CITY OF VENTURA

Special STUDIES for Santa Clara River Estuary

PRESENTATION

September 2010

carollo
Engineers...Working Wonders With Water™

Stillwater Sciences

We are here today to discuss …

- The Santa Clara River Estuary Special Studies
- Provide an update on the Estuary Subwatershed Study
- Facilitate initial discussion of alternatives to be evaluated
- Get input from you, the Stakeholders

Agenda for the day

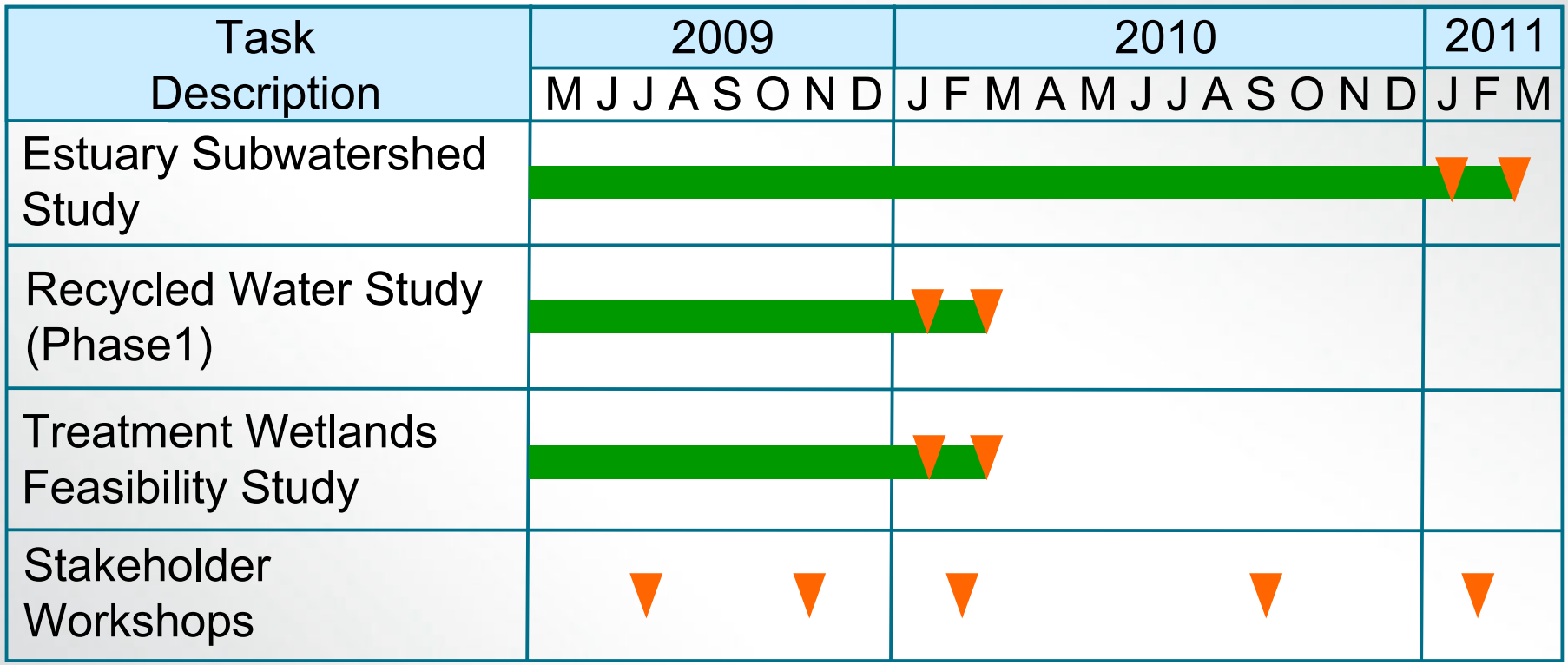
- Introduction/Background
- Update on the Estuary Subwatershed Study
  - Overview of study intent and approach
  - Focal species and habitat needs
  - Physical/Hydrologic characteristics
  - Water Quality
  - Estuary Function
- Discussion of future discharge alternatives
  - Initial scenario evaluation
  - Climate change effects
- Questions and Next Steps

Introduction

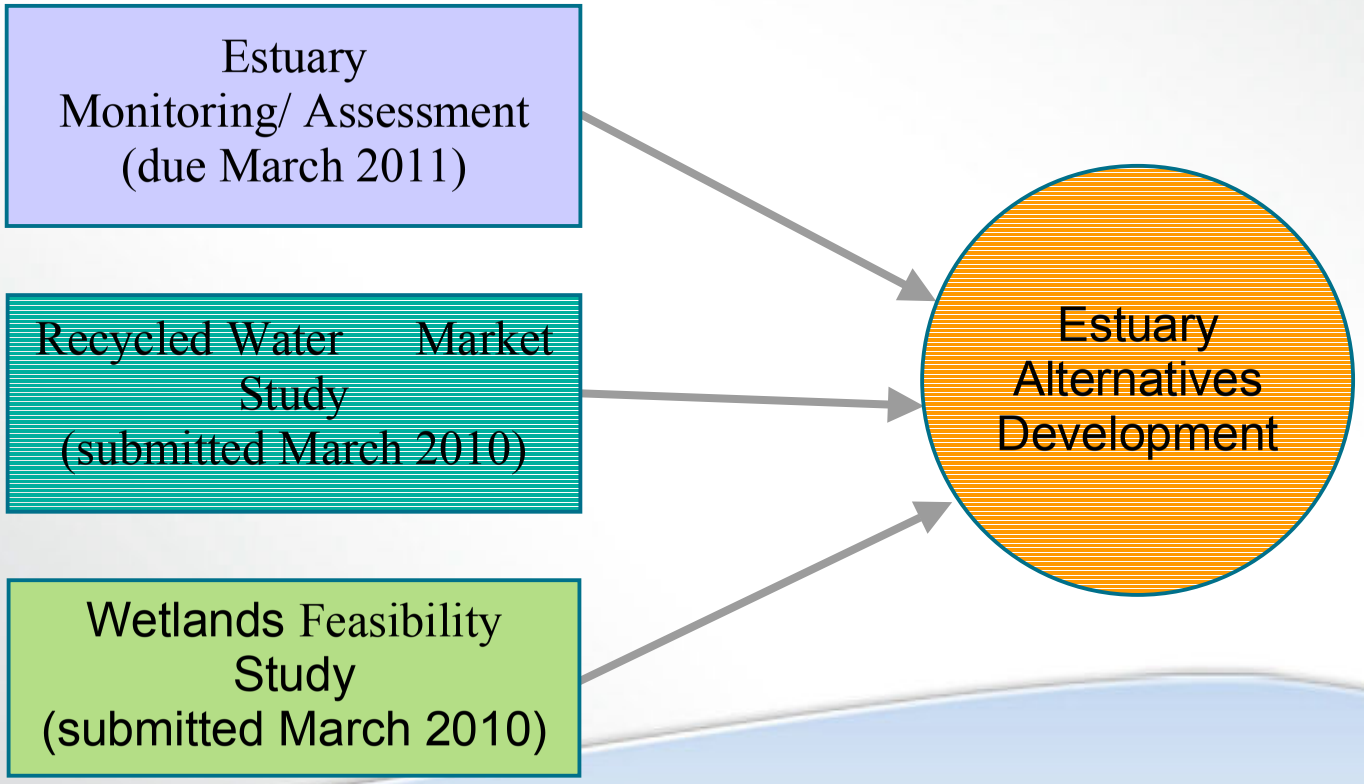
The special studies will answer …

…What is the best use of the treated water resources from the Ventura Water Reclamation Facilities to protect the health of the Santa Clara River Estuary?

Project Schedule



Last meeting, we provided an update on the Year 1 Estuary Monitoring Study and a recap of the Recycled Water Market and Wetlands Feasibility Studies



What we want from you today is …

- Listen to an update on the Estuary Subwatershed Study
  - Is it providing the information you need/hoped for?
  - Do you understand how the data and conceptual models will be used?
- Based on the analysis to date, what are your suggestions for the alternatives evaluation?

Estuary Subwatershed Study

Estuary Subwatershed Study Approach

Data Review and Collection

Estuary Water Balance

Estuary Physical/Biological Condition

Estuary Ecosystem Function

Climate Change

Develop/Optimize Discharge Scenarios

Overview

1. **Ecosystem Overview**
   - Overall conceptual model
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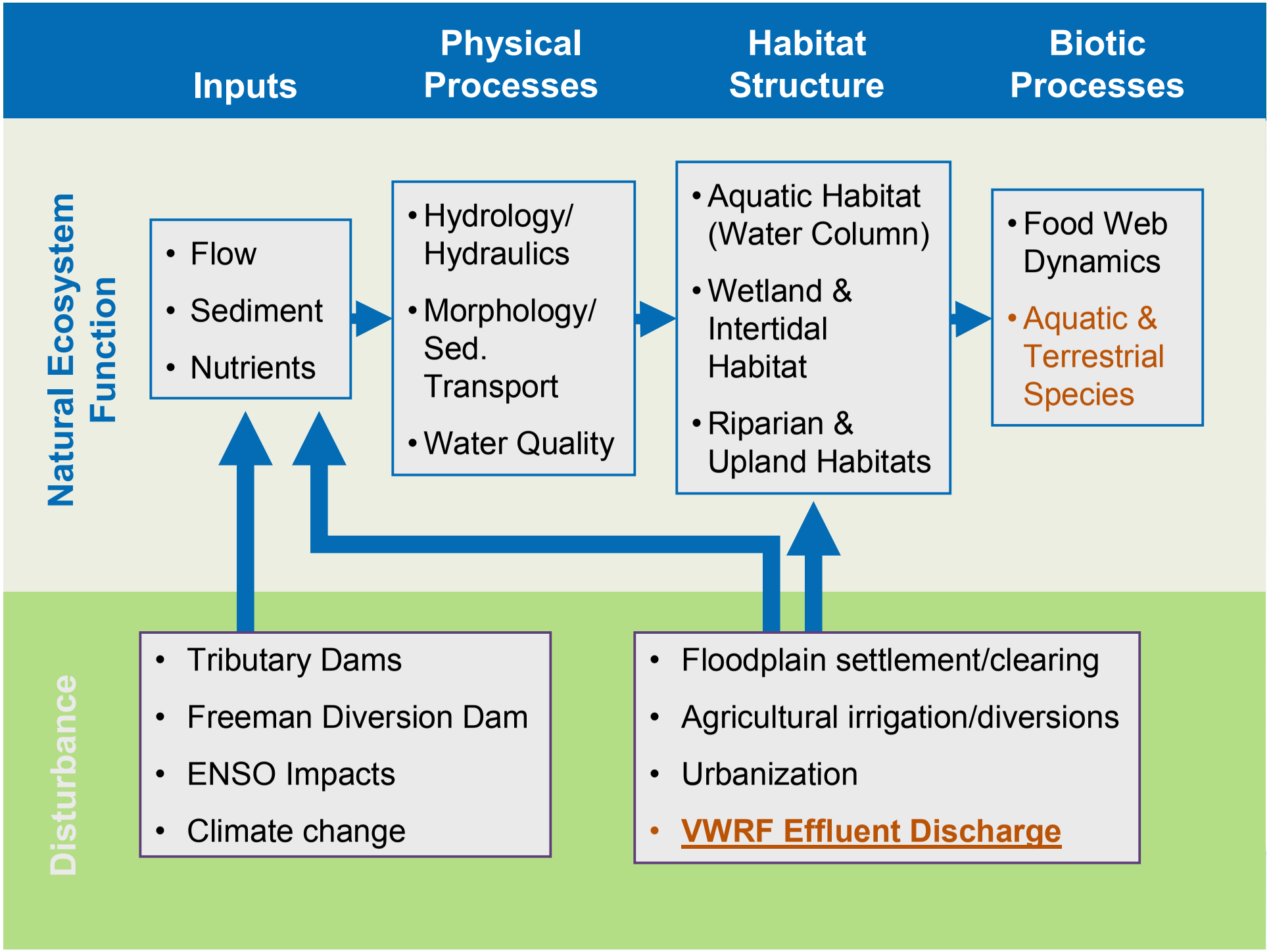
   - Current functioning
   - Stage-Habitat Relationships (2009-2010)
5. **Discharge Scenarios**


Inputs
Physical Processes
Habitat Structure
Biotic Processes
Natural Ecosystem Function
• Flow
• Sediment
• Nutrients
• Hydrology/ Hydraulics
• Morphology/ Sed. Transport
• Water Quality
• Aquatic Habitat (Water Column)
• Wetland & Intertidal Habitat
• Riparian & Upland Habitats
• Food Web Dynamics
• Aquatic & Terrestrial Species
Disturbance
• Tributary Dams
• Freeman Diversion Dam
• ENSO Impacts
• Climate change
• Floodplain settlement/clearing
• Agricultural irrigation/diversions
• Urbanization
• VWRF Effluent Discharge

Focal Species: Tidewater Goby

Tidewater Goby

- *Eucyclogobius newberryi*

Listing Status

- Federally endangered

General Characteristics

- Prefers a stable lagoon water levels
- Requires shallow areas with coarse sand for construction of nesting burrows
- Egg incubation and rearing from April to October with year-round residency of adults

Photo: SWS

Habitat Needs:

- Temp: 8 - 25° C (44 - 79° F)
- Salinity: 0 - 41 ppt
- Depth: 1.0 - 4.9 ft

Focal Species: Steelhead

Steelhead Trout

- *Oncorhynchus mykiss*
  Southern Steelhead ESU

Listing Status

- Federally endangered

General Characteristics

- Larger smolts prefer deeper water with cover (i.e., large woody debris, overhanging vegetation, man-made structures, etc.)
- Rearing steelhead may be found year-round, although upmigrant adults typically arrive during open mouth conditions in winter/spring

Photo: SWS

Habitat Needs:

- Temp: 15 - 24° C (59 - 79° F)
- Dissolved Oxygen
  - Survival: >1.5-2.0 mg/L
  - Growth: >7.0 mg/L
- Depth
  - Open water: >3.0 ft
  - Inundated veg: >0.5 ft
  - Edge: 0.5 - 3.0 ft

Focal Species: Least Tern

California Least Tern

- *Sternula antillarum browni*

Listing Status

- Federally and state endangered

General Characteristics

- Nests in spring and summer on barren to sparsely-vegetated beaches above high tide
- Nesting April-September
- Absent October-March
- Forages on small fish by hovering and plunging into shallow estuaries, lagoons, coastal ponds, or nearshore waters

Photo: USFWS

Habitat Needs:

- Foraging areas
  - >0.5 ft water depth

Focal Species: Snowy Plover

Western Snowy Plover

- *Charadrius alexandrinus nivosus*

Listing Status

- Federally endangered

General Characteristics

- Nests in spring and summer on barren to sparsely-vegetated beaches above high tide
- Year-round residency, with larger over-wintering population (September-February)
- Forages by gleaning for small invertebrates on sand, surf-cast seaweed, or low-growing plants

Photo: Callie Bowdish

Habitat Needs:

- Foraging areas
  - Open beach and foredune habitats (e.g., *Abronia* spp. - *Ambrosia chamissonis* plant alliance)

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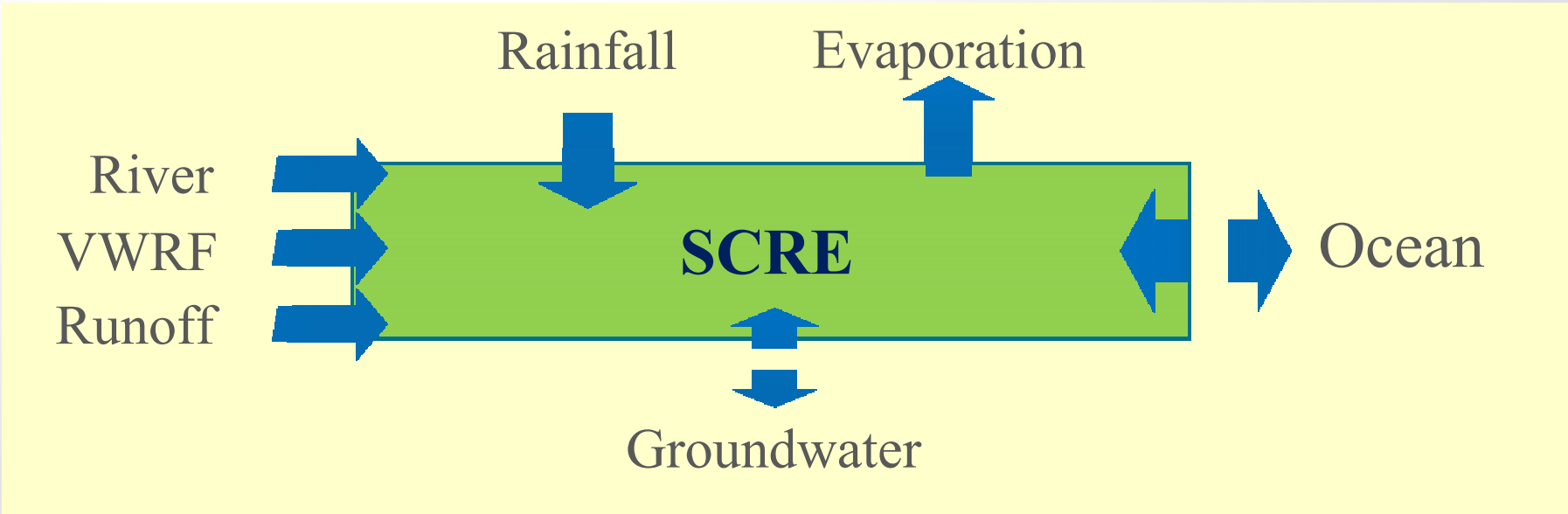
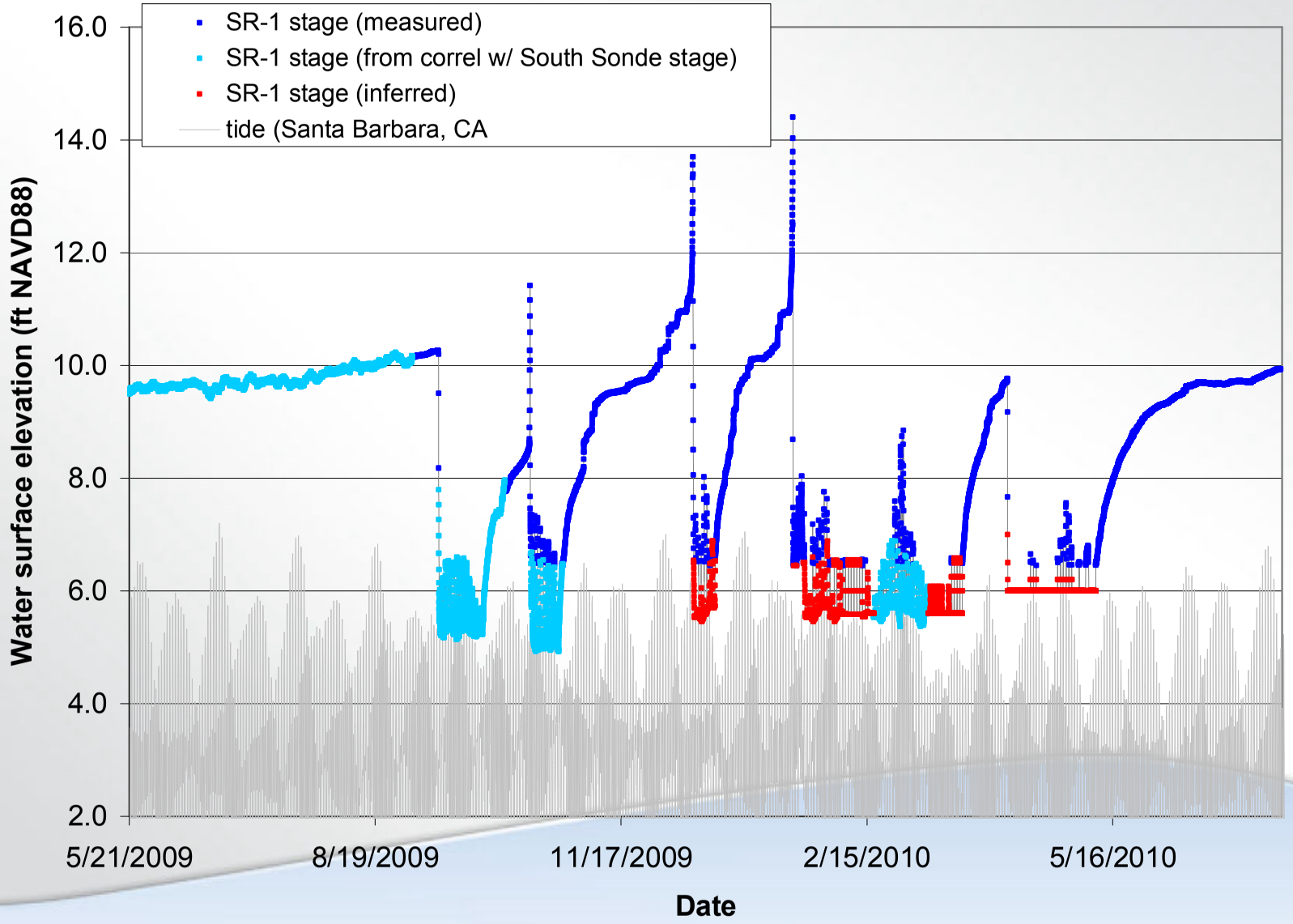
Simplified SCRE Water Balance



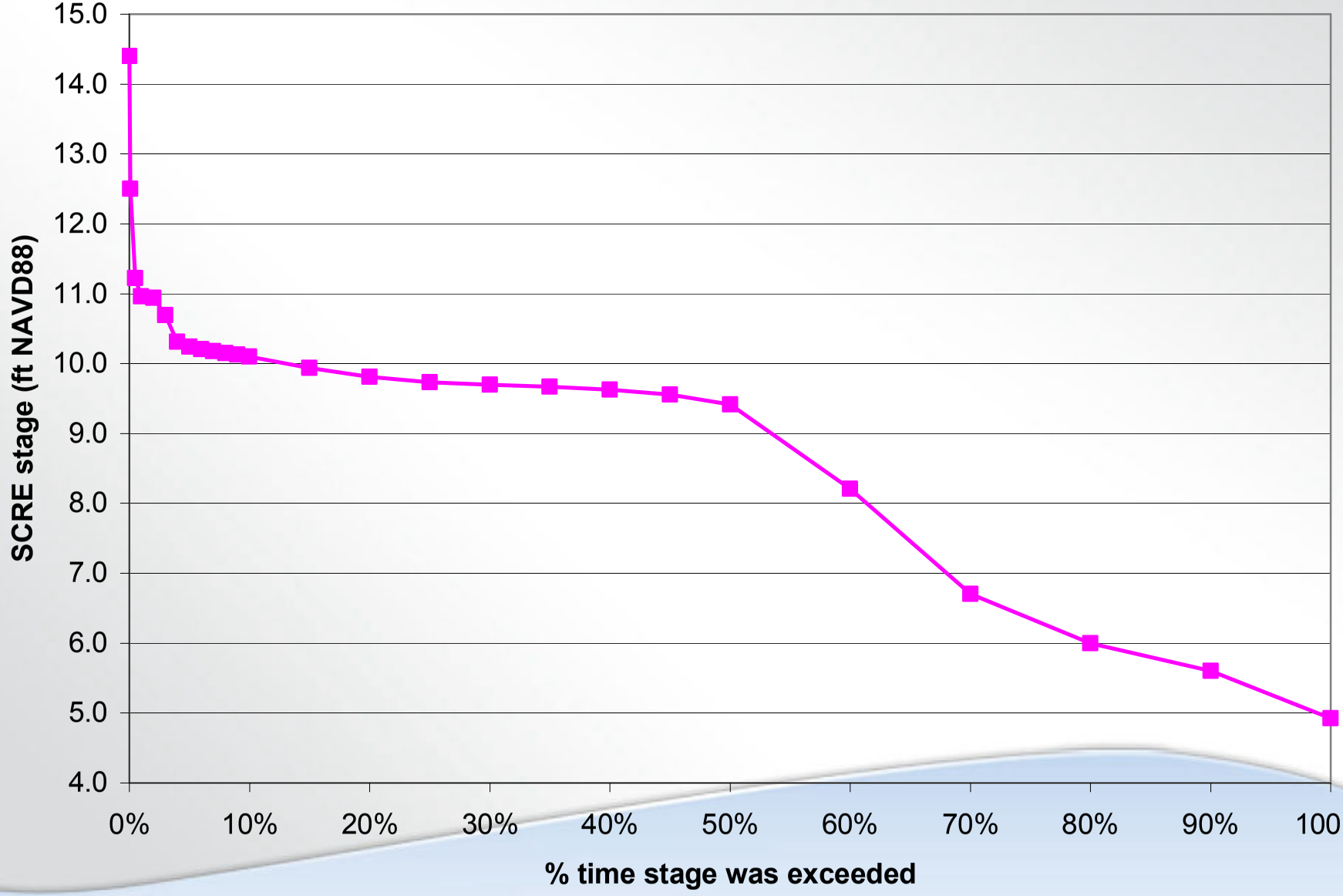
$$V_{SCRE} = \text{River} + \text{VWRF} + \text{Runoff} + \text{Rain} + \text{GW(in)} + \text{Ocean(in)} - \text{GW(out)} - \text{Ocean(out)} - \text{Evaporation}$$

