Bringing it All Together
Water Budget Framework

Presenter:
Saquib Najmus, Ph.D., P.E., PMP
RMC Water and Environment

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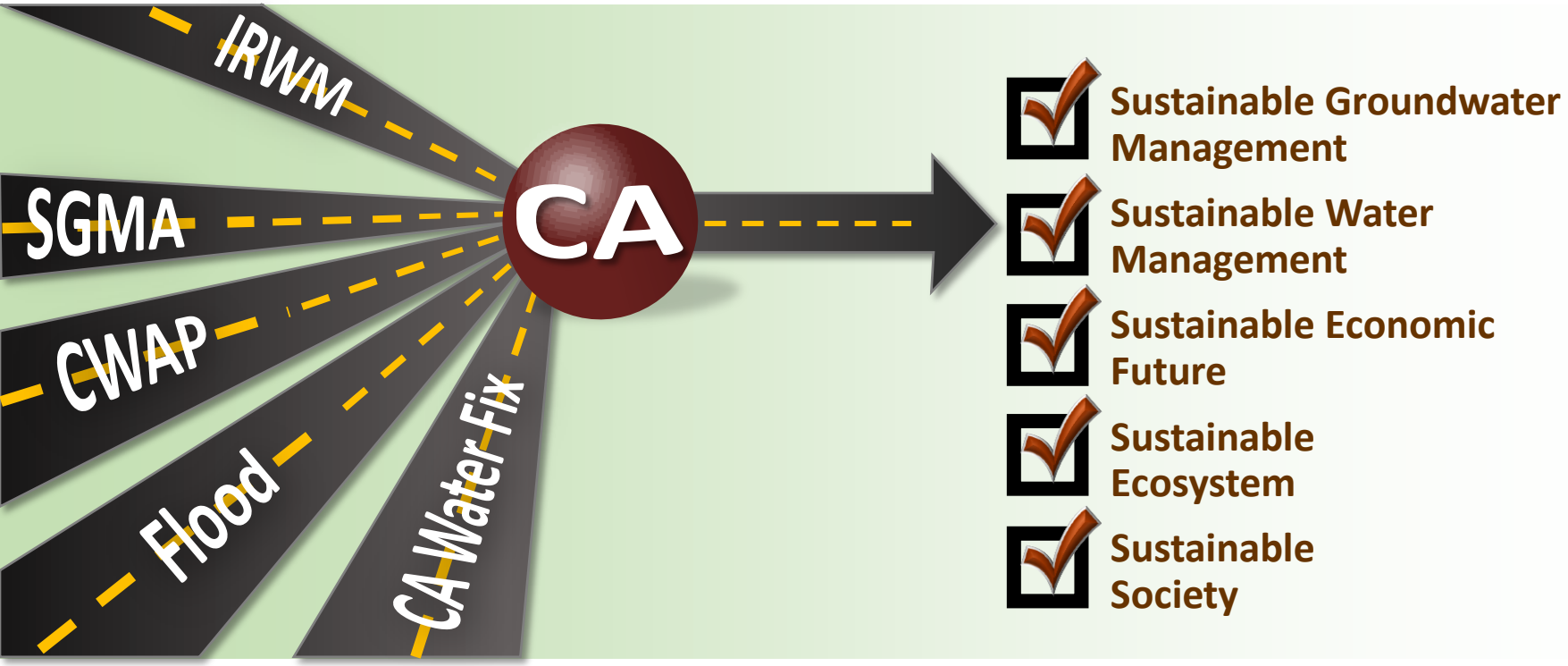
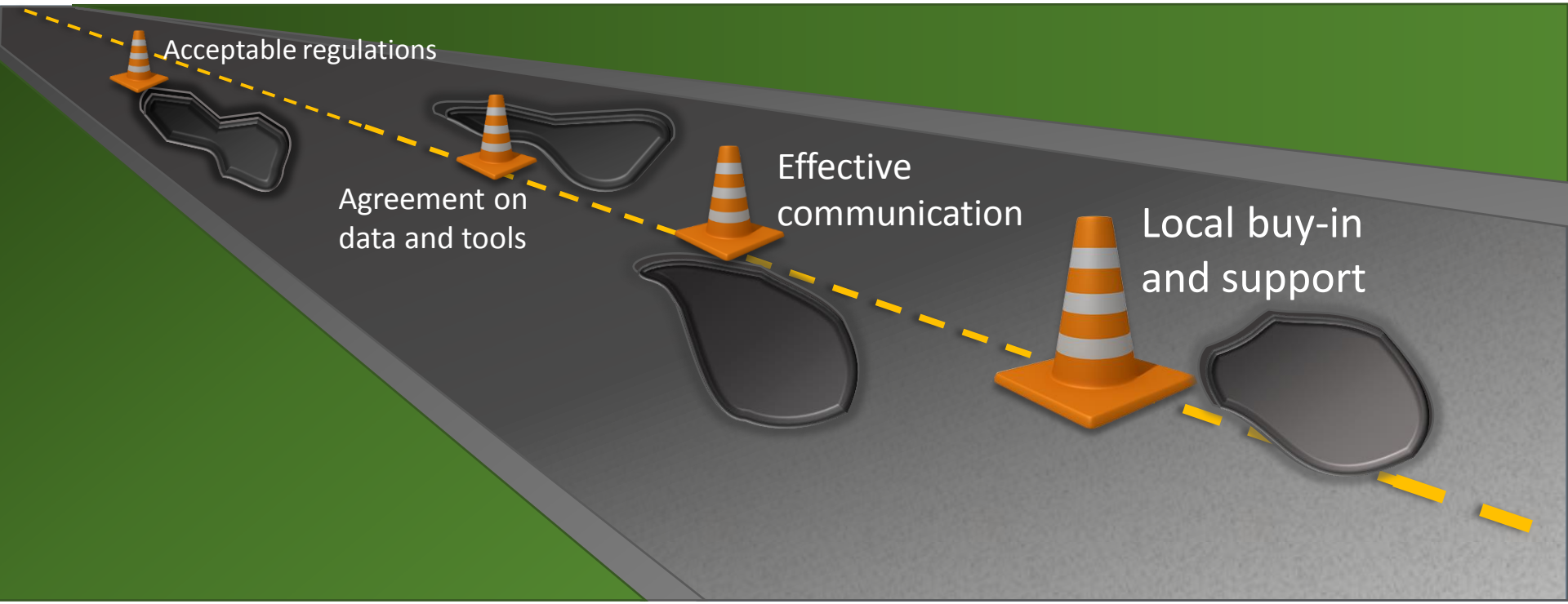
Complex Challenges | Innovative Solutions

