

# RESTORATION AND ENHANCEMENT OF SOUTHERN CALIFORNIA LAGOONS

by

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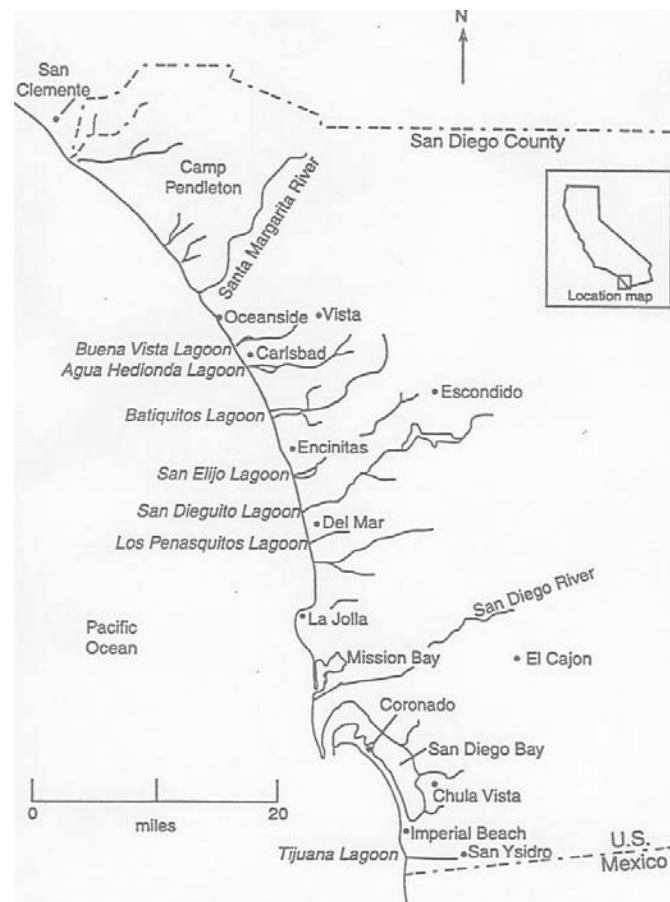
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# San Diego County Lagoons



Map showing major lagoons and wetlands in the area.

# Characteristics

- Estuarine (located at lower ends of rivers or creeks)
- Small
- Narrow (60 ft) and long inlets
- Basins are shallow (water depths lower than 2 m)

# Issues

- Lagoons are too small to maintain an open inlet
- Sedimentation
- Summer low flow
- Impacts of artificial lagoon inlet openings on beaches
- Lack of biological diversity
- Pollutant input from storm drains, street runoff, and sewage spills
- Encroachment of invasive species

# Enhancement and Restoration

- Enhancement involves improving lagoon conditions (i.e., water quality and increasing biological diversity in the lagoon) by:
  - Keeping the lagoon inlet open,
  - Controlling low flows,
  - Controlling sediment input,
  - Reducing pollutant and sewage spills, and
  - Minimizing invasive species.
- Restoration involves increasing wetland areas by:
  - Buying adjacent lands and converting them to wetlands,
  - Changing some of the upland areas to tidal areas, or
  - Connecting adjacent lower areas to the tides by channels.

# Why Do We Need to Keep Lagoon Inlets Open?

- Biological reasons
  - Lagoons are important ecological systems.
    - Southern California lagoons have been recognized by pioneering wetlands scientists for their value in supporting diversity and endangered species.
    - Lagoons provide habitat for migratory birds.
- Economic reasons
  - These lagoons support fish spawning, which supports local commercial and sport fishermen.
  - These lagoons provide recreation to the public.