Stage and GW Elev. Monitoring Locations

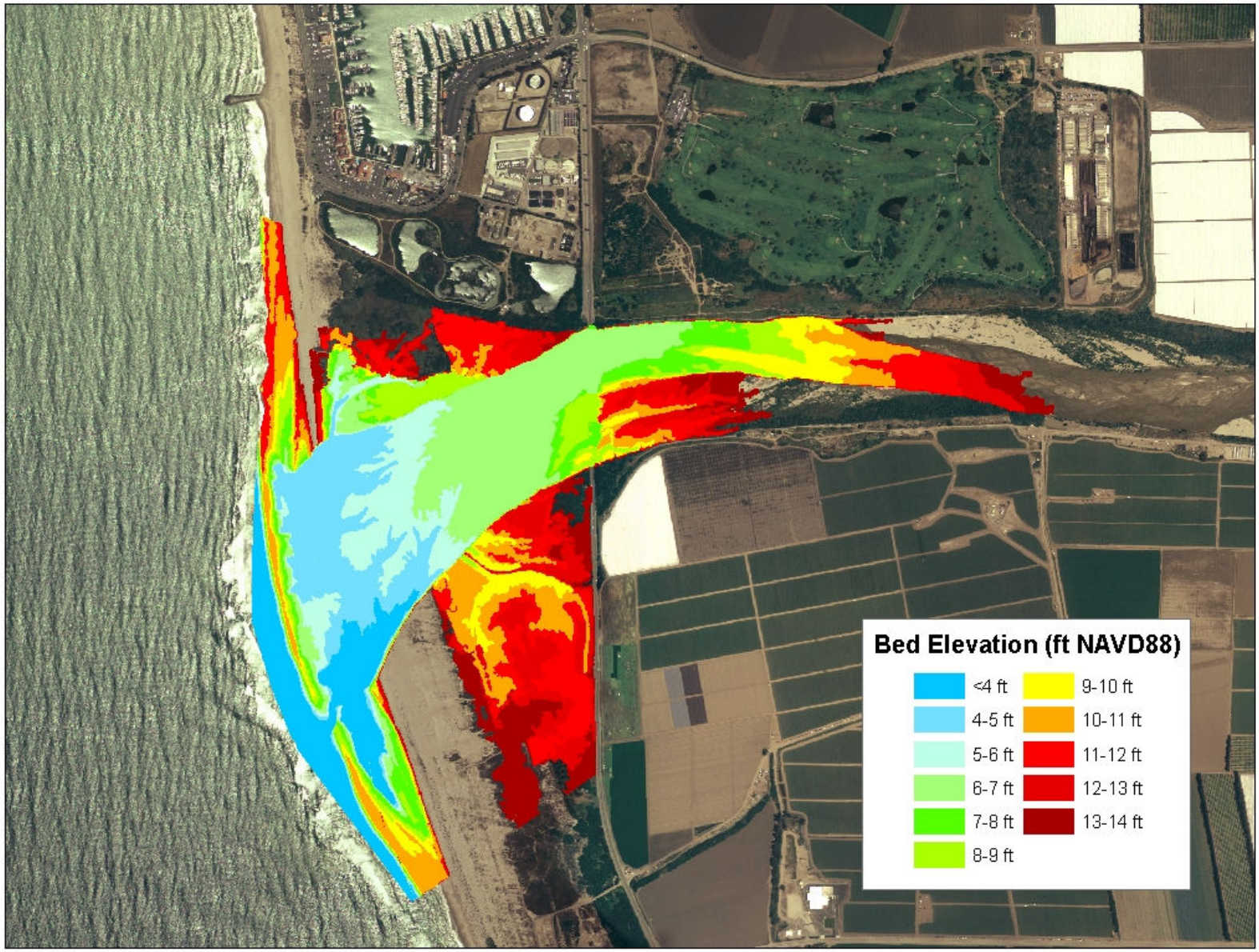
Compiled SCRE Stage (May 2009 to July 2010)



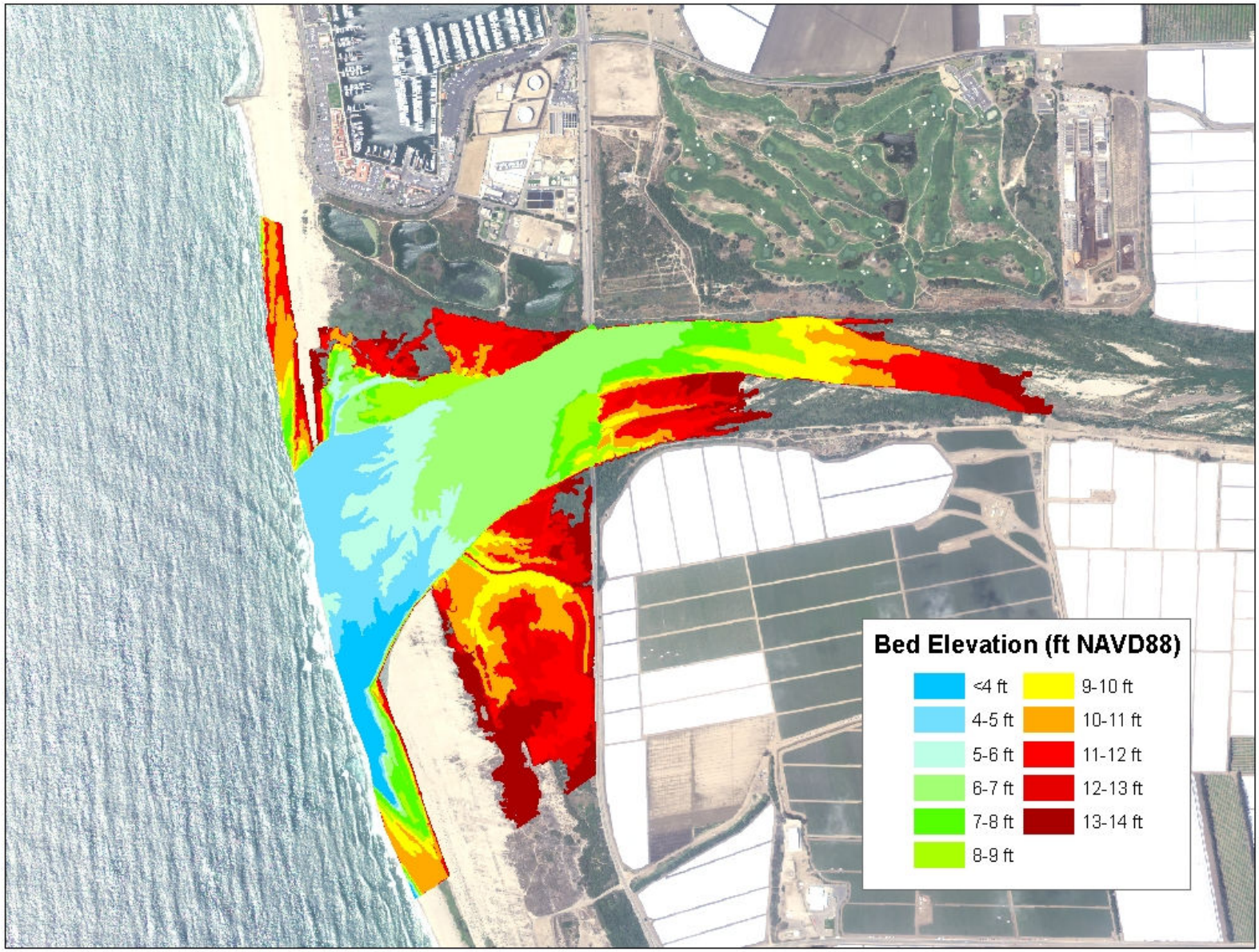
SCRE Stage: Time Exceeded
(May 2009 to July 2010)



2005 Bathymetry from 2005 LiDAR

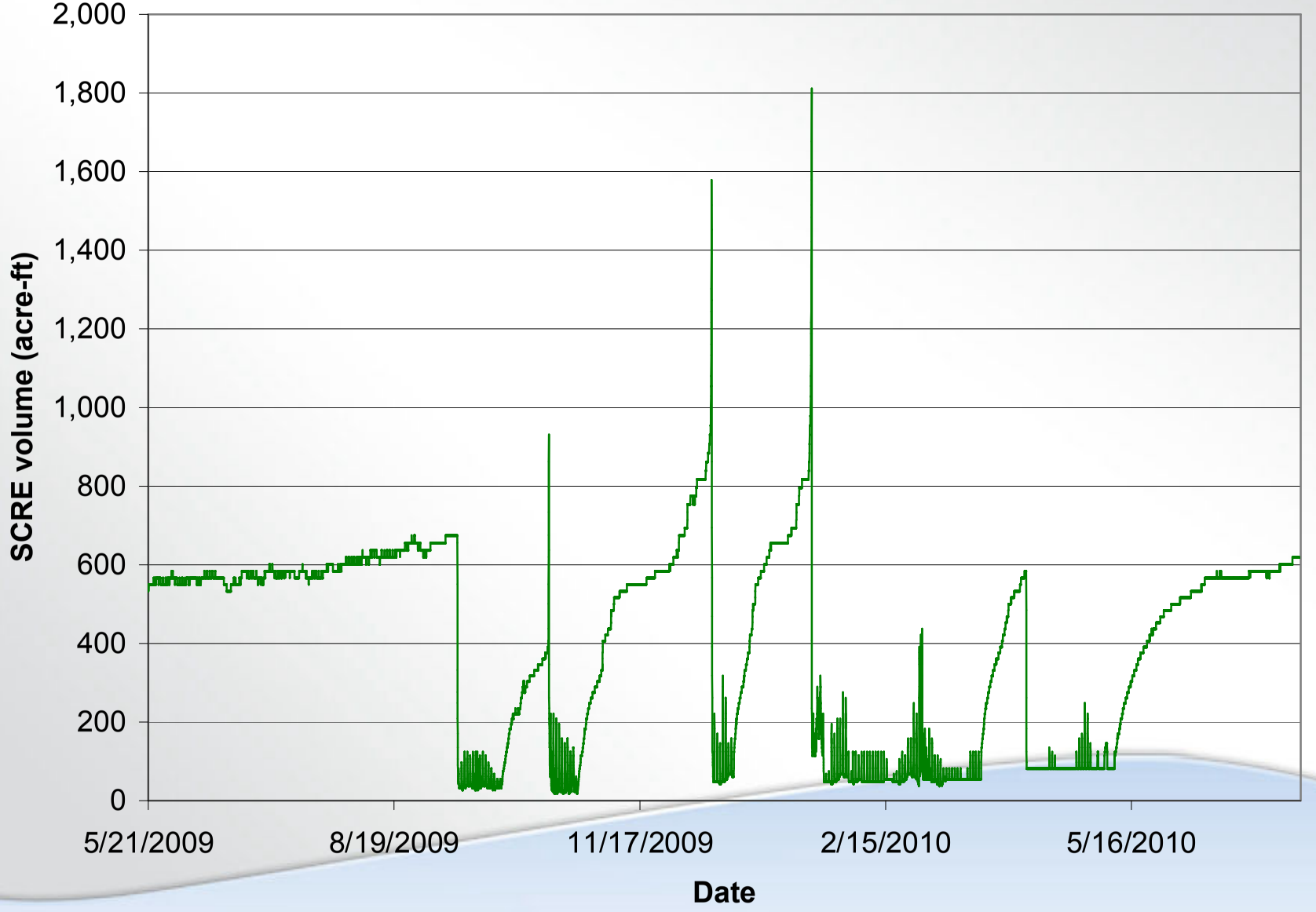


2009 Bathymetry from 2005 LiDAR

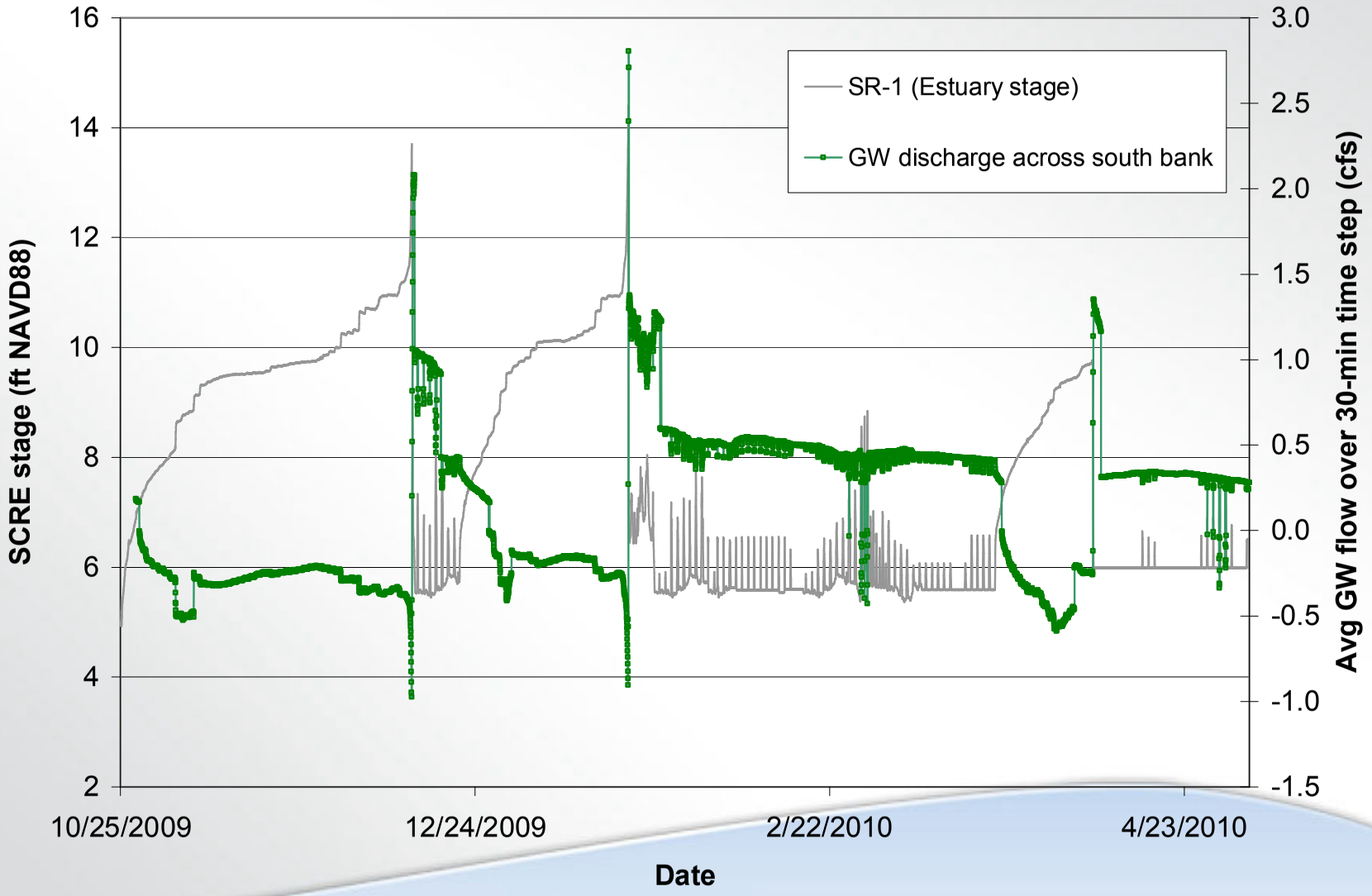


Current 'Full' Area (below ~10 ft NAVD88)

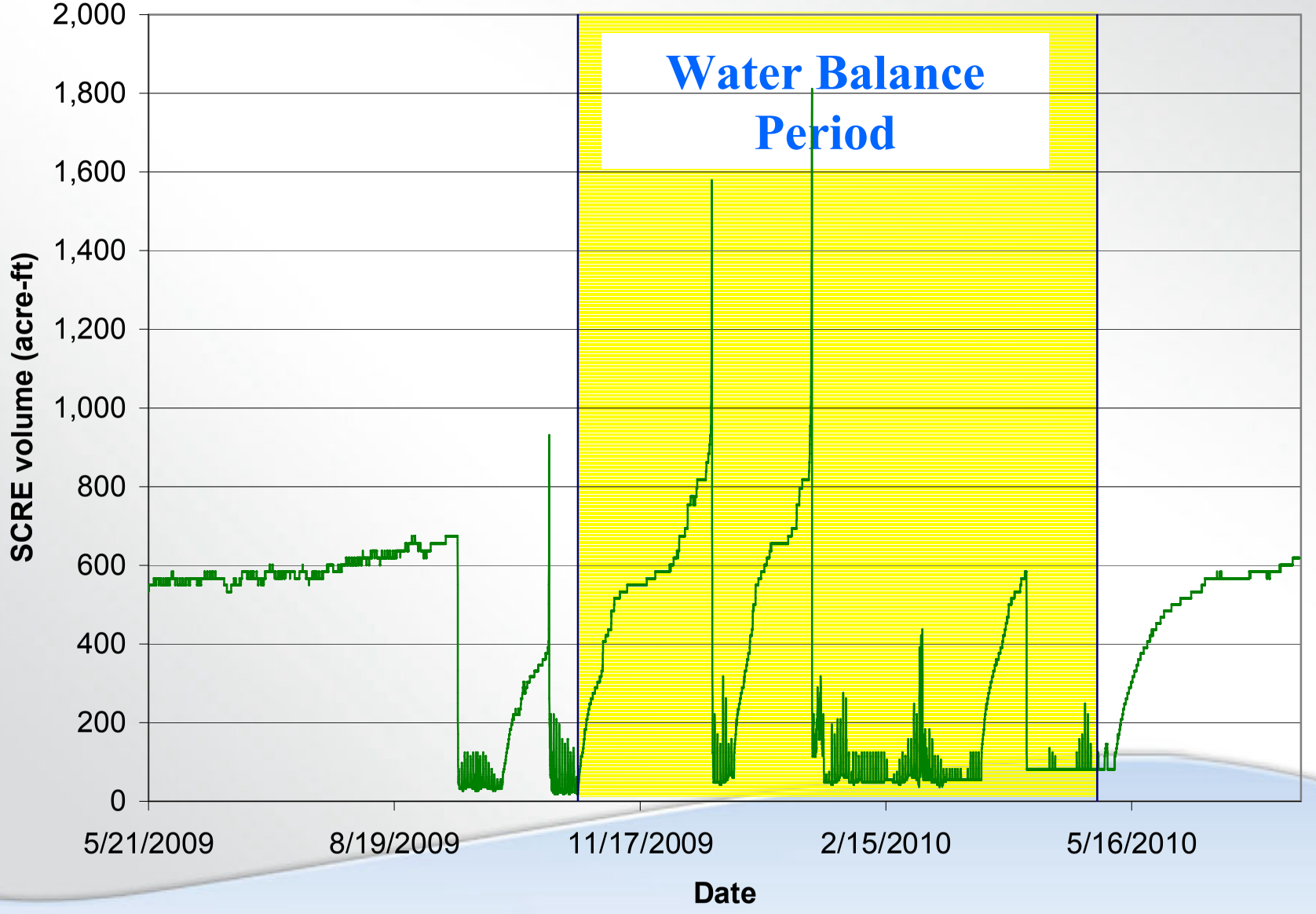
SCRE Inundated Volume (May 2009 to July 2010)



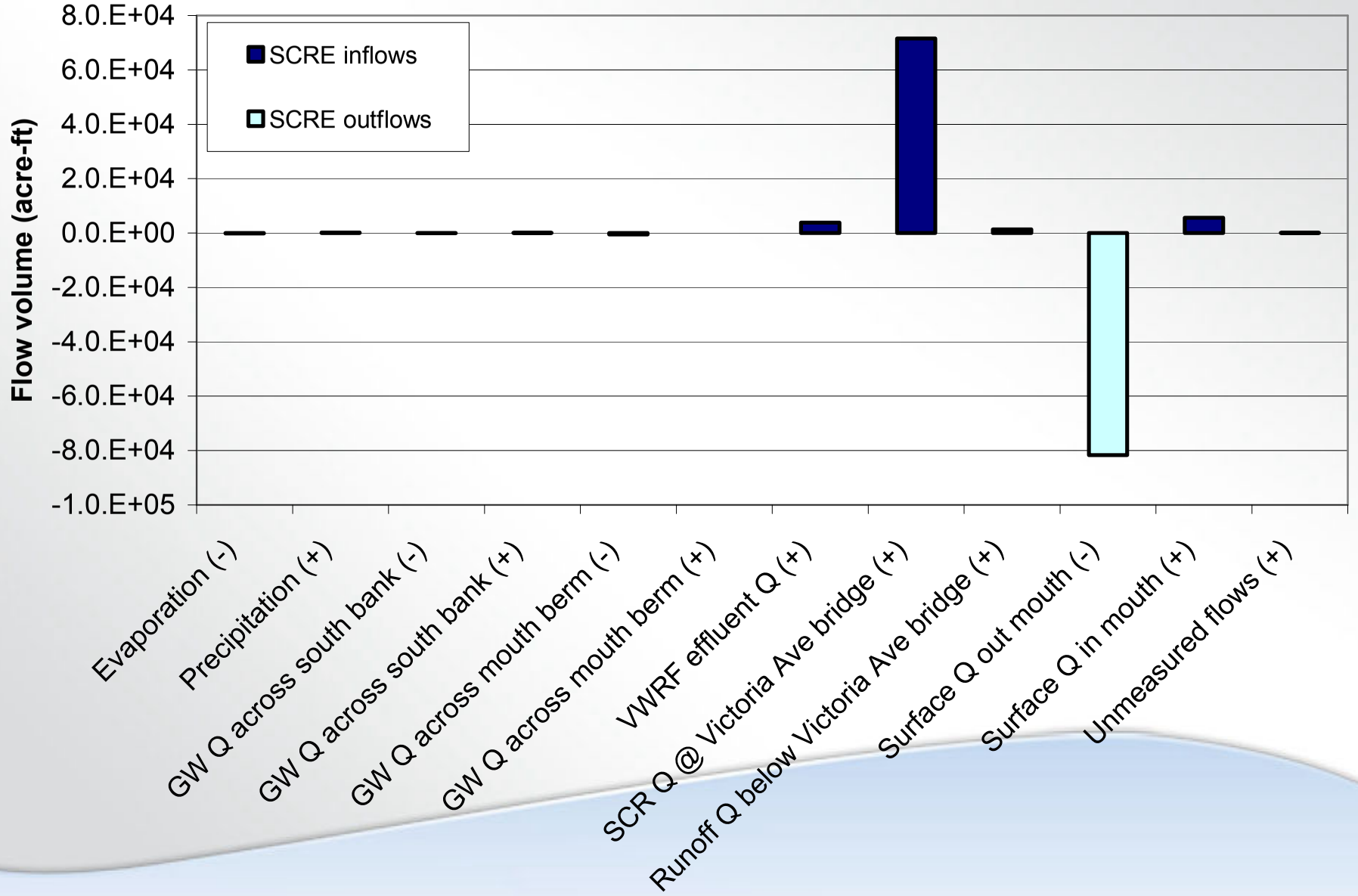
South Bank Groundwater Flow
(October 2009 to May 2010)



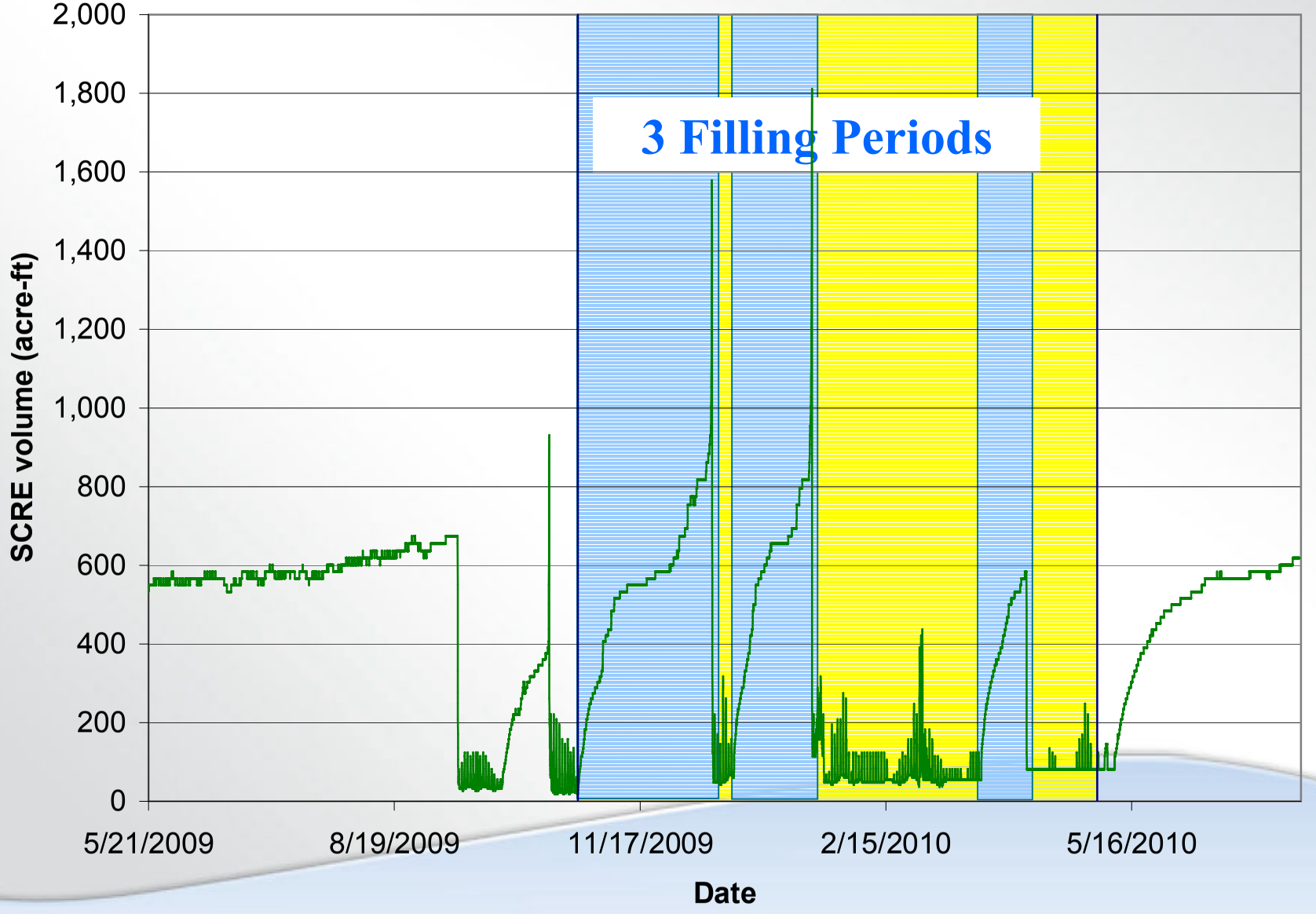
SCRE Inundated Volume (May 2009 to July 2010)



