What is a climate ready estuary?

Presented to:
64th FSBPA Annual Conference
Delray Beach, Florida
September 15-17, 2021

By:
Randall W. Parkinson, Ph.D., P.G.,
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and

Sea Level Solutions Center
Institute of Environment
Florida International University
Miami, FL

A climate ready estuary is in a watershed managed to ensure the effects of climate change on water quality and ecosystem function are mitigated through purposeful actions designed to reduce future pollutant loadings from anthropogenic sources

INDIAN RIVER LAGOON

Climate Ready Estuary

Understanding risks and taking action to build estuary and community resilience.

ONE LAGOON

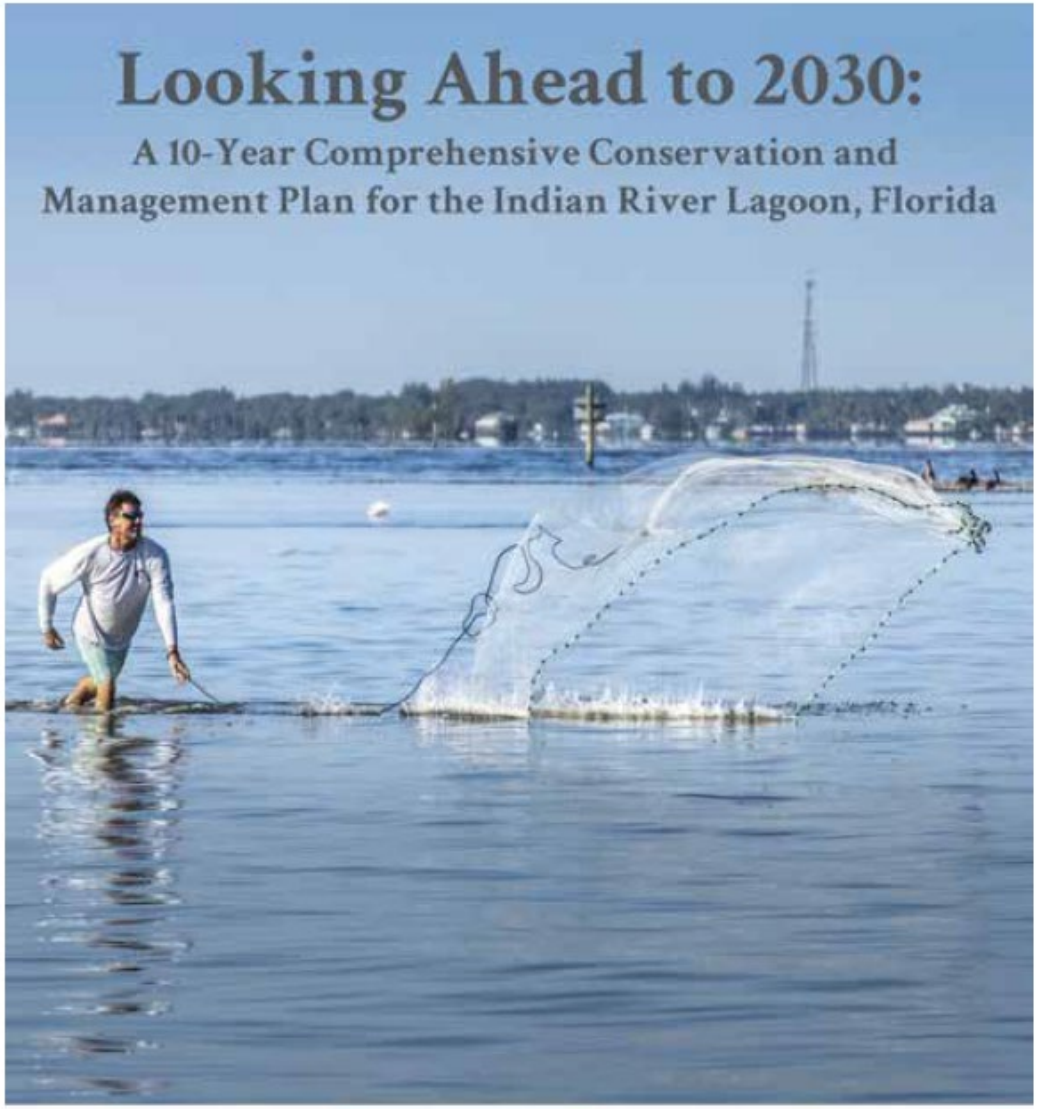
ONE COMMUNITY · ONE VOICE

INDIAN RIVER LAGOON NATIONAL ESTUARY PROGRAM

TECHNICAL REPORT NO. 003
FEBRUARY 2021

Looking Ahead to 2030:

