Introduction to the California Rapid Assessment for Wetlands (CRAM)

Presented by: Dr. Christopher Solek
Wetlands Biologist
Southern California Coastal Water Research Project

Webinar hosted by the California Water Quality Monitoring Collaboration Network

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KEY TAKE-HOME MESSAGES

- Why was CRAM developed?
- What is CRAM and how does it work?
- How can CRAM be useful to my agency or organization?

Wetland Management Challenges

- Numerous State and Federal programs focus on regulating and managing wetlands

- Lot's of wetland monitoring is being conducted throughout California

- Lack of coordinated and standardized assessment tools

Wetland Management Challenges

Millions of public and private funds expended on wetland acquisition, restoration and enhancement

- **Are we making a difference?**
- **What is the net effect of our actions?**
- **Are our programs effective?**
- **Is additional investment justified?**

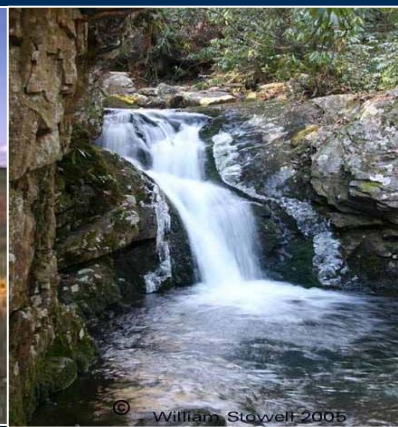
Goal of Developing CRAM

Provide rapid, scientifically defensible, standardized, cost-effective assessments of the status and trends in the condition of wetlands and the performance of related policies, programs and projects throughout California.

What is CRAM?

Topics for Discussion

- Development and Overview
- Context
- Mechanics: Attributes and Metrics



CRAM Development

Funded through USEPA since 2002 to build state and tribal capacity to assess wetlands:

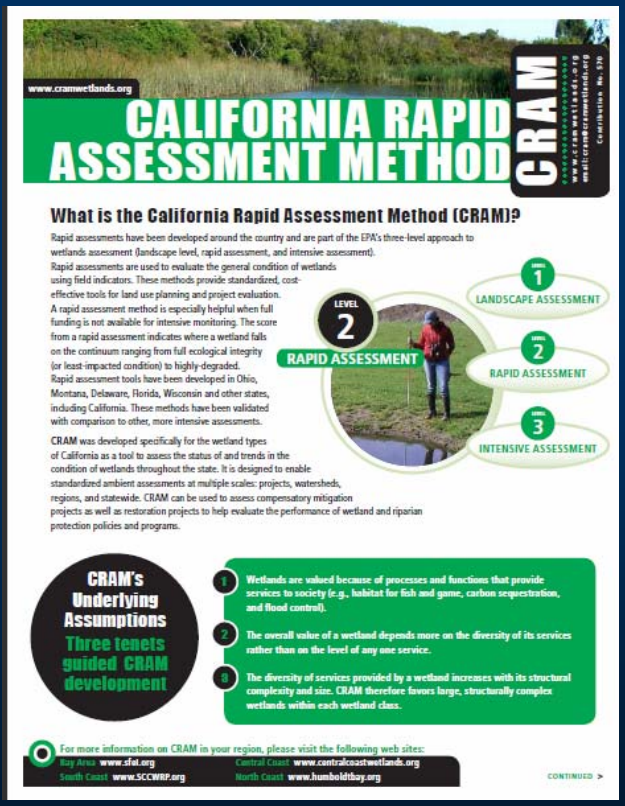
- Wetland Development Grants (104(b)3)
- PI Team, Statewide, Regional Teams
- Principal authors include:
  - San Francisco Estuary Institute
  - SCCWRP
  - Moss Landing Marine Labs
  - California Coastal Commission

CRAM Development

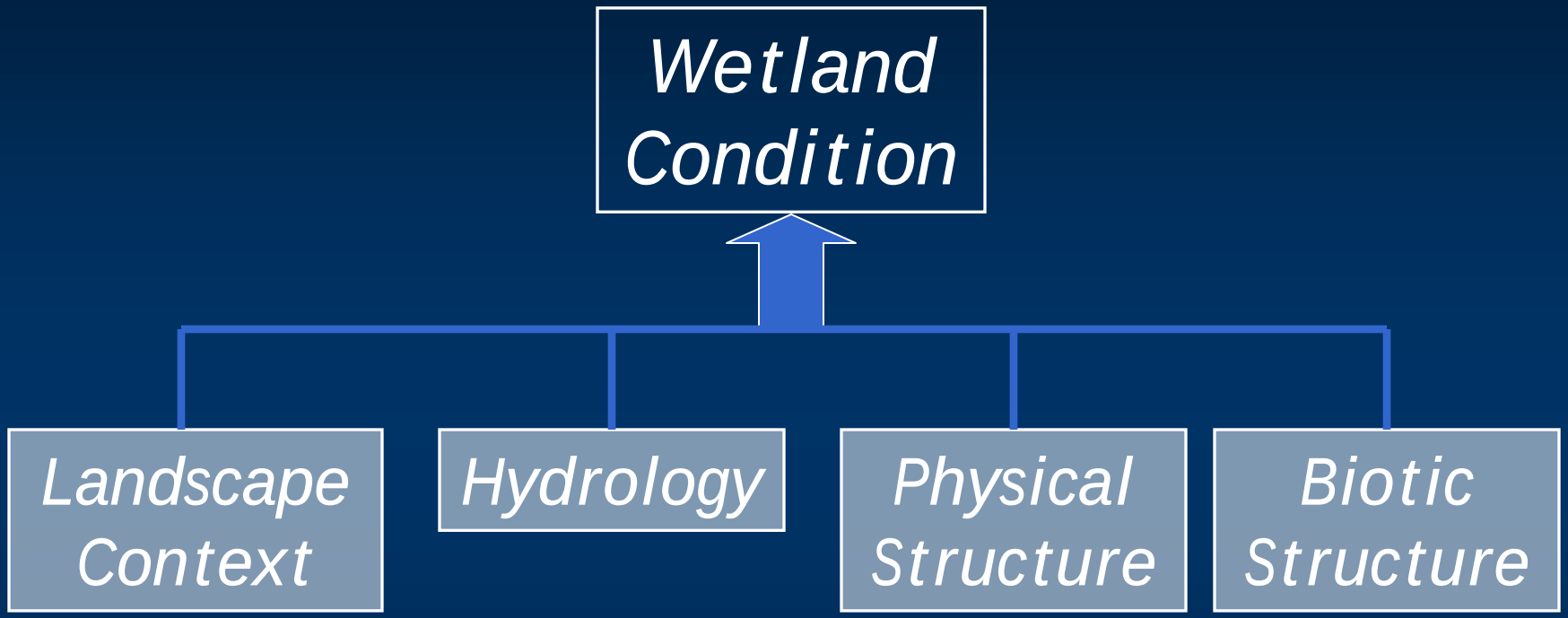
- Conceptual models of wetland form and function
- Review of other RAMs
- Verification ⇨ revisions
  - BPJ and field testing
- Validation ⇨ revisions
  - Correlated CRAM scores to quantitative data
  - Tested repeatability within and among teams

CRAM Overview

- Standardized “walk and talk” diagnostic tool to assess wetland condition (health)
- Less than 4 hrs field time
- Team of 2-3 trained people
- Requires expertise comparable to a wetland jurisdictional delineation



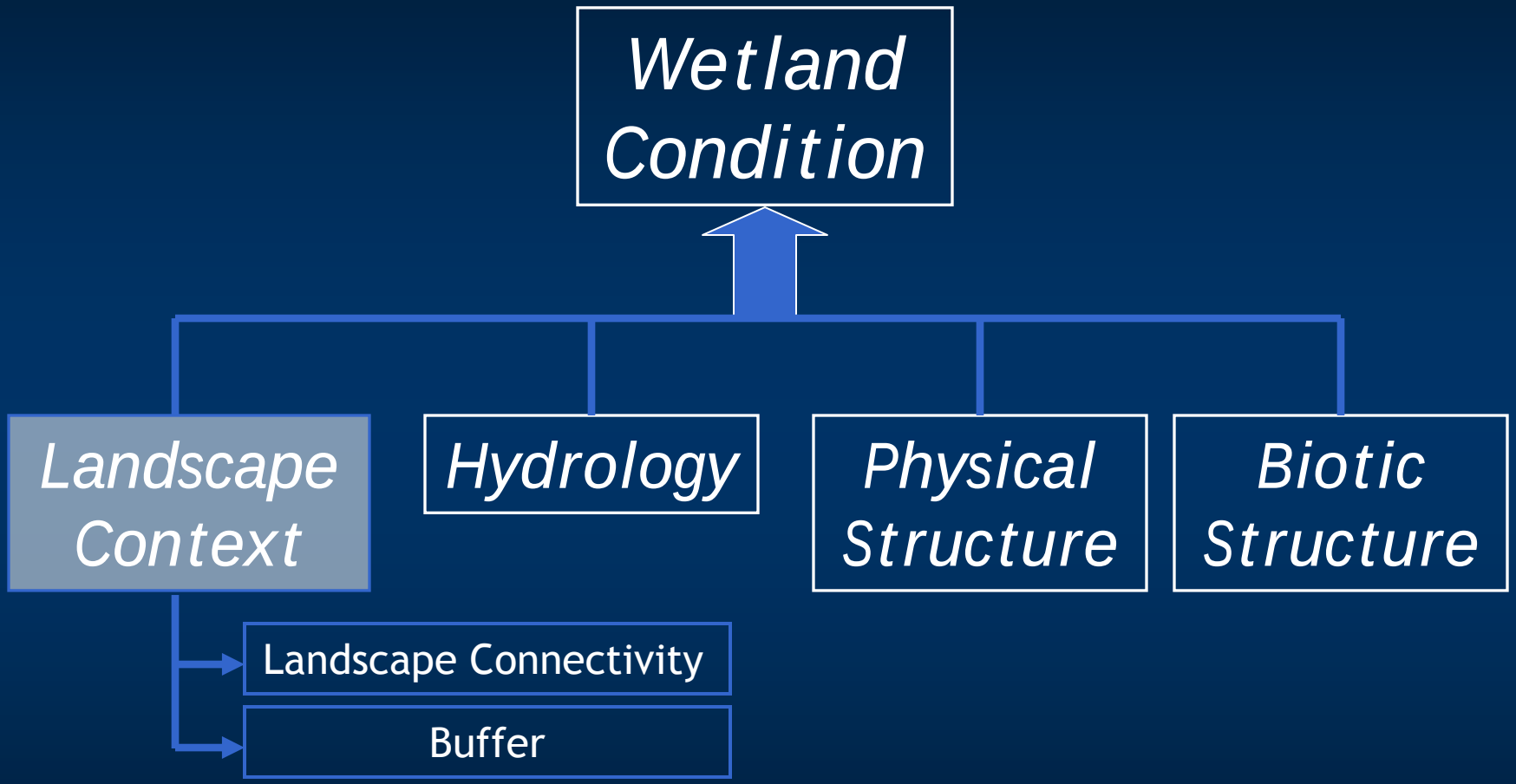
CRAM Design: Attributes



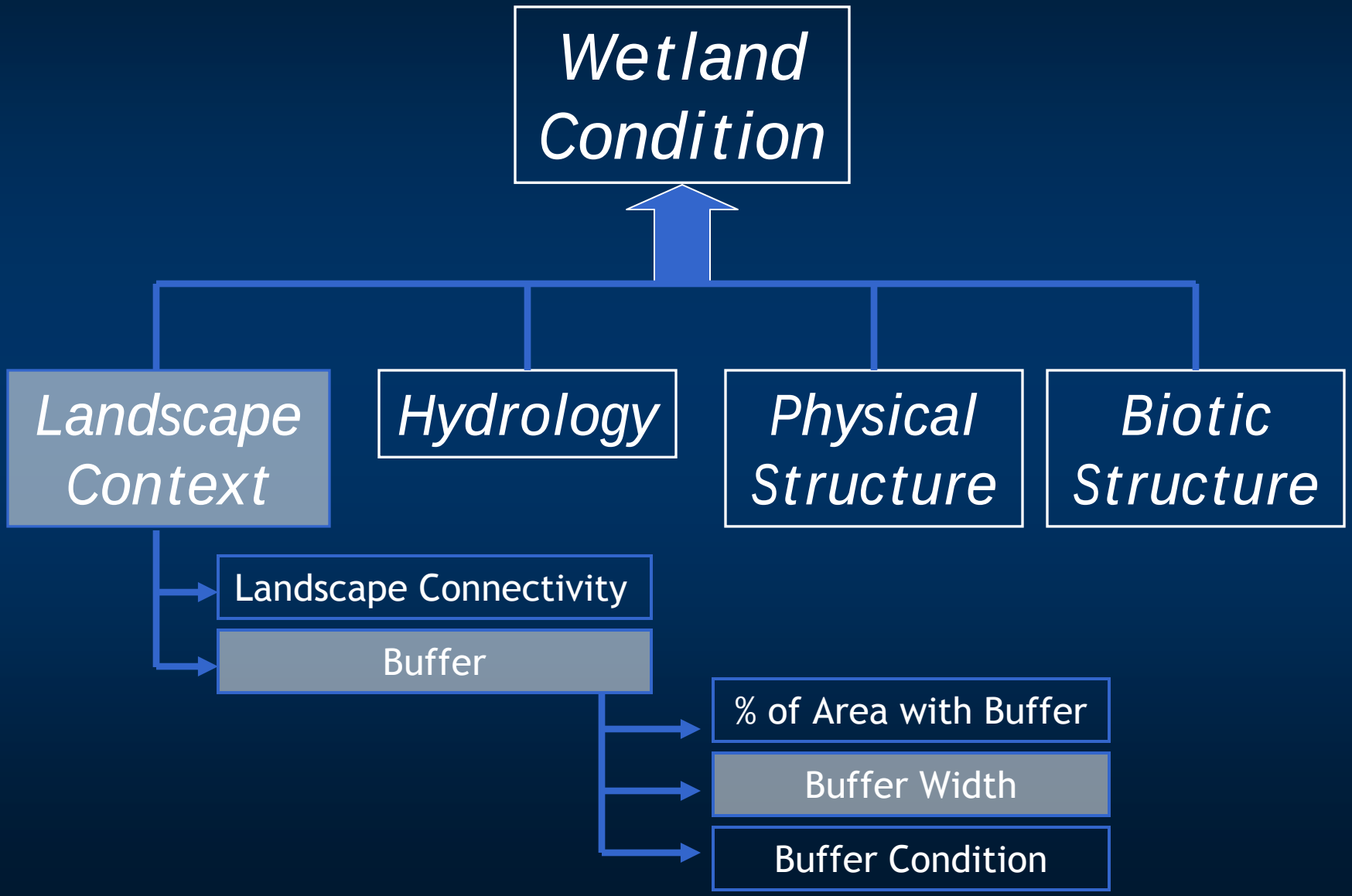
Geographic Scope
All Wetlands in California

- Estuaries
  - Perennial/seasonal tidal
- Rivers and streams
  - Confined/unconfined
- Depressional Wetlands
  - Vernal Pools
- Lacustrine (lakes)
- Slope Wetlands
  - Wet Meadows
  - Seeps and Springs
- Playas

