Laguna Conceptual Restoration Design

Draft Habitat Restoration Alternatives

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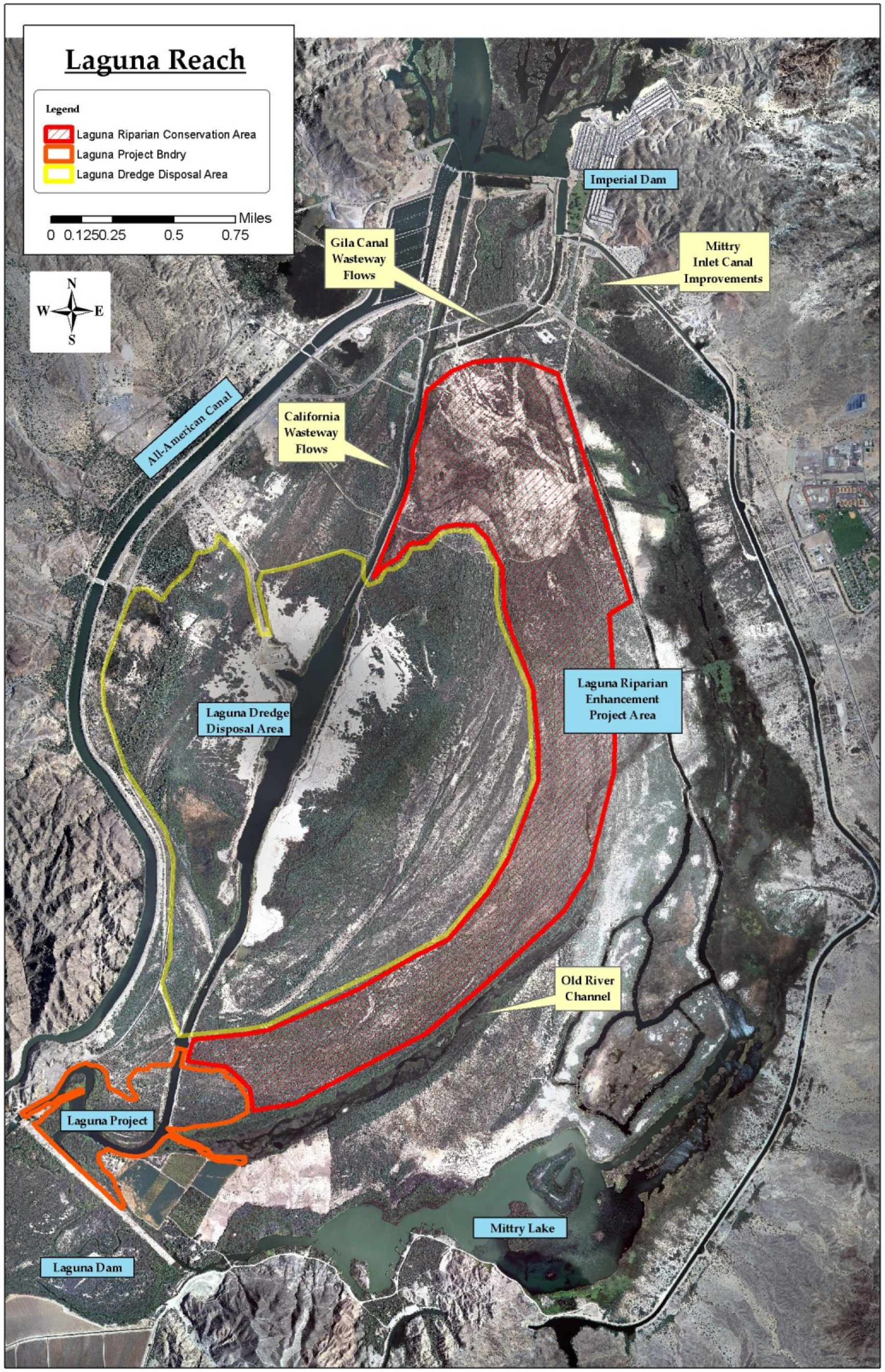
Lower Colorado River Multi-Species Conservation Program

