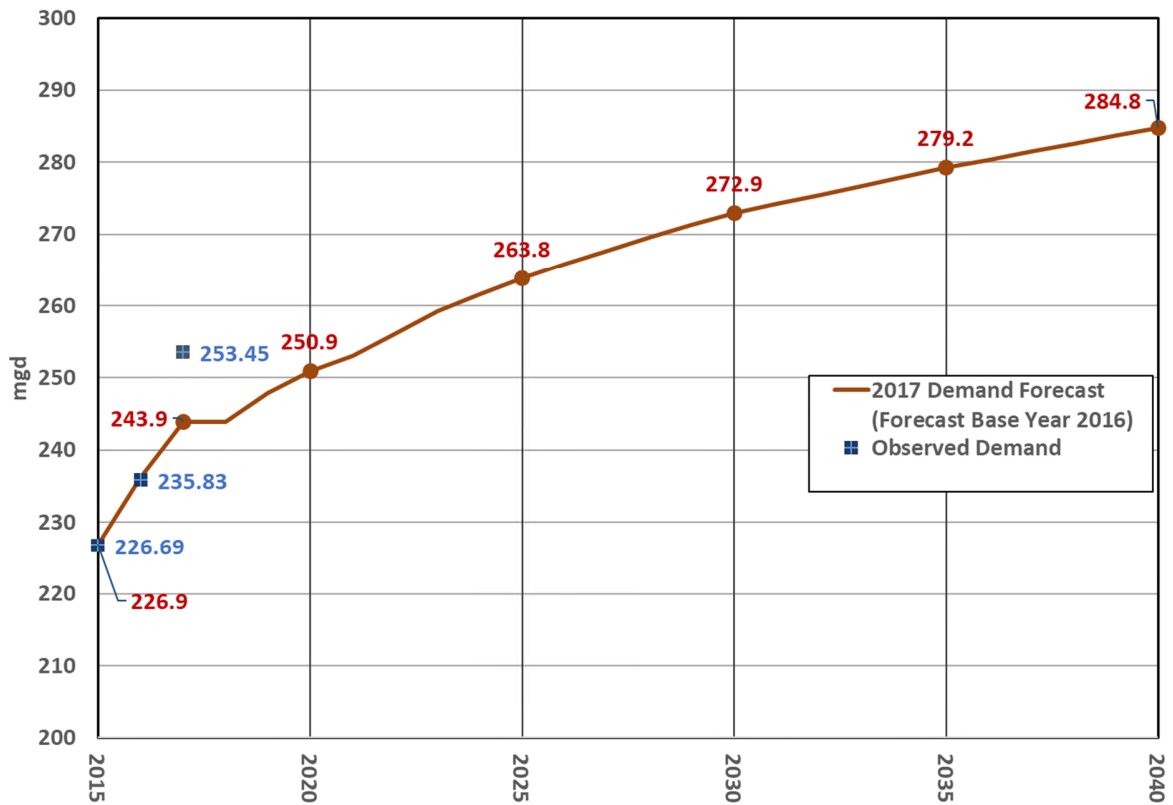


Figure 4-6 Tampa Bay Water 2017 Projected Regional Water Demands

**Table 4-4: Projected Water Demands for Tampa Bay Water Member Governments**

| Water Year | Pasco County (mgd) | City of New Port Richey (mgd) | Hillsborough County (mgd) | City of Tampa (mgd) | Pinellas County (mgd) | City of St. Petersburg (mgd) | Total Member Government Demand (mgd) |
|------------|--------------------|-------------------------------|---------------------------|---------------------|-----------------------|------------------------------|--------------------------------------|
| 2020       | 31.9               | 3.4                           | 61.1                      | 76.3                | 49.2                  | 29.1                         | 251.0                                |
| 2025       | 34.2               | 3.3                           | 66.3                      | 81.1                | 49.5                  | 29.5                         | 263.9                                |
| 2030       | 35.8               | 3.2                           | 70.5                      | 84.5                | 49.5                  | 29.5                         | 273.0                                |
| 2035       | 37.1               | 3.1                           | 73.7                      | 86.8                | 49.2                  | 29.5                         | 279.3                                |
| 2040       | 38.3               | 3.0                           | 76.8                      | 88.8                | 48.7                  | 29.3                         | 284.8                                |

**Table 4-5: Projected Tampa Bay Water Annual Average Delivery, mgd**

| Water Year | Pasco County (mgd) | City of New Port Richey (mgd) | Hillsborough County (mgd) | City of Tampa (mgd) | Pinellas County (mgd) | City of St. Petersburg (mgd) | Tampa Bay Water Projected Average Annual Delivery (mgd) |
|------------|--------------------|-------------------------------|---------------------------|---------------------|-----------------------|------------------------------|---------------------------------------------------------|
| 2020       | 30.0               | 3.1                           | 61.1                      | 6.0                 | 49.2                  | 29.1                         | 178.5                                                   |
| 2025       | 32.3               | 3.0                           | 66.3                      | 6.0                 | 49.5                  | 29.5                         | 186.6                                                   |
| 2030       | 33.9               | 2.9                           | 70.5                      | 8.5                 | 49.5                  | 29.5                         | 194.7                                                   |
| 2035       | 35.2               | 2.8                           | 73.7                      | 10.8                | 49.2                  | 29.5                         | 201.1                                                   |
| 2040       | 36.4               | 2.7                           | 76.8                      | 12.8                | 48.7                  | 29.3                         | 206.6                                                   |

#### 4.5 Estimated New Supply Need Over Planning Horizon

Table 4-4 shows the projected annual average amount of water for each Tampa Bay Water member government through the planning horizon and Table 4-5 shows the average annual amount projected that Tampa Bay Water needs to deliver through the planning horizon. As described in previous sections, several of Tampa Bay Water's member governments self-supply a portion of their demands. The City of Tampa has a permit to withdraw up to 82 mgd annually from the Hillsborough River, provided the water is available in the river. Annual and seasonal flow in the Hillsborough River can vary substantially from year to year and during times of drought, river flow can be well below normal for months. In determining how much water Tampa Bay Water should plan to deliver, the Agency takes the projected region demand and subtracts the amount of water that is self-supplied by the members and adds back 6 mgd to account for the flow uncertainty of the Hillsborough River. This calculation is performed assuming normal hydrologic conditions. The result of this calculation is shown in Table 4-5 for the planning horizon.

The amount of new supply needed during the next planning horizon (2020-2040) is a combination of demand projections, existing supply, hydrologic uncertainty, system reliability and Interlocal Agreement



requirements. Tampa Bay Water recognizes that annual demand projections are uncertain. Tampa Bay Water has developed a delivery projection for water supply planning purposes based on the long-term annual average demand projections plus an additional 5.5% of water to account for uncertainty in the long-term forecast. The result of this calculation is shown in Figure 4-7. Based on this analysis the projected average annual delivery for the 2040 planning timeframe is 218 mgd.

Surface water in Tampa Bay Water's regional system plus the City of Tampa's Hillsborough River source constitutes about 50% of the total existing supplies. The Hillsborough River, Tampa Bypass Canal, and Alafia River are dependent on seasonal and annual rainfall to provide enough flow above the permit-established minimum flow requirements to meet regional water supply needs. These systems are subject to sustained reductions in available water during prolonged drought periods. The Tampa Bay region has sustained two significant drought periods over the past 20 years: 1999-2001 and 2006-2009. In addition, 2017 was one of driest years in recent times. Tampa Bay Water constructed a surface water reservoir that provides the region with a buffer against normal dry seasons and can sustain the regional surface water treatment plant for about one year if all river flows fall below withdrawal thresholds. If, however, a drought was to persist beyond one year, and no river flow was available to replace lost storage, then it would be difficult to continue meeting demands even under mandatory watering restrictions and other demand management and supply augmentation actions. In the event of prolonged drought, Tampa Bay Water has developed a Water Shortage Mitigation Plan as discussed in Section 5 that addresses demand management and supply augmentation actions to mitigate the short-term impacts during these extreme hydrologic periods.

As part of this Long-term Master Water Plan update, Tampa Bay Water has identified three supply capacities to be used in planning for future supplies:

- aggregate permitted capacity -- complies with the Interlocal Agreement terms to define this quantity which reflects the total permitted capacity of Tampa Bay Water's regional system
- sustainable water supply – the amount that can be sustainably supplied based on hydrologic uncertainty, permitting requirements and operational constraints, and
- hydrologic dry supply conditions – regional water supply available during hydrologic dry events in which supply from the Hillsborough River drops below the permitted annual rate of 82 mgd and Tampa Bay Water's surface water treatment plant relies on stored reservoir water for up to a period of one year. These three supply capacities are shown in Figure 4-7.

Based on an analysis of sustainable system capacity, drought supply capacities and projected water supply planning demands through the year 2040, Tampa Bay Water has determined that approximately 20 mgd of new supplies need to be developed during this planning horizon Figure 4-7.

The exact timing of when new supplies need to be on line will continue to be evaluated during the next several years as demand forecasts are updated and supply feasibility projects completed. However, based on the current projections it appears that a new supply of at least 10 mgd will be required by 2028. In addition, this update recognizes the need for additional supplies to be delivered to south Hillsborough County prior to the 2028 timeframe. Details of this need and project concept are included in this update and detailed in Section 7.

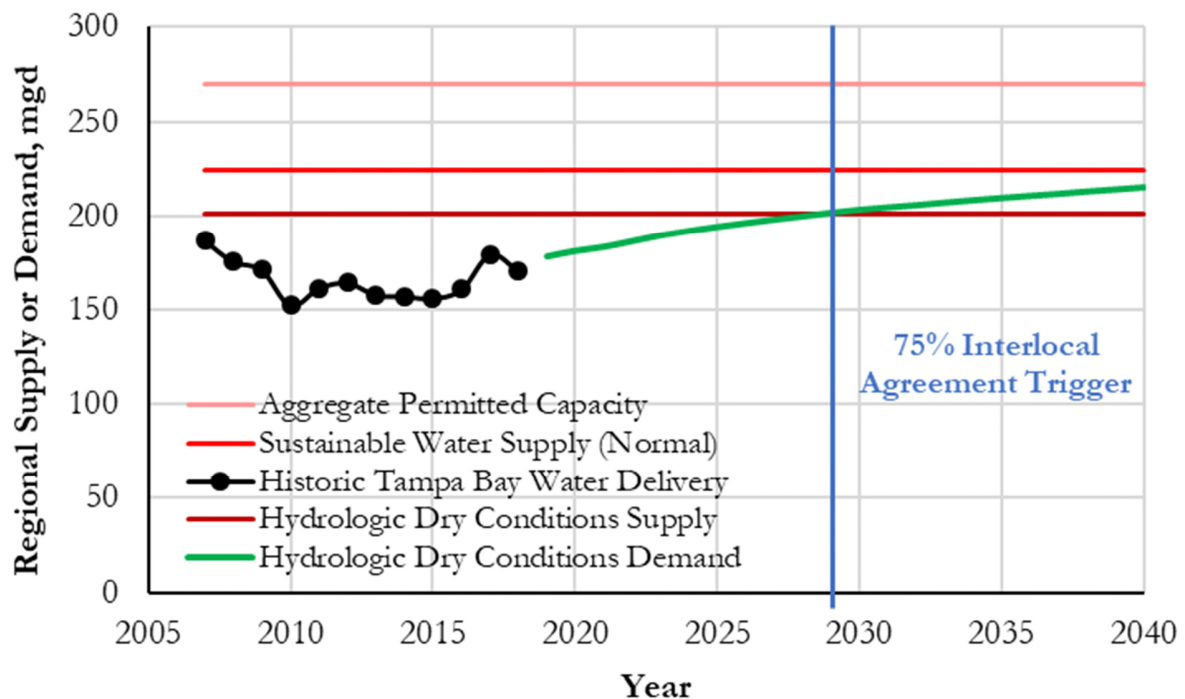


Figure 4-7: Historic and Projected Regional Tampa Bay Water Delivery as Compared with Available Tampa Bay Water Supplies

#### 4.6 Interlocal Agreement Requirements/Recommended Planning and Management Activities

The Interlocal Agreement requires that Tampa Bay Water actively monitor the members' demands and the permitted capacity of Tampa Bay Water facilities as outlined below:

- 3.03.C. The General Manager shall actively monitor the quantity of Quality Water delivered to member governments and the aggregate permitted capacity of the Authority's facilities.
- 3.03.C.(1). If Member Government demand exceeds the Authority's permitted capacity by 75% during any twelve-month period, the Authority shall initiate a preparation of Primary Environmental Permit applications necessary to ensure adequate supply.
- 3.03.C.(02). If Member Government demand exceeds the Authority's permitted capacity by 85% during any twelve-month period, the General Manager shall report to the Board and recommend that the Authority file Primary Environmental Permit applications to ensure adequate supply. The Authority shall file any such applications expeditiously.
- 3.19 Production Failure. Defined as when actual delivery by the Authority during any 12-month period to the member governments exceeds 94% of the aggregate permitted capacity. If the Authority has submitted a primary environmental permit and entered into final design and bid construction of the facilities, the additional capacity in the permit application can be included in the aggregate permitted capacity.

Tampa Bay Water should also continue to implement and further enhance its planning and management activities to address both seasonal and severe drought events and long-term future water supply needs. These include such things as continuing the implementation of existing activities and planning tools approved by the Board and looking at the agency's operations for enhancements that might further its capacity within existing permit limits. For instance, relatively small but cost-effective improvements to things such as chemical feed systems that could enhance the agency's effective capacity could be explored further. Participation in State water policy and regulatory discussions will also further an understanding by policy-makers of the complexities associated with developing and operating surface water supply systems in a state that experiences annual and cyclically severe drought events. As other regions of the State turn to the use of surface water to meet their future needs, understanding any beneficial initiatives such as conjunctive use approaches that may be proposed State-wide could also assist the agency.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 5. Water Shortage Mitigation Plan

The purpose of the Water Shortage Mitigation Plan (WSMP) is to provide Tampa Bay Water and its member governments a strategy for identifying and responding to water supply shortages caused by extended hydrologic drought conditions. The WSMP does not affect long-term demand, but rather is a plan for Tampa Bay Water to meet member government water needs during extended hydrologic droughts with its existing regional system in an environmentally sustainable manner. Implementation of this plan would potentially allow the Agency to meet demands during infrequent but extended drought events, avoiding infrastructure investment specifically for these events that would seldom be used. Thus, the WSMP allows the Long-term Master Water Plan to focus on long-term water supply needs for the future. This section highlights the key aspects of the WSMP, details of which can be found in the 2017 Water Shortage Mitigation Plan Report.

The WSMP defines four incremental stages of water shortage, as well as hydrologic and supply-based triggers for determining entry and exit conditions for each defined stage. Recommended supply management actions, potential demand management actions, and a communications plan are included to guide the selection of appropriate actions for minimizing the impacts of water shortage in areas served by Tampa Bay Water Member Governments.

### 5.1 Background

The Tampa Bay region has historically experienced numerous occurrences of reduced rainfall and subsequent water shortages. For example, from January 2007 through June 2009, the Tampa Bay region experienced water shortage conditions due to continuing below-normal hydrologic conditions. During the spring of 2009, conditions were so extreme that the City of Tampa issued a ban on all outdoor irrigation until the summer rains returned (references include SWFWMD order 07-02 and SWFWMD order 08-044).

In response to an increased reliance on surface water supplies, which are inherently more vulnerable to unfavorable hydrologic conditions, Tampa Bay Water developed a three-phase drought mitigation plan which was approved by its Board in December 2001. This plan was subsequently updated to coincide with redevelopment of water shortage rules (Chapter 40D-21, FAC) by the District. Major modifications included the addition of a fourth water shortage phase (Phase IV), so this Plan was more consistent with District rules and an additional trigger to monitor flow in the Hillsborough River. The revised WSMP was approved by Tampa Bay Water's Board in 2009. The recent 2017 WSMP update included further revisions to terminology for consistency with District rules, as well as revised hydrologic triggers that allow forecasted reservoir levels as a leading indicator of severe shortage stages. The Water Shortage Mitigation Plan report (Tampa Bay Water, 2017) describes the development of the current plan in detail.

### 5.2 Goal and Objectives of Water Shortage Mitigation Plan

The goal of the 2017 WSMP was to provide a water management plan which **proactively** mitigates water supply shortages driven by prolonged below-normal hydrologic conditions in Tampa Bay Water's service area. To achieve this goal, the 2017 WSMP had the following objectives:

- Integrate supply infrastructure improvements and changes in water use permit limits since the 2009 WSMP.
- Use new modeling tools to evaluate water supply actions for various levels of water shortages.
- Integrate the WSMP into the 2018 Long-term Master Water Plan (this report).
- Analyze and explore how the Consolidated Water Use Permit wellfields could be used to meet demands in an environmentally sustainable manner under situations of low surface water availability. This would allow more fiscally responsible planning for future water supplies by minimizing infrastructure constructed specifically to handle infrequent water shortage events.

### 5.3 Hydrologic and Supply Shortage Trigger Identification

Nearly 50 percent of potable water supplies in the Tampa Bay Water service area, including the City of Tampa's self-supply from the Hillsborough River, are derived from surface water sources. These surface water sources are the first and most adversely impacted during hydrologic drought events; therefore, decline in surface water flow is indicative of impending water supply shortage conditions.

The WSMP consists of four water shortage stages of increasing severity and each is defined by its corresponding hydrologic- and/or supply-based triggers that establish both entry and exit conditions. Two types of triggers were developed for the WSMP, which include:

- Hydrologic triggers, used to provide early warning of a potential drought; and
- Supply shortage triggers, used to describe the severity of surface water supply shortage.

The hydrologic triggers are based on the hydrologic indicators listed below. Evaluation for each indicator are conducted on the first day of each month. See Tampa Bay Water (Water Shortage Mitigation Plan, 2017) for calculation details and examples of these hydrologic triggers:

**Rainfall:** characterized by the 12-month rolling cumulative deficit rainfall (RCD-rainfall); calculated based on the past 12 months of rainfall from a network of rainfall reporting stations across the Tampa Bay Water service area.

**Streamflow:** characterized by the rolling median deficit flow (RMD-flow); expressed as the median of the previous 12 monthly streamflow surpluses or deficits at the Hillsborough River USGS Morris Bridge gauge.

The supply shortage triggers are based on streamflow conditions plus forecasted reservoir stage, which is used to determine reservoir storage. The three-month-ahead forecasts of reservoir stage are obtained through a simulation model that incorporates streamflow forecasts, relevant operational constraints, and current field measurement of reservoir stage:

**Surface Water Storage:** characterized by reservoir water surface elevation (Reservoir Elev); expressed as water level (feet NVGD) in the C.W. "Bill" Young Regional Reservoir measured on the last day of the previous month, corresponding to remaining days of supply. Numerical values for the indicators were developed to trigger entering and exiting each stage based on various combinations of RCD-rainfall, RMD-flow, and Reservoir Level as listed in Table 5-1.

Table 5-1: Summary of WSMP Water Shortage Stages and Triggers

| Water Shortage Stages                          | Triggers                                                                                                                                           |                                                                                                                                |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|                                                | On                                                                                                                                                 | Off                                                                                                                            |
| <b>I. Drought Alert (Moderate)</b>             | RCD Rainfall: deficit $\geq 5''$<br><b>OR</b><br>RMD Flow: deficit $\geq 10$ mgd                                                                   | RCD-rainfall: deficit eliminated and surplus created<br><b>AND</b><br>RMD-flow: deficit relieved to less than 5 MGD            |
| <b>II. Drought Warning (Severe)</b>            | RCD Rainfall: deficit $\geq 5''$<br><b>AND</b><br>RMD Flow: deficit $\geq 10$ mgd                                                                  | RCD-rainfall: deficit eliminated and surplus created<br><b>OR</b><br>RMD-flow: deficit relieved to less than 5 MGD             |
| <b>III. Regional Supply Shortage (Extreme)</b> | RMD Flow: deficit $\geq 10$ mgd<br><b>AND</b><br>Reservoir forecasts less than reservoir elevation defined by Stage III -supply shortage curve     | RMD Flow: deficit $\leq 5$ mgd<br><b>OR</b><br>Both current <b>AND</b> forecasted reservoir levels above Stage III exit levels |
| <b>IV. Water Supply Crisis (Critical)</b>      | RMD Flow: deficit $\geq 10$ mgd<br><b>AND</b><br>Reservoir forecasts less than reservoir elevation defined by Stage IV - water supply crisis curve | RMD Flow: deficit $\leq 5$ mgd<br><b>OR</b><br>Both current <b>AND</b> forecasted reservoir levels above Stage IV exit levels  |

The first two WSMP stages are defined by hydrologic indicators, while the last two WSMP stages are defined by stream flow conditions and three-month-ahead forecasts of reservoir levels, which indicate reservoir storage.

**STAGE I: *Drought Alert*** is the first indication of a potential water shortage condition. In Stage I, there is a shortage in rainfall or streamflow (but not necessarily both). Stage I conditions indicate that hydrologic conditions are either deteriorating and could lead to a potential supply shortage or have improved from more severe conditions.

**STAGE II: *Drought Warning*** is the next level indicating severe hydrologic conditions; if these conditions continue, a water shortage condition could occur. In Stage II, there is a shortage in both rainfall and streamflow, but reservoir storage is not impacted. This stage indicates that a loss of surface supply availability may occur requiring increased use of reservoir storage. For exiting this stage, either rainfall deficit has diminished, or the streamflow deficit has reached 5 MGD or less.

**STAGE III: *Regional Supply Shortage*** condition indicates an extreme water supply situation. In Stage III, a shortfall in streamflow and a shortfall in reservoir storage exist. This stage indicates surface water supply is compromised due to dry hydrologic conditions and may be lost altogether if those conditions persist. For exiting this stage, the reservoir storage must have recovered as indicated by a reservoir level at the 35th percentile or greater.

**STAGE IV: *Water Supply Crisis*** (Stage IV) is the most critical water shortage condition. In this situation, a prolonged shortage in streamflow has required extended use of reservoir storage. Forecasted reservoir level at three-month-ahead is at or below the 10th percentile, resulting in near or total exhaustion of reservoir storage. When this stage occurs, increased reliance on other water sources and consistent District water



shortage phase adoption will likely occur soon. For exiting this stage, reservoir storage must have recovered as indicated by an increase in the reservoir level to the 25th percentile or greater.

Once the hydrologic triggers signal a given diminished hydrologic condition and subsequent water supply shortage, the corresponding water shortage stage is triggered, initiating the implementation of supply management actions by Tampa Bay Water as described in the WSMP (see Section 5.5 below). Demand management actions implemented by the Member Governments, as described in the WSMP (Section 5.5) are triggered by and correspond to the provisions of any applicable emergency water shortage order or executive director order issued by the District.

## **5.4 Determining Entry and Exit Conditions for Water Shortage Stages**

The WSMP triggers listed in Table 5.1 are evaluated using a structured decision procedure (Water Shortage Mitigation Plan, 2017). This decision procedure is applied at the beginning of each month using data up through the end of the previous month. Based on the current conditions of the hydrologic indicators, the procedure identifies Tampa Bay Water's proposed water shortage stage for the current month. The decision rules of this procedure are designed such that water shortage stages must be triggered in a step-wise fashion from month to month. Shortage declarations can improve or worsen by at most one stage per month, even if trigger conditions dictate larger changes. The reason is to allow member governments and end use customers to respond to changing conditions in a step-wise fashion through regular media updates. This approach has been found to result in better community communication and larger demand reductions during drought events.

### **5.4.1 Consistency with District Declarations**

The implementation of the Tampa Bay Water WSMP does not affect the authority of the District to declare or rescind a water shortage within the same geographic areas affected by this WSMP. Thus, member governments will implement demand management actions which correspond to the provisions of any applicable District-issued water shortage order or executive director order. Those actions will continue for the duration of the District declaration regardless of the current stage established by the Tampa Bay Water WSMP. Member governments may maintain or implement watering days or times more restrictive, or equally restrictive but different, than those allowed by the District water shortage declaration to address local water supply system constraints or extend the availability of regional water supplies, given concurrence from the District.

For supply management actions by Tampa Bay Water and demand management actions by the member governments to be consistent, it is necessary that the District declare water shortage phases, within Tampa Bay Water's service area, which correspond to a Tampa Bay Water WSMP stage declaration. Consistency between the WSMP stage and District 40D-21 phase will assist the region in effectively managing water shortage conditions to meet water demand requirements. Therefore, once Tampa Bay Water applies the WSMP decision procedure to identify the current water shortage stage for the month, the Member Government and District primary contacts are notified of the current water shortage stage and associated hydrologic conditions leading to this stage. Supply management actions are then implemented based on the triggers defined in the WSMP.

## 5.5 Demand and Supply Management Actions

Demand and supply management actions recommended for implementation in each WSMP water shortage stage were assigned based on the severity of the shortage and/or their ability to moderate water demands. Combining the water shortage stage and triggers with the demand and supply management actions forms the basis of the response strategy for the Tampa Bay Water WSMP.

The rationale behind the development of these actions is to increase surface water supply reliability and moderate water demands which could minimize reliance on groundwater withdrawals during hydrologic-based shortage periods. Demand management actions prescribed in the District's Water Shortage rule, Chapter 40D-21, FAC, are intended to achieve decreases in demand based on District declaration of water shortages and implementation of water restrictions. Demand reductions during water shortages will extend the ability of the surface water system to meet demands.

Demand management activities referenced in the WSMP are those of the District's Water Shortage Plan, Chapter 40D-21 F.A.C. Therefore, it is important that the District declare water shortage phases consistent with Tampa Bay Water's declaration of water shortage stages. The supply management actions identified in the WSMP are those that can be initiated by Tampa Bay Water. Member Governments are encouraged to implement interconnects to alleviate local hydraulic or pressure issues within their distribution systems. Table 5.2 summarizes the four water shortage stages and corresponding demand and supply management activities associated with each. The Water Shortage Mitigation Plan Report (Tampa Bay Water, 2017) details the demand and supply management activities for each water shortage stage.

Supply management actions summarized below and in Table 5-2 have been identified by Tampa Bay Water to extend the capability of existing supply sources with temporary use of emergency supply sources during periods of extreme shortage. It is assumed that the agency will continue to maximize its use of the surface water system and desalination facility during various water shortage stages as part of its internal operations program. Implementation of many of these supply augmentation actions require approval by District. Therefore, the actions include a timeline for when Tampa Bay Water submits a request for authorization from the District to implement the required supply actions.

- **Maximize Use of Desalination**

When a Stage II – Drought Warning is declared by Tampa Bay Water, the Agency will implement increased production at the Tampa Bay Seawater Desalination Plant to the maximum sustainable water production, subject to any physical constraints or water treatment constraints. Production rates at the Tampa Bay Seawater Desalination Plant will remain at sustainable levels until the region returns to normal hydrologic conditions. Maximum sustainable production rates will be determined by Tampa Bay Water.

- **Temporary increase in Alafia River withdrawals, allowing withdrawal of 19 percent of previous-day Alafia River flow at Bell Shoals (when River flow at Bell Shoals flow is greater than 80 mgd) up to the maximum permitted limit of 60 mgd.**

This action consists of increasing the percent-of-flow specified in the current Alafia River withdrawal permit from 10 to 19 percent. Withdrawals would still only occur when Bell Shoals flow is greater than 80 mgd. This emergency authorization is requested in Stage II, and when

approved by the District, this action is implemented once a Stage III Regional Supply Shortage is declared.

- **Activate Tampa Bypass Canal Middle Pool for Harney Augmentation (to City of Tampa)**

Tampa Bay Water maintains a Water Use Permit granted by the District which, during periods of low flow and low reservoir elevation in the Hillsborough River Reservoir, allows water in the Tampa Bypass Canal middle pool to be pumped back into the Hillsborough River Reservoir. To alleviate low elevations in the Hillsborough River Reservoir and maintain City of Tampa supply, Hillsborough River Reservoir Augmentation from the Middle Pool and Harney Canal is often performed, referred to as “Harney Augmentation”. The augmentation permit allows the Tampa Bypass Canal middle pool to be drawn down to a stage of 12 feet NGVD. When Tampa Bay Water has declared a Stage II - Drought Warning, the Agency will request emergency authorization by the District to lower the middle pool stage to 10 ft. NVGD. This authorization increases water availability for City of Tampa to meet its demand. Once the pool stage reaches 10 feet, augmentation through the Harney Canal will cease.

- **Activate Tampa Bypass Canal Lower Pool emergency operation**

The Tampa Bypass Canal lower pool is the primary source of regional water supply during water shortage periods. Permitted withdrawals are defined to allow use of stored water above a pool elevation of 9 feet. Under Stage IV emergency operation, when the request for emergency authorization is approved by the District, the lower pool elevation can be further lowered to 7.5 feet NVGD.

- **Request emergency authorization to continue groundwater pumping from the Consolidated Water Use Permit wellfields to meet demand when all other sources are exhausted**

When Stage IV-Water Supply Crisis demand management actions have been implemented, and all other supply management actions are exhausted and there remains unmet water demand, Tampa Bay Water anticipates it will meet this demand with groundwater. When a Stage IV Water Supply Crisis is triggered, Tampa Bay Water will request emergency authorization from the District to continue groundwater pumping from the Consolidated Water use Permit wellfields to meet demands and prevent a public health and safety incident from occurring. This request will occur in stage IV (see Table 5-2) when there is no permitted river flows and the desalination plant is operating at sustainable maximum levels. Both during the emergency authorization and until water levels at control point monitoring wells under the Consolidated Water Use Permit are back to pre-drought water levels, all surface water sources shall continue to be maximized to minimize groundwater level recovery time.

**Table 5-2: Summary of WSMP Stages, Triggers, and Actions**

| Water Shortage Stages<br>(with District Name)            | Triggers                                                                                                                            |                                                                                                                                | Actions                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                           | Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                          | Enter Stage                                                                                                                         | Exit Stage                                                                                                                     | Demand Management<br>(Member Governments)                                                                                                                                                                                                                                      | Demand Management<br>(Tampa Bay Water)                                                                                                                                                                                                                                                    | Supply Management<br>(Tampa Bay Water)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Stage I: Drought Alert<br/>(Moderate)</b>             | <i>RCD-rainfall</i> : deficit exceeds 5”<br><b>OR</b><br><i>RMD-flow</i> : deficit exceeds 10 MGD                                   | <i>RCD-rainfall</i> : deficit eliminated<br><b>AND</b><br><i>RMD-flow</i> : deficit less than 5 MGD                            | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.621, F.A.C., or any applicable District order. | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.621, F.A.C.,(3)(B)3.b or any applicable District order.   | <ul style="list-style-type: none"> <li>● Initiate public notices of water supply conditions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Stage II: Drought Warning<br/>(Severe)</b>            | <i>RCD-rainfall</i> : deficit exceeds 5”<br><b>AND</b><br><i>RMD-flow</i> : deficit exceeds 10 MGD                                  | <i>RCD-rainfall</i> : deficit eliminated<br><b>OR</b><br><i>RMD-flow</i> : deficit less than 5 MGD                             | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.631, F.A.C., or any applicable District order. | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.631, F.A.C., (3)(B)2.a. or any applicable District order. | <ul style="list-style-type: none"> <li>● Monitor regional water supplies and continue public notices.</li> <li>● Monthly reporting of ESWS production and storage limitations to Board and District.</li> <li>● Obtain maximum sustainable production rates at Tampa Bay Desal Plant</li> <li>● Request emergency authorization from the District to increase Alafia River withdrawals in Stage III.</li> <li>● Request emergency authorization to lower middle pool stage to 10 feet for augmentation of Hillsborough River Reservoir</li> </ul> |
| <b>Stage III: Regional Supply Shortage<br/>(Extreme)</b> | RMD Flow: deficit $\geq$ 10 mgd<br><b>AND</b><br>Reservoir forecasts less than reservoir elevation defined by supply shortage curve | RMD Flow; deficit $\leq$ 5 mgd<br><b>OR</b><br>Both current <b>AND</b> forecasted reservoir levels above Stage III exit levels | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.641, F.A.C., or any applicable District order. | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.641, F.A.C. (3)(B)3.b., or any applicable District order  | <ul style="list-style-type: none"> <li>● Monitor regional water supplies and continue public notices.</li> <li>● Monthly reporting of ESWS production and storage limitations to Board and District.</li> <li>● Alafia River Withdrawals increased to 19%.</li> <li>● Continue TBC middle pool for Harney Augmentation until pool stage reaches 10 feet</li> <li>● Request District approval to activate TBC lower pool in Stage IV (9ft to 7.5ft)</li> </ul>                                                                                     |

| Water Shortage Stages<br>(with District Name)   | Triggers                                                                                                                                |                                                                                                                               | Actions                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                    | Actions                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | Enter Stage                                                                                                                             | Exit Stage                                                                                                                    | Demand Management<br>(Member Governments)                                                                                                                                                                                                                                      | Demand Management<br>(Tampa Bay Water)                                                                                                                                                                                                                                             | Supply Management<br>(Tampa Bay Water)                                                                                                                                                                                                                                                                                                                                  |
| <b>Stage IV: Water Supply Crisis (Critical)</b> | RMD Flow: deficit $\geq 10$ mgd<br><b>AND</b><br>Reservoir forecasts less than reservoir elevation defined by water supply crisis curve | RMD Flow; deficit $5 \leq$ mgd<br><b>OR</b><br>Both current <b>AND</b> forecasted reservoir levels above Stage IV exit levels | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.651, F.A.C., or any applicable District order. | Upon District declaration of a water shortage or water shortage emergency, and execution of a water shortage, water shortage emergency or executive director order, implement response mechanisms as required by Chapter 40D-21.651, F.A.C.(3)b, or any applicable District order. | <ul style="list-style-type: none"> <li>• Monitor regional water supplies and continue public notices.</li> <li>• Monthly reporting of ESWS production and storage limitations to Board and District</li> <li>• Activate TBC lower pool to 7.5 feet</li> <li>• Request authorization to continue groundwater pumping to meet public health and safety demands</li> </ul> |

## 5.6 WSMP Recovery Actions

When a Stage IV Water Supply Crisis occurs, one of the supply actions Tampa Bay Water will implement is continuing production from the Consolidated Wellfields to meet demands, thus avoiding a public health and safety emergency from occurring. While its expected occurrence of is rare, the WSMP contemplates this action. If the Agency has had to continue groundwater pumpage, resulting in production greater than the regulatory limit during Stage IV, then the Agency will implement recovery actions once hydrologic conditions improve. When hydrologic conditions begin to improve, and Tampa Bay Water moves from a Stage IV Water Supply Crisis to a Stage III Regional Water Supply Shortage, recovery of groundwater levels starts. The surface water system and the desalination facility will continue at their maximum sustainable production rates until groundwater level recovery is achieved. Water level recovery occurs when the post-event groundwater levels are equal to pre-event levels.

Included in the 2017 WSMP Report is a detailed analysis on the effects of increasing groundwater pumpage from the Consolidated Wellfields over the permit limits and the ability of the groundwater system to recover once favorable hydrologic conditions return. The two key messages from the recovery analysis are: 1) the median water level change in groundwater head is less than 1 foot for all possible events; and 2) the median recovery time is less than 1 year for nearly all possible events. Implementation of this groundwater - surface water management framework is the foundation of the WSMP.

## 5.7 WSMP Communication Plan

When water shortage conditions are present or expected, the level of communication with key stakeholders and the media should be increased to enhance the delivery of key messages and implementation of demand management activities. Success of these efforts relies on the existence of predefined strategies to be used by key stakeholders for communicating with the public and media as the level of shortage intensifies and subsequently decreases.

A water shortage communication plan delineates a wide range of key messages and communication tactics for use once a water shortage is triggered. The effectiveness of a communication plan generally relies on the identification of the following aspects prior to a water shortage declaration:

- Stakeholder groups and communication roles
- Specific demand and supply management activities required during a shortage
- Appropriate key messages, communication tools and delivery tactics
- Public outreach and media strategies
- Timing of expected communications

The Communication Plan provides an overview of the WSMP triggers and actions and how they relate to the suggested communication activities during a water shortage. Communication goals and objectives intended to help delineate a common direction among the key stakeholder groups during a water shortage are identified. Once a WSMP water shortage stage is entered or exited, and in consideration of the District declaring the same water shortage phase or some slight modification to the phase, effective and ongoing communication is essential. Figure 5-1 provides a stakeholder communications structure that identifies the communication roles included in Table 5-2. Public outreach and education strategies to help guide Tampa Bay Water and its

member governments in their efforts to educate and inform tri-county residents about specific water conservation methods that may be used to reduce the risk and/or severity of a regional water supply shortage are provided. A detailed communications plan is included in the Water Shortage Mitigation Plan Report (Tampa Bay Water, 2017).

## **5.8 Water Shortage Mitigation Plan Implementation**

Implementation of the WSMP will be coordinated between Tampa Bay Water, the District and member governments, who have direct contact with their customers enabling communication, enforcement, and monitoring at the local level. During WSMP implementation, Tampa Bay Water's primary focus is placed on the evaluation of hydrologic indicators and supply-side management actions and informing the District of local hydrologic/supply issues while the Member Governments' focus is on implementation of demand-side management actions. The District's role is to track water shortage conditions in the region, insure timely response to shortages and consider execution of executive orders identified at various stages of shortage identified in this document. Implementation of Communication Plan elements will be a cooperative effort carried out by all agencies. The key components of the Tampa Bay Water WSMP are summarized in Table 5-2 and illustrated by the Implementation Procedure, Figure 5-2. Further details regarding WSMP implementation can be found in the WSMP report (Tampa Bay Water, 2017)

## **5.9 Planned Revisions**

This 2017 Water Shortage Mitigation Plan was updated as part of the 2018 Long-term Master Water Plan. The update includes an evaluation of how using a groundwater-surface water management strategy, which includes using more groundwater during severe hydrologic droughts, can be accomplished in an environmentally sustainable manner. In addition, the WSMP may be incorporated into the Consolidated Water Use Permit during the renewal process in 2020. Implementing the WSMP strategy described herein would allow Tampa Bay Water to meet demands with the existing regional water supply system during infrequent but extended drought events, avoiding infrastructure investment specifically for these events that would seldom be used, and allowing the LTMWP to focus on long-term water supply needs of the member governments. Updates will occur at least once every five years, consistent with the Long-term Master Water Plan updates, and/or District rule changes, or when new experience gained.



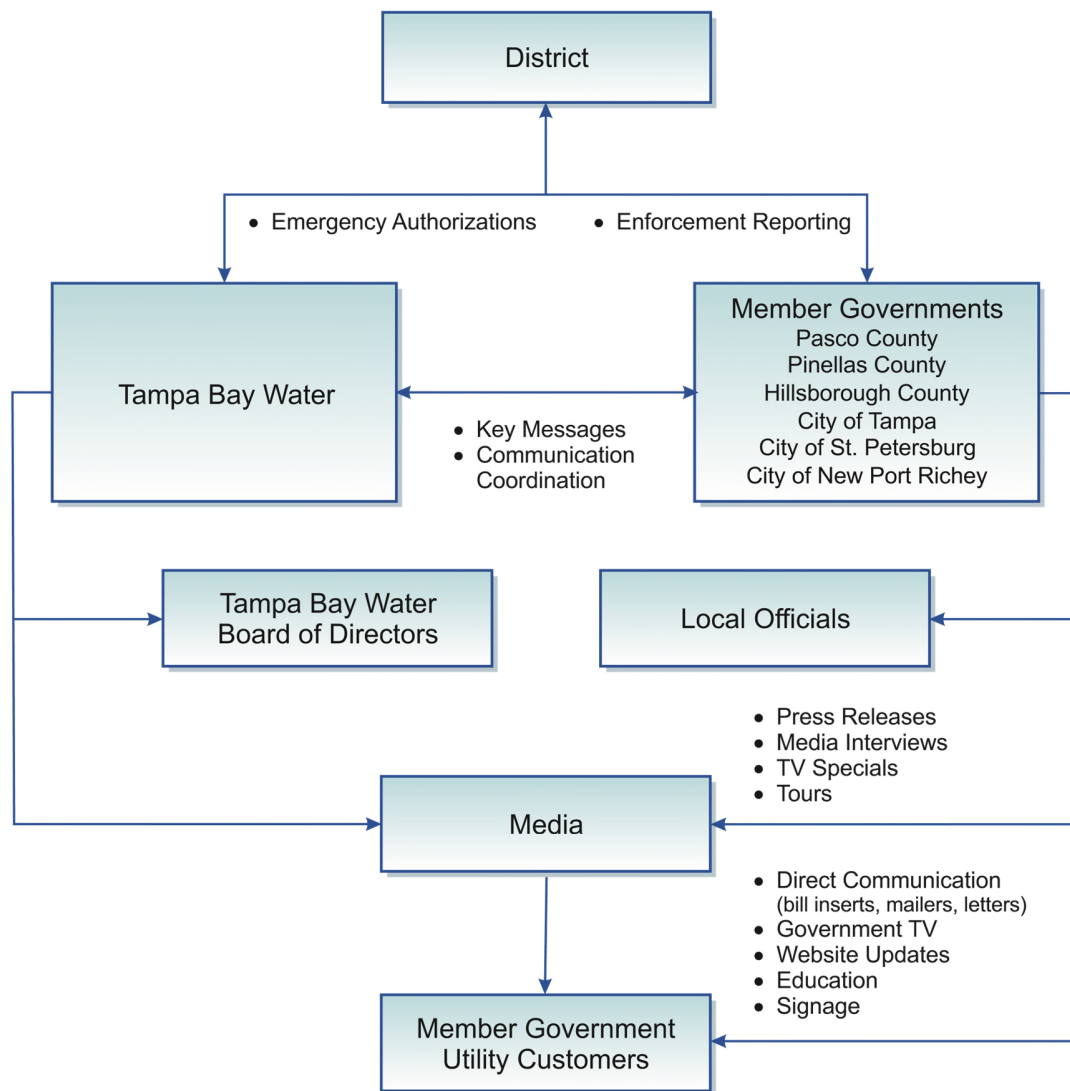


Figure 5-1: Water Shortage Mitigation Plan Communications Structure

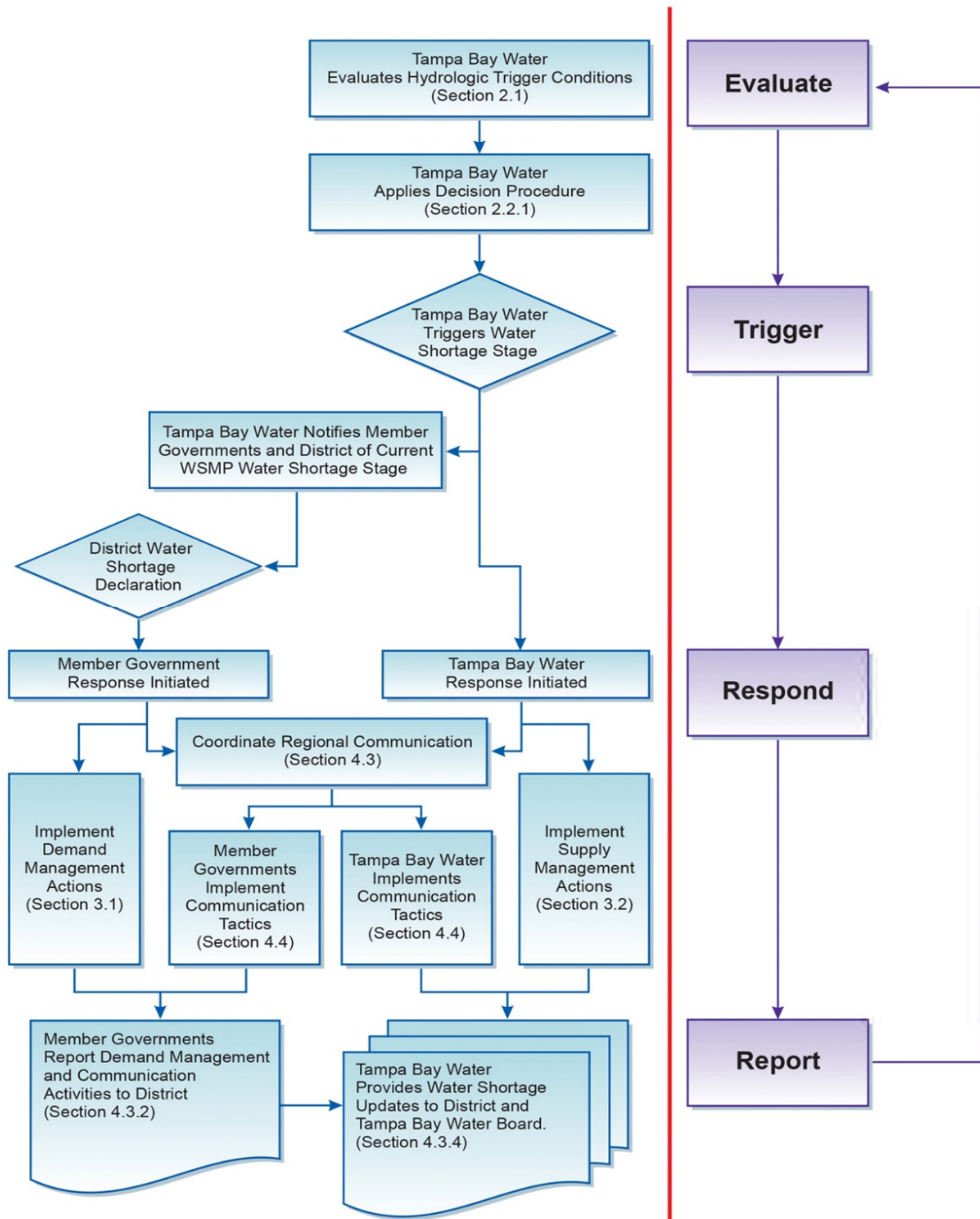


Figure 5-2: Water Shortage Mitigation Plan Implementation Procedure

## **6. Identification of Potential Future Water Supply Projects**

A wide range of potential water supply projects were taken into consideration for the 2018 Long-term Master Water Plan, spanning surface water, groundwater, seawater, and reclaimed water sources. Seven of these potential water supply sources were previously identified and recommended for further evaluation in the 2013 Long-term Master Water Plan, while others were new to the cycle. Individual projects are discussed in this section, including whether each project was recommended for detailed assessment.

### **6.1 Previously Identified Projects**

During the 2013 Long-term Master Water Plan, demand projections showed that the existing supply facilities were sufficient to meet the demand for quality drinking water, thus negating the need to implement a new water supply project during that Master Water Plan cycle. Despite the lack of need for near-term implementation, Tampa Bay Water did carry seven water supply projects into the 2013 Long-term Master Water Plan as part of a planning-feasibility program. These seven projects, which were approved for further evaluation by the Tampa Bay Water Board of Directors in December 2008 were identified in the 2008 Long-term Master Water Plan after Tampa Bay Water considered approximately 300 potential future water supply projects. The seven supply projects that were approved by the board during the 2008 Long-term Master Water Plan were as follows:

- Small Footprint Reverse Osmosis
- Tampa Bay Seawater Desalination Plant Expansion
- Gulf Coast Desalination Plant
- Additional Potable Groundwater from Existing Northern Wellfields
- Thonotosassa Wells
- Surface Water Expansion
- Aquifer Recharge

#### **6.1.1 Small Footprint Reverse Osmosis**

In December 2008, the board approved monitoring the Small Footprint Reverse Osmosis Projects in Pinellas County as part of the update to the Agency's Master Water Plan. These projects, including work in the City of Tarpon Springs, the City of Oldsmar, and the City of Clearwater, were of interest to Tampa Bay Water because they were expected to impact the extent to which these cities needed to purchase water from Pinellas County, thus also affecting Tampa Bay Water's demand projections.

The City of Oldsmar constructed a brackish water wellfield, brackish water transmission system, a reverse osmosis water treatment facility, and a deep injection disposal well to provide a long-term alternative drinking water source to the City. Prior to the construction of this new water supply, the City relied upon approximately 1.54 mgd of purchased water from Pinellas County. The City's new long-term alternative drinking water source is now online, and the City intends to only maintain their current interconnect with Pinellas County as a backup water supply during plant shutdowns.

Similar to the City of Oldsmar, the City of Tarpon Springs has historically relied on purchased water (approximately 3 mgd) from Pinellas County. To diversify and strengthen the City's water supply portfolio, as well as improve self-sufficiency, the City implemented 5 mgd of new supply through the construction of production wells, raw water pipelines, a reverse osmosis treatment facility, and disposal pipelines.

The City of Clearwater used to purchase approximately 9 mgd of drinking water supply from Pinellas County. To reduce reliance on purchased water, the City decided to build a new 6 mgd Brackish Water Facility and expand their existing Reverse Osmosis Water Treatment Plant No. 1 to a capacity of 4 mgd. The City's project is now online, which included design and construction of a brackish water wellfield, associated transmission system, a 6 mgd reverse osmosis water treatment facility, and a deep injection disposal well. The City plans to meet current and future water demands with their expanded system, as well as purchased water from Pinellas County.

As of the 2018 Long-term Master Water Plan, the three Small Footprint Reverse Osmosis Projects have been completed and associated demand impacts have been taken into account for demand projections and supply needs. Monitoring of the Small Footprint Reverse Osmosis Projects in Pinellas County is no longer needed, and the supply benefits provided by these projects has been accounted for in the 20 mgd supply deficit identified in this Master Water Plan.

#### **6.1.2 Tampa Bay Seawater Desalination Plant Expansion**

Tampa Bay Water currently benefits from the use of groundwater, surface water, and seawater in its water supply portfolio. This water supply project involves expanding the Tampa Bay Seawater Desalination Plant located in south Hillsborough County. The existing plant uses Tampa Electric Company's (TECO's) Big Bend Power Station cooling water as its seawater supply source from Tampa Bay. The cooling water from the Power Plant is also used to dilute desalination concentrate before being returned to the Bay. Due to space constraints at the existing site, this water supply option is limited to approximately 10 mgd of additional yield. The primary infrastructure components for the Tampa Bay Seawater Desalination Plant expansion include seawater intake and treatment process upgrades, the most significant of which pertains to pretreatment. This project was recommended for detailed assessment.

To expand the Desalination Plant's finished water yield by 10 mgd, the seawater supply system capacity must also be expanded by approximately 20 mgd, assuming a 50% recovery rate across the reverse osmosis system. This improvement to the seawater intake would also help address the existing reliability concerns associated with the existing seawater supply pipeline, specifically the two 375 feet sections constructed from fiberglass reinforced plastic. Based on a recent condition assessment, the pipes were estimated to have a remaining useful life of approximately 10 years. The expansion of the seawater intake was assumed to include 4,500 feet (0.8 miles) of new 66-inch pipe to replace the existing 54-inch pipeline.

The reliability of the existing system is also challenged by fluctuations in power supply that can delay restart of the existing diatomaceous earth pretreatment process. As a result, an expansion of the Desalination Plant assumes power supply improvements and a complete replacement of the pretreatment process with dissolved air flotation and membrane filtration. The dissolved air flotation/membrane filtration system will have a total firm capacity of 70 mgd; 50 mgd is for replacing the existing system and the remaining 20 mgd is to accommodate the plant expansion. This combination of technologies was

selected as the replacement pretreatment process because it is less sensitive to power fluctuations, generates less process residuals, provides a higher level of pretreatment to the downstream reverse osmosis system, and reduces energy consumption. Dissolved air flotation is a process that uses fine air bubbles to lift solids for recovery from the raw seawater stream and membrane filtration is a process that uses finer filtration than the existing process without requiring an applied coating of diatomaceous earth material. The new pretreatment system will be designed to fit within the existing basins to minimize construction costs and stay within the boundaries of the existing site. A new building will be included in the design to cover the dissolved air flotation/membrane filtration system and serve as protection against adverse weather conditions. The new pretreatment system will minimize downtime at the facility and improve water quality to the downstream reverse osmosis process.

Additionally, treatment process expansions are required for the steps that follow pretreatment. A 10 mgd increase in the Tampa Bay Seawater Desalination Plant's finished water yield requires an expansion of the existing reverse osmosis, post treatment, and residuals management processes. The reverse osmosis expansion is assumed to include three first-pass reverse osmosis trains and six second-pass reverse osmosis trains with associated feed pumps, cartridge filters, high pressure pumps, and elements. The expanded post treatment process includes an additional lime silo, lime saturator, and two saturated lime pumps for alkalinity and pH adjustment to stabilize the reverse osmosis permeate before introducing it into the regional system. The existing carbon dioxide and post-disinfection system are sufficient for the expansion.

Expansion of the Desalination Plant requires improvements to the residuals treatment systems, including the components used for coagulation sludge/spent filter backwash and concentrate. Coagulation sludge and spent filter backwash waters are pumped to the sludge treatment system, which consists of polymer addition, rapid mixing, flocculation, lamella clarification, and solids dewatering with belt presses. Improvements to the expanded system will include new lamella and belt filter presses to ensure capacity. Additionally, the expansion requires that the capacity of the concentrate disposal system be increased by 10 mgd, which entails 4,500 feet (0.8 miles) of new 60-inch pipeline to replace the existing 48-inch pipeline and 1,000 feet of new 42-inch pipeline to replace the existing 36-inch pipeline discharging from the splitter boxes. Expansion of the concentrate disposal system would also require modifications to the splitter box and tunnel connection, the extent of which would be determined in the preliminary design phase.

Increased transfer pumping would also be required to deliver finished water through the existing regional pipeline or to south Hillsborough County by way of a new point of connection in the proximity of the Tampa Bay Seawater Desalination Plant.

### **6.1.3 Gulf Coast Desalination Plant**

Tampa Bay Water previously considered the feasibility of developing a second seawater desalination plant along the coast of the Gulf of Mexico and this project recommended was for additional feasibility study. The identified site would be co-located with the Anclote Power Plant in southwest Pasco County. The purpose of co-locating the Gulf Coast Desalination Plant with the Anclote Power Plant is to take advantage of existing structures, thus minimizing environmental and economic impacts of new construction. Moreover, the power plant can supply power and dilution water to the waste concentrate produced by the desalination plant. The coal-fired power plant is owned and operated by Duke Energy.

This water supply project includes the construction of a new reverse osmosis desalination plant. The desalination plant would share the intake infrastructure with the Anclote Power Plant. The waste concentrate from the desalination process would be diluted with the cooling water from the Anclote Power Plant and discharged into the Anclote Power Plant's cooling water discharge canal. Finished water would be delivered to the regional point of connection in northeast Pinellas County, near the Keller Water Treatment Plant. The proposed facility has a finished water firm capacity of 20 mgd (25 mgd design capacity), thus requiring a 40 mgd capacity (50 mgd design capacity) system upstream of reverse osmosis. The primary infrastructure components for the Gulf Coast Desalination Plant are raw water supply, treatment, finished water delivery, and residuals management Figure 6-1.

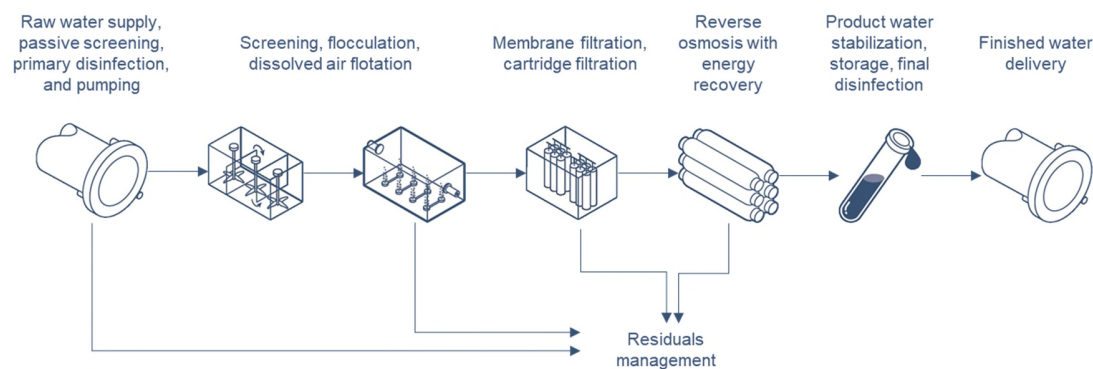


**Figure 6-1: Process Flow Diagram for the Gulf Coast Desalination Plant**

Raw water supply will be withdrawn from a location in the Anclote Power Plant cooling water canal downstream of the power plant's cooling water discharge. Raw water will flow by gravity through the passive intake screens installed slightly above the bottom on the canal. The intake screens will be equipped with airburst systems to periodically remove debris that has accumulated on the surface of the intake screens. The screens will be piped directly to a pump station through buried high-density polyethylene piping. The pump station will be equipped with vertical turbine pumps with variable frequency drives to control the flow of water into the plant. Primary disinfection will be provided using chlorine dioxide that is generated onsite from sodium hypochlorite and sodium chlorite.

Once raw water is supplied to the Gulf Coast Desalination Plant, the primary objective of the treatment process is desalination with reverse osmosis. The reverse osmosis system requires substantial pretreatment for successful and cost-effective operation. The proposed pretreatment process includes additional screening to remove shells and other large debris that has accumulated in the raw water supply system. After fine screening, the raw seawater will be treated with coagulants to bind colloidal materials and suspended organics for removal by dissolved air flotation. In the coagulation process, ferric chloride is assumed to be added ahead of a multistage flocculation process. During flocculation, the chemically treated raw water is mixed at a high mixing energy and then progressively lower mixing speeds to encourage floc particle growth. Coagulated solids from the multistage flocculator will be recovered in the dissolved air flotation system. Following dissolved air flotation, clarified water is pumped downstream to an automatic backwashing strainer, followed by pressurized membrane filtration. Water and dissolved components pass through the membrane, and solids are retained on the membrane surface. The retained solids are periodically recovered through backwashing, using a combination of pumped membrane filtrate and compressed air.



Filtrate from the membrane filtration pre-treatment process is pumped through cartridge filters and then pressurized for the reverse osmosis system. The reverse osmosis includes first- and second-pass processes for approximately 50% recovery and polishing, respectively. The reverse osmosis processes will require periodic chemical cleaning using a clean-in-place system, which involves the use of heated, high pH cleaning primarily to remove biological and organic fouling and heated, low pH cleaning to recover inorganic foulants and scales. After reverse osmosis treatment, permeate from the second pass and untreated first pass permeate combine and flow to a post treatment stabilization and disinfection process. During post treatment, lime and carbon dioxide will be added to control corrosivity and then sodium hypochlorite and liquid ammonium sulfate will be added to create chloramines for disinfection.

Disinfected and stabilized water from the treatment process will be stored onsite in a single five-million-gallon storage tank and then pumped to a tie-in point at the Tampa Bay Water Regional Interconnect near the Pinellas County Keller Water Treatment Facility. A pumping station using multistage horizontal split case pumps with variable frequency drives will deliver water into a common discharge point for connection into the distribution system. The delivery of finished water will require approximately 56,500 feet (10.7 miles) of 42-inch piping to reach the Keller Water Treatment Facility.

Finally, the Gulf Coast Desalination Plant will include a residuals management system for process wastes from screenings, dissolved air flotation, membrane filtration backwash solids, membrane filter and reverse osmosis clean-in-place waste, and reverse osmosis concentrate. Facilities will be constructed for solids dewatering, and chemical neutralization and discharge facilities will be constructed for liquid waste streams.

#### **6.1.4 Additional Potable Groundwater from Existing Northern Wellfields**

The current Combined Permit for the 11-Consolidated Regional Wellfields will expire January 25, 2021. The Southwest Florida Water Management District and Tampa Bay Water are continuing to evaluate progress and assumptions made concerning regional recovery of water levels by analyzing trends in aquifer and surface water levels. This water supply project involves increasing the allowable annual average withdrawal rate of these wellfields from the current annual average permitted flow of 90 mgd, assuming the environmental analysis being conducted shows that additional supply can be developed in an environmentally-sustainable way. Tampa Bay Water is committed to ongoing monitoring, modeling, and forecasting activities to demonstrate whether or not an increase in groundwater withdrawals could be approved, while remaining consistent with regulatory rules and still meeting the water resource recovery goals set forth by the Southwest Florida Water Management District.

The potential for additional potable groundwater withdrawals from the existing Northern Wellfields is supported by supply diversification, increased regional rotational capacity, wetland mitigation, and drainage mitigation projects that are all improving conditions in the Northern Tampa Bay area. As such, a potential increase in the Combined Permit will continue to be pursued as a solution for drought mitigation and as an opportunity for potential supply in the future, but it will not be further considered as a project for meeting the 20 mgd supply deficit identified in this Master Water Plan. Tampa Bay Water will refrain from requesting an increase in the Combined Permit until sufficient data has been collected to support the request and until the Combined Permit is due for renewal (January 2021).



#### **6.1.5 Thonotosassa Wells**

The Thonotosassa Wellfield water supply project originally consisted of constructing new groundwater production wells on City of Tampa property in the Thonotosassa area, as well as a chlorination facility, storage, and pump station. Finished water would be delivered via a new transmission main to the North Central Hillsborough Intertie.

A Thonotosassa Wells Feasibility Study was completed and documented in a Technical Memorandum dated April 2016 (Appendix 6A). The study identified significant regulatory and environmental challenges associated with the Thonotosassa Wells and estimated that the average yield available from this water supply project would be limited to approximately 1 mgd. The study concluded that the limited yield of the Thonotosassa Wells makes this water supply project unappealing from a regional capacity perspective. Thus, the Thonotosassa Wells will not be further considered as a project for meeting the 20 mgd supply deficit identified in this Master Water Plan.

#### **6.1.6 Surface Water Expansion**

In the 2013 Long-term Master Water Plan, this water supply project involved expanding the existing surface water supply system with new infrastructure components to deliver, store, and treat additional surface water. Analysis was performed by Montgomery Watson Harza (MWH) to determine the yield, reliability, and cost of expanding the existing surface water system. MWH estimated that the project could result in average increases of yield between 0.3 and 17.4 mgd depending on the assumed expansion conditions.

Following the 2013 Long-term Master Water Plan, modeling was conducted by Tampa Bay Water using the Enhanced Surface Water System Model to determine the optimal infrastructure expansions to realize the most cost-effective yield increase. The Model includes operational constraints for existing system components based on operational experience to date, available supply based on simulated basin rainfall, and new infrastructure projects based on user inputs. The model and results that inform sizing of the Regional Surface Water Treatment Plant expansion are discussed in detail in Section 8.

The primary infrastructure components for the Regional Surface Water Treatment Plant expansion include influent piping system improvements and treatment process expansions to handle increased flows through the facility. Tampa Bay Water's Regional Surface Water Treatment Plant withdraws water from the Tampa Bypass Canal and Alafia River, and surplus water is stored in the C. W. Bill Young Regional Reservoir to supply the water treatment plant during periods of low flow. The influent piping system must be expanded to accommodate the expansion of the treatment facility. Piping modifications will include new raw water piping parallel to the existing pipeline from the raw water storage tank to the influent of the plant. Numerous additional large diameter isolation and control valves for influent flow control will also be included.

The existing treatment process at the Regional Surface Water Treatment Plant is comprised of three main stages of treatment, including ACTIFLO®, ozone disinfection, and biofiltration. As a final step, water is subject to a two-step secondary disinfection process involving chlorine and chloramines. This treatment process has performed well since 2002, producing high quality drinking water, and would be retained for the plant expansion. To treat and deliver additional flows from the existing surface water source to the

regional distribution system, each individual treatment process must be expanded. The processes and support systems to be expanded include the influent piping system, ACTIFLO®, ozone, biofiltration, chlorine contact tanks, the chemical stabilization building, and residuals processing.

Existing and planned storage, pumping, and piping from the Regional Surface Water Treatment Plant to the regional system, including a new high service pump that will be brought online prior to the expansion, are sufficient for increased flows, thus no additional improvements are needed in terms of finished water delivery.

#### **6.1.7 Aquifer Recharge**

In the 2013 Long-term Master Water Plan, the aquifer recharge water supply project involved recharging the Floridan aquifer with highly treated reclaimed water and a remote groundwater withdrawal for potable water supply such that a net benefit to Floridan aquifer levels was achieved. It was suggested that aquifer recharge could be achieved by installing Upper Floridan aquifer recharge wells or surficial rapid infiltration basins. Reclaimed water from the City of Tampa's Howard F. Curren Advanced Wastewater Treatment Plant could be a major supply source for the recharge locations. MWH identified areas feasible for aquifer recharge and estimated that an aquifer recharge project could take up to 13 years to complete pilot testing, design, permitting, construction, and obtaining the resulting groundwater supply credits.

The aquifer recharge water supply project has evolved based on member government activities to be slightly different than what was proposed in the 2013 Long-term Master Water Plan. New projects related to aquifer recharge are discussed in Section 6.2.

### **6.2 New Projects**

In 2014, the Tampa Bay Water Board of Directors directed that the Agency not only consider the potential water supply projects that were identified in the 2013 Long-term Master Water Plan in the next cycle, but also reclaimed water projects due to technical and regulatory developments related to potable reuse throughout the industry. Accordingly, Tampa Bay Water refreshed a list of potential reclaimed water projects that had been developed for a previous Master Water Plan cycle. In order to identify new additions to the list, member governments were asked to provide several pieces of information, including:

- Water, wastewater, and reclaimed water master plans,
- Projected reclaimed water demands,
- Wastewater treatment plant(s) location and capacity,
- Discharge location and effluent quality, and
- Ongoing or planned reclaimed water projects.

Over 300 potential reuse projects were identified as a preliminary list. These reuse projects included various permutations of non-potable reuse to offset the use of potable water supplies, surface water augmentation, groundwater augmentation, raw water augmentation, and treated water augmentation, all of which are defined below.

- Non-potable reuse: The delivery and reuse of recycled water in non-potable applications, such as irrigation, toilet flushing, and industrial processes,

- Surface water augmentation: The planned placement of recycled water into a raw surface water (reservoir, lake, river) used as a source of domestic drinking water supply for a public water system,
- Groundwater augmentation: The planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system,
- Raw water augmentation: The planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system,
- Treated water augmentation: The planned placement of recycled water into the water distribution system of a public water system.

The identified reuse projects were further narrowed down to a list of approximately 130 projects based on aggregation of nearly identical projects and overall feasibility. From there, the 130 projects were evaluated and compared as part of a reuse-specific coarse screening process. The coarse screening criteria and scoring possibilities for each criterion are provided in Table 6-1.

**Table 6-1: Coarse Screening Criteria for the Shortlisting of Potential Reuse Projects**

| Score | Environmental and Source Water Protection                                                  | Implementation/ Feasibility                                                           | Total Cost per 1,000 gallons | Regulatory Requirements                                                                              | Yield                                          |
|-------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 1     | Environmental benefits, low vulnerability, potential to improve water quality              | Easy system integration; Good expansion potential; Significant benefits to the region | Lowest                       | Local source water, least permitting requirements                                                    | Maximum yield with no seasonal impacts         |
| 0     | Potential for environmental impact, some vulnerability to source water quality degradation | Reasonable integration; some expansion potential; some benefits to the region         |                              | Moderate permitting requirements with some policy changes                                            | Moderate yield with some seasonal impacts      |
| -1    | Suspected environmental impact requiring mitigation and limited benefits to water quality  | Difficult integration; poor expansion potential; limited benefits to the region       | Highest                      | Non-local source water, multiple challenging permits requiring change in current permitting policies | Lowest yield with significant seasonal impacts |

The results of the coarse screening process were presented to the member governments and are provided in Appendix 6B. Based on the results of the coarse screening process, several reuse projects were prioritized for further consideration, ultimately leading to two reuse concepts for continued inclusion in the 2018 Long-term Master Water Plan evaluation and ranking process. The prioritized reuse concepts were: aquifer recharge and indirect potable reuse via the Tampa Bay Bypass Canal. The new projects that were developed with respect to these two prioritized reuse concepts are described below.

## 6.2.1 Aquifer Recharge

### 6.2.1.1 New Groundwater Supply and Treatment Plant via Net Benefit from SHARP Program

This water supply project involves the construction of a groundwater withdrawal wellfield and groundwater treatment facility in south Hillsborough County, with accommodations for finished water to be delivered to the regional system or to Hillsborough County by way of a new point of connection in proximity to the new groundwater treatment facility. The groundwater supply for this water supply project would be enabled by Hillsborough County's South Hillsborough Aquifer Recharge Program (SHARP), in which reclaimed water is used to recharge the coastal aquifer, thus serving as a barrier to saltwater intrusion, providing a net benefit to the aquifer, and also generating credits for additional groundwater withdrawals Figure 6-2. The groundwater supply project is initially limited to a maximum yield of 7.5 mgd based on the availability of reclaimed water in south Hillsborough County, withdrawal constraints, and groundwater modeling as discussed briefly below and in detail in Appendix 6C. Tampa Bay Water and Hillsborough County have engaged in discussed to collaboratively evaluate the implications of SHARP, mutual commitments, and future negotiations regarding credit valuation (Appendix 6D).

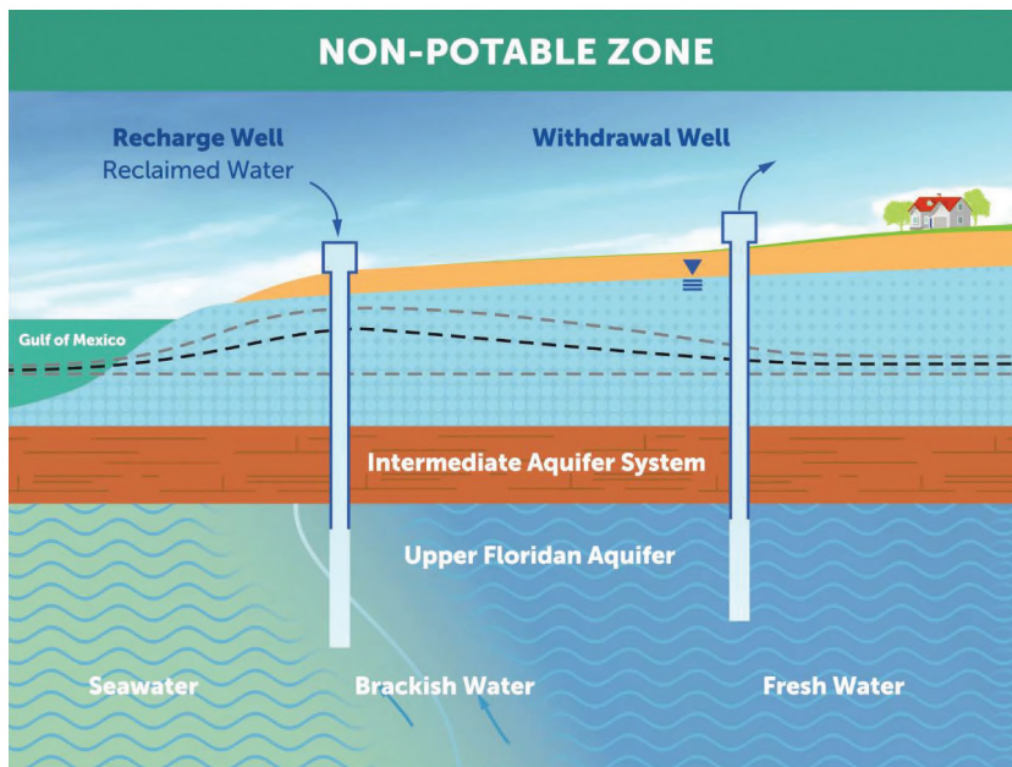


**Figure 6-2: Depiction of the SHARP Concept**

Modeling was performed to determine how much groundwater could be withdrawn as a function of reclaimed water recharge when constraints related to the Southern Water Use Caution Area (SWUCA) and Minimum Level Highland Ridge Lakes (ML Lakes) in Polk County are taken into consideration. An

aquifer recharge rate of 10 mgd was assumed for groundwater modeling efforts based on south Hillsborough County's reclaimed water availability projections; modeled withdrawals were limited to values that maintained a ten percent net benefit to the SWUCA aquifer, as well as less than 0.049 feet of net drawdown at the ML Lakes to meet the Southwest Florida Water Management District's Water Use Permit (WUP) conditions for issuance. Model results showed that a maximum yield of 7.8 mgd could be realized with 10 mgd of aquifer recharge based on anticipated Hillsborough County recharge well locations and an iteratively determined withdrawal location Figure 6-3. A maximum yield of 7.5 mgd at wellfield site 1a is assumed for planning purposes.

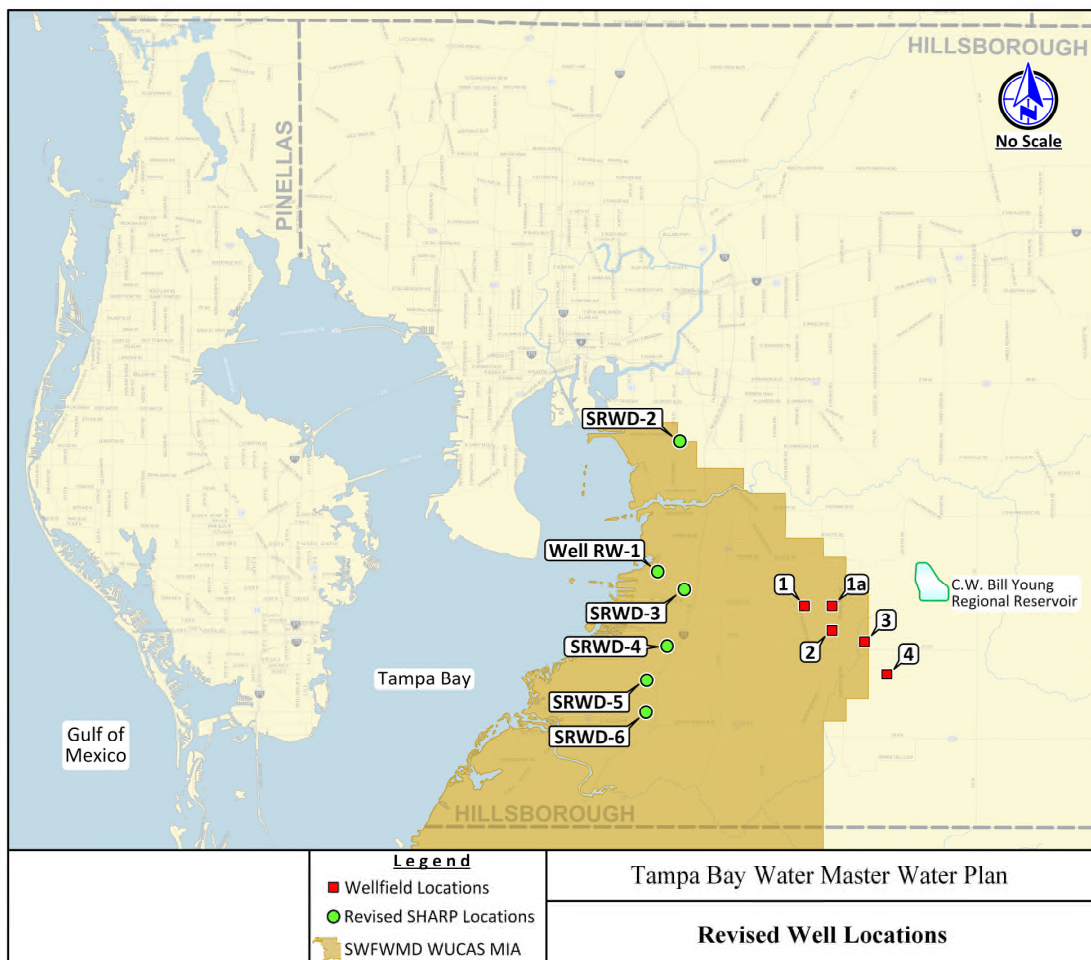


**Figure 6-3: Anticipated Aquifer Recharge Well Sites and Modeled Withdrawal Wellfield Sites**

The new groundwater supply via aquifer recharge credits involves two systems, the aquifer recharge system and the groundwater supply system. The aquifer recharge system, part of which has already been constructed, will be under the ownership and operation of Hillsborough County. In order to generate groundwater withdrawal credits, Hillsborough County would develop and continuously operate a 10 mgd reclaimed water aquifer recharge system. The groundwater supply system would be Tampa Bay Water's



responsibility. Tampa Bay Water would develop and operate a new 7.5 mgd annual average production wellfield, groundwater treatment plant, and finished water transmission back to the regional system. This water supply project involves the transfer of credits from Hillsborough County to Tampa Bay Water.