CRAM Design: Metrics



CRAM Design: Sub-metrics



Sub-metric Scoring Example

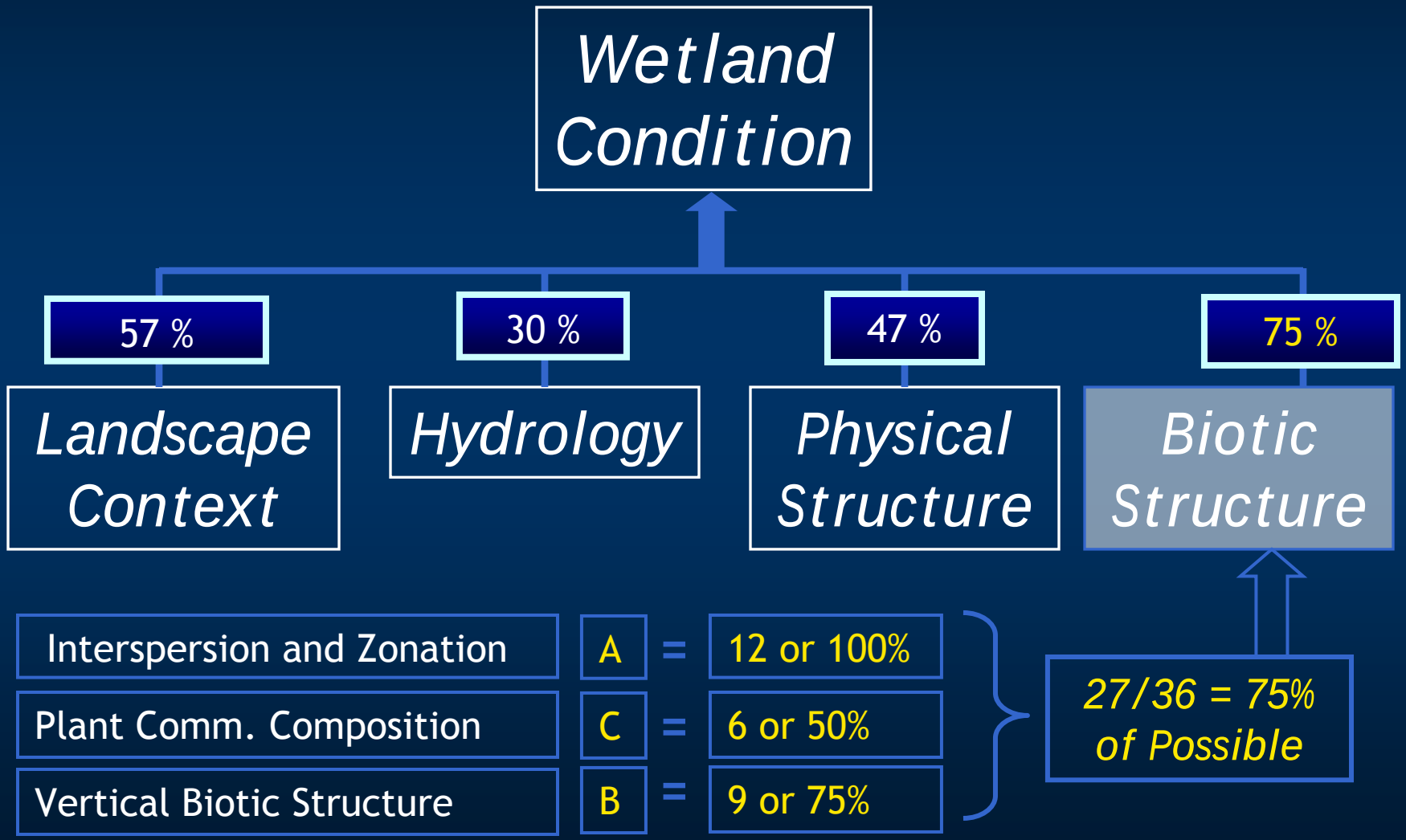
- Mutually exclusive alternative states
- Represent full range of possible condition

Buffer Width

Alphabetic Score	Numeric Score	Alternative State
A	**12**	Average buffer width 190-250m
B	**9**	Average buffer width is 130 – 189m
C	**6**	Average buffer width is 65 – 129m
D	**3**	Average buffer width 0 -64m

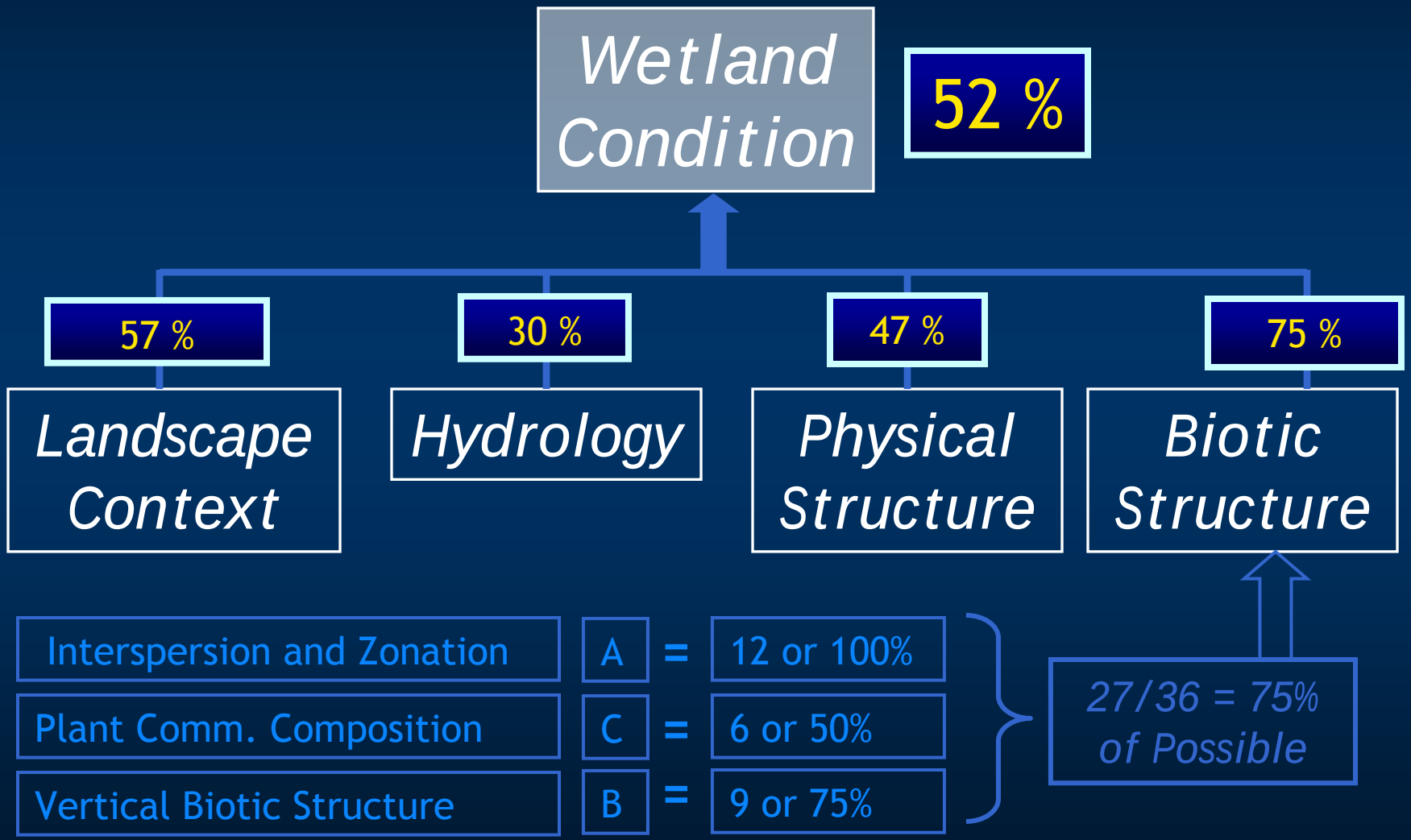
CRAM Scoring:

Ratio of metric scores → Attribute score

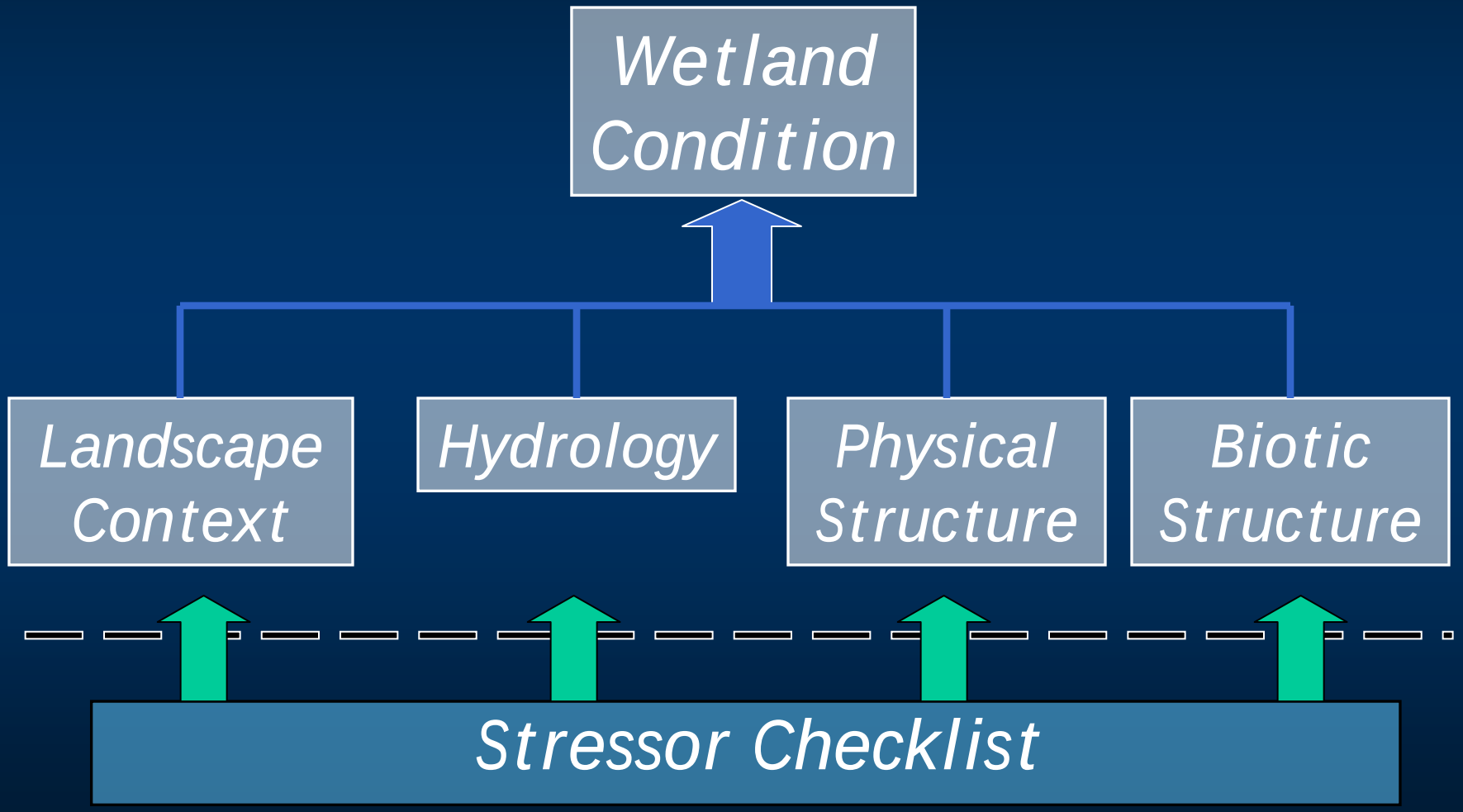


CRAM Scoring:

Average of Attribute scores = Overall score



Stressors are Identified



Uses of the Stressor Checklist

- Identify possible causes for low CRAM scores
- Identify possible corrective actions
- Develop testable hypotheses relating scores to stressors

Articles and Peer Review*

- CRAM Validation: riverine and estuarine modules (Stein et al. 2009)*
- Rapid Assessment in California (Sutula et al. 2006)*
- Mitigation project review (Ambrose et al. 2005, 2006)*
- USACE ERDC Review (completed 2008)*
- SWRCB Review (complete and results pending)
- Technical Bulletin on using CRAM to assess wetland projects for regulatory/management programs*

*Available for download at www.cramwetlands.org

Context for CRAM

Evolving State Program

- California Water Quality Monitoring Council
  - Created via SB 1070
  - Co-chaired by Natural Resources and CalEPA
- Two Major Goals
  - Improve coordination of water quality monitoring programs in California
  - Make information more accessible to agencies and the public

www.CaWaterQuality.net

.GOV CALIFORNIA WATER QUALITY MONITORING COUNCIL

Home | Safe to Drink | Safe to Swim | Safe to Eat Fish | Ecologic Health | Stressors & Processes | Contact Us

My Water Quality - hosted by the Surface Water Ambient Monitoring Program (SWAMP) |

GOVERNOR SCHWARZENEGGER
Visit his Website

- Cal/EPA
- The Resources Agency
- About the California Water Quality Monitoring Council
- State & Regional Water Boards
- Web Portal Partners
- Monitoring Programs, Data Sources & Reports
- Water Quality Standards, Plans and Policies
- Regulatory Activities
- Enforcement Actions
- Research

- About SWAMP
- SWAMP Tools

SWAMP
Surface Water Ambient Monitoring Program

Welcome to My Water Quality

This web portal, supported by a wide variety of public and private oraganizations, presents California water quality monitoring data and assessment information from a variety of perspectives that may be viewed across space and time.

IS OUR WATER SAFE TO DRINK?

Safe drinking water depends on a variety of chemical and biological factors regulated by a number of local, state, and federal agencies. More >>

IS IT SAFE TO SWIM IN OUR WATERS?

Swimming safety of our waters is linked to the levels of pathogens that have the potential to cause disease. More >>

IS IT SAFE TO EAT FISH AND SHELLFISH FROM OUR WATERS?

Aquatic organisms are able to accumulate certain pollutants from the water in which they live, sometimes reaching levels that could harm consumers. More>>

ARE OUR AQUATIC ECOSYSTEMS HEALTHY?

The health of fish and other aquatic organisms and communities depends on the chemical, physical, and biological quality of the waters in which they live. More>>

WHAT STRESSORS AND PROCESSES AFFECT OUR WATER QUALITY?

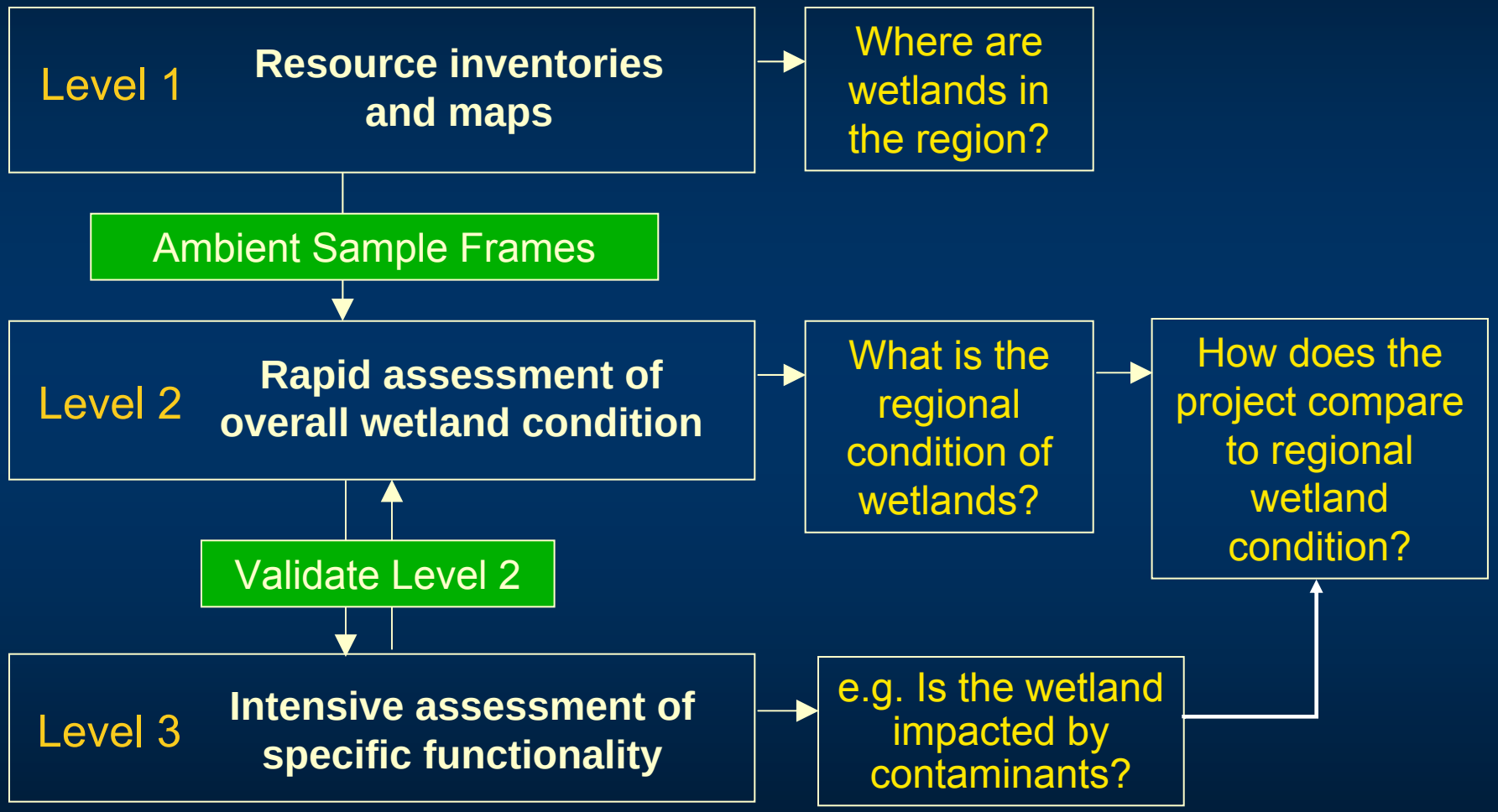
Benefical uses of our waters are affected by emerging contaminants, invasive species, trash, global warming, acidification, pollutant loads, and flow. More>>

