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Evaluating Water Risk

Information to Motivate Action

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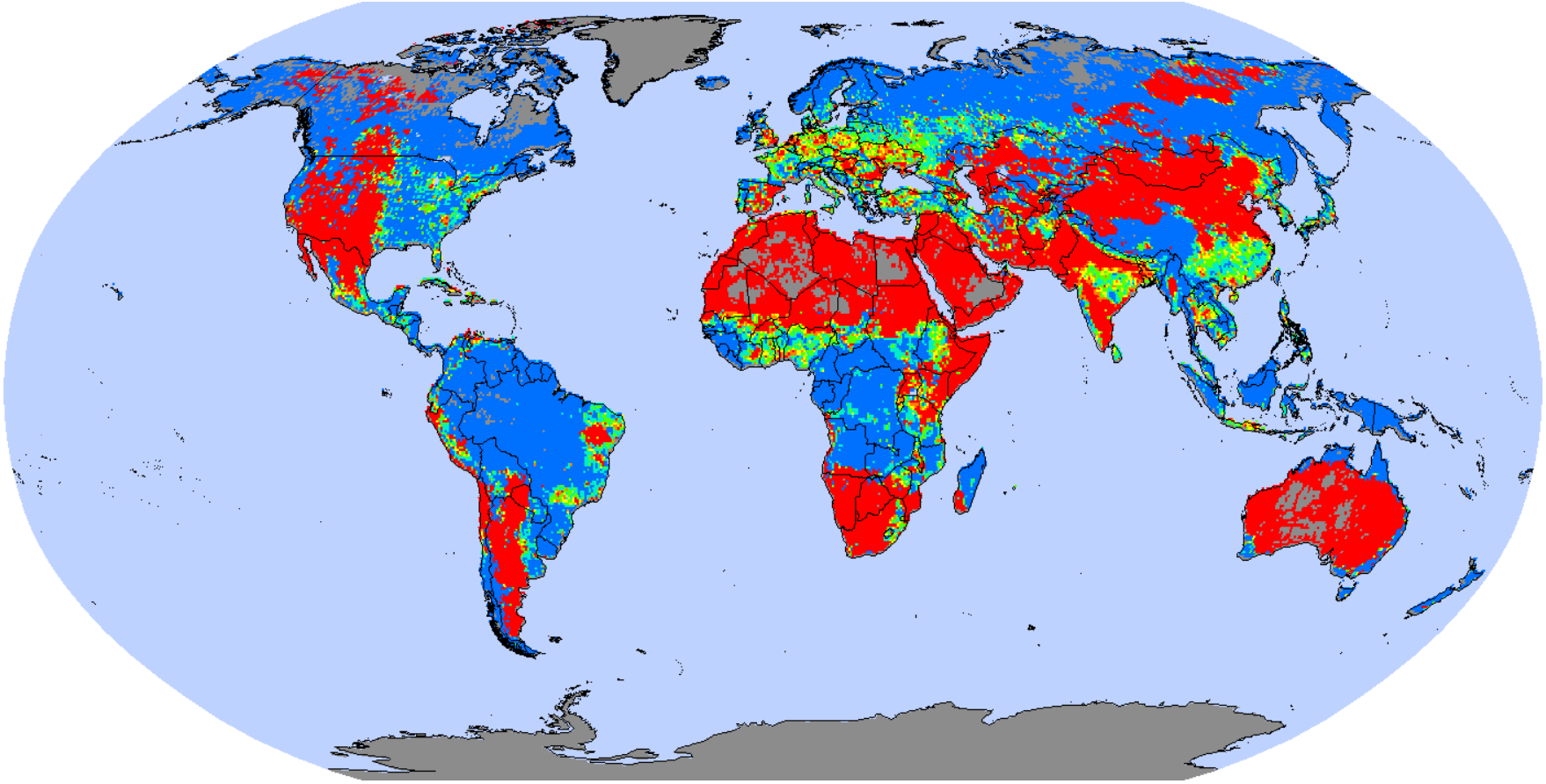
Water scarcity in 2025 – we arrived early

3.3 billion people, or almost half of the world's population, live in areas of physical scarcity and/or face economic water shortage

$17 trillion **22%** of Global GDP is currently generated in water-scarce areas. By 2050 it will be 45%



Source: Center for Environmental Systems Research, University of Kassel, www.usf.uni-kassel.de

The water, energy and food nexus

Water for energy

Energy for water

Water is needed to generate energy

Energy is needed to extract, treat and transport water

Water and energy for food

Water scarcity trajectory – an opportunity to “deflect”

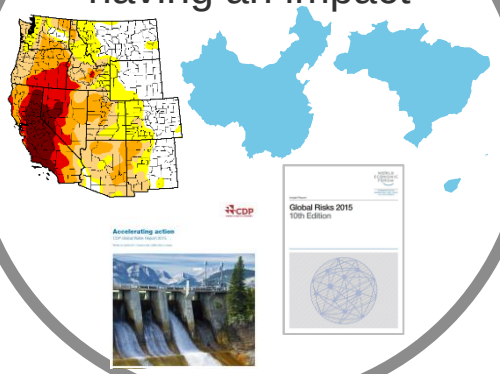
We need more

Surge in demand ← Rising Population, Rising Middle Class
- 60% more food by 2050
- 80% more energy by 2050
- 55% more water by 2050

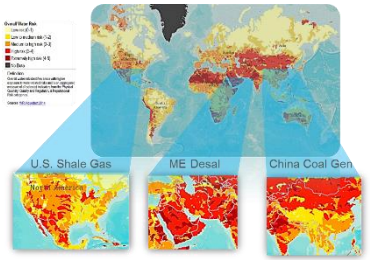
Instability of supply ← Climate Change, Political factors
- severe weather patterns
- water rights/treaties

Depleted assets ← Groundwater, Surface water
- greater extraction
- lower replenishment

It’s already having an impact



It’s global



More than 50% of U.S. reserves of shale and tight gas are located in water stress areas.

