Introduction to Green Asset Management for Small Systems

July 27, 2022

ENVIRONMENTAL FINANCE CENTER

Jennifer Egan, PG, PhD
Program Manager
Environmental Finance Center

Michelle Kokolis
Program Manager
Environmental Finance Center

Agenda

- Welcome & Introductions
- The Asset Management Cycle
  - Define Assets & Conduct an Inventory
  - Level of Service
  - Criticality
  - Life Cycle Costing
  - Funding & Financing

ENVIRONMENTAL FINANCE CENTER

Asset Management Resources

Integrated Asset Management
https://swefc.unm.edu/iamf/

GSI Asset management toolkit

https://giexchange.org/wp-content/uploads/2021/12/GSI-AM-Resources-Toolkit-Final-Dec-17.pdf#page=43

Asset Management:
A Handbook for Small Water Systems

One of the Simple Tools for Effective Performance (STEP) Guide Series

Asset Management:
A Handbook for Small Water Systems
*Worksheets provided *

https://www.vdh.virginia.gov/content/uploads/sites/14/2016/04/AM_STEP.pdf

ENVIRONMENTAL FINANCE CENTER

Asset Management Cycle

- Define asset and conduct an inventory
- Level of Service
- Criticality
- Life Cycle Costing
- Long-Term Funding

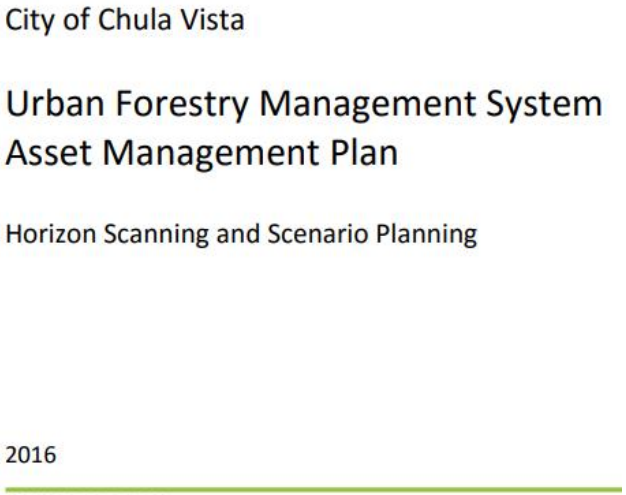
https://www.wsp.com/en-CA/services/asset-management-for-water

ENVIRONMENTAL FINANCE CENTER

Why Use (Green) Asset Management?

- Current state and future needs
- Proactive rehabilitation and replacement
- Probability and consequence of failure
- Manage high-risk assets
- Minimize the life-cycle cost
- Develop a systematic methodology for prioritizing work and budget
- Be transparent by involving the City Council and the Public in the development of the asset management program and the associated decisions

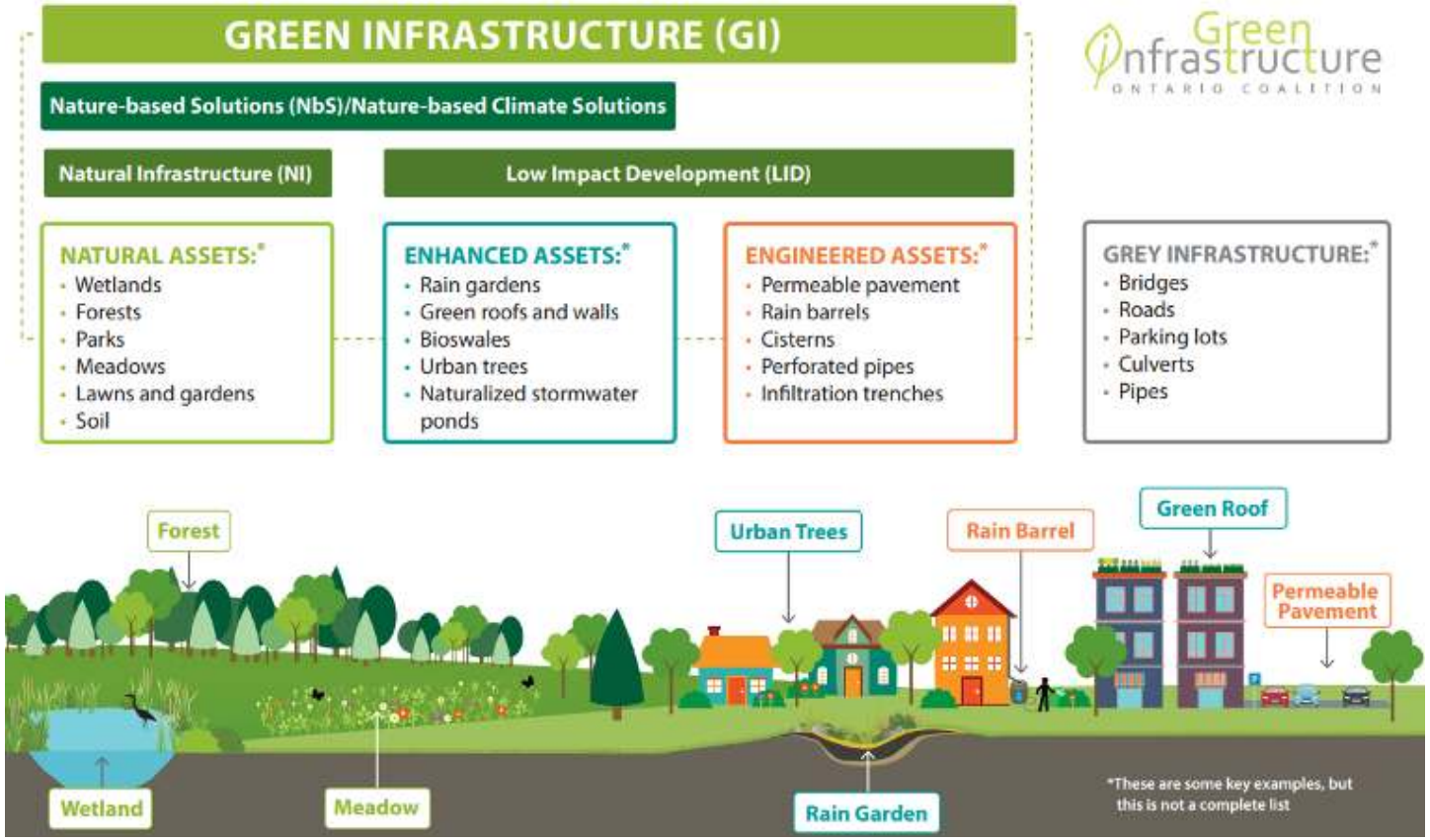
CITY OF CHULA VISTA



https://www.chulavistaca.gov/home/showdocument?id=12382

ENVIRONMENTAL FINANCE CENTER

What are assets?



https://greeninfrastructureontario.org/what-is-green-infrastructure/

- Asset Definition
  - What
  - Where
- Inventory
  - Ownership
  - Condition
  - Useful life
  - Replacement cost

What are Assets?

