CITY OF VENTURA

Special STUDIES for Santa Clara River Estuary

PRESENTATION

NOVEMBER 2009

carollo
Engineers...Working Wonders With Water™

Stillwater Sciences

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We are here today to discuss….

- The Santa Clara River Estuary Special Studies
- What these studies are about
- Provide an update on work to date
- Get input from you, the Stakeholders

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Last time we met, our discussion addressed…

- VWRF discharge and monitoring locations
- Historical data and planned sampling schedule (including groundwater)
- Estuary subwatershed boundaries
- Existing VWRF effluent flows to estuary and reuse
- Opportunities to discuss Recycled Water Market Study and Wetland Feasibility Study

Agenda for the Day

- Introductions – 10 min.
- Special Studies Overview – 10 min.
- Recycled Water Market Study
  - Presentation of existing reuse and future opportunities – 30 min.
  - Discussion/Q&A – 15 min.
- Treatment Wetlands Feasibility Study
  - Presentation of existing water quality, existing ponds, and future opportunities – 30 min.
  - Discussion/Q&A – 15 min.
- Summary – Next Steps – 10 min.

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?

What we want from you…

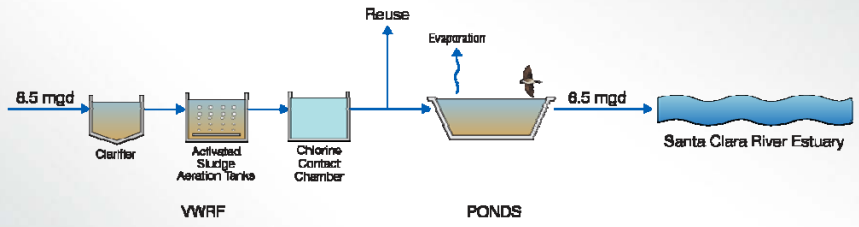
- Listen to presentations on projects to learn about options and issues/benefits of additional reuse and/or wetlands
- Provide input on work- to- date
  - Is it providing the information you need/hoped for?
- Provide input on your interests about:
  - Type of reuse for future
  - Uses of on-site ponds
  - Potential locations for offsite wetlands

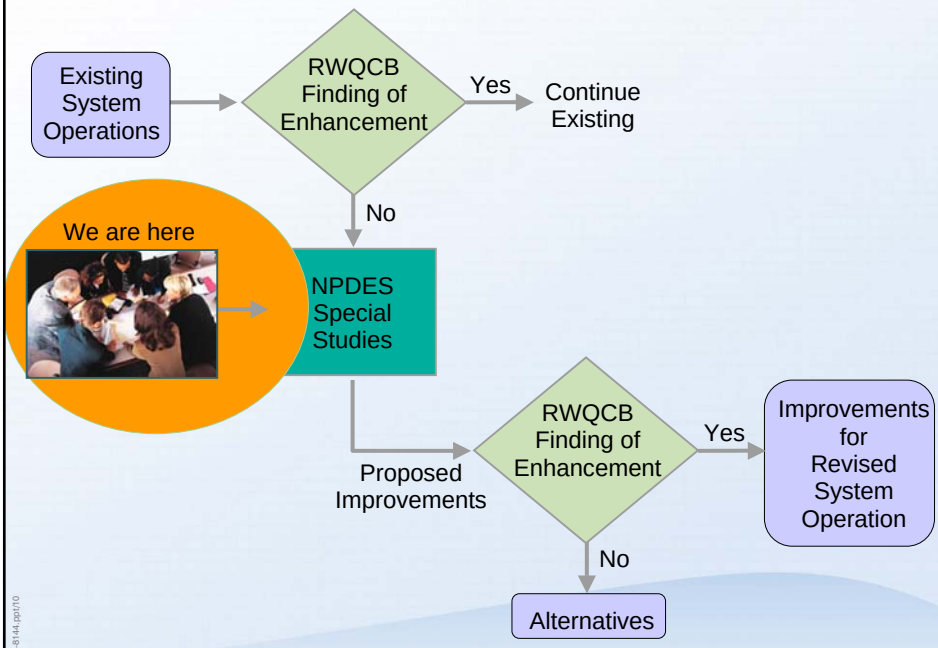
Introductions - Please tell us ….

- Your Name
- Your Affiliation
- Why you are here. What is your interest in this project. (one person from each group – why agency interested in this project)

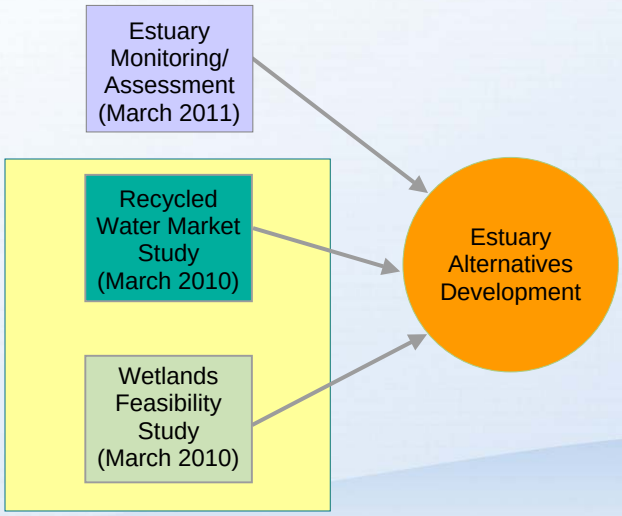
Special Studies Overview

The existing system provides ~1 MGD of recycled water and ~6.5 MGD to the Estuary

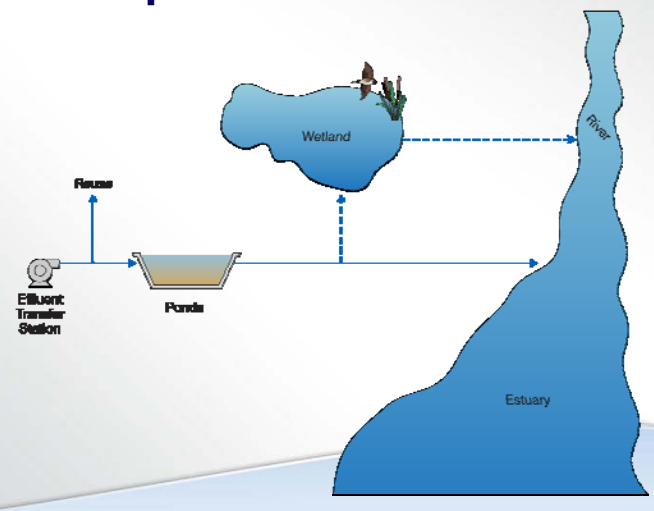




The three Special Studies all feed into developing scenarios for enhancement



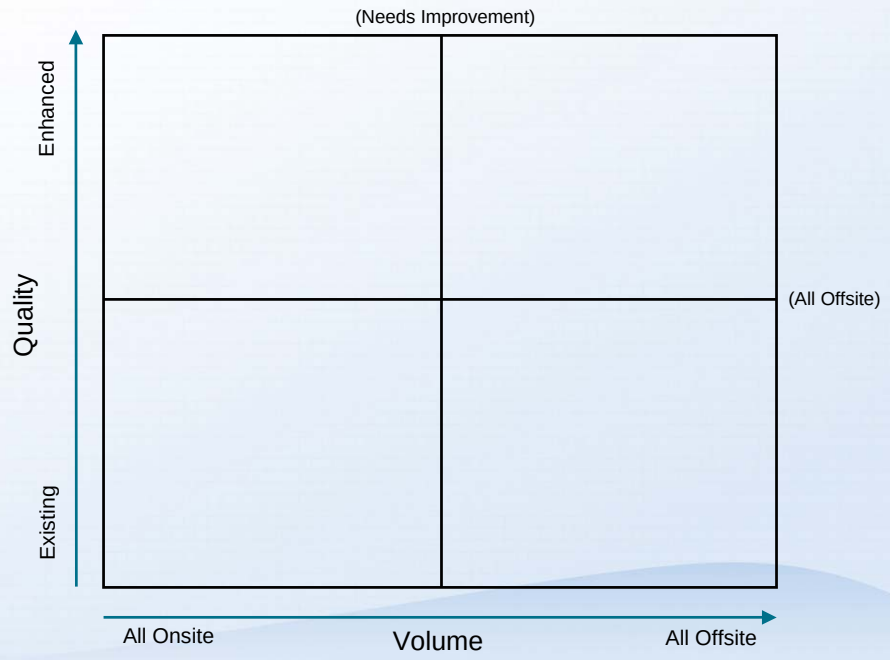
The wetlands and reuse studies will identify and develop opportunities - <u>not</u> come up with an answer



What we need to know is what is the optimum...