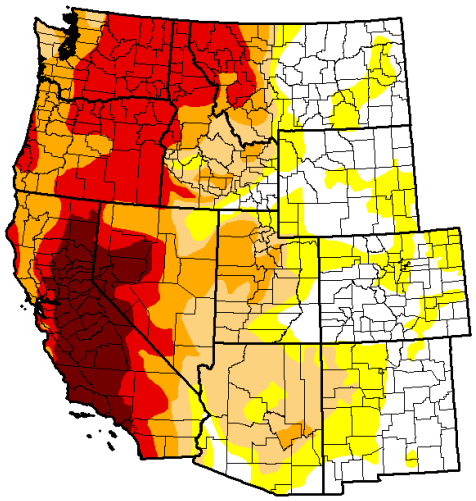
ME has 1% of global water. 70% of the world’s desal plants are located ME. 75% of desal costs are energy.

60% of planned coal-fired power plants are in provinces that have 5% of the water.

All sectors

- **Power & Utilities**
- **Energy Intensive Industries**
- **Oil & Gas**

The public sector and water risk - have we learned?



October 13, 2015

- Abnormally dry (18%)
- Moderate Drought (15%)
- Severe Drought (15%)
- Extreme Drought (19%)
- Exceptional Drought (8%)

http://droughtmonitor.unl.edu/

The past is not a guide to the future

Scarcity impacts economic and business growth

Public policy will align with the "new normal"

Scarcity drives innovation – "business ecosystems" and technology

Data analytics are essential for a fact based dialog with stakeholders

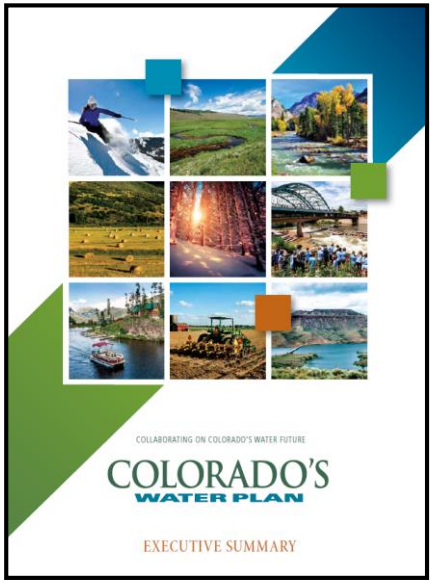
Public policy and long term strategy

California

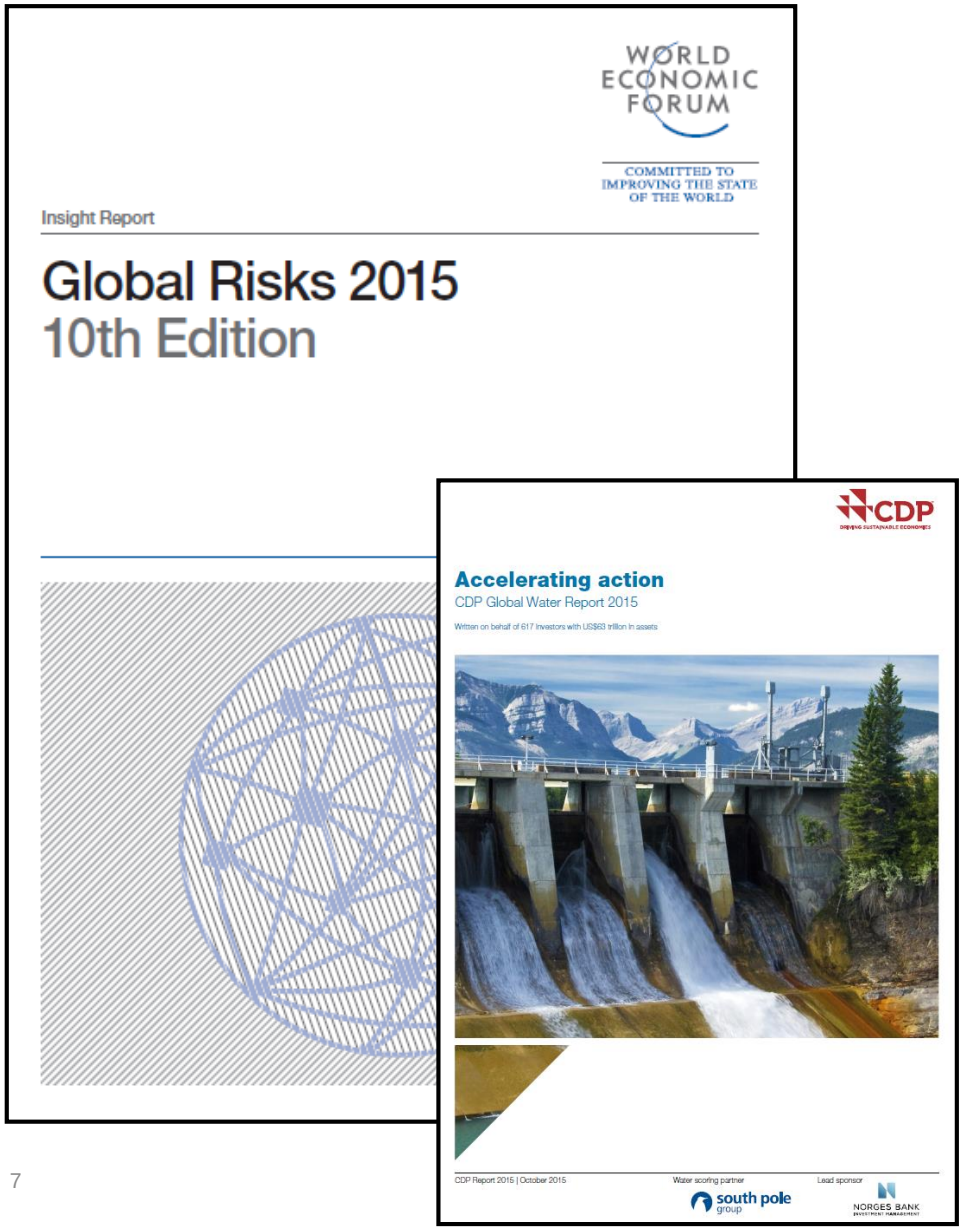
Set a statewide water reduction target of 20% per capita by December 31, 2020; passed a $7B water bond and new groundwater legislation in 2014; Adopted mandatory conservation requirements for urban water suppliers in 2015