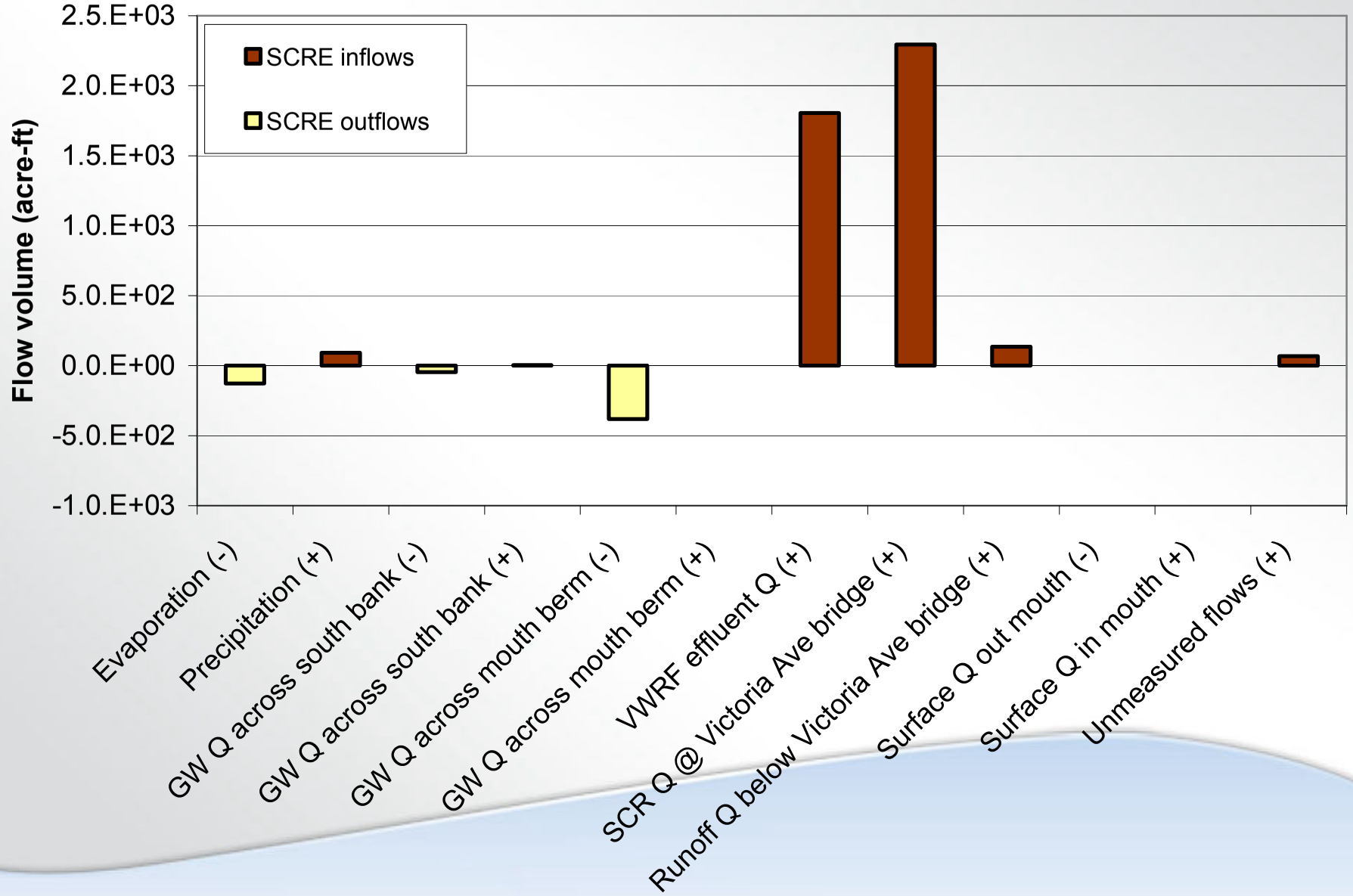
SCRE Component Flow Volume
(10/25/09 – 5/3/10)



SCRE Inundated Volume (May 2009 to July 2010)



SCRE Component Flow Volume
(3 filling periods)



Water balance summary

- SCRE reaches quasi-equilibrium stage and volume when mouth closed (i.e., 'full' condition)
- Takes 2-4 weeks to reach 'full' condition
- On average, dominant inflow = river discharge, dominant outflow = surface flow out mouth
- During filling periods, VWRF discharge accounts for a large portion of inflow, especially during low-flow conditions
- Water Balance will be used as predictive tool in assessing VWRF discharge alternatives

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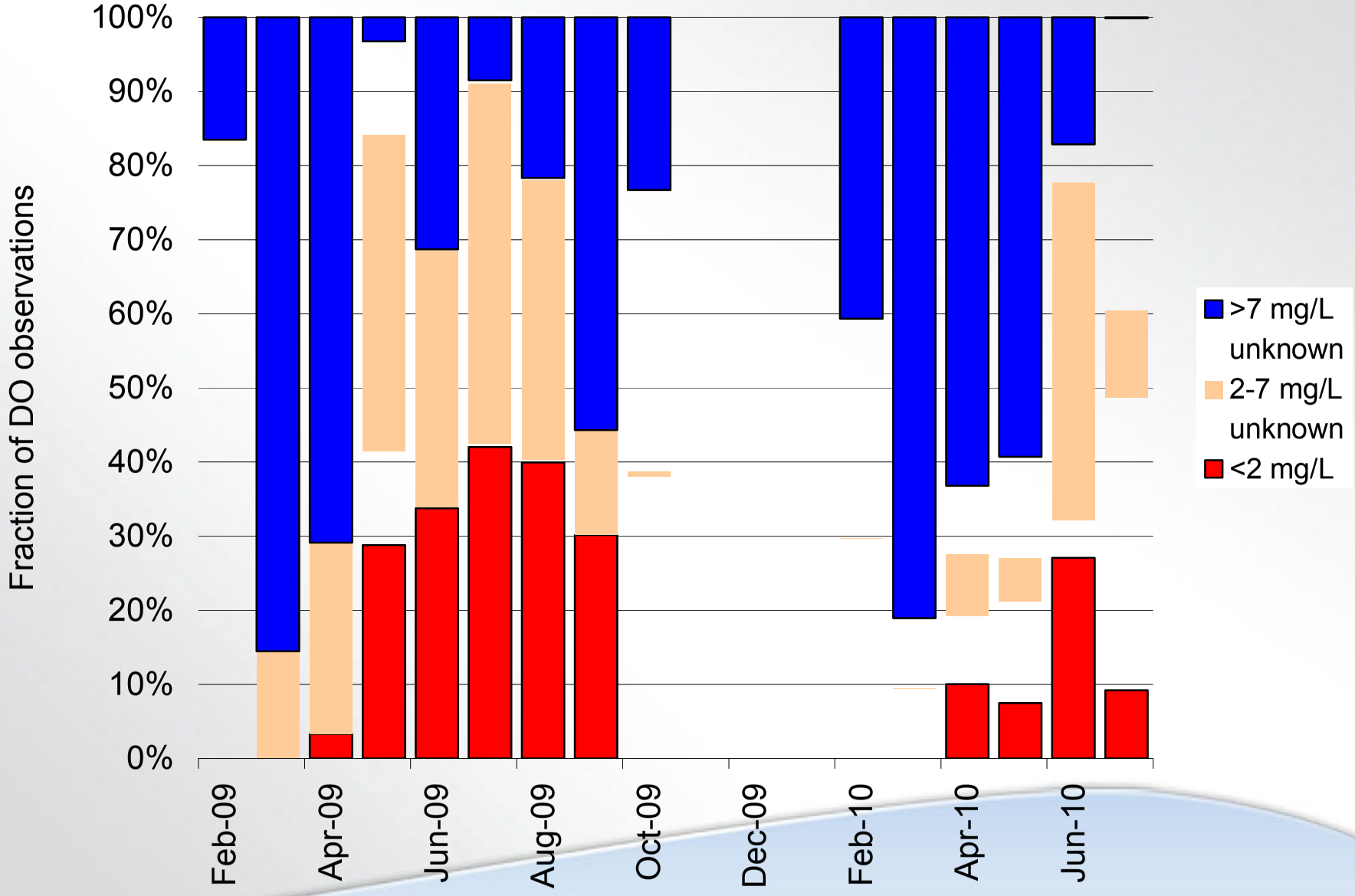
Existing Water Quality Conditions

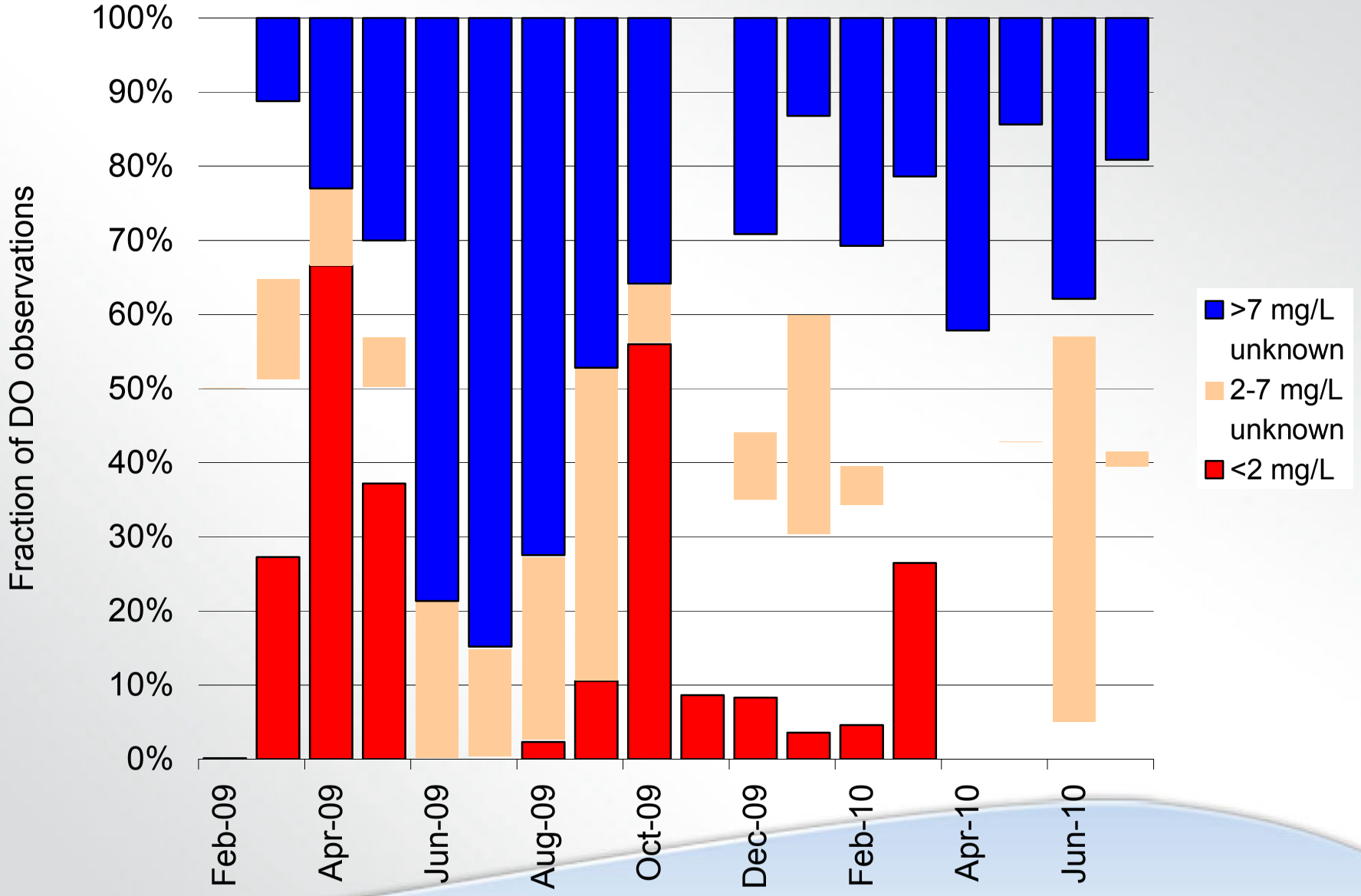
- Historical (2000-2010) samples periodically exceed Basin Plan water quality objectives for
  - Ammonia
  - Biostimulatory substances (303(d) list)
  - DO
  - pH
  - Pesticides (303(d) list)
  - Toxicity (303(d) list)
- Generally within suitable ranges for focal fish species
  - Avg. DO: 7.6-18.0 mg/L (Open); <7-18.3 mg/L (Closed)
  - Temp: 55-73°F (Open); 55-77°F (Closed)

WQ Sampling Locations

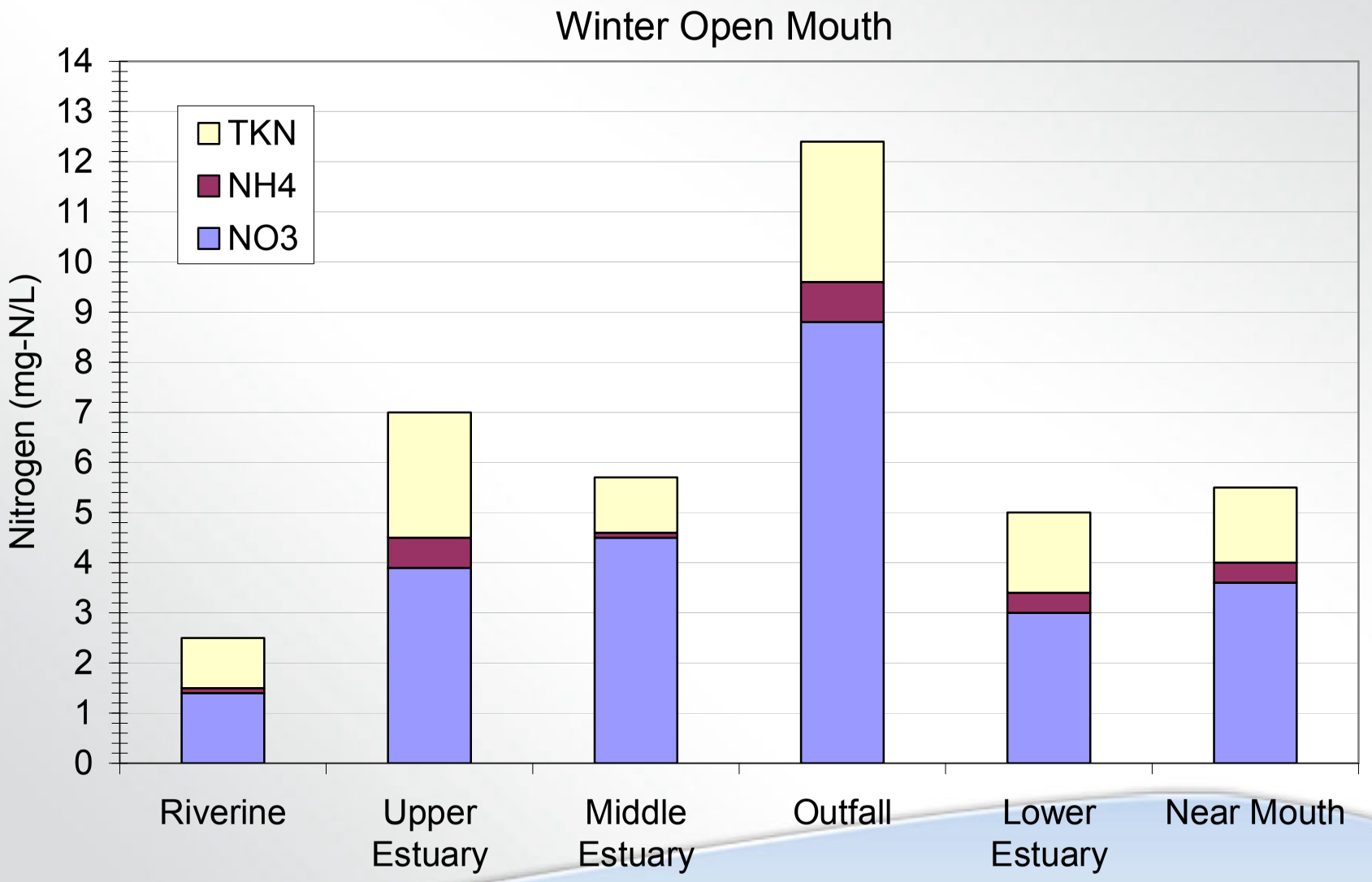
DO Percent Exceedance – North Sonde



DO Percent Exceedance – South Sonde



Avg. SCRE Nutrients (2000-2010)



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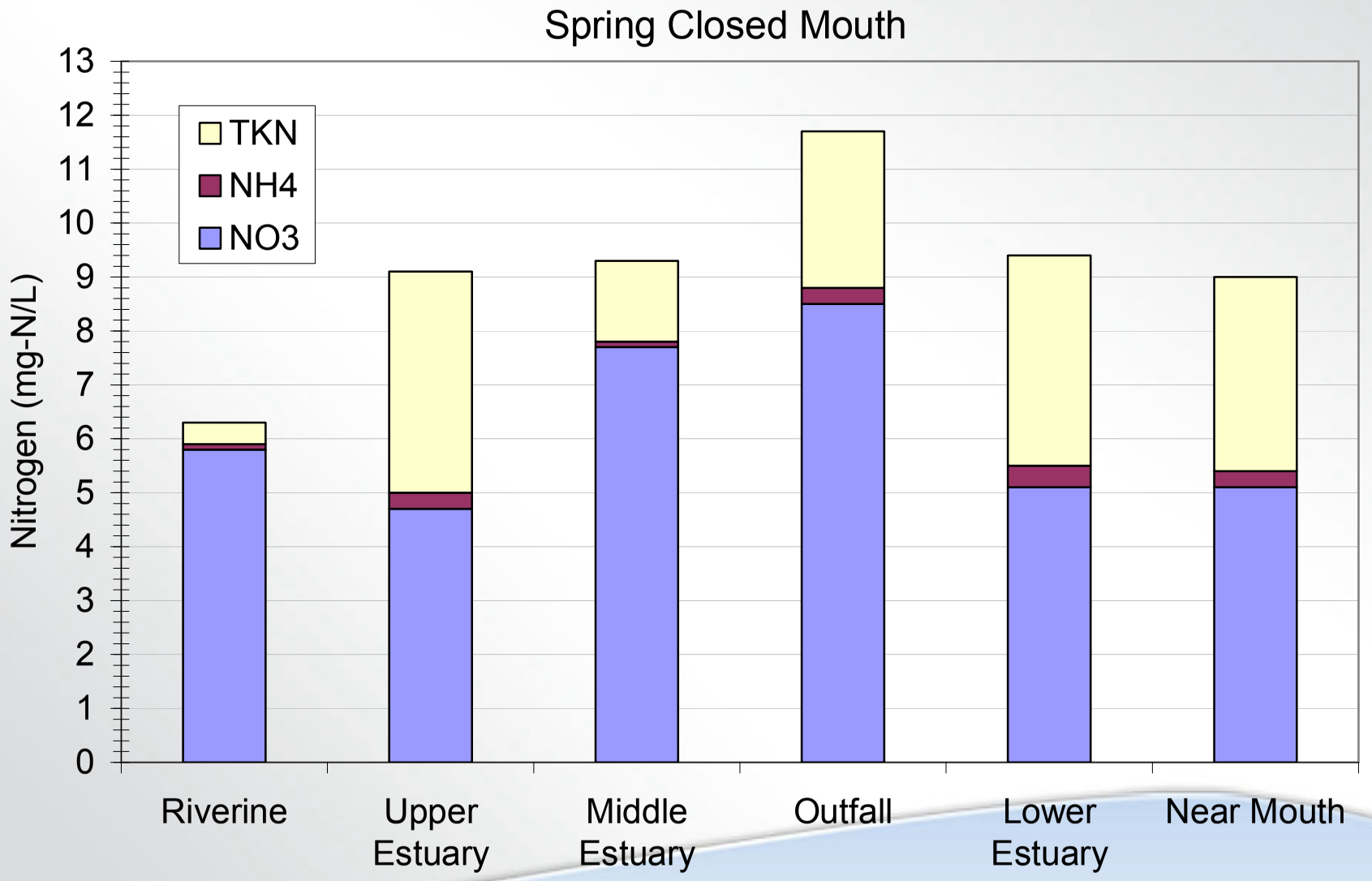
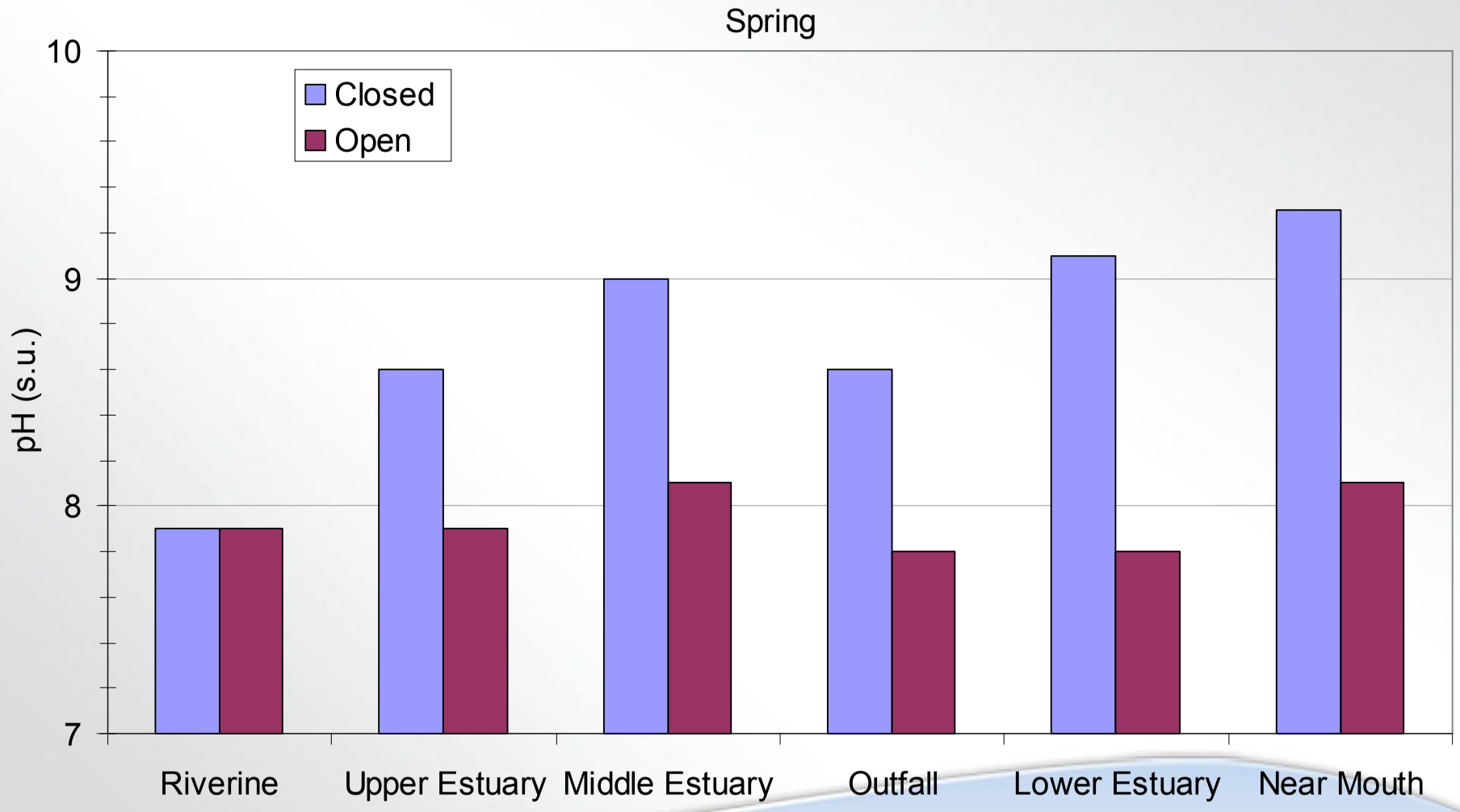
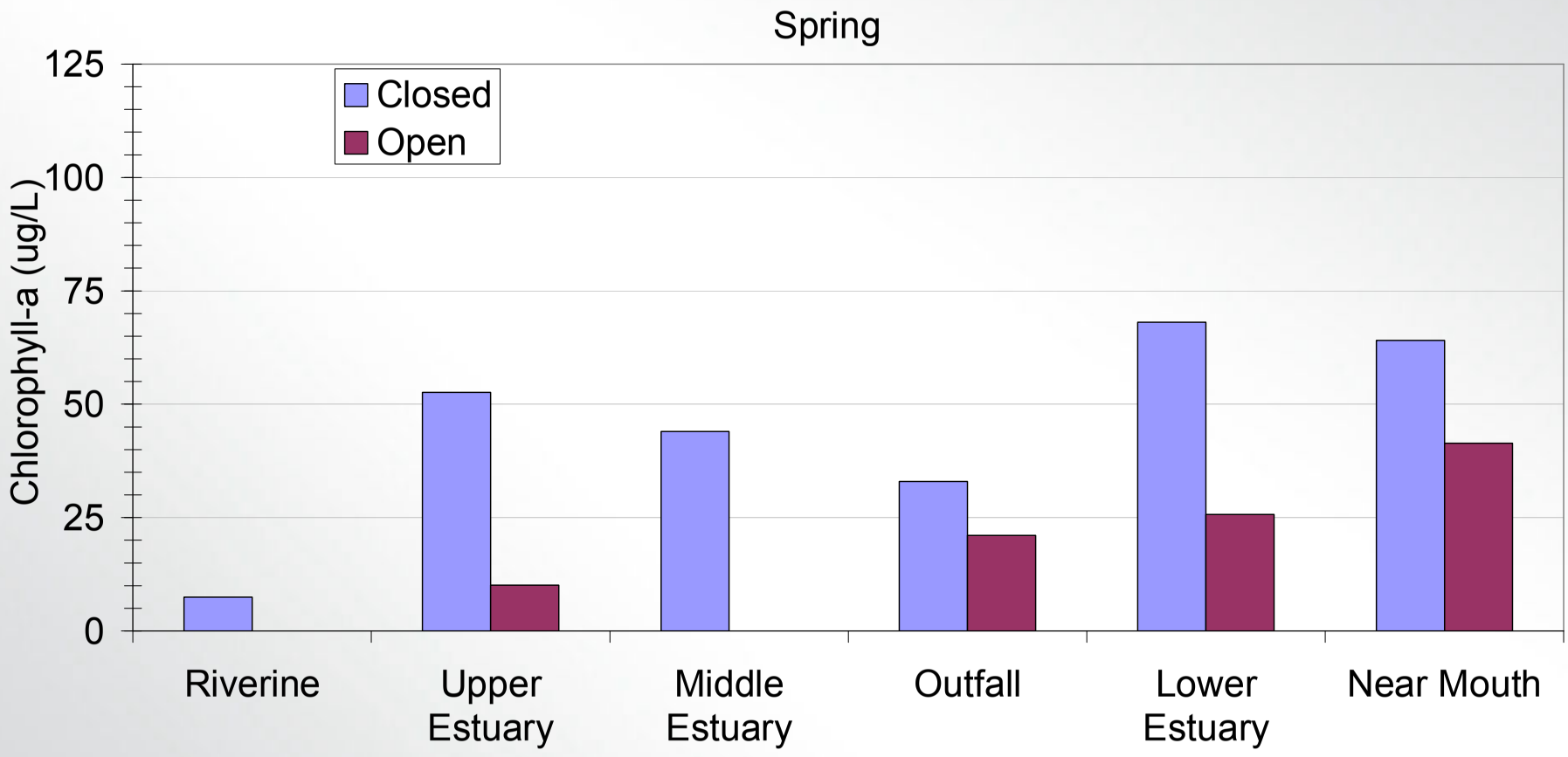


Avg. SCRE pH (2000-2010)



Avg. SCRE Chlorophyll-a (2000-2010)



Metals are meeting permit limits at VWRF

Metal (ug/L)	Permit Average Monthly	Monthly Average at ETS (2008-2009)
Copper	6.7	3.1*
Mercury	0.051	<0.02
Silver	0.71	<0.2
Zinc	45	24.9