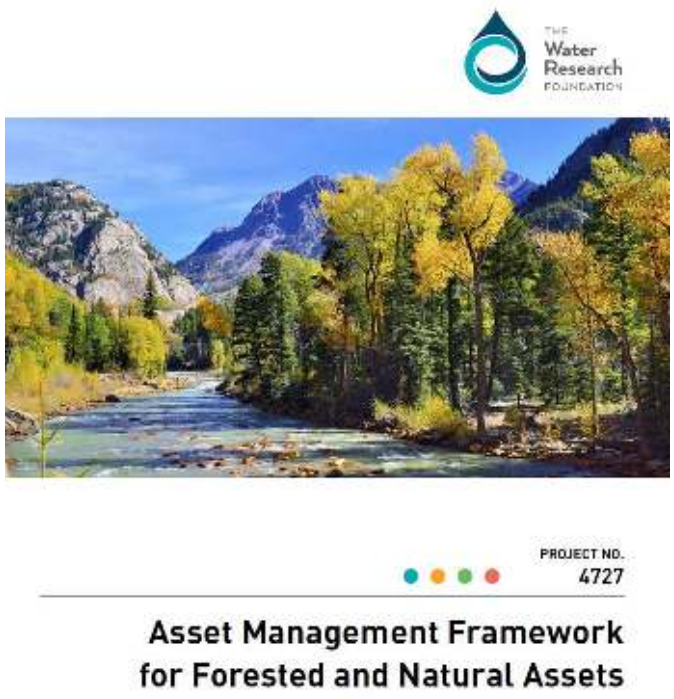
Pump (Gray)

- Entire pump is the asset
- Pump is an asset, motor is an asset, controls are an asset

Vegetated Swale (Green)

- Entire swale is an asset
- Swale is divided into one-mile segments, each mile is an asset
- Swale is divided into segments within GIS system, each segment is an asset

Natural Assets that Protect Drinking Water



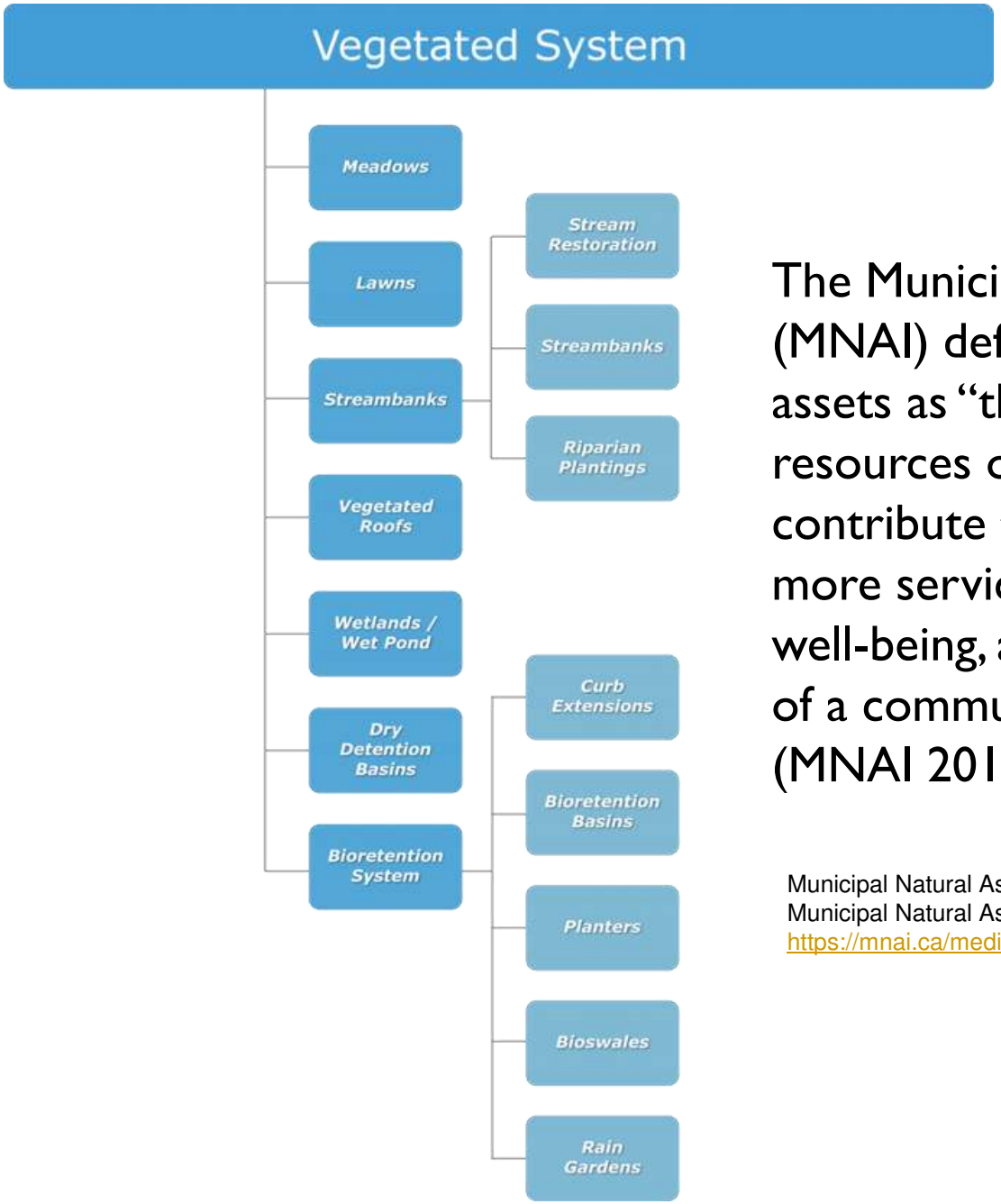
Green Infrastructure

Natural Assets
- Wetlands
- Forests
- Parks
- Lakes/Rivers/Creeks
- Fields
- Soil

Enhanced Assets
- Rain Gardens
- Bioswales
- Urban Trees
- Urban Parks
- Biomimicry
- Stormwater Pond

Engineered Assets
- Permeable Pavement
- Green Roofs
- Rain Barrels
- Green Walls
- Cisterns

Asset Management Framework for Forested and Natural Assets
https://www.waterrf.org/research/projects/asset-management-framework-forested-and-natural-assets



The Municipal Natural Asset Initiative (MNAI) defines municipal natural assets as "the stocks of natural resources or ecosystems that contribute to the provision of one or more services required for the health, well-being, and long-term sustainability of a community and its residents" (MNAI 2017).