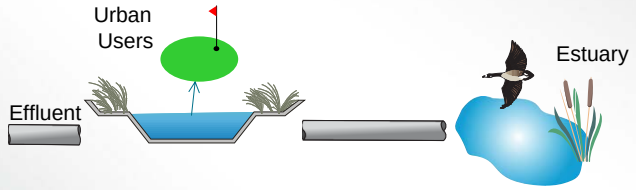
- Volume
- Timing (seasonal variation)
- Quality

…of releases to estuary (to protect its health)

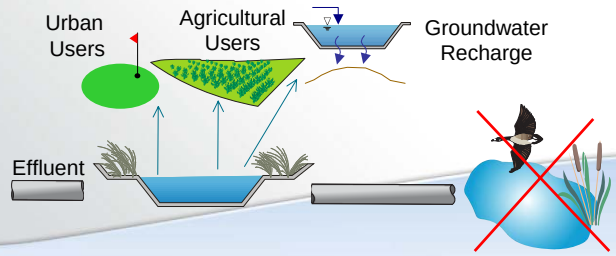


Potential outcomes of Estuary Study - Volume

- Keep Existing System – Flow to Estuary

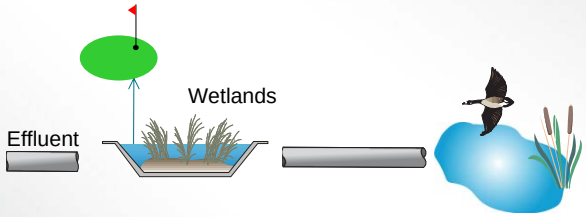


- Remove all Flow from Estuary

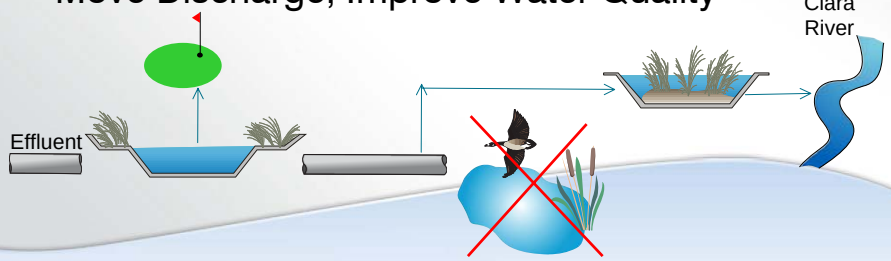


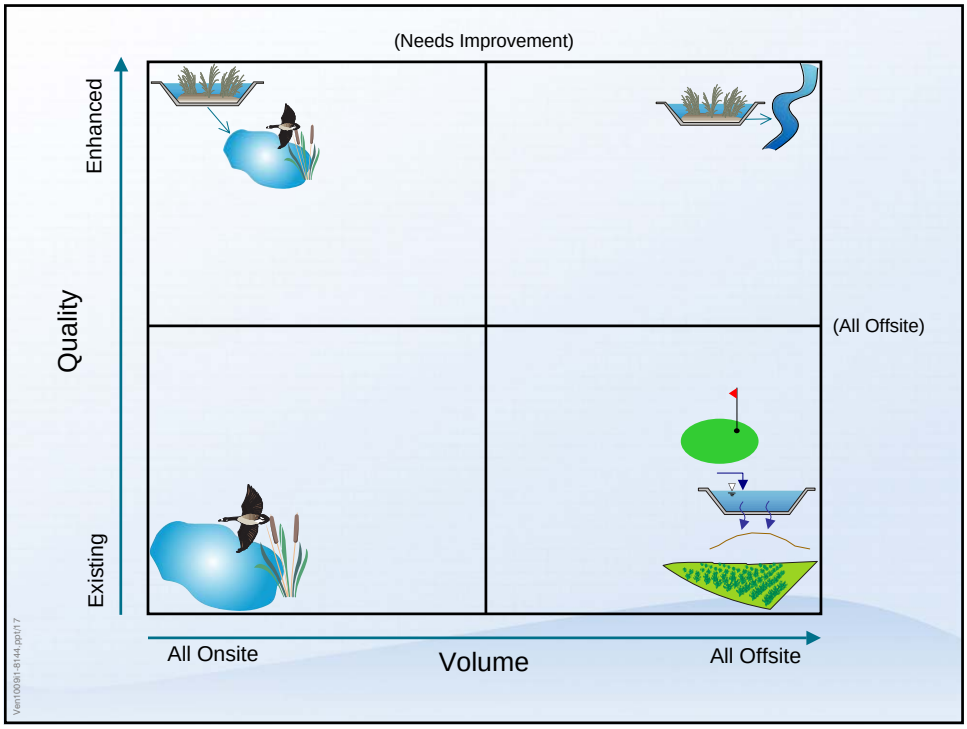
Potential Outcomes, cont. - Quality

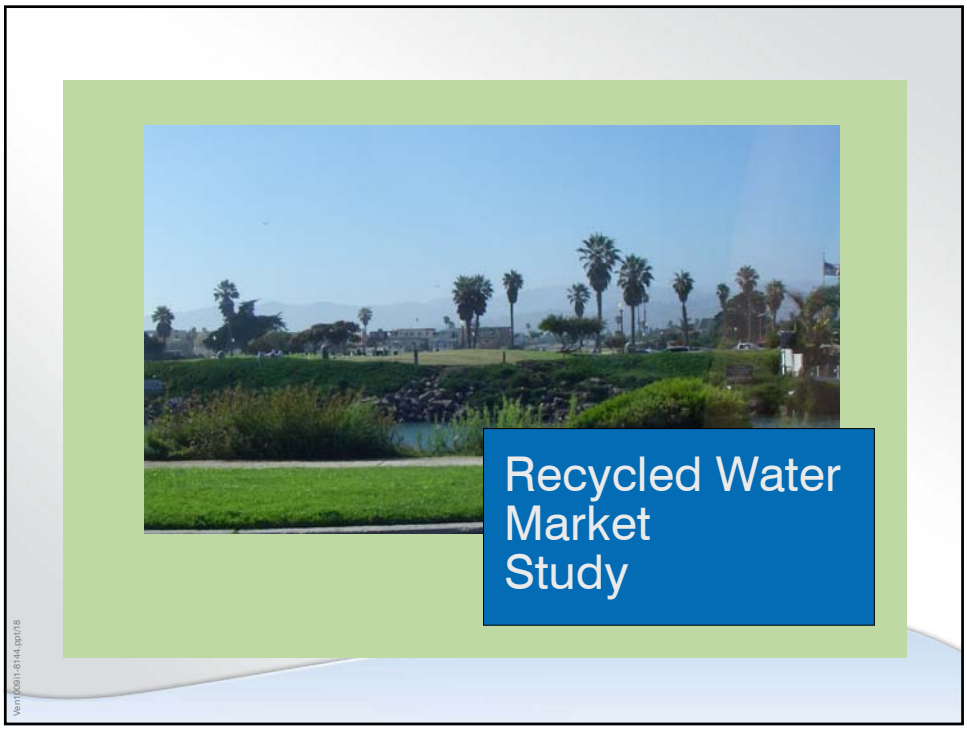
- Keep Existing Discharge, Improve Water Quality



- Move Discharge, Improve Water Quality




(Needs Improvement)
Enhanced
Quality
Existing
(All Offsite)
All Onsite
Volume
All Offsite


Recycled Water
Market
Study

Study Objectives

- Identify the recycled water opportunities within a 5 mile radius
  - Developing alternatives for serving potential users
  - Developing costs to implement alternatives

There are several direct and indirect benefits of expanding the City's recycled water system

- Decrease the wastewater discharge to the estuary
- Offset potable water demands in the City's service area
- Offset groundwater demands for agricultural irrigation

Stepwise approach was designed to meet study objectives

- Review Existing Recycled Water System
- Identify Opportunities for Expansion
  - Location and Demands
  - Regulatory Requirements
  - Specific Water Quality Objectives
  - Additional Treatment Needs
- Develop Alternatives
  - Pipeline Alignments
  - Additional Treatment (if needed)
  - Costs

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Existing Recycled Water System

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Existing recycled water pipeline extends from harbor to golf course

Existing recycled water uses include golf course and landscape irrigation

- Users
  - 2 Golf Courses
    - Olivas Links Golf Course (~160 acres)
    - Buenaventura Golf Course (~100 acres)
  - Landscape irrigation near Olivas Drive
  - Harbor area landscape irrigation
  - Marina Park
- Average annual recycled water demand ~0.6 mgd
- Annual average VWRF flow to Estuary ~6.5 mgd

Existing recycled water supply meets unrestricted reuse regulations

- California Department of Public Health (CDPH) Title 22 regulations for unrestricted reuse
  - Treatment process
  - Coliform
  - Turbidity

Treatment Level	Approved Use	Total Coliform Standard (median)
Disinfected Tertiary Recycled Water	Spray Irrigation of Food Crops	2.2 / 100 ml
	Landscape Irrigation(1)	
	Non-restricted Recreational Impoundment	

(1) Includes unrestricted access golf courses, parks, playgrounds, school yards, and other landscaped areas with similar access.