Groundwater treatment requirements were assumed to include hydrogen sulfide removal with ozone, along with disinfection with chlorine, and the addition of ammonia to form monochloramines. It is possible that treatment measures to reduce hydrogen sulfide levels may not be required for this groundwater supply source; however, additional sampling and water quality analyses would be needed to confirm the treatment requirements of withdrawn groundwater. Siting of the withdrawal wellfield should not only consider acceptable withdrawal quantities, but also groundwater quality and proximity to potential sites of contamination. In addition to a 7.5 mgd firm capacity groundwater treatment plant with hydrogen sulfide removal and chloramination processes, a 2 MG finished water ground storage tank and 10 mgd firm capacity pumping station would also be located at the treatment facility Figure 6-4. The proposed groundwater treatment facility is estimated to require a 6-acre parcel of land.

Two routing configurations were considered for the transmission of finished water from the groundwater treatment plan to the existing Tampa Bay Water Regional Transmission System. The first pipeline option extended from the new groundwater treatment plant to the existing Desalination Transmission Main, located near the Tampa Bay Seawater Desalination Plant. The second pipeline option terminated at the existing Regional Transmission System near the Lithia Water Treatment Plant. Based on a preliminary hydraulic analysis and system integration assessment, both options are feasible and need to be further evaluated, but the pipeline project that extended to the Desalination Transmission Main was preferred based on distance and operational flexibility. A new point of connection with Hillsborough County may also be developed in south Hillsborough County and be connected to this finished water pipeline assuming that an agreement is reached between Hillsborough County and Tampa Bay Water. All or a portion of the supply capacity from the new groundwater treatment plant would be delivered to the new point of connection in south Hillsborough County based on existing demand projections. If demand at the new point of connection is less than the supply from the new groundwater treatment plant, the excess finished water supply could be delivered through the new finished water pipeline into the Tampa Bay Water Regional System. If the demand at the new point of connection is greater than the new groundwater treatment plant supply, additional supply from the Tampa Bay Water Regional System could be sent through the new finished water pipeline to the point of connection in south Hillsborough County.

The costs associated with Hillsborough County selling/transferring groundwater withdrawal credits to Tampa Bay Water would need to be defined and agreed upon to develop this concept. Herein, groundwater withdrawal credits are assumed to be \$0 per 1,000 gallons.

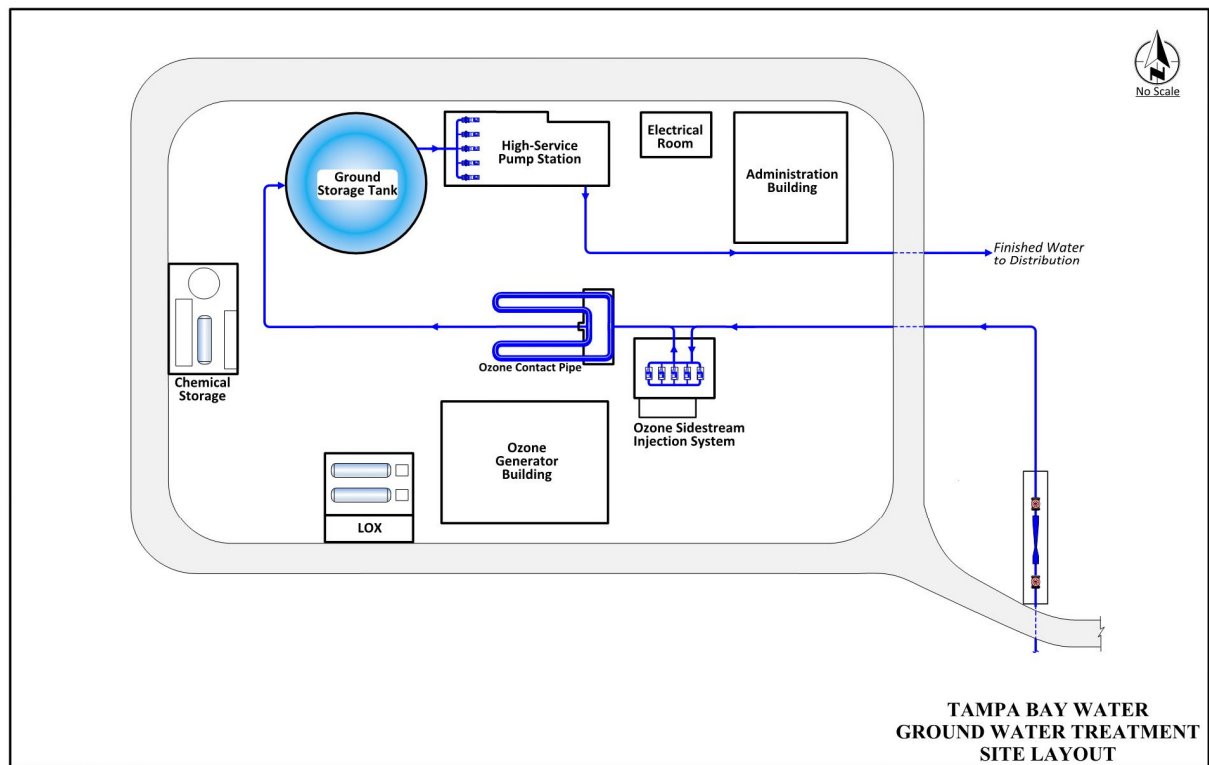


**Figure 6-4: Preliminary Layout for the Groundwater Treatment Facility**

#### 6.2.1.2 *New Groundwater Supply and Treatment Plant via Net Benefit from Expanded SHARP Program*

In Section 6.2.1.1, it is noted that the new groundwater supply via aquifer recharge credits is limited to 7.5 mgd by the availability of reclaimed water in south Hillsborough County and permitting constraints. In this water supply project, a maximum yield of 20 mgd is assumed for the groundwater supply based on the combined availability of reclaimed water from south Hillsborough County and another member government, withdrawal constraints, and groundwater modeling. Groundwater modeling results (Appendix 6C) showed that a yield of 20 mgd requires 30 mgd of aquifer recharge when constraints related to the SWUCA and the ML Lakes are considered.

It is assumed that 7.5 mgd of the total 20 mgd of yield is realized through the use of groundwater credits generated by south Hillsborough County via aquifer recharge. For the remaining 12.5 mgd of yield, for the purposes of this LTMWP, it is assumed that reclaimed water would be obtained from the City of Tampa and delivered to an expanded aquifer recharge program for the generation of additional credits. For the purposes of developing a cost estimate, it was assumed that Hillsborough County would still be responsible for their aquifer recharge system, but Tampa Bay Water's responsibilities would increase. In addition to the groundwater withdrawal, treatment, and delivery system, it was assumed that Tampa Bay Water would be responsible for the construction and operation of conveyance infrastructure from the Howard F. Curren Advanced Wastewater Treatment Plant to the aquifer recharge well sites, as well as recharge infrastructure and credit documentation. However, the ownership and operation of reclaimed water infrastructure required for a given water supply project would be negotiated between Tampa Bay



Water and relevant member governments during the feasibility evaluation phase. A maximum yield of 20 mgd at wellfield site 1a is assumed when both Hillsborough County and Tampa Bay Water are engaged in aquifer recharge for the generation of groundwater credits. This water supply project involves the transfer of aquifer recharge credits from Hillsborough County to Tampa Bay Water, as well as the purchase of reclaimed water from the City of Tampa or another member government.

The additional infrastructure components that differentiate this water supply project from that involving only the transfer of credits from Hillsborough County to Tampa Bay Water for groundwater withdrawals are reclaimed water transmission, recharge wells, and increased treatment/finished water delivery. The costs associated with Hillsborough County selling/transferring groundwater withdrawal credits to Tampa Bay Water, as well as City of Tampa selling reclaimed water to Tampa Bay Water, would need to be defined and agreed upon to develop this concept. Herein, groundwater withdrawal credits and reclaimed water are assumed to be \$0 per 1,000 gallons.

#### *6.2.1.3 Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water in South Hillsborough County*

An additional variation of the aquifer recharge and recovery project was developed through the reuse project identification and coarse screening process. The previously described aquifer recharge and recovery projects involve aquifer recharge with remote groundwater withdrawal. Stated differently, the reclaimed water serves as a saltwater intrusion barrier in the aquifer and to increase overall groundwater levels, but the injected reclaimed water is not serving as potable water supply. In this new variation, aquifer recharge and recovery would be co-located, thus allowing the injected reclaimed water to serve as the source water Figure 6-5.

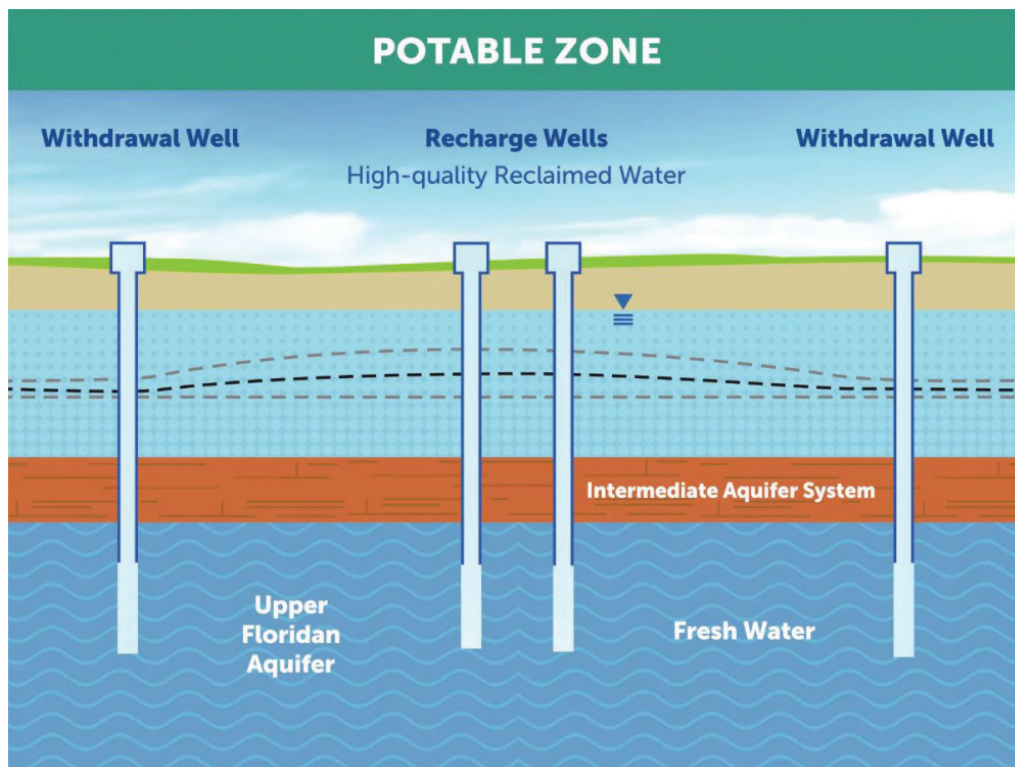


**Figure 6-5: Depiction of Aquifer Recharge and Recovery Concept**

This water supply project is an indirect potable reuse scenario that involves the advanced treatment of reclaimed water the City of Tampa's Howard F. Curren Advanced Wastewater Treatment Plant or another member government before it is pumped to aquifer recharge wells in south Hillsborough County Figure 6-6. A wellfield around the perimeter of the recharge wells would then withdraw the highly treated reclaimed water that was previously injected into the aquifer to be used as source water. The withdrawn groundwater would be delivered to a new groundwater treatment facility to provide a finished water supply to the Tampa Bay Water Regional System. The finished water may also be directly delivered to south Hillsborough County by way of a new point of connection in the proximity of the groundwater treatment plant. It is assumed that this water supply project will not be limited by reclaimed water availability nor space, thus allowing it to provide 20 mgd of new supply without being combined with another water supply project.

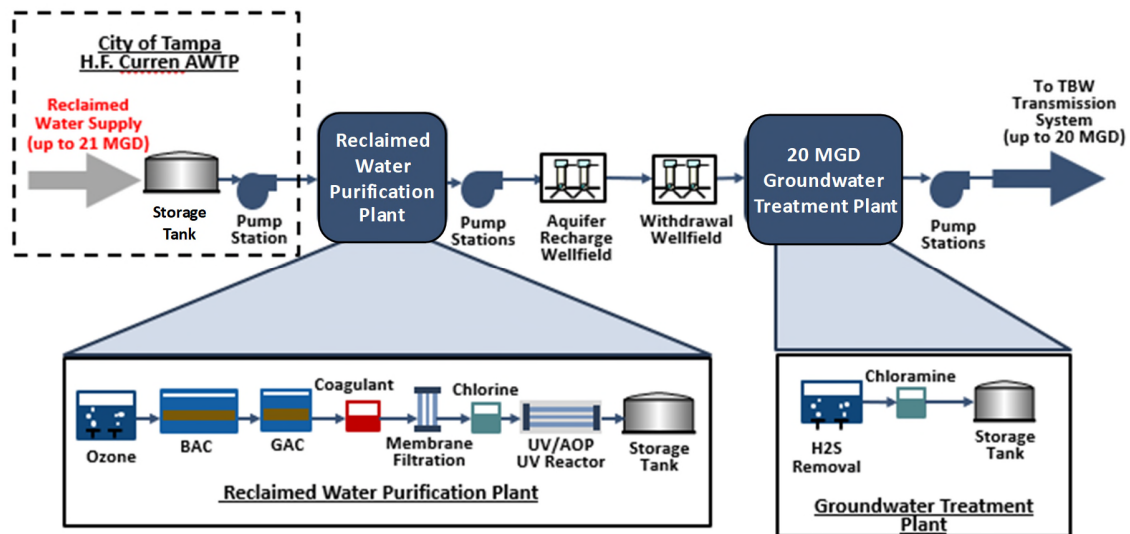


**Figure 6-6: Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water**

The primary infrastructure components of this project concept include reclaimed water transmission to the Regional Facilities site from the Howard F. Curren Advanced Wastewater Treatment Plant or another member government facility, an advanced water treatment plant for the treatment of reclaimed water at the Regional Facilities Site, and transmission to deliver the treated reclaimed water from the Regional Facilities Site to the recharge wellfield. The advanced water treatment plant is assumed to include ozone, biofiltration, granular activated carbon, membrane filtration, and advanced oxidation with ultraviolet irradiation treatment processes. In Florida, there is currently no regulatory framework for the direct use of reclaimed water as drinking water supply, although regulations are in place for aquifer recharge. Accordingly, treatment requirements for this project concept, in which reclaimed water is used as the source water, are based on regulatory and operational precedents set by other states and utilities.

Following advanced treatment, this project concept requires a recharge wellfield in order to use the aquifer as environmental buffer and storage, a withdrawal wellfield to retrieve the injected reclaimed water, and a treatment plant for the withdrawn groundwater. The withdrawn groundwater will be high quality due to the advanced treatment prior to injection, but additional groundwater treatment is assumed in case water quality is adversely affected by transmission to the recharge wellfield and/or aquifer storage (e.g., bacterial contamination; mineral dissolution). Transmission is also needed to deliver the finished water to the Tampa Bay Water Regional System and/or to south Hillsborough County by way of a potential new point of connection.

#### 6.2.1.4 Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP Credits)

This water supply project involves obtaining groundwater withdrawal credits from the City of Tampa, as generated by the City of Tampa's injection of reclaimed water into a non-potable aquifer zone. This practice by the City of Tampa is part of the Tampa Augmentation Project (TAP). If agreed upon in the future by Tampa Bay Water and City of Tampa, the credits would be used to permit a 20 mgd withdrawal wellfield in central Hillsborough County. The groundwater supply would be pumped and delivered to the

expanded Tampa Bay Regional Surface Water Plant for blending with existing, raw surface water supplies at the head of the plant before treatment. Tampa Bay Water has engaged City of Tampa regarding potential future participation in this water supply project option and City of Tampa has confirmed that it does not intend to provide any reclaimed water or “water from the TAP project” to Tampa Bay Water as described in this water supply project option (Appendix 6E). An evaluation of the Regional Surface Water Treatment Plant expansion with groundwater via TAP credits is provided herein for future reference if conditions regarding supply availability change.

Due to the uncertainty in withdrawn groundwater quality at this point in the development of the City of Tampa’s TAP program, two versions of this water supply project were developed: one in which groundwater quality is assumed to be compatible with existing treatment processes at the Regional Surface Water Treatment Plant and another in which withdrawn groundwater is substantially impacted by reclaimed water, thus requiring upgraded treatment at the Regional Surface Water Treatment Plant.

Expansion of the Regional Surface Water Treatment Plant with groundwater would be enabled by aquifer recharge credit generated by the City of Tampa. It is assumed that the City of Tampa would develop and operate the aquifer recharge component for this water supply project. For this feasibility study, the following assumptions were made regarding the aquifer recharge component of this project concept:

- The City of Tampa will be responsible for the installation, testing, permitting and operations of the aquifer recharge system at a rate that provides Tampa Bay Water with a 20 mgd groundwater withdrawal credit.
- The City of Tampa will sell/transfer groundwater withdrawal credits generated from the aquifer recharge to Tampa Bay Water to obtain a water use permit for a new 20 mgd annual average production wellfield. The costs associated with the City of Tampa selling/transferring the groundwater withdrawal credits to Tampa Bay Water as part of this water supply concept would need to be defined and agreed upon to develop this concept. Herein, groundwater withdrawal credits generated by the City of Tampa are assumed to be valued at \$0 per 1,000 gallons.

After the water use permit is obtained via the groundwater credits from Tampa aquifer recharge, Tampa Bay Water would develop and operate the new 20 mgd groundwater supply system. The primary infrastructure components for the groundwater supply and expanded Regional Surface Water Treatment Plant are summarized below, assuming native groundwater quality.

- New 20 mgd wellfield at the Tampa aquifer recharge location(s) – A wellfield consisting of eleven 2 mgd wells and a collection piping system would be constructed to provide a firm capacity and average production rate of 20 mgd. The estimated property requirement for the wellfield is 16-acres.
- Groundwater transmission system – Raw groundwater supply from the new 20 mgd wellfield (located in proximity to the City of Tampa aquifer recharge wells) would be sent to the expanded Tampa Bay Water Regional Surface Water Treatment Plant through a new transmission pipeline. Approximately 5 miles of pipeline will be needed, along with a new storage tank and pump station.

- Treatment process expansions – New groundwater withdrawals are assumed to require the same treatment as is currently practiced at the Regional Surface Water Treatment Plant, but each unit process would require an expansion to handle the increase in flow. The expansion would be designed to provide an annual average yield of 20 mgd. To provide this additional yield to the regional system, a 25 mgd design capacity was assumed for the expansion.
- Finished water delivery – If the Regional Surface Water Treatment Plant is expanded, no improvements would be required for finished water delivery, as the existing and planned storage, pumping, and piping to the regional system is sufficient for increased flows.

If withdrawn groundwater quality is found to be substantially impacted by reclaimed water, additional treatment processes may be required at the Regional Surface Water Treatment Plant. For this option, the Regional Surface Water Treatment Plant is assumed to not only require a capacity expansion of the existing processes, but also the addition of advanced treatment processes to address the reclaimed water component of influent flows. To minimize capital expenditures and maintain the reliability of the existing Regional Surface Water Treatment Plant, it is assumed that the reclaimed water/groundwater mixture is treated with advanced treatment processes as a separate treatment train and then blended with finished water from the Surface Water Treatment Plant. In Florida, there is currently no regulatory framework for the direct use of reclaimed water as drinking water supply, although regulations are in place for aquifer recharge. Accordingly, treatment requirements for this project concept are based on regulatory and operational precedents set by other states and utilities. An ozone/biofiltration/granular activated carbon based-treatment train is assumed for potable reuse, with the addition of advanced oxidation with ultraviolet irradiation. It is anticipated that non-reverse osmosis-based treatment will be sufficient for the production of potable quality water from reclaimed water as part of this project; however, blending of finished water with other finished water supplies may be required prior to entry into the distribution system to avoid total dissolved solids compliance issues.

### 6.2.2 Potable Reuse

Multiple variations of potable reuse water supply projects are described below, including surface water augmentation (indirect potable reuse), raw water augmentation (direct potable reuse), and finished water augmentation (direct potable reuse).

#### 6.2.2.1 *Purified Water to Tampa Bypass Canal*

One of the reuse water supply projects that was identified and favorably scored in the reuse coarse screening evaluation involved the advanced treatment of reclaimed water, followed by its discharge to the Tampa Bypass Canal. The reclaimed water was intended to augment flows in the Tampa Bypass Canal, thus allowing for increased withdrawals to be used as source water at the Regional Surface Water Treatment Plant.

To further quantify the impacts of augmenting flows in the Tampa Bypass Canal, Tampa Bay Water conducted modeling. The Agency evaluated the relationship between discharges to the Tampa Bypass Canal and withdrawal allowances considering constraints related to minimum flows and levels required to maintain environmental services. Modeling results showed that despite the addition of significant reclaimed water flows to the Tampa Bypass Canal, allowable withdrawals would not be significantly

increased due to surface water flow variability and a disconnect between when additional withdrawals would be needed (i.e., periods of high demand) and when it would actually be available (i.e., periods of surplus flow). In summary and as discussed in Section 8, modeling results demonstrated that if 20 mgd were discharged to the Tampa Bypass Canal on a regular basis, it would benefit Tampa Bay Water's withdrawal capabilities by approximately 1.0 to 2.0 mgd on an annual average basis. In response to these modeling results, three additional reuse water supply projects were developed, in which the uncertainty of the Tampa Bypass Canal was eliminated. In these new reuse water supply projects, reclaimed water is either separately treated at a dedicated advanced water treatment plant or blended with existing, raw source waters prior to treatment at upgraded existing facilities.

#### 6.2.2.2 *Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site*

This project concept involves the construction of a new advanced water treatment plant to be used exclusively for the production of drinking water from reclaimed water. The new advanced water treatment plant would be a direct potable reuse facility. Finished water supply from the new facility would be blended with finished water from existing Regional Surface Water Treatment Plant at the regional site and delivered to the Tampa Bay Water Regional System.

Tampa Bay Water's Regional Facilities Site has space available for the construction of a new advanced treatment facility for the treatment of reclaimed water. This water supply project is not limited by reclaimed water availability nor space with respect to the regional supply need. To use reclaimed water as a source, a new pipeline is needed from the member government providing reclaimed water to the Regional Facilities Site. For this evaluation, the pipeline is assumed to begin at the Howard F. Curren Advanced Wastewater Treatment Plant and terminate at the Tampa Bay Water Regional Facilities Site. For 20 mgd of new supply, the new pipeline will include approximately 43,000 feet of 42-inch pipe, which requires nine acres of land/easement acquisition. Additionally, a 5 MG reclaimed water storage tank, a 25 mgd pump station, and a reclaimed water point of connection are required to consistently supply the Regional Surface Water Treatment Plant with reclaimed water.

The new advanced treatment facility will be co-located with the Regional Surface Water Treatment Plant at the Regional Facilities Site but will not be combined with any existing facility. As such, the facility will be newly constructed with a design capacity of 25 mgd and include the following treatment processes, pending regulatory approval: ozone, biofiltration, granular activated carbon, membrane filtration, and advanced oxidation with ultraviolet irradiation Figure 6-7. Additionally, provisions will be put in place for residuals and reject water management.

If additional yield is made available through the construction of a new advanced water treatment plant, additional transfer pumping will be required for the delivery and blending of finished water from the advanced water treatment plant with finished water from the Regional Surface Water Treatment Plant prior to entry into the distribution system. For this evaluation, a 25 mgd pump station at the Regional Facilities Site is assumed for the transmission of finished water from the advanced treatment facility using reclaimed water as the source.



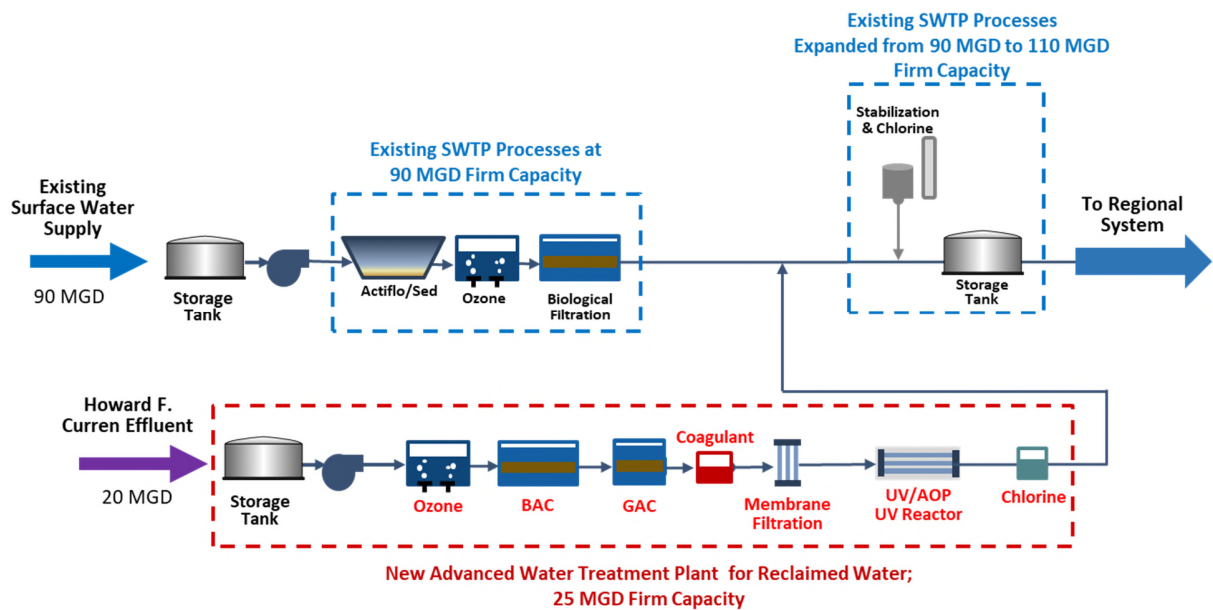


**Figure 6-7: Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending**

#### 6.2.2.3 Regional Surface Water Treatment Plant Expansion with Reclaimed Water

Tampa Bay Water’s Regional Surface Water Treatment Plant treats water from the Tampa Bypass Canal and Alafia River, and surplus water is stored in the C. W. Bill Young Regional Reservoir. The benefit of expanding the Regional Surface Water Treatment Plant with the use of reclaimed water is that the expansion would no longer be limited by the availability of surface water supplies. To expand the facility using reclaimed water, a new pipeline is needed from the member government providing reclaimed water to the Regional Facilities Site. For this evaluation, the pipeline is assumed to begin at the Howard F. Curren Advanced Wastewater Treatment Plant and terminate at the Regional Facilities Site. The new pipeline will include approximately 43,000 feet of 42-inch pipe, which requires nine acres of land/easement acquisition. Additionally, a 5 MG reclaimed water storage tank and a 25 mgd pump station, and a reclaimed water point of connection are required to consistently supply the Regional Surface Water Treatment Plant with reclaimed water.

The existing Regional Surface Water Treatment Plant is comprised of three main stages of treatment, including ACTIFLO®, ozone disinfection, and biofiltration. As a final step, water is subject to a two-step secondary disinfection process involving chlorine and monochloramines. Historical treatment performance and finished water quality support the retainment of the existing treatment paradigm at the Regional Surface Water Treatment Plant if the expansion was to be achieved using the existing source. However, to treat and deliver additional flows using reclaimed water as the source, each individual treatment process must be expanded, and other treatment processes must be added Figure 6-8. The processes and support systems to be expanded include ACTIFLO®, ozone, biofiltration, chlorine contact tanks, the chemical stabilization building, and residuals processing; the processes and support



systems to be added to address reclaimed water quality include granular activated carbon and advanced oxidation with UV irradiation (Figure 6-8). Existing and planned storage, pumping, and piping from the Regional Surface Water Treatment Plant to the regional system are sufficient for increased flows.

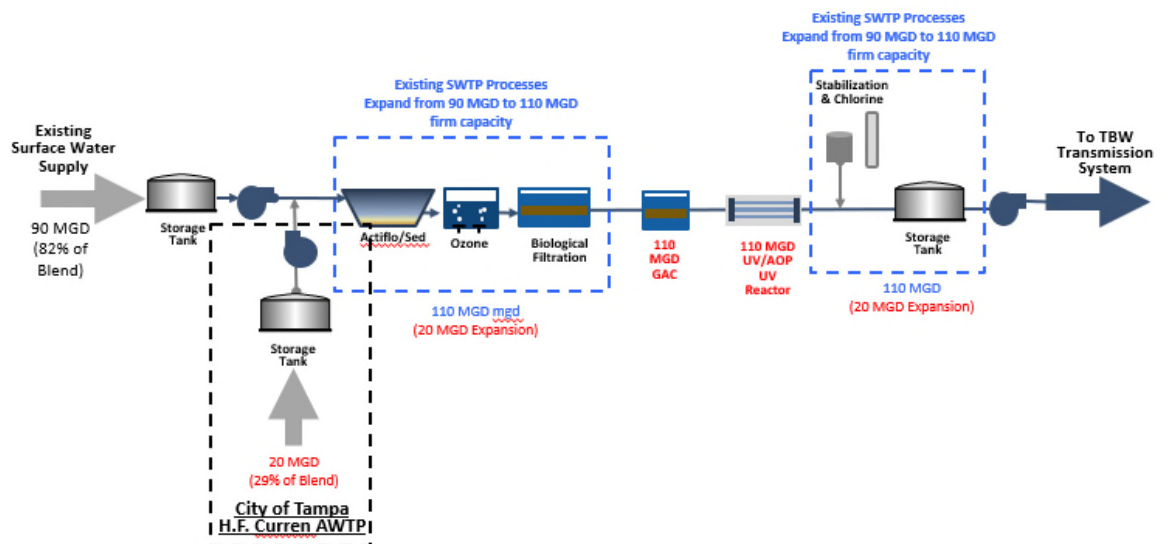


**Figure 6-8: Treatment Process Expansions and Upgrades for the Regional Surface Water Treatment Plant Expansion with Reclaimed Water**

#### 6.2.2.4 Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water

This water supply project involves expanding the existing Tampa Bay Seawater Desalination Plant, but instead of using the existing source water (seawater) as the increased raw water supply, the expansion is to be carried out with the use of reclaimed water Figure 6-9. The driver for exploring the use of reclaimed water as a source for the Tampa Bay Seawater Desalination Plant expansion is that the blending of reclaimed water with seawater will reduce the overall total dissolved solids concentration of the influent feedwater, thus also reducing the reverse osmosis feed pressure. A reduced reverse osmosis feed pressure relates to a reduced power requirement and reduced operating cost. In order for this water supply project to be cost-effective, the reduction in operating cost from the blending reclaimed water with seawater must be greater than the capital expenditure required for delivery and modified treatment of reclaimed water from the Howard F. Curren Advanced Wastewater Treatment Plant. Although the source water has changed, this water supply project is still limited to 10 – 15 mgd of additional yield due to space constraints at the existing site.

To expand the Tampa Bay Seawater Desalination Plant's finished water yield by 10 mgd, the reclaimed water supply must have a capacity of 20 mgd, conservatively assuming a 50% recovery rate across the reverse osmosis system. The required pipeline must begin at the source of reclaimed water, which is assumed to be the Howard F. Curren Advanced Wastewater Treatment Plant in this evaluation, and end at the Tampa Bay Seawater Desalination Plant, where reclaimed water would be blended with raw seawater supply. The new pipeline will include approximately 75,000 feet (14.2 miles) of 36-inch pipe,

which requires 16 acres of land/easement acquisition. Additionally, a 5 MG reclaimed water storage tank, a 25 mgd pump station, and a reclaimed water point of connection are required to consistently supply the Desalination Plant with reclaimed water as a supply.

To address the overall reliability of the Tampa Bay Seawater Desalination Plant, whether using seawater or reclaimed water as the source, the existing diatomaceous earth pretreatment process is assumed to be replaced with a dissolved air flotation and membrane filtration as the pretreatment system. The new dissolved air flotation/membrane filtration pretreatment system will have a total firm capacity of 70 mgd; 50 mgd is for replacing the existing system and the remaining 20 mgd is to accommodate the plant expansion. This new pretreatment process was selected as the replacement pretreatment process because it is less sensitive to power fluctuations, generates less process residuals, provides a higher level of pretreatment to the downstream reverse osmosis system, and reduces energy consumption. The dissolved air flotation/membrane filtration system will be designed to fit within the existing basins to minimize construction costs and stay within the boundaries of the existing site. A new building will be included in the design to cover the pretreatment system and serve as protection for the dissolved air flotation process against adverse weather conditions. The new pretreatment system will minimize downtime at the facility and improve water quality to the downstream reverse osmosis process.

In addition to replacing and expanding the desalination pretreatment process, the Tampa Bay Seawater Desalination Plant expansion with reclaimed water requires expansion of the reverse osmosis process, post treatment, residuals treatment, and concentrate disposal systems. Due to the nature of influent reclaimed water being blended with seawater at the intake, the Tampa Bay Seawater Desalination Plant expansion also requires the addition of an ultraviolet irradiation advanced oxidation process, which serves as a barrier against recalcitrant organic compounds (e.g., NDMA, 1,4-dioxane). Ultraviolet advanced oxidation also serves as a barrier against pathogens, although ultraviolet disinfection would be sufficient for that purpose.

To deliver finished water from the expanded Tampa Bay Seawater Desalination Plant to the regional system, the capacity of the existing finished water pump station will be expanded to include a fourth pump. The fourth pump will increase the capacity of the pump station by 14.5 mgd. If an expansion of the Tampa Bay Seawater Desalination Plant is pursued, a more detailed hydraulic evaluation should be conducted to determine the required increase in the finished water pumping capacity pending any increases in discharge pressure requirements and/or increased reliance on the Tampa Bay Seawater Desalination Plant after the implementation of reliability improvements.

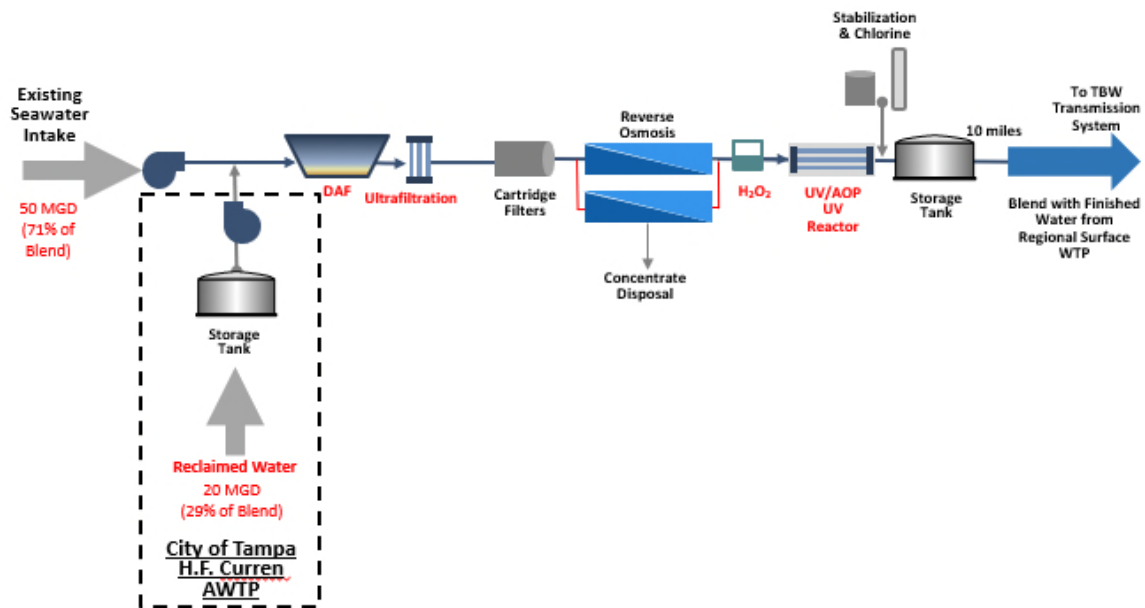


Figure 6-9: Treatment Process Expansions and Upgrades for the Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water

### 6.3 Recommended Projects

Based on the 2013 Long-term Master Water Plan, board direction, and the coarse screening of identified reuse projects, several water projects were recommended for more detailed assessment as potential strategies for meeting future demands in the Tampa Bay Water region. Table 6-2 summarizes the considered water supply projects and each project’s recommendation for further consideration within this Master Plan.

Table 6-2: Water Supply Project Summary

| Category                       | Potential Water Sources                                          | Recommended for Detailed Assessment? |
|--------------------------------|------------------------------------------------------------------|--------------------------------------|
| Previously Identified Projects | Small Footprint Reverse Osmosis Projects                         | No                                   |
|                                | Tampa Bay Seawater Desalination Plant Expansion                  | Yes                                  |
|                                | Gulf Coast Desalination Plant                                    | Yes                                  |
|                                | Additional Potable Groundwater from Existing Northern Wellfields | No                                   |
|                                | Thonotosassa Wells                                               | No                                   |
|                                | Surface Water Expansion                                          | Yes                                  |
|                                | Aquifer Recharge                                                 | Yes – see “New Projects”             |

| Category     | Potential Water Sources                                                                           | Recommended for Detailed Assessment? |
|--------------|---------------------------------------------------------------------------------------------------|--------------------------------------|
| New Projects | New Groundwater Supply via Net Benefit from SHARP Program                                         | Yes                                  |
|              | New Groundwater Supply via Net Benefit from Expanded SHARP Program                                | Yes                                  |
|              | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                               | Yes                                  |
|              | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP) | Yes                                  |
|              | Purified Water to Tampa Bypass Canal                                                              | No                                   |
|              | Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site               | Yes                                  |
|              | Regional Surface Water Treatment Plant Expansion with Reclaimed Water                             | Yes                                  |
|              | Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water                              | Yes                                  |

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 7. South Hillsborough County Supply Options

South Hillsborough County is projected to experience significant growth as discussed in Section 4 of this Master Water Plan. Hillsborough County is projecting that demands will exceed the available delivery capacity in south Hillsborough County by 2025, as shown in Table 7-1 and Figure 7-1. Tampa Bay Water agreed to use the County's projections for planning purposes.

Tampa Bay Water has adequate regional supply to meet the projected demands by 2025; however, the Agency's ability to meet the projected demand is constrained by existing regional infrastructure and permitted capacity of the South-Central Hillsborough Regional and Brandon Urban Wellfields. Tampa Bay Water will need to either expand an existing point of connection or install a new point of connection to meet 2025 projected needs and beyond. These changes will be needed before development of the new water supplies under this Master Water Plan to avoid exceeding the permit limit of the South-Central Hillsborough Regional or Brandon Urban Wellfields. This section summarizes the potential projects and evaluation process to select a south Hillsborough County supply option.

**Table 7-1: South Hillsborough County Demand Projections**

| Year              | Annual Average Daily Flow (mgd) |
|-------------------|---------------------------------|
| 2015 <sup>1</sup> | 35.2                            |
| 2018 <sup>1</sup> | 41.0                            |
| 2020 <sup>3</sup> | 43.5                            |
| 2025 <sup>2</sup> | 49.8                            |
| 2030              | 56.4                            |
| 2035              | 62.8                            |
| 2040              | 68.6                            |

<sup>(1)</sup> The flows for 2015 and 2018 are actual flows

<sup>(2)</sup> The annual average delivery capacity is limited to 49.1 mgd by existing system hydraulics and permit limits, which is projected to be exceeded in 2025.

<sup>(3)</sup> Future flows based on Hillsborough County projections

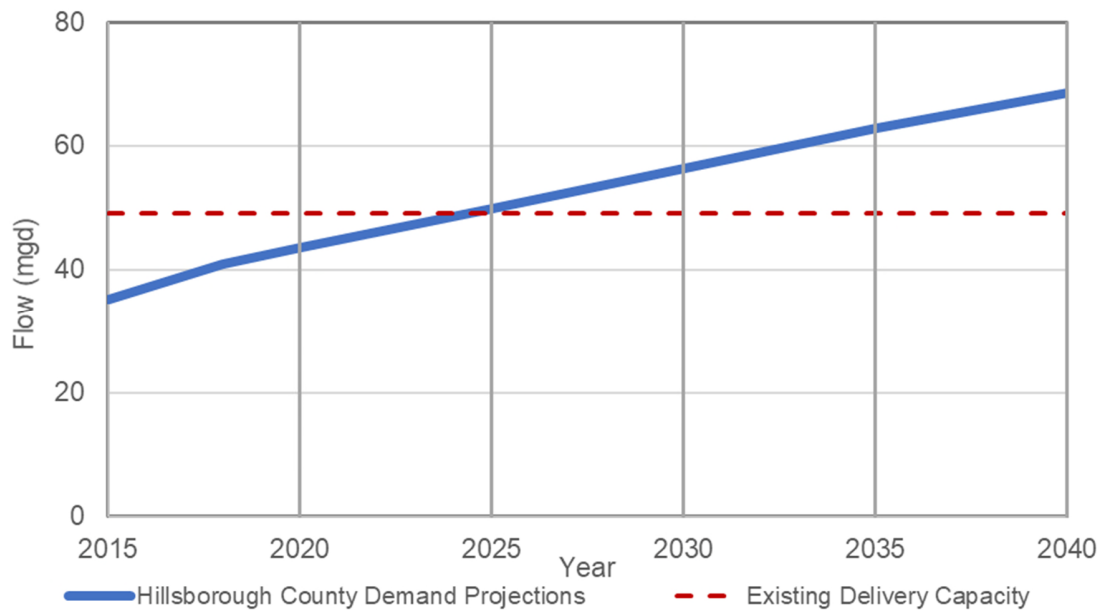


**Figure 7-1: Projected South Hillsborough County Annual Average Daily Flow**

## 7.1 Overview of South Hillsborough County Deficits and Supply Option Concepts

The south Hillsborough water demand production area is presently served by three points of connection with a total annual average delivery capacity of 49.1 mgd. The locations, supply sources and connection capacity limitations are listed in Table 7-2 below.

**Table 7-2: Existing Points of Connection in Hillsborough County to the Tampa Bay Water Regional System**

| POC Location                | Source of Supply                                                   | Capacity Limit                                             |                                                              |                                                             |
|-----------------------------|--------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|
|                             |                                                                    | Annual Average                                             | Max Month                                                    | Max Day                                                     |
| <b>Central Hillsborough</b> | Regional supply                                                    | 11 mgd based on current distribution piping configuration  | 13.75 mgd based on current distribution piping configuration | 17.6 mgd based on current distribution piping configuration |
| <b>Lithia Regional</b>      | Regional supply + treated Brandon Urban Dispersed Wellfield supply | Up to 14 mgd limited on HSPS pressure and on pipeline size | Up to 14.5 mgd limited on HSPS pressure and on pipeline size | 15 mgd limited on HSPS pressure and on pipeline size        |
| <b>Lithia Wellfield</b>     | South-central Hillsborough Regional Wellfield                      | 24.1 mgd annual average permit limit                       | 33.0 mgd peak month permit limit                             | 45.0 mgd max day demand permit limit                        |

Tampa Bay Water and Hillsborough County will have increasing difficulty meeting future demands with the existing supply and distribution delivery infrastructure. The existing three points of connection each have limitations on how much supply can be delivered and distributed, as described below.

The Central Hillsborough Point of Connection is located on Columbus Drive, adjacent to the Tampa Bay Water Regional Surface Water Treatment Plant. Tampa Bay Water could increase regional supply to this



location at the required pressure of 20 psig; however, the County's distribution system has hydraulic limitations due to the number and diameter of the pipelines that are routed from this facility. The maximum annual average supply this facility can deliver is 11.0 mgd and the peak day is 16.0 mgd. The facility is located at the far northwest portion of the service area and is approximately 20 miles from the future growth in the south Hillsborough County area. To increase delivery at this location, Hillsborough County would need to install at least a 20-mile, 36-inch diameter pipeline from this facility to the growth area and likely increase the capacity of the Central facility.

Regional supply is also delivered to the Lithia Water Treatment Facility via the Brandon Transmission Main. The Brandon Urban Dispersed Wellfield supply is also conveyed to the Lithia Regional Point of Connection by this pipeline. The existing delivery capacity is limited to 14 mgd by the diameter of the transmission mains and the pressure rating of the pipelines. The pipe route consists of 5.4 miles of 36-inch diameter pipeline, and 11.4 miles of 30-inch diameter pipeline. The design working pressure of the pipelines is 100 psi and the required delivery pressure is 20 psig. Either a parallel pipeline or booster station(s) on the existing pipeline would be needed to increase delivery of regional supply to the existing Lithia Regional Point of Connection.

The South-Central Hillsborough Regional Wellfield includes 17 production wells permitted for an average day supply of 24.1 mgd, a maximum monthly supply of 33.0 mgd, and a peak day supply of 45.0 mgd. Increasing supply from the South-Central Hillsborough Regional Wellfield would require a permit modification to allow additional pumping. In addition, the 2035 System Hydraulic and Emergency Scenario Analysis identified a failure of the South-Central Hillsborough Regional Wellfield Transmission Main as the largest risk in Tampa Bay Water's system for a pipeline failure. The other two points of connection could only deliver a combined 25 mgd of supply, resulting in a supply deficit of 16 mgd in the event of a pipeline failure, based on 2018 demands.

The existing delivery locations and infrastructure are not sufficient to meet future demands, thus requiring action on the part of Tampa Bay Water and/or Hillsborough County. Tampa Bay Water evaluated several options to deliver additional supply to the south Hillsborough County area, consistent with the requirements of the Master Water Supply Contract, including those that involve the existing points of connection, as well as new points of connection. Evaluated options included the following:

- Tampa Bay Water installing additional pumps or parallel piping to expand delivery of existing permitted regional supplies to existing delivery locations.
- Adding a new Point of Connection from the Tampa Bay Water Regional System to a new location within south Hillsborough County.
- Hillsborough County expanding its distribution system.
- Early completion of one of the potential water supply projects identified in Section 6: Groundwater Treatment Plant via Credits from Hillsborough County South Hillsborough Aquifer Recharge Project or Expansion (SHARP/SHARE). This project not only provides new supply to the region but because of its location, also satisfies the short-term needs in south Hillsborough County.

## 7.2 Potential Projects

Infrastructure improvement concepts were developed into potential projects by Hillsborough County and Tampa Bay Water staff, each with a scope, capital and operation/maintenance cost estimate, and delivery capacity based on hydraulic analysis by Tampa Bay Water and Hillsborough County. The potential projects and associated capacities are listed in Table 7-3.

**Table 7-3: Potential Projects to Provide Supply to South Hillsborough County**

| Project | Project Description                                       | Additional Capacity (mgd) |
|---------|-----------------------------------------------------------|---------------------------|
| 1       | Bloomingdale Booster Station                              | 5                         |
| 2       | Two Booster Stations (HSPS and Bloomingdale)              | 10                        |
| 3       | Parallel Transmission Main                                | 10                        |
| 4       | Direct feed from Desal Facility                           | 7.5                       |
| 5       | New regional feed pipeline to Balm                        | 25                        |
| 6       | New regional feed pipe to the South County Repump Station | 7.5                       |
| 7       | New distribution pipe to Ruskin area                      | 9                         |
| 8       | Aquifer Recharge with a new Balm Wellfield                | 7.5                       |

### 7.2.1 Project Overview

Graphical representations of the eight projects under consideration for the provision of addition supply to south Hillsborough County are provided in Figure 7-2 through Figure 7-9. The first three projects increase the potential flow through Tampa Bay Water’s existing Brandon Transmission Main to deliver more regional supply to the Lithia Regional Point of Connection:

- Project 1 includes the installation of a 20 mgd booster station in the Bloomingdale area, which could deliver an additional 5 million gallons per day. Hillsborough County would also have distribution system improvements.
- Project 2 includes the installation of two 25 mgd booster stations, one in Bloomingdale and one at the Regional Facilities Site. This project could provide up to 10 mgd of additional supply. Hillsborough County would also have distribution system improvements.
- Project 3 includes the installation of an 11-mile, 36-inch parallel pipeline to the Brandon Urban Dispersed Wells transmission main from the Intersection of Wheeler and Kingsway to the Lithia regional point of connection rather than a booster station. This project would increase the delivery capacity to the Lithia Regional Point of Connection by 10 million gallons per day. Hillsborough County would also have distribution system improvements.

Projects 4, 5, and 6 would deliver supply to new points of connection:

- Project 4 includes additional treatment improvements at the desalination facility to further stabilize water prior to distribution. Additional storage and separate 15 mgd pump station would be needed at the desalination facility, and a 15 mgd pump station would also be necessary at the Regional Facilities Site to pump supply south to the new point of connection when the desalination facility is seasonally offline. A 6.7 mile 36-inch diameter transmission main would route supply to Hillsborough County's South County Repump Facility. Project 4 provides up to 7.5 mgd to the County's South Repump Station directly from the desalination facility. Hillsborough County would also have distribution system improvements.
- Projects 5 include installing 20 miles of 42-inch transmission main from the Regional Facility Site to the Balm area, which could supply up to 25 mgd. Hillsborough County would also have storage, pumping and distribution system improvements.
- Project 6 includes the installation of approximately 20 miles of 36- to 42-inch diameter transmission main from the Regional Facility Site to the Existing South County Repump Facility and could supply up to 7.5 mgd. Hillsborough County would also have storage, pumping and distribution system improvements.
- Project 7 includes the expansion of Hillsborough County's distribution system from its Central Hillsborough Plant by installing 21 miles of 36-inch transmission main to convey an additional 9 mgd from its Central Water Treatment Facility to the Ruskin area.
- Project 8 is an early implementation of the groundwater treatment plant in the south Hillsborough County area based on credits from the South Hillsborough Aquifer Recharge Project/Expansion (SHARP/SHARE). The first phase of this project could provide an estimated 7.5 mgd of new supply to the south Hillsborough County area. This project includes a new supply wellfield, ozonation system for hydrogen sulfide removal, storage tanks and high service pumping. The injection wells would be owned and operated by Hillsborough County, and the County would also need storage, pumping and distribution system improvements.

Supply options for south Hillsborough County span those that include increased delivery to existing points of connection and those that involve a new point of connection. Section 10 of the Master Water Supply Contract addresses proposed changes to member government points of connection. Generally, points of connected can be added, deleted, or modified by mutual agreement between the parties. If a member government requests a new or modified point of connection, the member government is solely responsible for the cost. If Tampa Bay Water initiates a change or addition of a point of a connection, Tampa Bay Water is solely responsible for the cost. Also, as a practical matter, it has been the practice if there is mutual benefit to Tampa Bay Water and a member government to add or modify a point of connection, the parties can negotiate the responsibility for the cost and implementation.

- Projects 1, 2, and 3 would provide additional supply to the existing Lithia Regional Point of Connection. The Tampa Bay Water components of this project would be at the sole cost and responsibility of Tampa Bay Water. Hillsborough County would also have improvements that

it would have to make in its distribution system to increase supply from the Lithia Water Treatment Plant location.

- Projects 4, 5, 6 and 8 would all add new points of connection. Hillsborough County would benefit by having the new supply closer to the area of future growth, and Tampa Bay Water would benefit by not bearing the sole cost of implementing a project to increase flow to the Lithia Regional Point of Connection, which is the case for Projects 1, 2, and 3. Project 4 also requires additional treatment for the desalinated water to meet Master Water Supply Contract Exhibit D standards.
- Project 7 would provide additional supply to the Central Hillsborough Point of Connection, without any improvements to the existing point of connection or to Tampa Bay Water's System; however, like Projects 4, 5 and 6, Project 7 requires Hillsborough County and Tampa Bay Water to agree on the location of the new point of connection for the new supply.

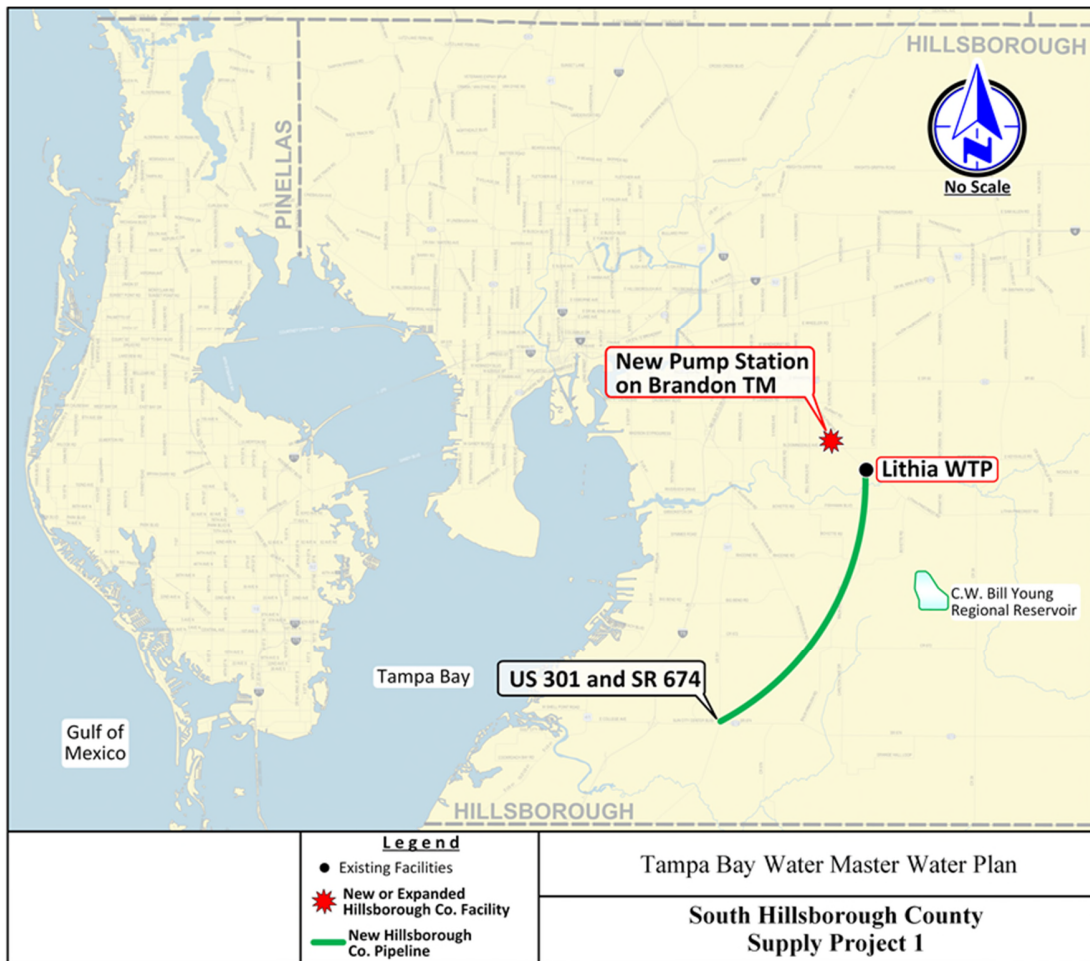


Figure 7-2: Schematic of South Hillsborough County Supply Project 1

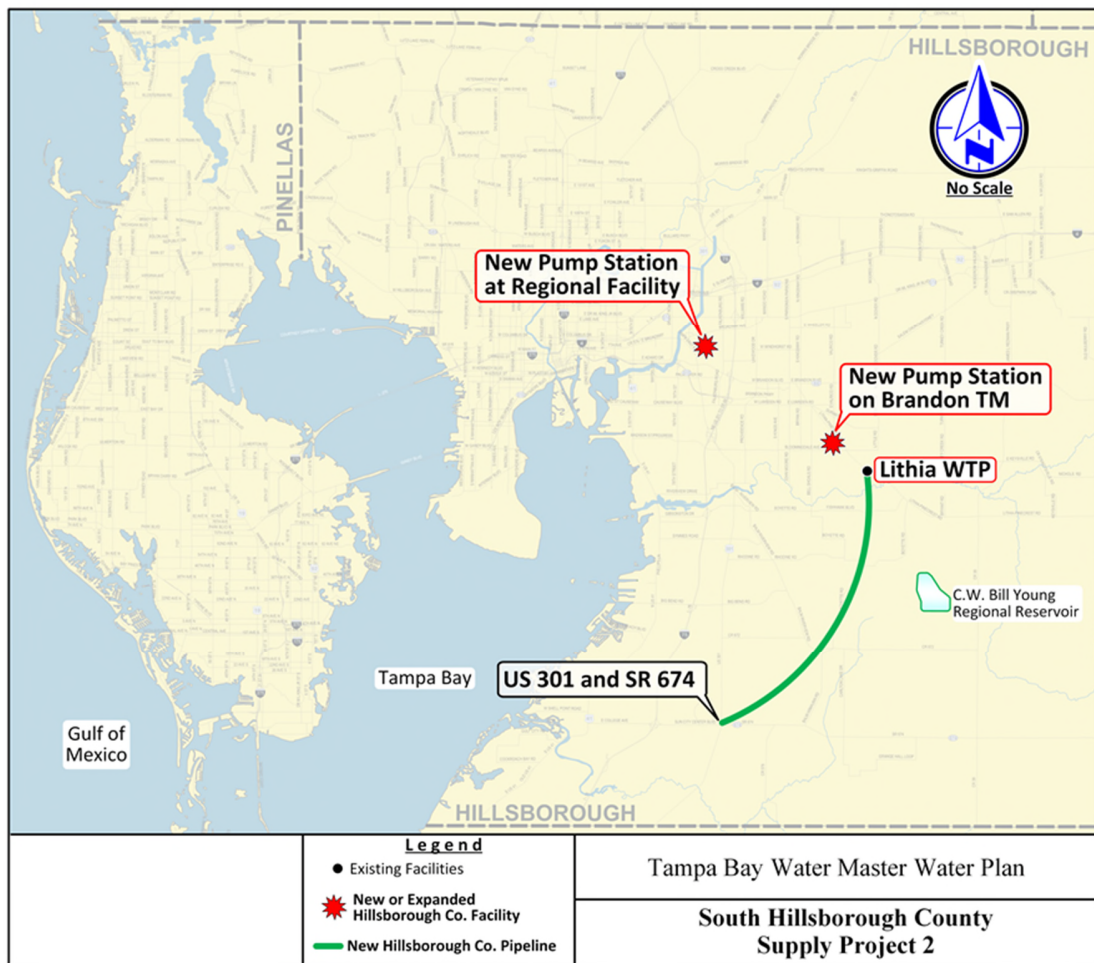


Figure 7-3: Schematic of South Hillsborough County Supply Project 2



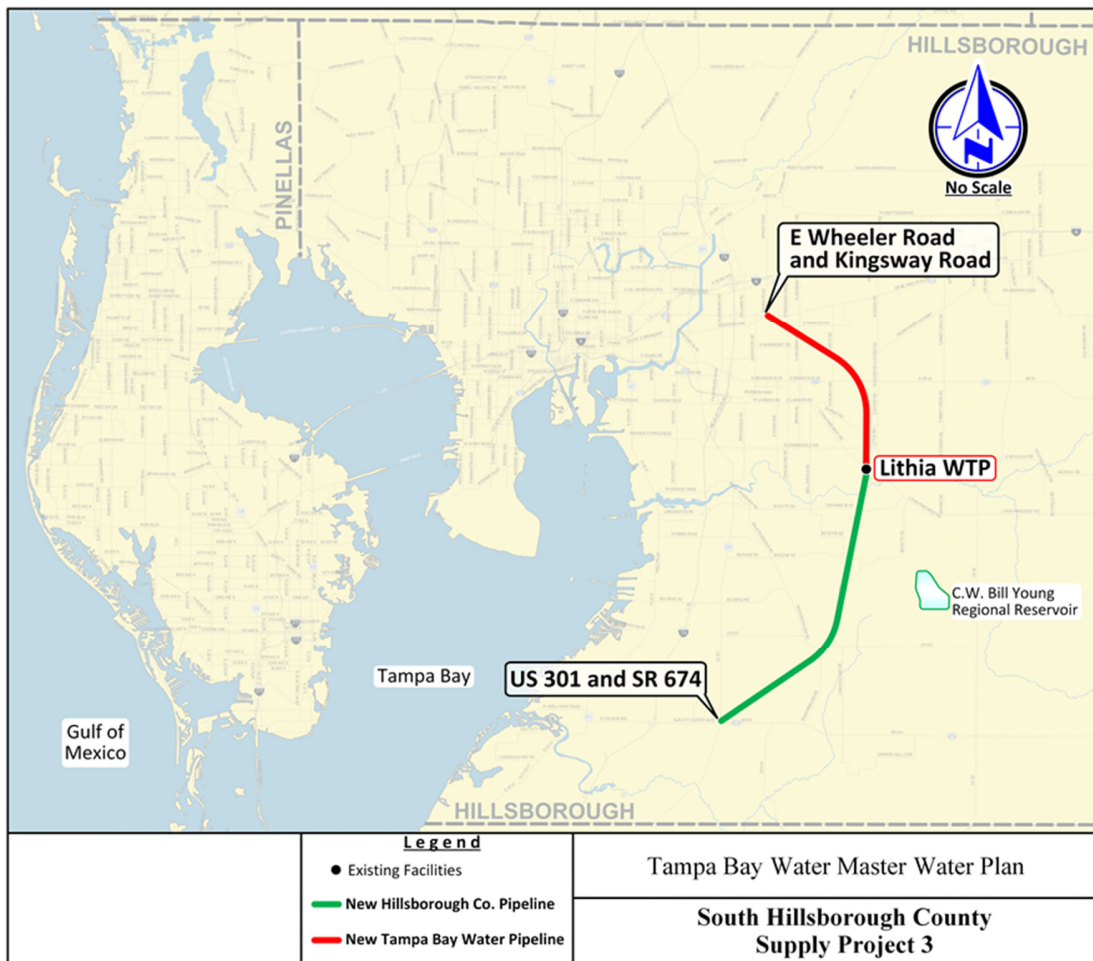


Figure 7-4: Schematic of South Hillsborough County Supply Project 3



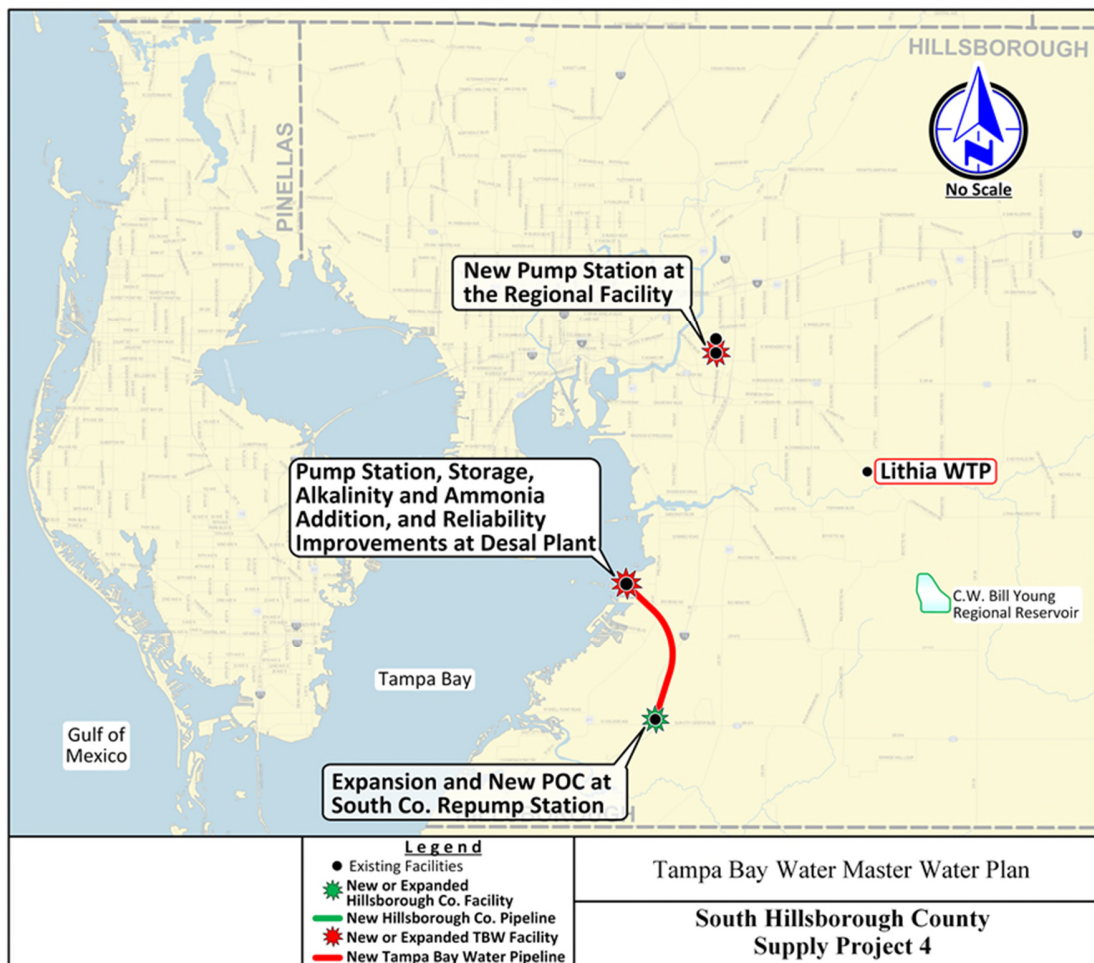


Figure 7-5: Schematic of South Hillsborough County Supply Project 4

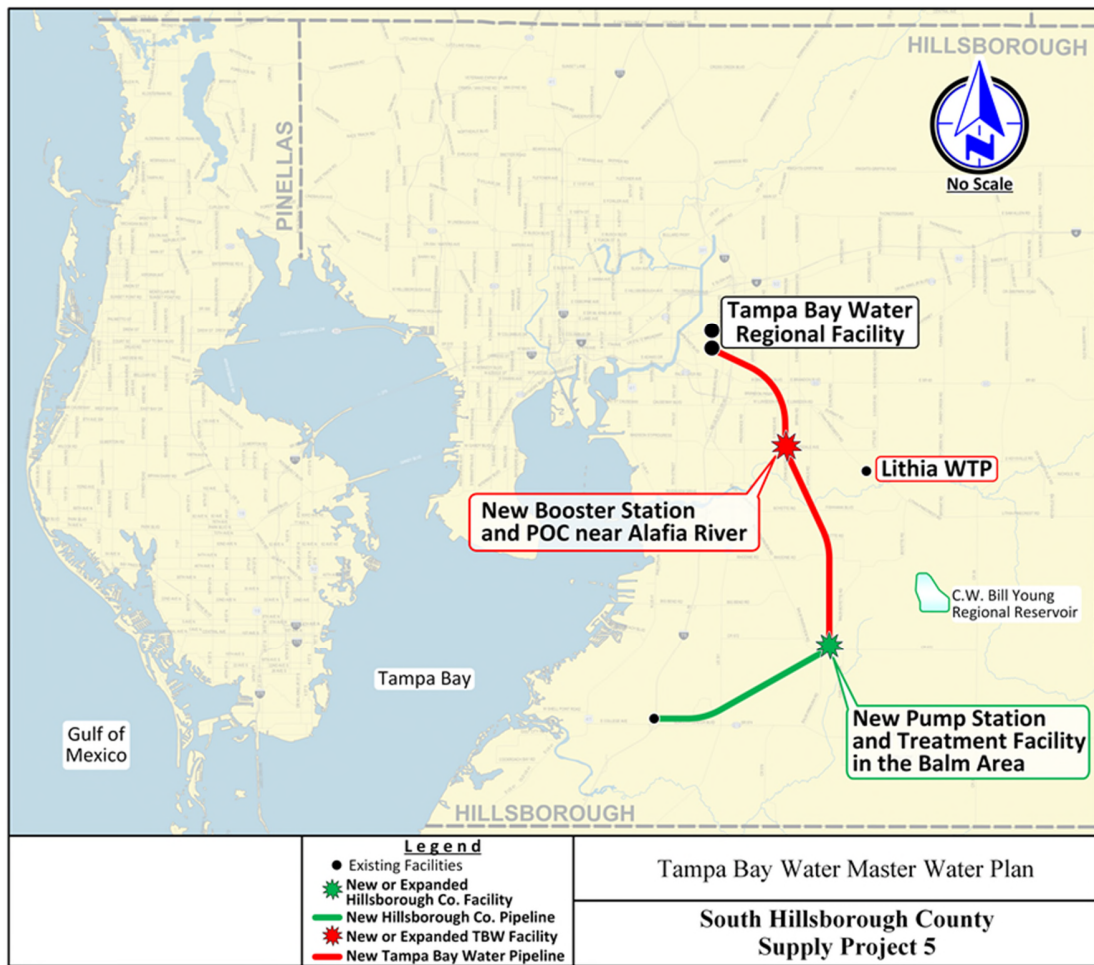


Figure 7-6: Schematic of South Hillsborough County Supply Project 5

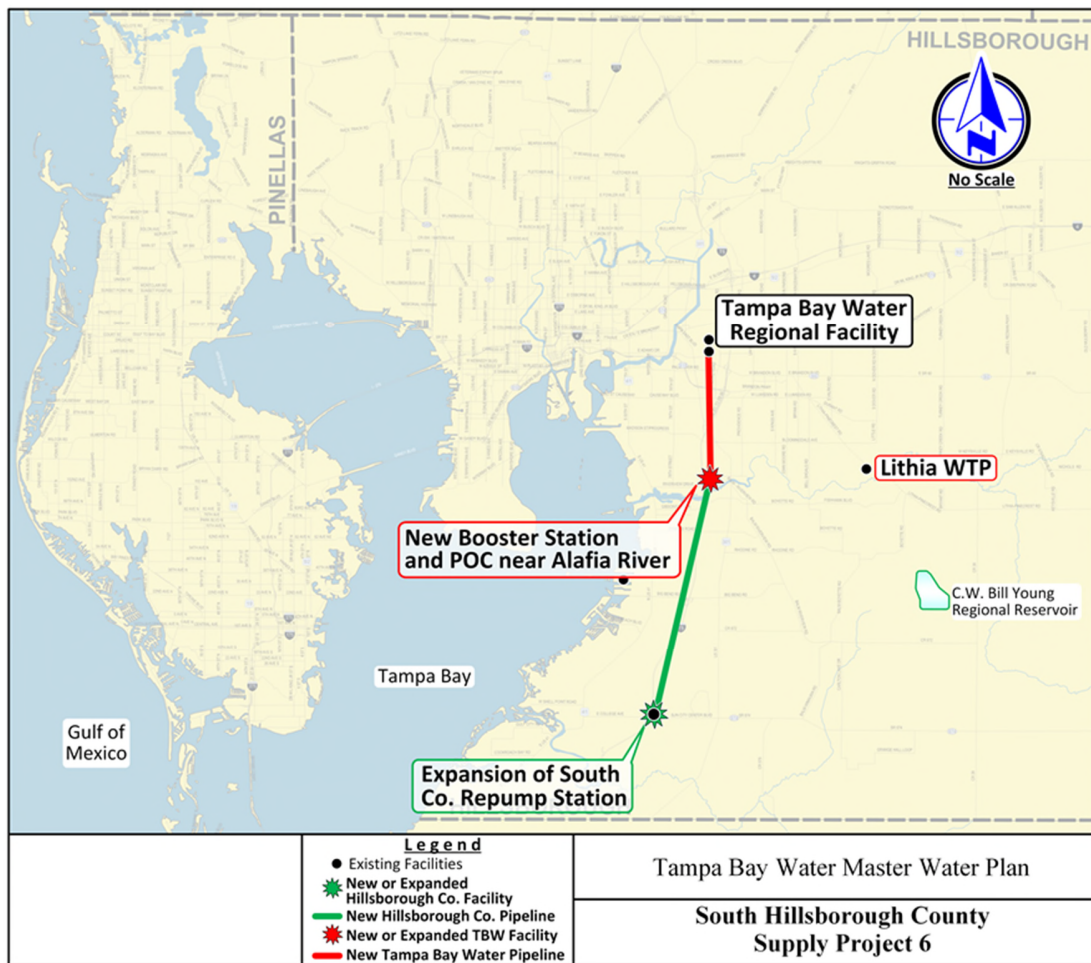


Figure 7-7: Schematic of South Hillsborough County Supply Project 6

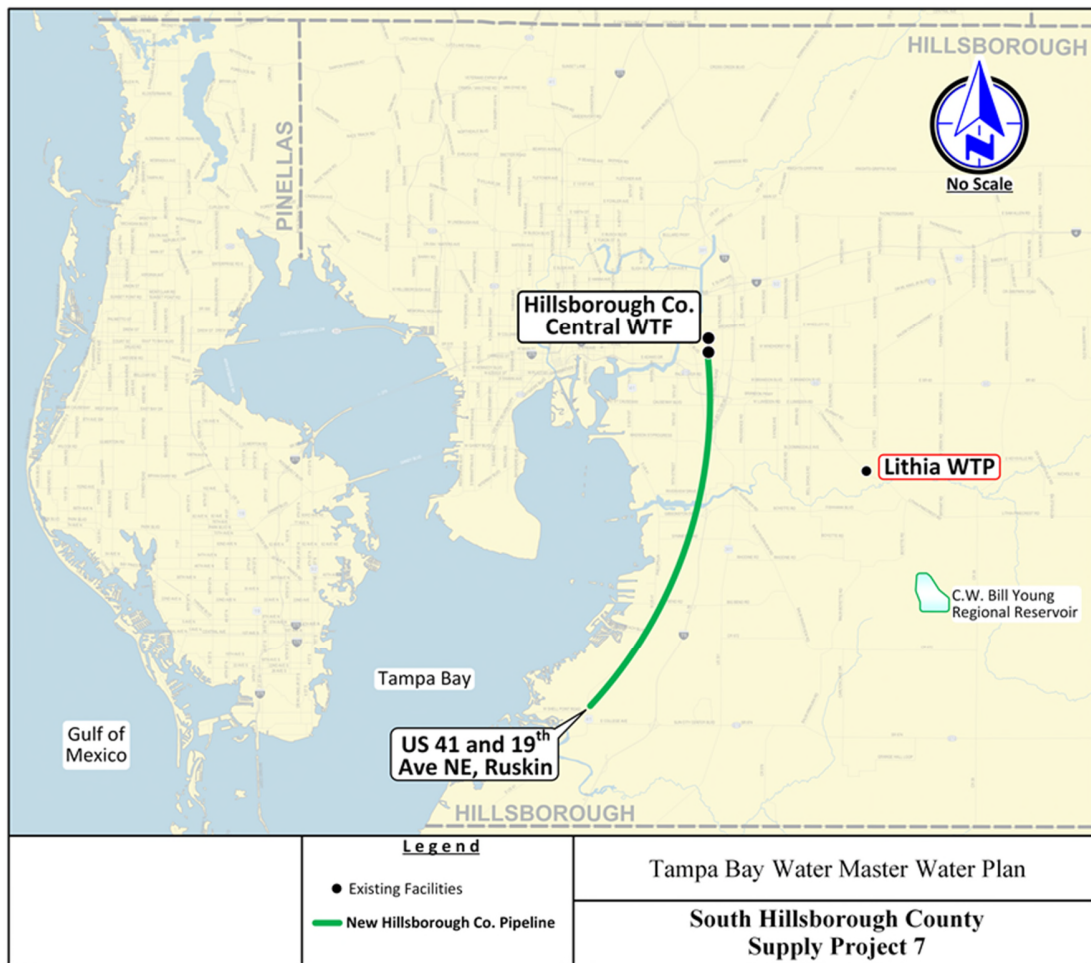


Figure 7-8: Schematic of South Hillsborough County Supply Project 7



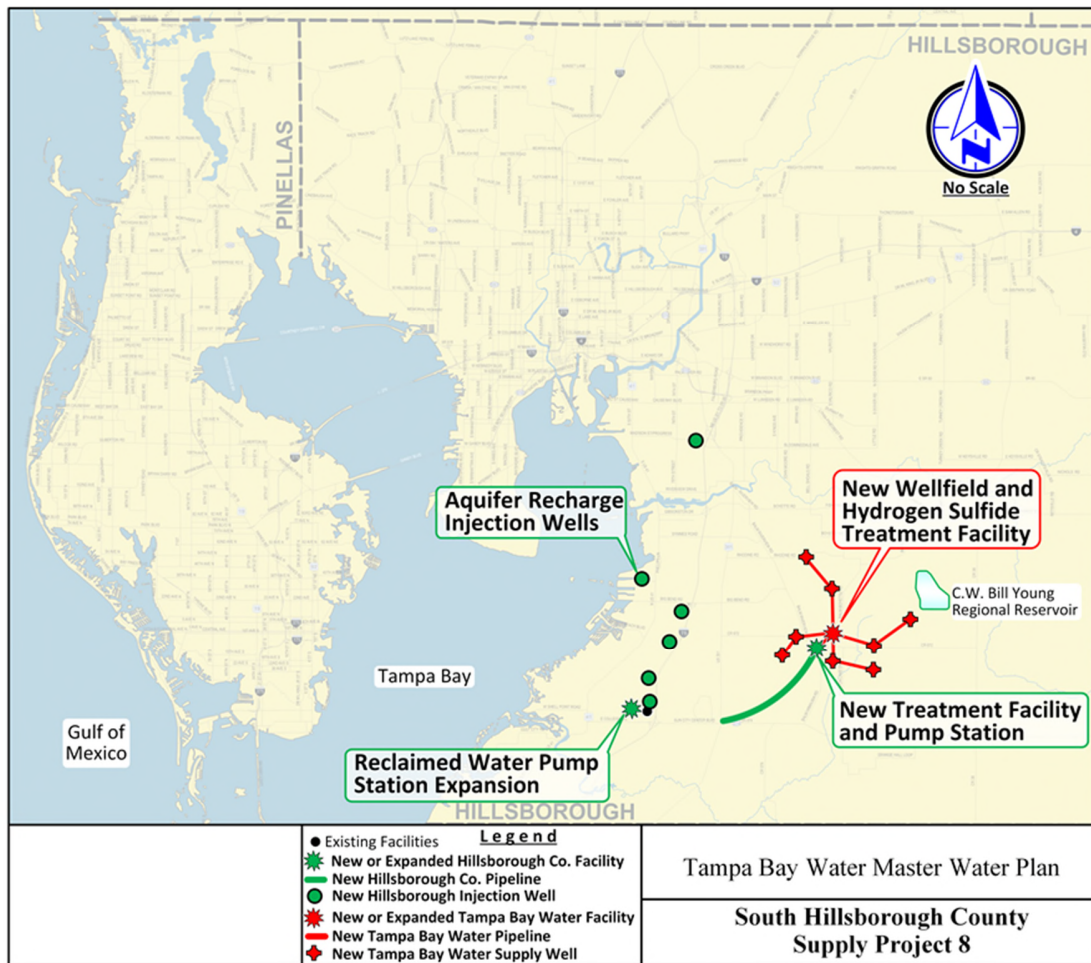


Figure 7-9: Schematic of South Hillsborough County Supply Project 8

### 7.2.2 Project Screening

The eight project concepts were compared and screened using the criteria and weightings shown in Table 7-4. Each criterion is further described in sub-sections below and a summary of the scoring is provided in Table 7-4.

