



Stantec Consulting Services Inc.
1340 Poydras Street Suite 1420, New Orleans LA 70112-1274

February 17, 2020
Sent Via Email to: pwallace@swbno.org

Attention: Patti Wallace
625 St. Joseph Street. Room 131
New Orleans, LA 70165

Dear Ms. Wallace,

Reference: Integrated Master Plan RFI

It is our pleasure to submit RFI response to participate in this planning effort and workshops for this important project for Sewerage and Water Board of New Orleans (SWBNO) and the New Orleans community. This much needed planning effort will create a framework and establish the pathways to achieve your goals of becoming a **resilient and sustainable utility**. Stantec has a long history of service to the Board and the City of New Orleans, serving as a **loyal partner** that has worked on every aspect of the SWBNO's system especially helping to get back on its feet after Katrina. We have **local institutional knowledge** that is invaluable to this master planning effort. We have provided planning, engineering and financial services. We led your SSERP Consent Decree Program, prepared the 2009 Water Master Plan, designed the Permanent Canal Closure and Pump Stations (PCCP) - your most state of the art and innovative assets, designed miles of watermains, and helped to get funding (WIFIA, LADEQ and FEMA). We have modeled and worked extensively on the water, sewer, drainage and pumping systems that are the backbone of your system. We led the 100 Resilient Cities Stormwater Pathways, which was the first step in the integrated master plan. We're currently leading some of the city's most **innovative** and forward-thinking projects like Hagan-Lafitte **Green Infrastructure** and Drainage and **Blue-Green Corridors**. Similar to what will be needed in a master planning effort, these projects included **intensive community outreach** programs.

We understand the challenges that you face, including aging infrastructure, lack of funding, sea level rise, climate change and public distrust. Our team sees this long-term integrated master plan as a **solution** that, if executed correctly, will help to solve these challenges and improve service to the customer and improve quality of life of the residents.

We offer you our **industry leading experts** in water, sewer and stormwater integrated long-term planning that have relevant experience from other communities in North America and across the world. We look forward to partnering with you in this effort.

Regards,

Stantec Consulting Services Inc.

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Attachment: Master Planning RFI Repose

Design with community in mind.

Firm Profile

Introduction and Local Understanding

Stantec has a long history in New Orleans and in-depth knowledge of your water, sewer and drainage programs and systems. We look forward to the opportunity to bring a unique perspective and understanding of the challenges and specific issues that must be addressed in order to create a long term resilient and forward-looking utility.

We have worked on key successful projects that have replaced and repaired systems, built new facilities, led planning efforts and assisted in obtaining crucial funding. The following are local projects we've delivered in New Orleans and uniquely position us to partner with S&WB to create a long-term, integrated master plan that addresses your communities' unique needs.

2009 Water Master Plan. Stantec conducted a Water Distribution System Assessment and Hydraulic Model (Water Master Plan) that culminated with the submittal of a Capital Improvement Plan (CIP) for the water distribution system. The Water Master Plan included an overview of the East and West Bank water distribution systems, development of a systemwide GIS, and hydraulic models. The Water Master Plan described recommendations based on the hydraulic and structural evaluation made for system improvements over a 20-year period and alternatively a 40-year period. Implementation of the structural rehabilitation program presented in the Water Master Plan was recommended to begin in 2005 in order to accommodate the additional time required for the design and bid phases, and end in 2030. For the purposes of the estimated construction cost, an annual rate of 3% inflation was calculated for the project duration. The projected capital improvements over a 20-year duration was \$2.8 billion.

Permanent Canal Closure and Pump Stations Projects (PCCP). One of the largest drainage pumping systems in the world with a combined capacity of 24,200 cfs. This is an incredible asset of the S&WB that must be an example and part of the overall drainage and power plan. As lead engineer and architect, we delivered this design-build project for the USACE New Orleans District. This \$731 million project reduces hurricane storm damage risk for New Orleans. Our solution includes surge barriers at an elevation of +18.0 ft. and pumps rainwater from the outfall canals into Lake Pontchartrain, providing drainage to a majority of the New Orleans area.

Back-up power is accomplished with twenty-four 2.6 MW generators backed up by six redundant units totaling 78 MW across all three sites. Proposed fuel farm and redundant site utilities at each site allow for self-sustained continuous operation of this facility for up to five days. Pump Station structures are designed for the possible future condition scenario allowing for deepening of the outfall canals and decommissioning of the intermediate S&WB drainage pumping stations. PCCP is a world class, state of the art facility designed with appropriate technologies including SCADA automated control and communication system. The successful implementation of PCCP allows the S&WB to operate key drainage pumping stations during hurricane events.

Sewer System Evaluation and Rehabilitation Program (SSERP). We are proud to lead this successful program. Under a Consent Decree, S&WB's Sewer System Evaluation & Rehabilitation Program (SSERP) was developed to repair and rehabilitate New Orleans' sewer collection system. SSERP was originally initiated in 1998. S&WB has remained in compliance with every aspect of the Consent Decree since the program's inception. Significant steps have been taken to gain efficiencies and mitigate risks through SSERP delivery approaches. Over the initial implementation of the project, sewer manhole and pipeline inspections have been completed for 98% of the system, nearly 1.7 million linear feet (27%) of sewer pipelines have been cleaned, 156,000 linear feet of sewer pipelines have been inspected by closed circuit television (CCTV), and nearly 380 recommendations for repair (totaling \$4.7 million) have been identified.

Gentilly Resilience District: Blue Green Corridors, Hagan-Laffite Green Infrastructure and St. Bernard. These three projects reflect our local experience in Green Infrastructure and strategic storage systems that can help with water quality and provide system storage to reduce the peak that is seen at the pump station. The projects are currently in design and construction and show how a mix of grey and green infrastructure and the "living with Water" approach can be taken from concept to reality with the proper engineering. Through system modeling, we have been able to achieve substantial reduction in flood levels through a combination of blue, green and underground storage. Additionally, these projects provide triple bottom line benefits which include financial, environmental and cultural benefits.



Post Katrina Recovery efforts. Assisting the City of New Orleans (City) and the S&WB after Hurricane Katrina, Stantec (formerly MWH) was able to provide emergency services for debris removal, storm drain cleaning, sewer system assessment and rehabilitation, and water system damage assessment. Initiated immediately following the dewatering of the City, the services were largely conducted on site, 12 hours per day, seven days per week. Support for these services, both to the Stantec team and City and Board staff, was difficult, requiring creativity and extensive effort. The Board was able to qualify and quantify their initial discussions with FEMA regarding the sewer and water system needs due to the information provided by Stantec. As part of these efforts over 4000 water distribution system breaks were identified and repaired, 63,000 catch basins were cleaned, 3.3 million feet of drainage pipelines were cleaned.

