

Stream Compensatory Mitigation - Monitoring for Sustainability

(33 CFR 332.5, 332.6 & 332.7)



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ELI, February 2019



Presentation Outline

- Regulatory Setting
- Performance Standards
- Monitoring Programs
- Management
 - Interim and Long-term management
 - Adaptive management

2008 Mitigation Rule

“Compensatory mitigation involves actions taken to offset unavoidable adverse impacts to wetlands, streams and other aquatic resources authorized by Clean Water Act section 404 permits and other Department of the Army (DA) permits.”

[73 Fed Reg 19594]



Federal Register

Thursday,
April 10, 2008

Part II

**Department of
Defense**

Department of the Army, Corps of
Engineers
33 CFR Parts 325 and 332

**Environmental
Protection Agency**

40 CFR Part 230
Compensatory Mitigation for Losses of
Aquatic Resources; Final Rule

Mitigation Plan Components

(33 CFR 332.4(c))

1. Objectives
2. Site selection
3. Site protection instrument
4. Baseline information
5. Determination of credits
6. Mitigation work plan
7. Maintenance plan
8. Performance standards
9. Monitoring requirements
10. Long-term management plan
11. Adaptive management plan
12. Financial assurances



Federal Register

Thursday,
April 10, 2008

Part II

**Department of
Defense**

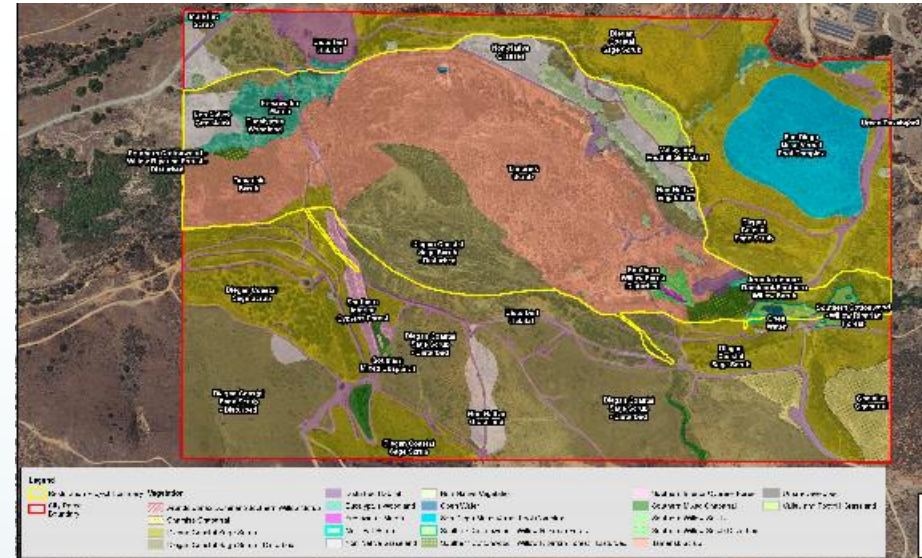
Department of the Army, Corps of
Engineers
33 CFR Parts 325 and 332

**Environmental
Protection Agency**

40 CFR Part 230
Compensatory Mitigation for Losses of
Aquatic Resources; Final Rule

It's all connected.....

- Projects Goals & Objectives
- Performance
- Suitable Metrics & Protocols
- Monitoring
- Management




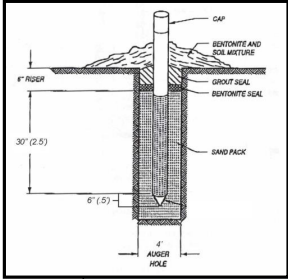

Measuring Mitigation Performance

- Administrative Measures
- Ecological Performance Standards
 - Observable
 - Measureable
 - Achievable
- Adaptive Management

DRAFT MITIGATION PLAN

Dairyland Stream Mitigation Site
RES Cape Fear 02 Umbrella Bank
Orange County, North Carolina

Cape Fear River Basin
HUC 03030002



Prepared for:

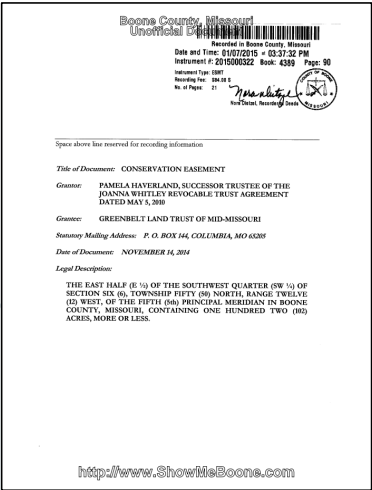
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April 2017

Administrative Measures



Site Protection
 332.7 (a), 332.8(m) & (t)



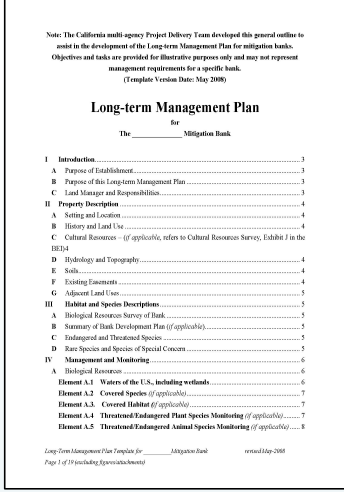
Construction Work Plan
 332.4 (c)(7) & 332.8(m)



Financial Assurances
 332.8(m)



Monitoring
 332.6, 332.8(a)(2)



Long Term Management
 332.8(u)