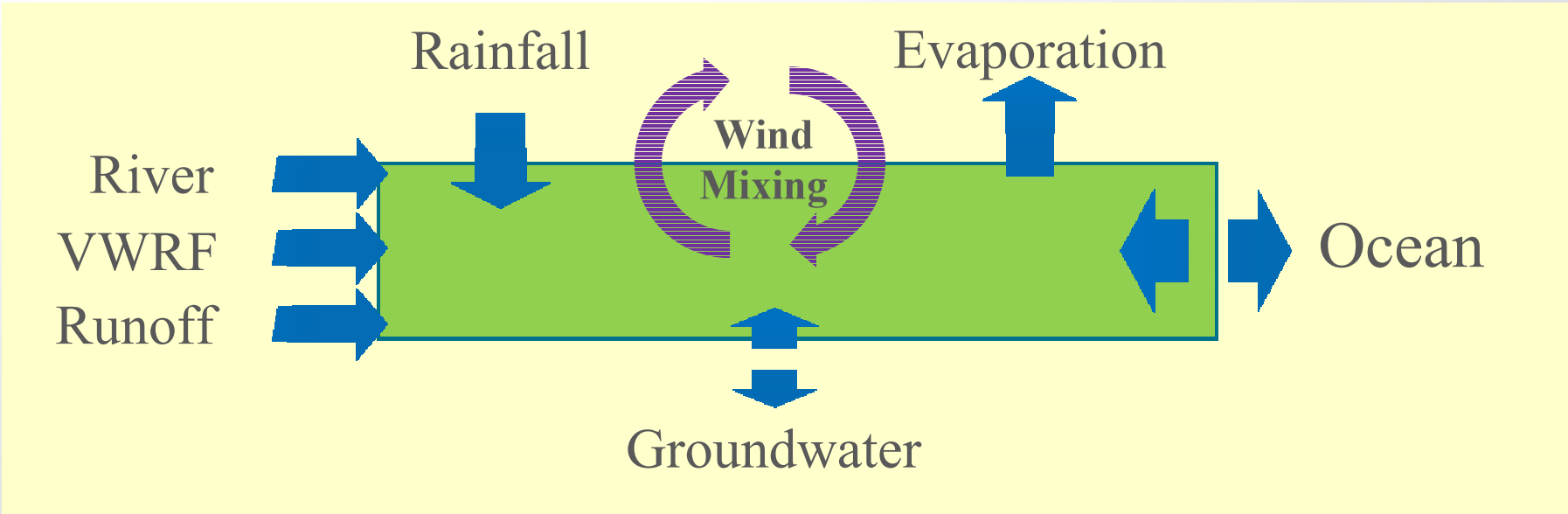
*More than 50% of samples were below detection limit (<2 ug/l)

Water quality mixing conditions

Typical:

Wind Salinity DO

Nutrient balance using mixing model approach



Storage = Inputs - Outputs

Concentration = (River + VWRF + Runoff + Rain + GW(in) – GW(out) – Ocean)/Volume

Predictive Tools: Water Quality (Nitrogen) Balance (2009-10)

Observed and Predicted Total Nitrogen (mg/L)

	Lower Estuary	Mouth	Estuary Predicted
Sept/09	NA	NA	NA
Nov/09	11.9	11.8	17.7
Jan/10	4.1	4.9	4.2
Mar/10	10.8	11.6	11.9
May/10	TBD	TBD	TBD
July/10	TBD	TBD	TBD

Predictive Tools: Water Quality (Phosphorus) Balance (2009-10)

Observed and Predicted Total Phosphorus (mg/L)

	Lower Estuary	Mouth	Estuary Predicted
Sept/09	NA	NA	NA
Nov/09	1.3	1.3	2.0
Jan/10	0.5	0.5	0.4
Mar/10	0.9	0.9	1.3
May/10	TBD	TBD	TBD
July/10	TBD	TBD	TBD

Water quality summary

- Historical (2000-2010) samples periodically exceed Basin Plan Water Quality Objectives for several parameters
- SCRE has high algal levels under both open and closed mouth conditions, affecting DO and pH
- VWRF has met RWQCB discharge effluent limitations, but is associated with elevated nutrient levels.
- Mixing Model approach will be used to model reductions in nutrient loads and to assess changes in algal levels

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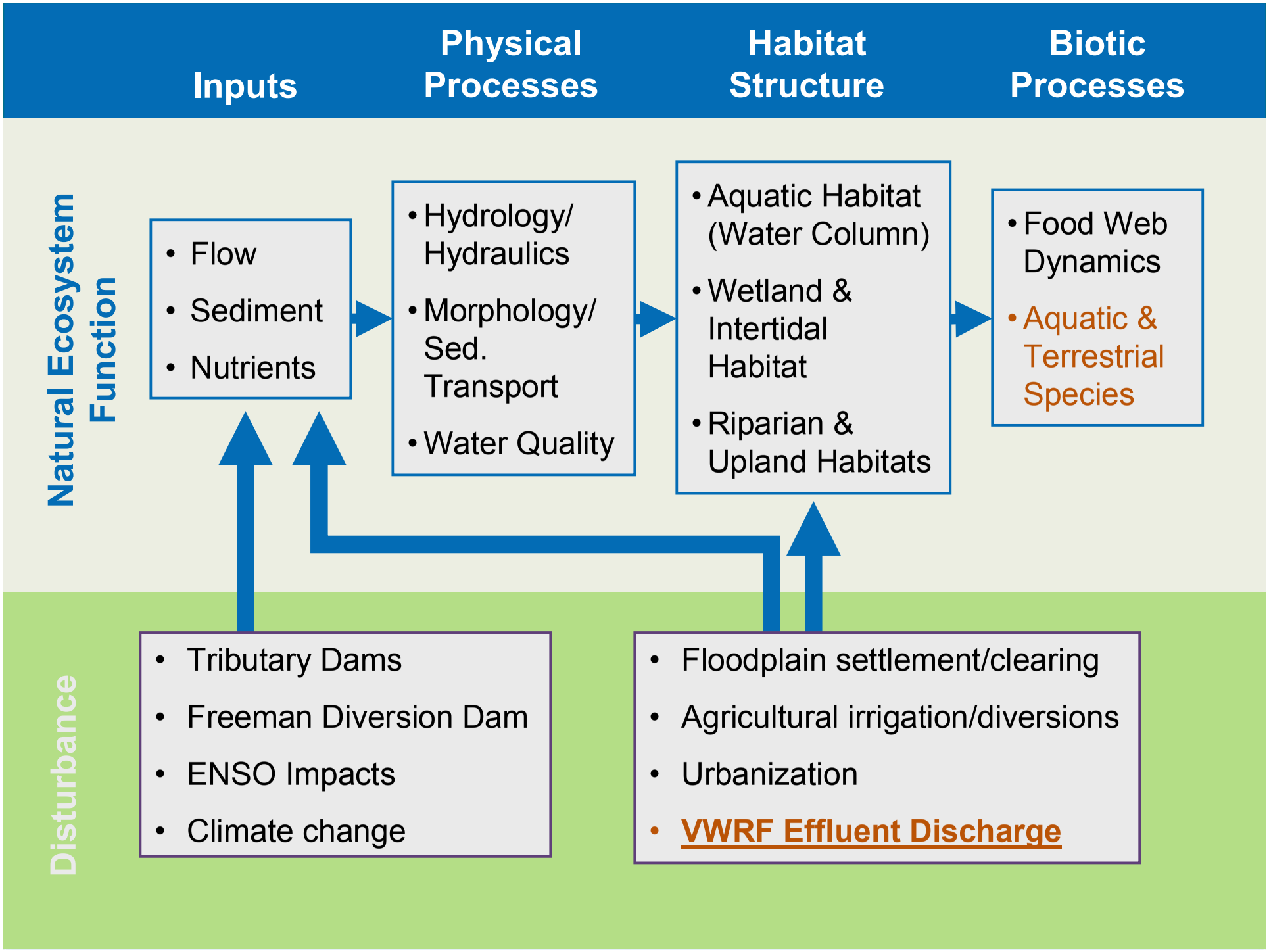
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• VWRF Effluent Discharge

Current Ecosystem Functioning

- Primary SCRE functions supporting existing Basin Plan beneficial uses
  - Flow regulation
  - Sediment storage and beach building
  - Water quality regulation
  - Aquatic habitat maintenance
  - Wildlife habitat maintenance
  - Recreational opportunities

Current Ecosystem Functioning: VWRF Effects on Primary Functions

- Primary SCRE functions supporting existing beneficial uses
  - Flow regulation
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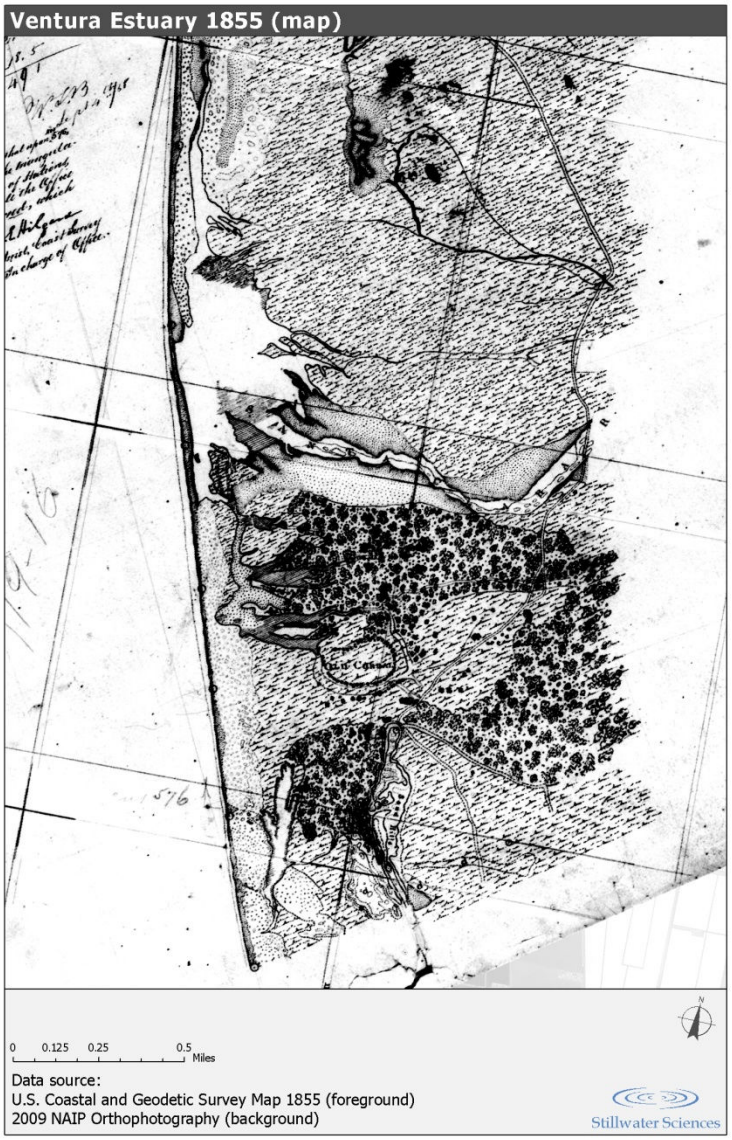
Historical SCRE



Current SCRE

Current Ecosystem Functioning: VWRF Effects on Primary Functions

- Primary SCRE functions supporting existing beneficial uses
  - Flow regulation
  - Sediment storage and beach building
  - Water quality regulation
  - Aquatic habitat maintenance
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  - Recreational opportunities

Water quality regulation

- Lagoonal System with Wind mixing
- Large Fluctuations in DO under Closed Mouth Conditions due to Algae
- Although VWRF appears as largest nutrient source, excess Nutrients (N, P) arriving from multiple sources

Current Ecosystem Functioning: VWRF Effects on Primary Functions

- Primary SCRE functions supporting existing beneficial uses
  - Flow regulation
  - Sediment storage and beach building
  - Water quality regulation
  - Aquatic habitat maintenance
  - Wildlife habitat maintenance
  - Recreational opportunities

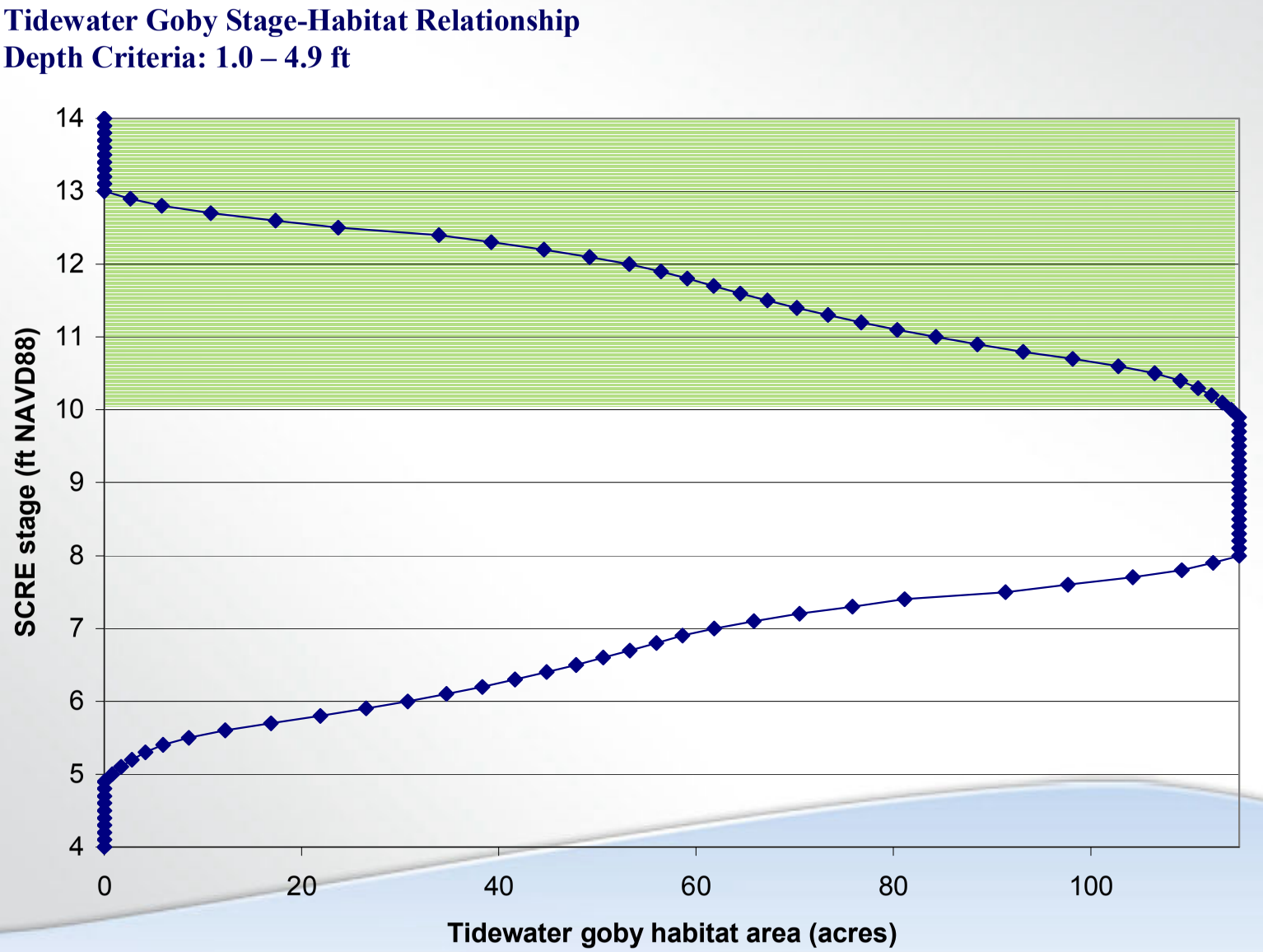
Aquatic and wildlife habitat maintenance

- Aquatic Habitat (Southern steelhead and Tidewater goby)
  - Existing DO conditions may not support steelhead rearing at all times
  - Stage-Habitat analysis centers upon maintenance of suitable depth and cover
- Wildlife Habitat (CA Least Tern and Snowy Plover)
  - Birds use beach and foredune habitats for nesting
  - Analysis centers upon maintenance of open water (CA Least Tern) and SCRE margin (Snowy Plover) foraging areas

Stage-habitat relationships

- Developed general ‘rules’ for determining suitable habitat as a function of stage
  - Range of suitable depths, substrate, and cover (or vegetation) associations
- Fish
  - Water depth
  - Distance from cover
- Birds
  - Minimum water depth
  - Vegetation density
  - Vegetation type

Tidewater Goby Stage-Habitat Relationship



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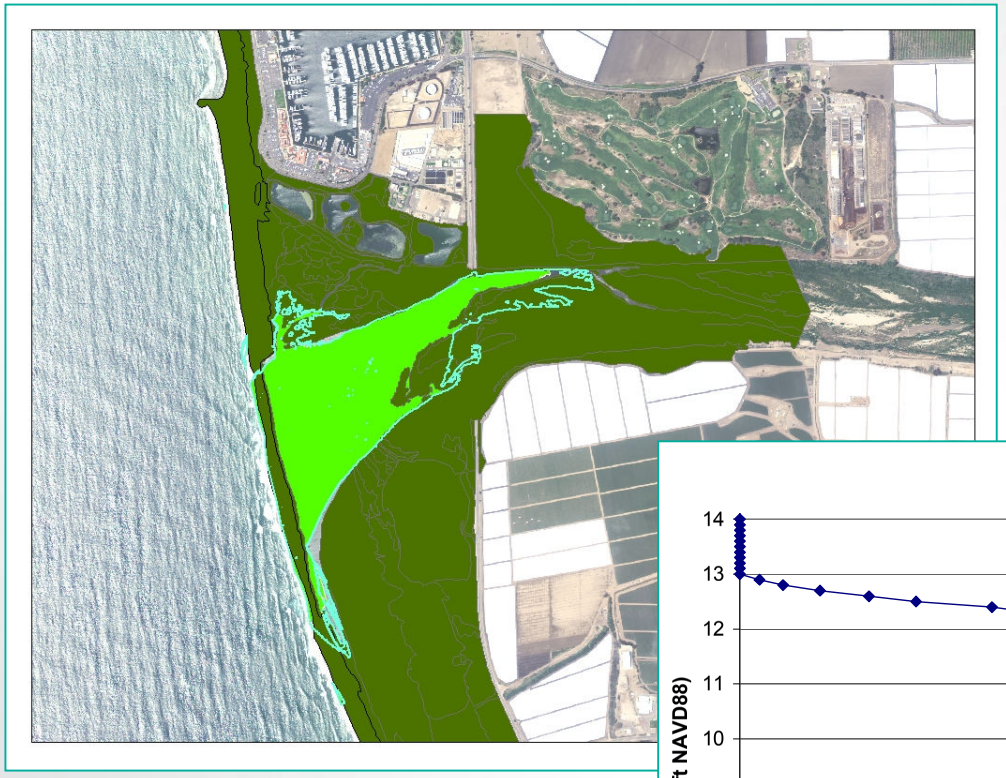

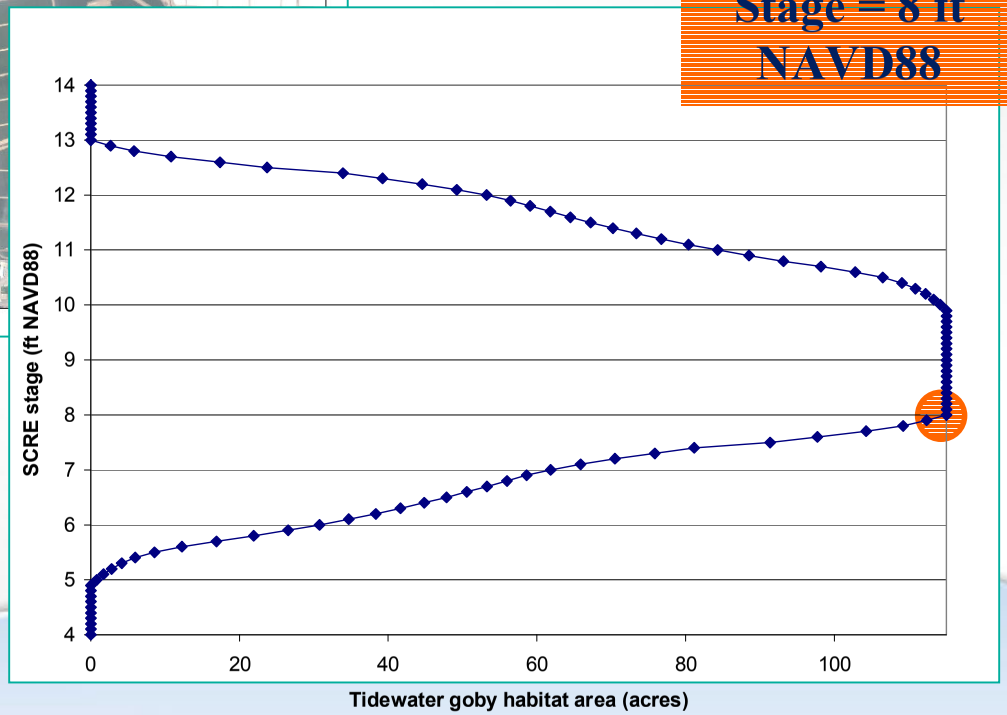

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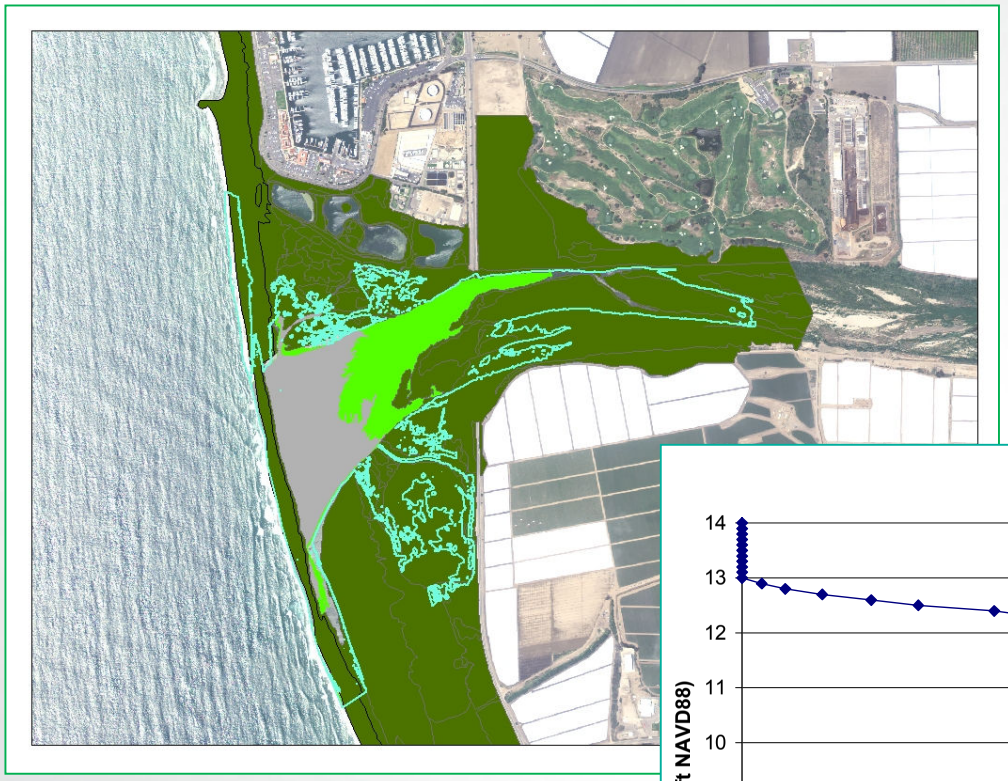
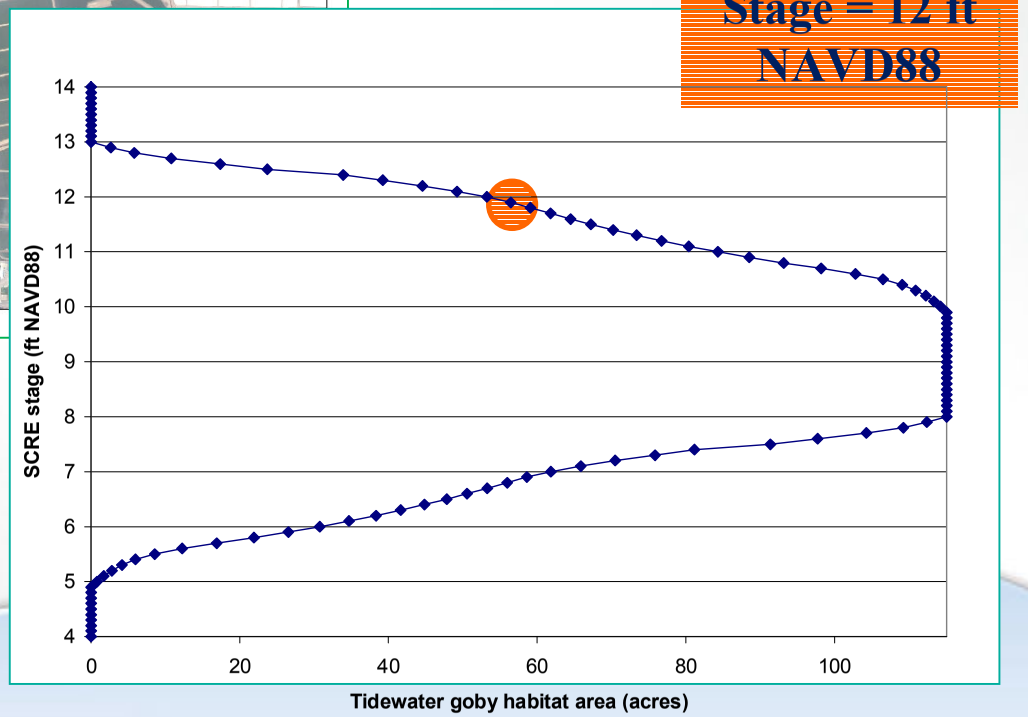
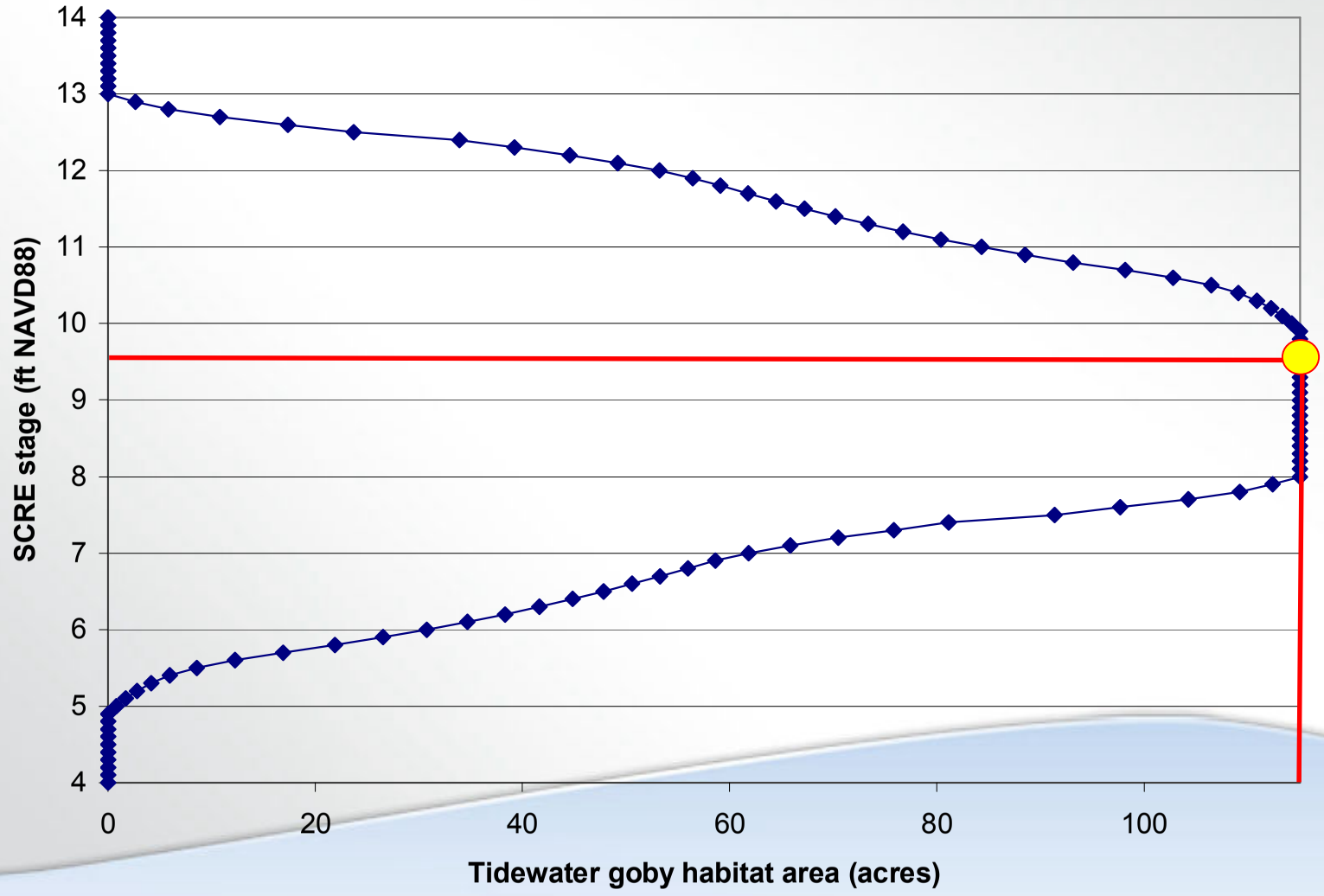