Texas

Launched a $2 billion infrastructure fund that will focus solely on water projects

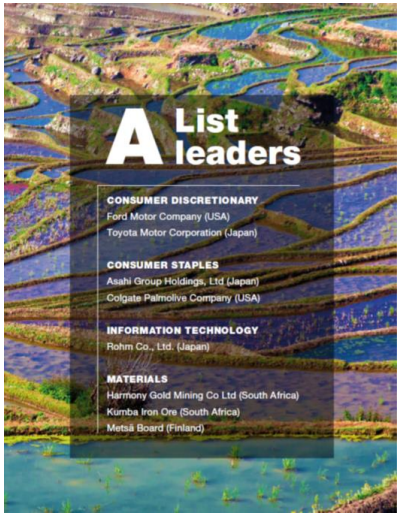


The private sector and water risk



2015 World Economic Forum

2012	2013	2014	2015
Major systemic financial failure	Major systemic financial failure	Fiscal crises	Water crises
Water supply crises	Water supply crises	Climate change	Rapid and massive spread of infectious diseases
Food shortage crises	Chronic fiscal imbalances	Water crises	Weapons of mass destruction
Chronic fiscal imbalances	Diffusion of weapons of mass destruction	Unemployment and underemployment	Interstate conflict with regional consequences



How the private sector views water risk

	Supply Chain	Operations	Product Use
Physical	Water scarcity drives up input prices (~2%-20%)	Increased capital expenditure on water treatment, extraction or alternative technologies raises costs	Non-availability or scarcity of water required for using product or service limits growth
Regulatory	Suspension or withdrawal of supplier's water license or discharge permits disrupts supply chain	Reallocation to more urgent needs during drought disrupts operations	Restrictions on use of particular products or services due to water intensity raises costs or checks growth
Reputational	Responsibility "by association" for suppliers' water pollution damages brand or reputation, hinders growth	Competition with household demands, or pollution incidents, damages brand or reputation, hinders growth	Public outcry regarding water intensity of product damages brand, reputation, hinders growth

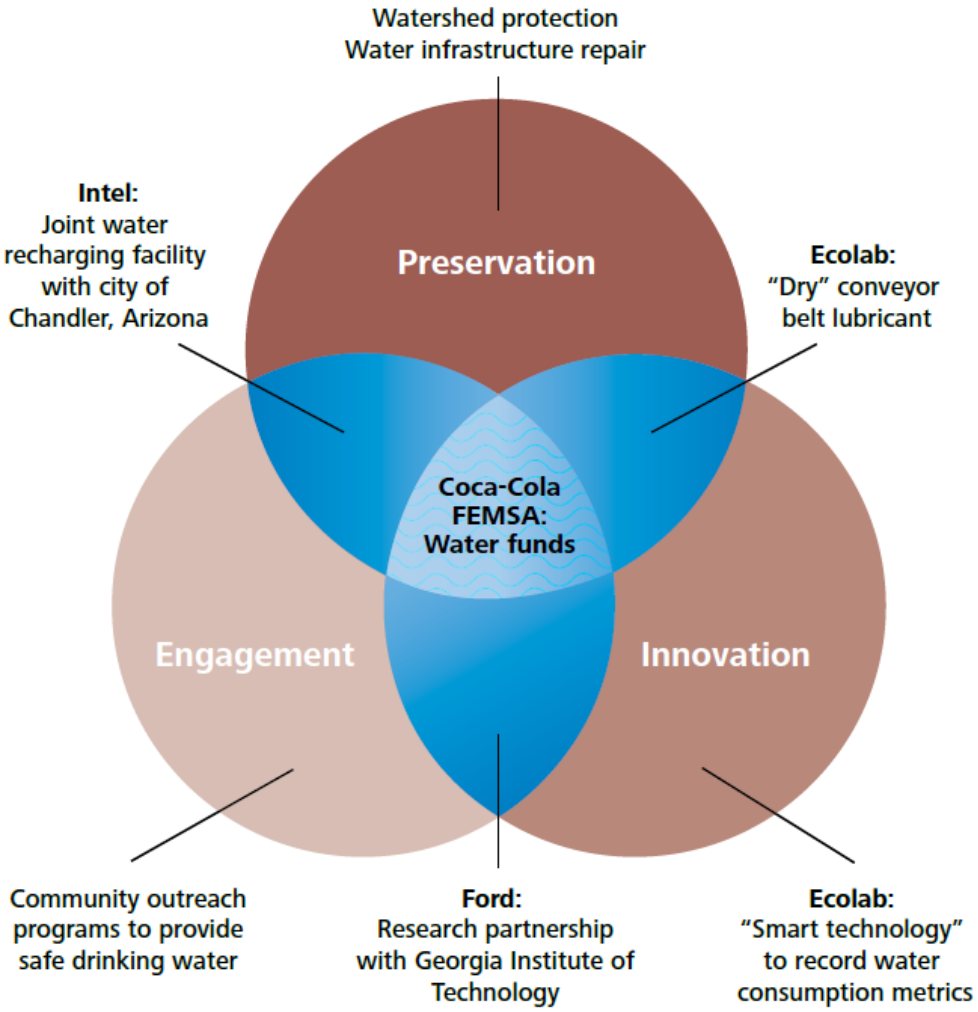
Financial Impact

- **Lost revenue**
- **Higher costs** from:
  - Supply chain
  - Changes in production
  - Capital expenditure
  - Regulatory compliance
  - Increasing price of consuming or discharging water
- **Delayed or suppressed growth**
- Potential **higher cost of capital**

