



NYCDEP Operational Excellence Phase 1 report to the Water Board

Prepared for the New York City Department of Environmental Protection
and the Water Board by Veolia Water

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Executive summary

Operational Excellence

In 2011, the New York City Water Board appointed Veolia Water to partner with the New York City Department of Environmental Protection (DEP) in an effort to identify opportunities to make improvements in every aspect of New York City's drinking water, sewage collection, and wastewater treatment operations. Veolia Water teamed with McKinsey & Company and Arcadis to provide additional analytical and technical expertise, respectively. The initiative, branded "Operational Excellence (OpX): The Best Always Do Better," is an opportunity for DEP to take employee ideas and best practices from water utilities across the globe to continue to achieve the agency's goal of being the "safest, most productive, cost-effective, and transparent water utility in the nation."

This report reflects six months of analytical work completed by the OpX team, DEP management, and employees. The analytical work of OpX has confirmed that DEP is a world leader in meeting drinking water and wastewater compliance, performing well above the average of similar utilities. At the same time, the analysis indicates opportunities exist to develop new areas of strength for the organization that could result in operating benefits of potentially **\$108–130 million per year**. These benefits include reducing operating expenses by **\$65–87 million** through actions such as reorganizing the maintenance of assets, changing contract specifications, and targeting modifications to the wastewater treatment process. In addition, strategic replacement of select large meters could improve revenue collection by an additional **\$43 million per year**. Together, these benefits represent 9.0–10.8 percent of the \$1.2 billion fiscal year 2012 budget.

The OpX program goes beyond individual projects and encompasses a number of transformational initiatives, including enhancing performance management, strengthening core capabilities in human resources and

procurement, and fostering an organizational culture focused on performance and continual improvement. To achieve this transformation in operations and the resulting savings will require considerable effort and decisive leadership.

DEP is already implementing many of the findings in this report. In fact, initiatives already implemented, such as chemical dosing changes, will have a sustained annual reduction on DEP's operational expenditures of approximately \$5 million.

We believe substantial opportunity remains to continue to identify operational improvements and to implement best practices within New York City's water and wastewater systems. Further, while the OpX diagnostic phase did not include DEP's capital program, we believe there may be opportunities to better prioritize capital allocation or improve productivity in project execution. The OpX team is ready to partner with DEP to continue the Operational Excellence program as it enters the implementation phase and to realize the identified opportunities. Through the implementation of these initiatives, DEP has the chance to make a significant improvement in core operations.

\$65–87 million
annual operating expenditure reduction opportunity

\$43 million
potential annual increase in revenue collection

9.0–10.8%
total recurring annual benefits of the FY2012
\$1.2 billion DEP operational expenditures



Context

In May 2011, the New York City Water Board issued a request for proposals (RFP) for consulting services focused on improving DEP's operations and maintenance (O&M) performance, while reducing costs and enhancing operational efficiencies. The RFP defined the following tasks as the scope of the project:

1. Evaluate DEP's current O&M, reviewing all aspects of DEP's responsibilities for potential improvements, and focusing on energy usage and production opportunities, chemical usage and pricing, and labor efficiencies.
2. Recommend implementable measures for DEP to improve or streamline O&M, increasing efficiencies and reducing costs.
3. Prepare a report summarizing findings and present analysis and recommendations to the Water Board and DEP.
4. Support public outreach, legislative initiatives, and other processes required to implement recommendations.
5. Work with DEP staff to manage implementation of recommended initiatives.

The Water Board appointed Veolia Water and subcontractors McKinsey & Company and Arcadis to provide consulting services to DEP in delivering the Water Board's goals.

OpX was conceived to build on the proactive steps that DEP has already taken to improve performance transparency, customer service and financial accountability. These steps have already helped reduce the organization's operating costs by more than 15 percent over the past three years.



DEP'S Goals

The Water Board envisioned OpX as a way to help DEP meet its goal to become the **“safest, most effective, cost-efficient and transparent water utility in the nation.”**

This mission requires that DEP successfully execute its four strategic functions:

- **Provide effective and responsive customer service:** “We are a customer service organization that serves more than 9 million New Yorkers, including 836,000 property owners who pay their water bills, and thousands of people and businesses who need to hook into the water system to build homes and businesses throughout the five boroughs.”
- **Operate a safe and high-performing water utility for the lowest possible cost:** “We are the largest municipal water and wastewater utility in the country, supplying and distributing more than one billion gallons of drinking water each day, and treating 1.3 billion gallons of wastewater generated in New York City and the watershed.”

- **Make cost effective capital investments:** “We have one of the largest capital programs in the region, with \$14 billion of projects currently in active design and construction, including City Water Tunnel No. 3, and the \$5 billion re-construction of Newtown Creek Wastewater Treatment Plant.”
- **Achieve a sustainable quality of life for all New Yorkers:** “We have a key role in making New York City sustainable today and for future generations by providing clean water, clean air, and a healthy environment for all New Yorkers, and the millions of commuters and visitors who come to the city every day.”