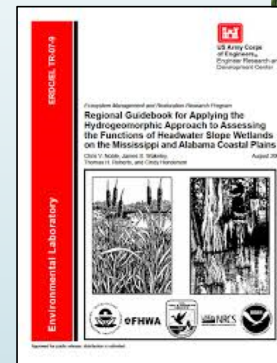
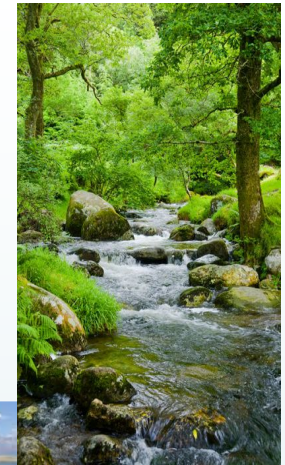
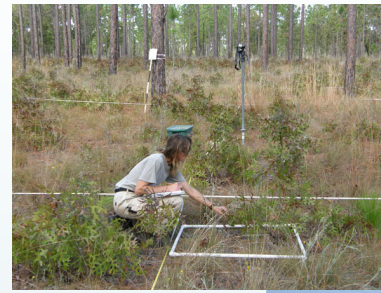


Maintenance
 332.4(c)(8)

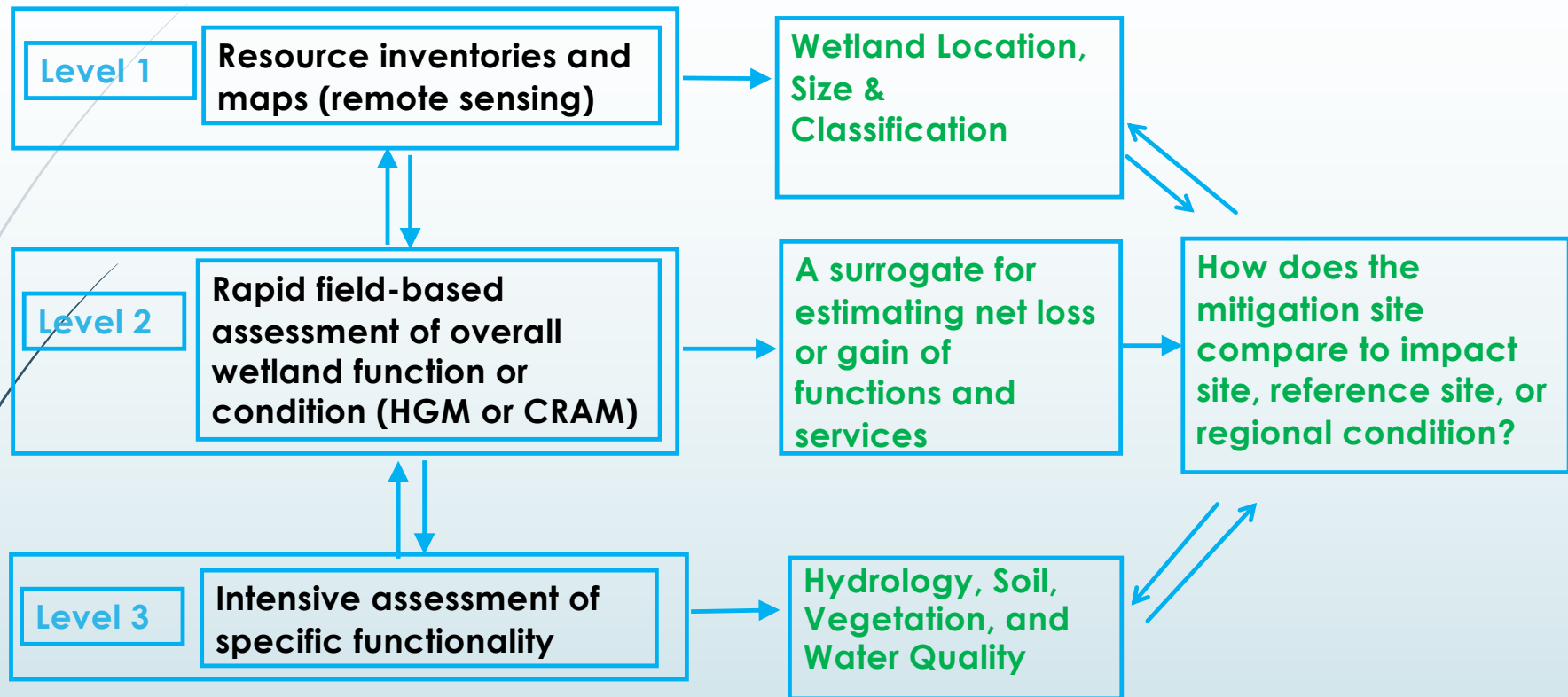
Ecological Performance Standards

(33 CFR 332.5)

- Based on attributes that are objective and verifiable
- Based on best available science assessed in a practicable manner
- Based on variables or measures of functional capacity
- **Performance standards across a spectrum of complexity**



Ecological Performance Standards & EPA 3-Level Approach to Monitoring



Developing Ecological Performance Standards

Goals

Statement of intended outcome
What will the mitigation project accomplish?

Objectives

Features critical to desired outcome
What functions/values will get us there?

