In the kNOW Webinar

Water Utility Resilience + COVID-19 Response

June 2, 2020
Welcome & Introductions

Why this issue is Important
- Adam Hosking, Jacobs, Vice President, Global Director for Water Resources

Incorporating Climate Resilience Planning into Asset Management
- Rob Taylor, Energy Manager, WSSC Water
- Laurens van der Tak, PE, D. WRE, Jacobs, Technology Fellow | Water Resources

Applying Resilience, Strategy and Tools to COVID-19 Response
- Richard Windsor, Asset Management Lead, TEAM2100 for UK Environment Agency
- Scott Haskins, Jacobs, Strategic Consulting | Water Market Lead

Questions & Answers
Resilience is the ability to anticipate and resist the effects of a disruptive event or trend, minimise adverse impacts, respond effectively, maintain or recover functionality, and adapt in a way that allows for learning and thriving.
Water Utility Resilience

- Disruptive events & trends
  - Pandemic
  - Climate change
  - Cyber attack
  - Aging infrastructure

- Minimize impacts
  - Adaptive actions
  - Continuity of operations plans
  - Response and recovery
  - Safety

- Adapt, learn and thrive
  - Recognise the opportunity
  - ‘Build back better’
  - Share learning
Where are We Now? What’s Next?

Utilities with low resilience are unprepared for shocks and are quickly overwhelmed. They recover slowly and may never achieve their former level of function.

Resilient utilities use shocks and disruptions to transform themselves, so that they thrive and “build back better”.

- **Anticipate**
- **Resist**
- **Absorb**
- **Adapt**
- **Build Back Better**
Incorporating Climate Resilience Planning into Asset Management: WSSC Water’s Climate Change Vulnerability Assessment, Adaptation and Mitigation Plan

Robert Taylor/WSSC Water
Laurens van der Tak/Jacobs
WSSC Water Service Area (Maryland)

- One of the largest water/wastewater utilities in the nation
- Serves 1.8 million customers in Maryland's Montgomery and Prince George's Counties
- Founded in 1918 - 102 years!
- Provides 170 MGD drinking water
- Collects 200 MGD wastewater
- Treats 70 MGD wastewater
- Supplies DC Water with 130 MGD wastewater
- (2) Water Filtration Plants
- (5) Water Resource Recovery Plants
- (13) Water Pumping Stations
- (50) Wastewater Pumping Stations
- (10) Field Offices/Lab/HQ
Climate Change Vulnerability Assessment, Adaptation, and Mitigation Planning (CCVAAMP) Project

- Climate Analysis & Projections
- Vulnerability Assessment
- Adaptation Analysis
- Mitigation Planning (GHG Inventory and Action Plan)

1. Develop Climate Adaptation Plan Framework
2. Identify Vulnerabilities And Risk
3. Develop Adaptation Strategies
4. Documentation
5. Implementation
6. Monitor and Re-assess
Climate Analysis and Projections
Climate Change Impacts Rainfall, Extreme Storms and Sea-Level Rise

**Precipitation - Driven**
- Stormwater/Drainage
  - 2- to 10-year storms
  - Localized flooding & increased SSOs
- Riverine
  - 100-year storms
  - Regional flooding

**Coastal**
- Sea-level rise
- Tidal flooding
- Storm surge
- Tropical storms
- Recurrent flooding from increased tide levels
- Coastal flooding
Climate Projections for WSSC Water Service Area (100 yr. storm)

24-hour rainfall depth projected to increase 15% by 2065

![Bar chart showing precipitation projections](chart.png)
Sea-Level Rise Projections for WSSC Water Service Area:

High Tide (MHHW) projected to increase from 2.0 ft to 4.0 ft in 2065

- Mean Higher High Water (MHHW) projected to increase from 2.0 ft in 2015 to:
  - 2.9 ft in 2040
  - 4.0 ft in 2065
  - 6.3 ft in 2100
Facility Vulnerability Assessments and Adaptation Planning
Flood Modeling Completed for Riverine and Coastal Facilities

Riverine: Above the Fall Line / Rainfall modeled with HEC-RAS

Coastal: Below the Fall Line, Storm Surge and SLR Modeled with MIKE21

Geologic “Fall Line” between Piedmont and Coastal Plain geologic provinces
Water and Wastewater Facilities Investigated to Date for WSSC Water

