# Tampa Augmentation Project

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The City of Tampa's (city) Howard F. Curren Advanced Wastewater Treatment Plant (HFCAWTP) has a permitted capacity of 96 mil gal per day (mgd), making it Florida's fourth largest treatment plant. Current flows are approximately 60 mgd, with approximately 10 mgd delivered to the south Tampa area reclaimed system on an annual average basis for residential and commercial irrigation, the Tampa International Airport for its cooling tower, the MacKay Bay Refuse-to-Energy Facility for various purposes, or HFCAWTP for use onsite. The remaining flow, averaging over 50 mgd, is discharged to Tampa Bay.

Both the city and the Tampa Bay area are growing and in need of additional water supplies. Although dual distribution systems have reduced potable water demands, they are expensive to construct and disruptive to install in the city's built-out service area. Seasonal variations in irrigation demands also make it difficult to achieve beneficial use of all the available reclaimed water supply.

In June 2016, the city initiated the Tampa Augmentation Project (TAP), a feasibility study cofunded by the Southwest Florida Water Management District (SWFWMD). This project initially considered two alternatives to deliver up to 20 mgd of reclaimed water for regional beneficial reuse by improving groundwater and surface water levels. In turn, this project will allow the city or Tampa Bay Water (TBW), the regional water supply authority, to make additional surface water withdrawals. With preliminary results from this two-year project, the project team has been able to redirect investigations toward a more promising strategy. This article documents the project's evolution and summarizes the current state of investigations.

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## Existing Regional Water Supply System

The city is a member government of TBW; however, its primary source of potable water is the Hillsborough River Reservoir. If needed to meet potable water demands, the city can receive more raw water supplies from the Tampa Bypass Canal through the Harney Canal. The city may also purchase finished water from TBW through an interconnect between the potable water systems. If needed, both raw water and potable water can also flow from the city's reservoir and finished water distribution systems back to TBW to provide additional water resources. An important element of the TAP project is determining how to integrate this new water resource into the existing regional water supply.

### Alternative I

The first TAP alternative considered constructing a 15-mi transmission pipe from HFCAWTP to the SWFWMD-owned property. Facilities on this site were to include constructed and natural wetlands, as well as engineered rapid infiltration systems. Reclaimed water delivered to the SWFWMD site would then travel both above and below the land surface to the Tampa Bypass Canal, which is part of the regional surface water supply system.

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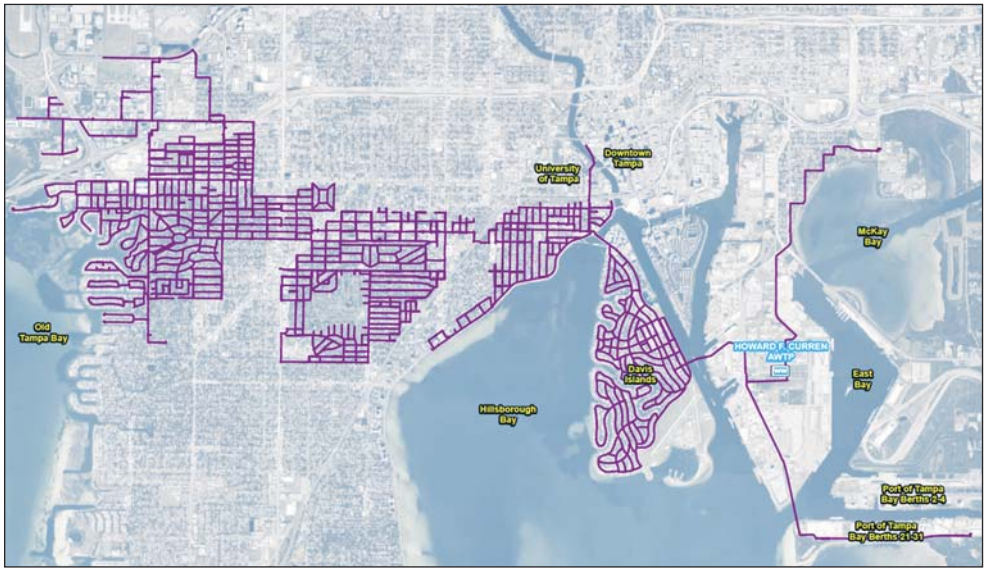


