San Diego River Watershed Report Card

Presentation to CA Water Quality Monitoring Council

Brock Bernstein, Chad Loflen

May 29, 2015
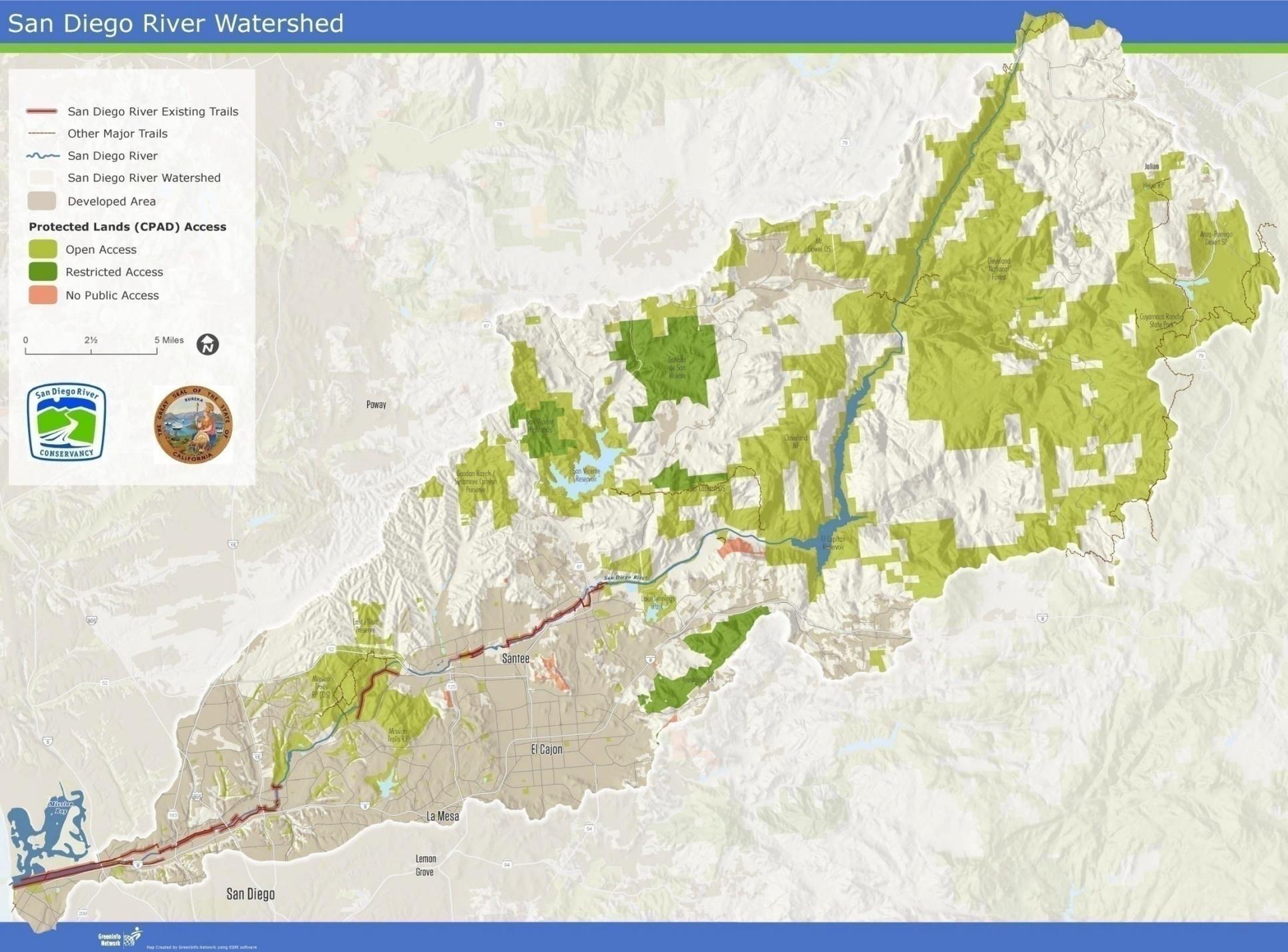
San Diego River Watershed

Legend

San Diego River Existing Trails
Other Major Trails
San Diego River
San Diego River Watershed
Developed Area

Protected Lands (CPAD) Access

Open Access
Restricted Access
No Public Access

0   2½   5 Miles

San Diego River CONSERVANCY

Poway
Julian
Anza-Borrego Desert SP
Cleveland National Forest
Mt. Gower OS
Cuyamaca Rancho State Park
Goodan Ranch / Sycamore Canyon Preserve
San Vicente Highlands
San Vicente Reservoir
Cleveland NF
El Capitan Reservoir
San Diego River
Lake Jennings Park
Santee
Mission Trails RP (OS)
Mission Trails RP
Sloan Canyon
El Cajon
La Mesa
Lemon Grove
Mission Bay
San Diego

GreenInfo Network
Map Created by GreenInfo Network using ESRI software

Motivation and Need

Monitoring poorly integrated

- Permittee vs. non-permittee
- Resource agencies vs. all others
- Data not readily accessible
- Many potential partners not engaged

Only partial assessment

- Mostly focused on chemical conditions
- Upper watershed poorly covered
- No overall assessment of key beneficial uses