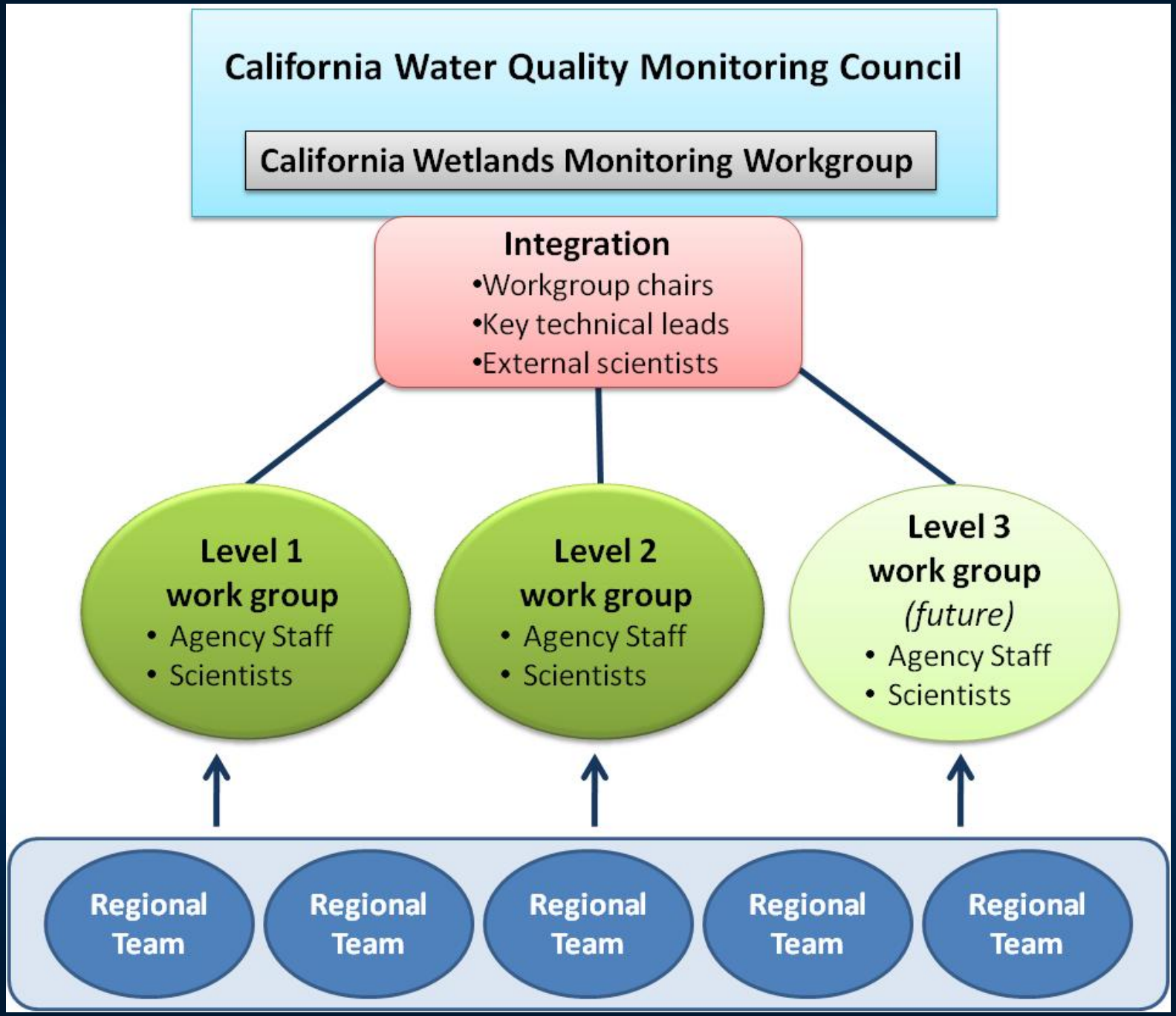
California Wetland Monitoring Workgroup (CWMW)

- Subcommittee of California Water Quality Monitoring Council
- State and Federal co-chairs + SB1070 liason
- Participating agencies:
  - 12 State, 5 Federal, 5 Academic/Research

Goal = development, coordination, and implementation of wetland monitoring across California

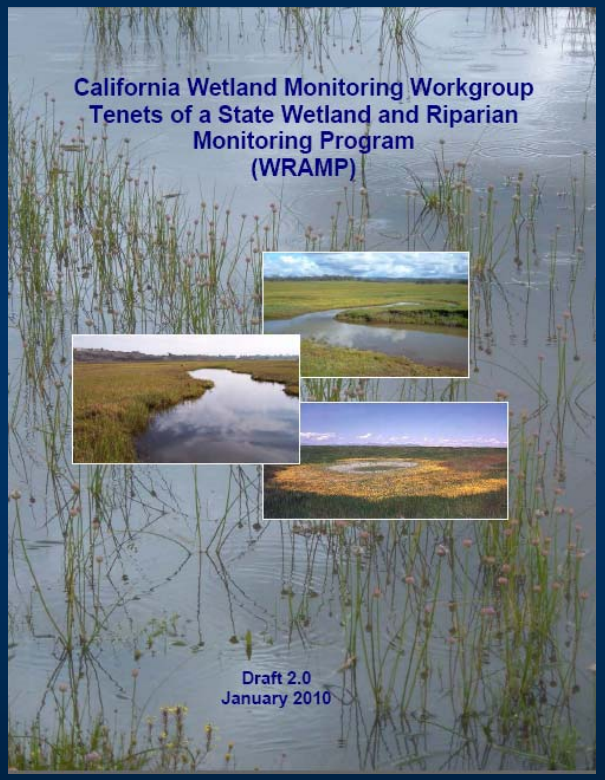
Three-tiered Monitoring Framework




California Water Quality Monitoring Council
California Wetlands Monitoring Workgroup
Integration
•Workgroup chairs
•Key technical leads
•External scientists
Level 1 work group
• Agency Staff
• Scientists
Level 2 work group
• Agency Staff
• Scientists
Level 3 work group
(future)
• Agency Staff
• Scientists
Regional Team
Regional Team
Regional Team
Regional Team
Regional Team

State Wetland Monitoring Plan

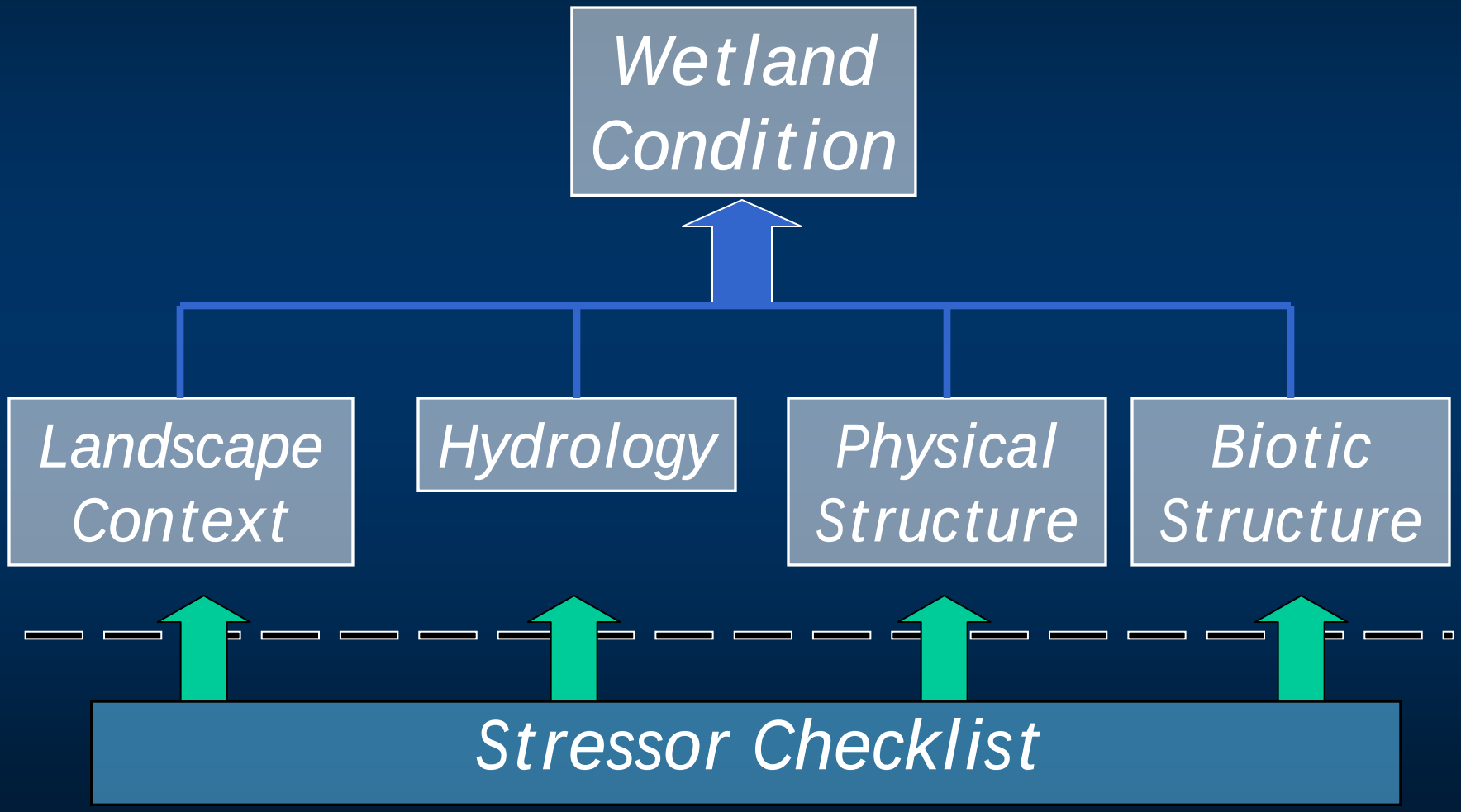
- Question driven
  - Flexible: support individual agency's info needs
  - Support, not subsume agency programs
- Consistent Statewide Framework
  - Common tools and data management
  - Focus on Levels 1 and 2 & data management
- Regional Implementation
  - Build on existing programs
  - Customize to meet regional/local needs



- Management of Statewide Products
  - Level 1 (mapping)
  - Level 2 (CRAM + other RAMs)
- Ongoing Technical Support and Coordination
  - CWMW provides statewide coordination
  - Most "work" occurs through regional teams

How Does CRAM Work?

CRAM Design


Wetland Condition
Landscape Context
Hydrology
Physical Structure
Biotic Structure
Stressor Checklist

Steps of CRAM Assessment

Step 1: Assemble background information
Step 2: Classify the wetland
Step 3: Verify the appropriate season
Step 4: Sketch the CRAM Assessment Area (AA)
Step 5: Conduct the office assessment of AA
Step 6: Conduct the field assessment of AA
Step 7: Complete CRAM QA/QC
Step 8: Submit assessment results using *e*CRAM

Materials and Training

- CRAM User's Manual (v5.0.2): Complete for all wetland classes
- CRAM Field Books: Complete for for riverine, estuarine, and vernal pools
- Regional 3-day practitioner trainings for one wetland type
  - 2-day add on modules for additional wetland type
- No certification at this time, but list of trained practitioners on CRAM website

Fundamental unit of CRAM is the Assessment Area (AA)

Considerations for delineating the AA

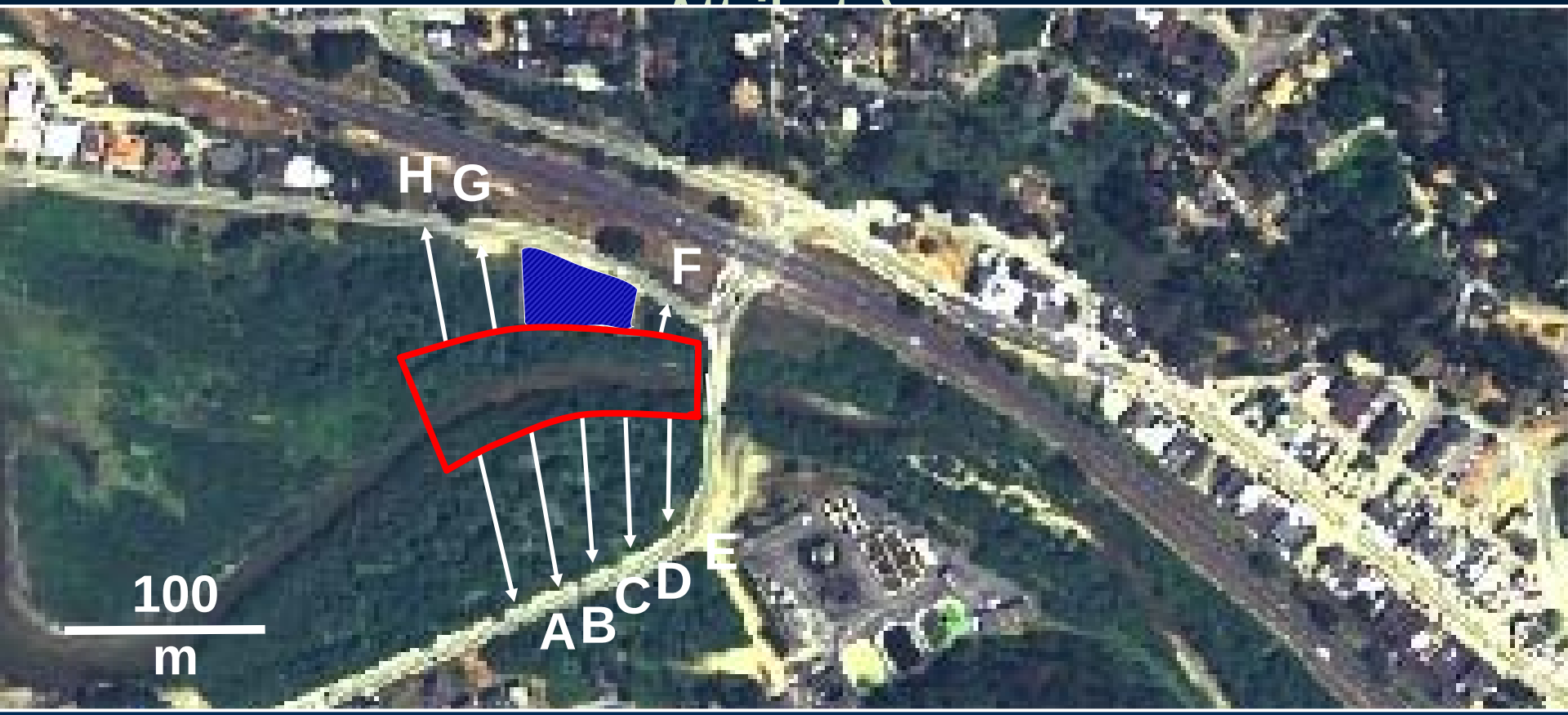
- Purpose of Assessment
  - Project (multiple AAs to cover site)
  - Ambient (AA located at probabilistic draw point)
- Hydrogeomorphic Integrity
  - Bounded by changes in flow and sediment regimes
  - Maximize detection of management effects
- Size Limits for AAs
  - Larger AAs have higher or more variable scores
  - Larger AAs take longer to assess

Office Assessment

Some CRAM metrics that rely on background information and broad geographic overview are best assessed in the office, subject to field verification

- **Buffer and Landscape Context Attribute**
  - **Landscape Connectivity (metric)**
  - **Percent of AA with Buffer (submetric)**
  - **Average Buffer Width (submetric)**
- **Hydrology Attribute**
  - **Water Source (metric)**

Average Buffer Width (Landscape Context Attributes)



Line A = 100m	Line D = 75m	Line G = 50m
Line B = 100m	Line E = 60m	Line H = 65m
Line C = 80m	Line F = 15m	**Avg. 490/8 = 68m**

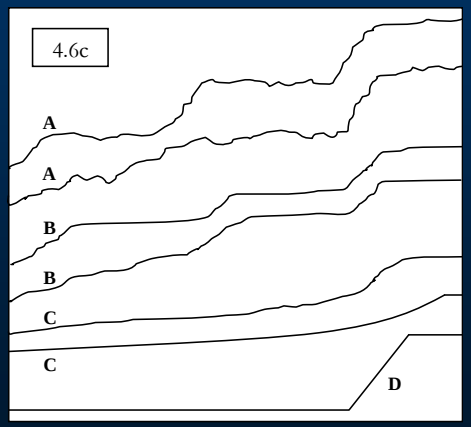
Average Buffer Width (Landscape Context Attribute)

Rating	Alternative States
A	Average Buffer Width is 190-250 m
B	Average Buffer Width is 130-189 m
C	Average Buffer Width is 65-129 m
D	Average Buffer Width is 0-64 m

Field Assessment

The majority of CRAM metrics are assessed in the field using narrative accounts, worksheets, diagrams, or a combination thereof.