A 10-Year Comprehensive Conservation and Management Plan for the Indian River Lagoon, Florida



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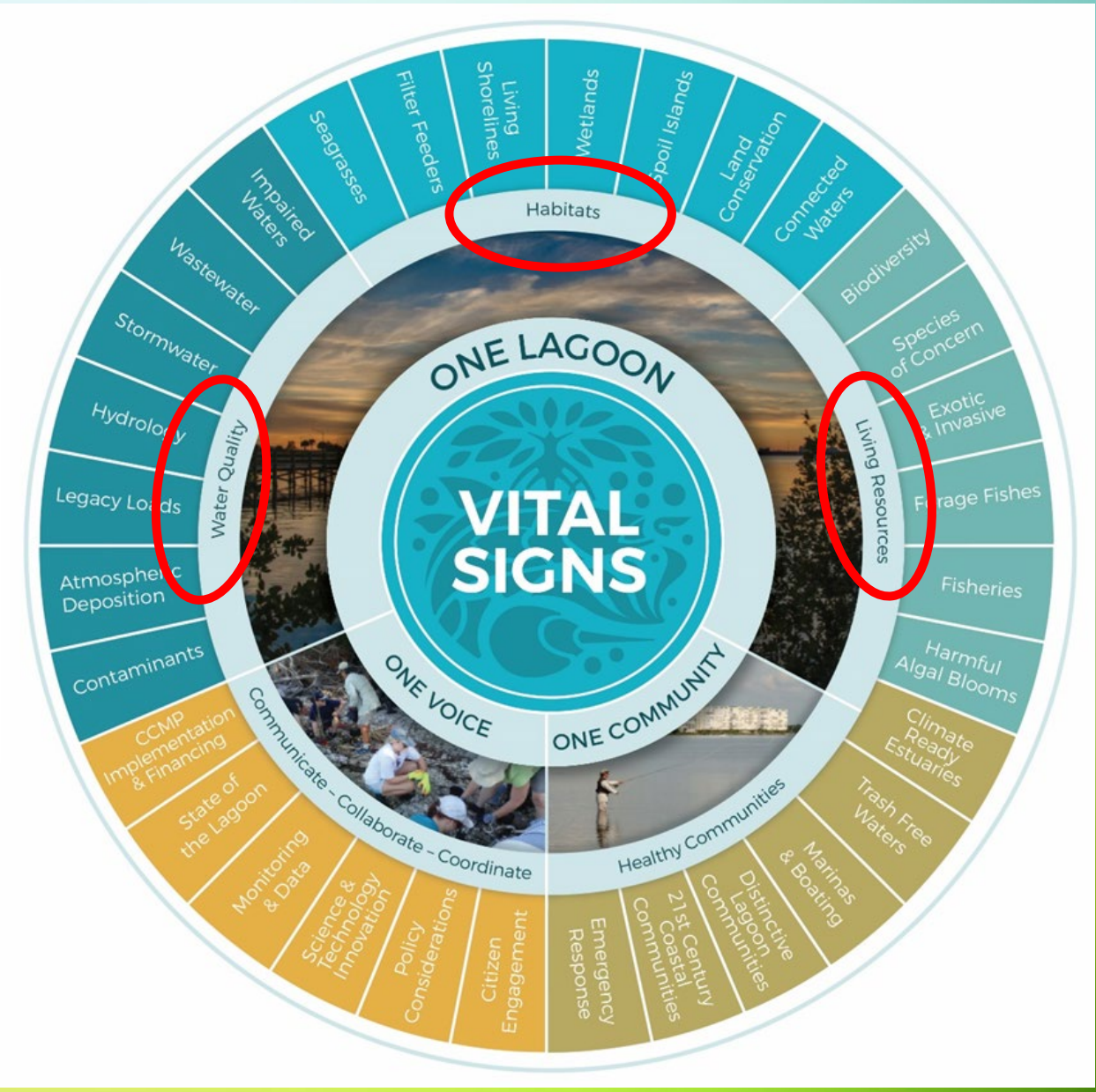
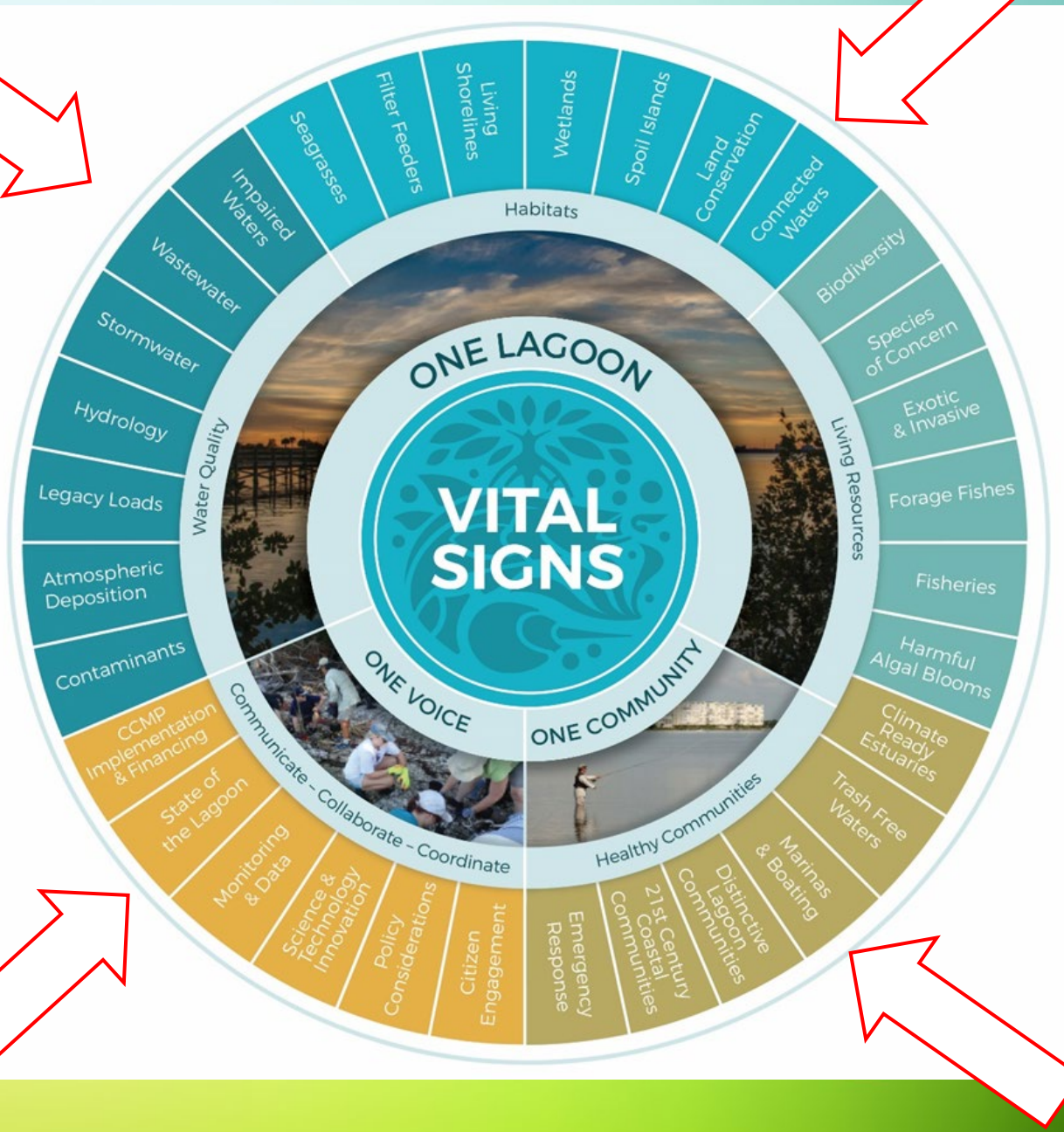
The analysis focused on elements of the IRL CCMP 'Vital Signs' wheel

