THE Water Research FOUNDATION

Webcast

Integrating Watersheds and other Natural Assets into Utility Asset Management Programs for Built Systems (4727)

November 17, 2020

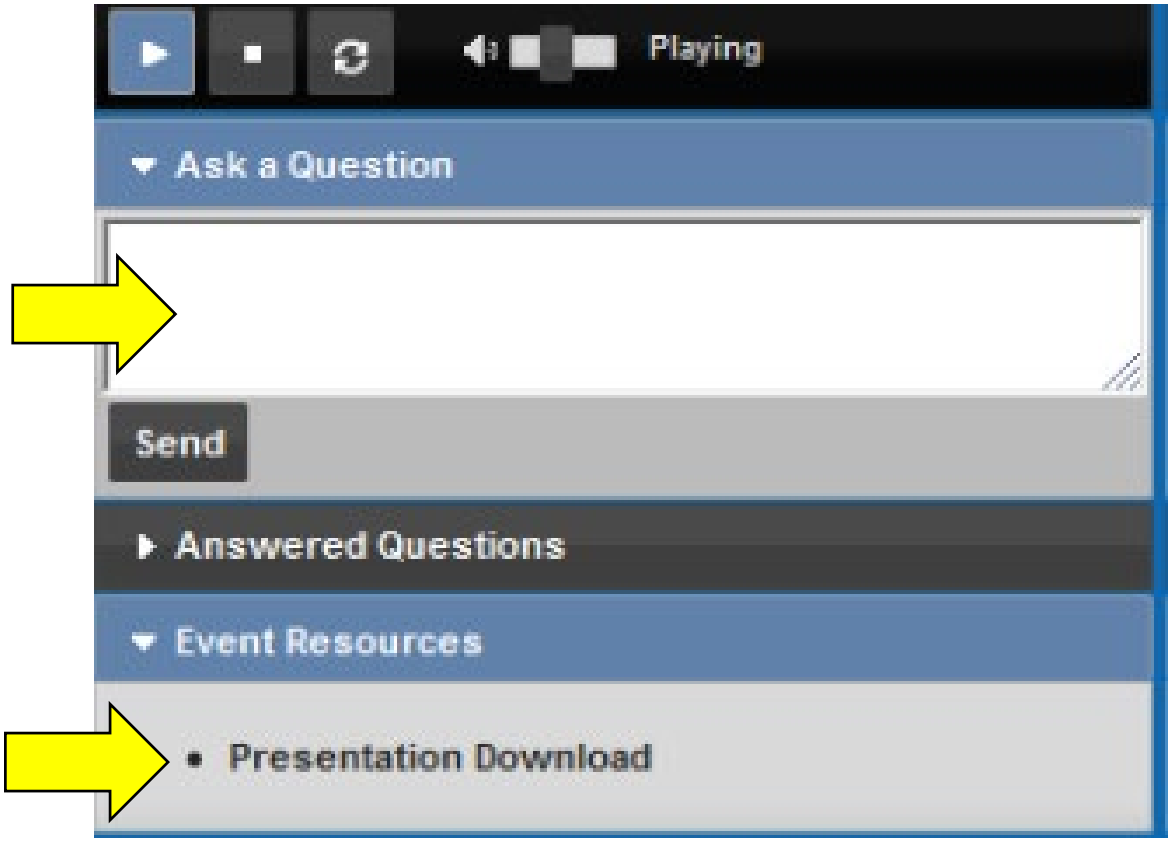
Agenda

Topic	Presenter	Timing
Introductions	**Maureen Hodgins**, WRF **Peter Stangel**, U.S. Endowment for Forestry and Communities	10 minutes
4727 Project Overview, Findings, & Insights	**Bob Raucher**, Raucher LLC **Kurt Vause**, StreamlineAM, LLC	35 minutes
Experiences in the Field.	**Rick Shean**, Albuquerque Bernalillo County Water Utility Authority **Roy Brooke**, Municipal Natural Assets Initiative	20 minutes
Q&A		15 minutes

Webcast Platform

Input your webcast questions

Q&A session at the end of the webcast.



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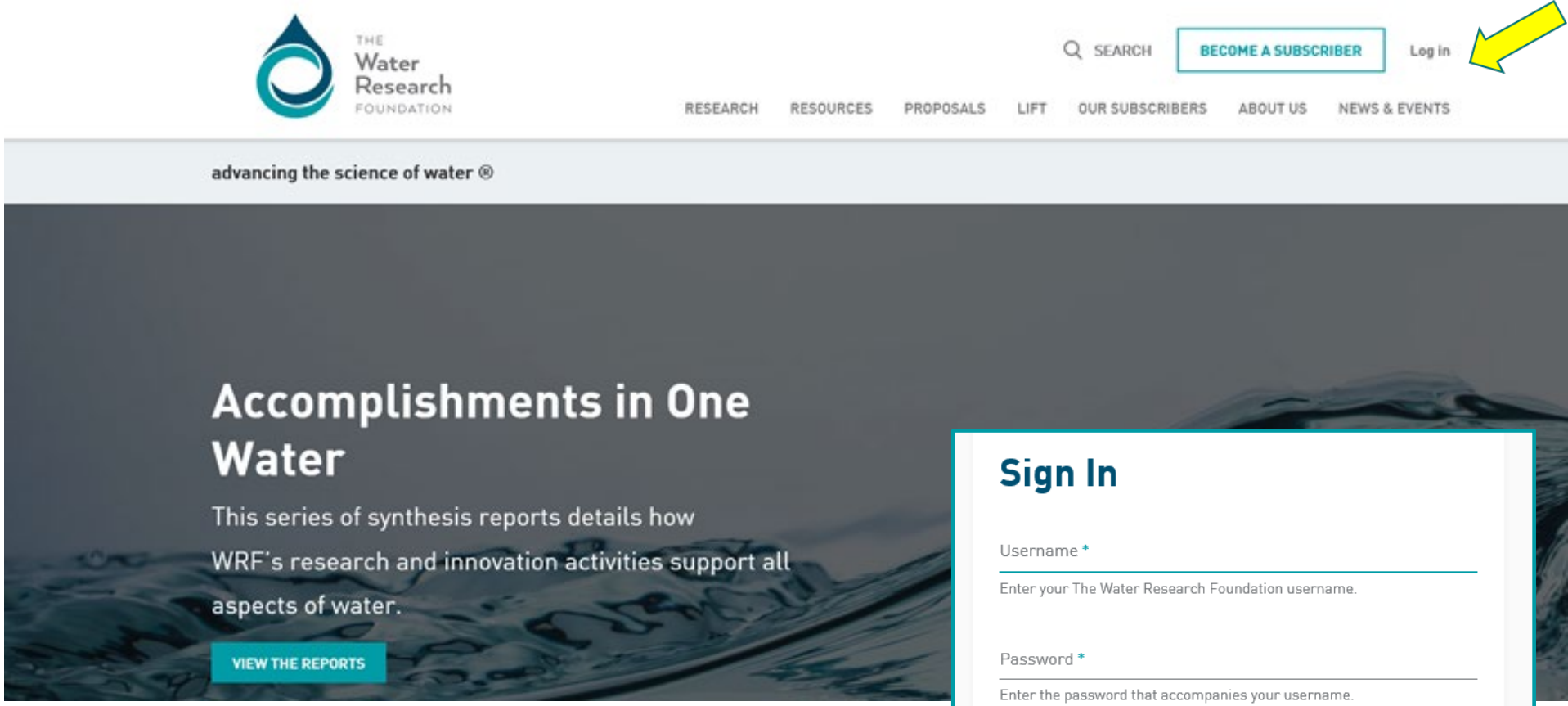

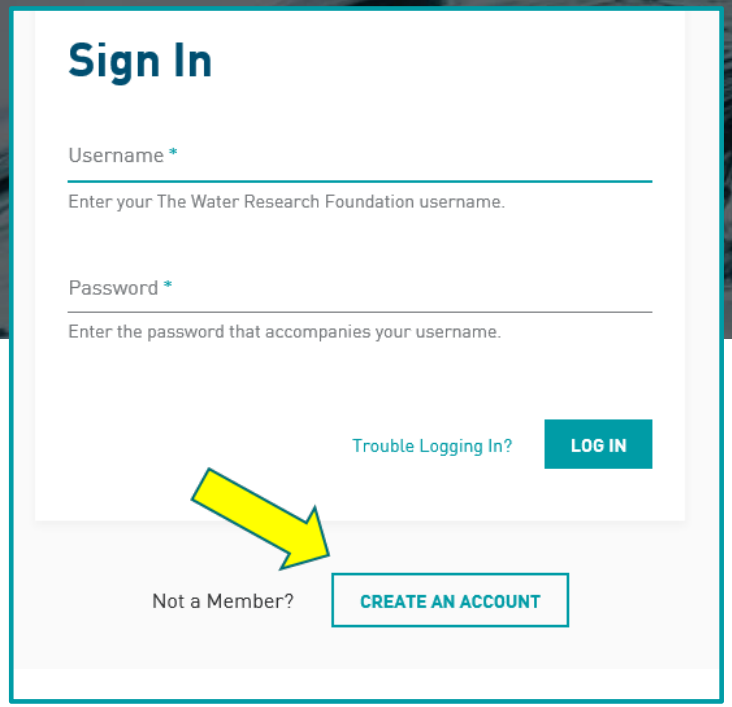

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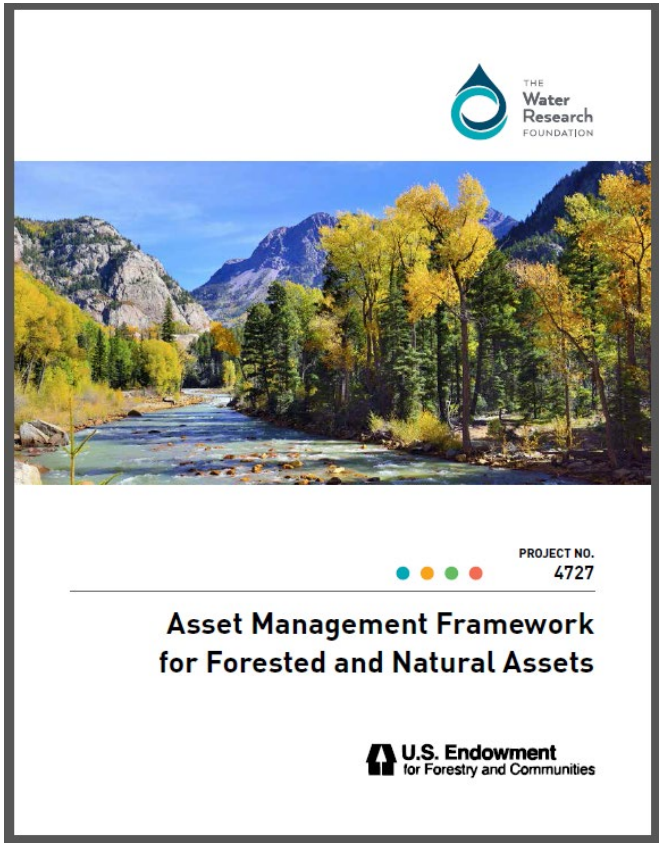
Asset Management Framework for Forested and Natural Assets

REPORT #4727 10/12/2020

10/12/2020

› View Executive Summary



WRF related projects

Source Water Protection / Land Use

- *4595, Advancing and Optimizing Forested Watershed Protection. 2015.
- 4748, Evaluation of Risk Management Frameworks and Tools and their Application for Managing Source Water Risks in the United States. Estimate completion in 2020.
- 4702, Quantifying the Potential Benefits of Land Conservation on Water Supply to Optimize Return on Investments. 2019.
- 4651, Forest Cover Impacts on Drinking Water Utility Treatment Costs in a Large Watershed. 2018.
- 4570, Source Catchments as Water Quality Treatment Assets: Industry Best Practices and Triple Bottom Line Cost Evaluation of Catchment Management Practices. 2015.