Ineffective support for decision making

- Adequate information missing for decision makers and the public

Goal

Integrated monitoring

- Indicators for beneficial uses and condition
- Data readily accessible
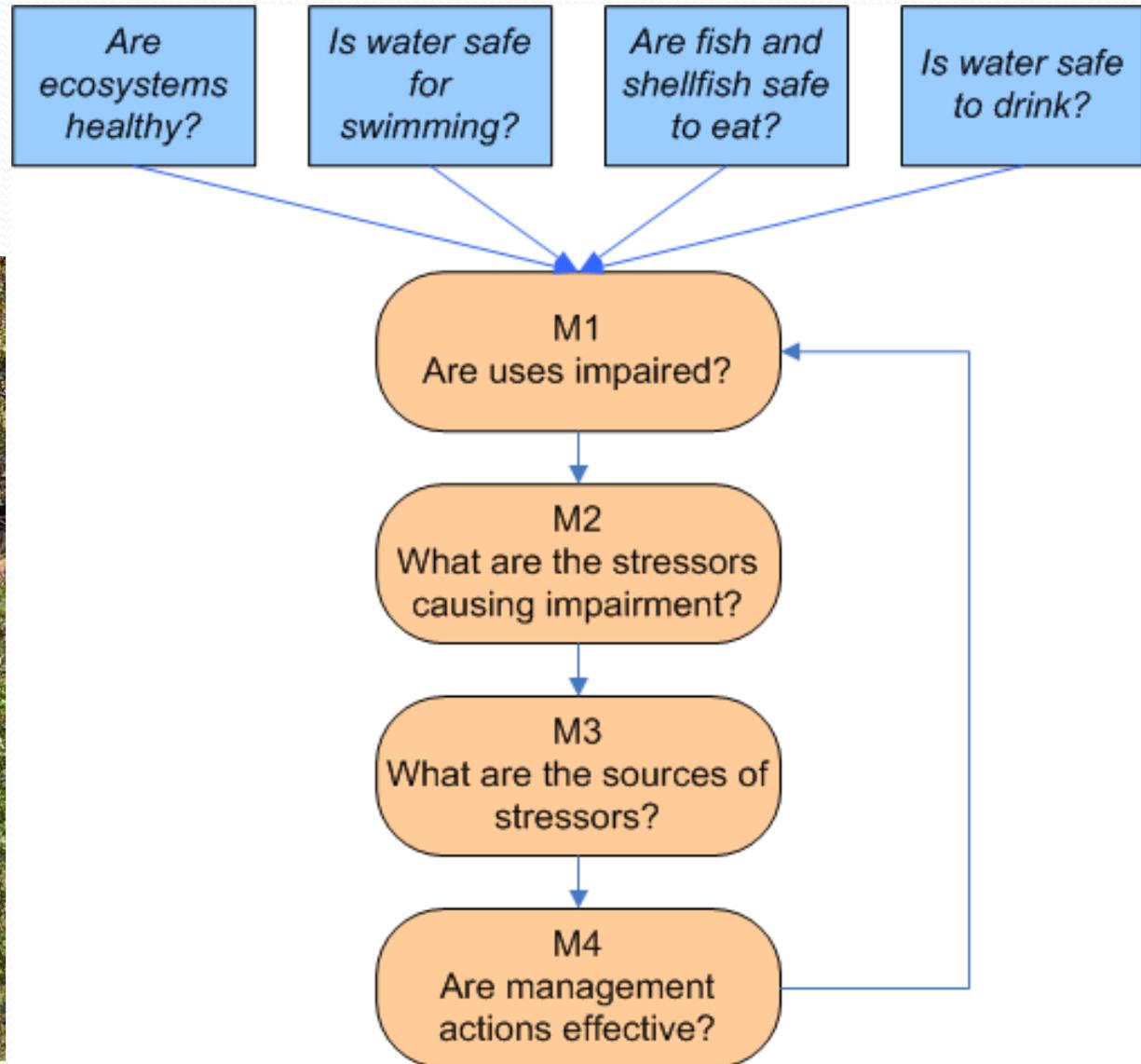- Coordination and collaboration across entire watershed with all stakeholders
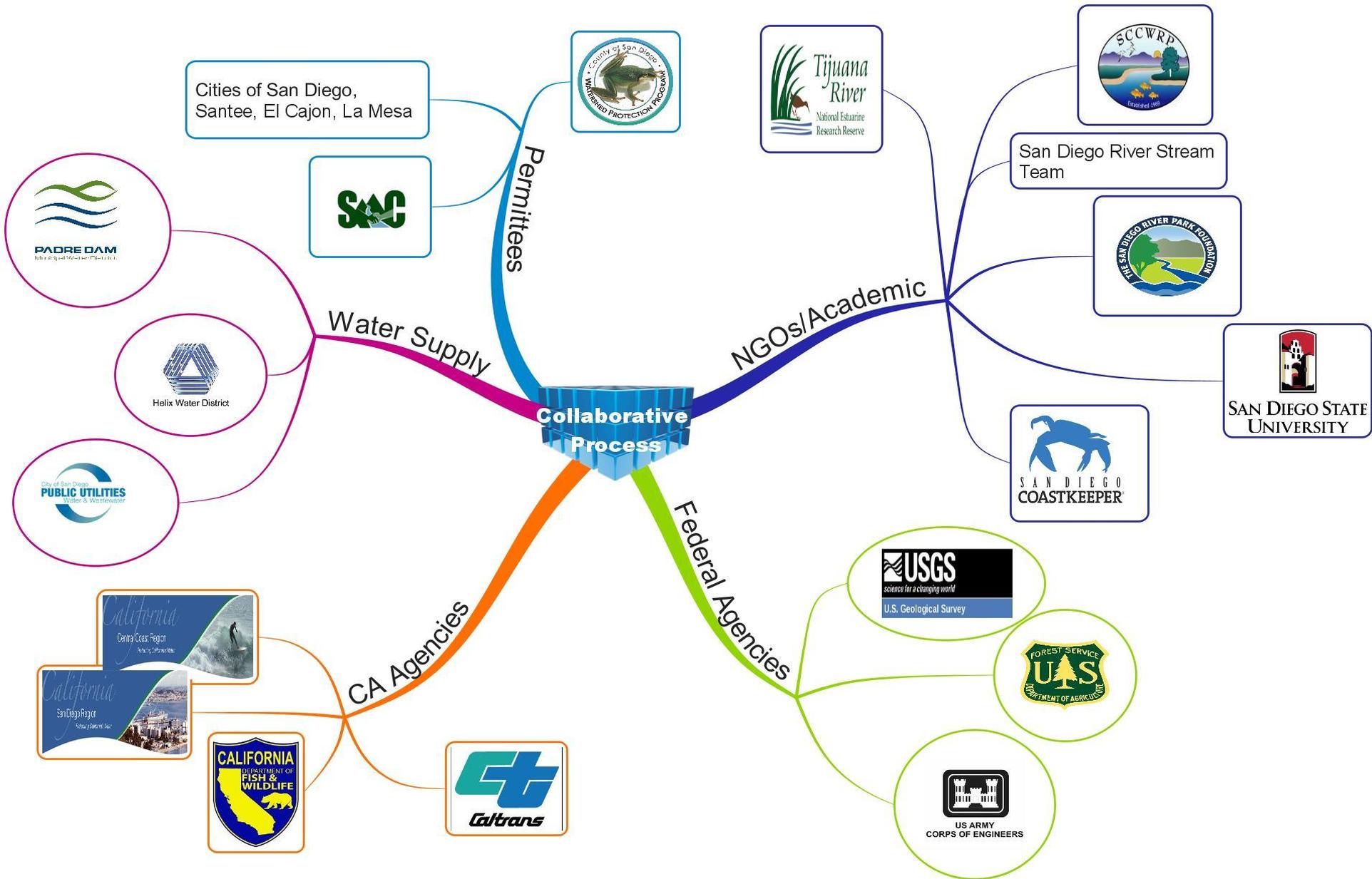
Comprehensive assessment

- Assess beneficial uses in entire watershed
- Support other Water Board programs
- Watershed report cards as transparent process

Effective support for decision making

- Prioritize problems and restoration
- Manage risk
- Track effectiveness of decisions and actions

Question Driven

- Are ecosystems healthy?
- Is water safe for swimming?
- Are fish and shellfish safe to eat?
- Is water safe to drink?