Of the five vital sign categories, three are at risk to climate change:

1. water quality
2. habitats
3. living resources



…and the 32 vital signs developed to provide guidance towards achieving the goals of each category



For example: wastewater
Objective: reduce principal source of pollutants:

- Septic (OSTDS)
- Wastewater treatment plants (WWTP)

Climate change will introduce new challenges towards achieving the goals of categories and related vital signs.

Category and Vital Sign	Stressor						Accept	Level of Risk			
	Temp	PPt	Storms	pH	SLR	**Sum**		Highest	Higher	High	**Sum**
Water Quality											
Impaired waters (IW)	5	54	57	0	55	**171**	5	162	4	0	**166**
Wastewater (WW)	1	10	10	1	10	**32**	2	30		0	**30**
Stormwater and surface water (SW)	5	8	8	1	9	**31**	3	24	2	2	**28**
Hydrology and hydrodynamics (HH)	3	3	0	0	3	**9**	0	3	6	0	**9**
Legacy loads and healthy sediments (LL)	0	0	1	0	0	**1**	0	0	1	0	**1**
Atmospheric deposition (AD)	1	1	1	0	0	**3**	3	0	0	0	**0**
Sum	15	76	77	2	77	**247**	13	219	13	2	**234**
Habitats											
Seagrass (S)	6	16	15	1	14	**52**	5	47	0	0	**47**
Living shorelines (LS)	1	1	2	1	2	**7**	3	0	4	0	**4**
Wetlands and impounded/altered marshes (W)	3	1	0	0	2	**6**	5	1	0	0	**1**
Sum	10	18	17	2	18	**65**	13	48	4	0	**52**
Living Resources											
Biodiversity (B)	3	16	11	1	17	**48**	5	33	10	0	**43**
Species of concern (SoC)	10	15	18	1	19	**63**	4	47	12	0	**59**
Invasive species (InS)	2	15	14	0	14	**45**	3	14	28	0	**42**
Commercial and recreational fisheries (CRF)	3	15	19	1	14	**52**	4	42	6	0	**48**
Sum	15	45	51	2	47	**160**	11	103	46	0	**149**
Grand Total	**40**	**139**	**145**	**6**	**142**	**472**	**37**	**370**	**63**	**2**	**435**

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50%

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Climate Stressor	Wastewater		
	WWTP	OSTDS	SWSC
Precipitation	Temporary increased infiltration and inflow from aging residential and commercial parcels.	Temporary saturation of drain field.	Temporary failure of WWTP and OSTDS within domain
Storminess	Temporary flooding and physical damage (wind, waves) to plant.	Temporary saturation of drain field and physical damage (wind, waves) to infrastructure.	Temporary failure of WWTP and OSTDS within domain
Sea-level rise	Permanent reduction in hydraulic head.	Permanent saturation of drain field and physical damage (erosion) to infrastructure.	Permanent failure of WWTP and OSTDS within domain.
	Permanent flooding and physical damage (wind, waves) to sanitary sewer lines and plant.	Permanent compromised performance due to saltwater intrusion.	Permanent reduction in hydraulic head.
			Permanent compromised performance due to saltwater intrusion

Table 4. Risks to water quality mitigated by the successful implementation of the nine adaptation actions. WWTP = wastewater treatment plant, OSTDS = on-site treatment and disposal system, SWSC = surface water storage and conveyance system.