Asset Management

- 1725 and 1726. Practitioner's Guide to Economic Decision Making in Asset Management. 2014.
- 4013, Sustainable Infrastructure Management Program Learning Environment. 2008.

Stormwater

- Holistic Stormwater Management with Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC), EPA National Priorities Grant 836173. 2016-2020, https://www.waterrf.org/community-enabled-lifecycle-analysis-stormwater-infrastructure-costs-clasic
- BMP Performance – International Stormwater BMP database, https://www.bmpdatabase.org/
- 4852, Framework and Tool for Quantifying the Triple Bottom Line Benefits of Green Stormwater Infrastructure. Estimate completion in 2020.

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Origins

Peter Stangel
Chief Operating Officer
U.S. Endowment for Forestry and Communities

Origins

2009 Healthy Watersheds through Healthy Forests

2011 Convening: Systematically Engage Water Utilities

2015 WRF/Endowment Workshop—Research Agenda

2017 Asset Management Framework

U.S. Endowment
for Forestry and Communities

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Integrating Watersheds and other Natural Assets into Utility Asset Management Programs for Built Systems

Bob Raucher, PhD
Raucher LLC

What are Natural Assets?

Utilities rely on 3 types of Assets to fulfill their missions:

- Physical Assets
  - Built systems; E.g., treatment plants, transmission mains, dams
- Human Assets
  - Professional, qualified staff throughout the organization
- **Natural Assets**
  - Watersheds (rivers, streams, lakes, forests, prairies, wetlands, etc.)
  - Aquifers and other natural systems
  - Green infrastructure, nature-based solutions, etc.

Natural Assets Provide Valuable Goods and Services

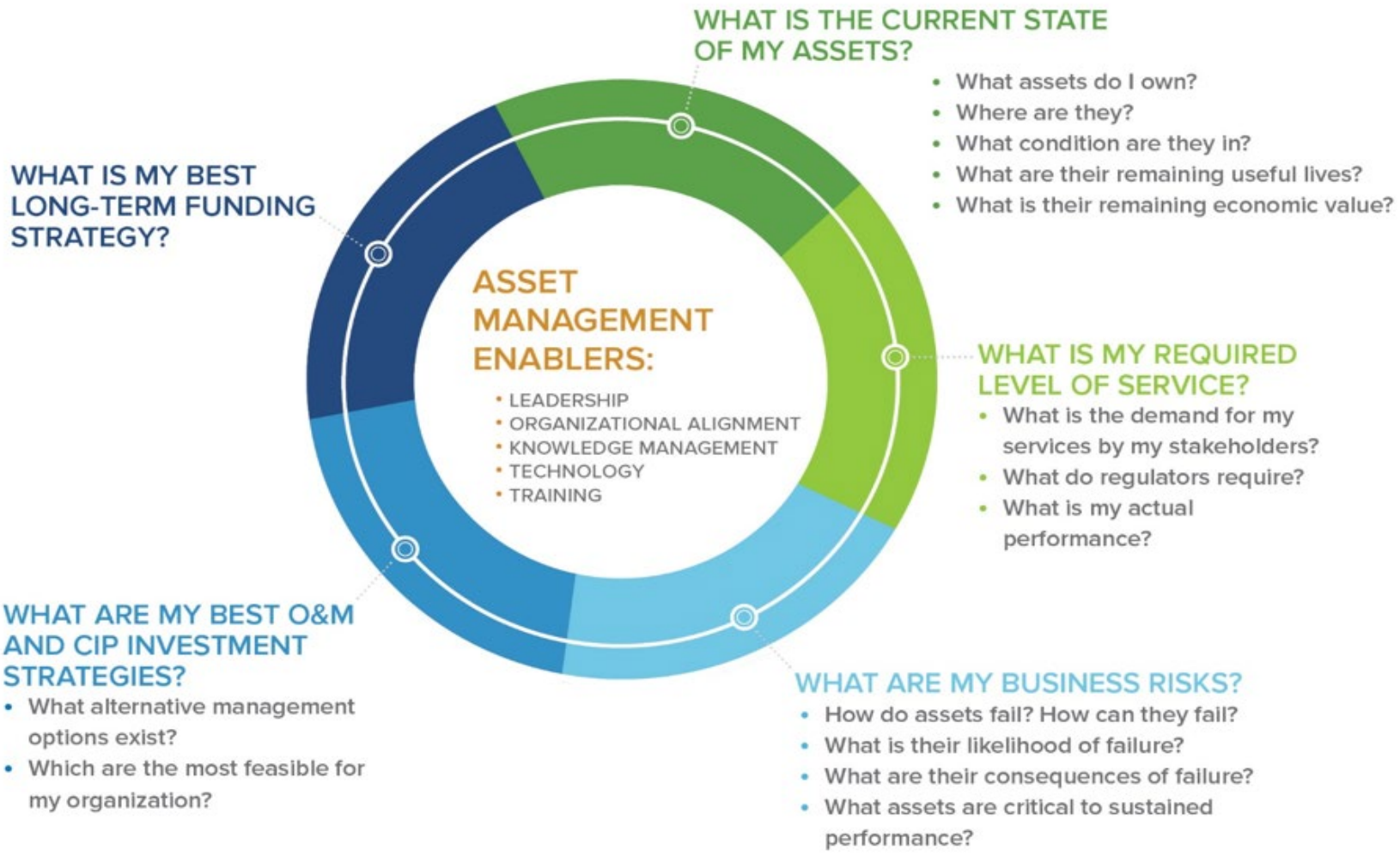
- Water!
  - Quantity, conveyance, and timing of source water flows
  - Quality of source waters
  - Stormwater management; recharge/infiltration
- Ecosystem services
  - Fishery and wildlife habitat
  - Recreational opportunities
- Aesthetic values (viewsheds)
- Timber, plant products, other harvestable goods
- Carbon sequestration

Research Objectives

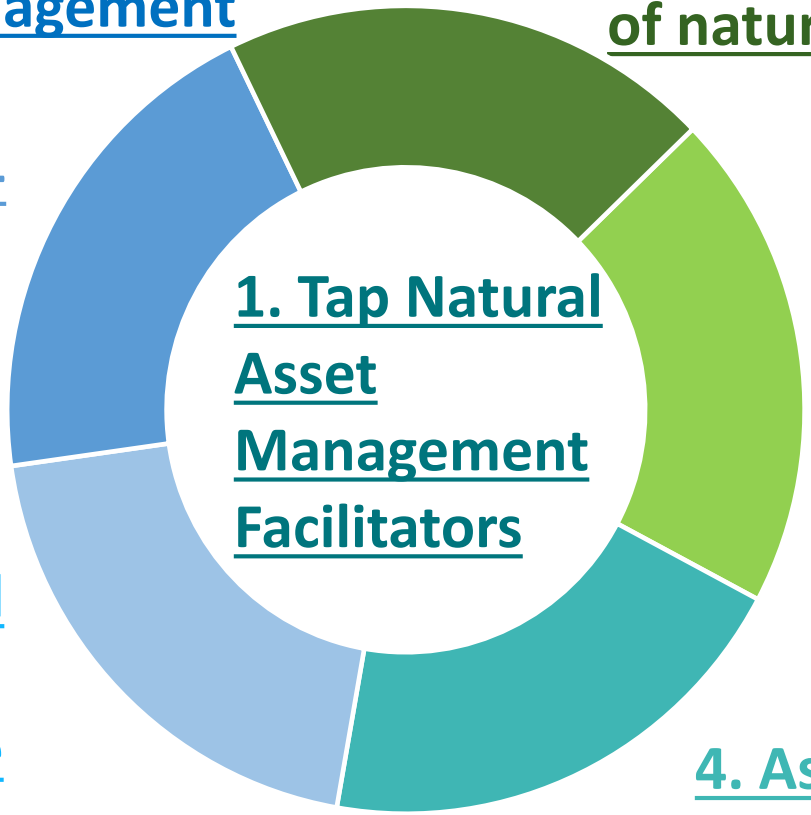
Strengthen water utilities' capacity to account for, invest in, and better manage their natural assets, by:

- ***Enhancing recognition*** of important goods and services provided by natural assets
- ***Developing a framework*** including forests and other natural assets ***in water utility AM programs*** for built systems
- Exploring avenues to ***enhance funding*** for managing natural assets

The Asset Management Wheel for Built Systems (source: AWWA)



AM Wheel for Natural Systems



7. Sustain Natural Asset Management

2. Describe the current state of natural assets

6. Create a long-term funding strategy

3. Determine desired levels of service (LOS)

5. Identify capital investment and maintenance opportunities

4. Assess business risks associated with natural assets

AM Wheel for Natural Systems

1. Tap Natural Asset Management Facilitators
- Leadership Commitment
- Align with utility mission and strategic objectives

2. Describe the current state of natural assets

3. Determine desired levels of service (LOS)

4. Assess business risks associated with natural assets

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7. Sustain Natural Asset Management

Step 1: Align with Utility Mission

Asset Management ties directly to utility strategic objectives

- Sustainability and Resiliency Planning
- Risk Management
- Fiscal prudence

It does not matter whether a service comes from an engineered asset or a natural asset…

…What matters is that the service be well provided

Challenges

- **Ownership:** Rarely owned or managed by utility
- **Accounting**: Awkward fit
  - Value not reflected in cash flow
  - Value often in form of “avoided costs”
- **Funding**: Limited ability to tap capital accounts
- **Building Support**: For expenditures

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

- **2. Describe the natural assets**
  - **Identify/Describe**
  - **Ownership**
  - **Condition**

6. Create a long-term funding strategy

3. Determine desired levels of service (LOS)

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4. Assess business risks associated with natural assets

Describe the Current State of Assets

Develop a Natural Asset Registry

- What natural assets contribute to achieving utility's level of service (LOS) targets?
- Who owns or has access to these assets, and how are they currently managed?