1 – "Watching Water," JP Morgan Chase Global Equity Research, April 2008.

Water stewardship strategy to address water risks

- **Incorporate water risk** into 'traditional' corporate risk management processes
- **Quantify the "real" value** of water to the business
- **Understand the energy-water nexus** and its potential business implications, set targets across the value chain
- **Increase** focus on **engagement and innovation**
- **Look for opportunities** in the overlaps
- **Make a public commitment** to water stewardship
- **Practice "radical transparency"** about water and seek opportunities to collaborate – or clear the (internal) path for collaboration



Getting Ahead of the "Ripple Effect" A Framework for a Water Stewardship Strategy. W. Sarni, Deloitte University Press. 2013

“Fueling growth” – defining leadership

No strategy

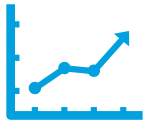
- Water scarcity not acknowledged as an issue
- All resources treated equally
- Cash flows heavily weighted
- Market price of water governs decisions

Efficiency strategy

- Water scarcity as a driver of cost
- Consider cost of acquisition and use of water
- Heavily weight profitability risk
- Focus on water conservation
- Set internal water efficiency goals

Risk strategy

- Manage water scarcity risk at the facility or business-unit level
- Pursue stakeholder engagement to improve water access
- May calculate full cost of water
- May participate in public policy formulation
- Ad hoc investment in technology innovation
- “Social license-to-operate” risks heavily weighted



License-to-grow strategy

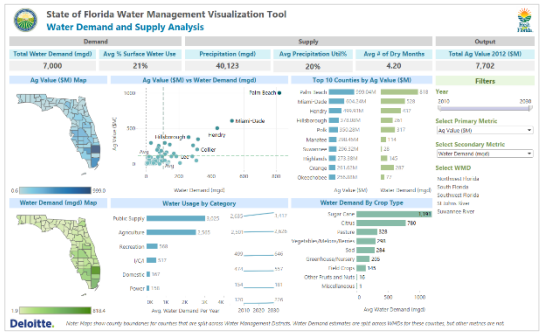
- **Quantify *value* of water**
- **Proactively drive business “ecosystems and “aligned action”**
- **Innovation - develop product/service offerings that address water scarcity**
- Internalize externalities
- Manage water scarcity as a platform for growth
- Participate in water-related policy development

INCREASING VALUE AND COLLECTIVE ACTION

Fueling Growth: You Can’t Always Buy What You Need. W. Sarni. Deloitte University Press. 2014.

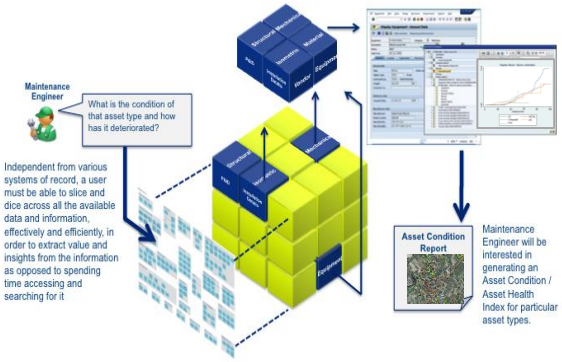
Informed decisions based upon *transparent* data sets

State-wide Economic Value of Water

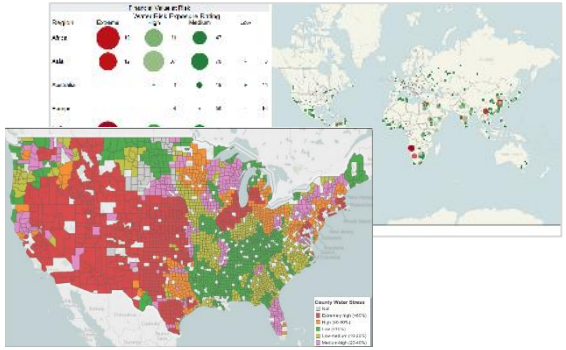


Reputational Risks – Social Media Sentiment Analysis

Water Infrastructure and Customer Analytics



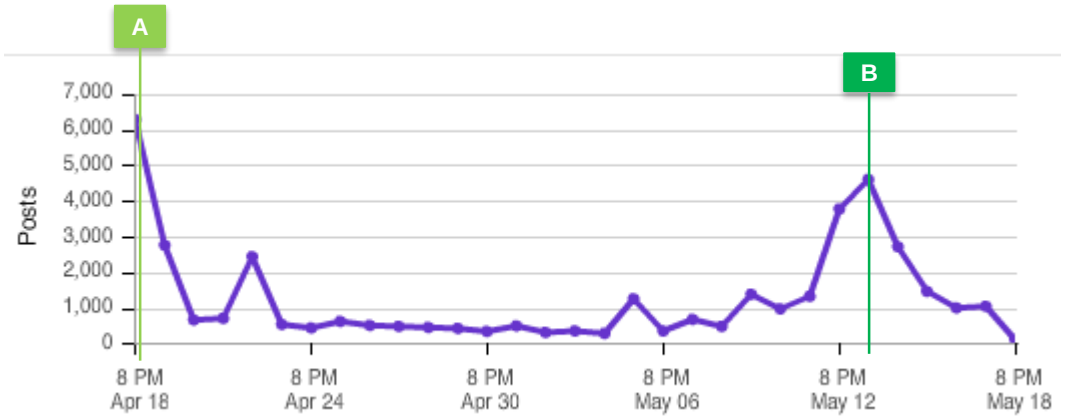
Business Value at Risk and Supply Chain Analytics