Strategy 2011–2014

The objective of Operational Excellence

Rather than responding to future financial pressures with budget cuts that might weaken critical services, the OpX initiative makes smart improvements that will increase the strength of DEP operations well into the future. The OpX program aims to streamline workflows, boost efficiency, and continuously identify opportunities for improvements that will allow DEP to maintain its high level of customer service, safety, and productivity while minimizing rate increases for its roughly 836,000 rate-payers. To achieve this, the Commissioner set an ambitious goal for OpX to achieve operating benefits of \$100–200 million by 2016.

“The significantly lower-than-projected rate proposal [7% rate increase] was also the result of a number of operational factors: DEP initiated three successive years of budget reductions – 8% in FY11, 4% in FY12 and 4% in FY13 – that have been used to self-fund other critical needs and reduce overall operations and maintenance costs; roughly \$4.8 million in savings in FY13 has already been achieved through the Operational Excellence program, which aims to reduce operational costs of more than \$100 million annually.”

– **Carter Strickland, Commissioner**
NYC DEP press release, March 30, 2012



Operational excellence program

OpX diagnostic phase results

The six-month diagnostic phase of OpX involved almost all aspects of DEP operations and supporting administrative functions. During this phase, we compared DEP with other leading utilities around the world (see Exhibit 1, next page) and gained a deep respect for the strengths that make DEP a world-class organization, while also identifying areas for improvement.

Current DEP strengths

DEP can take pride in its accomplishments. Based on our exposure to the organization and our knowledge of many large water and wastewater utilities, we see three core areas of strength that provide a strong foundation for DEP:

OPERATIONS ARE WELL MANAGED AND RUN

DEP's excellent safety and reliability record in recent years is due, in large part, to the clear delineation of responsibility and personal accountability across the organization— notably at the level of the executive management in each of the operating bureaus. For instance, the Commissioner reviews agency-wide operating metrics with the top team at regular utility meetings and specific operating bureau metrics on a quarterly basis through the H2OStat review process. The fact that DEP has maintained 99.995 percent compliance on drinking water quality, with zero maximum contaminant level (MCL) violations, testifies to the effectiveness of this process.

EMPLOYEES HAVE STRONG TECHNICAL KNOWLEDGE AND DEEP PASSION FOR DEP'S MISSION

Employees consistently demonstrate their pride in DEP and their commitment to sustaining its status as a world-class organization. For instance, employees consistently go beyond their call of duty to respond to emergencies and secure safe and reliable water and wastewater services for the city.

DEP STRIVES TO EXCEED COMPLIANCE REQUIREMENTS AND KEEP CRITICAL ASSETS IN SERVICE

We have observed consistently that there is a mindset in DEP, from the front line to senior management, that simply meeting permit levels is not enough; DEP strives to outperform. For example, DEP removes 90–95 percent of solids in its wastewater treatment, outperforming the 85 percent removal rates required in the operating license mandate.

Methodology: Structure, approach and set-up

The insights contained in this report were generated through a six-month diagnostic phase, from November 2011 through April 2012, which included a full analysis of improvement opportunities available to DEP.

The OpX program has been executed in a joint delivery model composed of DEP leadership and personnel working hand in hand with consultants from Veolia Water. In addition, McKinsey & Company provided analytical support and Arcadis provided technical support to the team. DEP has embraced this effort and committed significant resources in hours and personnel by assigning DEP employees as leaders on specific subject matters and holding regular meetings with senior staff.

The joint work teams spent significant time in the field making detailed observations and gaining a thorough understanding of DEP operations, including:

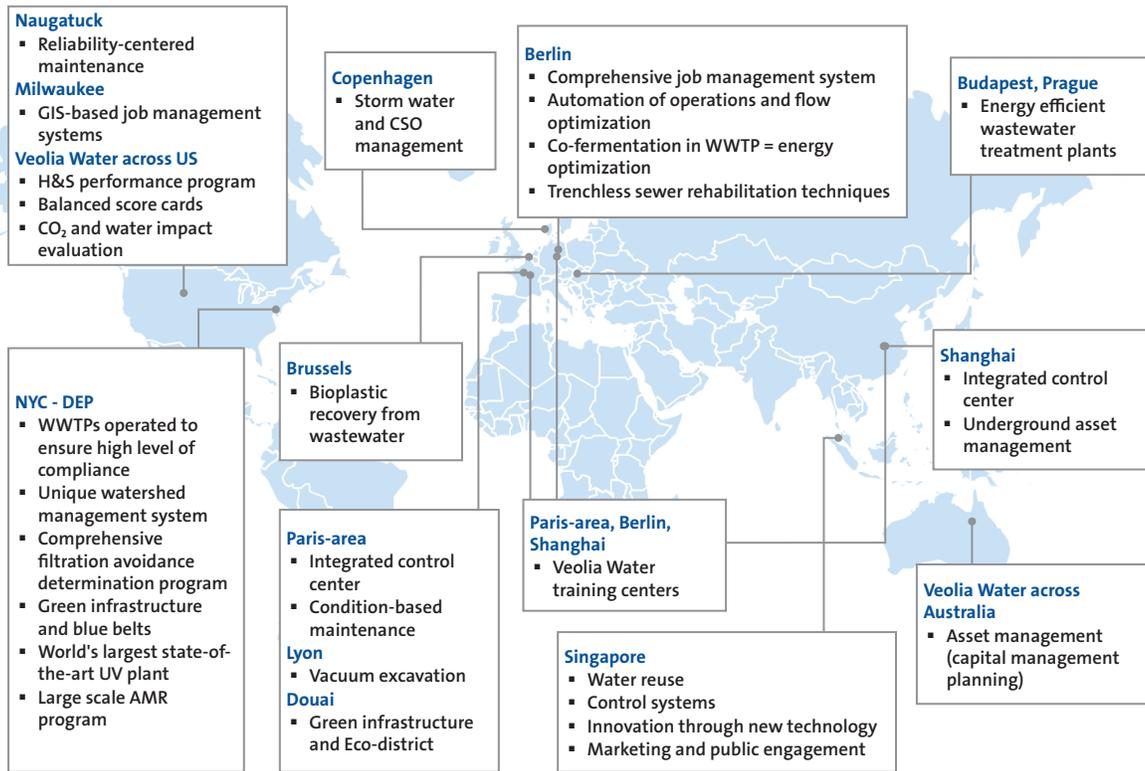
IN THE BUREAU OF WATER SUPPLY (BWS)