Performance Standards

Demonstrate how each objective will be achieved:
Attribute, Level, Time Period

Monitoring:
Evaluate Performance

Adaptive
Management:
Flexibility

Ecological Performance Standards



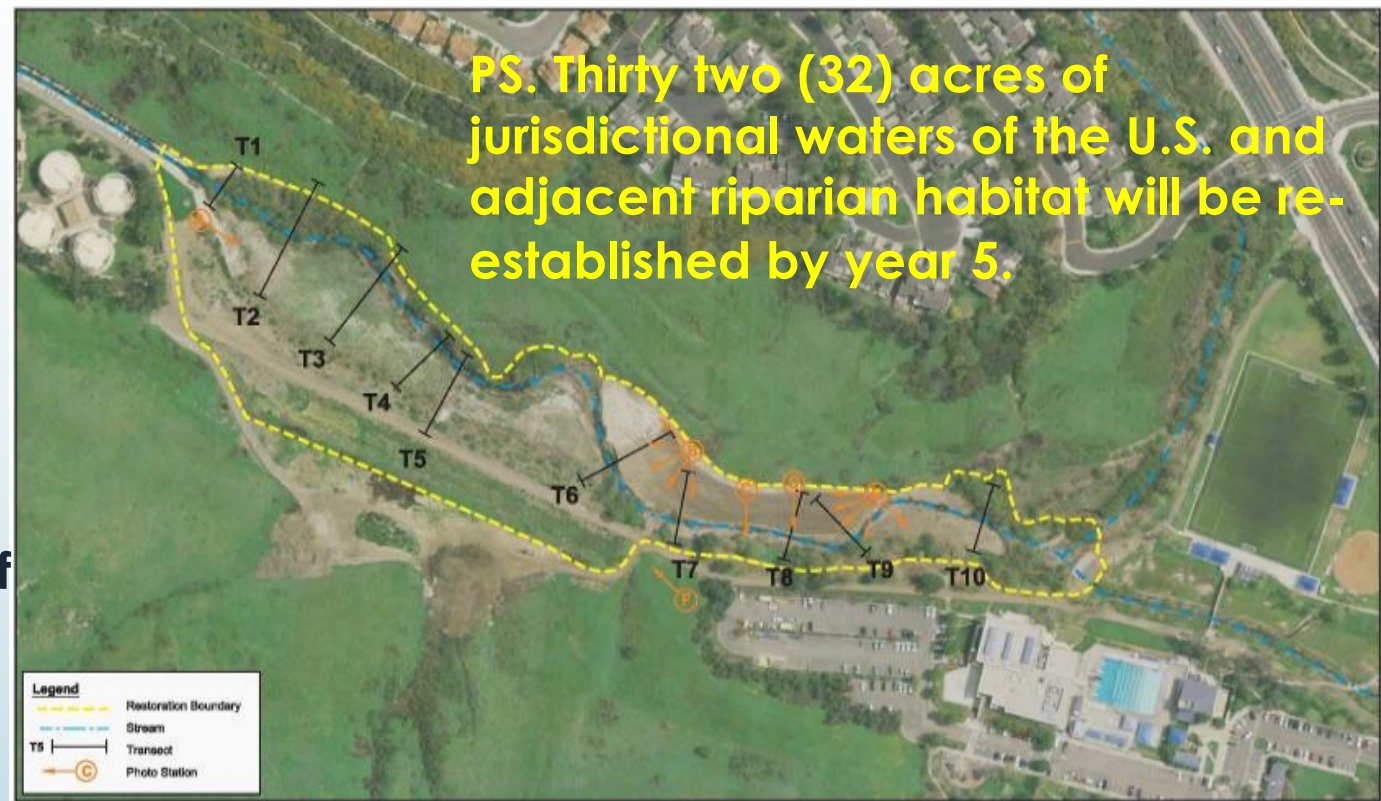
PHYSICAL
(Hydrology/Soils)

BIOLOGICAL

CHEMICAL

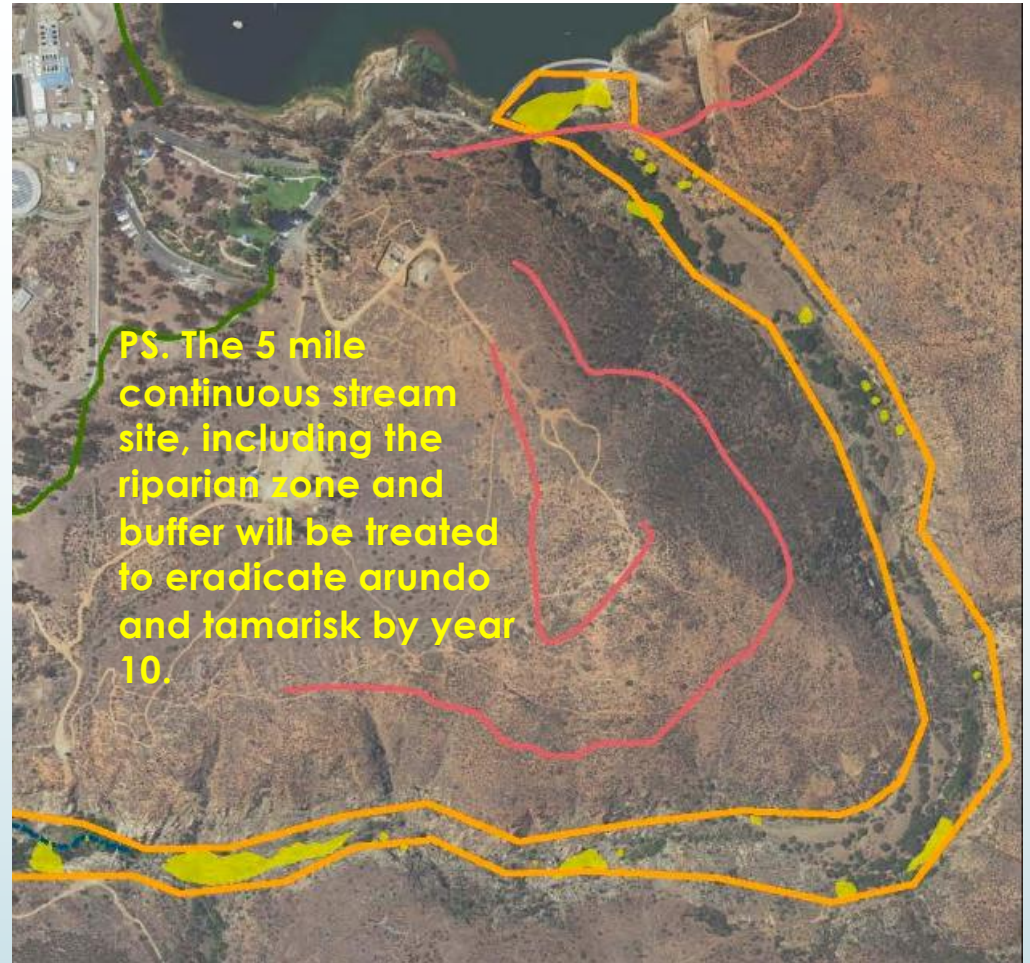
Level 1 Monitoring – Remote Sensing and Mapping