- **e.g. Buffer condition submetric, most Hydrology metrics, and all metrics comprising the Physical Structure and Biotic Structure attributes**

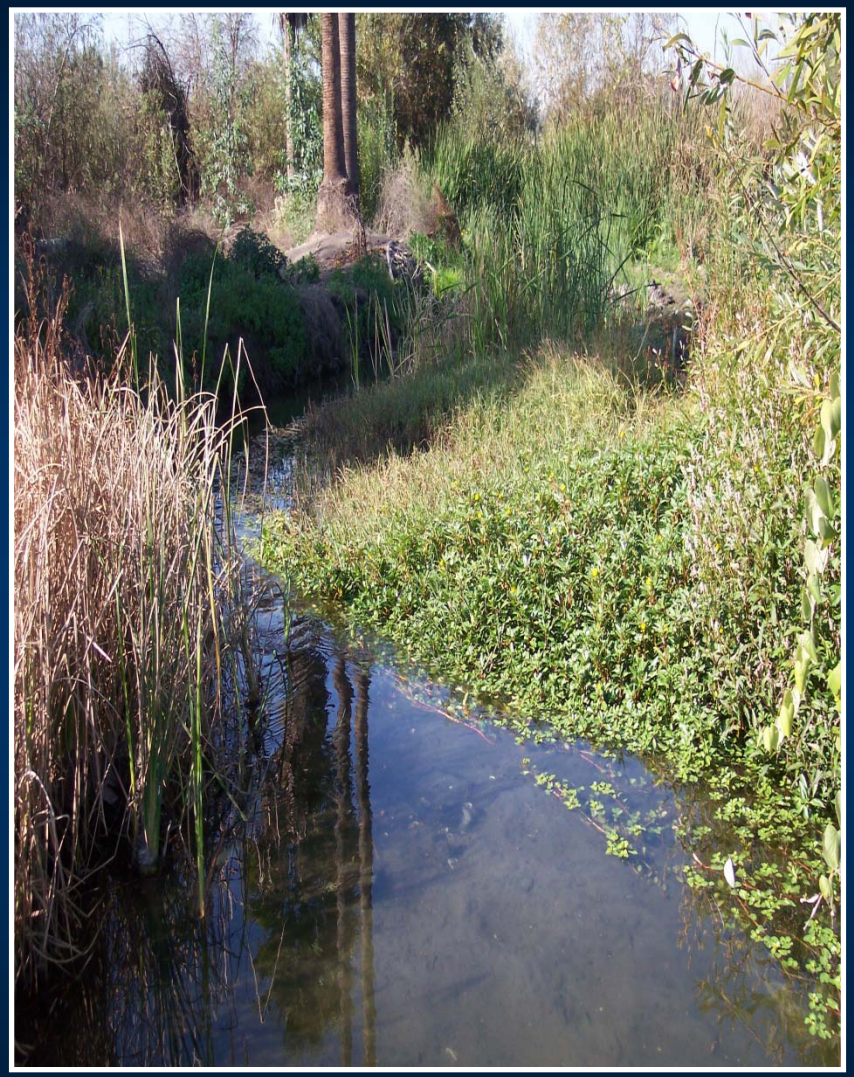


Rating for Buffer Condition

Rating	Alternative States
A	Buffer for AA is dominated by native vegetation, has undisturbed soils, and is apparently subject to little or no human visitation.
B	Buffer for AA is characterized by an intermediate mix of native and non-native vegetation, but mostly undisturbed soils, and is apparently subject to little or no human visitation.
C	Buffer for AA is characterized by substantial amounts of non-native vegetation, AND there is at least a moderate degree of soil disturbance/compaction undisturbed soils, and/or there is evidence of at least moderate intensity of human visitation.
D	Buffer for AA is characterized by barren ground and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intense human visitation.

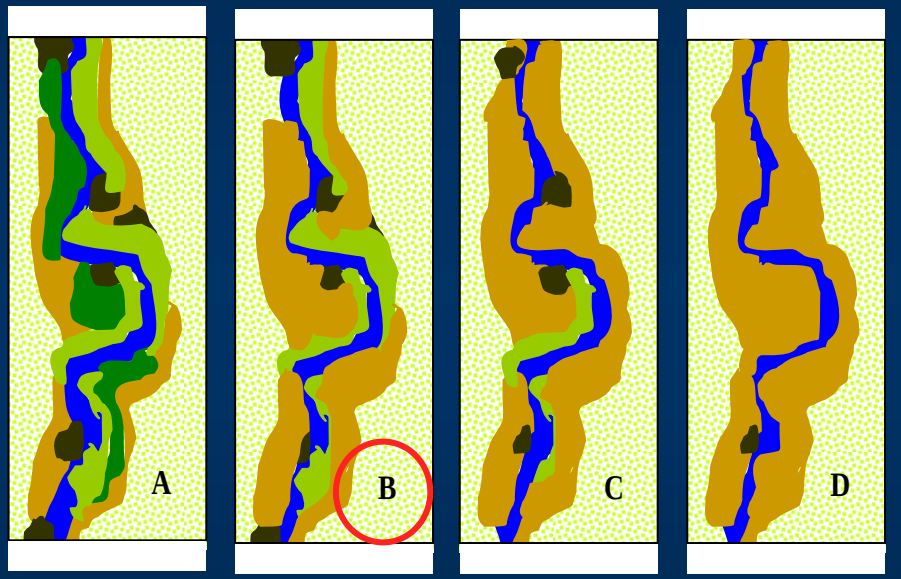
Structural Patch Type Worksheet

STRUCTURAL PATCH TYPE (check for presence)	Riverine (Non-confined)	Riverine (Confined)
Minimum Patch Size	**3 m^2**	**3 m^2**
Secondary channels on floodplains or along shorelines	1	0
Swales on floodplain or along shoreline	1	0
Pannes or pools on floodplain	1	0
Vegetated islands (mostly above high-water)	1	0
Pools or depressions in channels (wet or dry channels)	1	1
Riffles or rapids (wet channel) or planar bed (dry channel)	1	1
Non-vegetated flats or bare ground (sandflats, mudflats, gravel flats, etc.)	0	0
Point bars and in-channel bars	1	1
Debris jams	1	1
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	1	1
Plant hummocks and/or sediment mounds	1	1
Bank slumps or undercut banks in channels or along shoreline	1	1
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	1	1
Animal mounds and burrows	0	0
Standing snags (at least 3 m tall)	1	1
Filamentous macroalgae or algal mats	1	1
Shellfish beds	0	0
Concentric or parallel high water marks	0	0
Soil cracks	0	0
Cobble and/or Boulders	1	1
Submerged vegetation	1	0
Total Possible	**16**	**11**
No. Observed Patch Types		



Horizontal Interspersion and Zonation

(Biotic attribute metric)

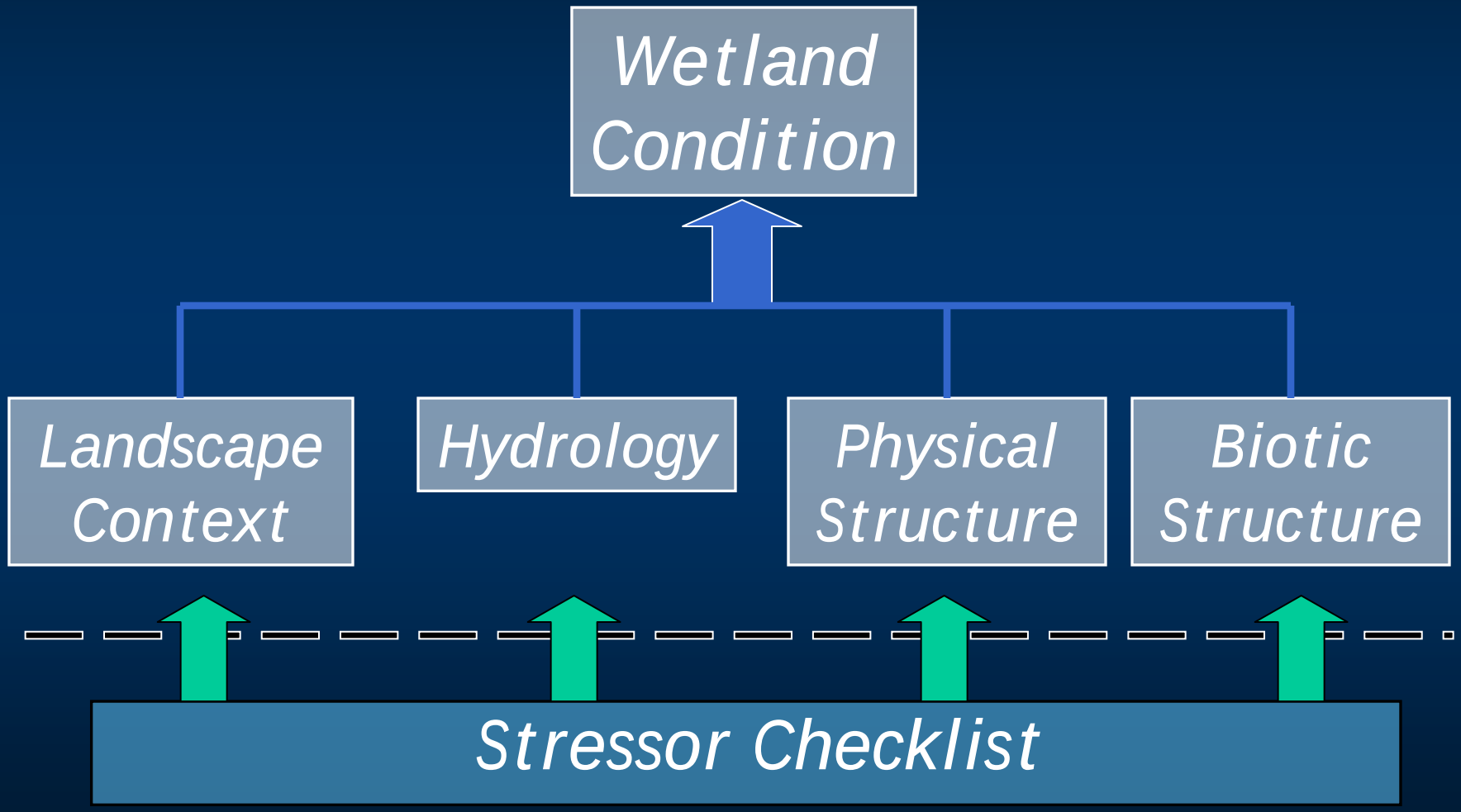


CRAM Scoring Sheet

Attribute
Metric
Sub-metric
Sub-metric
Sub-metric
Attribute
Metric
Metric
Metric
Attribute
Metric
Metric
Attribute
Sub-metric
Sub-metric
Sub-metric
Metric
Metric
Metric
Overall Index Score

AA Name:				(m/d/y)			
Attributes and Metrics		**Scores**		**Comments**			
Buffer and Landscape Context							
Landscape Connectivity (D)							
Buffer submetric A: Percent of AA with Buffer							
Buffer submetric B: Average Buffer Width							
Buffer submetric C: Buffer Condition							
D + [C x (A x B)$^{1/2}$] $^{1/2}$ = **Attribute Score**		Raw	Final	Final Attribute Score = (Raw Score/24)100			
Hydrology							
Water Source							
Hydroperiod or Channel Stability							
Hydrologic Connectivity							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/36)100			
Physical Structure							
Structural Patch Richness							
Topographic Complexity							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/24)100			
Biotic Structure							
Plant Community submetric A: Number of Plant Layers							
Plant Community submetric B: Number of Co-dominant species							
Plant Community submetric C: Percent Invasion							
Plant Community Metric *(average of submetrics A-C)*							
Horizontal Interspersion and Zonation							
Vertical Biotic Structure							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/36)100			
Overall AA Score				**Average of Final Attribute Scores**			

CRAM Design


Wetland Condition
Landscape Context
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Stressor Checklist

Stressor Checklist

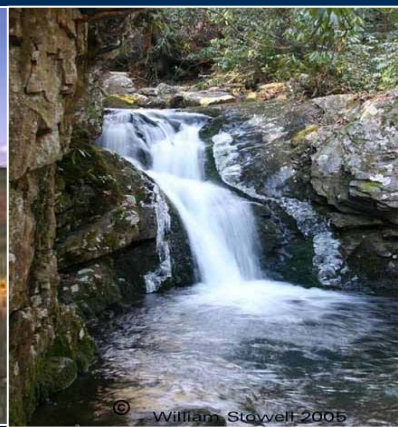
Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present and likely to have negative effect on AA	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)		
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

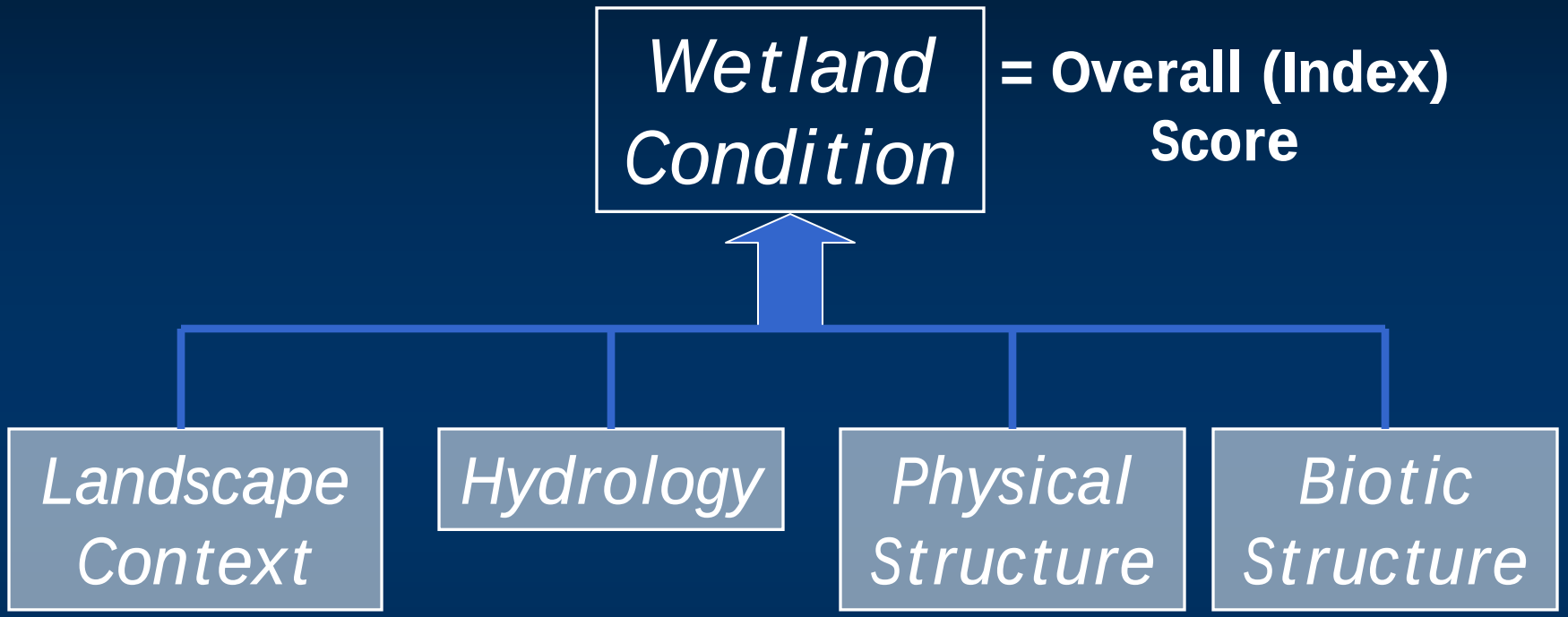
CRAM Application and Implementation

Topics for Discussion

- Interpretation of CRAM scores
- Applications of CRAM
  - project assessment
- CRAM Data Management



CRAM Design



- CRAM recognizes four attributes of wetland condition
- Each attribute is represented by 2-3 metrics, some of which have sub-metrics.