Master Planning Expertise

Beyond our local experience, we can help guide a comprehensive master plan with our planning and implementation expertise in the following areas:

Financial Services. Stantec’s financial services team plays a key role in assisting numerous utilities with Financial Planning and Affordability assessments which is at the core of integrated planning efforts. Our financial services team evaluates affordability using an advanced tool to measure household-level financial burdens, called WARi® for “weighted average residential indicator”—a name for which we have a registered trademark. Our advanced affordability approach combines long-term financial planning and financial forecasting with income distributions, usage characteristics, unique household types, and essential costs of living. By using actual billing data for all services, the latest census information, geographic mapping tools, and our collective industry experience, we are better able to understand what is affordable. Therefore, we can evaluate alternative funding scenarios to assist in developing the approach that impacts ratepayers the least.

Grant Expertise. Our funding specialist are poised to share their grant funding knowledge to assist S&WB in developing a 1) funding strategy, 2) apply, compete, secure and maximize grant funding opportunities and 3) administer funding in a way which will minimize stress on traditional budgets while contributing to the overall success

of the utility. We have provided this for S&WB and New Orleans obtaining WIFIA funding, LADEQ funding and providing the pavement assessment that was back up for the FEMA \$1.4 billion recovery roads program.

Information Management. As the water and wastewater business has transformed into “doing more with less”, leveraging the use of information technology has become a critical success factor for many clients. Our Information Management services optimize the use of data collected from various electronic sources, while our management consulting professionals assist you with delivering services that are aligned with your organization’s goals and objectives.

Wastewater and Stormwater Pumping Stations and Conveyance. Stantec provides planning, design and construction management services for pumping stations ranging in size from small to the largest systems in the world. Our designs reflect the close attention we pay to specific site considerations, aesthetic and environmental concerns, and your individual and/or unique needs. From a thorough

Stantec

FUNDING EXPERTISE AND INTEGRATED RESOURCES

Identifying a project is easy. Finding funding is not. Our team understands how challenging and time consuming it can be to identify funding sources, navigate the application process, and manage the funds once awarded.

We work with you to understand the projects that are most important to your community. Whether it is a brownfield redevelopment, alternative transportation project, or water treatment plant expansion, our team can help you de-mystify the funding process. With Stantec, you have an integrated team of resources at your fingertips - not only grant writers, but experienced financial consultants, engineers, urban planners, architects, and technologists.

We help turn your plans into projects by simplifying a complex and competitive process with nimble project teams that help your project stand out from the rest. We support you every step of the way. This is a breakdown of our approach.

01 Develop a Funding Strategy

- Identify priority projects
- Research potential funding sources
- Evaluate probability of success and return on effort
- Confirm eligibility
- Prioritize which grants and loans are worth pursuing
- Finalize funding strategy and schedule

02 Application Preparation

- Designate lead funding specialist and team
- Facilitate funding application kick off
- Develop and manage all elements of application (i.e. narrative, attachments, letters of support)
- Assemble application package and assist with delivery

03 Project Management & Oversight

- Provide project management and oversight as needed
- Support funding agreement negotiations
- Refine scope and budget if needed
- Assist with reporting requirements

Secure Funding

140+ Funding Specialist across North America

\$4B+ in grants and loans secured by our teams

100+ Funding programs leveraged to advance critical community projects



understanding of the complexities facing today's utilities and municipalities, Stantec consistently develops creative solutions that successfully balance efficiency and effectiveness. For conveyance, our world-class skills enable us to provide innovative services in the following areas related to collection systems: design and construction; condition assessment; data collection and management; GIS; hydrologic and hydraulic modeling; risk assessment; design/performance standards and benchmarking; infrastructure rehabilitation including the development of preventive and predictive maintenance measures; and infrastructure asset management.

Hydraulic Modeling. Stantec has a specialized, integrated team of hydraulic modelers with significant experience in developing, calibrating, testing and analyzing computer models that simulate the hydraulics of potable water distribution and wastewater (sanitary & storm) collection systems. Our hydraulic modeling team also includes personnel with experience in related specialized fields such as real time control and transient/water hammer modeling.

Computational Fluid Dynamics (CFD) Modeling. A virtual hydraulic laboratory numerically solves the full sets of flow and turbulence equations in three-dimensional space; therefore, it provides detailed information on flow patterns, temperature distribution, chemical mixing, and other important performance parameters. Stantec's CFD experts have been successfully using the state-of-the-art CFD modeling approach for solving flow problems in a wide range of applications in wastewater and water engineering. These include pump stations, chemical mixing in contactors and effluent channels, treated water reservoirs, diffusers, outfalls, mechanical and static mixers, flood control, river engineering, etc.

Municipal Water Treatment. As water treatment experts, we address current needs meeting future capacity requirements using easily upgradeable processes. We design efficient and reliable systems that achieve capital cost savings and minimize long-term expenditures. Whether it's membranes, high-rate filtration, advanced oxidation, biological filtration, ozone, or UV disinfection, we implement the most appropriate treatment technology for each specific situation. Providing safe and abundant clean water requires thoughtful investments by our communities. That's why we invest so much of ourselves into the process of selecting the best treatment technology for our client's specific needs.

Municipal Wastewater Treatment. At Stantec we provide value by rehabilitating, upgrading, and expanding new and existing wastewater treatment plants through the use of technologically advanced treatment processes. We have designed a wide range of treatment processes, including: activated sludge; biological nutrient removal; oxidation ditches; trickling filters; pure oxygen; rotating biological contactors; chemical precipitation; dissolved air flotation; oxidation; aeration lagoons; disinfection, including ultraviolet irradiation, chlorination/ de-chlorination, and ozone; as well as solids stabilization, thickening, and dewatering systems.



Relevant Projects

London 2100 – Water

Client

Thames Water Utilities Ltd., London, England

Contact

Mark Lewington, Head of Wastewater Non-Infrastructure Strategy & Planning
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E: mark.lewington@thameswater.co.uk

Start: 3/2017

Completed: 12/2019

Relevance to RFI

- Community Stakeholder Facilitation/Workshops
- Demand Forecasting
- Wastewater Collection/Treatment/Distribution Analysis
- Reuse System Evaluation
- Resilience/Climate Change Assessment
- Aging Infrastructure Assessment
- Affordability Analysis
- Living Master Plan

London's water system will face significant challenges over the next century with a rapidly growing population – by 2100 – 7 million more than it is now. Challenges to accommodate this accelerating growth include land constraints, aging infrastructure, increasing customer expectations, climate change and customer affordability.

Phase 1, completed in 2017, analyzed London's existing treatment and network systems to fully understand its condition and capacity to create a baseline. Different future scenarios were applied to look at potential medium- and long-term impact on the systems to understand underlying issues and the need for a long-term strategy.