Municipal Natural Assets Initiative. 2017. Defining and Scoping Municipal Natural Assets. Report, Sept. 2017. 14 p. Accessed at: https://mnai.ca/media/2018/02/finaldesignedsept18 mnai.pdf

Asset Types and Sub-Types with Codes

Asset Type	Asset Sub-type	Code[1]
1. Lawn	1a. Manicured Lawn - Creation	LWN-cr
2. Individual Trees	2a. Individual Tree - Softscape	TRE-s
	2b. Individual Tree - Hardscape	TRE-h
3. Stream corridors	3a. Stream Corridor - Small[2] System Rehabilitation	SC-sm
	3b. Stream Corridor - Large[3] System Rehabilitation	SC-lg
	3c. Stream Corridor Erosion Control - Small System[2]	SEC-sm
	3d. Stream Corridor Erosion Control - Large System[3]	SEC-lg
4. Wetlands	4a. Wetland - Meadow Marsh - Creation	MAM-cr
	4b. Wetland - Meadow Marsh - Acquisition	MAM-ac
	4c. Wetland - Thicket Swamp - Acquisition	SWT-ac
5. Upland Meadows	5a. Cultural Meadow - Creation	CUM-cr
	5b. Cultural Meadow - Acquisition	CUM-ac
6. Upland Forests	6a. Deciduous or Mixed Forest - Creation	FOD/M-cr
	6b. Deciduous Forest - Acquisition	FOD-ac
	6c. Cultural Plantation to be managed as Mixed Forest - Acquisition	FOM-ac

[1] Asset sub-type codes have been developed for this project to facilitate cross-referencing.

[2] "Small systems" for this project are defined as up to 5 m bankfull width

[3] "Large systems" for this project are defined as between 6 m and 20 m bankfull width

https://cvc.ca/wp-content/uploads/2021/09/2020-12-15_CVC_NatAssetLifeCycleReport_220046_FINAL.pdf

Asset Inventory Example

Field	Description
Asset ID	Unique identifier for the assets
Location	The physical location of the asset. (e.g., coordinates, intersection, or street address)
Quantity	The amount of the asset (e.g., length, volume, size, area)
Year Installed	The year the asset was installed or acquired
Ownership	Who owns the asset
Management Responsibility	Who is responsible
Age	The current year m date of installation
Unit Replacement Cost	Cost per unit to rep
Replacement Value	The cost of replacir
Expected Useful Life	Theoretical service
Remaining Useful life	Estimated number useful life, or basec
Condition Rating	A rating of the conc

GSI Asset management toolkit https://giexcha
Resources-Toolkit-Final-Dec-17.pdf#page=43

Cost information may not be relevant

- Size
- Protective status

1 VERY GOOD	New or nearly new. No noticeable issues. No Action Required. Continue routine maintenance.
2 GOOD	Minor noticeable issues; no longer a new asset. Continue routine maintenance.
3 MODERATE	Noticeable issues which may impact functionality in the next 3-5 years. Monitor progress of issue during next inspection. Continue routine maintenance. No additional immediate inspections or tests required.
4 POOR	Noticeable issues which may impact functionality in the next few years (1-2 years). Need a more detailed inspection or infiltration tests.
5 VERY POOR	Functionality of the asset is questionable. Immediate action required. A more detailed inspection or infiltration tests required within 30 days.

Level of Service - Mission

Contra Costa Water District

"To strategically provide a reliable supply of high quality water at the lowest cost possible, in an environmentally responsible manner"

City of Hot Springs, Division of Stormwater Management

"To promote the health, safety, and welfare of the City of Hot Springs citizens by preventing the pollution, impairment or destruction of its natural resources"

Louisville/Jefferson County Metropolitan Sewer District

"Provide quality wastewater, stormwater, and flood protection services to protect public health and safety through sustainable solutions, fiscal stewardship, and strategic partnerships"

Level of Service

Ecosystem Function	Natural Asset Type Able to Contribute to Specified Service	Related Municipal Services[1]
Water quantity management	• forests / woodlands • waterbodies[2] and stream corridors • wetlands • meadows • naturalized or manicured open spaces	• flood protection and risk reduction to property and human life • protection of drinking water through groundwater recharge functions
Maintenance of soil quality and erosion management	• forests / woodlands • waterbodies[2] and stream corridors • wetlands • meadows • trees (outside natural areas) • naturalized or manicured open spaces	• protection of drinking water • risk reduction to property and human life • protection of recreational fisheries • provision of safe recreational areas, including shoreline erosion control
Water quality management	• forests / woodlands • waterbodies[2] and stream corridors • wetlands • meadows • trees (outside natural areas) • naturalized or manicured open spaces • groundwater[3]	• protection of drinking water • improving recreational value of receiving waters (e.g., for swimming, fishing, boating)

- What service levels do your customers want?
- What service levels can you provide?
- How will you measure performance?
- How do natural assets provide the service?

Level of Service – Goals and Data

What data do we need to measure the goal?	How will we collect or save the data?	How often will we check whether we met this goal?	Who would want to know whether you met the goal?
Maintenance Records	Word Table	Weekly?	The Community?
Complaint Type	Excel Spreadsheet	Monthly?	Managers?
Call Time	Database	Quarterly?	Elected Leaders?
Response time	Computer Program	Semi-annually?	Customers?
		Annually?	

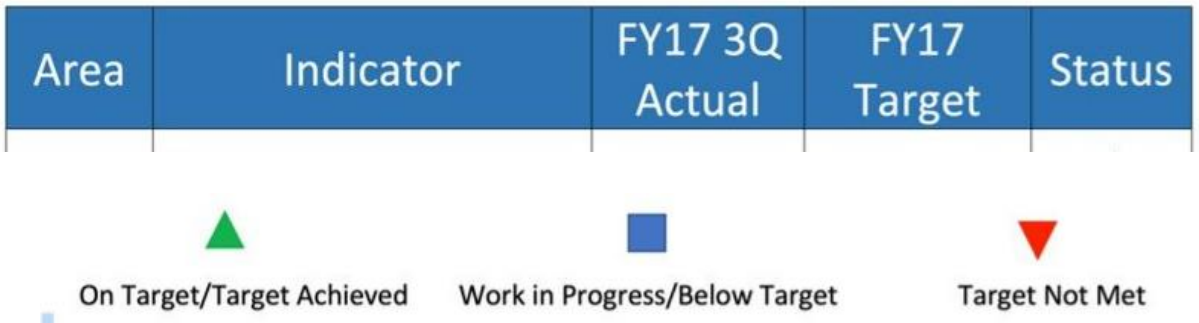
ENVIRONMENTAL FINANCE CENTER

Core Services – Bioretention		
Service Attributes that Matter to Customers or Elected Leaders	**External LOS Performance Indicator**	**Internal LOS Performance Indicator**
An **effective** green infrastructure stormwater system in the ROW	Percent of residents satisfied with performance of stormwater infrastructure	Volume of runoff diverted from the gray system per square meter or yard (or neighborhood or drainage area)
		Percent of bioretention systems operating at their design criteria rate
		Percent of features with ponding beyond 24 hours after a rain event.
		Percent of bioretention features in good or very good condition
	Response time to customer complaints	Annual operating expenditures on bioretention features
		Percent of assets inspected every 5 years
Clean receiving waters	Percent of days beaches are open	Number of combined sewer overflow (CSO) events
	Number of key fish species present	Percent of community with sufficient stormwater quality control (Sufficient could mean the target level of total suspended solids (TSS) or other pollutants, e.g., phosphorus to achieve)
GSI contribute to **aesthetically** pleasing neighborhoods	Percent of residents satisfied with bioretention features	Percent of road reconstruction projects (by project length) using bioretention practices
		Percent of bioretention feature with adequate sight lines (plants below a maximum height).
	Average number of pieces of trash in feature	Frequency of trash removal based on asset location
	Response time to removing invasive species	Frequency of weed removal (or % of weed cover below a target amount)
	Percent of residents satisfied with the plant health and aesthetics in bioretention features	Percent irrigation system inspections completed on schedule
		Percent plants that are appropriate for climate and operations (e.g., salt tolerant)
		Percent of successfully established plants at the end of the warranty period (or replacement frequency during establishment)
Trees are used to manage stormwater runoff	Percent of trees in bioretention assets surviving annually	Percent of street trees that have at least 30 cubic meters of soil volume
		Tree canopy percentage in the ROW

