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A tale of integrated regional water supply planning: Meshing socio-economic, policy, governance, and sustainability desires together



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SUMMARY

In 1998, Tampa Bay Water, the largest wholesale water provider in South East USA with over 2.3 million customers, assumed the role of planning, developing, and operating water supply sources from six local water supply utilities through an Interlocal Agreement. Under the agreement, cities and counties served by the agency would have their water supply demands met unequivocally and share the cost of delivery and/or development of new supplies based on their consumption, allowing a more holistic approach to manage resources in the region. Consequently, the agency was able to plan and execute several components of its Long-Term Master Water Plan to meet the region's demand, as well as diversify its sources of water supply. Today, the agency manages a diverse and regionally interconnected water supply system that includes 13 wellfields, two surface water supply sources, off-site reservoir storage, a sea water desalination plant, a surface water treatment plant, and 14 pumping/booster stations. It delivers water through 390 km of large diameter pipe to 19 potable water connections.

It uses state-of-the-practice computer tools to manage short and long-term operations and planning. As a result, after the agency's inception, groundwater pumpage was reduced by more than half in less than a decade—by far one of the largest cutback and smaller groundwater utilization rate compared to other utilities in Florida or elsewhere. The region was able to witness a remarkable recovery in lake and wetland water levels through the agency's use of this diverse mix of supply sources. For example, in the last three years, 45–65% of water supply came from groundwater sources, 35–45% from surface water sources and 1–9% from desalinated seawater—very different from 100% groundwater only supply just few years ago. As an “on demand” wholesale water provider, the agency forecasts water supply availability and expected water demands from seasonal to decadal time frames using a suite of forecasting tools and a structured decision-making process. This paper presents a case study of the approach taken by Tampa Bay Water to meet the region's growing water demands while satisfying other competing objectives in a sustainable fashion and documents the remarkable environmental improvement observed in the area.

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1. Introduction

1.1. Historical background

In 1998, Tampa Bay Water was created to provide water supply for six member governments: Pasco, Pinellas and Hillsborough counties and the cities of New Port Richey, St. Petersburg and Tampa. Prior to 1998 the West Coast Regional Water Supply Authority (WCRWSA), structured as a cooperative entity, had been

providing water for the region with uneven cost to member governments. Historically, groundwater was (and it still is) the least expensive source of drinking water in Florida. Older wellfields provided water at a significantly lesser cost than newer wellfields, which needed to be built to meet the growing demand of the region. The cost to develop these new wellfields impacted the water rate for some members, but not the others. In addition, some members owned their own supply facilities and contracted with the Authority to share water from certain facilities. Other members owned none of the facilities and had to contract with the Authority to purchase water from several facilities. Some were even precluded from developing their own supplies. This uneven structure created friction and significant dispute among the member

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governments. Adding yet another element of conflict was the fact that the groundwater extraction boundary did not coincide with the political boundaries of the counties and the cities served by the Authority. This further exacerbated the problem; pumpage of groundwater from one member government jurisdiction caused environmental stress at another. This created a perfect storm that would ensue and change the drinking water supply paradigm.

During 1980s and 1990s, the Tampa Bay region experienced severe drought. This problem was further exacerbated by a booming population which increased by 108% between 1970 and 2000. By 1998 the region's population was over 2 million. As each member government owned and operated its wellfields, not much attention was given to the regional impact of declining water levels and environmental damage. Lack of rainfall and continuous reliance solely on the region's aquifer led to extreme stress on the region's wetlands and wellfields. Demand for water outpaced the Authority's water supply development. The agency developed only 40,700 m³/day (8 million gallons per day (mgd)) of additional supply from 1989 to 1998. While the Authority's system failed to grow, the Tampa Bay region's population continued to expand. In December 1995, the board had approved a Master Water Plan for the region which would have brought on line an additional 0.433 million m³/day (85 million gallons of water per day), and greater conservation to the region to meet the public's and environment's water needs. Under the Authority's cooperative structure, with disparities among members, there was no fair and implementable way to fund the new water plan.