M1 Are uses impaired?

M2 What are the stressors causing impairment?

M3 What are the sources of stressors?

M4 Are management actions effective?

Cities of San Diego, Santee, El Cajon, La Mesa

Permittees

Water Supply

NGOs/Academic

San Diego River Stream Team

Collaborative Process

CA Agencies

Federal Agencies

Helix Water District

San Diego State University

PADRE DAM Municipal Water District

City of San Diego PUBLIC UTILITIES Water & Wastewater

SWAMP
Surface Water
Ambient Monitoring
Program

Final Technical Report | 2014

San Diego River Watershed Monitoring and Assessment Program

Brock B. Bernstein

Prepared for the San Diego Regional Water Quality Control Board

SWAMP-MR-RB9-2014-0001

January 2014

Water Boards

www.waterboards.ca.gov/swamp

Oriented on Key Uses

- Four core categories of use

- Focus on condition, watersheds/waterbodies vs. discharges

- Enable views of data and assessment results from differing perspectives

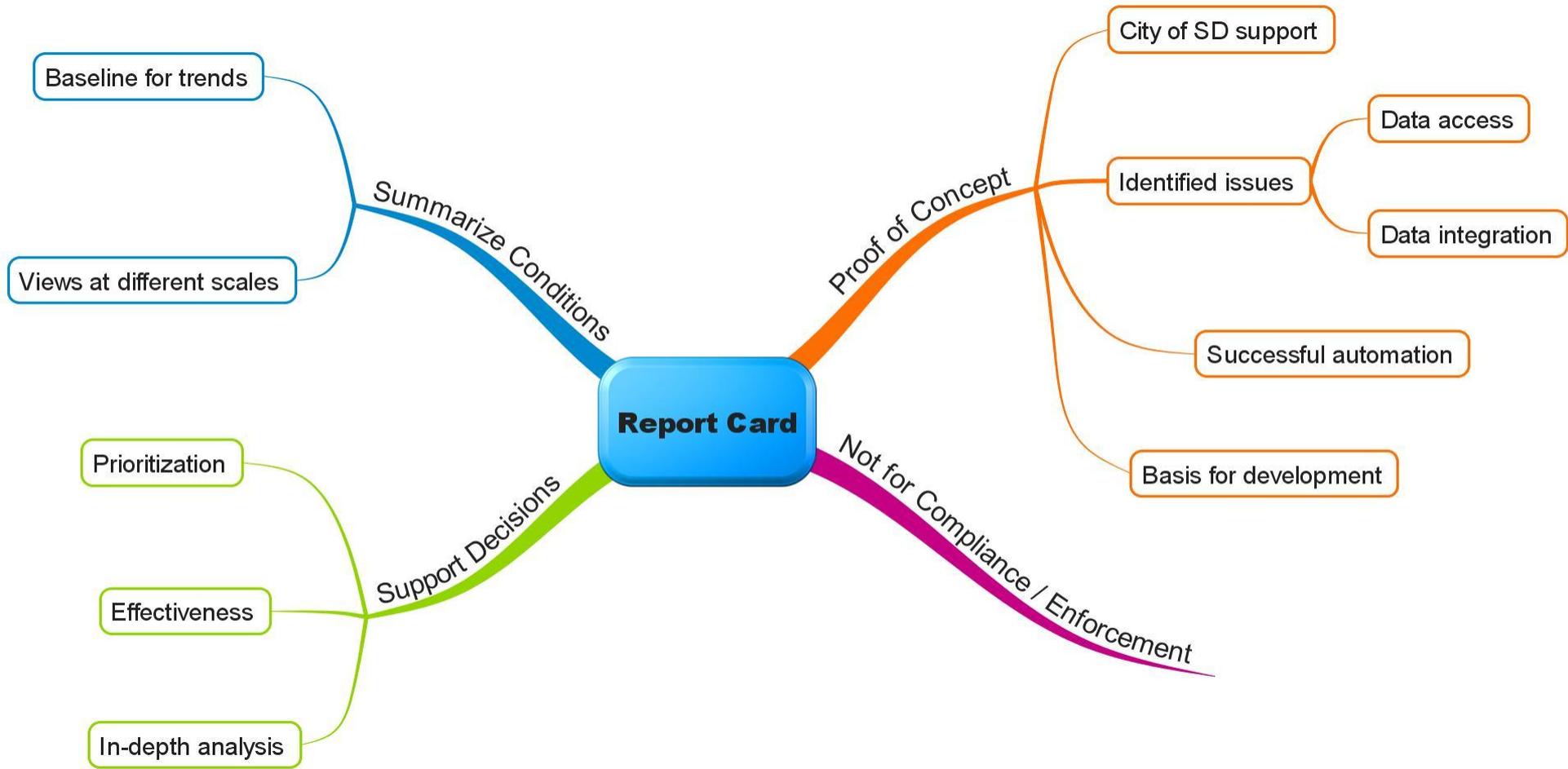- Engage public and academic communities in research, assessment, management

Watershed Report Card

- Means for integrating / synthesizing data from multiple programs
- Vehicle for communicating to multiple audiences
- Readily track spatial and temporal trends
- Diagnostic tool for improving coverage, coordination
- Catalyst for collaboration with others at watershed and regional scales

Millers River — WATER QUALITY REPORT CARD — 2000 Assessment

COLOR KEY: GOOD, CONCERN, FAIR, POOR, N/A

SEGMENT	AQUATIC LIFE							RECREATION		FISH EDIBILITY
	BIOLOGY	CHEMISTRY	NUTRIENTS	TOXICS	SEDIMENTS	FLOW	HABITAT	BACTERIA	AESTHETICS	FISH TISSUE
MILLERS RIVER										
to Whitney pond										
to Winchendon WWTF										
to Otter River										
to South Royalston										
to Orange Center										
to Erving WWTF										
to Connecticut River										
OTTER RIVER										
to Gardner WWTF										
to Seaman Paper Co.										
to Millers River										
TULLY RIVER										
East Branch										
Boyce Brook										
West Branch										
Lawrence Brook										
Main Stem										