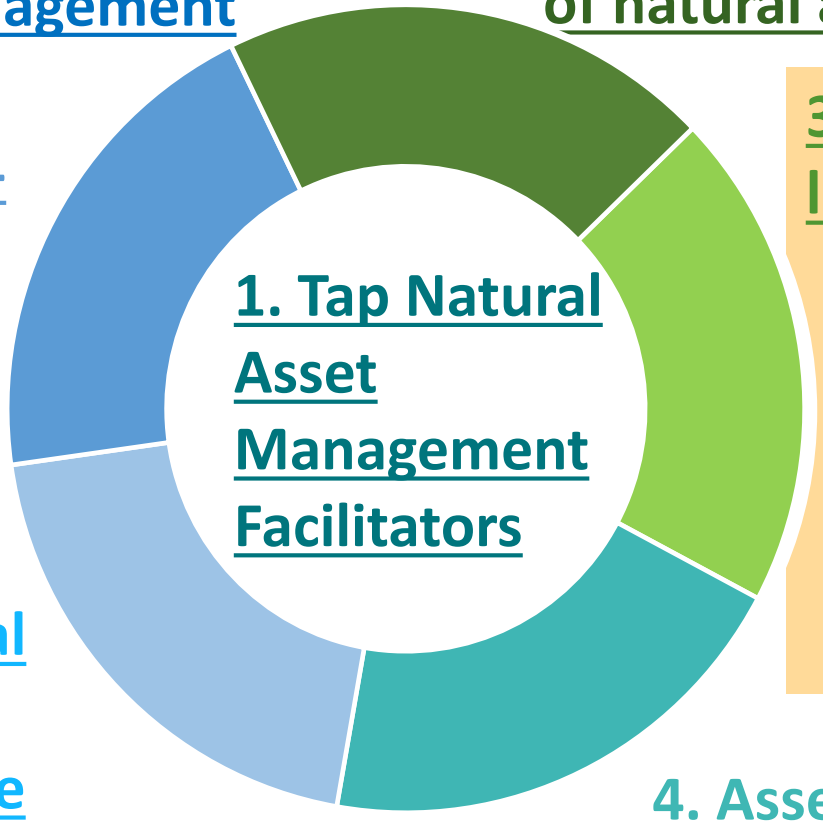
Assess Current Condition

- What is the current condition?
- How does the current condition influence LOS?

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

2. Describe the current state of natural assets



3. Determine desired levels of service (LOS)

- **How do assets affect** performance for core business goals?
- **What asset LOS is needed?**
- **What LOS metrics** inform performance?

6. Create a long-term funding strategy

5. Identify capital investment and maintenance opportunities

4. Assess business risks associated with natural assets

Step 3: Setting Level of Service Targets

- Challenge: Measuring and impacting ability of natural asset to deliver desired LOS
  - Harder than for built assets
  - Especially where asset is owned, managed, and/or accessed by others

- Opportunity: Iterating back along the AM Wheel may inform prior steps. LOS insights may:
  - Guide how to describe assets within the asset registry
  - Offer insight on how to assess and report asset condition

AM Wheel for Natural Systems

1. Tap Natural Asset Management Facilitators

2. Describe the current state of natural assets

3. Determine desired levels of service (LOS)

4. Assess business risks of degradation

- **Causes** of failure to deliver LOS?
- **Likelihood** of failure?
- **Potential consequences** of degraded LOS?

5. Identify capital investment and maintenance opportunities

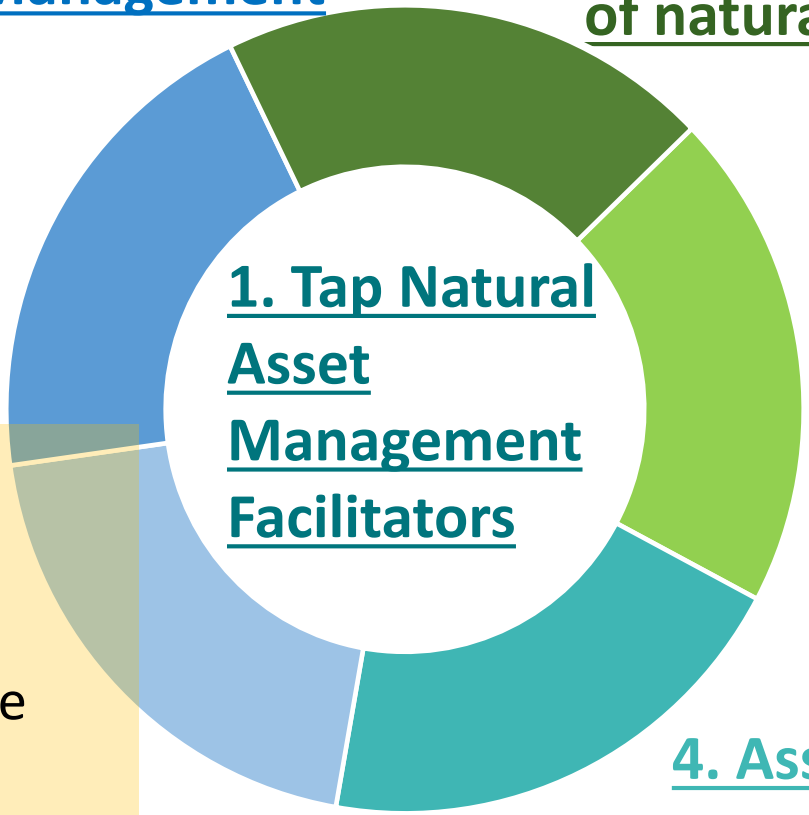
6. Create a long-term funding strategy

7. Sustain Natural Asset Management

Step 4: Assess Risks: *Consequence* of Failure

- Health & Safety of Public and Employees
- Direct Financial Impact
- Water quality
- Public Image & Confidence
- Regulatory Compliance
- Service Delivery
- Inter-agency Coordination
- Environmental Impact
- 3rd party loss / Liability

AM Wheel for Natural Systems



7. Sustain Natural Asset Management

2. Describe the current state of natural assets

6. Create a long-term funding strategy

3. Determine desired levels of service (LOS)

5. ID capital and O&M opportunities

- **Options**: to manage the risk
- **Partnerships:** required to execute options?

4. Assess business risks associated with natural assets

Step 5: Managing Risks Associated with Natural Assets

- **Actions:**
  - Protect, restore, enhance
  - Forest management and watershed partnerships
  - Agricultural BMPs (Farm Bill funds for conservation)

- **Utility Business Practice Integration**
  - CAPEX and OPEX resource allocation
  - Making a Business Case
  - Long-range financial planning

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

2. Describe the current state of natural assets

6. Create long-term funding strategy

- **Recoup spending** thru rates?
- **Capital budget:** debt financed?
- **External funding:** partnerships?

3. Determine desired levels of service (LOS)

4. Assess business risks associated with natural assets

5. Identify capital investment and maintenance opportunities

Step 6: Making Investments in Natural Assets

A utility can manage natural asset risk by:

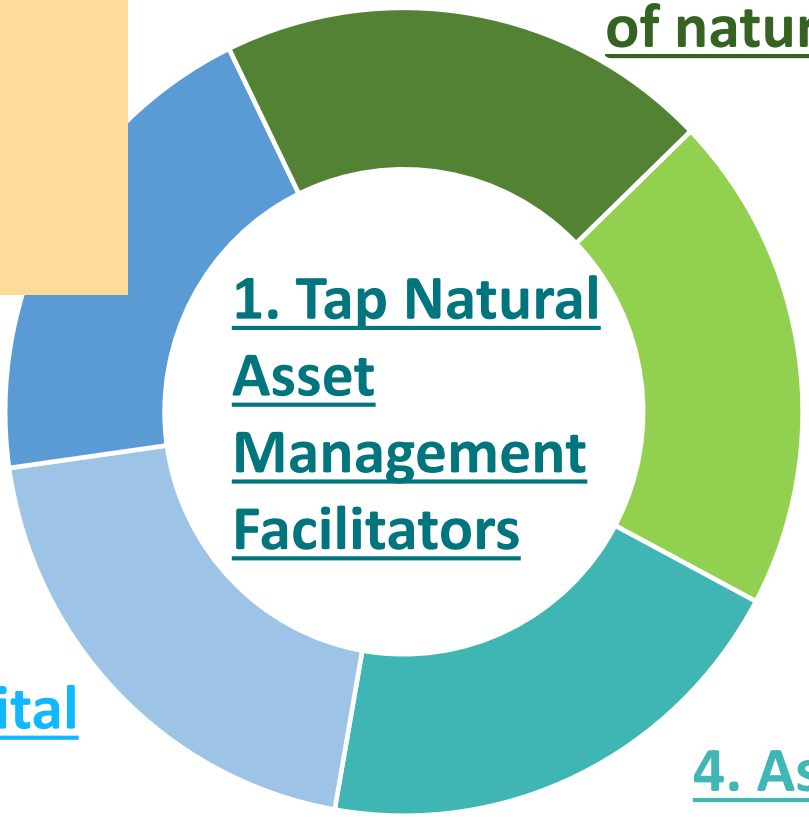
- **Performing Maintenance**
  - E.g., supporting land management activities that reduce erosion, wildfire risk, etc.
- **Making Capital Investments**
  - E.g., acquiring or restoring sensitive source watershed lands to limit future development and degradation.