<table>
<thead>
<tr>
<th>Facilities in GIS</th>
<th>Coastal Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 +</td>
<td>Anacostia WWPS #1</td>
</tr>
<tr>
<td></td>
<td>Anacostia WWPS #2</td>
</tr>
<tr>
<td></td>
<td>Broad Creek WWPS</td>
</tr>
<tr>
<td></td>
<td>Western Branch WRRF</td>
</tr>
<tr>
<td></td>
<td>Hyattsville WWPS</td>
</tr>
<tr>
<td></td>
<td>Piscataway WRRF</td>
</tr>
<tr>
<td></td>
<td>Anacostia Depot</td>
</tr>
<tr>
<td></td>
<td>Colmar Manor WWPS</td>
</tr>
<tr>
<td></td>
<td>Forest Heights WWPS</td>
</tr>
<tr>
<td></td>
<td>Fort Foote WWPS</td>
</tr>
</tbody>
</table>

| Facilities located in or near floodplain | 49 |

| Facilities prioritized for future flood modeling | 18 |

| Vulnerability assessments completed to date | 18 |

| Facilities located in or near floodplain |

| Facilities prioritized for future flood modeling |

| Vulnerability assessments completed to date |

| Coastal Facilities |

| Riverine Facilities |

| Air Park WPS |
| Decatur Street WWPS |
| Hyattstown WRRF |
| Marlboro Meadows WWPS |
| Parkway WRRF |
| Reddy Branch WWPS |
| Rocky Gorge WPS |
1. Identify all assets at risk below recommended design flood elevation (DFE).
2. Determine Level of Service (LOS) of all assets at risk.
3. For high LOS assets under the DFE, develop asset-level strategy.
4. For all buildings at risk, develop building-level strategies.
5. Calculate benefit of adaptation.
6. Compare benefits to cost of flood-proofing alternatives.
Cumulative Risk Avoided Accounts for Climate Change Over the Expected Life of Each Asset

\[
Cumulative\ Risk\ Avoided = \sum_{i=2017}^{2040} Annual\ Risk\ Avoided
\]

**Annual Risk Avoided** = (Probability of flood event in given year) \* (Asset Replacement Cost) \* (1−Strategy Failure Potential)

Includes:
- Increasing probability of floods from now to 2040
- Potential of strategy failure
- Annual risk discounted to present dollars
## Adaptation Strategies for Treatment Facilities and Pump Stations

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Resiliency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>No Protection</td>
</tr>
<tr>
<td>Sandbagging</td>
<td>Low</td>
</tr>
<tr>
<td>Temporary Barriers</td>
<td>Moderate</td>
</tr>
<tr>
<td>Seal Building/Control Room</td>
<td>Moderate/ Medium</td>
</tr>
<tr>
<td>Construct Static Barrier</td>
<td>High</td>
</tr>
<tr>
<td>Flood-proof Equipment</td>
<td>High</td>
</tr>
<tr>
<td>Elevate Equipment</td>
<td>Very High</td>
</tr>
</tbody>
</table>
## Compare Strategy Costs to Cumulative

### Assets at Risk and Area Level Strategies

<table>
<thead>
<tr>
<th>Building/Area</th>
<th>Quantity</th>
<th>Cost of Replacement</th>
<th>Strategy Costs</th>
<th>Cumulative Risk Avoided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Yard</td>
<td>7</td>
<td>$5,510,000</td>
<td>$452,000*</td>
<td>$1,070,000</td>
</tr>
<tr>
<td>Generator Building</td>
<td>5</td>
<td>$20,520,000</td>
<td>$300,000</td>
<td>$390,000</td>
</tr>
<tr>
<td>Pump Station Building</td>
<td>23</td>
<td>$22,300,000</td>
<td>$300,000</td>
<td>$2,160,000</td>
</tr>
<tr>
<td>Screening Building</td>
<td>5</td>
<td>$1,340,000</td>
<td>$160,000</td>
<td>$130,000</td>
</tr>
<tr>
<td>Valve Vaults</td>
<td>8</td>
<td>$260,000</td>
<td>$90,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>Surge Tank Area</td>
<td>1</td>
<td>$20,000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Recommended Strategies Based on Benefit-Cost Analysis
- Elevate Electrical Yard
- Install temporary door covers around Generator Building and Pump Station Building

---

© Jacobs 2020
CCVAAMP Vulnerability Assessment Results
Priority Ranking Based On Risk Alone

Facility Ranked by Cumulative Risk Avoided
(Benefits = Avoided Asset Damage for All Assets)
CCVAAMP Vulnerability Assessment Results
Priority Ranking Based Return on Investment: $ Net Return per $ Invested in Resilience