**Table 7-4: Project Screening Evaluation Criteria and Weighting**

| Evaluation Criteria                      | Point Weight |
|------------------------------------------|--------------|
| Capital cost per unit of capacity        | 10           |
| Operation and maintenance cost           | 10           |
| Timeframe for another project            | 5            |
| Long-term Master Water Plan coordination | 3            |
| Reliability and redundancy               | 5            |
| Constructability                         | 3            |
| Operational complexity                   | 3            |

#### 7.2.2.1 Capital cost per Unit of Capacity

Planning level capital costs for the Hillsborough County and Tampa Bay Water components were estimated for each project to facilitate screening. These costs ranged from \$94 to \$181 million. Since the potential projects had different capacities, the capital cost was divided by the capacity for the scoring, which is summarized in Table 7-5.

**Table 7-5: Capital Cost per Unit Capacity Scoring**

|   | Project                                                   | Capital Cost (\$M)<br><sup>1</sup> | Additional Capacity (mgd) | Capital Cost/unit capacity (\$/gallon capacity) | Score |
|---|-----------------------------------------------------------|------------------------------------|---------------------------|-------------------------------------------------|-------|
| 1 | Bloomingdale Booster Station                              | \$94                               | 5                         | 19                                              | 3.6   |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | \$103                              | 10                        | 10                                              | 8.3   |
| 3 | Parallel Transmission Main                                | \$130                              | 10                        | 13                                              | 6.8   |
| 4 | Direct feed from Desal Facility                           | \$176                              | 7.5                       | 23                                              | 1.0   |
| 5 | New regional feed pipeline to Balm                        | \$181                              | 25                        | 7                                               | 10    |
| 6 | New regional feed pipe to the South County Repump Station | \$119                              | 7.5                       | 16                                              | 5.2   |
| 7 | New distribution pipe to Ruskin area                      | \$98                               | 9                         | 11                                              | 8.0   |
| 8 | Aquifer Recharge with a new Balm Wellfield                | \$114                              | 7.5                       | 15                                              | 5.6   |

<sup>(1)</sup> Capital cost for Tampa Bay Water and Hillsborough County infrastructure components

#### 7.2.2.2 *Operation and Maintenance Cost*

The Tampa Bay Water operation and maintenance costs for each project concept were estimated for the entire supply capacity to the south Hillsborough County water demand planning area for a projected 10-year period. These costs included pipeline maintenance, labor, chemical and energy costs at facilities that would be owned and operated by Tampa Bay Water. The estimated operation and maintenance cost for Project 8 do not include an O&M cost for operating the injection wells, or payment to Hillsborough County for the groundwater credits. A financial study conducted by Raftelis in 2017 concluded that the credits may be valued at a cost up to \$0.98 per 1000 gallons. The range of costs for the various projects was \$0.79 to \$1.19 per 1,000 gallons as summarized in 7-6. These costs should be gauged against the variable portion of the Uniform Rate, which is currently \$.3988 per 1000 gallons.

**Table 7-6: Operation and Maintenance Cost Scoring**

|          | <b>Project</b>                                            | <b>O&amp;M Cost<br/>(\$/1000 gallons)</b> | <b>Score</b> |
|----------|-----------------------------------------------------------|-------------------------------------------|--------------|
| <b>1</b> | Bloomingdale Booster Station                              | \$0.99                                    | 5.5          |
| <b>2</b> | Two Booster Stations (HSPS and Bloomingdale)              | \$1.02                                    | 4.7          |
| <b>3</b> | Parallel Transmission Main                                | \$0.96                                    | 6.1          |
| <b>4</b> | Direct feed from Desal Facility                           | \$1.19                                    | 1.0          |
| <b>5</b> | New regional feed pipeline to Balm                        | \$1.08                                    | 3.4          |
| <b>6</b> | New regional feed pipe to the South County Repump Station | \$1.01                                    | 5.0          |
| <b>7</b> | New distribution pipe to Ruskin area                      | \$1.01                                    | 5.1          |
| <b>8</b> | Aquifer Recharge with a new Balm Wellfield                | \$0.79 <sup>1</sup>                       | 10.0         |

<sup>(1)</sup> O&M cost for Project 8 do not include payment to Hillsborough County for the aquifer recharge credits.

#### 7.2.2.3 *Timeframe for Another Project*

Population growth is projected to continue in south Hillsborough County for many years into the future. All projects, except for Project 5 (new regional feed pipeline to Balm), would require additional supply expansion prior to the year 2040. This criterion considered the timeframe that another project would need to be completed beyond the year 2025, which ranged from as early as 4 years or as late as 15 years as summarized in Table 7-7.



**Table 7-7: Timeframe for Another Project Scoring**

|   | Project                                                   | Year Another Project Needed | Years beyond 2025 | Score |
|---|-----------------------------------------------------------|-----------------------------|-------------------|-------|
| 1 | Bloomingdale Booster Station                              | 2029                        | 4                 | 1.0   |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 2033                        | 8                 | 2.5   |
| 3 | Parallel Transmission Main                                | 2033                        | 8                 | 2.5   |
| 4 | Direct feed from Desal Facility                           | 2031                        | 6                 | 1.7   |
| 5 | New regional feed pipeline to Balm                        | 2040                        | 15                | 5.0   |
| 6 | New regional feed pipe to the South County Repump Station | 2031                        | 6                 | 1.7   |
| 7 | New distribution pipe to Ruskin area                      | 2032                        | 7                 | 2.1   |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 2031                        | 6                 | 1.7   |

#### 7.2.2.4 Long-term Master Water Plan Coordination

Compatibility with Tampa Bay Water’s Long-term Master Water Plan efforts were evaluated to assess whether the various project concepts would still be useful and cost effective when the long-term supply expansion projects are built. The following four categories were scored for each of the south Hillsborough County projects versus the long-term supply expansion projects:

- Viability – Will the Project still be fully utilized when the long-term supply expansion project is built.
- Lost Cost – Is there a potential for lost cost of the Project Components that would no longer be needed when the long-term supply expansion is completed.
- Sufficiency – Will the combined project and long-term supply expansion be enough to meet south Hillsborough County’s long-term demand increases.
- Additional Cost – Will the project require additional cost to be added to the long-term supply expansion.

The scoring is summarized in Table 7-8.

**Table 7-8: Long-term Master Water Plan Coordination Scoring**

|   | Project                                                   | Viability | Lost Cost | Sufficiency | Cost Impact | Total | Score |
|---|-----------------------------------------------------------|-----------|-----------|-------------|-------------|-------|-------|
| 1 | Bloomingdale Booster Station                              | 0.6       | 0.1       | 0.9         | -1.0        | 0.6   | 1.3   |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 0.8       | 0.9       | 0.9         | -1.0        | 1.5   | 2.0   |
| 3 | Parallel Transmission Main                                | 0.9       | 0.5       | 0.9         | -2.0        | 0.3   | 1.0   |
| 4 | Direct feed from Desal Facility                           | 1.1       | 1.1       | 1.6         | -1.0        | 2.9   | 3.0   |
| 5 | New regional feed pipeline to Balm                        | 0.9       | -0.1      | 1.6         | -1.9        | 0.5   | 1.2   |
| 6 | New regional feed pipe to the South County Repump Station | 0.9       | 0.5       | 1.6         | -1.8        | 1.3   | 1.8   |
| 7 | New distribution pipe to Ruskin area                      | 0.9       | 0.3       | 1.6         | -1.6        | 1.1   | 1.7   |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 1.0       | 0.6       | 0.9         | -0.3        | 2.3   | 2.5   |

#### 7.2.2.5 Reliability and Redundancy

This category evaluated whether the project concepts would provide redundancy of supply, potential impacts for major infrastructure failures or reliance on existing facilities. These scores are summarized in Table 7-9.

**Table 7-9: Reliability and Redundancy Scoring**

|   | Project                                                   | Score |
|---|-----------------------------------------------------------|-------|
| 1 | Bloomingdale Booster Station                              | 1     |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 1     |
| 3 | Parallel Transmission Main                                | 2     |
| 4 | Direct feed from Desal Facility                           | 2     |
| 5 | New regional feed pipeline to Balm                        | 5     |
| 6 | New regional feed pipe to the South County Repump Station | 4     |
| 7 | New distribution pipe to Ruskin area                      | 3     |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 4     |

#### 7.2.2.6 Constructability

Constructability was evaluated based on the difficulty to construct the various projects and potential risks. This included considerations for public impacts. The proportion the capital cost estimate for each project component were scored based on the constructability values listed in Table 7-10.

**Table 7-10: Constructability Values Weighting for Project Components**

| Project Components                                          | Constructability Value Weighting |
|-------------------------------------------------------------|----------------------------------|
| Open Cut Pipeline                                           | 5                                |
| Major Road Crossing Pipeline (up to 30-inch diameter)       | 2                                |
| Major Road Crossing Pipeline (36-inch diameter and greater) | 1                                |
| Storage Tanks                                               | 5                                |
| Pump Station                                                | 4                                |
| Treatment Plant (not Desal)                                 | 3                                |
| Desal Treatment Plant                                       | 2                                |
| Injection Well                                              | 3                                |
| Extraction Well                                             | 4                                |
| Property Acquisition                                        | 4                                |

The total calculated constructability value and the scores are summarized in Table 7-11.

**Table 7-11: Constructability Scoring**

|   | Project                                                   | Total Constructability Value | Score |
|---|-----------------------------------------------------------|------------------------------|-------|
| 1 | Bloomingdale Booster Station                              | 4.2                          | 2.7   |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 4.2                          | 2.7   |
| 3 | Parallel Transmission Main                                | 4.4                          | 2.9   |
| 4 | Direct feed from Desal Facility                           | 2.7                          | 1.0   |
| 5 | New regional feed pipeline to Balm                        | 4.5                          | 3.0   |
| 6 | New regional feed pipe to the South County Repump Station | 4.1                          | 2.6   |
| 7 | New distribution pipe to Ruskin area                      | 4.1                          | 2.6   |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 3.9                          | 2.4   |

#### 7.2.2.7 Operational Complexity

The complexity of the various project concepts to operate and maintain was considered as part of the Operational Complexity criterion. This was based on the type of treatment and integration of the project to the existing system. The proportion the operation and maintenance costs estimated were multiplied by operational complexity values listed in Table 7-12.

**Table 7-12: Operational Complexity Values Weighting**

| Project Components                | Operational Complexity Value Weighting |
|-----------------------------------|----------------------------------------|
| New Pipeline                      | 5                                      |
| Pump Station                      | 4                                      |
| Surface Water Treatment           | 3                                      |
| Desalination Treatment            | 1                                      |
| Full Disinfection                 | 3                                      |
| Disinfectant Trim                 | 4                                      |
| Ozone Hydrogen Sulfide Removal    | 3                                      |
| Fluoride/Corrosion Inhibitor Trim | 3                                      |
| Additional Alkalinity Adjustment  | 4                                      |
| Wellfield                         | 4                                      |

The total calculated operational complexity value and score are summarized in Table 7-13.

**Table 7-13: Operational Complexity Scoring**

|   | Project                                                   | Total Operational Complexity Value | Score |
|---|-----------------------------------------------------------|------------------------------------|-------|
| 1 | Bloomingdale Booster Station                              | 2.82                               | 2.9   |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 2.85                               | 3.0   |
| 3 | Parallel Transmission Main                                | 2.79                               | 2.8   |
| 4 | Direct feed from Desal Facility                           | 2.29                               | 1.0   |
| 5 | New regional feed pipeline to Balm                        | 2.81                               | 2.9   |
| 6 | New regional feed pipe to the South County Repump Station | 2.80                               | 2.8   |
| 7 | New distribution pipe to Ruskin area                      | 2.77                               | 2.7   |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 2.83                               | 2.9   |

A summary of the project scoring for all the scoring criteria is shown in Table 7-14; lower scoring projects are less favorable.

Table 7-14: Project Scoring Summary

|   | Project                                                   | Capital Cost per Unit of Capacity | O&M Cost | Timeframe for Another Project | LTMWP Co-ordination | Reliability and Redundancy | Construct-ability | Operational Complexity | Total |
|---|-----------------------------------------------------------|-----------------------------------|----------|-------------------------------|---------------------|----------------------------|-------------------|------------------------|-------|
| 1 | Bloomingdale Booster Station                              | 3.6                               | 5.5      | 1.0                           | 1.3                 | 1                          | 2.7               | 2.9                    | 18.0  |
| 2 | Two Booster Stations (HSPS and Bloomingdale)              | 8.3                               | 4.7      | 2.5                           | 2.0                 | 1                          | 2.7               | 3.0                    | 24.2  |
| 3 | Parallel Transmission Main                                | 6.8                               | 6.1      | 2.5                           | 1.0                 | 2                          | 2.9               | 2.8                    | 24.1  |
| 4 | Direct feed from Desal Facility                           | 1.0                               | 1.0      | 1.7                           | 3.0                 | 2                          | 1.0               | 1.0                    | 10.7  |
| 5 | New regional feed pipeline to Balm                        | 10.0                              | 3.4      | 5.0                           | 1.2                 | 5                          | 3.0               | 2.9                    | 30.5  |
| 6 | New regional feed pipe to the South County Repump Station | 5.2                               | 5.0      | 1.7                           | 1.8                 | 4                          | 2.6               | 2.8                    | 23.1  |
| 7 | New distribution pipe to Ruskin area                      | 8.0                               | 5.1      | 2.1                           | 1.7                 | 3                          | 2.6               | 2.7                    | 25.2  |
| 8 | Aquifer Recharge with a new Balm Wellfield                | 5.6                               | 10.0     | 1.7                           | 2.5                 | 4                          | 2.4               | 2.9                    | 29.1  |

### 7.2.3 Recommended Projects for Detailed Assessment

Project 5, delivery of existing regional supply to a new Point of Connection in Balm area; and Project 8, the early implementation of the groundwater treatment plant via credits from SHARP/SHARE, are the two highest scoring projects. Both projects have the benefit of delivering the supply directly to the growth area. The new regional Point of Connection in the Balm area has the benefit of having the most delivery capacity (up to 25 mgd), but it also has a high initial capital cost. The new groundwater treatment plant via SHARP/SHARE can initially provide an estimated 7.5 mgd but could be phased over time and expanded as demands increase. This project also has the benefit of developing new supply but may be a challenge due to regulatory uncertainty.

### 7.3 Incorporation of Recommended Projects into Master Water Plan

In April 2018, Tampa Bay Water staff presented to the Tampa Bay Water board the intent of pursuing both Projects 5 and 8. Since Project 8 not only addresses the supply needs in south Hillsborough County but also increases the regional supply, the Board directed Tampa Bay Water to incorporate these projects within the Long-term Master Water Plan for evaluation as part of the other supply concepts. Section 15 discusses how these projects will be incorporated into various water supply concepts to meet both the regional water supply needs and the needs of south Hillsborough County. Tampa Bay Water will

continue to evaluate both south Hillsborough County projects in parallel as part of the Capital Improvement Program until a final decision is made by February 2020 on which project with which to proceed. This is discussed further in the Implementation Section of this report, Section 22. Initial tasks include finalizing a Memorandum of Understanding with Hillsborough County, that will include a negotiated a rate for the aquifer recharge credits, completing a pipeline route study, and installing a test production well.

## 8. System wide Reliability and Future Needs

Tampa Bay Water has diverse sources of supply and associated integrated infrastructure system. This includes a surface water treatment plant with permitted capacity of 120 mgd, three permitted surface water withdrawal intakes, a seawater desalination plant with permitted capacity of 28.75 mgd, a 15.5-billion-gallon storage reservoir, 120.1 mgd of average annual permitted groundwater production, and several groundwater treatment plants and booster stations. Tampa Bay Water delivers potable water to its member governments at 20 points of connection in daily quantities ranging from approximately 130 mgd to over 270 mgd. The Agency's aggregate permitted capacity is 269.85 million gallons per day. However, the aggregate permitted capacity does not reflect the total reliable supply available at any one time for two reasons: 1) aggregated infrastructure capacity based on maximum design capacities for the regional surface water treatment plant and seawater desalination treatment plant are not achievable over a sustained period of time; 2) permitted surface water availability can vary greatly from month to month and from year to year depending on the amount of rainfall the region receives. In addition, operating protocols and source water quality issues can reduce available supplies. This section summarizes the approach used to assess the required future water supply needs and the potential yield of each water supply project identified in Section 6, which considers the overall availability and reliability of the existing and future sources.

Figure 8-1 shows the existing permitted capacity, sustainable yield and hydrologic dry supply lines for the Agency's existing system. For this five-year cycle of the LTMWP, it is estimated that new sources of supply will be needed by the 2028 timeframe, as indicated by the surpassing of the hydrologic dry supply line by the projected Tampa Bay Water delivery for water supply planning. Tampa Bay Water's Board of Directors approved the updated Water Shortage Mitigation Plan (WSMP) in April 2017. The WSMP allows Tampa Bay Water to apply adaptive management techniques for both demand management and supply utilization during pending water shortage conditions. Implementation of the WSMP provides Tampa Bay Water a way to meet demands during short term extreme events without new supply capacity. A summary of how the WSMP is implemented is provided in Section 5.



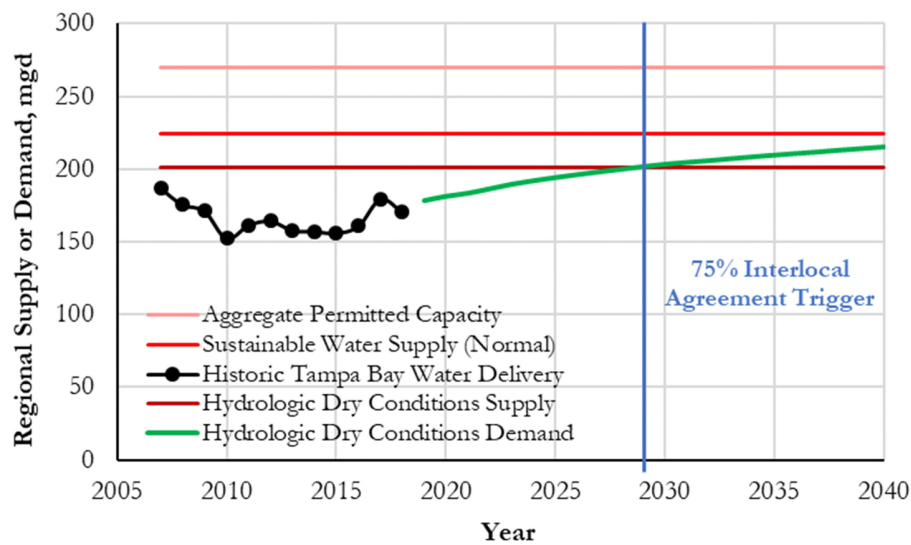


Figure 8-1: Historic and Projected Regional Tampa Bay Water Demands as Compared with Available Supplies

## 8.1 Regional System Performance Evaluation Model

The reliability and resiliency of the Agency’s supply and delivery system underlie its efforts to meet water needs both now and in the future and set expectations for a dependable water supply under varying hydrologic conditions. Tampa Bay Water has developed a coupled simulation – optimization model of the entire regional water supply and delivery system known as the Regional Performance Evaluation Model (RPEM). The RPEM includes all the water supply sources and facilities, and water demands of Tampa Bay Water and its member governments including the City of Tampa.

The current model includes Tampa Bay Water’s 13 groundwater wellfields and the ability to distribute groundwater production among Consolidated Wellfields and wells using Tampa Bay Water’s Optimized Regional Operations Plan (OROP). OROP is a real-time decision support tool that the Agency uses as part of water supply management programs and compliance with the Consolidated Water Use Permit. It combines source availability, demand, and infrastructure sustainable capacity and constraints to guide groundwater production while protecting the environment. In addition, the current RPEM includes surface water simulation models, operational simulation model, probabilistic daily demands by points of connection for existing and future projected demand scenarios, operational protocols, source utilization priorities and protocols, and the Optimized Regional Operations Plan. Figure 8-2 provides a schematic view of the model. A detailed description of the model including operating protocols and system constraints is provided in Appendix 8A.

Establishing the reliability (reliable yield) of the current regional system under varying hydrologic conditions is one of the primary objectives of this model. Implementation of the WSMP is not explicitly included in the RPEM, however, the model simulations do include periods of drought which would trigger the WSMP. In Section 5, information is provided regarding how implementation of the WSMP may extend Tampa Bay Water’s supplies during drought periods. In addition, this model is used to

evaluate how system reliability may change when new water supply facilities are added or when modifications to operational protocols and water use permits occur. Results from the RPEM were used to evaluate changes in reliability and performance for different potential water supply project concepts as part of this Long-term Master Water Plan Update. The planning horizon for this update is 2040.

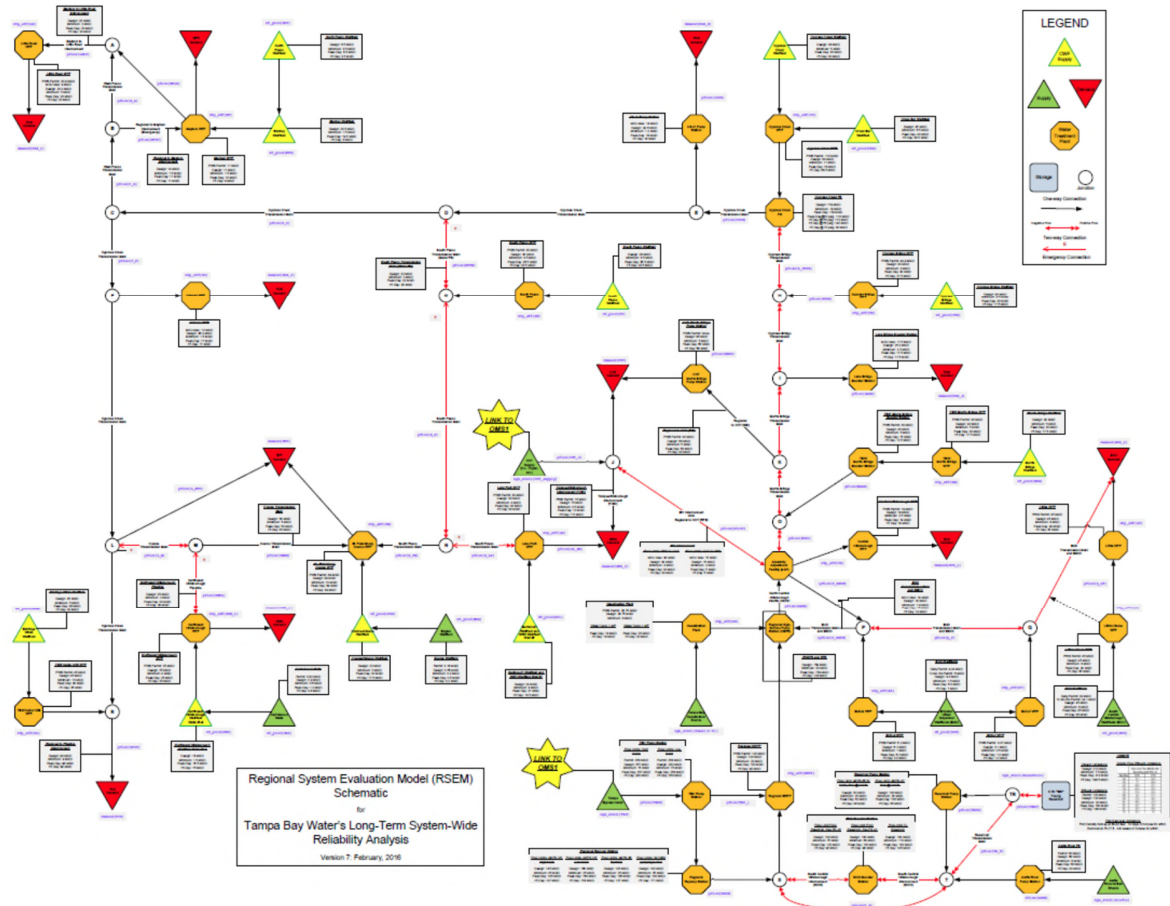


Figure 8-2: Regional Performance Evaluation Model

### 8.1.1 Overview of Modeling Setup

The RPEM requires inputs in the form of daily demands at each of the 20 potable points of connection and daily stream flows for all the surface water sources to evaluate system performance. The model includes all the operational information needed to route water from sources of supply, through treatment and pumping stations, and deliver the required quantities at the points of connection. The model runs at a daily time step. To evaluate the LTMWP project concepts, a simulation time of 20 years was used for each model run using daily time steps.

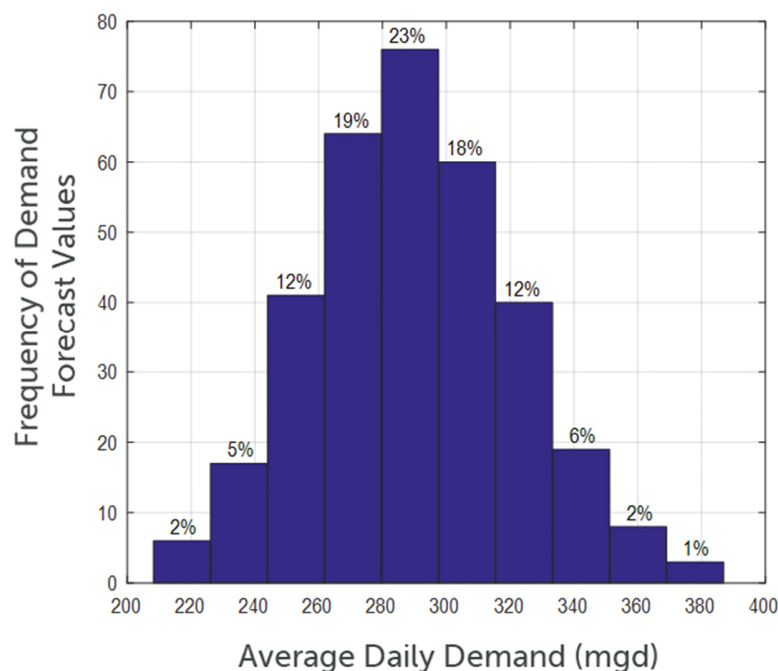
One of the benefits of the model is that it can simulate many scenarios during one set of simulations to evaluate a range of demand under various hydrologic conditions. Detailed descriptions of development of probabilistic demand time series and stochastic stream flow timeseries are provided in Appendix 8A. A summary is provided in the next section.

#### 8.1.1.1 Demand Projections and Supply Simulation

Probabilistic future water demands for each member government were projected for the year 2040. Development of the probabilistic demand forecasts for 2040 is described in Appendix 8A. Figure 8-3 shows the distribution of this regional demand. In Figure 8-3, the x-axis presents blocks of demand forecasts with 200 mgd to 400 mgd. The y-axis refers to how many demand forecast values (count) fell within each blocks of demand forecast shown on the x-axis.

**Figure 8-3: Range of Regional 2040 Demands in Millions of Gallons per Day (mgd)**

As shown in Figure 8-3 there is an 84% chance that the demand of all of Tampa Bay Water's member governments in 2040 on average would be between 250 and 330 mgd (12% + 19% + 23% + 18% +



12%), with a median demand of 289 mgd. This includes future water demand for the City of Tampa.

As described in Appendix 8A, one thousand flow simulations each 100-years long were generated to provide the surface water supplies. Only the first 22-years of the supply-side simulations were used in this Long-term Master Water Plan update to match the 22-year demand simulations. This allows the evaluations of a range of demands with varying hydrologic conditions that have been experienced historically in the Tampa Bay region.

### **8.1.2 Model Setup – Concept of Realization and Latin Hyper Cube Sampling**

The probabilistic demands generate one thousand demand simulations representing the range of 2040 socio-economic conditions. The stochastic supply simulations generate one thousand stream flow simulations representing plausible future supply conditions in the Tampa Bay area. Each of these plausible future scenarios is called a realization. Each realization is equally likely to happen as any other realization. This results in one million possible future demand and supply scenarios. Evaluating one million scenarios is not tractable and is not necessarily needed. Instead, a Latin Hypercube resampling scheme was used to limit the number of representative realizations needed. Details of the Latin Hypercube resampling technique are provided in Appendix 8A. Using the Latin Hypercube technique, the number of realizations was reduced to 334, which is sufficient to cover the full range of demand and supply possibilities.

The LTMWP project concepts were then subjected to the full 334-realizations of demand-supply pair. This allowed each new project concept to be evaluated over the full range of demand scenarios with varying hydrologic conditions that represent historic hydrologic conditions in the Tampa Bay region.

### **8.1.3 Simulation Optimization Approach**

Tampa Bay Water's Regional Performance Evaluation Model is built as a simulation-optimization application. This approach is described in more detail in Appendix 8A. At each daily time step, the simulation model uses an initial condition, gets forecasted supply information and calculates supply availability. The availability of supply from different sources is estimated based on operational protocols and permit conditions. Once the supply availabilities are known, the optimization model then runs with an objective of meeting all demands at the delivery points, using all available sources (groundwater, surface water and desalinated seawater) at that daily time step. The simulation model waits until the optimization is complete for the current time step to receive updated initial conditions.

The regional demand must be met at a given time step for the optimization to progress into the next time step. Once the optimization model meets the demand it will note what sources and how much of the available supply was used and pass this information to the simulation model with the final supply that was used to meet demands at that time step. The simulation model then updates the initial condition based on what was used by the system and progresses to the next time step. In the next time step, the model will use prior day information and supply forecasts and calculate supply availability and pass that information to the optimization model. This process continues until time step 7,304 is reached (20 years). This process is then repeated for all 334 realizations of unique demand-supply pairs. This completes the model run for a given LTMWP project concept.

Optimization modeling requires that a solution is feasible. As demands get higher or system constraints exists then a feasible solution may not be possible. A technique referred to as "slack variables," is used (see Appendix 8A) which allows the model to reach a feasible solution and keep track of the problem areas. Analyzing this information aids in identifying where additional supplies and infrastructure improvements are needed to meet the 2040 demands.

#### **8.1.4 Methodology for Calculation Project Yield Results**

All LTMWP project concept analyses are conducted using 334 realizations which are unique demand-supply scenarios over a 20-year simulation period. Each realization represents a different demand-rainfall relationship covering all conditions from very high projected demand for the year 2040 and wet and dry conditions to very low projected demands and wet and dry hydrologic conditions. The 334 realizations allow for a range of demands from 211 mgd to 387 mgd to be evaluated.

For each 20-year simulated period, the runs are classified as either successful or not successful. A successful realization either meets all system demand for each day of the realization or is allowed to not meet demand for up to 14 continuous days. Tampa Bay Water's operational experience has shown it can meet very high demands for short periods of time (e.g. up to 14 days) without violating permits or operational constraints. A not successful realization is one where demands are not met for 365 continuous days or longer. For those realizations in which demand is not met for a more than 15 continuous days but less than 365 days, the period when demand is not met is excluded from the average demand calculation for that realization. However, these realizations are still considered successful. The demands for all successful realizations are calculated as the average over the period of success. These average demands are then ranked, and the 99-percentile demand is selected as the best demand that the Run can achieve under varying hydrologic conditions and within operating and permitting criteria. A detail description of the demand calculation is provided in Appendix 8A.

Storage in the Regional Reservoir is the metric used to evaluate reliability of the Regional System and changes in reliability due to new water supply projects. Tampa Bay Water's Regional Reservoir capacity is 15.5 billion gallons. The analysis determines the long-term median storage (volume and elevation) as a measure of system reliability. Each of the project concepts were evaluated on whether the concept improved or worsened the baseline reliability. Additional information is included in Appendix 8A.

### **8.2 Project Yield and Reliability Analysis**

This section describes the projects that were evaluated using the RPEM reliability and project yield analysis for this LTMWP update. The RPEM was used to identify project that should be further evaluated based on their ability to provide adequate yield within the constraints of Tampa Bay Water's regional system. The RPEM was also used to eliminate project that did not provide enough yield or were not feasible within the existing operational and permitting constraints of Tampa Bay Water's regional system.

Three sets of evaluations were completed which included:

- Projects recommended for detailed assessment in Section 6
- Impacts to the existing system and project if the permitted withdrawal rate of the Alafia River increased from the current 10% of the minimum flow to 19% of the minimum flow, and
- Potential impacts to the regional system demand if the City of Tampa's Tampa Augmentation Project was determined to be feasible and implemented.

**Table 8-1: Water Supply Projects from Section 6**

| Category                              | Potential Water Sources                                                                           | Recommended for Detailed Assessment? |
|---------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Previously Identified Projects</b> | Small Footprint Reverse Osmosis Projects                                                          | No                                   |
|                                       | Tampa Bay Seawater Desalination Plant Expansion with Existing Source                              | Yes                                  |
|                                       | Gulf Coast Desalination Plant                                                                     | Yes                                  |
|                                       | Additional Potable Groundwater from Existing Northern Wellfields                                  | No                                   |
|                                       | Thonotosassa Wells                                                                                | No                                   |
|                                       | Regional Surface Water Treatment Expansion with Existing Source                                   | Yes                                  |
|                                       | Aquifer Recharge                                                                                  | Yes – see “New Projects”             |
| <b>New Projects</b>                   | New Groundwater Supply via Aquifer Recharge Credits (SHARP)                                       | Yes                                  |
|                                       | New Groundwater Supply via Aquifer Recharge Credits (Expanded SHARP)                              | Yes                                  |
|                                       | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                               | Yes                                  |
|                                       | Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP) | Yes                                  |
|                                       | Purified Water to Tampa Bypass Canal                                                              | No                                   |
|                                       | Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site               | Yes                                  |
|                                       | Regional Surface Water Treatment Plant Expansion with Reclaimed Water                             | Yes                                  |
|                                       | Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water                              | Yes                                  |

An initial set of runs were developed to test the RPEM using conceptual scenarios to better define the projects in terms of potential yield and overall system impacts. Initial model simulations evaluated the following conceptual scenarios:

- Increase Regional Surface Water Treatment Plant sustainable capacity from 90 mgd to 110 mgd
- Add 20 mgd of reclaimed water to the Tampa Bypass Canal as new source water with increased Regional Surface Water Treatment Plant capacity
- Add 20 mgd of reclaimed water to the Tampa Bypass Canal and increase reservoir storage to 23.5 billion gallons (8 billion-gallon increase)
- Increase Alafia River permitted withdrawal to 19% with existing reservoir and expanded capacity reservoir



### 8.2.1 Preliminary Analysis, Results and Adjustments

Given the magnitude of simulations and the complexity of Tampa Bay Water's regional system, the project team approached the initial problem by stress testing the regional system model using a select number of realizations that represented a range of hydrologic conditions and high demands. For different conceptual scenarios, the project team used three realizations with high regional demands covering relatively drier, normal, and relatively wet hydrologic conditions to quickly screen out some of the initial project configurations and identify any system constraints. These realizations (#171, #260, and #301) have a regional annual demand ranging from 310 mgd to 316 mgd. This helped the project team evaluate a larger set of projects concept in less time than running the full suite of 334 realizations.

In general, the key findings from these preliminary analyses were:

- Expanding Tampa Bay Water's Regional Surface Water Treatment Plant capacity to 110 mgd gains 10-15 mgd increase in annual average production, but without a new source, the reservoir storage will be reduced.
- Adding 20 mgd of purified reclaimed water to the Tampa Bypass Canal only increases production at the Regional Surface Water Treatment Plant by 1.0 mgd to 2.0 mgd and does increase storage in the reservoir. This result is based on the three screening realizations which represented dry, normal and wet hydrologic conditions with the existing surface water treatment plant capacity of 90 mgd and increasing this capacity to 110 mgd. In addition, these results were affirmed after the HSPS capacity was increased.
- Increasing the Alafia River permitted withdrawal to 19% with the existing system would increase the yield of the system by 1.6 mgd and add about 4 billion gallons of additional long-term storage to the reservoir. Tampa Bay Water should consider applying for a modification of the existing Alafia River withdrawal water use permit within this planning period to increase the percent withdrawal from 10% to 19% of the minimum flow; however, this permit increase will not allow Tampa Bay Water to rely solely on a Regional Surface Water Treatment Plant expansion with the existing source to meet the 20 mgd supply need.
- Increasing the reservoir capacity by 8 billion gallons does increase available storage by about 16% but does not increase Regional Surface Water Treatment Plant production with the addition of 20 mgd of source water to the Tampa Bypass Canal.

In addition, the stress testing identified a key hydraulic constraint with the High Service Pump station. The analysis revealed a limitation in hydraulic capacity, which was preventing available supplies from being delivered to the members' points of connection. The project team recommended adding a seventh pump, which would increase the station capacity up to 140 mgd. This recommendation is in the process of being implemented by Tampa Bay Water.

### 8.2.2 Project Screening Runs

After the preliminary runs were completed and the adjustment in capacity at the High Service Pump Station was made, a new baseline run was established: run number 79. All project concepts are compared to this "baseline scenario". The baseline scenario includes the expansion of the High Service Pump to a



capacity of 140 mgd, the Regional Surface Water Treatment is fixed at a sustainable capacity of 90 mgd, and the Tampa Bay Seawater Desalination Plant is fixed at a sustainable capacity of 15.5 mgd.

Model runs were conducted for each individual project that was noted as recommended in Table 8-1 to confirm yield and impacts on reservoir elevation. Descriptions of all the model runs used to screen the projects are provided in Appendix 8A. The project yields and median reservoir elevation/storage are shown in Table 8-2. Each can provide approximately 10 – 20 mgd of additional regional supply to meet the projected 2040 demands. As the results for the baseline run (#79) indicate, the baseline reliability of the surface water system is 12.4 billion gallons. This indicates that the regional reservoir is about 80% of capacity on a long-term median basis. This represents a very reliable surface water supply system. Each of the projects were evaluated using this metric as an indicator of whether the concept improved or worsened the surface water reliability. Those projects that expanded the regional surface water treatment plant capacity without adding a new supply source reduce the reliability of regional reservoir as shown by the decrease in median reservoir volume. Projects that added “new” water into the system such as the Seawater Desalination Plant expansion, Regional Surface Water Treatment Plant expansion with reclaimed water, and new groundwater supply via aquifer recharge credits tend to have higher reliability as indicated by the higher median reservoir volume stored.

**Table 8-2: Project Yield and Reliability Results**

| Project                                                                                           | Annual Demand (mgd) | Project Yield (mgd) | Median Reservoir Elevation/Storage (FT/BG) | RunID |
|---------------------------------------------------------------------------------------------------|---------------------|---------------------|--------------------------------------------|-------|
| Baseline                                                                                          | 300                 | NA                  | 126/12.4                                   | 79    |
| Tampa Bay Seawater Desalination Plant Expansion with Existing Source                              | 315.6               | 15.6                | 126.5/12.4                                 | 80    |
| Gulf Coast Desalination Plant                                                                     | 321                 | 21                  | 127/12.6                                   | 83    |
| Regional Surface Water Treatment Plant Expansion with Existing Source                             | 315.6               | 15.6                | 126.5/12.4                                 | 81    |
| New Groundwater Supply via Aquifer Recharge Credits (SHARP)                                       | 311.7               | 11.7                | 126.4/12.4                                 | 99    |
| New Groundwater Supply via Aquifer Recharge Credits (Expanded SHARP)                              | 319.6               | 19.6                | 126/12.4                                   | 85    |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                               | 319.6               | 19.6                | 126/12.4                                   | 85    |
| Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (TAP) | 321.3               | 21.3                | 124/11.8                                   | 87    |
| Advanced Treatment of Reclaimed Water with Blending at the Regional Facilities Site               | 321.1               | 21.1                | 130/13.6                                   | 88    |
| Regional Surface Water Treatment Plant Expansion with Reclaimed Water                             | 321.3               | 21.3                | 124/11.8                                   | 87    |

| Project                                                              | Annual Demand (mgd) | Project Yield (mgd) | Median Reservoir Elevation/Storage (FT/BG) | RunID |
|----------------------------------------------------------------------|---------------------|---------------------|--------------------------------------------|-------|
| Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water | 315.6               | 15.6                | 126.5/12.4                                 | 80    |

The results of these analyses were used to select projects that would either provide the required 20 mgd of new supply or would meet the yield requirements in combination with another project. The result of this analysis was a listing of projects that were further analyzed, as well as the combining of projects into concepts to achieve the 20 mgd of additional supply need as discussed further in Sections 14 and 15.

#### 8.2.2.1 Tampa Augmentation Project Yield Results

In addition to the model run described above, in which the Regional Surface Water Treatment Plant is expanded using groundwater via TAP credits, several model simulations were performed by the project team to evaluate the regional benefits of TAP if excess groundwater were to be transferred to the region via surface water discharge in lieu of credits. Each of the runs are described in Appendix 8A. The final set of runs (Runs 108 and 109) were used in the final evaluation.

Given the model assumptions and the scenarios evaluated, TAP could allow the City of Tampa to fully self-supply during most of the conditions evaluated; half of the time (50th percentile), the City's use of water from TAP would be approximately 26.5 mgd of the 50 mgd anticipated from this project. Tampa's self-supply would remove approximately 16 mgd (on average) of demand from the Tampa Bay Water's regional system at the Morris Bridge connection to the City (given projected demands in the year 2040). Whereas an average of about 22 mgd would have been removed from the regional system if Tampa Bay Water were to build any of the Master Water Plan project configurations and the City fully self-supplies.

Two critical assumptions in this assessment are: 1) 100% efficiency in implementation of TAP (50 mgd of water available for Tampa's use), and 2) Tampa Bay Water will not be responsible for developing additional water supplies to meet this future growth in demand in the City (the demand in the year 2040 and beyond). The issue of how much water supply Tampa Bay Water would plan to deliver the City during drought or emergency conditions was not addressed by these analyses.

The model scenario requested by the City (Run 109) assumes that Tampa Bay Water prioritize the regional use of TAP over existing regional water supplies (if the Tampa Bay Water Board directs that TAP be prioritized over existing sources and such prioritization does not adversely impact permitted quantities of existing sources). Although this scenario seems to suggest that an additional supply of up to 9 mgd on average could be available for the region in 2040, it also shows that Tampa Bay Water would leave approximately 5.6 mgd of available water in the Tampa Bypass Canal for the baseline scenario (model run 79) yielding a net benefit to the region of approximately 3.4 mgd. Much of this remaining offset is likely the result of further groundwater withdrawal reductions from existing facilities. Compared to Tampa Bay Water's Master Water Plan projects (Runs 96, 100, 82), unused TBC water ranges between 5 mgd to 15 mgd. (See Appendix 8B for details of model runs).

Any additional regional water supply identified in Run 109 is based on an average condition and not a drought-year condition, which is the basis of Tampa Bay Water's supply planning analyses. As such, there

would be no significant increase in the drought year surface water supply quantity that Tampa Bay Water uses for water supply development planning.

Model Run 108 shows that if TAP is fully implemented and Tampa Bay Water uses water from TAP as available and as needed, the Agency could utilize an additional 1.8 mgd on average within this planning period from the Middle Pool of the Tampa Bypass Canal; this is the potential additional regional supply gained by no longer augmenting Hillsborough River Reservoir through the Harney Canal except during exceptionally dry conditions. However, the model results also indicate that the City would have to utilize additional sources of water beyond TAP, Sulfur Springs and Blue Sink to meet the required Minimum Flow in the lower Hillsborough River using demands in the year 2040. If the City used water from the Tampa Bypass Canal to make up their Minimum Flow requirement deficit (2.2 mgd on a median basis), there would be no net benefit realized by Tampa Bay Water from the Tampa Bypass Canal. Table 8-3 provides a summary of the modeling results.

**Table 8-3: Potential Regional Benefits of TAP in 2040 – Median Basis (50<sup>th</sup> Percentile)**

|                                                        |                       | Run 108  | Run 109   |
|--------------------------------------------------------|-----------------------|----------|-----------|
| Regional demand reduction if Tampa fully self-supplies | Run 79 (baseline)     | 16.2 mgd | 16.2 mgd  |
|                                                        | Run 96                | 21.4 mgd | 21.4 mgd  |
|                                                        | Run 100               | 22.3 mgd | 22.3 mgd  |
|                                                        | Run 82                | 21.5 mgd | 21.5 mgd  |
|                                                        | Run 85 <sup>1</sup>   | N/A      | N/A       |
|                                                        | Run 87 <sup>2</sup>   | N/A      | N/A       |
| Use of TAP by Tampa Bay Water                          |                       | 0.7 mgd  | 9.0 mgd   |
| Water not harvested from TBC                           | Run 79 (baseline)     | -0.1 mgd | -5.6 mgd  |
|                                                        | Run 96                | -9.7 mgd | -15.2 mgd |
|                                                        | Run 100               | -5.5 mgd | -4.9 mgd  |
|                                                        | Run 82                | -0.6 mgd | -14.8 mgd |
|                                                        | Run 85 <sup>(1)</sup> | N/A      | N/A       |
|                                                        | Run 87 <sup>(2)</sup> | N/A      | N/A       |
| Potential regional net benefit                         | Run 79 (baseline)     | 16.6 mgd | 19.4 mgd  |
|                                                        | Run 96                | 12.3 mgd | 15.1 mgd  |
|                                                        | Run 100               | 17.5 mgd | 26.4 mgd  |
|                                                        | Run 82                | 21.6 mgd | 15.7 mgd  |
|                                                        | Run 85 <sup>1</sup>   | N/A      | N/A       |
|                                                        | Run 87 <sup>2</sup>   | N/A      | N/A       |
| Additional factors to consider                         |                       |          |           |
| Regional water available through use of Harney Canal   |                       | 1.8 mgd  | 1.8 mgd   |
| Hillsborough River Minimum Flow deficit                |                       | 2.2 mgd  | 2.2 mgd   |

<sup>(1)</sup> Run 85 assumes 12.5 mgd water available from City of Tampa's reclaim water for an expanded SHARP project

<sup>(2)</sup> Run 87 assumes 12.5 mgd water available from City of Tampa's water from TAP for a surface water treatment expansion project.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## **9. Water Supply Concept Development**

### **9.1 Conditions for Concept Development**

New sources of supply are estimated to be needed in the Tampa Bay Water region by 2028. Accordingly, the Agency underwent feasibility studies on potential new water supply projects as part of this Long-term Master Water Plan update because it takes between 10 and 15 years to plan, permit, design and construct a new project.

Water supply projects identified in Section 6 were considered individually and in combination with each other to create potential water supply concepts. Every concept was required to provide at least 20 mgd of additional, reliable yield to the regional system based on studies and forecasting models developed by Tampa Bay Water, as discussed in Sections 4 and 8 of this LTMWP. Additionally, every concept had to be deemed feasible from a technical and regulatory perspective, although the ease with which technical and regulatory goals are anticipated to be achieved varied across concepts. This section presents an overview of the various water supply concepts, which will be further shortlisted and evaluated as discussed in the later sections of this report. The water supply concepts identified in this section were primarily evaluated in terms of their ability to provide supply to the region and not exclusively to south Hillsborough County.

### **9.2 Concepts**

Thirteen water supply concepts were developed for consideration as pathways for supplying the Tampa Bay Water service area with an additional 20 mgd of water supply. These concepts spanned individual and combinations of water supply projects. Each concept, comprised of water supply projects that were previously introduced in Section 6, is discussed below. Water supply concepts are also described in detail in four Technical Memoranda that were prepared as part of the Tampa Bay Water Long-term Master Water Plan, which are provided in Appendix 10A through 10D.

Table 9-1 summarizes the 13 water supply concepts and are discussed further in this section, all of which provide a total additional yield of 20 mgd to the Tampa Bay Water region. Water supply projects were either anticipated to be able to provide 20 mgd as a sole supply or they were combined with other water supply projects due to source water and/or site limitations. These 13 water supply concepts were evaluated, compared, and ranked as part of the coarse screening process, which is described in Section 14.

Table 9-1: Summary of Water Supply Concepts to Achieve 20 mgd of Additional Yield

| Water Supply Concept                                                                                   | Individual Projects                 |                                          |                           |                                                    |                                   |                                     |                                          |                                  |                               | Notes                                                                       |
|--------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------|---------------------------|----------------------------------------------------|-----------------------------------|-------------------------------------|------------------------------------------|----------------------------------|-------------------------------|-----------------------------------------------------------------------------|
|                                                                                                        | SWTP Expansion with Existing Source | Desal WTP Expansion with Existing Source | Gulf Coast Desal Facility | New Groundwater via Net Benefit from SHARP Program | SWTP Expansion with Tampa Credits | SWTP Expansion with Reclaimed Water | Desal WTP Expansion with Reclaimed Water | Advanced WTP for Reclaimed Water | Aquifer Recharge and Recovery |                                                                             |
| SWTP and Desalination WTP Expansions with Existing Sources                                             | 10                                  | 10                                       |                           |                                                    |                                   |                                     |                                          |                                  |                               | SWTP limited by surface water availability; desal WTP limited by site       |
| New Gulf Coast Desalination Facility                                                                   |                                     |                                          | 20                        |                                                    |                                   |                                     |                                          |                                  |                               | No source water or site limitations                                         |
| SWTP Expansion with Existing Source and New Groundwater via Net Benefit from SHARP Program             | 12.5                                |                                          |                           | 7.5                                                |                                   |                                     |                                          |                                  |                               | SWTP limited by surface water availability; groundwater limited by recharge |
| Desalination WTP Expansion with Existing Source and New Groundwater via Net Benefit from SHARP Program |                                     | 12.5                                     |                           | 7.5                                                |                                   |                                     |                                          |                                  |                               | Desal WTP limited by site; groundwater limited by recharge                  |
| New Groundwater via Net Benefit from Expanded SHARP Program                                            |                                     |                                          |                           | 20                                                 |                                   |                                     |                                          |                                  |                               | Groundwater limited by recharge                                             |
| SWTP Expansion with New Groundwater via Tampa Credits (Native Groundwater Quality)                     |                                     |                                          |                           |                                                    | 20                                |                                     |                                          |                                  |                               | No source water or site limitations                                         |

| Water Supply Concept                                                                                   | Individual Projects                 |                                          |                           |                                                    |                                   |                                     |                                          |                                  |                               | Notes                                                |
|--------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------|---------------------------|----------------------------------------------------|-----------------------------------|-------------------------------------|------------------------------------------|----------------------------------|-------------------------------|------------------------------------------------------|
|                                                                                                        | SWTP Expansion with Existing Source | Desal WTP Expansion with Existing Source | Gulf Coast Desal Facility | New Groundwater via Net Benefit from SHARP Program | SWTP Expansion with Tampa Credits | SWTP Expansion with Reclaimed Water | Desal WTP Expansion with Reclaimed Water | Advanced WTP for Reclaimed Water | Aquifer Recharge and Recovery |                                                      |
| SWTP Expansion with New Groundwater via Tampa Credits (Impacted Groundwater Quality)                   |                                     |                                          |                           |                                                    | 20                                |                                     |                                          |                                  |                               | No source water or site limitations                  |
| SWTP Expansion with Reclaimed Water                                                                    |                                     |                                          |                           |                                                    |                                   | 20                                  |                                          |                                  |                               | No source water or site limitations                  |
| New Advanced WTP for Reclaimed Water                                                                   |                                     |                                          |                           |                                                    |                                   |                                     |                                          | 20                               |                               | No source water or site limitations                  |
| SWTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water                           | 10                                  |                                          |                           |                                                    |                                   |                                     |                                          | 10                               |                               | SWTP expansion limited by surface water availability |
| Desalination WTP with Existing Source and New Advanced WTP for Reclaimed Water                         |                                     | 10                                       |                           |                                                    |                                   |                                     |                                          | 10                               |                               | Desal WTP limited by site                            |
| Desalination WTP Expansion with Reclaimed Water and New Groundwater via Net Benefit from SHARP Program |                                     |                                          |                           | 7.5                                                |                                   |                                     | 12.5                                     |                                  |                               | Desal WTP limited by site                            |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                                    |                                     |                                          |                           |                                                    |                                   |                                     |                                          |                                  | 20                            | No source water or site limitations                  |



### **9.2.1 Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant Expansions with Existing Sources**

Tampa Bay Water currently benefits from the use of groundwater, surface water, and seawater in its water supply portfolio. Two of these existing sources, surface water and seawater, have the potential to provide additional supply if existing treatment facilities are expanded. This water supply concept involves expanding both the Regional Surface Water Treatment Plant and the Tampa Bay Seawater Desalination Plant at their existing sites for increased treatment and delivery of existing source waters to the regional system. These two water supply projects were combined to create this water supply concept because each individual expansion cannot meet the required 20 mgd increase in yield as individual projects. The Regional Surface Water Treatment Plant expansion is limited to an annual average yield increase of 12.5 mgd because of the variability and availability of the existing surface water supplies and potential impacts on the reliability of the C.W. Bill Young Regional Reservoir (See Section 8). The Tampa Bay Seawater Desalination Plant is also limited to approximately 12.5 mgd of additional yield due to space constraints at the existing site. The coupling of these two expansions allows for a reliable 20 mgd increase in available water supply, assuming 10 mgd from each expansion, thus satisfying the projected demands with projects that rely only on existing sources. This water supply concept is discussed in detail in Appendix 9A.

### **9.2.2 New Gulf Coast Desalination Facility**

An updated evaluation of the Gulf Coast Desalination Facility was performed to further refine and update infrastructure requirements, yield estimates, costs and other key planning information to supply a feasibility assessment of the project from a technical, regulatory, environmental, and economic perspective. This water supply concept may be considered independently as a strategy for Tampa Bay Water because it can meet the 20 mgd yield requirement without being coupled with another water supply project. The new Gulf Coast Desalination Facility is expected to be able to provide the required 20 mgd of additional supply due the ample availability of space and seawater supply. This water supply concept is discussed in detail in Appendix 9B.

### **9.2.3 Regional Surface Water Treatment Plant Expansion with Existing Source and New Groundwater Supply via Net Benefit from SHARP Program**

Existing infrastructure can also be coupled with other new water supply projects to meet the region's future water needs. This configuration includes one water supply project that was previously discussed in Section 9.2.1, the Regional Surface Water Treatment Plant expansion, and one new water supply option. The new water supply project involves the construction of a groundwater withdrawal wellfield and groundwater treatment facility in south Hillsborough County, with accommodations for finished water to be delivered to the regional system or to Hillsborough County by way of a new point of connection in proximity to the new groundwater treatment facility. The groundwater supply for this water supply project would be enabled by Hillsborough County's South Hillsborough Aquifer Recharge Program (SHARP), in which reclaimed water is used to recharge the coastal aquifer, thus serving as a barrier to saltwater intrusion, providing a net benefit to the aquifer, and also generating credits for additional groundwater withdrawals. The groundwater supply project is initially limited to a maximum yield of 7.5 mgd based on the availability of reclaimed water in south Hillsborough County, withdrawal constraints, and groundwater modeling as discussed in Section 6 of this LTMWP and the Technical Memorandum in Appendix 6B. To achieve a total yield of 20 mgd for this water supply concept, 12.5 mgd of yield is assumed from the Regional Surface Water Treatment Plant expansion.

Surface water modeling conducted by Tampa Bay Water has demonstrated that this yield is possible at the Regional Surface Water Treatment Plant if it is expanded by 20 mgd in treatment capacity, but it will have a greater impact on the reliability of the C.W. Bill Young Regional Reservoir storage than those concepts that only assume 10 mgd from the Regional Surface Water Treatment Plant expansion. This water supply concept is discussed in detail in Appendix 9C.

#### **9.2.4 Tampa Bay Seawater Desalination Plant Expansion with Existing Source and New Groundwater Supply via Net Benefit from SHARP Program**

This water supply concept is a combination of two water supply projects that were previously discussed in Section 9.2.1 and 9.2.3, including the Tampa Bay Seawater Desalination Plant expansion with the existing source water and a new groundwater supply via aquifer recharge credits from Hillsborough County's SHARP program. Due to the groundwater supply project being limited to 7.5 mgd based on reclaimed water availability in south Hillsborough County and groundwater modeling, 12.5 mgd of additional yield is assumed from the Tampa Bay Seawater Desalination Plant expansion to achieve a total of 20 mgd of new supply for the region. Preliminary engineering indicates that this yield is possible at the Tampa Bay Seawater Desalination Plant if Tampa Bay Water relies more on the existing capacity of the Tampa Bay Seawater Desalination Plant on an annual average basis to increase the overall plant yield, as enabled by system wide improvements included as part of the expansion. This water supply concept is discussed in detail in Appendix 9C.

#### **9.2.5 New Groundwater Supply via Net Benefit from Expanded SHARP Program Aquifer Recharge Credits**

In Section 9.2.3, it is noted that the new groundwater supply via aquifer recharge credits is limited to 7.5 mgd by the availability of reclaimed water in south Hillsborough County and the water use permitting limitations. In this water supply concept, a maximum yield of 20 mgd is assumed for the groundwater supply based on the combined availability of reclaimed water from Hillsborough County and another member government. Groundwater modeling results (Appendix 6B) showed that a yield of 20 mgd requires 30 mgd of aquifer recharge when constraints related to the SWUCA, MIA, and the ML Lakes are considered. It is assumed that 7.5 mgd of the total 20 mgd of yield is realized through the use of groundwater credits generated by south Hillsborough County via aquifer recharge. For the remaining 12.5 mgd of yield, for purposes of this LTMWP, it is assumed that reclaimed water would be obtained from the City of Tampa and delivered to an expanded aquifer recharge program for the generation of additional credits. In this water supply concept and for the purposes of developing a cost estimate, it was assumed that Hillsborough County would still be responsible for its aquifer recharge system, but Tampa Bay Water's responsibilities would increase. In addition to the groundwater withdrawal, treatment, and delivery system, it was assumed Tampa Bay Water would be responsible for the construction and operation of conveyance infrastructure from the Howard F. Curren Advanced Wastewater Treatment Plant to the aquifer recharge well sites, as well as recharge infrastructure and credit documentation. However, the ownership and operation of reclaimed water infrastructure required for a given water supply project would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase. A maximum yield of 20 mgd at wellfield site 1a is assumed when both Hillsborough County and Tampa Bay Water are engaged in aquifer recharge for the generation of groundwater credits. This water supply concept involves the transfer of aquifer recharge credits from Hillsborough County to Tampa Bay Water, as well as the obtainment of reclaimed water from the City of Tampa (or another member government). This water supply concept is discussed in detail in Appendix 9C.

#### **9.2.6 Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Native Groundwater Quality)**

In Section 9.2.1, it is noted that the additional yield provided by the Regional Surface Water Treatment Plant expansion is limited by the variability and availability of the existing surface water supplies and potential impacts on the reliability of the C.W. Bill Young Regional Reservoir. To address yield limitations, this water supply concept assumes a new source of groundwater that could supplement the existing surface water supplies with an expansion of the existing Regional Surface Water Treatment Plant. The reliance on additional groundwater rather than the existing surface water supplies could provide a more reliable and consistent source than the existing surface water supplies.

The additional use of groundwater would be enabled by aquifer recharge credits generated by the City of Tampa through the Tampa Augmentation Program (TAP), in which reclaimed water would be used for aquifer recharge. If agreed upon by Tampa Bay Water and City of Tampa, the credits would be used to permit a new 20 mgd withdrawal wellfield in the City of Tampa, although the City of Tampa has indicated that they do not intend to transfer credits or water from TAP to Tampa Bay Water at this time (Appendix 6E). The groundwater supply would be delivered to the expanded Regional Surface Water Treatment Plant for blending with existing surface water supplies prior to treatment. The City of Tampa projects that sufficient aquifer recharge and groundwater credit generation will take place through TAP to allow for this water supply project to serve as a water supply concept on its own. A key assumption of this water supply project is that the withdrawn groundwater supply will have a raw water quality that is compatible with existing treatment processes at the Regional Surface Water Treatment Plant in terms of suitability for operation and finished water goals. This water supply concept is discussed in detail in Appendix 9C.

#### **9.2.7 Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Impacted Groundwater Quality)**

This water supply concept is similar to that described in Section 9.2.6, in which the Regional Surface Water Treatment Plant is expanded, and groundwater supply enabled by TAP is used as additional source water; however, this water supply concept assumes that withdrawn groundwater quality will be significantly impacted by aquifer recharge with reclaimed water. The TAP program plans to inject reclaimed water into a non-potable zone of the aquifer, and this water supply concept assumes that reclaimed water migrates to a potable aquifer zone, thus impacting the quality of withdrawn groundwater. Aquifer recharge credits would still be used to permit a new 20 mgd withdrawal wellfield in the City of Tampa, and the distribution of responsibilities between the City of Tampa and Tampa Bay Water would be the same as described in 9.2.6, but treatment at the Regional Surface Water Treatment Plant would need to be both expanded and upgraded to address the reclaimed water component of influent flows. To minimize capital expenditures and maintain the reliability of the existing Regional Surface Water Treatment Plant, it is assumed that the reclaimed water/groundwater mixture is treated with advanced treatment processes as a separate treatment train and then blending with finished from the existing treatment trains that treat existing source waters. This water supply concept is expected to be able to provide 20 mgd to the Tampa Bay Water region as a sole supply due to the projected availability of groundwater credits by the City of Tampa and a lack of space constraints at the Regional Facilities Site. This water supply concept is discussed in detail in Appendix 9C, although City of Tampa has indicated that they do not intend to transfer credits or water from TAP to Tampa Bay Water at this time (Appendix 6E).

#### **9.2.8 Regional Surface Water Treatment Plant Expansion with Reclaimed Water**

The Regional Surface Water Treatment Plant expansion with reclaimed water involves the blending of reclaimed water from the City of Tampa's Howard F. Curren Advanced Wastewater Treatment Plant or another member government with raw surface water prior to treatment at the Regional Surface Water Treatment Plant. This water supply concept essentially converts the existing Regional Surface Water Treatment Plant into a direct potable reuse facility, thus requiring process expansions due to the increase in influent flows, as well as process upgrades, due to the introduction of reclaimed water. Finished water supply from the expanded and upgraded facility would be delivered to the Tampa Bay Water Regional System. This water supply concept may be referred to as a raw water augmentation.

Similar to the water supply concept involving groundwater with quality that has been impacted by reclaimed water (Section 9.2.7), this water supply concept assumes the addition of advanced treatment processes to the Regional Surface Water Treatment Plant based on regulatory and operational precedents set by other states and utilities because no requirements have yet been established by Florida. Due to the fact that reclaimed water is assumed to be blended with other source waters prior to treatment, these new advanced processes (granular activated carbon sorption and advanced oxidation with ultraviolet irradiation) must be used to treat the entire forward flow at the Regional Surface Water Treatment Plant.

This water supply concept is expected to be able to provide 20 mgd to the Tampa Bay Water region as a sole supply due to the projected availability of reclaimed water from member governments and a lack of space constraints at the Regional Facilities Site. This water supply concept is discussed in detail in Appendix 9D. For this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Regional Facilities Site; however, the ownership and operation of reclaimed water infrastructure in any water supply concept would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase.

#### **9.2.9 New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Site**

This water supply concept involves the construction of a new, separate advanced water treatment plant to be used exclusively for the production of drinking water from reclaimed water. The new advanced water treatment plant would be a direct potable reuse facility. Finished water supply from the new facility would be blended with finished water from existing surface water supplies at the Regional Facilities Site and delivered to the Tampa Bay Water Regional System. This water supply concept may be referred to as treated water augmentation. Instead of expanding and upgrading existing treatment processes at the Regional Surface Water Treatment Plant, a new facility may be designed and sized specifically for reclaimed water flows.

This water supply concept is expected to be able to provide 20 mgd to the Tampa Bay Water region as a sole supply due to the projected availability of reclaimed water from member governments and a lack of space constraints at the Regional Facilities Site for the construction of a new advanced water treatment plant for reclaimed water. This water supply concept is discussed in detail in Appendix 9D. For this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Regional Facilities Site; however, the ownership and operation of reclaimed water infrastructure in any water supply concept would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase.

**9.2.10 Regional Surface Water Treatment Plant Expansion with Existing Source and New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Facilities Site**

This water supply concept is a combination of two water supply projects that were previously discussed in Section 9.2.1 and 9.2.9, including the Regional Surface Water Treatment Plant expansion with the existing source water and a new advanced water treatment plant for reclaimed water with finished water blending at the Regional Facilities Site. In this water supply concept, the planned capacity of the advanced water treatment plant for reclaimed water is reduced to 10 mgd in order to benefit from the supply coming from the expanded Regional Surface Water Treatment Plant and still achieve 20 mgd of additional supply for the region. This water supply concept is discussed in more detail in Appendix 9D. For the this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Regional Facilities Site; however, the ownership and operation of reclaimed water infrastructure in any water supply concept would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase.

**9.2.11 Tampa Bay Seawater Desalination Plant with Existing Source and New Advanced Treatment Plant for Reclaimed Water with Blending at the Regional Site**

This water supply concept is a combination of two water supply projects that were previously discussed in Section 9.2.1 and 9.2.9, including the Tampa Bay Seawater Desalination Plant expansion with the existing source water and a new advanced water treatment plant for reclaimed water with finished water blending at the Regional Facilities Site. Similar to that described in Section 9.2.10, the planned capacity of the advanced water treatment plant for reclaimed water is reduced to 10 mgd in order to benefit from the supply coming from the expanded Tampa Bay Seawater Desalination Plant and still achieve 20 mgd of additional supply for the region. This water supply concept is discussed in more detail in Appendix 9D. For the this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Regional Facilities Site; however, the ownership and operation of reclaimed water infrastructure in any water supply concept would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase.

**9.2.12 Tampa Bay Seawater Desalination Plant Expansion with Reclaimed Water and New Groundwater Supply via Net Benefit from SHARP Program**

This water supply concept is a combination of one previously discussed water supply project and one new water supply project. The previously discussed project is a new groundwater supply via aquifer recharge credits from Hillsborough County's SHARP program (Section 9.2.3) with a yield of 7.5 mgd. The new project is a 10 mgd expansion of the Tampa Bay Seawater Desalination Plant with the use of reclaimed water as the additional source water. The Tampa Bay Seawater Desalination Plant expansion with reclaimed water is assumed to provide an additional yield of 12.5 mgd. This higher yield assumes that Tampa Bay Water relies more on the existing capacity of the Tampa Bay Seawater Desalination Plant on an annual average basis to increase the overall plant yield, as enabled by system-wide improvements included as part of the expansion. This water supply concept may be referred to as raw water augmentation and is discussed in more detail in Appendix 9D. For the this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Desalination Plant; however, the ownership and operation of reclaimed water infrastructure in any water supply concept



would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase.

### **9.2.13 Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water**

Aquifer recharge and recovery with treated reclaimed water is an indirect potable reuse water supply concept that involves advanced treatment of reclaimed water from the City of Tampa's Howard F. Curren Advanced Wastewater Treatment Facility or another member government before it is pumped to aquifer recharge wells in south Hillsborough County. A wellfield around the perimeter of the recharge wells would then withdraw the highly treated reclaimed water that was previously injected into the aquifer to be used as drinking water supply. The withdrawn groundwater would be delivered to a new groundwater treatment facility to provide a finished water supply to the regional system. The finished water may also be directly delivered to south Hillsborough County by way of a new point of connection in the proximity of the groundwater treatment plant. This water supply concept is not anticipated to be limited by reclaimed water availability nor space, thus allowing it to provide 20 mgd of new supply without combining it with another water supply project.

The primary infrastructure components of this water supply concept include reclaimed water transmission to the Regional Facilities Site from the Howard F. Curren Advanced Wastewater Treatment Plant or another member government facility, an advanced water treatment plant for the treatment of reclaimed water at the Regional Facilities Site, and transmission to deliver the treated reclaimed water from the Regional Facilities Site to the recharge wellfield. For this LTMWP and the purpose of developing a cost estimate, it is assumed that Tampa Bay Water would own and operate the infrastructure required to deliver reclaimed water to the Regional Facilities Site and beyond; however, the ownership and operation of reclaimed water infrastructure in any water supply concept would be negotiated between Tampa Bay Water and relevant member governments during the feasibility evaluation phase. Additionally, this water supply concept requires a recharge wellfield in order to use the aquifer as environmental storage, a withdrawal wellfield to retrieve the injected reclaimed water, and a treatment plant for the withdrawn groundwater. Additionally, transmission is needed to deliver the finished water to the regional system or to south Hillsborough County by way of a new point of connection.