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

- **Continuous Improvement**
- **Strategic Communication**

2. Describe the current state of natural assets



3. Determine desired levels of service (LOS)

6. Create a long-term funding strategy

5. Identify capital investment and maintenance opportunities

4. Assess business risks associated with natural assets

Step 7: Sustaining Long-Term Natural Asset Management (Unified AM Program)

- Commitment to continuous improvement business process
  - Plan=>Do/Implement=>Check/Review=>Adjust… repeat
  - Adaptive Management as a practical approach
  - Including within the Utility's Long-term Strategic Plan

- Effective Communication is a Key to Success
  - Numerous and diverse audiences: Internal and External
  - Requires planning, sustained effort, and continuous two-way dialogue

The Water Research Foundation, Project 4727: *An Asset Management Framework for Forested and Natural Assets*

- Co-funded by the US Endowment for Forests and Communities
- Research Team
  - Bob Raucher, Mark Lorie, Karen Raucher (Corona Environmental/Raucher LLC)
  - Kurt Vause, Co-PI; Todd Helgeson (StreamlineAM)
  - Jan Cassin (Forest Trends);
  - Jeff Hughes (Environmental Finance Center, Univ. of North Carolina)

Participating Utilities

- Albuquerque Bernalillo County Water Utility Authority
- American Water Company
- Bozeman Public Works
- California Water Service Company
- Central Arkansas Water
- City of Westminster
- Massachusetts Dept. of Conservation and Rec.
- Marin Municipal Water District
- Raleigh Public Utilities Department
- San Francisco Public Utilities Commission
- Seattle Public Utilities
- Seqwater (Australia)
- US Forest Service

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Research Manager and Project Advisory Committee

- Maureen Hodgins, WRF Research Manager
- Peter Stangel (US Endowment for Forestry and Communities)
- Roy Brooke (Brooke and Associates)
- Nancy Toth (Eugene Water and Power)
- David Warne (NYCDEP)
- Seth Doull (Tacoma Water)
- Paul Hunt (Portland Water Dept., ME)
- Christina Burri (Denver Water)

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Exploring Key Elements of AM Framework for Natural Assets

Kurt Vause, PE
StreamlineAM LLC

Key elements are where heavy lifting is done

- Step 3: Setting Level of Service Targets
- Step 4: Assessing and Managing Risk
- Step 5: Moving to Risk Mitigation: Identify Investment/Maintenance Opportunities in Natural Assets

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

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3. Determine desired levels of service (LOS)

- For core business goals, how do natural assets affect performance?
- What LOS from the asset is required to maintain or improve that performance?
- For other strategic goals, what LOS will meet community expectations and regulatory requirements?

Step 3: Level of Service Targets

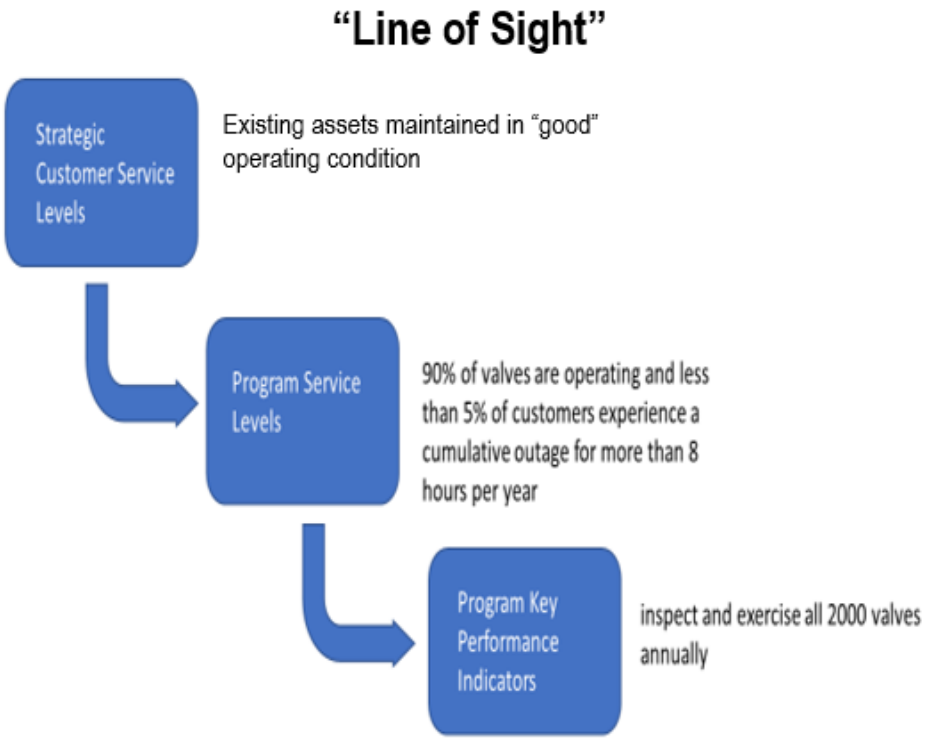
- Service levels - expressions of desired outcomes from the perspective of customers and other stakeholders
- Service levels vary between organizations (size, region)
- Service levels can change within organizations over time

Step 3: Setting Level of Service Targets

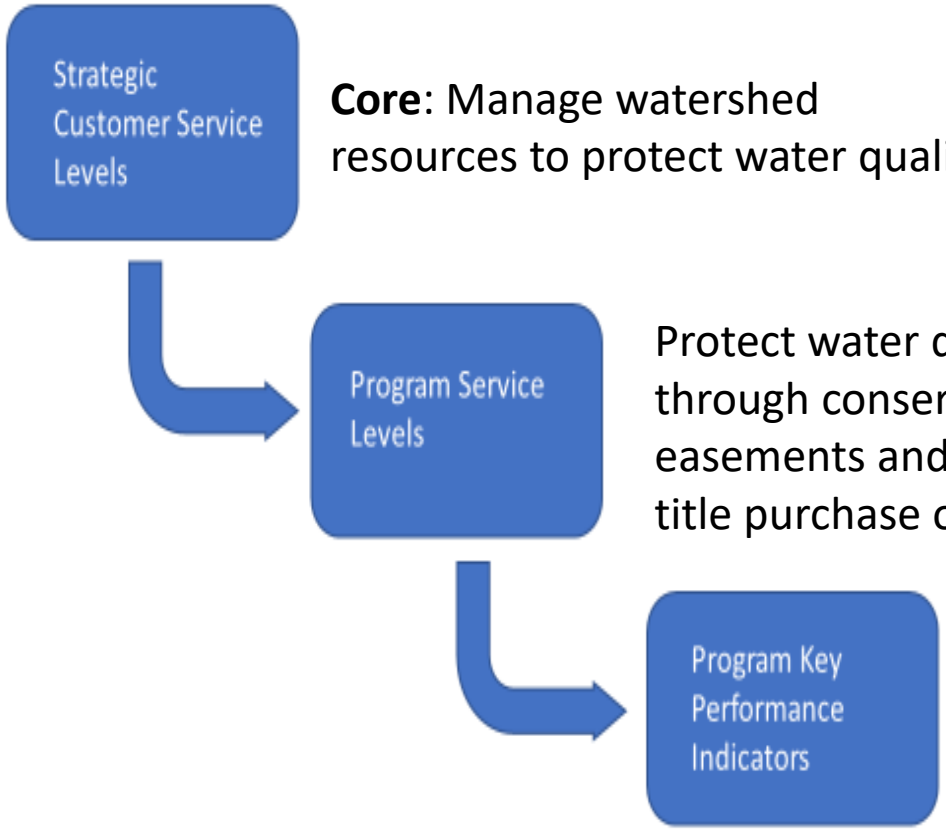
- Differentiate LOS Targets supporting *core* business objectives
- Use KPIs to link specific asset performance measurement with LOS

Aim for developing “line of sight” in Service Levels

- Translating Guiding Principles into concrete actions: e.g.,
  - Existing assets maintained in “good operating condition”
  - Life cycle cost comparisons when evaluating alternatives for projects
- Alignment of staff to get most out of documenting, tracking, reporting results
  - Guiding principles → KPIs
  - Involves whole of organization



As applied to natural assets:



Core: Manage watershed resources to protect water quality

Stewardship: Manage watershed resources to restore terrestrial and aquatic species and habitats

Protect water quality through conservation easements and/or fee title purchase of property

Purchase X acres permanent easements and/or fee title of property draining into in Utility Raw Water Reservoirs A,B and C in next Y yrs.

AM Wheel for Natural Systems

7. Sustain Natural Asset Management

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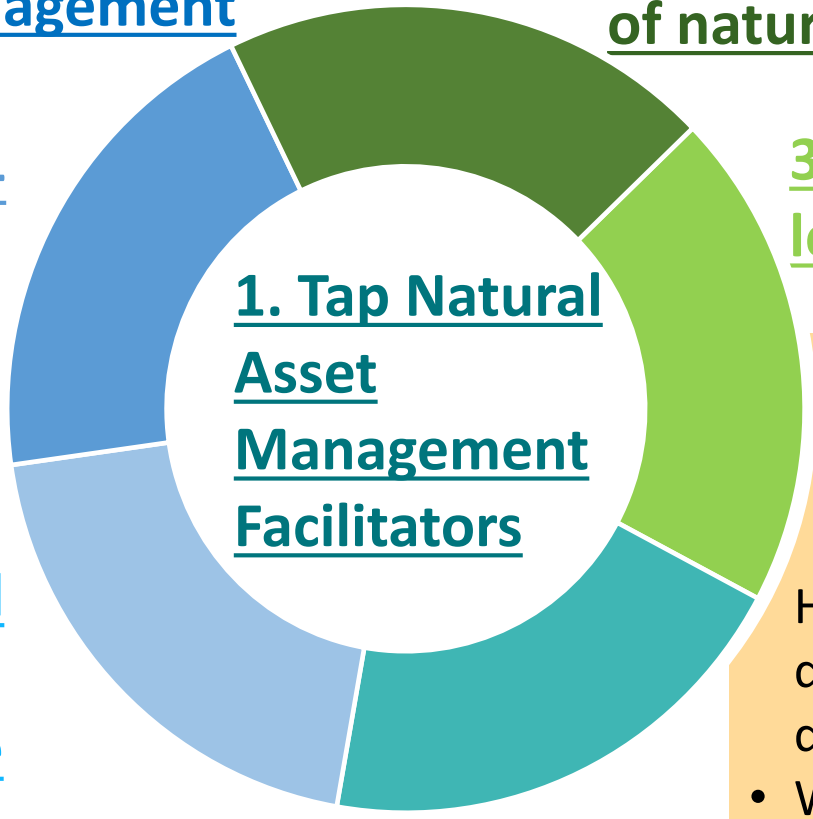
6. Create a long-term funding strategy

3. Determine desired levels of service (LOS)



5. Identify capital investment and maintenance opportunities

4. Assess business risks associated with natural assets

How can natural assets degrade and fail to deliver desired LOS?

- What is the likelihood of degradation?
- What are the potential consequences of degraded LOS?