California Stands at a Crossroad

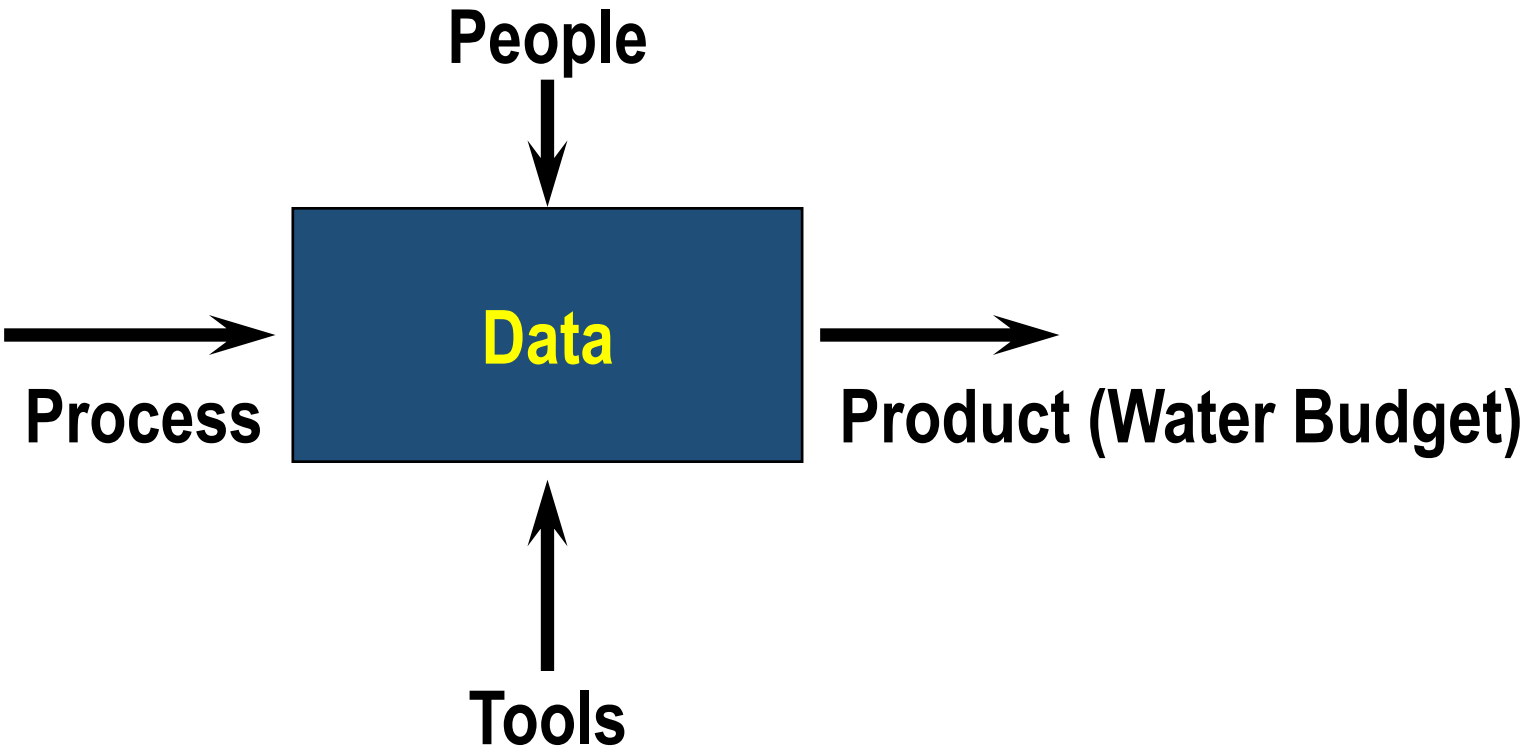


- Sustainable Groundwater Management
- Sustainable Water Management
- Sustainable Economic Future
- Sustainable Ecosystem
- Sustainable Society