## **9.3 Next Steps**

The water supply concepts identified in this section yield a total of 20 mgd of new supply to the Tampa Bay Water region, but other factors, such as environmental impact, cost, and property requirements, need to be further evaluated to determine which water supply concepts warrant more detailed consideration.

Implications related to property, integration with existing infrastructure, vulnerability, and environmental sustainability are explored in Sections 10 through 13 for each water supply concept. This information that spans various decision-making criteria was synthesized and concurrently taken into consideration as part of the coarse screening evaluation, which is described in Section 14.

**THIS PAGE INTENTIONALLY LEFT BLANK**



## 10. Property Assessment

Several of the future water supply concepts identified in Section 9 that are being investigated as part of this 2018 Long-term Master Water Plan (LTMWP) update would require the acquisition of property to site the new infrastructure components. The property requirements for each option can vary significantly. Some of the future water supply concepts involve expansions of existing facilities on property already owned by Tampa Bay Water and would not require the acquisition of additional property; whereas other water supply concepts involve a significant amount of property to site new facilities and the associated pipelines to connect the water supply to the existing regional system and member government delivery points of connection.

Preliminary property assessments were completed for the future water supply concepts considered as part of this 2018 LTMWP update. This section of the report summarizes the estimated property requirements for each water supply concept, and the results of preliminary investigations of the property needs for these concepts.

### 10.1 Anticipated Property Needs for Future Water Supply Concepts

Table 10-1 lists the future water supply concepts evaluated as part of this planning effort and provides a brief description of the estimated property and easement needs for each water supply concept.

**Table 10-1: Future Water Supply Options Property Needs**

| Future Water Supply Option                                             | Estimated Property Needs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regional Surface Water Treatment Plant Expansion with Existing Sources | No additional property needed <ul style="list-style-type: none"> <li>Proposed improvements would be sited on existing facility property owned by Tampa Bay Water.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Seawater Desalination Plant Expansion with Existing Source             | No additional property needed <ul style="list-style-type: none"> <li>Proposed improvements would be sited on existing facility property leased by Tampa Bay Water.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Gulf Coast Desalination                                                | Total estimated property required = 23 acres <ul style="list-style-type: none"> <li>11 acres of property for new desalination plant</li> <li>12 acres of easements for the new pipeline</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                         |
| New Groundwater via Aquifer Recharge Credit (SHARP Credit)             | Total estimated property required = 26 acres <ul style="list-style-type: none"> <li>10 acres of property for new withdrawal wellfield, including production and monitoring wells, and the associated collection pipelines and access roads</li> <li>6 acres of property for new water treatment plant and pump station</li> <li>10 acres for easements for the new finished water pipeline</li> </ul>                                                                                                                                                                                                      |
| New Groundwater via Aquifer Recharge Credit (Expanded SHARP)           | Total estimated property required = 94 acres <ul style="list-style-type: none"> <li>2 acres of property for new reclaimed water tank and pump station</li> <li>18 acres of easements for reclaimed water pipeline</li> <li>20 acres of property for new tank, pump station and injection wells</li> <li>24 acres of property for new withdrawal wellfield, including production and monitoring wells, and the associated collection pipelines and access roads</li> <li>20 acres of property for new groundwater treatment plant</li> <li>10 acres of easements for new finished water pipeline</li> </ul> |

| Future Water Supply Option                                                                                                           | Estimated Property Needs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Native or Impacted Groundwater Quality) | <p>Total estimated property required = 26 acres</p> <ul style="list-style-type: none"> <li>• 16 acres of property for new withdrawal wellfield, including production and monitoring wells, and the associated collection pipelines and access roads</li> <li>• 3 acres of property for new groundwater supply tank and pump station</li> <li>• 7 acres of easements for groundwater supply pipeline</li> <li>• No additional property requirements at the Regional Facilities Site</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                |
| Regional Surface Water Treatment Plant Expansion with Reclaimed Water                                                                | <p>Total estimated property required = 9 acres</p> <ul style="list-style-type: none"> <li>• 2 acres of property for new reclaimed water tank and pump station</li> <li>• 7 acres of easements for reclaimed water pipeline</li> <li>• No additional property requirements at the Regional Facilities Site.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| New Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending                                                  | <p>Total estimated property required = 9 acres</p> <ul style="list-style-type: none"> <li>• 2 acres of property for new reclaimed water tank and pump station</li> <li>• 7 acres of easements for reclaimed water pipeline</li> <li>• No additional property requirements at the Regional Facilities Site.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Seawater Desalination Plant Expansion with Reclaimed Water                                                                           | <p>Total estimated property required = 16 acres</p> <ul style="list-style-type: none"> <li>• 2 acres of property for new reclaimed water tank and pump station</li> <li>• 14 acres of easements for reclaimed water pipeline</li> <li>• No additional property requirements at the Desalination Plant</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Aquifer Recharge and Recovery with Treated Reclaimed Water                                                                           | <p>Total estimated property required = 107 acres</p> <ul style="list-style-type: none"> <li>• 2 acres of property for new reclaimed water tank and pump station</li> <li>• 7 acres of easements for reclaimed water pipeline</li> <li>• Reclaimed water treatment facility is assumed to be located within existing Regional Facilities Site property</li> <li>• 24 acres of easements for new treated reclaimed water pipeline</li> <li>• 30 acres of property for new treated reclaimed water injection and withdrawal wellfields</li> <li>• 9 acres of easements for wellfield collection and transmission piping to the water treatment plant</li> <li>• 20 acres of property for new water treatment plant and pump station</li> <li>• 12 acres of easements for new finished water pipeline</li> <li>• 3 acres of property for finished water storage tank and pump station</li> </ul> |

## 10.2 Preliminary Investigation of Property Needs

This section of the report describes the preliminary investigations and assumptions used to define the estimated property requirements noted in Table 10-1.

### 10.2.1 General Property Requirement Assumptions

The following are general assumptions used to define property requirements for the type of infrastructure components that are included as part of the water supply project options:

- **Pipelines** – Estimated property requirements for pipelines are based on needing to acquire a 35-foot wide easement along 25% of the total length of the pipeline (with the remaining 75% of the total length of the pipeline being located in right-of-way properties that do not require land/easement acquisition). It should be noted that the easement acquisition requirements for pipelines can vary significantly based on the location and specific route that is selected. This general assumption for pipeline easement acquisition requirements should be refined for each individual pipeline project as part of future route studies.

- **Wellfields** – Estimated land requirements for wellfields are based on the following:
  - One acre per well
  - The number of wells required for a wellfield system are based on:
    - Groundwater withdrawal wells = 2 to 2.5 mgd capacity each
    - Aquifer recharge/injection wells = 3 mgd capacity each
    - Deep monitor wells = 1 for every 4 mgd of injection/recharge well capacity
    - Shallow monitor wells = 1 for every 4 mgd of injection/recharge well capacity, and 1 for every 2.5 mgd of withdrawal well capacity
  - Property requirements for wellfield collection system piping and access roads are based on preliminary wellfield layout plans developed as part of the feasibility studies for the water supply concepts. In general, the minimum distance between wells is 1,500 ft, and 35-ft wide easements are assumed along the collection pipeline routes from the wells to the water treatment plants.
- **Water Treatment, Storage and Pumping Facilities** – Estimated land requirements for water treatment, storage and pumping facilities are based on conceptual facility layouts developed for each of the water supply options. Additional information regarding the conceptual facility layouts and property requirements for these facilities is provided in the remainder of this section of the report.

## 10.2.2 Property Assessment for Water Supply Concepts

Additional information regarding the estimated property needs for the water supply concepts listed in Table 10-1 is provided in the sub-sections below. The estimated property requirements noted in this section of the report are based on conceptual planning level information and would need to be refined for any options that are selected for further evaluation or detailed design.

### 10.2.2.1 *Gulf Coast Desalination*

The Gulf Coast Desalination Facility consists of a new desalination water treatment plant, co-located near the Duke Anclote Power Plant. The power plant is located on the north side of the Anclote River, on an island in southwest Pasco County, near the northern border of Pinellas County. The desalination plant will occupy approximately 11 acres adjacent to the power plant see Figure 10-1. To convey the finished water to the Tampa Bay Water Regional System, a new pipeline would be constructed from the plant to a new point of connection near the Pinellas County Keller Water Treatment Plant see Figure 10-2. The pipeline is estimated to be approximately 56,500 linear feet, with an estimated 12 acres of property required along the route.



Figure 10-1: Preliminary Layout of the Gulf Coast Desalination Plant

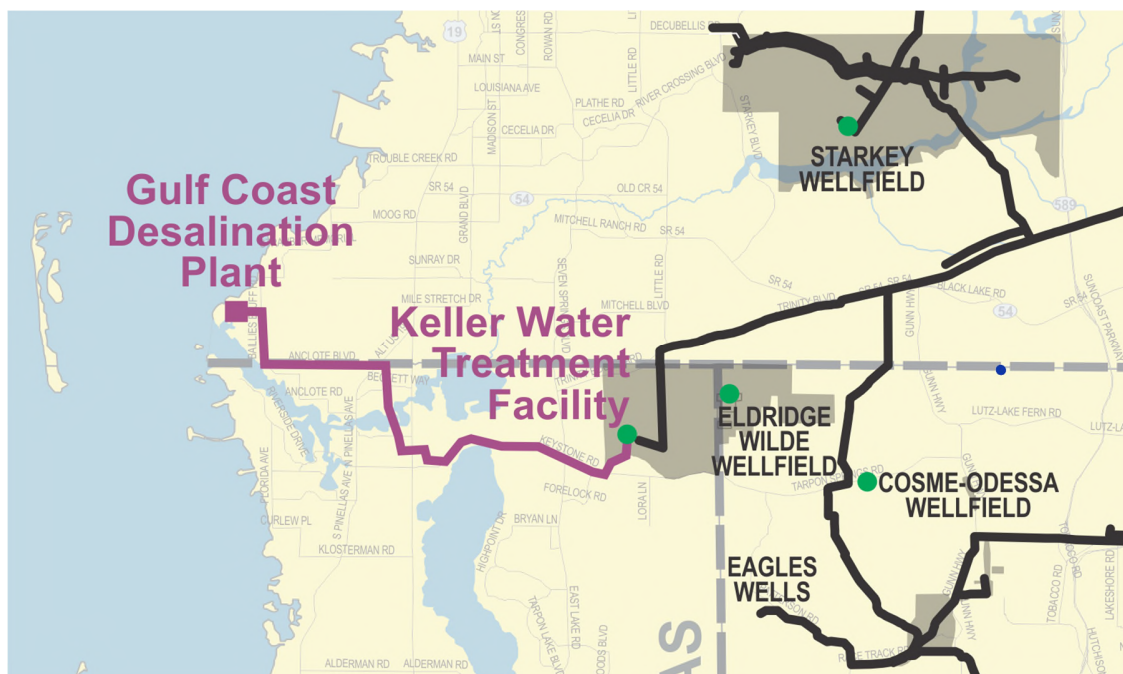


Figure 10-2: Preliminary Pipeline Route from Gulf Coast Desalination Plant to Regional Interconnect Point



#### 10.2.2.2 New Groundwater via Aquifer Recharge Credit (SHARP Credit)

The New Groundwater via Aquifer Recharge Credit (SHARP Credit) water supply project includes a new 7.5 mgd annual average withdrawal wellfield, groundwater treatment plant (including treatment, storage and high service pumping), and 61,000-foot long 36-inch diameter finished water transmission pipeline in South Hillsborough County. The total estimated land acquisition required for this option is 26 acres: 10 acres for the withdrawal wellfield (including production and monitoring wells, and wellfield collection pipelines and access roads); 6 acres for the groundwater treatment plant and pump station; and 10 acres of property for the finished water pipeline route to connect the new plant into the regional system. Figure 10-3 shows the general location of the water treatment plant and a potential pipeline routes for the proposed option.

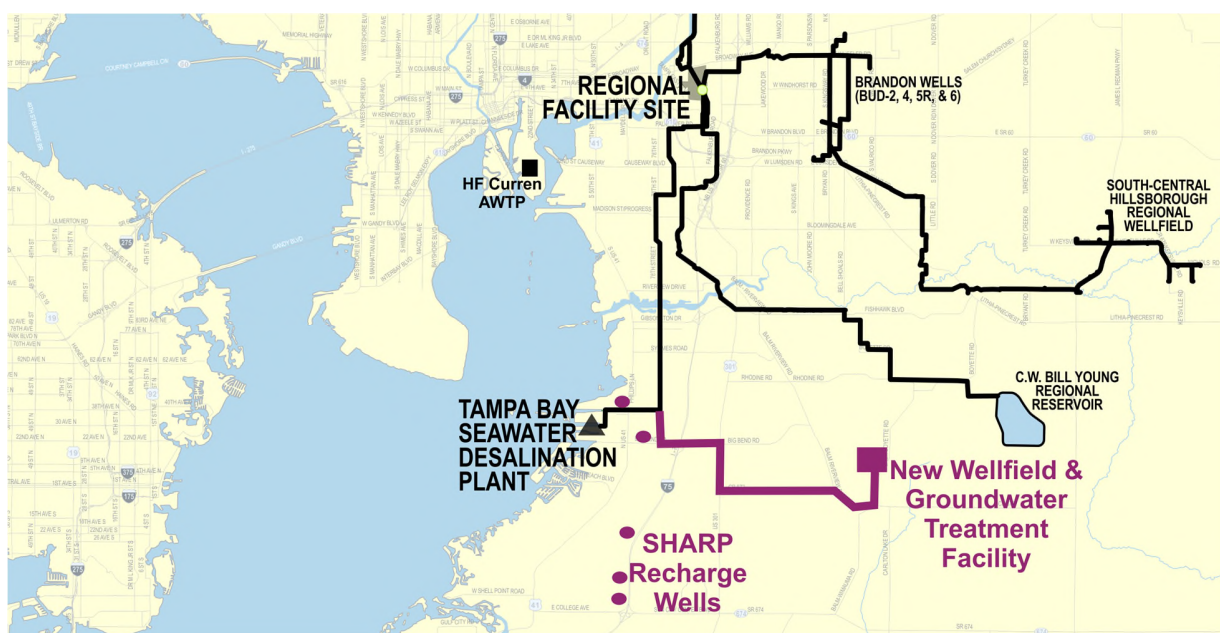


**Figure 10-3. Proposed via Net Benefit SHARP System Pipeline Routing**

#### 10.2.2.3 New Groundwater via Aquifer Recharge Credit (Expanded SHARP)

The new Groundwater via Aquifer Recharge Credit (Expanded SHARP) project consists of a new reclaimed water tank and pump station at H.F. Curren AWTP, approximately 74,000 linear feet of 36-inch diameter pipeline from H.F. Curren AWTP to a new 20 mgd injection wellfield, a new 20 mgd groundwater withdrawal wellfield, water treatment plant and pump station in southern Hillsborough County, and a 61,000-foot long 36-inch diameter pipeline to connect the new groundwater treatment plant to the existing Tampa Bay Water Regional Supply System. The total estimated land required is 94 acres: 20 acres for the tank, pump station and pipeline from H.F. Curren to the injection wellfield; 20 acres for the tank and pump station and injection wells; 24 acres for the withdrawal wells (including production and monitoring wells, and wellfield collection pipelines and access roads); 20 acres for a groundwater treatment plant and pump station, and 10 acres of property for the finished water pipeline route to connect the plant to the regional system. Figure 10-4 shows the proposed pipeline routes and approximate water treatment plant location.

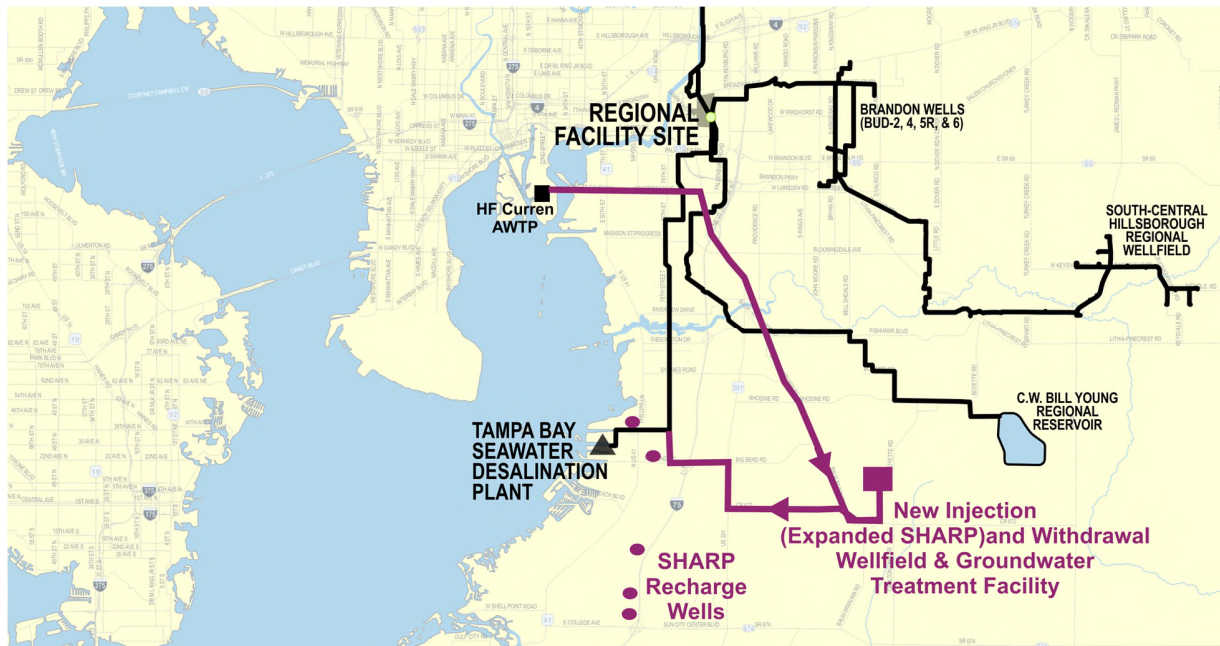


**Figure 10-4. Proposed via Net Benefit from Expanded SHARP Proposed Pipeline Routing**

*10.2.2.4 Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal (Native or Impacted Groundwater Quality)*

The Regional Surface Water Treatment Plant Expansion with Tampa Aquifer Recharge and Withdrawal consists of the City of Tampa installing an aquifer recharge system of wells that would allow Tampa Bay Water to withdraw 20 mgd from a new wellfield. The water would then be sent to the Regional Surface Water Plant, which would be expanded by 20 mgd for treatment and distribution into the regional system. This water supply project would involve 11 wells and 15,000 linear feet of 16-inch diameter collection piping, approximately 27,000 linear feet of 42-inch diameter pipeline to connect the new wellfield to the Regional Surface Water Plant, and the expansion of the surface water treatment plant. The total estimated land required is 26 acres: 16 acres for the withdrawal wellfield (including production and monitoring wells, and wellfield collection pipelines and access roads) and 10 acres of property for the pipeline that connects the wellfield to the Regional Surface Water Treatment Plant. The surface water plant expansion improvements (for either native or impacted groundwater quality sub-options) do not require additional land acquisition based on the expanded facilities being sited on land already owned by Tampa Bay Water. Figure 10-5 shows the general location of the wellfield and a proposed route for the pipeline for this option.



**Figure 10-5. Proposed Pipeline Route from Tampa Area Recharge Project to Regional Facilities Site**

#### 10.2.2.5 Regional Surface Water Treatment Plant Expansion with Reclaimed Water

The Regional Surface Water Treatment Plant Expansion with Reclaimed Water project consists of an expansion of the Regional Surface Water Treatment Plant, a tank and pump station at the H. F. Curren AWTP and approximately 43,000 linear feet of 42-inch diameter reclaimed water pipeline. The total estimated land required is 9 acres which is for the tank, pump station and pipeline. There are no land requirements for the expansion of the surface water plant, as the proposed expansion would fit on land already owned by Tampa Bay Water. Figure 10-6 shows the proposed route from H. F. Curren AWTP to the Regional Site.

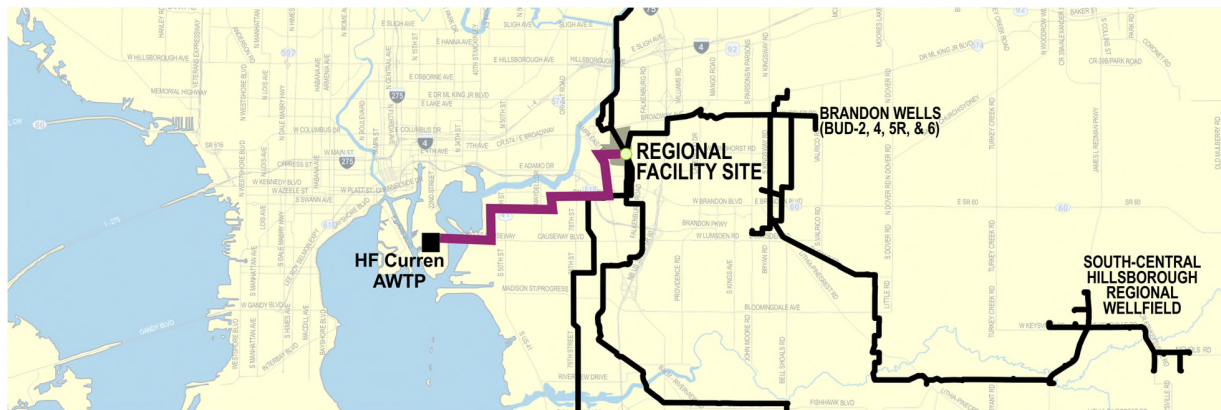


**Figure 10-6. Proposed Pipeline Route from H. F. Curren AWTP to the Regional Surface Water Plant**



#### 10.2.2.6 New Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending

The Advanced Water Treatment Plant for Reclaimed Water with Finished Water Blending includes a new advanced water treatment plant next to the existing Regional Surface Water Plant to treat the reclaimed water from the H. F. Curren AWTP. The new water treatment plant would be located on the existing Regional Facilities Site property and would not require any additional property acquisition. The total estimated land required is 9 acres, which is for the reclaimed water storage tank, pump station and pipeline. Figure 10-7 is a preliminary site plan drawing that shows the new advanced water plant next to the Regional Surface Water Plant.



Figure 10-7. Preliminary Site Plan for Proposed Advanced Water Treatment Plant

#### 10.2.2.7 Seawater Desalination Plant Expansion with Reclaimed Water

The Seawater Desalination Plant Expansion with reclaimed water option involves the storage, pumping and piping of reclaimed water from the H.F. Curren AWTP to the desalination plant and the expansion of the plant. The desalination plant expansion would be built on land that is already under a long-term lease from TECO and is not anticipated to require additional land acquisition. Property will be required for the reclaimed water storage, pumping and pipeline from the H.F. Curren AWTP to the desalination plant. The estimated land required for these project components is 16 acres. Figure 10-8 shows the proposed pipeline from H.F. Curren AWTP to the Tampa Bay Seawater Desalination Plant.

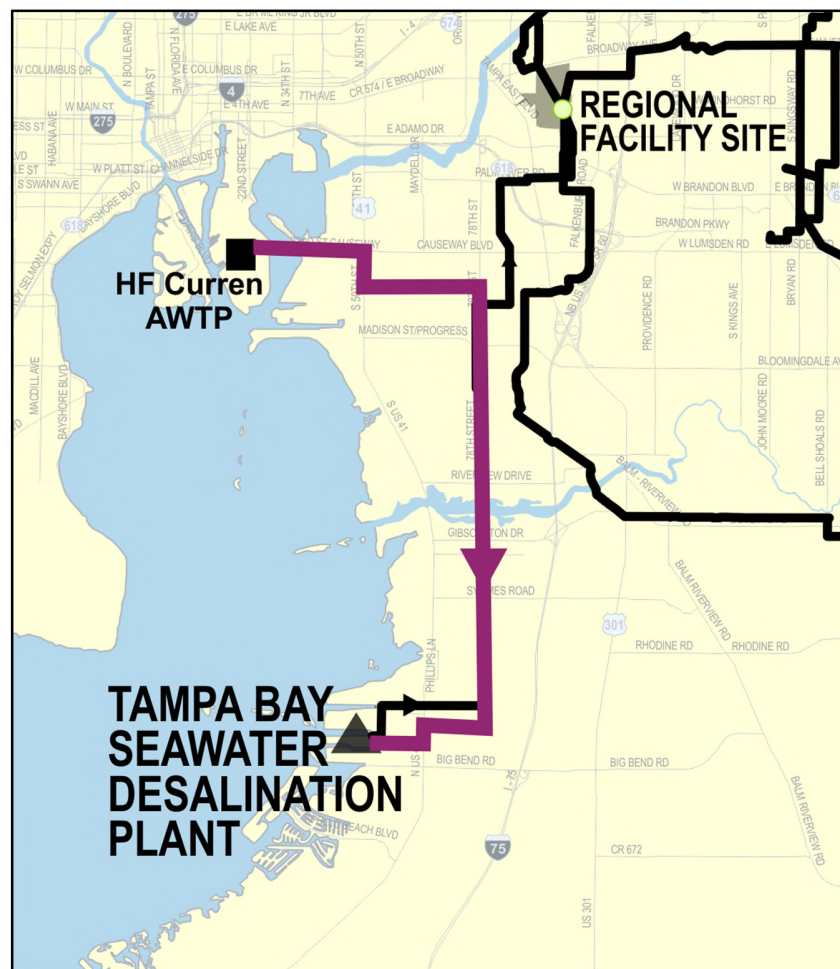


Figure 10-8. Proposed Route from H. F. Curren AWTP to the Desalination Plant

#### 10.2.2.8 Aquifer Recharge and Recovery with Treated Reclaimed Water

The Aquifer Recharge and Recovery with Treated Reclaimed Water project includes a storage tank, pump station and 43,000 linear feet of 42-inch diameter reclaimed pipeline. The reclaimed water would be treated with a new advanced water treatment plant, stored and pumped to a new injection wellfield in southern Hillsborough County, through approximately 110,000 linear feet of 36 and 42-inch diameter treated water pipeline. A new withdrawal wellfield would be constructed to take water to a new ground water treatment plant, and then the finished water supply would be pumped to the regional system. The total estimated land required is 107 acres: 9 acres for the reclaimed water storage tank, pump station and pipeline; 24 acres for the treated reclaimed water pipeline from the Regional Facilities Site to the injection/withdrawal wellfield; 39 acres for the injection and withdrawal wellfields (including production and monitoring wells, and wellfield collection pipelines and access roads); 20 acres for the groundwater treatment plant and pump station; and 15 acres for the finished water storage tank, pump station, and pipeline to deliver the water supply to the regional system. The new advanced water treatment plant is assumed to be located at the Regional Facilities Site which is already owned by Tampa Bay Water. Figure 10-9 shows proposed routes for the pipelines and general locations for the new water treatment and transmission facilities.

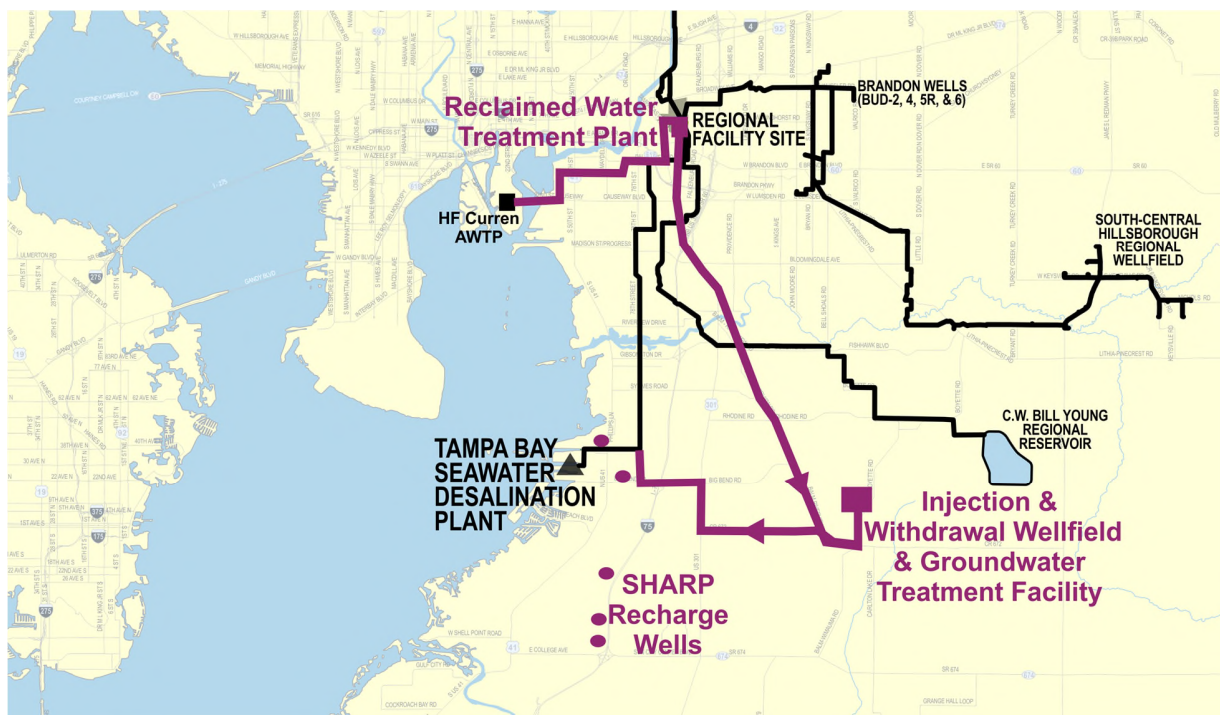


Figure 10-9. Proposed Pipeline Routes for the Aquifer Recharge and Recovery with Treated Reclaimed Water Option

## 11. System Analysis

Tampa Bay Water regularly performs hydraulic analyses for its regional supply and transmission system to study current system operating conditions and how best to integrate new water supply concepts into the regional system to meet the future supply needs and potentially alleviate emergency conditions due to loss of supplies. This section provides an overview of the system analyses and the potential effect of future water supply concepts on system hydraulics.

### 11.1 Systems Analysis Tools

Tampa Bay Water uses a number of computer modeling and analysis tools to evaluate its system. A summary of the system analysis tools that are currently used is provided below:

- Regional System and Enhanced Surface Water System Surge Models – Surge models for Tampa Bay Water’s Regional System and Enhanced Surface Water transmission systems developed in Bentley’s HAMMER software. The models are used to predict potential system transient control issues and evaluate options to mitigate or reduce potential transient control problems.
- Regional Supply and Transmission System and Enhanced Surface Water System Hydraulic Models– The hydraulic models use the ArcGIS based InfoWater software. The hydraulic model of Tampa Bay Water’s regional finished water transmission system is used to study current and projected future system operations and evaluate potential system improvement options. The hydraulic model of Tampa Bay Water’s Enhanced Surface Water System components is used to determine hydraulic limitations for the existing transmission system infrastructure and evaluate potential future expansions of the system.
- Hydraulic Grade Spreadsheets – These excel spreadsheets graph the hydraulic grade of Tampa Bay Water’s major pipelines based on supply input and demand output. The tools have been upgraded to include approximations for chemical usage and electricity. These estimates can be used for annual budgeting purposes.
- Enhanced Surface Water System Operational Model – A stochastic model of Tampa Bay Water’s Enhanced Surface Water System. The model is used to estimate supply availability based on climate related seasonal and long-term drought and heavy rainfall periods, for the existing supply sources, storage, and transmission system infrastructure, and evaluate potential yield and reliability of future expansions of the system. This is discussed in more detail in Section 8.
- Regional System Performance Model – This model includes the Enhanced Surface Water Operation Model, probabilistic demand projections, operating rules and constraints for the groundwater, surface water and desalination facilities to evaluate the performance and reliability of Tampa Bay Water’s regional water supply and delivery system. This is discussed in more detail in Section 8.



## **11.2 Previous Hydraulic and Systems Analyses**

### **11.2.1 Surge Modeling**

Tampa Bay Water operates large finished and raw water transmission systems with limited numbers of water supply inputs and water demand outlets. Large transmission system with limited inlets and outlets can be susceptible to significant transient pressure events, also known as water hammer or surge pressures and vacuum conditions. In order to mitigate surge pressure events, Tampa Bay Water has implemented a variety of operating strategies, control systems, and surge mitigation devices throughout its systems. The transmission mains are furnished with combination air/vacuum relief valves to reduce the potential for water column separation and associated pressure surges and vacuums conditions that can occur during transient causing events, such as power outages at pumping facilities or the unintentional rapid closing of a valve.

Transient surge model has been developed for the Tampa Bay Water Regional System and the Enhanced Surface Water System. These models were developed in Bentley HAMMER software, and are updated periodically when changes to the transmission system inlets or outlets are made. The Regional System surge model was updated in 2015, and the Enhanced Surface Water System model was updated in 2017. These models were used to analyze potential transient pressure control issues and evaluate options to mitigate transient pressure problems for both current and future system operating conditions.

In order to ensure that the recommended surge mitigation devices and strategies have been implemented and continue to function as intended, Tampa Bay Water has developed a comprehensive database for the surge mitigation features throughout the system. The database serves as an inventory of the surge mitigation features and also includes information regarding recommended settings and maintenance requirements for each. Tampa Bay Water Staff periodically reviews the surge mitigation features throughout the system to document field consistency with the recommendations indicated in the database.

### **11.2.2 Hydraulic Analysis of the Regional Transmission System**

The Regional Transmission System model is run in the GIS based software InfoWater, and has been calibrated to the existing system infrastructure. It incorporates the major components of the Regional Transmission system, including the supply sources, storage, pumps, piping, demands, and their associated diurnal flow patterns. The model has been used to assess whether pumps and pipe sizes are adequate to convey supply for projected future member demands at the required system pressures, without exceeding the design pressures of the pipelines. The results of the previous hydraulic modeling analyses indicated the following:

- System pressures during peak future flow scenarios (in year 2035) were predicted to reach up to 168 pounds per square inch, which is approaching the maximum working pressure of the pipeline of 175 pounds per square inch. The maximum system pressures should continue to be monitored and further analysis should be completed as updated demand projections become available.
- Providing additional finished water storage capacity or adding pipeline capacity between the Morris Bridge Booster Pump Station and the Cypress Creek Pump Station could increase the

hydraulic capacity and reliability of the Regional Transmission System; however, these improvements would also result in increased water age. Additional water age and water quality modeling should be performed prior to making decisions to add more capacity and/or transmission pipelines to the system.

### **11.2.3 2035 System Hydraulic and Emergency Scenario Analysis**

Tampa Bay Water completed the *Tampa Bay Water 2035 System Hydraulic and Emergency Scenario Analysis* in 2015. This analysis was performed to:

- Determine if the existing transmission system has sufficient hydraulic capacity to handle projected average and maximum day demand conditions through year 2035.
- Evaluate if the system has sufficient operational flexibility and capacity to meet water demands during emergency scenarios such as:
  - System wide commercial power outage conditions.
  - Pipeline failures at 14 locations.
  - Facility shutdowns at 3 locations.
- Re-evaluate recommended improvements from the previous 2025 System Analysis (that had not been implemented yet) to determine if these improvements are still necessary, and recommend additional improvements to increase the reliability and delivery capacity of the regional system.
- Compare Tampa Bay Water's contract requirements and level of service to five similar wholesale supply utilities.
- Evaluate the expected reliability of facilities to produce supply based on planned maintenance and unplanned outages of the major equipment and components at each facility.

## **11.3 System Analysis for Future Water Supply Project Concepts**

### **11.3.1 System Analysis for Future Water Supply Project Concepts**

As part of Tampa Bay Water's current Long-term Water Supply Planning process, several potential water supply concepts were developed. These water supply concepts are described in Section 10. Preliminary hydraulic analyses were completed to define estimated sizing requirements for the water transmission infrastructure proposed with each of the future water supply concepts. The results of these hydraulic analyses are reflected in the pipeline and pump station sizing estimates that are described for the various project concepts, which are further described in the Technical Memoranda in Appendices 9A, 9B, 9C, and 9D.

In addition to the hydraulic analyses performed to define estimates for the sizing of the pump stations and pipelines associated with the future water supply concepts, preliminary assessments were also

completed to identify the anticipated hydraulic impacts associated with integrating the new supply capacity into the existing regional transmission system. Table 11-1 identifies the locations where the new water supply sources are proposed to be connected to the existing Regional System, and summarizes the anticipated impacts to the existing Regional Transmission System. The proposed locations for connecting the new supply options to the existing Tampa Bay Water regional system are also shown in Figure 11-1.

As the water supply concepts are short-listed for additional consideration and evaluations, it is recommended that additional hydraulic analyses be completed to further evaluate how the implementation of the potential new water supply sources could impact the operation of the Regional Transmission System. The future analyses should consider the seasonal differences in demand and supply availability, the diurnal fluctuation in demand at delivery locations and the projected system demand conditions through year 2035. The analyses should specifically investigate whether the new supplies will improve or exacerbate the hydraulic restrictions in the Morris Bridge Transmission Main, Cypress Bridge Transmission Main, Brandon Transmission Main, and Brandon South Central Connector. The analyses should also evaluate the need for increased operational flexibility and identify potential system operating restrictions. The results of the future analyses will help define the need for the future transmission system improvements as demand projections increase and additional supply sources are added.

**Table 11-1: Future Water Supply Project Concepts**

| Water Supply Concepts                                                                                                                            | New Supply Capacity | Location Where New Supply Enters the Regional System & Estimated Impacts to Existing System Hydraulics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tampa Bay Seawater Desalination Plant Expansion</b>                                                                                           | 10 mgd              | Tampa Bay Seawater Desalination Plant – Increasing the Desalination Plant production by 10 mgd would result in higher discharge flowrates and pressures from both the Product Water Pump Station (at the Desalination Plant) and the Regional High Services Pump Station (at the Regional Facilities Site). The average increase in pressure at the Regional High Services Pump Station is anticipated to be limited due to the projected increases in water demands in south Hillsborough County.                                                                                                                                                                                                                                                              |
| <b>Gulf Coast Seawater Desalination Plant</b>                                                                                                    | 20 mgd              | Keller Water Treatment Facility – The additional water supply capacity in the western portion of the system would result in reducing the pressures throughout the majority of the Regional Transmission system (from the Regional Facilities Site, to the Cypress Creek WTP, to the Pinellas Regional point of connection).                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Surface Water Expansion</b><br><br>(Includes all six water supply concepts that involve expanding the Regional Surface Water Treatment Plant) | 10-20 mgd           | Regional Facilities Site - Increasing the supply capacity at the Regional Facilities Site by 10 mgd would result in higher discharge flowrates and pressures from the Regional High Services Pump Station; however, the average increase in pressure is anticipated to be minor due to projected increases in water demands in south Hillsborough County. An increase of 20 mgd at the Regional Facilities Site may begin to cause some hydraulic capacity issues in the Morris Bridge and Cypress Bridge Transmission Mains under some future system operating conditions. Additional analyses should be performed as future demand projections are updated and the plans for future supply sources and transmission system infrastructure are better defined. |
| <b>New South Hillsborough Wellfield via Net Benefit from SHARP Program</b>                                                                       | 10-20 mgd           | Lithia Water Treatment Facility, Desalination Transmission Main (near the Seawater Desalination Plant), or new South Hillsborough Pipeline – It is anticipated that a majority of the new supply capacity would be delivered to a new point of connection in Southern Hillsborough County. The remaining supply capacity that is delivered into the Regional System could result in some hydraulic capacity impacts to portions of the existing Regional System. Additional hydraulic analyses should be performed as the plans for future supply delivery in Southern Hillsborough County are further developed.                                                                                                                                               |



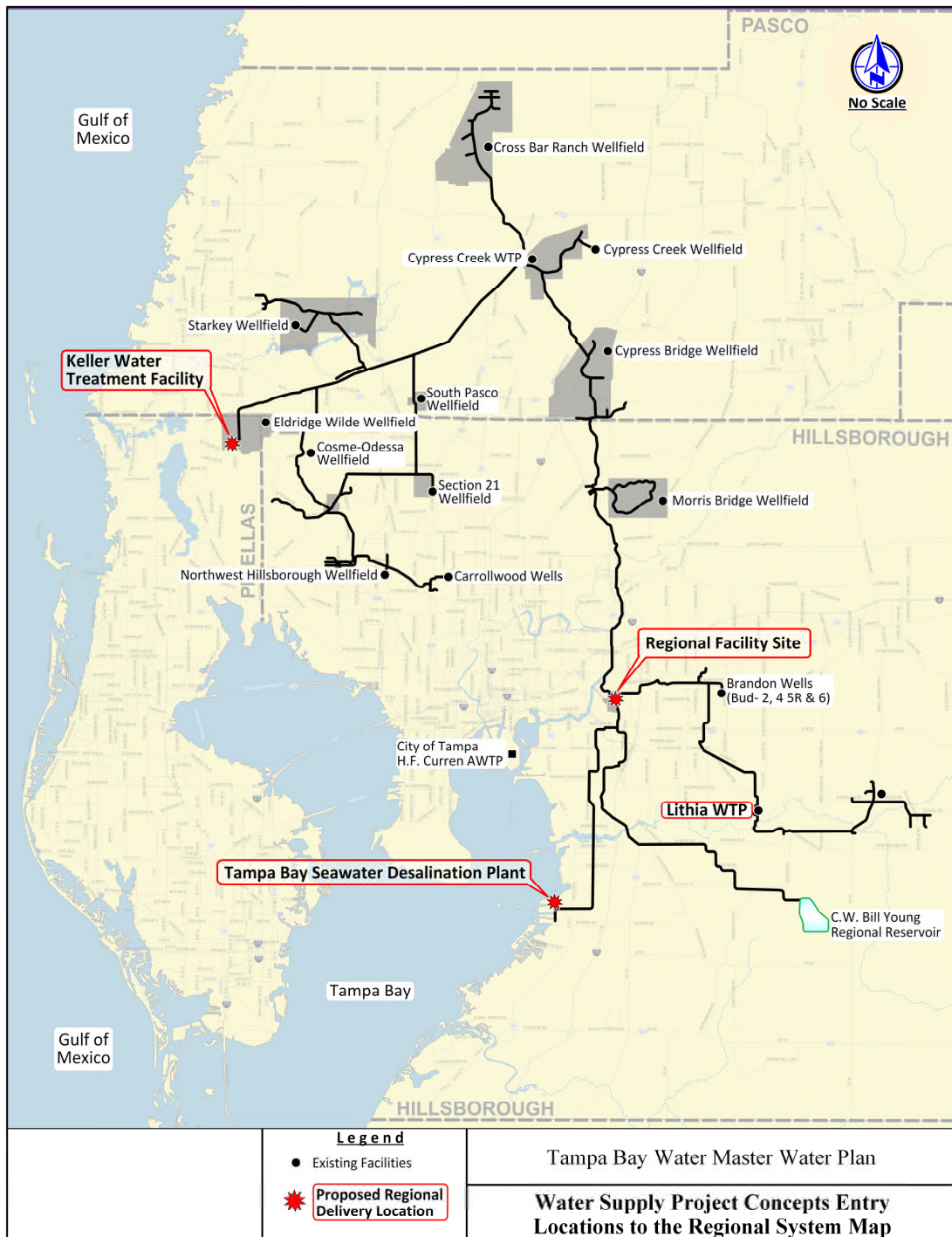


Figure 11-1: Water Supply Project Concepts Entry Locations to the Regional System

### 11.3.2 Future System Surge Analysis

Tampa Bay Water's future plans for continuing to maintain adequate surge protection throughout the system include:

- Completing updates to the surge mitigation feature database, including field observations and testing to document the settings and functionality of the surge mitigation devices and control systems. Any discrepancies between the recommendations and the field observations will be further evaluated and addressed as necessary.
- Evaluation of the integration of future water supply sources to the existing system and changes to system operating conditions to allow for proactive implementation of appropriate surge mitigation devices and operating strategies.

These efforts will support Tampa Bay Water's ability to continue providing a safe and reliable potable water supply to its Member Governments.

## 11.4 System Reliability and Emergency Scenario Planning

The Member Governments rely on Tampa Bay Water to provide them with a reliable supply of potable water throughout the year. The previously mentioned *Tampa Bay Water 2035 System Hydraulic and Emergency Scenario Analysis* included a number of analyses to develop and evaluate options to improve system reliability. The analyses resulted in several recommendations that will improve Tampa Bay Water's ability to maintain reliable service during potential wide spread power outage conditions that can occur during inclement weather conditions such as hurricanes. The analysis also provided recommendations for improvements that would increase the system's ability to continue delivering adequate water supply to each of the Member Governments during a variety of other emergency conditions such as pipeline failures or facility outage events.

There are numerous potential facility or pipeline outage events that could occur in a water supply and transmission system at any given time. Tampa Bay Water's system was evaluated to determine which system outage scenarios result in the greatest operational challenges. The following water supply deficiencies resulting from potential system outage scenarios were identified:

- Demands in south Hillsborough County were projected to grow rapidly and would exceed the available supplies within the 20-year planning horizon. Therefore, any system outage scenarios that impact the infrastructure associated with delivering water to south Hillsborough County could result in temporary deficiencies in the amount of water supply delivered to south Hillsborough County.
- Pipe Breaks at four locations along the Cypress Creek Transmission Main between the Cypress Creek Water Treatment plant and the Pinellas County regional delivery POC could temporarily impact the ability to meet required flowrates and delivery pressure requirements for some of the Pinellas County and Pasco County points of connection.
- A pipe break on the South-Central Hillsborough Regional Wellfield Transmission Main could result in a temporary supply deficiency to Hillsborough County.
- A facility outage at the D. L. Tippin WTP could result in a temporary water supply deficiency for the City of Tampa.

The impacts that the various future water supply concepts would have on the reliability of the system during critical facility and pipeline outage scenarios were considered, and are summarized in Table 11-2.

**Table 11-2: Impact to System Reliability and Emergency Scenario Planning**

| Water Supply Concepts                                                                                                                     | Impact to System Reliability and Emergency Scenario Planning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tampa Bay Seawater Desalination Plant Expansion                                                                                           | <ul style="list-style-type: none"> <li>Expansion of the existing Desalination Plant provides additional capacity from a drought proof supply source in south Hillsborough County, however the supply from the Desalination Plant is currently delivered north to the Regional Facilities Site for blending with surface water supply before entering the regional water transmission system. The additional supply capacity at the Regional Facilities Site does not improve the ability to deliver water to the areas that were determined to have potential supply deficiencies under the worst-case facility and pipeline outage scenarios.</li> <li>Some improvements can be considered to allow desalinated water supply to be delivered directly to a new point of connection in south Hillsborough County to increase system reliability in this area. Additional evaluations of this concept are required to further identify and address potential water quality and compatibility concerns associated with this concept.</li> </ul> |
| Gulf Coast Seawater Desalination Plant                                                                                                    | <ul style="list-style-type: none"> <li>The Gulf Coast Desalination Plant would provide additional capacity from a drought proof supply in the northwest portion of the regional system, near the regional point of connection to Pinellas County. Additional supply capacity in this portion of the regional system would improve the ability to maintain delivery pressures and flowrates to several points of connection on the western side of the regional system during a Cypress Creek Transmission Main pipe break scenario.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Surface Water Expansion<br><br>(Includes all six water supply concepts that involve expanding the Regional Surface Water Treatment Plant) | <ul style="list-style-type: none"> <li>Expanding the Regional Surface WTP at the existing location would not improve the system performance for the critical facility and pipeline outage scenarios that have been identified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| New South Hillsborough Wellfield via Net Benefit from SHARP Program                                                                       | <ul style="list-style-type: none"> <li>A new wellfield in south Hillsborough County would improve the reliability of supply to south Hillsborough County in anticipation of the projected rapid growth that would exceed the available supplies within the 20-year planning horizon. The additional supply capacity in this area would also improve the ability to meet water demands during some of the critical facility and pipeline outage scenarios that have been identified, including a South-Central Hillsborough Regional Wellfield Collection Main Pipe Break scenario.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 12. Climate Variability and Coastal Hazards Vulnerability Assessment

The Tampa Bay area and the Tampa Bay Water Regional Supply System can experience significant impacts from long-term climate variability and coastal hazards. Climate variability and coastal hazards include natural occurring events, such as extended drought or wet weather conditions, flooding, hurricane/storm surge events, and sea level rise (SLR). Some of the Tampa Bay Water supply sources and system infrastructure components are more vulnerable to impacts from climate variability and coastal hazards than others. In order to effectively plan for the potential impacts that climate variability and coastal hazards can have on the Agency's water supply system, Tampa Bay Water has been engaged in several activities and studies aimed at helping the Agency better understand long-term climate variability and potential vulnerabilities to coastal hazards.

An understanding and proactive planning for climate variability and coastal hazards is not only important for the existing Tampa Bay Water supply sources and system components, but also for the potential future water supply concepts that are being considered. As part of this LTMWP, a coastal hazards vulnerability assessment was completed to characterize the vulnerability of the potential future water supply concepts to coastal hazards and other related "threat factors" that could temporarily or permanently impact the availability of the water supply. This section of the master plan provides background information regarding the activities that Tampa Bay Water has performed to continue improving its understanding and planning efforts related to climate variability, and a summary of the coastal hazards vulnerability assessment that was performed as part of the evaluation of the future water supply concepts identified in Section 10. Details of this assessment are included in the technical memorandum, Coastal Hazards Vulnerability Assessment Technical Memorandum included in Appendix 12-A.

### 12.1 Background on Climate Variability and Sea Level Rise

Tampa Bay Water has been engaged in research with the University of Florida on the impacts of climate change to west central Florida. Research objectives include:

- Evaluate the ability of Global Climate Models (GCM) to reproduce observed temperature and rainfall in the Tampa Bay region,
- Evaluate the ability of global climate model outputs to reproduce historic hydrologic behavior when used with Tampa Bay Water's Integrated Hydrologic Model,
- Evaluate changes in hydrologic behavior resulting from global climate model future projections, and
- Evaluate impact of future climate scenarios on future water supply availability in the Tampa Bay region.

Tampa Bay Water has also been a member of the Water Utility Climate Alliance since 2010. This organization is a consortium of 12 major water utilities across the United States. A core objective of this coalition is promoting "actionable science" through data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making. More

information is available on the website: [www.WUCA.org](http://www.WUCA.org). Tampa Bay Water is also a founding member of the Florida Water and Climate Alliance in 2010, a coalition of local, state and regional governments, universities, and utilities. This coalition is focused on increasing the relevance of climate science data and tools for water resource planning and supply operations in Florida. More information is available on the web site. [www.floridawca.org](http://www.floridawca.org).

The Tampa Bay Water regional system is shown in Figure 12-1. As indicated in this figure, Tampa Bay Water relies on surface water, coastal wellfields, a desalination plant and other coastal infrastructure to deliver drinking water to its member governments. Initial climate change research efforts were focused on improving the understanding of how changes in rainfall patterns will or could impact stream-flows. Research to date has confirmed increasing temperatures for the region; however, changes in rainfall have varied from 22 percent less to 11 percent more annual rainfall. The Agency is continuing to research and study these changes. Changing rainfall patterns and volumes will shift seasonal flow patterns, which may reduce surface water availability. Increasing temperatures will likely impact treated water quality and could have adverse impacts on infrastructure and field personnel. In addition, climate change could adversely impact coastal assets, including water treatment plants or pumping stations through sea level rise, more severe or frequent storm surge events, or increasing flooding events.



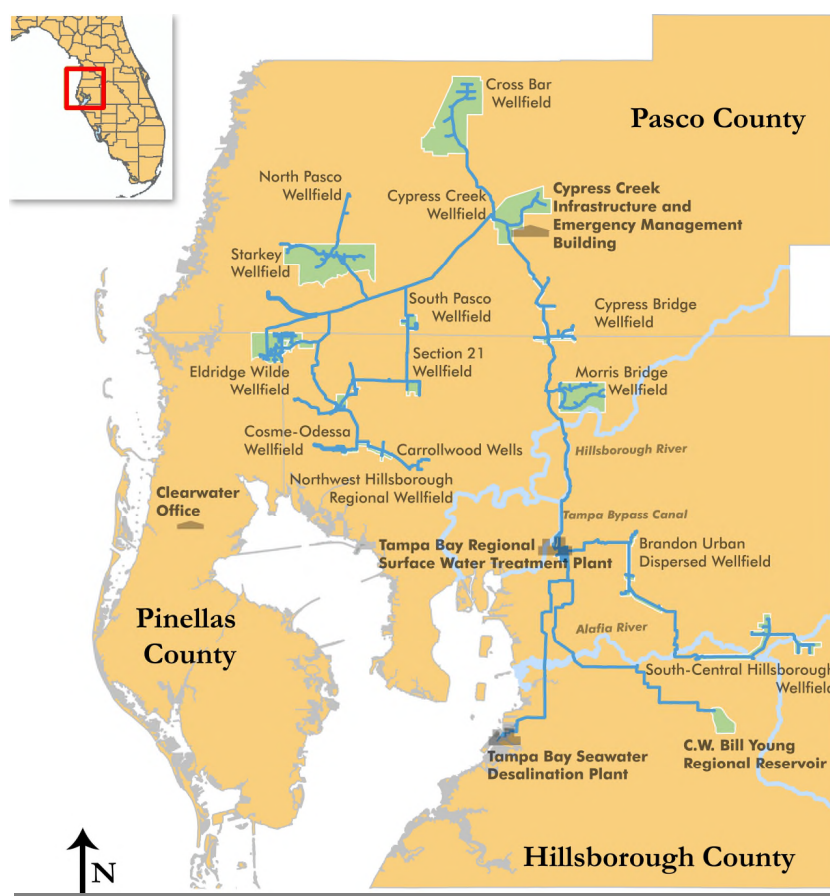


**Figure 12-1: Tampa Bay Water System**

The Tampa Bay Climate Science Advisory Panel (CSAP), formed in spring 2014, is an ad hoc network of scientists and resource managers working in the Tampa Bay region (Pinellas, Hillsborough, Manatee, and Pasco counties). The group's goal is to collaboratively develop recommendations for local governments and regional agencies as they make decisions about responding to climate change and associated SLR. The CSAP has assessed the best-available scientific data to determine a regional set of SLR projection scenarios through 2100. With this shared projection, local governments can coordinate, develop and implement appropriate coastal adaptation and risk reduction strategies. In 2015, the CSAP published a document (*Recommended Projection of Sea Level Rise in the Tampa Bay Region*, August 2015), which provides recommended sea level rise projections Table 12-1 for the Tampa Bay Region. This document was approved by the Tampa Bay Regional Planning Council for use in infrastructure maintenance and planning.

Based upon a thorough assessment of scientific data and literature on SLR, the Tampa Bay region can expect to see SLR somewhere between 6 inches to 2.5 feet in 2050, and between 1 to 7 feet in 2100. Given this uncertainty in the future sea level rise, Tampa Bay Water will use this information in multiple scenarios to assist in the decision process for future infrastructure. For example, projected life of a new water treatment plant or pumping station, if located along the coastal areas, can be used to evaluate the impacts of expected SLR. Facilities of concern would be those with long projected asset life and are critical to the success of Tampa Bay Water's mission.



**Table 12-1: Relative Sea Level Change Scenarios for St. Petersburg, Florida in feet above Lower Mean Sea Level (LMSL), base year 1992 control for national survey datum.**

| Year              | NOAA Low (Feet) <sup>2</sup> | NOAA Intermediate Low (Feet) <sup>2</sup> | NOAA Intermediate High (Feet) <sup>2</sup> | NOAA High (Feet) <sup>2</sup> |
|-------------------|------------------------------|-------------------------------------------|--------------------------------------------|-------------------------------|
| 1992 <sup>1</sup> | 0.00                         | 0.00                                      | 0.00                                       | 0.00                          |
| 2012              | 0.17                         | 0.21                                      | 0.29                                       | 0.38                          |
| 2032              | 0.34                         | 0.49                                      | 0.80                                       | 1.16                          |
| 2052              | 0.52                         | 0.84                                      | 1.54                                       | 2.36                          |
| 2072              | 0.69                         | 1.26                                      | 2.52                                       | 3.96                          |
| 2092              | 0.86                         | 1.75                                      | 3.72                                       | 5.97                          |
| 2100              | 0.93                         | 1.97                                      | 4.26                                       | 6.89                          |

<sup>1</sup> The National Tidal Datum Epoch is calculated using tide gauge observations from 1983-2001. Therefore, the mid-point of 1992 is used as the starting point for the projected curves.

<sup>2</sup> NOAA (National Oceanic and Atmospheric Administration) has identified four SLR scenarios (low, intermediate-low, intermediate-high, and high) that consider a range of future SLR for risk planning purposes.

## 12.2 Coastal Hazards Vulnerability Assessment

The Tampa Bay region, with nearly 700 miles of coastline and 3.2 million residents - most of whom live near Tampa Bay or the Gulf of Mexico - is highly vulnerable to the potential effects of SLR. Citizens, emergency managers and regional leaders have been accustomed to thinking of these hazards in terms of the episodic effects of hurricanes or coastal storms; however, it is also important for local governments and regional agencies to consider the long-term, sustained effects of SLR on real property, quality of life, and perhaps most importantly, our ability to sustain growth in the regional economy.

A coastal hazards vulnerability assessment was completed to characterize the vulnerability of the water supply concepts to coastal hazards and other related “threat factors” that could negatively impact the short or long-term operations or production capacity of the supply source. The results of this vulnerability assessment are one of the many factors being considered as part of the overall evaluation and selection of future water supply concepts as part of this Tampa Bay Water LTMWP Update. The following sub-sections describes the vulnerability assessment approach and the resulting vulnerability scores developed for each of the future water supply concepts being considered.

### 12.2.1 Overview of Approach and Criteria

A vulnerability assessment was completed to evaluate the potential for current and potential future facilities to be negatively impacted based on the following four coastal hazards or “threat factors”:

- Flooding (based on location within defined flood zones)
- Storm surge from hurricanes
- Sea level rise
- Potential short or long-term water quality impacts from coastal hazards or “threat factors”

Many of the water supply concepts involve a number of infrastructure components that are spread out over a large area. Some of the infrastructure components may be located in areas that are more vulnerable to coastal hazards than others. For water supply concepts that have multiple components spread over wide areas, the vulnerability assessment considered how critical each component was for continuing the production of potable water supply of the water supply concept. For example, some of the water supply concepts could temporarily lose one or more components and continue to produce potable water supply, whereas other concepts could lose one component that prevents the ability to continue producing potable water supply. The primary components that make up the water supply concepts are listed below and discussed in Section 9, Water Supply Concept Development.

- Regional Surface WTP – Some of the future water supply concepts involve expansion and modifications to this existing treatment facility located in central Hillsborough County, east of downtown Tampa.
- Seawater Desalination Plant – Some of the future concepts involve expansion and modifications to this existing treatment facility that is located on the west coast of southern Hillsborough County on the coast of Tampa Bay.
- New Gulf Coast Desalination Facility – This is a potential new water intake and treatment facility located on the southwest corner of Pasco County, on the coast of the Gulf of Mexico.
- New South Hillsborough Wellfield and Groundwater WTP – This is a potential new wellfield and groundwater treatment facility located in south central Hillsborough area, east of Tampa Bay.
- New Tampa Augmentation Project Wellfield – This is a potential new wellfield located in central Hillsborough County, north of downtown Tampa.
- New Advanced WTP – This is a potential new water treatment facility that is proposed to be located on the existing Tampa Bay Water Regional Facilities Site (and Surface WTP) property in central Hillsborough County, east of downtown Tampa.
- New Treated Reclaimed Water Recharge & Recovery Wellfield and WTP - This is a potential new recharge and withdrawal wellfield and groundwater treatment facility located in south central Hillsborough area, east of Tampa Bay.
- Hillsborough County SHARP Recharge Wellfield – This is an existing recharge wellfield system owned and operated by Hillsborough County, and located near the west coast of southern Hillsborough County. Some of the future options rely on groundwater withdrawal credits obtained through the continued operation (and expansion) of this recharge wellfield system.

- Hillsborough County South County Advanced Wastewater Treatment Plant (AWTP) - This is an existing advanced wastewater treatment plant owned and operated by Hillsborough County, and located in southern Hillsborough County, east of Tampa Bay. Some of the future options rely on groundwater withdrawal credits obtained through the reclaimed water supply generated from this facility.
- City of Tampa H. F. Curren Advanced Wastewater Treatment Plant (AWTP) - This is an existing advanced wastewater treatment facility owned and operated by the City of Tampa, on the coast of Tampa Bay. Some of the future options rely on the reclaimed water supply generated from this facility.

The coastal hazards vulnerability assessment included an evaluation of flood zones (base flood elevations), storm surge, and sea level rise relevant to the above listed components of the future water supply concepts. In addition, the vulnerability assessment considered the potential for short or long-term impacts to the water supply sources that may be caused by the threat factors considered. For example, sea level rise or storm surge events could result in short or long-term impacts to the water quality in a surface water supply source. The sub-sections below describe the evaluations that were completed.

#### 12.2.2 Flood Zone Location Analysis

Data from the Federal Emergency Management Agency (FEMA) was used to investigate if the infrastructure associated with the future water supply concepts were located in a designated flood or impacted zone. The base flood is the flood having a one percent chance of being equaled or exceeded in any given year. Base flood elevations were investigated to assess which facilities are located within a designated flood or impacted zone. The base flood elevations for the water supply concept components located within the flood plain are listed on Table 12-2.

**Table 12-2: Future Water Supply Option Facilities Located within the Flood Plain**

| Facility                                                                       | Base Flood Elevation<br>(Feet, NAVD88) | Critical Facility Elevation for Reference<br>(Feet, NAVD88) |
|--------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------|
| Regional SWTP                                                                  | NA <sup>3</sup>                        | 34                                                          |
| Seawater Desalination Plant                                                    | 11                                     | 9.5-11.5                                                    |
| New Gulf Coast Desalination Facility <sup>1</sup>                              | 11                                     | 9-12                                                        |
| New South Hillsborough Wellfield and Groundwater WTP <sup>1</sup>              | NA <sup>3</sup>                        | 100                                                         |
| New Tampa Augmentation Project Wellfield <sup>1</sup>                          | NA <sup>3</sup>                        | 43                                                          |
| New Advanced WTP (at the Regional Facilities Site) <sup>1</sup>                | NA <sup>3</sup>                        | 27                                                          |
| New Treated Reclaimed Water Recharge & Recovery Wellfield and WTP <sup>1</sup> | NA <sup>3</sup>                        | 100                                                         |
| Hillsborough County SHARP Recharge Wellfield <sup>2</sup>                      | 10                                     | 9                                                           |
| Hillsborough County South County AWTP <sup>2</sup>                             | NA <sup>3</sup>                        | 38                                                          |

| Facility                                     | Base Flood Elevation<br>(Feet, NAVD88) | Critical Facility Elevation for Reference<br>(Feet, NAVD88) |
|----------------------------------------------|----------------------------------------|-------------------------------------------------------------|
| City of Tampa H. F. Curren AWTP <sup>2</sup> | 10                                     | 9-13                                                        |

<sup>1</sup> Potential future facility.

<sup>2</sup> Existing facility that is a component of a Tampa Bay Water future water supply option, but is owned by a member government.

<sup>3</sup> “NA” represents facilities located in areas that are not located in a designated flood zone.

### 12.2.3 Storm Surge Analysis

The SLOSH (Sea, Lake, and Overland Surge from Hurricanes) model is used by the National Hurricane Center and National Weather Service to predict the maximum storm surge that could occur at a given location for each category of hurricane. The SLOSH Display program is a tool that NOAA (National Oceanic and Atmospheric Administration) makes available so users can obtain the results of the NOAA model runs.

Information from the SLOSH model was used to define the potential for storm surge throughout the Tampa Bay area based on different hurricane intensities (wind speeds), approach directions, approach speeds, and tidal conditions. The model results indicated the following:

- Storm surge increased as the speed of advance increased for storms moving in an easterly or northeasterly direction; for other directions there was little effect of speed of advance on surge levels.
- Surge levels are directly related to tide stage.
- Surge increased as the hurricane category increased.
- The worst-case hurricane approach direction was one that is moving east-northeast (ENE).

The maximum storm surge maps predicted by the SLOSH model are shown on Figure 12-2 and Figure 12-3 for a Category 4 and Category 5 hurricane, respectively. To provide an indication of potential impacts, the location of a limited number of existing and potential future water supply facilities are shown on the figure and described in the top right corner for geographic reference.

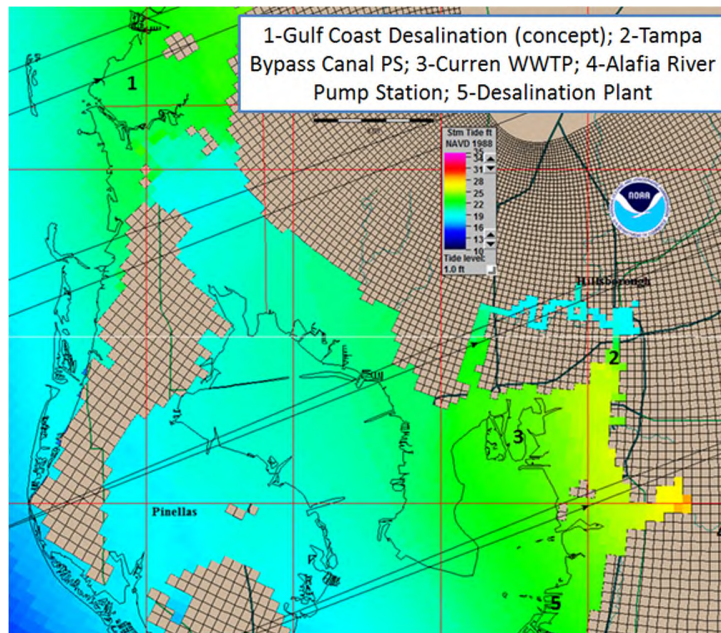


Figure 12-2: SLOSH Model Results for Category 4 Hurricane

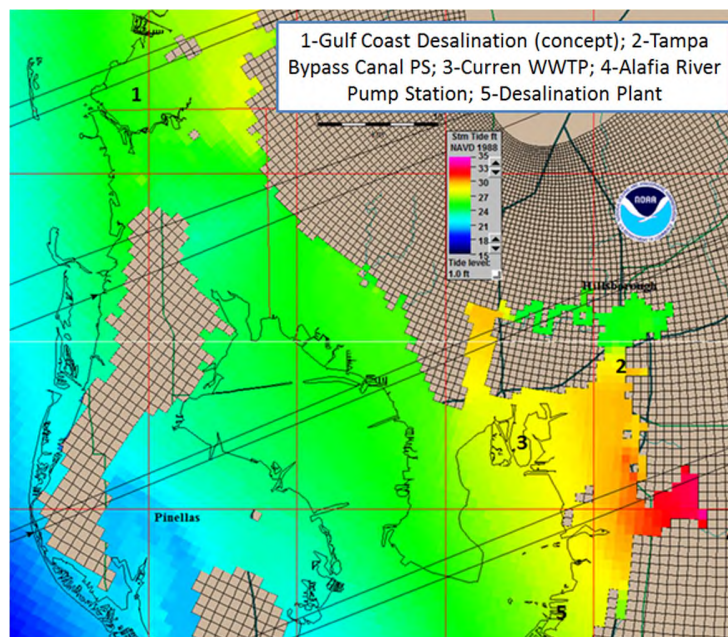


Figure 12-3: SLOSH Model results for Category 5 Hurricane

The predicted storm surge elevations and approximate ground elevations are listed on Table 12-3. In some cases, a facility was located immediately outside of a grid that was inundated. These are indicated on the table as “adjacent to” the elevation for the inundated grid. Facilities listed in bold have surge elevations for a Category 4 hurricane that exceed the ground elevation.



Table 12-3: Facilities Potentially Affected by Hurricane Storm Surge

| FACILITY                                                                       | Approximate Low Ground Elevation (NAVD88) | Surge Elevation Category 4 Hurricane (Feet, NAVD88) | Surge Elevation Category 5 Hurricane (Feet, NAVD88) |
|--------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Regional SWTP                                                                  | 34                                        | Adjacent to 25.2                                    | Adjacent to 29.6                                    |
| Seawater Desalination Plant                                                    | 9.5                                       | 22.7                                                | 27.1                                                |
| New Gulf Coast Desalination Facility <sup>1</sup>                              | 9                                         | 21.6                                                | 25.6                                                |
| New South Hillsborough Wellfield and Groundwater WTP <sup>1</sup>              | 100                                       | NA                                                  | NA                                                  |
| New Tampa Augmentation Project Wellfield <sup>1</sup>                          | 43                                        | NA                                                  | NA                                                  |
| New Advanced WTP (at Regional Facilities Site) <sup>1</sup>                    | 34                                        | Adjacent to 25.2                                    | Adjacent to 29.6                                    |
| New Treated Reclaimed Water Recharge & Recovery Wellfield and WTP <sup>1</sup> | 100                                       | NA                                                  | NA                                                  |
| Hillsborough Co. SHARP Recharge Wellfield <sup>2</sup>                         | 6                                         | 22.8 to 23.5                                        | 27.2 to 28.4                                        |
| Hillsborough County South County AWTP <sup>2</sup>                             | 38                                        | NA                                                  | NA                                                  |
| City of Tampa H. F. Curren AWTP <sup>2</sup>                                   | 9                                         | 23.5                                                | 27.8                                                |

<sup>1</sup> Potential future facility.<sup>2</sup> Existing facility that is a component of a Tampa Bay Water future water supply option, but is owned by a member government.

#### 12.2.4 Sea Level Rise Assessment

The sea level rise analysis completed as part of this assessment was based on information from the Tampa Bay Climate Science Advisory Panel (CSAP). The CSAP's August 2015 report made the following recommendations:

- Tampa Bay region may experience sea level rise somewhere between 6 inches to 2.5 feet in 2050 and between 1 to 7 feet in 2100.
- Given this range of uncertainty in future sea level rise, local governments and other agencies are encouraged to use multiple scenarios in order to allow experts and decision makers the flexibility to consider a variety of contextual factors, including the expected lifespan of the project, project cost, and criticality of function, when developing adaptation strategies.

The projections in the CSAP report are based on four different scenarios of sea level rise projected by NOAA as shown on Figure 12-4. For this evaluation the two intermediate projections were used for sea level rise over the next 50 years.

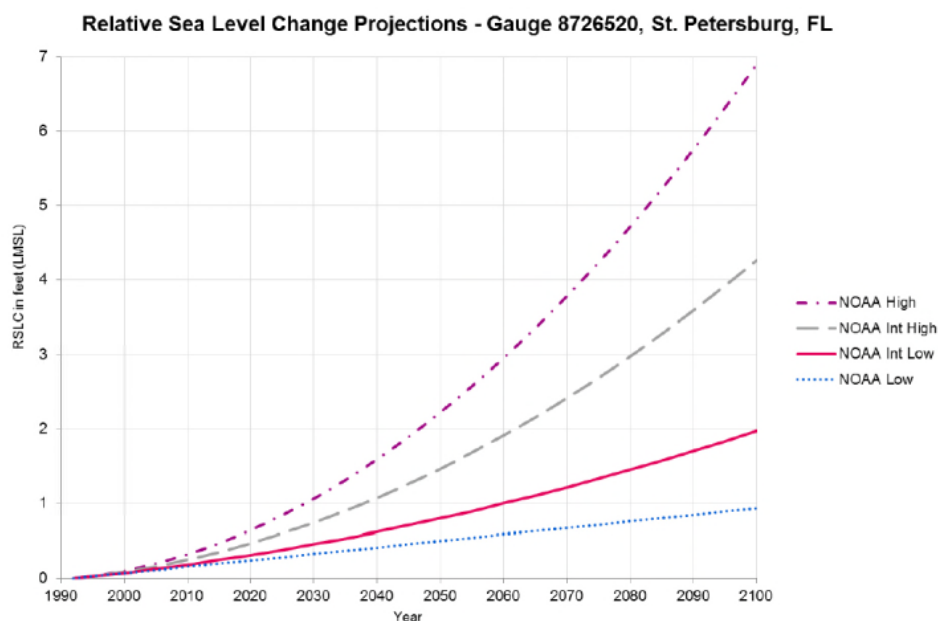


**Figure 12-4: Relative Sea Level Change Projections for the Tampa Area**

Facilities potentially affected from Sea Level Rise are shown in Table 12-4. Storm surge from hurricanes will be proportionately higher and the area of inundation will expand. Sea level rise can also push salt water farther into rivers, potentially affecting the water quality at water supply intakes along rivers, especially during times of low river flow.

**Table 12-4: Facilities Potentially Affected by Sea Level Rise**

| FACILITY                                              | Approximate Low Ground Elevation (NAVD88) | Surge Elevation Plus Intermediate Low SLR Projection (Feet, NAVD88) | Surge Elevation Plus Intermediate High SLR Projection (Feet, NAVD88) |
|-------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------|
| Seawater Desalination Plant                           | 9.5                                       | 23.8                                                                | 24.8                                                                 |
| New Gulf Coast Desalination Facility <sup>1</sup>     | 9                                         | 22.7                                                                | 23.8                                                                 |
| New Tampa Augmentation Project Wellfield <sup>1</sup> | 22                                        | 25.2                                                                | 26.2                                                                 |
| Hillsborough Co. SHARP Recharge WF <sup>1</sup>       | 6                                         | 23.9 to 24.6                                                        | 25.0 to 26.8                                                         |
| Hillsborough County South County AWTP <sup>2</sup>    | 38                                        | 23.1                                                                | 24.1                                                                 |
| City of Tampa H. F. Curren AWTP <sup>2</sup>          | 9                                         | 24.6                                                                | 25.6                                                                 |

<sup>1</sup> Potential future facility.

<sup>2</sup> Existing facility that is a component of a Tampa Bay Water future water supply option, but is owned by a member government.