Step 4: Starting out, a Reconnaissance-Level for Assessing and Managing Risks

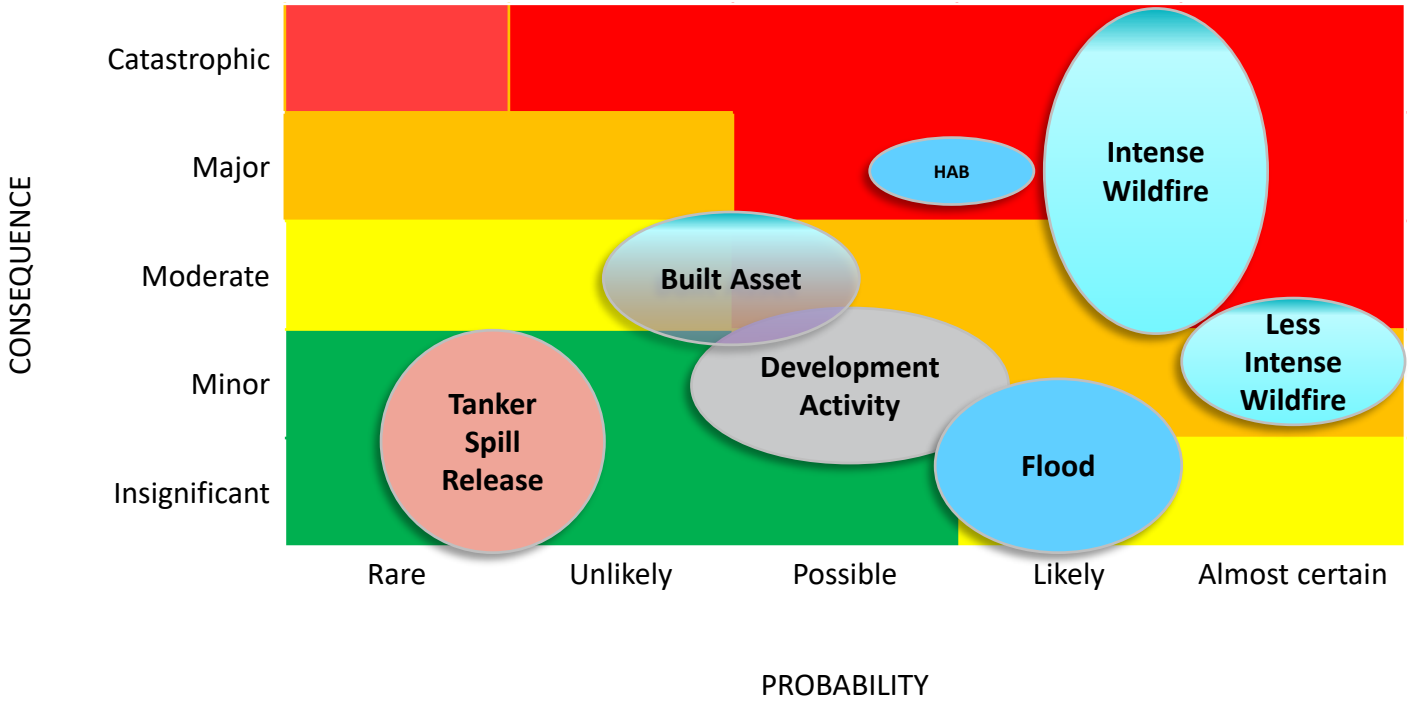
Subjective risk profiling (e.g., risk matrix) is a starting point:

- Apply **subjective** likelihood and consequences (e.g., Low, Med, High)
- Document key assumptions and uncertainties
- Develop initial risk-driven priorities – what risks "bubble to the top"

What we are on the lookout for?

- First - natural assets affecting **core** utility services.
- Locations relative to raw water intakes, reservoirs, treatment facilities, & locations closely tied to regulatory requirements (e.g., sensitive stream reaches)
- Natural assets subject to disruption by human activities, e.g., mining, resource extraction, urban/industrial development

Recon-Level, *Initial* Risk Assessment and Prioritization



Extreme
High
Moderate
Low

TAKEAWAY:

Consider potential risk mitigation options to reduce:

a) Probability
b) Consequences
c) Uncertainties

With better data and quantification, a Deeper Dive for Assessing and Managing Risks is possible

1. Assets supporting “Core” business functions and carrying prioritized risks
2. Fully consider all the potential adverse consequences
   (Triple Bottom Line perspective)
3. Consider moving from risk categorization toward risk unitization

A Deeper Dive: Consider where we are starting from:

- How do natural assets degrade and/or fail to provide functions?

Hydrological Service to Utility	Natural Asset Type	
	Aquifers and Aquifer Recharge Zones	**Mountain Snowpack, Glaciers**
Hydrological Service to Utility: Maintain dry season flows / dry season supply	Aquifers that are connected to surface waters (e.g., floodplain aquifers, springs in headwaters to streams) can augment dry season flows as groundwater is discharged to streams or rivers.	By slowly releasing water stored in snowpack and glaciers during spring and summer, mountain snowpack and glaciers contribute significantly to maintaining dry season flow.
Examples of potential degradation and Failure to provide target Levels of Service	Declining aquifer levels driven by reduced natural recharge due to human uses of recharge zones, including urban or industrial development. Over-pumping (e.g., due to unregulated well development and use) can also deplete aquifer levels and discharge to streams.	Increasing temperatures due to climate change can reduce annual snowpack or increase long-term melting of glaciers. Deposition of dust or other pollutants on glaciers can accelerate melting due to increase absorption of solar radiation.

Appendix in Section 6 provides list of natural asset services. It is a start

Like built assets, modeling is sometimes used to assess probability (likelihood) of degradation of function

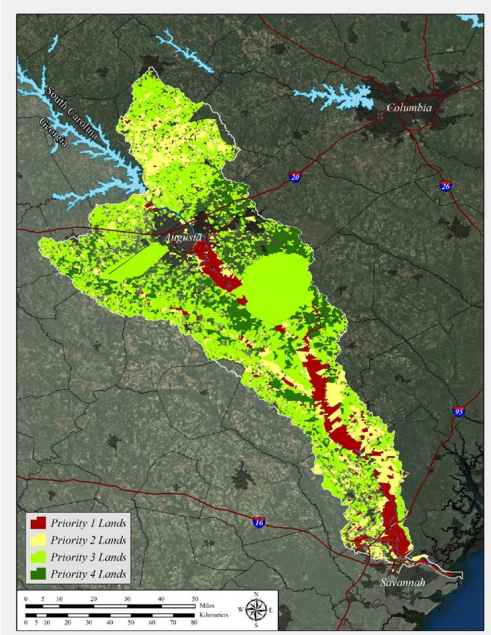
- Examples:
  - Source Water Assessments --“Susceptibility” of water sources (surface and groundwater) to threats
  - Land Conservation Trust WQ preservation prioritization modeling
- Compare to models predicting failure of pipe segments in a distribution system (e.g., descriptive statistics)

Modeling similarities:

Scored on 0-3 scale	CPI Conservation Priority Index	RPI Restoration Priority Index	SWMPI Storm Water Management
Land Use	3 = Forested, Natural Land Cover	3 = Ag, Barren, Sparse Veg 2 = Grasslands	3 = High Intensity Urban 1 = Low Intensity Urban
Proximity to Streams	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters
Proximity to ponds/wetlands	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters	3 = 0-30 meters 2 = 30-60 meters 1 = 60-90 meters
Soil Hydrologic Group	3 = C/D: Low Infiltration Rates 2 = B: Moderate Infiltration 1 = A: High Infiltration Rates	3 = C/D: Low Infiltration Rates 2 = B: Moderate Infiltration 1 = A: High Infiltration Rates	3 = C/D: Low Infiltration Rates 2 = B: Moderate Infiltration 1 = A: High Infiltration Rates
Soil Erodibility (Kfact)	3 = High 2 = Moderate 1 = Low	3 = High 2 = Moderate 1 = Low	3 = High 2 = Moderate 1 = Low
Slope	3 = greater than 18% 2 = 8% - 18% 1 = less than 8%	3 = greater than 18% 2 = 8% - 18% 1 = less than 8%	3 = greater than 18% 2 = 8% - 18% 1 = less than 8%
100 yr Floodplain	3 = In Floodplain	3 = In Floodplain	3 = In Floodplain

Natural Assets – Forested Land

(Krueger, E. and Jordan, N. undated. Preserving Water Quality in the Savannah River:
Protecting the Future of Drinking Water Supply)