# When the Lagoon Inlet is Closed...

- Biologically
  - The system begins to deteriorate rapidly
  - Invertebrate and fish species die
  - Habitat for commercial fish species is lost (e.g., halibut)
  - Migratory birds cannot use the lagoon
  - Increased freshwater leads to habitat change (e.g., invasive species and algae)
  - Potential increases for mosquito infestations and viral outbreaks (e.g., West Nile virus)



- Salinity high
- Oxygen low
- Temperature high
- Algae growth



# Sedimentation

- From the ocean
  - This sediment will be deposited near the inlet and accumulate with time until the lagoon closes.
- From river flow
  - This sediment will be deposited in the lagoon basin.
  - Rates vary from one lagoon to another, but the range is 0.5 – 2.0 cm.
- From adjacent areas such as canyons



# Sedimentation (cont.)

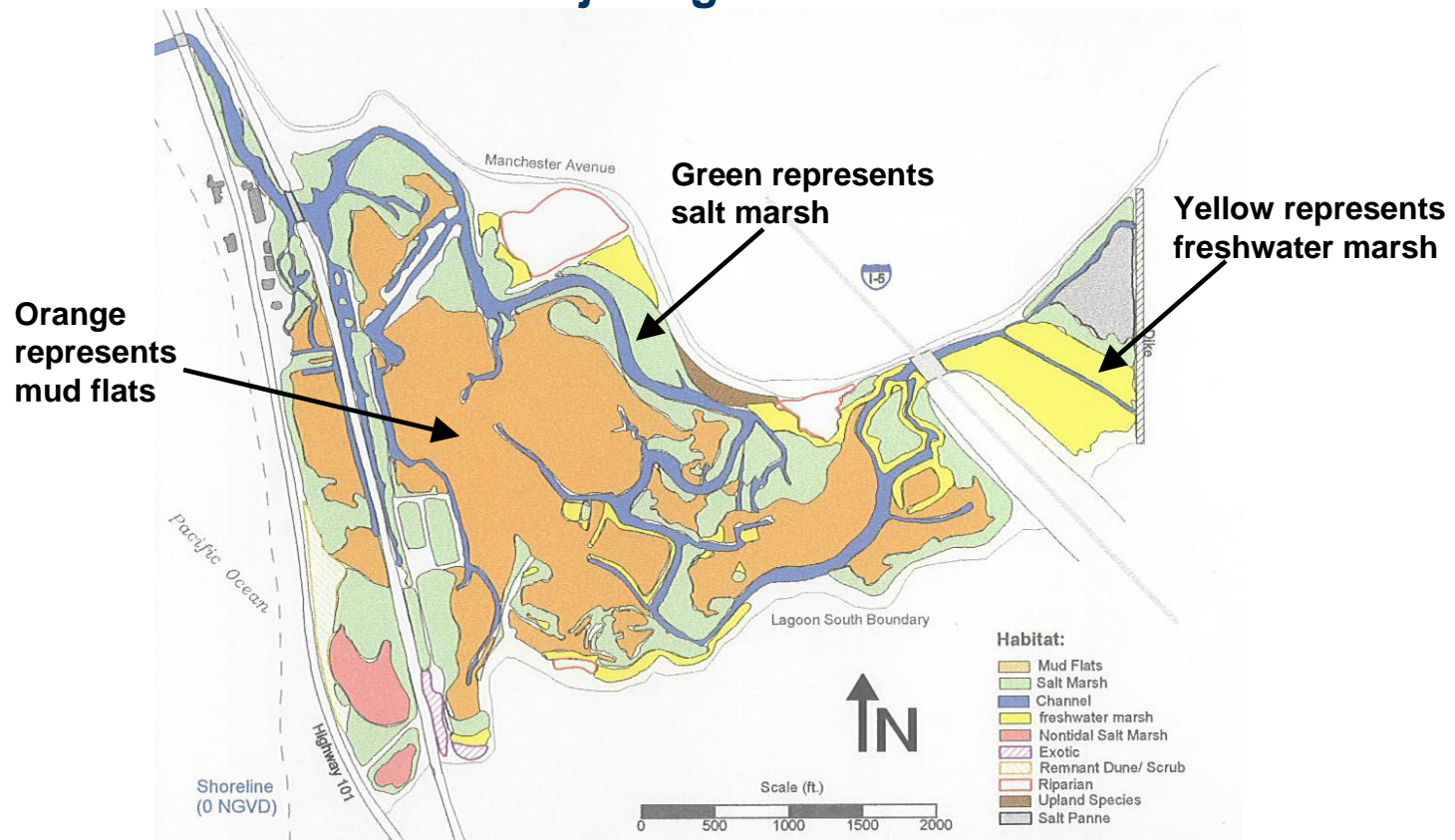
## San Elijo Lagoon Bathymetry

Green  
represents  
areas having  