- Boundary of the Site
- Limits of each treatment:
enhancement, re-establishment
- Jurisdictional limits or classification
- Identification of maintenance actions such as the location of invasive species, trespass - new trails, dumping



Level 1 Monitoring – Remote Sensing and Mapping

- Example of mapping invasive species with little ground trothing based on remote sensing (looking for species “signatures” on the aerial and digitizing)
- And mapping trail locations using remote sensing



Level 2 Monitoring – Rapid Assessments of Function or Condition (HGM, CRAM, TXRAM, ORAM, etc.)

PS: The 5 mile stream restoration site must meet or exceed the CRAM target scores for individual metrics by Year 3 and Year 5 as provided in Table 3.

Monitoring Program for CRAM: Assess the mitigation site and the reference site pre-construction, post-construction/baseline/as-built, and at Years 3 and 5 to evaluate meeting the PS targets by metric value. Conduct a CRAM assessment every 5 years thereafter as part of the LTMP.

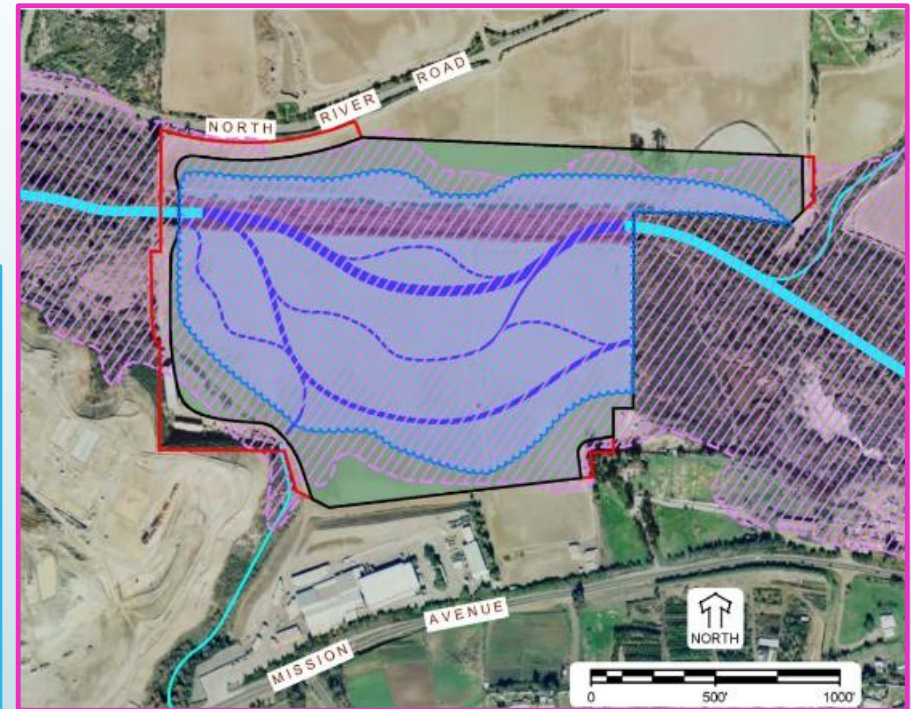
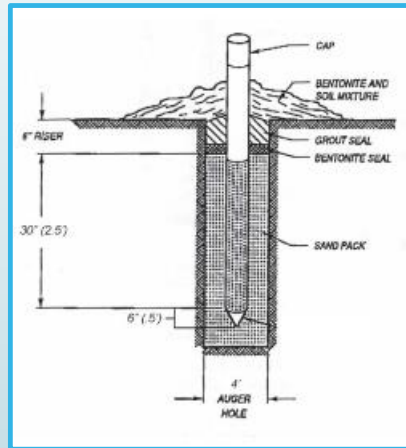
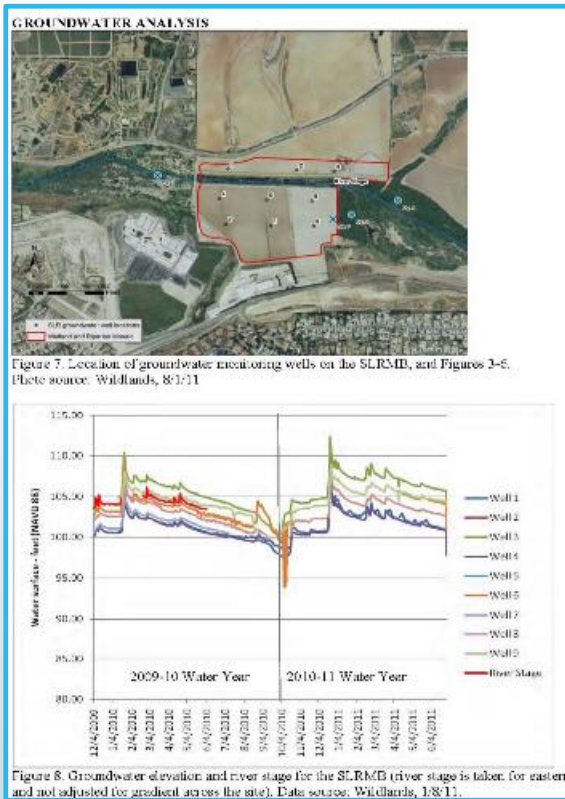
**Table 3
CRAM DATA SUMMARY**