- Observed more than 300 person-hours of work across the bureau's many divisions and locations.

IN THE BUREAU OF WATER AND SEWER OPERATIONS (BWSO):

- Visited 13 yards and five distribution facilities staffed 24/7 (pump stations, reservoirs, etc.).

Exhibit 1. DEP is part of a worldwide network of water utilities among which best practices are shared



- Observed more than 300 person-hours of field operations (repair, sewer and maintenance yard work).

IN THE BUREAU OF WASTEWATER TREATMENT (BWT):

- Conducted site assessments at all 14 wastewater treatment plants, including detailed modeling of energy consumption and sludge generation at seven plants.
- Observed 215 person-hours of work across 12 wastewater treatment plants.
- Built a model to optimize the transport and disposal of sludge generated by all 14 plants.

IN DEP'S PROCUREMENT GROUP:

- Reviewed specifications, terms, and conditions of more than 35 contracts with a combined value exceeding \$100 million.
- Ran negotiation training for DEP contract managers and the Department of Citywide Administrative Services (DCAS) personnel.

IN THE BUREAU OF CUSTOMER SERVICE:

- Ran a statistical analysis on a population of 15,300 meters with three years of historical information.

- Compared this data with European and American meter reference data sets.

- Conducted bench tests to validate the model.

ACROSS ALL BUREAUS:

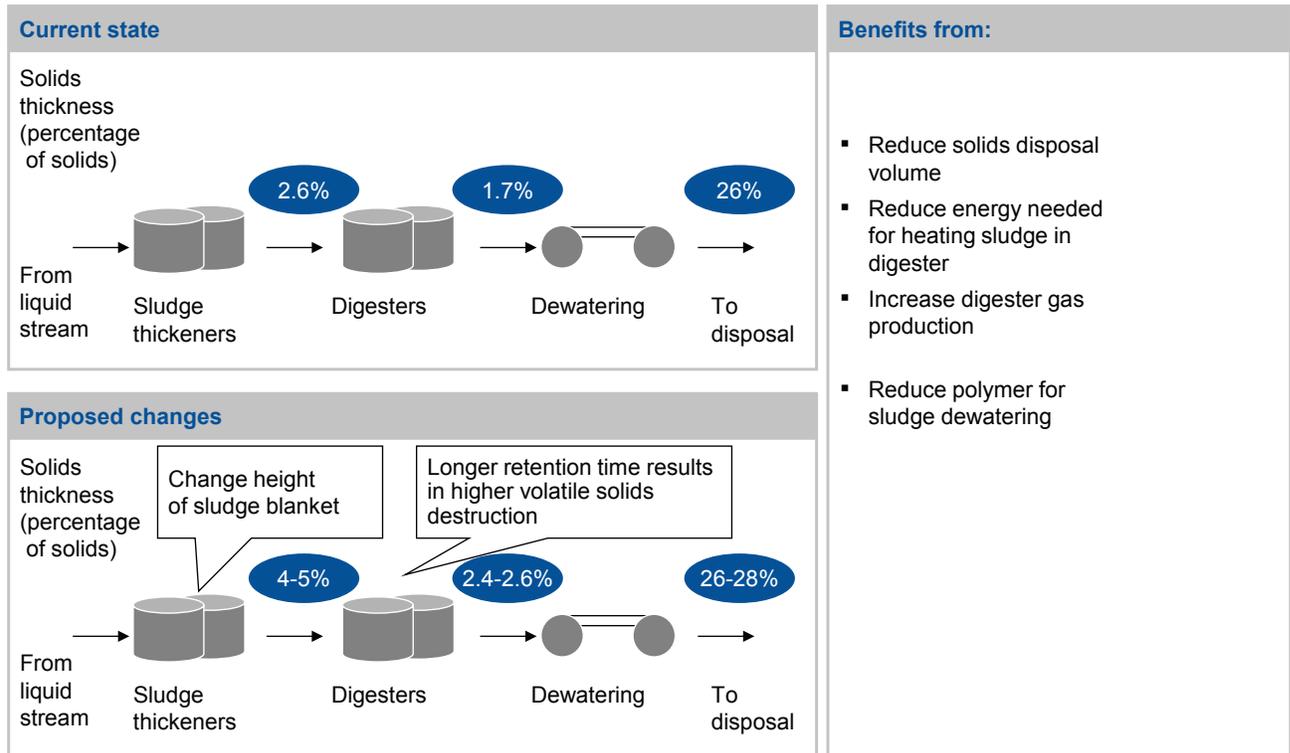
- Conducted dozens of interviews and workshops with leadership, supervisors, and field personnel.
- Analyzed data available across the organization, building new databases where necessary to generate insight.
- Facilitated workshops to generate, prioritize, and refine initiatives across bureaus.