**12.2.5 Potential for Source Water Quality Impacts from Coastal Hazards**

The water supply source quality and availability were evaluated based on the potential impacts to supply quality resulting from the saline water hazards. Short-term impacts are such that the water quality or availability might be impacted during the event or for a short time afterwards. Long-term impacts are such that the water supply source might not be suitable or available over time due to contamination. Facilities potentially impacted by changes in water supply source quality & availability are shown in Table 12-5.

**Table 12-5: Facilities Potentially Affected by Changes in Water Supply Source Quality & Availability**

| FACILITY                                                                       | Source Water Quality Vulnerability |            |
|--------------------------------------------------------------------------------|------------------------------------|------------|
|                                                                                | Short-Term                         | Short-Term |
| Regional SWTP                                                                  | Yes                                | Yes        |
| Seawater Desalination Plant                                                    | Yes                                | No         |
| New Gulf Coast Desalination Facility <sup>1</sup>                              | Yes                                | No         |
| New South Hillsborough Wellfield and Groundwater WTP <sup>1</sup>              | No                                 | Yes        |
| New Tampa Augmentation Project Wellfield <sup>1</sup>                          | Yes                                | Yes        |
| New Advanced WTP (at Regional Facilities Site) <sup>1</sup>                    | Yes                                | No         |
| New Treated Reclaimed Water Recharge & Recovery Wellfield and WTP <sup>1</sup> | Yes                                | No         |
| Hillsborough Co. SHARP Recharge Wellfield <sup>2</sup>                         | Yes                                | No         |
| Hillsborough County South County AWTP <sup>2</sup>                             | Yes                                | No         |
| City of Tampa H. F. Curren AWTP <sup>2</sup>                                   | Yes                                | No         |

<sup>1</sup> Potential future facility.

<sup>2</sup> Existing facility that is a component of a Tampa Bay Water future water supply option, but is owned by a member government.

**12.2.6 Results of Vulnerability Assessment Scoring for Water Supply Project Components**

The coastal hazards considered as part of this analysis were weighted as indicated below:

- Flooding (based on Base Flood Elevation) = 25%
- Storm Surge = 35%
- Sea Level Rise = 15%
- Changes in Water Supply Source Quality & Availability = 25%

Storm surge was given the highest weighting due to the significance of impacts that storm surge could cause to the facilities. Conversely, sea level rise was weighted the lowest because the threat that sea level rise represents occurs slowly over long periods, which presents an opportunity to adapt over time as more is learned.

The identified project concept components were evaluated for potential impacts from each of the four identified coastal hazard threats. For each of the four threats evaluated, scoring metrics were developed to define the conditions for each scoring grade. The scoring metrics are identified below:

1. Vulnerability to Flooding, based on the Base Flood Elevation (BFE)
  - 5 = Within the inundation area on the FEMA map
  - 3 = Marginal, adjacent to area on the FEMA map or close to the elevation
  - 1 = Outside of the flood area
2. Vulnerability to Storm Surge
  - 5 = Within the surge area and facility elevation below the surge elevation. (Surge area = the area of inundation for a Category 4 storm moving ENE at 25 mph, at high tide.)
  - 3 = Marginal, adjacent to or near the surge area
  - 1 = Outside of the surge area
3. Vulnerability to Sea Level Rise
  - 5 = Within the surge area (Category 4) plus 1.7 feet (the average of the two intermediate projections for Sea Level Rise)
  - 3 = Marginal, adjacent to or near the surge area plus 1.7 feet
  - 1 = Outside of the flood area
4. Vulnerability to Changes in Water Supply Source Quality & Availability
  - 5 = Potential for significant changes in water quality and/or availability that result in negatively impacts over a long period.
  - 3 = Potential for minor changes in water quality and/or availability that result in negatively impacts over a short period.
  - 1 = Unlikely to experience or be impacted by changes in water quality and/or availability.

These scores were weighted as discussed above and combined for each facility to provide a ranking of water supply project components based on vulnerabilities to coastal hazards. Figure 12-5 below illustrates the results of the coastal hazards vulnerability assessment for the water supply project concept components.

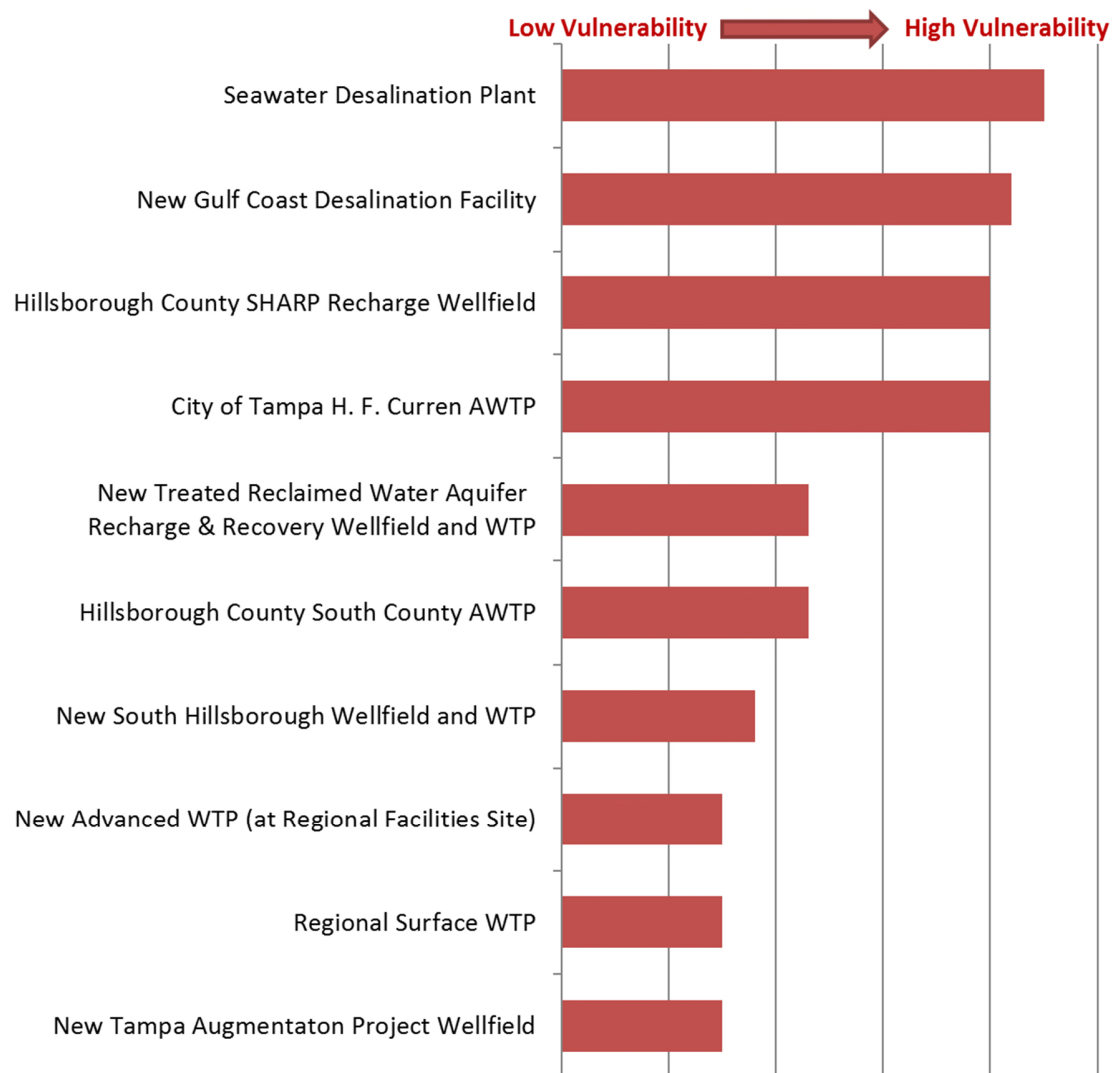


Figure 12-5: Results of Vulnerability Assessment Scoring for Water Supply Project Components

### 12.3 Summary of Findings and Recommendations

The coastal hazards vulnerability assessment evaluated the numerous components that make up the potential future water supply concepts to define a vulnerability score for each. The results of the assessment identified the expansion of the existing surface water treatment plant (with surface water) as the least vulnerable to coastal hazards compared to the other future water supply concept components being considered. The expansion of the existing desalination plant (with seawater or reclaimed water) was determined to have the greatest vulnerability to coastal hazards based on the location and design of the existing desalination plant.

Applying the assessment of the various project components to each project concept identified in Section 9, Table 12-6 provides additional information regarding the results of the coastal hazards vulnerability assessment for each of future water supply project concepts, which is incorporated into the detailed project concept assessment discussed in Section 9. A vulnerability score of “1” represents options with significant vulnerabilities to coastal hazards, whereas a score of “5” represents options with minimal vulnerabilities to coastal hazards.

**Table 12-6: Results of Vulnerability Assessment of Components of New Water Supply Project Concepts**

| Components of New Water Supply Project Concepts                   | Overall Vulnerability Score | Vulnerability Assessment & Scoring Notes                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surface WTP Expansion with Surface Water                          | 5                           | <ul style="list-style-type: none"> <li>Facility located in area with low vulnerability to coastal hazards.</li> </ul>                                                                                                                                                                                                                                                                                       |
| New Groundwater via SHARP Credits                                 | 3                           | <ul style="list-style-type: none"> <li>The recharge wells used to obtain groundwater credits for this option are in an area with high vulnerability to coastal hazards, but other key project components are in low vulnerability areas and could continue to produce water if the recharge wells were temporarily offline.</li> </ul>                                                                      |
| New Groundwater via Expanded SHARP Credits                        | 2.5                         | <ul style="list-style-type: none"> <li>The recharge wells and a portion of the reclaimed water supply source (from H.F. Curren AWTP) used to obtain groundwater credits for this option are in areas with high vulnerability to coastal hazards. Other key project components are in low vulnerability areas and could continue to produce water if the recharge wells were temporarily offline.</li> </ul> |
| New Groundwater via Tampa Credits                                 | 2.5                         | <ul style="list-style-type: none"> <li>The reclaimed water supply source used to obtain groundwater credits for this option is in an area with high vulnerability to coastal hazards, but other key project components are in low vulnerability areas and could continue to produce potable water supply if the reclaimed water supply source was temporarily unavailable.</li> </ul>                       |
| New Gulf Coast Desalination Facility                              | 2                           | <ul style="list-style-type: none"> <li>Facility located in area with high vulnerability to coastal hazards.</li> <li>New facility can be designed with features to better withstand coastal hazards.</li> </ul>                                                                                                                                                                                             |
| Aquifer Recharge & Recovery with Advanced Treated Reclaimed Water | 2                           | <ul style="list-style-type: none"> <li>The reclaimed water supply source for this option is in an area with high vulnerability to coastal hazards. Water supply from this option would be discontinued until the reclaimed water source became available.</li> </ul>                                                                                                                                        |
| Surface WTP Expansion with Reclaimed Water                        | 2                           | <ul style="list-style-type: none"> <li>The reclaimed water supply source for this option is in an area with high vulnerability to coastal hazards. Water supply from this option would be discontinued until the reclaimed water source became available.</li> </ul>                                                                                                                                        |
| New Advanced WTP with Reclaimed Water                             | 2                           | <ul style="list-style-type: none"> <li>The reclaimed water supply source for this option is in an area with high vulnerability to coastal hazards. Water supply from this option would be discontinued until the reclaimed water source became available.</li> </ul>                                                                                                                                        |
| Desalination WTP Expansion with Seawater                          | 1                           | <ul style="list-style-type: none"> <li>Facility located in area with very high vulnerability to coastal hazards.</li> <li>Limited ability to harden existing facility (as part of an expansion project) to be less vulnerable to coastal hazards.</li> </ul>                                                                                                                                                |
| Desalination WTP Expansion with Reclaimed Water                   | 1                           | <ul style="list-style-type: none"> <li>Reclaimed water supply source and treatment facility are located in areas with high vulnerability to coastal hazards.</li> <li>Limited ability to harden existing facility (as part of an expansion project) to be less vulnerable to coastal hazards.</li> </ul>                                                                                                    |

**THIS PAGE INTENTIONALLY LEFT BLANK**

### 13. Environmental Sustainability Assessment

An environmental sustainability assessment was performed to evaluate each of the potential future water supply concepts identified in Section 9 with regards to their impacts and benefits to the environment. The assessment was based on the current conceptual level planning information that has been developed for each of the water supply concepts and considered a variety of factors relevant to environmental sustainability, including the following:

- Approximate locations and land requirements for new infrastructure
- Energy use and resulting greenhouse gas emissions
- Air, light and noise pollution
- Protection and/or conservation of fresh water sources
- Waste products generated from the construction and continued operations and maintenance of the facilities
- Impacts or benefits to natural systems
- Recycling and beneficial re-use of waste products
- Synergies with existing infrastructure, systems and regional partners
- Resiliency, including adaptability to short and long-term climate variability

The environmental sustainability assessment also leveraged the Envision™ sustainability rating system as a guideline for defining and assessing environmental sustainability aspects for the multiple water supply sources, facilities and system infrastructure components associated with the future water supply concepts. The results from this environmental sustainability assessment are one of the many aspects being considered as part of the overall feasibility study and selection of future water supply options for further consideration as part of this LTMWP. This section provides an overview of the environmental assessment for each project concept, details of which are included in the Environmental Sustainability Assessment Technical Memorandum in Appendix 13A.

#### 13.1 Overview of Envision™ Sustainability Evaluation Approach

The Envision™ sustainability rating system provides a framework for comparing the sustainability aspects of each project concept across a wide range of criteria. It was developed by the Institute for Sustainable Infrastructure and includes five major categories and multiple sustainability related sub-categories under each. Table 13-1 summarizes the five main categories and the subcategories under each.

**Table 13-1. Envision Categories**

| Category        | Subcategories |            |           |
|-----------------|---------------|------------|-----------|
| Quality of Life | Purpose       | Wellbeing  | Community |
| Leadership      | Collaboration | Management | Planning  |



| Category            | Subcategories |              |              |
|---------------------|---------------|--------------|--------------|
| Resource Allocation | Materials     | Energy       | Water        |
| Natural World       | Siting        | Land & Water | Biodiversity |
| Climate and Risk    | Emissions     | Resilience   |              |

Between these categories, Envision™ is comprised of 60 sustainability metrics – known as credits. A credit comprises a sustainability indicator on an aspect of environmental, social or economic concern. Each credit then has five levels of achievement: Improved, Enhanced, Superior, Conserving and Restorative as summarized in Table 13-2. The various achievement levels are earned based on the degree to which the project exceeds the sustainability of a conventional project or industry standard practices.

**Table 13-2. Envision Achievement Levels**

| Achievement Level | Description                                                 |
|-------------------|-------------------------------------------------------------|
| Improved          | Performance that is above conventional                      |
| Enhanced          | Sustainable performance that adheres to Envision principles |
| Superior          | Sustainable performance that is noteworthy                  |
| Conserving        | Performance that has achieved essentially zero impact       |
| Restorative       | Performance that restores natural or social systems         |

Points are scored for each criterion according to achievement level and prescribed evaluation criteria defined by the Envision™ sustainability rating system. Projects with higher levels of achievement score more points and can be considered as superior projects with regards to sustainability considerations.

Each credit within Envision™ has prescribed requirements (Evaluation Criteria) that must be met to reach the specified achievement levels. Not all criteria in the Envision™ rating system are applicable to the infrastructure associated with the water supply concepts being considered as part of this LTMWP. There are also some criteria that each water supply concepts would score equally on, and result in no differentiation when comparing the concepts to each other. In addition, some of the credits are focused on the design and construction stages of projects and are not applicable to the planning stage of this assessment. Therefore, an initial screening was completed to identify credits that were not applicable or were determined to result in equal scores for each concept.

After removing the criteria that were considered inapplicable or did not provide a differentiator among the concepts, the following Envision sustainability criteria remained:

- Leadership:
  - Management: Pursue by-product synergy opportunities; and Improve infrastructure integration.
  - Planning: Address conflicting regulations and policies; and Extend useful life of existing infrastructure and systems.
- Resource Allocation:
  - Energy: Reduce energy consumption and greenhouse gas emissions.
  - Water - Protect fresh water availability and use alternative supply sources.
- Natural World:
  - Siting - Preserve prime habitat, farmland, and greenfields.

- Land & Water - Prevent surface and groundwater contamination.
- Biodiversity – Maintain wetland and surface water functions.
- Climate and Risk
  - Resilience - Prepare for long-term adaptability.

### 13.2 Summary of Environmental Sustainability Assessment Scoring

The future water supply project concepts were scored based on an assessment of their impacts and benefits to environmental sustainability. The scores ranged from 1 to 5, where a higher score represents a more favorable project concept with regards to environmental sustainability. The environmental sustainability score for each concept is based on the Envision™ sustainability rating system as described earlier in the section.

**Table 13-3. Environmental Sustainability Scores for Water Supply Project Concepts**

| Project Component                                                            | Score | Environmental Sustainability Assessment Notes                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>New Groundwater via Net Benefit from SHARP Program</b>                    | 5     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium new footprint / development requirements.</li> <li>• Benefits: Net benefit to aquifer (restorative); Low energy use; Beneficial use of by-product; Synergies / integration with other infrastructure and partners in region; Sustainable/drought resistant supply source.</li> </ul>    |
| <b>New Groundwater via Tampa Credits</b>                                     | 4     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium energy use; Medium new footprint / development requirements.</li> <li>• Benefits: Net benefit to aquifer (restorative); Beneficial use of by-product; Synergies / integration with other infrastructure and partners in region; Sustainable/drought resistant supply source.</li> </ul> |
| <b>New Groundwater via Net Benefit from Expanded SHARP Program</b>           | 4     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium energy use; High new footprint / development requirements.</li> <li>• Benefits: Net benefit to aquifer (restorative); Beneficial use of by-product; Synergies / integration with other infrastructure and partners in region; Sustainable/drought resistant supply source.</li> </ul>   |
| <b>Surface WTP Expansion with Reclaimed Water</b>                            | 4     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium energy use.</li> <li>• Benefits: Beneficial use of by-product, Synergies / integration with other infrastructure and partners in region, Low new footprint / development requirements. Sustainable/drought resistant supply source.</li> </ul>                                          |
| <b>New Advanced WTP with Reclaimed Water</b>                                 | 4     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium to high energy use.</li> <li>• Benefits: Beneficial use of by-product, Synergies / integration with other infrastructure and partners in region, Low new footprint / development requirements. Sustainable/drought resistant supply source.</li> </ul>                                  |
| <b>Desalination WTP Expansion (with Reclaimed Water)</b>                     | 3.5   | <ul style="list-style-type: none"> <li>• Impacts / Issues: High energy use; Medium new footprint / development requirements.</li> <li>• Benefits: Beneficial use of by-product, Synergies / integration with other infrastructure and partners in region, Sustainable/drought resistant supply source.</li> </ul>                                         |
| <b>Aquifer Recharge &amp; Recovery with Advanced Treated Reclaimed Water</b> | 3.5   | <ul style="list-style-type: none"> <li>• Impacts / Issues: Medium to high energy use; High new footprint / development requirements.</li> <li>• Benefits: Beneficial use of by-product, Synergies / integration with other infrastructure and partners in region; Sustainable/drought resistant supply source.</li> </ul>                                 |
| <b>New Gulf Coast Desalination Facility</b>                                  | 2     | <ul style="list-style-type: none"> <li>• Impacts / Issues: High energy use. Brine concentrate disposal needs; Medium new footprint / development requirements.</li> <li>• Benefits: Sustainable/drought resistant supply source.</li> </ul>                                                                                                               |

| Project Component                                 | Score | Environmental Sustainability Assessment Notes                                                                                                                                                                                                                                     |
|---------------------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Desalination WTP Expansion (with Seawater)</b> | 2     | <ul style="list-style-type: none"> <li>• Impacts / Issues: High energy use; Brine concentrate disposal needs.</li> <li>• Benefits: Sustainable/drought resistant supply source; Low new footprint / development requirements.</li> </ul>                                          |
| <b>Surface WTP Expansion (with Surface Water)</b> | 1     | <ul style="list-style-type: none"> <li>• Impacts / Issues: Uses a fresh water source; Potential for significant seasonal and long-term variations in surface water availability; Medium energy use.</li> <li>• Benefits: Low new footprint / development requirements.</li> </ul> |

### 13.3 Summary of Findings

The environmental sustainability assessment for each project component resulted in higher scores for the water supply concepts that involved the use of reclaimed water as part of the water supply option. The positive environmental sustainability aspects associated with using reclaimed water as part of a potable water supply option include: beneficial use of a by-product, synergies / integration with other infrastructure and partners in region, and a sustainable/drought resistant supply source. Among the concepts that use reclaimed water, the Groundwater via Net Benefit from SHARP Program option scored highest based on the restorative nature of the aquifer recharge component of this project, and a lower estimated energy use.

The concepts that scored the lowest in the environmental sustainability assessment were the Surface WTP Expansion (with surface water), Desalination WTP Expansion (with seawater), and Gulf Coast Desalination Facility. The existing Surface WTP Expansion project option scored lowest in terms of sustainability due to its use of a fresh water supply source and the potential for significant seasonal and long-term variation in surface water availability. The concepts that involve seawater desalination scored low in environmental sustainability due to the high energy use and brine disposal needs.

## 14. Coarse Screening of Future Water Supply Concepts

### 14.1 Evaluation Overview

Thirteen water supply concepts were developed for consideration as pathways for supplying the Tampa Bay Water service area with an additional 20 mgd of water supply as discussed in Section 9. These concepts spanned individual and combinations of water supply projects to yield at least 20 mgd. To determine if any of the water supply concepts could be eliminated before conducting a more detailed evaluation, the concepts were subjected to a coarse screening evaluation by the project team. This section describes the coarse screening process and the water supply concepts identified for more detailed assessment. The details of this process are included in Technical Memorandum No. 5 within Appendix 14A.

Overall, the coarse screening process involved the following steps, all of which are described in subsequent sub-sections:

- Defining and weighting coarse screening decision-making criteria with which to evaluate and compare the water supply concepts;
- Scoring each water supply concept across the decision-making criteria;
- Aggregating scores to determine a final score for each water supply concept;
- Interpreting the results and providing recommendations.

### 14.2 Coarse Screening Criteria

The coarse screening involved the use of five decision-making criteria Table 14-1, all of which have been used in previous Tampa Bay Water LTMWPs. The five criteria capture potential impacts of a new water supply concept with respect to cost, yield reliability, the environment, source water protection, implementation, feasibility, risk, regulations, contracts, and public reception.

Each of the five decision-making criteria in the coarse screening evaluation were equally weighted, meaning that each individual criterion had equal influence a water supply concept's total score. For each criterion, a water supply concept may receive a score of +1, 0, or -1, with +1 being the most favorable and -1 being the least favorable. A water supply concept's final score was determined by summing the product of each criterion's score and associated weighting; however, due to the equal criteria weightings used in this evaluation, total water supply concept scores were determined by averaging each concept's scores across the five criteria.

Table 14-1: Criteria for Coarse Screening Evaluation of Water Supply Concepts

| Criteria                                                             | Weighting | Explanation of Numerical Scores                                                                                                   |                                                                                                                       |                                                                                                                                                         |
|----------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                      |           | +1                                                                                                                                | 0                                                                                                                     | -1                                                                                                                                                      |
| <b>Total Cost per 1,000 Gallons</b>                                  | 20%       | Less than \$3.50 per 1,000 gallons                                                                                                | \$3.50 - \$5.00 per 1,000 gallons                                                                                     | Greater than \$5.00 per 1,000 gallons                                                                                                                   |
| <b>Yield Reliability</b>                                             | 20%       | Strong long-term yield reliability; minimal impacts on reservoir storage; minimal dependence on new modeling                      | Moderate long-term yield reliability; moderate impacts on reservoir storage; moderate dependence on new modeling      | Uncertain long-term yield reliability; strong impacts on reservoir storage; strong dependence on new modeling                                           |
| <b>Environmental and Source Water Protection</b>                     | 20%       | Environmental benefits; low vulnerability to climate change; minimal seasonal impacts                                             | Potential for environmental impact; some vulnerability to climate change and/or seasonality                           | Suspected environmental impact requiring mitigation; significantly impacted by climate change and/or seasonality                                        |
| <b>Implementation, Feasibility, and Risk</b>                         | 20%       | Easy system integration; good expansion potential; good potential for phased construction; significant benefits to the region     | Reasonable integration; some expansion potential; some potential for phased construction; some benefits to the region | Difficult integration; poor expansion potential; poor potential for phased construction; limited benefits to the region                                 |
| <b>Regulatory and Contractual Requirements, and Public Reception</b> | 20%       | Local source water; least permitting requirements; no dependence on other entities (e.g., member governments, power plants, etc.) | Moderate permitting requirements with some policy changes; moderate dependence on other entities                      | Non-local source water; multiple difficult/challenging permits requiring change in current permitting policies; strong dependence on other stakeholders |

### 14.3 Water Supply Concept Scoring

The intermediate results of the coarse screening evaluation are provided in Table 14-2. Each water supply concept received a score of +1, 0, or -1 for the five decision-making criteria based on the listed pros and cons. Due to the fact that several water supply concepts include more than one water supply type, the evaluation required that each individual water supply be considered independently, as well as in combination with other supplies.

Table 14-2: Coarse Screening Evaluation Scores and Explanations

| Water Supply Concept                                                                                  | Coarse Screening Criteria                                                    |                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                       | Total Cost per 1,000 Gallons <sup>1</sup>                                    | Yield Reliability                                                                                                                                                          | Environmental and Source Water Protection                                                                                                                                                                                                                                                                                       | Implementation, Feasibility, and Risk                                                                                                                                                                                                  | Regulatory and Contractual Requirements, and Public Reception                                                                                                                                                    |
| SWTP and Desalination WTP Expansions with Existing Sources                                            | 0                                                                            | 0                                                                                                                                                                          | 0                                                                                                                                                                                                                                                                                                                               | +1                                                                                                                                                                                                                                     | +1                                                                                                                                                                                                               |
|                                                                                                       | \$4.34/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 1 for details | <b>Pros:</b> Seawater is a reliable, long-term source;<br><b>Cons:</b> Increased surface water use impacts reservoir storage                                               | <b>Pros:</b> Seawater is a reliable and drought resistant supply;<br><b>Cons:</b> Surface water yield and quality are sensitive to seasonality and climate change; large energy footprint for RO                                                                                                                                | <b>Pros:</b> Easily integrated into the existing infrastructure; no new supply types; provides additional supply to south Hillsborough County; known water quality; good potential for phased construction;<br><b>Cons:</b> NA         | <b>Pros:</b> No new contractual requirements; precedent has already been set for public and regulatory acceptance;<br><b>Cons:</b> NA                                                                            |
| New Gulf Coast Desalination Facility                                                                  | -1                                                                           | +1                                                                                                                                                                         | 0                                                                                                                                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                      | 0                                                                                                                                                                                                                |
|                                                                                                       | \$7.77/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 2 for details | <b>Pros:</b> Seawater is a reliable, long-term source;<br><b>Cons:</b> NA                                                                                                  | <b>Pros:</b> Seawater is a reliable and drought resistant supply;<br><b>Cons:</b> Coastal facility is subject to seawater rise; large energy footprint for RO                                                                                                                                                                   | <b>Pros:</b> Reasonable integration into the existing systems;<br><b>Cons:</b> Entirely new system and supply; poor potential for phased construction                                                                                  | <b>Pros:</b> Precedent has been set for public and regulatory acceptance; outreach needed to address previously expressed stakeholder concerns;<br><b>Cons:</b> Requires coordination with Duke Energy           |
| SWTP Expansion with Existing Source and New Groundwater via SHARP Credits                             | 1                                                                            | 0                                                                                                                                                                          | 0                                                                                                                                                                                                                                                                                                                               | +1                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                |
|                                                                                                       | \$2.40/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 3 for details | <b>Pros:</b> Some existing SHARP modeling;<br><b>Cons:</b> Long-term availability of groundwater via SHARP credits is uncertain                                            | <b>Pros:</b> Reclaimed water and groundwater reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Surface water yield and quality are sensitive to seasonality and climate change                                                                    | <b>Pros:</b> Easily integrated into the existing infrastructure; provides additional supply to south Hillsborough County; good potential for phased construction; simple treatment for new groundwater withdrawals;<br><b>Cons:</b> NA | <b>Pros:</b> Some SHARP modeling has been shared with regulators; precedent for surface water;<br><b>Cons:</b> Requires coordination with Hillsborough County; no regulatory or cost precedent for SHARP credits |
| Desalination WTP Expansion with Existing Source and New Groundwater via SHARP Credits                 | 0                                                                            | 0                                                                                                                                                                          | 0                                                                                                                                                                                                                                                                                                                               | +1                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                |
|                                                                                                       | \$4.80/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 3 for details | <b>Pros:</b> Some existing SHARP modeling; no impact on reservoir storage;<br><b>Cons:</b> Long-term availability of groundwater via SHARP credits is uncertain            | <b>Pros:</b> Seawater, reclaimed water, and groundwater are reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Large energy footprint for RO                                                                                                       | <b>Pros:</b> Easily integrated into the existing infrastructure; provides additional supply to south Hillsborough County; good potential for phased construction; simple treatment for new groundwater withdrawals;<br><b>Cons:</b> NA | <b>Pros:</b> Some SHARP modeling has been shared with regulators; precedent for seawater;<br><b>Cons:</b> Requires coordination with Hillsborough County; no regulatory or cost precedent for SHARP credits      |
| New Groundwater via Expanded SHARP Credits                                                            | 0                                                                            | 0                                                                                                                                                                          | +1                                                                                                                                                                                                                                                                                                                              | +1                                                                                                                                                                                                                                     | 0                                                                                                                                                                                                                |
|                                                                                                       | \$3.77/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 3 for details | <b>Pros:</b> Some existing SHARP modeling; no impact on reservoir storage;<br><b>Cons:</b> Long-term availability of groundwater via SHARP credits is uncertain            | <b>Pros:</b> Additional SHARP wells serve as a saltwater intrusion barrier; reclaimed water is reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> NA                                                                                               | <b>Pros:</b> Simple treatment for the new supply (groundwater); provides additional supply to south Hillsborough County; good potential for phased construction;<br><b>Cons:</b> NA                                                    | <b>Pros:</b> Some SHARP modeling has been shared with regulators;<br><b>Cons:</b> Requires coordination with Hillsborough County; no regulatory or cost precedent for SHARP credits                              |
| SWTP Expansion with New Groundwater via Tampa Aquifer Recharge Credits (Native Groundwater Quality)   | 1                                                                            | 0                                                                                                                                                                          | +1                                                                                                                                                                                                                                                                                                                              | 0                                                                                                                                                                                                                                      | -1                                                                                                                                                                                                               |
|                                                                                                       | \$1.98/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Some existing modeling by City of Tampa; no impact on reservoir storage;<br><b>Cons:</b> Long-term availability of groundwater via Tampa credits is uncertain | <b>Pros:</b> Reclaimed water is reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Uncertainty regarding the impact of groundwater injection and withdrawals on surface waters                                                                     | <b>Pros:</b> Reasonable integration into the existing infrastructure;<br><b>Cons:</b> No geographical diversity in supplies; poor potential for phased construction                                                                    | <b>Pros:</b> NA;<br><b>Cons:</b> Requires coordination with the City of Tampa; regulatory uncertainty regarding Tampa credits and minimal modeling results to date; no precedent for Tampa credits               |
| SWTP Expansion with New Groundwater via Tampa Aquifer Recharge Credits (Impacted Groundwater Quality) | 0                                                                            | 0                                                                                                                                                                          | 0                                                                                                                                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                      | -1                                                                                                                                                                                                               |
|                                                                                                       | \$3.75/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Some existing modeling by City of Tampa; no impact on reservoir storage;<br><b>Cons:</b> Long-term availability of groundwater via Tampa credits is uncertain | <b>Pros:</b> Reclaimed water is reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Degrades withdrawal aquifer water quality and impacts future users; uncertainty regarding the impact of groundwater injection and withdrawals on surface waters | <b>Pros:</b> Reasonable integration into the existing infrastructure;<br><b>Cons:</b> No geographical diversity in supplies; poor potential for phased construction                                                                    | <b>Pros:</b> NA;<br><b>Cons:</b> Requires coordination with the City of Tampa; regulatory uncertainty regarding Tampa credits and minimal modeling results to date; no precedent for Tampa credits               |
| SWTP Expansion with Reclaimed Water                                                                   | -1                                                                           | +1                                                                                                                                                                         | 0                                                                                                                                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                      | -1                                                                                                                                                                                                               |
|                                                                                                       | \$5.95/1,000 gallons                                                         | <b>Pros:</b> Reclaimed water is a reliable, long-term source; no impact on reservoir storage;<br><b>Cons:</b> NA                                                           | <b>Pros:</b> Reclaimed water is reliable and resistant to seasonality and climate change; diverts wastewater effluent away from surface waters;                                                                                                                                                                                 | <b>Pros:</b> Reasonable integration with existing infrastructure;                                                                                                                                                                      | <b>Pros:</b> NA;<br><b>Cons:</b> Requires coordination with City of Tampa; entirely dependent on regulatory and public                                                                                           |



| Water Supply Concept                                                                     | Coarse Screening Criteria                                                    |                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                          | Total Cost per 1,000 Gallons <sup>1</sup>                                    | Yield Reliability                                                                                                                                                                                               | Environmental and Source Water Protection                                                                                                                                                                                                            | Implementation, Feasibility, and Risk                                                                                                                                                                                                           | Regulatory and Contractual Requirements, and Public Reception                                                                                                                                                                                          |
|                                                                                          | See LTMWP Technical Memorandum No. 4 for details                             |                                                                                                                                                                                                                 | <b>Cons:</b> Subjects existing raw water quality (surface water supplies) and treatment processes to the uncertainties of reclaimed water quality                                                                                                    | <b>Cons:</b> No geographical diversity in supplies; poor potential for phased construction                                                                                                                                                      | acceptance of potable reuse with no environmental buffer                                                                                                                                                                                               |
| New Advanced WTP for Reclaimed Water                                                     | 0                                                                            | +1                                                                                                                                                                                                              | +1                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                               | -1                                                                                                                                                                                                                                                     |
|                                                                                          | \$3.68/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Reclaimed water is a reliable, long-term source; no impact on reservoir storage;<br><b>Cons:</b> NA                                                                                                | <b>Pros:</b> Reclaimed water is reliable and resistant to seasonality and climate change impacts; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> NA                                                                           | <b>Pros:</b> Reasonable integration with existing infrastructure;<br><b>Cons:</b> No geographical diversity in supplies; poor potential for phased construction                                                                                 | <b>Pros:</b> NA;<br><b>Cons:</b> Requires coordination with City of Tampa; entirely dependent on regulatory and public acceptance of potable reuse with no environmental buffer                                                                        |
| SWTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water             | 1                                                                            | 0                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                                    | 0                                                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                                      |
|                                                                                          | \$3.12/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Reclaimed water is a reliable, long-term source; no impact on reservoir storage;<br><b>Cons:</b> Increased surface water use impacts reservoir storage                                             | <b>Pros:</b> Reclaimed water is a reliable and resistant supply; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Surface water yield and quality are sensitive to seasonality and climate change                               | <b>Pros:</b> Reasonable integration with existing infrastructure;<br><b>Cons:</b> No geographical diversity in supplies; poor potential for phased construction                                                                                 | <b>Pros:</b> Precedent for surface water supply;<br><b>Cons:</b> Requires coordination with City of Tampa; half dependent on regulatory and public acceptance of potable reuse with no environmental buffer                                            |
| Desalination WTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water | -1                                                                           | +1                                                                                                                                                                                                              | +1                                                                                                                                                                                                                                                   | +1                                                                                                                                                                                                                                              | 0                                                                                                                                                                                                                                                      |
|                                                                                          | \$5.58/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Seawater and reclaimed water are reliable, long-term sources; no impact on reservoir storage;<br><b>Cons:</b> NA                                                                                   | <b>Pros:</b> Reclaimed water and seawater are reliable and resistant supplies; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> Large energy footprint for RO                                                                   | <b>Pros:</b> Reasonable integration with existing infrastructure; provides additional supply to south Hillsborough County;<br><b>Cons:</b> NA                                                                                                   | <b>Pros:</b> Precedent for seawater supply;<br><b>Cons:</b> Requires coordination with City of Tampa; half dependent on regulatory and public acceptance of potable reuse with no environmental buffer                                                 |
| Desalination WTP Expansion with Reclaimed Water and New Groundwater via SHARP Credits    | -1                                                                           | 0                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                                    | +1                                                                                                                                                                                                                                              | -1                                                                                                                                                                                                                                                     |
|                                                                                          | \$5.49/1,000 gal<br><br>See LTMWP Technical Memorandum No. 4 for details     | <b>Pros:</b> Some existing SHARP modeling; no impact on reservoir storage; reclaimed water is a reliable, long-term source<br><b>Cons:</b> Long-term availability of groundwater via SHARP credits is uncertain | <b>Pros:</b> Seawater and reclaimed water are reliable and resistant supplies;<br><b>Cons:</b> Large energy footprint for RO; subjects existing raw water quality (seawater) and treatment processes to the uncertainties of reclaimed water quality | <b>Pros:</b> Provides additional supply in south Hillsborough County; good potential for phased construction; simple treatment for new groundwater withdrawals;<br><b>Cons:</b> Substantial transmission with no equivalent operational benefit | <b>Pros:</b> NA;<br><b>Cons:</b> Requires coordination with Hillsborough County and City of Tampa; half dependent on regulatory and public acceptance of potable reuse with no environmental buffer; no regulatory or cost precedent for SHARP credits |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                      | -1                                                                           | +1                                                                                                                                                                                                              | +1                                                                                                                                                                                                                                                   | 0                                                                                                                                                                                                                                               | 0                                                                                                                                                                                                                                                      |
|                                                                                          | \$7.74/1,000 gallons<br><br>See LTMWP Technical Memorandum No. 4 for details | <b>Pros:</b> Reclaimed water is a reliable, long-term source; no impact on reservoir storage; co-location of injection and withdrawal to minimize uncertainty<br><b>Cons:</b> NA                                | <b>Pros:</b> Reclaimed water is reliable and resistant to seasonality and climate change impacts; diverts wastewater effluent away from surface waters;<br><b>Cons:</b> NA                                                                           | <b>Pros:</b> Provides additional supply in south Hillsborough County;<br><b>Cons:</b> Poor potential for phased construction                                                                                                                    | <b>Pros:</b> Regulatory framework exists for potable reuse in this form;<br><b>Cons:</b> Dependent on public acceptance of potable reuse with an environmental buffer; requires coordination with the City of Tampa                                    |

<sup>1</sup> Costs assume no cost (\$0 per 1,000 gallons) for the purchase of reclaimed water and/or groundwater credits



## 14.4 Score Aggregation

Once scores were assigned, the aggregate score for each water supply concept was determined by averaging scores across the five decision-making criteria Table 14-3. As with the criteria-specific scores, a higher aggregate score is indicative of favorability. The aggregate scores of the coarse screening evaluation allowed for the grouping of water supply concepts into three tiers:

- Tier 1 includes concepts with the highest (i.e., most favorable) aggregate scores. These high scores suggest that these concepts have benefits relative to other concepts with respect to environmental protection, source water protection, implementation, feasibility, risk, cost, regulations, contracts, public reception, and yield reliability. Tier 1 concepts were recommended for inclusion in the subsequent fine screening evaluation.
- Tier 2 includes concepts with moderate aggregate scores, ranging from 0.0 to 0.2. These concepts ended up in the mid-range of final scores because they may be characterized by benefits with respect to some criteria, but disadvantages with respect to other criteria. Tier 2 concepts were further evaluated as part of the coarse screening process to determine movement upward or downward into Tier 1 or Tier 3, respectively.
- Tier 3 includes concepts with the lowest (i.e., least favorable) aggregate scores. These low scores suggest that these concepts have disadvantages relative to other concepts with respect to environmental protection, source water protection, implementation, feasibility, risk, cost, regulations, contracts, public reception, and yield reliability. Tier 3 concepts were not recommended for inclusion in the subsequent fine screening evaluation. Tier 3 projects can be further evaluated at some point in the future, but they do not appear to provide additional benefits relative to the other projects being evaluated under the LTMWP at this time.

**Table 14-3: Coarse Screening Evaluation Aggregate Scores and Tiers**

| Water Supply Concept                                                                  | Aggregate Score | Tier <sup>1</sup> |
|---------------------------------------------------------------------------------------|-----------------|-------------------|
| SWTP and Desalination WTP Expansions with Existing Sources                            | 0.4             | 1                 |
| New Gulf Coast Desalination Facility                                                  | 0.0             | 2                 |
| SWTP Expansion with Existing Source and New Groundwater via SHARP Credits             | 0.4             | 1                 |
| Desalination WTP Expansion with Existing Source and New Groundwater via SHARP Credits | 0.2             | 2                 |
| New Groundwater via Expanded SHARP Credits                                            | 0.4             | 1                 |
| SWTP Expansion with New Groundwater via Tampa Credits (Native Groundwater Quality)    | 0.2             | 2                 |
| SWTP Expansion with New Groundwater via Tampa Credits (Impacted Groundwater Quality)  | -0.2            | 3                 |
| SWTP Expansion with Reclaimed Water                                                   | -0.2            | 3                 |
| New Advanced WTP for Reclaimed Water                                                  | 0.2             | 2                 |

| Water Supply Concept                                                                     | Aggregate Score | Tier <sup>1</sup> |
|------------------------------------------------------------------------------------------|-----------------|-------------------|
| SWTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water             | 0.2             | 2                 |
| Desalination WTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water | 0.4             | 1                 |
| Desalination WTP Expansion with Reclaimed Water and New Groundwater via SHARP Credits    | -0.2            | 3                 |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                      | 0.2             | 2                 |

<sup>(1)</sup> Tier 1 concepts were recommended for inclusion in the fine screening evaluation; Tier 2 concepts were further evaluated as part of the coarse screening process to determine movement upward or downward into Tier 1 or Tier 3, respectively; Tier 3 concepts were not recommended for inclusion in the fine screening evaluation

#### 14.4.1 Further Evaluation of Tier 2 Concepts

Concepts in Tier 2 required further consideration to determine if they should be included in or excluded from the fine screening evaluation. Further evaluation involved determining if each Tier 2 concept included a unique element relative to concepts that were already in Tier 1. If a Tier 2 concept was identified as having a unique element relative to Tier 1 concepts, it was moved upward into Tier 1 for inclusion in the fine screening. If a Tier 2 concept was redundant relative to Tier 1 concepts, it was moved downward to Tier 3 for exclusion from the fine screening. A summary of the Tier 2 evaluation is provided in Table 14-4.

**Table 14-4: Results for Further Evaluation of Tier 2 Water Supply Concepts**

| Tier 2 Water Supply Concepts                                                          | Unique Element?                                                                                                                                                          | Include in Fine Screening? |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| New Gulf Coast Desalination Facility                                                  | Yes: this concept involves a new supply type and does not rely on aquifer recharge credits and/or reclaimed water                                                        | Yes                        |
| Desalination WTP Expansion with Existing Source and New Groundwater via SHARP Credits | Yes: this concept provides two new sources of supply to south Hillsborough County, which aligns with projected demands without fully relying on aquifer recharge credits | Yes                        |
| SWTP Expansion with New Groundwater via Tampa Credits (Native Groundwater Quality)    | Yes: this concept uses aquifer recharge credits generated by the City of Tampa to withdrawn new groundwater supply for the SWTP expansion                                | Yes                        |
| New Advanced WTP for Reclaimed Water                                                  | No: this concept simply relies solely on direct potable reuse, whereas another Tier 1 concept relies partially on direct potable reuse and partially on existing sources | No                         |
| SWTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water          | Yes: a more cost-effective version of a Tier 1 concept, in which direct potable reuse and an existing source are relied on as new/expanded supply                        | Yes                        |
| Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                   | Yes: this concept involves indirect potable reuse with advanced treatment ahead of aquifer injection                                                                     | Yes                        |

## 14.5 Recommendations

The coarse screening evaluation resulted in a refined list of water supply concepts to further consider in the fine screening evaluation Table 14-5. The water supply concepts that were excluded from this recommended list include three that were deemed as Tier 3 due to a low aggregate score, and one that was moved from Tier 2 to Tier 3 due to a moderate aggregate score in combination with a lack of a unique project element. These water supply concepts are further evaluated in Section 15.

**Table 14-5: Recommended Water Supply Concepts for Inclusion in the Fine Screening Evaluation**

| Tier 1 | Water Supply Concept                                                                     |
|--------|------------------------------------------------------------------------------------------|
|        | SWTP and Desalination WTP Expansions with Existing Sources                               |
|        | New Gulf Coast Desalination Facility                                                     |
|        | SWTP Expansion with Existing Source and New Groundwater via SHARP Credits                |
|        | Desalination WTP Expansion with Existing Source and New Groundwater via SHARP Credits    |
|        | New Groundwater via Expanded SHARP Credits                                               |
|        | SWTP Expansion with New Groundwater via Tampa Credits (Native Groundwater Quality)       |
|        | SWTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water             |
|        | Desalination WTP Expansion with Existing Source and New Advanced WTP for Reclaimed Water |
|        | Aquifer Recharge and Recovery with Advanced Treated Reclaimed Water                      |

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 15. Configuration Development and Fine Screening

The coarse screening evaluation resulted in a list of water supply concepts to move forward to the fine screening evaluation; however, these water supply concepts were developed primarily based on meeting the regional supply need of 20 mgd. The discussion in Section 7, including projected water supply deficits and preferred solutions in south Hillsborough County, highlights the need to develop configurations that not only address regional needs, but also Hillsborough County's needs. This section combines the Tier 1 water supply concepts identified from the coarse screening evaluation in Section 14 with the recommended south County solutions in Section 7 to develop several water supply configurations that address both the regional supply and south Hillsborough County needs. The process used to further evaluate these configurations as part of a fine screening processes is also discussed in this section.

Overall, the fine screening process involved the following steps, all of which are described in subsequent sub-sections:

- Developing water supply configurations that address projected regional and south Hillsborough County demands;
- Defining and weighting fine screening decision-making criteria with which to evaluate and compare the configurations;
- Aggregating scores to determine a final score for each configuration;
- Interpreting the results and providing recommendations.

### 15.1 Water Supply Configurations

Fifteen configurations were developed for more detailed consideration as pathways for supplying the Tampa Bay Water service area with an additional 20 mgd of water supply, including serving south Hillsborough County with additional supply, Table 15-1. Configuration development was based on the following:

- Each configuration included a preferred water supply concept from the coarse screening evaluation and one of the two recommended projects for providing south Hillsborough County with supply.
- Each configuration obtained a potential regional supply yield of 20 mgd with either a combination of water supply projects or with one project.
- The two recommended projects for south Hillsborough County supply include either a new regional pipeline from the Regional Facilities Site to the Balm point of connection or a new groundwater treatment plant via Net Benefit SHARP Program as the first supply project in a configuration.
- If the regional pipeline is involved in a given configuration, its required capacity is noted in Table 15-1. The required pipeline capacity was determined by assuming a 20 mgd requirement in south Hillsborough County, less any supply provided to south Hillsborough County by a project in the

configuration. The selection of a regional pipeline or new groundwater treatment plant via via Net Benefit SHARP Program as the south county supply solution will affect the necessary timing of subsequent projects as the regional pipeline only provides additional supply to south county, whereas the new groundwater treatment plant via Net Benefit SHARP Program provides new supply to both south Hillsborough County and region. The implication of timing is discussed further in Section 22 of this LTMWP.

**Table 15-1: Water Supply Configurations for Fine Screening Evaluation**

| Configuration | Potential Yield of Individual Projects (mgd) |                                   |                                   |                      |                                                 |                                      |                               | New Regional Pipeline to south Balm Area (Capacity) |
|---------------|----------------------------------------------|-----------------------------------|-----------------------------------|----------------------|-------------------------------------------------|--------------------------------------|-------------------------------|-----------------------------------------------------|
|               | SWTP Exp. w/ Existing Source                 | Desal WTP Exp. w/ Existing Source | New Groundwater via SHARP Credits | Gulf Coast Desal WTP | SWTP Exp. w/ Tampa Augmentation Project Credits | New Advanced WTP for Reclaimed Water | Aquifer Recharge and Recovery |                                                     |
| 1             | 10                                           | 10                                |                                   |                      |                                                 |                                      |                               | 10 mgd                                              |
| 2A            |                                              |                                   | 7.5 <sup>1</sup>                  | 12.5                 |                                                 |                                      |                               | 12.5 mgd                                            |
| 2B            |                                              |                                   |                                   | 20                   |                                                 |                                      |                               | 20 mgd                                              |
| 3             | 12.5                                         |                                   | 7.5 <sup>1</sup>                  |                      |                                                 |                                      |                               | 12.5 mgd                                            |
| 4A            |                                              | 12.5                              | 7.5 <sup>2</sup>                  |                      |                                                 |                                      |                               | NA                                                  |
| 4B            |                                              | 12.5                              | 7.5 <sup>3</sup>                  |                      |                                                 |                                      |                               | NA                                                  |
| 5A            |                                              |                                   | 20 <sup>2</sup>                   |                      |                                                 |                                      |                               | NA                                                  |
| 5B            |                                              |                                   | 20 <sup>3</sup>                   |                      |                                                 |                                      |                               | NA                                                  |
| 6A            |                                              |                                   | 7.5 <sup>1</sup>                  |                      | 12.5                                            |                                      |                               | 12.5 mgd                                            |
| 6B            |                                              |                                   |                                   |                      | 20                                              |                                      |                               | 20 mgd                                              |
| 7A            |                                              |                                   | 7.5 <sup>1</sup>                  |                      |                                                 | 12.5                                 |                               | 12.5 mgd                                            |
| 7B            | 10                                           |                                   |                                   |                      |                                                 | 10                                   |                               | 20 mgd                                              |
| 8             |                                              | 10                                |                                   |                      |                                                 | 10                                   |                               | 10 mgd                                              |
| 9A            |                                              |                                   | 7.5 <sup>2</sup>                  |                      |                                                 |                                      | 12.5                          | NA                                                  |
| 9B            |                                              |                                   | 7.5 <sup>3</sup>                  |                      |                                                 |                                      | 12.5                          | NA                                                  |

<sup>1</sup> Finished water transmission main connects to the regional system at the end of the south county pipeline; <sup>2</sup> finished water transmission main connects to the regional system at the desalination WTP transmission main; <sup>3</sup> finished water transmission main connects to the regional system at the regional site

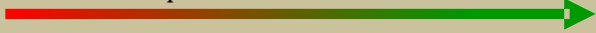


## 15.2 Fine Screening Criteria

The decision-making criteria for the fine screening evaluation were developed in accordance with three Master Water Plan goals that were approved by the Tampa Bay Water Board of Directors: environmental stewardship, project costs, and reliability. To further refine the assessment and screening process, each of these goals were broken down into specific criteria, which are described in Table 15-2 along with the basis for the scoring. Each of the three goals was given an equal overall weighting in the decision-making process (33.3% each) as approved by the Tampa Bay Water's board, whereas the individual criteria within a category were weighted based on Tampa Bay Water's prioritization. For example, the project costs goal contributes 33.3% to the decision-making process, but the three criteria within this category are not equally weighted. Life cycle costs have the most influence on the project costs goal, whereas the ability to phase the implementation of a configuration is accounted for but less influential on the total, aggregate score. For all criteria, a score of 5 is the most favorable option, whereas a score of 1 is indicative of poor favorability.

**Table 15-2: Criteria for Fine Screening Evaluation of Water Supply Configurations**

| Criteria                            | Measure                                                                                                                                        | Weighting within Category | Overall Weighting | Explanation of Numerical Scores                                                                                  |   |                                                                                 |   |                                                                                             |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------|
|                                     |                                                                                                                                                |                           |                   | 1                                                                                                                | 2 | 3                                                                               | 4 | 5                                                                                           |
| Category: Environmental Stewardship |                                                                                                                                                |                           |                   |                                                                                                                  |   |                                                                                 |   |                                                                                             |
| Ease of permitting                  | Ease with which configuration can be permitted considering local, state, and federal requirements, future regulations, and existing precedents | 30%                       | 10%               | Configuration is difficult to permit under existing rules and/or requires changes to existing rules or new rules |   | Configuration is permissible, but requires significant supporting documentation |   | Configuration is easily permitted under current rules with limited supporting documentation |
| Environmental sustainability index  | Environmental sustainability configuration based on evaluation in Sustainability Assessment Technical Memorandum                               | 40%                       | 13%               | Configuration is ranked least favorably in the Sustainability Assessment                                         |   | Configuration is ranked moderately in the Sustainability Assessment             |   | Configuration is ranked most favorably in the Sustainability Assessment                     |
| Public reception                    | How the public expected to receive the given water supply configuration                                                                        | 30%                       | 10%               | Configuration anticipated to be negatively received by the public                                                |   | Configuration anticipated to be neutrally received by the public                |   | Configuration anticipated to be positively received by the public                           |
| Category: Project Costs             |                                                                                                                                                |                           |                   |                                                                                                                  |   |                                                                                 |   |                                                                                             |
| Life cycle cost                     | Total cost of configuration per 1,000 gallons, including capital, and operation/maintenance expenditures over a 30-year period                 | 60%                       | 20%               | Configuration has the highest estimated life cycle cost                                                          |   | Configuration has a moderate estimated life cycle cost                          |   | Configuration has the lowest estimated life cycle cost                                      |
| Ability to phase                    | Ability to implement configuration in phases                                                                                                   | 15%                       | 5%                | Configuration cannot be practically phased, thus having a significant impact on rates                            |   | Configuration can be phased, but small increments are impractical               |   | Configuration can be easily phased in practical increments with less rate impacts           |
| Cost risk factors                   | Potential for configuration to be affected by unforeseen schedule delays and/or construction issues that affect cost                           | 25%                       | 8%                | Highest potential for various unforeseen risks that negatively impact costs                                      |   | Moderate potential for various unforeseen risks that negatively impact costs    |   | Lowest potential for various unforeseen risks that negatively impact costs                  |
| Category: Reliability               |                                                                                                                                                |                           |                   |                                                                                                                  |   |                                                                                 |   |                                                                                             |
| Source water supply resiliency      | Ability of configuration to resist and/or recover from loss of water                                                                           | 15%                       | 5%                | Configuration is easily affected by drought and/or catastrophic                                                  |   | Configuration is intermittently affected by drought and/or                      |   | Configuration is rarely affected by drought and/or catastrophic                             |

| Criteria                                   | Measure                                                                                                                                                                                                                                  | Weighting within Category | Overall Weighting | Explanation of Numerical Scores                                             |   |                                                                                                                                                           |   |                                                                                                                                                     |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |                                                                                                                                                                                                                                          |                           |                   | 1                                                                                                                                                              | 2 | 3                                                                                                                                                         | 4 | 5                                                                                                                                                   |
|                                            | supply due to drought or catastrophic event                                                                                                                                                                                              |                           |                   | events with poor ability to recover                                                                                                                            |   | catastrophic events with reasonable ability to recover                                                                                                    |   | events with rapid ability to recover                                                                                                                |
| <b>Vulnerability index</b>                 | Vulnerability of configuration to extreme or unplanned conditions based on evaluation in Vulnerability Assessment Technical Memorandum                                                                                                   | 25%                       | 8%                | Configuration is ranked least favorably in the Vulnerability Assessment                                                                                        |   | Configuration is ranked moderately in the Vulnerability Assessment                                                                                        |   | Configuration is ranked most favorably in the Vulnerability Assessment                                                                              |
| <b>Regional system operational impacts</b> | Extent to which configuration fits into/impacts the regional system's existing operations and maintenance requirements; ability to maintain level of service; ability of configuration to provide service/relief during emergency events | 30%                       | 10%               | Configuration requires significant modifications to existing operation and maintenance practices; configuration does not satisfy emergency scenario conditions |   | Configuration requires moderate modifications to existing operation and maintenance practices; configuration satisfies some emergency scenario conditions |   | Configuration requires no modifications to existing operation and maintenance practices; configuration satisfies most emergency scenario conditions |
| <b>Contractual requirements</b>            | The extent to which the configuration aligns with the terms of existing governance documents and agreements and/or requires new governance documents and agreements                                                                      | 30%                       | 10%               | Configuration requires new contract documents or significant changes to existing documents                                                                     |   | Configuration requires moderate changes to existing contract documents, but requires no new contract documents                                            |   | Configuration requires no changes to existing contract documents, nor requires new contract documents                                               |

### 15.3 Fine Screening Evaluation

Table 15-3 and Table 15-4 summarize the results of the fine screening evaluation. Table 15-3 shows all of the unweighted, individual scores that were assigned to each configuration across the 10 decision-making criteria, with a higher value being indicative of higher favorability for all. The most and least favorable configuration for each criterion are further discussed below to provide an example of how scores were justified and differentiated. All of the individual scores were aggregated for each configuration; Table 15-4 provides the aggregate scores in both an unweighted and weighted fashion. For the unweighted scores, all criteria are given equal influence in the decision-making process; for the weighted scores, criteria are assigned with weightings from Table 15-2 to reflect Tampa Bay Water's prioritization of factors. The scoring process was completed independently by several project team members.

#### 15.3.1 Ease of Permitting

Configuration 1 was given the most favorable score of 5.0 for the ease of permitting criterion. Configuration 1, which includes expansion of the Tampa Bay Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant with existing sources, was given the most favorable score because it involves the continued use of sources that have already been deemed acceptable by regulatory agencies. Tampa Bay Water also modeled the anticipated increase in yield at the Regional Surface Water Treatment Plant, which confirmed that increased withdrawals would comply with existing permitting restrictions on surface water supplies.

Configuration 7A was given the least favorable score of 1.0 for the ease of permitting criterion. Configuration 7A includes two projects, neither of which have a regulatory precedent in Florida. One of projects is the use of new groundwater withdrawals via SHARP credits generated by aquifer recharge with reclaimed water. Although there have been discussions among the Southwest Florida Water Management District, Tampa Bay Water, and Hillsborough County regarding this project, there is still regulatory uncertainty surrounding the details of allocating new groundwater withdrawals to an agency in exchange for aquifer recharge. The second project in Configuration 7A is the construction of a new advanced water treatment plant for the treatment of reclaimed water; the final product water would be blended with finished water from the Regional Surface Water Treatment Plant prior to entering Tampa Bay Water's distribution system. This project type is generally referred to as "finished water augmentation," which is a form of direct potable reuse (DPR). Currently, there is no federal and state regulatory framework for the implementation of DPR; however, the Potable Reuse Commission is working toward the development of legislative and regulatory language recommendations for the Florida Legislature to consider in its 2019 session (see Section 3).

#### 15.3.2 Environmental Sustainability Index

The criteria and scores that were used to determine each configuration's environmental sustainability index are discussed in detail in the Environmental Sustainability Assessment Technical Memorandum, which is included in Appendix 13A.

Configuration 6A, which includes the new groundwater treatment plant and a Regional Surface Water Treatment Plant expansion via groundwater credits from the City of Tampa, received the most favorable

score of 5.0 for the environmental sustainability criterion. Configuration 6A was scored favorably for this criterion because it involves aquifer recharge and recovery with reclaimed water. The potential environmental benefits of this water supply project include the diversion of nutrient loads away from surface waters and an increasingly drought-proofed regional water supply. This water supply concept also has the potential to avoid resource intensive treatment (e.g., reverse osmosis) due to the improved quality of reclaimed water prior to withdrawal by way of natural treatment in the aquifer.

The least favorable configuration with regard to environmental sustainability was determined to be Configuration 1. Configuration 1, which includes expansion of the Tampa Bay Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant, was scored unfavorably because it includes increased use of surface water supplies without any action to augment those supplies, as well as increased use of seawater, which requires energy intensive treatment due to the required removal of total dissolved solids via reverse osmosis. Configuration 1 does not include the beneficial reuse of reclaimed water for potable or non-potable applications.

### **15.3.3 Public Reception**

Configuration 1 is anticipated to be the most favorably received by the public. Configuration 1 includes the increased use of existing source waters via expansions of the Regional Surface Water Treatment Plant and the Tampa Bay Seawater Desalination Plant. This configuration is expected to be well-received by the public because a precedent has been set for the use of existing surface water supplies and seawater (e.g., a safe, aesthetically pleasing supply, known water quality). The public's tendency to be more accepting of existing source waters is discussed in more detail in Section 21, as well as overall public reception of various source water options across different water use applications (e.g., drinking versus bathing).

Configurations 6B and 7A are expected to be the most poorly received by the public. Both configurations involve the use of reclaimed water as a source of potable water supply, as opposed to the configurations involving SHARP, in which reclaimed water is recharged in an area that is remote from the withdrawals. Configuration 6B is entirely reliant on co-located aquifer recharge and withdrawal by the City of Tampa and the subsequent treatment of withdrawn groundwater at a facility that was not designed specifically for reclaimed water. Configuration 7A foregoes the environmental buffer and involves the treatment of reclaimed water for blending into the distribution system as a version of direct potable reuse, referred to as treated water augmentation. Treated water augmentation has not been previously implemented in Florida and only rarely implemented outside of Florida. As discussed in Section 21, the public is substantially less willing at this time to accept the reuse of reclaimed water for potable applications.

### **15.3.4 Life Cycle Cost**

Opinions of probable construction costs and annual operation and maintenance costs were developed for each configuration (see Appendix 15A). Using an assumed loan term of 30 years, an interest rate of 6%, and the additional yield provided by each configuration, these cost estimates were translated to a life cycle cost per unit of water (i.e., cost per 1,000 gallons). The assumed annual interest rate of 6% was selected based on discussions with Tampa Bay Water's Chief Financial Officer. Over the last 20 years of Tampa Bay Water's bond funding history, it has had bond coupon rates of approximately 3.07% to 5.93%; the 6% annual interest rate used herein represents a conservative assumption for future financial planning.

The estimated life cycle costs per 1,000 gallons for all configurations were normalized to a scale of 1 to 5, with 1 representing the highest life cycle cost per 1,000 gallons (least favorable) and 5 representing the lowest life cycle cost per 1,000 gallons (most favorable). Configuration 3 was ultimately assigned the most favorable life cycle cost score with an estimated cost of \$2.89 per 1,000 gallons, while Configuration 2B was assigned the least favorable life cycle cost with an estimated cost of \$8.72 per 1,000 gallons. Configuration 3 includes an expansion of the Regional Surface Water Treatment Plant with the existing source water, as well as new groundwater via net benefit from the SHARP program; Configuration 2B is a 20 mgd new Gulf Coast Desalination Facility.

#### **15.3.5 Ability to Phase**

The ability to phase the implementation of a configuration is important because it allows Tampa Bay Water to closely match new supply with demand. The most favorably scored configuration in terms of ability to phase is Configuration 4A, which received a score of 5.0. This configuration includes a new groundwater treatment plant via SHARP credits as the south Hillsborough County supply solution and the first phase of regional supply, as well as an expansion of the existing desalination plant with the existing source. This configuration scored favorably for its ability to be phased for several reasons:

- It involves no major pipelines (e.g., a new regional pipeline from the regional site to the Balm point of connection as a south county supply or a new reclaimed water pipeline from the Howard F. Current Advanced Wastewater Treatment Plant to the SHARP recharge wells for a SHARP expansion). Pipelines are typically difficult to phase due to acquisition of easements, available right of ways and the costs associated with installing parallel pipelines. Thus, if a larger size pipeline is required for a future phase, it is typically installed at the project onset.
- The new groundwater supply that is enabled via SHARP aquifer recharge credits can be implemented in a step-wise fashion, with new wells being added as needed and as additional reclaimed water is available to increase the injection into the aquifer, thus increasing withdrawal credits.
- The Tampa Bay Seawater Desalination Plant expansion can also be phased into implementation, as there is the potential for increased yield with improvements to the existing facility and then greater potential for increased yield with treatment expansion.

The least favorably scored configuration for its ability to be phased into implementation is Configuration 2B, which received a score of 1.0. Configuration 2B is the new 20 mgd Gulf Coast Desalination Facility, which not only includes a large, completely new treatment facility, but also a 20 mgd regional pipeline from the regional site to the Balm point of connection to serve as south Hillsborough County. Both the Gulf Coast Desalination Facility and the new regional pipeline have minimal opportunity for phased implementation, thus requiring large capital investments over a short period of time and more significant impacts to rates.

#### **15.3.6 Cost Risk Factors**

Configuration 7B, expanding at the Regional Surface Water Treatment Plant with the existing source water and a new advanced water treatment plant, has given the most favorable score of 5.0 for the cost risk factors criterion. Configuration 7B was scored favorably due to the lack of construction activities with high levels of

uncertainty, as uncertainty has the potential to result in cost increases and schedule delays. Configuration 7B involves work at a known site with a known water quality and treatment implications for the Regional Surface Water Treatment Plant expansion. Both the Regional Surface Water Treatment Plant expansion and the new advanced water treatment plant for reclaimed water lack the need for groundwater modeling, the construction of test and withdrawal wells, and space constraints, all of which involve cost risk factors due to uncertainties.

Configuration 9B was given the least favorable score of 1.0 for the cost risk factors criterion due to its inclusion of several activities with cost risk factors. This configuration includes a new groundwater treatment plant via SHARP credits, which requires groundwater modeling to demonstrate a net benefit to the aquifer and acceptable impacts to nearby surface waters, an evaluation of yield and water quality from preferred sites identified during modeling, and the design of a new treatment facility. Furthermore, this configuration includes the construction of a new advanced water treatment plant for reclaimed water, a large finished water pipeline, and a new aquifer recharge and recovery wellfield. The wellfield has many uncertainties associated with it, such as siting, well construction, and aquifer interactions. Lastly, this configuration also assumes that the finished water pipeline from the new groundwater treatment plant enabled by SHARP credits will extend back to the regional site, which has cost risk factors due to the property and easement implications.

#### **15.3.7 Source Water Supply Resiliency**

Configuration 2B was given a score of 5.0 for the source water supply resiliency criterion. This configuration relies entirely on seawater for the new Gulf Coast Desalination Facility, which is an abundant and resilient supply.

The least favorable score of 1.0 was given to Configuration 3, which involves the increased use of surface water supplies and new groundwater withdrawals through the use of SHARP credits. The surface water supply is sensitive to climate change impacts (e.g., drought conditions to limit surface water availability; extreme precipitation events that affect surface water quality). The availability of groundwater supply is also potentially challenged in terms of resiliency because it depends on the accuracy of groundwater modeling, other factors that may potentially affect the conditions of nearby surface waters, and continued recharge by Hillsborough County to the extent needed for sufficient credits.

#### **15.3.8 Vulnerability Index**

In this evaluation, vulnerability is primarily defined by a configuration's sensitivity to sea level rise and extreme coastal events. The criteria and scores that were used to determine each configuration's vulnerability index are discussed in detail in the Vulnerability Assessment Technical Memorandum, which is included in Appendix 12A.

Configuration 3 was deemed the most favorable with respect to vulnerability because it heavily relies on inland facilities, including the Regional Surface Water Treatment Plant and a new groundwater treatment facility. The most vulnerable element of Configuration 3 is the aquifer recharge wells that are owned and operated by Hillsborough County due to their proximity to the coast.

Configuration 2B, Gulf Coast Desalination Facility, was determined to be the least favorable with respect to vulnerability because it relies entirely on a coastal desalination facility.



### **15.3.9 Regional System Operational Impacts**

Configuration 4B, the Tampa Bay Seawater Desalination Plant expansion and a new groundwater treatment plant via SHARP credits, was scored the most favorably with regard to the regional system operational impacts criterion because it introduces two sources of new supply to south Hillsborough County, which is where substantial increases in demand are projected to occur. Furthermore, the expansion of the seawater desalination plant is assumed to include improvements to the entire pretreatment system for the existing treatment capacity and proposed expansion, thus improving the overall reliability of the treatment facility for regional dependency.

Configuration 6B was scored the least favorably with regarding to the regional system operational impacts criterion because it brings 20 mgd of new supply to an area of the region where water demands are not projected to substantially increase. Configuration 6B, due to it involving only the expansion of the Regional Surface Water Treatment Plant with groundwater credits generated by the City of Tampa, further centralizes supply availability at the Regional Facilities Site.

### **15.3.10 Contractual Requirements**

Configuration 1 was assigned the most favorable score of 5.0 for the contractual requirements criterion because this configuration involves only the use of existing source waters that either lack a reliance on stakeholders outside of Tampa Bay Water or involve a relationship that has already been established. Increased use of the existing source water supplies and an expansion of the Regional Surface Water Treatment Plant does not require changes to existing contract documents, nor requires new contract documents, as the intake, treatment system, and finished water distribution are owned and operated by Tampa Bay Water. An expansion of the existing Tampa Bay Seawater Desalination Plant does involve continued coordination with the TECO Energy Inc. for use of existing canals for raw water withdrawals and concentrate discharge, but there is at least an existing relationship and agreement between Tampa Bay Water and TECO Energy Inc. for current operations at the facility.

Both Configurations 5A and 5B were given the least favorable score of 1.0 for the contractual requirements criterion because these configurations not only require reliance on Hillsborough County for continuous aquifer recharge with reclaimed water such that an agreed upon amount of groundwater credits are generated, but also the purchasing of reclaimed water from the City of Tampa or another member government to enable an expansion of the SHARP program. New contractual documents would need to be developed in order to ensure continued availability of groundwater credits and reclaimed water, as well as to set a pricing agreement for these goods.

**Table 15-3: Unweighted Fine Screening Scores for Individual Criteria**

| Configuration                                                             | Environmental Criteria |                                    |                  | Project Cost Criteria |                  |                   | Reliability Criteria           |                     |                                     |                          |
|---------------------------------------------------------------------------|------------------------|------------------------------------|------------------|-----------------------|------------------|-------------------|--------------------------------|---------------------|-------------------------------------|--------------------------|
|                                                                           | Ease of Permitting     | Environmental Sustainability Index | Public Reception | Life Cycle Cost       | Ability to Phase | Cost Risk Factors | Source Water Supply Resiliency | Vulnerability Index | Regional System Operational Impacts | Contractual Requirements |
| 1: SWTP and Desal WTP Exp. w/ Existing Source                             | 5.0                    | 1.0                                | 4.5              | 3.4                   | 3.0              | 4.0               | 3.0                            | 3.0                 | 3.0                                 | 5.0                      |
| 2A: New Groundwater via SHARP Credits + Gulf Coast Desal WTP              | 3.0                    | 3.0                                | 3.0              | 2.3                   | 3.0              | 3.5               | 3.5                            | 2.5                 | 3.0                                 | 2.5                      |
| 2B: Gulf Coast Desal WTP                                                  | 3.5                    | 2.0                                | 3.5              | 1.0                   | 1.0              | 4.0               | 5.0                            | 1.0                 | 1.5                                 | 3.0                      |
| 3: SWTP Exp. w/ Existing Source + New Groundwater via SHARP Credits       | 4.0                    | 3.0                                | 4.0              | 5.0                   | 4.0              | 4.0               | 1.0                            | 5.0                 | 3.0                                 | 3.5                      |
| 4A: Desal WTP Exp. w/ Existing Source + New Groundwater via SHARP Credits | 3.5                    | 3.5                                | 3.5              | 3.7                   | 5.0              | 3.5               | 3.5                            | 2.0                 | 4.0                                 | 3.0                      |
| 4B: Desal WTP Exp. w/ Existing Source + New Groundwater via SHARP Credits | 3.5                    | 3.5                                | 3.5              | 3.3                   | 4.0              | 3.0               | 3.5                            | 2.0                 | 5.0                                 | 3.0                      |
| 5A: New Groundwater via Expanded SHARP Credits                            | 2.5                    | 4.0                                | 2.5              | 4.4                   | 3.5              | 3.0               | 2.0                            | 3.0                 | 4.0                                 | 1.0                      |
| 5B: New Groundwater via Expanded SHARP Credits                            | 2.5                    | 4.0                                | 2.5              | 4.0                   | 3.0              | 2.5               | 2.0                            | 3.0                 | 4.5                                 | 1.0                      |

| Configuration                                                            | Environmental Criteria |                                    |                  | Project Cost Criteria |                  |                   | Reliability Criteria           |                     |                                     |                          |
|--------------------------------------------------------------------------|------------------------|------------------------------------|------------------|-----------------------|------------------|-------------------|--------------------------------|---------------------|-------------------------------------|--------------------------|
|                                                                          | Ease of Permitting     | Environmental Sustainability Index | Public Reception | Life Cycle Cost       | Ability to Phase | Cost Risk Factors | Source Water Supply Resiliency | Vulnerability Index | Regional System Operational Impacts | Contractual Requirements |
| 6A: New Groundwater via SHARP Credits + SWTP Exp. w/ Tampa Credits       | 2.0                    | 5.0                                | 2.5              | 4.8                   | 3.5              | 2.0               | 2.5                            | 3.0                 | 3.0                                 | 1.5                      |
| 6B: SWTP Exp. w/ Tampa Credits                                           | 2.0                    | 4.0                                | 2.0              | 4.9                   | 2.5              | 2.0               | 3.0                            | 2.5                 | 1.0                                 | 2.0                      |
| 7A: New Groundwater via SHARP Credits + Advanced WTP for Reclaimed Water | 1.0                    | 4.5                                | 2.0              | 4.0                   | 4.0              | 3.5               | 3.0                            | 3.0                 | 3.0                                 | 2.5                      |
| 7B: SWTP Exp. w/ Existing Source + Advanced WTP for Reclaimed Water      | 2.5                    | 2.5                                | 3.0              | 4.0                   | 3.0              | 5.0               | 2.5                            | 4.0                 | 1.5                                 | 4.0                      |
| 8: Desal WTP Exp. w/ Existing Source + Advanced WTP for Reclaimed Water  | 2.0                    | 3.0                                | 2.5              | 2.8                   | 3.0              | 4.0               | 4.5                            | 2.0                 | 3.0                                 | 3.5                      |
| 9A: New Groundwater via SHARP Credits + Aquifer Recharge/Recovery        | 3.0                    | 4.0                                | 2.5              | 2.4                   | 3.0              | 1.5               | 3.0                            | 3.0                 | 4.0                                 | 2.5                      |
| 9B: New Groundwater via SHARP Credits + Aquifer Recharge/Recovery        | 3.0                    | 4.0                                | 2.5              | 1.9                   | 2.5              | 1.0               | 3.0                            | 3.0                 | 4.5                                 | 2.5                      |

**Table 15-4: Aggregate Unweighted Scores, Aggregate Weighted Scores, and Rankings from Fine Screening Evaluation**

| Configuration                                                             | Unweighted Aggregate Scores | Ranking based on Unweighted Scores | Weighted Aggregate Scores | Ranking based on Weighted Scores |
|---------------------------------------------------------------------------|-----------------------------|------------------------------------|---------------------------|----------------------------------|
| 1: SWTP and Desal WTP Exp. w/ Existing Source                             | 3.5                         | 3                                  | 3.5                       | 3                                |
| 2A: New Groundwater via SHARP Credits + Gulf Coast Desal WTP              | 2.9                         | 10                                 | 2.8                       | 13                               |
| 2B: Gulf Coast Desal WTP                                                  | 2.6                         | 15                                 | 2.3                       | 15                               |
| 3: SWTP Exp. w/ Existing Source + New Groundwater via SHARP Credits       | 3.7                         | 1                                  | 3.9                       | 1                                |
| 4A: Desal WTP Exp. w/ Existing Source + New Groundwater via SHARP Credits | 3.5                         | 2                                  | 3.5                       | 2                                |
| 4B: Desal WTP Exp. w/ Existing Source + New Groundwater via SHARP Credits | 3.4                         | 4                                  | 3.4                       | 4                                |
| 5A: New Groundwater via Expanded SHARP Credits                            | 3.1                         | 6                                  | 3.3                       | 5                                |
| 5B: New Groundwater via Expanded SHARP Credits                            | 2.9                         | 11                                 | 3.1                       | 9                                |
| 6A: New Groundwater via SHARP Credits + SWTP Exp. w/ Tampa Credits        | 3.0                         | 9                                  | 3.2                       | 7                                |
| 6B: SWTP Exp. w/ Tampa Credits                                            | 2.6                         | 14                                 | 2.9                       | 12                               |
| 7A: New Groundwater via SHARP Credits + Advanced WTP for Reclaimed Water  | 3.1                         | 7                                  | 3.1                       | 8                                |
| 7B: SWTP Exp. w/ Existing Source + Advanced WTP for Reclaimed Water       | 3.2                         | 5                                  | 3.2                       | 6                                |
| 8: Desal WTP Exp. w/ Existing Source + Advanced WTP for Reclaimed Water   | 3.0                         | 8                                  | 3.0                       | 10                               |
| 9A: New Groundwater via SHARP Credits + Aquifer Recharge/Recovery         | 2.9                         | 12                                 | 2.9                       | 11                               |
| 9B: New Groundwater via SHARP Credits + Aquifer Recharge/Recovery         | 2.8                         | 13                                 | 2.8                       | 14                               |

## 15.4 Fine Screening Results

The 15 configurations were put in order of rank and those with an aggregate, weighted score of 3.0 or higher were extracted for further evaluation. Figure 15-1 provides the breakdown of fine screening results for top ranked configurations. Schematics of each of the top ranked configurations are also provided in Figure 15-2 and Figure 15-10.