CRAM Attributes	METRICS	BASELINE SCORES			TARGET SCORES	
		Impact Site/ Pre-Rest ¹	Post-Rest ² (Baseline)	Reference Site	Year 3	Year 5
Buffer and Landscape Context	Landscape Connectivity	12		3	12	12
	Buffer Sub-metrics:					
	- Percent of Assessment Area with	3		12	12	12
	- Average Buffer Width	3		3	3	3
	- Buffer Condition	3		9	9	12
	Attribute Score (Raw/Final)	15/63		10/42	19/79	20/83
Hydrology	Water Source	6		6	6	6
	Hydroperiod or Channel Stability	12		9	9	12
	Hydrologic Connectivity	9		12	9	12
	Attribute Score (Raw/Final)	27/75		27/75	27/75	30/83
Physical	Structural Patch Richness	9		9	9	9
	Topographic Complexity	3		6	6	6
	Attribute Score (Raw/Final)	12/50		15/63	15/63	15/63
Structure	Plant Community Sub-metrics:					
	- Number of Plant Layers	9		9	6	9
	- Number of Co-dominant Species	3		6	3	6
	- Percent Invasion	3		3	12	12
	Horizontal Interspersion and Zonation	6		6	6	6
	Vertical Biotic Structure	3		9	3	9
	Attribute Score (Raw/Final)	14/39		21/58	16/44	24/67
Overall AA Score		57		60	65	74

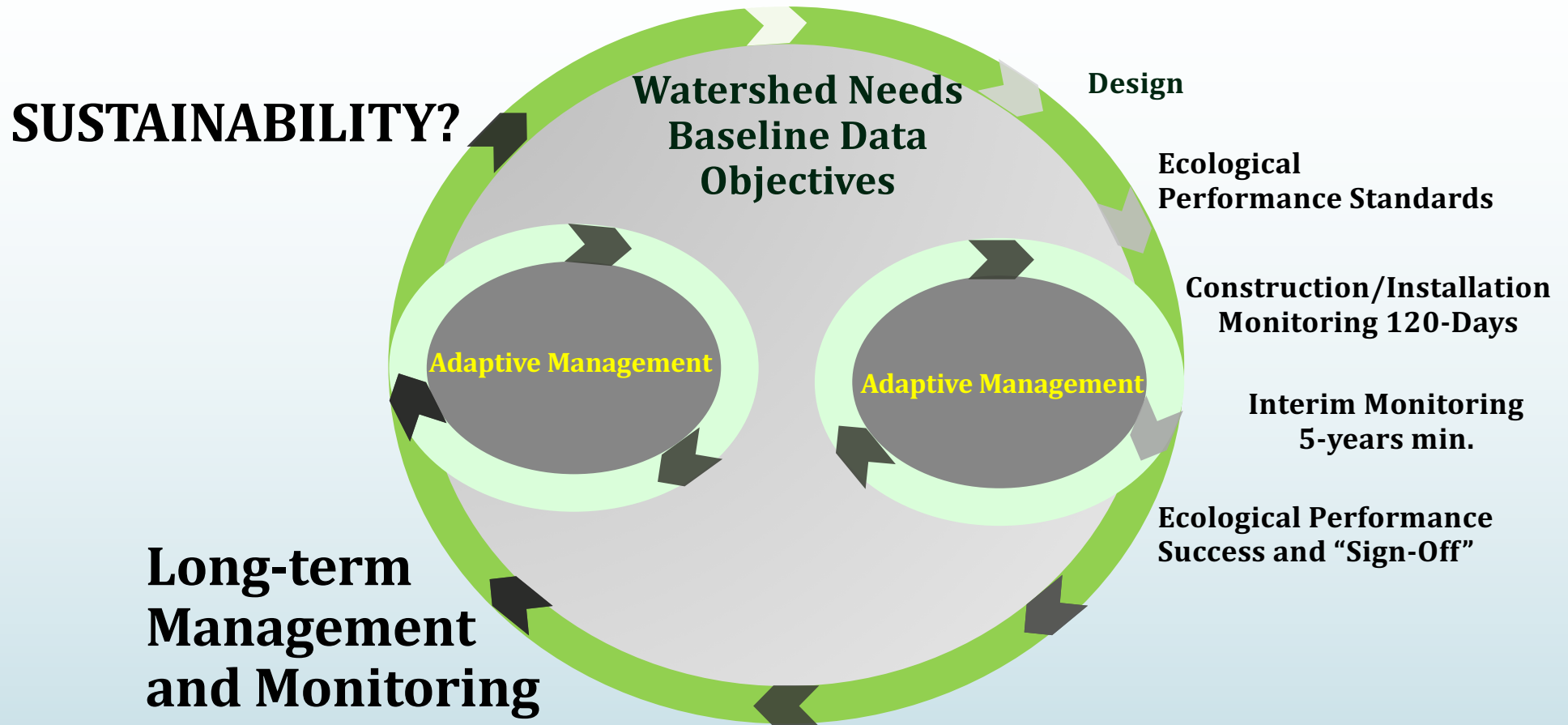
Level 3 Monitoring - Shallow Groundwater Example

Hydrology Monitoring

PS: Shallow groundwater across floodplain wetland shall be within 18 inches of the ground surface during the wet season (Oct – Feb) and 36 inches of the ground surface during the dry season based on well data or as observed in the approved reference site by year 5.