Phase 2 is nearing completion. It focuses on options development considering a comprehensive range of potential solutions. This exercise involved capturing best practices from similar international cities. We held workshops engaging an innovation facilitator, international experts, client staff, industry stakeholders and academics. This led to the development of options focused directly at local challenges facing London. A second innovation workshop concentrated on developing partnership options.

Phase 3 will involve options feasibility analysis and potential benefits and lead to a selection of the optimum blend of options to take forward with a proposed budget.

Integrated Water Resource Plan

Client

Colorado Springs Utilities, Colorado Springs, Colorado

Contact

Kevin Lusk - Principal Water Resources Engineer
Colorado Springs Utilities
P: (719) 668-8719
E: klusk@csu.org

Start: 7/2011

Completed: 4/2017

Relevance to RFI

- Long-Range Strategic Water Resources Planning
- Regional Water Resource Planning
- Integrated Planning
- Vulnerabilities and Risk Assessments
- Future Conditions Analysis
- Identification of Preferred Plans
- Financial Planning
- Stakeholder Facilitation

Stantec provided program and technical support services for preparation of an Integrated Water Resource Plan (IWRP). The IWRP is a holistic approach to long-range strategic water resources planning that incorporates water supply with elements of water demand, water quality, environmental protection, water rates, financial planning, energy use, and public participation. Related disciplines of wastewater, stormwater, power, and other factors were included. Stantec identified risks and vulnerabilities to water reliability in the areas of hydrology, demand, environment, infrastructure, regulator, political/social, financial, and water-energy nexus. The potential for Utilities to serve regional water providers was evaluated. Risks were prioritized to determine the greatest threats to water supply reliability between current conditions and build-out conditions.

A planning approach combining scenario planning and robust decision-making was developed for analysis of water resource options and strategies. A MODSIM model of Utilities water sources, developed previously by Stantec, was used to simulate performance of the water supply system under a broad range of possible future conditions. Thousands of possible future scenarios were assembled from scenarios for individual uncertainty factors (e.g., demand forecasts, infrastructure failure, hydrologic variability) and potential water supply solutions (e.g., additional storage, interruptible supply agreements, demand management). The result was identification of preferred water supply plans that are effective over a broad range of possible futures, as opposed to one optimal plan to address one assumed future. Tableau visualization software was used to succinctly display results for stakeholders and decision-makers. Stantec assisted with development and implementation of a stakeholder outreach program

to solicit input and feedback from a broad spectrum of the public. This included general public outreach, a citizen's advisory group, surveys, and open houses.



100 Resilient Pathways – New Orleans

Client

City of New Orleans and S&WB,
New Orleans, Louisiana

Contact

Tyler Antrup, Director of Planning
+ Strategy, Sewerage and Water
Board of New Orleans

P: (504) 585-2167

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Start: 8/2018

Completed: 4/2019

Relevance to RFI

- Long-Range Strategic Water Resources Planning
- Regional Stormwater Planning
- Vulnerabilities and Risk Assessments
- Future Conditions Analysis
- Financial Planning
- Stakeholder Facilitation
- Records Research and Data Gap Analysis

Stantec collaborated with the City of New Orleans, the Sewerage & Water Board, and 100 Resilient Cities by providing planning and conceptual design services related to the New Orleans stormwater drainage system. 100 Resilient Cities engaged Stantec to review the drainage issues, assist with defining the stormwater needs, and establish strategic pathways to achieve a sustainable and resilient future. This effort considered the effects of sea level rise, subsidence and aging infrastructure in comparison to the costs needed to overcome these challenges. Analysis also included evaluating funding and rate structure options and leading interactive City leadership workshops to identify the needed “right mix” of funding.

The services included reviewing existing drainage system reports, hydrologic and hydraulic models, and other data to provide a planning level technical analysis and flood risk assessment. The existing level of service for the drainage system was estimated to be a 1.5-year design storm. Stantec developed several alternatives and combinations of conceptual flood risk reduction projects in various portions of the drainage system to improve resilience of the sewer network and to reduce the risk of flooding. Some of the alternatives included pump station upgrades, new pump stations, green infrastructure, regional storage, and additional conveyance capacity.

Stantec simulated design storms in the SWMM models for both existing conditions and future condition scenarios by making simplified assumptions to determine the flood risk reduction benefit of certain measures. The goal was to review projects that met the guiding principles of risk reduction, reliability, sustainability, resilience, adaptability, affordability, cost-

effectiveness, and quality of life. Throughout the project, Stantec coordinated with the stakeholders through multiple conference calls, presentations and interactive workshops to discuss the identification and prioritization of the flood risk reduction projects. We reviewed the flooding impacts and used a structure-based risk assessment model to automate assessment of flood risk and mitigation needs. Risk assessment results produced by the model identified the number of structures at risk to flooding and estimated the anticipated dollar loss due to flooding at standard recurrence intervals, annualizing the dollar loss. The modeling and risk assessment for the flood prone areas of New Orleans led to multiple future scenarios through the identification of potential improvements and varying levels of service. A mix of grey and green infrastructure was identified as a key part of the solution.

Stantec then analyzed several funding scenarios to help bridge the gaps between the desired level of service or even maintaining the current system with the available funding streams which are inadequate. Stormwater utilities, additional mills, special taxing districts, fees in lieu of, tourism taxes and other options were explored with stakeholders. The study recommended a Comprehensive Master Plan focusing on 50- to 100-year timeframe, creation of a steady revenue source in the way of stormwater utility and utilizing the tourism dollars to ease the financial impacts on the residents. Several workshops were conducted with the many stakeholders including the Mayor’s transition team to help guide their understanding and recommendations.

Question 1

What will be New Orleans' biggest stormwater/drainage challenges in 50 years and what is the best approach to integrated, long-range planning to address those challenges?

Stormwater / Drainage System

The Challenge

The New Orleans stormwater and drainage system provides a vital role in the health and well-being of its residents. Through land development, levee construction and subsidence, the drainage pumping system has become the necessary back bone to keep the City safe from flooding.

Overtime, these same factors (development, subsidence, and aging infrastructure) have combined with increased storm intensity to degrade the system's level of service. Today, many areas of the system experience flooding for rain events exceeded once every two years.

Recent work performed by Stantec in conjunction with the 100 Resilient Cities, evaluated the risk of flooding across the drainage system. In many locations, street flooding was observed for storms greater than the 1-year recurrence level and flood damages for a 1:10 year storm event were estimated to exceed \$1 billion system-wide.