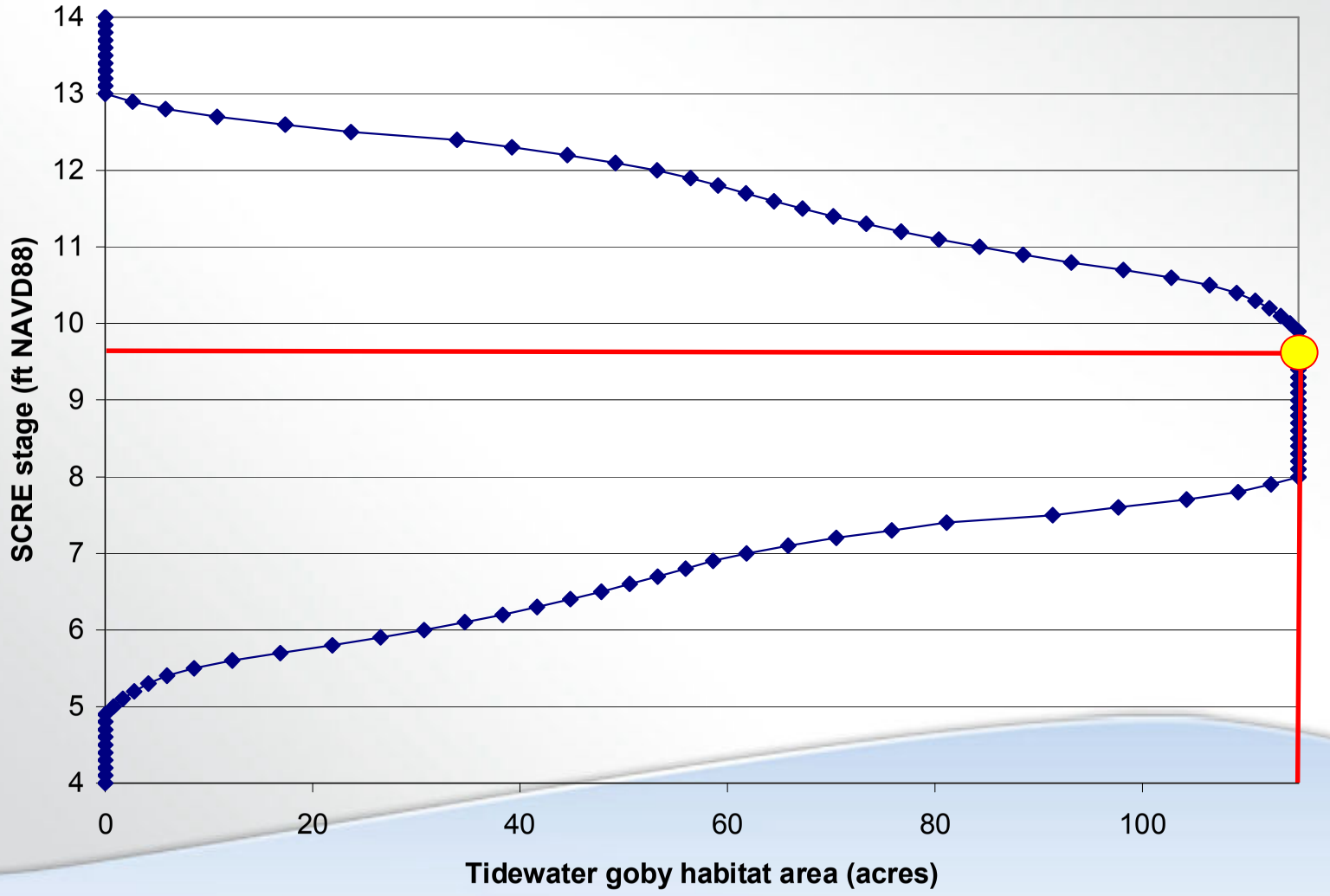
Tidewater Goby Habitat Availability
(available >50% of the time)

Spring (Breeding and Rearing):
May-Jun 2009



Tidewater Goby Habitat Availability
(available >50% of the time)

Summer (Breeding and rearing):
July-Sept 2009



Tidewater Goby Habitat Availability
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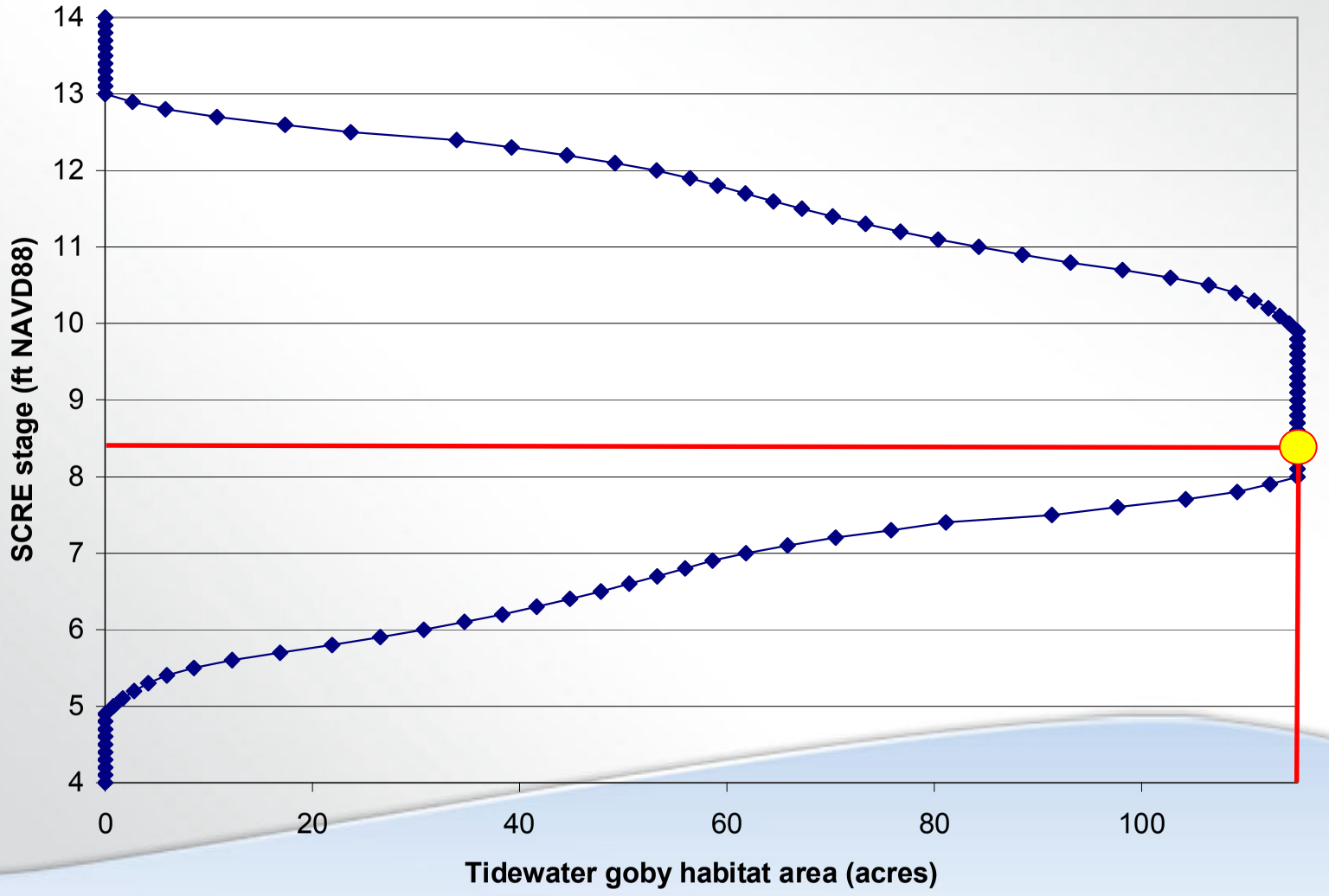
Fall (Adult Residency):
Oct-Dec 2009



Tidewater Goby Habitat Availability
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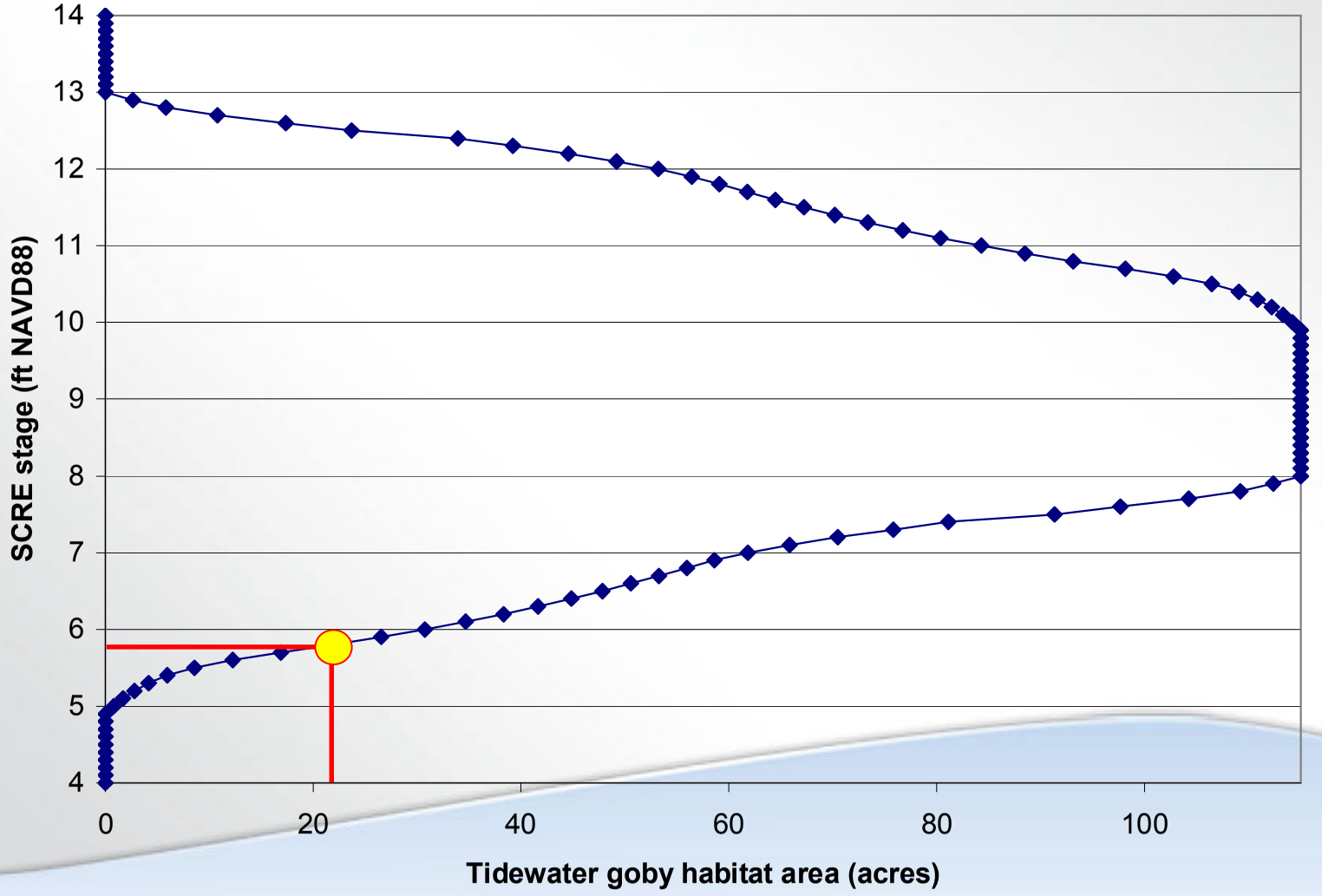
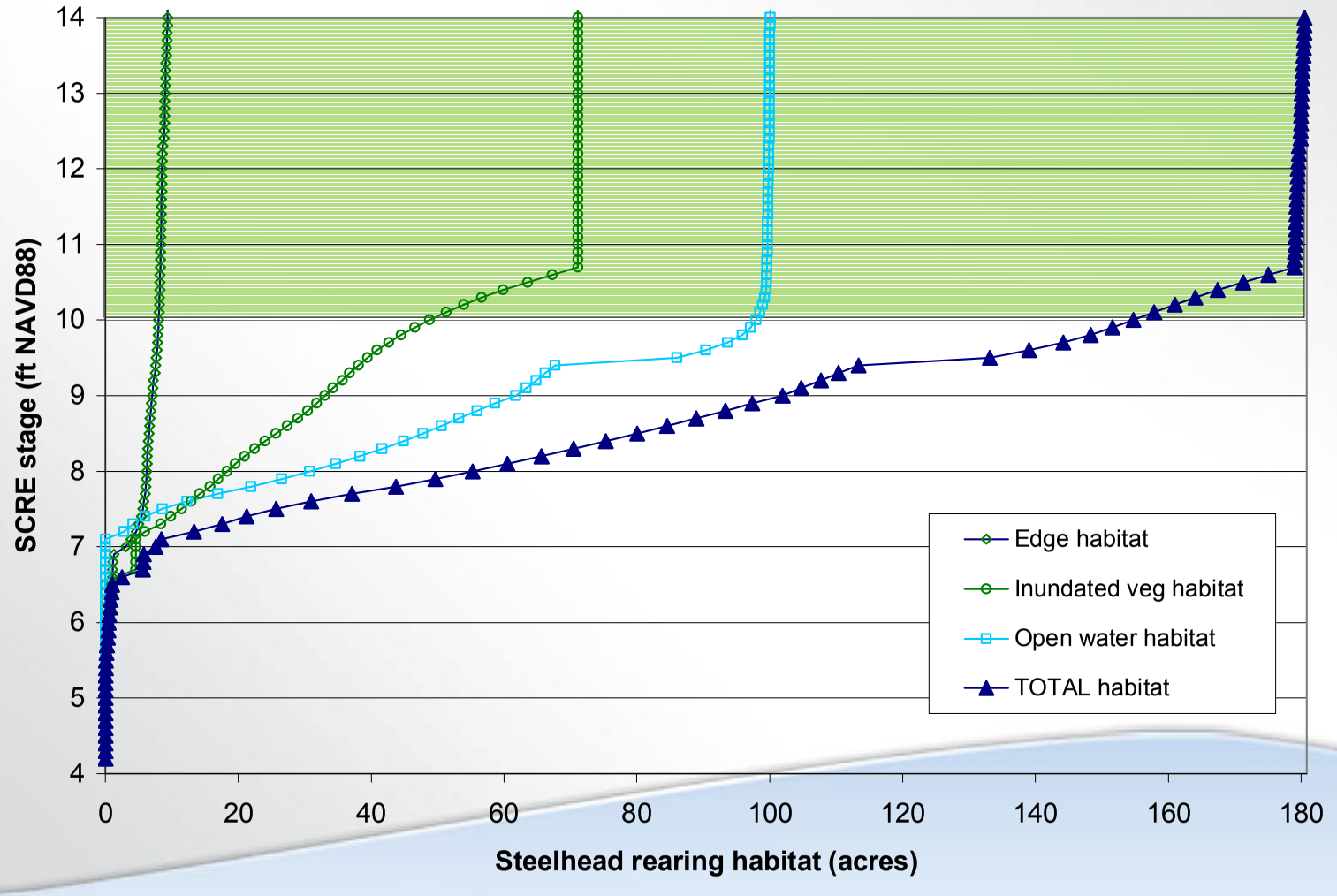
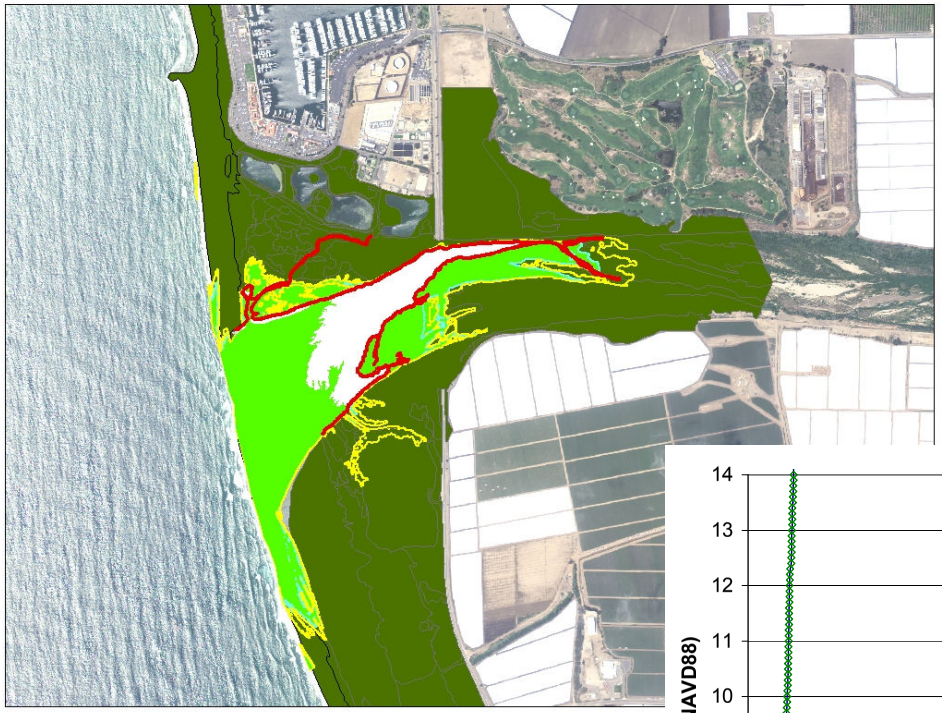
Winter (Adult Residency):
Jan-March 2010