There are Challenges Along the Road to Success



Tools are Necessary, But not Sufficient



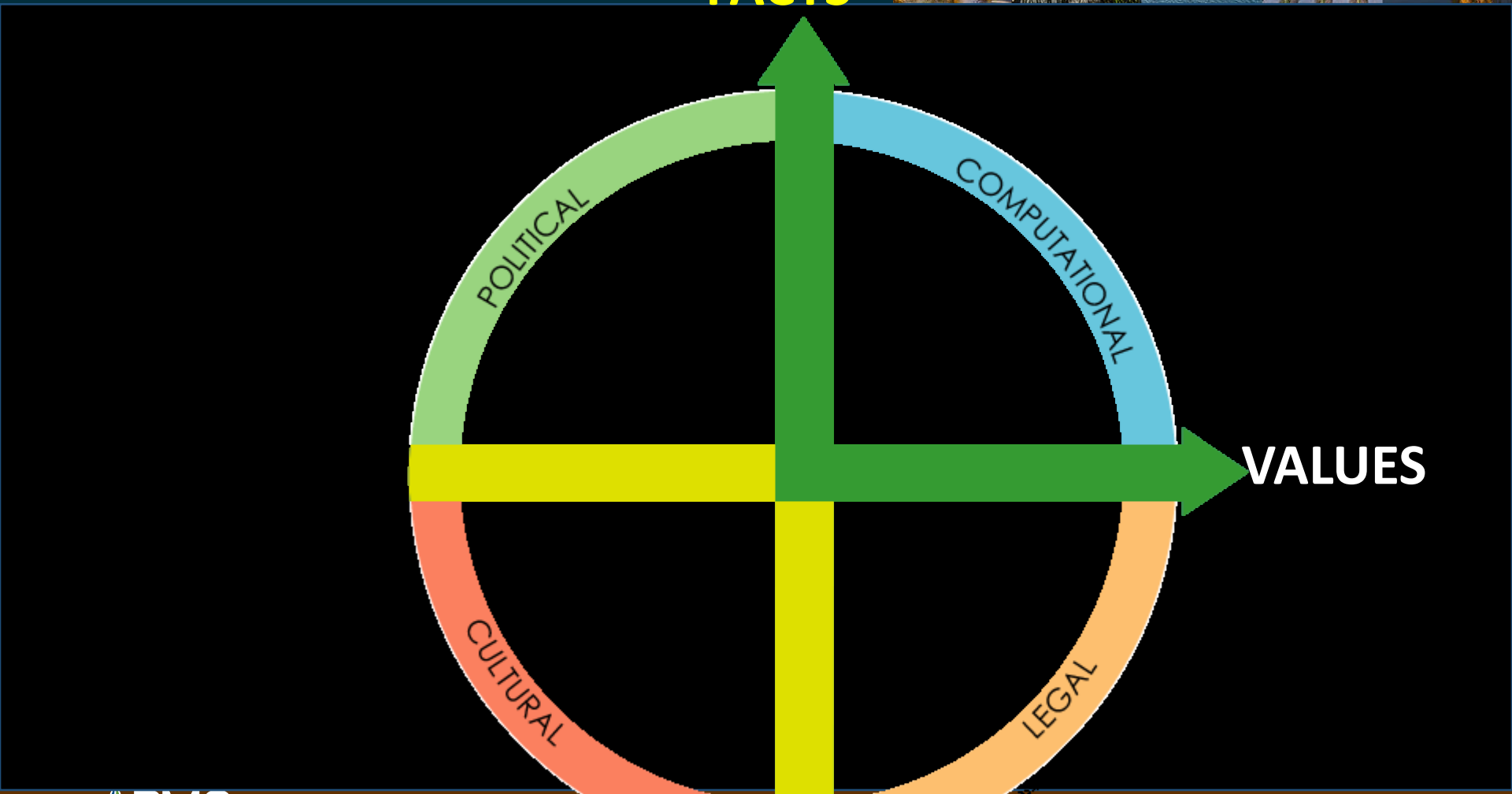
We Need to Understand the Disagreement Problem Domain

RESOLVE CONFLICTS BETWEEN

SCIENTIFIC FACTS
things that are known to be true

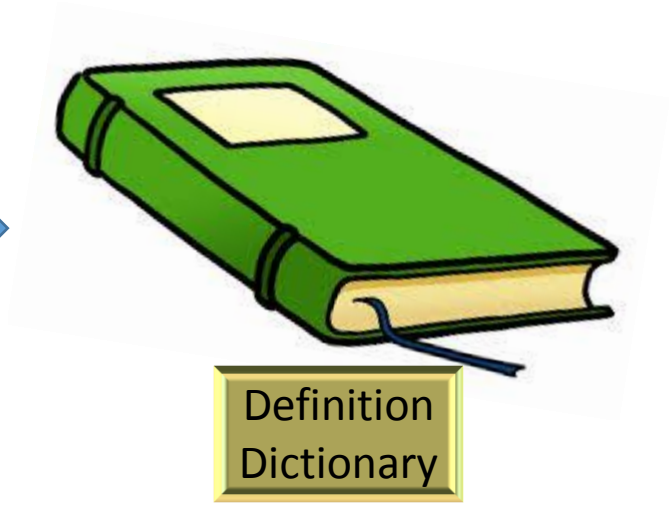
PUBLIC VALUES
things that are regarded as desirable

Disagreement Problem Domain



Challenge of
Common vocabulary

- Same agency, different programs, different terminologies
- Different agencies, different terminologies
- Different models, different terms
- Different agreements, different terms
- Different assumptions, different meanings



Battle of Models

- Platform:

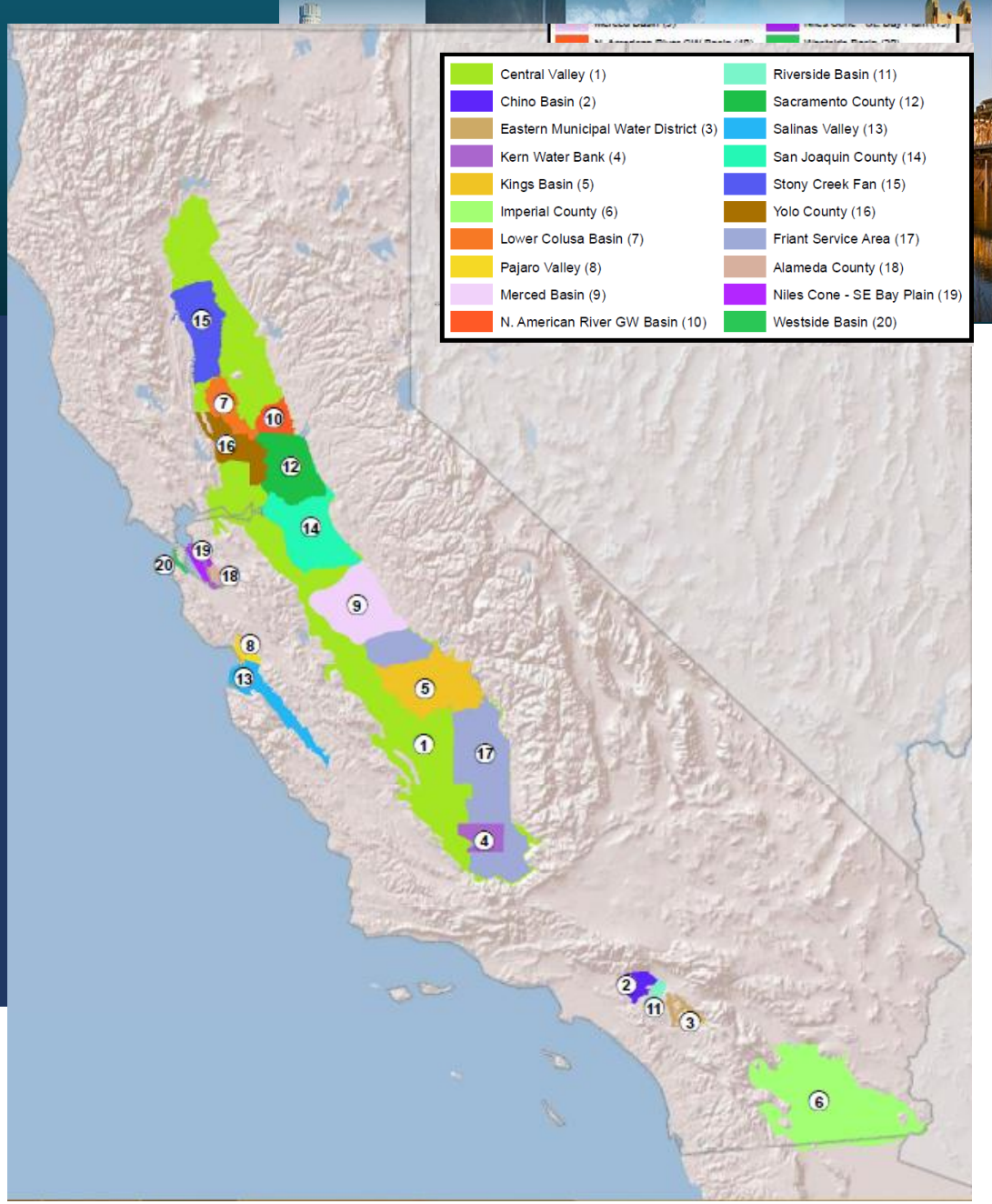
MODFLOW, IGSM, IWFM, MicroFEM

- Geography

Local, Regional, Valley-wide

- Hydrostratigraphy

3-layer, 10-layer, 9-layer, 7-layer



Shakespearean Dilemma

"To model (be), or not to model (be), that is the question

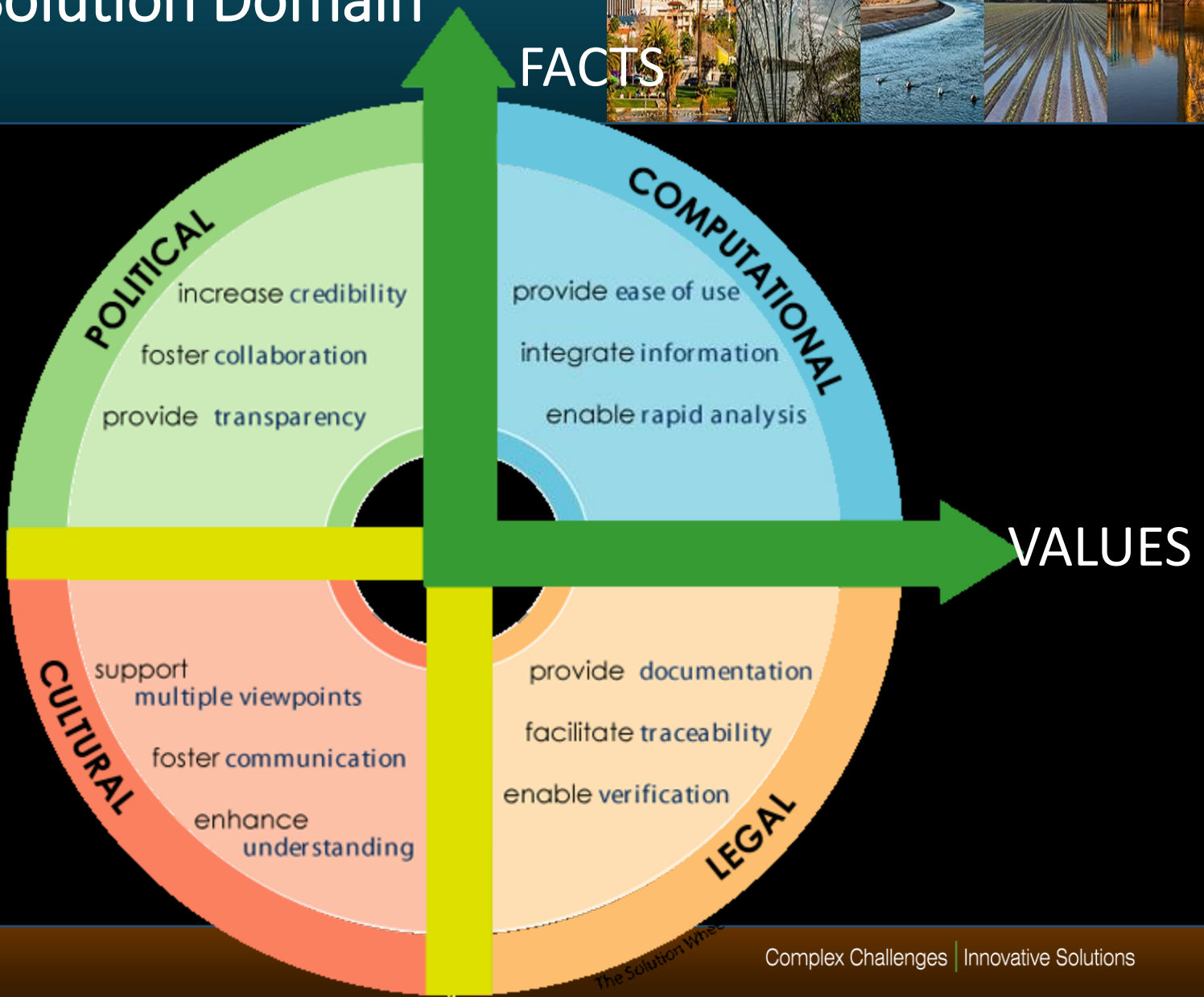
Whether 'tis Nobler in the mind to suffer

The Slings and Arrows of SGMA regulations [outrageous Fortune],

Or to take Arms against a Sea of troubles,

And by collaborating (opposing) end them.."

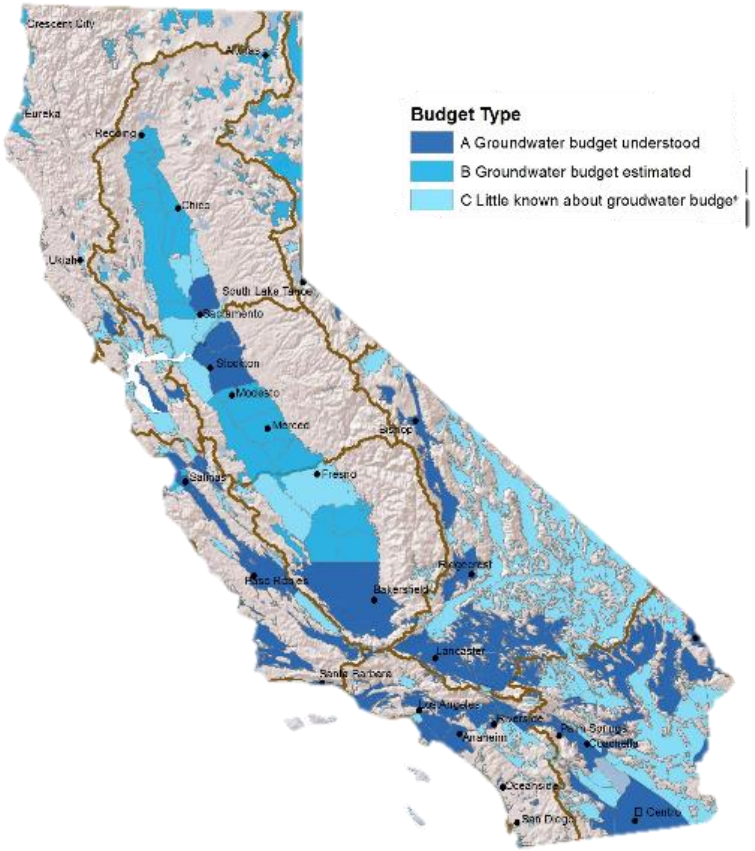
Possible Solution Domain



SGMA is a Big Unifier!
A Solution Framework for Water Budget

- Compilation of all readily available water budgets basin by basin
- Pilot Studies for 2 hydrologic regions to compare and resolve inconsistencies in vocabulary, data, assumptions, and computational methods
- Integrated data framework to share data to improve transparency and credibility
- Draft Water Budget Framework with standard vocabulary, data, assumptions, computational methods and approach to resolving inconsistencies
- Option for developing water budget with and without model