The Monitoring Program that Never Dies



Overall Monitoring Program:

Links to objectives, performance standards & maintenance plan

Qualitative:

- Trash/Debris/Fencing/Tress pass
- Photo monitoring (Fixed Stations)
- Wetland hydrology observation
- Vegetation community
 - Visual Estimates of:
 - Plant death/replacement needs, nuisance species mgmt. needs (marking plants to be removed/treated)
- Wildlife utilization (scat, prints, photo monitoring)
- Biological integrity assessment

Quantitative:

- Hydrologic
 - Gauges/piezometers
- Vegetation
 - % cover and composition
 - Canopy, sub-canopy, shrub, groundcover layers
 - Stem counts
- Water Quality
 - PH, salinity, DO, bacteria
- Functional/Conditional assessments

Qualitative Monitoring

Annual Photo Monitoring: at fixed locations and direction.
Data should be record on photo log and attached to the Annual Monitoring Report

City of Laguna Niguel
Upper Sulphur Creek Restoration Project (Site 7 - Site 9)
PHOTO LOG
AECOM



*Photos taken before January 2009 were taken by Aspen Environmental Group. Work transitioned to AECOM in December of 2008. Due to the transition, photo monitoring was delayed until January 2009.
**Photo station UUU, UM1W, UM3W, UM4, UM4W, UDW, MMW, and MDW are supplemental photo stations that were added in Year 1 (2007-2008) to further document the progress of the restoration site.

Date*	Time	Photo Station**	Monitor	Panoramic or Single	Subject of Photo	Comments
01/09/2009	11:23am	UU	L. Teunis	P	Upper Site 7, upstream looking west	Riparian canopy filling in nicely
01/09/2009	11:10am	UUW	L. Teunis	P	Upper Site 7, upstream looking east	Riparian canopy filling in nicely
01/09/2009	11:38am	UM1	L. Teunis	P	Upper Site 7, middle looking west	Typha choking channel, cut channel to improve flow
01/09/2009	10:53am	UM1W	L. Teunis	P	Upper Site 7, middle looking east	Sage scrub species filling in, need riparian canopy
01/09/2009	11:46am	UM2	L. Teunis	P	Upper Site 7, downstream looking west	Downstream end looks great.
01/09/2009	12:53pm	UM3	L. Teunis	S	Lower Site 7, upstream looking west	Riparian canopy filling in. Tamarisk observed in channel.
01/09/2009	12:16pm	UM3W	L. Teunis	S	Lower Site 7, upstream looking east	Riparian canopy filling in. Monitor Brazilian pepper.
01/09/2009	12:43pm	UM4	L. Teunis	P	Lower Site 7, middle looking west	Riparian great at site. Patches of sparse sage scrub on west bank.
01/09/2009	12:24pm	UM4W	L. Teunis	P	Lower Site 7, middle looking east	Riparian and sage scrub thriving.
01/09/2009	12:39pm	UD	L. Teunis	S	Lower Site 7, downstream looking west	Riparian coming in quickly
01/09/2009	12:28pm	UDW	L. Teunis	P	Lower Site 7, downstream looking east	Riparian great at site. Patches of sparse sage scrub on west bank.
01/09/2009	2:23pm	MU	L. Teunis	S	Site 8, upstream looking west	Need riparian cover
01/09/2009	2:29pm	MM	L. Teunis	P	Site 8, middle looking west	Need riparian cover



Qualitative Monitoring Memos

Attached to the Annual Monitoring Reports
Often Directs Adaptive Management Actions

SECOND QUARTER (APRIL TO JUNE 2011) MAINTENANCE PRIORITIES

Nature's Image greatly appreciates any feedback from Nature's Image based on its monitoring of other native restoration sites. If Nature's Image has any alternative solutions for any given recommendation, AECOM is open to discussing options.

If any recommendations are for maintenance work approved from the City is requested before proceeding.

RESTORATION SITE SUMMARY TABLE

RESTORATION PROJECT	SITE NAME	LOCATION (CITY OF CHANDLER)	RESTORATION STATUS	ISSUES (DATE OF VISIT) (SEE TABLE)
Upper Sulphur Creek Restoration Project	Upper Site 7	North of Moulton Parkway	None	None
	Upper Site 8	Between La Paz Road and Nueva Vista Drive	None	Two large fig trees remain at the site. One was identified last October during the site visit with the City, Nature's Image, and AECOM and the other is newly observed along the western upstream slope on HOA property. <i>This is the fourth reminder as the City approved this over a year ago.</i>
	Upper Site 9	South of La Plata Road	None	Yucca and acacia saplings occur throughout the site. They should be sprayed with herbicide. In addition, eucalyptus stumps need to be sprayed until the stumps no longer resprout.
Lower Sulphur Creek Restoration Project	Lower Site 7	Between Moulton Parkway and Nueva Vista Drive	None	None
	Lower Site 8	Between Moulton Parkway and Nueva Vista Drive	None	None

PRIORITIES AND GENERAL MAINTENANCE

Priorities

- Nature's Image should increase frequency of maintenance visits from nine (February 2011) through June or July (depending on weather conditions) to reduce the nonnative cover as all sites to under 5%. AECOM recommends at least bi-weekly (once per month) visits to all sites.
- Please make sure the crew are fully trained on native species growing on site. During the February site visit, one member of the maintenance crew did not know the name of a native species growing on site in a field cover in the narrow riparian. In addition, the resprouts on a native willow stump were also sprayed. This is unacceptable.
- Please have a supervisor with each of the sites following each maintenance visit.
- Monitor and spray gartland chrysanthemum (*Gaillardia coronarium*) at Upper Site 7.