Potential Recycled Water Opportunities

Several potential types of recycled water opportunities in the region

- Urban Users (< 5 miles)
  - Irrigation
    - Parks, schools, municipal areas, commercial areas, churches, golf courses, roadway medians, cemeteries
  - Process Water
    - Commercial and industrial uses
- Agricultural Users (< 5 miles)
- Groundwater Recharge (> 5 miles)

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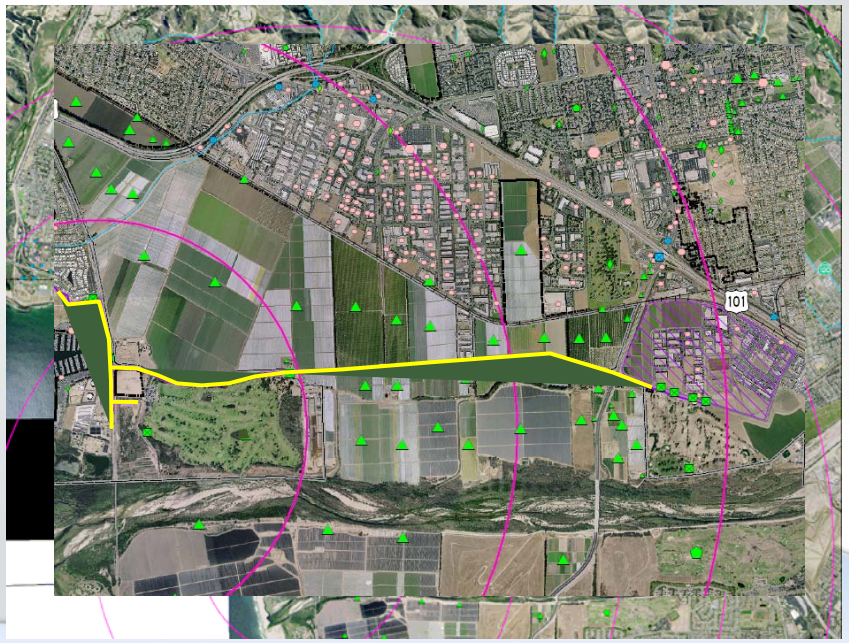
Potential Urban and Agricultural Users - North



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Potential Urban and Agricultural Users - South

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Potential Urban Users

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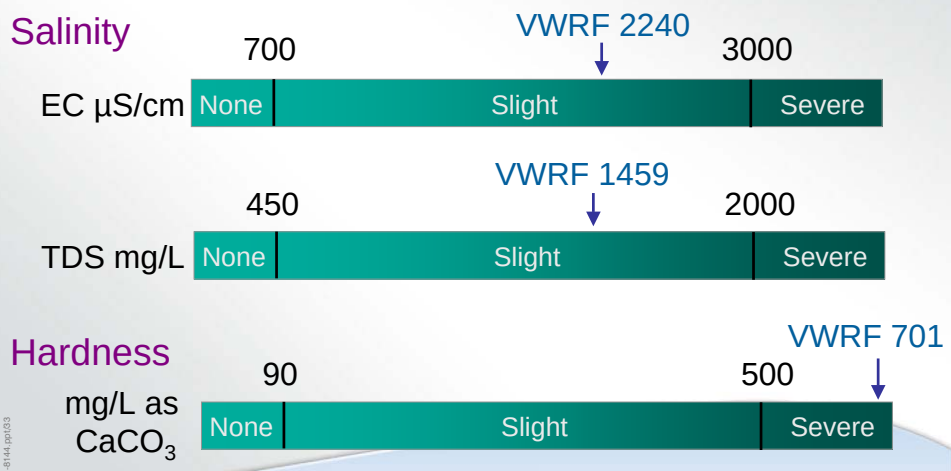
Approach and assumptions for developing potential urban demands

- Approach
  - Provide recycled water to users in Recycled Water Focus Area
  - Expand system by targeting largest potential demands
- Assumptions
  - Irrigation accounts can be converted to recycled water
  - Other potential demands identified
  - Industrial users not included

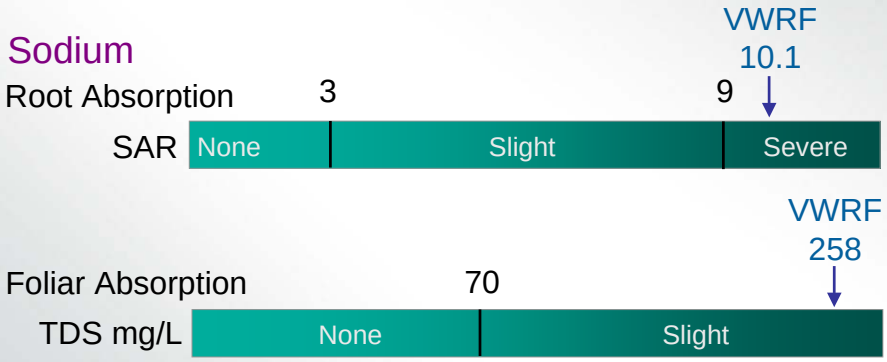
Urban landscape irrigation regulated under Title 22 regulations for unrestricted reuse

- California Department of Public Health – Title 22
  - Regulations for Unrestricted Reuse
- Attainment of Regulations
  - Expected based on existing system performance

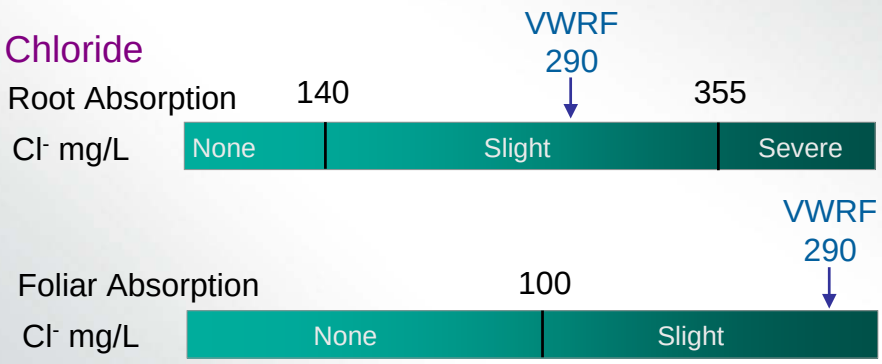
General irrigation water quality guidelines are used to assess degree of use restrictions



Water quality guidelines are used to assess degree of use restrictions for landscape irrigation



Water quality guidelines are used to assess degree of use restrictions for landscape irrigation

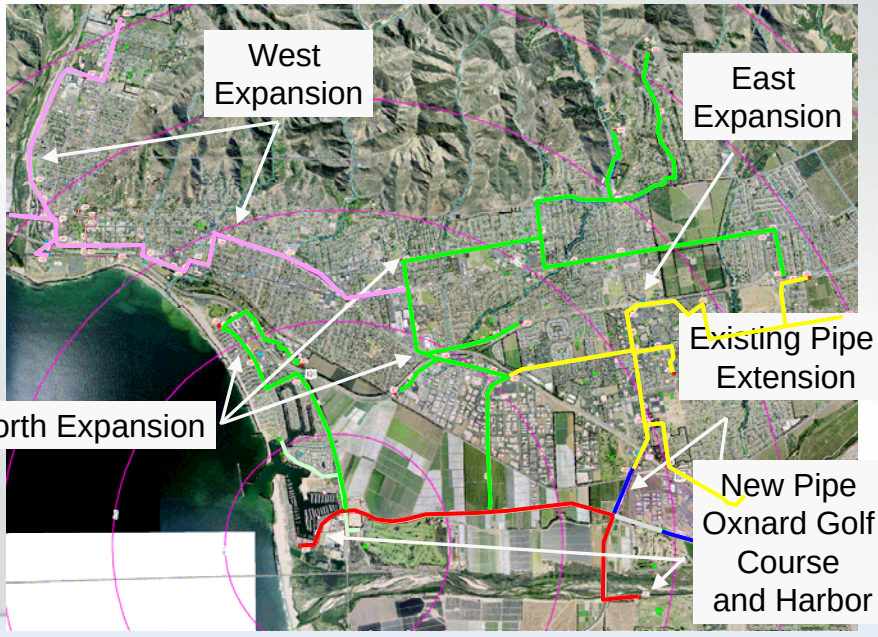


Summary of water quality guidelines for irrigation suggests some restrictions

Parameter	Degree of Restriction
Salinity	Slight
Permeability	None
Sodium	Slight to Severe
Chloride	Slight
Boron	Slight
Alkalinity	Slight
Total Nitrogen	Slight

- However, recycled water from VWRF is currently being used for golf course and landscape irrigation

Urban network is extensive



Summary of demands and estimated planning level project costs

Alternative	Incremental	Cumulative	
	Annual Average (mgd)	Annual Average (mgd)	Pipeline and Pump Station Costs ($ Millions)
Existing Pipe Extension	0.07	0.1	2
New Pipe – Golf Course and Harbor	0.9	1.0	7
New Pipe – North Extension	0.5	1.5	11
New Pipe – East Extension	0.4	1.9	47
New Pipe – West Extension	0.3	2.2	58

- Demands vary seasonally
  - At annual average demand = 2.2 mgd
    - Minimum month = 1.1 mgd
    - Maximum month = 3.7 mgd