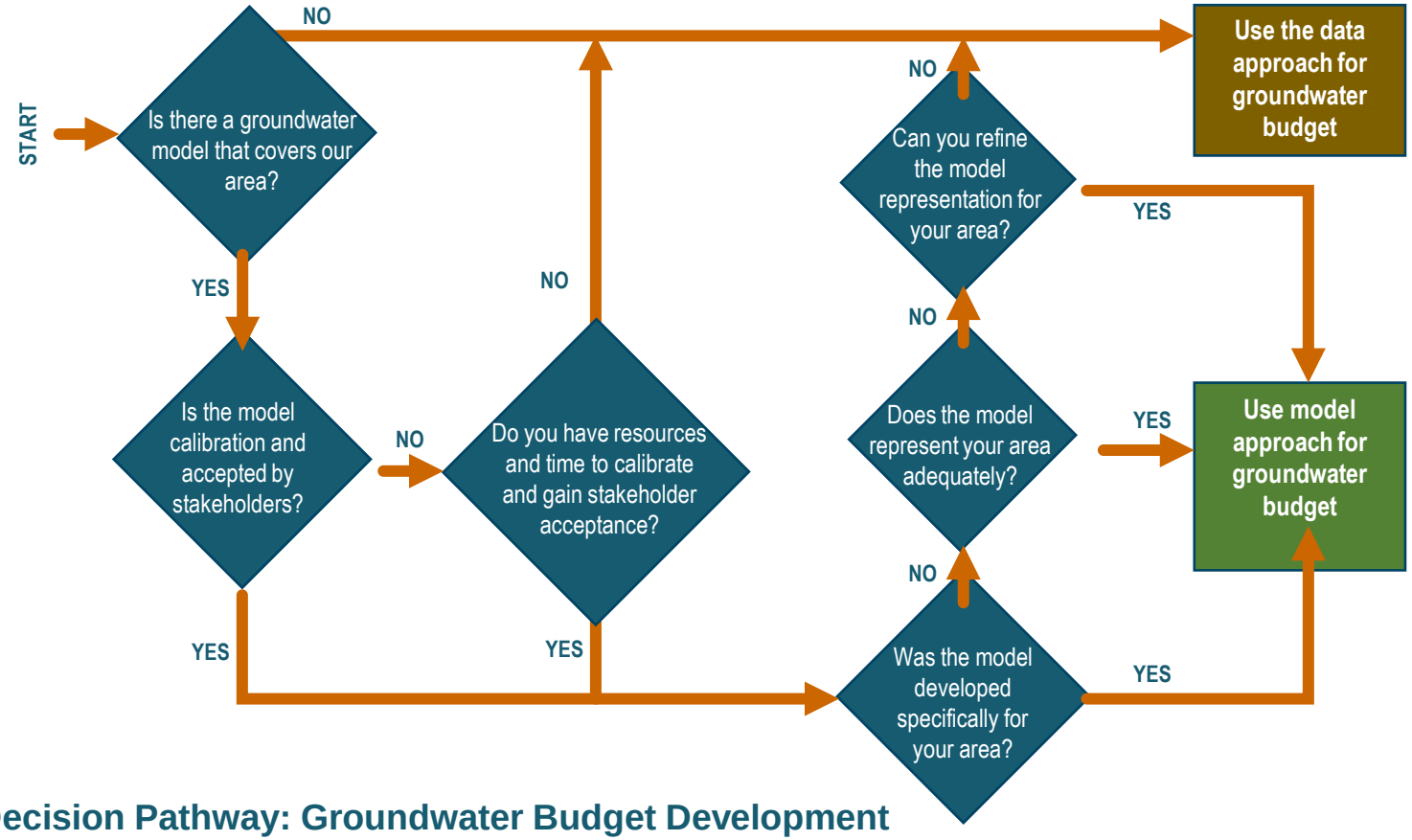
State of water budget and modeling in California



Bulletin 118, 2003
Water Budget Status

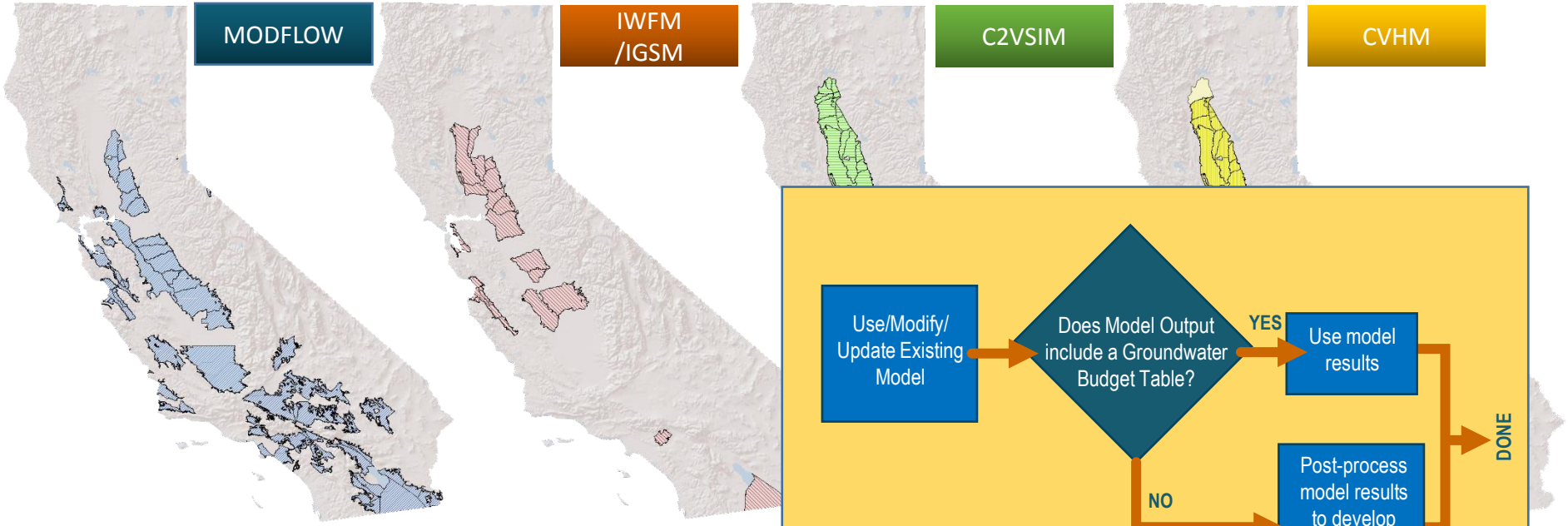
Modeling and
Data Management

Water Budget Development
To model or not to model?