Facility Ranked by Return on Investment (Net Return/Cost)
Design Guide for Protecting Facilities from Future Climate Extremes

- Guidance for flood protection criteria
  - Criteria for design of new facilities and protection of existing facilities
  - Outfall tailwater design elevations for treatment process
  - Site stormwater design guidance based on climate projections
- Guidance for resiliency of electrical and instrumentation & controls systems
- Greenhouse gas emissions reporting guidance for new projects
Greenhouse Gas Reduction (Mitigation) Progress
What a GHG inventory includes…

SCOPE 1
- direct
  - fuel combustion
  - company owned vehicles

SCOPE 2
- indirect
  - purchased electricity for own use

SCOPE 3
- indirect
  - product use
  - outsourced activities
  - employee business travel
  - contractor owned vehicles
  - waste disposal

<table>
<thead>
<tr>
<th>CO₂</th>
<th>SF₆</th>
<th>CH₄</th>
<th>N₂O</th>
<th>PFCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>purchased electricity for own use</td>
<td>fuel combustion</td>
<td>company owned vehicles</td>
<td>production of purchased materials</td>
<td>waste disposal</td>
</tr>
</tbody>
</table>
## GHG Emissions Impacts of Current Projects (tonnes CO2e/Yr)

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Emissions (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patuxent Solids (2019)</td>
<td>200</td>
</tr>
<tr>
<td>Patuxent UV (2019)</td>
<td>1,100</td>
</tr>
<tr>
<td>Increased Patuxent Production (20 MGD) (2019)</td>
<td>-2,700</td>
</tr>
<tr>
<td>Rocky Gorge Pump and Force Main (2020)</td>
<td>-100</td>
</tr>
<tr>
<td>HVAC/Lighting Upgrades (2019)</td>
<td>-2,600</td>
</tr>
<tr>
<td>Office Equipment (2019)</td>
<td>-100</td>
</tr>
<tr>
<td>Telecommuting (ongoing)</td>
<td>-200</td>
</tr>
<tr>
<td>Parkway Mixer Replacement (2020)</td>
<td>-100</td>
</tr>
<tr>
<td>Potomac Intake (2025)</td>
<td>-25</td>
</tr>
<tr>
<td>Piscataway Bioenergy (2023)</td>
<td>-7,100</td>
</tr>
<tr>
<td>Potomac Solids (2020 and 2026)</td>
<td>2,800</td>
</tr>
<tr>
<td>Seneca Data Center (2021)</td>
<td>3,900</td>
</tr>
<tr>
<td>Potomac Air Scour Blower (2020)</td>
<td>100</td>
</tr>
<tr>
<td><strong>Net (2035)</strong></td>
<td>-5,200</td>
</tr>
</tbody>
</table>
GHG Emissions Reductions (Goal: 60% reduction by 2035)

WSSC Emissions Projections (2005 - 2035)
Impact of Project, Strategies, Wind Contract and RECs vs. WSSC Water Goal
Your turn…

Poll Question #1
Applying Resilience Strategy and Tools to COVID-19 Response

Richard Windsor, Richard Windsor, Asset Management Lead, TEAM2100, UK
Scott Haskins, Jacobs, Water Market Lead, Strategic Consulting
TEAM2100 Overview Description and Purpose

Our Vision
To increase the resilience of communities, wildlife and business within London and the Thames Estuary through the sustainable management of flood defenses

Our Values
What we are
Integrated, Collaborative and Innovative

What we do
Deliver on commitments and finish the job

How we work
Safely, efficiently and flexibly

Our Pathfinder
Mission Principles
Be a world-class asset management enterprise

Be a catalyst for change delivering efficiencies for the Environment Agency

Be a place where people want to work that has a culture of caring and safety
TEAM2100 Overview Description and Purpose

- 2100 Plan
- Delivering the Thames Estuary
- UK’s largest single flood risk programme of works, Environment Agency; one of worth over £300m

- Pathfinder Project for the Environment Agency
- UK government top 40 major infrastructure project
## TEAM2100 Overview Description and Purpose