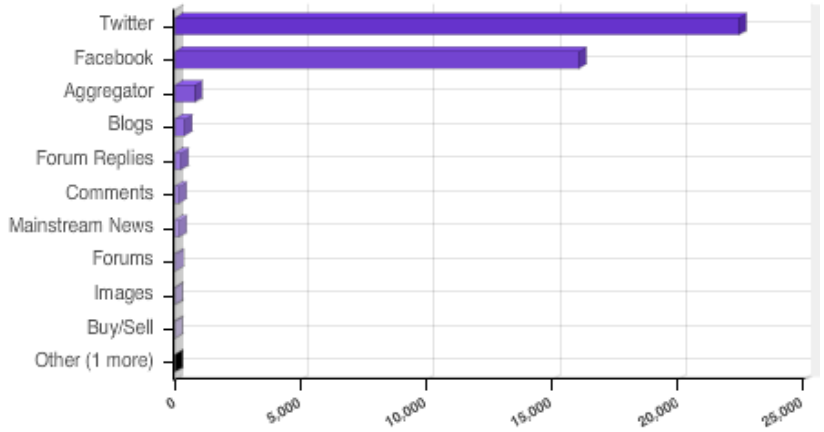
Private sector reputational risk – social media

Rank	Brand	Posts	Net Sentiment	Positive	Negative
1	XXXXX	40,900	-41.2%	29.4	70.6

Social Conversations: Volume Trend



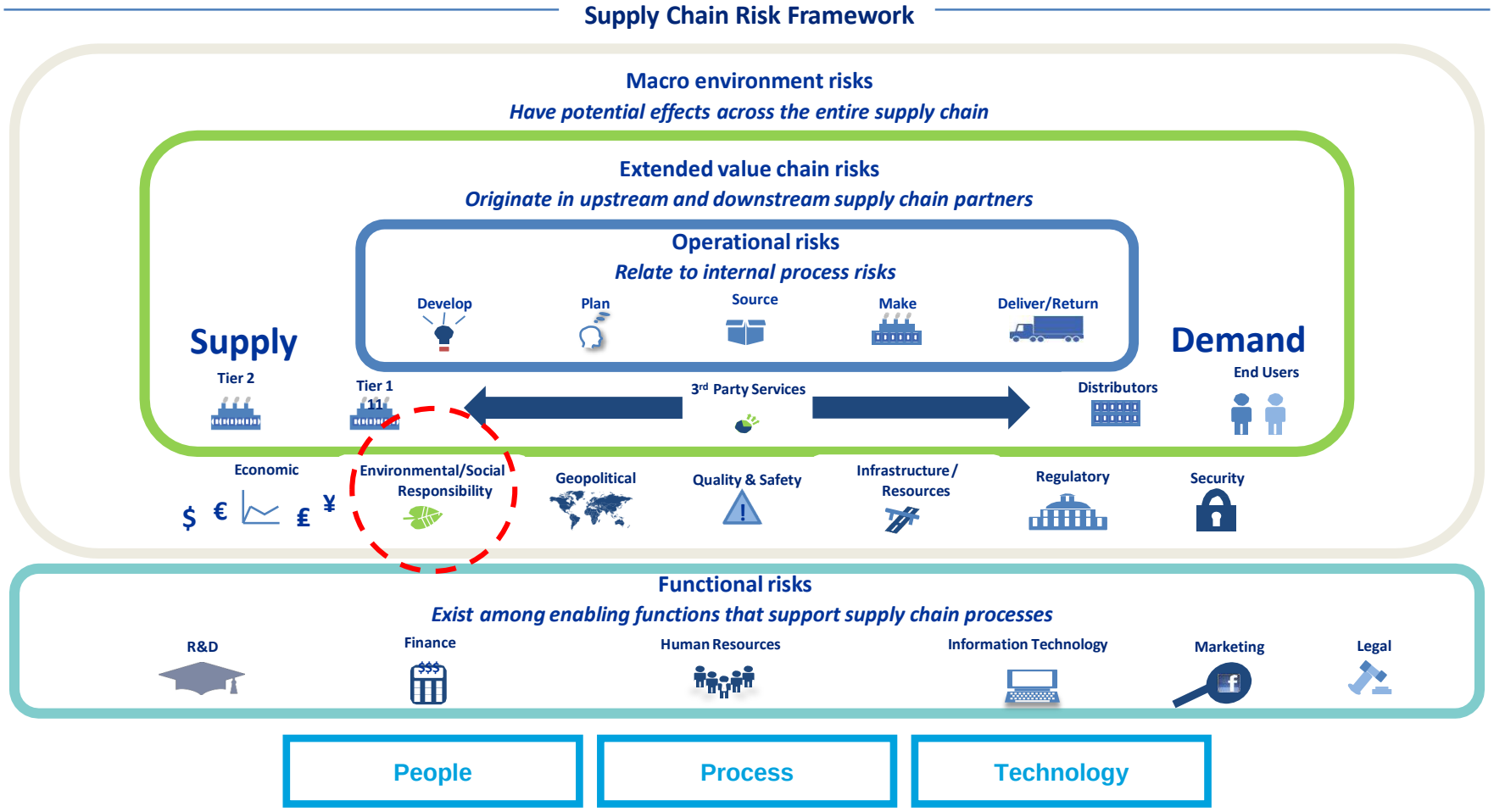
Top Sources



Top Terms

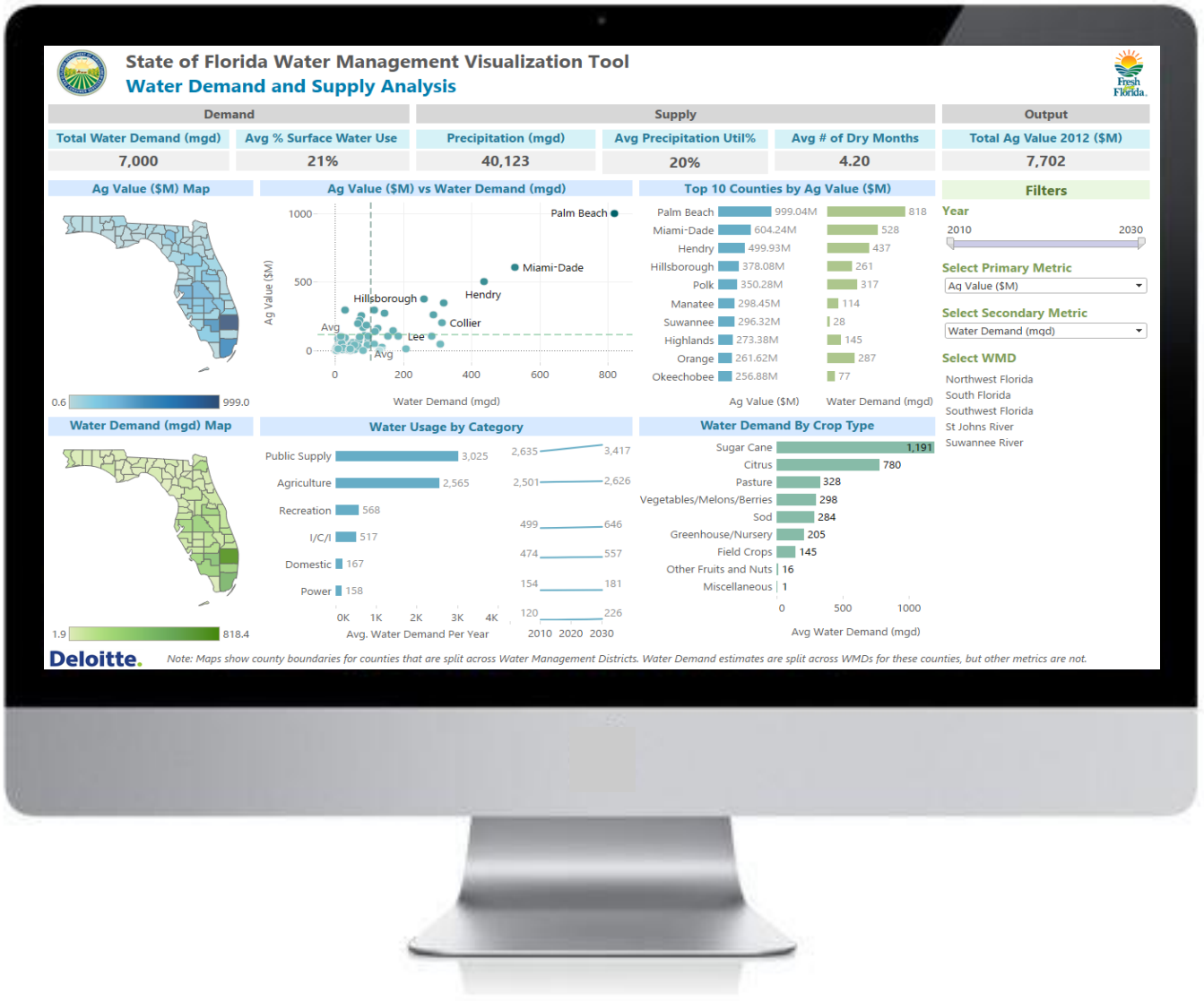
Supply chain risk thinking and “sustainability”

In our experience, companies place focus on identifying risk with the biggest immediate impacts on cost and performance. Environmental and Social Responsibility related topics receive the least focus. .



Business value at risk – supply chain