CRAM Field Scoring Sheet

Attribute →

Sub-metric →
Sub-metric →
Sub-metric →

Attribute →
Metric →
Metric →
Metric →

Attribute →
Metric →
Metric →

Attribute →
Sub-metric →
Sub-metric →
Sub-metric →
Metric →
Metric →
Metric →

Overall Index Score →

AA Name:				(m/d/y)			
Attributes and Metrics		**Scores**			**Comments**		
Buffer and Landscape Context							
Landscape Connectivity (D)							
Buffer submetric A: Percent of AA with Buffer							
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Water Source							
Hydroperiod or Channel Stability							
Hydrologic Connectivity							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/36)100			
Physical Structure							
Structural Patch Richness							
Topographic Complexity							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/24)100			
Biotic Structure							
Plant Community submetric A: Number of Plant Layers							
Plant Community submetric B: Number of Co-dominant species							
Plant Community submetric C: Percent Invasion							
Plant Community Metric *(average of submetrics A-C)*							
Horizontal Interspersion and Zonation							
Vertical Biotic Structure							
Attribute Score		Raw	Final	Final Attribute Score = (Raw Score/36)100			
Overall AA Score				**Average of Final Attribute Scores**			

What Does a CRAM Score Mean?

- CRAM Index Score represents overall condition, functional capacity, or "health."
  - numerical, repeatable, but unitless
  - does not represent any particular function or set of functions (that's Level 3).

Analogous to:

- **Apgar Scores (newborn infant health)**
- **Dow Jones Industrial Average (DOW)**
- **Gross National Product (GNP)**
- **Grade Point Average (GPA)**

Scientific Meaning of CRAM Scores

- Identical Index Scores can be derived from different Attribute Scores
  - **Must refer to Attribute Scores and sometimes Metric Scores to interpret Index Scores**

Landscape - Buffer	Hydrology	Physical Structure	Biotic Structure	Index Score
50	35	72	68	56
68	50	35	72	56

Scientific Meaning of CRAM Scores

- Each Attribute Score represents a suite of expected functions
  - e.g., Landscape and Buffer Attribute represents ecological connectivity at landscape scale, ability of buffer to mediate external stressors, etc.
  - e.g., Hydrology Attribute represents recharge, peak stage reduction, water quality maintenance, etc.
- Condition = status at specific time point
- Function = process occurring over time

Application of CRAM Scores

- Scores based on internal reference standard
  - Best achievable condition statewide
  - Scores range from 25-100
- Ability to compare CRAM scores
  - Project-ambient
  - Project-project
  - Wetland-wetland
  - Detecting changes in wetland condition over time

How is CRAM being Used?

- Statewide assessments
  - Perennially tidal estuaries
  - SWAMP Perennial Stream Assessment (PSA)
- Regional assessments
  - Stormwater Monitoring Coalition (SMC)
  - San Gabriel River Monitoring Program
- Program evaluation
  - Compensatory mitigation – 404/401 CWA
  - Restoration effectiveness – Wetland Recovery Project

CALIFORNIA
CRAM

Using CRAM
(California Rapid Assessment Method)
To Assess Wetland Projects
As an Element of Regulatory and Management Programs

Technical Bulletin

June 5, 2009

Available at:
www.waterboards.ca.gov/mywaterquality/monitoring_council/wetland_workgroup or
www.cramwetlands.org

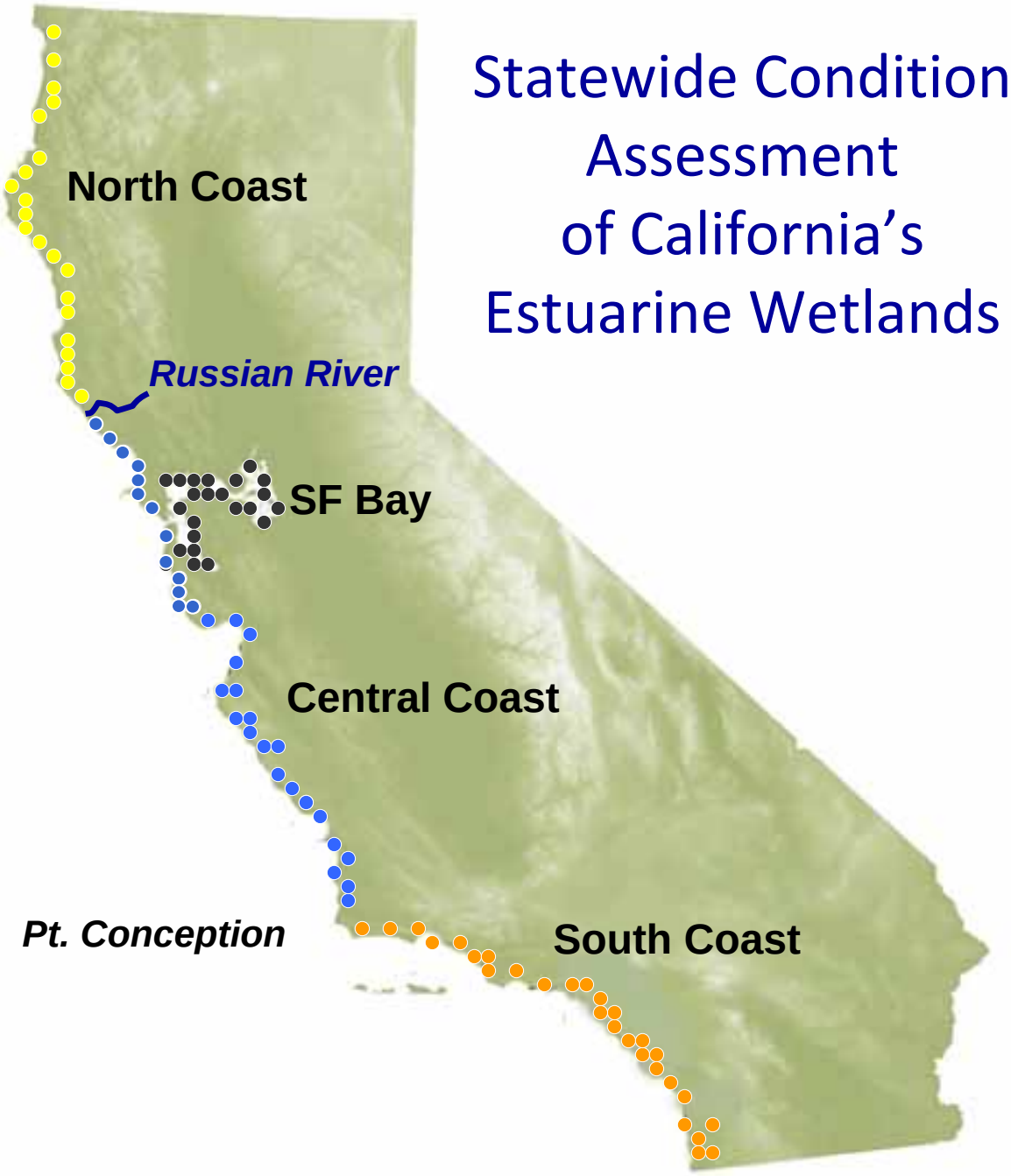
Selected Components of CRAM Technical Bulletin

- Appropriate and inappropriate uses
- How to address situation when project area ≠AA
- How to interpret a CRAM score
- Practitioner requirements
- Necessary documentation to accompany a CRAM assessment
- Quality assurance measures – regional audit teams
- Sample assessment scenarios

Appropriate Uses of CRAM: Ambient Assessment and Monitoring

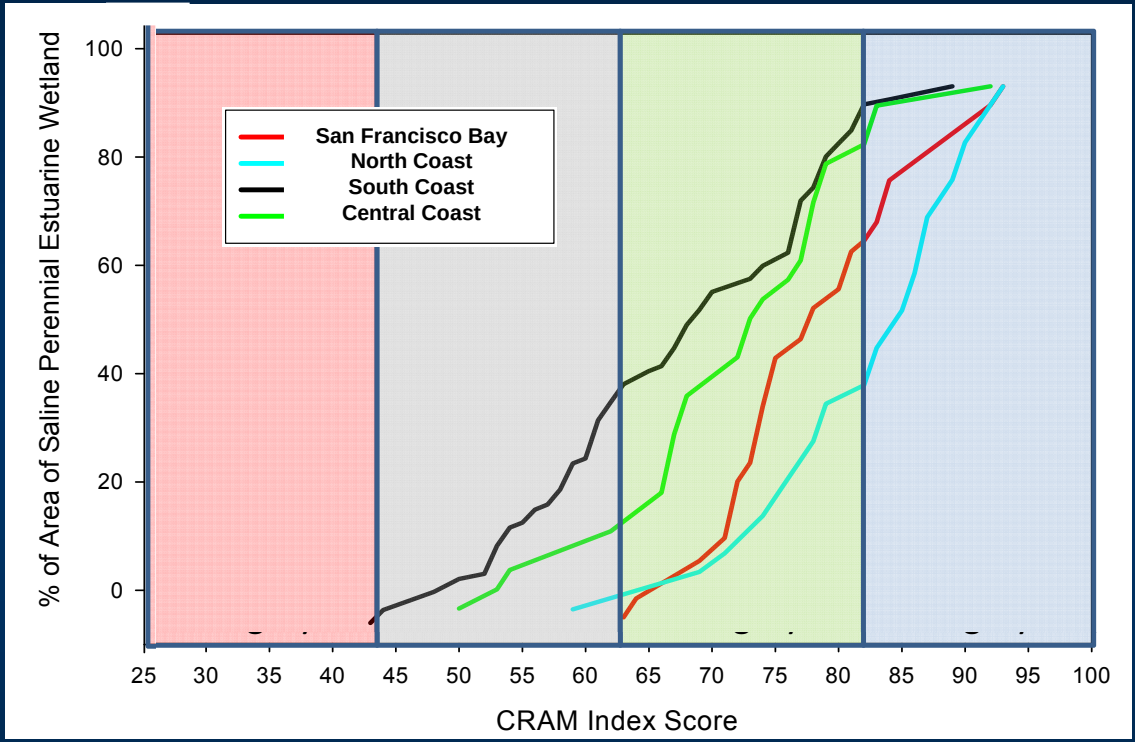
- Ambient assessment of wetland condition
- Monitoring of ecological reserves, mitigation banks, wildlife refuges, etc.

Statewide Condition Assessment of California's Estuarine Wetlands



- Focus on four coastal regions
- Perennially tidal saline estuaries targeted
- 150 sites probabilistically selected
- Used CRAM to assess condition

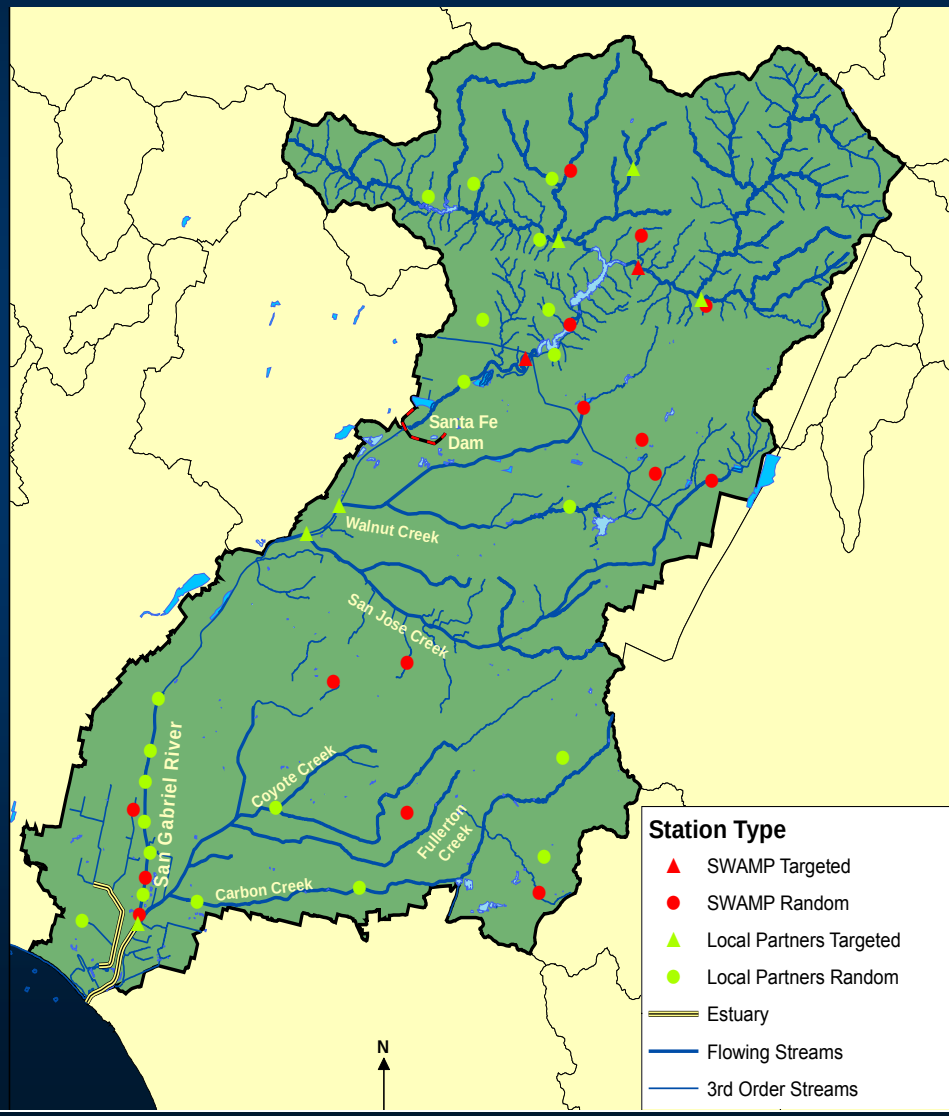
Regional Differences in Condition



- Gradient in condition from North to South Coast

Multi-metric Assessment of Watershed Condition

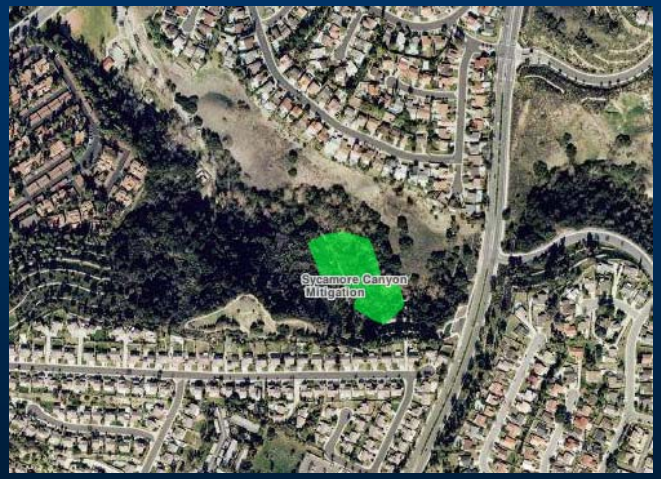
- Probabilistic sampling of 30 “ambient sites”
- Targeted sampling at key confluence points
- Multiple metrics (Levels 2 & 3)
  - CRAM
  - Water chemistry
  - Bioassessment
  - Toxicity