Presentation Outline

- Purpose and objectives
- Site location
- Design considerations
- Design Process
  - Geomorphic Characteristics (Allen Haden)
  - Water Delivery and Control (John Wesnitzer)
  - Vegetation and Habitat (Fred Phillips)
- Restoration Alternatives
  - Alternative 1
  - Alternative 2
  - Alternative 3
- Water Budget
- Cost Analysis
- Discussion
- Questions & Comments

Purpose & Objectives

- Large Scale Riparian and Marsh Restoration/Enhancement
- Determine the cost effectiveness and technical feasibility of a mosaic of habitat types
- Provide evaluation of three enhancement alternatives



Project Site Map

- Project Area – 920 acres
- Reach Length – 4 miles
- Existing Conditions
  - Extensive/dense tamarisk monoculture

Design Considerations

- Up to 100 cfs available for project use
- Habitat Targets
  - Open Water/Marsh: 50 – 100 ac
  - Cottonwood/Willow: >200 ac
  - Upland(mesquite): <500 ac
  - Include specific habitat for T&E species
- No detrimental effect on existing Mittry Lake or Old River Channel Habitats
- Minimize impacts to existing operations (sluicing, dredge disposal, water delivery, etc.)
- Minimize both initial construction and long-term operating costs

Habitat Targets

Open Water/Marsh: 50 – 100 ac

Cottonwood/Willow: >200 ac

Upland (Mesquite): <500 ac

Target Species

California Black Rail

Yuma Clapper Rail

Southwestern Willow Flycatcher

Yellow Billed Cuckoo

Yuma Hispid Cotton Rat

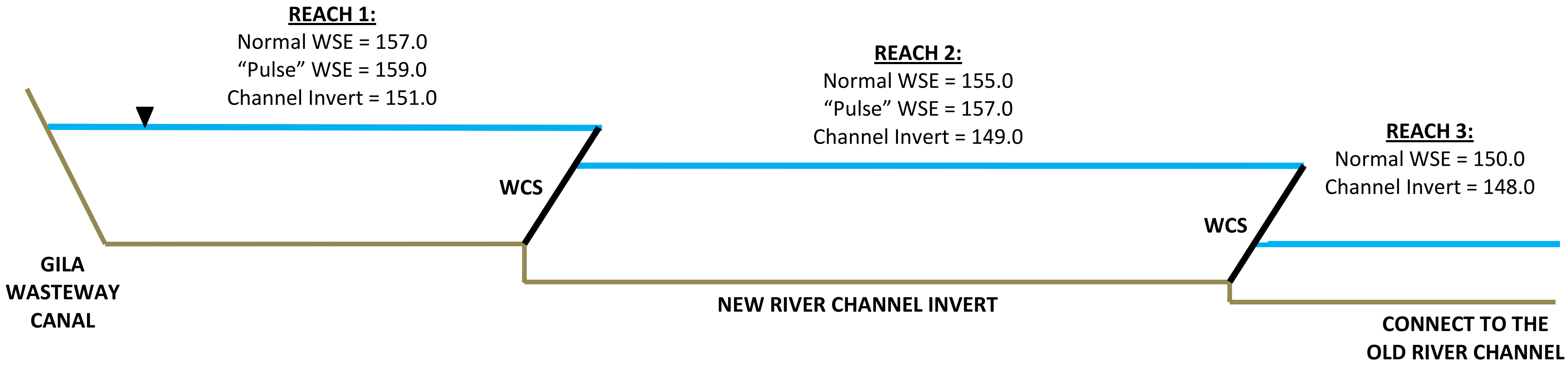
Colorado River Cotton Rat

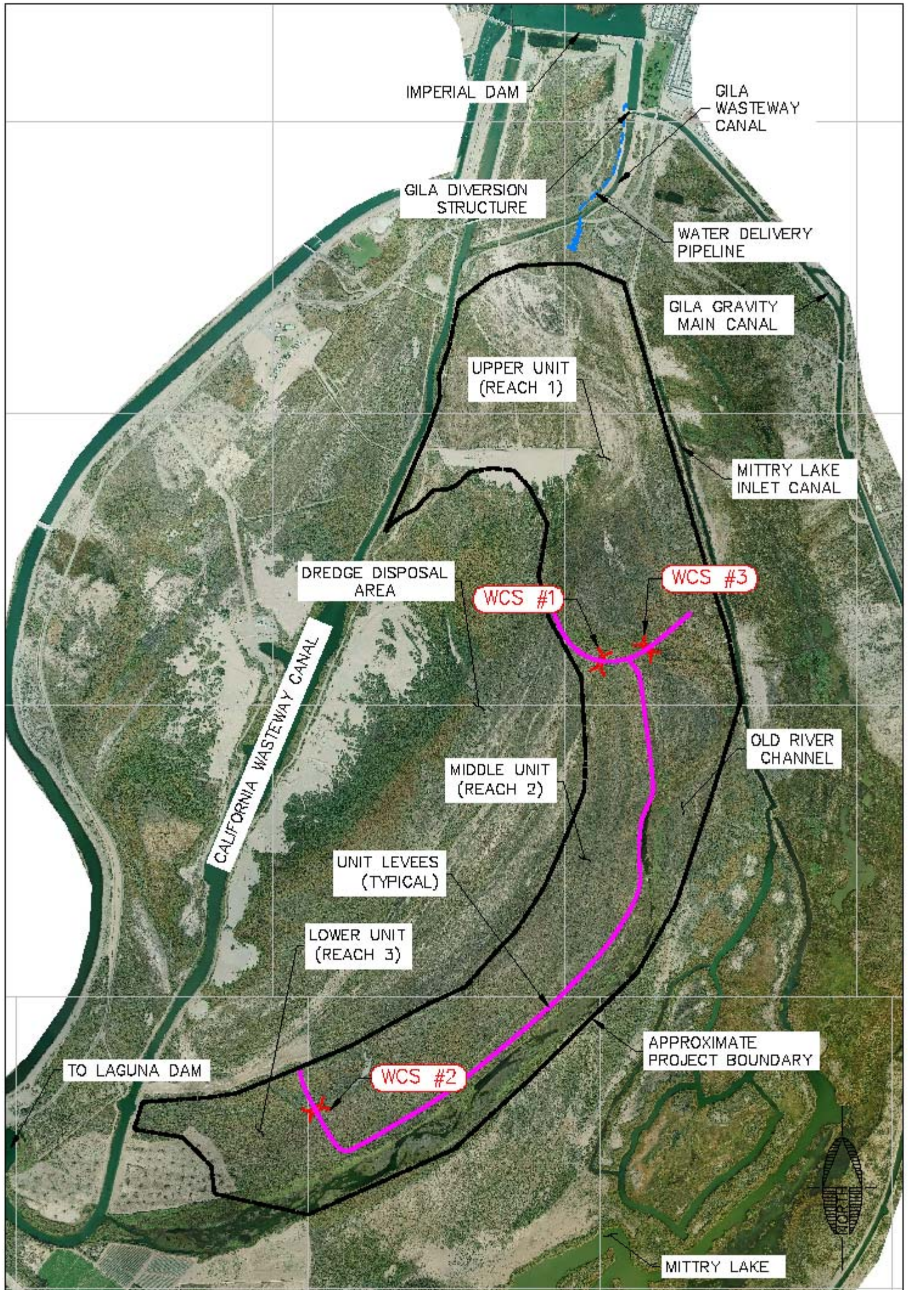
Western Least Bittern

Design Process: Geomorphology

Need to provide the topography to support water conveyance and vegetation for habitat