https://giexchange.org/wp-content/uploads/2021/12/GSI-AM-Resources-Toolkit-Final-Dec-17.pdf#page=43

UNIVERSITY OF MARYLAND ENVIRONMENTAL FINANCE CENTER

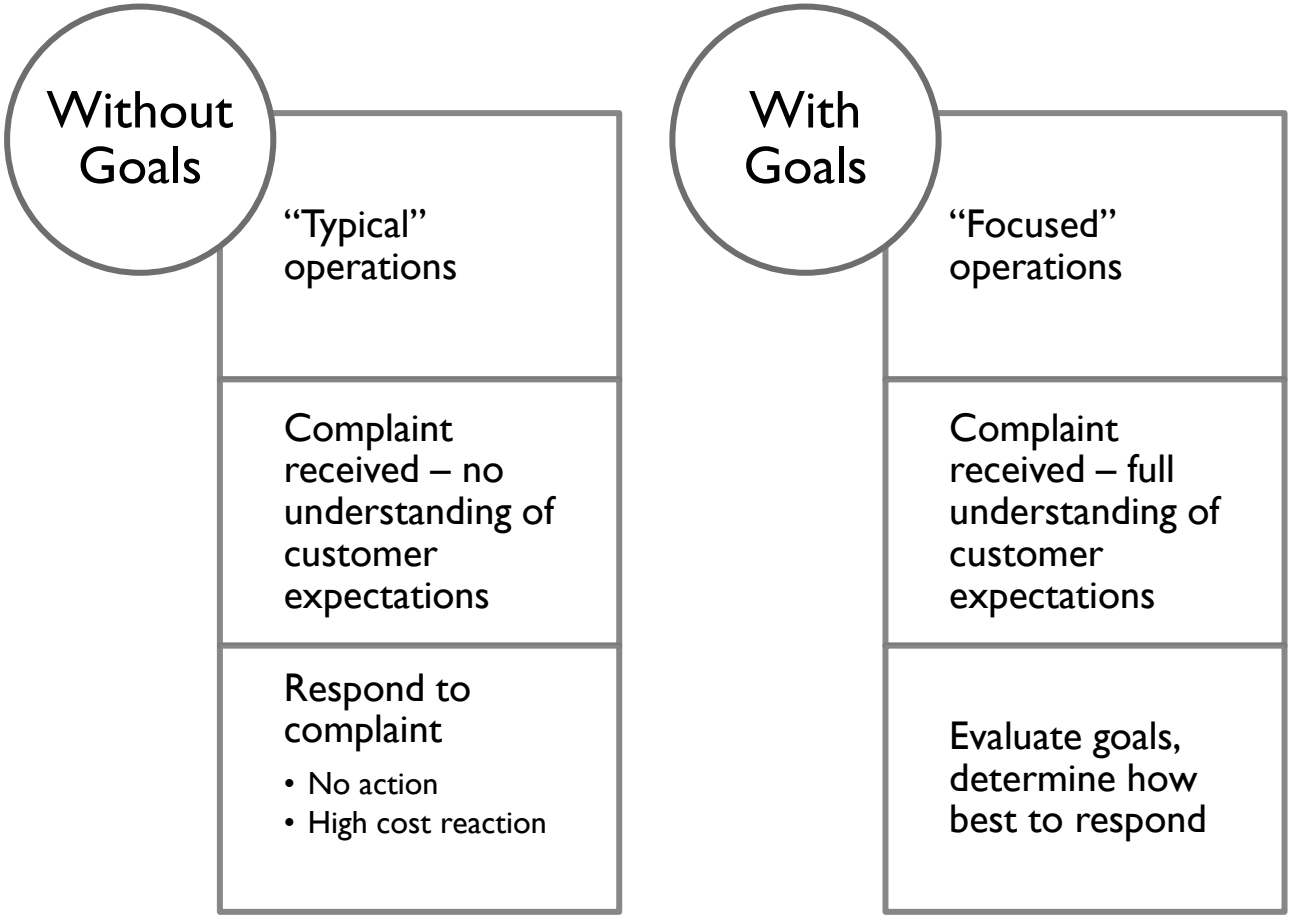
Secondary Services – Bioretention		
Service Attributes that Matter to Customers or Elected Leaders	External LOS Performance Indicator	Internal LOS Performance Indicator
There are **shaded** places to stop along sidewalks	Percent of sidewalk shaded by street trees	Number of trees per linear meter/foot of sidewalk
Planted areas contribute to improved **biodiversity**		Percent of features with 2 or more native plant species



https://giexchange.org/wp-content/uploads/2021/12/GSI-AM-Resources-Toolkit-Final-Dec-17.pdf#page=43