Improvement ideas reflect external industry best practices, data analysis, and ideas generated by DEP personnel.

Functional experts, operators, and managers from other American and European large-scale water utilities were involved in the assessment and modeling of DEP's operations and contributed case examples of alternative strategies.

Working with DEP, the team identified more than 100 ideas that warranted additional analysis and evaluation. The team evaluated each idea for impact, feasibility, and potential barriers to implementation. As ideas were substantiated, they were put through an established escalation process to receive input from and to be vetted and approved by DEP senior management.

Figure 1. At the 26th Ward wastewater treatment plant, sludge pilot underway that has wide-ranging benefits



As a result of this structured approach, the findings in this report were developed with and are recognized by DEP senior leadership and supporting personnel.

Opportunities for improvement

In the first six months of the OpX program, more than 100 individual improvement ideas were identified and thoroughly evaluated. The cumulative annual impact of successfully transforming operations is projected to be \$108–130 million by 2016. It is composed of cost-oriented improvements of \$65–87 million and revenue collection initiatives worth approximately \$43 million. Most ideas offer relatively fast payback, while a few would take time or require capital investment to capture the full financial impact. If capital or operating investments are necessary, only those ideas with short payback requirements are considered.

The scale of opportunity identified is consistent with what we have seen at other very high-performing water utilities. However, DEP faces no small task in rethinking how it operates to achieve \$108–130 million in benefits. To be successful, DEP needs to strengthen many aspects of its organization. For example, DEP will need to enhance its approach to hiring, training, and talent development

to renew the organization, ensuring the continuation of its engineering and service excellence. By fostering an organizational culture focused on performance and embracing change, DEP will thrive as an organization with the skill and agility to adapt to future challenges.

We have identified five categories of improvement through which DEP can achieve world-class excellence by 2016:

1. USE RESOURCES AND MATERIALS EFFICIENTLY AND SUSTAINABLY

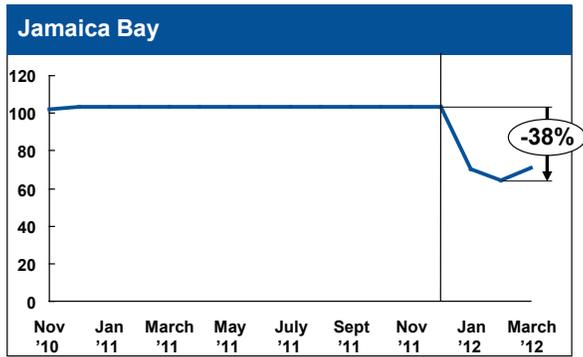
Leverage technical innovation and best-in-class processes and procedures to continue delivering high-quality service cost-efficiently. Examine and analyze drivers of resource usage and impact to ensure that DEP is getting maximum productivity out of the resources it uses. Adopting these new ways of doing business are projected to generate \$40–57 million in yearly savings.

Opportunities include:

- a) Increase energy generation and reduce the volume of sludge transported for disposal by improving sludge thickness from gravity thickeners in wastewater treatment plants to save \$4–7 million yearly. See Figure 1, above.

Figure 2. At Jamaica Bay wastewater treatment plant, operating more efficiently to meet dissolved oxygen targets reduces energy consumption

Volume of blown air (MCF/day)



- b) Improve monitoring of dissolved oxygen and control of air blowers at wastewater treatment plants to optimize aeration tank performance and reduce energy costs by \$3.5–5 million yearly. See Figure 2, left.
- c) Obtain procurement benefits from improving sourcing specifications, increasing competition amongst suppliers, understanding supply market dynamics better, and employing strategic sourcing methodology to ensure DEP pays the best price for goods and services, at savings of \$8–15 million yearly.
- d) Optimize fleet profile to meet needs most efficiently and reduce the annual cost of fleet ownership by more than \$2 million. See Figure 3, below.

2. HELP DEP’S WORKFORCE BECOME MORE EFFECTIVE

Ensure existing equipment is available for use, provide more appropriate and innovative tools and equipment, plan work better, implement automation where safe and feasible, reduce administration, and simplify processes. These changes would generate \$25–30 million in yearly savings.