Potential Agricultural Users

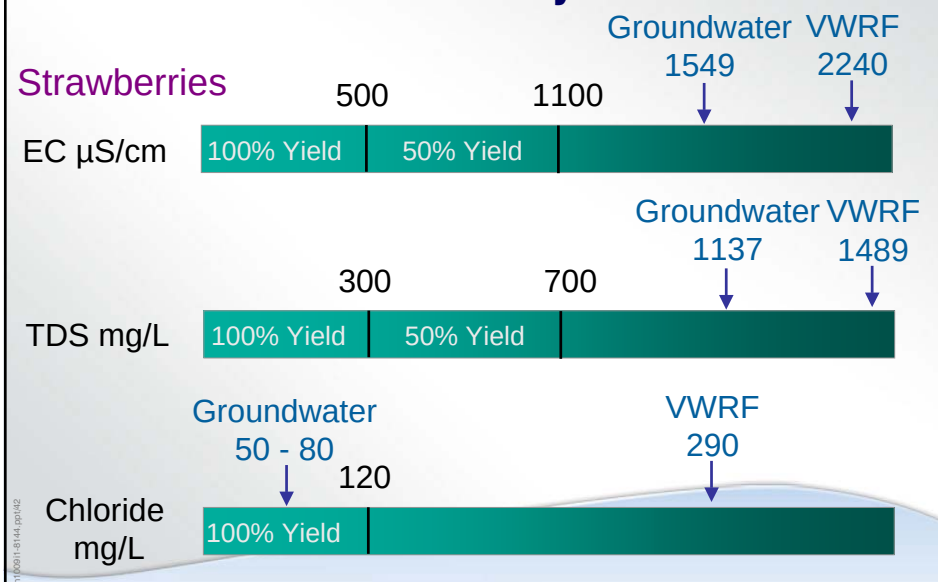
Approach and assumptions for developing agricultural demands

- Approach
  - Expand system by targeting largest potential demands
- Assumptions
  - Predominant crops are row crops, strawberries, lemons and avocados
  - Water usage = 2.5 AF/AC per year
  - Monthly usage percentages based on regional data

Agriculture irrigation regulated under Title 22 regulations for unrestricted reuse

- California Department of Public Health – Title 22
  - Regulations for Unrestricted Reuse
- Attainment of Regulations
  - Expected based on existing system performance

Crop specific water quality guidelines are used to assess feasibility



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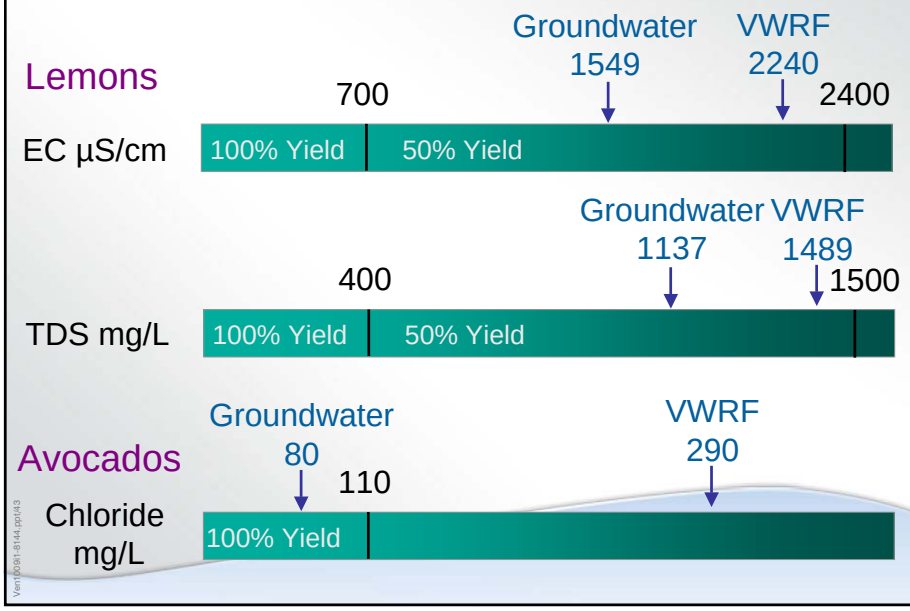


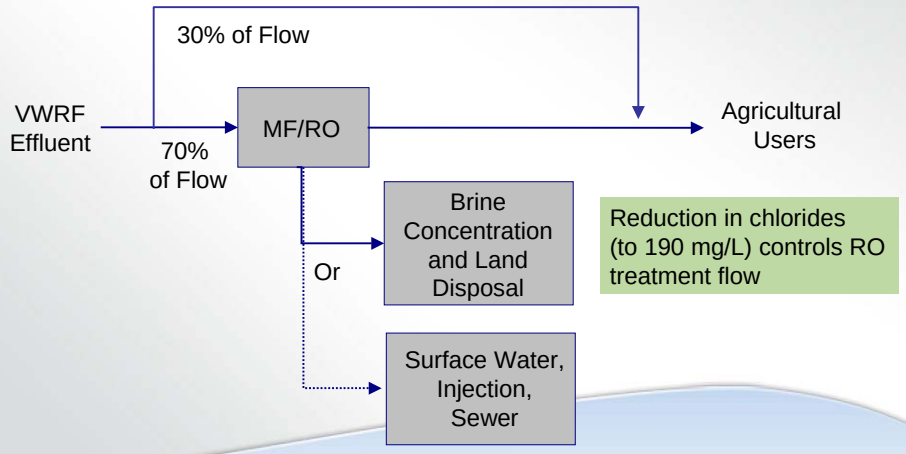
Targeted reductions are based on achieving an overall improvement in water quality

- At least 190 mg/L reduction in chloride
- At least 500 mg/L reduction in TDS
- Reduction in sodium to decrease SAR

Water quality can be improved through source control and treatment

- Source control for TDS and chlorides
  - Potable source water
    - Estimated average TDS = >700 mg/L
    - Significant changes in quality not expected
  - Self regenerating water softeners
    - ~ 50 mg/L chloride reduction
    - ~ 200 mg/L TDS reduction
- Treatment
  - VWRF effluent
  - Point of Use
  - Potable supply

TDS and chloride can be removed from VWRF effluent by microfiltration followed by reverse osmosis (RO)



Reduction in chlorides (to 190 mg/L) controls RO treatment flow

Preliminary RO and brine treatment planning level cost estimates indicate high treatment costs

- Assumptions
  - VWRF effluent flow = 14 mgd
  - 70% of effluent flow (~10 mgd) treated by RO

Process	Project Cost ($ Millions)
Microfiltration (MF)	30
Reverse Osmosis (RO)	40
Brine Treatment	30
Total	100

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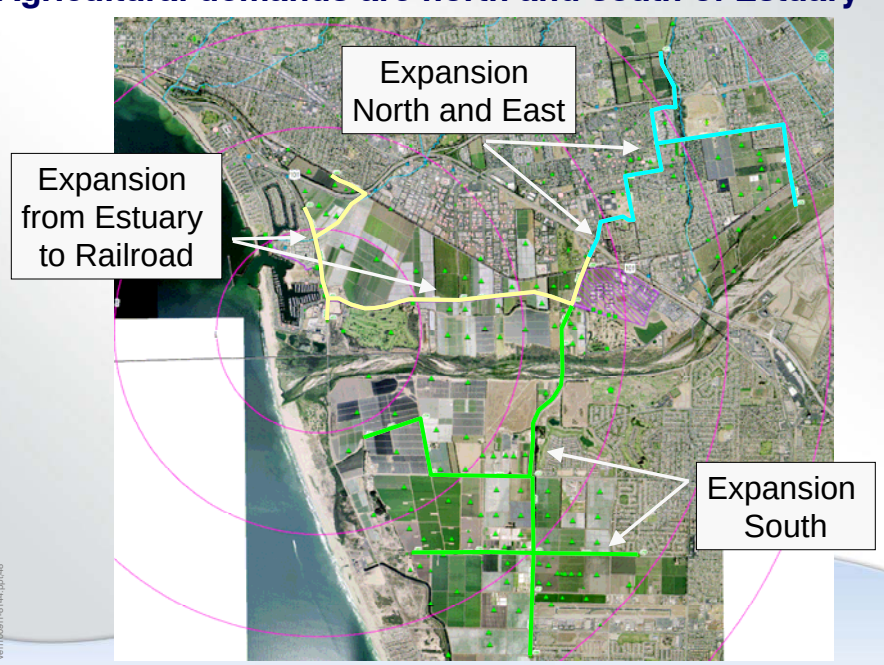
Agricultural demands are north and south of Estuary



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Summary of demands and planning level estimated pipeline and pump station costs

Alternative	Incremental	Cumulative	
	Annual Average (mgd)	Annual Average (mgd)	Pipeline and Pump Station Costs ($ Millions)
Expansion – Estuary to Railroad	3.5	3.5	20
Expansion – North and East	2.5	6	41
Expansion – South	7.6	13.6	Not Calculated

- Demands vary seasonally
  - At annual average demand = 6 mgd
    - Minimum month = 1.5 mgd
    - Maximum month = 10 mgd
- Demands vary hourly
  - Requires significant storage – conversion of ponds
  - Supplemental water sources (groundwater wells)

Groundwater Recharge

Analysis of potential groundwater recharge opportunities in area

- Groundwater recharge
  - Recharge pits or spreading basins
  - Percolation through soil to aquifer
- Potential groundwater recharge site
  - United Water Conservation District (UWCD)
- Not explored
  - Other potential sites for recharge
  - Injection wells
  - Underground storage