ENVIRONMENTAL FINANCE CENTER

Goals should help control cost



ENVIRONMENTAL FINANCE CENTER

Criticality

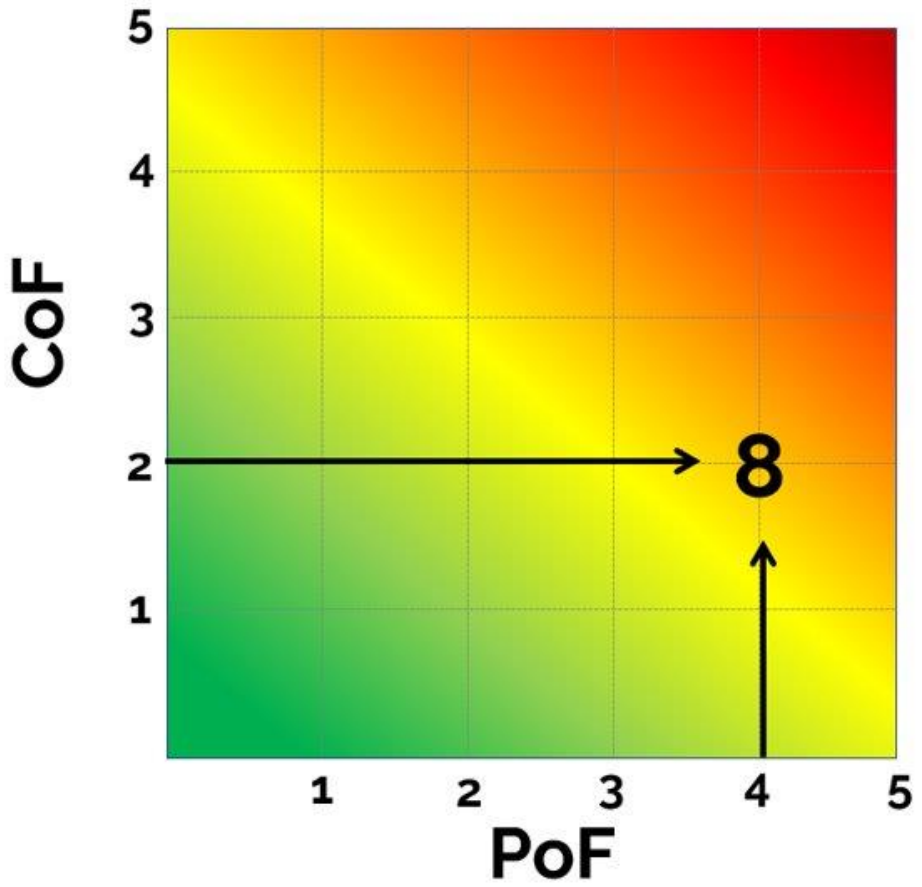
- Measure of risk associated with asset, probability of failure and the consequence of failure
- Projects and activities should be prioritized based on criticality/risk to ensure limited financial and personnel resources are used efficiently.

Criticality – evaluate then rank

- Probability of Failure (PoF)
  - Consider asset history, condition, repair, and age
  - Assign a ranking high probability to low probability
- Consequence of Failure (CoF)
  - Financial – e.g. damage or legal fees
  - Environmental – e.g. violations, fines, habitat loss
  - Social – e.g. health and safety, consumer distress
  - Assign a ranking high to low consequences

Criticality – evaluate then rank

Consequence of Failure	5	5	10	15	20	25
	4	4				
	3	3				
	(2)	2				
	1	1				
Multiplied		1				
	Pro					



ENVIRONMENTAL FINANCE CENTER

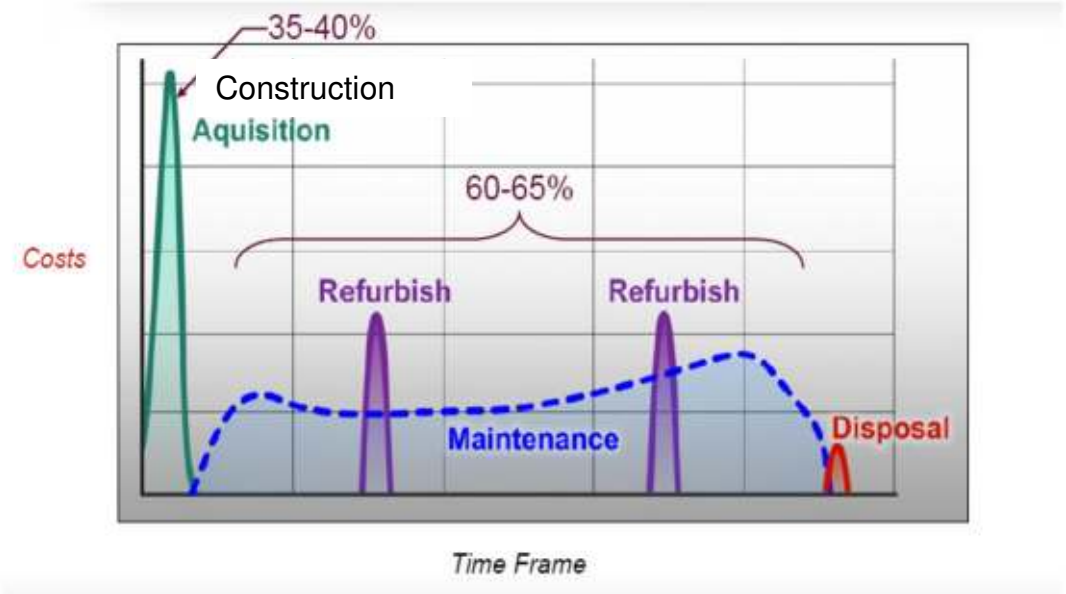
Reduce Risk

Routine & Preventative Maintenance	Monitoring	Spare Parts
Specialized Training	Replace Assets Early	Redundancy

ENVIRONMENTAL FINANCE CENTER

Life Cycle Costing

- Total capital, operating, and maintenance costs of an asset over its operating life
- **Optimize** O&M, repair, rehabilitation, and replacement of **system assets**
- **Helps develop capital** **and O&M plans**