Report Card

- Summarize Conditions
  - Baseline for trends
  - Views at different scales
- Proof of Concept
  - City of SD support
  - Identified issues
    - Data access
    - Data integration
  - Successful automation
  - Basis for development
- Not for Compliance / Enforcement
- Support Decisions
  - Prioritization
  - Effectiveness
  - In-depth analysis

San Diego River Watershed Assessment

A conceptual model was developed to assess watershed conditions at different geographic scales over time based on multiple parameters and associated data types. In general, each parameter was assigned to a data type (e.g. SC IBI is included in the "Bugs" data type) and the scores from related data types were then aggregated to produce an assessment score for each of the 4 main watershed assessment categories (Aquatic Biology, Biological Stressors, Habitat Related Stressors, and Water Quality Stressors). More specifically, raw data for each parameter were compiled and scored based on the current methods that are used to assess each parameter. Parameter scores were averaged by year (if multiple samples were collected within the same geographic unit) and converted into a uniform 0-100 scale. For each data type, an average score was calculated (by year and geographic location) based on the component parameter scores. The data type scores were then averaged (again by year and geographic location) to calculate an overall assessment score and associated narrative rating (Excellent, Good, Fair, or Poor) for each of the 4 main watershed assessment categories.
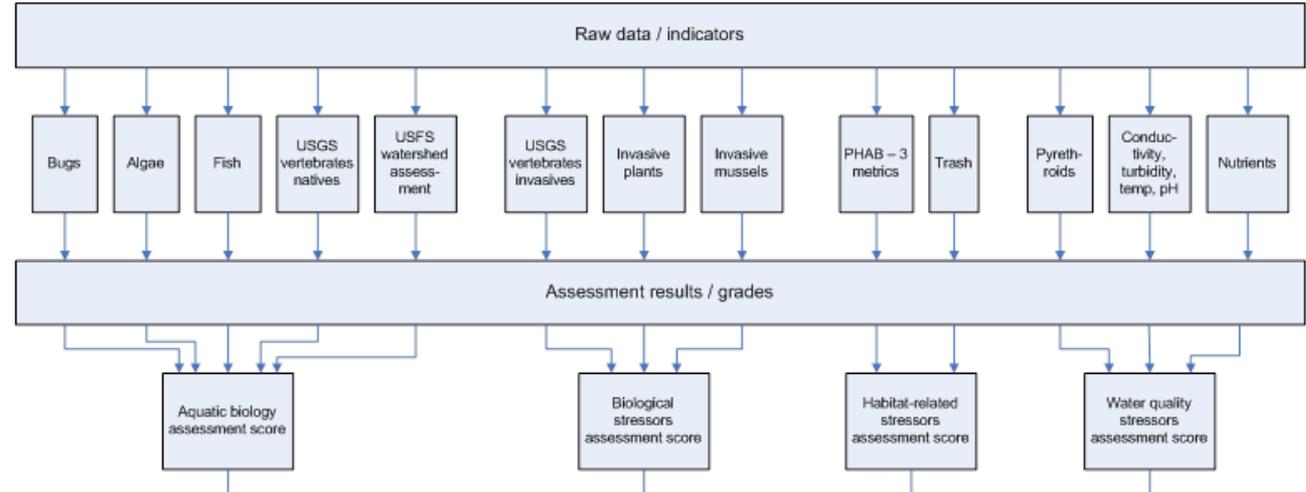
Example Assessment

San Diego River Watershed Assessment

Group Number 5

Group Number	Group Name	Year	GroupID	Biological Indicators	Biological Stressors	Habitat Stressors	Water Quality Stressors
5	HA						
		2005					
			Boulder Creek	Poor			
			El Capitan	Poor			Poor
			Lower San Diego				Poor
			San Vicente	Poor			
		2006					
			Lower San Diego	Poor			Poor
		2007					
			Boulder Creek	Poor			
			El Capitan	Poor			
			Lower San Diego		Excellent		Fair
			San Vicente	Poor			
		2008					
			Boulder Creek	Poor	Good		Excellent
			El Capitan	Poor			Poor
			Lower San Diego	Poor	Good	Fair	Poor
			NA		Excellent	Excellent	
			San Vicente	Poor	Fair		

San Diego River Watershed Assessment

Group Number 5

Group Number	Group Name	Year	GroupID	Biological Indicators	Biological Stressors	Habitat Stressors	Water Quality Stressors
5	HA						
		2009					
			Boulder Creek	Poor	Good	Excellent	Excellent
			El Capitan	Fair			Excellent
			Lower San Diego		Good	Poor	Poor
			NA		Excellent	Excellent	
			San Vicente	Poor	Poor		
		2010					
			Boulder Creek	Poor	Fair	Good	Fair
			El Capitan	Poor		Good	Fair
			Lower San Diego	Poor	Good	Poor	Poor
			NA		Excellent	Excellent	
			San Vicente	Poor	Fair		Poor
		2011					
			Boulder Creek	Poor		Good	Excellent
			El Capitan	Good		Good	Excellent
			Lower San Diego		Good	Good	Fair
			NA		Excellent	Excellent	
		2012					
			Boulder Creek		Good		
			El Capitan	Fair			Excellent
			Lower San Diego	Poor	Good	Fair	Fair
			NA		Excellent	Excellent	
			San Vicente		Good		

Flexible Scaling

Conceptual Model | Data Sources | Scoring Methodology | Data Import | **Generate Assessment**

The user must select a geographic group at which the variables for the Assessment will be assembled. There are 8 groups available (listed below from smallest to largest). Group number 4 (HUC12) is the default group and splits the San Diego River watershed into 14 separate units.

1. Stream Reaches, NHD+ v2 (n=524)
2. Subcatchments from modeling (SWSID) (n=715)
3. Hydrologic Subarea (HSA) (n=14)
4. HUC12 (n=14) [DEFAULT]
5. Hydrologic Area (HA) (n=4)
   -- Boulder Creek
   -- El Capitan
   -- San Vicente
   -- Lower San Diego River
6. HUC10 (n=3)
   -- Upper San Diego River
   -- San Vicente Creek
   -- Lower San Diego River
7. Upper vs. Lower San Diego River (n=2)
8. Entire Watershed (n=1) (all within HUC08)

Group Number   [4   ▼]

Assessment View Type [Report View   ▼]

If the user changes the GroupNumber (above) close the report before clicking the Generate Report Card button (below).