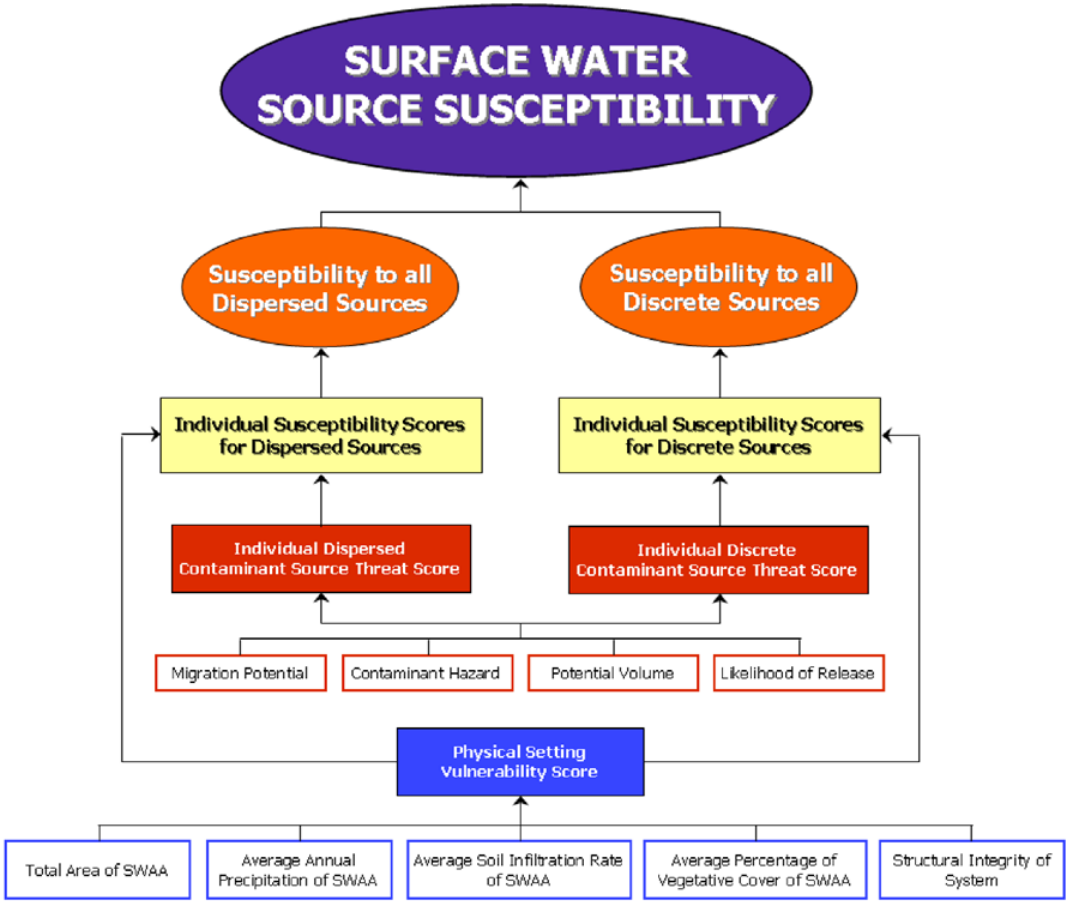
Likelihood Category	Physical Condition	Performance	Operability	Maintainability	Reliability History	Age (EUL)	Detailed Description
A – Improbable	Sound physical condition	Asset performs as needed and meets future expectations	Asset operates as designed and intended	Asset likely to perform adequately without major work in the planning horizon	Asset has no history of emergency or condition based repairs	>50% Remaining estimated useful life	Asset meets operational needs Asset likely to perform adequately without major work in the planning horizon.
B – Low	Acceptable condition	Asset has minor deterioration in performance	Asset is generally operable, but does not meet current sopecifications	Asset is generally maintainable, but does not meet current specifications	Asset has increased demand for PM's to maintain operability	50-75% Remaining estimated useful life	Minimal short-term failure risk, but potential for deterioration in the long-term (10 years plus). Only minor work required (if any).
C – Medium	Deterioration evident	Asset has moderate deterioration in performance	Asset is operable, but requires work-arounds	Asset is difficult to maintain due to physical condition or availability of parts	Asset has experienced failure or malfunction, but is repairable with low expectation of failure recurrance in short term window.	75-85% Remaining estimated useful life	Failure unlikely within next 2 years, but further deterioration likely and major replacement likely needed within next 10 years. Minor components or isolated sections of the asset may need replacement or repair now, but asset still functions at adequate level of service. Work required, but asset still serviceable.
D – High	Failure likely in short term	Asset has significant deterioration in performance	Asset is operable with significant effort, and is prone to failure	Asset is no longer current and repair parts are available, but difficult to obtain or require custom fabrication	Asset has a history of repeated failures	85-95% Remaining estimated useful life	Likely need to repair or replace asset within 2 years to maintain service level. Substantial work required in short term, asset barely serviceable.
F – Very High	In current state of failure	Asset does not meet current performance needs	Asset is not operable in current state	Asset is no longer able to be adequately maintained due to obsolesence and	Asset has a high occurance of failure related repairs and is therefore	>95% Remaining estimated useful life	Immediate need to repair or replace asset to maintain service level. Major work or replacement

Distribution Pipe

Total Likelihood	Linear Feet	Percent of System
3	488,962	68.52%
4	57,525	8.06%
5	2,217	0.31%
6	71,201	9.98%
8	7,086	0.99%
10	65,764	9.22%
12	13,214	1.85%
16	3,440	0.48%
18	1,438	0.20%
20	835	0.12%
24	939	0.13%
36	274	0.04%
40	671	0.09%
	713,567	100%

Modeling similarities continued:

Susceptibility defined: the state or fact of being ***likely or liable*** to be influenced or harmed by a particular thing (Google, 2019)



Colorado Method for estimating Susceptibility of DW Sources (after Eneco Tech, 2004)

Consider Consequences of Failure

Health and Safety of Public and Employees		Direct Financial Impact	
Safety (Employee & Public)	Public Health	One Time Event Costs	Recurring Operating
Fatality, amputation of limb, person on life support, other immediately life threatening incidents, widespread serious injuries or illnesses	Widespread illness and/or fatalities	>250K Incident impact	> 20K Annual Impact
A serious injury or long term illness or lost time injury (minimum 1 day lost per injury)	Serious illness requiring hospitalization	100K-250K Incident impact	10K - 20K Annual Impact
Significant near miss incident, injury or illness requiring medical treatment	Deterioration in water quality parameters, reportable event, increase in illnesses	50K-100K Incident impact	5 - 10K Annual Impact
Illness or injury requiring first aid Eg. Minor burns, abrasions, strains	Deterioration in water quality parameters, reportable event, no increase in illnesses	25K-50K Incident impact	3K - 5K Annual Impact
Near misses/accidents	Non-reportable event	<25K Incident impact	< 3K Annual Impact

Consequence Assessment	Health and Safety of Public and Employees		Direct Financial Impact		Public Image & Confidence	Regulatory Compliance	Service Delivery	Environmental Impact	3rd Party Loss/Liability
	Safety (Employee & Public)	Public Health	One Time Event Costs	Recurring Operating					
5 – Extreme	Fatality, amputation of limb, person on life support, other immediately life threatening incidents, widespread serious injuries or illnesses	Widespread illness and/or fatalities	>250K Incident impact	> 20K Annual Impact	Widespread loss of community confidence in govt, sustained adverse large-scale media	Significant compliance breach - may result in operating license sanction and/or high impact prosecution.	Complete Disruption to services > 1week and affecting > 30% of customers	Large Scale, Irreversable, uncontained harm to environment	>50K Incident impact
4 – High	A serious injury or long term illness or lost time injury (minimum 1 day lost per injury)	Serious illness requiring hospitalization	100K-250K Incident impact	10K - 20K Annual Impact	Considerable community concern, adverse local media	Compliance breach - may result in severe enforcement action, regulatory sanction or prosecution	Partial disruption > 2 days, affecting 10-30% of customers in system	Large Scale, Long-term (>2 years), uncontained harm to the environment	25K-50K Incident impact
3 – Medium-High	Significant near miss incident, injury or illness requiring medical treatment	Deterioration in water quality parameters, reportable event, increase in illnesses	50K-100K Incident impact	5 - 10K Annual Impact	Some public concern raised, local media concern	Compliance breach - may result in ministerial corrective action or business requirement, Possible fine	5-10% of customers affected, significant increase in # of complaints	Small Scale, Medium Term (1-2 years), uncontained harm to the environment. Eg small fire on utility property that damages adjoining protected wilderness	10K-25K Incident impact
2 – Medium	Illness or injury requiring first aid Eg. Minor burns, abrasions, strains	Deterioration in water quality parameters, reportable event, no increase in illnesses	25K-50K Incident impact	3K - 5K Annual Impact	Minor public concern	Compliance breach - may result in minor corrective action or business requirement	Multiple customer complaints	Short-term (<1 year), reversible, contained harm to the environment. Eg damage to a heritage building	10K-20K Incident impact
1 – Low	Near misses/accidents	Non-reportable event	<25K Incident impact	< 3K Annual Impact	Minimal public concern	Technical compliance breach with limited material impact	Isolated customer complaints	Temporary reversible environmental degradation eg industrial noise emissions at night.	<10K Incident impact

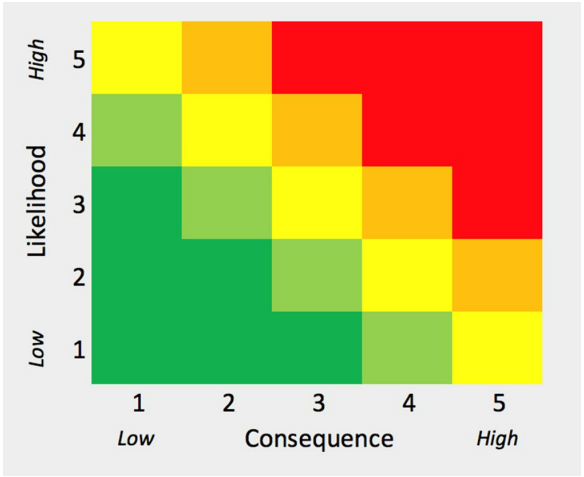
Consider comparable methods for consequence of failure

Distribution Pipe Risk Matrix

Likelihood	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
5 (High)	1.36	0%	0.16	0%	0.20	0%	0.00	0%	0.00	0%
4	3.79	1%	0.81	0%	0.31	0%	0.00	0%	0.00	0%
3	12.13	2%	1.53	0%	0.94	0%	0.00	0%	0.00	0%
2	31.92	5%	7.21	1%	5.44	1%	0.10	0%	0.00	0%
1 (Low)	447.71	71%	54.11	9%	61.42	10%	0.43	0%	0.00	0%
	1 (Low)		2		3		4		5 (High)	

Consequence

?

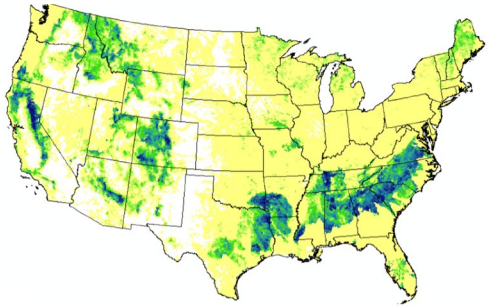


Probability Category	5 Year Cumulative Break Probability
1	< 0.05
2	0.05 to 0.125
3	0.125 to 0.25
4	0.25 to 0.5
5	> 0.5

(Level 5 means there is a 50% chance the pipe will break in the next 5 years)

Consequence Category	Direct and Indirect Cost of Failure
1	≤ $50,000
2	$50,001 to $100,000
3	$100,001 to $200,000
4	$200,001 to $500,000
5	> $500,000

(Level 5 means one failure will have costs greater than $500,000)



Before moving on to Step 5 – Deeper Dive Thoughts

- Use risk matrix to consider options to reduce risk
- Takeaways:
  - Define consequence in units of common measure based on factors uniquely important to your utility
  - Risk "Scores" comparable between built and natural assets (unitize risk!)
  - Look for consequence factors with sufficient data to be used with confidence
- Goal: Risk mitigation provides more benefit than costs to implement solutions

AM Wheel for Natural Systems

5. ID capital and O&M opportunities

- Are there feasible options (acquisition, easement, or restoration; O&M)?
- What partnerships might be required to execute these?