ENVIRONMENTAL FINANCE CENTER

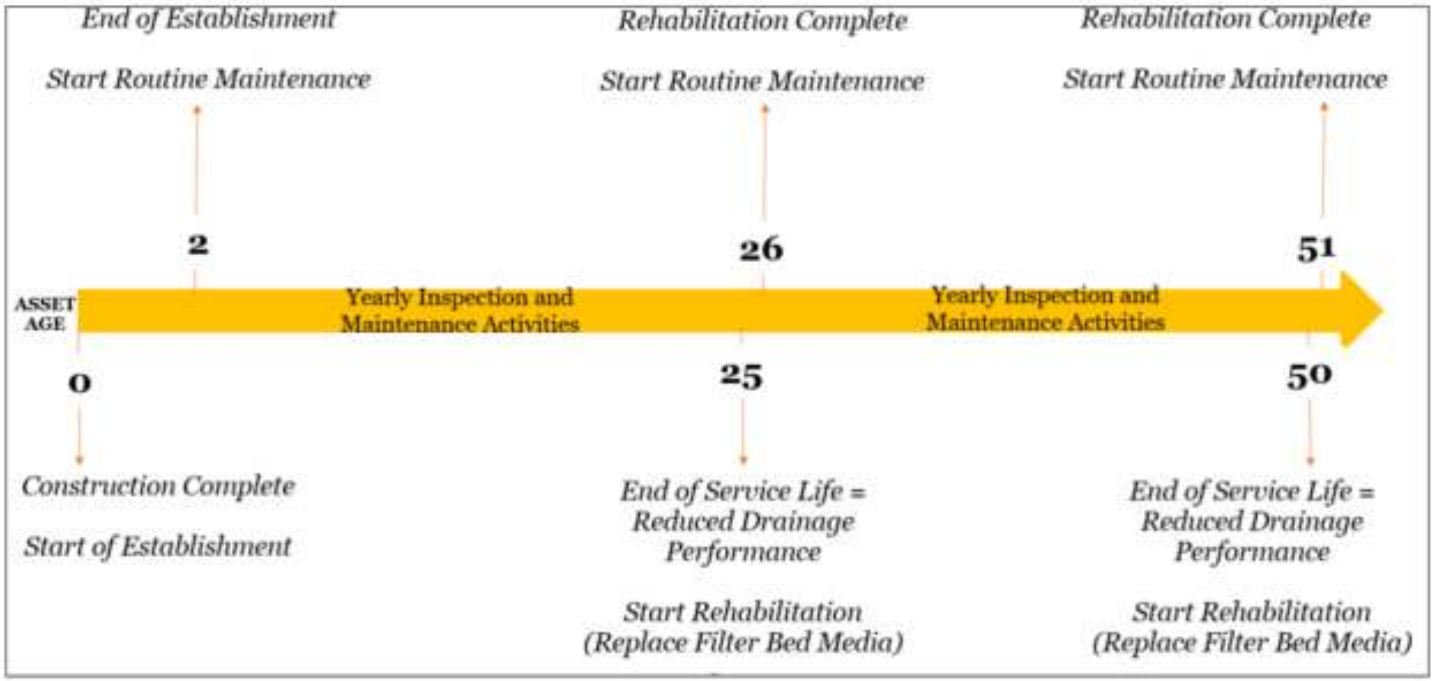
Life Cycle Costing

- Opportunity to effect asset life
- Influences asset operation
- After construction, comes the intersection of asset management and managing assets

ENVIRONMENTAL FINANCE CENTER

Life Cycle Costing
Operations and Maintenance Phase

- During the whole life cycle of an asset, there are many possible interventions at many points during the asset's life



https://giexchange.org/wp-content/uploads/2021/12/GSI-AM-Resources-Toolkit-Final-Dec-17.pdf#page=43

ENVIRONMENTAL FINANCE CENTER

Life Cycle Costing Maintenance

- Planned and strategic interventions to improve and prolong asset life

Routine or Planned

Maintenance Activity	Activity Type and Description	Min. Freq. (Source: STEP)	High Freq. (Source: STEP)	Existing Freq. (Vancou-ver)	Proposed Freq. (Vancou-ver)	Program Implementation Notes/ Assumptions	Unit Cost ($) (per Asset)	Assump-tions
Inspection	Visual Inspection	Com-plaint Driven	1x - 2x per Year	1x / Year	Once Every 2 Years	Assess the condition of each asset component and determine asset functionality. To be performed by staff trained on functionality of green rainwater infrastructure assets, and on using electronic form. Effort will also require detailed pre- and post-inspection steps. Data will be used to determine non-routine maintenance requirements. On average, inspector will spend an hour at each site.		
Routine Maintenance	***Part of Community Stewardship Program*** Remove sediment, trash, and debris from pre-treatment devices, the filter bed surface and inlet and outlets.	2x per Year	4x per year	1x / Year	1x / Year	Scope is limited to a quick 30 min visit per site. Assuming 20% of assets are part of community stewardship program. Assumption based on current state of 30 assets of 152 assets being part of community stewardship program.		

Natural Assets

Because managing natural assets may be an entirely new endeavor for water utilities, it will be beneficial to start with a simplified implementation of AM methods called a reconnaissance-level implementation. For traditional AM with built assets, this is sometimes referred to as desk-top assessment. In other contexts, it may be described as a screening-level approach. The key is that it is a simplified version of the AM methods that sets a foundation for full implementation later.

"There is widespread recognition that natural assets provide highly valuable services to water sector utilities and the communities they serve. There also is broad appreciation that active engagement by utilities is needed to ensure the services provided by those natural assets upon which utilities rely are preserved or enhanced." (p.34)

Asset Management Framework for Forested and Natural Assets
https://www.waterrf.org/research/projects/asset-management-framework-forested-and-natural-assets

ENVIRONMENTAL FINANCE CENTER

Credit Valley Conservation, Ontario – Life Cycle Costing for Streams

Credit Valley Conservation
inspired by nature

Life Cycle Costing of Restoration and Environmental Management Actions: Costing Natural Assets in Peel Region

Prepared by: Beacon Environmental Limited with Green Analytics and Associated Engineering

Prepared for: Credit Valley Conservation

December 2020

Overview of Natural Asset Types and Sub-Types Selected for Costing

Asset Type	Asset Sub-type	Code[1]
1. Lawn	1a. Manicured Lawn - Creation	LWN-cr
2. Individual Trees	2a. Individual Tree - Softscape	TRE-s
	2b. Individual Tree - Hardscape	TRE-h
3. Stream corridors	3a. Stream Corridor - Small[2] System Rehabilitation	SC-sm
	3b. Stream Corridor - Large[3] System Rehabilitation	SC-lg
	3c. Stream Corridor Erosion Control - Small System[2]	SEC-sm
	3d. Stream Corridor Erosion Control - Large System[3]	SEC-lg
4. Wetlands	4a. Wetland - Meadow Marsh - Creation	MAM-cr
	4b. Wetland - Meadow Marsh - Acquisition	MAM-ac
	4c. Wetland - Thicket Swamp - Acquisition	SWT-ac
5. Upland Meadows	5a. Cultural Meadow - Creation	CUM-cr
	5b. Cultural Meadow - Acquisition	CUM-ac
6. Upland Forests	6a. Deciduous or Mixed Forest - Creation	FOD/M-cr
	6b. Deciduous Forest - Acquisition	FOD-ac
	6c. Cultural Plantation to be managed as Mixed Forest - Acquisition	FOM-ac

[1] Asset sub-type codes have been developed for this project to facilitate cross-referencing.
[2] "Small systems" for this project are defined as up to 5 m bankfull width
[3] "Large systems" for this project are defined as between 6 m and 20 m bankfull width

https://cvc.ca/wp-content/uploads/2021/09/2020-12-15_CVC_NatAssetLifeCycleReport_220046_FINAL.pdf

ENVIRONMENTAL FINANCE CENTER

Why take this approach?

"By helping GASB clarify the use of one of its standards – a clarification that was recently published in GASB's 2018 Implementation Guide – **we opened a way for state and local agencies to count natural capital as assets**. This change will allow agencies to unlock the financing needed to scale up installations of green infrastructure as well as conservation and **restoration projects that can save utilities money while also improving community health and resilience."**

https://www.eartheconomics.org/gasb62

ENVIRONMENTAL FINANCE CENTER

Questions for Participants…

1. Do you have a Green Asset or Combined Asset Management Plan that you are willing to share? If so, can you provide the link to the website or report in the chat?