Decision Pathway: Groundwater Budget Development

Model based approach: A partial snapshot



Data based approach:

Step 1: Develop conceptual model and determine data need/adequacy

Aquifer

Collect well logs, e-logs, pump tests, study reports to develop a conceptual model of the aquifer

Past Studies

Compile any previous estimates of groundwater budget components in your area and surrounding groundwater basin

Data Checklist

Complete the GW budget calculation checklist to determine which component is applicable in your area and which data is required

Yes

Groundwater Budget - Data Matrix

$\Delta S = I - O$

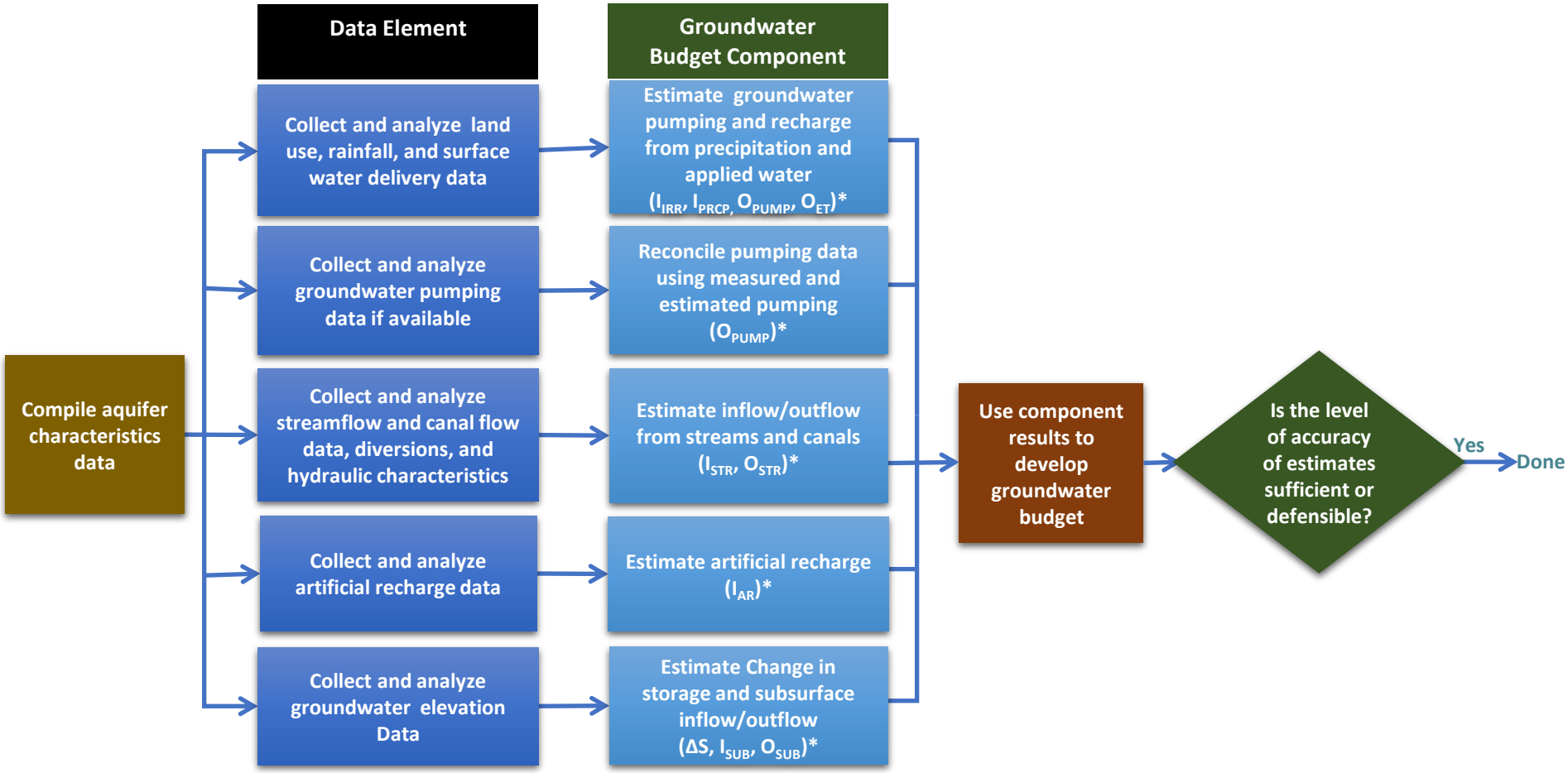
$I = I_{RAIN} + I_{AW} + I_{SUB} + I_{STR} + I_{AR}$