bottom  
> 2 ft NGVD



# Sedimentation (cont.)

## San Elijo Lagoon Habitat



# Sedimentation (cont.)

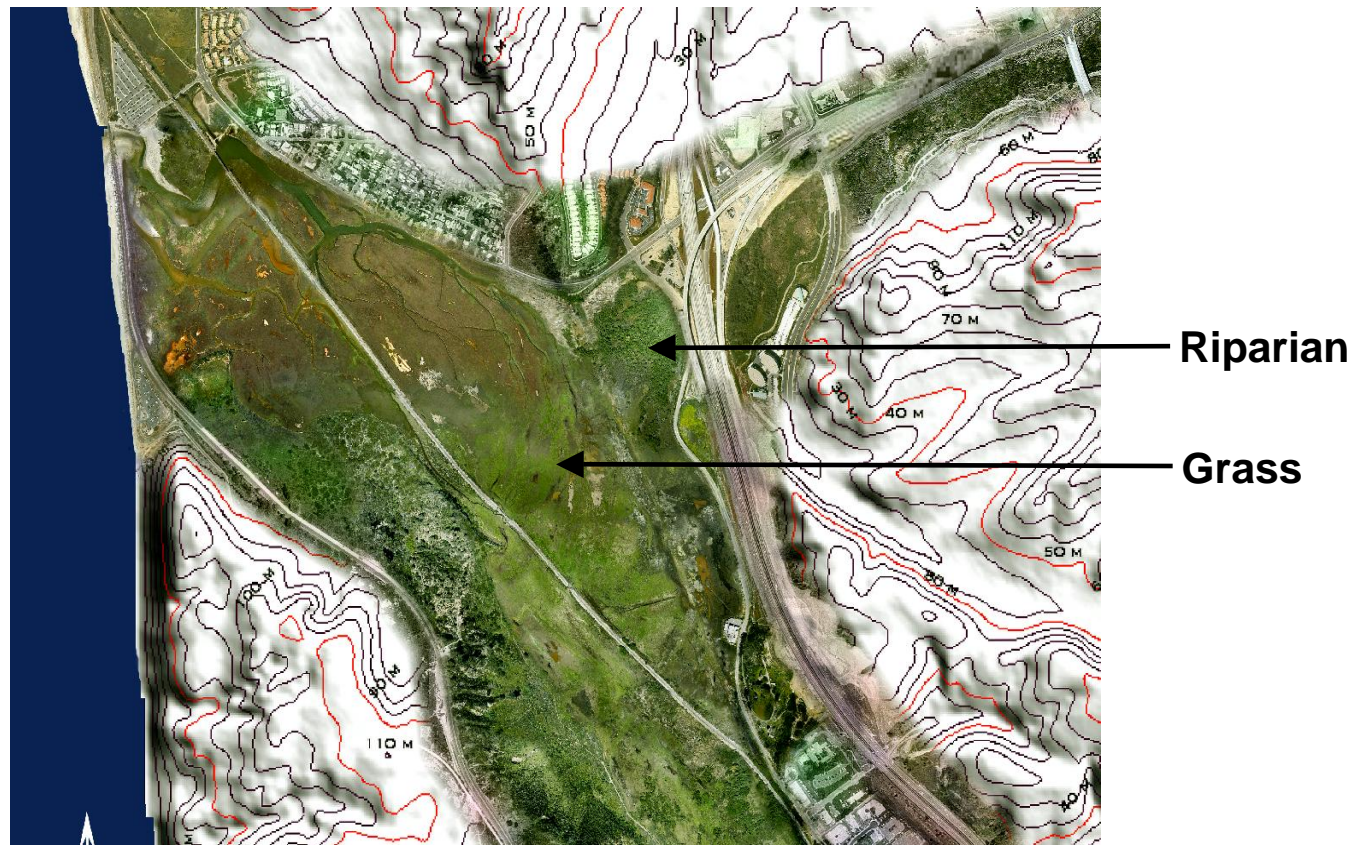
## Southern Tijuana Estuary



Sand from Goat Canyon is distinguished by its yellow color

Goat Canyon

# Low Flow Input



Photograph taken in 2002 of Los Peñasquitos Lagoon

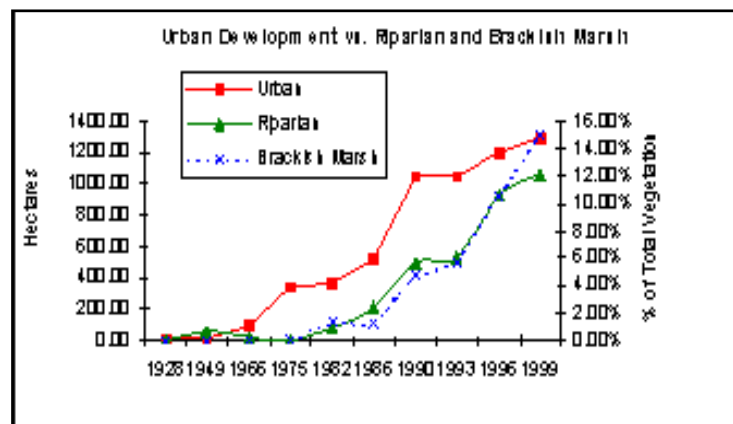
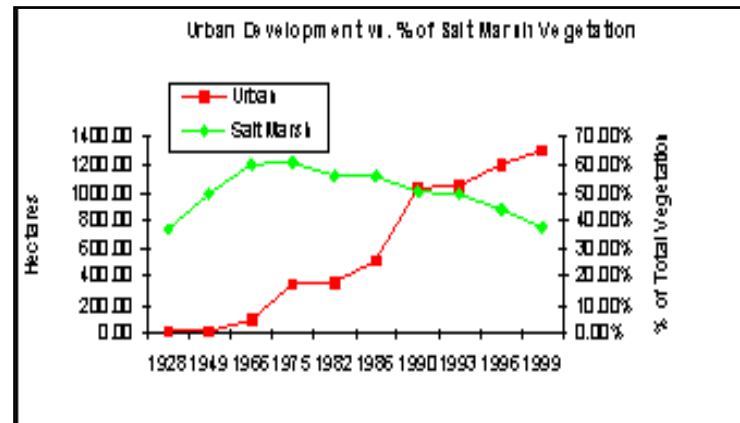
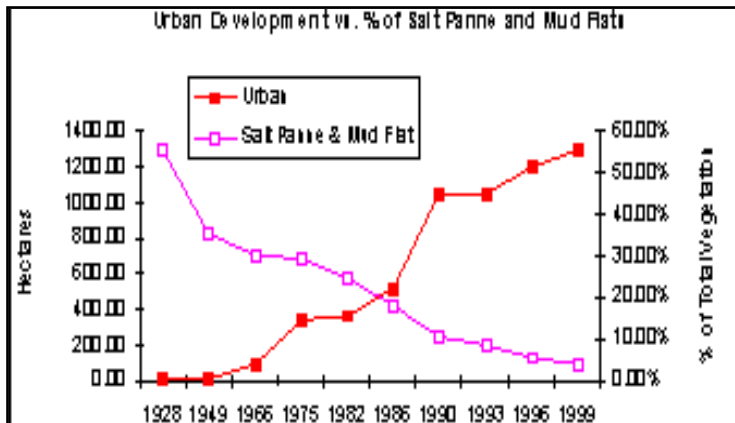
## Low Flow Input (cont.)