Figure 1. City of Tampa Existing Public Access Reuse System


Figure 2. Regional Potable Water Supply System Considered in the Tampa Augmentation Project

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Ultimately, any additional flows to the Tampa Bypass Canal would be diverted to the city's Hillsborough River Reservoir via the Harney Canal, thereby increasing raw water availability to the city.

*Status of Alternative 1 Investigations*

Evaluating this alternative involved conducting site-specific hydrogeologic investigations, followed up by groundwater modeling and an environmental assessment of SWFWMD property. These investigations confirmed initial concerns that the site might not be able to accommodate the target flows of 20 mgd. Subsurface investigations also determined that much of the site has a thick layer of clayey soils within 20 ft of land surface.

Groundwater modeling set the site's upper limit capacity for receiving reclaimed water to infiltration systems at less than 4 mgd, with expected water recovery in the Tampa Bypass Canal being less than 1 mgd. Similarly, an evaluation of the existing wetlands onsite found them in good health and not hydrologically altered, a positive finding for the overall health of the property's ecology; however, the excellent condition of the wetlands actually limits their use as components of a land treatment system. Based on the ecological assessment, applying the appropriate wetlands rules and numeric nutrient criteria, the total capacity of the property's wetlands is on the order of 3 mgd.

Given these limitations, Alternative 1 is infeasible. Because this determination was made relatively early in the study, the project team was able to redirect resources toward additional evaluations to support Alternative 2. The most significant change to the Alternative 1 activities was removing a pilot-scale wetland to be constructed at HFCAWTP. Funds for the pilot were repurposed into Alternative 2, which is also discussed.

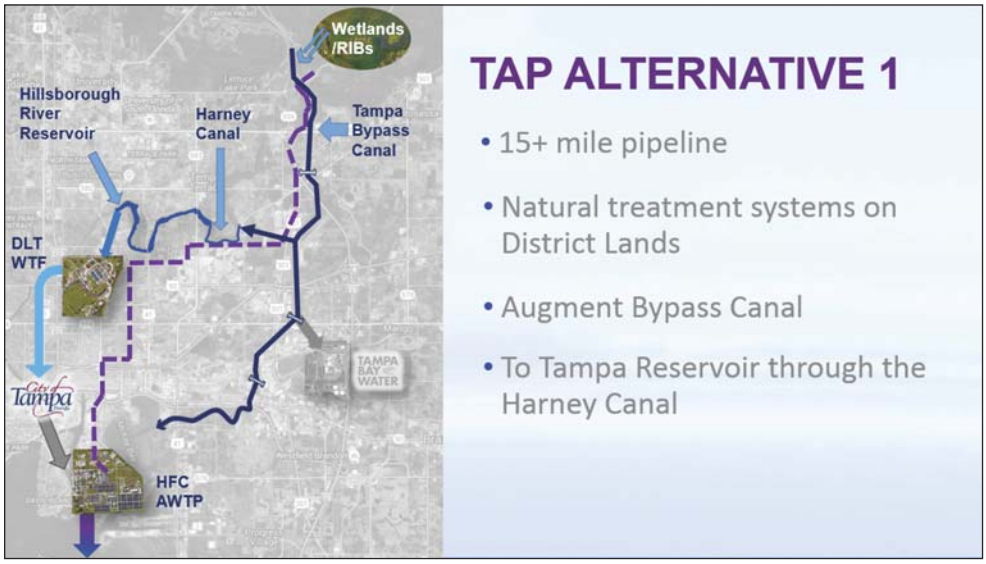


Figure 3. Alternative 1: Natural Treatment Systems on Property Owned by the Southwest Florida Water Management District