### What Does the System Protect?

<table>
<thead>
<tr>
<th>People &amp; Property</th>
<th>Industry</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ 1.3 million residents</td>
<td>▪ 40,000 commercial and industrial properties</td>
<td>▪ 400 schools</td>
</tr>
<tr>
<td>▪ Over 500,000 homes</td>
<td></td>
<td>▪ 16 hospitals</td>
</tr>
<tr>
<td>▪ £275 bn property value</td>
<td></td>
<td>▪ 8 power stations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heritage</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Over 3100 hectares of sensitive heritage sites</td>
<td>▪ More than 1000 electricity substations</td>
<td>▪ 167 km of railway</td>
</tr>
<tr>
<td>▪ 4 world heritage sites</td>
<td>▪ 167 km of railway</td>
<td>▪ 35 tube stations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Culture</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Art galleries and historic buildings</td>
<td>▪ 51 rail stations</td>
</tr>
<tr>
<td></td>
<td>▪ Over 300 km of roads</td>
</tr>
</tbody>
</table>
TEAM2100 Continual Improvement and Resilience

Business Strategies
- Emergency preparedness
- Innovation
- Maturity assessment
- Certification
- Risk management
Continual Improvement and Resilience

The ‘new normal’ challenges in the COVID-19 Pandemic

- A new focus on emergency operations and teleworking
- Depressed economy and business function
- Pressure from customers to be more sensitive to costs and affordability
- Need to optimize and fund capital projects amid changing priorities
- Staffing challenges, including illnesses among staff and making decisions about short-term and long-term personnel needs
- Reduction in customer demand for services and forced shutdowns of offices and facilities
- New operational efficiency, performance, and service delivery imperatives
- Supply chain disruptions

Friday night 5 pm rush hour in downtown Washington, D.C. illustrates the new normal
Continual Improvement and Resilience

**Identifying Adaptive and Resilient Solutions**

- Deploying proven approaches: strategic planning, decision analysis, financial forecasting, asset management/maintenance, and risk management increases the likelihood of your organization’s ability to adapt.

- TEAM2100 adaptive and resilient solutions to address the COVID-19 pandemic includes:
  - Capital improvement refocus to address new near-term priorities
  - Staffing and resource level changes or deployment changes
  - Refocus of technology and innovation, e.g. supporting working from home
  - Initiatives to improve operational efficiency
  - Elevating efforts in safety and risk reduction
Recovery Will Occur Over a Range of Timeliness and Support Continuity of Operations

- **This Week**: Business Continuity
- **Next Month**: Prioritize OPEX/CAPEX, Contingency Planning
- **Next Quarter**: Transition Planning
- **Recovery**: Performance Analytics, Review Timetables & Scheduling, Delivering Work within Outage/Possessions Review, People as Assets & COVID-19 Impact Modeling

- **Opportunities**: Condition Surveys, Addressing Systemic Issues

- **Optimizing/Resilience**: Condition Surveys, Addressing Systemic Issues

©Jacobs 2020
Continual Improvement and Resilience

### Scenario Planning Helps Define COVID-19 Response Strategies

<table>
<thead>
<tr>
<th>External drivers</th>
<th>Flattening the Curve</th>
<th>Midrange</th>
<th>Laissez Faire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Capital and Finance</td>
<td>Market uncertainties result in unclear interest rates and restricted access for many.</td>
<td>Less complete early results and restricted access for some.</td>
<td>More support for companies to generate earlier recovery, so greater access to capital.</td>
</tr>
<tr>
<td>Operations and Efficiency</td>
<td>Focus on essential operations; ability to perform operations affected by remote teleworking, furloughs, access to work sites and supply chain.</td>
<td>Impacts on efficiency from regulatory constraints, significant disease in the population and revenue challenges but less pronounced.</td>
<td>Ability to perform operations affected by worker safety issues with widespread, sustained disease in the population.</td>
</tr>
<tr>
<td>Customer Relations And Service Levels</td>
<td>Significant near-term reduction in demand for service as a result of mandated lockdowns and voluntary company closures.</td>
<td>Mid-range impact on demand for service.</td>
<td>Some reduction in near-term demand for service but more moderate than in scenarios with widespread mandated lockdowns.</td>
</tr>
<tr>
<td>Affordability</td>
<td>Customer issues related to illness and unemployment and need for emergency bill relief for growing unemployed base.</td>
<td>Combination of illness and financially based needs for emergency bill assistance.</td>
<td>Many customers needing emergency assistance with bills due to rapid growth in significantly ill customers.</td>
</tr>
<tr>
<td>Workforce and Change Management</td>
<td>Immediate impacts on staffing, production and needed organizational changes from physical distancing; impacts extended over 6 to 8 months.</td>
<td>Mid-range impacts due to necessary workforce changes and new work practices.</td>
<td>Significant staff impacts due to extended illness period casualties and disruption; innovation restructuring for needed change.</td>
</tr>
</tbody>
</table>
Applying Tools and Strategies