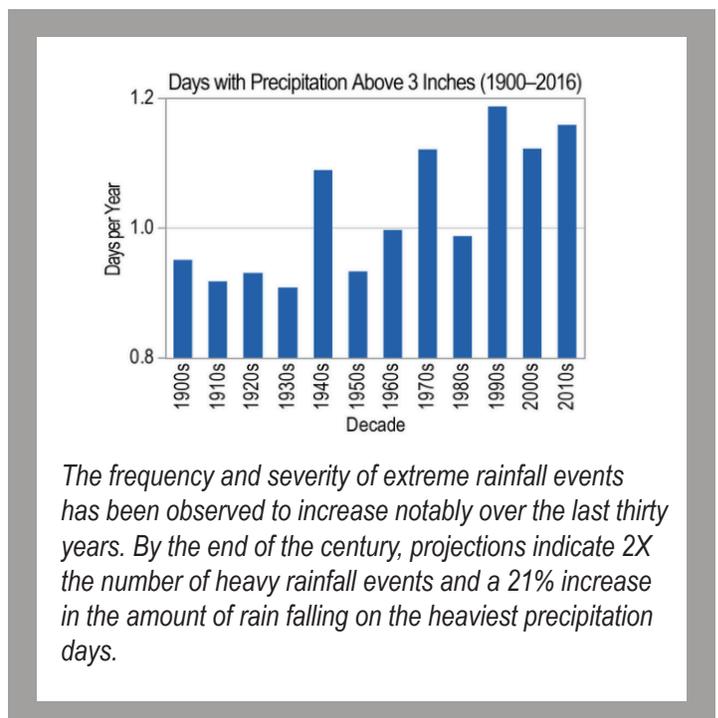
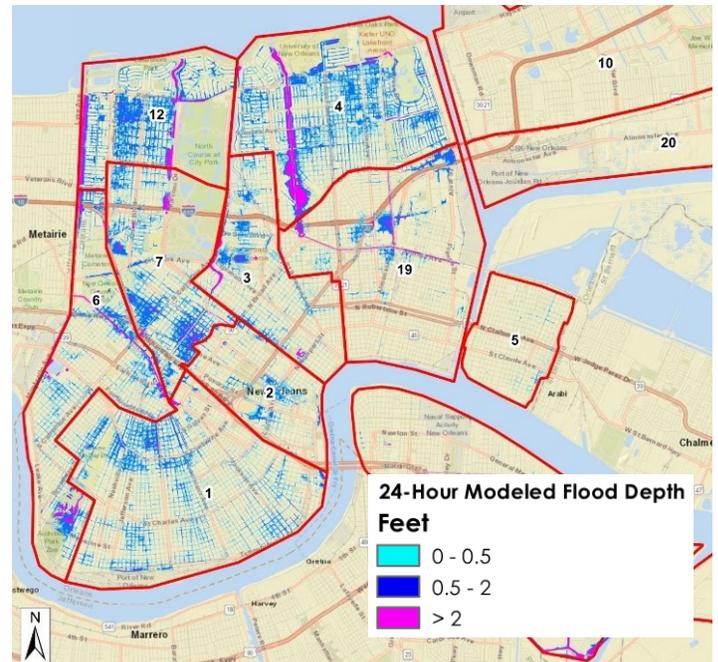
Today's flood risk is a result of both insufficient capacity within the existing storm sewer network and the limited capacity of the drainage pumping system.

Over the next 50 years, the flood risk to New Orleanians will increase without significant intervention. Many of the existing pump stations are at or near their useful life and climate change projections indicate both a higher frequency and intensity of storms and an increase in relative sea level rise.

Today the drainage system faces a significant gap between the existing and desired level of service. With these pressures, the service gap will increase.

The Approach

Successful integrated planning goes beyond operational and financial metrics and incorporates a larger vision for the health and well-being of the community. The process recognizes that the large investments in infrastructure can be a catalyst for growth and a establishing a more resilient New Orleans.



The planning process will layout a road map to achieve the SWBNOS&WB's long-term goals. The following is a brief approach to integrated, long-range planning:

Establish a Vision

The Integrated Plan must be established with participation and buy-in from the City's residents, institutions and leaders. We recognize that significant work has been advanced previously in visioning the future of the New Orleans' drainage network including the Resilient New Orleans strategy.

The Resilient New Orleans Vision

Adapt to Thrive

We are a city that embraces our changing environment

Connect to Opportunity

We are an equitable city.

Transform City Systems

We are a dynamic and prepared city.

The contributions of stakeholders during previous efforts must be acknowledged and incorporated into this planning process. SWBNOS&WB must highlight the value of this new process and how it will build upon and advance the previous efforts.

During this phase, the following goals / metrics should be defined:

- **Level of Service.** At its simplest, this is how often the system floods. This critical discussion will balance project costs versus the benefits to the community. Long-term success of SWBNOS&WB will be measured against this goal and more specifically how this goal has been communicated to and endorsed by the Community.
- **Values.** During the planning process, selection and prioritization of project alternatives must be determined according to a set of metrics. Integrated plans typically incorporate a triple-bottom line approach that weighs economic, social and environmental impacts. During the vision process, establishment of the value framework will be key to setting forth the future planning efforts.

Align Organization and Policy with Integrated Utility Vision

This process will consider internal and external with the goal is to establish a foundation for building an integrated utility and policies that will allow for incremental growth towards the vision.

Schedule Projects toward Long-Term Goals

Based on the selected Level of Service and financial funding, a long-term capital improvement program (CIP) can be planned in conjunction with the water and sewer plans. By coordinating across these programs and other transportation and development



plans, projects may be scheduled to minimize costs, provide larger returns on investment and limit continuous disruptions to the community.

The CIP should incorporate the following features:

- **Early Wins.** Utilizing hydraulic model results and stakeholder feedback, initial projects should be identified to resolve acute stormwater flooding problems and demonstrate the program vision. These projects should be prioritized to demonstrate the integrated planning framework and incorporation of stakeholder feedback.
- **The Right Project Mix.** To meet long-term goals, the project mix will likely incorporate a mixture of green and gray solutions. This will allow for reliability of traditional infrastructure and the environmental / social benefits of green.
- **Flexibility.** The program/schedule should be adaptable to potentially leverage external partners and opportunities. During the planning process, future development and funding sources may not be anticipated. A successful plan will allow for integration of these opportunities in the future to capture external funding sources.

- **Transformational Projects.** Significant improvements to the Level of Service for the drainage and stormwater system will likely require fundamental changes to the existing arrangement and function of SWBNOS&WB assets. These projects may include elimination of internal pump stations, deepening of the main drainage canals, diversion of flow to the river, and conversion of public spaces / assets to open water storage. In the near term, significant barriers exist towards implementation of these large capital/institutional changes. But if the community supports and adopts the larger vision, incremental progress over a longer-planning cycle can be made to pave the way for transformational projects. Once such resiliency project is Blue-Green Corridors: See Engineering a Resilient New Orleans from Environment Magazine.



ENGINEERING A RESILIENT NEW ORLEANS



New Orleans has some of the world's most sophisticated systems to manage storm water. But the city is sinking because these systems prevent groundwater recharging. Could a more natural approach tackle both problems while making the city more resilient to climate change?