Public sector water management dashboard



FDACs - overview of approach

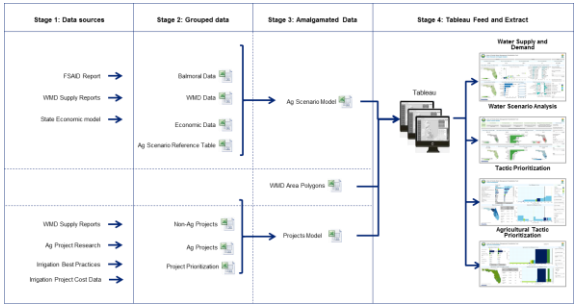
Collected data from a variety primary sources across Florida to develop a compelling set analytical dashboards

Our approach

Collect data

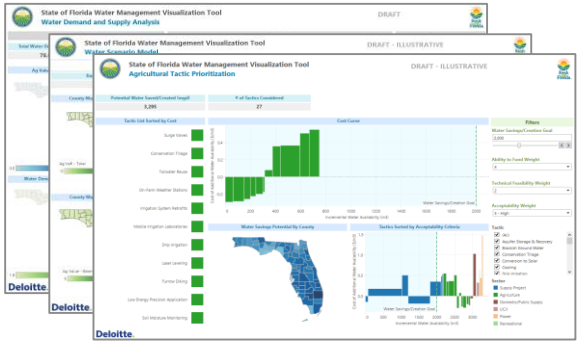
- Florida Statewide Agricultural Irrigation Demand Report and Geodatabases (2015) and supporting technical memos
- Water Management District (WMD) Regional Water Supply Plans
- Water Withdrawals, Use, and Trends in Florida
- NOAA National Climatic Data Center precipitation data
- USGS Statewide Evapotranspiration Data