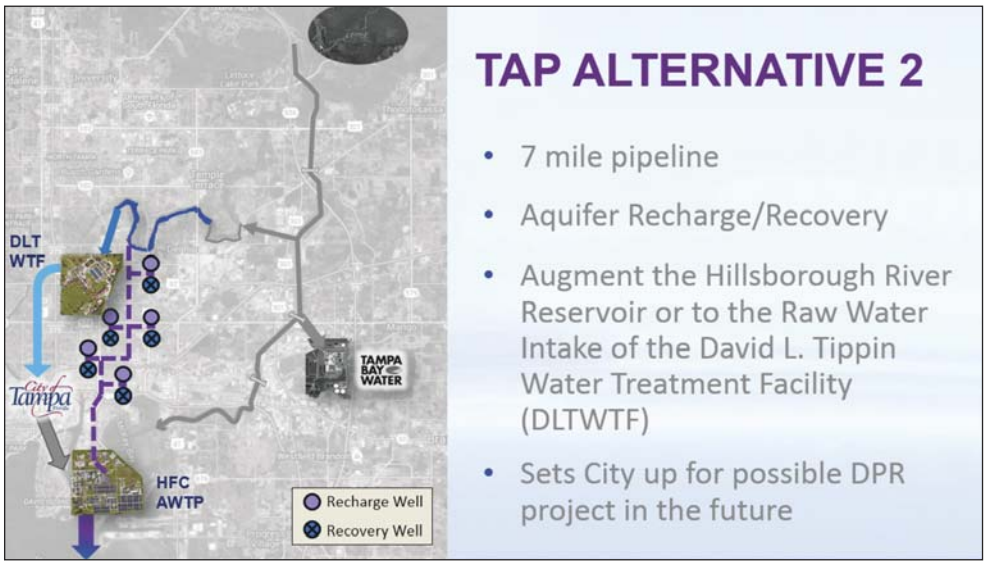


Figure 4. Alternative 2: Aquifer Recharge/Recovery System

**Alternative 2**

The goal of TAP Alternative 2 was to add to the regional water supplies while reintroducing reclaimed water into the Hillsborough River Reservoir or to the raw water intake system of the David L. Tippin Water Treatment Facility (DLTWTF) using aquifer recharge/recovery wells. In this alternative, reclaimed water would be injected into the aquifer's Avon Park formation, facilitating withdrawals from the overlying Suwanee formation. This, in turn, will increase potable water supplies for the region.

A notable difference between Alternatives 1 and 2 is the shorter transmission piping, which is approximately half of what Alternative 1 requires. Of equal importance, recharging the Avon Park formation can continue independently of surface conditions. Alternative 2 can also provide a transmission pipeline from HFCAWTP to DLTWTF, setting the city up for direct potable reuse in the future.

*Status of Alternative 2 Investigations*

During the original Alternative 2 investigations, three cores were completed in the potential recharge/recovery corridor to a depth of approximately 900 ft. This included collecting continuous cores from approximately 200 ft and performing pump tests every 50 ft to evaluate aquifer characteristics. A comprehensive set of water quality samples was taken between 300 and 350 ft and 800 and 900 ft below ground surface, corresponding to the recovery and recharge zones. The project team also used a handheld probe to take continuous measurements of pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), conductivity/salinity, and temperature throughout each depth.

Additional Alternative 2 investigations included the following:

- Constructing a full-scale recharge/recovery test well system using potable water.