A-1

- As of February 2011, the two large fig trees at Site 8 had not been removed. One was identified last October during the site visit with the City, Nature's Image, and AECOM and the other is newly observed along the western upstream slope on HOA property. *This is the fourth reminder as the City approved this over a year ago.*

General Maintenance Comments

- Cye should be used at all times during herbicide application.
- Please make sure that the crew treats weeds that are sprouting habitat such as salt grass and frankenia patches or around native plants to alleviate competition for limited resources and result in higher survival of native species.
- At this time no manual or electric tools should be used to remove weeds (unless approved by the restoration ecologist), as this is the weeds and the soil disturbance further encourages nonnative growth. The maintenance crew should remove large weeds by hand if otherwise, they can simply spray the plants.*

- No native plant material should be removed from the site. Native willows should be trimmed unless instructed by the City.
- As discussed previously, do not remove fallen willows from the riparian quickly and are a great way to increase the tree canopy the willow is a flood hazard. Otherwise, on-site trees are needed standards, and the larger willows will eventually shade out the smaller increasing flow in the channel.
- Maintenance should be conducted bi-monthly (twice a month) from now through June or July in an effort to control newly emerging weeds.

A-2

SITE-SPECIFIC MAINTENANCE PRIORITIES AND OVERVIEW

The following summarizes each of the sites within the two restoration projects (see table above) and describes any issues identified and maintenance priorities.

Upper Sulphur Creek Restoration Project (Upper Sulphur)

In general for Upper Sulphur Creek Restoration Project, north refers to upstream and south refers to downstream. In addition, the east is the area closest to Crown Valley Parkway and west is the area furthest from Crown Valley Parkway.

Upper Site 7 (north of Moulton Parkway)

- Continue to monitor and spray the eucalyptus stumps that are resprouting on-site. The maintenance crew should spray the new sprouts (leaves) with Garlon or a suitable alternative (following label instructions) and repeat every 4 to 6 weeks until no more resprouts appear. At that point, the dead stumps can be cut.
- Acacia saplings should be removed. If a large shrub becomes established within the restoration site, it should also be removed.
- Monitor and spray gartland chrysanthemum (*Gaillardia coronarium*). It was previously observed at the southern end along the west slope mixed with the *Encelia californica*.



Lower Site 7 (between Moulton Parkway and Nueva Vista Drive)

- Eucalyptus stump sprouts should continue to be sprayed with Garlon (following label instructions) and repeated every 4 to 6 weeks until no more resprouts appear. At that point, the dead stumps can be cut.



A-3

Site 8 (between La Paz Road and Nueva Vista Drive)

- The eucalyptus and acacia saplings that continue to occur throughout this site should be sprayed with herbicide. The site should be walked in its entirety to remove all saplings and young trees. There are large specimens along the eastern downstream slope.
- As of February 2011, the two large fig trees remain at the Site 8. One was identified last October during the site visit with the City, Nature's Image, and AECOM and the other is newly observed along the western upstream slope on HOA property. These species are highly invasive in riparian systems and should be immediately removed. A simple check by a biologist can confirm the absence of nesting birds. *This is the fourth reminder as the City approved this over a year ago.*



Upper Site 8 (between La Paz Road and La Plata)

- Remove Brazilian pepper tree along walkway.
- Eucalyptus saplings occur throughout this site. They should be sprayed with herbicide. In addition, eucalyptus stumps need to be sprayed until the stumps no longer resprout.
- Monitor for pampas grass and tamarisk.
- The acacia on the west slope are encroaching into the site and should be kept trimmed back to allow the native plants room to grow. Nature's Image can use the native shrubs as a reference for the historical restoration boundary.



Lower Site 8 (south of La Plata)

- Do a thorough check for tamarisk and see lavender (*Lavandula sp.*) throughout the site. There should be NO TAMARISK, please have a supervisor confirm that this is done.
- Thoroughly treat the west slope and push back acacia. This is a two-sided area and the crew appears to be focusing on the east side (closest to the street). Nature's Image can use the native shrubs as a reference for the historical restoration boundary.



A-4

Quantitative Monitoring

Detailed data collection for hydrology, soils, vegetation and sometimes wildlife if an objective and associated performance standard.

Some examples are provided later of monitoring programs for Streams and Vernal Pools



Stream Restoration Monitoring Requirements*

Pre-Construction:

- WQ: DO, Temperature, Conductivity, pH - STATE CERTIFIED LAB
- Benthic: Should follow standard protocols – STATE CERTIFIED LAB

Post-Construction:

- As-built survey: Cross-sections/profile
 - Permanent locations
 - Installed at frequency of 1 per 20 bkfl widths
 - 50% pools & 50% riffles
 - Profile for length of restored channel
- Crest gauges installed at mitigation and reference sites
- Vegetation Plots: Boundaries staked and marked.
 - Plots represent 2% of planted area
 - Planting should occur 11/15 – 3/15.
 - All stems (plots) tagged, numbered, and species noted.

*Charleston District

Adaptive Management

332.7 Management

Why?

- Address unforeseen changes
- Learn from success/failure
- Increased sustainability & reduces uncertainty

How?

- Plan, including contingencies
- Monitor
- Analyze outcomes
- Adapt
- Incorporate results into future actions!