Dan Grandal reports



Growing numbers of coastal cities are becoming all too familiar with flooding and the negative impacts associated with climate change. Changes in precipitation patterns have had a significant impact on our low-lying, coastal communities.

These changes, combined with ageing, undersized, and overworked infrastructure, have created increasingly soggy communities. Building resilient, adaptive systems that account for existing and future demand is a difficult challenge – but will be critical to the future of New Orleans.

Resilience is often defined as the capacity to adapt to changing conditions and to maintain or recover functionality

in the face of stress or disturbance. More plainly stated, resilience often means the ability and strength to bounce back after a disturbance or an interruption.

For New Orleans, resilience is built through improvements to the stormwater management and drainage systems, but also through addressing New Orleans' social resilience. Successful urban water-management strategies that promote resilient and adaptive design require us to open our minds, to a new norm, treating water as a resource instead of a nuisance or threat.

The traditional approach focuses on collecting stormwater in a pipe network and conveying – or pumping – it away from a developed area to be managed elsewhere.

In New Orleans, stormwater is collected in pipes during wet weather, pumped into canal systems, and discharged over levees to Lake Pontchartrain.

Over the years, in reaction to flooding, the city's water-management system has been improved with higher levees and with increased pumping capacity to get the water out of the city as fast as possible. Even though New Orleans has some of the largest stormwater systems in the world, these powerful systems are often overwhelmed by storms that, due to climate change, are becoming more intense and frequent.

Unfortunately, the unintended consequence is to prevent groundwater recharge, drying out the organic soils,

which increases rates of subsidence. New Orleans is sinking.

To address these concerns, the city has launched Living with Water, which aims to manage stormwater where it falls, using infiltration-based practices and strategic storage systems. This approach demands unique resident partnerships and community education since these innovative stormwater-management practices are often placed within the public right of way.

At its core, Living with Water means safeguarding an area from flooding by introducing natural methods of water management, at the same time beautifying the neighbourhood, which creates a spark for redevelopment. This allows residents to reconnect with water, making it a resource and amenity for them to enjoy.

A NEW COURSE

In 2015, the City of New Orleans submitted a proposal to the US Department of Housing and Urban Development's National Disaster Resilience Competition (NDRC) to create the city's first resilience district. The competition required the city authorities to identify the biggest threats, risks, and vulnerabilities and to present opportunities to enhance resilience.

The city landed more than US\$141 million worth of funding through the NDRC, supplementing previously allocated investments funded through FEMA's Hazard Mitigation Grant Programme.

The Blue and Green Corridor project is the backbone of Gentilly Resilience District, aiming to reduce flood risk, slow land subsidence, and revitalise the neighbourhood. The project creates a network of canals, recreational parks, complete streets, walkways, bike paths, and community spaces along eight linear miles of arterial roadways and right of ways.

Surrounded by water, New Orleans was founded due to its proximity to the Mississippi river and Gulf of Mexico. Today, however, most residents live behind levees and flood walls and have lost that connection with water. That creates one of the toughest tasks for the city; convincing generations of residents to reverse their received wisdom, that water needs to be removed and kept out of the city, and that they should now keep it in.

Since these projects were announced in 2018, the city and the public have been building a relationship of trust and mutual learning. These infrastructure projects are like nothing residents have seen before, making it critical to explain the networks' benefits.

Throughout the design phase, community organisations and residents have discussed environmental concerns and community needs to guide the project. The unique perspective about their neighbourhoods and streets creates a consultant-community partnership that centres and improves the end product.

TRANSFORMATION

Many areas of Gentilly are low- and moderate-income communities that have been de-prioritised since Hurricane Katrina. They have ageing infrastructure and lack community amenities. This project will invest heavily in the community to create vibrant, attractive public spaces. It will enhance and beautify the area and spur reinvestment into the neighbourhood – eventually improving quality of life, job creation, increased economic conditions and higher property values.

Living with Water means safeguarding an area from flooding by introducing natural methods of water management, at the same time beautifying the neighbourhood

Along the streets slated as blue corridors, the city will construct open recreational waterways within the wide neutral grounds, or medians, between vehicle travel lanes to receive and store runoff, and relieve stress on the pumping system, allowing it to catch up. On an average day, the waterway functions as a recreational amenity alongside a welcoming, park-like space. During storms it acts as strategic storage for the drainage system.

Along the streets slated as green corridors, the city will construct several green infrastructure features – such as bioswales and permeable pavement – to store stormwater runoff, allowing it to seep slowly back into the ground. Where possible, the project proposes road diets

to reduce impervious cover, beautify the neighbourhood with landscaping and calm traffic, but also to build complete streets for safe walking and biking.

This project aims to create safe and functional streets by re-assessing the wide pavements and numerous traffic lanes. Road diets, pavement reductions, and correctly sized travel lanes will create traffic calming features and the opportunity to increase green space. The reclaimed roadway areas are being designed to include rain gardens and community parks.

Another focus for Living with Water is to integrate street designs. These streets will be adapted to increase walking, bicycling, and/or transit trips within the Gentilly Resilience District through creative wayfinding, multimodal facilities, and improved access to jobs, educational opportunities, commercial areas, and recreational destinations.

Creating a vision that frames blue and green corridors is one thing; implementing a transformational community-based project that can deliver, measure and celebrate broad benefits is another. Living with Water wants every resident to feel as though they have a park outside their own front door.

By creating an interconnected, linear district that offers local people every amenity within walking distance, residents will spend more time enjoying their community, building strong ties with their neighbours. Interactive activities will bring the neighbourhood together, using public art and education to reflect New Orleans' unique natural history and culture.

The people of the Gentilly and New Orleans have proved to be resilient. The Blue and Green Corridors project has designed a dynamic urban landscape that revitalises the neighbourhood and reduces flood risk by adapting to the changing environment through innovative techniques.

This project serves as a model for urban adaptation in New Orleans and for delta communities around the world. It's a vision for resilience, grounded in reality. ◉

Daniel Grandal is vice-president water and senior project manager with Stantec in New Orleans, where he leads the Blue-Green Corridors project



Question 2

What will be New Orleans' biggest wastewater/sewerage challenges in 50 years?