Opportunities include:

- a) Improve preventive maintenance procedures and introduce on-site roving mechanics and hot-swaps

Figure 3. Proposed fleet initiatives aim to reduce annual fleet cost by 13%

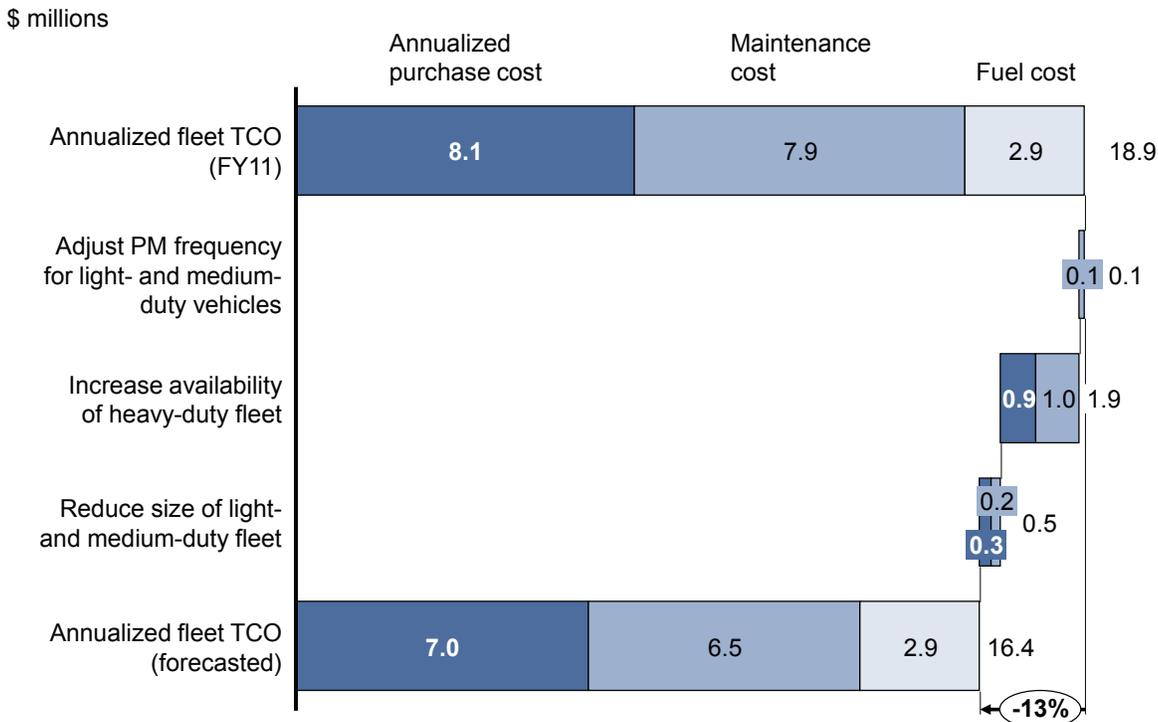
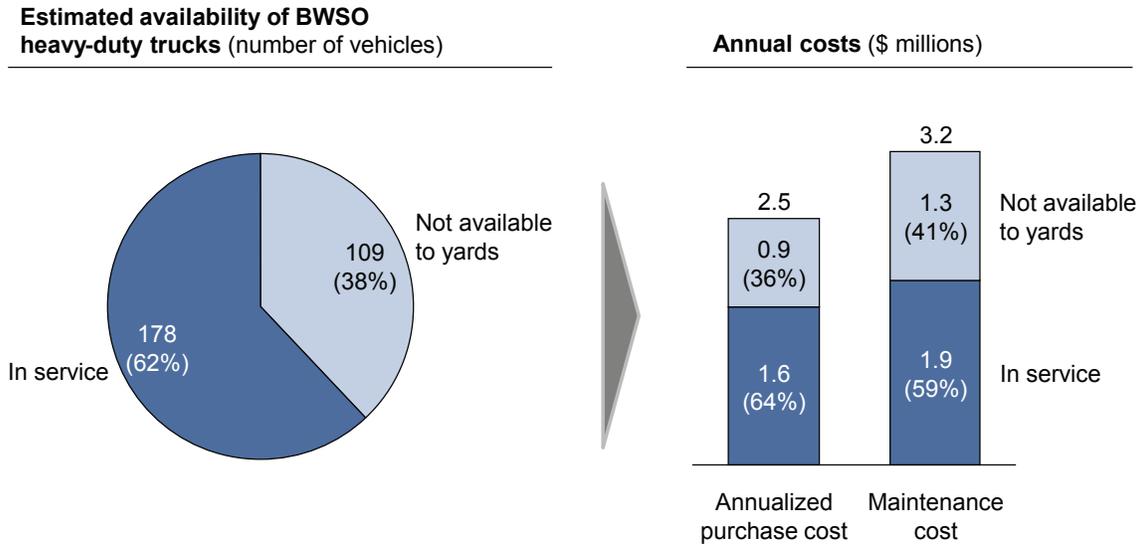


Figure 4. In FY11, 38% of BWSO’s heavy-duty fleet was unavailable to the yards, while costing DEP \$2.2 million per year

\$ millions



of components such as compressors to minimize downtime of heavy vehicles. See Figure 4, next page.