[Generate Assessment]   [Number of Datapoints]

The Assessment can be saved or printed for reference later.
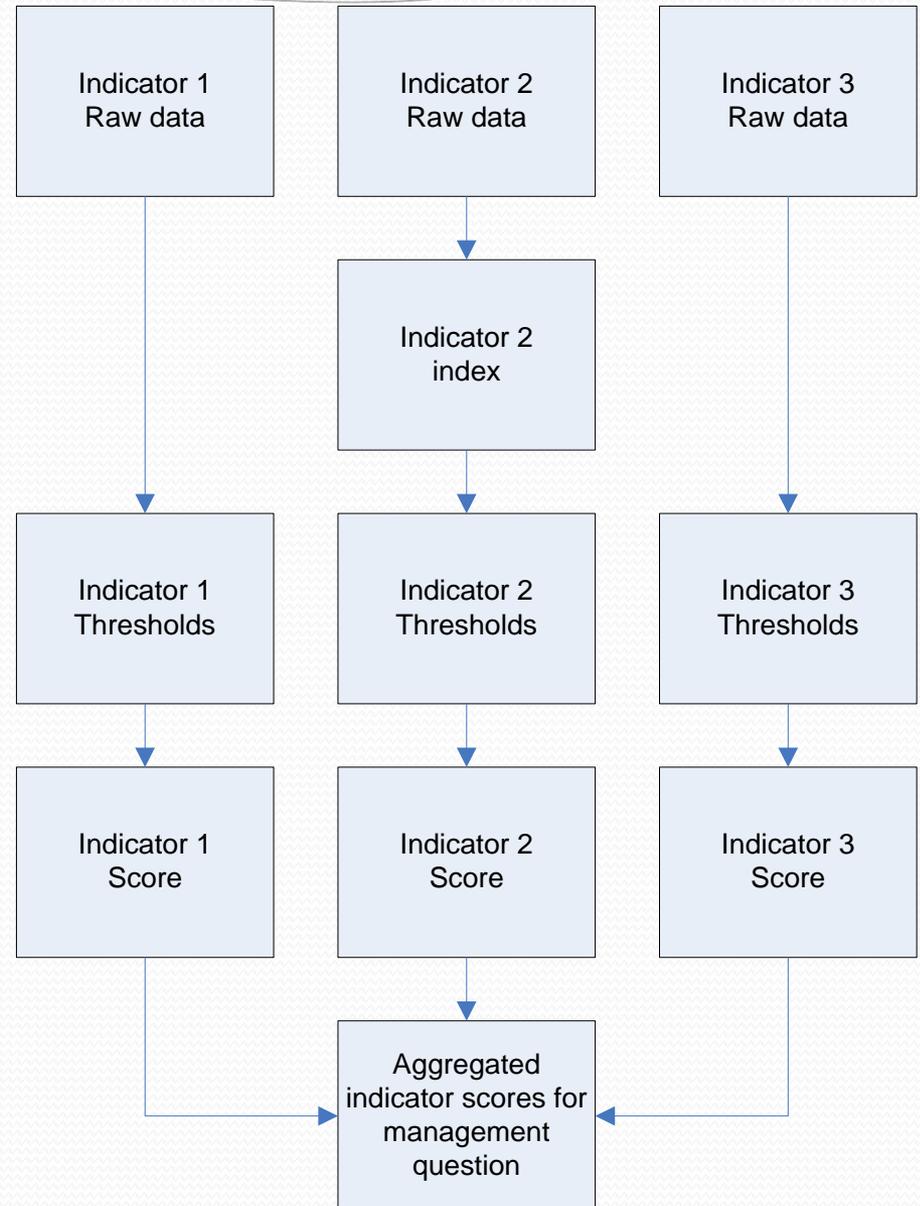
Report Card Approach

- Identify uses and other assessment endpoints
- Define stream segments / watershed subareas
- Select indicators
- Identify scoring thresholds
- Create scoring / assessment method OR
- Convert scores to SD River Report Card scores
- Conduct data acquisition / integration
- Decide level of integration / aggregation
- **All involve intensive collaboration and iteration**

Overall Report Card Structure
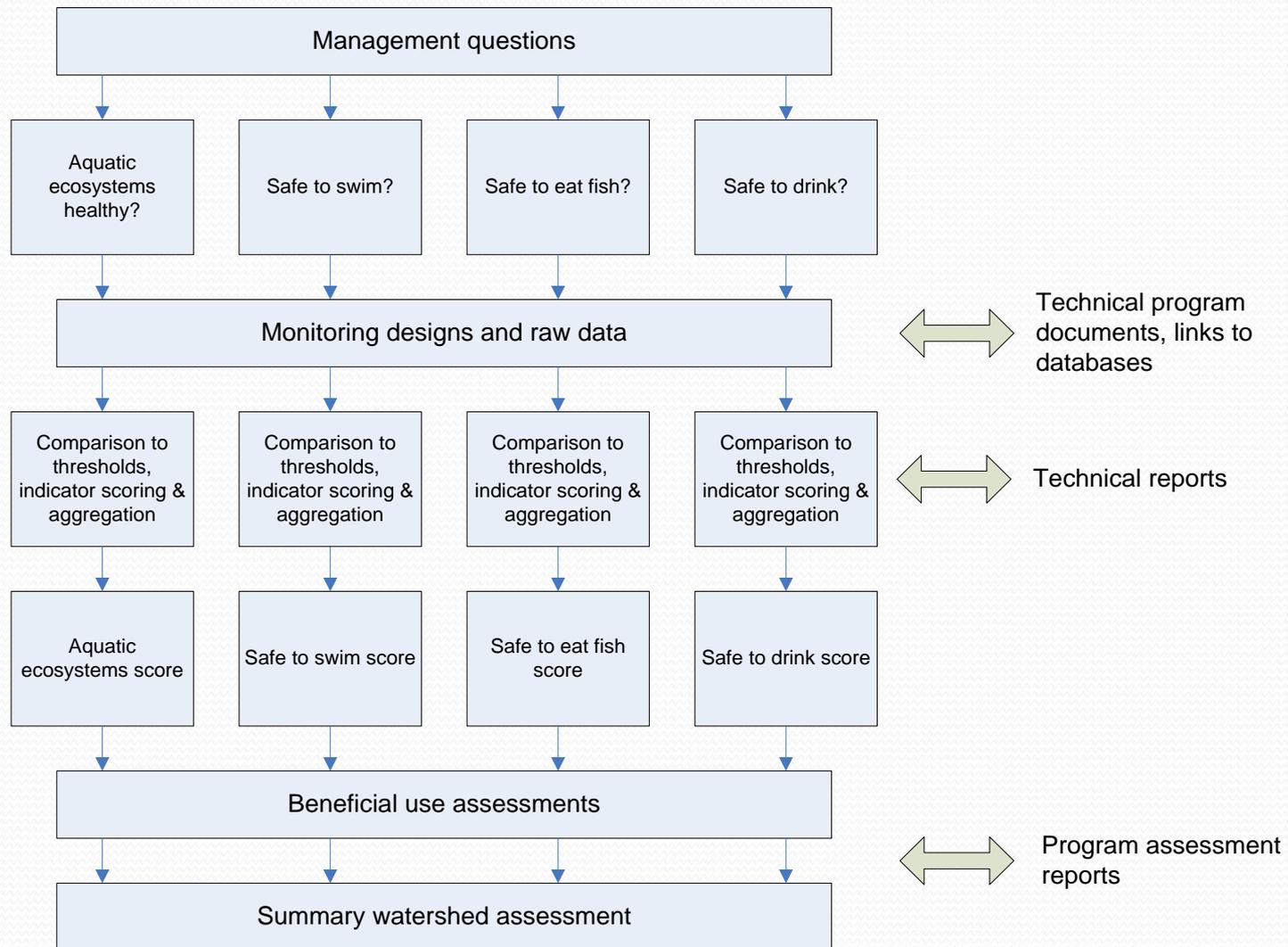
Management Question Detail