From Parkinson et al. 2021, Journal of Coastal Management

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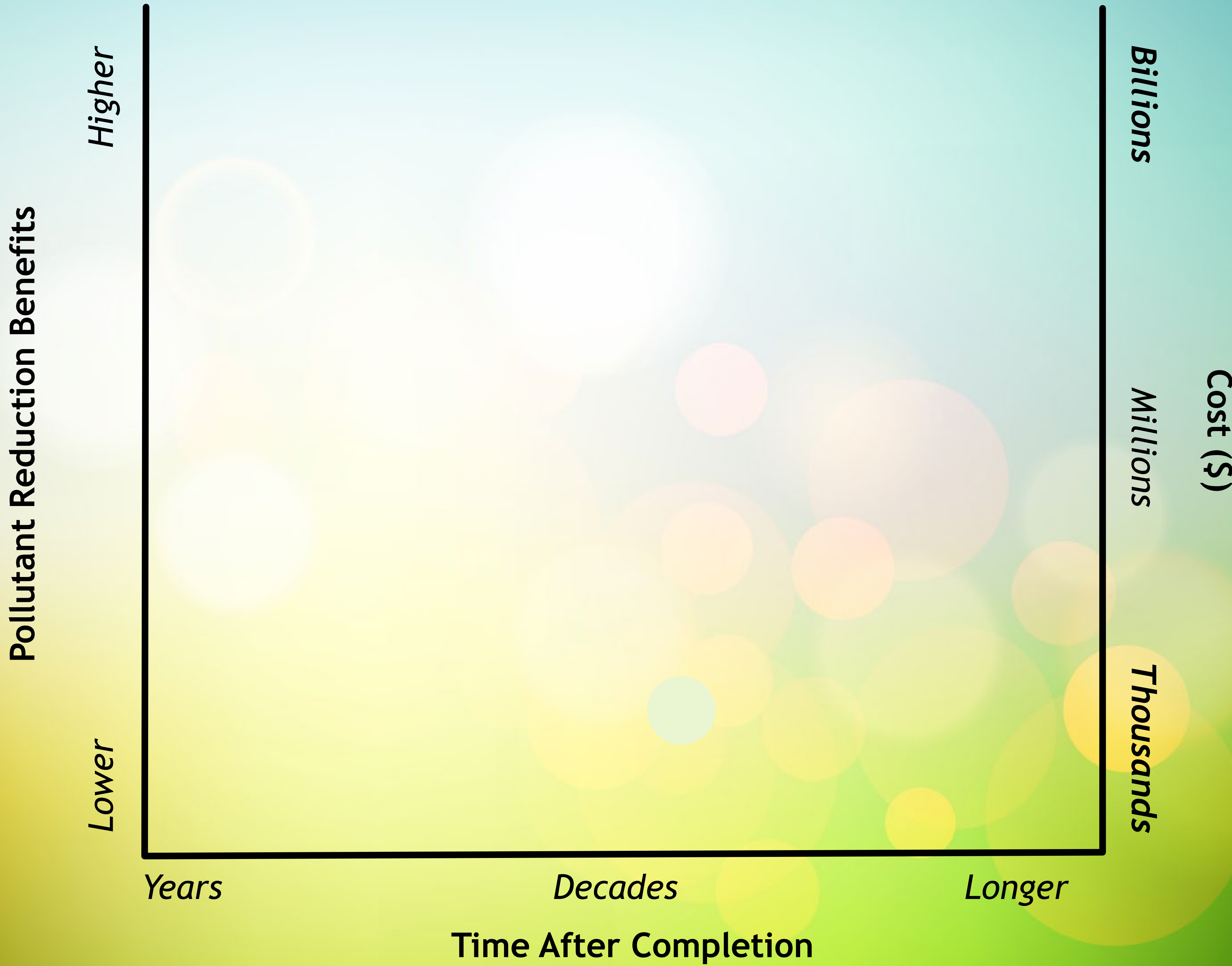
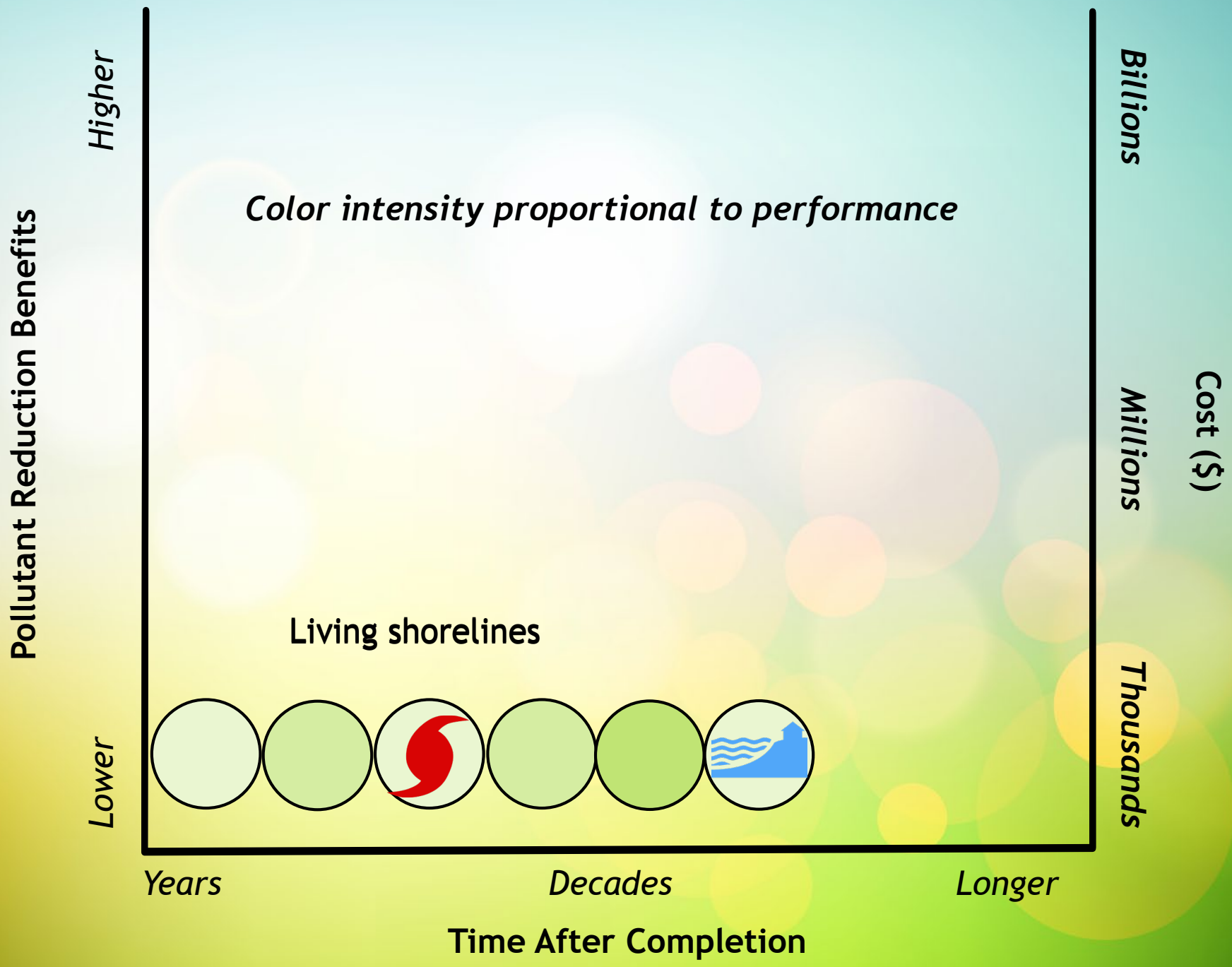
What is the best path forward?