- b) Pilot equipment such as new compressors and mini excavators that may expedite workers’ ability to execute their responsibilities.
- c) Strengthen maintenance planning processes to ensure that the right people with the right equipment are sent to do the right jobs; for example, ensure that staff with the talent to do maintenance work are not inappropriately assigned to administration tasks.
- d) Take into account the impact of automation by rebalancing watch stations.
- e) Identify additional opportunities for DEP’s workforce to unlock benefits for DEP, including:

» *Work currently done by external contractors that can be done in-house. For example, select maintenance, repair, and cleaning activities from 14 separate contracts worth more than \$4 million each year could potentially be done by DEP’s labor force.*

» *Additional maintenance work that can reduce expenses in other areas. For example, more frequent cleaning of diffuser heads will reduce energy consumption.*

3. IMPROVE REVENUE COLLECTION FOR SERVICES RENDERED

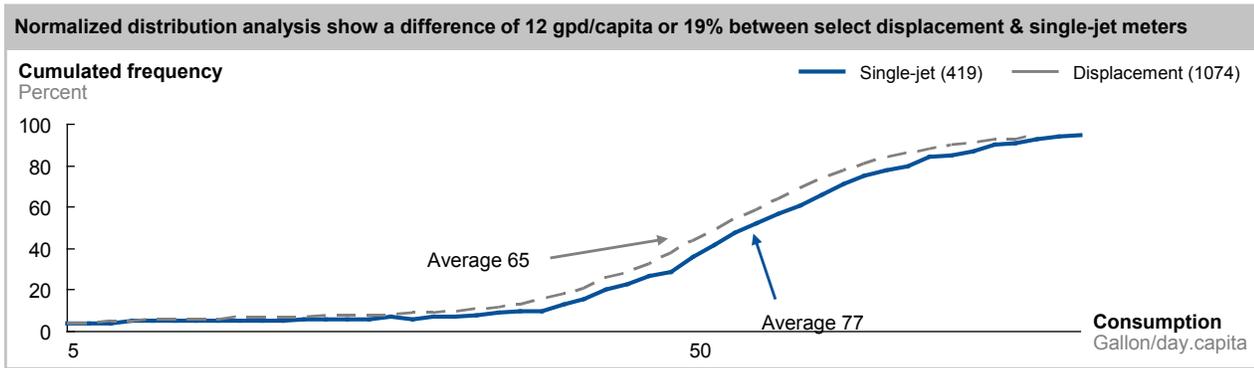
Evaluate current programs and develop new statistical models to predict when older meters will start to underreport a customer’s consumption. Use data to ensure that the customers are charged for the actual services provided. The revenue yield from billing for previously underrecorded services is estimated to be approximately \$43 million yearly.

Opportunities include:

- a) Evaluate large water meter technology and lifetime to ensure meters dependably capture volume and consumption patterns for accurate data collection and billing.

Figure 5. Statistical analysis of different large meter types indicates that some meters are likely under-registering usage

Example: 2" displacement meters, apartments buildings with elevators



- b) Expand the large meter replacement program to optimize revenue collections and capital costs. See Figure 5, next page.

4. STRENGTHEN FACT-BASED PERFORMANCE CULTURE AND MANAGEMENT APPROACH ACROSS THE ORGANIZATION

Increase emphasis on fiscal transparency, understanding, and accountability across DEP through scorecards and operational metrics. This initiative would build upon the transparency that already exists through H2OStat and allow DEP to cascade responsibility and ownership down the line, empower the entire organization to drive performance, and promote good stewardship of public funds.

Opportunities include:

- a) Develop site-level reporting for wastewater treatment plants to provide new facility managers with transparency to manage safety, compliance, and efficiency.

5. INVEST IN ORGANIZATIONAL SUPPORT, CULTURE AND TECHNOLOGY

To implement the first four themes successfully and sustain the changes over time, DEP will need to strengthen support functions and governance. These functions contribute to every financial and core operational performance improvement, and they are critical to organizational change at DEP. The team recognizes that certain changes must occur within the constraints of the civil service system. Each requires that DEP has the right capacity and capabilities in people, culture, and tools.

Opportunities include:

- a) Attract, develop, and retain DEP talent

Figure 6. Human Resource effectiveness and efficiency were assessed using a comprehensive survey



Streamline the hiring process, ensure that on-boarding effectively prepares new hires, and build talent through the right developmental experiences. See Figure 6.

Growing human resources

The OpX Team administered a survey and facilitated workshops to evaluate how the HR functions at DEP meet the needs of the operating bureaus in areas such as recruiting and professional development. Initial findings from the survey and workshops suggest that DEP needs to improve its tracking of HR performance, recruiting and processing of new employees, and professional development and succession planning to make sure that employees have the skills and experience required to assume senior roles.

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- b) Build organizational purchasing capability to ensure DEP pays a fair price

Develop tools, processes, and systems for strategic sourcing to ensure DEP pays a fair price for procured goods and services.

- c) Foster an organizational culture focused on performance and embracing change

Assess DEP's organizational culture and implement targeted interventions to provide a foundation from which to develop a more positive environment with a workforce committed to the organization's values.