- Multiple indicators per question
- Different scoring for each indicator
- One aggregated score per question
- **Scoring and aggregation key issues**

Indicator 1 Raw data	Indicator 2 Raw data	Indicator 3 Raw data
	Indicator 2 index	
Indicator 1 Thresholds	Indicator 2 Thresholds	Indicator 3 Thresholds
Indicator 1 Score	Indicator 2 Score	Indicator 3 Score

Aggregated indicator scores for management question

Safe to Swim Example

Fecal coliforms	*E. coli*	*Enterococcus*

← Thresholds

Indicator scores

← Average of scores

Safe to Swim assessment score
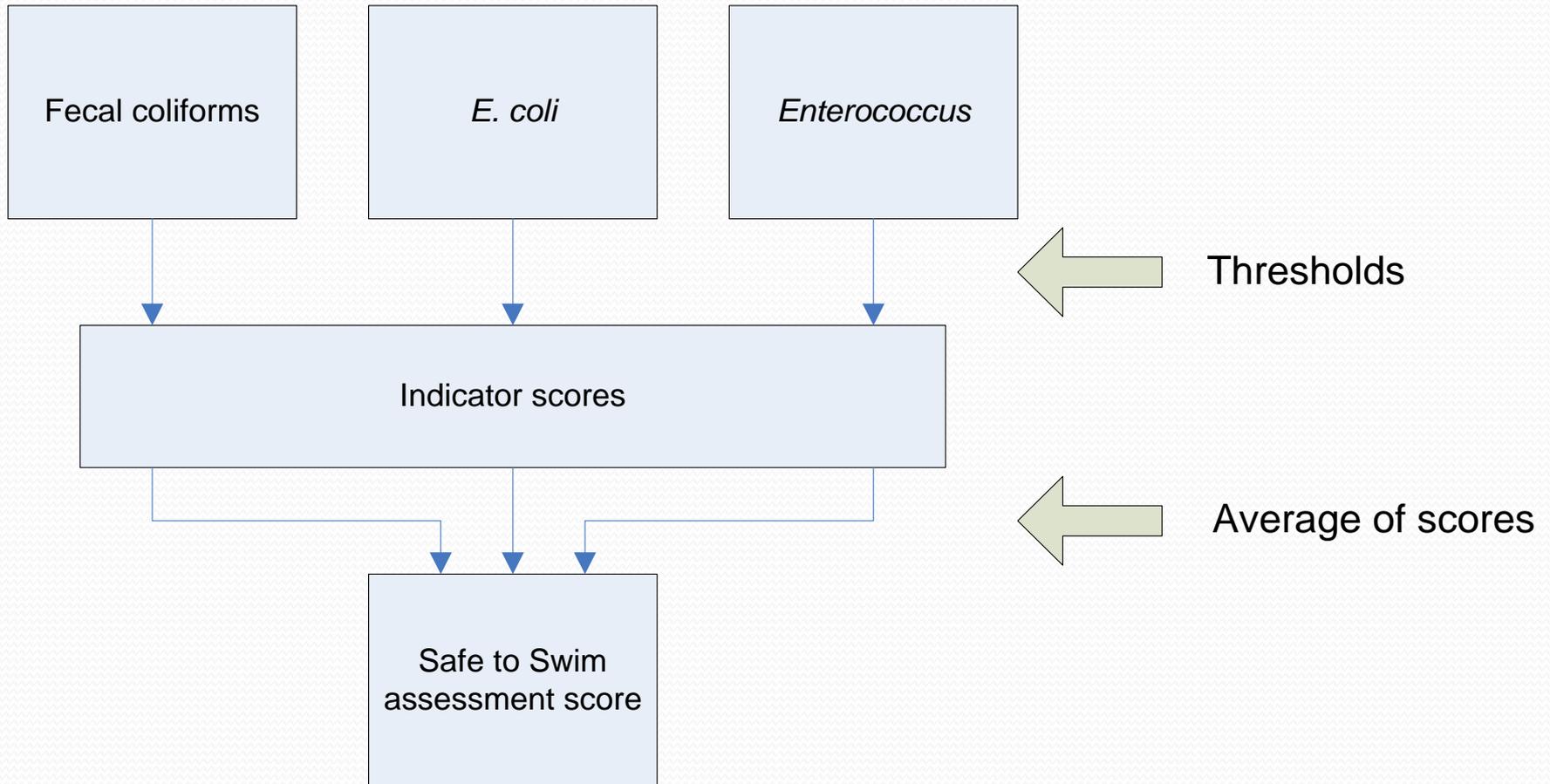
Availability of Scores