The City of New Orleans' biggest wastewater / sewerage challenges in 50-years relate to:

- Aging infrastructure, long-term deferred maintenance and revenue challenges
- Continued need to prepare, respond, recover and mitigate the impacts of being a historical port community located within the Mississippi River delta on the Gulf coast
- Subsidence
- Adapting to a changing climate including impacts of changing weather patterns, more frequent severe rain events, drought, heat and sea-level rise
- Increasing and changing regulatory requirements
- Addressing the needs of vulnerable, economically challenged neighborhoods
- Providing cost-effective, efficient water network with integrated SMART technologies
- Addressing risks associated with cyber security and homeland security
- Contributing to the overall community's resilience and sustainability
- Providing improved quality of life for residence and visitors
- Supporting the greater community to remain competitive in a growingly world marketplace

Challenges and Opportunities - Historical

The City of New Orleans, which celebrated its tricentennial in 2018, is known worldwide for its unique architecture, food, music, and its dynamic cross-cultural heritage. This culture was developed over nearly 100 years of French and Spanish influence. The Louisiana Purchase helped establish New Orleans as the principal southern city as a result of commodities trading from surrounding sugar and cotton plantations. At the turn of the 20th century, New Orleans reinvented itself, modernizing transportation, ports, and developing a manufacturing sector. During this time, S&WB emerged as a global model in governance reform and innovation, combining water, sewer, and drainage under a single, independent, and public agency.

New Orleans' strategic location along the Mississippi River and unique culture continue to be its strongest assets. The Port of New Orleans is the 4th largest port in the United States, and also hosts the 6th largest cruise ship terminal, which supports nearly 20,000 direct jobs and generates approximately \$4 billion in output locally. The City's tourism industry also sees nearly 18 million visitors annually, with an \$8.7 billion contribution to the economy. The City also continues to be a regional hub for the energy industry, with almost 4,000 local employees supporting the state's second-ranked crude oil production and fourth-ranked production of natural gas. The success of each of these economic drivers can only be supported with high performing water, sewer, and drainage infrastructure.

Despite this success, New Orleans and S&WB continue to recover from Hurricane Katrina, which ravaged the city by taking 1,500 lives and displacing almost the entire population. In addition to the physical and financial loss of Katrina, long-term deferred maintenance and ongoing revenue challenges have limited S&WB's ability to cultivate a culture of proactive maintenance and continuous improvement. Recent efforts by S&WB to identify new revenue streams and undertake a first-in-a-generation master planning process are leading S&WB toward more strategic, innovative, and integrated planning. Identifying new partners and associated new grant funding opportunities is a crucial cornerstone to freeing up sorely needed capital to reinvest in the system for future generations.

Challenges and Opportunities - Geographic / Climatic / Weather:

New Orleans is surrounded by water in every direction and the City's unique topography has created a 'bowl' that is over 10 feet below sea level. Rainwater must be pumped up and over the levees that protect the City. The City's pumping facilities are some of the largest in the world but are still overwhelmed by large storm events. This strains the sanitary sewer system and contributes to one of New Orleans' biggest threats and most unique water resource challenges. Breaks and leaks in sewer and drain lines which constantly infiltrate the groundwater, reducing the water table and causing the city's organic and clay



soils to consolidate, oxidize, and subside. When water levels rise, as is the case when there are storms, a greater strain is placed on the City’s sewer infrastructure due to infiltration and inflow (I&I). Subsidence and low groundwater have also allowed saltwater intrusion into the City’s groundwater from Lake Pontchartrain. Reduction of subsidence through sewer system rehabilitation and repair is key to reducing flood risk, mitigating rising sea levels, and maintaining critical infrastructure.

Located on the Gulf Coast, New Orleans experiences frequent high intensity rain and tropical weather events. The resulting flooding has a tremendous negative effect on the City’s sewer infrastructure and creates overflows and environmental damage. Weather events stress and further damage the aging sanitary sewer and put public health in danger.

The City’s drainage and flood control pumping facilities are some of the largest in the world but are still overwhelmed by large storm events. This strains the sanitary sewer system and contributes to one of New Orleans’ biggest threats and most unique water resource challenges. Data from the East Bank Wastewater Treatment plant suggest that an inch of rain can result in an increase in effluent of up to 100 million gallons a day. By replacing ineffective sewer lines and putting in place more resilient manholes, the stress on our system will be reduced, ensuring high quality treatment of wastewater returned to the environment.

The Approach

Challenges and Opportunities - Continued focus on Economically Stressed Communities: New Orleans is a city that is proud of its diverse population. However, it has long struggled with low and persistently unequal wages, particularly when considered by race. The City’s inequity is also reflected by geography, and most perniciously, by topography with wealthier residents occupying high ground and poorer residents occupying lower lying, flood-prone areas.

Analysis and focus on the various sewer basins within S&WB network with a significantly higher share of minority residents, people living below the poverty level, and lower median household income as compared to the State of Louisiana according to the 2016 ACS 5-year estimates must remain a priority. Project focused on these areas will serve to not only improve the performance of the utility, improve the condition of aging pipes and water quality in parts of the City which are typically underserved but also improve the quality of life for those residents living in these economically stressed, typically under-served areas. Additionally, many of these underserved areas are designated as Opportunity Zones, which could lead to additional financial leveraging opportunities. Refer to below for a list of three representative communities that represent such a referenced opportunity.

Basin	Population	Percent Minority	Percent Below Poverty	Average Per Capita Income	Median Household Income
South Shore	40,456	97.8%	35.1%	\$ 16,588	\$ 27,810
Mid-City	43,394	51.9%	31.4%	\$ 24,485	\$ 30,162
Carrollton	44,675	51.9%	30.9%	\$ 26,539	\$ 43,883
State of Louisiana	4,645,670	37.4%	19.7%	\$ 25,515	\$ 45,652

Challenges and Opportunities - Focus on Basins with Aging Infrastructure

At present, maintenance is limited to emergency responses; S&WB, however, is beginning to shift toward a culture of proactive replacement, rehabilitation, identification and prioritization of issues before they become emergencies. SSERP is a prime example in this shift and will make the wastewater /

sewerage line of business the first in the system to fully embrace the concept.

In general, the average age of sewer mains in the City is over 77 years. The targeted approach that focuses on addressing the basins with the oldest critical sewerage infrastructure should remain a priority. Below table summarizes the age of sewer mains in the various basins.



Basin	Average Age of Pipe (years)
Carrollton	93
CBD	105
Gentilly	67
Lakeview	60
Mid-City	100
New Orleans East	49
Ninth Ward	86
South Shore	48
Uptown	103
System Average	77.3

Challenges and Opportunities - SSERP to SSERP-II

Building on and expanding on your existing SSERP program, a new SSERP-II program will result in a community with a more resilient sewer collection system that better weathers the storms - protecting our environment, our citizens, and our ability to invest before chronic infrastructure failures become emergencies. Next generation SSERP-II represents the prioritized continuation of remedial measures required to ensure the adequate structure condition of the collection systems, basin by basin. Successful construction of future projects will complement the multi-decade sewer system rehabilitation and will contribute to S&WB having a foundationally-sound and more resilient sewer system. Successful implementation of SSERP-II will enable S&WB to free up funding and direct resources to other infrastructure asset priorities across the City of New Orleans.