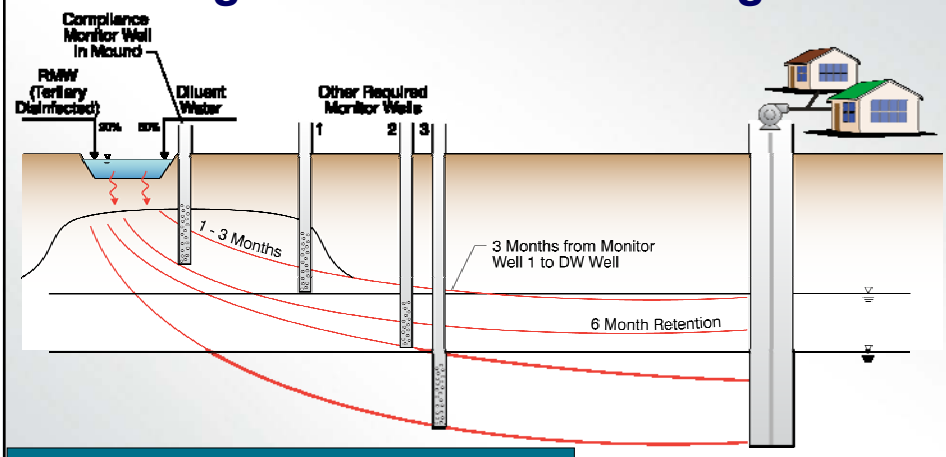
Groundwater recharge is governed by CDPH and State Board regulations

- California Department of Public Health – Title 22
  - Groundwater Recharge Reuse - Draft Regulations August 2008
- State Water Resource Control Board - Basin Plan
  - Groundwater quality objectives

Draft Groundwater Recharge Reuse Regulations include several control measures

- Recycled water contribution (RWC)
- Pathogenic microorganisms
- Nitrogen
- Regulated chemicals and physical characteristics (Title 22 MCLs and action levels)
- Total organic carbon
- Source water control

Attainment of regulations would require modeling studies and monitoring



Attainment of Regulations
- Travel time to potable wells
- Volumes of effluent and diluent water
- Water quality data for mound

UWCD facilities provide potential opportunity for recharge with recycled water

Summary of potential groundwater demands and planning level costs

- Preliminary Analysis
  - VWRF flow of 14 mgd
  - Total nitrogen concentration in mound of 7 mg/L
    - Assumes 20% effluent and 80% river water
  - Sufficient diluent water to meet 4:1
    - September thru April
    - Reduced year round flows
    - Adjustments required in low water years.

Alternative	Pipeline and Pump Station Costs ($ Millions)
UWCD	35

Summary of Opportunities and Challenges

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Summary of opportunities and challenges

	Opportunity	Challenge
Urban Users	• Potential demand = 2.2 mgd, varies seasonally • Does not require additional treatment	• Cost = $58 Million • Extensive pipe network • Feasibility of serving Oxnard golf course unknown
Agricultural Users	• Potential demand = 14 mgd , varies seasonally	• Cost = $140 Million • Requires additional treatment • Additional storage • Requires agreement by growers
Groundwater Recharge	• Potential seasonal demand up to 14 mgd	• Cost = $35 Million • September thru April more potential • Regulatory feasibility uncertain • Requires agreement with UWCD • Requires long term monitoring effort

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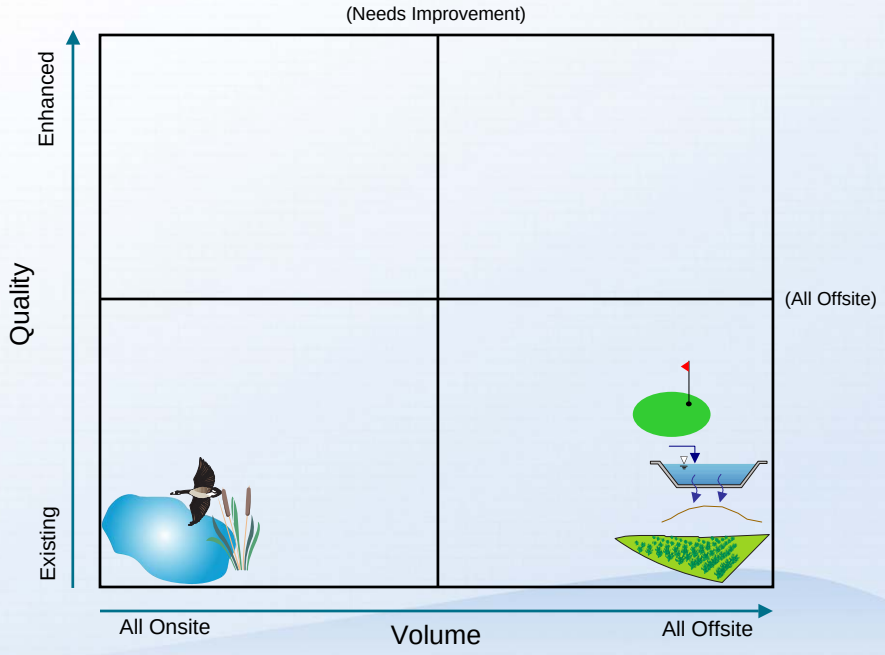
Discussion/Q&A



Treatment Wetlands Feasibility Study

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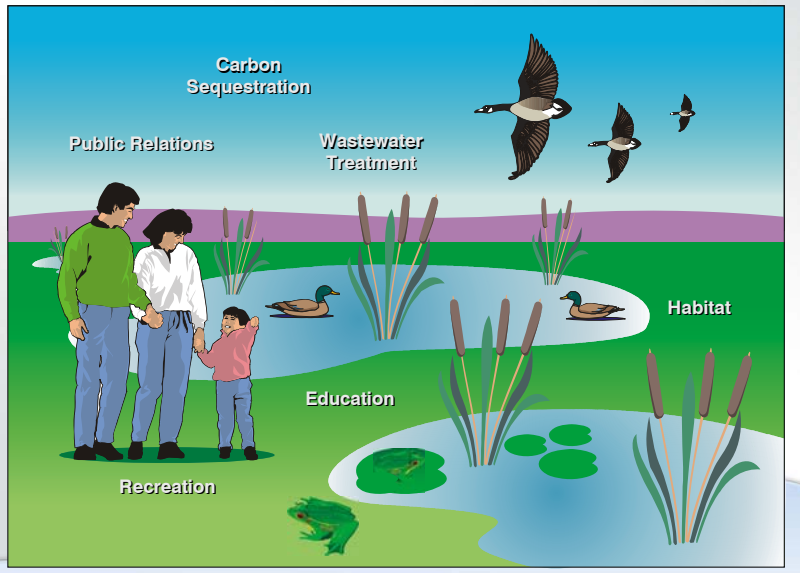
We recognize there are many benefits of wetlands



What are the objectives of our Study?

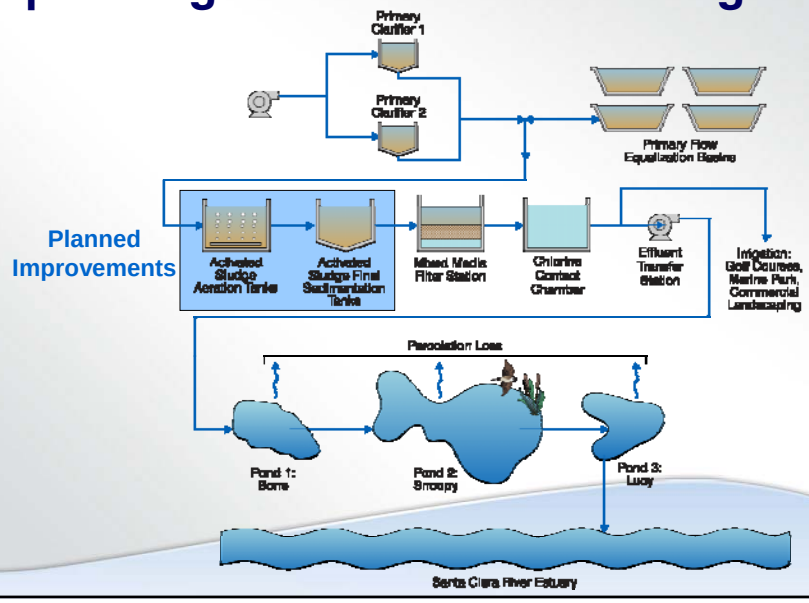
1. Can wetlands improve water quality? (Primary Objective)
2. Can we improve habitat? (Secondary Objective)

To accomplish the goals, the overall approach to the study requires a series of steps

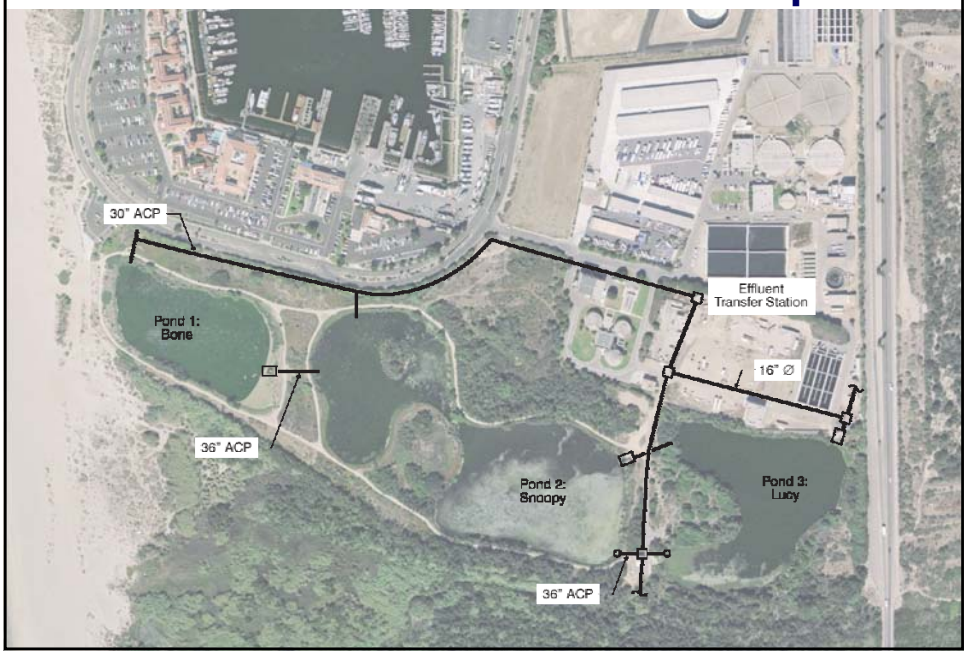
- Evaluate existing condition
  - VWRF site
  - Water quality
- Determine opportunities for water quality Improvement
- Consider onsite opportunities
- Consider offsite opportunities
- How do habitat opportunities fit in?