Ambient Condition as Context for Site Conditions

Appropriate Uses of CRAM: Project Assessment

- Pre-project conditions at impact, mitigation, or restoration sites
- Unauthorized (enforcement) actions
- Project performance/success
- Compliance with mitigation targets/performance criteria
- Comparison of proposed alternatives for regulatory and restoration planning



Inappropriate Uses of CRAM

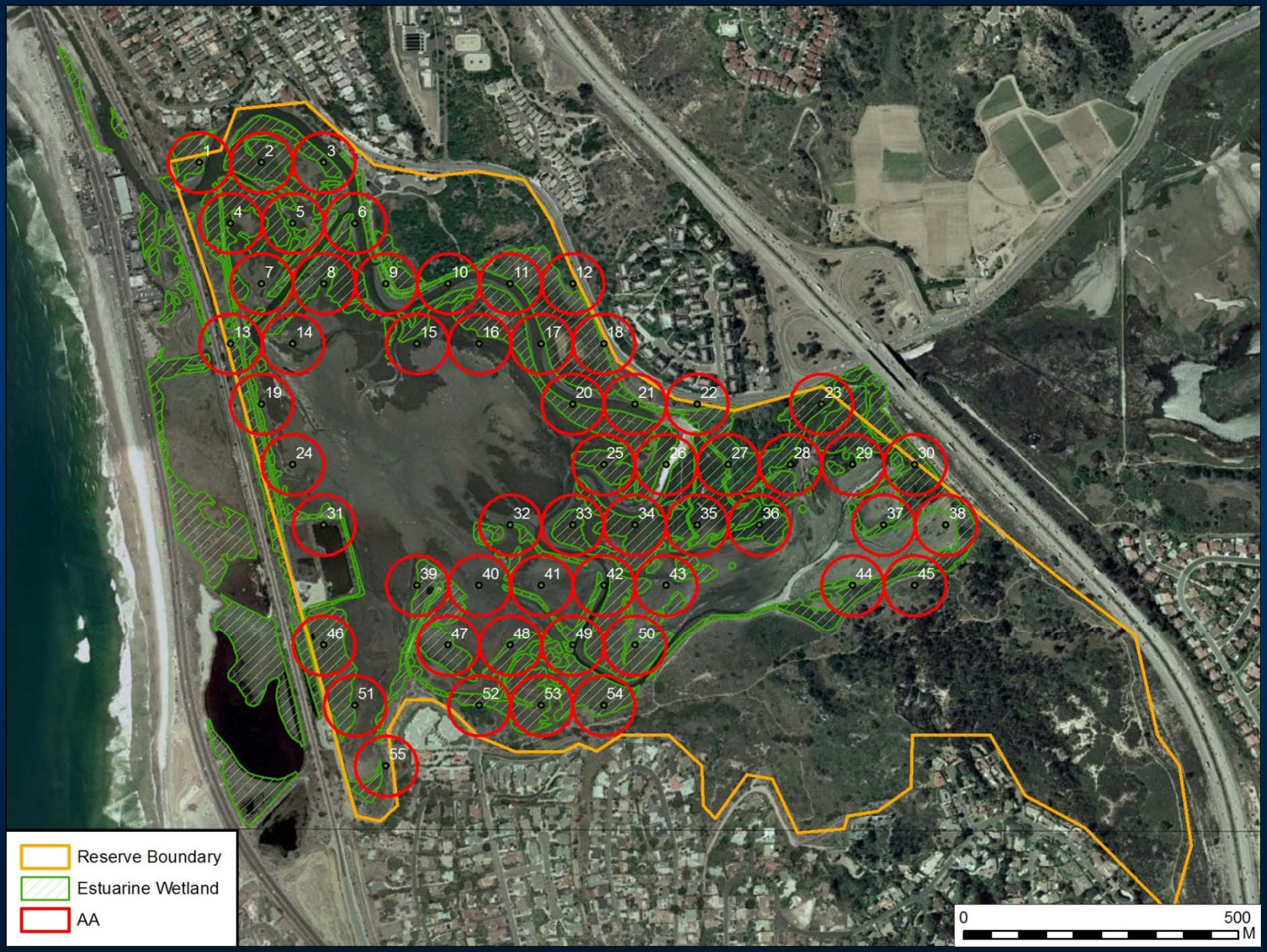
- Jurisdictional determinations
- Focused/endangered/threatened spp. monitoring
- Substitute for Level 3 monitoring
- Compliance with water quality objectives
- Assessment of wetland mechanisms/processes
- Assessment of wetland values
- “Designing projects to the metric”

Agencies Retain Discretion on Specific Applications

Project Area < AA

- Two CRAM Assessments
  - Entire AA
  - Project area

Project Area > AA



Appendix 1 CRAM User's Manual ver. 5.0.2

APPENDIX I:
PROTOCOL FOR PROJECT ASSESSMENT BASED ON CRAM
Version 1.1

Introduction

There are generally two kinds of CRAM applications: assessments of ambient condition and assessments of project conditions. The approach is essentially the same in each case. The critical concepts common to both are Sample Universe and Sample Frame. The Sample Universe is the population of possible CRAM Assessment Areas (AAs) that is supposed to be assessed. The Sample Frame is a map of the Sample Universe. For more information about sample frames go to http://epa.gov/nheerl/arm/designing/design_intro.htm.

In the case of an ambient assessment, the Sample Universe consists of all the possible AAs of a single wetland type within a prescribed area that is larger than a project. For example, an ambient Sample Universe might encompass all of the possible AAs for lacustrine wetlands within a watershed, administrative region of an agency, congressional district, etc. In the case of a project assessment, the Sample Universe is all of the possible AAs for one kind of wetland within the boundaries of one project. The results are used to characterize the project.

Project Definition

For the purposes of CRAM, a "project" is any activity authorized under Section 404 of the US Clean Water Act, under the State's 401 Certification/WDR Programs, or under Section 1600 of the State's Fish and Game Code that directly changes the extent, type, or condition of at least 0.1 ha of non-riverine wetland, or at least 100m of riverine wetland length as defined in the CRAM Manual.

Project Assessment Steps

Step 1: Identify the Project Boundary

The project boundary is usually designated by the project sponsors and could include upland areas and other non-wetland areas (Figure 1). The project boundary has to be imported into a GIS as an overlay on 1-3m pixel resolution aerial imagery or a wetland inventory of comparable resolution and of recent vintage.

If a project is part of a larger wetland and is less that 80% of the recommended minimum size for a CRAM Assessment Area than conduct two assessments, one that is confined to project and one for the larger Assessment Area that includes the project.

Step 2: Identify the Sample Universe

Overlay the project boundary on the aerial imagery in the GIS and digitize the boundary of all non-riverine wetlands at least 0.1 ha in area and all riverine wetlands at least 100m long within the footprint of the project (Figure 1). All the wetlands of one type comprise a separate Sample Universe. There will be as many Sample Universes as there are wetland types within the project that meet the minimum polygon size requirements.

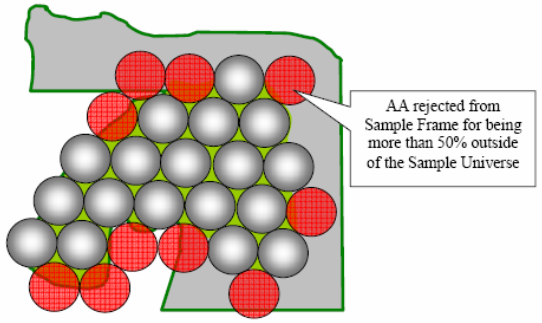


Figure 3: Map of the maximum number of candidate AAs showing AAs rejected for being more than 50% outside of the sample universe (red AAs.

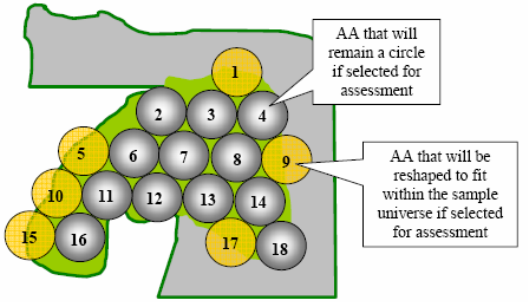


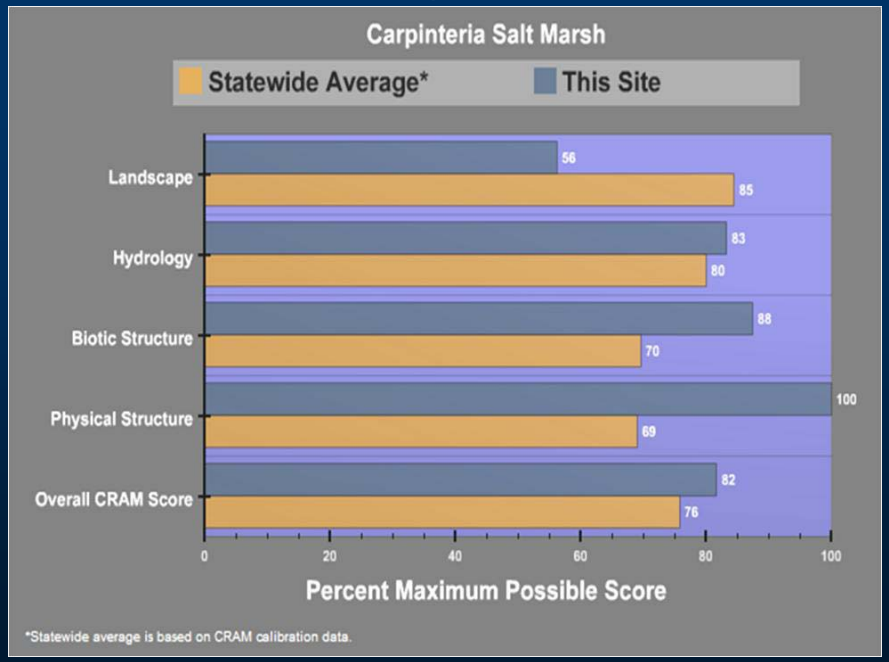
Figure 4: Sample Frame of final candidate AAs showing those entirely within the Sample universe (grey AAs) that do not have to be re-shaped if selected for assessment, and THOSE at 20% outside the sample universe (yellow AAs) that have to be reshaped if assessed. Each AA of the sample frame is numbered for random selection.

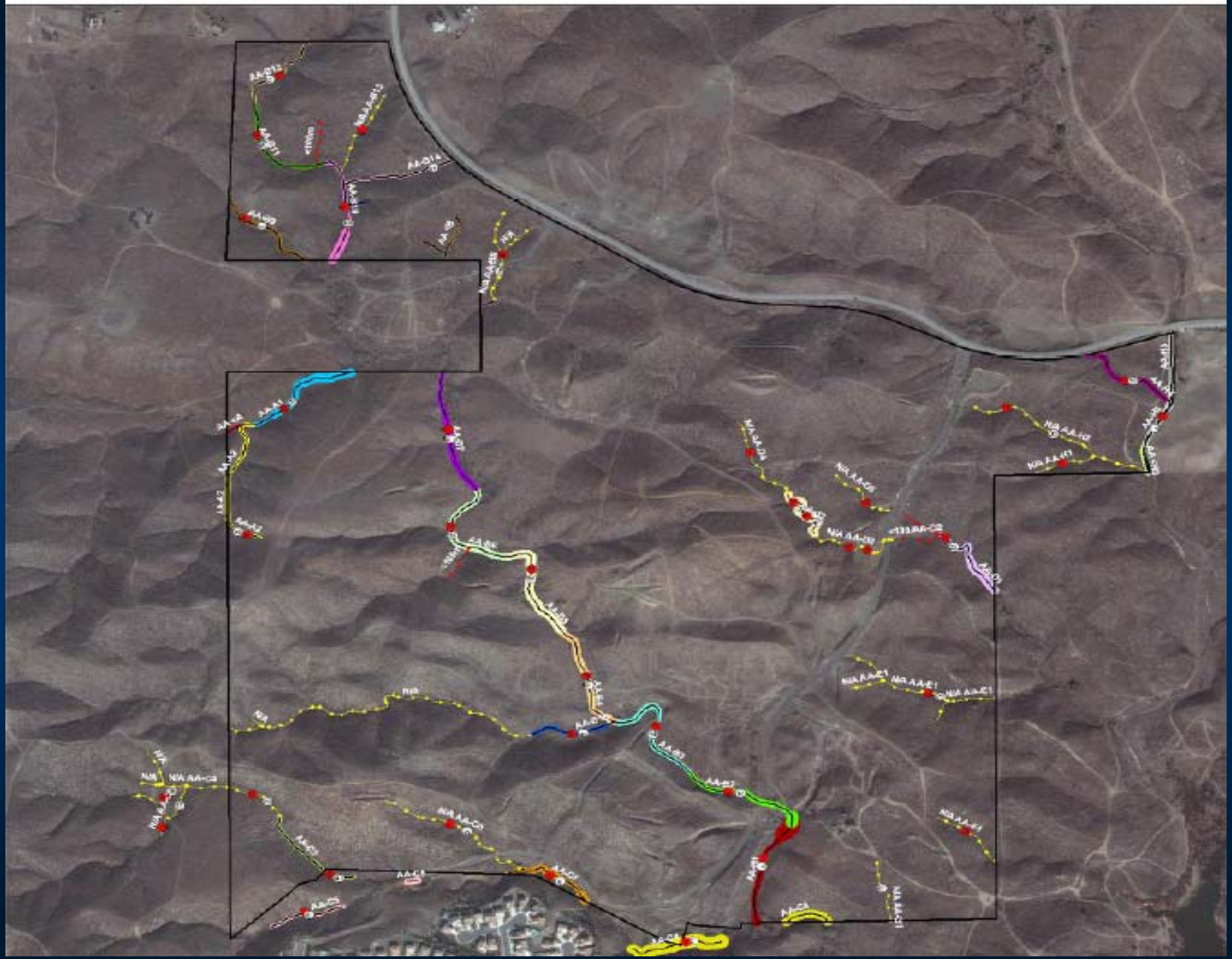
Project Assessment Caveats

- Do not modify metrics or attributes
- Avoid multiplying CRAM scores by area/linear distance for mitigation ratios
- Changes in wetland area are more appropriately assessed using a Level 1 tool.