From Keith Allen Greer,  
Master's Thesis, 2001

Photograph taken in 1975 of Los Peñasquitos Lagoon

# Low Flow Input (cont.)

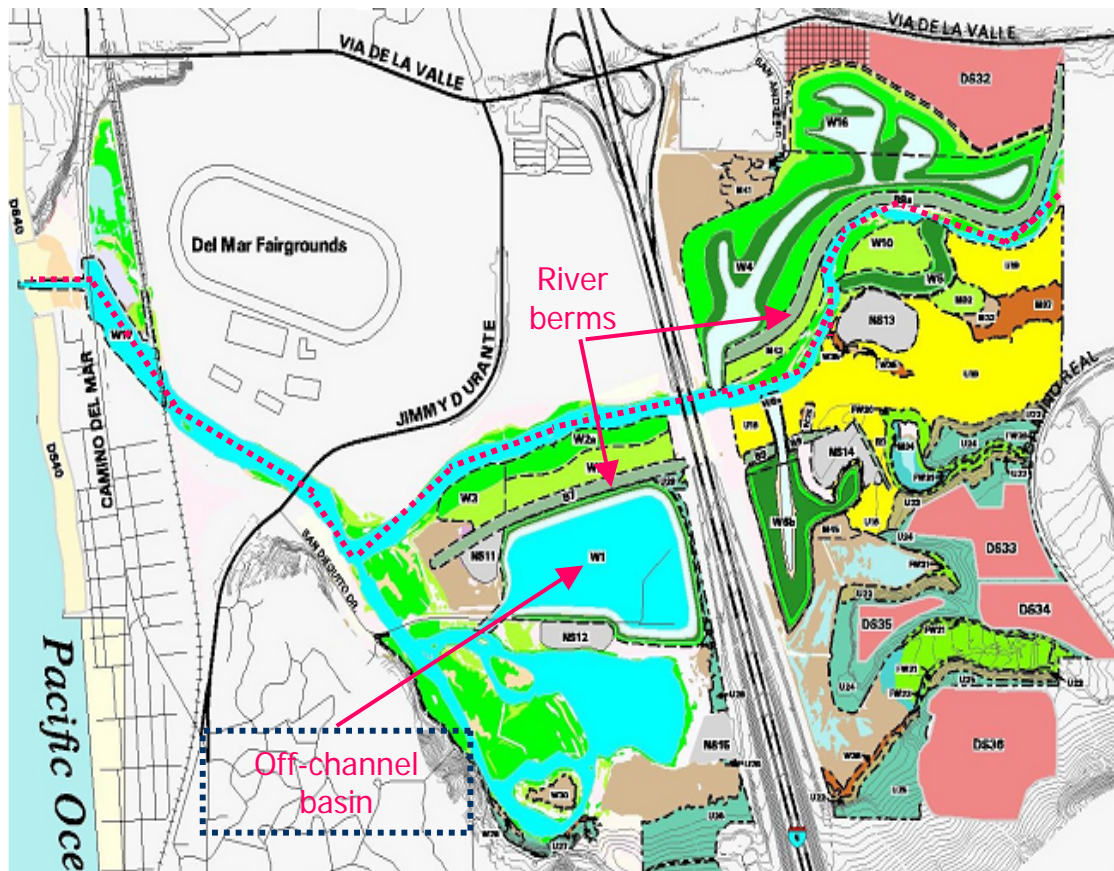


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# San Dieguito Lagoon Prior to Restoration



# San Dieguito Lagoon Restoration Project by Southern California Edison



- Basins
- Channels
- Four Nesting Sites

SCE obtained the following credits:

- 135 acres for restoration, and
- 15 acres for keeping the inlet open.



# Effects of Restoration Projects on Beaches and Access to Beaches

## Conclusions Were Derived From:

1. Knowledge of beaches and lagoon inlets,
2. Numerical modeling,
3. Coastal processes and inlet dynamics,
4. Past restoration project at San Dieguito Lagoon (1980), and
5. Comparison of San Dieguito Lagoon with other local lagoons.