- Scoring methods exist for some indicators
  - Macroinvertebrates
  - Algae
  - Toxicity and many chemicals
  - Fish tissue
  - Bacteria
  - Invasive plants
- No scoring methods for other indicators
  - Invasive mussels
  - Fish communities
  - Physical habitat
  - Vertebrates (amphibians, reptiles)
  - *Had to create scoring methods for these*
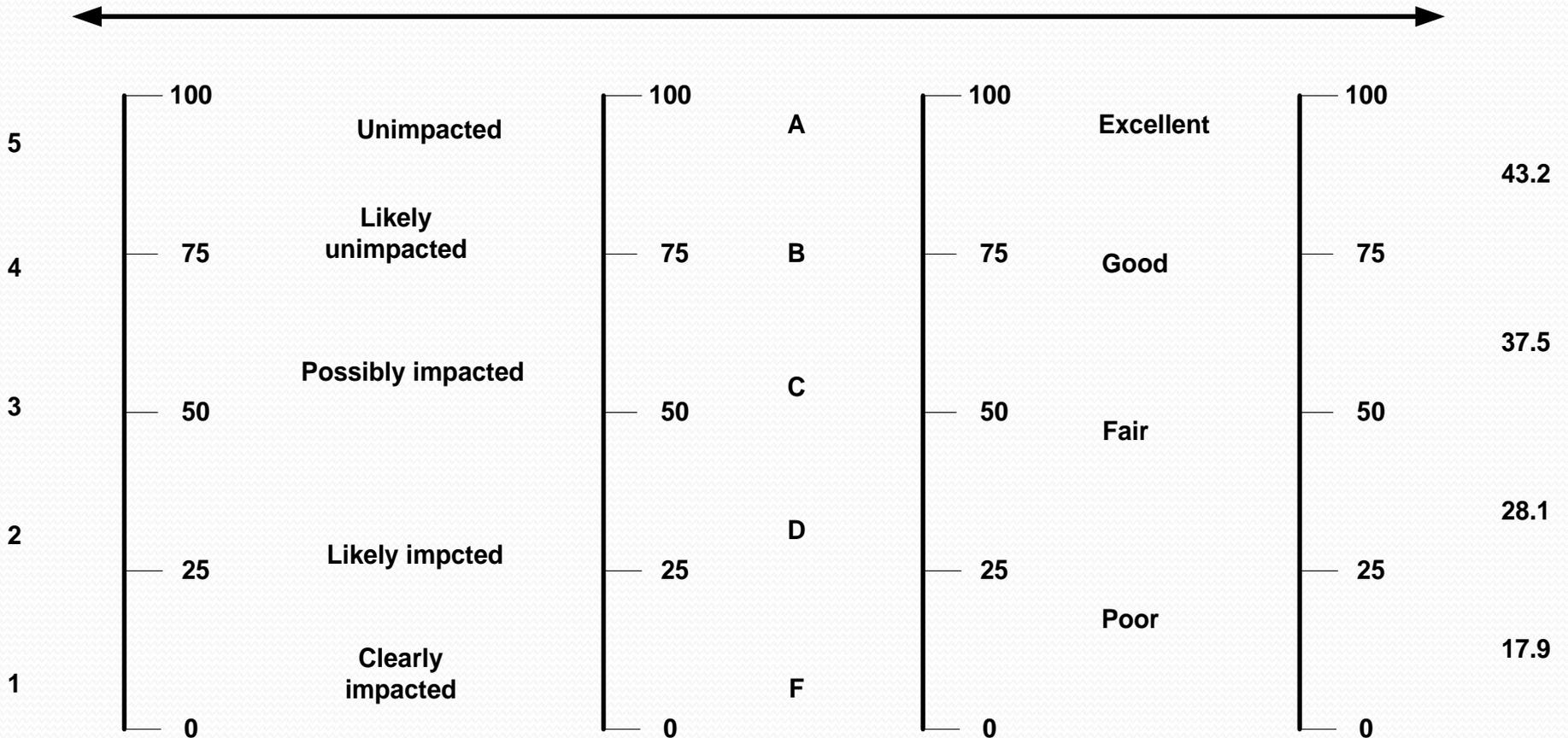- **Scoring methods all differ from each other**

Scoring & Thresholds

- Scores turn raw data into dimensionless values
  - IBI, invasive plant index, water quality index, 0 – 100 score
- Thresholds make raw data and/or scores meaningful
  - Letter grades; poor, good, excellent; unimpaired, likely impaired, impaired
- Anchored to reference condition if possible
- Should show differences between good and bad condition
- Reflect management goals
  - Compliance, prioritization, compare / track overall condition
- **BUT: No single set of universally accepted thresholds and scoring algorithms**

Created a Common Scale

Excellent:	95 – 100	Comparable with reference; absence of threat or impairment
Good:	80 - 94	Consistently meets criteria with only rare departures from desired conditions; beneficial uses protected with only minor threat or impairment
Fair:	65 – 79	Usually meets criteria but beneficial uses occasionally threatened or impaired
Poor:	0 - 64	Frequently or never meets critera; beneficial uses frequently or usually threatened or impaired

Conversion to the Common Scale

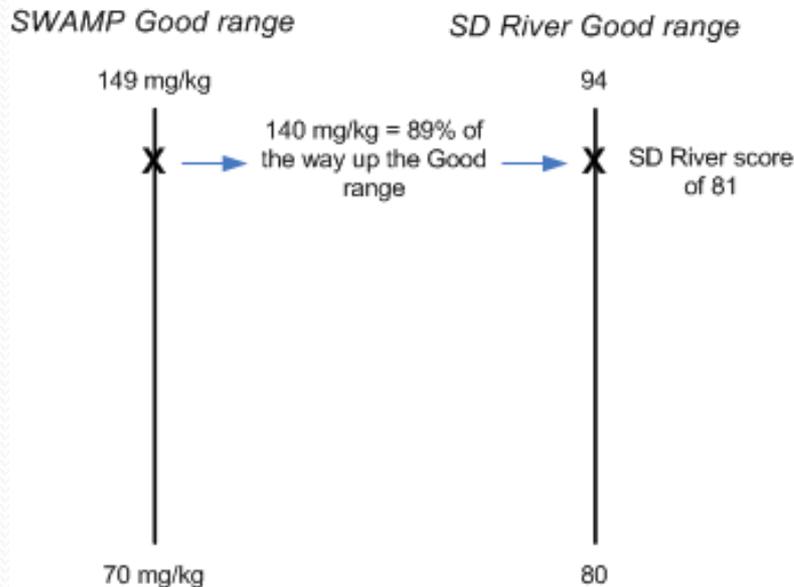|							
5	**100**	**Unimpacted**	**100**	**A**	**100**	**Excellent**	**100**
							43.2
4	**75**	**Likely unimpacted**	**75**	**B**	**75**	**Good**	**75**
							37.5
3	**50**	**Possibly impacted**	**50**	**C**	**50**	**Fair**	**50**
2	**25**	**Likely impcted**	**25**	**D**	**25**		**28.1**
							25
1	**0**	**Clearly impacted**	**0**	**F**	**0**	**Poor**	**17.9**
							0