Step 5 : Identify Capital and/or O&M opportunities

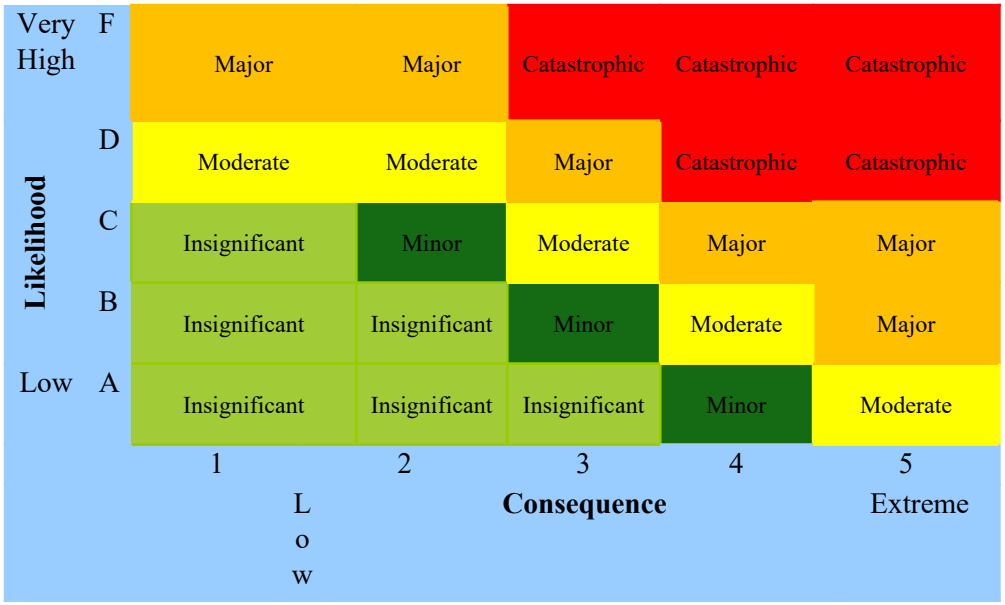
(Like life cycle planning and risk management for built assets !)

- Manage natural asset risk by:
  - Performing maintenance
    (e.g., supporting land management activities that reduce erosion),
  - Making capital investments
    (e.g., acquiring source watershed lands to conserve ecosystem services).
  - Cooperative agreements with others
  - Do nothing!
- Use **risk management policy & risk response plan**
  - Guide choices about expending resources (CAPEX, OPEX or from net income) to manage risk.

Within risk management policy place boundaries on options and prioritize response

- Risk Response: reflects risk tolerance and management guidance in utility policy
- Characteristics:
  - Type of management action necessary
  - Timeline for action
  - Can include CAPEX or OPEX actions
  - May involve “cost-effective” measures to core business, or meeting other strategic objectives
  - Unique to each utility – driven by Utility Risk Management Policy

Examples:



Risk Level	Risk Description	Risk Response
Level 5	Catastrophic	Immediate Response Needed
Level 4	Major	Include on 0-5 Year CIP
Level 3	Moderate	Include on 6-15 Year CIP
Level 2	Minor	No Current Action Required
Level 1	Insignificant	No Current Action Required

Example Built Assets (Water and Wastewater mains) Risk Response

***Australian Drinking Water Guidelines – Drinking Water Quality Management Framework* – Relevant Element**	**Factor**	**Sydney Catchment Authority (AS4360)**
Commitment to Drinking Water Quality		
Partnership Agencies	Internal	Yes
	External	Water industry only
Assessment of the Drinking Water Supply System		
Water Supply System Analysis		GIS map of catchment and pollutant sources
Review of Water Quality Data		Raw water compliance and investigative sampling data used to identify key issues
Hazard Identification and Risk Assessment	Hazard or event based	Hazard based
	Hazard information – causes and scenarios Risk assessment level – qualitative or quantitative	Water quality evaluation parameters used to determine primary consequence Qualitative with outcomes that a re Semi-quantitative. Risk = Consequence Score × Probability of Occurrence
Corrective Action		Risk treatment actions contained in risk action implementation program.

Example Natural Assets (Sydney Catchment Authority) – after Miller, Whitehill and Deere, 2005)

Step 5: Figuring out risk mitigation efforts

- Develop business case for your selected alternative:
  - OPEX funds
  - Capital funds
  - External funds

  } Or combinations
- Recognize opportunities and constraints for each funding type
  - Capitalization Policy
  - Fund sources (restricted funds; loans; partnership options, etc.)
  - Regulatory rules: allowable expenses, Use of net income, etc.
  - Intergenerational equity
- Let's look at some examples:

Conservation of a Natural Asset

- Typical targets – forested watersheds/wetlands/groundwater recharge areas
- Assets managed – primary objective sustaining valued water quality & related services
- Non-core objectives may be included as well
- Accounting methods a definite consideration (discussed in Chapter 10)

(Photo credit: City and Borough of Sitka, Alaska)

Maintenance of Natural Assets

- Carrying out maintenance activities on natural assets for same reasons as maintenance on built assets
- Activities tailored to types of assets; tailored to stressors or hazards
- Utility partnerships with those who receive benefits too
- Accounting methods a definite consideration (discussed in Chapter 10)

(Photo credit: Anchorage Water Wastewater Utility)

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Albuquerque Bernalillo County (NM) Water Utility Authority's Natural Asset Management Efforts

Rick Shean, Water Rights Program Manager
Diane Agnew, Environmental Manager
Albuquerque Bernalillo County Water Utility Authority

Water Authority's Natural Asset Efforts

- Water Rights

- Environmental Plan

Water Rights / Resources Portfolio

Surface Water

Ground Water

Reservoir Storage

Aquifer Storage and Recovery Water (SJC)

Reuse Water

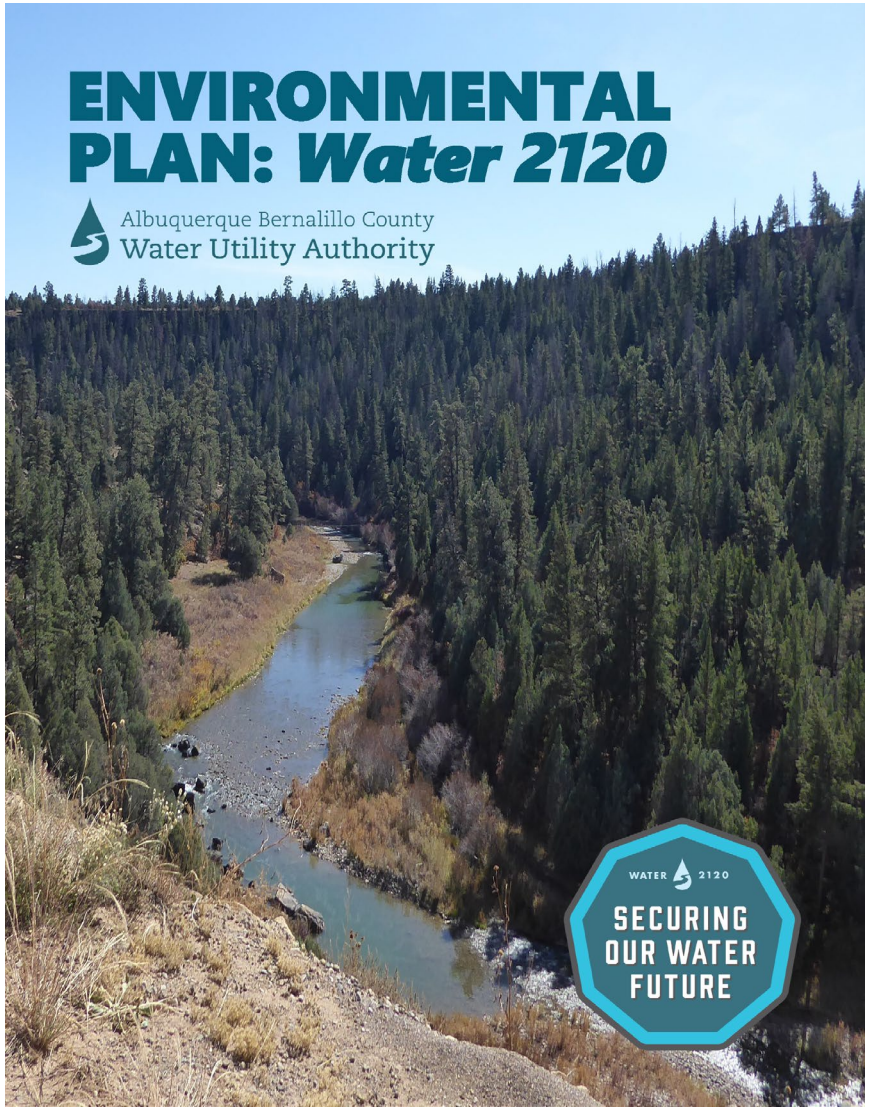
Water Rights

Senior Water Rights Assets

- What is a senior right?
  - NM is a prior appropriation state…. “first in time, first in line.”
- Magic date = 1907
- Water Authority has over 4,900 AF of senior water rights.
- Appraisal of Value of senior rights
- Tracking transactions in Maximo (IBM), where they were purchased / acquired, State declaration of water rights, current application of rights (“use it or lose it,” & beneficial use) .