Eventually, the stresses to the wetlands and lake levels were brought to the attention of Southwest Florida Water Management District (District) by the increasingly angry public who alleged that the pumping from the Authority owned wellfields was causing nearby wetlands and lakes to dry up (Regan, 2003). The District conducted the analysis and concluded that the pumping of the wellfields is indeed the reason for the environmental stress; this led to the change in District's policy which led to the refusal to renew permits for the four of the Authority's wellfields. In 1995, the Authority entered into litigation with the District. The Administrative Law Judge ultimately ruled that the drawdown in the Floridan Aquifer in the vicinity of the four wellfields was due to Authority's pumping of groundwater. However, he also concluded that, despite the now existing environmental stresses, continued pumping at the consistent quantities will not cause new adverse impacts (Regan, 2003). This seeming contradiction was further challenged by the District, primarily as it relates to the permitting rules set forth in the Florida Statutes. Finally, after protracted and expensive litigation, the two parties entered into settlement negotiations. The District accepted to temporarily renew permits for the four wellfields in question, but it mandated that the Authority introduces alternative water supply options. This ultimately led to the creation of Tampa Bay Water in 1998. The restructuring affected voting rights between the six member governments, memberships and terms of office. It also mandated that the agency create a long-term water supply planning tool. The agency would have to phase out pumping of its various groundwater sources as new, alternative supplies became available.

Tampa Bay Water would be created and serve as a sole provider of drinking water to all six member governments. The agency would be governed by three documents: (1) the Interlocal Agreement, which requires Tampa Bay Water and its member governments to resolve their differences over permitting using alternative dispute resolution; (2) the Master Water Supply Contract, which states that the agency then has unequivocal obligation to meet member water needs while sharing costs of supply development, share in environmental stewardship, sharing voting rights and paying the same wholesale rate; and (3) the Master Bond

Resolution, which created funds and accounts, disposed of gross revenues, secured capital improvement funding, annual budgeting process, rate structuring process and the enforcement of charges to the agency's members (Fig. 1). The members would have to renounce ownership of their historical supply facilities and turn them over to the newly formed Tampa Bay Water.

Within the first 12 months, Tampa Bay Water accomplished its entire restructuring, member water supply buy-outs and new project feasibility studies. The system still relied 100% on groundwater from the region's 11 consolidated wellfields and 2 stand-alone wellfields. Soon after, the agency developed a Long-Term Master Water Plan and invested heavily into alternative water supply projects. The Long-Term Master Water Plan (20 year outlook) document serves as the agency's official planning tool. Today, the agency's water supply system looks much different than it did in 1998. The agency invested \$1 billion in its system. It relies on surface water (Hillsborough River, Alafia River and the Tampa Bypass Canal), an off-site reservoir, desalinated seawater, and groundwater sources. More historical exposition can be found in Rowland (2000) and Regan (2003).

1.2. Governance

Tampa Bay Water activities are overseen by nine board members representing the three counties' and three cities' stakeholders. Stakeholder chosen commissioners, council persons, or mayors are members of the board, where a rotating chair and vice chair from two counties serve for two consecutive years. Each and every substantial decision regarding projects would require a majority vote of the elected board. In the past, not all decisions were unanimous. Technical staffs from each of the member government entities, who in turn advise their board representative, work with technical staff from Tampa Bay Water to make sure that projects pursued by the agency are in the best interest of the stakeholders.

1.3. Environmental recovery

The creation of Tampa Bay Water has set a series of cutbacks in groundwater withdrawal. Tampa Bay Water, the Southwest Florida Water Management District (District), a regional water Authority in charge of water use permit issuance for Tampa Bay area as well as other 13 counties, and member governments entered into a partnership agreement, which required new sources to be developed. It also called for reduction of pumpage from 11 wellfields in three phases: an immediate reduction from 0.727 million m³/day (192 million gallons per day, mgd) to 0.598 million m³/day (158 mgd); then to 0.458 million m³/day (90 mgd). In return, SWFWMD committed up to \$183 million to assist with developing alternative sources (Wanakule and Shea, 2001). Concurrent with the Master Water Plan partnership agreement, SWFWMD issued a Consolidated Water Use Permit (CWUP) in 1999 that called specifically for Optimized Regional Operation Plan (OROP) to be implemented for managing groundwater withdrawal from 11 wellfields, an Environmental Management Plan (EMP), a mitigation plan, and a monitoring program. Development of the original OROP is documented in Tampa Bay Water (1998) and subsequent modification to the model is reflected in annual OROP reports. Wanakule and Adams (2013) present the current version of the model, after several significant changes to the original model occurred. As the system expanded, several connections between production and delivery points were added.

Once OROP was implemented, wellfield operation was guided by the optimization model to rotate production among wellfields, by seeking increased groundwater levels at areas of environmental stress. Monitoring wells provide a basis for evaluating water-level conditions and response to groundwater management (Wanakule

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