Through the continuation of your SSERP program, the City will be positioned to leverage lessons learned and to adapt to ever changing regulatory, economic, political situations while creating a new environment where New Orleanians can thrive. Aligning the infrastructure and urban environment with the realities of the delta soils and neighborhood economics through programs like a SSERP-II, creates a culture that embraces “living with water”, resilience and builds on the confluence of Louisiana’s culture, history, and geography.

The critical purpose of the original SSERP and now SSERP-II is to rehabilitate S&WB sewer system infrastructure to minimize sanitary system overflows, reduce infiltration, reduce the rate of subsidence, gain

efficiencies and free up funding to address the next generation of sewerage and wastewater challenges. This proposed continued investment in vital rehabilitation will reduce the frequency and volume of polluted discharges into Lake Pontchartrain and alleviate negative human health impacts related to discharged pollutants. The SSERP-II would include measures necessary to enable S&WB to cost-effectively and proactively achieve compliance with the Clean Water Act, including the terms of Permit No. LA0038091, the Clean Air Act, and all future regulations promulgated under those acts.

SSERP-II will build on the tradition of adaption and streamlining the planning, design, permitting, and construction process, an approach codified in the Rehabilitation Decision Support System (RDSS). SSERP-II will continue to utilize GIS mapping tools with the addition of SMART, computer added learning technologies.

SSERP-II’s vision will align with the New Vision for Delta Cities as captured in the 2013 - *Greater New Orleans Urban Water Plan and built upon in your 2014 - S&WB Green Infrastructure Plan; 2015 - The City of New Orleans Master Plan and 2015 - Resilient New Orleans.*



Question 3

What will be New Orleans' biggest drinking water challenges in 50 years and what is the best approach to integrated, long-range planning to address those challenges?

While some of S&WB's biggest challenges may not be unique to New Orleans', some of your bigger challenges including aging infrastructure, need for modernization, vulnerabilities to natural hazards have been exacerbated by historical lack of community awareness, lack of historical maintenance, real concerns about community affordability and overall location with significant portions of the utility's critical infrastructure located below sea level and vulnerable to the many natural hazards associated with being located within the Mississippi delta and on the Gulf of Mexico. Draining of these organic soils has caused subsidence that has exacerbated the condition of the distribution system. A large amount of processed and treated water is lost in the system without customer revenue for the expense of treating and pumping this water. The water is lost into the groundwater through the leaky system.

In response to these and many other challenges, Stantec commends and supports S&WB's decision to advance an integrated approach to your water resource planning. Specifically, we support the integrated water framework as prepared by Stantec and sponsored by The Water Research Foundation for evaluating water resources, balancing cost and reliability, resilience and sustainability.

In the last several decades, water resource planning has become more challenging for utilities like the S&WB due to complexities associated with resource needs for different purposes and geographic areas, changes in hydrologic and climatic conditions, and changes in social preferences and living standards. In addition to the growing number of risks and threats from internal, external, natural and man-made factors, many developments over the past several decades have challenged the traditional approach to municipal water resources planning based on one future demand forecast, one future supply forecast, and other static assumptions about future regulations and system performance.

Stantec is leader in supporting our communities apply principles framed around One Water, reliability, resilience, and sustainability. We thrive in environments supporting forward-thinking communities apply tools and concepts to incorporate

the uncertainty around key risks into their modeling and decision-making processes. Stantec has been a leader in assisting our Water industry identify principles of reliability, resilience, and sustainability, vulnerability, performance and their derivatives. Principles that provide insights on system performance under changing climatic conditions and other uncertainties. Stantec is familiar with the numerous industry leading analytical methods and tools that have been developed to address the technical challenges of analyzing and evaluating water treatment, distribution and water supply options.

Stantec on an increasingly frequent basis is assisting our water utility clients apply integrated water resource planning, evaluation tools and frameworks that will help them address reliability, resilience, and sustainability aspects of water resources management and overcome the limitations of traditional cost-based approaches. Stantec is assisting our clients replace traditional methods or measures, like benefit-cost analysis or "firm yield," with alternative frameworks for conceptualizing study needs and evaluating options to support more robust, long-term (50-100 years) decision making, and for a systematic evaluation of the trade-offs between cost and reliability, resilience, and sustainability.

Stantec commends the S&WB for selecting an integrated, One Water approach to water resources management. Stantec promotes the framework as published by The Water Research Foundation that will help your utility evaluate options within the context of uncertainty and integrated water resources planning. Following is an overview of the framework:

- Community / utility background and research
- Assessment of drivers for alternative water resources techniques
- Water evaluation integrating objectives, planning horizons, options and constraints
- Risks and uncertainties
- Level of service goals and performance metrics
- Approach to incorporating reliability, resilience and sustainability
- Models, tools and performance monitoring



- Balancing costs and reliability, resilience and sustainability benefits
- Adaptive implementation
- Communication planning

The framework includes practical steps and proven industry best practices. The framework does not make specific recommendations but rather leads engaged stakeholders and community through a process to make decisions appropriate for your specific water system, budget, level of sophistication, and community values. The framework will assist S&WB accomplishes the following goals:

- Selection of system measures to evaluate water resources system performance
- Prioritization of risks and uncertainties to be addressed in integrated water plan
- Selection of database management and modeling tools to aid in required analyses
- Selection of methods and metrics for investigating alternatives balancing cost with reliability, resilience, and sustainability

Approach to Integrated Master Planning

Now that we have discussed the three components, we would like to address how we integrate these into a comprehensive master plan that also includes operation, maintenance, life cycle costs, capital improvements, power and funding.

Following the signing of the Water Infrastructure Improvement Act (WIIA), or the Integrated Planning Bill, essentially codifying the United States Environmental Protection Agency's (EPA) 2012 framework into law, Stantec has been engaged leading our clients through the development of integrated approaches to water, wastewater, and stormwater / drainage management. In keeping with our water client's many strategic programs surrounding customer affordability, driving performance, leveraging technology, and resilience, Stantec's approach adheres to the overarching principles of Integrated Master Planning (IMP) including:

- Maintain existing regulatory standards
- Maximize the cost and non-cost project benefits to all stakeholders
- Balance Clean Water Act (CWA) requirements to address the most pressing public health and

environmental protection issues first

- Apply innovative favorable technologies and strategies
- Create an affordable sustainable / resilient plan.

A major component of a cost-effective roadmap towards a sustainable and thriving utility and community includes following the principles of IMP and realizing the following six benefits:

- To achieve and where possible exceed operational, regulatory, and business goals through balancing of financial commitments,
- To prioritize projects based on cost and non-cost (economic, environmental and quality of life) benefits, ensuring the highest value projects are prioritized;
- To increase utility efficiency through quantifying needs, prioritizing and implementing capital and operational projects;
- To be sensitive to affordability, financial and environmental sustainability;
- To create a flexible schedule that is adaptable to changing conditions, including environmental, regulatory, and financial cycles;

Communication - in coordination with S&WB to initially compile and review capital and operational planning information and current status of projects, share findings, and relay strategy and guidance. Periodic stakeholder and frequent targeting workshops will provide a platform for the communication and the outcomes from these sessions will shape the IMP.