- The city operates a series of aquifer storage recovery (ASR) wells as part of its potable water system, which includes the ASR-B site on the city's Woodland Terrace Park. The existing system consists of a single ASR well that injects potable water into the Avon Park formation when excess surface water is available. This water is then recovered and conveyed to the reservoir via the stormwater system.
- The TAP Alternative 2 investigations include constructing a recovery well on the Woodlands Terrace Park site. This well takes water from the Suwanee formation at an approximate depth of 350 ft below ground surface. Water recovered is returned to the reservoir through the stormwater system using the existing yard piping originally constructed for the ASR system.
- The recharge/recovery system went into operation in April 2017 and remained in operation through the end of February 2018. Water samples were collected weekly to monitor water quality changes in response to pumping. The hydrogeologic information collected in the cores and recharge/recovery system was then used to develop a groundwater model to evaluate the alternative's feasibility of increasing regional water supplies.

- Enhanced modeling efforts included two enhancements to the groundwater modeling effort that will also be made to the Alternative 2 analysis.
  - Variable density modeling will be included in the Alternative 2 analysis. This change was made in direct response to the additional information on the groundwater quality in the recharge and recovery zones made possible by the cores taken in the TAP study's recharge corridor section.
  - Geochemical modeling was also added to the groundwater modeling efforts. This will help determine the changes in reclaimed water quality as it moves from the injection zone to the recovery zone in response to pumping.

*Water Quantity Considerations*

As previously noted, the original TAP authorization targeted up to 20 mgd of reclaimed water. To verify the volume of water potentially available for TAP, approximately three years of hourly flow data were evaluated for the TAP feasibility analysis. A statistical evaluation of historical discharges to the bay was conducted, assuming the flows represent

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Figure 5. Drilling an Exploratory Core at the Woodlands Terrace Park Site

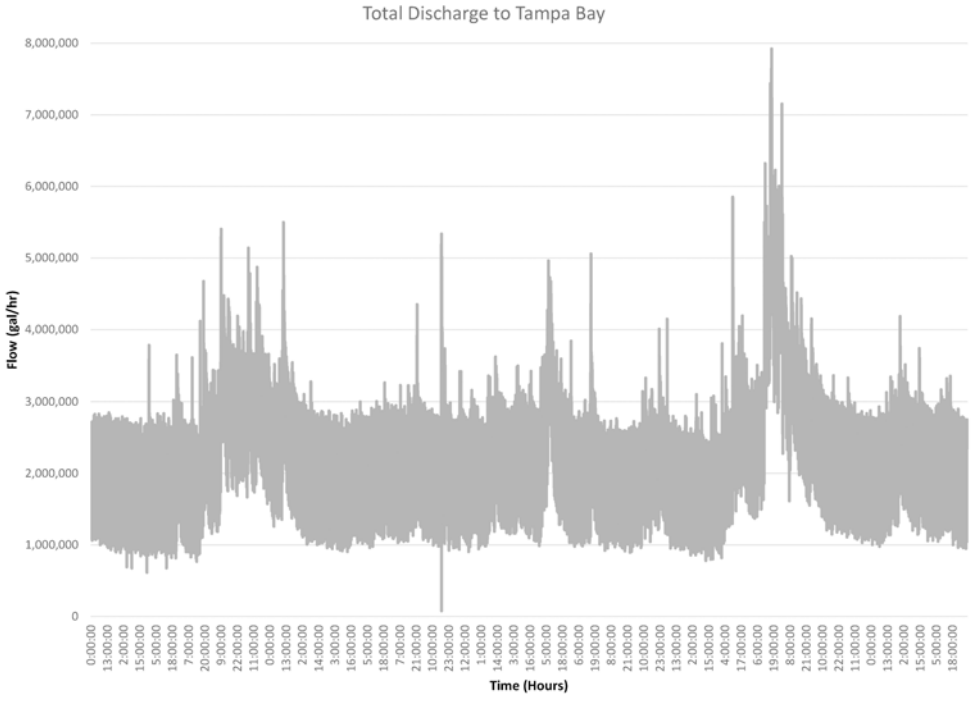


Figure 6. Howard F. Curren Advanced Wastewater Treatment Plant Historical Hourly Flows to the Bay

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the water available for a future TAP project. As Figure 6 shows, the hourly flow varies significantly over the period of record, primarily in response to rainfall and the rise and fall of groundwater levels in the service area.