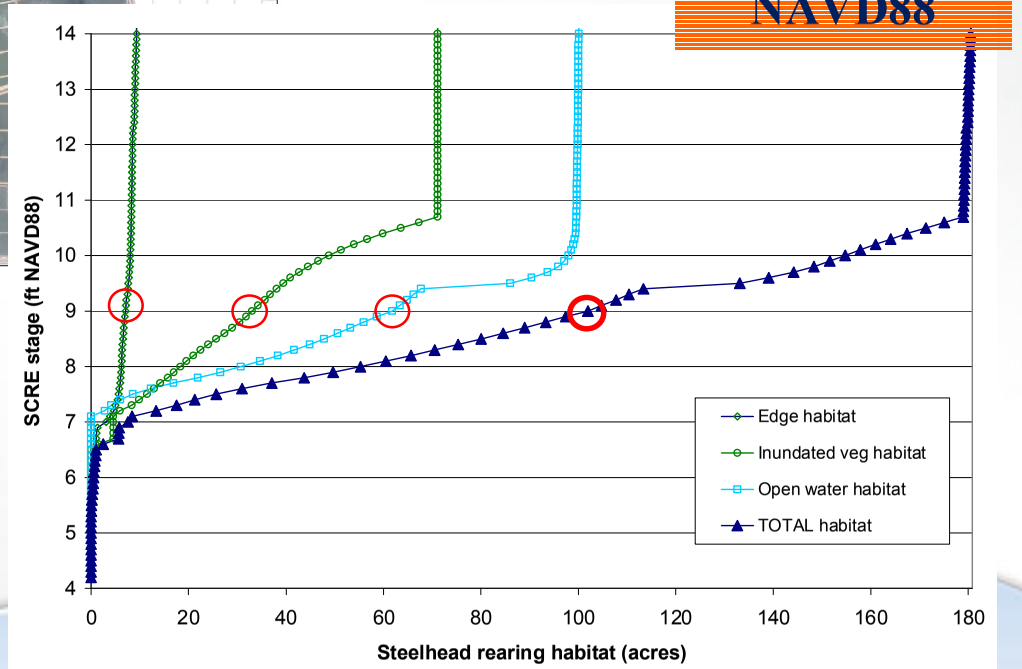
Steelhead Stage-Habitat Relationship



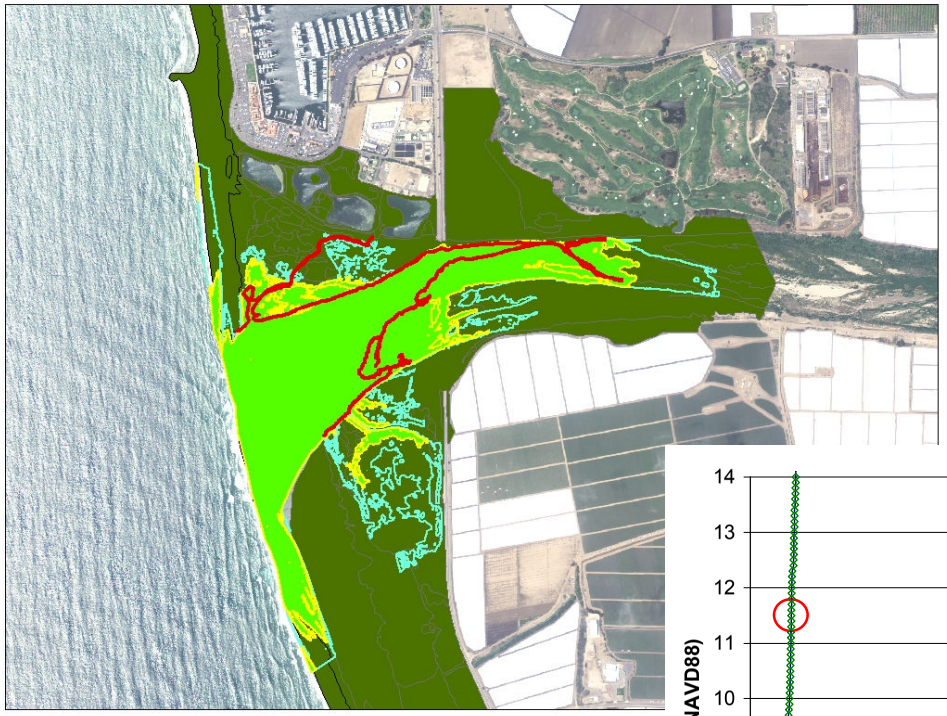
Steelhead Stage-Habitat Relationship



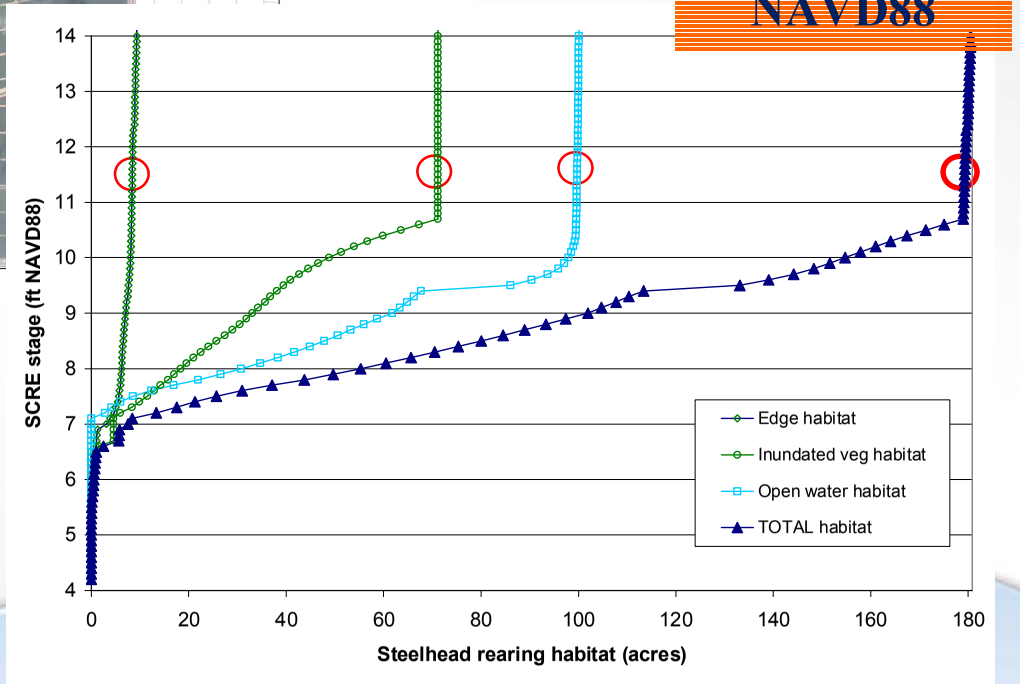
Stage = 9 ft NAVD88



Steelhead Stage-Habitat Relationship

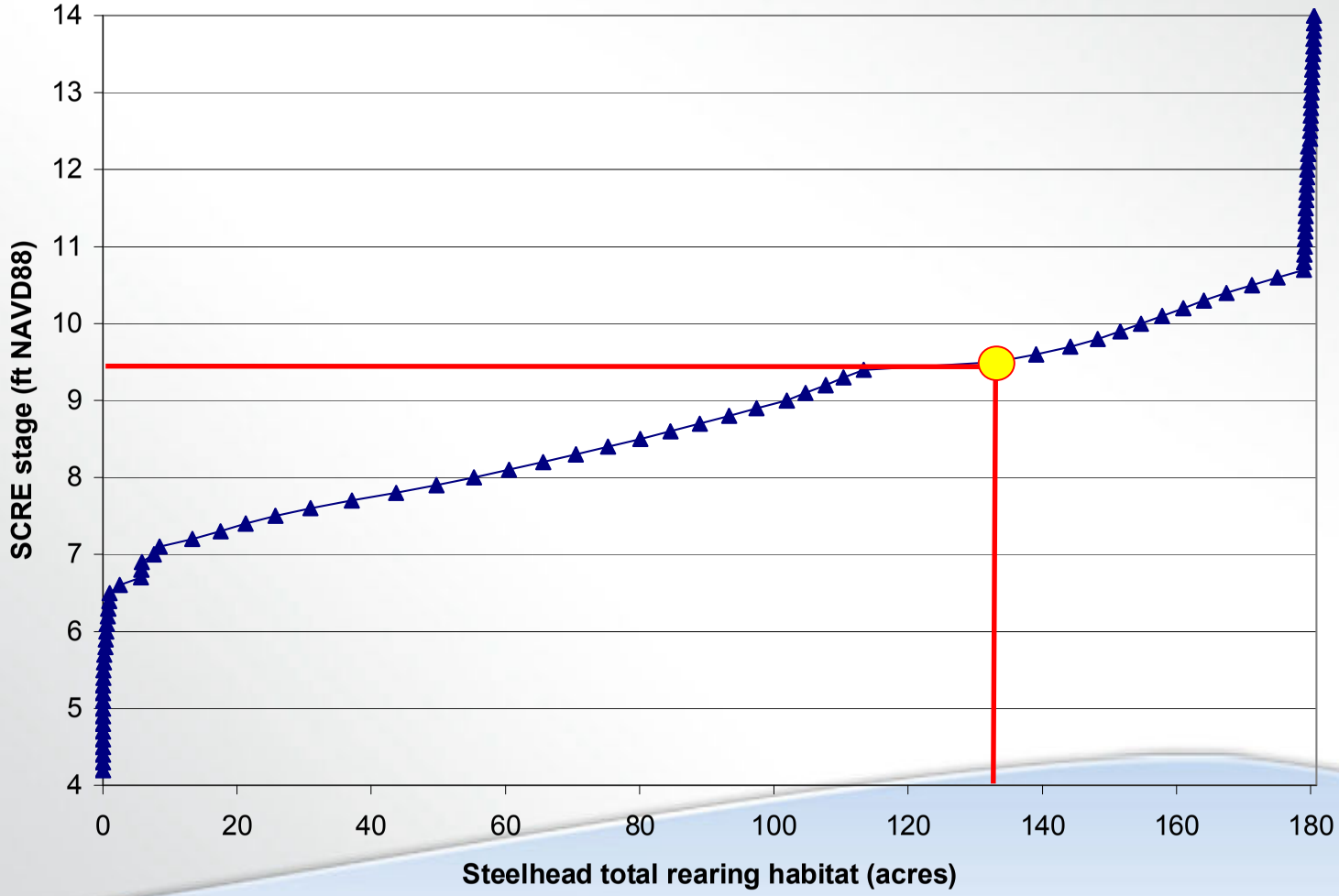


Stage = 12 ft NAVD88



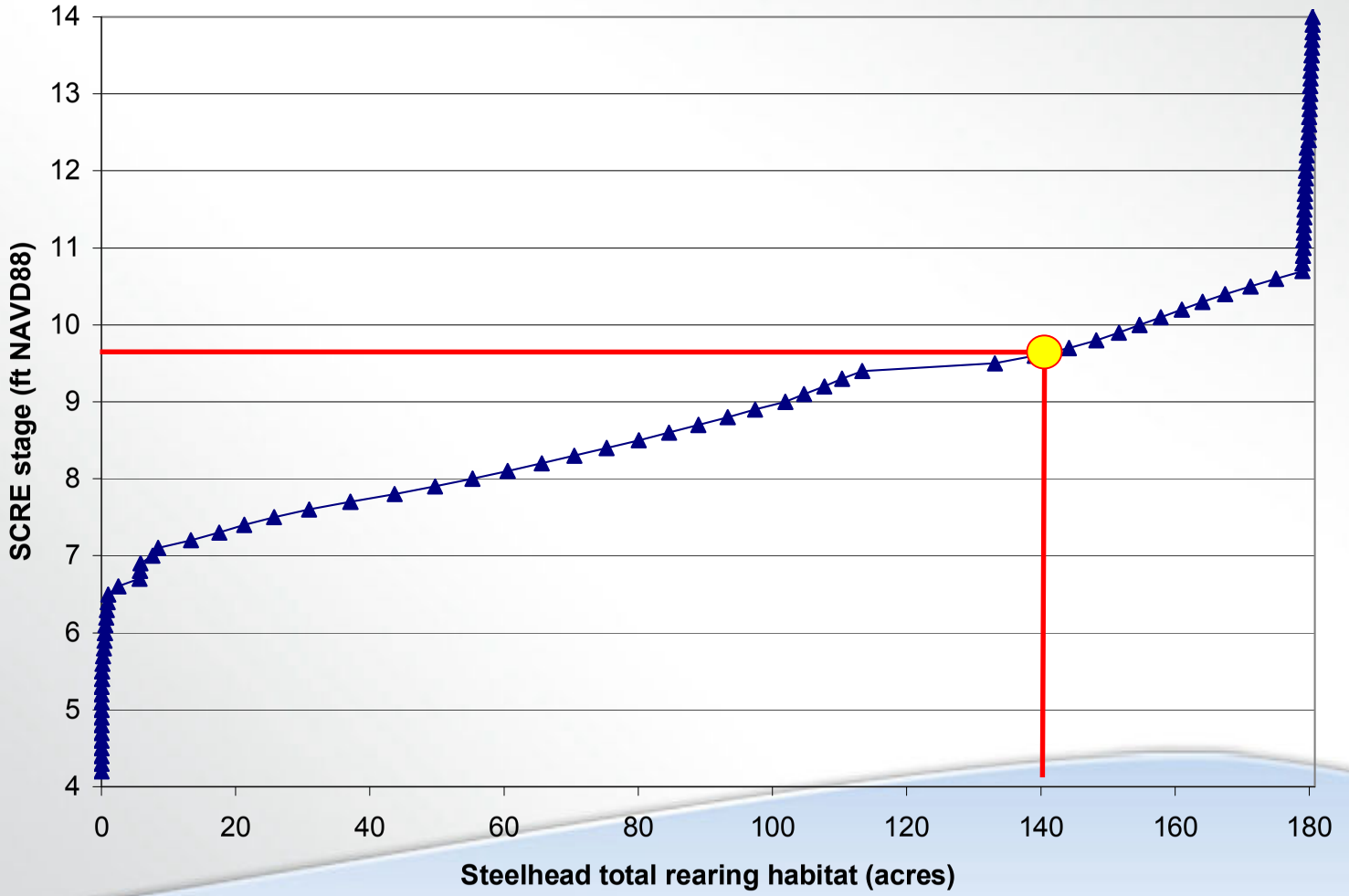
Steelhead Habitat Availability (available >50% of the time)

Spring (Juvenile rearing)
May-Jun 2009



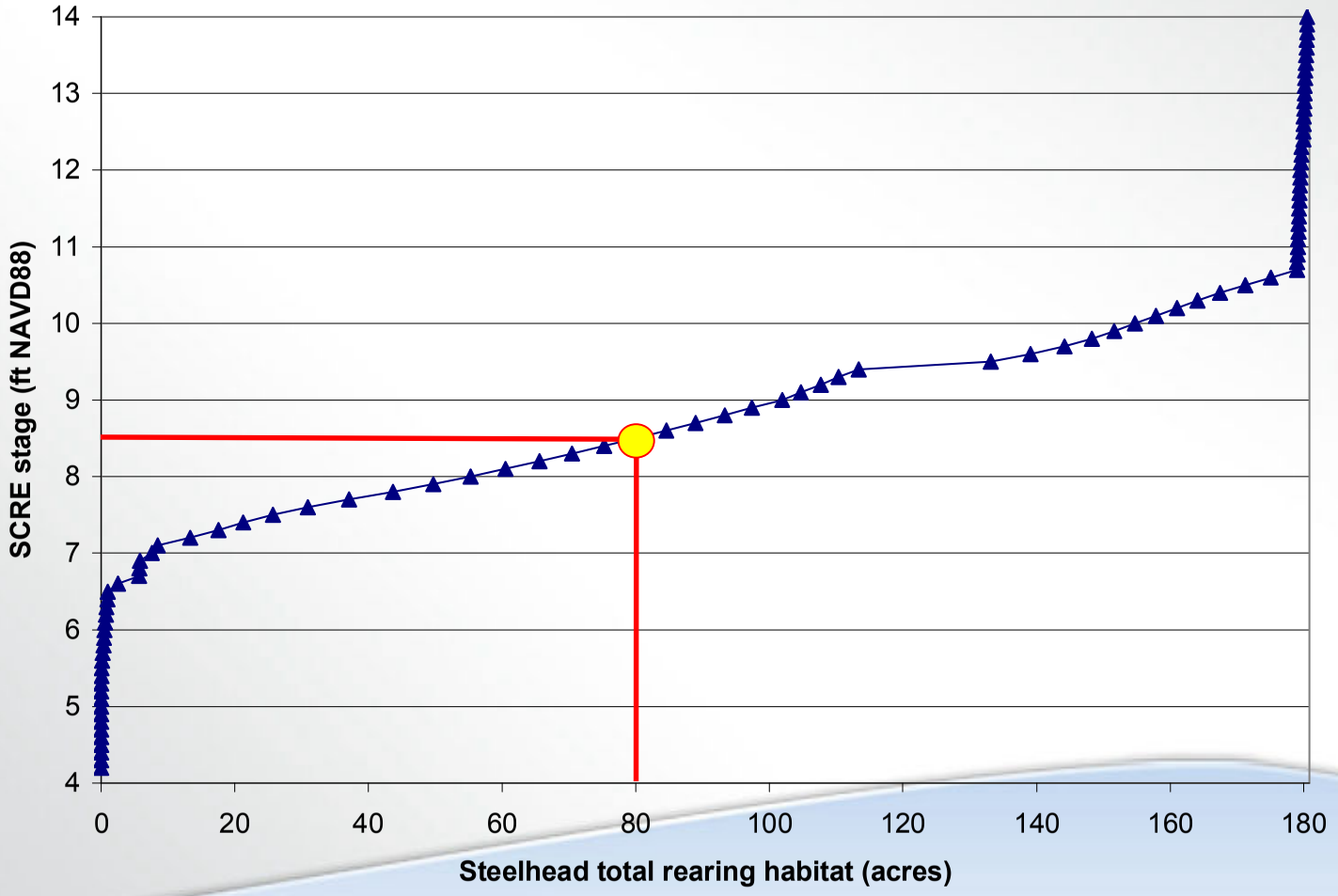
Steelhead Habitat Availability (available >50% of the time)

Spring (Juvenile rearing)
Jul-Sep 2009



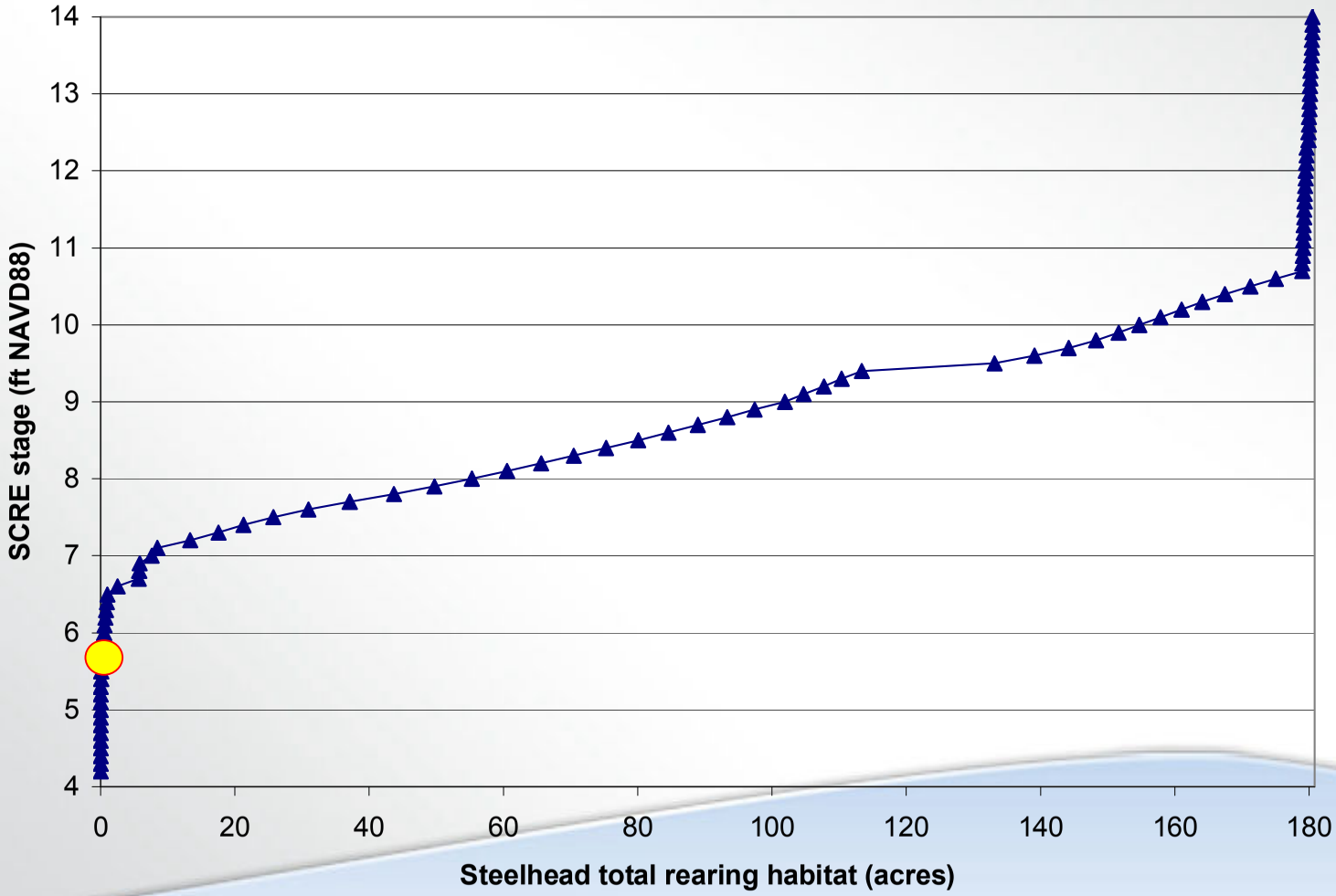
Steelhead Habitat Availability (available >50% of the time)

Fall (Rearing and up-migration)
Oct-Dec 2009



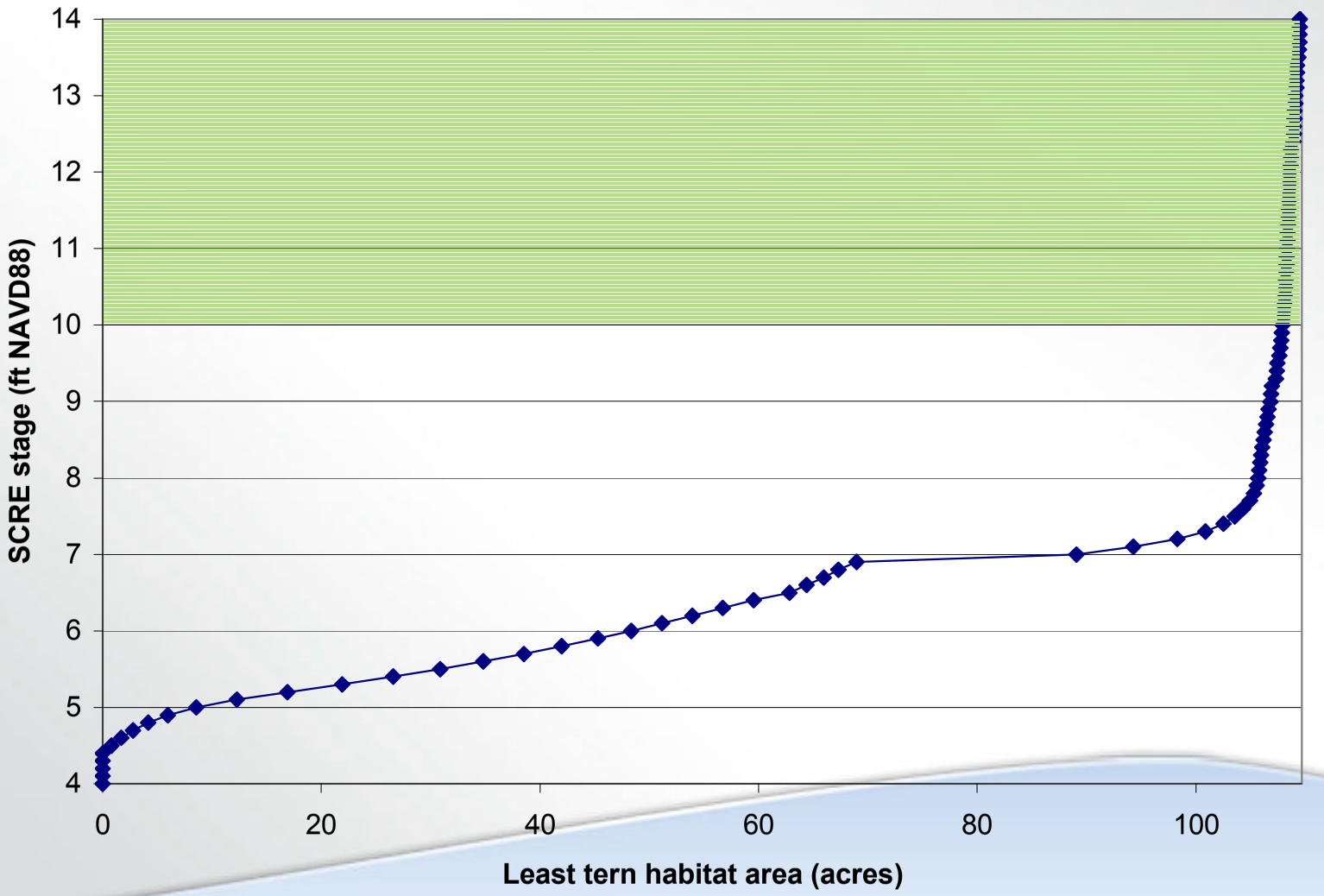
Steelhead Habitat Availability (available >50% of the time)

Winter (Rearing and up-migration)
Jan-March 2010

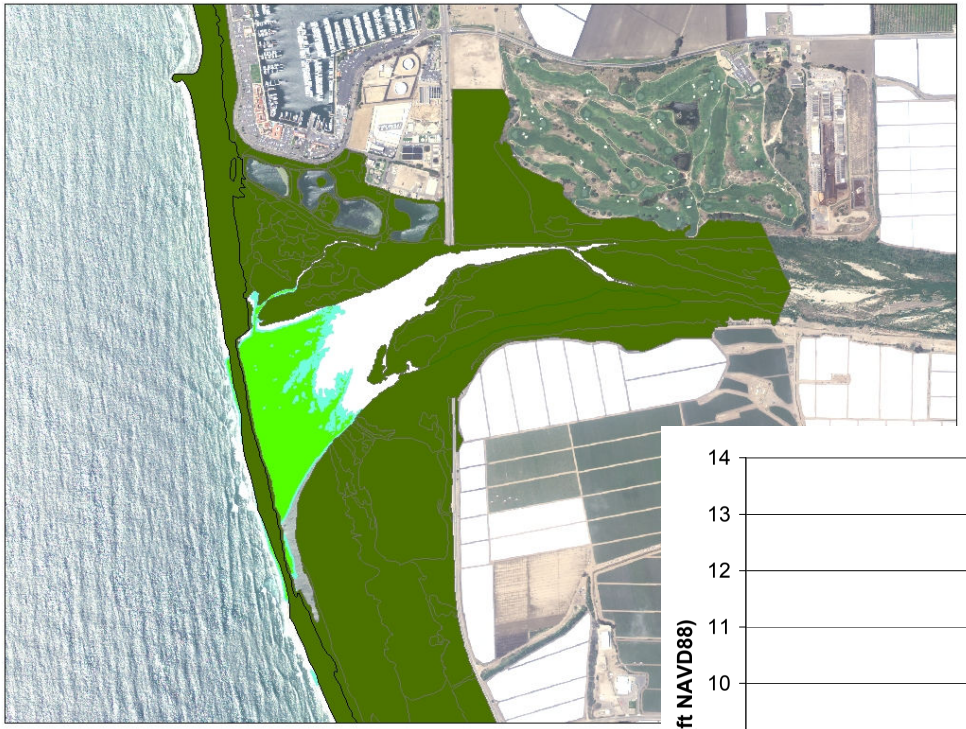


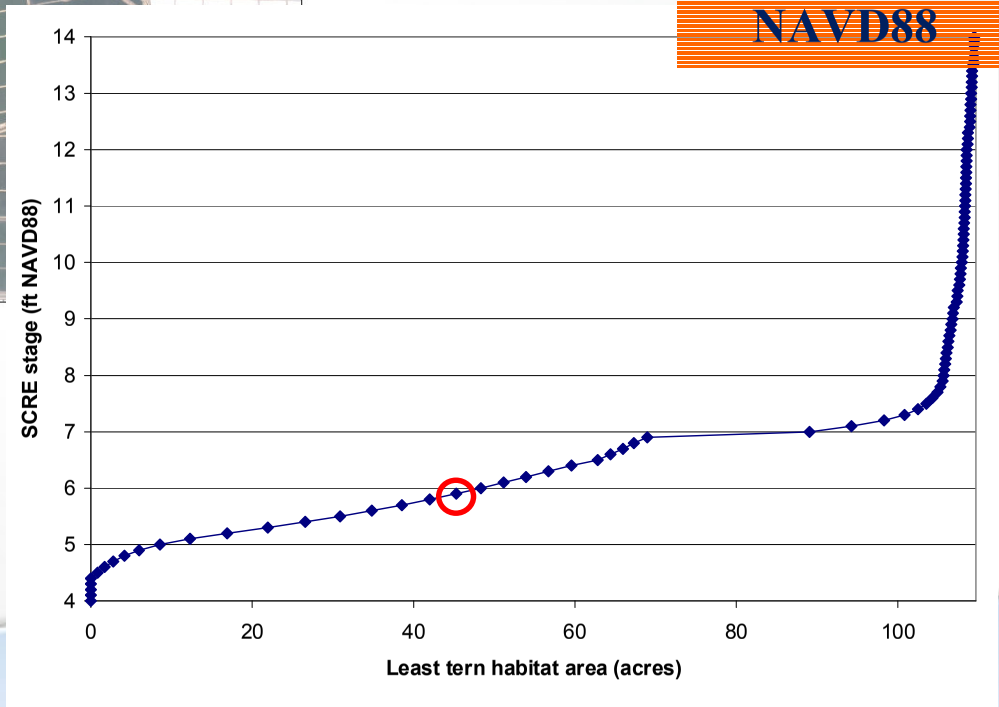
Least tern Stage-Habitat Availability

(Depth criteria >0.5 ft)