Cultural transformation

Organizational performance is correlated positively with the strength of an organization's culture. The team is currently administering a survey to all DEP employees that will provide objective data on DEP's ability to execute its mission and renew its organization over time. The survey benchmarks DEP against other institutions, providing quantitative and qualitative insights into DEP's culture. The outcome of the survey will help identify specific initiatives to transform the organization.

d) Use technology to innovate the way DEP works

Help DEP ensure it has the right strategy and ability to adapt practical IT solutions to support the changes included in OpX.

Early success case studies

To date, the results of OpX are already being realized. The following provides details on the main components of these early savings and a look into our processes, with case examples of opportunities identified and implemented by OpX. More detail on the path forward is provided in the next section:

Chemical usage

While assessing the use of chemicals across DEP, the OpX team identified an opportunity to bring dosing into line with recently revised national guidelines. The idea was developed into a business case, which was assessed and validated by the responsible DEP managers before a decision was made by DEP to implement the idea. DEP's prompt action is now saving the agency more than \$1.6 million per year. See Figure 7, right.

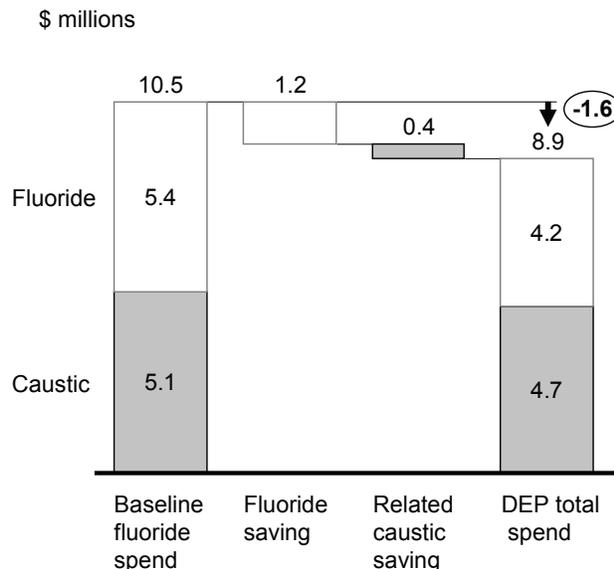
Aeration

The team benchmarked DEP's operational performance data against more than 100 other wastewater treatment plants and determined that energy consumption for aeration was high relative to other utilities. Site visits to DEP's 14 wastewater treatment plants confirmed dissolved oxygen levels were higher than expected at some plants, and interviews with the site team identified a number of challenges in controlling air supply more tightly. The team helped develop new standard operating procedures and developed the business case for investing in improved control systems. DEP already implemented procedural changes to manually control aeration at four wastewater treatment plants, saving up to \$2 million per year.

Procurement

For two chemicals, DEP and DCAS have been able to achieve lower prices than those previously paid as a result of renegotiations with incumbent vendors. To achieve this, the OpX team executed vendor economic modeling and found that DEP was likely overpaying for the commodities. Prior to entering negotiations, DEP and DCAS procurement professionals went through negotiation training and a preparation workshop. These

Figure 7. DEP has set fluoride dosing in line with revised standards, saving \$1.6 million per year



actions are already saving the agency more than \$0.7 million per year.



Recommended path forward

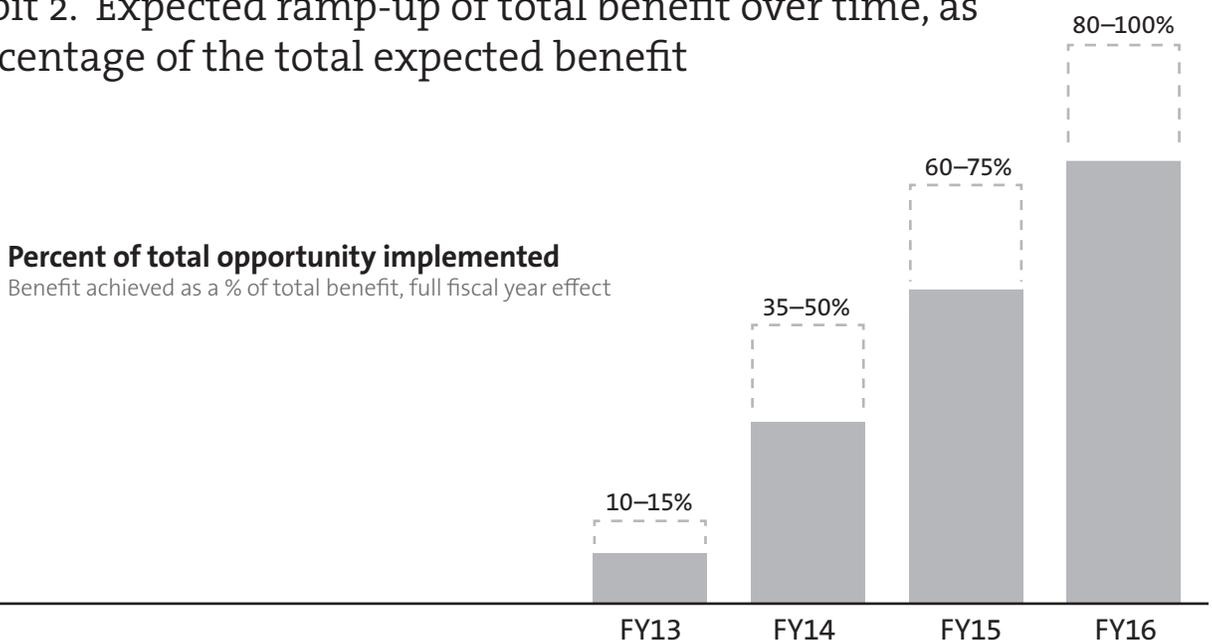
OpX Phase 1 has clearly identified the potential for DEP to improve core operations—by taking an institution with areas of standout performance to the status of a consistent world-class performer. These improvements will help DEP achieve its goal of being the “safest, most effective, cost-efficient and transparent water utility in the nation.” We feel confident that this program has the potential to transform how DEP operates and deliver attractive savings to its customers. Exhibit 2 illustrates the expected ramp-up of benefit over time, as a percentage of total expected benefit based on our typical experience and the nature of the identified ideas.