Proven Approaches & Tools Help Manage the New Risks

Approaches that can help make informed decisions amid current uncertainty include:

- Short-term and long-term demand and financial forecasting
- Scenario planning
- Programmatic and work planning
- Prioritization and decision analysis
- Strategic planning
- Systems for financial planning and delivery analysis
- Risk and performance management
- Change management, training, and business process improvement
Industry Collaboration - Organizational and Asset Management Benchmarking

Focus Areas:
- Strategy & Planning
- Finance & Decision-Making
- Life Cycle Delivery
- Information & Systems
- Organization & People
- Risk & Resilience

Customer

- Facilitated Workshop
- Pre-Workshop Meeting
- Re-Assess
- Implement
- Gap Closure Plan/ Roadmap
- Reporting

executive sponsorship
cross-functional teams

Assessment
Networking
Improvement

- Organizational Report
- Industry Report
- Leading Practice Conference
- Peer Exchanges
Industry Collaboration – Organizational and Asset Management Benchmarking

Organizational Process Benchmarking

Enabling Business and Customer Value through better Asset Management

World’s largest process benchmarking project, delivering:

- An asset/organizational management maturity assessment.
- Understanding of leading-edge practice across the lifecycle.
- Peer networks with other organizations internationally.

Value proposition for Clients

- Demonstrate to customers and regulators that utilities are effective and efficient.
- Continuous improvement via practices, metrics and safety performance.
- Target-setting, improvement initiatives and linkages to organizational strategic plans.
- Peer collaboration and learning, particularly leading practices, consortium benchmarking, and networking with leading practitioners nationally and internationally.
- Integration with IAM and ISO55000 standards.
- Achieving efficiency, improved practices and service level improvements.
Industry Collaboration - Business Process Improvements
Utility Analysis and Improvement Methodology

**Business Processes Describes**

- Who is involved in the business process (swim lanes)
- Work flow (sequence paths of activities)
  - What decisions need to be made (and by whom)
- What resources (e.g. time, staff, equipment) are needed
- The metrics impacted by the process
- What data is required to execute work and make decisions
- Where (in what systems) the required data resides

**Major Features**

- LEAN Six Sigma
- 19 participating utilities
- Research and Develop “To Be” processes for:
  - CIP Delivery (TEAM2100 Lead)
  - BCE/CIP Prioritization (DC Water Lead)
  - Asset Management Plans (MCES Lead)
  - Enterprise Risk (Portland Water Lead)
  - Change Management
  - Organization Culture
  - Workforce Development
The UPTIME ELEMENTS Framework by ReliabilityWeb is an Industry Framework

TEAM2100

- Training & Networking
- Peer Conferences
- Maintenance Excellence Maturity Assessment
- Chartering
- Implementation Plans

TEAM2100 Average Maturity Scores
“I’ve seen it first hand. You gather up a diverse group of employees, put them in a room and allow them to discuss and ultimately score the assessment questions. Through this practice, the team gains a greater understanding of the business processes being assessed, and a greater respect for the differing viewpoints from each team member. It’s real...paradigms shift and momentum for real change begins.”

Andrew Pearce, Deputy Director – Asset Management, Environment Agency
TEAM2100 major risks include:

- Securing partnership funding in medium-term
- Significant weather event
- Third party owned asset interventions

Program Risk Register
Prioritize program risks and finalize risk register; identify mitigations and risk owners; develop action plans and metrics; monitor and report status; updates for new risks and actions to be managed.
TEAM2100 Tools and Strategies Applied – Collaboration, Diversity, Innovation

Align organization, culture, tools and processes to future strategic direction

- Insights workshops – fostering diversity
- Positive challenge – ‘zones of uncomfortable discussion’
- Leadership example, team empowerment
- Staff rotations across our organizations
- Interchangeability - best person for the role
TEAM2100 Results of Resilience, Tools and Strategies Applied

- Improved decision-making (MODA, Prioritization, updated Strategic Plan, Process Improvements)
- Implementing AM Improvement recommendations; leading practices
- ISO55001 AM certified – focus on world class
- Over £30m of efficiencies recorded to date
- 300+ innovation ideas submitted, over 50 implemented
- Zero lost-time incidents since day one – 1.3m hours to date
- Team Innovation Award from Institute for Asset Management
Your turn…

Poll Question #2
Questions & Answers

Or send to: lori.irvine@Jacobs.com
A PDH certificate will be provided to those who participated in the live webinar.
Thank You!