Long-term Management

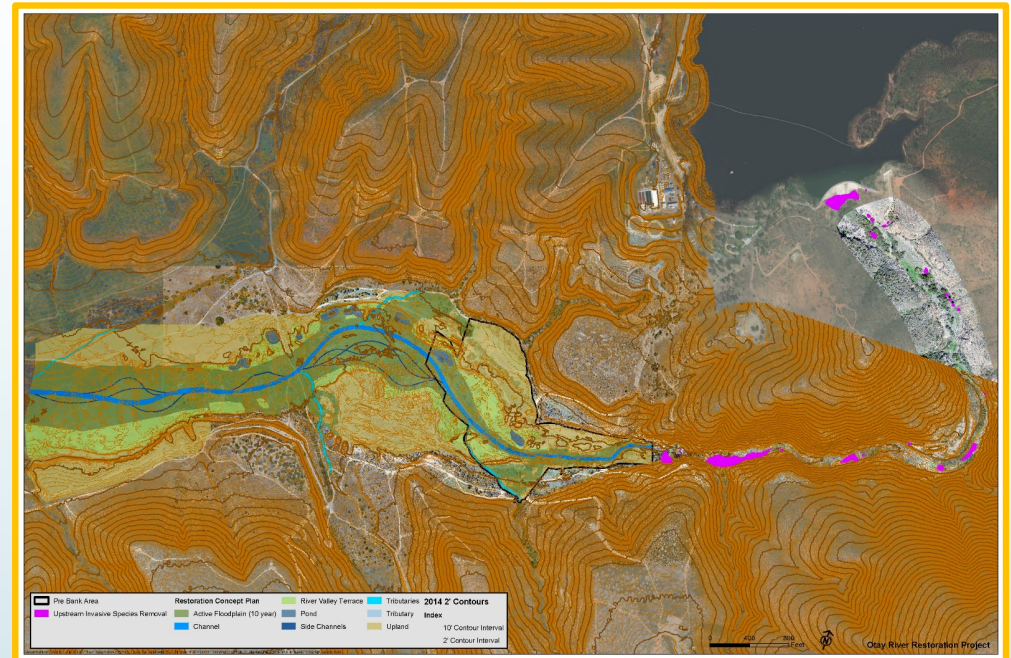
332.7 Management

- a) Site Protection - Real Estate Instrument or other
- b) Sustainability - mitigation should be "*self-sustaining*" but management *may be needed* to meet objectives
- c) Adaptive Management - measures to address unforeseen deficiencies
- d) Long-term Management - Ensure sustainable mitigation *after* performance standards are met

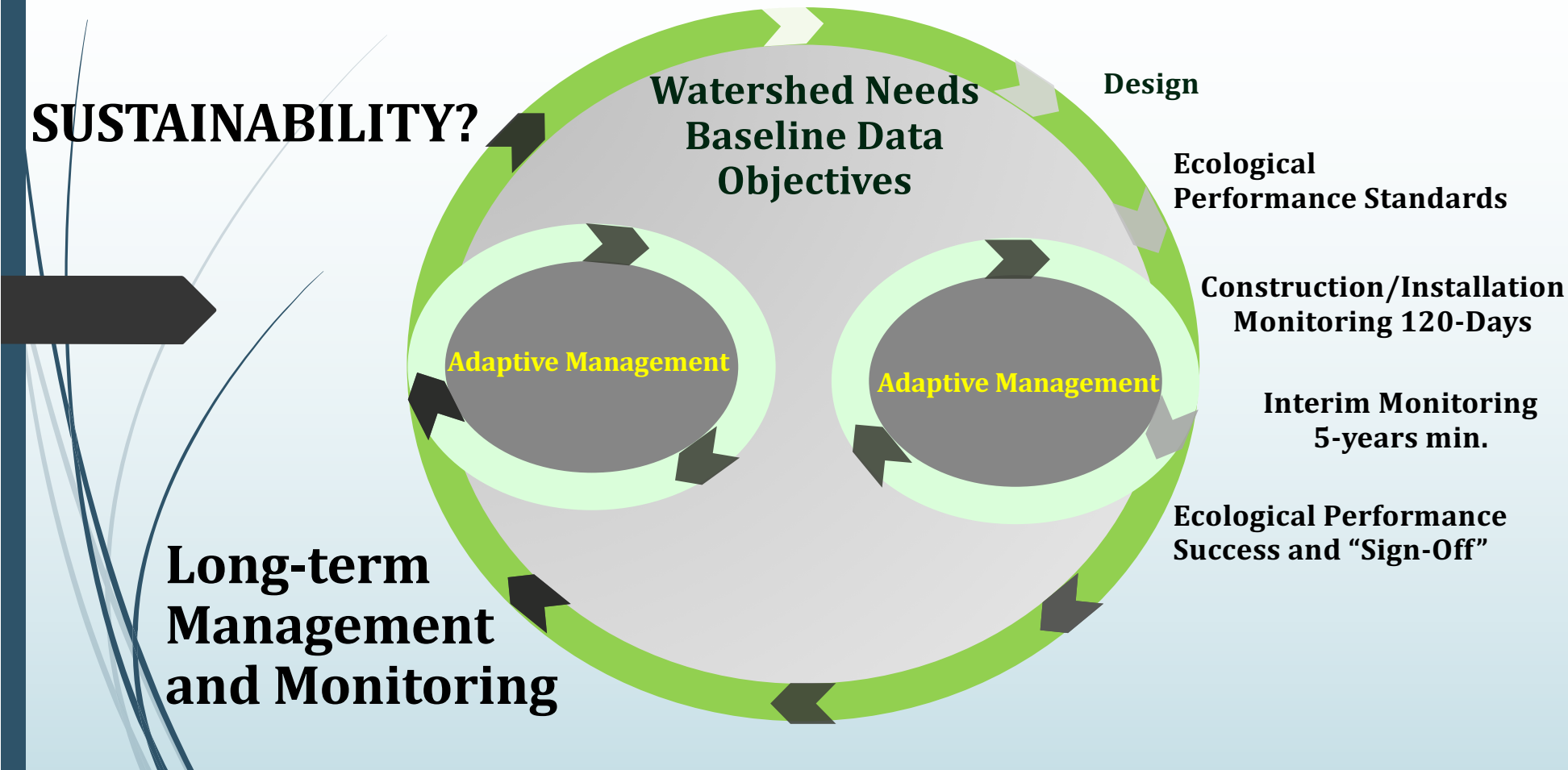


Long-Term Management and Monitoring Plan Elements

- Background conditions
- Characterize site
- Instrument requirements
- Management goals & objectives
- Management strategies & tasks
- Adaptive management plan & procedures
- Reporting procedures
- Contingencies
- Legal provisions
- Funding mechanism and task itemization



The Monitoring Program that Never Dies





Questions?