A spreadsheet model was developed to consider flows that could be transmitted to TAP as a function of design pumping capacities, the results of which are shown in Figure 7. As the figure shows, hourly flows are consistently greater than approximately 30 mgd, meaning a TAP pumping station with a design capacity of 30 mgd would theoretically run at its design rate 100 percent of the time; however, a 30-mgd pumping station could only use approximately 50 percent of the flow now going to the bay. As pumping capacity increases, TAP can receive more water currently being discharged to the bay, but the available water supply will sometimes be less than the pumping station's design capacity.

Based on the results shown in Figure 7 and Table 1, the TAP project team selected a design capacity of 50 mgd for the TAP pumping station, more than twice the original target flow of 20 mgd. This will use nearly 80 percent of the water now going to the bay, while also reducing nutrient loadings to surface waters.

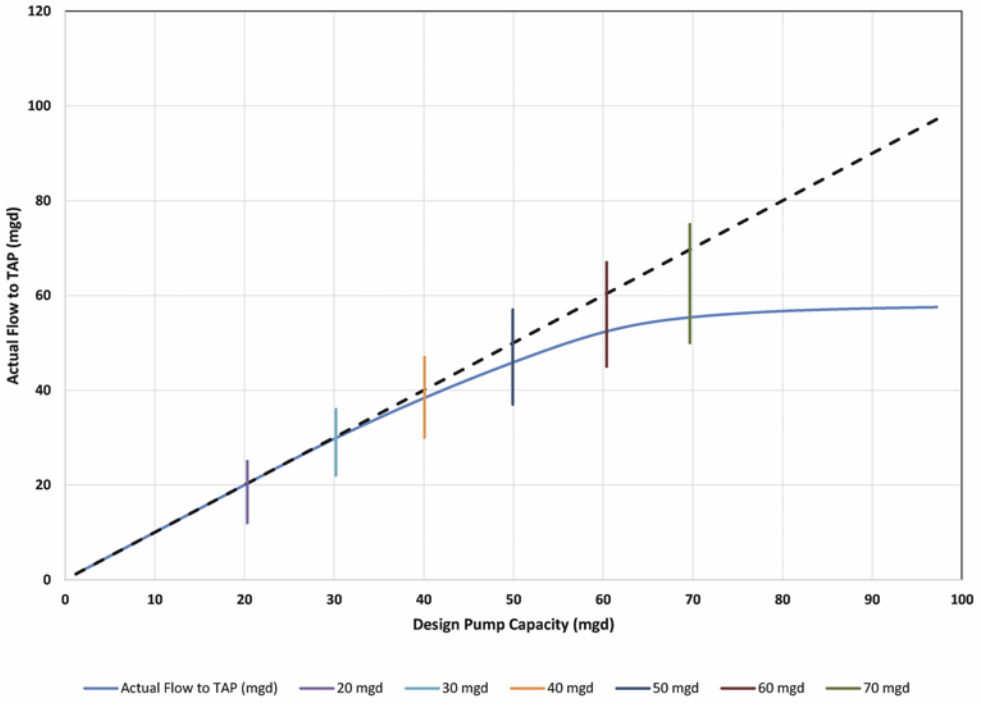


Figure 7. Results of Pump Station Analysis

**Water Quality**

The TAP project assembled historical water quality data from HFCAWTP, selected elements of the city's ASR program, and raw water quality data from the Hillsborough River Reservoir. Additional water quality data specifically for the TAP project were also generated, including detailed analysis of groundwater quality in the recharge and recovery zones collected for the TAP cores and time series water quality data that will be generated from the full-scale recharge/recovery system under construction at the Woodlands Terrace park site. The current water quality database includes over 70,000 observations from both time series and grab samples.

Table 2 summarizes water quality data collected to date. The data are currently being analyzed, focusing on primary and secondary drinking water standards, selected constituents of emerging concern (CEC), and Class I surface water standards.