# Knowledge of Beaches and Lagoon Inlets

## Beach Conditions in Summer and Winter



SUMMER

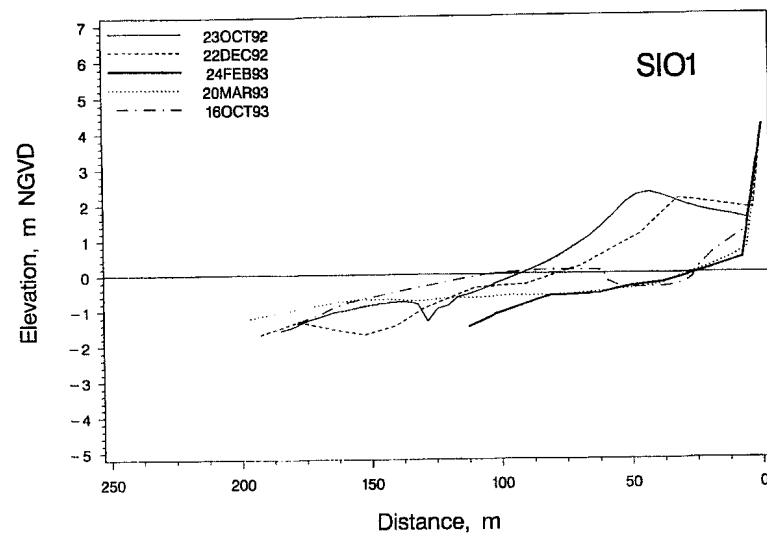


WINTER

*Difference between beach widths during summer and winter is 150 feet (regardless of whether the inlet is open or closed)*

# Knowledge of Beaches and Lagoon Inlets (cont.)

## Effect of February 1993 Flood on Beaches



*Conclusion: Floods have large effects on beaches near the lagoon (beach width decreased by 300 ft), regardless of whether the inlet was open or closed before the flood.*



# Knowledge of Beaches and Lagoon Inlets (cont.)

Inlet Area at High and Low Tides



LOW TIDE



HIGH TIDE

*NO beach access during high tides*

# Numerical Modeling

- Numerical modeling is a commonly used method of prediction that gives reasonable estimates of effects and their sizes.
- Dr. Scott Jenkins modeled the effect of the restoration project on beaches and found *no measurable effect*.

# Coastal Processes and Inlet Dynamics

- Our lagoons are small and shallow, making them different from lagoons on the East Coast and in Mexico and North Africa.
- Outflow velocities from our lagoons are small and do not interrupt longshore sand transport.
- Floods play a major role in keeping our lagoons open.
- When a flood occurs, the outflow scours lagoon channels and erodes adjacent beaches.
- The amount of sand trapped in our lagoons is small compared to the volume of longshore transport.

*Conclusion: Small Southern California lagoons, such as San Dieguito Lagoon, have no effect on beaches.*

## Past Restoration Project at San Dieguito Lagoon (1980)

**In 1980, U.S. Fish & Game restored 60 acres of “South Basin” with**  
*no noticeable effect on adjacent beaches or inlet channel dimensions.*

# Comparison of San Dieguito Lagoon to Other Local Lagoons

- In its existing condition, *San Elijo Lagoon* has an area larger than the restored San Dieguito Lagoon (1.5 times). However, *its inlet channel dimensions are comparable to the existing San Dieguito inlet dimensions.*
- Tijuana Estuary is five times larger than the restored San Dieguito Lagoon. Although its inlet channel is wider than the existing San Dieguito inlet, *its depth is more or less the same as that of San Dieguito Lagoon.*

*Conclusion: The restored San Dieguito Lagoon inlet will not normally be deeper than 2-3 ft mean sea level.*



# How Can We Enhance/Restore Lagoons in Minimal Time Frame?

- Recognize during early stages of project that the understanding of physical processes, such as hydraulics, hydrology, sedimentation, and coastal processes are of great importance for wetland restoration.
- Involve governmental agencies during planning of project.
- Explain project benefits to the public, and involve them as needed.
- Recognize future project issues, and conduct necessary studies to address these issues.
- Obtain data to support your project, and do not depend entirely on numerical modeling.
- Publish your results in recognized journals.