Develop integrated database



- Combined data from a variety of datasets into a single, integrated database
- Required reformatting and moving data from a pdf, excel, and text files into a single, readable format
- Allows data to be queried at a variety of levels (state, WMD, and county), sectors, and timeframes (2015 – 2035)

Create visualizations

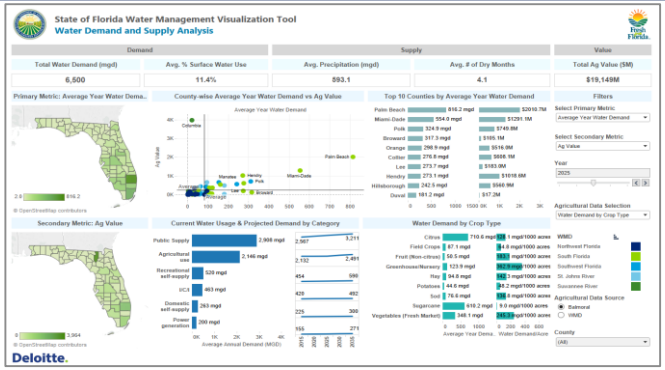


- View projected water demand metrics at the state, water management district, and county level by year and usage category
- Create alternative scenarios specific to agricultural water demand based on changes in crop type acreage, irrigation efficiency
- View and prioritize water conservation and supply projects based on estimated costs, benefits and other criteria

FDACs dashboards examples

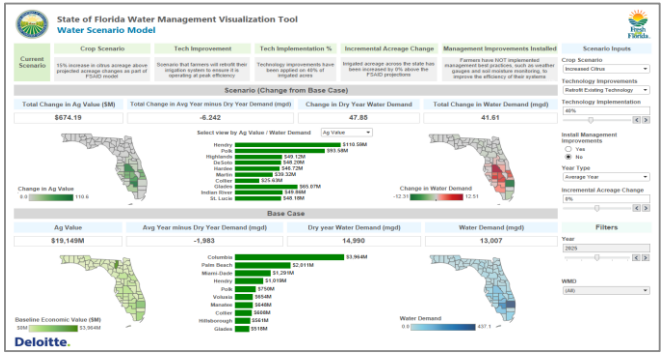
Developed four dashboards that allow FDACS to understand current and projected scenarios, run scenario analysis, and prioritize efficiency tactics

Water Demand and Supply



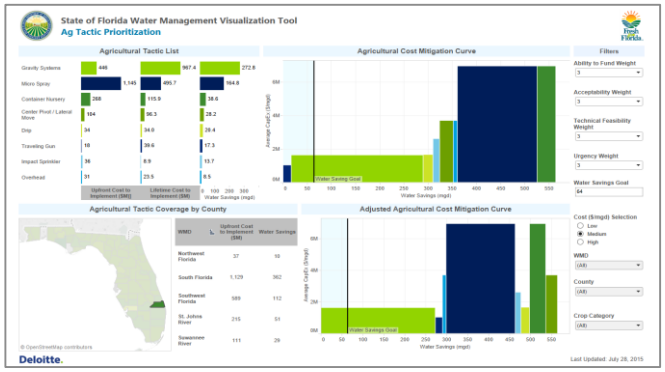
Allows slicing and dicing of WMD, FSAID and Regional Water Supply data to analyse current and future water supply vs demand metrics by county and WMD

Water Scenario Analysis



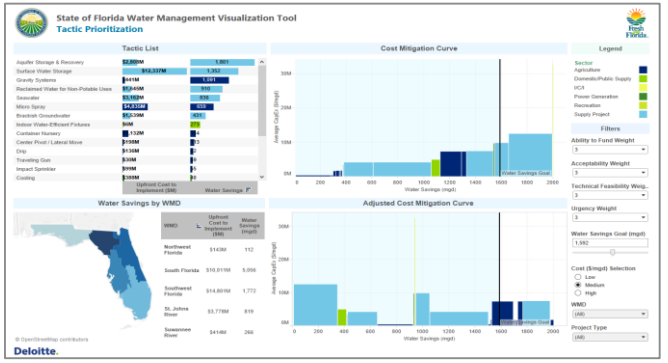
Enables users to build out an optimum water supply and demand scenario using external factors and observe their effects across a 20 year time horizon

Agricultural Tactic Prioritization



Helps users to further understand Water Saving Tactics needed in the Agricultural sector by County in order to achieve Water Saving goals

Tactic Prioritization

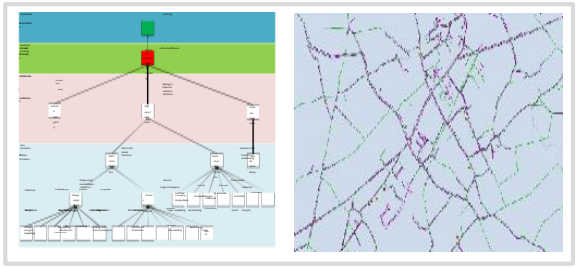


Allows users to visualize cross-sector tactics to reach water saving goals based on multiple metrics such as Feasibility, Urgency, Capex