Evaluate Existing Condition

VWRF treats to tertiary standards and is planning to further reduce nitrogen



VWRF has 20 acres of constructed ponds



Effluent transfer station (ETS) data for conventional constituents show VWRF is meeting permit limits

Constituent	Permit Average Monthly	2006-2008 Average Monthly Effluent
TSS (mg/L)	15	0.83
BOD (mg/L)	20	2.27
Turbidity (NTU)	<2	<2
Total Coliform (mpn)	2.2	2.2
Temperature (°C)	<30	21.1
DO (mg/L)	>5	6.47
pH	6.5 to 8.5	7.2

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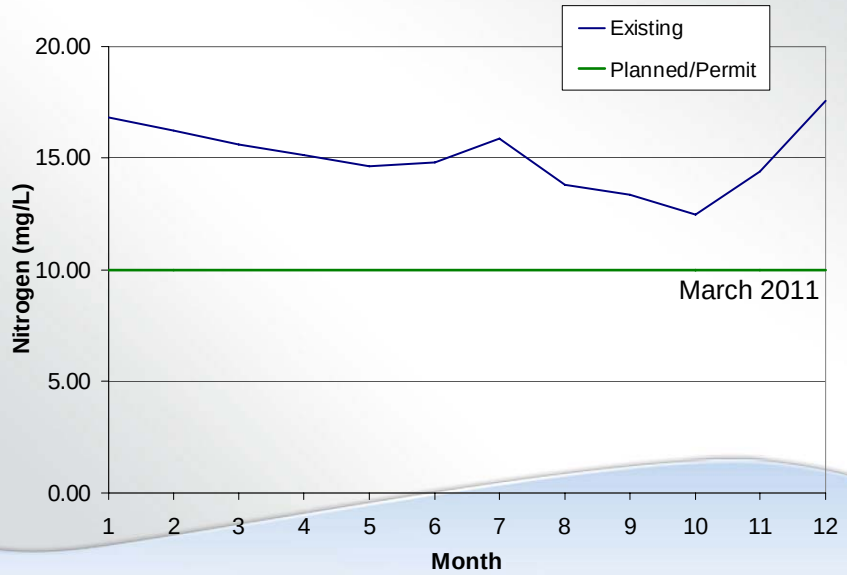
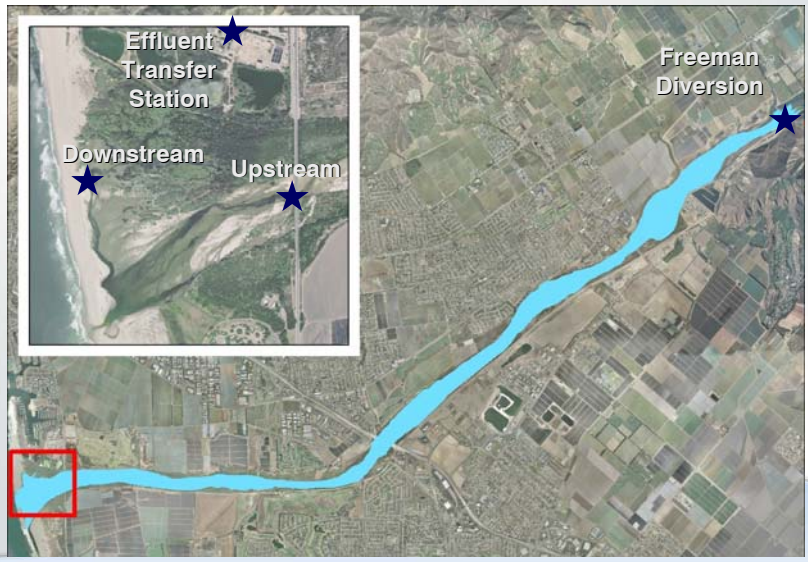
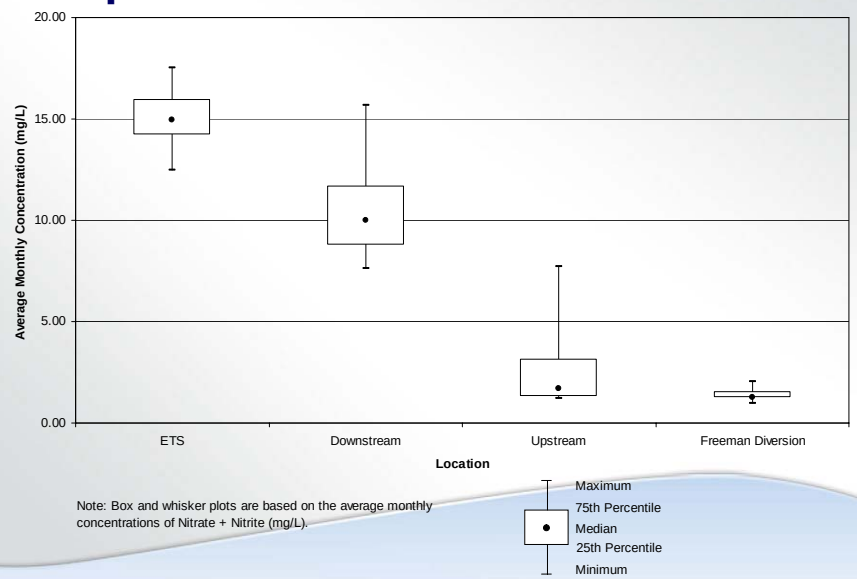
Nitrogen levels will drop below permit levels after updates are complete



Data were analyzed and compared to receiving water stations



Nitrate box and whisker plots show the spread of data at each station



Note: Box and whisker plots are based on the average monthly concentrations of Nitrate + Nitrite (mg/L).

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Metals average monthly levels are also meeting permit limits at ETS

Metal (ug/L)	Permit Average Monthly	Existing Average Monthly Effluent (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)		

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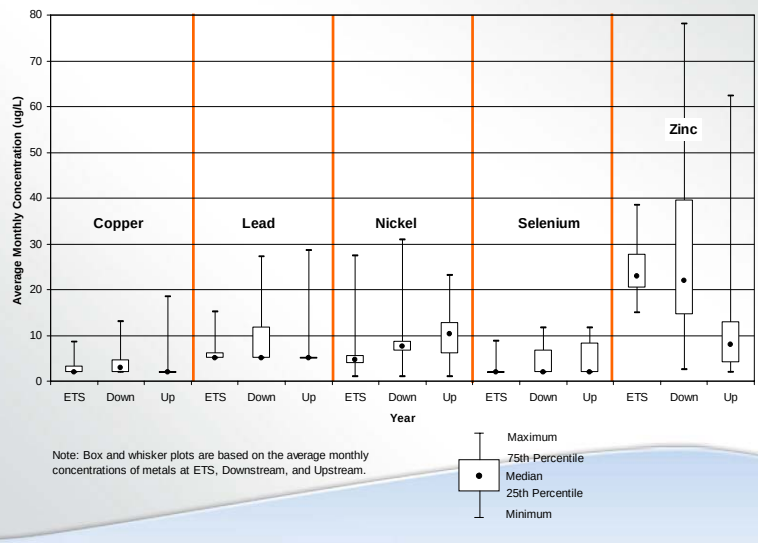
Comparison of other metals data from ETS with receiving water locations



Note: Box and whisker plots are based on the average monthly concentrations of metals at ETS, Downstream, and Upstream.