Table 15-5 provides a summary of the top ranked configurations, as well as each configuration's recommendation for further consideration.

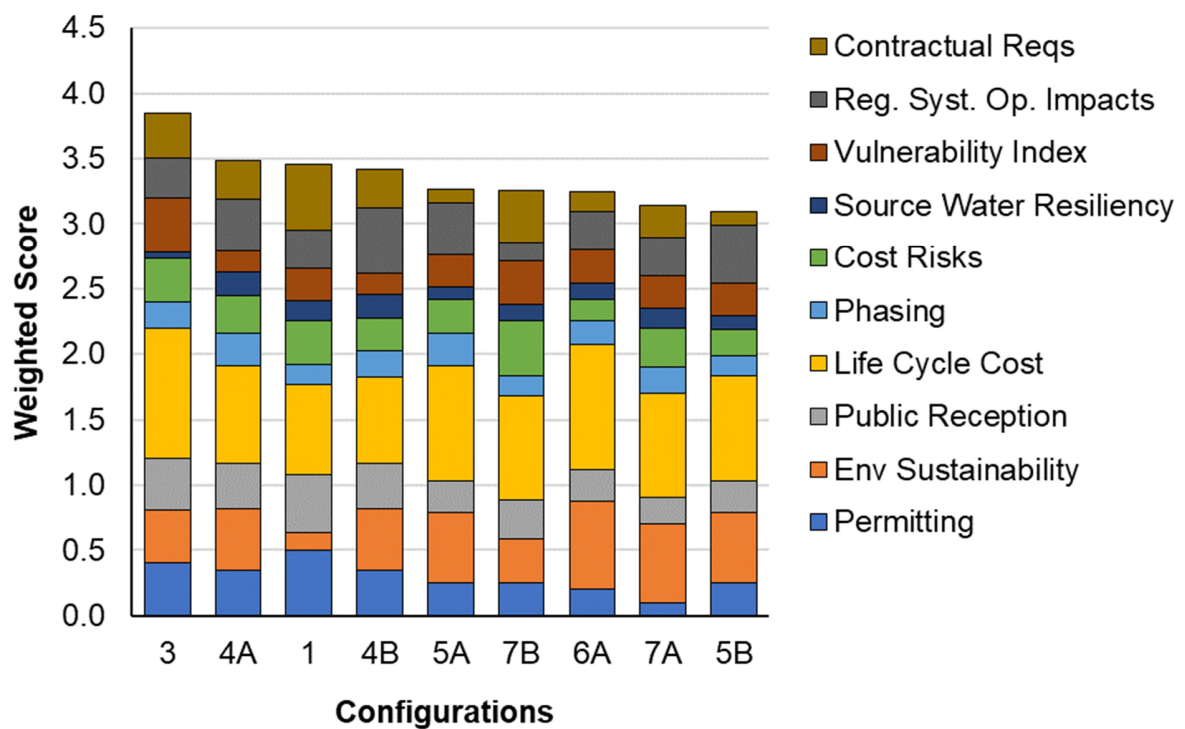


Figure 15-1: Detailed Fine Screening Results for Top Ranked Configurations

**Table 15-5: Top Nine Configurations and Recommendations for Further Evaluation**

| Rank | Configuration | Description                                                                                                                                                                | Recommended? |
|------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1    | 3             | SWTP expansion with existing source and new groundwater via SHARP credits with finished water transmission main to the end of the south county pipeline                    | Yes          |
| 2    | 4A            | Desalination WTP expansion with existing source and new groundwater via SHARP credits with finished water transmission main to the desalination WTP transmission main      | Yes          |
| 3    | 1             | SWTP expansion with existing source and desalination WTP expansion with existing source                                                                                    | Yes          |
| 4    | 4B            | Desalination WTP expansion with existing source and new groundwater via SHARP credits with finished water transmission main back to the regional site                      | No           |
| 5    | 5A            | New groundwater via expanded SHARP credits with finished water transmission main to the desalination WTP transmission main                                                 | Yes          |
| 6    | 7B            | SWTP expansion with existing source and new advanced water treatment plant for reclaimed water                                                                             | No           |
| 7    | 6A            | SWTP expansion with Tampa credits and new groundwater via SHARP credits with finished water transmission main to the end of the south county pipeline                      | No           |
| 8    | 7A            | New advanced water treatment plant for reclaimed water and new groundwater via SHARP credits with finished water transmission main to the end of the south county pipeline | No           |
| 9    | 6B            | SWTP expansion with Tampa with finished water transmission main to the end of the south county pipeline                                                                    | No           |

Four of the top nine configurations (highlighted) as shown in Table 15-5 are recommended for continued pursuit beyond the 2018 Long-term Master Water Plan Update as potential supply solutions. Justification for exclusion of five of the top nine configurations from these recommendations is provided below:

- Configuration 4B was not recommended for continued pursuit because it is nearly identical to Configuration 4A, the one caveat being where the finished water transmission main from the new groundwater treatment plant ties into the regional system. In Configuration 4A, the finished water transmission main from the groundwater treatment plant extends to the Tampa Bay Seawater Desalination Plant transmission main, whereas the termination point is at the regional site in Configuration 4B. A major benefit of Configuration 4 is the inclusion of 20 mgd of new supply in south Hillsborough County, thus eliminating the need for a new regional pipeline to the Balm Point of Connection. In Configuration 4B, this benefit is negated by the unnecessary long finished water transmission main to the regional site.
- Both Configuration 7A and Configuration 7B were not recommended for continued pursuit because they include a new advanced water treatment plant for reclaimed water. Although interest in potable reuse is strengthening in Florida, across the United States, and worldwide, there is not a significant driver for its implementation at this time in the Tampa Bay Water region due to the availability and suitability of other source waters (e.g., existing surface water supplies, groundwater, seawater). At this time, there is no legislative or regulatory framework for potable reuse in Florida.
- Configuration 6A, which involves the use of groundwater credits generated by the City of Tampa through aquifer recharge, was not recommended for continued consideration because

the City of Tampa does not support transferring credits to Tampa Bay Water at this time (Appendix 6E). This configuration assumes that Tampa Bay Water would purchase groundwater credits from the City of Tampa, thus allowing Tampa Bay Water to withdraw groundwater to supplement surface water supplies at the Regional Surface Water Treatment Plant. At this point in the development of the Tampa Augmentation Project (TAP), the City of Tampa aims to only provide withdrawn groundwater to the David Tippin Plant. This would allow Tampa Bay Water to obtain additional water via surface water from the Harney Canal Augmentation Water Use Permit (Permit No. 20006675006), as well as excess water that may be made available in the Hillsborough River (Section 8).

- Configuration 6B was not recommended for continued pursuit because it is completely reliant on an uncertain supply (i.e., new groundwater withdrawals via credits generated by the City of Tampa for aquifer recharge), whereas Configuration 6A relies both on an expansion of the Regional Surface Water Treatment Plant with Tampa credits, as well as new groundwater via SHARP credits. The City of Tampa has not yet begun the construction or operation of its aquifer recharge system, nor has the permissibility or feasibility of the project been confirmed.

Three unique water supply projects are included in the top ranked configurations, which are recommended for continued evaluation as potential strategies for increased water supply in the Tampa Bay Water region while meeting the more urgent needs in south Hillsborough County Table 15-6. These projects are listed below. Due to these overlap between these projects across the top ranked configurations, as well as the remaining feasibility study to be conducted for each, all three projects are recommended for further evaluation. Furthermore, concurrent investigation of the three projects will help inform the optimal pairing of first and second phase supply projects.

- Expansion of the Regional Surface Water Treatment Plant with existing source water (included in Configurations 1 and 3),
- Expansion of the Tampa Bay Seawater Desalination Plant with existing source water (included in Configurations 1 and 4A), and
- New groundwater treatment plant with withdrawals enabled by SHARP credits (included in Configurations 3, 4A, and 5A).

In addition to these water supply projects, two of the top four configurations also include a new regional pipeline from the Regional Facilities Site to the Balm point of connection to address water supply limitations in south Hillsborough County (included in Configurations 1 and 3). Also, Tampa Bay Water will continue to monitor the City of Tampa's evaluation of the TAP project feasibility.

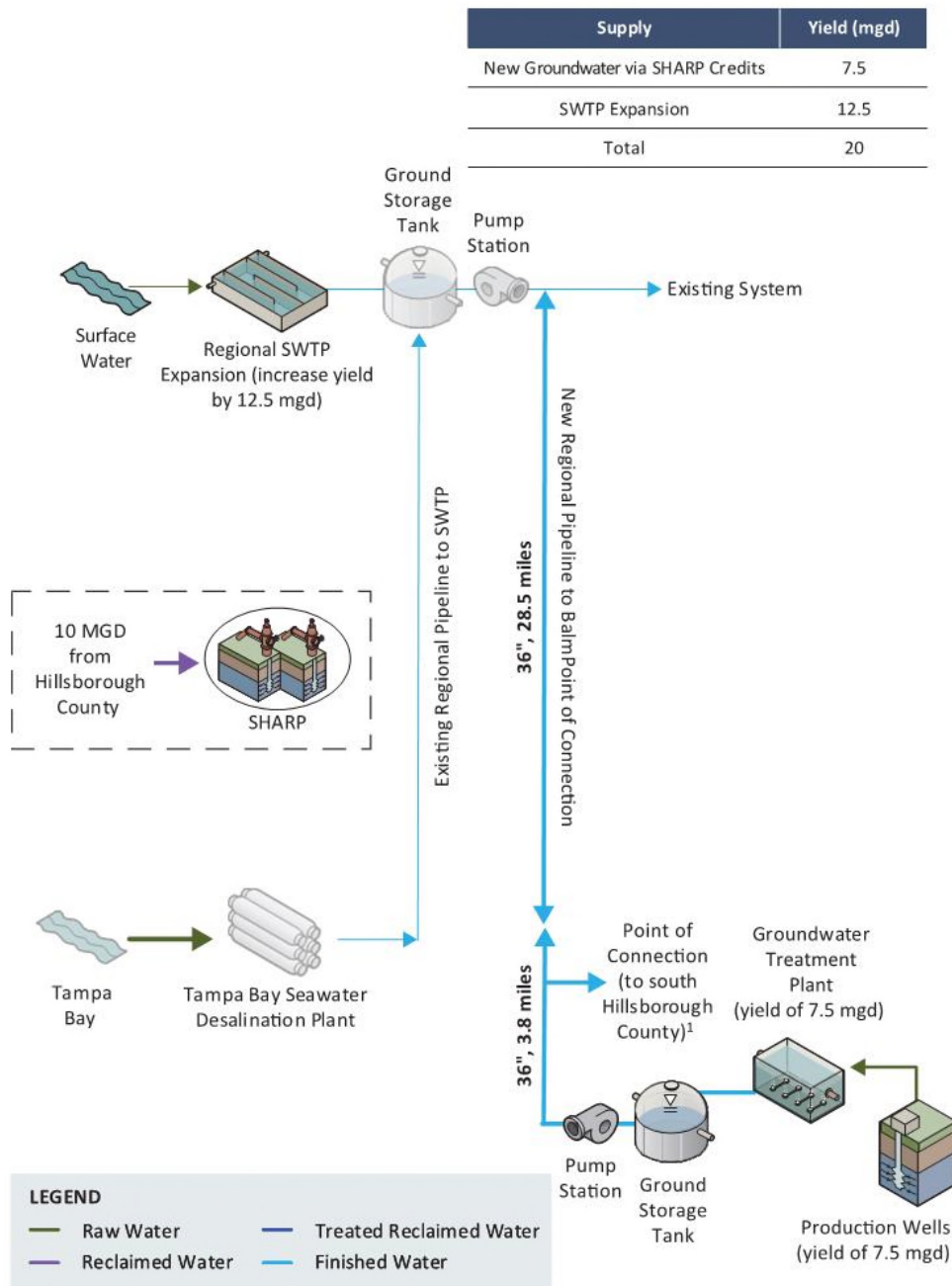
**Table 15-6: Recommended Water Supply Projects for Further Evaluation**

| Project                                         | Source                         | Additional Yield |
|-------------------------------------------------|--------------------------------|------------------|
| SWTP Expansion with Existing Source             | Existing surface water sources | 10 – 12.5 MGD    |
| Desalination WTP Expansion with Existing Source | Existing seawater source       | 10 – 12.5 MGD    |
| New Groundwater via SHARP Credits               | Groundwater                    | 7.5 MGD          |



### CONFIGURATION 3 - Regional Surface Water Treatment Plant (SWTP) Expansion with Existing Source Water and Groundwater Treatment Plant via Net Benefit from SHARP Program

Regional SWTP expansion with existing source water, and new groundwater supply and groundwater treatment plant via credits generated through Hillsborough County's SHARP Program. The finished water transmission from the new groundwater treatment plant extends to the end of the new regional pipeline to the Balm Point of Connection.



<sup>1</sup> Location of Point of Connection to be confirmed

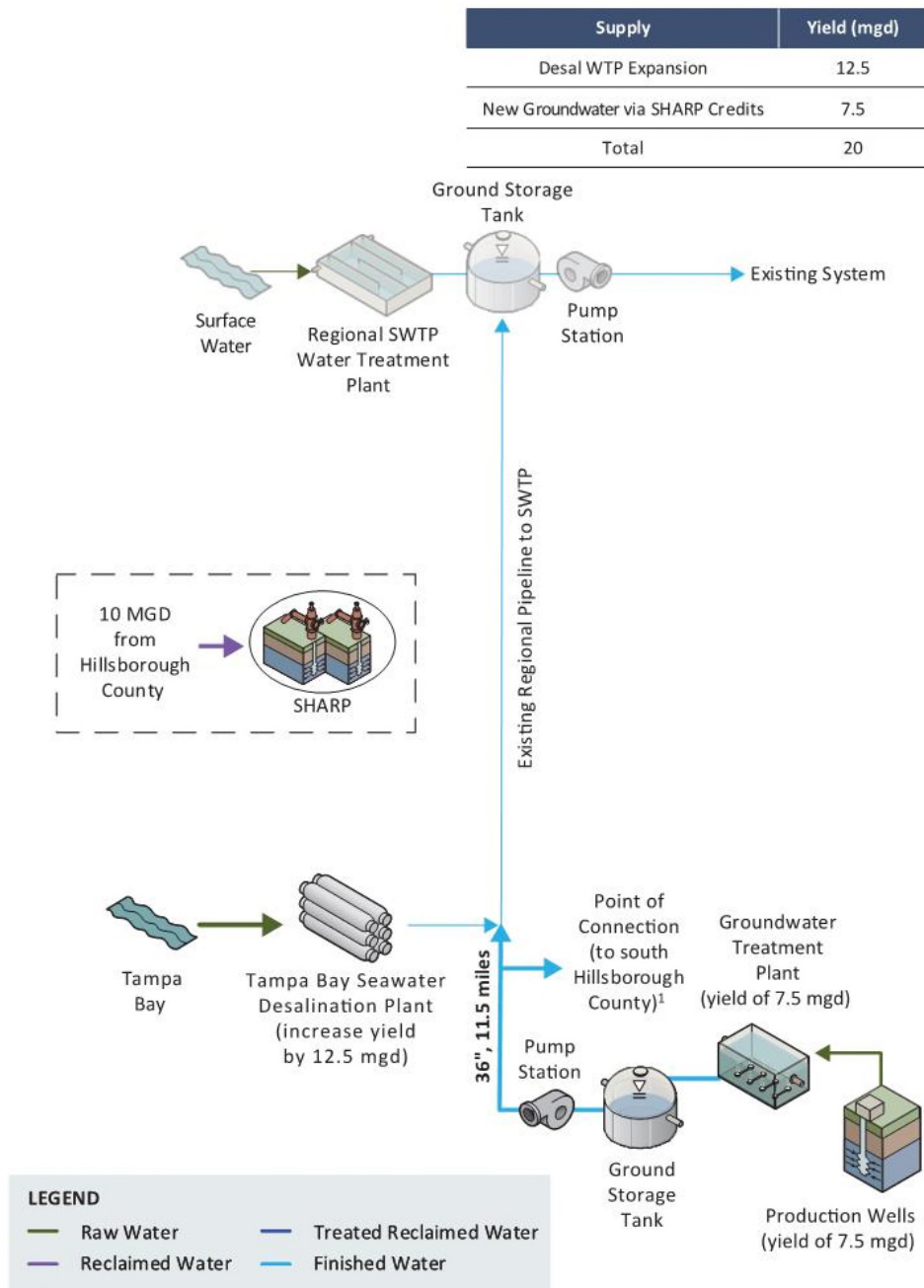
<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-2: Schematic of the Number One Ranked Configuration, Configuration 3

#### CONFIGURATION 4A - Tampa Bay Seawater Desalination Plant Expansion with Existing Source Water and Groundwater Treatment Plant via Net Benefit from SHARP Program

Tampa Bay Seawater Desalination Plant expansion with existing source water, and new groundwater supply and groundwater treatment plant via credits generated through Hillsborough County's SHARP Program. The finished water transmission from the new groundwater treatment plant extends to the existing regional pipeline from the Seawater Desalination Plant to the Regional Facilities Site.



<sup>1</sup> Location of Point of Connection to be confirmed

<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

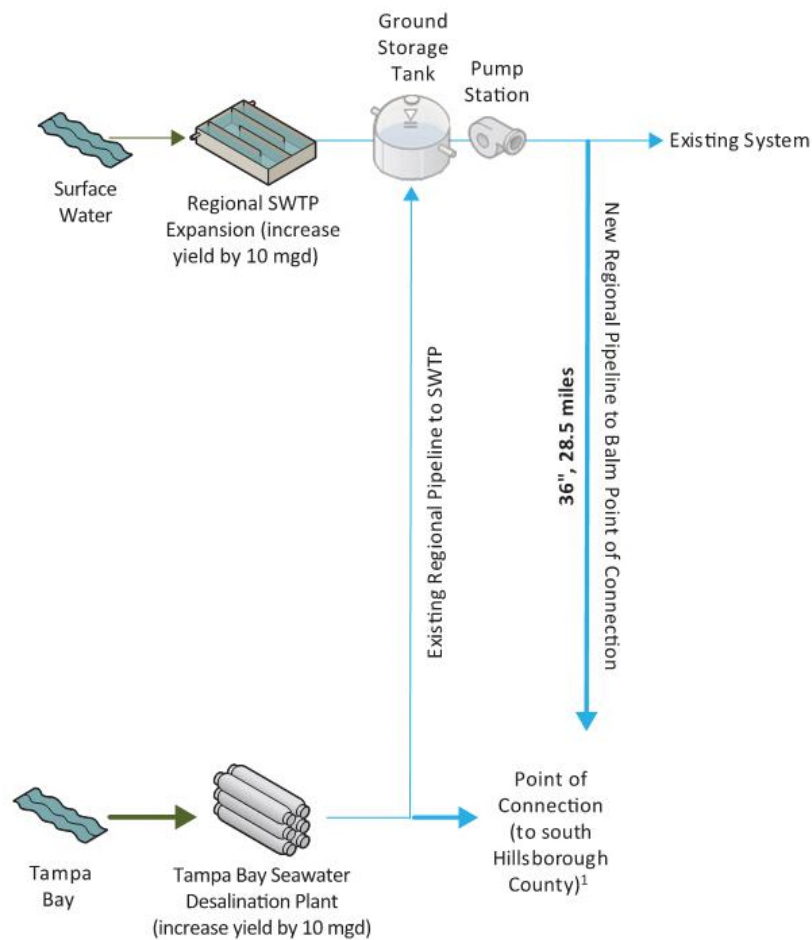
<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-3: Schematic of the Number Two Ranked Configuration, Configuration 4A

### CONFIGURATION 1 - Regional Surface Water Treatment Plant (SWTP) and Tampa Bay Seawater Desalination Plant Expansions with Existing Source Waters

Regional SWTP expansion with additional use of existing source waters and Tampa Bay Seawater Desalination Plant expansion with additional use of existing source water.

| Supply              | Yield (mgd) |
|---------------------|-------------|
| Desal WTP Expansion | 10          |
| SWTP Expansion      | 10          |
| Total               | 20          |



#### LEGEND

Raw Water      Treated Reclaimed Water  
Reclaimed Water      Finished Water

<sup>1</sup> Location of Point of Connection to be confirmed

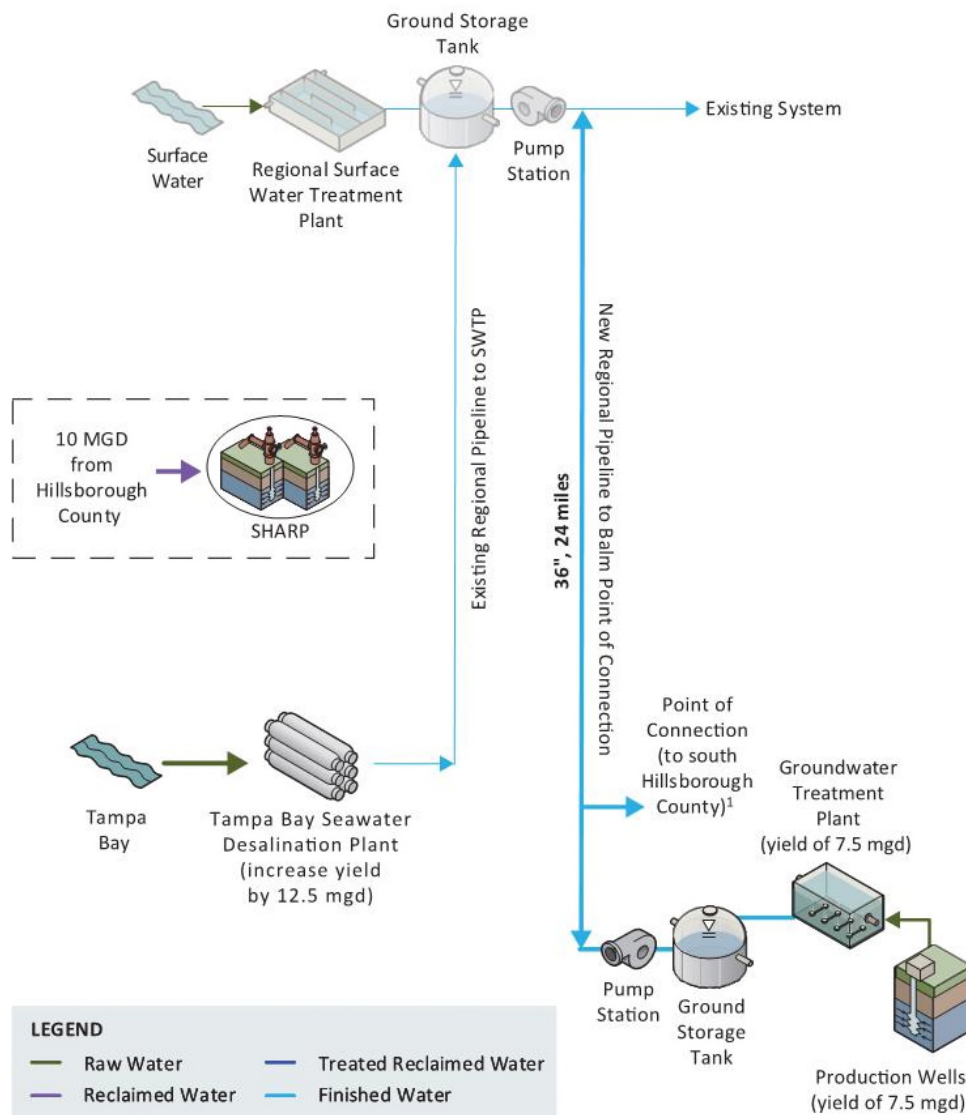
<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

Figure 15-4: Schematic of Number Three Ranked Configuration, Configuration 1

### CONFIGURATION 4B - Tampa Bay Seawater Desalination Plant Expansion with Existing Source Water and Groundwater Treatment Plant via Net Benefit from SHARP Program

Tampa Bay Seawater Desalination Plant expansion with existing source water, and new groundwater supply and groundwater treatment plant via credits generated through Hillsborough County's SHARP Program. The finished water transmission from the new groundwater treatment plant extends to the Regional Facilities Site.

| Supply                            | Yield (mgd) |
|-----------------------------------|-------------|
| Desal WTP Expansion               | 12.5        |
| New Groundwater via SHARP Credits | 7.5         |
| <b>Total</b>                      | <b>20</b>   |



<sup>1</sup> Location of Point of Connection to be confirmed

<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

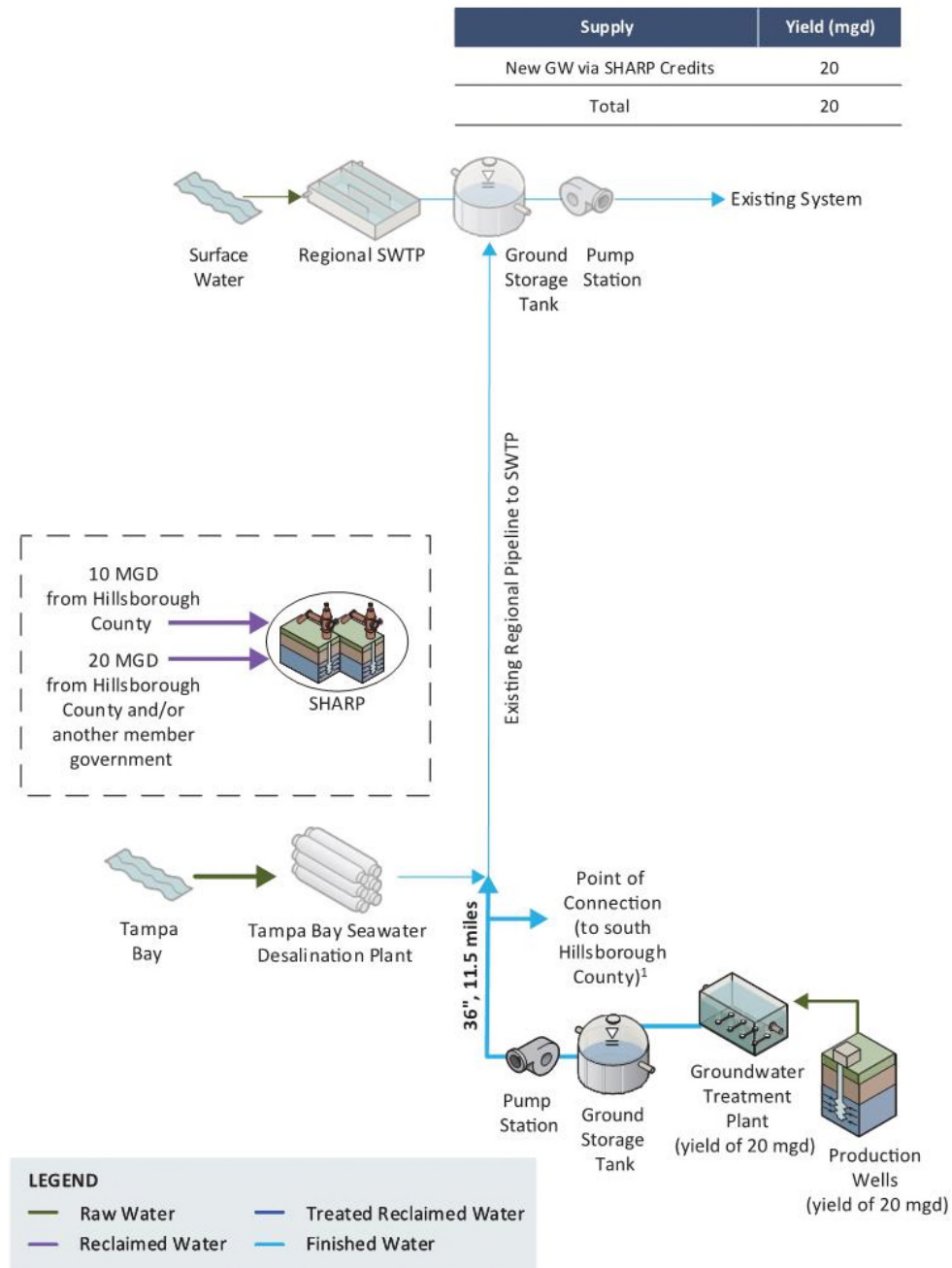
<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-5: Schematic of the Number Four Ranked Configuration, Configuration 4B



### CONFIGURATION 5A - Groundwater treatment plant via Net Benefit from Expanded SHARP Program

New groundwater supply and groundwater treatment plant via credits generated through an expanded version of Hillsborough County's SHARP Program. The finished water transmission from the new groundwater treatment plant extends to the existing regional pipeline from the Seawater Desalination Plant to the Regional Facilities Site.



<sup>1</sup> Location of Point of Connection to be confirmed

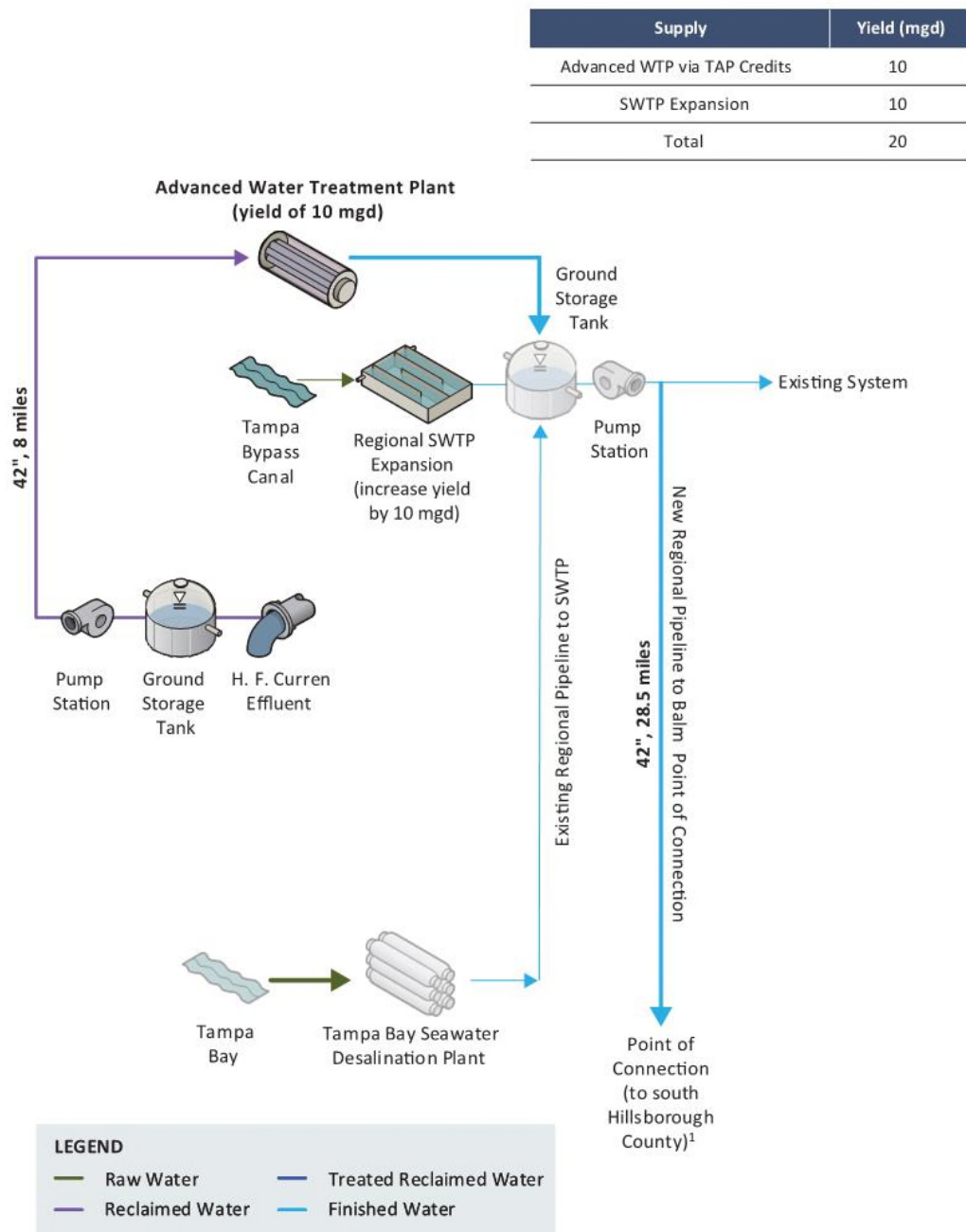
<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-6: Schematic of the Number Five Ranked Configuration, Configuration 5A

### CONFIGURATION 7B - Advanced Water Treatment Plant for Reclaimed Water and Regional Surface Water Treatment Plant (SWTP) Expansion with Existing Source Water

Regional SWTP expansion with existing source water and new advanced water treatment plant at the Regional Facilities Site for the treatment reclaimed water from a member government.



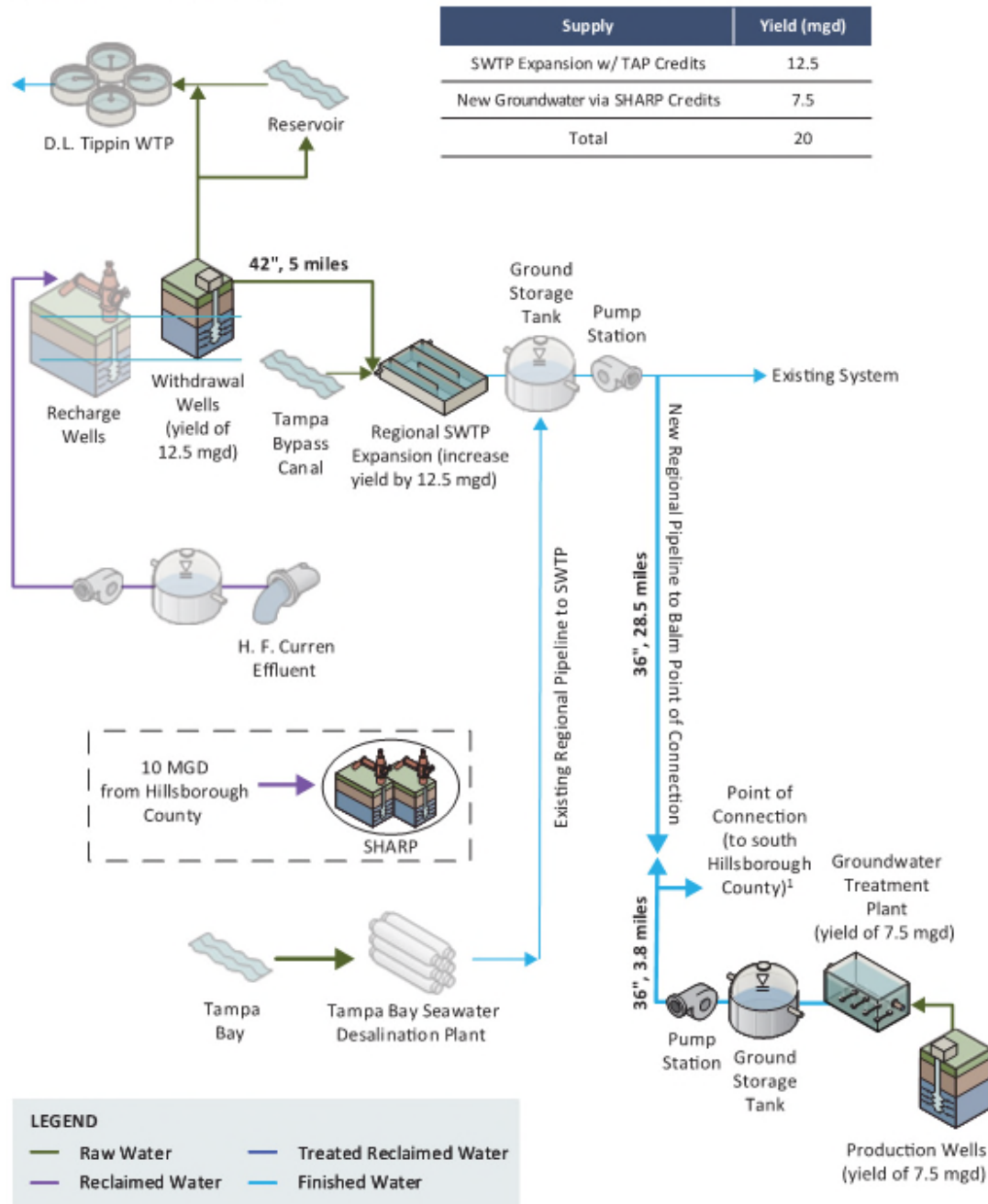
<sup>1</sup> Location of Point of Connection to be confirmed

<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

Figure 15-7: Schematic of the Number Six Ranked Configuration, Configuration 7B

### CONFIGURATION 6A - Regional Surface Water Treatment Plant (SWTP) Expansion via Tampa Augmentation Project (TAP) Credits and Groundwater Treatment Plant via Net Benefit from SHARP Program

Regional SWTP expansion with groundwater credits from City of Tampa's TAP, and new groundwater supply via SHARP credits with new groundwater treatment plant and finished water transmission main to the new regional pipeline to Balm Point of Connection.



<sup>1</sup> Location of Point of Connection to be confirmed

<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

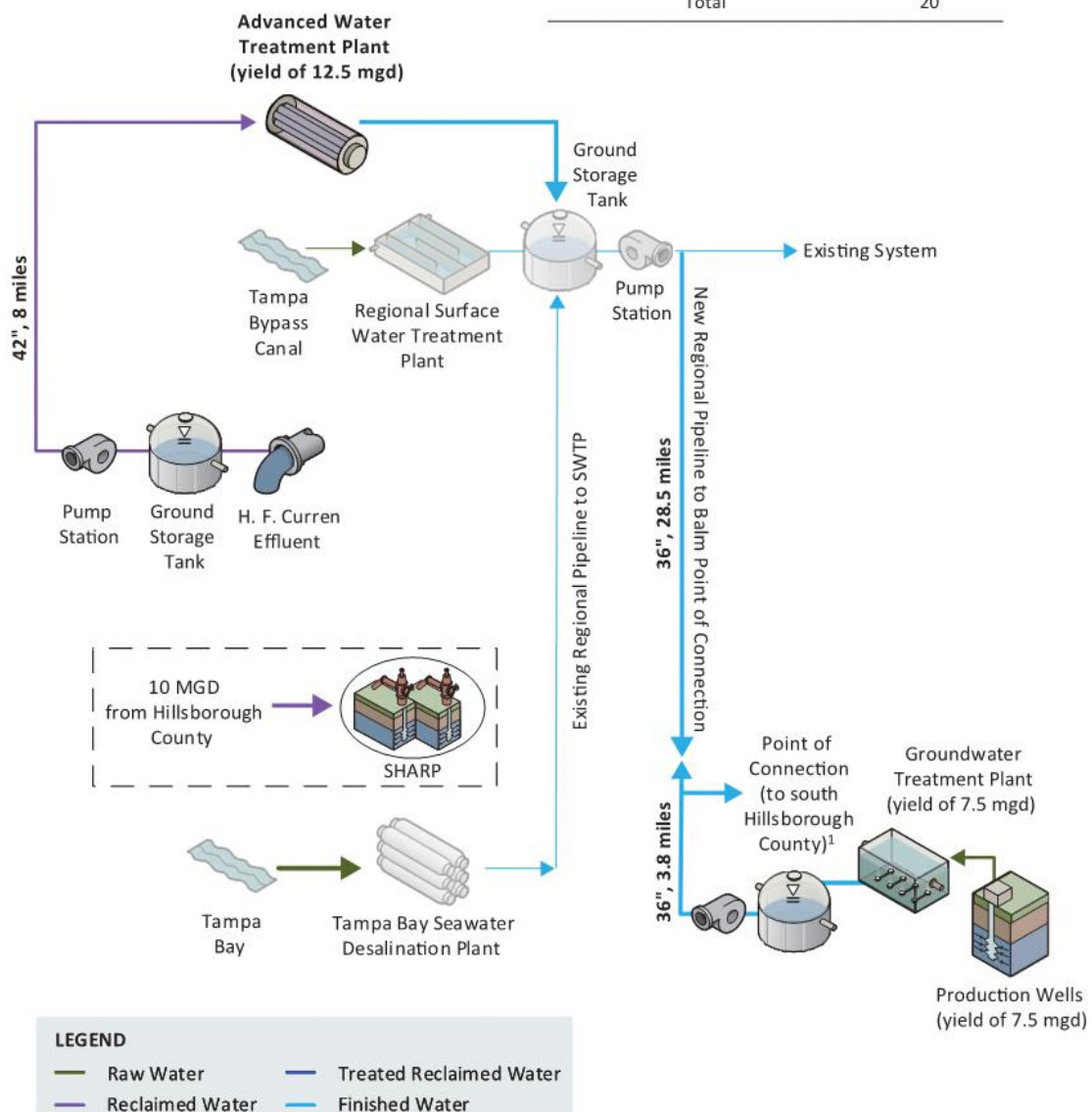
Figure 15-8: Schematic of the Number Seven Ranked Configuration, Configuration 6A



### CONFIGURATION 7A - Advanced Water Treatment Plant for Reclaimed Water and Groundwater Treatment Plant via Net Benefit from SHARP Program

New advanced water treatment plant at the Regional Facilities Site for the treatment of reclaimed water from a member government, and new groundwater supply and treatment plant via credits generated by Hillsborough County's SHARP Program. The finished water transmission main from the new groundwater treatment plant extends to the end of the new regional pipeline to the Balm Point of Connection.

| Supply                       | Yield (mgd) |
|------------------------------|-------------|
| Advanced WTP via TAP Credits | 12.5        |
| New GW via SHARP Credits     | 7.5         |
| Total                        | 20          |



<sup>1</sup> Location of Point of Connection to be confirmed

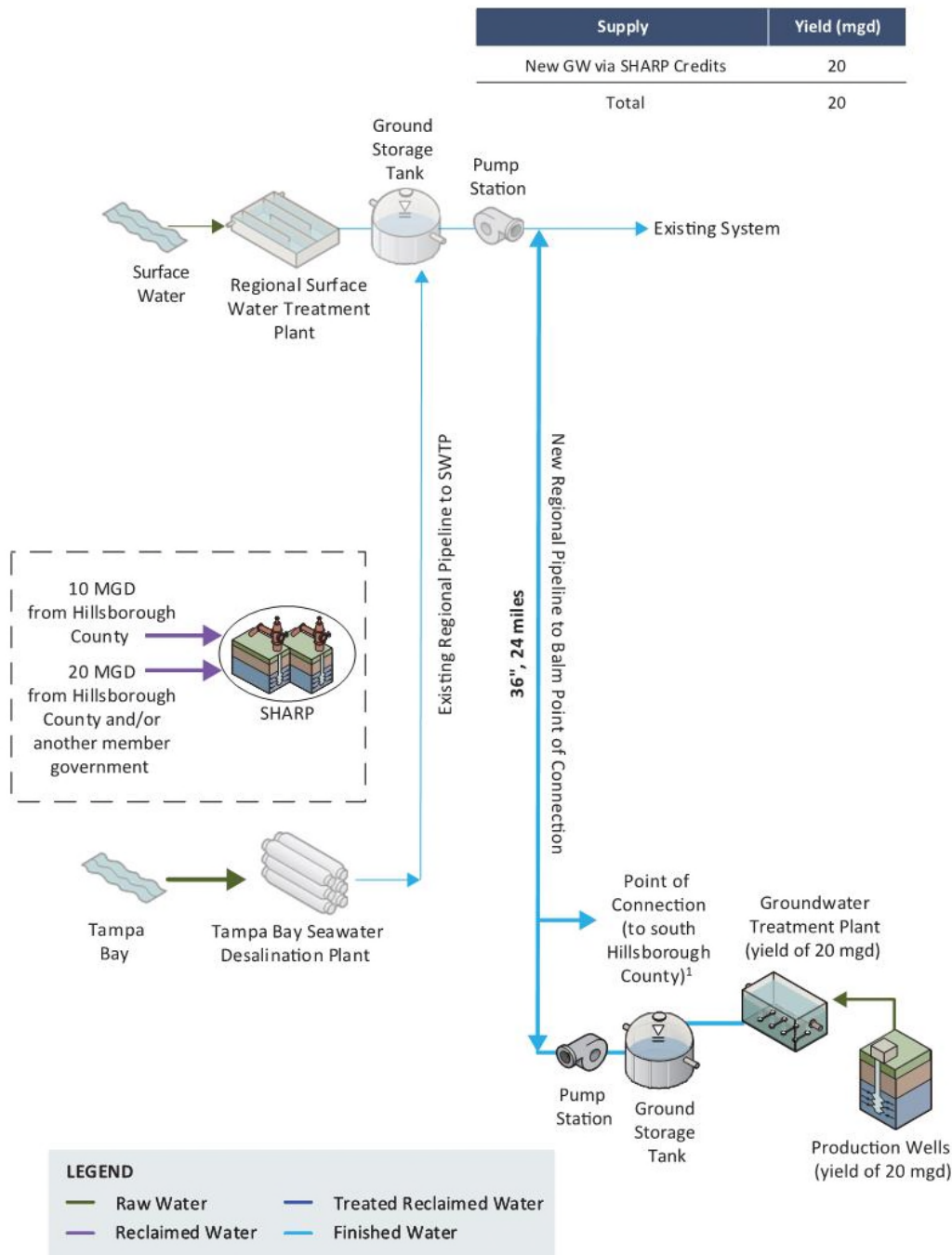
<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-9: Schematic of the Number Eight Ranked Configuration, Configuration 7A

### CONFIGURATION 5B - Groundwater Treatment Plant via Net Benefit from SHARP Program

New groundwater supply and groundwater treatment plant via credits generated through an expanded version of Hillsborough County's SHARP Program. The finished water transmission from the new groundwater treatment plant extends to the Regional Facilities Site.



<sup>1</sup> Location of Point of Connection to be confirmed

<sup>2</sup> Lighter lines and faded graphics are representative of existing, unimproved infrastructure

<sup>3</sup> SHARP is the South Hillsborough Aquifer Recharge Program

Figure 15-10: Schematic for the Number Nine Ranked Configuration, Configuration 5B

## 16. Top Ranked Water Supply Projects for Meeting Future Demands

### 16.1 Overview of Top Ranked Configurations and Associated Projects

Section 15 provided a detailed discussion of the fine screening evaluation of potential water supply configurations. As a result of the fine screening process, four configurations were recommended for further evaluation as water supply strategies due to strong aggregate scores spanning environmental, economic, and reliability criteria Figure 16-1.

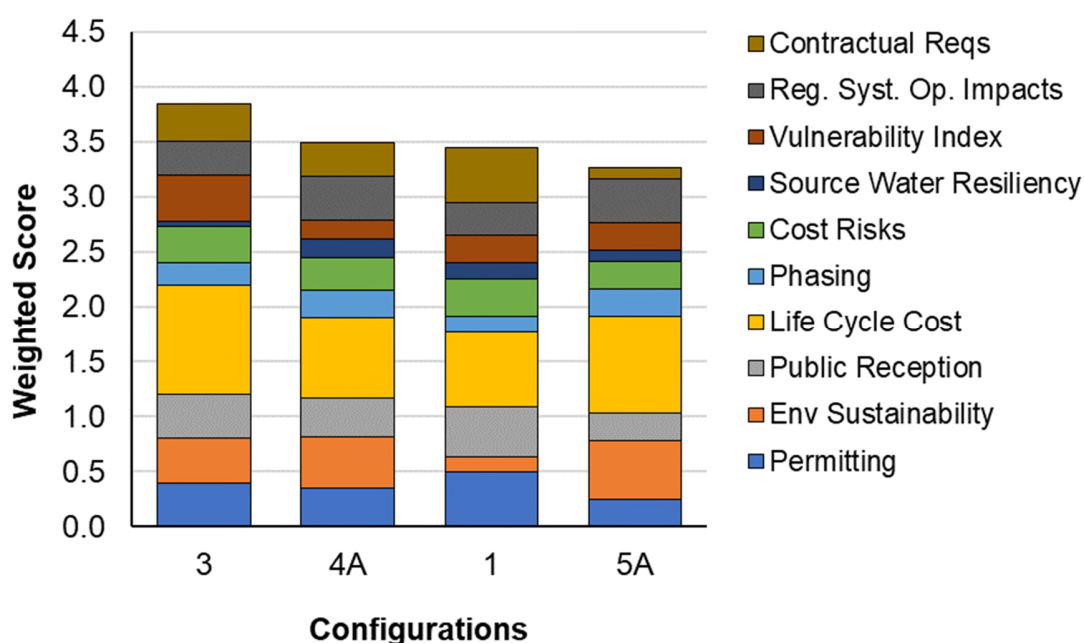


Figure 16-1: Weighted Fine Screening Scores for Recommended Configurations

Altogether, the four recommended configurations are comprised of three water supply projects, with the assumed yield of each being dependent on the specific configuration Table 16-1. Additionally, two of the top four configurations include a new regional pipeline from the Regional Facilities Site to the Balm Point of Connection to address water supply needs in south Hillsborough County. The two configurations that do not include a new regional pipeline are able to meet both regional and south Hillsborough County supply needs with the supply projects themselves.

This section provides further details on each of the three water supply projects common to the top four ranked configurations, including an overall description, major components, costs, and special considerations. The descriptions and costs for each project assume that it is being implemented as a first phase project as both a regional and south Hillsborough County supply because the actual phasing of these projects is unknown at this time. Details of implementation, including phasing and factors that may impact timing, are discussed in Section 22.

**Table 16-1: Recommended Water Supply Configurations from Fine Screening Evaluation**

| Configuration                                                             | Supply Projects (Yield, mgd) |                                   |                                   |                                                 | New Regional Pipeline to South Balm Area (Capacity) |
|---------------------------------------------------------------------------|------------------------------|-----------------------------------|-----------------------------------|-------------------------------------------------|-----------------------------------------------------|
|                                                                           | SWTP Exp. w/ Existing Source | Desal WTP Exp. w/ Existing Source | New Groundwater via SHARP Credits | SWTP Exp. w/ Tampa Augmentation Project Credits |                                                     |
| 3: SWTP Exp. w/ Existing Source + New Groundwater via SHARP Credits       | 12.5                         |                                   | 7.5 <sup>1</sup>                  |                                                 | 12.5 mgd                                            |
| 4A: Desal WTP Exp. w/ Existing Source + New Groundwater via SHARP Credits |                              | 12.5                              | 7.5 <sup>2</sup>                  |                                                 | NA                                                  |
| 1: SWTP and Desal WTP Exp. w/ Existing Source                             | 10                           | 10                                |                                   |                                                 | 10 mgd                                              |
| 5A: New Groundwater via Expanded SHARP Credits                            |                              |                                   | 20 <sup>2</sup>                   |                                                 | NA                                                  |

<sup>(1)</sup> Finished water transmission main connects to the regional system at the end of the south county pipeline; <sup>2</sup> finished water transmission main connects to the regional system at the desalination WTP transmission main

## 16.2 Individual Water Supply Projects

### 16.2.1 New Groundwater Treatment Plant via Net Benefit from SHARP Program

New groundwater withdrawals would be enabled by the generation of groundwater withdrawal credits through aquifer recharge with reclaimed water, which serves as a barrier against saltwater intrusion and provides a net benefit to the receiving aquifer. Two variations of this water supply project were included in the top four configurations from the fine screening evaluation: one in which groundwater withdrawal credits were generated solely by Hillsborough County and transferred to Tampa Bay Water, and another in which the aquifer recharge program is expanded using reclaimed water from Hillsborough County and another member government to provide additional groundwater withdrawal credits to Tampa Bay Water. In both variations, aquifer recharge and new groundwater withdrawals are remote from each other, thus allowing for reclaimed water to generate credits and provide a net benefit to the aquifer without serving as the actual supply of source water.

If the new wellfield and groundwater treatment plant were to be implemented as a first phase project, it would entail only the variation of this project in which groundwater credits are generated by Hillsborough County, thus providing 7.5 mgd to the region and to south Hillsborough County. A maximum yield of 7.5 mgd is assumed based on the availability of 10 mgd of reclaimed water, withdrawal constraints, and groundwater modeling. A brief summary of projects costs and considerations is provided below, and a more detailed discussion of project infrastructure, costs, and benefits is provided in Appendix 9C.

#### 16.2.1.1 Major Components

The 7.5 mgd water supply project includes three major components:

- Groundwater withdrawal wellfield;
- New groundwater treatment plant; and
- Finished water transmission from the new groundwater treatment plant to the regional system.

For cost estimating purposes, the withdrawal wellfield is assumed to include not only production wells, but also several thousand feet of ductile iron pipe for collection, shallow monitoring wells, sitework, and a ten-acre site requiring acquisition.

Based on local water quality, groundwater treatment is assumed to include ozonation for the removal of hydrogen sulfide, as well as disinfection, although water quality testing will be required to confirm additional treatment requirements. In addition to the treatment processes themselves, this water supply option requires ground storage, a finished water pump station, and approximately six acres of land for treatment.

Finished water may be delivered to Hillsborough County through a new point of connection in the vicinity of the new groundwater treatment plant. Alternatively, finished water may be delivered to the regional system by way of approximately 11.5 miles of 36-inch transmission main that will be installed from the new groundwater treatment plant to the Tampa Bay Seawater Desalination Plant transmission main. In this evaluation, it is assumed that finished water will generally be sent to Hillsborough County via the new point of connection considering its demand projections, but the finished water transmission main will be used for emergency purposes and to avoid stranded water supply during times when excess supply is available.

#### 16.2.1.2 *Cost Opinion*

An estimated opinion of probable construct costs (EOPCC) was developed for the water supply option involving a new groundwater treatment plant in south Hillsborough County with withdrawals being enabled by aquifer recharge credits. The detailed EOPCC and cost summary are provided in Table 16-2. No cost is included for the transferral of groundwater credits nor reclaimed water from a member government to Tampa Bay Water. It should also be noted that acreage requirements for pipeline easements were estimated based on needing to acquire a 35-foot wide easement along 25% of the total length of the pipeline with the remaining 75% of the total length of the pipeline being located in right-of-way properties. If this project is selected for construction, Tampa Bay Water may elect to run the majority of the length of the pipeline through easements; easement requirements and right-of-way preferences should be evaluated during the feasibility phase.

Table 16-2: EOPCC for New Groundwater Treatment Plant via Net Benefit from SHARP – 7.5 mgd Yield

| Capital Costs                                                                 |                 |               |             |                      |
|-------------------------------------------------------------------------------|-----------------|---------------|-------------|----------------------|
| Item                                                                          | Unit of Measure | Quantity      | Unit Price  | Extension            |
| <b>Withdrawal Wellfield</b>                                                   |                 |               |             |                      |
| 7.5 mgd Production Wellfield                                                  | LS              | 1             | \$2,600,000 | \$2,600,000          |
| 16" DIP – Open Cut                                                            | LF              | 5,625         | \$200       | \$1,125,000          |
| 36" DIP – Open Cut                                                            | LF              | 5,000         | \$420       | \$2,100,000          |
| Land/Easement Acquisition                                                     | AC              | 10            | \$220,000   | \$2,200,000          |
| Shallow Monitoring Wells                                                      | EA              | 4             | \$200,000   | \$800,000            |
| 10 mgd Production Wellfield Sitework                                          | LS              | 1             | \$780,000   | \$780,000            |
| <b>Groundwater Treatment</b>                                                  |                 |               |             |                      |
| Groundwater Treatment                                                         | mgd             | 9.4           | \$1,000,000 | \$9,375,000          |
| Ground Storage Tank                                                           | MG              | 2             | \$750,000   | \$1,500,000          |
| Pump Station – 11 to 25 mgd                                                   | mgd             | 13            | \$200,000   | \$2,500,000          |
| Land/Easement Acquisition                                                     | AC              | 6             | \$220,000   | \$1,320,000          |
| <b>Treated Groundwater Transmission</b>                                       |                 |               |             |                      |
| 36" DIP – Open Cut                                                            | LF              | 60,171        | \$420       | \$25,272,000         |
| 36" DIP – Microtunneling                                                      | LF              | 779           | \$1,230     | \$959,000            |
| 36" DIP – Microtunneling with Adverse Conditions                              | LF              | 245           | \$1,660     | \$407,000            |
| Point of Connection                                                           | LS              | 1             | \$260,000   | \$260,000            |
| Ground Storage Tank                                                           | MG              | 2             | \$750,000   | \$1,500,000          |
| Pump Station – 1 to 10 mgd                                                    | mgd             | 9.4           | \$280,000   | \$2,625,000          |
| 36" DIP – Open Cut                                                            | LF              | 5,000         | \$420       | \$2,100,000          |
| Land/Easement Acquisition                                                     | AC              | 10            | \$220,000   | \$2,200,000          |
| <i>Subtotal</i>                                                               |                 |               |             | <i>\$59,623,000</i>  |
| <i>Contingency</i>                                                            |                 |               | <i>30%</i>  | <i>\$17,887,000</i>  |
| <i>Overhead and Profit</i>                                                    |                 |               | <i>20%</i>  | <i>\$15,502,000</i>  |
| <i>Subtotal with Contingency and Overhead and Profit</i>                      |                 |               |             | <i>\$93,012,000</i>  |
| <i>Engineering, Legal, and Administration</i>                                 |                 |               | <i>25%</i>  | <i>\$23,253,000</i>  |
| <b>Total Capital Cost</b>                                                     |                 |               |             | <b>\$116,265,000</b> |
| Annual Operation and Maintenance Costs                                        |                 |               |             |                      |
| Item                                                                          | Unit of Measure | Quantity      | Unit Price  | Extension            |
| <b>Withdrawal Wellfield</b>                                                   |                 |               |             |                      |
| Withdrawal Well Electricity                                                   | kWh             | 1,134,137     | \$0.09      | \$103,000            |
| Pipeline O&M                                                                  | LF              | 10,625        | \$2.25      | \$24,000             |
| Groundwater Credits – SHARP                                                   | kgal            | 2,737,500     | \$0.00      | \$0                  |
| <b>Groundwater Treatment</b>                                                  |                 |               |             |                      |
| Groundwater Treatment                                                         | mgd             | 7.5           | \$35,000    | \$263,000            |
| Pumping Electricity                                                           | kWh             | 2,268,274     | \$0.09      | \$205,000            |
| Pump Station O&M                                                              | mgd             | 7.5           | \$5,000     | \$38,000             |
| <b>Treated Groundwater Transmission</b>                                       |                 |               |             |                      |
| Pipeline O&M                                                                  | LF              | 66195         | \$2.25      | \$149,000            |
| Interconnect pumping electricity                                              | kWh             | 2,551,808     | \$0.09      | \$230,000            |
| Pump Station O&M                                                              | mgd             | 7.5           | \$5,000     | \$38,000             |
| <b>Total Annual Operation and Maintenance Cost</b>                            |                 |               |             | <b>\$1,050,000</b>   |
| SUMMARY                                                                       |                 |               |             |                      |
| <b>Capital Cost <sup>1</sup></b>                                              |                 | \$116 million |             |                      |
| <b>Annual Operation and Maintenance Cost <sup>2</sup></b>                     |                 | \$1.1 million |             |                      |
| <b>Capital Cost per 1,000 gallons <sup>1,3</sup></b>                          |                 | \$3.11        |             |                      |
| <b>Annual Operation and Maintenance Cost per 1,000 gallons <sup>2,3</sup></b> |                 | \$0.38        |             |                      |
| <b>Total Unit Cost per 1,000 gallons <sup>1,2,3</sup></b>                     |                 | \$3.49        |             |                      |

<sup>(1)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs<sup>(2)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor; no inclusion of costs related to the transfer of groundwater credits from Hillsborough County to Tampa Bay Water<sup>(3)</sup> Assumes a 30-year bond term and 6% interest rate



### 16.2.1.3 *Special Considerations*

A new groundwater treatment plant enabled by aquifer recharge credits is a promising water supply option for Tampa Bay Water, as it addresses both regional and south Hillsborough County supply needs, as well as incentivizes the beneficial use of reclaimed water. Furthermore, this water supply project allows for the use of high-quality groundwater, which is expected to require simplified treatment relative to other supply options. As this water supply project is further pursued as a potential solution, certain considerations should be continuously taken into account to further inform feasibility and cost/benefit analyses:

- **Permitting and long-term availability of groundwater credits:** Continued discussions and eventual contractual agreements are needed between Tampa Bay Water, the Southwest Florida Water Management District, and the member government(s) providing groundwater credits and/or reclaimed water to ensure the long-term availability of groundwater credits to be used at the new groundwater treatment plant. Furthermore, the issuing of a water use permit (WUP) based on aquifer recharge activities with reclaimed water is unprecedented in the region, thus requiring special attention to be allocated to the permitting process, including the relationship between recharge and withdrawal, required monitoring, duration of guaranteed groundwater credit availability, if/then scenarios for future circumstances, and responsible parties.
- **Groundwater credit and reclaimed water costing:** In the EOPCCs presented herein, no cost is assumed for the transferral of groundwater credits and/or reclaimed water from a member government to Tampa Bay Water. The unit cost for these products (e.g., cost per 1,000 gallons of groundwater credits; cost per 1,000 gallons of reclaimed water) must be agreed upon by Tampa Bay Water and associated member governments. The feasibility of this water supply project may be challenged if the unit price skews the cost/benefit of the new groundwater treatment plant relative to other options.
- **South Hillsborough County implications:** This water supply project may be implemented as a first or second phase option for the provision of additional supply to the region and to south Hillsborough County. For the region, the 7.5 mgd water supply project must be coupled with another option that provides 12.5 mgd of additional supply in order to reach the 20 mgd regional need over the 2020 – 2040 planning horizon. For south Hillsborough County, this 7.5 mgd water supply project must be coupled with either another 12.5 mgd option that is also located in south Hillsborough County in order to reach the 20 mgd south county need over the 2020 – 2040 planning horizon, or if this water supply is coupled with another 12.5 mgd option that is not located in south county, a regional pipeline from the regional system to south Hillsborough County must be constructed.
- **If this groundwater via aquifer recharge credits option is implemented as the first phase project,** the construction of the regional pipeline to south county can be deferred due to the provision of 7.5 mgd to the region and to south Hillsborough County. The decision to construct the pipeline as part of a later phase should be contingent upon the water supply option that is selected as the second phase project.



#### **16.2.2 Desalination Water Treatment Plant Expansion with Existing Source Water**

The Tampa Bay Water Seawater Desalination Plant is part of Tampa Bay Water's alternative water supply system, which also includes the C.W. Bill Young Regional Reservoir, the Regional Surface Water Treatment Plant, and the Regional Facility Site High Service Pump Station. This water supply project involves expanding the existing desalination facility to provide an additional 10 – 12.5 mgd of yield (depending on the specific configuration) within the existing site constraints and with increased use of the existing source water. An expansion of the Seawater Desalination Plant would increase supply to the region, as well as to south Hillsborough County. The project infrastructure, costs, and benefits of expanded the Desalination Water Treatment Plant are briefly described herein and are described in detail in an accompanying technical memorandum (Appendix 9A).

A preliminary layout of the Desalination Water Treatment Plant expansion with the existing source water is provided in Figure 16-3. The assumed yield is limited to 10 – 12.5 mgd due to the space limitations at the existing site.

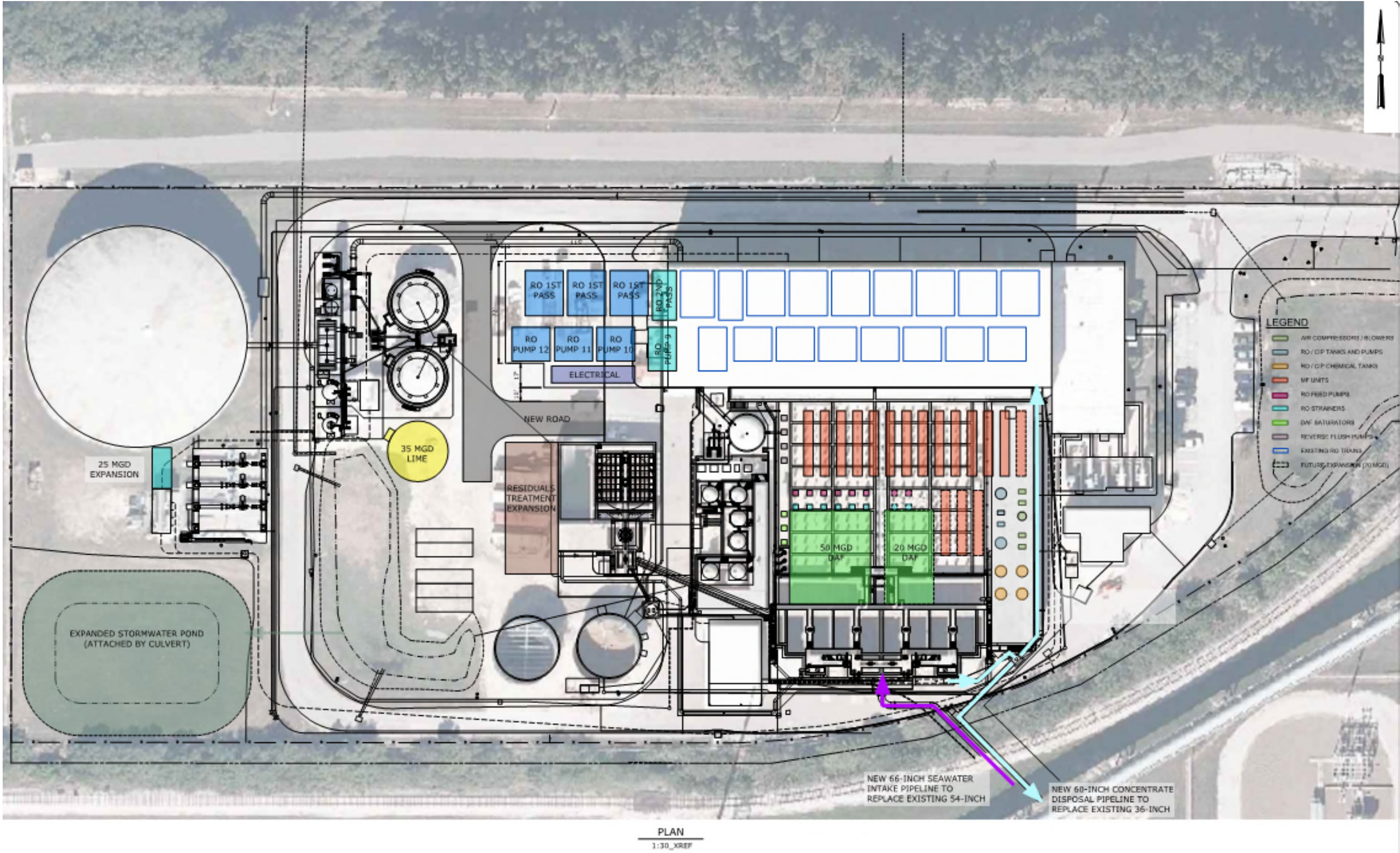


Figure 16-2: Preliminary Layout for the Desalination Water Treatment Plant Expansion



#### 16.2.2.1 Major Components

Expansion of the existing Desalination Water Treatment includes the following major components:

- Seawater supply line and pump station improvements;
- Pretreatment process upgrades;
- Reverse osmosis, post-treatment, and residuals management process expansions;
- Finished water pump station expansion.

To expand the Tampa Bay Seawater Desalination Plant's finished water yield by 10 – 12.5 mgd, the seawater supply system capacity must also be expanded by approximately 20 mgd, assuming a 50% recovery rate across the reverse osmosis system. To address the overall reliability of the facility, the existing diatomaceous earth pretreatment process requires substantial upgrades or replacement. In this evaluation, it was assumed that the existing pretreatment process will be replaced with a dissolved air flotation (DAF)/membrane filtration (MF) system. The DAF/MF system is expected to reduce downtime at the facility because it is less sensitive than the diatomaceous earth process to fluctuations in power supply. Furthermore, the DAF/MF system will provide a higher quality water to the reverse osmosis system, thus supporting sustained membrane operation at high recovery rates.

A 10 – 12.5 mgd increase in the Desalination Water Treatment Plant's yield requires an expansion of the existing reverse osmosis, post treatment, and residuals management processes. The reverse osmosis expansion includes three first-pass reverse osmosis trains and six second-pass reverse osmosis trains with associated feed pumps, cartridge filters, high pressure pumps, and elements. The expanded post treatment process includes an additional lime silo, lime saturator, and two saturated lime pumps for alkalinity and pH adjustment to stabilize the reverse osmosis permeate before introducing it into the regional system. The existing carbon dioxide and post-disinfection system are sufficient for the expansion.

Expansion of the Desalination Plant requires improvements to the residuals treatment systems, including the components used for coagulation sludge/spent filter backwash and concentrate. Coagulation sludge and spent filter backwash waters are pumped to the sludge treatment system, which consists of polymer addition, rapid mixing, flocculation, lamella clarification, and solids dewatering with belt presses. Improvements to the expanded system will include new lamella and belt filter presses to ensure capacity. The concentration disposal system must also be expanded to handle the increased flows through the facility.

Finally, to deliver finished water from the expanded Desalination Water Treatment Plant to the regional system, the capacity of the existing finished water pump station will be expanded to include a fourth pump.

#### 16.2.2.2 Cost Opinion

An EOPCC was developed for the Desalination Water Treatment Plant expansion, assuming a yield increase of 10 mgd to 12.5 mgd, as the required increase will depend on the other water supply options with which this expansion is paired. The detailed EOPCC and cost summary are provided for the 10 mgd expansion in Table 16-3; the detailed EOPCC and cost summary for the 12.5 mgd expansion are provided in Table 16-4. The capital requirements to achieve 10 mgd and 12.5 mgd of additional yield are identical, whereas the annual

operation and maintenance costs are higher for the 12.5 mgd yield than the 10 mgd yield. It should also be noted that acreage requirements for pipeline easements were estimated based on needing to acquire a 35-foot wide easement along 25% of the total length of the pipeline with the remaining 75% of the total length of the pipeline being located in right-of-way properties. If this project is selected for construction, Tampa Bay Water may elect to run the majority of the length of the pipeline through easements; easement requirements and right-of-way preferences should be evaluated during the feasibility phase.