Environmental Plan

- Environmental Plan covers the implementation of policies in *Water 2120*
- 8 policies with sub-policies
- Source waters and watershed scale as well as localized components

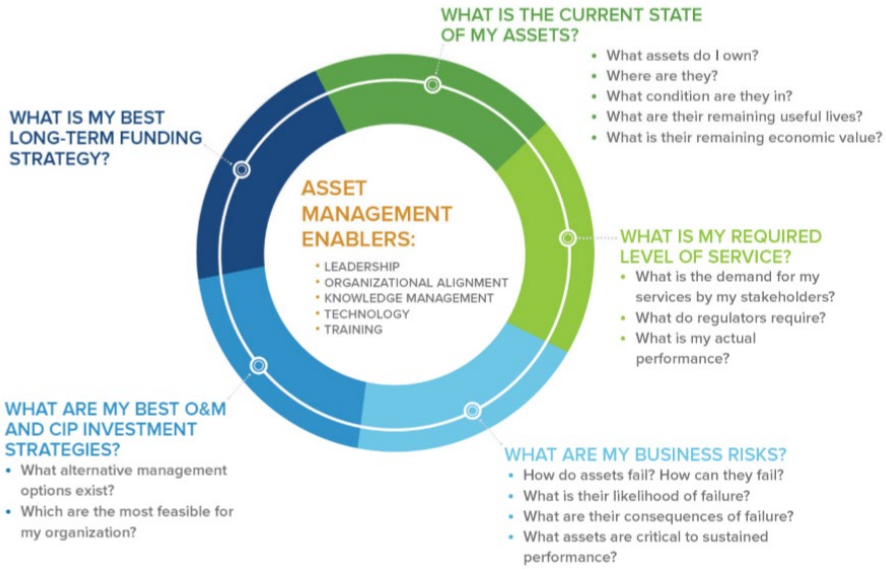


Focus Areas, LOSs, and KPIs

- Grouped policies into five focus areas:
  - Water Resources Planning and Management
  - Source Water Protection
  - Endangered Species
  - Environmental and Cultural Resources
  - Public Involvement and Outreach
- Levels of Service (LOSs) → *Water 2120* Policy
- Key Performance Indicators (KPIs) outlined out we will make sure we are meeting the LOS/policy

Next Steps

- Metrics and reporting – how do we track and how do we communicate with decision-makers?
- Assigning costs
- Integration with Water Authority built asset management



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MNAI Making Nature Count

Natural Asset Management

An overview of the opportunities

Roy Brooke
Executive Director
Municipal Natural Assets Initiative (MNAI)

Overview

- Introduce natural asset management and recent examples from Canada
- Discuss possible implications for USA

Core Idea

- Nature is:
  - one of our most vital assets
  - central to any resilient infrastructure system
  - potentially an investable asset

Natural Assets

Can deliver core services

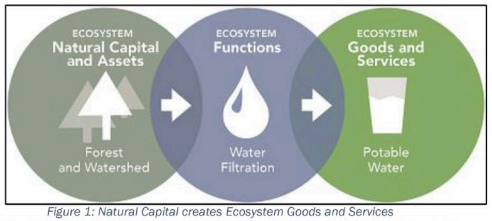
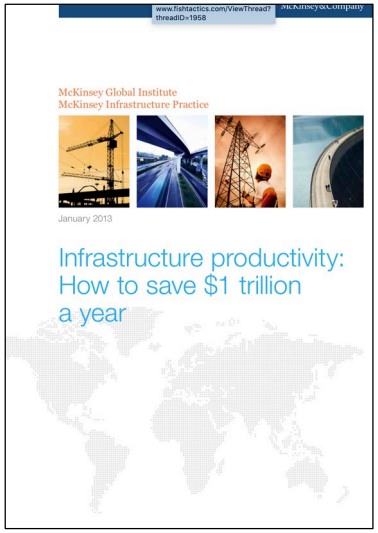


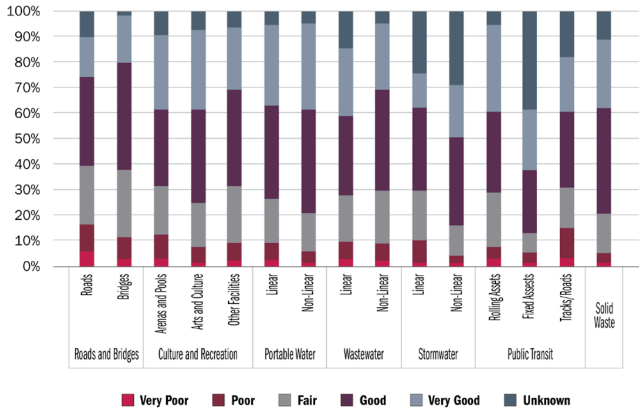
Figure 1: Natural Capital creates Ecosystem Goods and Services
(image source: Earth Economics http://www.eartheconomics.org/science-economics/)

Can be managed

Often over-used, under recognized

State of Infrastructure





Canada & USA much of existing infrastructure in very poor to fair condition.

StatsCan 2017: 164.3 billion litres of raw sewage overflows from combined sewers: systems are not handling downpours effectively.

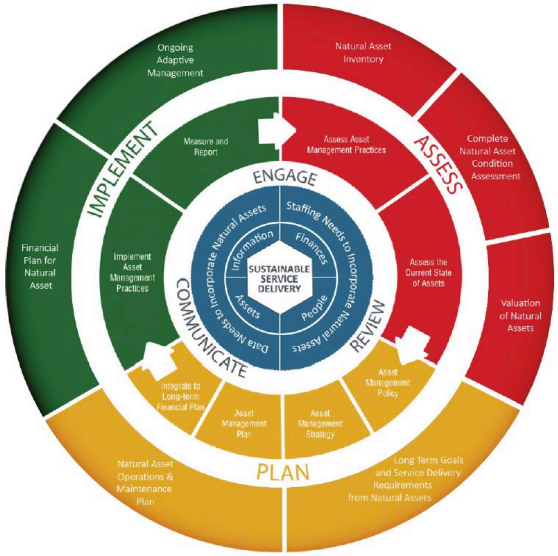
New service delivery solutions needed in changing climate

CP 2019

Good News

Asset Management:

an integrated process, bringing together skills, expertise, and activities of **People**; with **Informatio** about a community's physical **Asset** and **Finances**; so that informed decisions can be made, supporting Sustainable Service Delivery.



Source: Adapted from Asset Management BC, 2014.

Asset management is proving to a be a valuable tool for managing natural assets.

A growing number of examples

(and not just the usual suspects…)

Core Work

Phase 1: Asset characteristics understood/documented, condition assessments, risk identification

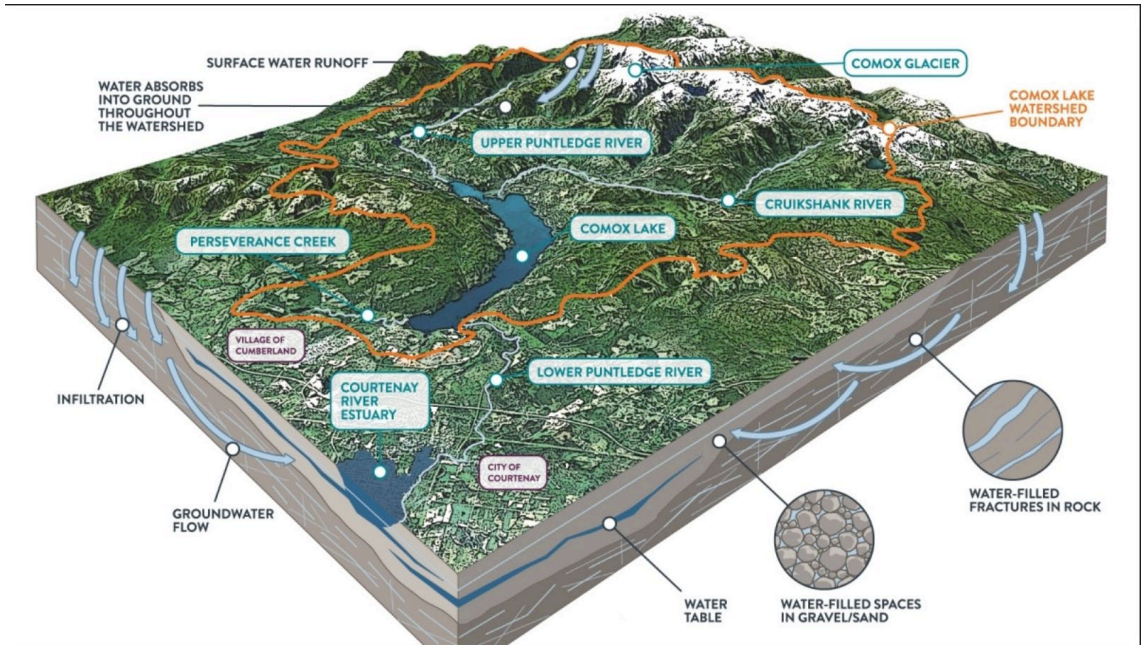
Phase 2: Asset beneficiary assessments, modelling, scenario development

Phase 3: Asset valuations (i.e. costs calculated for substitute engineered asset & operating costs); service levels assessed (current & future)

Phase 4: Operation / financial plans; final reports and project evaluation

Ongoing: Implementation/monitoring

Comox Lake Watershed



City of Comox

City of Courtenay

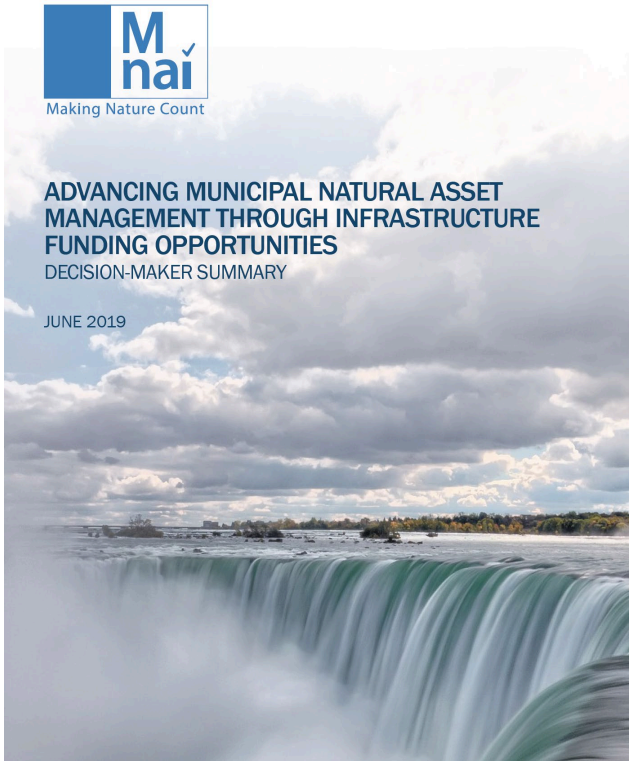
Comox Valley RD

K'omoks First Nation

Village of Cumberland

Water source for 49,000 people

A growing enabling environment



PSAB
Public Sector Accounting Board

Upcoming/ongoing opportunities:

- PSAB
- Engineering sector in BC & beyond and other professional disciplines
- Norms for asset management cycle
- Norms for data
- Funding environment

Possible US Implications

- Basic idea: no reason this can't work in USA
- Initial informal discussions with ELI, Earth Economics, WRF
- One possible approach:
- Explore context and method changes with US partners
- Adapt method for US use
- Run small number of pilots to determine if approach works well enough to be scaled

Other Considerations

- COVID-19 pandemic & possible rehabilitation restoration funding
- Inventory projects
- Royal Roads University & MNAI online course: https://secure.royalroads.ca/cscourses/natural-asset-management-online
- Swiss Re / IBC initiative
- Species at Risk
- First Nations cultural assets tool development

Discussion & Contacts

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Questions?

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