**Transmission Piping**

The TAP team completed a route analysis for the Alternative 2 transmission piping, the results from which are shown in Figure 8. The recharge/recovery system will consist of the following elements:

- A 48-in. transmission pipe from HFCAWTP to DLTWTP, which will use abandon transmission piping rehabilitated by slip lining or Insituform.

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Table 1. Tampa Augmentation Project Pumping Capacity and Resulting Flows

| TAP Pump Station Capacity (mgd) | Actual Flow to TAP (mgd) | Percent of Available Flow to TAP | Pump Station Utilization |
|---|---|---|---|
| 20 | 20 | 35% | 100% |
| 30 | 30 | 51% | 99% |
| 40 | 38 | 66% | 95% |
| 50 | 45 | 78% | 91% |
| 60 | 53 | 91% | 88% |
| 70 | 56 | 96% | 79% |

Table 2. Summary of Water Quality Parameters Included in the Tampa Augmentation Project Analysis

| Sample Location | Source | Number of Parameters Sampled | Number of Observation | Data Set - Time Series - Grab | Start Date | End Date |
|---|---|---|---|---|---|---|
| HFCAWTP Influent | City of Tampa | 13 | 1,261 | Time Series | 2/19/2008 | 8/9/2016 |
| HFCAWTP Effluent | City of Tampa | 215 | 14,193 | Time Series | 2/24/2001 | 4/30/2016 |
| Hillsborough River Reservoir | City of Tampa | 119 | 54,198 | Time Series | 12/1/1999 | 8/1/2016 |
| ASR B Site | City of Tampa | 97 | 681 | Grab | NA | NA |
| Core Site 1 - 300' | TAP | 316 | 317 | Grab | NA | NA |
| Core Site 2 - 300' | TAP | 327 | 369 | Grab | NA | NA |
| Core Site 2 - 900' | TAP | 324 | 333 | Grab | NA | NA |
| Core Site 3 Giddens Park - 350' | TAP | 314 | 314 | Grab | NA | NA |
| Core Site 3 Giddens Park - 800' | TAP | 317 | 321 | Grab | NA | NA |

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- Stub-outs as required to access recharge/recovery sites located on city-owned parcels within the recharge corridor, which are primarily parks and stormwater management facilities. As Figure 8 shows, the city is considering converting the existing Rome Avenue ASR system into a future TAP recharge/recovery system.
- In this phase, recovered water will be returned to the Hillsborough River Reservoir via the existing stormwater system. In some locations, this will require extending pressure mains to access stormwater systems within the reservoir drainage basin. Water recovered from the Rome Avenue system is anticipated to be delivered to DLTWTF's intake using existing transmission facilities.

The proposed TAP transmission system will facilitate delivery of reclaimed water to DLTWTF for a potential direct potable reuse project in the future, if needed.

**Public Outreach**

At project start-up, public outreach for TAP was a unique concern because no project had been selected, meaning no details could be made available to the public; however, the city took a proactive approach and planned on interacting with the public and laying the groundwork for a consistent, accurate message of its efforts to meet future potable water demands.

One of the most likely interactions between TAP and the public would occur when field crews worked on SWFWMD property for Alternative 1 and the cores were being completed for Alternative 2. To prepare for communication with anyone approaching the field crew and asking about these activities, the TAP team developed a notice and posted it on a billboard at the park's entrance and also developed a "quick facts" card that field crews could carry and distribute if approached.

All fieldwork is complete on SWFWMD property and on the cores, and public interaction has been unexpectedly low; however, the proactive approach was the preferred strategy.

The TAP team has prepared a series of outreach materials that will lay the foundation for interacting with the public while TAP is implemented. These materials are:

- A stakeholder database
- Project information sheets (Figure 8)
- Key messages plan
- TAP frequently asked questions (FAQs)
- A rapid response plan

## Summary and Project Look Ahead

The TAP project was authorized in June 2016 and the final feasiblity report is scheduled for completion in May 2018.