**Table 16-3: EOPCC for Desalination Water Treatment Plant Expansion with Existing Source – 10 mgd Yield**

| Capital Costs                                                          |                 |            |               |                      |
|------------------------------------------------------------------------|-----------------|------------|---------------|----------------------|
| Item                                                                   | Unit of Measure | Quantity   | Unit Price    | Extension            |
| <b>Desalination Water Treatment Plant Intake Modifications</b>         |                 |            |               |                      |
| Seawater intake improvements                                           | EA              | 1          | \$5,900,000   | \$5,900,000          |
| <b>Desalination Water Treatment Plant Improvements</b>                 |                 |            |               |                      |
| Desalination pretreatment                                              | mgd             | 87.5       | \$780,000     | \$68,250,000         |
| Residuals                                                              | EA              | 1          | \$6,060,000   | \$6,060,000          |
| RO expansion                                                           | mgd             | 10         | \$3,060,000   | \$30,600,000         |
| RO post treatment                                                      | EA              | 1          | \$6,180,000   | \$6,180,000          |
| Concentrate disposal improvements                                      | EA              | 1          | \$5,700,000   | \$5,700,000          |
| Pump station - 11 to 25 mgd                                            | mgd             | 12.5       | \$200,000     | \$2,500,000          |
| <i>Subtotal</i>                                                        |                 |            |               | <i>\$125,190,000</i> |
| <i>Contingency</i>                                                     |                 |            | <i>30%</i>    | <i>\$37,557,000</i>  |
| <i>Overhead and Profit</i>                                             |                 |            | <i>20%</i>    | <i>\$32,550,000</i>  |
| <i>Subtotal with Contingency and Overhead and Profit</i>               |                 |            |               | <i>\$195,297,000</i> |
| <i>Engineering, Legal, and Administration</i>                          |                 |            | <i>25%</i>    | <i>\$48,825,000</i>  |
| <b>Total Capital Cost</b>                                              |                 |            |               | <b>\$244,122,000</b> |
| Annual Operation and Maintenance Costs                                 |                 |            |               |                      |
| Item                                                                   | Unit of Measure | Quantity   | Unit Price    | Extension            |
| <b>Desalination Water Treatment Plant Intake</b>                       |                 |            |               |                      |
| Seawater supply pumping                                                | kWh             | 2,000,000  | \$0.09        | \$180,000            |
| <b>Desalination Water Treatment Plant Improvements</b>                 |                 |            |               |                      |
| Desalination pretreatment consumables                                  | mgd             | 10         | \$92,000.00   | \$920,000            |
| RO consumables                                                         | mgd             | 10         | \$9,700.00    | \$97,000             |
| Residuals treatment consumables                                        | mgd             | 10         | \$4,300.00    | \$43,000             |
| Post treatment consumables                                             | mgd             | 10         | \$19,000.00   | \$190,000            |
| Desalination WTP distribution chemicals                                | mgd             | 10         | \$4,700.00    | \$47,000             |
| Pump station O&M                                                       | mgd             | 10         | \$5,000       | \$50,000             |
| Pretreatment electricity                                               | kWh             | 5,708,696  | \$0.09        | \$514,000            |
| RO electricity                                                         | kWh             | 41,485,757 | \$0.09        | \$3,734,000          |
| Residuals electricity                                                  | kWh             | 163,287    | \$0.09        | \$15,000             |
| Post treatment electricity                                             | kWh             | 74,655     | \$0.09        | \$7,000              |
| Distribution electricity                                               | kWh             | 4,665,951  | \$0.09        | \$420,000            |
| <b>Total Annual Operation and Maintenance Cost</b>                     |                 |            |               | <b>\$6,217,000</b>   |
| SUMMARY                                                                |                 |            |               |                      |
| Capital Cost <sup>1</sup>                                              |                 |            | \$244 million |                      |
| Annual Operation and Maintenance Cost <sup>2</sup>                     |                 |            | \$6.2 million |                      |
| Capital Cost per 1,000 Gallons <sup>1,3</sup>                          |                 |            | \$4.88        |                      |
| Annual Operation and Maintenance Cost per 1,000 Gallons <sup>2,3</sup> |                 |            | \$1.70        |                      |
| Total Unit Cost per 1,000 Gallons <sup>1,2,3</sup>                     |                 |            | \$6.58        |                      |

(1) Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

(2) Pertains to reoccurring chemical and electricity costs; no inclusion of labor

(3) Assumes a 30-year bond term and 6% interest rate

**Table 16-4: EOPCC for Desalination Water Treatment Plant Expansion with Existing Source – 12.5 mgd Yield**

| Capital Costs                                                          |                 |            |               |                      |
|------------------------------------------------------------------------|-----------------|------------|---------------|----------------------|
| Item                                                                   | Unit of Measure | Quantity   | Unit Price    | Extension            |
| <b>Desalination Water Treatment Plant Intake Modifications</b>         |                 |            |               |                      |
| Seawater intake improvements                                           | EA              | 1          | \$5,900,000   | \$5,900,000          |
| <b>Desalination Water Treatment Plant Improvements</b>                 |                 |            |               |                      |
| Desalination pretreatment                                              | mgd             | 87.5       | \$780,000     | \$68,250,000         |
| Residuals                                                              | EA              | 1          | \$6,060,000   | \$6,060,000          |
| RO expansion                                                           | mgd             | 10         | \$3,060,000   | \$30,600,000         |
| RO post treatment                                                      | EA              | 1          | \$6,180,000   | \$6,180,000          |
| Concentrate disposal improvements                                      | EA              | 1          | \$5,700,000   | \$5,700,000          |
| Pump station - 11 to 25 mgd                                            | mgd             | 12.5       | \$200,000     | \$2,500,000          |
| <i>Subtotal</i>                                                        |                 |            |               | <i>\$125,190,000</i> |
| <i>Contingency</i>                                                     |                 |            | <i>30%</i>    | <i>\$37,557,000</i>  |
| <i>Overhead and Profit</i>                                             |                 |            | <i>20%</i>    | <i>\$32,550,000</i>  |
| <i>Subtotal with Contingency and Overhead and Profit</i>               |                 |            |               | <i>\$195,297,000</i> |
| <i>Engineering, Legal, and Administration</i>                          |                 |            | <i>25%</i>    | <i>\$48,825,000</i>  |
| <b>Total Capital Cost</b>                                              |                 |            |               | <b>\$244,122,000</b> |
| Annual Operation and Maintenance Costs                                 |                 |            |               |                      |
| Item                                                                   | Unit of Measure | Quantity   | Unit Price    | Extension            |
| <b>Desalination Water Treatment Plant Intake</b>                       |                 |            |               |                      |
| Seawater supply pumping                                                | kWh             | 2,000,000  | \$0.09        | \$180,000            |
| <b>Desalination Water Treatment Plant Improvements</b>                 |                 |            |               |                      |
| Desalination pretreatment consumables                                  | mgd             | 12.5       | \$92,000.00   | \$1,150,000          |
| RO consumables                                                         | mgd             | 12.5       | \$9,700.00    | \$122,000            |
| Residuals treatment consumables                                        | mgd             | 12.5       | \$4,300.00    | \$54,000             |
| Post treatment consumables                                             | mgd             | 12.5       | \$19,000.00   | \$238,000            |
| Desalination WTP distribution chemicals                                | mgd             | 12.5       | \$4,700.00    | \$59,000             |
| Pump station O&M                                                       | mgd             | 12.5       | \$5,000       | \$63,000             |
| Pretreatment electricity                                               | kWh             | 7,135,870  | \$0.09        | \$643,000            |
| RO electricity                                                         | kWh             | 51,857,197 | \$0.09        | \$4,668,000          |
| Residuals electricity                                                  | kWh             | 204,109    | \$0.09        | \$19,000             |
| Post treatment electricity                                             | kWh             | 93,319     | \$0.09        | \$9,000              |
| Distribution electricity                                               | kWh             | 5,832,439  | \$0.09        | \$525,000            |
| <b>Total Annual Operation and Maintenance Cost</b>                     |                 |            |               | <b>\$7,730,000</b>   |
| SUMMARY                                                                |                 |            |               |                      |
| Capital Cost <sup>1</sup>                                              |                 |            | \$244 million |                      |
| Annual Operation and Maintenance Cost <sup>2</sup>                     |                 |            | \$7.7 million |                      |
| Capital Cost per 1,000 Gallons <sup>1,3</sup>                          |                 |            | \$3.89        |                      |
| Annual Operation and Maintenance Cost per 1,000 Gallons <sup>2,3</sup> |                 |            | \$1.69        |                      |
| Total Unit Cost per 1,000 Gallons <sup>1,2,3</sup>                     |                 |            | \$5.58        |                      |

<sup>(1)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>(2)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor

<sup>(3)</sup> Assumes a 30-year bond term and 6% interest rate

#### 16.2.2.3 Special Considerations

An expansion of the existing Desalination Water Treatment Plant with the existing source water is a promising water supply option for Tampa Bay Water for several reasons. The expansion would address both regional and south Hillsborough County supply needs, as well as improve the overall reliability of the existing system. This water supply project allows for the use of a source water with known water quality and an

existing site. As this water supply project is further pursued as a potential solution, certain considerations should be taken into account to further inform feasibility and cost/benefit analyses:

- **TECO operations:** Continued operation of the existing and expanded Desalination Water Treatment Plant are reliant on continued access to cooling water channels, owned by TECO Energy, Inc., which provide seawater supply and dilution water for concentrate streams. Tampa Bay Water met with TECO to discuss TECO's future operations and any potential impacts on water supply. TECO stated that there are plans to convert a portion of its facility from coal to natural gas, but there has been no discussion of converting the remaining coal-based portion of the facility, which provides source water to the Tampa Bay Seawater Desalination Plant. TECO indicated that it would continue to provide Tampa Water with water for supply and concentrate dilution regardless of conversions from coal- to natural gas-based energy production; however, long-term changes may result in a cooler source water temperature and/or reduced flows for concentrate dilution. Discussions between Tampa Bay Water and TECO must be continued to determine the extent to which changes at TECO would impact the desalination process, including membrane performance as a function of source water temperature and limitations on concentrate discharge.
- **Finished water delivery:** This evaluation assumes an increase in the capacity of the existing finished water pump station at the Desalination Plant through the addition of a fourth pump. If expansion is pursued, a more detailed hydraulic evaluation should be conducted to determine the required increased in the finished water pump capacity depending on any increases in discharge pressure requirements and/or increased reliance on the Desalination after the implementation of reliability improvements. For example, finished water pump station requirements may differ depending on if finished water is simply delivered to the regional system to be further blended with other finished water supplies versus if a new Hillsborough County point of connection is constructed at the Desalination Water Treatment Plant.
- **South Hillsborough County implications:** This water supply project may be implemented as a first or second phase option for the provision of additional supply to the region and to south Hillsborough County. For the region, this water supply project must be coupled with another option that provides 7.5 mgd or 10 mgd of additional supply (depending on the planned yield from the expanded Desalination Water Treatment Plant) in order to reach the 20 mgd regional need over the 2020 – 2040 planning horizon. For south Hillsborough County, this water supply project must be coupled with either another 7.5 mgd or 10 mgd option that is also located in south Hillsborough County in order to reach the 20 mgd south county need over the 2020 – 2040 planning horizon. If this water supply is coupled with another 7.5 mgd or 10 mgd option that is not located in south Hillsborough County, a regional pipeline from the regional system to south county must be constructed.

If this Desalination Water Treatment Plant expansion option is implemented as the first phase project, the construction of the regional pipeline to south county can be deferred due to the provision of 10 mgd or 12.5 mgd to the region and to south Hillsborough County. The decision to construct the pipeline as part of a later phase should be contingent upon the water supply option that is selected as the second phase project.

### **16.2.3 Regional Surface Water Treatment Plant Expansion with Existing Source Water**

The Regional Surface Water Treatment Plant is part of Tampa Bay Water's alternative water supply system, which also includes the C.W. Bill Young Regional Reservoir, the Tampa Bay Seawater Desalination Plant, and the Regional Facility Site High Service Pump Station. This water supply project involves expanding the existing Regional Surface Water Treatment Plant to provide an additional 10 – 12.5 mgd of yield (depending on the specific configuration) within the existing site constraints and with increased use of the existing source waters. Currently, the Regional Surface Water Treatment Plant withdraws water from the Tampa Bypass Canal and Alafia River, and excess water is stored in the C.W. Bill Young Regional Reservoir. An expansion of the Regional Surface Water Treatment Plant would allow Tampa Bay Water to optimize use of the existing surface water supplies by having more treatment capacity to process more water when it's available. The project infrastructure, costs, and benefits of expanded the Regional Surface Water Treatment Plant are briefly described herein and are described in detail in an accompanying technical memorandum (Appendix 9A).

A preliminary layout of the Regional Surface Water Treatment Plant expansion with the existing source water is provided in Figure 16-3. The assumed yield is limited to 10 – 12.5 mgd due to constraints on allowable surface water withdrawals. Surface water withdrawals must be limited to ensure sufficient surface water flows for downstream environmental services and to minimize the impacts on the reservoir storage. To further inform the layout of the Regional Surface Water Treatment Plant expansion and associated costs, additional feasibility studies should include a review of historical data and additional testing if needed to confirm the capacity of ancillary and dewatering equipment, thus determining the sufficiency of existing infrastructure or the need for additional capital investments.



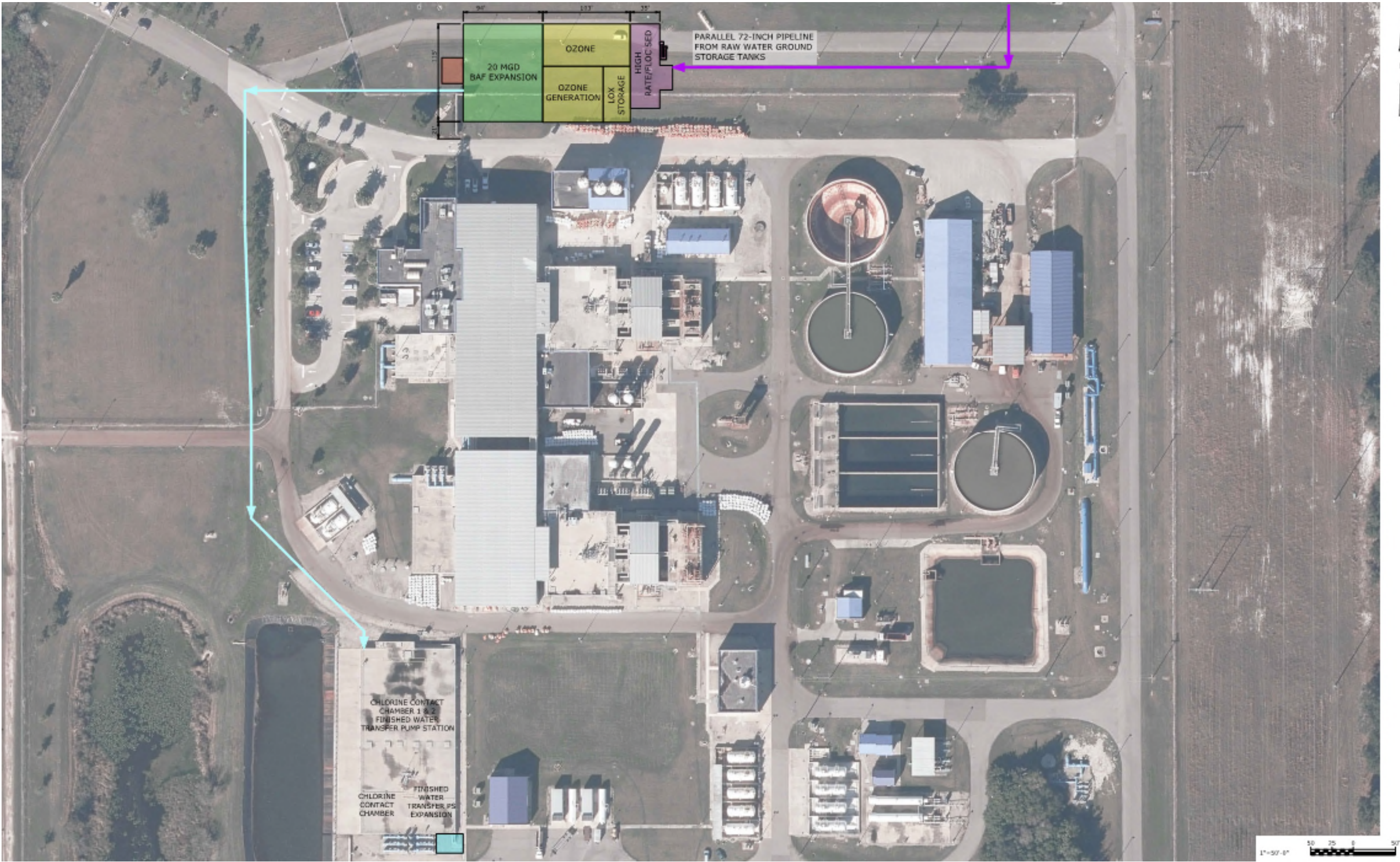


Figure 16-3: Preliminary Layout for the Regional Surface Water Treatment Plant Expansion



#### 16.2.3.1 *Major Components*

Expansion of the existing Regional Surface Water Treatment Plant includes the following major components:

- Influent piping system improvements;
- Process and support system expansions for the ACTIFLO®, ozone, biofiltration, chlorination, and residuals unit processes; and
- Increased chemical storage.

Tampa Bay Water's Regional Surface Water Treatment Plant withdraws water from the Tampa Bypass Canal and Alafia River, and surplus water is stored in the C. W. Bill Young Regional Reservoir to supply the water treatment plant during periods of low flow. The influent piping system must be expanded to accommodate the expansion of the treatment facility via a new parallel supply line.

The existing Regional Surface Water Treatment Plant is comprised of three main stages of treatment, including ACTIFLO®, ozone disinfection, and biofiltration. This treatment process has performed well since 2002, producing high quality drinking water, and would be retained for the plant expansion. To treat and deliver additional flows from the existing surface water source to the regional distribution system, each individual treatment process must be expanded. The processes and support systems to be expanded include the influent piping system, ACTIFLO®, ozone, biofiltration, chlorine contact tanks, the chemical stabilization building, and residuals processing.

Existing and planned storage, pumping, and piping from the Regional Surface Water Treatment Plant to the regional system, including a new high service pump currently in the capital improvements plan, are sufficient for increased flows, thus no improvements are needed in terms of finished water delivery.

#### 16.2.3.2 *Cost Opinion*

An EOPCC was developed for the Regional Surface Water Treatment Plant expansion, assuming a yield increase of 10 mgd and 12.5 mgd, as the required increase will depend on the other water supply options with which this expansion is paired. The detailed EOPCCs and cost summaries are provided below in Table 16-5 and Table 16-6 for 10 mgd and 12 mgd yield projects, respectively. The capital requirements to achieve 10 mgd and 12.5 mgd of additional yield are identical because excess capacity is required to achieve these yields due to surface water flow variability. For both the 10 mgd and 12.5 mgd projects, a 25 mgd design capacity expansion is assumed. The annual operation and maintenance costs, however, are higher for the 12.5 mgd yield than the 10 mgd yield. It should also be noted that acreage requirements for pipeline easements were estimated based on needing to acquire a 35-foot wide easement along 25% of the total length of the pipeline with the remaining 75% of the total length of the pipeline being located in right-of-way properties. If this project is selected for construction, Tampa Bay Water may elect to run the majority of the length of the pipeline through easements; easement requirements and right-of-way preferences should be evaluated during the feasibility phase.

**Table 16-5: EOPCC for Regional Surface Water Treatment Plant Expansion with Existing Source – 10 mgd Yield**

| Capital Costs                                                          |                 |               |             |                     |
|------------------------------------------------------------------------|-----------------|---------------|-------------|---------------------|
| Item                                                                   | Unit of Measure | Quantity      | Unit Price  | Extension           |
| <b>Regional Surface Water Treatment Plant Intake Improvements</b>      |                 |               |             |                     |
| RSWTP influent pump station modifications                              | LS              | 1             | \$2,000,000 | \$2,000,000         |
| <b>Regional Surface Water Treatment Plant Process Improvements</b>     |                 |               |             |                     |
| Actiflo/sedimentation                                                  | mgd             | 25            | \$500,000   | \$12,500,000        |
| Ozone                                                                  | mgd             | 25            | \$260,000   | \$6,500,000         |
| Biofiltration                                                          | mgd             | 25            | \$400,000   | \$10,000,000        |
| Chlorine contact tanks                                                 | mgd             | 25            | \$120,000   | \$3,000,000         |
| Chemical stabilization building                                        | mgd             | 25            | \$150,000   | \$3,750,000         |
| Residuals                                                              | mgd             | 25            | \$300,000   | \$7,500,000         |
| <i>Subtotal</i>                                                        |                 |               |             | <i>\$45,250,000</i> |
| <i>Contingency</i>                                                     |                 |               | <i>30%</i>  | <i>\$13,575,000</i> |
| <i>Overhead and Profit</i>                                             |                 |               | <i>20%</i>  | <i>\$11,765,000</i> |
| <i>Subtotal with Contingency and Overhead and Profit</i>               |                 |               |             | <i>\$70,590,000</i> |
| <i>Engineering, Legal, and Administration</i>                          |                 |               | <i>25%</i>  | <i>\$17,648,000</i> |
| <b>Total Capital Cost</b>                                              |                 |               |             | <b>\$88,238,000</b> |
| Annual Operation and Maintenance Costs                                 |                 |               |             |                     |
| Item                                                                   | Unit of Measure | Quantity      | Unit Price  | Extension           |
| <b>Regional Surface Water Treatment Plant Intake</b>                   |                 |               |             |                     |
| Influent piping system operation                                       | kWh             | 3,024,366     | \$0.09      | \$273,000           |
| <b>Regional Surface Water Treatment Plant Process Improvements</b>     |                 |               |             |                     |
| Actiflo/sedimentation                                                  | mgd             | 10            | \$10,000    | \$100,000           |
| Ozone                                                                  | mgd             | 10            | \$15,000    | \$150,000           |
| Biofiltration                                                          | mgd             | 10            | \$25,000    | \$250,000           |
| Chlorine contact tanks                                                 | mgd             | 10            | \$20,000    | \$200,000           |
| Chemical stabilization building                                        | mgd             | 10            | \$20,000    | \$200,000           |
| Residuals management                                                   | mgd             | 10            | \$15,000    | \$150,000           |
| Transfer pump station O&M                                              | mgd             | 10            | \$5,000     | \$50,000            |
| <b>Total Annual Operation and Maintenance Cost</b>                     |                 |               |             | <b>\$1,373,000</b>  |
| SUMMARY                                                                |                 |               |             |                     |
| Capital Cost <sup>1</sup>                                              |                 | \$88 million  |             |                     |
| Annual Operation and Maintenance Cost <sup>2</sup>                     |                 | \$1.4 million |             |                     |
| Capital Cost per 1,000 Gallons <sup>1,3</sup>                          |                 | \$1.78        |             |                     |
| Annual Operation and Maintenance Cost per 1,000 Gallons <sup>2,3</sup> |                 | \$0.38        |             |                     |
| Total Unit Cost per 1,000 Gallons <sup>1,2,3</sup>                     |                 | \$2.16        |             |                     |

<sup>(1)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>(2)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor

<sup>(3)</sup> Assumes a 30-year bond term and 6% interest rate

**Table 16-6: EOPCC for Regional Surface Water Treatment Plant Expansion with Existing Source – 12.5 mgd Yield**

| Capital Costs                                                          |                 |           |               |                     |
|------------------------------------------------------------------------|-----------------|-----------|---------------|---------------------|
| Item                                                                   | Unit of Measure | Quantity  | Unit Price    | Extension           |
| <b>Regional Surface Water Treatment Plant Intake Improvements</b>      |                 |           |               |                     |
| RSWTP influent pump station modifications                              | LS              | 1         | \$2,000,000   | \$2,000,000         |
| <b>Regional Surface Water Treatment Plant Process Improvements</b>     |                 |           |               |                     |
| Actiflo/sedimentation                                                  | mgd             | 25        | \$500,000     | \$12,500,000        |
| Ozone                                                                  | mgd             | 25        | \$260,000     | \$6,500,000         |
| Biofiltration                                                          | mgd             | 25        | \$400,000     | \$10,000,000        |
| Chlorine contact tanks                                                 | mgd             | 25        | \$120,000     | \$3,000,000         |
| Chemical stabilization building                                        | mgd             | 25        | \$150,000     | \$3,750,000         |
| Residuals                                                              | mgd             | 25        | \$300,000     | \$7,500,000         |
| <i>Subtotal</i>                                                        |                 |           |               | <i>\$45,250,000</i> |
| <i>Contingency</i>                                                     |                 |           | <i>30%</i>    | <i>\$13,575,000</i> |
| <i>Overhead and Profit</i>                                             |                 |           | <i>20%</i>    | <i>\$11,765,000</i> |
| <i>Subtotal with Contingency and Overhead and Profit</i>               |                 |           |               | <i>\$70,590,000</i> |
| <i>Engineering, Legal, and Administration</i>                          |                 |           | <i>25%</i>    | <i>\$17,648,000</i> |
| <b>Total Capital Cost</b>                                              |                 |           |               | <b>\$88,238,000</b> |
| Annual Operation and Maintenance Costs                                 |                 |           |               |                     |
| Item                                                                   | Unit of Measure | Quantity  | Unit Price    | Extension           |
| <b>Regional Surface Water Treatment Plant Intake</b>                   |                 |           |               |                     |
| Influent piping system operation                                       | kWh             | 3,024,366 | \$0.09        | \$273,000           |
| <b>Regional Surface Water Treatment Plant Process Improvements</b>     |                 |           |               |                     |
| Actiflo/sedimentation                                                  | mgd             | 12.5      | \$10,000      | \$125,000           |
| Ozone                                                                  | mgd             | 12.5      | \$15,000      | \$188,000           |
| Biofiltration                                                          | mgd             | 12.5      | \$25,000      | \$313,000           |
| Chlorine contact tanks                                                 | mgd             | 12.5      | \$20,000      | \$250,000           |
| Chemical stabilization building                                        | mgd             | 12.5      | \$20,000      | \$250,000           |
| Residuals management                                                   | mgd             | 12.5      | \$15,000      | \$188,000           |
| Transfer pump station O&M                                              | mgd             | 10        | \$5,000       | \$50,000            |
| <b>Total Annual Operation and Maintenance Cost</b>                     |                 |           |               | <b>\$1,637,000</b>  |
| <b>SUMMARY</b>                                                         |                 |           |               |                     |
| Capital Cost <sup>1</sup>                                              |                 |           | \$88 million  |                     |
| Annual Operation and Maintenance Cost <sup>2</sup>                     |                 |           | \$1.6 million |                     |
| Capital Cost per 1,000 Gallons <sup>1,3</sup>                          |                 |           | \$1.42        |                     |
| Annual Operation and Maintenance Cost per 1,000 Gallons <sup>2,3</sup> |                 |           | \$0.36        |                     |
| Total Unit Cost per 1,000 Gallons <sup>1,2,3</sup>                     |                 |           | \$1.78        |                     |

<sup>(1)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs

<sup>(2)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor

<sup>(3)</sup> Assumes a 30-year bond term and 6% interest rate

### 16.2.3.3 Special Considerations

An expansion of the existing Regional Surface Water Treatment Plant with the existing source water is a promising water supply option for Tampa Bay Water for several reasons. The expansion will benefit from an existing site, known water quality and associated treatment requirements, and an existing precedent for surface water use for public and regulatory acceptance. At this point in the evaluation, there are two special considerations to take into account when further evaluating the feasibility and cost/benefit of expanding the Regional Surface Water Treatment Plant.

- Surface water treatment plant location: The main decision to be made based on surface water modeling and risk analyses is whether the additional surface water treatment capacity should

be accomplished by expanding the existing Regional Surface Water Treatment Plant as described herein, or by constructing another surface water treatment plant at an alternate site near the C.W. Bill Young Regional Reservoir for easier access by south Hillsborough County. The reliability and vulnerability of a new surface water treatment plant at this alternate location would need to be further evaluated.

- South Hillsborough County implications: This water supply project may be implemented as a first or second phase option for the provision of additional supply to the region. For the region, this water supply project must also be coupled with another option that provides 7.5 mgd or 10 mgd of additional supply (depending on the planned yield from the expanded Regional Surface Water Treatment Plant) in order to obtain the 20 mgd regional need over the 2020 – 2040 planning horizon. It should be noted that this water supply option is not located in south Hillsborough County, thus requiring a new regional pipeline to be constructed from the Regional Facility Site to south Hillsborough County (Balm Point of Connection) in order to meet both regional and south county needs. If this expanded Regional Surface Water Treatment Plant option is selected as the first phase supply project, the regional pipeline is needed, the size of which depends on the anticipated second phase supply project. If the expanded Regional Surface Water Treatment Plant is expected to be coupled with another water supply option that is not located in south Hillsborough County to meet the 20 mgd need, the pipeline must be sized for the delivery of 20 mgd to south Hillsborough County (42-inch diameter); if this expanded Regional Surface Water Treatment Plant option is coupled with a water supply option that is located in south Hillsborough County (i.e. new groundwater plant or Tampa Bay Seawater Desalination Plant expansion) to meet the 20 mgd need, the pipeline may be reduced in size (36-inch diameter) to deliver up to 12.5 mgd to south Hillsborough County.

A detailed EOPCC and cost summary are provided below for both the 42-inch and 36-inch diameter regional pipeline, assuming that the capital cost of the pipeline would be split between Tampa Bay Water and Hillsborough County Table 16-7 and Table 16-8. It should also be noted that acreage requirements for pipeline easements were estimated based on needing to acquire a 35-foot wide easement along 25% of the total length of the pipeline with the remaining 75% of the total length of the pipeline being located in right-of-way properties. If this project is selected for construction, Tampa Bay Water may elect to run the majority of the length of the pipeline through easements; easement requirements and right-of-way preferences should be evaluated during the feasibility phase.

**Table 16-7: EOPCC for Regional Pipeline from the Regional Facility Site to the Balm Area POC in South Hillsborough County – 42-inch Diameter**

| Capital Costs                                                                  |                 |                  |            |                      |
|--------------------------------------------------------------------------------|-----------------|------------------|------------|----------------------|
| Item                                                                           | Unit of Measure | Quantity         | Unit Price | Extension            |
| <b>42-inch Regional Pipeline</b>                                               |                 |                  |            |                      |
| 42" DIP - open cut                                                             | LF              | 147,490          | \$490      | \$72,271,000         |
| 42" DIP - microtunneling                                                       | LF              | 1,910            | \$1,320    | \$2,522,000          |
| 42" DIP - microtunneling (adverse conditions)                                  | LF              | 600              | \$1,750    | \$1,050,000          |
| Ground storage tank                                                            | MG              | 10               | \$750,000  | \$7,500,000          |
| Pump station - 11 to 25 mgd                                                    | mgd             | 25               | \$200,000  | \$5,000,000          |
| Fluoride and corrosion inhibitor                                               | GPD             | 20,000,000       | \$0        | \$1,000,000          |
| Disinfection trim                                                              | GPD             | 20,000,000       | \$0        | \$1,000,000          |
| Land/easement acquisition                                                      | AC              | 40               | \$220,000  | \$8,800,000          |
| <i>Subtotal</i>                                                                |                 |                  |            | <i>\$99,143,000</i>  |
| <i>Contingency</i>                                                             |                 |                  | <i>30%</i> | <i>\$29,743,000</i>  |
| <i>Overhead and Profit</i>                                                     |                 |                  | <i>20%</i> | <i>\$25,778,000</i>  |
| <i>Subtotal with Contingency and Overhead and Profit</i>                       |                 |                  |            | <i>\$154,664,000</i> |
| <i>Engineering, Legal, and Administration</i>                                  |                 |                  | <i>25%</i> | <i>\$38,666,000</i>  |
| <b>Total Capital Cost <sup>1</sup></b>                                         |                 |                  |            | <b>\$193,330,000</b> |
| Annual Operation and Maintenance Costs                                         |                 |                  |            |                      |
| Item                                                                           | Unit of Measure | Quantity         | Unit Price | Extension            |
| <b>42-inch Regional Pipeline</b>                                               |                 |                  |            |                      |
| Electricity                                                                    | kWh             | 6,804,823        | \$0.09     | \$613,000            |
| Pipeline O&M                                                                   | LF              | 150,000          | \$2.25     | \$338,000            |
| Pump station O&M                                                               | mgd             | 20               | \$5,000    | \$100,000            |
| <b>Total Annual Operation and Maintenance Cost</b>                             |                 |                  |            | <b>\$1,051,000</b>   |
| SUMMARY                                                                        |                 |                  |            |                      |
|                                                                                |                 | For 10 mgd Yield |            | For 12.5 mgd Yield   |
| <b>Capital Cost <sup>2</sup></b>                                               |                 | \$96.7 million   |            |                      |
| <b>Annual Operation and Maintenance Cost <sup>3</sup></b>                      |                 | \$1.1 million    |            |                      |
| <b>Capital Cost per 1,000 Gallons <sup>2, 4</sup></b>                          |                 | \$1.95           |            | \$1.56               |
| <b>Annual Operation and Maintenance Cost per 1,000 Gallons <sup>3, 4</sup></b> |                 | \$0.29           |            | \$0.23               |
| <b>Total Unit Cost per 1,000 Gallons <sup>2, 3, 4</sup></b>                    |                 | \$2.23           |            | \$1.79               |

<sup>(1)</sup> This is the total capital cost, half of which is assumed to be covered by Tampa Bay Water and the other half by Hillsborough County

<sup>(2)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs; assumes that Hillsborough County will cover half of the capital cost

<sup>(3)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor

<sup>(4)</sup> Assumes a 30-year bond term and 6% interest rate

**Table 16-8: EOPCC for Regional Pipeline from the Regional Facility Site to the Balm Area POC in South Hillsborough County – 36-inch Diameter**

| Capital Costs                                                                  |                 |            |                  |                      |
|--------------------------------------------------------------------------------|-----------------|------------|------------------|----------------------|
| Item                                                                           | Unit of Measure | Quantity   | Unit Price       | Extension            |
| <b>36-inch Regional Pipeline</b>                                               |                 |            |                  |                      |
| 36" DIP - open cut                                                             | LF              | 147,490    | \$420            | \$61,946,000         |
| 36" DIP - microtunneling                                                       | LF              | 1,910      | \$1,230          | \$2,350,000          |
| 36" DIP - microtunneling (adverse conditions)                                  | LF              | 600        | \$1,660          | \$996,000            |
| Ground storage tank                                                            | MG              | 5          | \$750,000        | \$3,750,000          |
| Pump station - 11 to 25 mgd                                                    | mgd             | 16         | \$200,000        | \$3,125,000          |
| Fluoride and corrosion inhibitor                                               | GPD             | 12,500,000 | \$0.05           | \$625,000            |
| Disinfection trim                                                              | GPD             | 12,500,000 | \$0.05           | \$625,000            |
| Land/easement acquisition                                                      | AC              | 20         | \$220,000        | \$4,400,000          |
| <i>Subtotal</i>                                                                |                 |            |                  | <i>\$77,817,000</i>  |
| <i>Contingency</i>                                                             |                 |            | <i>30%</i>       | <i>\$23,346,000</i>  |
| <i>Overhead and Profit</i>                                                     |                 |            | <i>20%</i>       | <i>\$20,233,000</i>  |
| <i>Subtotal with Contingency and Overhead and Profit</i>                       |                 |            |                  | <i>\$121,396,000</i> |
| <i>Engineering, Legal, and Administration</i>                                  |                 |            | <i>25%</i>       | <i>\$30,349,000</i>  |
| <b>Total Capital Cost <sup>1</sup></b>                                         |                 |            |                  | <b>\$151,745,000</b> |
| Annual Operation and Maintenance Costs                                         |                 |            |                  |                      |
| Item                                                                           | Unit of Measure | Quantity   | Unit Price       | Extension            |
| <b>36-inch Regional Pipeline</b>                                               |                 |            |                  |                      |
| Electricity                                                                    | kWh             | 3,402,411  | \$0.09           | \$307,000            |
| Pipeline O&M                                                                   | LF              | 150,000    | \$2.25           | \$338,000            |
| Pump station O&M                                                               | mgd             | 12.5       | \$5,000          | \$63,000             |
| <b>Total Annual Operation and Maintenance Cost</b>                             |                 |            |                  | <b>\$708,000</b>     |
| SUMMARY                                                                        |                 |            |                  |                      |
|                                                                                |                 |            | For 10 mgd Yield | For 12.5 mgd Yield   |
| <b>Capital Cost <sup>2</sup></b>                                               |                 |            | \$75.9 million   |                      |
| <b>Annual Operation and Maintenance Cost <sup>3</sup></b>                      |                 |            | \$0.7 million    |                      |
| <b>Capital Cost per 1,000 Gallons <sup>2, 4</sup></b>                          |                 |            | \$1.53           | \$1.23               |
| <b>Annual Operation and Maintenance Cost per 1,000 Gallons <sup>3, 4</sup></b> |                 |            | \$0.19           | \$0.16               |
| <b>Total Unit Cost per 1,000 Gallons <sup>2, 3, 4</sup></b>                    |                 |            | \$1.73           | \$1.38               |

<sup>(1)</sup> This is the total capital cost, half of which is assumed to be covered by Tampa Bay Water and the other half by Hillsborough County

<sup>(2)</sup> Includes 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs; assumes that Hillsborough County will cover half of the capital cost

<sup>(3)</sup> Pertains to reoccurring chemical and electricity costs; no inclusion of labor

<sup>(4)</sup> Assumes a 30-year bond term and 6% interest rate

#### 16.2.4 Summary of Recommended Water Supply Projects

A summary of the individual water supply projects and associated cost implications is provided in Table 16-9.



**Table 16-9: Summary of Recommended Water Supply Projects and Costs <sup>1</sup>**

| Water Supply Project                         | Yield (mgd) | With No South County Pipeline |           | With a 36-inch South County Pipeline <sup>2</sup> |           | With a 42-inch South County Pipeline <sup>2</sup> |           |
|----------------------------------------------|-------------|-------------------------------|-----------|---------------------------------------------------|-----------|---------------------------------------------------|-----------|
|                                              |             | Capital Cost (\$M)            | Unit Cost | Capital Cost (\$M)                                | Unit Cost | Capital Cost (\$M)                                | Unit Cost |
| New groundwater via SHARP credits            | 7.5         | \$116                         | \$3.49    | NA                                                | NA        | NA                                                | NA        |
| New groundwater via SHARP credits (expanded) | 20          | \$325                         | \$3.77    | NA                                                | NA        | NA                                                | NA        |
| Desal WTP expansion w/ existing source       | 10          | \$244                         | \$6.58    | NA                                                | NA        | NA                                                | NA        |
| Desal WTP expansion w/ existing source       | 12.5        | \$244                         | \$5.58    | NA                                                | NA        | NA                                                | NA        |
| SWTP expansion w/ existing source            | 10          | \$88                          | \$2.16    | \$164                                             | \$3.89    | \$185                                             | \$4.39    |
| SWTP expansion w/ existing source            | 12.5        | \$88                          | \$1.78    | \$164                                             | \$3.16    | \$185                                             | \$3.57    |

<sup>(1)</sup> Capital costs include 30% contingency, 20% overhead and profit, and 25% engineering/legal/administration costs; unit costs include capital costs and annual O&M costs comprised of reoccurring chemical and electricity costs; no inclusion of labor or costs related to the transfer of groundwater credits in unit costs; unit costs assume a 30-year bond term and 6% interest rate and are normalized to the stated yield.

<sup>(2)</sup> The regional pipeline from the Regional Facility Site to the Balm area POC in south Hillsborough County would be needed with the SWTP expansion because this water supply project is not located in south Hillsborough County; the required size of the pipeline depends on the additional water supply project that the SWTP expansion is coupled with (i.e., if the other water supply option is located in south Hillsborough County); 50% of the pipeline's capital cost is assumed to be covered by Tampa Bay Water and the remaining capital cost is covered by Hillsborough County.

## 17. Optimization of Existing Facilities

### 17.1 Introduction

Two of the top ranked water supply projects for meeting future demands, the Regional Surface Water Treatment Plant and the Tampa Bay Seawater Desalination Plant Expansions, involve the expansion of existing treatment facilities as discussed in Section 16. In order to implement these expansions in a cost-effective manner, existing assets should first be leveraged to the greatest extent possible to maximize the reliability and yield of existing infrastructure, as well as inform any additional feasibility and design work associated with the expansion.

A systematic approach is needed to optimize the performance and productivity of existing treatment facilities while minimizing capital expenditures. Based on a preliminary assessment as part of this Master Plan, this section provides an overview of potential opportunities to optimize the existing facilities and the corresponding potential increases in yield, which should be further evaluated as part of additional feasibility studies.

### 17.2 Regional Surface Water Treatment Plant

The Regional Surface Water Treatment Plant consists of four parallel treatment trains and is currently rated as a 120 mgd facility with 90 mgd being the sustainable capacity. The facility is rated as a 120 mgd facility because the combined capacity of the filtration unit process is 120 mgd assuming original design and operating criteria. Each pairing of Actiflo and ozone contactors, however, has a potential treatment capacity of 33 mgd based on the original design criteria, thus giving Actiflo and ozone a combined treatment capacity of 132 mgd. In fact, previous capacity analyses of the Regional Surface Water Treatment Plant have noted that the facility has a capacity of 132 mgd, with the exception of the filters, which are rated at 120 mgd, thus making the entire facility rated at 120 mgd. The sustainable capacity is then determined by assuming a total rated capacity of 120 mgd with four trains in service, thus giving each train a capacity of 30 mgd; the sustainable capacity assumes that only three of the four trains are in service with one train offline for backup / maintenance purposes.

If additional flow could be treated through the filtration unit process, either by re-rating the existing filters or expanding the existing filters, the Regional Surface Water Treatment Plant could be rated as a 132 mgd facility, with 33 mgd of capacity being allocated to each train. As a result, the sustainable capacity would increase from 90 mgd to 99 mgd. The design loading rate of the existing filters is 3.7 gallons per minute per square foot (gpm/ft<sup>2</sup>) and the design empty bed contact time is 8 minutes, thus resulting in a rated capacity of 8 mgd per filter. If the filter loading rate were to be increased to 4.1 gpm/ft<sup>2</sup> and the empty bed contact time were to be decreased to 7.3 minutes, the resulting rated capacity would be 8.8 mgd. This change in capacity per filter is important because the combined capacity of the 15 filters at 8 mgd each is 120 mgd, as compared with a combined capacity of 132 mgd at 8.8 mgd per filter.

If the existing filters are re-rated, another filter is added to increase the filter's total treatment capacity, or redundancy is reevaluated to achieve a sustainable filter capacity of 99 mgd, then the capacity of the filtration unit process would match the other plant infrastructure. This 9 mgd increase in treatment

capacity is expected to increase the yield of the existing Surface Water Treatment Plant by an additional 5 mgd on an annual average basis. Surface water modeling as described in Section 8 indicated that this was possible using the existing supply if the facility capacity was expanded to treat additional flows when the water was available in the surface water system. The estimated costs to add another 8 mgd filter is approximately \$6.5 million, including markups for contingency, overhead and profit, and engineering/legal/administrative services. The cost to achieve additional yield at the Regional Surface Water Treatment Plant may be increased or decreased depending on filter re-rating potential and the identification of other optimization opportunities.

To confirm the potential increase in yield and other potential modifications at the Surface Water Treatment Plant to consistently obtain the additional yield, the following additional tasks are recommended as part of the any additional feasibility efforts conducted on this project:

- Conduct a detailed capacity analysis of the existing Regional Surface Water Treatment Plant to identify potential process restrictions that limit the overall yield of the facility. This includes the feasibility, costs, and benefits of rerating and/or modifying unit processes to address identified process restrictions.
- Perform demonstration studies to confirm existing and/or rerated unit process capacities, as needed. For example, with regard to the identified biofiltration unit process restriction, an additional 9 mgd of treatment capacity may be gained at the Regional Surface Water Treatment Plant by either rerating the existing biofilters or by expanding the biofiltration unit process. Field testing would help quantify the operational and water quality impacts of operating the existing biofilters at a higher loading rate to determine the cost/benefit of treating additional flow through the existing biofilters as compared with constructing new biofiltration capacity. This would need to be coordinated with the Florida Department of Environmental Protection.
- Conduct additional modeling to verify potential yields if the facility is optimized to increase the sustainable capacity.
- Rerun the Agency hydraulic model to confirm the transmission capacity at system pressure leaving the high service pump station and if modifications are needed to accommodate increased flows from the Regional Surface Water Treatment Plant as a result of optimization.

### **17.3 Tampa Bay Seawater Desalination Plant**

The Tampa Bay Seawater Desalination Plant has a design capacity of 25 mgd, but presently operates at capacities between 14 and 18 mgd because of equipment availability and treatment process performance upstream of membrane filtration. As part of the 2018 Long-term Master Water Plan, Tampa Bay Water held several workshops to review performance at the Desalination Plant, identify opportunities for improvement, and develop strategies for addressing these opportunities. Workshops were attended by staff from Tampa Bay Water, Hazen and Sawyer, and Louis Berger. Following the workshops, a roadmap was developed to outline the critical improvements that can be performed to improve equipment availability while optimizing the existing facility and moving toward an upgraded treatment process. A key upgrade for the Desalination Plant is the eventual phasing out of the existing DynaSand® and

diatomaceous earth filtration pretreatment processes and possibly converting to dissolved air flotation and membrane filtration pretreatment. As part of this process, a preliminary assessment was conducted, which is summarized in the Technical Memorandum in Appendix 17A. A summary of the key recommendations from this memorandum include:

- Conduct a detailed capacity analysis of the existing Tampa Bay Seawater Desalination Plant to identify potential process restrictions that limit the overall yield of the facility. Preliminary efforts have identified several potential process restrictions, which include:
  - Aging infrastructure and the configuration of the existing power supply to the facility are directly responsible for power-related shutdowns and associated mechanical damage to piping and mechanical equipment. These issues may be addressed with electrical upgrades.
  - The existing pretreatment process at the Tampa Bay Seawater Desalination Plant includes diatomaceous earth filtration, which is sensitive to fluctuations in power supply. Power supply fluctuations cause the pretreatment system to shut down and the flow of water to stop, which subsequently results in diatomaceous earth filter media falling to the bottom of the filter vessels where it is no longer usable. Once the diatomaceous earth pretreatment process has shut down, the filter vessels must be cleaned, and a new layer of filter media must be reapplied. The process of filter reestablishment requires 18 hours. In summary, the existing diatomaceous earth pretreatment process is resource intensive, causes substantial downtime at the facility, and reduces the overall capacity of the Tampa Bay Seawater Desalination Plant because effective pretreatment is critical for the performance of downstream processes. Accordingly, pilot-scale testing of alternative pretreatment systems is recommended to reduce the footprint of the expansion while improving overall system reliability and providing more consistent water quality to the downstream unit processes. Pilot-scale testing should also be conducted to evaluate alternative membranes that could increase the flux rates through the membrane filtration processes to increase overall plant recovery and limit the required footprint of the expansion. Prior to selecting an alternative membrane or any process/equipment change, pilot-testing should be conducted to confirm capability of the process/equipment change with upstream and downstream processes (i.e., pilot-test the system as opposed to a single process).
  - The existing RO trains are equipped with vertical turbine RO feed pumps, cartridge filtration and high-pressure pumps equipped with pelton wheel style energy recovery devices. The energy recovery devices are directly coupled to the high-pressure pump motors. Variable salinity in the source water requires operation at changing recovery levels, which are problematic to the pelton wheels. Damage caused by this mode of operation creates imbalanced forces on the motor shafts, which can damage the motors. Changes in energy recovery device technology are required to address this challenge. Additionally, the high-pressure pump motors were not supplied with sufficient bearing cooling systems and operation during summer months can lead to high motor temperatures and motor faults. Motor improvements should include upgrades to provide better bearing cooling.
  - The current RO clean in place (CIP) system uses two neutralization tanks to store neutralized spent cleaning solution and provide metering for all disposed solutions during

transfers to the local sanitary sewer. This volume is critical because it allows operations to verify that the solution has been adequately stabilized prior to offsite disposal. However, the current verification process requires laboratory verification prior to disposal and because of the time for the lab work, the existing system can become a bottleneck when multiple RO trains require cleaning in response to event driven fouling. The discharge requirements and flow are currently being discussed/negotiated with the local service provider. The discussions presently focus on reducing the laboratory verification requirements. If the disposal flow limitations are reduced, additional yard piping and pump improvements may be required to transfer larger flows to the sewer.

- Continued operation of the existing and expanded Desalination Water Treatment Plant is reliant on continued access to cooling water channels, owned by TECO Energy, Inc., which provide seawater supply and dilution water for concentrate streams. TECO has indicated that it would continue to provide Tampa Water with water for supply and concentrate dilution regardless of future operational decisions; however, long-term changes may result in a cooler source water temperature and/or reduced flows for concentrate dilution. Water quality sampling should be conducted and coordinated with TECO Energy, Inc. to evaluate potential future changes in influent water quality. Additionally, alternative intake configurations should be developed and evaluated to account for the expansion, as well as future TECO operations.
- The existing concentrate management system, as well as potential modifications, should be evaluated based on changes in recovery, increases in concentrate disposal quantities, and future TECO operations. The current residuals management strategy uses plate settlers to thicken solids prior to belt press dewatering. The dewatering system is aging, and equipment replacement is under evaluation. The operation and maintenance of the existing equipment has been presented by plant staff as a reliability consideration since the current filter press technology is fabricated overseas. Sourcing of replacement parts requires additional time due to international shipping and customs considerations. If the system is expanded, or replaced, use of domestically manufactured equipment is recommended to improve the availability of replacement components.
- Evaluate the vulnerability of the facility to storm surge and potential for infrastructure failures to maintain continuous operation of the existing and potentially expanded Tampa Bay Seawater Desalination Plant. Opportunities to mitigate weaknesses as part of overall system improvements and the expansion should be identified.

Based on a preliminary assessment of the Tampa Bay Seawater Desalination Plant as part of this LTMWP, Tampa Bay Water has the potential to increase the annual average (sustainable) yield at the Desalination Plant by approximately 5 mgd, which has the potential to delay the timing for future water supply projects by optimizing the existing assets. Additionally, optimization of treatment at the Desalination Plant may decrease the operating costs to produce the existing yield.

#### **17.4 Summary of Preliminary Findings**

Tampa Bay Water has the potential to increase the annual average (sustainable) yields from both the existing Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant by approximately 5 mgd for each facility, which has the potential to delay the timing for future water supply projects by optimizing the existing assets. Further analysis is required at both treatment plants to confirm potential improvements, yield impacts, and estimated costs. The timing implications of these projects are discussed further in Section 20 of this Master Water Plan.

**THIS PAGE INTENTIONALLY LEFT BLANK**



## 18. Staffing Requirements

### 18.1 Existing System Staffing Plan

Tampa Bay Water manages and operates its regional water supply system with an appropriate level of staffing to fulfill the missions of the departments while maintaining a responsible fiscal program to serve the member governments. Figure 18-1 shows the current organization structure and staffing positions per department. At this time, the Agency operates and maintains 150 equivalent full-time positions. This section summarizes Tampa Bay Water's existing staffing requirements and additional staffing needs if either of the potential water supply projects are implemented.

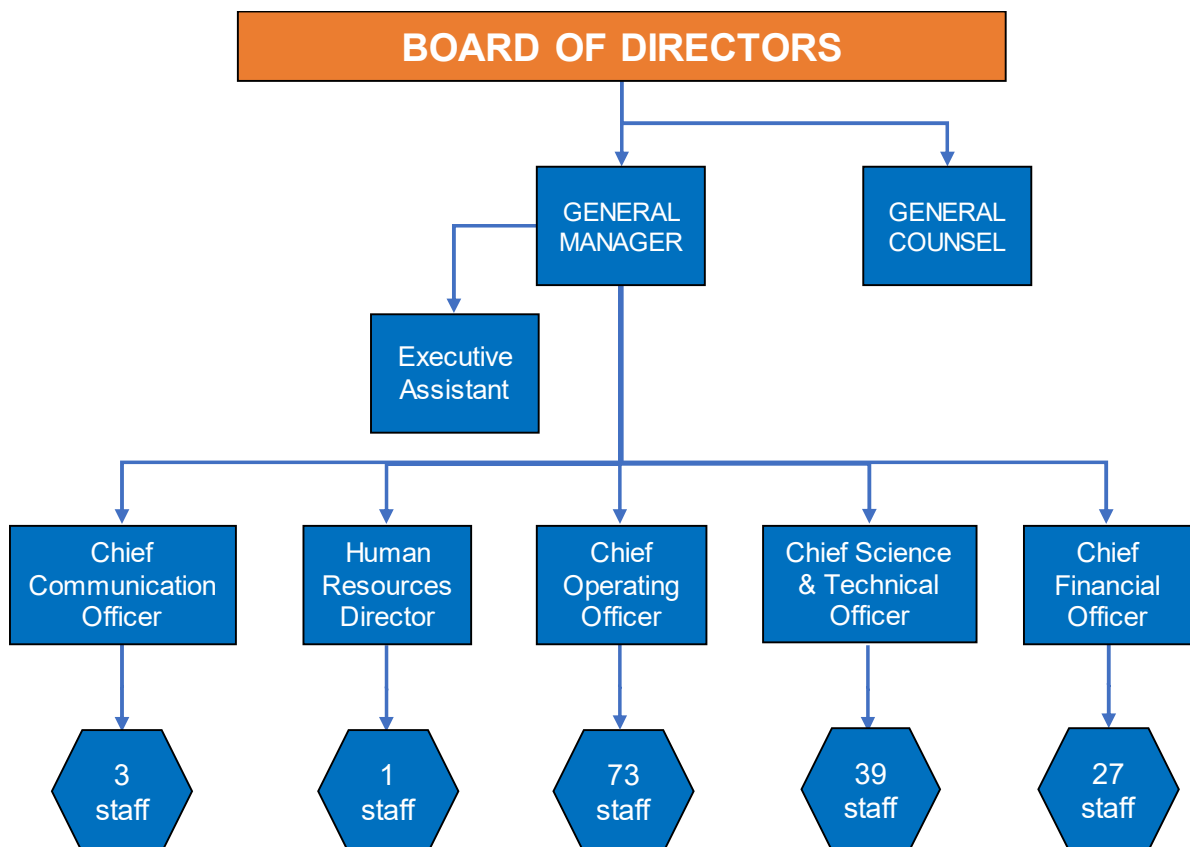


Figure 18-1: Tampa Bay Water Organization Chart

In 2012, Tampa Bay Water shifted its focus from planning and construction of new water supplies to maintaining and optimizing the existing supplies and facilities. With this new focus, a new strategic plan was created to provide a road map towards meeting the Agency's goals. Tampa Bay Water also underwent a reorganization process to better meet the goals of the strategic plan and to become more efficient within the organization structure. The latest strategic plan was approved by the Tampa Bay Water Board in February 2016. The primary goals include:

- Maintain water supply and delivery system reliability and sustainability
- Increase efficiency of all Agency operations
- Maintain financial stability and sustainability
- Maintain open, collaborative relationships with member governments and other stakeholders
- Uphold a health and safety culture

In order to ensure that its staffing levels remain consistent with the Agency goals and strategic plan, Tampa Bay Water reviews staffing through formal performance audits and management studies every five years, as required in Section 2.10 of the Amended and Restated Interlocal Agreement. As required in the Interlocal Agreement, performance audits and management studies are performed by a nationally recognized accounting or management consulting firm that reviews and compares the activities performed by the Agency with other similarly sized organizations for efficient, effective, and economical operations. The latest performance audit was presented and received by the Board in August 2015.

Additionally, a salary survey is conducted at least every three years to ensure the Agency remains competitive within the current market and attracts and retains talented professional staff. The pay plan and benefits package are reviewed by outside consulting firms which compare the current Agency plan with other similarly sized organizations. The latest pay plan was approved by the Tampa Bay Water Board in October 2016.

Tampa Bay Water is also in the process of completing a staffing study that focuses on the operations of various divisions to perform the required job functions and an assessment of the Agency's outsourced contract-operated facilities to better understand the implications to the Agency if they are continued or modified. The staffing study is part of the strategic plan objectives.

## **18.2 Estimated Staffing Needs for Future Supply Options**

The addition of new or expanded facilities to the existing Tampa Bay Water regional system is anticipated to result in additional staffing needs for the Agency. Section 16 of this report identifies the four highest ranked future water supply project options that were selected for further consideration and evaluation to meet the region's future water supply needs. Table 18-1 provides a preliminary opinion of the additional staffing requirements associated with each of the four future water supply options. The table does not associate the staffing by specific disciplines (i.e. operators, maintenance, electrical, instrumentation, SCADA, laboratory, etc.) but as a cumulative total of all disciplines for each project. A more detailed analysis to finalize the staffing requirements would be performed if the projects were selected for further evaluation or implementation.

Table 18-1 also provides an indication of whether the anticipated staffing could be considered for reduced staffing per the Florida Department of Environmental Protection guidelines, FAC 62-699.

**Table 18-1: Potential Staffing Levels**

| Project                                                                         | Additional Design Capacity, mgd | Additional Tampa Bay Water O&M Staff |                         | Potential FDEP Staffing - Reduced Monitoring |    |
|---------------------------------------------------------------------------------|---------------------------------|--------------------------------------|-------------------------|----------------------------------------------|----|
|                                                                                 |                                 | Tampa Bay Water Staff                | Contract Operator Staff | Yes                                          | No |
| Regional Surface Water Treatment Plant Expansion– Existing Source               | 10 to 12.5                      | 0                                    | 1 to 2                  |                                              | X  |
| Desalination Plant Expansion – Existing Source                                  | 10 to 12.5                      | 0                                    | 1 to 2                  |                                              | X  |
| New Groundwater Treatment Plant via Net Benefit from SHARP Program <sup>1</sup> | 7.5                             | 3 to 6                               | 0                       | X                                            |    |

<sup>1</sup> Staffing can be affected by disinfectant type and if FDEP reduced monitoring is an option per the process selections

**Regional Surface Water Treatment Plant Expansion – Existing Source** – The operation and maintenance of the existing Tampa Bay Regional Surface Water Treatment Plant is currently performed by a contract operations and maintenance firm. Expanding this existing facility with one additional treatment train (from four to five trains) is not anticipated to impact the current plant operating structure, as it appears to be adequate to control and monitor the facility with an additional similar treatment train added. The maintenance activities for equipment, instrumentation, and the SCADA network are anticipated to require some additional staff based on the additional infrastructure and equipment added. Existing lab personnel are anticipated to be adequate to manage the additional water quality testing.

**Desalination Plant Expansion – Existing Source** – The operation and maintenance of the existing Desalination Plant is currently performed by a contract operations and maintenance firm. A 10 mgd expansion of the existing facility is anticipated to require some additional staff to supplement the current staffing level provided by the contract operator. The operation and maintenance requirements for the pretreatment modifications are anticipated to require additional maintenance activities compared to the existing processes. No staffing changes are anticipated with the current plant operating structure, as it appears adequate to control and monitor the existing and proposed new processes. The maintenance activities for equipment, instrumentation, and the SCADA network are anticipated to require some additional staff based on the additional infrastructure and equipment added. No additional lab staff is anticipated for water quality testing efforts.

**New Groundwater Treatment Plant via Net Benefit from SHARP Program** – Additional operations and maintenance staff will be required for the new facilities and systems associated with this project, including the groundwater production wells, pipelines, storage tank, pumping stations, and groundwater treatment plant. The new facilities and systems would require Tampa Bay Water to bring on additional staff to supplement the existing operations and maintenance personnel for the Agency's south region. Operation of the new groundwater wells is not anticipated to require additional staff for control and monitoring. The maintenance activities for the new infrastructure, equipment, instrumentation, and the SCADA network are anticipated to require additional staff. Existing lab personnel is anticipated to be adequate to manage the water quality testing.

Operation of the new groundwater treatment plant may also require 24/7 coverage based on assuming an ozone treatment process for hydrogen sulfide removal, similar to the ozonation process at the Hillsborough Lithia Water Treatment Plant. Tampa Bay Water may also pursue a reduced staffing plan with FDEP for this proposed new facility.

Note: Future water supply projects that involve expansion of existing facilities that currently use a contract operations and maintenance firm would require modifications and renegotiation of the existing service agreement to handle the operations and maintenance requirements associated with the additional infrastructure proposed.

## 19. Source Water Assessment and Protection

### 19.1 Introduction

Tampa Bay Water has expended significant resources to develop a regional system that is resilient, reliable and sustainable under fluctuating and changing hydrologic conditions, new regulatory requirements and rapid population growth. The regional system currently withdraws, treats and blends source water from groundwater wellfields, river withdrawals, a large off-stream reservoir and seawater. Although management of water quantity and environmental impacts were key drivers for regional system development, maintaining consistent source water quality is critical for continued reliability and treatment efficiency while also meeting public health and environmental goals. Source water quality assessment and protection activities help ensure three major goals in the Tampa Bay Water Strategic Plan: achieve a reliable water supply and delivery system; maintain the Agency's financial stability and sustainability; and develop, improve, and maintain collaborative relationships with stakeholders.

Tampa Bay Water, like most other water utilities, is required to meet finished drinking water standards but has no authority to protect source water quality. To help ensure drinking water quality, source water assessment and protection programs typically incorporate the Safe Drinking Water Act-recommended multi-barrier approach of risk prevention/management, monitoring/compliance, and individual action. Source water assessment and protection programs also typically follow the American Water Works Association (AWWA) water industry standard, which includes source water protection, optimized water treatment, distribution system management, and water quality monitoring (AWWA 2014).

Tampa Bay Water's initial source water assessment and protection program plan was developed with Board of Directors approval as a part of the 2008 Long-term Master Water Plan update efforts and implemented by staff after approval in December 2011. Components of Tampa Bay Water's Source Water Assessment and Protection Program include: source water monitoring and assessment, evaluation of current and future land use activities, stakeholder interaction, education and communication, and research activities to address source assessment/protection and treatment needs. Specific activities for each of these components have been identified and are implemented by Tampa Bay Water staff based on available resources. Tampa Bay Water's 2011 Source Water Protection Program document will be updated in 2019 to incorporate past, current and future activities.

This section presents an overview of Tampa Bay Water's current Source Water Assessment and Protection Program and the required implementation activities for current and potential future regional supply projects identified in Section 16.

### 19.2 Source Water Assessment and Protection – Current Supplies

Current surface water supply sources in Tampa Bay Water's regional system include:

- Alafia River: intake is located downstream of the tidally-influenced part of the river,
- Tampa Bypass Canal/Hillsborough River: integrated canal/river system managed for flood control with significant seasonal groundwater inputs,

- C.W. Bill Young Regional Reservoir: above-ground, off-stream reservoir supplied by the Alafia River and Tampa Bypass Canal sources,
- Tampa Bay Seawater Desalination Plant: co-located with Tampa Electric's Big Bend Power Plant on the Hillsborough Bay segment of Tampa Bay.

Current groundwater supply sources in Tampa Bay Water's regional system include:

- Consolidated Wellfields: separate groundwater wellfield areas in Hillsborough, Pasco and Pinellas counties operated based on regulatory/environmental constraints and water quality conditions (Cypress Creek, Cross Bar, Cypress Bridge, Cosme-Odesa, Starkey, South Pasco, Morris Bridge, Eldridge-Wilde, Section 21 and Northwest Hillsborough). These wellfields are referred to as "consolidated" because their operation is governed by one consolidated permit.
- Groundwater supply wells in Hillsborough County operated based on regulatory/environmental constraints and water quality conditions (South-Central Hillsborough Regional Wellfield, Brandon Urban Dispersed Wells and Carrollwood Wells).

#### **19.2.1 Source Water Monitoring and Assessment**

Tampa Bay Water's ongoing source water monitoring and assessment for regional public drinking water supplies includes water quality monitoring, vulnerability assessments for potential contaminant sources, and implementation of an internal Geographic Information System (GIS) database platform to facilitate monitoring and assessment activities by staff and contractors. Tampa Bay Water also participates in research projects with the Water Research Foundation and other utilities to develop new tools for improved source water monitoring and assessment.

Tampa Bay Water's source water quality monitoring for surface water supplies includes collection of water quality data in surface water supplies, and assessment based on monitoring thresholds and criteria for key water quality parameters. Some water quality data is collected on a continuous basis through the use of online instrumentation, whereas other water quality data is collected on a monthly basis by manually collecting grab samples. Source monitoring goals and objectives include:

- Detect and provide early warning of potential contamination incidents
- Optimize utilization of supply sources and identification of treatment needs
- Monitor threats to long-term water quality due to watershed changes.

Water quality monitoring programs have been implemented and refined for the Alafia River supply source and are currently being developed for implementation in the Tampa Bypass Canal. For groundwater wellfields, water quality monitoring programs are reviewed and refined as-needed based on potential water quality issues. Current source water monitoring for the Tampa Bay Seawater Desalination Plant includes limited Bay monitoring near the Plant and intake water quality.

Source vulnerability assessments for the Alafia River and Tampa Bypass Canal surface water supplies provide detailed inventories of potential contamination sources such as fuel tanks and chemical storage areas that could impact drinking water sources, as well as outfalls that discharge stormwater to surface water supplies

from potential contamination sources. These detailed inventories were developed using aerial imagery analysis, field surveys, and publicly-available GIS data and other information. Application of this detailed inventory approach was completed in 2018 for a portion of Tampa Bay Water's groundwater supply sources and will be expanded in 2019 to include additional groundwater supply sources.

Tampa Bay Water is currently completing a "barrier assessment" for the Alafia River, Tampa Bypass Canal and Regional Reservoir surface water supplies. A "barrier assessment" evaluates how well source waters are protected from contaminant vulnerabilities by employing a formalized, systematic review of water quality monitoring data, potential contamination source inventories, existing treatment processes and known or potential contaminants to identify specific risk mitigation and monitoring needs to ensure the production of safe, high-quality drinking water. This approach is based on the hazard assessment and critical control (HACCP) methodology originally developed for the food industry and subsequently used in the water industry for distribution systems and direct potable reuse facilities. This HACCP approach will be expanded to include all Tampa Bay Water current and future supplies..

#### **19.2.2 Current and Future Land Use Activities**

As provided above, Tampa Bay Water's current regional system covers three counties and includes groundwater wellfield areas and dispersed wells, a free-flowing river system, an integrated canal/river system managed for flood control, and an above-ground, off-stream reservoir.

For current supply sources, existing source protection measures include County Wellhead Protection Ordinances and Surface Water Resource Protection Ordinances (where applicable) adopted by member governments (Hillsborough, Pasco and Pinellas counties). These ordinances provide protective measures to prevent potential impacts of certain types of development on or near public drinking water supply sources, especially groundwater wellfields. Development proposals within areas near public drinking wells and upstream of surface water intakes are reviewed to ensure that they are complying with set rules and regulations of the ordinances. Historically, limited source water protection has existed with respect to wastewater discharges and chemical storage in the proximity of surface water supplies due to the lack of State of Florida protection of these drinking water supply uses. Tampa Bay Water has worked extensively with the Florida Department of Environmental Protection and stakeholders to develop and implement appropriate Florida water quality standards to protect regional surface waters sources of drinking water. Some progress has been made to address this protection need, and these efforts will continue.

Tampa Bay Water has implemented an ongoing land use and development proposal review program to assist the member governments in their technical and planning reviews of new developments and re-zoning of existing developments relative to drinking water source protection. Tampa Bay Water continues to act as a resource to county planning and growth management departments, offering technical and scientific reviews to county staff. Tampa Bay Water staff also review proposed National Pollutant Discharge Elimination System (NPDES) discharge permits and Environmental Resource Permits (ERPs) issued by the Florida Department of Environmental Protection (FDEP) or the Southwest Florida Water Management District (SWFWMD) and provide comments related to drinking water source protection as-needed. Tampa Bay Water has developed an internal GIS database platform to facilitate identification and assessment of potential contamination sources near drinking water supplies. This tool has been implemented for Tampa Bay Water surface water sources and is being developed for groundwater wellfields (see Source Water Monitoring and Assessment). Tampa



Bay Water will continue to work with public and private stakeholders to address source protection needs for drinking water supplies.

### **19.2.3 Stakeholder Interaction**

Source water quality protection relies on efforts and actions by state and local regulatory agencies and other public/private stakeholders. Stakeholder interaction is a key component of Tampa Bay Water's Source Water Assessment and Protection Program for the regional drinking water system.

Types of stakeholder activities range from reviewing and providing input on rules and regulations to assisting other entities with environmental initiatives that protect and maintain source water quality. Key stakeholders and activities related to maintaining and protecting surface water and groundwater supplies include:

- Florida Department of Environmental Protection- responsible for water quality standards and permitting pollutant discharges affecting source waters.
- Southwest Florida Water Management District- responsible for consumptive use permitting, environmental flows and levels, flood control, stormwater management, and environmental resource permitting affecting source waters.
- County Planning and Growth Management Departments- responsible for development and implementation of Wellhead and Surface Water Resource Protection Ordinances and land use change approvals affecting source waters.
- Environmental Protection Commission of Hillsborough County- responsible for enforcement of delegated state water quality standards, environmental rules and regulations, and local protection ordinances affecting source waters.
- Tampa Bay Water's Water Quality Work Group- coordination of member government distribution system compliance and water quality issues affected by source water quality.
- Tampa Bay Estuary Program- coordination of regional public and private partners for water quality improvement/protection and watershed management actions affecting source waters.

Tampa Bay Water will continue to work with these groups to assess and manage watershed and development activities potentially impacting drinking water quality for current and future supply sources, as well as identify opportunities to work together for enhanced resource management.

### **19.2.4 Education and Communication**

Tampa Bay Water's current education and communication activities related to source water assessment and protection include:

- Residential customer education/outreach for general source water protection efforts and ways they can help protect drinking water sources, and public opinion surveys and feedback to inform related communication efforts.

- Education and outreach through the Agency's website, and social media platform postings for specific projects and issues.
- Annual Consumer Confidence Report summarizing activities and issues for source water assessment and protection for regional drinking water supplies.
- Routine participation in watershed, environmental and community groups as-needed for environmental and source water protection issues.
- Source Water Protection Mini Grant Program which offers funding to community groups, non-profits, schools and universities that will join the water utility in preventing pollution, cleaning local waterways and protecting our drinking water sources.

#### **19.2.5 Research and Related Activities**

The Agency is an active participant and recognized leader in drinking water research activities for water quality, treatment technologies, regulatory requirements and communication needs. Activities are coordinated with the Water Research Foundation (merged with Water Environment & Reuse Foundation), the American Water Works Association, the U.S. Environmental Protection Agency, university researchers and other public/private utilities. As a contributing member of the Water Research Foundation, Tampa Bay Water has access to data, reports, and recognized experts in water quality and treatment.

Current Source Water Assessment and Protection Program research and related activities include:

- Member of the AWWA/ANSI G-300 Source Water Protection Standards Committee updating U.S. source protection standards and guidance.
- Sponsor and participant for Water Research Foundation project for Development of Risk Management Framework and Tools for Source Water Risks to be piloted by multiple participating public/private drinking water utilities.
- Contributor and participant for Water Research Foundation project to develop a Decision Support Framework for Water Treatment Plants undergoing watershed and source water changes including a future Tampa Bay Water workshop.
- Member of U.S. EPA's Online Water Quality Monitoring Forum and Steering Committee for distribution systems and supply sources.
- Coordination and participation with U.S. EPA testing and related studies on currently unregulated constituents (e.g., algal toxins, additional metals, fluorinated substances or PFAS, additional disinfection byproducts) that may be found in drinking water, at what concentrations, where in the U.S. and effectiveness of treatment technologies. These studies are used by U.S. EPA to determine the need and basis for new constituent regulations.

### **19.3 Source Water Assessment and Protection Needs – Future Supplies**

The 2018 LTMWP update not only addresses the construction of new water supply projects, but also includes the anticipation and management of future supply needs, optimizing the regional system, meeting regulatory requirements, and providing high-quality drinking water.

As discussed in Section 15, the decision-making criteria for the selection of new water supply projects include Environmental Stewardship (ease of permitting, environmental sustainability index, public reception), Project Costs (life cycle cost, ability to phase, cost risk factors) and Reliability (supply resiliency, vulnerability index, system operational impacts, contractual requirements). Most or all these criteria are affected to some degree by source water quality because assessing and maintaining consistent water quality for future regional supply sources is critical for continued reliability and meeting strategic plan goals.

Three Master Water Plan projects have been short-listed for additional study as identified in Section 16:

- New Groundwater Water Treatment Plant via Net Benefit from SHARP Program (groundwater source)
- Regional Surface Water Treatment Plant Expansion with Existing Sources (Tampa Bypass Canal/Hillsborough River and Alafia River)
- Tampa Bay Seawater Desalination Plant Expansion with Existing Source (TECO/Hillsborough Bay)

The water supply projects that are ultimately selected for implementation will be incorporated into Tampa Bay Water's Source Water Assessment and Protection Program. An assessment of short-listed projects relative to the source water assessment and protection components above are planned as part of the feasibility studies. Some specific additional anticipated source water assessment and protection activities for each of these projects are identified below.

#### **19.3.1 New Groundwater Water Treatment Plant via Net Benefit from SHARP Program (groundwater source)**

- Develop source water quality monitoring program for the new wellfield including data collection and criteria for key water quality parameters.
- Complete potential contamination source inventories for the new Tampa Bay Water wellfield and south Hillsborough County aquifer recharge areas.
- Develop comprehensive barrier assessment for groundwater supply based on the HACCP methodology, as described above for existing surface water supplies.

#### **19.3.2 Surface Water Treatment Plant Expansion with Existing Sources (Tampa Bypass Canal/Hillsborough River and Alafia River)**

- Review and update as-needed, existing source water quality monitoring including collection of continuous and monthly water quality data; and assessment based on monitoring thresholds and criteria for key water quality parameters.

- Review and update as-needed, existing potential contamination source and outfall inventories for Tampa Bypass Canal and Alafia River supplies, expand assessment to Hillsborough River watershed as-needed.
- Review and update as-needed, focused comprehensive barrier assessment for surface water sources based on the hazard assessment and critical control methodology.

19.3.3 **Desalination Facility Expansion with existing source (TECO Plant/Hillsborough Bay)**

- Review and update as-needed, source water quality monitoring including collection of continuous, daily or monthly water quality data; and assessment based on monitoring thresholds and criteria for key water quality parameters.
- Perform assessment of current and future land use activities near the facility including near future port development and transportation plans.
- Complete potential contamination source and outfall inventories near the facility.
- Develop focused comprehensive barrier assessment for the facility based on the HACCP methodology, as described above for existing surface water supplies.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 20. Demand Management Plan

### 20.1 Introduction

Tampa Bay Water currently helps meet the water demands of more than 2.5 million people in the tri-county region. Residential demands account for nearly 75 percent of billed water consumption, with the remainder associated with the needs of commercial businesses and industry. The Agency has been actively involved in quantifying and forecasting water demand and potential changes in demand through water use efficiency efforts, mainly through passive water efficiency and active member government implementation, since adoption of its original demand management plan in 1997 (As West Coast Regional Water Supply Authority). Additionally, the agency developed tools to quantify ongoing member water use efficiency programs that helped to meet the 1998 Board of Directors adopted planning goals.

As Tampa Bay Water's reliance on surface water and other alternative water sources continues to increase, the avoided cost of water supply through anticipated demand management has become a more critical element of the water supply planning process. Avoiding or delaying the cost of more expensive alternative supply development prior to its need helps mitigate rate impacts to Tampa Bay Water's member governments and their customers.