Project Assessment Caveats

- Summarizing multiple CRAM scores:
  - Average of Metric scores to calculate Attribute and Overall scores
  - Compare scores to regional ambient assessment





Interpretation of CRAM Scores

Pre vs. Post comparisons

AA	Buffer and Lanscape Context			Hydrology			Physical Structure			Biotic Structure		
	pre	post	change	pre	post	change	pre	post	change	pre	post	change
A1	85	100	15	100	100	0	50	88	38	64	100	36
A2	85	100	15	100	100	0	50	75	25	39	100	61
B1	85	0	(85)	100	0	(100)	63	0	(63)	31	0	(31)
B2	85	0	(85)	100	0	(100)	50	0	(50)	50	0	(50)
B3	85	0	(85)	92	0	(92)	63	0	(63)	44	0	(44)
B4	85	0	(85)	100	0	(100)	75	0	(75)	64	0	(64)
B5	85	0	(85)	100	0	(100)	75	0	(75)	60	0	(60)
H2	0	59	59	0	92	92	0	63	63	0	100	100
H3	0	52	52	0	92	92	0	75	75	0	100	100
H4	83	97	14	100	83	(17)	63	88	25	53	100	47
H5	85	93	8	100	92	(8)	63	88	25	61	100	39

Sulphur Creek Restoration Monitoring

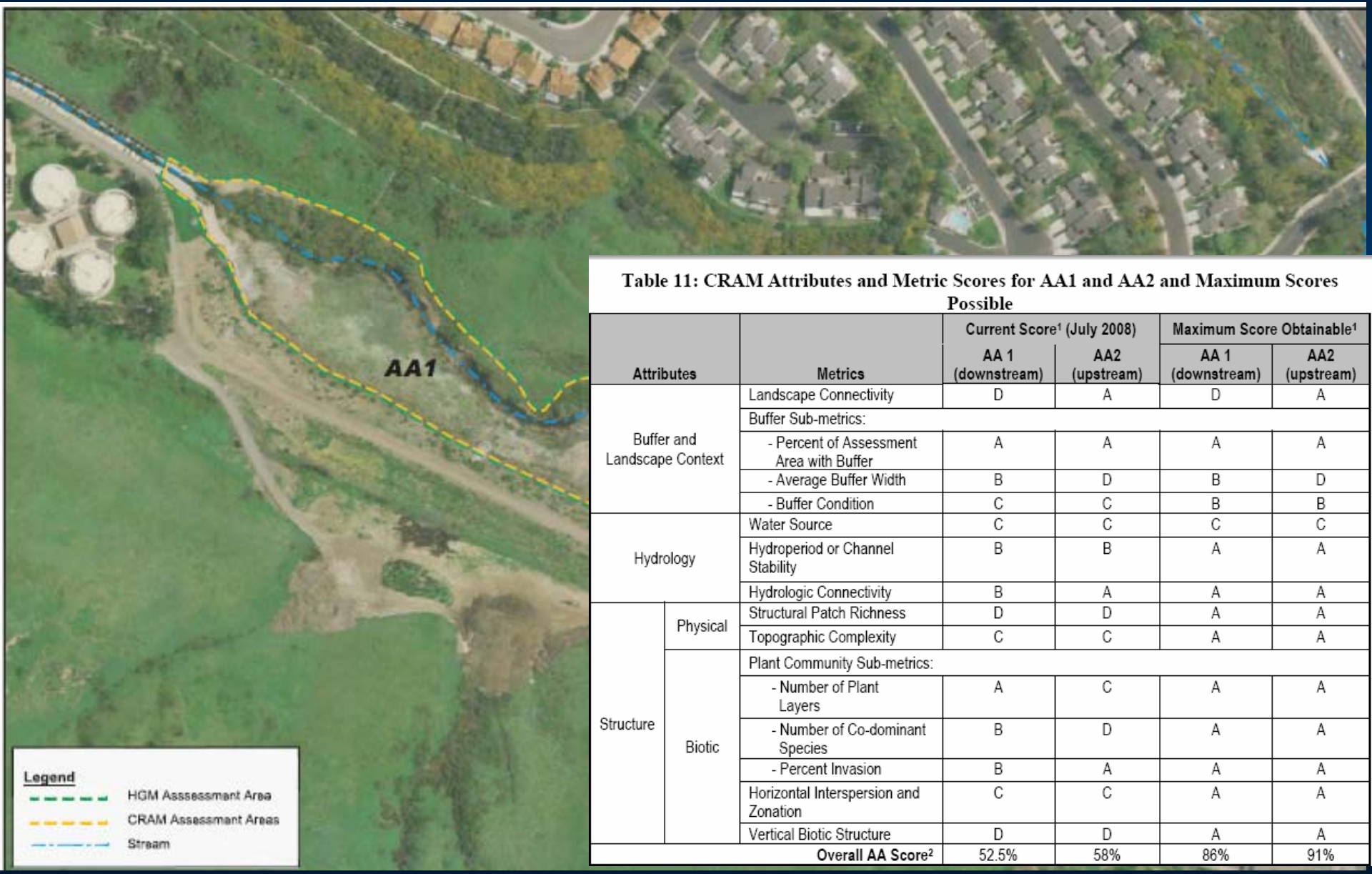


Table 11: CRAM Attributes and Metric Scores for AA1 and AA2 and Maximum Scores Possible

Attributes		Metrics	Current Score[1] (July 2008) AA 1 (downstream)	Current Score[1] (July 2008) AA2 (upstream)	Maximum Score Obtainable[1] AA 1 (downstream)	Maximum Score Obtainable[1] AA2 (upstream)
Buffer and Landscape Context		Landscape Connectivity	D	A	D	A
		Buffer Sub-metrics:				
		- Percent of Assessment Area with Buffer	A	A	A	A
		- Average Buffer Width	B	D	B	D
		- Buffer Condition	C	C	B	B
Hydrology		Water Source	C	C	C	C
		Hydroperiod or Channel Stability	B	B	A	A
		Hydrologic Connectivity	B	A	A	A
Structure	Physical	Structural Patch Richness	D	D	A	A
		Topographic Complexity	C	C	A	A
	Biotic	Plant Community Sub-metrics:				
		- Number of Plant Layers	A	C	A	A
		- Number of Co-dominant Species	B	D	A	A
		- Percent Invasion	B	A	A	A
		Horizontal Interspersion and Zonation	C	C	A	A
		Vertical Biotic Structure	D	D	A	A
		Overall AA Score[2]	52.5%	58%	86%	91%

Interpretation of CRAM Scores
comparison to reference

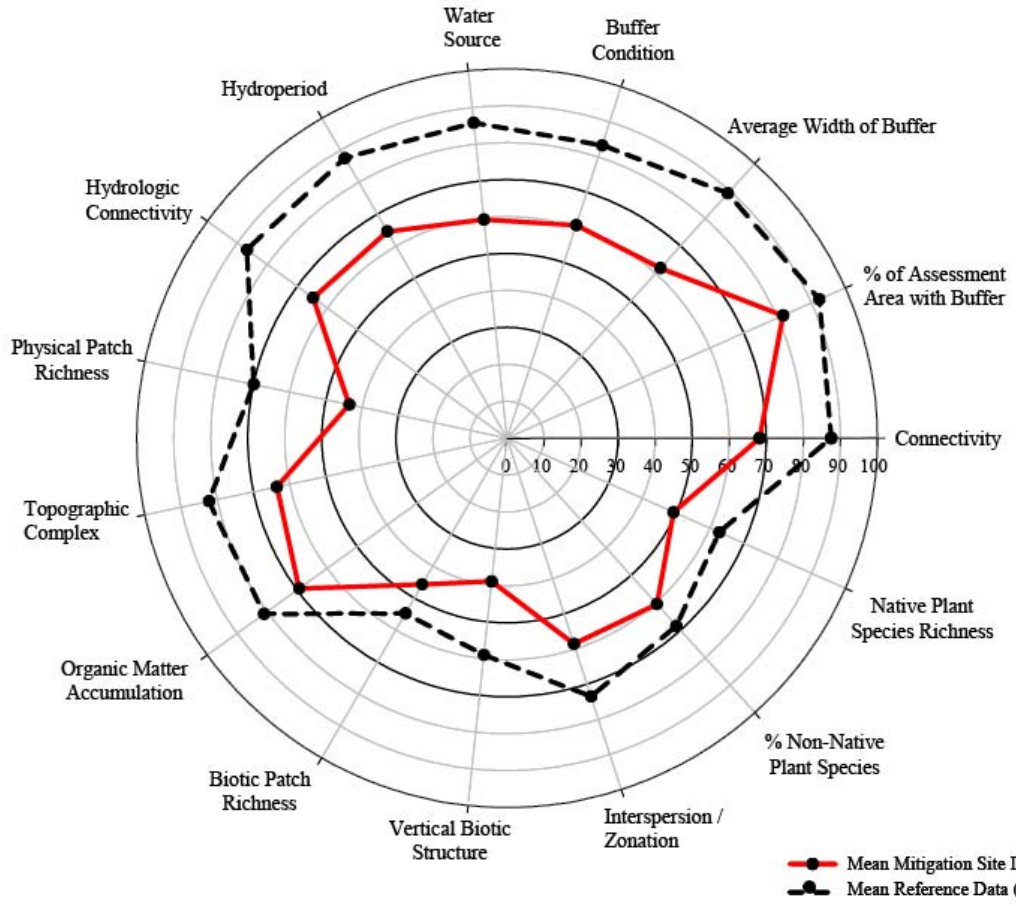
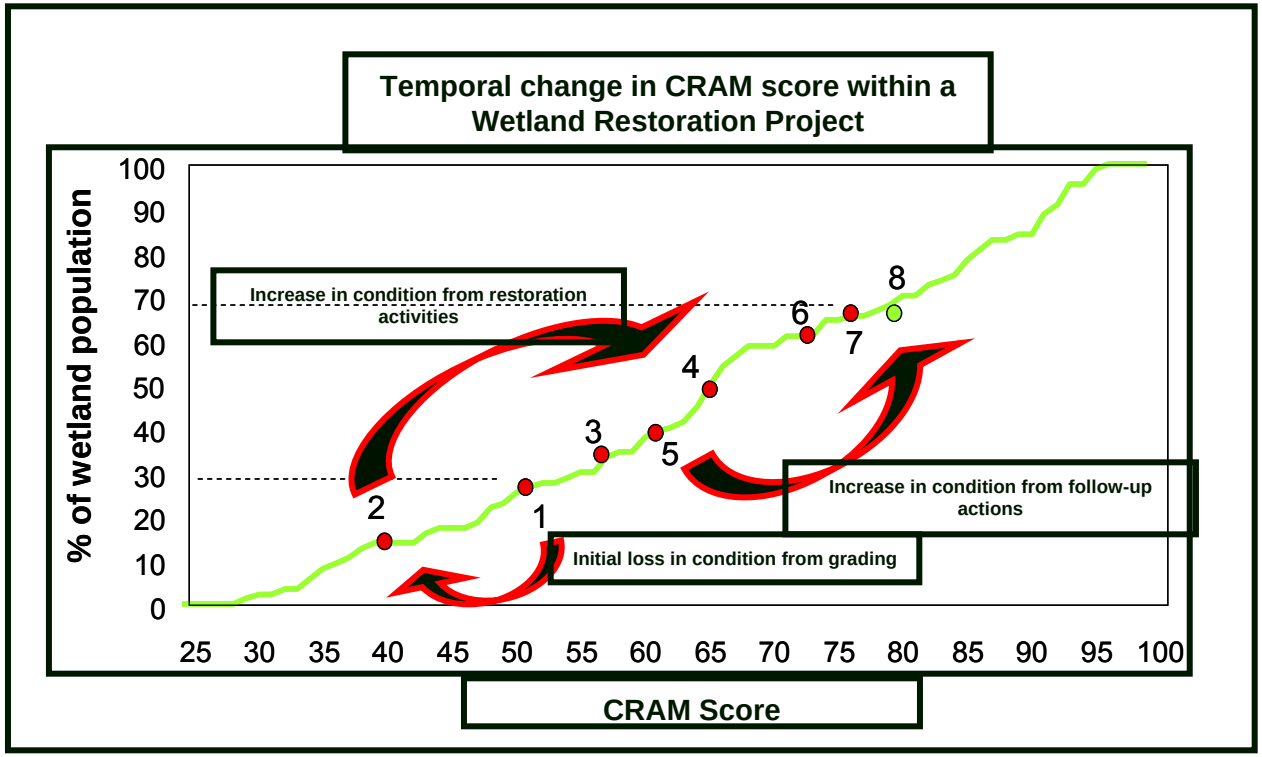


Figure 46. Mean percentage scores for each CRAM metric for mitigation sites (N=204) and reference sites (N=47).

Monitoring CRAM Scores Over Time



CRAM QA/OC

- Minimum reporting requirements
- Audit process
- Precision targets
  - *10 pts./Overall score; 5 pts./Attribute score*
- Accuracy of assessments
  - Testing at reference sites
- Seasonal variability
- Multiple versions of CRAM

CRAM Data Management

CALIFORNIA CRAM

www.CRAMWetlands.org

CRAM

Home | View Results

- CRAM Home
- About
- News
- Get started
- Data entry
- View results
- Training
- Tips
- Documents
- Help

- Wetland Tracker

The California Rapid Assessment Method (CRAM) is a standardized, cost-effective tool for assessing the health of wetlands and riparian habitats. CRAM software guides users through assessments that take less than one-half field day to complete. CRAM is applicable to all wetland types. It is designed for assessing ambient conditions within watersheds, regions, and throughout the State. It can also be used to assess the performance of compensatory mitigation projects and restoration projects.

New & Featured

- Vernal pool fieldbook coming soon. See News
- **Version 5.0.2** of the CRAM method has been released. See Documents
- Reports on wetlands mitigation available.
- Keep up with the latest CRAM developments. Join the CRAM News mailing list
- Information on **CRAM training**

Register here

- Read more about CRAM
- Get started with CRAM
- Enter CRAM data on the web
- View CRAM results
- Browse CRAM documents

Download eCRAM Software,* User's Manual, Field Books

*Registration required

CRAM Factsheet

www.CaWaterQuality.net

.GOV CALIFORNIA WATER QUALITY MONITORING COUNCIL

Home | Safe to Drink | Safe to Swim | Safe to Eat Fish | Ecologic Health | Stressors & Processes | Contact Us

My Water Quality - hosted by the Surface Water Ambient Monitoring Program (SWAMP) |

GOVERNOR SCHWARZENEGGER
Visit his Website

- Cal/EPA
- The Resources Agency
- About the California Water Quality Monitoring Council
- State & Regional Water Boards
- Web Portal Partners
- Monitoring Programs, Data Sources & Reports
- Water Quality Standards, Plans and Policies
- Regulatory Activities
- Enforcement Actions
- Research

- About SWAMP
- SWAMP Tools

SWAMP
Surface Water Ambient Monitoring Program

Welcome to My Water Quality

This web portal, supported by a wide variety of public and private oraganizations, presents California water quality monitoring data and assessment information from a variety of perspectives that may be viewed across space and time.

IS OUR WATER SAFE TO DRINK?

Safe drinking water depends on a variety of chemical and biological factors regulated by a number of local, state, and federal agencies. More >>

IS IT SAFE TO SWIM IN OUR WATERS?

Swimming safety of our waters is linked to the levels of pathogens that have the potential to cause disease. More >>

IS IT SAFE TO EAT FISH AND SHELLFISH FROM OUR WATERS?

Aquatic organisms are able to accumulate certain pollutants from the water in which they live, sometimes reaching levels that could harm consumers. More>>

ARE OUR AQUATIC ECOSYSTEMS HEALTHY?

The health of fish and other aquatic organisms and communities depends on the chemical, physical, and biological quality of the waters in which they live. More>>

WHAT STRESSORS AND PROCESSES AFFECT OUR WATER QUALITY?

Benefical uses of our waters are affected by emerging contaminants, invasive species, trash, global warming, acidification, pollutant loads, and flow. More>>

GOVERNOR SCHWARZENEGGER

Visit his Website

→ State & Regional Water Boards

AQUATIC HEALTH LINKS

→ Stressors
→ Laws, Regulations, Standards & Guidelines
→ Regulatory Activities
→ Enforcement Actions
→ Research
→ Monitoring Programs, Data Sources & Reports

Are Our Aquatic Ecosystems Healthy?