2. Have you used any specific accounting standards that have enabled you to count and fund green assets in your Asset Management Plan? If so, and we can we contact you to learn more, please put your contact info in the chat. Put info in the chat

ENVIRONMENTAL FINANCE CENTER

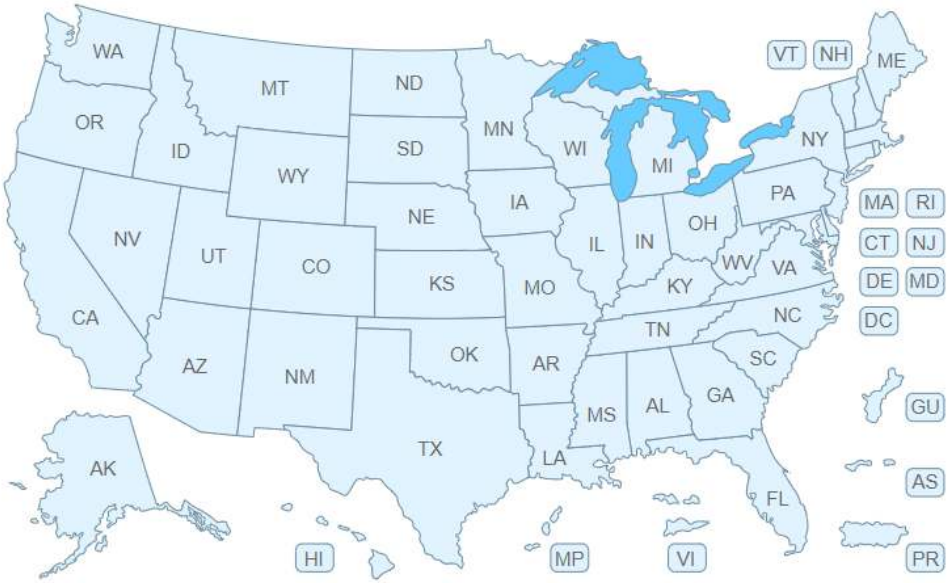
Finance Options

Source	Cost Coverage		Strengths	Weakness
	Capital	O&M		
Grants	Yes	No	Good source for "shovel ready/worthy" project implementation, demonstration projects, and initial program staff	Not guaranteed, highly competitive, suitable for demonstration projects, not sustainable in the long-term
SRF & Loan Programs	Yes	No	Can offer up-front capital for larger projects	Not guaranteed fund source, highly competitive, must repay – often with interest
Bond Financing	Yes	No	Can be used for large, long-term expenditures	Dependent on fiscal capacity, must repay with interest, cost of securing bond may be high
Permit, Development & Inspection Fees	Yes	No	Offers nexus to system and program expansion needs	May not sufficiently cover program costs, may deter development
User Fees/Rates	Yes	Yes	Can generate sufficient revenue, sustainable, dependable, equitable depending on design, supports all program costs	Requires significant public dialogue, can create administrative challenges
Tax Districts	Yes	Yes	Can generate sufficient revenue, sustainable, dependable	Necessitates enabling statute, can have equity problems sue to property value basis

EFCN Funding Tables

Funding Sources By State Or Territory

We work with state and federal agencies to make sure that current funding opportunities are consolidated in one place. Click the map below to find water and wastewater infrastructure funding sources for your state or territory.



Additional Funding Tables:

- **Navajo Nation** Water and Wastewater Funding Sources
- **Puerto Rico** Water and Wastewater Funding Sources, Spanish version
- **Tribal** Water and Wastewater Funding Sources

https://efcnetwork.org/resources/funding-tables/

Additional State and Territorial Resources:

- **California** Natural Resources Agency Funding Sources
- **Great Lakes** Environmental Infrastructure Center Funding Guide
- **Maine** CDC Drinking Water Program Table
- **Tennessee** Finding Money for Municipal Water, Wastewater and Solid Waste Projects
- **Texas** Private Financing List
- **Tribal** EPA Drinking Water Infrastructure Grants

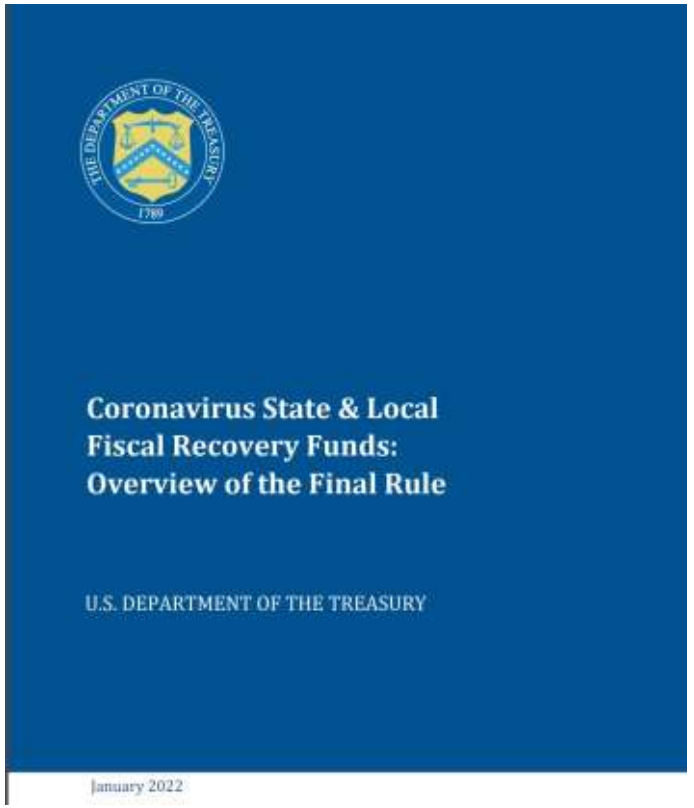
ARPA and the Coronavirus State & Local Fiscal Recovery Fund

The American Rescue Plan Act of 2021 (ARPA)

- Facilitate recovery from COVID-19 health and economic impacts

State and Local Fiscal Recovery Fund (SLFRF)

- $350 billion to ensure governments have the resources needed to:
  - Fight the pandemic
  - Support families and business struggling with impacts
  - Maintain vital public services in the face of revenue loss
  - Invest in long-term growth for a strong, resilient, equitable recovery



https://home.treasury.gov/system/files/136/SLFRF-Final-Rule-Overview.pdf

ENVIRONMENTAL FINANCE CENTER

What Projects are Eligible?

Clean Water State Revolving Fund

- Centralized or decentralized wastewater treatment
- Stormwater
- Agricultural BMPs
- Contaminated sites and landfills
- Habitat protection and restoration
- Silviculture
- Desalination
- Groundwater and surface water protection & restoration
- Planning & assessment
- Energy & water conservation