Constituents driving the design of wetland options are…

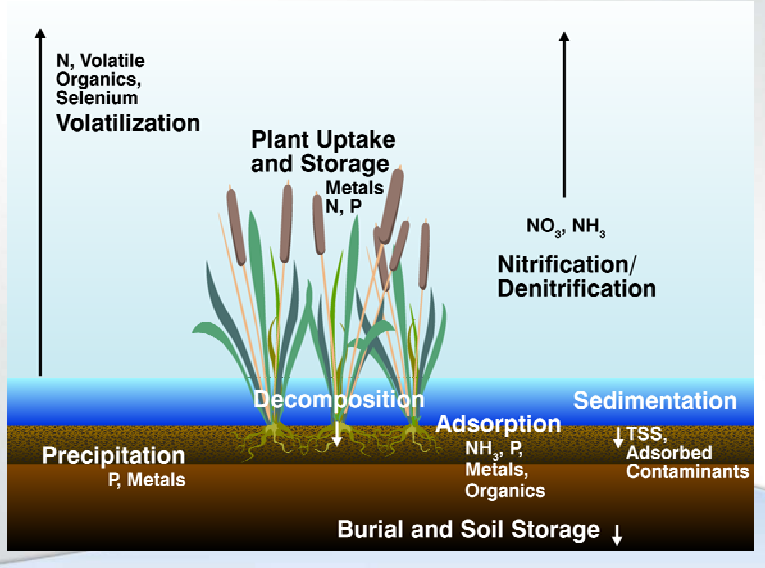
- Conventional Constituents
- Metals
- Nitrate

Constituents driving the design of wetland options are…

- ~~Conventional Constituents~~
- ~~Metals~~
- Nitrate

Determine Opportunities for Improvement

Removal mechanisms in free water surface (FWS) wetlands systems



Wetlands are a natural process and performance is variable

- Temperature has a large effect on nitrogen removal
- Vegetation is important and not always controllable
- Adequate residence time
  - Short circuiting
  - Seasonal flow variation
- Predictive models vary greatly
  - Based on site specific field data

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There are wide ranges of removal rates for each metal in FWS wetlands

Metal (ug/L)	Existing Average Monthly Effluent	Range in Wetland Effluent*
Aluminum	48	40-600
Copper	3	2-22
Lead	6.5	0.2-7
Nickel	6	4-16
Selenium	2.7	2-10
Zinc	25	5-56

**Based on literature review.*

Free water surface wetland studies show significant nitrate reduction

Wetland	Flow (MGD)	Wetland Area/Depth (Acres, Ft)	Nitrate Influent (mg/L)	Nitrate Effluent* (mg/L)
Prado Basin (Orange County Water District, CA)	52	465 0.7 - 4	6 - 14	<1 - 6
San Joaquin Marsh (Irvine Ranch Water District, CA)	3-6.5	80 1 - 3	3 - 15	<1 - 4
Arcata (Arcata, CA)	2.3	38 1.5 - 2	10 - 15	<10
Hemet/San Jacinto (Eastern Municipal Water District, CA)	0-0.25	25 4 - 6	<1- 3	<1 - 1.5
Tres Rios (Phoenix, AZ)	2	4 0.5 - 4	6 - 8	<1 - 2.5
Summary of other studies Kadlec and Wallace 2009 (160 FWS wetlands)			5 - 50	4 - 10

*Ranges shown for nitrate effluent concentration shows summer to winter (i.e. high to low end of removal).

Characteristics of wetlands to improve nitrogen removal

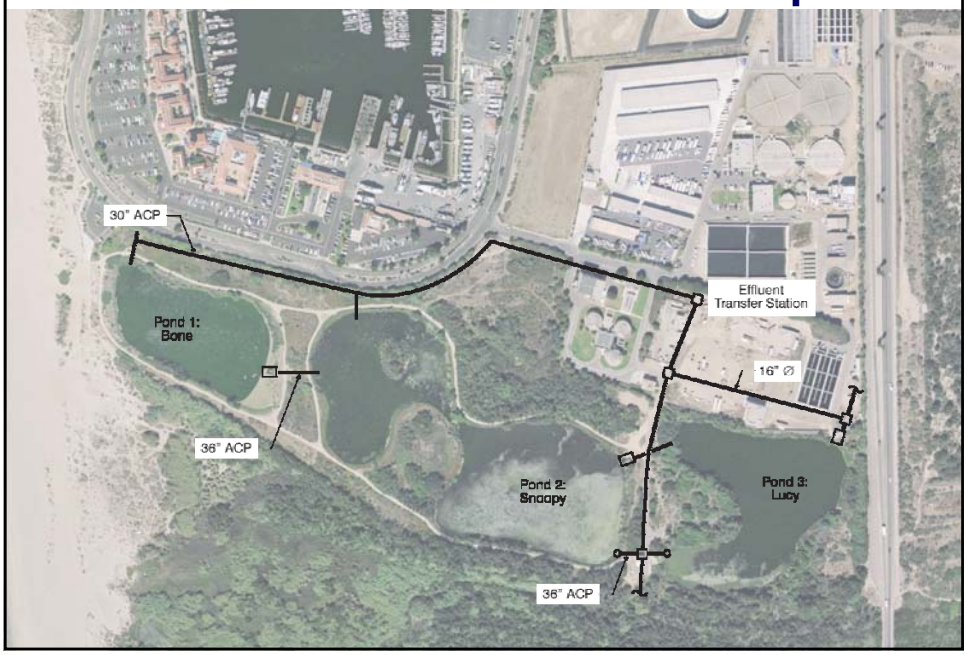
- Dense/mature vegetation
- Adequate source (quality and quantity) of carbon for denitrification
- Steady anoxic conditions (always wet)
  - Reduce changes in redox potential
- Steady pH

In contrast, characteristics to remove trace constituents are compound specific

- Shallow, clear surface waters
  - Photodegradation
- Aerobic and anaerobic zones
  - Biodegradation

Onsite Treatment Wetlands Opportunities

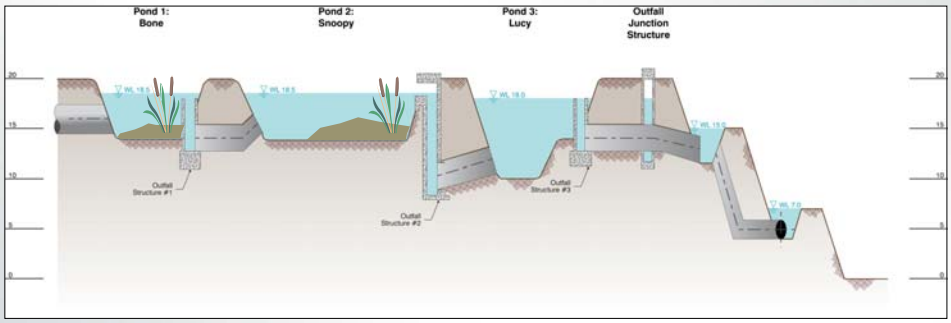
VWRF has 20 acres of constructed ponds



The existing constructed ponds could be converted partially or completely into constructed wetlands…

Pond	Area (acres)	Depth (feet)	Type
Pond 1: Bone	4.46	4	Open
Pond 2: Snoopy	10.16	4	Open
Pond 3: Lucy	5.74	8	Open

The hydraulics of the ponds will drive the process used to develop potential onsite wetland options



Offsite Treatment Wetlands Opportunities

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Local parcels were considered for potential offsite wetland opportunities

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Considering various obstacles, three parcels have the greatest potential to be an offsite wetland

City-Owned site limited acreage due to sewer line, recycled water line and River Haven Housing

The potential offsite wetland sites vary in size and distance from VWRF

Options	Approximate Area (acres)	Pipe Length from VWRF (feet)	Planning Level Pipeline Project Cost Estimates ($)*
Site 1: City-Owned	48	1,425	$1.1 M
Site 2: Berry	108	5,965	$6.6 M
Site 3: McGrath/TNC	137	17,530	$14 M

*Planning Level Pump Station Project Cost Estimates for each option range between $1.25-1.5 M

Costs do not include land purchase or development of wetlands

Implementation Issues/Benefits

Options	Issues/Benefits
Site 1: City-Owned	• Existing utilities and River Haven limit usable area • Closest to plant – shortest pipeline, least $
Site 2: Berry	• Large area • Need to cross river • May not be consistent with SOAR policies • Unwilling seller
Site 3: McGrath/TNC	• Largest area – some planned for restoration • Disturbance of existing habitat at southern end and discharge to river may make permitting difficult • May not be consistent with SOAR policies • Furthest from plant - longest pipeline, highest $

Habitat Opportunities

Multiple habitat types & features are currently supported by the ponds

A wide variety of wildlife species are associated with the habitats

Open water	Western pond turtles*, dabbling ducks, diving ducks, gulls, phalaropes, grebes, swallows
Emergent marsh	Tri-colored blackbird*, rails, herons, egrets, shorebirds, marsh wren, common yellowthroat, song sparrows, Pacific chorus frogs, garter snakes
Riparian forest	Southwestern willow flycatcher*, yellow warbler*, yellow-breasted chat*, Least Bell's vireo*, black phoebe, bushtit, Pacific-slope flycatcher, yellow-breasted chat, black-headed grosbeak, Swainson's thrush, bats
Dunes	California least tern*, western snowy plover*, killdeer, western fence lizard, side-blotched lizard

*special-status species (none documented at site except western snowy plover and California least tern)

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Potential to enhance existing habitat by implementing various features, such as:

Emergent Freshwater Marsh

Open Water

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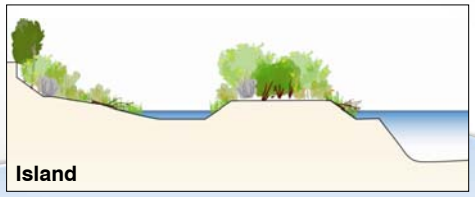
And…

Snags with Cavities

Downed Wood



Island

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The habitats and features of the ponds provide many benefits to wildlife