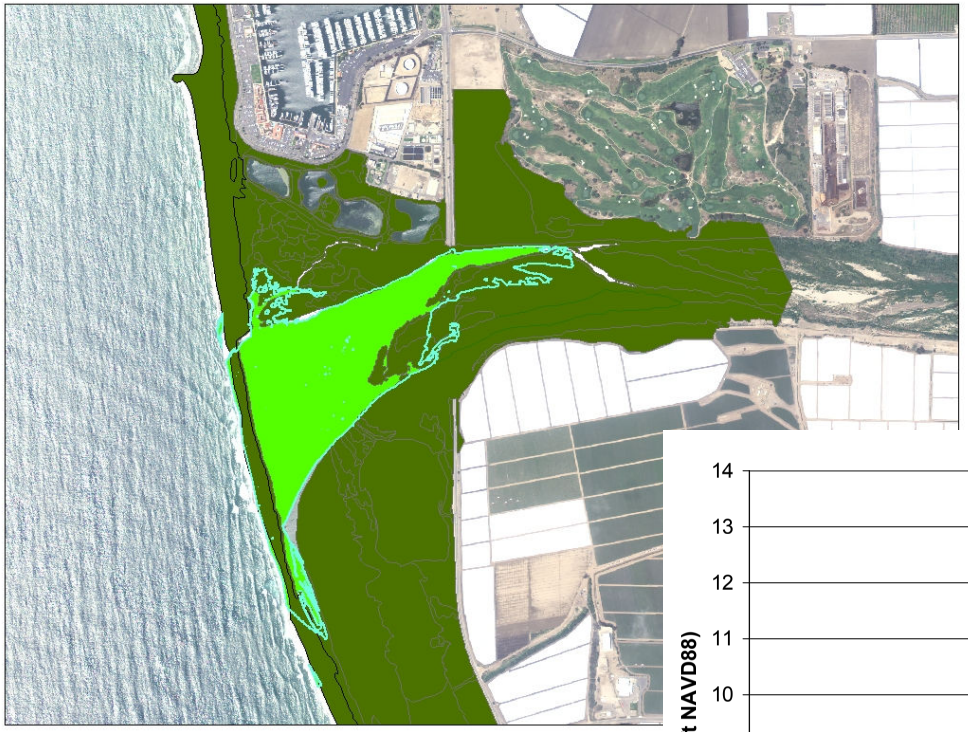


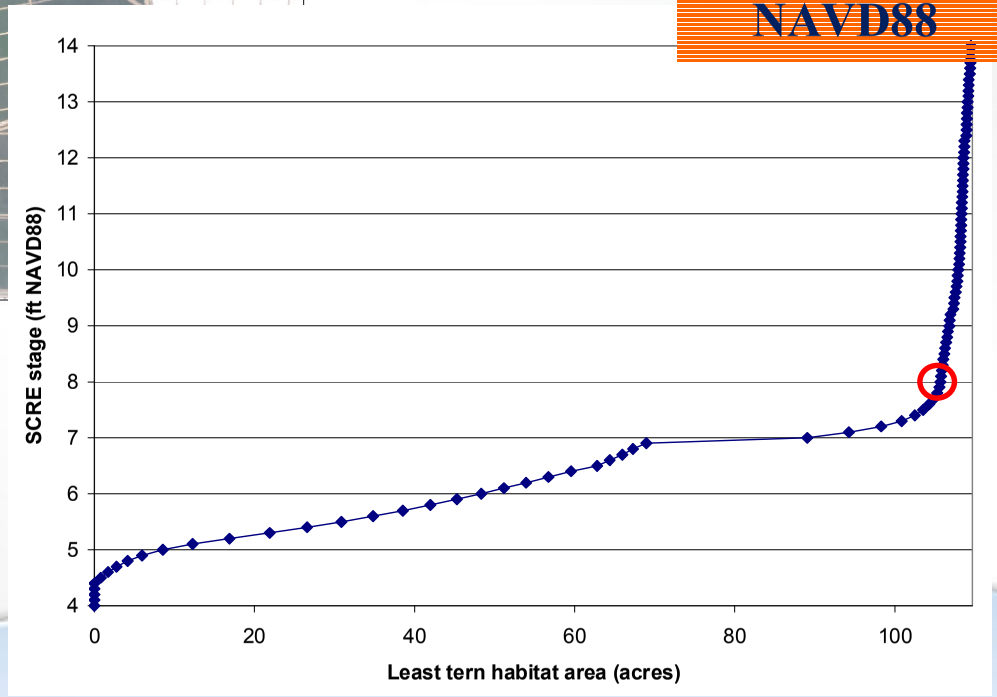
Least tern Stage-Habitat Relationship





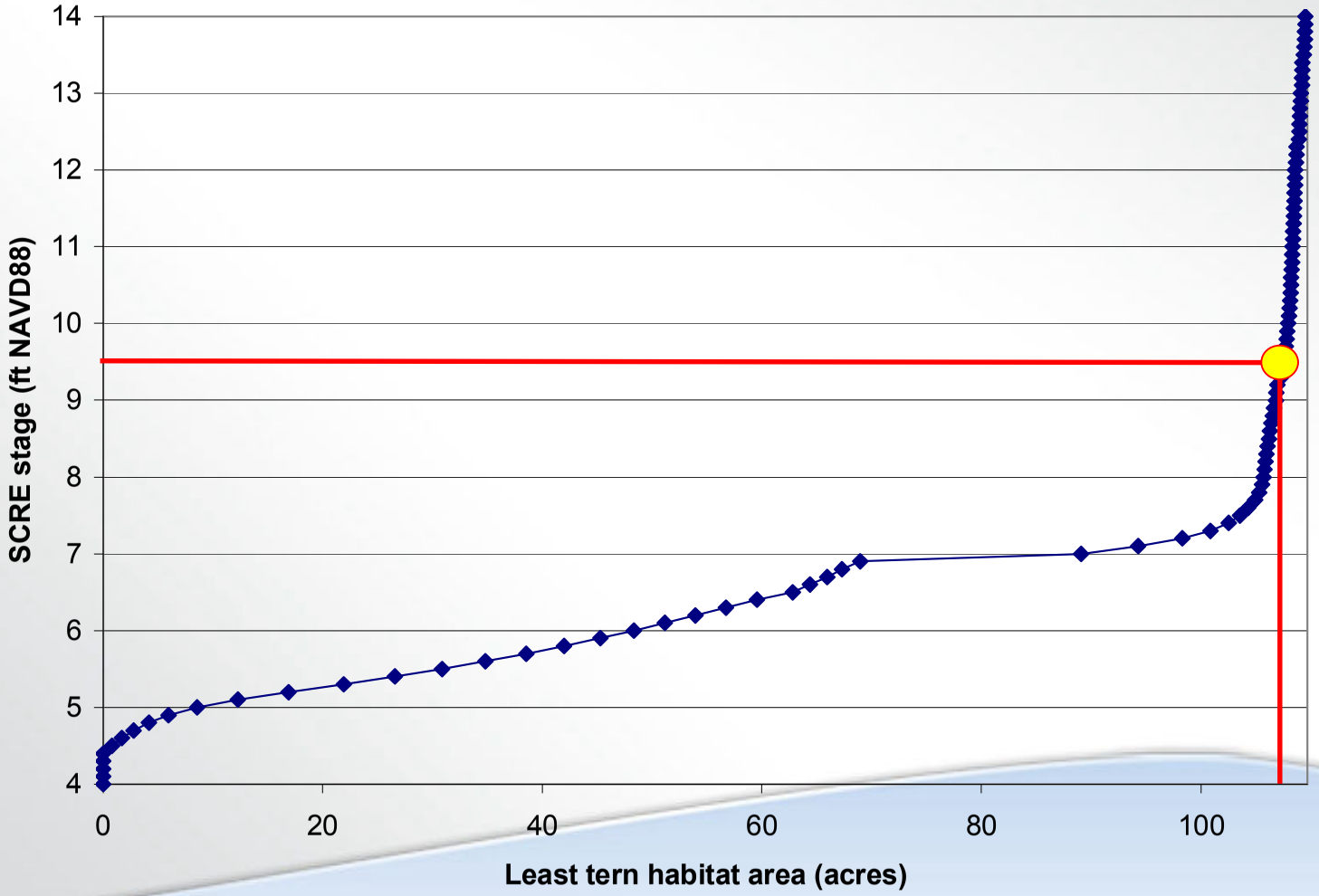
Least tern Stage-Habitat Relationship





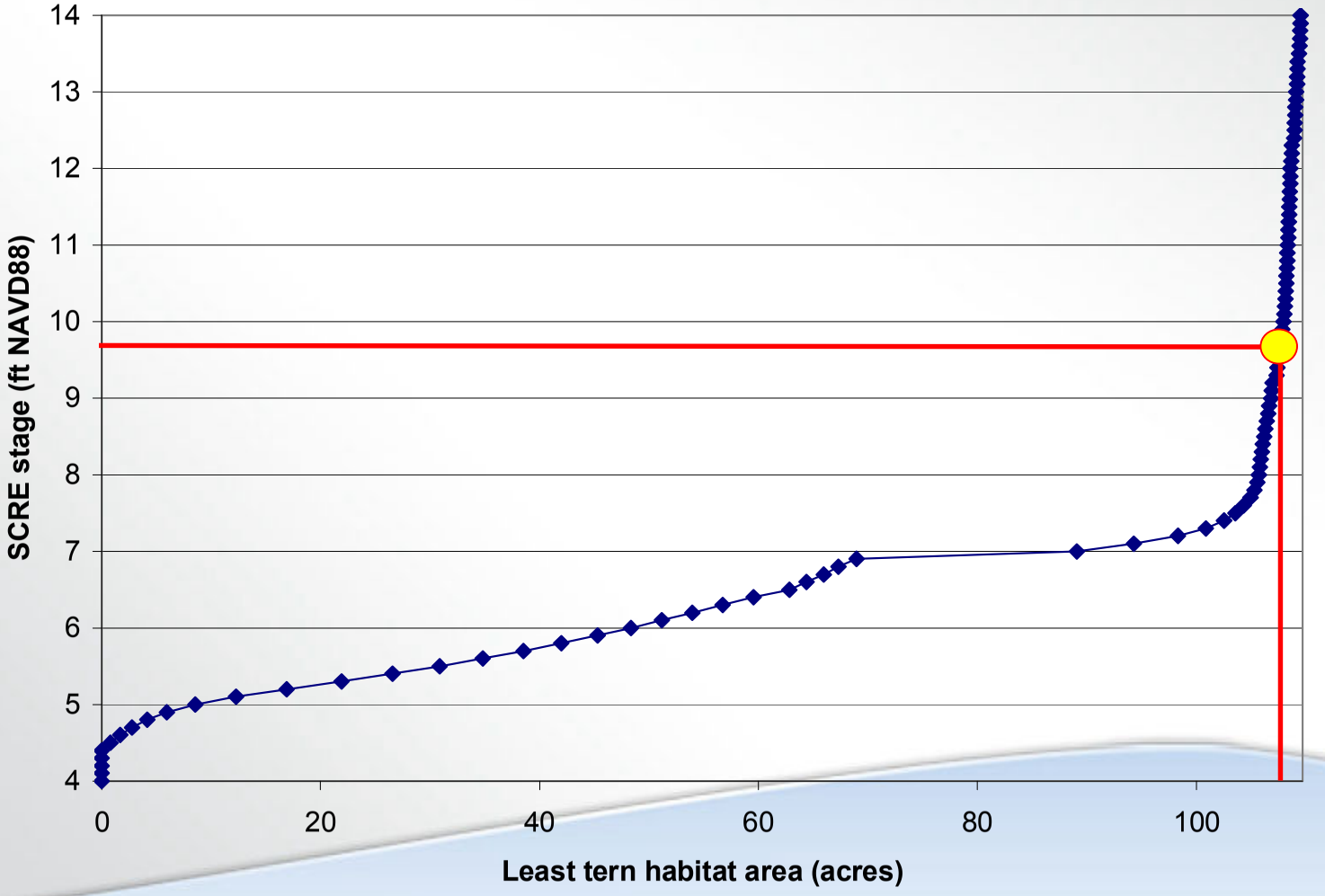
Least tern Habitat Availability (available >50% of the time)

Spring (Nesting and rearing)
May-Jun 2009



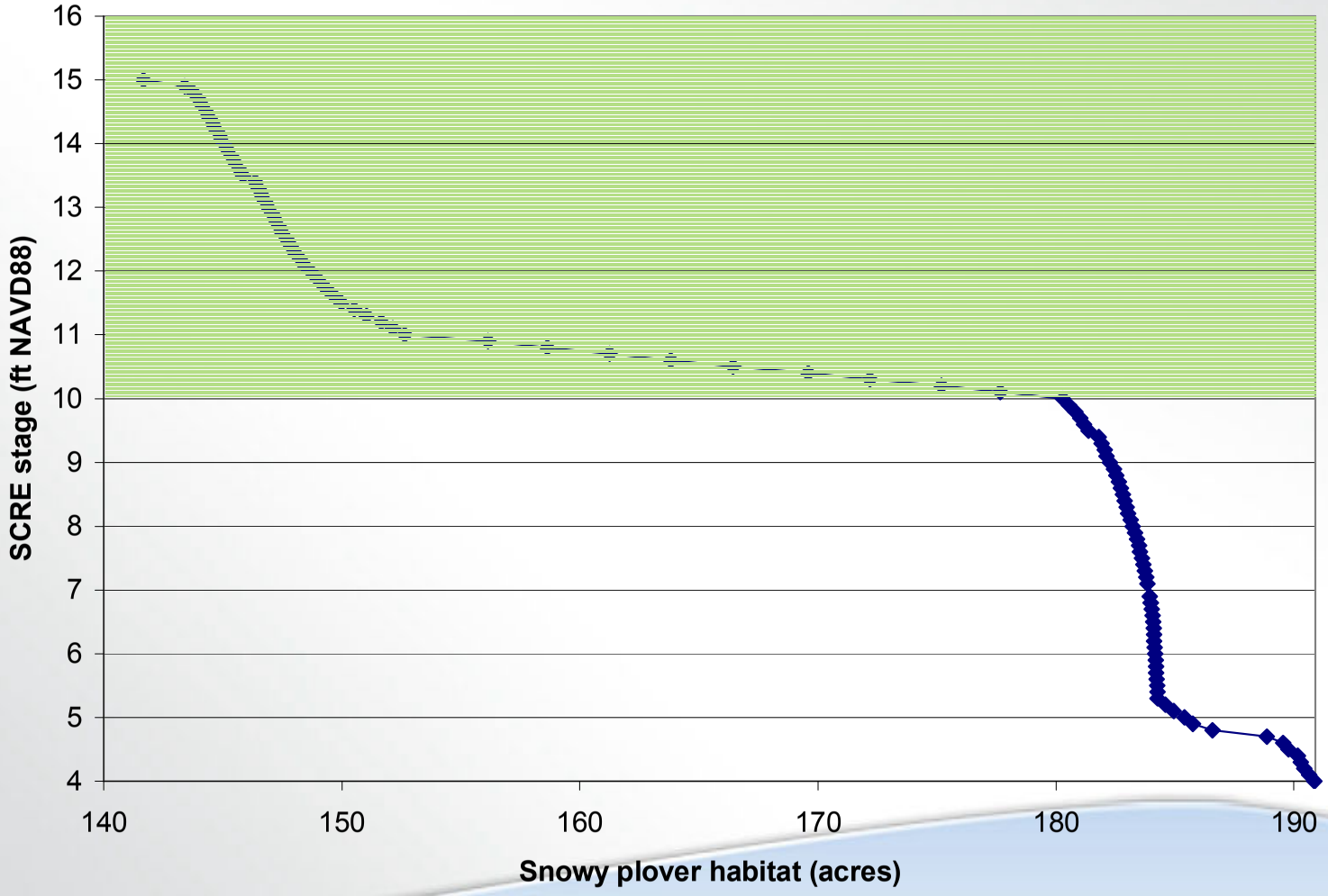
Least tern Habitat Availability (available >50% of the time)

Summer (Nesting and rearing)
July-Sept 2009

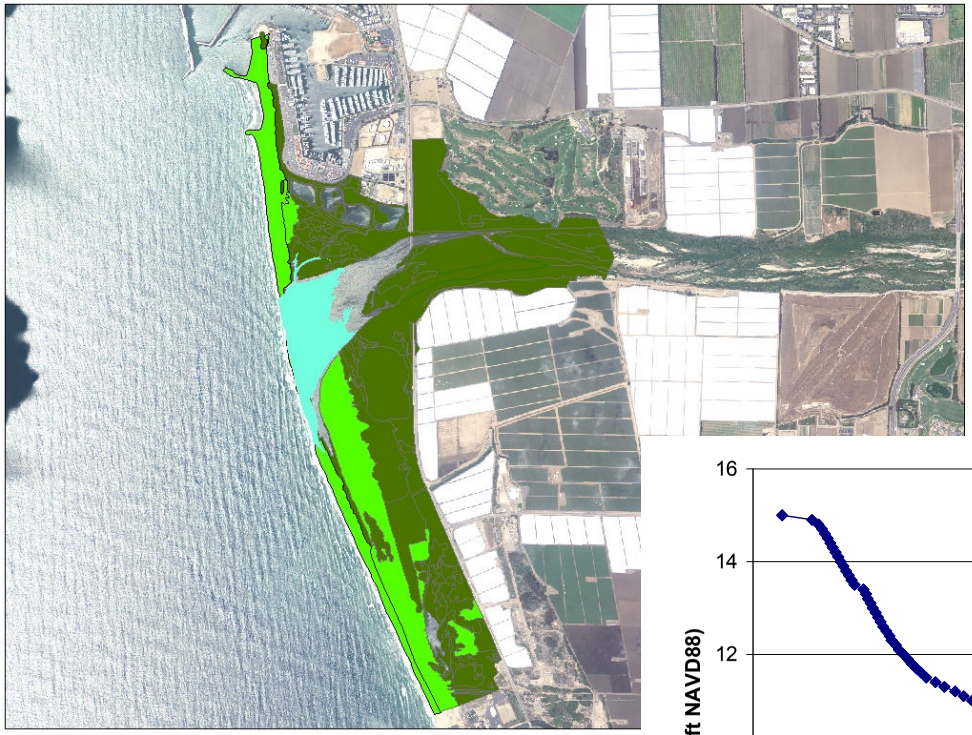


Snowy Plover Stage-Habitat Relationship

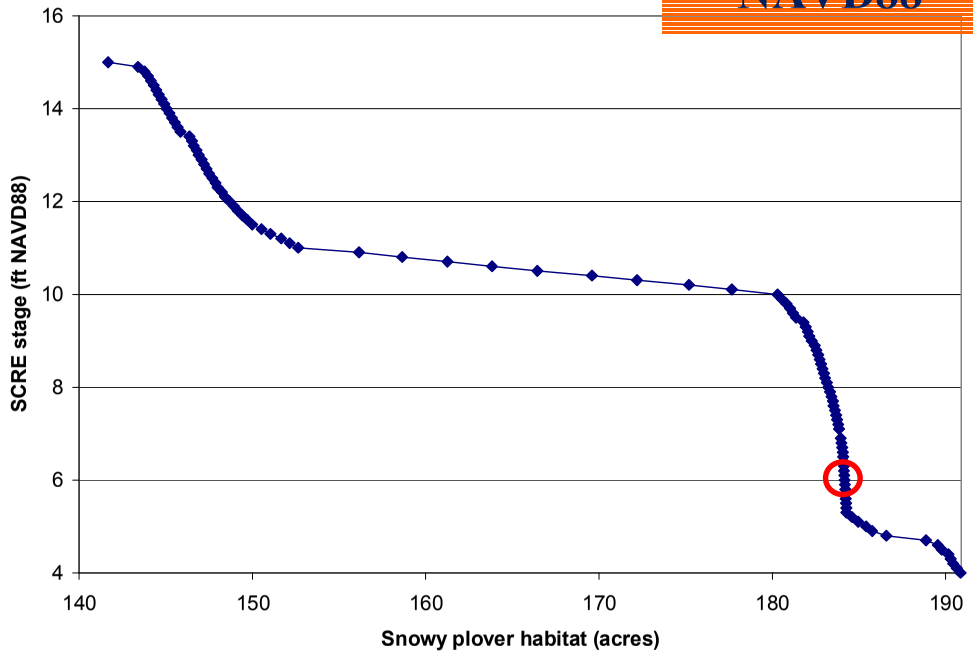
Open beach and foredune habitat



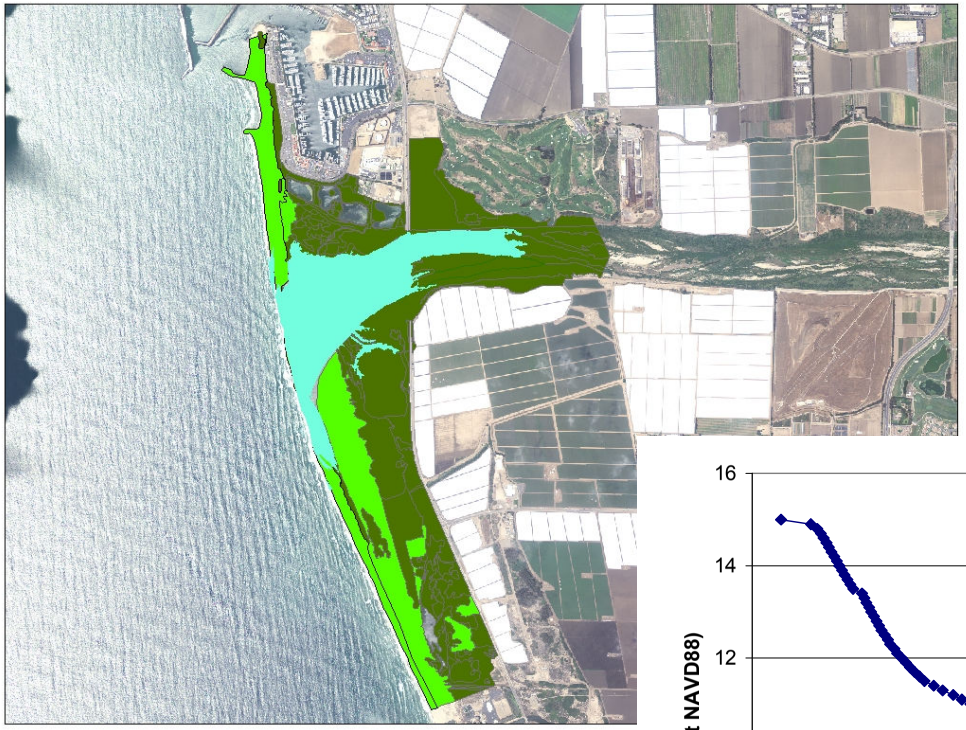
Snowy Plover Stage-Habitat Relationship



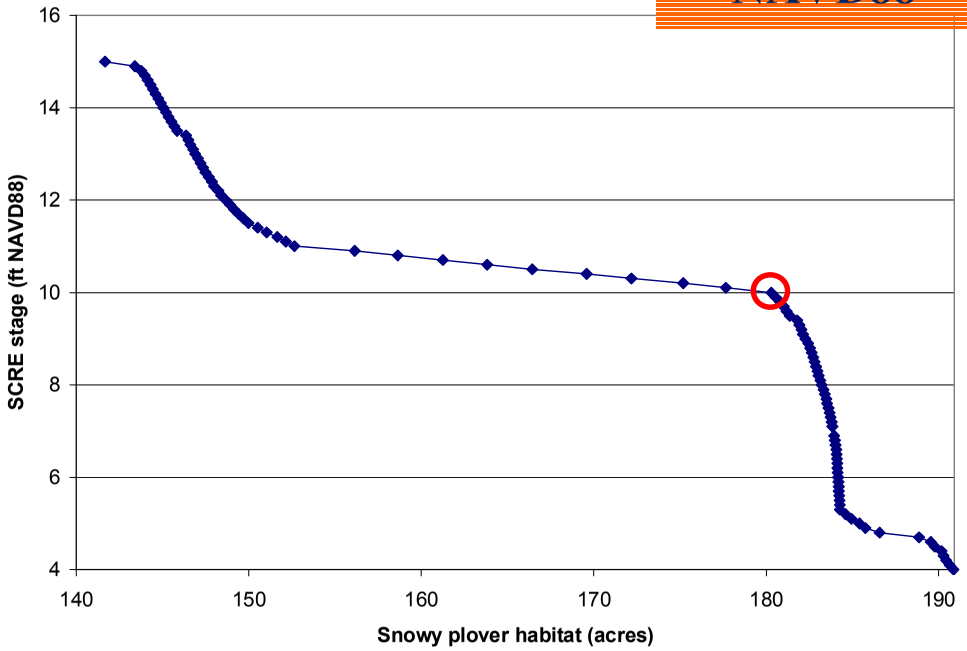
Stage = 6 ft NAVD88



Snowy Plover Stage-Habitat Relationship



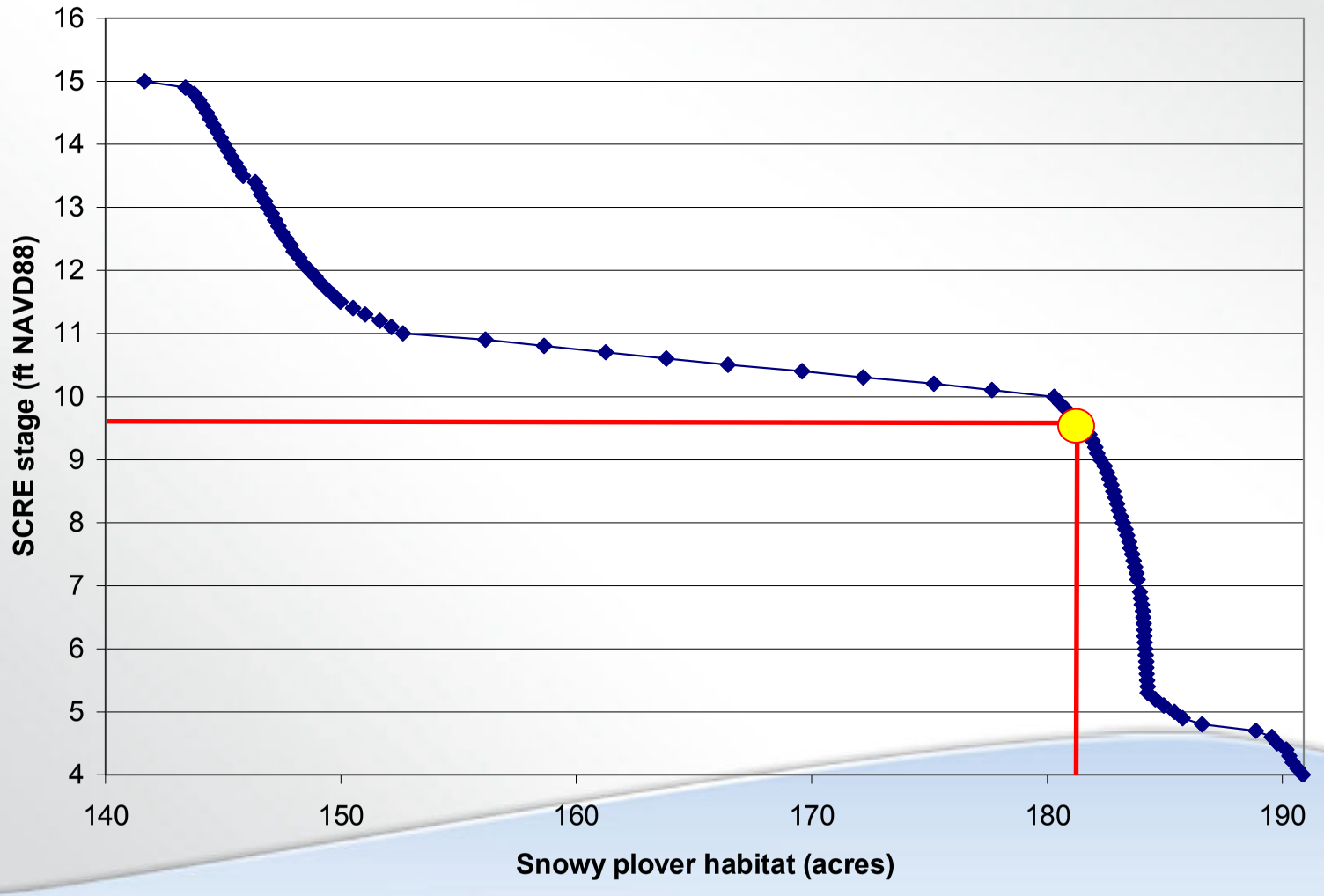
Stage = 10 ft NAVD88



Snowy Plover Habitat Availability

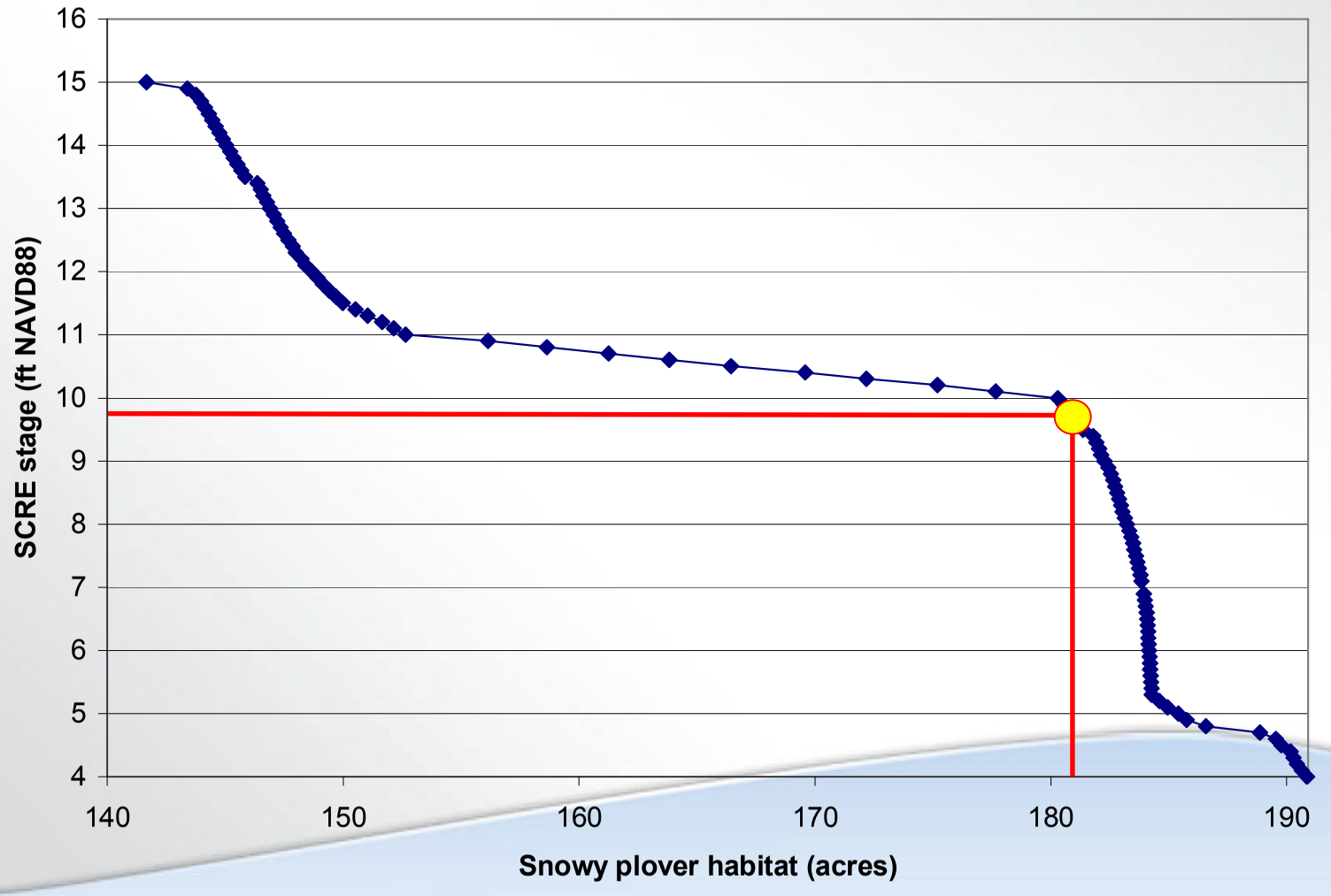
(available >50% of the time)