Tampa Bay Water's Demand Management Plan (DMP) evaluates the benefits and costs of water demand management as a quantifiable, supplement to water supplies. The DMP is considered one component of the agency's strategic goals to increase reliability of its existing water supply and delivery system to our member governments. Tampa Bay Water is required to evaluate and update the Demand Management Plan every five years, with the most recent update completed in 2018 (Appendix 20A).

Demand side management efforts are intended to serve as a complementary component to traditional water supply planning processes in meeting current and future water demands. Demand-side management encompasses a set of activities designed to:

- Provide a better understanding of how and why water is used;
- Forecast human demands for water supplies;
- Develop prospective water-using efficiency (demand reduction) measures;
- Identify programmatic and project goals, evaluation criteria, performance measures, and monitoring mechanisms;
- Define and evaluate program effectiveness and goal achievement; and
- Evaluate the benefits and costs of efficiency measures as an alternative or complement to supply development.

Through efficient use of available supplies and use of targeted implementation strategies, water use efficiency can help manage peak and average day water demand in conjunction with reducing long-term future water supply requirements. Cost-effective alternatives to new supply development and other

valuable benefits can be realized through demand side management including: optimization of existing facilities, deferred capital investment costs, improved public perception, and environmental stewardship and protection. This section provides an overview of the DMP and its potential impacts on the future water supply projects.

## **20.2 Components of Tampa Bay Water's Demand Management Plan**

The 2018 DMP, which can be found in its entirety in Appendix 20A, is an update of the 2013 Plan and consists of a comprehensive evaluation of benefits and costs of integrated water demand management as a quantifiable, complementary alternative to conventional water supply sources. As a baseline, this document reflects improvements in the state of water use efficiency occurring since 1997 when the first DMP was adopted. The DMP also includes an evaluation of potential demand management projects as a beneficial tool for long-term water supply planning. Results define how water efficiency activities can fit into Tampa Bay Water's long-term water supply planning process, which includes supply reliability and member government long range demand projections.

The demand management evaluation effort includes an analysis of water savings (past and future) and an analysis of avoided supply costs related to improved water use efficiency. The "avoided supply cost" analysis considers increments of conserved water versus (a) cost to operate existing water supply sources and (b) total cost (capital and operating costs) to develop new water supply. Consideration of cost savings and water supply benefits permits a consistent "apples to apples" comparison to other water supply alternatives.

Consistent with board direction, various demand management implementation strategies were evaluated to determine how demand management could be implemented to secure savings within identified time frames. Tampa Bay Water is working with its member governments to develop water efficiency programs that will help secure up to more than 11 mgd demand reduction by 2030 if ultimately adopted by the board. An overview of the 2018 DMP is presented below, and additional details can be found in the Demand Management Plan Report (Tampa Bay Water, 2018).

## **20.3 Profile of Regional Water Demand**

Demand profiling provides a comprehensive understanding of demand trends and how these trends relate to or can be affected by water use efficiency improvements. The 2013 DMP (used as a baseline in the 2018 analysis) included a comprehensive Regional Baseline Water Demand Profile to quantify and describe the water using and economic characteristics of Tampa Bay Water's member government customers. This included:

- Geographic and seasonal analyses of water use patterns among the major water using sectors in the Tampa Bay region
- Assessment of water savings estimates achieved from previously implemented conservation programs
- Analysis of water technologies and baseline efficiency levels



The regional profile supported the estimation of the remaining market for water efficiency technologies and regional water efficiency potential, which was conducted in the update.

## 20.4 Evaluation of Water Efficiency Alternative (Forecast)

Water savings can be realized from either passive or active water use efficiency measures.

- *Passive* water efficiency is achieved through a natural process of replacing old fixtures with new, more efficient fixtures as they wear out or become effectively obsolete, or by installing efficient water-using fixtures in new construction due to codes or driven by market changes. Passive water efficiency typically occurs indoors with the replacement of toilets, clothes washers, dishwashers, and urinals.
- *Active* water efficiency measures include programs designed to expedite the replacement process described above. Such programs are often sponsored by water utilities to ensure a target installation rate and associated water savings and can include outdoor efficiency technologies.

Estimating passive water savings is essential in determining efficacy of active water efficiency programs and for projecting long term water demands. Before the potential benefits of active water efficiency alternatives can be assessed, passive savings must be estimated. An assessment of remaining efficiency potential was used to identify, develop, screen and select technically applicable active alternatives with initially significant amount of savings potential.

### 20.4.1 Passive Fixture and Savings Estimates

The U.S. Energy Policy Act (EPAAct), effective in 1994, mandated flow standards for many fixtures (e.g., toilets, faucets and showerheads, among others). Since then, manufacturers have introduced, and marketed fixtures and appliances that far exceed EPAAct standards, leading to EPA WaterSense and Energy Star programming, which certify and label products meeting consumer expectations while performing at higher efficiency rates than current national efficiency standards. These programs influence the market by encouraging consumers to purchase high-efficiency (HE) water-using products. WaterSense labeled products differ from Energy Star products because they require independent third-party certification of performance and product durability, insuring product use is consistent with labeling over a defined life. As consumers decide to purchase and install HE water products, water consumption efficiency increases.

Accounting for prospective changes in efficiency standards, fixture life, and market penetration of high efficiency products allows adjustment of the Agency's baseline demand forecast to reflect market-based passive demand reductions. A water efficiency index was derived using toilets used as indicator of efficiency trends. The index reflects the weighted average flush volume across the distribution of existing efficiency levels in the base year, relative to future values in each forecast year. By 2040, approximately 17 mgd of water savings potential is estimated and attributable to passive efficiency assuming a 25-year product life (in reality product life has some variability).

**20.4.2 Screening and Selection of Active Efficiency Technologies/Programs**

The 2013 DMP update screening process considered 24 programs/technologies, either applied through existing programs (regionally and nationally) or developed based upon specific application of technologies in specific sectors or water end uses. Ultimately 10 programs were included in the 2013 DMP. Estimates of cost-effectiveness are critical for screening, ranking and selection of conservation measures. As part of the 2018 update, savings rates, utility costs, benefit cost ratios and implementation strategies were reviewed and updated as deemed appropriate to ensure feasible targeting and implementation strategies. This assessment resulted in the selection of 11 programs for the 2018 update.

Remaining market potential for water efficient technology (beyond what is likely accounted for by passive measures) was determined through the 2040 demand forecast planning horizon for the 11 programs selected for inclusion in the 2018 DMP update. The portfolio of programs included in the 2018 update are shown in Table 20-1. Of the 11 programs, 6 programs are applicable to the non-residential (NR) sector, 3 to the single-family (SF) sector and 1 to the multi-family (MF) sector. Estimates of gallons saved reflect savings over the life of each measure, which vary depending on measure implementation assumptions, unit savings rates, and useful life of the technology. Estimated unit costs were compared with unit costs of supply alternatives to evaluate the viability of demand management alternatives. As identified in Table 20-1, the most cost-effective program is cooling tower retrofits at an average cost of \$0.09/1000 gallons. The least cost-effective program identified selected is the /Florida Water Star/Florida-Friendly Landscaping Modification incentive program at an average cost of \$0.57/1000 gallons.

**Table 20-1: Programs Meeting Screening Criteria**

| <b>Program</b>                       | <b>Class</b> | <b>Utility Cost (\$/unit)</b> | <b>Unit Savings (GPY)</b> | <b>Useful Life of Savings (yrs)</b> | <b>Gallons Saved Over Useful Life</b> | <b>\$/1000 gal</b> | <b>Benefit to Cost Ratio</b> |
|--------------------------------------|--------------|-------------------------------|---------------------------|-------------------------------------|---------------------------------------|--------------------|------------------------------|
| <b>Cooling Tower (DMP)</b>           | NR           | \$1,225.00                    | 1,386,530                 | 10                                  | 13,865,299                            | \$0.09             | 8.64                         |
| <b>Valve-Type HE Toilets</b>         | NR           | \$100.00                      | 22,103                    | 25                                  | 552,578                               | \$0.18             | 3.61                         |
| <b>Spray Rinse Valve (DMP)</b>       | NR           | \$75.00                       | 37,426                    | 10                                  | 374,260                               | \$0.20             | 2.81                         |
| <b>HE Urinal (1/2 Gallon)</b>        | NR           | \$100.00                      | 18,928                    | 25                                  | 473,200                               | \$0.21             | 4.54                         |
| <b>Alternative Irrigation Source</b> | SF           | \$575.00                      | 94,034                    | 25                                  | 2,350,850                             | \$0.24             | 2.97                         |
| <b>Tank-Type HE Toilets</b>          | NR           | \$100.00                      | 13,020                    | 25                                  | 325,489                               | \$0.31             | 2.41                         |
| <b>Dishwasher Conveyor</b>           | NR           | \$425.00                      | 59,951                    | 20                                  | 1,199,020                             | \$0.35             | 2.08                         |
| <b>Residential HE Toilets</b>        | SF           | \$125.00                      | 12,854                    | 25                                  | 321,350                               | \$0.39             | 1.83                         |
| <b>Residential HE Toilets</b>        | MF           | \$100.00                      | 9,679                     | 25                                  | 241,977                               | \$0.41             | 1.17                         |
| <b>SMS/ET Irrigation Controller</b>  | SF           | \$300.00                      | 56,645                    | 10                                  | 566,449                               | \$0.53             | 1.44                         |
| <b>FWS/FFL Modification</b>          | SF           | \$725.00                      | 50,560                    | 25                                  | 1,264,000                             | \$0.57             | 1.27                         |

Table 20-1 presents the projected water savings from the passive conservation in the region, combined with the proposed active programs above.

## 20.5 Economic Analysis of Alternative Demand Management Strategies

Quantification of supply-side benefits (end use customers also receive benefits but are not defined here) that are based on the accrual of avoided costs demonstrates the benefits of proposed efficiency measures and deferral of source development to the Agency. Avoided costs (or benefits) from water use efficiency generally result from:

- Capital deferral;
- Capital elimination; and
- Reduction in variable cost.

Savings and costs were determined over a 60-year planning horizon (2014-2073) allowing savings rates in this analysis to mature over the life of the technology installed. Net avoided costs of viable demand management alternatives were evaluated over two separate timeframes; the total life of all savings and through the 2040 forecast horizon. When costs and benefits of the portfolio of viable demand management alternatives are evaluated over total life of the savings (through the end of 2073), a net present value of more than \$32 million in benefits was identified (as shown in Table 20-2. Given these benefits and costs, the collective portfolio of demand management alternatives has a benefit to cost ratio (benefits/costs) of 2.00 (this value is doubled when using any matching funds). When costs and benefits are evaluated over the much shorter 2040 forecast horizon, the net present value of avoided costs remain positive but is reduced to \$8.3 million.

**Table 20-2: Net Present Value (NPV) of Avoided Costs**

| Net Present Value (NPV) of Avoided Costs |               |                  |           |      |
|------------------------------------------|---------------|------------------|-----------|------|
|                                          | PV Cost (\$M) | PV Benefit (\$M) | NPV (\$M) | BCR  |
| Life of Savings to 2073                  | \$30.9        | \$63.1           | \$32.3    | 2.00 |
| Life of Savings to 2040                  | \$31.3        | \$39.2           | \$8.3     | 1.27 |

<sup>(i)</sup> Typically, avoided capital and operating costs from greater water efficiency are also associated with greater environmental benefits, because more water is available to serve ecological purposes and secondary impacts from energy use is minimized. Environmental benefits of greater efficiency were not quantified as part of the Demand Management Plan Update.

## 20.6 2018 Evaluation of Demand Management Implementation Strategies

The draft 2018 DMP Update, including implementation strategies, was presented to the Tampa Bay Water's Board of Directors in August 2018. These potential strategies were developed to create ways to secure demand reduction goals the board may set, and reduce the need for new supply development, while meeting the Agency's unequivocal obligation to supply water to its members.

While initially using the active savings component of the 2013 Demand Management Plan, Tampa Bay Water identified demand management activities which had the opportunity to reduce the need for future water supply development and presented three potential ways to receive Southwest Florida Water Management District (the District) co-funding options to the board in a way that help secure savings in a timely manner:

- Members apply to the District for funding (pre-2018 strategy)
- Members and Tampa Bay Water apply to the District
- Tampa Bay Water apply to the District for block grants

After development of the 2018 Demand Management savings potential, Tampa Bay Water's Board of Directors chose the third option during the August 2018 Board meeting. This option calls for Tampa Bay Water to apply for cooperative funding to SWFWMD, work with member governments to develop implementation strategies that can timely be implemented to realize savings proposed, while meeting the Agency's Interlocal Agreement requirements. The goal is to determine the best ways to timely secure the savings identified in the plan. The objectives are to identify acceptable methods that optimize implementation within member government service areas, meet the DMP's savings expectations, provide agreeable oversight and management, allow members the opportunity to opt in or out of the program or provide additional elements in the future, and for them to continue to operate existing or proposed programs. Strategies are being developed that help meet the goals and objectives. This effort needs to be completed and agreed upon by April 2019, so the Agency can include costs in its draft 2020 budget. Once agreed upon, program implementation would occur in the middle of water year 2020 and would conclude by water year 2030.

## 21. Public Engagement Program

### 21.1 Summary of Efforts: 2015 – 2018

Tampa Bay Water has a strong track record of public education and outreach for its Master Water Plan. Every Master Water Plan developed by the regional water supply wholesaler since 1995 has incorporated transparent, proactive public outreach into the decision-making process. Public engagement for the Long-term Master Water Plan is conducted in concert with the project concept evaluations. In the early stages of the Master Water Plan update, when projects are conceptual and loosely defined, engagement is more general, focusing on potential sources and concepts as well as the planning process. Once project concepts are better developed and projects are selected for detailed planning and feasibility studies, more project-specific outreach occurs.

Tampa Bay Water’s proactive approach is consistent with the American Water Works Association’s policy statement on public involvement, which states, “Opportunities for input and involvement are essential to public understanding and acceptance of utility programs and projects... Opportunities for involvement must, however, be meaningful, inclusive and clearly linked to the decision-making process.”

For the 2018 Long-term Master Water Plan update, the purpose of the education and outreach effort was to:

- Inform residents on the planning and decision-making processes,
- Educate residents about the potential projects and sources under consideration, and
- Ensure stakeholders’ priorities and concerns are included and considered in project ranking and selection.

Additionally, the WaterReuse Foundation recommends public education regarding water quality to help facilitate development of alternative supplies. Because a new source of supply (reclaimed water) was being considered in this update of the Long-term Master Water Plan, water quality education became an important component of our public engagement.

Tampa Bay Water began public information and outreach for the LTMWP 2018 in 2014. Efforts completed since that time include:

- Establishing and meeting regularly with a Member Government Working Group to obtain input and feedback on reuse options. The first meeting was in August 2014.
- A statistically valid public opinion survey in 2015 which provided a basis for multiple communications efforts (this survey was conducted in Tampa Bay Water’s service area and is statistically valid in each member county as well as the three-county area)
- Discussions with an ad hoc committee of scientists and a representative from the Florida Department of Health
- Two focus groups to further explore opinions on water quality
- A targeted water quality campaign and microsite ([tampabayh2o.com](http://tampabayh2o.com)) to educate residents on drinking water quality
- A fact pack and web content for Tampa Bay Water’s web site

- Speakers bureau presentations to more than 20 community groups
- A dedicated microsite (futurewater.org) and fact pack to inform and education residents and obtain feedback via an online survey; “Have a Voice” campaign to publicize futurewater.org
- Three telephone town hall meetings engaging approximately 1,400 people in Hillsborough, Pasco and Pinellas counties
- A statistically valid public opinion survey in 2018 (this survey was conducted in Tampa Bay Water’s service area and is statistically valid in each member county as well as the three-county area)

All of the above efforts were developed with input from Tampa Bay Water’s member governments through the Member Government Work Group.

A brief description of each public information and outreach effort follows, and more detailed more information can be found in Appendix 21A through 21L.

#### **21.1.1 Member Government Working Group**

In September 2014, Tampa Bay Water and its member governments formed a working group, which was established pursuant to board direction to explore direct and indirect potable reuse concepts in the LTMWP update. The purpose of the Member Government Working Group was to share information on existing potable reuse projects within each of the member government jurisdictions and identify new potable reuse projects that could serve as reliable water supplies to help Tampa Bay Water meet its unequivocal obligation to provide high-quality drinking water to its member governments. The Member Government Working Group met 13 times between August 2014 and July 2017; meeting agendas and minutes can be found in Appendix 21A.

The group provided input on project concepts, public engagement efforts, screening and evaluation criteria, cost assumptions, reclaimed water valuation (Raftelis Reclaimed Water Valuation Framework) and more. Input provided by the member governments was used in developing a short list of potential potable reuse projects that included Hillsborough County’s South Hillsborough Aquifer Recharge Project (SHARP) and iterations of Tampa’s Augmentation Project. After the Member Government Working Group completed its objective, Tampa Bay Water staff continued to support member government reclaimed discussions by facilitating the member government’s reclaimed committee meetings and the Long-term Master Water Plan update project team presented information, as requested.

#### **21.1.2 2015 Public Opinion Survey**

From March 18, 2015 to April 3, 2015, Kerr & Downs research conducted a telephone and internet survey of 1,200 randomly selected households in the Tampa Bay Water service area. The margin of error for responses from the three-county service area is 2.8 percentage points, and it is 4.9 percentage points for each county. If 100 identical studies were conducted, results from 95 of those studies would be within 2.8 percentage points of the results that would be obtained if all residents in the Tampa Bay Water service area were interviewed. Following are key findings from the 2015 survey related to the Long-term Master Water Plan:

- Water quality remains a priority with the surveyed water users. Sixty percent of respondents say they drink household tap water and 40% do not. Forty-nine percent think bottled water is safer to drink than tap water, and those respondents who prefer bottled water over tap water cite taste, quality, and safety as some of the top reasons for not drinking tap water.
- When asked about protecting water resources, 86% of respondents either agree or strongly agree that there should be more comprehensive rules and regulations to protect the region's water resources.
- Forty-three percent of residents are willing to drink treated wastewater that has been purified to drinking water standards then put back into groundwater, reservoirs or rivers, then withdrawn and treated again before being sent to homes and businesses. Three in ten (31%) residents are not willing to drink this water, and 26% are not sure.
- Two in five residents (40%) are willing to drink wastewater that has been purified to drinking water standards before being sent to homes and businesses, while nearly the same percentage of residents (35%) are not willing to drink water treated in this manner.
- More than one in three residents (36%) are willing to drink wastewater that has been put back into groundwater, reservoir or rivers then withdrawn and treated again, while the same percentage of residents are not willing to do so.
- About seven in ten residents believe that purified wastewater may include contaminants (70%) or pharmaceutical byproducts (68%) or may cost more (67%). The concept of purified wastewater makes over six in ten residents (63%) uncomfortable.

The 2015 Public Opinion Survey executive summary can be found in Appendix 21B.

### 21.1.3 Ad Hoc Committee

On Oct. 27, 2016, Tampa Bay Water and the Long-term Master Water Plan project team met with an ad hoc committee of scientists and a representative from the Florida Department of Health to discuss to potential projects and hear concerns and input from the participants. Meeting minutes (Appendix 21C) show a list of attendees and an overview of input provided. Following is a snapshot of input provided at that meeting:

- Cost and public acceptance are two of the biggest concerns.
- On the technical side, with aquifer recharge, there is the potential for mobilizing arsenic. The team should look at the mineralogy and geochemical aspects, if they had not already done so.
- From a microbiological perspective, there isn't a good way to test for a multitude of pathogens and some pathogens may be shocked by chlorine but not killed. Injecting reclaimed water into the aquifer raises a number of unknowns as it provides an environment that may be conducive to microbial persistence and horizontal gene exchange.
- Public acceptance will be affected by being transparent with all the options and alternatives that were/are being considered. Residents may want to know that factors outside Tampa Bay Water's purview have been considered, such as breaking apart infrastructure and reducing demand. People are becoming aware of options and may want an intermediary option. They may want to know which option is considered the riskiest. Research suggests the public would want distance and more treatment.



- The conservation piece should be put together with the demand piece, so the public understands the whole picture and how their actions can affect demand and need.
- On terminology, FDA defines purified water for the bottled water industry as a process that deionizes the water and/or uses membrane separation processes; reverse osmosis would meet that definition.

#### 21.1.4 Focus Groups

April 11, 2017, and Aug. 21, 2017, Tampa Bay Water conducted focus groups to further explore perceptions of water quality and safety in adults, 25-54. The focus groups were a result of resident concerns for water quality as identified in the 2015 public opinion survey. The April 2017 focus group explored what to say or do to give residents more confidence in the safety and quality of their tap water. This focus group also tested residents' perceptions of bottled and tap water. A few key findings of this research, found in Appendix 21D, included:

- Terminology that communicates safety: certified, consistent, clean, tested
- Trusted sources of information: Florida Department of Health, Florida Department of Environmental Protection
- Trusted source for certifying safety: Florida Department of Health
- Approaches for convincing the public of safety: a video showing water being tested, Florida Department of Health "seal of approval," scientific comparisons of tap and bottled water



The input received at the April 2017 focus group was used to develop public information materials that were tested in the August 2017 focus group. Focus group participants were asked to provide input on seven social media posts, five short video vignettes, a video (with and without sound) and a microsite that contained the video, a quiz and information about water quality. The input from this focus group, detailed in Appendix 21E, was used to refine the campaign before it was launched.

### 21.1.5 Water Quality Campaign and Microsite (tampabayh2o.com)

The Water Research Foundation has done extensive research on developing reuse projects. In both its Model Communications Plan for Increasing Awareness and Fostering Acceptance of Direct Potable Reuse and Best Practices for Developing Indirect Potable Reuse Projects, the Foundation recommends



that utilities “establish the water agency and investment as the source of water quality.” This builds confidence and trust in the water utility and its current supply and can facilitate development of alternative source projects.

Tampa Bay Water and the project team developed a water quality campaign (see Appendix 21F) based on these recommendations and after seeing the results of the 2015 public opinion survey and subsequent input from the 2017 focus groups. Campaign elements included digital display ads, digital audio and video, as well as social media that encouraged residents to visit a dedicated microsite, tampabayh2o.com, to

learn more about water quality and take an online quiz. The advertising campaign generated more than 14 million impressions, with 58,657 website visits, 956 video views and 877 completed quizzes. All campaign elements were designed to be customizable, so member governments could include their respective logos or seals and use the campaign on their social media platforms, if they chose.

### 21.1.6 Fact Pack and Web Content

To provide more information on the Long-term Master Water Plan, Tampa Bay Water developed an informational fact pack. The fact pack, shown in Appendix 21G, consisted of a folder and fact sheets on the individual project concepts. The folder contained copy and graphics that explained the overall Long-term Master Water Plan, and each fact sheet educated readers on the different concepts under consideration, including desalination, aquifer storage and recovery, and surface water expansion. Printed fact packs were distributed at events and speakers bureau engagements. The information was also posted online at tampabaywater.org and futurewater.org.



### 21.1.7 Speakers Bureau

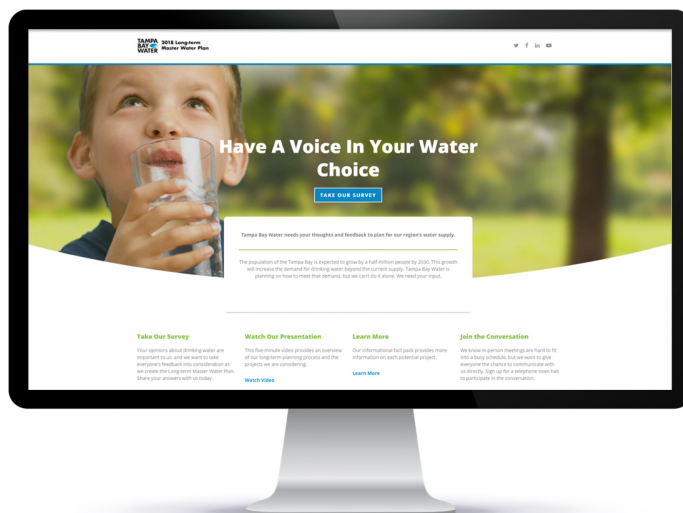
In 2018, Tampa Bay Water’s speaker’s bureau focused primarily on the Long-term Master Water Plan. To



educate and inform audience members, the project team developed an automated PowerPoint that highlighted water quality, future water needs, and discussed potential new sources to meet those needs (Appendix 21H). The automated PowerPoint was posted on the Long-term Master Water Plan microsite, futurewater.org, and used in presenting to more than 300 people at 18 different community groups. After each speakers bureau presentation, staff answered questions from attendees and encouraged residents to visit futurewater.org to learn more, opt-in to telephone town hall meetings, and take an online survey.

### 21.1.8 Dedicated Microsite (futurewater.org) and “Have a Voice” Campaign

Tampa Bay Water launched a microsite in February 2018 dedicated to educating residents and soliciting feedback. Futurewater.org featured the agency’s automated PowerPoint video of the long-term planning process and potential projects, the informational fact pack with more detailed discussion of each project concept, a link to the agency’s online survey, and a link where visitors could sign up to participate in the agency’s three telephone town hall meetings. From February through August 2018, the site had 82,800 visitors. Screenshots of the site are included in Appendix 21I.



Much of the web traffic at futurewater.com is due to Tampa Bay Water’s digital marketing campaign, “Have a Voice.” This campaign encouraged residents to have a voice in their water choice by visiting futurewater.org and taking the online survey. The campaign featured Facebook and Instagram ads, retargeting display ads, pay-per-click ads, email marketing campaign and ABC Action News online ads. The campaign ran periodically from February through April 2018 and garnered more than 11.7 million

impressions, produced 82,800 website visits or clicks, and a .71% click-through rate. Campaign ads and more detailed results can be found in Appendix 21J.

### 21.1.9 Online Survey

From Feb. 2, 2018, through June 1, 2018, residents were able to take an online survey to provide input on potential future water projects. During this timeframe, 1,644 surveys were completed. The online survey provided a snapshot of respondents' opinions; however, this survey should be considered qualitative input due to limitations. Respondents to this survey do not represent a probability sample of the general populations and the results cannot be considered statistically valid. For example, the online survey responses do not equally represent each member county. Additionally, it lacks input from low income residents and those without regular access to email or the Internet. Qualitative input of note from this survey is as follows:

- Of the 1,400 respondents that ranked selection criteria in order of importance, 74% ranked cost as their least important criterion behind reliability and environmental stewardship.
- When asked: would you drink cleaned, high quality tap water that came from:
  - Groundwater from the Florida Aquifer - 84% said yes, 16% said no
  - River water - 79% said yes, 21% said no.
  - Reclaimed water - 32% said yes, 68% said no.
  - Desalinated seawater – 75% said yes, 35% said no
- Project concepts with the highest level of willingness to drink the water are those that use current sources: seawater desalination (69-73%), surface water (72%). Among the reclaimed projects, aquifer recharge and withdrawal had 58% willingness to drink the water, aquifer recharge with surface water augmentation had about 51% willing to drink the water, and direct potable reuse trailed with only 39% willing to drink the water

Full survey results are available in Appendix 21J.

### 21.1.10 Telephone Town Hall Meetings

In an effort to reach as many residents as possible within Tampa Bay Water's service area, the project team held three telephone town hall meetings in 2018: Feb. 22, March 15, and April 18. More than 67,000 calls were made to land lines, those who opted in to the calls, and texts were sent to mobile phones to solicit participation. Each telephone town hall was interactive, with staff presenting in three short segments, each followed by a live question and answer session. Over the three calls, 1,400 people connected and stayed on the call for some period of time. Over the course of the entire one-hour events, from 45 to 110 people stayed on for at least 30 minutes. Most questions centered on water quality, particularly concerns regarding reclaimed water quality. Reports from each of the telephone town hall meetings are available in Appendix 21K.



#### 21.1.11 18.2 Summary of 2018 Public Opinion Survey Findings

From June 16, 2018 to June 26, 2018, Downs & St. Germain Research conducted a telephone and internet survey of 1,200 randomly selected households in the Tampa Bay Water service area. The margin of error for responses from the three-county service area is 2.8 percentage points, and it is 4.9 percentage points for each county. If 100 identical studies were conducted, results from 95 of those studies would be within 2.8 percentage points of the results that would be obtained if all residents in the Tampa Bay Water service area were interviewed. The full survey and results report are provided in Appendix 21L and the following are key findings from the 2018 survey related to the Long-term Master Water Plan:

- Water quality remains a priority among residents. The percentage of residents who say they drink tap water is down from 60% in 2015 to 56% in 2018. Fifty-three percent think bottled water is safer to drink than tap water.
- When asked about protecting water resources, 82% of respondents believe there should be more comprehensive rules and regulations to protect the region's water resources, while fewer than one in ten (8%) disagrees.
- Willingness to drink reclaimed water ranges from 33% (clean, blend, and send) to 39% (clean, redeposit, withdraw, treat, and send) depending on the treatment process. This narrow range of results suggest that people think all treatment methods for reclaimed are similar in terms of effectiveness or people do not really understand treatment processes and how they affect the quality of drinking water.
- Sixty percent of respondents say they do care what the source of new water supplies is if the quality remains the same or better. The reasons cited as to why source is important include:
  - To make sure it's safe – 36%
  - I want to know where my water comes from – 30%
  - To make sure it's a source I would be okay drinking from – 25%
  - To protect the environment – 22%
- Respondents are more willing to drink water from existing sources than from reclaimed water. Percentage of residents who are willing to drink tap water from source options are as follows:
  - Floridan Aquifer - 69%
  - River water – 56%
  - Seawater – 53%
  - Reclaimed water – 30%
- As uses of reclaimed water become more personal, willingness to completely accept these sources declines precipitously (Table 21-1).

**Table 21-1: Willingness to Accept Reclaimed Water by Use Type**

| Uses of Reclaimed Water   | Percentage of Responses          |                                    |
|---------------------------|----------------------------------|------------------------------------|
|                           | Somewhat + Completely Acceptable | Somewhat + Completely Unacceptable |
| Gardening and Landscaping | 85%                              | 10%                                |



| Uses of Reclaimed Water                      | Percentage of Responses          |                                    |
|----------------------------------------------|----------------------------------|------------------------------------|
|                                              | Somewhat + Completely Acceptable | Somewhat + Completely Unacceptable |
| Irrigation                                   | 81%                              | 12%                                |
| Industrial Use                               | 74%                              | 14%                                |
| Household Use: Laundry, Showers, Dishwashers | 57%                              | 35%                                |
| Drinking Water                               | 37%                              | 53%                                |

## 21.2 Findings and Implications with Respect to Potential New Sources

The Long-term Master Water Plan public education and outreach effort provided valuable insights for the project team and Tampa Bay Water. The totality of input received is presented to help inform Tampa Bay Water's board of directors as it selects projects for further evaluation and possible implementation. The input was also factored into the project scoring with existing sources ranked higher from a public acceptance perspective than new alternative sources. Key findings include:

- Water quality remains a priority among residents. Less than 60% of survey respondents currently drink their tap water. Waning confidence in the current water supply will complicate public acceptance of an alternative supply that has more complex water quality concerns than the existing sources.
- Protecting the Floridan Aquifer is a priority for residents. Residents expressed concern about any activity that could harm the aquifer, including fracking, aquifer recharge and excessive groundwater pumping that would allow saltwater intrusion.
- Government trust plays a role in public acceptance. Residents are keenly aware of water crises that have occurred across the country (e.g. Flint, Michigan) and are also attuned to problems that have occurred statewide and locally (surface water problems, tap water quality concerns, wastewater overflows, etc.).
- Given the concern for water quality and the mistrust of government, it is not surprising that residents favor existing sources (groundwater, river water and desalinated seawater) over reclaimed water. Health and safety are the top concerns for reclaimed water cited by residents.
- Conservation and growth are also factors that residents cite when discussing the need for new water supplies. Reducing demand and eliminating waste is important to residents. Residents want to know that the resource is being used wisely and efficiently and see conservation as an important step before new supplies are built.

All of the public input received over the past three years will be used to tailor project-specific public information and outreach programs for projects short-listed by the Board in December 2018. Input will be used to develop key messages, educational elements, outreach programs and more to ensure residents are fully informed and engaged as the projects move through final design. Input gathered in the next phase will be presented to Tampa Bay Water's board of directors to inform its decision in selecting the next water supply for the Tampa Bay region.

**THIS PAGE INTENTIONALLY LEFT BLANK**



## 22. Implementation Plan for Recommended Future Water Supply Projects

Section 16 describes the shortlisted projects for additional feasibility study as part of this the Long-term Master Water Plan (LTMWP) to meet the initial phase of the regional water supply needs. These projects are:

- New Groundwater Treatment Plant via Net Benefit from SHARP Program
- Tampa Bay Seawater Desalination Plant Expansion with Existing Source Water
- Regional Surface Water Treatment Plant Expansion with Existing Source Water

The goal of additional feasibility studies is to select one of the above projects for implementation to meet the initial regional water supply needs. As described in Section 15, either of the remaining projects or another one of the shortlisted projects can then be coupled with the selected project to meet the long-term regional supply needs within the 2040 planning period.

One factor that affects the timing of these project is which project is built to meet the needs of south Hillsborough County as discussed in Section 7. The projects shortlisted for further evaluation to meet the short-term needs of south Hillsborough County by 2025 are:

- New Groundwater Wellfield and Treatment Plant via Net Benefit from SHARP Program
- Pipeline from the Regional Surface Water Treatment Plant site to the Balm area of south Hillsborough County

The Groundwater Wellfield and Treatment Plant not only meet the short-term water supply needs of south Hillsborough County but also provide additional supply to the entire region. If chosen, this water supply project would affect when another water supply project will be required to meet the overall regional demand. As a result, a major consideration for both the regional supply and south Hillsborough County projects is determining when to finalize a decision on what project to build and when it should be built to ensure that both regional and south Hillsborough County needs are met in a timely manner. This section summarizes the preliminary implementation plan for these projects based on the current demand projections, but also addresses the potential impacts depending on which project is selected to meet the short-term needs for south Hillsborough County. The implications of other aspects of the master plan on the project timing are also discussed, including:

- Optimization of existing facilities
- Implementation of demand management
- Tampa Augmentation Program (TAP)
- Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19%
- Water Shortage Mitigation Plan

## 22.1 Timing and Phasing Under Current Demand Projections

The current demand projections as discussed in Section 4 and presented in Figure 22-1 indicate that up to 10 mgd of new regional water supplies is required by 2028 (Phase 1) and an additional 10 mgd by 2035 (Phase 2) to meet the projected needs of 20 mgd for the entire region within this planning period.

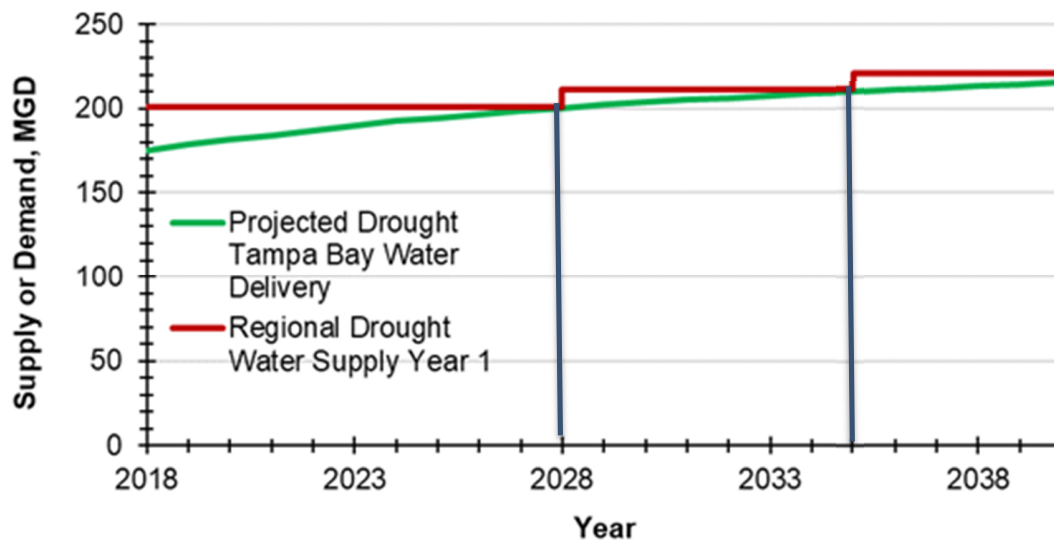


Figure 22-1: Regional Supply and Projected Demands used in the LTMWP Planning Process

The shortlisted projects for additional feasibility will provide additional supply by 2028; however, due to yield limitations for each of these projects, the actual timing of a second water supply project in Phase 2 (to obtain a total new supply of 20 mgd) depends on which project is implemented as part of the Phase 1 as summarized in Table 22-1.

Table 22-1: Preliminary Project Timing of 2<sup>nd</sup> Phase Based on Current Demand Projections

| Project                                                                                                   | Potential Yield if Implemented in Phase 1 (mgd) | Estimated Year for Phase 2 to Obtain 20 mgd |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------|
| New Groundwater Wellfield and Treatment Plant using Aquifer Recharge Credits from the SHARP/SHARE Program | 7.5                                             | 2033                                        |
| Desalination Water Treatment Plant Expansion with Existing Source                                         | 10                                              | 2035                                        |
| Regional Surface Water Treatment Plant Expansion with Existing Source                                     | 10                                              | 2035                                        |

The typical timing to plan, design, permit and construct a new water supply projects through a traditional design bid build process is eight to 10 years, depending on the project. The estimated timing for

additional feasibility, conceptual design, property acquisition, permitting, detailed design and construction for the Phase I Project is presented in Figure 22-2. Based on this preliminary schedule, a decision for which of the shortlisted projects to proceed with should be made no later than December 2022, before detailed design is initiated.

| Activity                     | Year |      |      |      |      |      |      |      |      |      |
|------------------------------|------|------|------|------|------|------|------|------|------|------|
|                              | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
| Additional Feasibility Study |      |      |      |      |      |      |      |      |      |      |
| Conceptual Design            |      |      |      |      |      |      |      |      |      |      |
| Property Acquisition         |      |      |      |      |      |      |      |      |      |      |
| Design                       |      |      |      |      |      |      |      |      |      |      |
| Permitting                   |      |      |      |      |      |      |      |      |      |      |
| Bidding and Construction     |      |      |      |      |      |      |      |      |      |      |
| Public Information           |      |      |      |      |      |      |      |      |      |      |

Figure 22-2: Preliminary Schedule for Phase 1 Implementation of Regional Water Supply Project

## 22.2 Implications of South Hillsborough County Projects

Hillsborough County is anticipating significant growth, particularly in the south Hillsborough County region as described in Section 7 of this report. The forecasted growth projected by Hillsborough County is more accelerated than Tampa Bay Water's projections for Hillsborough County. For this Master Water Plan, the County's projections were used to determine when additional water supply is needed in south Hillsborough County to provide a more conservative planning approach. The water supply projections for south Hillsborough County are presented in Figure 22-3. Coincidentally, these projections show a similar long-term water supply need as the regional water supply needs over the 2040 planning period of 20 mgd.

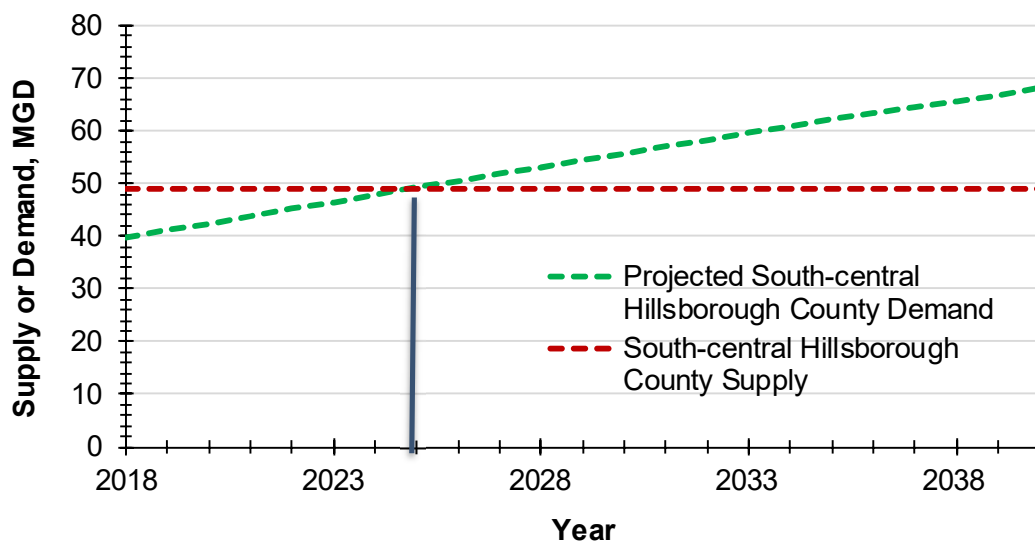


**Figure 22-3: South-central Hillsborough County Supply and Projected Demands used in the LTMWP Planning Process**

Based on these projections and the existing available supplies to south Hillsborough County, additional water supply is required in that region by 2025. The estimated timing for additional feasibility, conceptual design, property acquisition, permitting, detailed design and construction for either of the shortlisted supply projects for south Hillsborough County is presented in Figure 22-4.

| Activity                     | Year |      |      |      |      |      |      |
|------------------------------|------|------|------|------|------|------|------|
|                              | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
| Additional Feasibility Study | ■    | ■    |      |      |      |      |      |
| Conceptual Design            |      | ■    | ■    |      |      |      |      |
| Property Acquisition         |      | ■    | ■    |      |      |      |      |
| Design                       |      |      | ■    | ■    | ■    |      |      |
| Permitting                   |      |      |      | ■    | ■    | ■    |      |
| Bidding and Construction     |      |      |      |      | ■    | ■    | ■    |
| Public Information           | ■    | ■    | ■    | ■    | ■    | ■    | ■    |

**Figure 22-4: Preliminary Schedule for Implementation of South Hillsborough County Project**

Based on this preliminary schedule, a decision for which of the south Hillsborough County project to proceed with should be made no later than February 2020, before detailed design is initiated, to complete the project by the 2025 timeframe. Additional feasibility is required to confirm potential pipeline routes and property requirements for both projects, the yield and available credits associated with SHARP/SHARE.

If the regional pipeline project to the new Balm area point of connection is selected as the project to meet the needs in south Hillsborough County, the timing of the regional water supply projects will not be

impacted. A new regional supply will still be required by 2028 as discussed in Section 22.1 because the new pipeline does not bring new supplies into the region but only addresses the water supply limitations in south Hillsborough County.

The new pipeline would supply as much as 25 mgd to the south Hillsborough County area. Thus, additional supply to the south Hillsborough County area will not be required until after 2040 as shown in Figure 22-5.

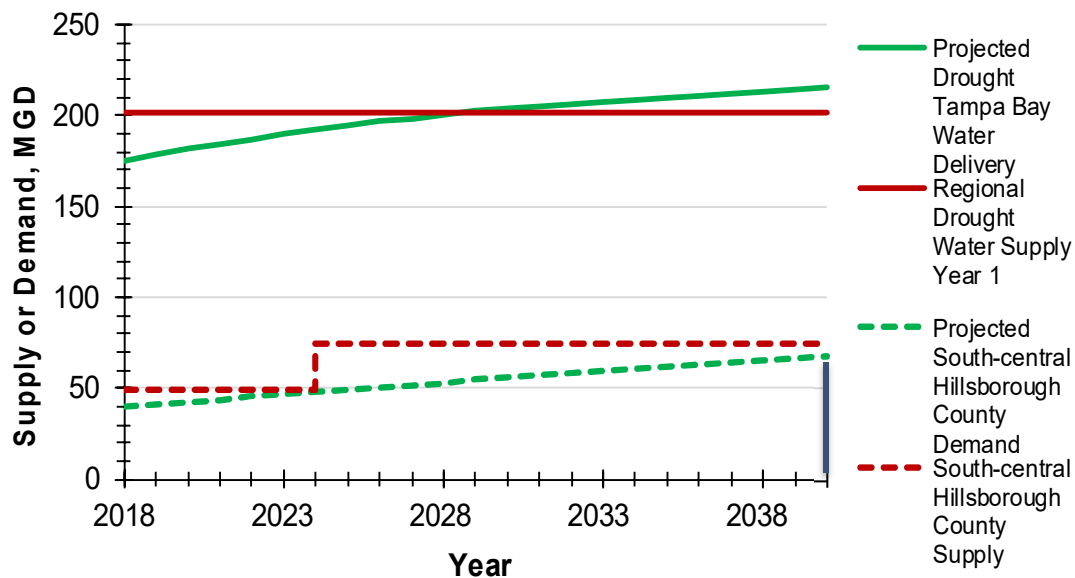


**Figure 22-5: Estimated Impact on Timing of New Regional Supply if Pipeline is Installed to Meet South Hillsborough County Supply Needs**

However, if the new Groundwater Treatment Plant project is selected as the solution for south Hillsborough County supply needs, the timing of Phase 1 of the regional supply project could be delayed until 2033 as presented in Figure 22-6.

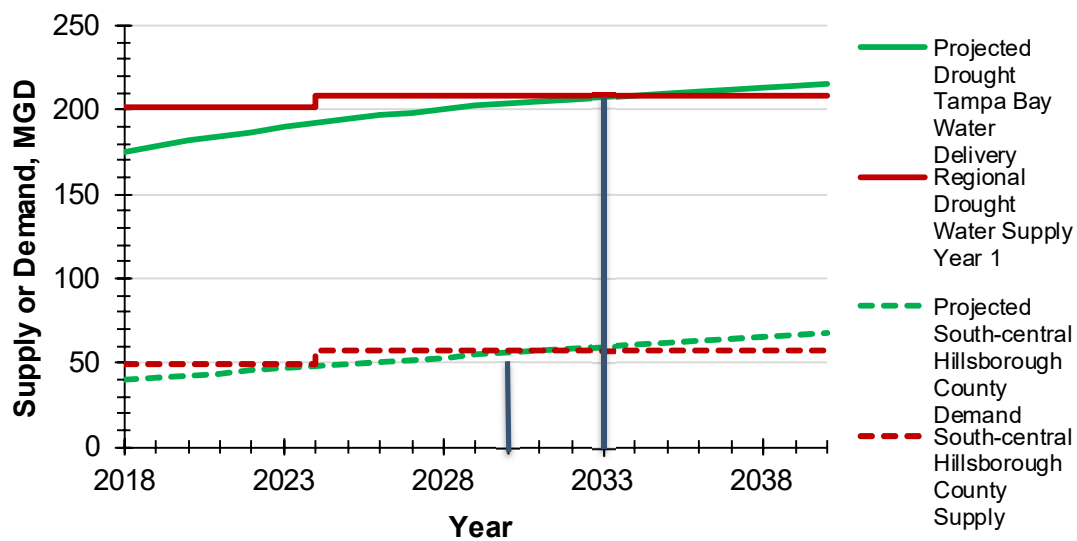


**Figure 22-6: Estimated Impact on Timing of new Regional Supply if New Groundwater Treatment Plant is Constructed to Meet South Hillsborough County Supply Needs**

The new Groundwater Treatment Plant provides up to 7.5 mgd of additional supply to both south Hillsborough County and the region. Based on this additional supply, the next regional project could be delayed until 2033. However, because the south Hillsborough County demand projections increase at a rate that is faster than the regional supply projections, additional supply will be required in south Hillsborough County by 2030. This could be met by any of the following projects for which additional feasibility would have already been completed:

- Installation of a smaller pipeline from the Regional Surface Water Treatment Plant to the new Groundwater Treatment Plant area to supplement supplies within the south Hillsborough County region. This would eventually require an expansion of the Regional Surface Water Treatment Plant to increase the available regional water supplies.
- Expansion of the Groundwater Treatment Plant by obtaining additional groundwater recharge credits from an expansion of SHARP (if available).
- Expansion of the Tampa Bay Seawater Desalination Plant.

A summary of the timing implications for the regional supply projects depending on which project is implemented for south Hillsborough County is included in Table 22-2.

**Table 22-2: Summary of Timing Implications for Regional Supply Projects Based on South Hillsborough County Project**

| Condition                                                                                       | Phase 1 | Phase 2                  |
|-------------------------------------------------------------------------------------------------|---------|--------------------------|
| Current regional demand projections without consideration of south Hillsborough County projects | 2028    | 2033-2038 <sup>(1)</sup> |

| Condition                                                                                         | Phase 1 | Phase 2                  |
|---------------------------------------------------------------------------------------------------|---------|--------------------------|
| If a regional pipeline is installed to meet south Hillsborough County needs by 2025               | 2028    | 2033-2038 <sup>(1)</sup> |
| If a new groundwater treatment plant is installed to meet south Hillsborough County needs by 2025 | 2033    | Beyond 2040              |

<sup>(1)</sup> Depends on which regional supply project is implemented in Phase 1

<sup>(2)</sup> The new groundwater treatment plant installed in 2025 serves as the south Hillsborough County solution and provides additional water supply to the region

### 22.3 Implications on Timing of Other Master Plan Components

As indicated in the beginning of this section, other components of this LTMWP that will affect the timing of the proposed projects include:

- Optimization of existing facilities
- Implementation of demand management
- Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19%
- Water Shortage Mitigation Plan
- Tampa Augmentation Program (TAP)

These components and the potential impacts, which are described further below, mainly impact the timing of the regional water supply projects but may have some impact on the later phases of the supply projects required to serve south Hillsborough County. Because of the uncertainty of the exact benefit of each component, the potential timing impacts are described below as independent impacts; however, they could be coupled together to have even greater impacts as described under the TAP scenario.

#### Optimization of Existing Facilities

As discussed in Section 17, Tampa Bay Water has the opportunity to optimize its existing Regional Surface Water Treatment Plant and Tampa Bay Seawater Desalination Plant, which has the potential to increase the available regional supplies up to 10 mgd, approximately 5 mgd from each facility. If both facilities are successfully optimized before 2028, the Phase 1 regional supply project could be delayed until approximately 2035.

Additional supply from the Seawater Desalination Plant could also be directly delivered to south Hillsborough County which has the potential to delay the second phase of a supply project to south Hillsborough County until approximately 2034 assuming a new Groundwater Treatment Plant (7.5 mgd) is constructed initially to meet the south Hillsborough County needs. If regional supplies are increased due to optimization of both facilities and the new Groundwater Treatment Plant is constructed, the need for additional regional supply could be delayed until beyond the 2040 planning horizon.



### Implementation of Demand Management

Implementation of the Demand Management Program as described in Section 20 can reduce the annual average demands within the region by approximately 11 mgd within the 2040 planning period, which maximizes the availability of the existing supplies. This program likely will not affect the timing of Phase 1 for either the regional supply or south Hillsborough County project because the benefits of implementing a demand management program may take several years to consistently observe, but demand management could delay the Phase 2 regional supply project until beyond the 2040 planning horizon. The impact of demand management on the long-term supply needs in south Hillsborough County is uncertain, thus demand management has not been assumed to impact the timing of south Hillsborough County projects herein.

### Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19%

Increasing the permitted withdrawal capacity of the Alafia River from 10% to 19% will potentially increase the yield of the Surface Water Treatment Plant Facility by approximately 2 mgd based on the modeling discussed in Section 8. This could result in a delay of the Phase 1 regional supply project by approximately 2 years and a delay of the Phase 2 regional supply project by 3 years.

### Water Shortage Mitigation Plan

The purpose of the Water Shortage Mitigation Plan (WSMP) is to provide Tampa Bay Water and its member governments a strategy for identifying and responding to water supply shortages caused by extended hydrologic drought conditions. The WSMP does not affect long-term demand, nor is it likely to impact the timing of Phase 1 or Phase 2 projects, but rather is a plan for Tampa Bay Water to meet member government water needs during extended hydrologic droughts with its existing regional system in an environmentally sustainable manner. Implementation of this plan would potentially allow the Agency to meet demands during infrequent but extended drought events, avoiding infrastructure investment specifically for these events that would seldom be used. Thus, the WSMP allows the Long-term Master Water Plan to focus on long-term water supply needs for the future.

### Tampa Augmentation Program

On-going feasibility work is being conducted by City of Tampa to confirm the potential yields of the City of Tampa's Augmentation Project (TAP) and Memorandum of Understanding (MOU) between City of Tampa and Tampa Bay Water is under development. The estimated completion date for the project is currently 2027. If successful, the City of Tampa will be able to self-supply by that date, thus eliminating the City's need for raw surface water augmentation from the Tampa Bypass Canal via the Harney Canal, which will make available approximately 1.8 mgd of additional source water on an annual average basis.<sup>1</sup> This project also has the potential to reduce the City of Tampa's dependence on Tampa Bay Water, which allows Tampa Bay Water to reallocate 6 mgd of regional supply that is currently budgeted to the City on an annual average basis, as well as that which is projected to be needed by the City over the 2040 planning horizon (a total of 16 mgd, including the annual budgeted allocation of 6 mgd). Based on the reduced demands and potential increase in available supplies, the implementation of TAP has the

---

<sup>1</sup> Refer to descriptions of Runs 108 and 109 in Appendix 8B

potential to delay the future water supply projects; however, the timing depends on which project is implemented as the south Hillsborough County solution and if other water supply improvements are implemented such as optimization of the existing facilities or increasing the permitted withdrawals of Alafia River.

Although City of Tampa estimates TAP to be implemented by 2027, approximately 3 years of operational data from TAP may be required before Tampa Bay Water can realize the benefits from TAP and depend on it to offset future supplies because of the uncertainty associated with yields, water quality, and permitting requirements. This may push off the potential date of when regional benefits may be observed from TAP until 2030. Based on the current regional demand projections, a Phase 1 regional supply project is needed by 2028 if the south Hillsborough County solution is a new pipeline. To avoid constructing a large water supply project by this date before understanding the benefits of TAP by 2030, Tampa Bay Water could implement one of the other water supply improvements previously mentioned, which could delay the timing of the Phase 1 regional supply project. For example, if Tampa Bay Water optimizes its existing facilities, that could extend the decision point of the Phase 1 project until 2035, which provides adequate time for Tampa Bay Water to assess the benefits of TAP and potentially defer any future regional water supply projects beyond 2040.

If the south Hillsborough County solution is a new groundwater treatment plant via net benefit from the SHARP program, this delays the need for additional regional water supplies until 2033, which also provides adequate time to confirm the viability of the TAP project before proceeding with a Phase 1 water supply project. If the TAP project provides the benefits as indicated above, future regional supply projects for both Phases 1 and 2 can be delayed beyond 2040. However, regardless of TAP implementation, additional supply would still be required to meet the needs of south Hillsborough County beyond the provision of 7.5 mgd through the new groundwater treatment plant. Project options for additional supply in south Hillsborough County are described in Section 22.2.

### Summary

Table 22-3 summarizes the timing implications of the other Master Plan components on both the regional and south Hillsborough County projects. Each row reflects a different scenario, comprised of a given “condition” and an assumed south Hillsborough County supply project (either a pipeline or new groundwater treatment plant via net benefit from the SHARP program). Depending on the condition and the selected south Hillsborough County supply project, anticipated implementation years for project completion are indicated for both regional supply projects and south Hillsborough County supply projects. A brief explanation of each condition follows:

- Condition 1 is the “baseline schedule”, which reflects the necessary timing of regional supply projects without consideration of the south Hillsborough County supply projects.
- Condition 2 is the revised baseline schedule considering the impacts of which south Hillsborough County supply project is implemented. For example, under Condition 2, if a pipeline is installed as the south Hillsborough County solution, the timing of the Phase 1 and 2 regional supply projects will not be impacted and are the same as Condition 1. If a new groundwater treatment plant through the use of SHARP credits is implemented as the south Hillsborough County solution, then the Phase 1 regional supply project can be delayed from

2028 to 2033, and the Phase 2 regional supply project can be delayed from 2033-2038 to Beyond 2040.

- Conditions 3 reflects the impacts on the timing of the regional supply projects and south Hillsborough County projects compared with Condition 2 if the existing Surface Water Treatment Plant and the Desalination Facility are optimized.
- Condition 4 reflects the impacts on the timing of the regional supply projects and south Hillsborough County projects compared with Condition 2 if the demand management project is implemented.
- Condition 5 reflect the impacts on the timing of the regional supply projects and south Hillsborough County projects compared with Condition 2 if Alafia permit is increased from 10% to 19%.
- Condition 6 reflects the impacts on the timing of the regional supply projects and south Hillsborough County projects compared with Condition 2 if the Water Shortage Mitigation Plan is implemented.
- Condition 7 reflects the impacts on the timing of the regional supply projects and south Hillsborough County projects compared with Condition 2 if TAP is implemented but also indicates the potential effects of implementing Conditions 3, 4, or 5 concurrent with TAP.

**Table 22-3: Summary of Potential Timing Implications for other Master Plan Components**

| Condition No. and Description |                                                                         | Selected South Hillsborough County Supply Option <sup>(1)</sup> | Schedule of South Hillsborough County Supply Project |             | Schedule of Regional Supply Project |                                 |
|-------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------------------------------------|-------------|-------------------------------------|---------------------------------|
|                               |                                                                         |                                                                 | Phase 1                                              | Phase 2     | Phase 1                             | Phase 2                         |
| 1                             | Current regional demand projections (Baseline Schedule)                 | N/A                                                             | NA                                                   | NA          | 2028                                | 2033-2038 <sup>(2)</sup>        |
| 2                             | Current regional demand with south Hillsborough County Projects         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | 2033-2038 <sup>(2)</sup>        |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2033                                | Beyond 2040                     |
| 3                             | If SWTP and Desalination Plant optimized by 2028 <sup>(3)</sup>         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2035                                | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2034        | Beyond 2040                         | Beyond 2040                     |
| 4                             | If full Demand Management Program is implemented by 2030 <sup>(4)</sup> | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | Beyond 2040                         | Beyond 2040                     |
| 5                             | If Alafia withdrawal permit is increased to 19% by 2028 <sup>(5)</sup>  | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2030                                | 2036-Beyond 2040 <sup>(2)</sup> |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2036                                | Beyond 2040                     |
| 6                             | If Water Shortage Mitigation Plan is implemented <sup>(6)</sup>         | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028                                | 2033-2038 <sup>(2)</sup>        |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | 2033                                | Beyond 2040                     |
| 7                             | If Tampa Augmentation Project is implemented by 2027 <sup>(7)</sup>     | Pipeline                                                        | 2025                                                 | Beyond 2040 | 2028-Beyond 2040 <sup>(8)</sup>     | Beyond 2040                     |
|                               |                                                                         | New WTP via SHARP credits                                       | 2025                                                 | 2030        | Beyond 2040                         | Beyond 2040                     |

<sup>(1)</sup> Assuming the pipeline to south Hillsborough County has a capacity of 20 mgd or more, and the groundwater treatment plant provides 7.5 mgd to the region and to south Hillsborough County through the use of SHARP credits

<sup>(2)</sup> Depends on which project is implemented in Phase 1; Phase 1 projects may range from 7.5 mgd to 12.5 mgd of yield

<sup>(3)</sup> Assumes a total of 10 mgd to the region, including 5 mgd from the Desal WTP to south Hillsborough County

<sup>(4)</sup> Assumes demand management activities increase available supply up to 11 mgd by 2030; impact of demand management on south Hillsborough County demand projections is uncertain

<sup>(5)</sup> Assumes an increase in the yield of the Regional Surface Water Treatment Plant up to 2 mgd

<sup>(6)</sup> Assumes the Water Shortage Mitigation Plan does not impact long-term supply needs

<sup>(7)</sup> Assumes 6 mgd is no longer needed by City of Tampa on an annual average basis, long-term City demands are met with self-supply, and up to 1.8 mgd annual average of additional surface water after full TAP implementation

<sup>(8)</sup> Timing could be shifted beyond 2028 if another water supply project is implemented in the near-term, such as optimization of existing facilities, to provide additional time to realize the benefits of TAP before implementing a major Phase 1 project.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 23. Recommendations

Tampa Bay Water’s Long-term Master Water Plan (LTMWP) encompasses several major components as discussed throughout this report and summarized in Figure 23-1. This document addresses each of these components and how they impact the overall LTMWP. This section summarizes the recommendations for each of these major components as it relates to meeting the long-term water supply needs of the Tampa Bay Water region through 2040 and identifies the next steps for implementation.

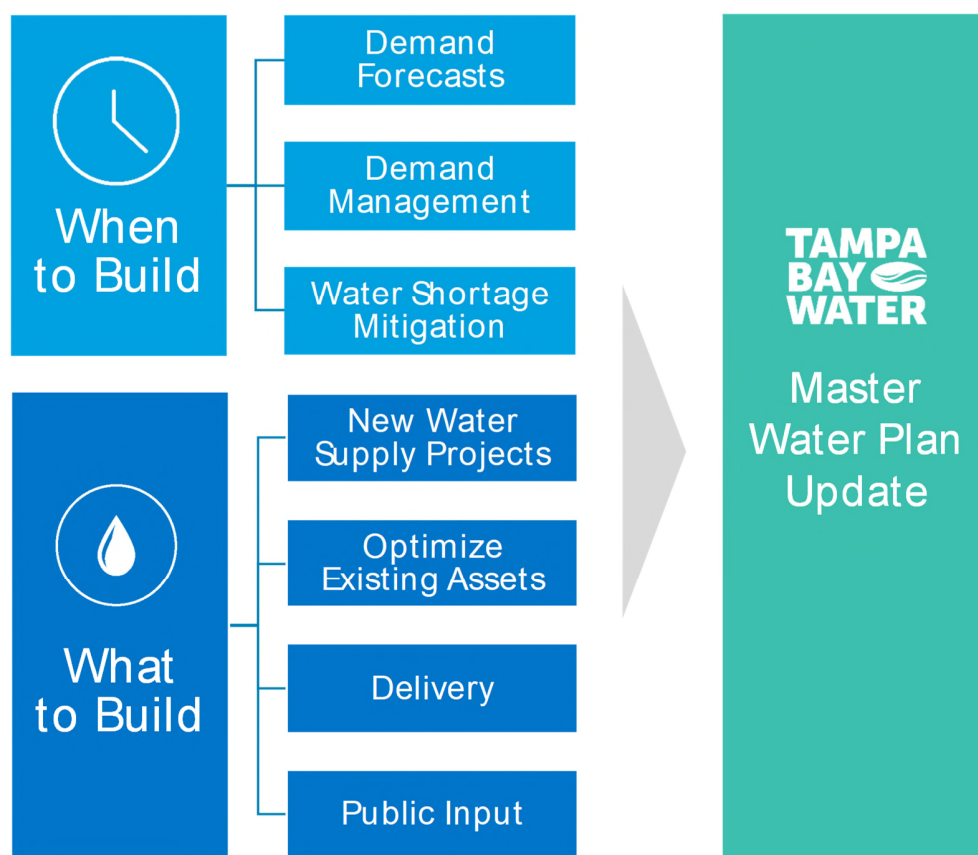


Figure 23-1: Tampa Bay Water Long-term Master Water Plan Components

### 23.1 Specific Recommendations for Each Master Plan Component

The specific recommendations for each major LTMWP component follow:

#### Demand Forecast

- Continue to update the annual demand forecast using updated socio-econometrics, regional growth pattern, and member governments billing information in order to understand regional demand growth pattern and timing of new supply sources.

- Continue annual demand forecast assessment, incorporating potential savings through demand management implementation;
- Continue to implement and further enhance Tampa Bay Water's planning and management activities to address both seasonal and severe drought events and long-term future water supply needs, all of which enables continued monitoring and assessment of existing and future water supply reliability.
- Continue to participate in State water policy and regulatory discussions to further an understanding by policy-makers of the complexities associated with developing and operating surface water supply systems.
- Understand any beneficial initiatives, such as conjunctive use approaches, that may be proposed State-wide that could also assist the agency with its planning efforts.
- Continue to monitor regional delivery to south Hillsborough County with regards to hydraulic / permitted capacity to determine potential impacts on the required timing of the selected south Hillsborough County supply project.

#### Demand Management

- Proceed with the Demand Management Implementation Plan as approved at the Tampa Bay Water August 2018 Tampa Bay Water Board of Directors meeting.
- Apply for financial support of the Demand Management Implementation Plan from the Southwest Florida Water Management District (District) through the Cooperative Funding Initiative.
- Develop an implementation strategy by April 2019 that can be implemented in a timely manner to realize proposed savings, working closely with the member governments.
- Once implemented, assess water savings and incorporate into annual demand forecast projections.

#### Water Shortage Mitigation Plan

- Continue to regularly update the Agency's Water Shortage Mitigation Plan (WSMP) to allow Tampa Bay Water to meet demands with the existing and future regional water supply system during drought events, thus allowing the LTMWP to focus on long-term water supply needs of the member governments.
- Continue working with the District for the implementation of the WSMP to address short term supply needs.

#### New Water Supply Projects

- Proceed with additional feasibility study of the three shortlisted water supply projects to confirm by December 2022 which regional supply project to move forward for implementation to meet the Phase 1 timeline of new supply by 2028:
  - New Groundwater Wellfield and Treatment Plant using Aquifer Recharge Credits from the SHARP/SHARE Program
  - Desalination Water Treatment Plant Expansion with Existing Source Water
  - Regional Surface Water Treatment Plant Expansion with Existing Source Water



- Proceed with the additional feasibility and preliminary investigation work associated with the two south Hillsborough County supply options to select by February 2020 which project to move forward for implementation to meet the south Hillsborough County supply needs by 2025:
  - New Groundwater Wellfield and Treatment Plant via Net Benefit from SHARP Program
  - New Pipeline from Tampa Bay Water's Regional Surface Water Treatment Plant to the Balm area of south Hillsborough County
- Finalize the Memorandum of Understanding (MOU) and cost for aquifer recharge credits associated with the south Hillsborough County project options.
- Continue to monitor the Tampa Augmentation Program and its feasibility to determine the potential impacts on the timing of future water supply projects.
- Continue to refine the new water supply implementation timing strategy by taking into consideration all LTMWP components. This will include a development of indicators (sign posts) and trigger mechanism for bringing in new water supply sources informed by continued annual update of demand forecast as well as demand management implementation.

#### Optimize Existing Assets

- Proceed with additional feasibility of the existing Regional Surface Water Treatment Plant and the existing Desalination Plant to optimize the existing facilities and increase potential sustainable yields for each facility.
- Continue to evaluate opportunities for optimizing and enhancing Tampa Bay Water's existing water supply systems.

#### Delivery

- Continue to perform hydraulic and other system analyses of Tampa Bay Water's regional transmission system to optimize current operations and refine plans for the projected future operating conditions and integration of new supply sources.
- Update the surge analysis in the future to account for any major changes to the system once a future project is selected, including plans for new transmission system infrastructure associated with future water supply sources.
- Confirm the hydraulics associated with integrating the selected future long-term water supply options in the coming five-year planning period once a specific project is selected. feasibility work for the recommended supply options.

#### Public Information

- Develop project-specific public information and outreach programs for the three short-listed projects and the two south Hillsborough County projects to ensure residents are fully informed and engaged as the projects move toward board selection and final design.

## 23.2 Additional Feasibly Study Recommendations for Water Supply Projects

Based on the above recommendations, additional feasibility will be required on the three shortlisted water supply projects and the two south Hillsborough County projects to confirm the yields, permittability, property requirements, and project costs. Specific additional feasibility requirements for each project are summarized in Table 23-1.

**Table 23-1: Additional Feasibility Study Recommendations for Shortlisted Projects**

| Shortlisted Regional Water Supply Projects                         | Additional Feasibility Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| New Groundwater Treatment Plant via Net Benefit from SHARP Program | <ul style="list-style-type: none"> <li>Reach consensus on a pricing approach and resulting cost for groundwater credits with Hillsborough County.</li> <li>Evaluate the siting, potential yields, and treatment requirements of a new groundwater treatment plant based on the finalized location of Hillsborough County injection wells as part of the SHARP/SHARE program.</li> <li>Perform additional groundwater modeling to confirm the withdrawal yields.</li> <li>Conduct water quality sampling to evaluate the potential water quality from the new withdrawal wells.</li> <li>Develop conceptual design of the new withdrawal wellfield and treatment plant.</li> <li>Conduct an assessment of additional property and pipeline routing that would be required.</li> <li>Develop source water quality monitoring program for proposed wellfield including data collection and criteria for key water quality parameters.</li> <li>Complete potential contamination source inventories for new Tampa Bay Water wellfield and south Hillsborough aquifer recharge areas.</li> <li>Develop comprehensive barrier assessment for groundwater supply and reclaimed water source based on the hazard assessment and critical control methodology.</li> </ul> |
| Desalination Water Treatment Plant Expansion with Existing Source  | <ul style="list-style-type: none"> <li>Evaluate potential opportunities to increase the capacity and improve the reliability of the facility.</li> <li>Conduct pilot scale testing of alternate pretreatment systems to reduce the footprint of the expansion while improving overall system reliability and providing more consistent water quality to the membranes. This includes an evaluation of alternate membranes that could increase the flux rate through the membranes while increase overall plant recoveries to limit the required footprint of the expansion.</li> <li>Conduct additional water quality sampling to evaluate future changes in influent water quality.</li> <li>Evaluate alternate intake configurations to account for the expansion.</li> <li>Evaluate concentrate management system based on changes in recovery and increases in the concentrate disposal quantities.</li> </ul>                                                                                                                                                                                                                                                                                                                                               |

| Shortlisted Regional Water Supply Projects                         | Additional Feasibility Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                    | <ul style="list-style-type: none"> <li>• Evaluate vulnerability of the facility to storm surge and infrastructure failures and opportunities to mitigate as part of the expansion.</li> <li>• Consider potential improvements based on future TECO operational changes as it relates to influent flow, water quality, and concentrate blending.</li> <li>• Confirm additional treatment and hydraulic requirements to directly feed supply to south Hillsborough County.</li> <li>• Complete preliminary permitting and modeling efforts to evaluate potential impacts to the Bay based on changes to the concentrate quality and increased flows.</li> <li>• Review and expand as-needed source water quality monitoring including collection of continuous, daily or monthly water quality data, and assessment based on monitoring thresholds and criteria for key water quality parameters.</li> <li>• Perform assessment of current and future land use activities near the facility including near future port development and transportation plans</li> <li>• Complete potential contamination source and outfall inventories near the facility.</li> <li>• Develop focused comprehensive barrier assessment for the facility based on the hazard assessment and critical control methodology.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                               |
| Surface Water Treatment Plant Expansion with Existing Source Water | <ul style="list-style-type: none"> <li>• Perform detailed capacity analysis of the existing Regional Surface Water Treatment Plant (SWTP) to identify process limitations and evaluate the feasibility of re-rating or modifying unit processes to address process limitations as required for the expansion.</li> <li>• Confirm capacity of ancillary and dewatering equipment/infrastructure using historical performance data and future design flows to confirm expansion requirements and associated costs.</li> <li>• Conduct field testing of existing biofiltration unit process or other treatment processes to evaluate the impact of operation and treatment at a higher loading rate.</li> <li>• Perform additional modeling to finalize the potential yield and withdrawal capacities from the existing sources to expand the existing SWTP.</li> <li>• Complete additional modeling and study to evaluate the feasibility of constructing a new 20 mgd surface water treatment plant at the C.W. Bill Young Regional Reservoir in lieu of expanding the existing facility. The study should evaluate the reliability and vulnerability of the new surface water treatment plant at this location to seasonality, drought conditions, and infrastructure failures.</li> <li>• Conduct a hydraulic evaluation of the raw water transmission and pumping system to accommodate the new surface water treatment plant.</li> <li>• Conduct a preliminary property assessment and piping route study for new surface water treatment plant location.</li> <li>• Review and expand as-needed existing source water quality monitoring including collection of continuous and monthly water quality data, and</li> </ul> |

| Shortlisted Regional Water Supply Projects                                                                            | Additional Feasibility Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                       | <p>assessment based on monitoring thresholds and criteria for key water quality parameters.</p> <ul style="list-style-type: none"> <li>Review and update as-needed existing potential contamination source and outfall inventories for Tampa Bypass Canal and Alafia River supplies, expand assessment to Hillsborough River watershed as-needed.</li> <li>Review and update as-needed focused comprehensive barrier assessment for surface water sources based on the hazard assessment and critical control methodology.</li> </ul> |
| Shortlisted South Hillsborough County Project                                                                         | Additional Feasibility Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| New Groundwater Treatment Plant using Aquifer Recharge Credits from the SHARP/SHARE Program                           | <ul style="list-style-type: none"> <li>Same as above Groundwater Treatment Plant project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Pipeline from Tampa Bay Water's Regional Surface Water Treatment Plant to the Balms area of south Hillsborough County | <ul style="list-style-type: none"> <li>Confirm hydraulic requirements of the proposed pipeline.</li> <li>Conduct a preliminary property assessment and piping route study for proposed pipeline, including an analysis of the water age.</li> <li>Confirm interconnect requirements with Hillsborough County.</li> <li>Finalize Memorandum of Understanding with Hillsborough County.</li> </ul>                                                                                                                                      |

### 23.3 Next Steps for Implementation

To facilitate the implementation of the LTMWP, several important next steps are required over the next 2 to 3 years to ensure decisions are made in a timely manner. These next steps are summarized in Table 23-2.

**Table 23-2: Next Steps for Master Plan Implementation Over Next 2 to 3 Years**

| Activity No. | Description                                                                                                                                 | Completion Date |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1            | Approve Long-term Master Water Plan                                                                                                         | December 2018   |
| 2            | Finalize MOU between Tampa Bay Water and Hillsborough County for south Hillsborough County projects, including cost for groundwater credits | February 2019   |
| 3            | Finalize SWFWMD co-funding applications for additional feasibility studies of shortlisted projects                                          | April 2019      |
| 4            | Develop demand management implementation strategies                                                                                         | April 2019      |
| 5            | Procure engineering services for additional feasibility studies of shortlisted projects                                                     | June 2019       |
| 6            | Obtain SWFWMD decision for co-funding of demand management and additional feasibility projects                                              | October 2019    |
| 7            | Finalize route study for south Hillsborough County projects                                                                                 | December 2019   |
| 8            | Confirm decision for south Hillsborough County projects                                                                                     | February 2020   |
| 9            | Update timing of regional projects based on south Hillsborough County project decision                                                      | February 2020   |
| 10           | Finalize additional feasibility studies of shortlisted projects                                                                             | December 2021   |
| 11           | Confirm feasibility of TAP and impact on future water supply projects                                                                       | December 2021   |

Tampa Bay Water should continue to monitor the above dates over the next few years and the impacts on the timing and prioritization of future water supply projects for the region.