Capital investments of at least \$60–70 million may be required over the five-year period to achieve the projected savings. These investments typically have a payback of less than three years, by which point the savings from the program will more than make up for the initial investment.

Phase 2 implementation

Achieving DEP’s full potential, in both operational performance and financial savings, will not be easy. To provide the greatest chance of success and sustainability, OpX must be embraced as a holistic performance transformation across the entire organization from the Commissioner to the front line, and DEP will need to devote considerable resources and effort to making OpX Phase 2 implementation a success. As with the diagnostic, success factors are strong decision-making, deployment of the best DEP resources and personnel, and collaboration among DEP, its sister agencies, labor representation and city leaders. In designing implementation, we believe that DEP must carefully consider the following topics:

Exhibit 2. Expected ramp-up of total benefit over time, as a percentage of the total expected benefit



Workstream organization

Managing the implementation of the more than 100 individual improvement ideas that have been identified is a complex task. With this in mind, we have grouped the implementation program into eight change initiatives, plus one initiative for all of the enablers. All improvement ideas are matched to an initiative, and these initiatives are organized around the three operational bureaus as well as the centralized administrative functions.

Each initiative will be led by a DEP sponsor who will drive implementation at a high level and has accountability for the success of the overall program. The initiatives will be managed on the ground by an initiative lead and supported by consultant partners as well as DEP team members.

DEP employees and the progress of OpX as a whole will benefit from the experience of content experts, who are familiar with the challenges to implementing and sustaining change on these topics. Areas of expertise include reliability-centered maintenance¹, procurement methodology, templates and processes, telemetry and automation, and performance management tools. In this way, DEP will continue to benefit from knowledge of best practices across the globe.

Governance

In addition to having sufficient resources, success of the implementation phase of OpX requires clear accountability and transparency.

- Regular Steering Committee meetings composed of top DEP management to review progress, make decisions and remove barriers.
- Executive sponsorship of initiatives to provide accountability and drive the pace of change.
- Dedicated unit within DEP to facilitate implementation of identified initiatives within operations and identify new initiatives on a rolling basis.
- Initiative leads to drive change on the ground.
- Rigorous implementation tracking.

Capability building

Since OpX is intended to be a true transformation of DEP's operations, a key objective of the project is to build knowledge and capabilities within DEP. While consultant

team members will take a leading role at the beginning of the project to jump-start change, DEP personnel will gradually take on more responsibilities to implement and drive continuous improvement. As the DEP team steps up to take the lead, the consultant team will provide hands-on support where needed. The following will support the transfer of responsibility:

- Formalized capability-building workshops
Participants and facilitators come together to learn and understand skill concepts.
- Field application
Participants apply the concepts in their day-to-day work soon after learning to reinforce new skills.
- Coaching
Participants and facilitators discuss how best to apply new capabilities, the results of that application, and how to continue to build strength.

Experts

Supplementing the increased capabilities of DEP employees, our consulting team expects to call on more than 20 technical experts across Veolia Water's international organization, in addition to our dedicated, full-time team.

Tools

Veolia Water will use tools to facilitate implementation, such as wastewater treatment simulators tools to help wastewater operations reach targets and energy optimization tools to help target and measure energy saving actions. As necessary, we will also develop or customize tools for DEP, targeted to specific areas of need.

Implementation across DEP

Complex initiatives across distributed assets, such as BWT's wastewater treatment plants or BWSO's yards, will begin with a pilot in a specific asset or plant, make refinements in that location, and then roll out the changes across the organization.

Vision for the future

We believe that achieving OpX targets will not only make the organization more efficient and productive, but also develop a sense of accomplishment and confidence. In the future, we see a state in which ongoing initiative

¹Reliability-centered maintenance (RCM) is a methodology used to design preventive maintenance schedules to optimize asset uptime and cost efficiency.

generation and a continuous improvement ethic become the “new normal” at DEP, standard operating procedures are visible across all DEP sites, and DEP is seen as a top employer in New York and in the public sector.

OpX has the potential to foster a new performance ethic in DEP and place DEP on a productivity improvement path consistently ahead of the rest of the water and wastewater utility sector.





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