- *Operate as a managed, leveed wetland rather than a river system to maximize limited water resource*
- *Use pulse flows to mimic flooding*
- *Requires water control structures to manage water levels*
- *Use existing overflow channels through project area to minimize excavation*





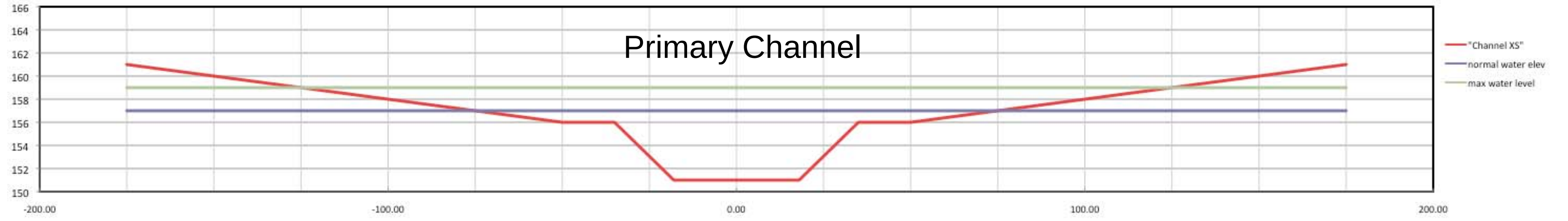
WATER CONTROL STRUCTURES (WCS)

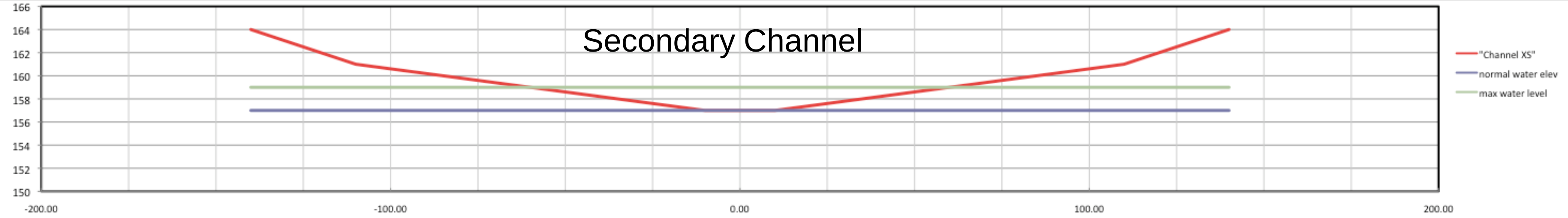
Locations

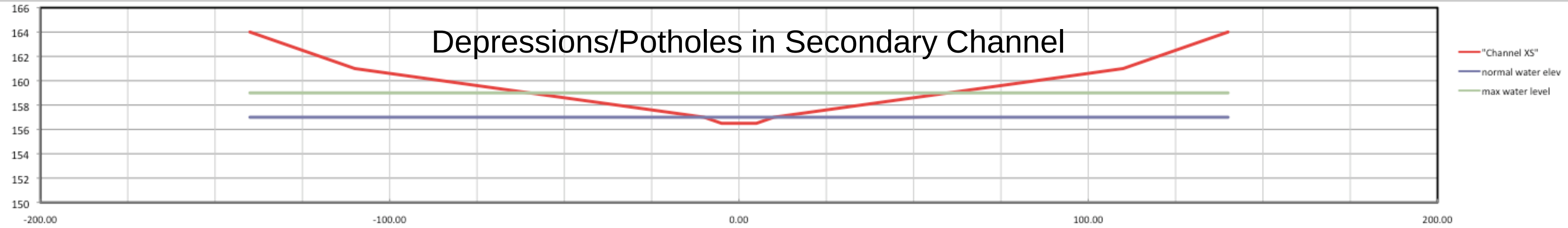
Three (3) structures to control water surface elevations within the new units