Spring (Nesting and rearing)
May-Jun 2009



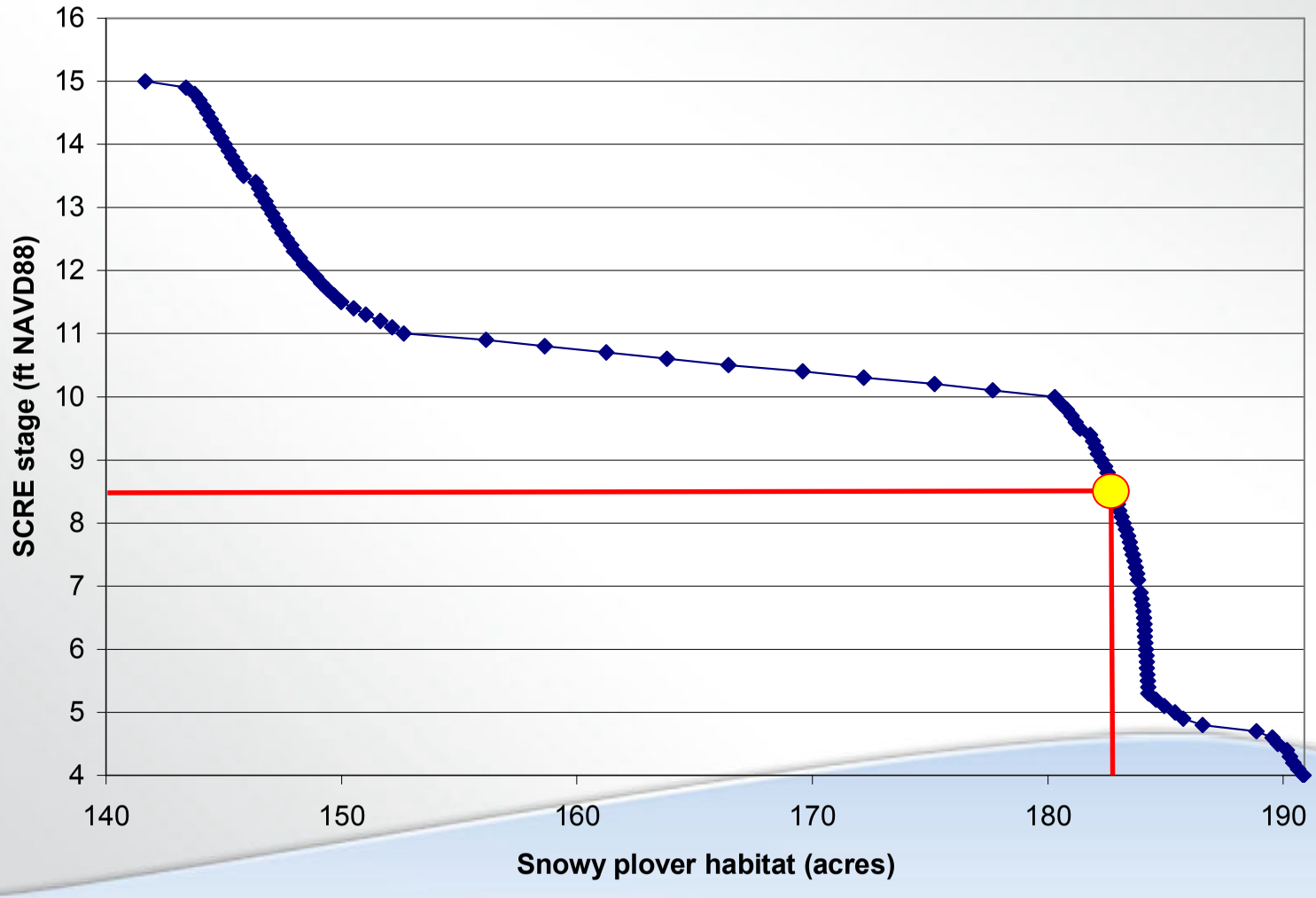
Snowy Plover Habitat Availability
(available >50% of the time)

Summer (Nesting and rearing)
July-Sept 2009



Snowy Plover Habitat Availability
(available >50% of the time)

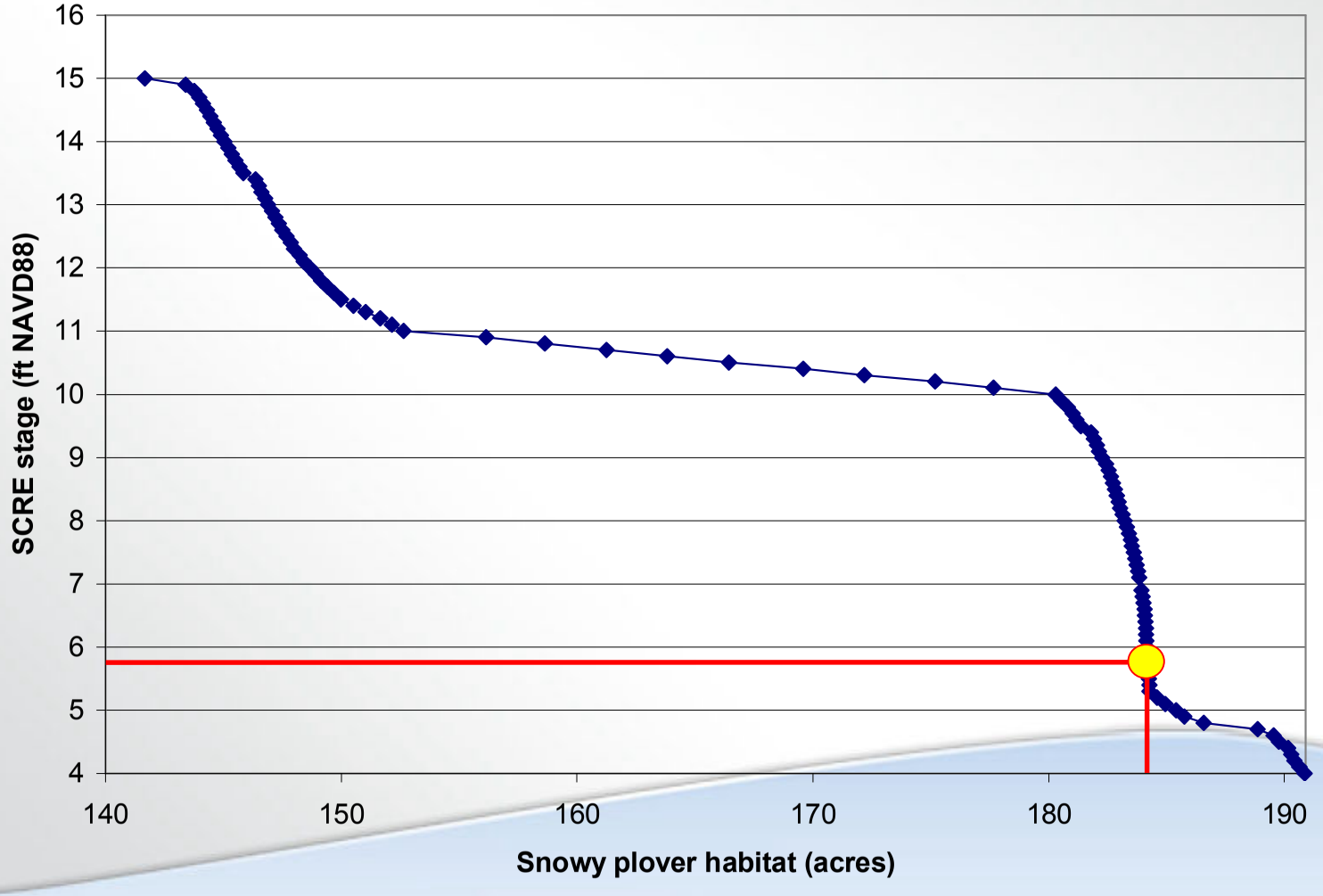
Fall (Non-breeding)
Oct-Dec 2009



Snowy Plover Habitat Availability

(available >50% of the time)

Winter (Non-breeding)
Jan-March 2010



Aquatic and wildlife habitat maintenance

- Available habitat generally increases with SCRE Stage
  - Max tidewater goby habitat area <10 ft
  - Max Southern steelhead habitat area >10 ft
  - Max Least tern foraging habitat area >8 ft
  - Max Snowy plover nesting and foraging habitat area at 5-10 ft

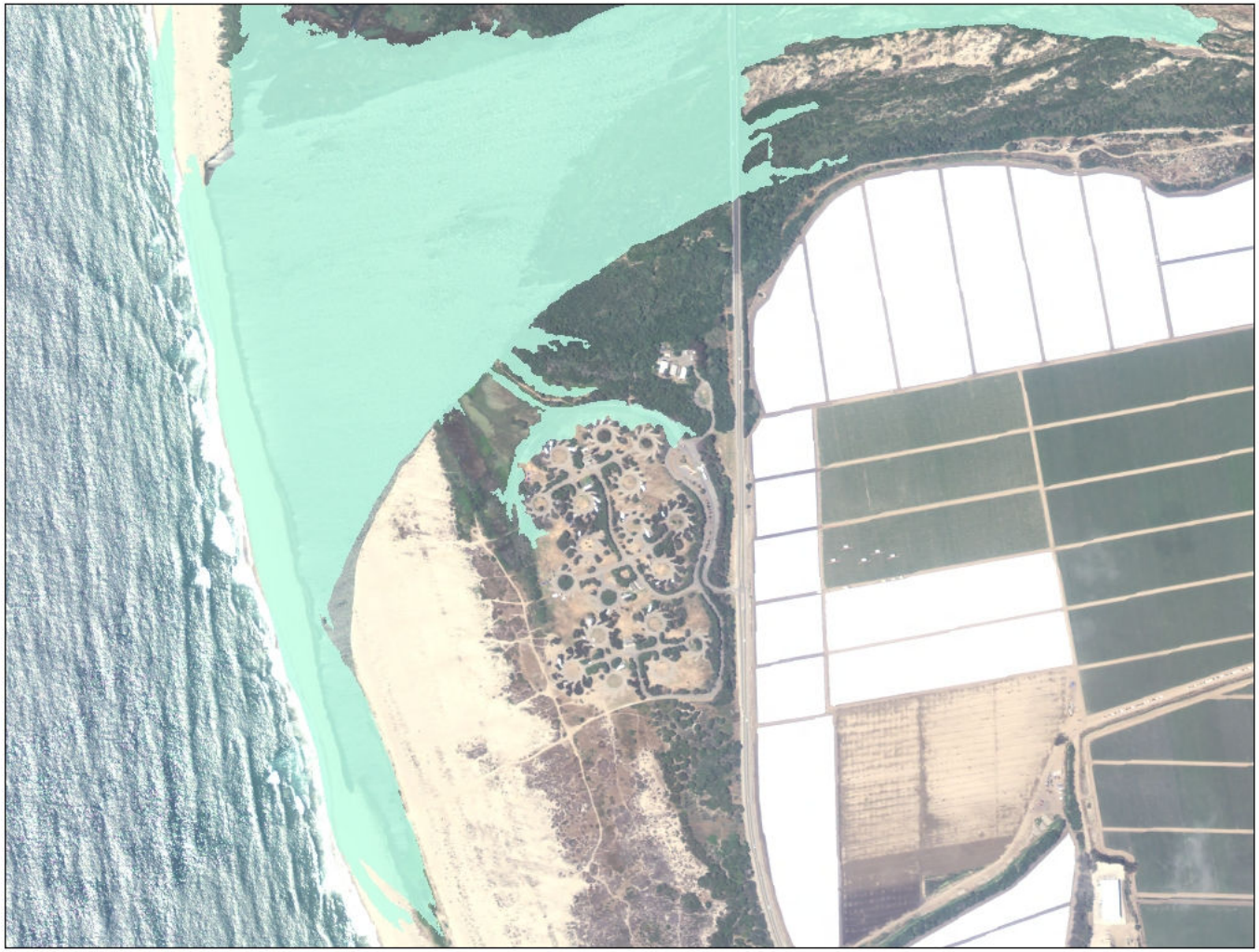
Current Ecosystem Functioning

VWRF effects on Primary Functions:

- Flow regulation
- Sediment storage and beach building
- Water quality regulation
- Aquatic habitat maintenance
- Wildlife habitat maintenance
- Recreational opportunities

Recreational Opportunities

‘Full’ SCRE Inundation Extent ~ 10 ft NAVD88



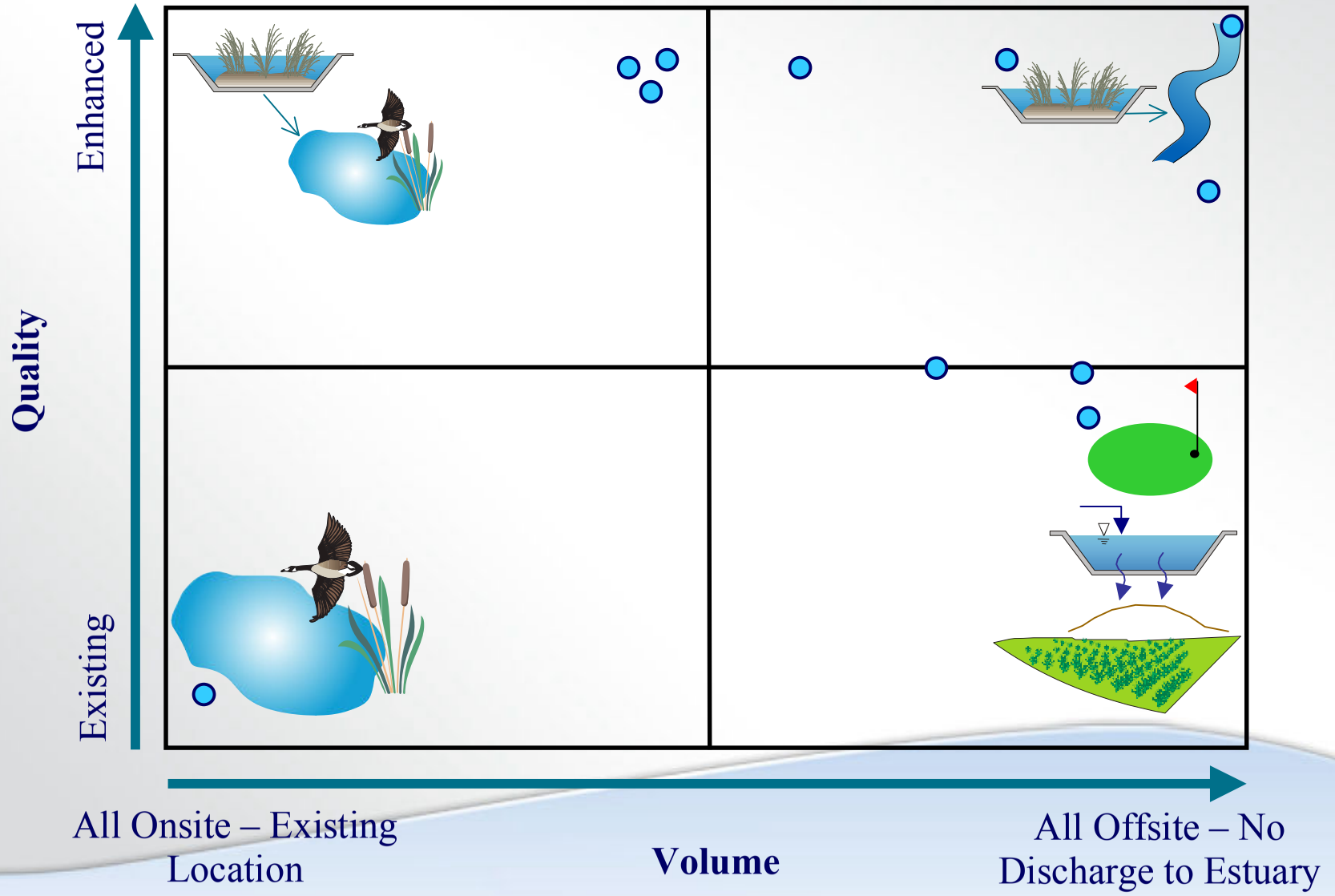
Recreational Opportunities

- McGrath State Beach campground gets saturated when SCRE stage and water table elevations are high ~10 ft NAVD88
  - Affects campground usage
  - Primarily summer months
- Likely that floodplain saturation existed historically

Overview

1. **Ecosystem Overview**
   - Overall conceptual model
   - Focal species habitat needs
2. **Water Balance**
   - Preliminary assessment (2009-2010)
3. **Water Quality**
   - Assessment (2001-2010)
   - Water quality (nutrient) balance
4. **Ecosystem Functioning**
   - Current functioning
   - Stage-Habitat Relationships (2009-2010)
5. **Discharge Scenarios**

Nov. 2009 - You provided input on potential alternatives for recycled water and wetlands



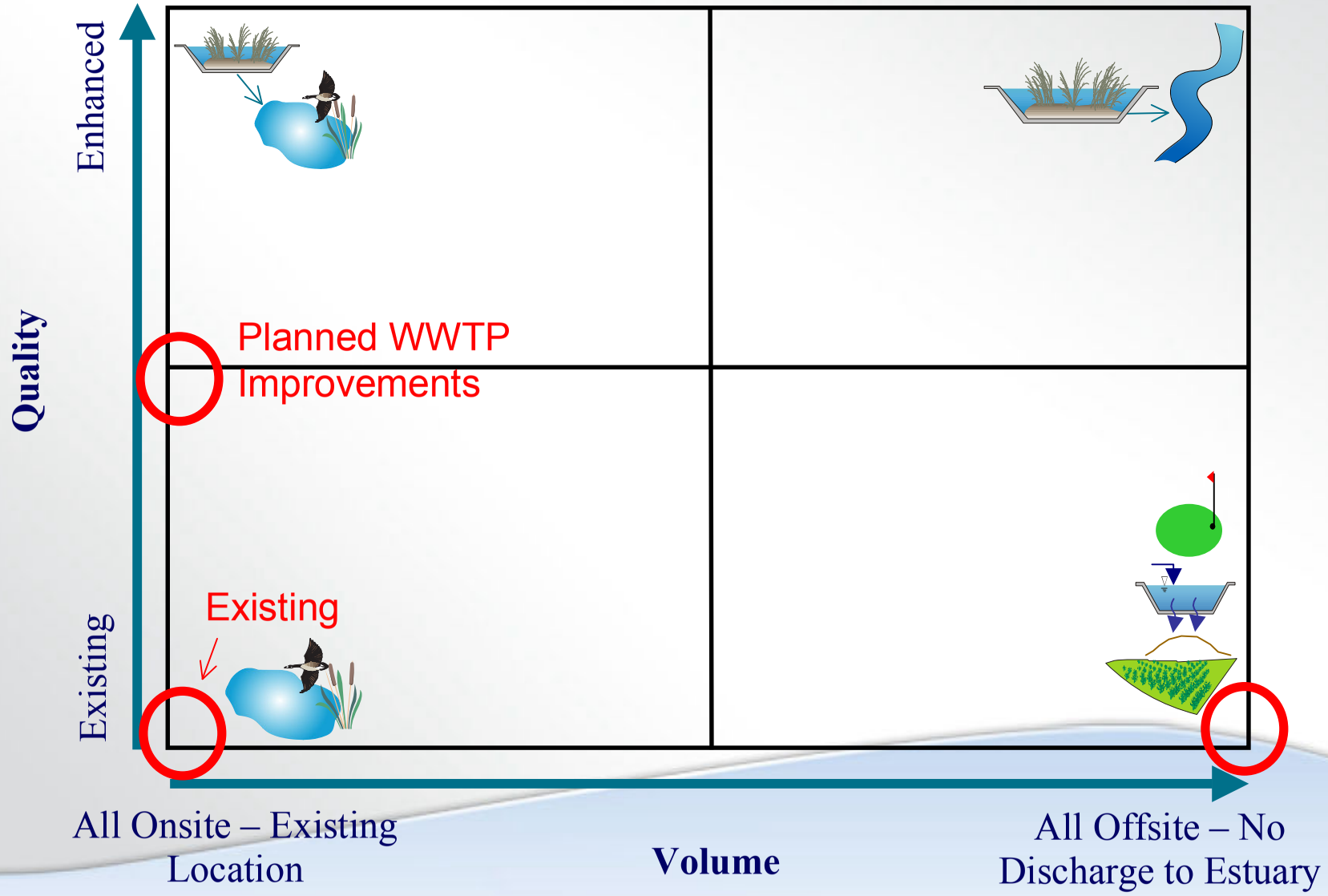
Discharge Scenarios

- Future Conditions Evaluation (baseline)
  - Climate change
- Scenario identification
  - Maintain existing (0% removal)
  - Complete diversion/recycling (100% removal)
  - TBD
  - TBD

Evaluating future scenarios

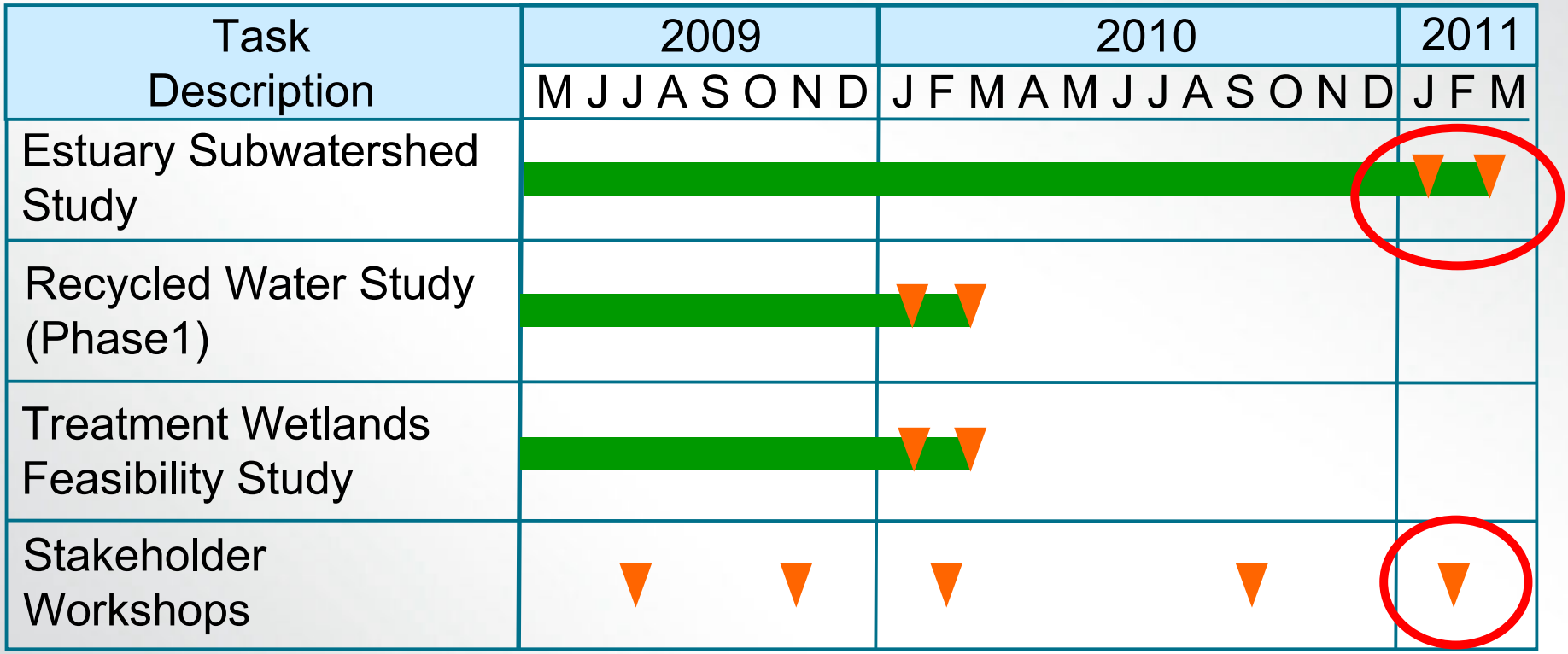
- Base Case (existing + planned improvements)
- Consideration of future changes:
  - Growth (higher flows)
  - Climate change
    - Temperature
    - Sea level
- Parameters can be varied:
  - Amount of flow into estuary
    - Total annual
    - Seasonal contribution
  - Quality of effluent into estuary

What scenarios should we consider evaluating?



Next Steps

Draft Estuary Subwatershed Synthesis Report will be released in January, finalized in March



Next Stakeholder Workshop in Feb 2011
to get comments on report

Opportunity to comment before February…

- Provide comments, questions to Karen Waln at KWaln@ci.ventura.ca.us
- Follow along on City website at www.cityofventura.net/rivers