Pollutant Reduction Benefits
Higher
Lower
Cost ($)
Billions
Millions
Thousands
Years
Decades
Longer
Time After Completion


Pollutant Reduction Benefits
Higher
Lower
Color intensity proportional to performance
Living shorelines
Years
Decades
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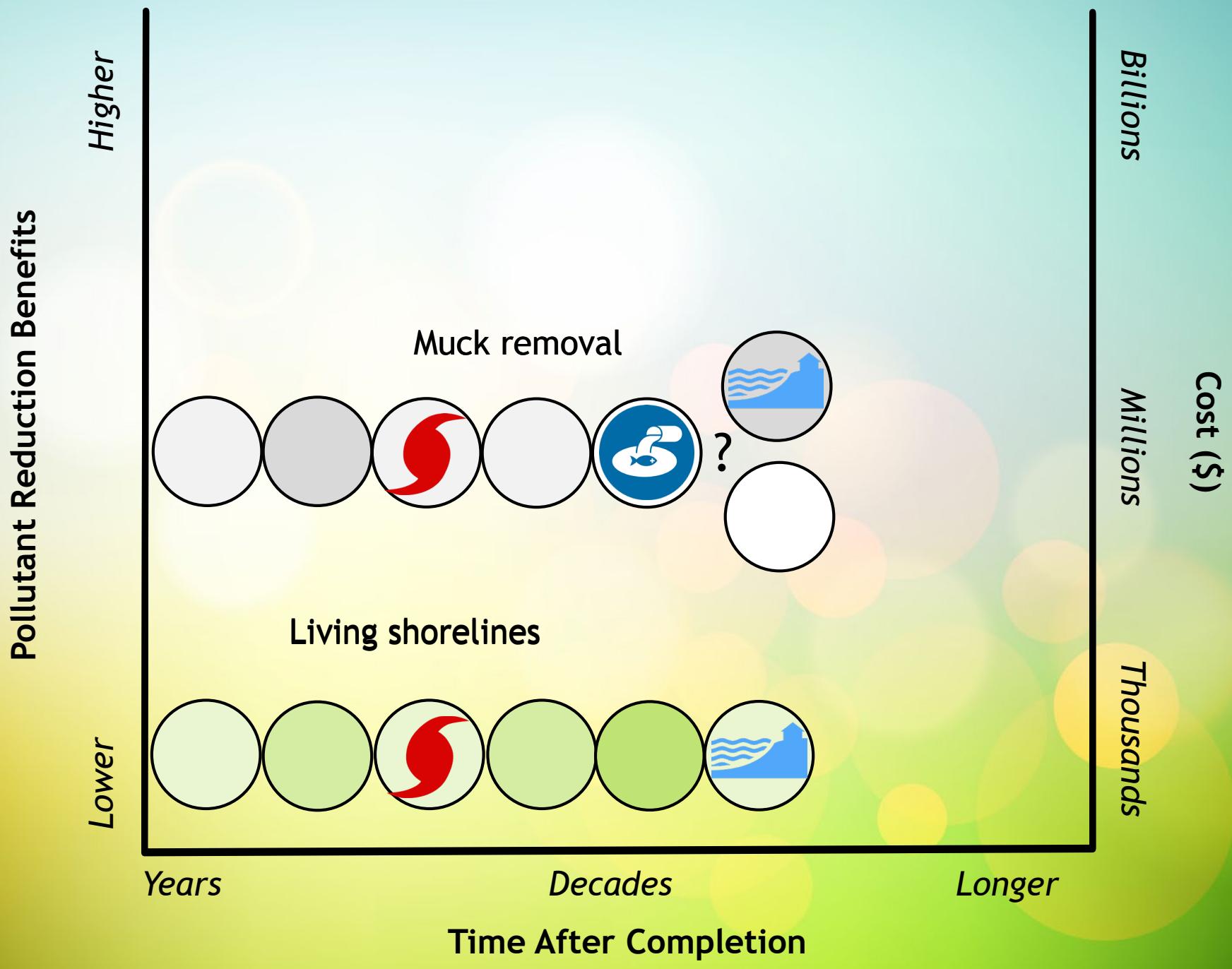
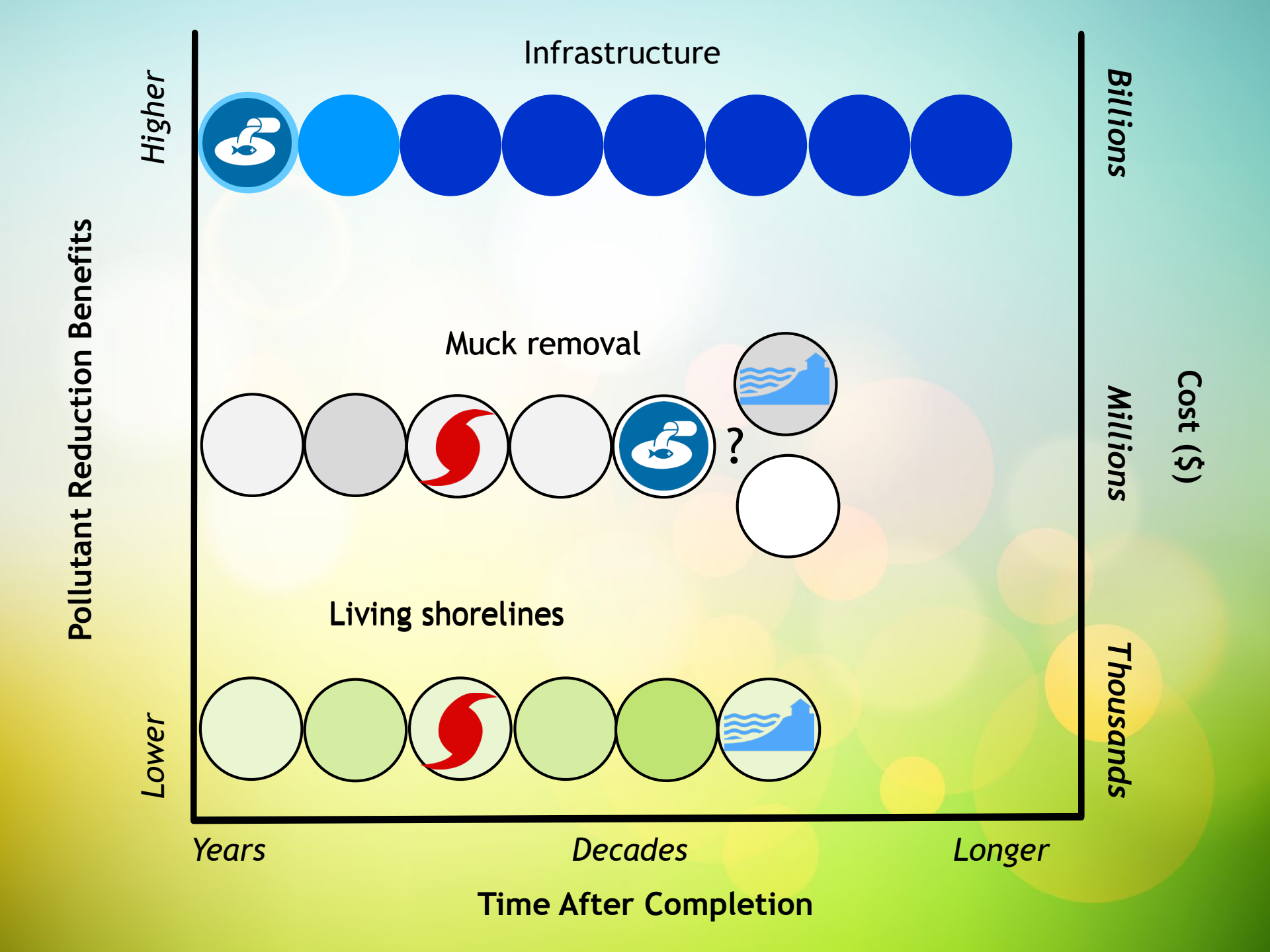
Billions
Millions
Thousands
Cost ($)


Pollutant Reduction Benefits
Higher
Lower
Billions
Millions
Thousands
Cost ($)
Muck removal
?
Living shorelines
Years
Decades
Longer
Time After Completion


Infrastructure
Higher
Billions
Muck removal
?
Millions
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Living shorelines
Lower
Thousands
Years
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The Bottom Line

To reduce IRL water quality impairment caused by historical land use changes, future land use changes, and climate change, we must reduce the input of nutrient pollution (N, P) from aging and failing infrastructure (priority implied): SWSC, OSTDS/WWTP.

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This will require an investment of billions of dollars over decades, but will stimulate the emergence of a more resilient, climate-ready estuary for future generations to enjoy.

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