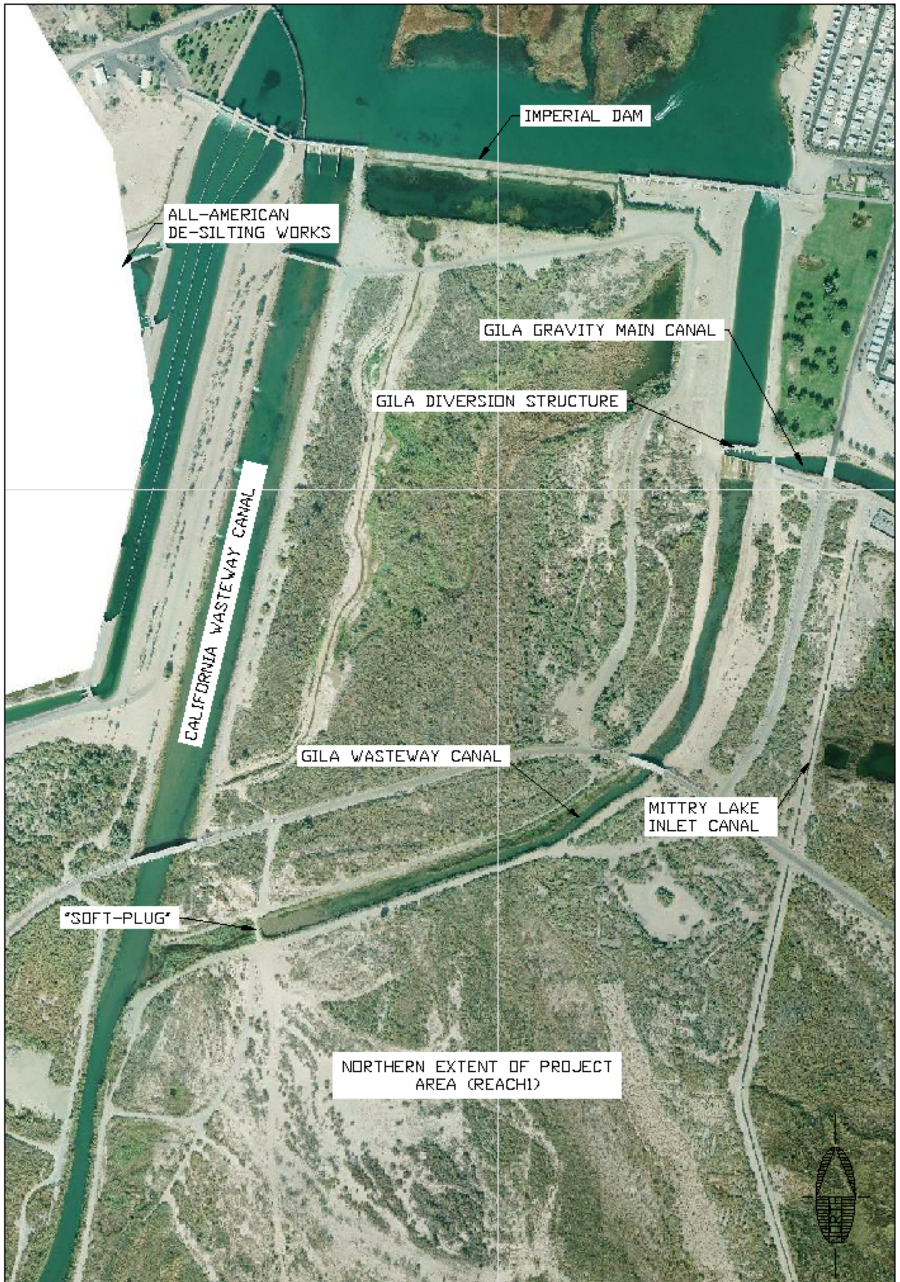
- WCS #1 and #2: In-line with new units
- WCS #3: Turn-out for the Historic River Channel Alignment