The project team has documented the finding that the Alternative 1 option is not feasible. The project team is completing the overall feasibility report. Evaluating the reclaimed water quality and geochemical modeling helped determine what, if any, additional treatment will be required at HFCAWTP before recharge.

Ultimately, this option's feasibility depends on the yield and the associated costs, which will combine to calculate the cost per gal of new water provided. These results will then be compared to the costs of other alternative water supplies now being considered in the Tampa Bay area. Stay tuned.

## Acknowledgments

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Johnson. Mirmiran & Thompson
Katz & Associates
Lane Engineering
Mirecki Geoscience
REA Remedial Solutions
SDI Environmental Services
Vistra Communications

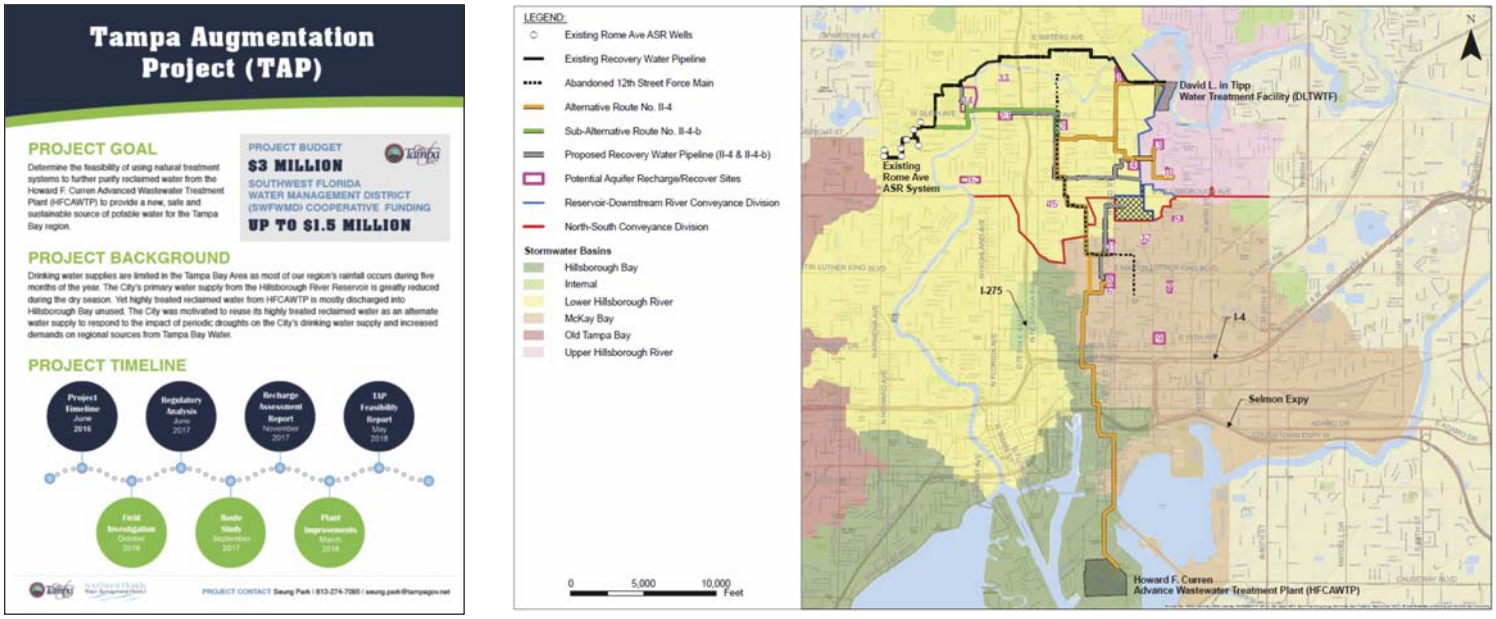


Figure 8. Alternative 2 Transmission Pipeline Analysis and Tampa Augmentation Project Information Sheet