Collaboration - working together with S&WB and other stakeholders to ensure that S&WB's key strategies are addressed and that the outcome of this IMP is based on objective evidence. The IMP will be able to be presented to the community as well the regulatory agencies to educate, secure support and achieve regulatory compliance.

Clarity - through initially defining a clear process, S&WB will establish a framework built upon a clear water, wastewater, stormwater, and water reuse capital and operational investment strategy that is aligned with current strategic programs. The process will comprise milestones and key deliverables; this approach has been applied and proven effective in the Baltimore, Maryland, Springfield, Massachusetts, Narragansett Bay Commission, and Lima, Ohio IMPs.





Stantec’s methodology for Integrated Master Plan for S&WB is summarized by the following six elements:

1: Expectations and Desired Outcomes

The IMP outcome will be applied so that in the future this approach and the outcome become a standard business practice for across water, wastewater and stormwater investment portfolios. The IMP will allow S&WB to develop a fair, equitable and sustainable methodology for prioritizing CIP and O&M funding for all water services based on limited and shared funding sources; including diversifying green infrastructure approaches and alternative funding mechanisms.

As part of this element, stakeholder contributions will be central to a shaping a successful IP. Stantec will support S&WB through creating clear and concise information about the process to share with stakeholders. We will also attend workshops at S&WB’s invitation to answer questions.

2: Organizational Baseline

This element considers organizational alignment needs and determines internal and external stakeholder involvement necessary for effective plan development and identifies organizational “ownership” for the IMP inputs and outputs. This is a critical step in defining responsibility for the IMP development in the near term as well as implementation in the future - a major component in becoming a sustainable utility, which is an aspiration of S&WB.

This element requires the development of a comprehensive action plan, comprising:

- **Identify** organizational drivers for developing the integrated plan;
- **Determine** overall strategy with specific organizational goals and necessary tactical actions; and
- **Collate and advise** on possible organization impacts as result of the plan implementation.

Also required will be a stakeholder engagement plan and strategies for building public support for plan

development and implementation. The legal strategy will unquestionably require this plan in place.

3: Capital and Operations & Maintenance Needs

This is the ‘engine room’ of the IP. This element will include:

- **Performing a regulatory assessment / investigation on current wastewater, stormwater and drinking water compliance programs including the CD:** Understand how the development of an integrated plan may help prioritize compliance requirements against the most current regulations.
- **Develop integrated systems model:** Evaluate efficacy of existing hydraulic and water quality models for integrated systems analyses to support IMP development. Identify improvements, enhancements and necessary upgrades required to develop data inputs for plan development; and prepare integrated systems model. Stantec’s SMEs will play a role in supporting S&WB to deliver this item.
- **Conduct integrated performance assessment of water, wastewater and stormwater systems including reliability and redundancy:** Apply integrated systems model to conduct performance evaluations against CWA requirements and customer driven level of service commitments.
- **Assess integrated capital improvement needs:** Determine integrated systems improvements collectively to address CWA requirements. Assess benefits of IMP and what changes / modifications are needed to the current CIP definitions. Review / evaluate existing capital and O&M investment programs and assess enhancement needs. Review/evaluate/update existing and future funding investment scenarios for capital and O&M planned expenditures.
- **Apply integrated framework analysis for CIP project scoring, prioritization, schedule and implementation to all ongoing and planned capital and O&M requirements for**



wastewater, stormwater and drinking water systems to meet regulatory and service level commitments. Scoring will utilize a triple bottom line scoring model to prioritize capital and O&M projects. Identify financial, operational, regulatory and other constraints. Build a constrained optimization model to create a prioritized plan and schedule for CIP implementation with affordability at the core.

4: Financial and Affordability Evaluations

This element will build on the works previously completed specifically in conforming current and future financial resources and constraints necessary to meet all utility obligations in an integrated fashion. Updating the Financial Capability Assessment given current priorities, commitments and regulatory obligations for all water programs will be completed in conjunction with the engineering completed under the Capital and Operations & Maintenance Needs.

5: Regulatory and Legal Strategy

The Regulatory and Legal Strategy will develop a strategic plan for addressing existing and potential future regulatory obligations as part of the IMP process. For this element Stantec will work with utility to create a plan for engagement of regulatory authorities in discussion of benefits and goals/ outcomes of the integrated plan. This element will be a constant throughout the IMP process to ensure all elements diverge to meet expectations and desired outcomes. If during the plan there is an identified need to re-examine existing regulatory commitments and compliance schedules, Stantec will advise on engagement with the appropriate regulatory agencies and how best for utility to address modifications to any existing and / or future enforcement actions or permit obligations.

6: Integrated Plan

The final element in the process, will produce an integrated plan document consistent with the EPA's IP Framework that includes an implementation schedule compliant with S&WB regulatory obligations and balanced in its investments to ensure sustainable utility operations for the long-term.

Overall the IMP will conclude with the following six benefits:

- Balancing current financial commitments to achieve and where possible exceed operational, regulatory and business goals;

- Project implementation based on cost and non-cost benefits, ensuring the highest value projects are prioritized;
- Increasing utility efficiency through quantifying need, prioritizing and implementing capital and operational projects;
- Inclusion of affordability and financial sustainability;
- Flexible and adaptable to changing conditions, including environmental, regulatory, financial cycles;
- A major component of a cost-effective roadmap to creating a sustainable utility.

THEN... Implement, Assess, Adjust, Reprioritize

Adaptive management is a term that is applied to many aspects of investment planning and IMP is no different. At the end of this project S&WB will know more about all aspects of its CIP and the impacts on affordability and rates. New information will likely have come to light on lifecycle of the assets, the influence of aging infrastructure, the impacts of unfunded infrastructure projects, including maintenance of green and blue-green infrastructure as well as cost implications of implementing the Living with Water program.

Our team understands the responsibility we have to be good stewards of our resources. Many of the world's top engineers and scientists have come together in our Water Sector because they view a community's interaction with water a bit differently—as a single holistic system rather than as unconnected networks. Throughout our water group there are a significant number of true industry experts whose work, intelligence, and innovation are steadily advancing the field. This group of specialists helps ensure every Stantec water projects benefit from our most advanced capabilities. The best solutions are built when we work as a team, so we share our experiences as scientists, engineers, planners, construction managers, and operators for communities across North America and the world. Stantec is looking forward to expanding our relationship with the Sewerage & Water Board of New Orleans.