$O = O_{PUMP} + O_{SUB} + O_{STR} + O_{ET}$

Budget Component		Is this budget component significant in your area?	Data Needed								
			Aquifer Characteristics	GW Head	GW Pumping	Rainfall	Land Use	Surface Water Diversions/ Delivery	Stream/ Canal Flow	Stream/Canal Characteristics	Artificial/ Other Recharge
Storage Change (ΔS)											
ΔS	Storage Change (ΔS)		✓	✓							
Inflow Components (I)											
I_{RAIN}	Recharge from Rain					✓	✓				
I_{AW}	Recharge from Applied Water				✓		✓	✓			
I_{SUB}	Subsuface Inflow		✓	✓							
I_{STR}	Gain from Stream			✓				✓	✓	✓	
I_{AR}	Artifificial/Other Recharge										✓
Outflow Components (O)											
O_{PUMP}	Groundwater Pumping				✓						
O_{SUB}	Subsurface Outflow		✓	✓							
O_{STR}	Loss to Streams			✓				✓	✓	✓	
O_{ET}	ET from Groundwater			✓			✓				

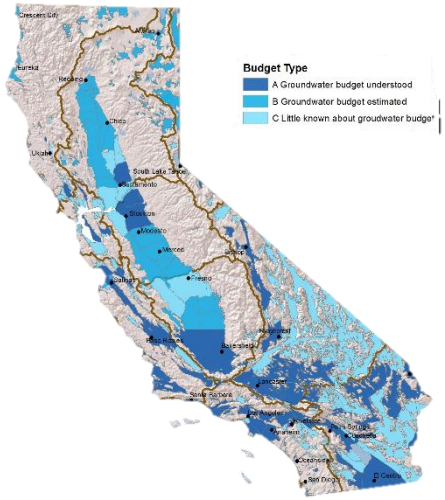
Data based approach:

Step 2: Analyze data and estimate groundwater budget components



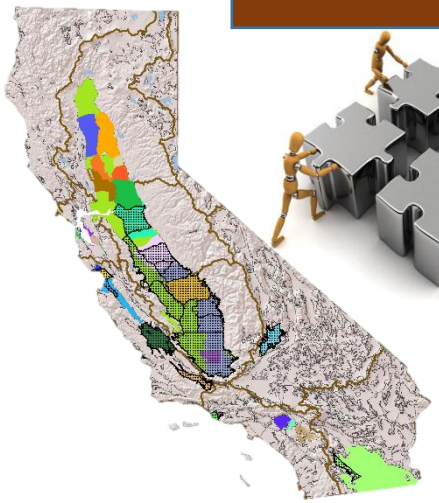
From Limited Water Budgets to Comprehensive Water Budgets

Water Budget Framework



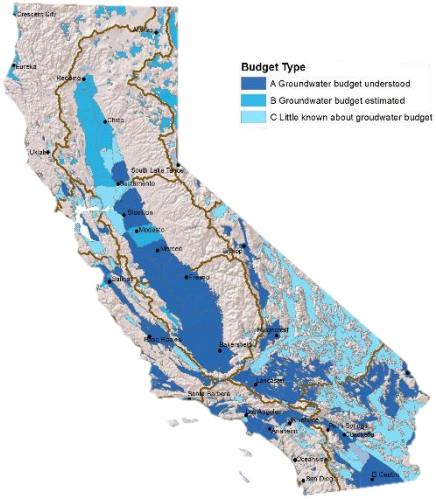
Bulletin 118, 2003 Water Budget Status

Today



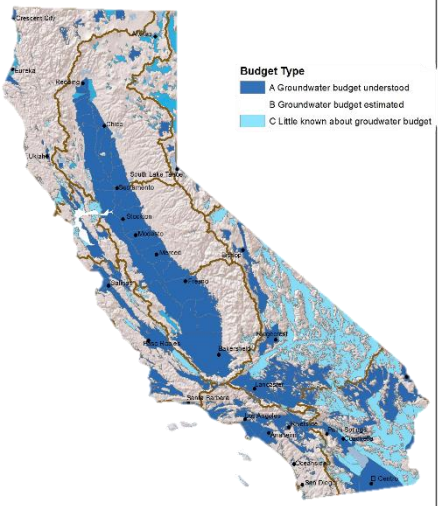
Existing Models, Data, and Tools

2016-2017



Significantly Better Water Budget Status

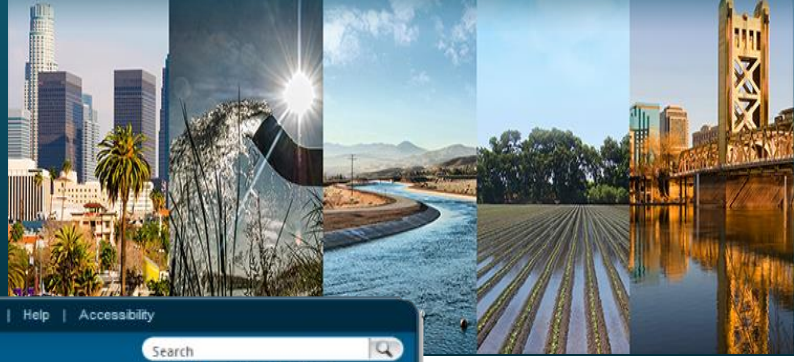
2018-2019



State has Comprehensive Water Budget for all Basins

2020

Water Budget, Integrated Data, and Sustainability Mapping



What's next?

- Water budget should be approached from a systems viewpoint
- Common vocabulary should be established as soon as possible
- Level 1 water budget should be developed for as many groundwater basins and GSAs as possible with existing models, data, and tools
- A water budget framework should be established for developing water budget with and without model
- A defensible period of record for development of water budgets should be established
- A transparent integrated data framework should be established for sharing water budget data