California dashboard

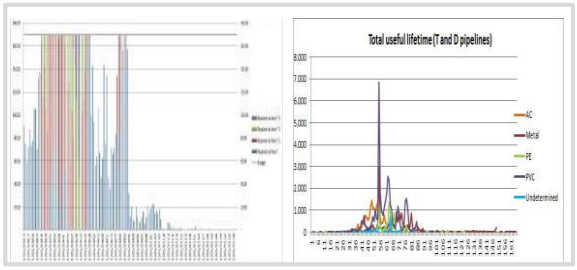
Water analytics: predictive asset maintenance

Risk Analysis Tree **Spatial Mining**



GIS visualization

Optimized investment program



Benefits

Financials

- OPEX reduction: Millions
- CAPEX reduction: Millions

Operations

- Reduced leakage
- Reduced interruption of service
- Reduced hindrance due to works

Expertise

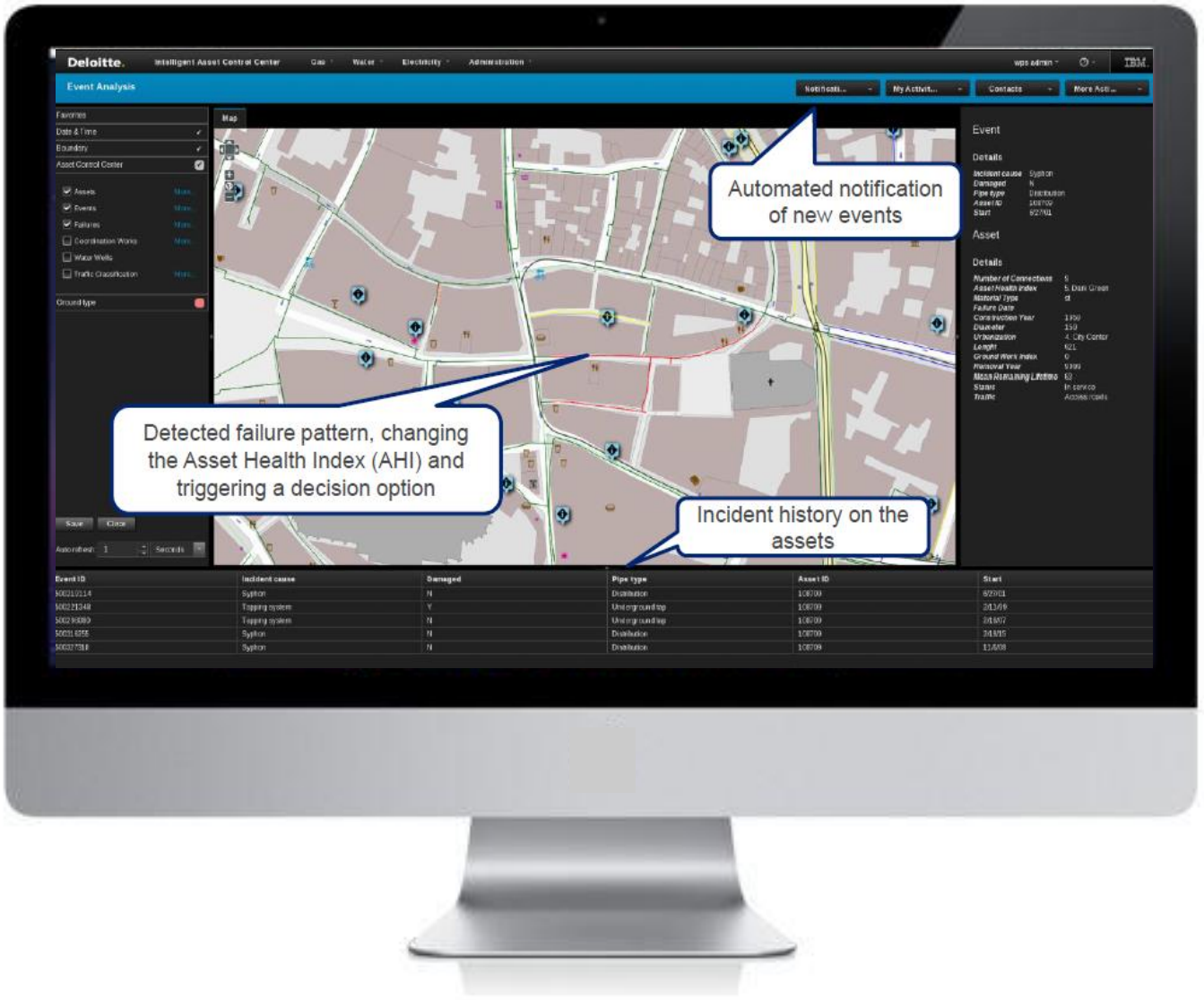
- Deep and data driven insights in the life cycle of the assets

Efficiency

- Improved data quality
- Supply chain optimization (procurement strategy, material management)
- Optimal allocation of scarce resources

Predictive asset maintenance

Automated notification, real-time asset condition monitoring



Predictive asset maintenance

Asset Management Planning (AMP), Scenario simulation, Budgeting

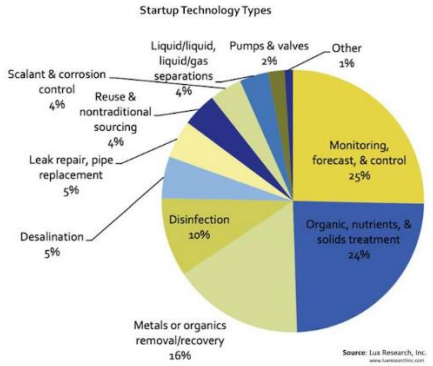
The solution provider market forecast

8.9 %

Global growth of the desalination market from 2013 to 2018

14.7 %

Global growth in smart meters market from 2014 to 2019



Start ups

25 % Monitoring forecast and control

24 % Organic nutrient and solids treatment and 16 % Metals or organics remediation or reclamation

5 % Desalination and 5 % Leak repair and pipe replacement