Drinking Water State Revolving Fund

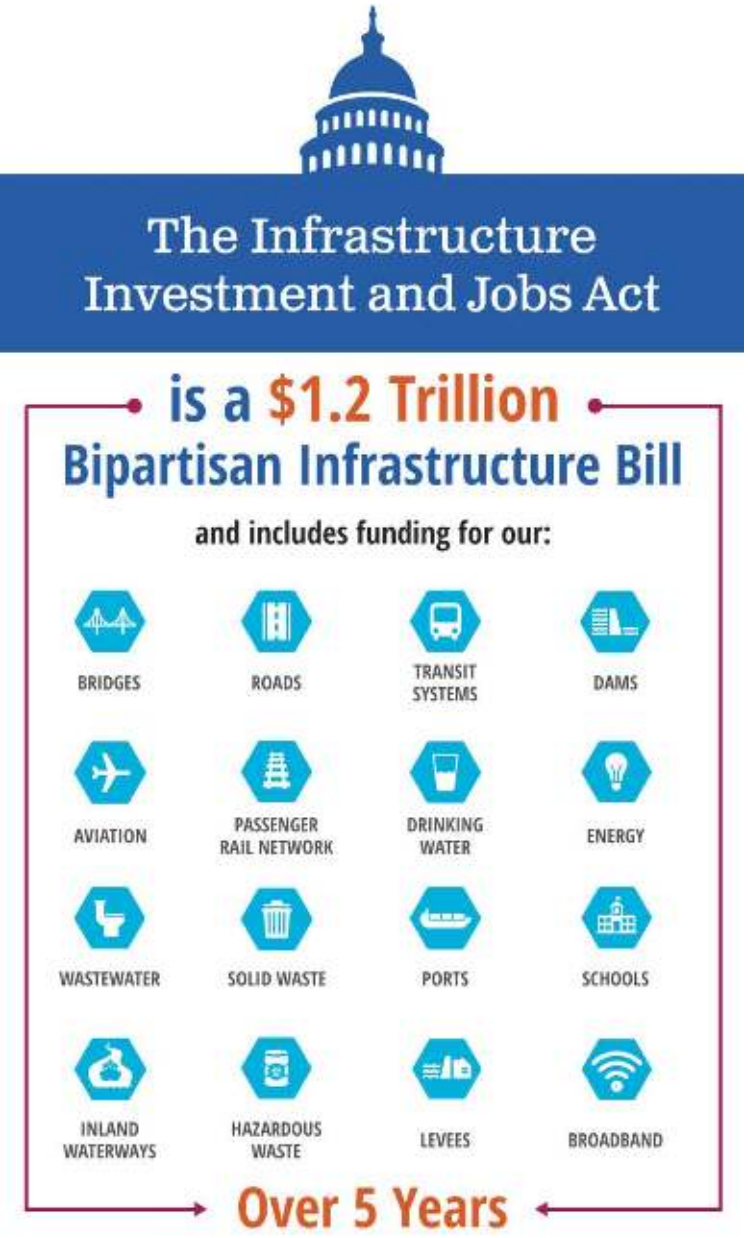
- Facilities to improve water quality
- Transmission & distribution
- Source water protection & green infrastructure
- Storage
- Consolidation of systems
- Creation of a new system
- Energy efficiency upgrades

Additional Eligible Projects

SLFRF can also fund:

- Culvert repair
- Replacement of storm sewers and other types of stormwater infrastructure
- Infrastructure to improve access to safe drinking water for individuals served by residential wells
- Dam and reservoir rehabilitation
- A broad set of lead remediation projects

The Infrastructure Investment and Jobs Act (IIJA)



Infrastructure Investment and Jobs Act (IIJA)

- Also referred to as "BIL"
- Historic investment in core infrastructure priorities

Drinking Water and Wastewater Infrastructure Act

- $55 billion investment to replace pipes, upgrade water facilities, and build resilient water systems

Infrastructure Investment and Jobs Act Clean Water SRF

Clean Water
$11.7 billion CWSRF
$1 billion PFAS

- 49% of SRF funds given as grants or principal forgiveness
- SRF state match 10% 2022 & 2023, and 20% for 2024-2026
- No state match required for PFAS

Infrastructure Investment and Jobs Act Drinking Water SRF

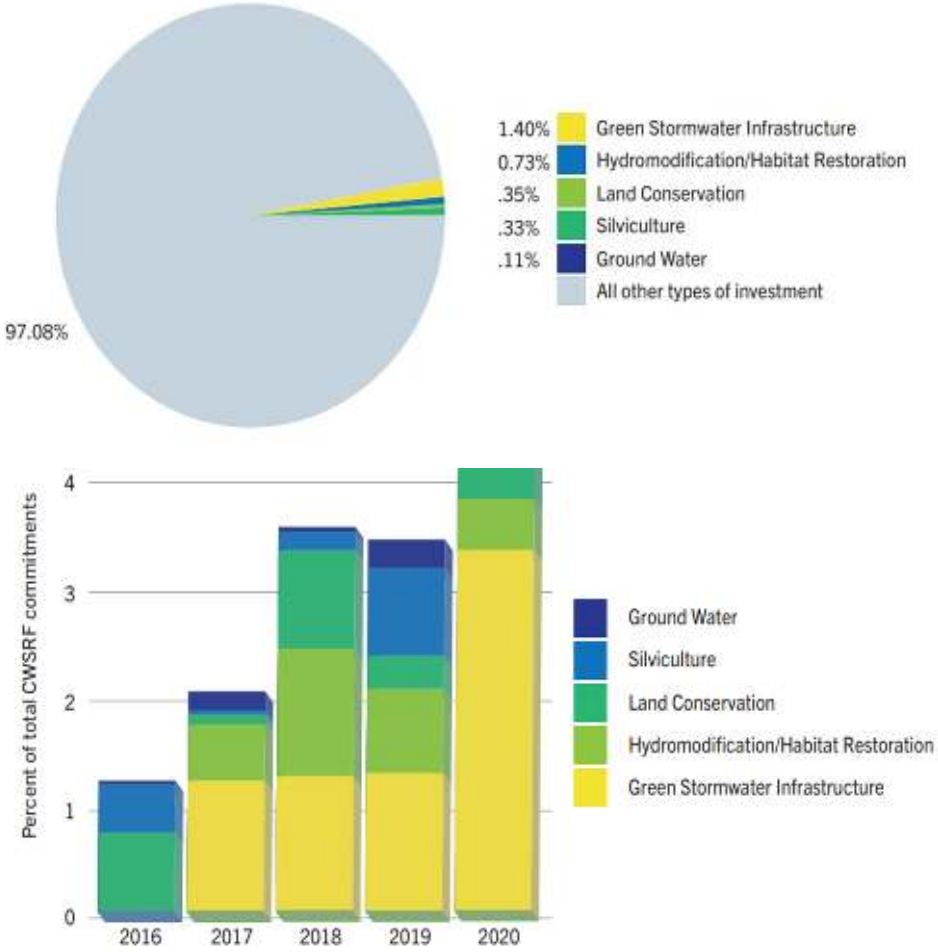
Clean Water
$11.7 billion DWSRF
$4 billion PFAS
$15 billion Lead

- 49% of SRF funds given as grants or principal forgiveness
- SRF state match 10% 2022 & 2023, and 20% for 2024-2026
- No state match required for PFAS, 25% directed to disadvantaged and small systems
- 49% of lead line replacement to disadvantaged communities

CWSRF Spending 2016-2020

- Green stormwater infrastructure and land conservation account for less than 2% of CWSRF spending
- This percent has been trending upward in recent years
- Loan forgiveness and grants in IIJA could accelerate this trend

https://www.epa.gov/cwsrf



Figures from the Environmental Policy Innovation Center

ENVIRONMENTAL FINANCE CENTER

Questions for Participants…

1. Do you have an innovative funding strategy that you have employed? If yes, put in chat

ENVIRONMENTAL FINANCE CENTER

Thank you!

Contact Us

Jennifer Egan

jegan@umd.edu

Michelle Kokolis

mkokolis@umd.edu

ENVIRONMENTAL FINANCE CENTER