California has many types of aquatic habitats. Follow the links below to learn more…

WETLANDS

Wetlands form along the shallow margins of deepwater ecosystems such as lakes, estuaries, and rivers. They also form in upland settings where groundwater or runoff makes the ground too wet for upland vegetation. More >>

ESTUARIES

Estuaries are unique habitats found where rivers and the ocean mix. They feature a diverse array of plants and animals adapted to life along this mixing zone. More >>

LAKES

California lakes, supporting deep water, wetlands, riparian woodlands, offer a quiet refuge for plants, animals and humans alike. More >>

STREAMS & RIVERS

California's streams and rivers flow through diverse habitats, from mountain canyons, valleys, deserts, estuaries and urban areas. Riparian woodlands develop along stream banks and floodplains, linking forest, chaparral, scrubland, grassland, and wetlands. More >>

OCEAN

California has 1,100 miles of shoreline and 220,000 square miles of state and federal oceanic habitat, featuring one of the world's most diverse marine ecosystems. More >>

California Wetlands Portal

CALIFORNIA WETLANDS

Search

California
- North Coast
- Bay Area
- Central Coast
- South Coast
- Central Valley
- Lahontan
- Colorado River Basin

Questions Answered

Background Info on Wetlands

About Wetlands Portal

Wetland Condition (CRAM)

Feedback

My Water Quality
- Home
- Water Quality Monitoring Council
- California Wetlands Monitoring Workgroup
- Contact Us

Welcome to the California Wetlands Portal

The purpose of the Wetlands Portal is to provide the public information on the quantity and quality of California wetlands.

Explore your wetlands

Select a region to view interactive maps monitoring information related to wetlands and wetland projects.

- North Coast
- San Francisco Bay Area
- Central Coast
- South Coast
- Central Valley
- Lahontan
- Colorado River Basin

Questions Answered

Click on a question below to view summary information based on available monitoring results.

- Where are California's wetlands? Is there a wetland near me?
- How much wetland habitat does California have?
- How much wetland habitat has California lost?
- How healthy are California's wetlands?
- What is being done to improve California's wetlands?
- What is the status of wetland mapping in California?

Wetland Condition

http://www.CaliforniaWetlands.net

Southern California Portal Page

CALIFORNIA WETLANDS

Search

California
South Coast
- Project List
- Map
- Summaries
- Questions

Questions Answered

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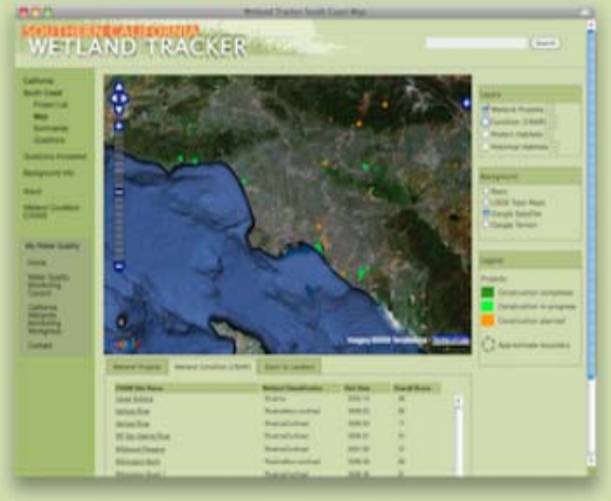
South Coast Wetland Information

The California Wetlands Portal provides wetland scientists, managers, and the public information about the wetlands of selected regions of California. The South Coast is one of several regions covered.



Information available

Wetland information currently available for the South Coast region includes:

- Habitat: historical (San Gabriel River watershed) and modern habitat maps
- Projects: estuarine, riverine and depressional wetland areas from Point Conception to the Tijuana Slough Estuary

- View a list of South Coast wetland projects
- See South Coast projects on an interactive map
- View summaries of South Coast wetland restoration activity
- View answers to questions about South Coast wetlands

Also: view a California map of wetland condition assessments(CRAM)

Southern California Portal Page

CALIFO

California
- North Coast
- Bay Area
- Central Coast
- South Coast
- Central Valley
- Lahontan
- Colorado River Basin

Questions Answered

Background Info on Wetlands

About Wetlands Portal

Wetland Condition (CRAM)

Feedback

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- California Wetlands Monitoring Workgroup
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Search

Background Information

- What are wetlands?
  As the name suggests, wetlands have aquatic ("wet") and terrestrial ("land") characteristics...
- How are wetlands protected?
  View a list of laws applied to projects affecting wetlands in California.
- Why are wetlands important?
  Wetlands provide a wide range of services to society...
- What is wetland health? How does it differ from function?
  Simply defined, "health" is the sum of the biological, chemical and physical integrity of wetland and associated habitats...
- What factors affect wetland health?
  View a list of human activities that result in a reduction in wetland quantity or quality.
- Have my wetlands been mapped?
  Has your wetland been mapped?
- Diversity of California's wetlands
  The natural diversity of California wetlands is unsurpassed by any region in the world...
- Wetland services, functions, and beneficial uses
  View a list of services provided by wetlands.
- California wetland assessment toolkit
  California's Wetland Assessment Toolkit consists of standardized mapping and assessment methods...

ed regions of

Southern California Portal Page

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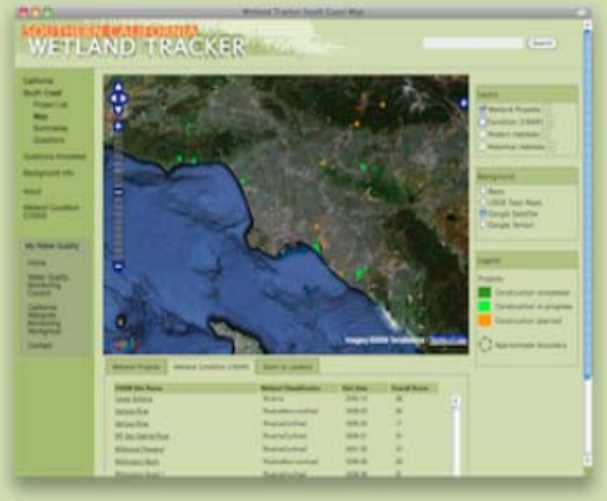

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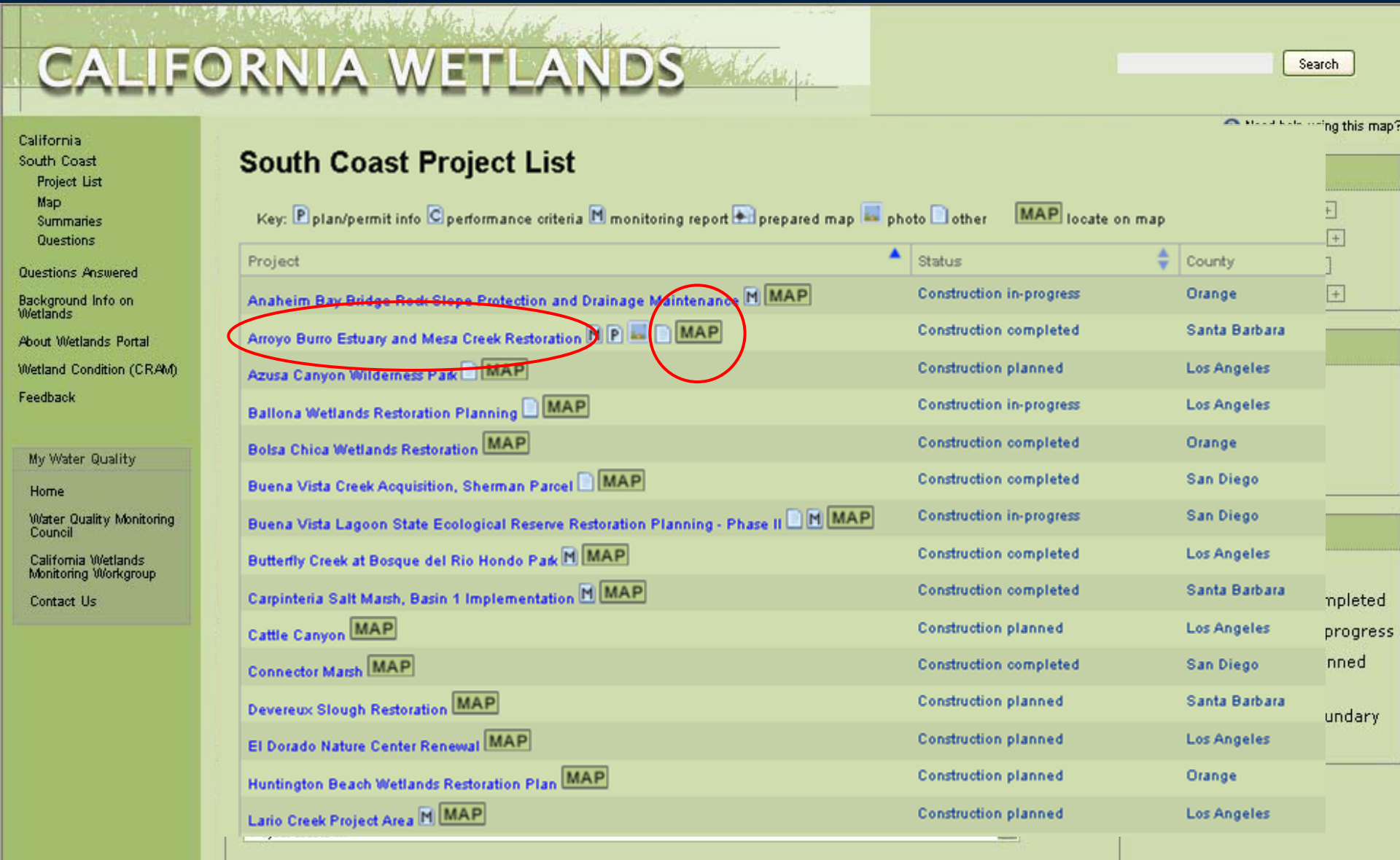
Also: view a California map of wetland condition assessments(CRAM)

Project Tracking Functionality



California Wetlands Portal : South Coast : Map - Mozilla Firefox

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http://www.californiawetlands.net/tracker/sc/map/1528/734

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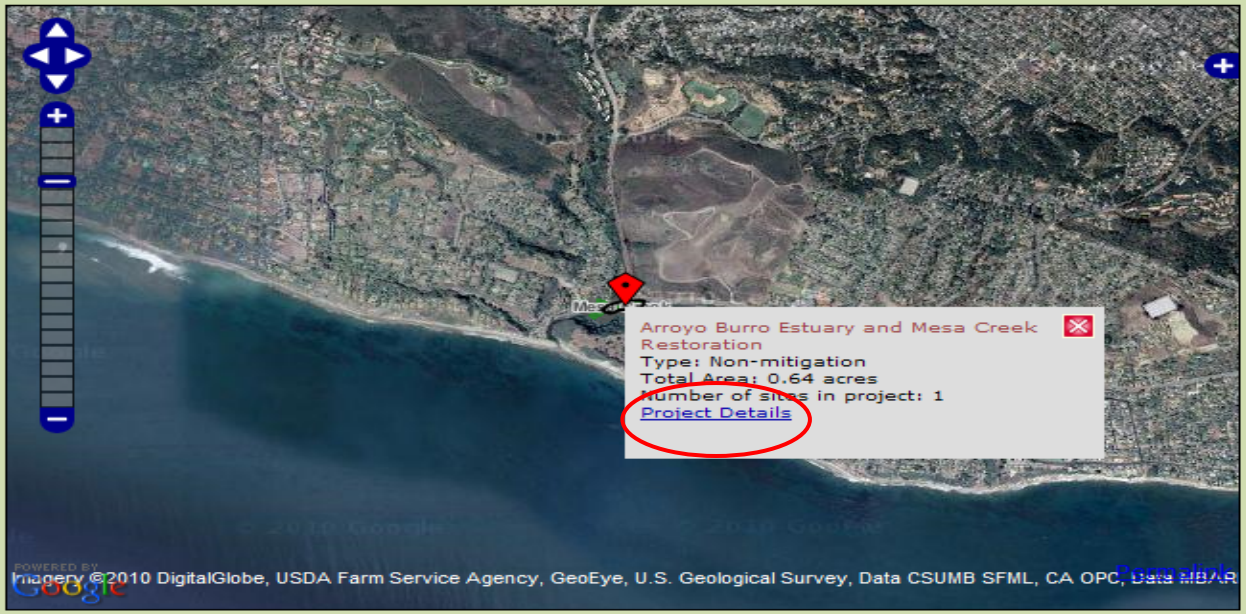

Wetland Projects | Wetland Condition (CRAM) | Zoom to Location

Project Locator...

Need help using this map?

Layers

- [x] Wetland Projects
- [ ] Condition (CRAM)
- [ ] Modern Habitats
- [ ] Historical Habitats

Background

- ( ) Basic
- ( ) USGS Topo Maps
- (•) Google Satellite
- ( ) Google Terrain

Legend

Projects

- Construction completed
- Construction in-progress
- Construction planned

Approximate boundary

CALIFORNIA WETLANDS

Search

Arroyo Burro Estuary and Mesa Creek Restoration

Basic Info | **Files & Links**

Status	Construction completed	County	Santa Barbara
Project Type	Non-mitigation	Location	34.40473° N -119.73982° W MAP
Project Area	0.6 acres		

Project Identification ?

ID	Type
1600-2004-0229-R5	CDFG - Streambed Alteration Agreement
200301218-JCM	USACE - Nationwide Permit
4-04-0008	CCC - Coastal Development Permit
not recorded	SCC - Project Number (Restoration)
not recorded	RWQCB - 401 Certification Letter Site Number

Habitat Plan ?

Habitat	Activity	Acres	Source
Adjacent/buffer habitats	Enhanced	0.5	Monitoring Report
Estuarine wetlands	CreatedOnsite	0.1	Monitoring Report

Related Habitat Impacts ?

Habitat	Acres Lost	Source
No Data		

Historical Habitats ?

Habitat	Acres
No Data	

Sites ?

Name	Status	Acres
Arroyo Burro Estuary	Construction completed	0.6

CALIFORNIA WETLANDS

Search

Arroyo Burro Estuary and Mesa Creek Restoration

Basic Info | **Files & Links**

Project files and web links

Add file or link

Sort by: Title | File Type | Submit Date | Submitted by

Project Site Native Plant Species List
Master plant species list for the Arroyo Burro Restoration project
Att 9_master plant list.doc
Submit date: 06/30/2008
Submitted by: Christopher Solek, Southern California Coastal Water Research Project, chriss@sccwrp.org
File type: dataset

Existing Topography at the Project Site
Existing Topography at the Arroyo Burro Restoration Project Site.
SWPP Fig 2.pdf
Submit date: 06/30/2008
Submitted by: Christopher Solek, Southern California Coastal Water Research Project, chriss@sccwrp.org
File type: other
Includes: map

Arroyo Burro Preliminary Restoration Plans
Plans of proposed site layout, landscaping, and tree removal/protection.
AB Estuary Draft Prelim Plans.ppt
Submit date: 06/30/2008
Submitted by: Christopher Solek, Southern California Coastal Water Research Project, chriss@sccwrp.org
File type: plan or permit
Includes: map

Restoration Landscape Plan
Restoration Landscape Plan for the Arroyo Burro Restoration Project. City of Santa Barbara, Public Works Dept., Engineering Division.
Att 1_restoration landscape plan.pdf

Next Steps for the Portal

- Additional functionality via current funding
  - Merge eCRAM + Project Tracking → Portal
  - Additional reporting capability
    - CRAM reports output
    - Customized data queries and standardized reports
- Online mapping functionality
- Data entry via new user interface
  - 401 online application
- Additional data
  - Historical data
  - Level 3 data (coordinate with new 404 monitoring requirements)

Next Steps for CRAM

- Reference network development
- Module development and refinement
  - Depressional wetland validation
  - Arid ephemeral stream module
  - Wet Meadow module
- 2-day agency-specific trainings planned for 2011
  - State Waterboard Training Academy


SCCWRP
Established 1969
SAN FRANCISCO ESTUARY INSTITUTE
Region-wide Science for Ecosystem Management
SFEI
Moss Landing Marine Laboratories
CALIFORNIA COASTAL TRAIL
Local Leadership
Regional Stewardship
Global Significance
Thank you!
chriss@sccwrp.org
714-755-3244
CRAM website www.CRAMWetlands.org
California Wetlands Portal: www.CaliforniaWetlands.net
California Wetlands Monitoring Workgroup:
www.waterboards.ca.gov/mywaterquality/monitoring_council/wetland_workgroup
My Water Quality website: www.CaWaterQuality.net