Open water	Foraging and resting habitat for birds, particularly ducks and grebes
Emergent marsh	Nesting habitat for birds; foraging habitat for birds, snakes, and frogs; protection from predators
Islands	Protection of nesting birds from predators such as feral cats and raccoons; potential location for snags
Snags (with cavities)	Bird roosting/perch sites (e.g., raptors); foraging habitat (e.g., woodpeckers); nesting sites (including cavity-nesting birds); bat roosting opportunities
Downed wood	Basking sites for western pond turtles

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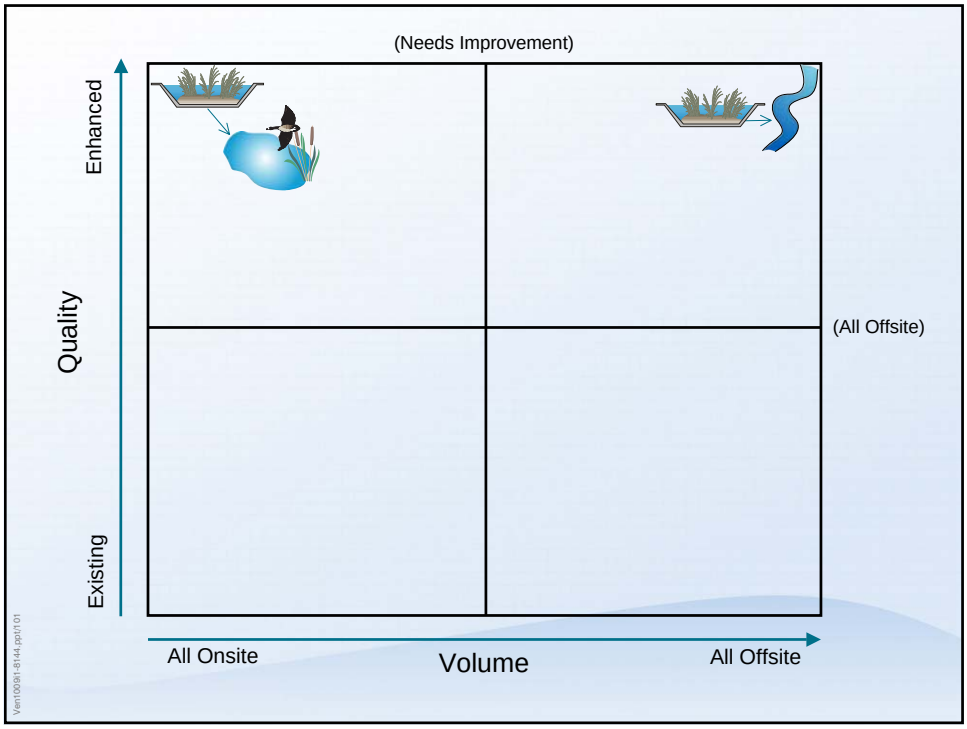
Summary of Key Findings

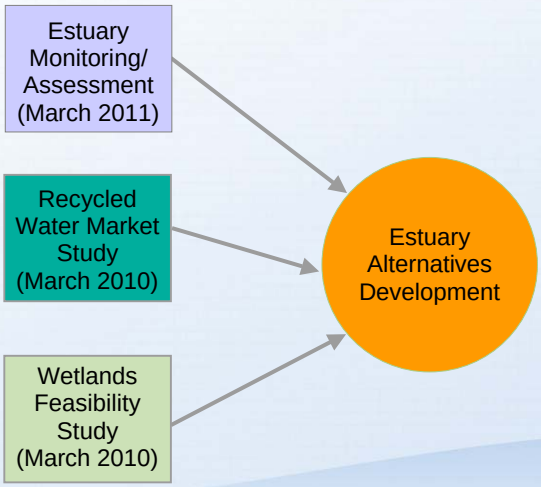
Summary of key findings from the treatment wetlands feasibility study

- Little opportunity for water quality improvement for conventional constituents or metals
- Some opportunity for improvement of nutrients
- Wetland can achieve TN (3-8 mg/L) depending on the season/temperature
- Final water quality from onsite ponds depends on flow and season
- Onsite opportunities are limited by the existing pond area and depths, as well as competing habitat goals
- Offsite opportunities are limited by costs, land use policies, willing sellers, and permitting hurdles



Summary and Next Steps

The three Special Studies all feed into developing scenarios for enhancement



What we need to know is what is the optimum ….

- Volume
- Timing (seasonal variation)
- Quality

…of releases to estuary (to protect its health)

This will dictate what reuse and wetlands alternatives are needed

There are many issues and benefits with the options being considered

- There is a potential to expand the existing reuse system to urban, Ag and groundwater recharge
- Limited potential for additional urban reuse (2 mgd)
- There are considerable implementation issues and costs associated with Ag reuse and GW recharge.
- Potential water quality benefits of wetlands are limited to some additional nutrient removal on a seasonal basis, depending on area available
- There are competing interests for onsite ponds
- Offsite wetlands will have considerable implementation issues

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What we want from you…

- Listen to presentations on projects to learn about options and issues/benefits of additional reuse and/or wetlands
- Provide input on work- to- date
  - Is it providing the information you need/hoped for?
- Provide input on your interests about:
  - Type of reuse for future
  - Uses of on-site ponds
  - Potential locations for offsite wetlands

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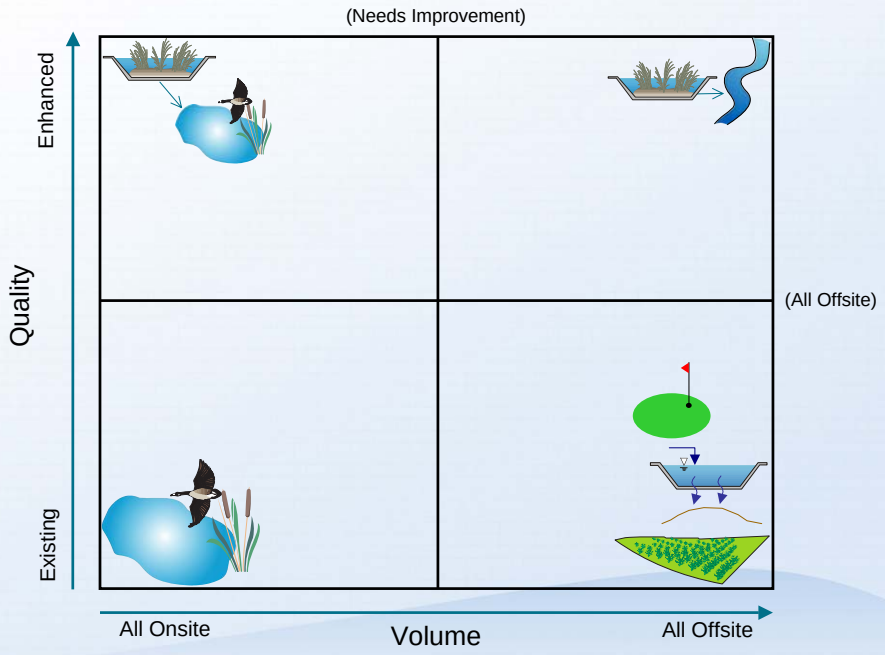
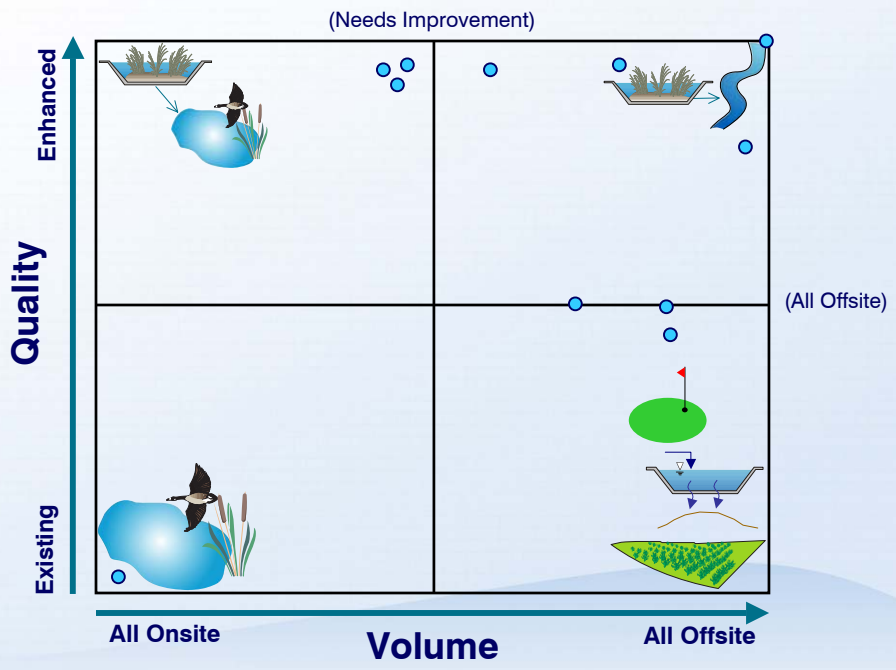
Discussion/Q&A



Next Steps

- Continue the Estuary Monitoring
  - Year One Monitoring Report – Feb 2010
- Draft Reuse and Wetlands Reports – Feb 2010
- Next Stakeholder Workshop – Feb 2010
  - To provide comments on Reports



Potential Wetlands Locations

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