Safe to Eat Fish Example

- Use OEHHA thresholds
- Convert OEHHA thresholds to SD River thresholds
- Convert raw data to SD River scores, using thresholds
- Convert SD River scores to narrative results (good, poor)

Mercury in fish tissue → **DDTs in fish tissue** → **PCBs in fish tissue**

⟸ Thresholds

Indicator scores

⟸ Average of scores

Safe to Eat assessment score

Mercury example

SWAMP Good range   *SD River Good range*

149 mg/kg   94

X → 140 mg/kg = 89% of the way up the Good range → X SD River score of 81

70 mg/kg   80
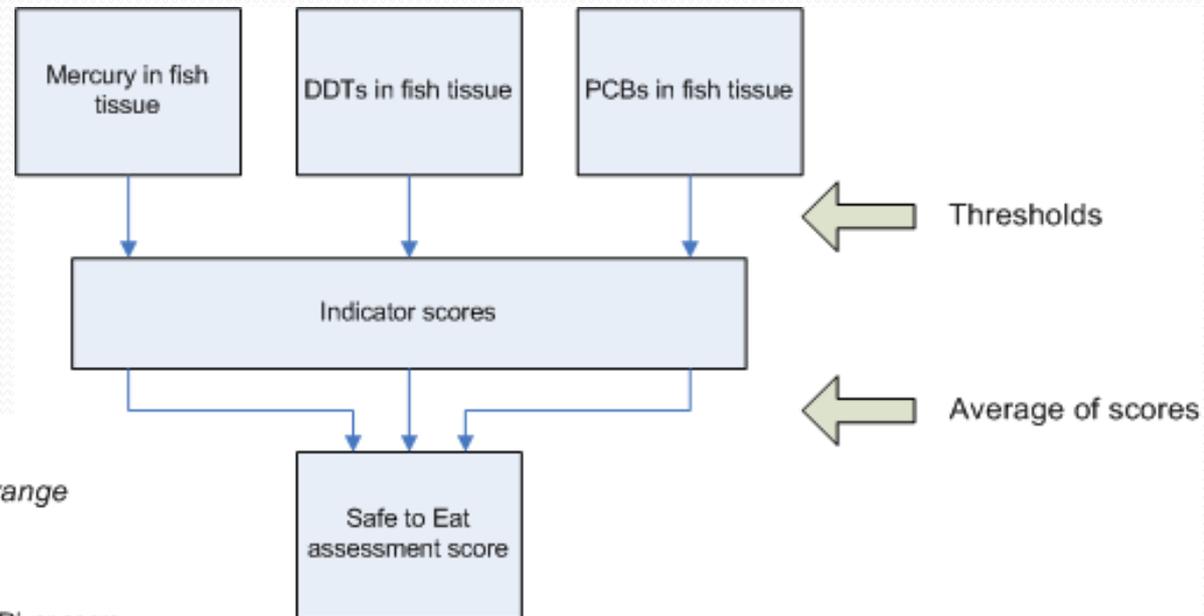
Confidence in the Assessment

- Two indicator categories
  - Traditional quality control
  - Study design
- Indicators scores on qualitative 1 – 4 scale
- Two scores reported separately
  - Reflect distinct aspects
  - If averaged together, same score could have dramatically different meaning
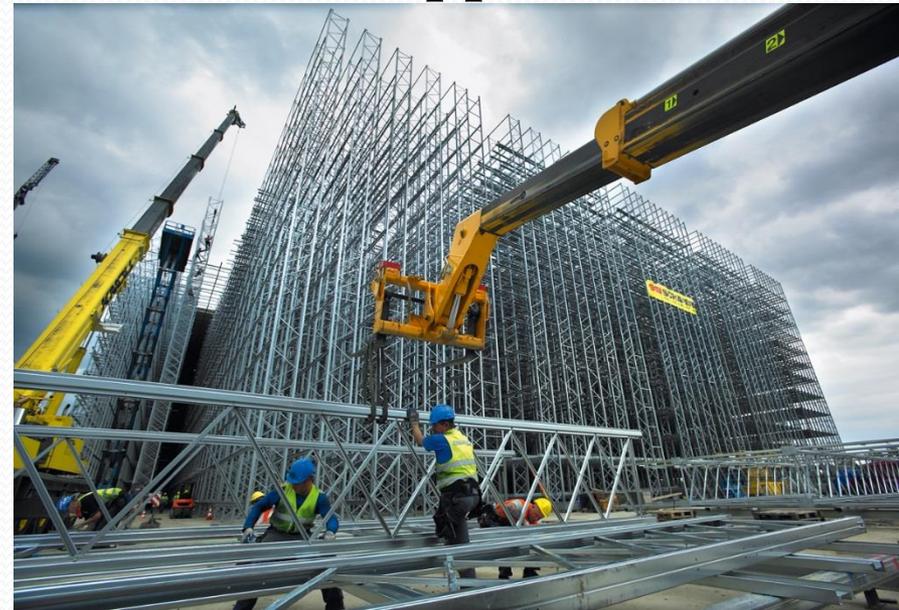
Confidence Indicators

	Confidence score			
	1	2	3	4
Traditional QC				
Informal QAPP / SOP				
Formal QAPP / SOP				
Laboratory accreditation				
Use established laboratory methods				
Use established field methods				
Informal data management plan				
Formal data management plan				
Data verification protocol				
Staff training program				
Field and/or laboratory intercalibration exercises				
Peer-reviewed publication(s) using data				
Data entered into CEDEN or equivalent				
Study design				
Old or limited data				
Some current data				
Current data				
Complete statistical model				
Reference condition defined				
Adequate replication				
Data analysis methods defined				

Implementation

- Ongoing work on indices and thresholds
  - CA Dept. F&W re fish community
  - SMC project on indices and visualization
  - Collaboration with Central Coast Water Board
- New SDSU Watershed Science Institute provides vehicle for report card R&D, modeling, mapping
- San Diego Water Board interest
  - Directly related to regional biological objectives
  - Effort to integrate regional monitoring and scoring into permit monitoring programs
- Continued interest & support from major permittees, NGOs, resource agencies

Key To-Dos

- Continue to expand scope of indicators
- Develop thresholds and/or indices where needed
- Coordinate with similar efforts regionally
- Develop GIS display features
- Create stable data management/database approach
- Link to landscape-scale models

Questions?