Typical Cross Sections



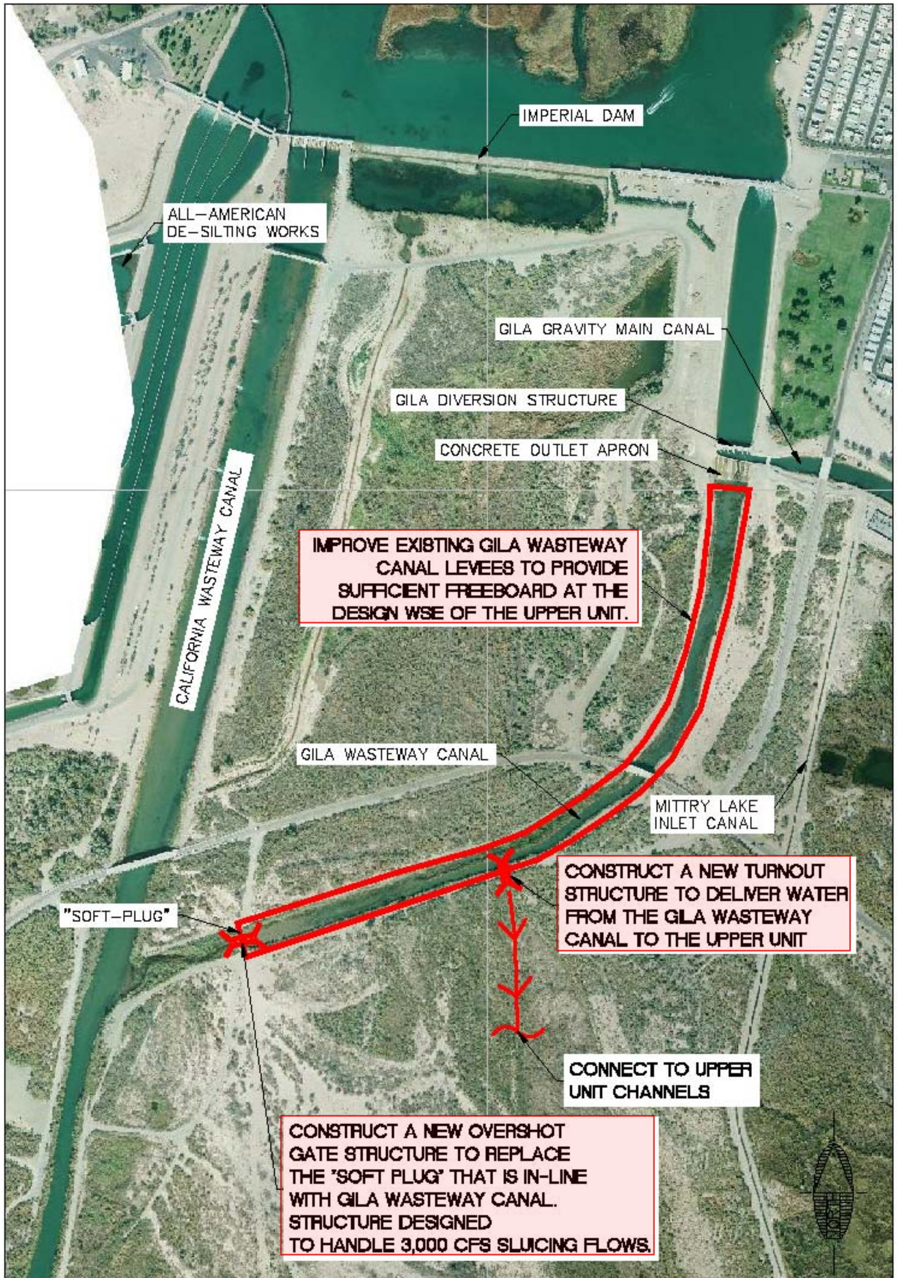






WATER DELIVERY OPTIONS
Overview

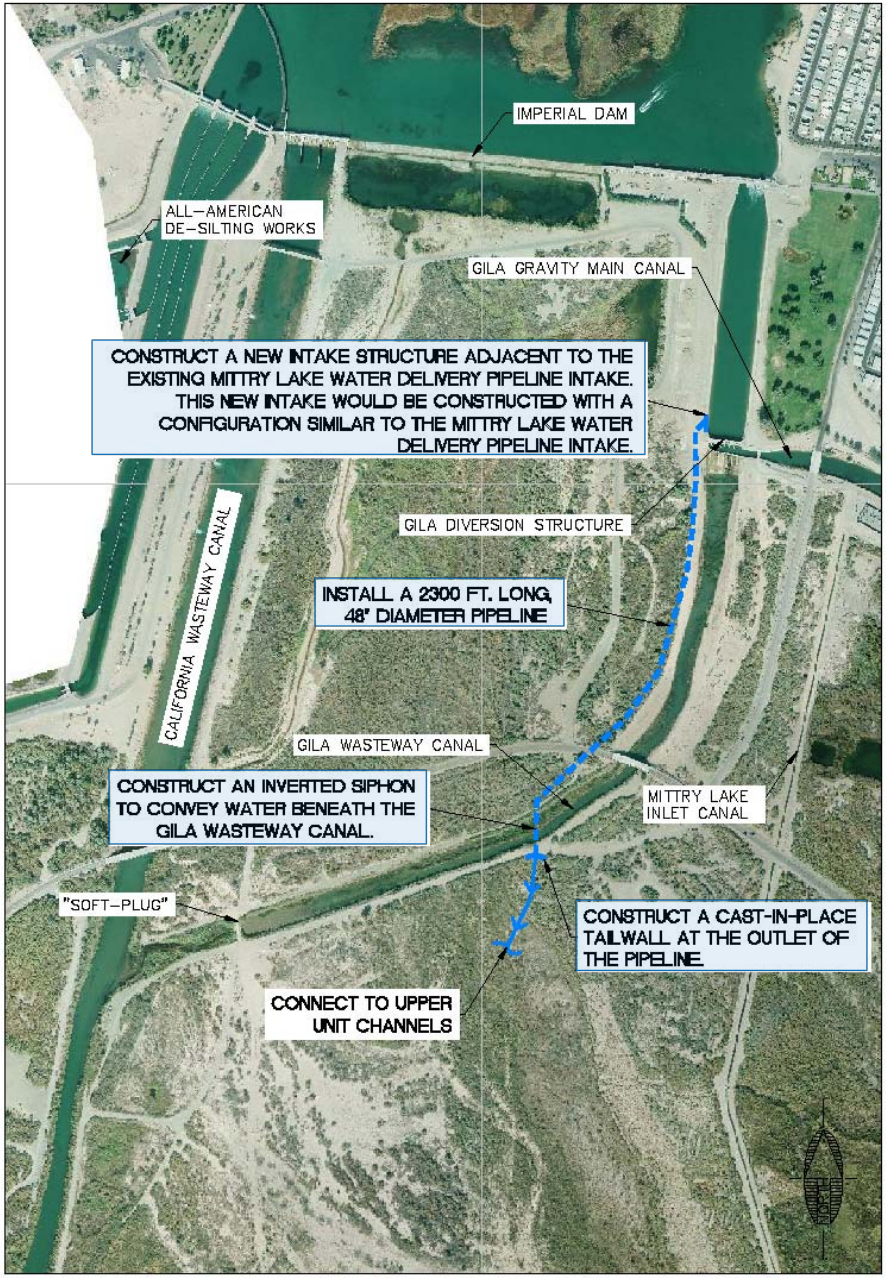
- Utilize/modify existing infrastructure at the northern extent of the project area
- Convey 100 cfs base flow to the project site
  - 2 gravity delivery systems
  - 2 pump delivery systems
- Other System Design Criteria
  - Minimize impacts to dam operations
  - Low O&M critical
  - Long life cycle ideal



WATER DELIVERY OPTION – 1

Gravity Feed From Gila Wasteway Canal

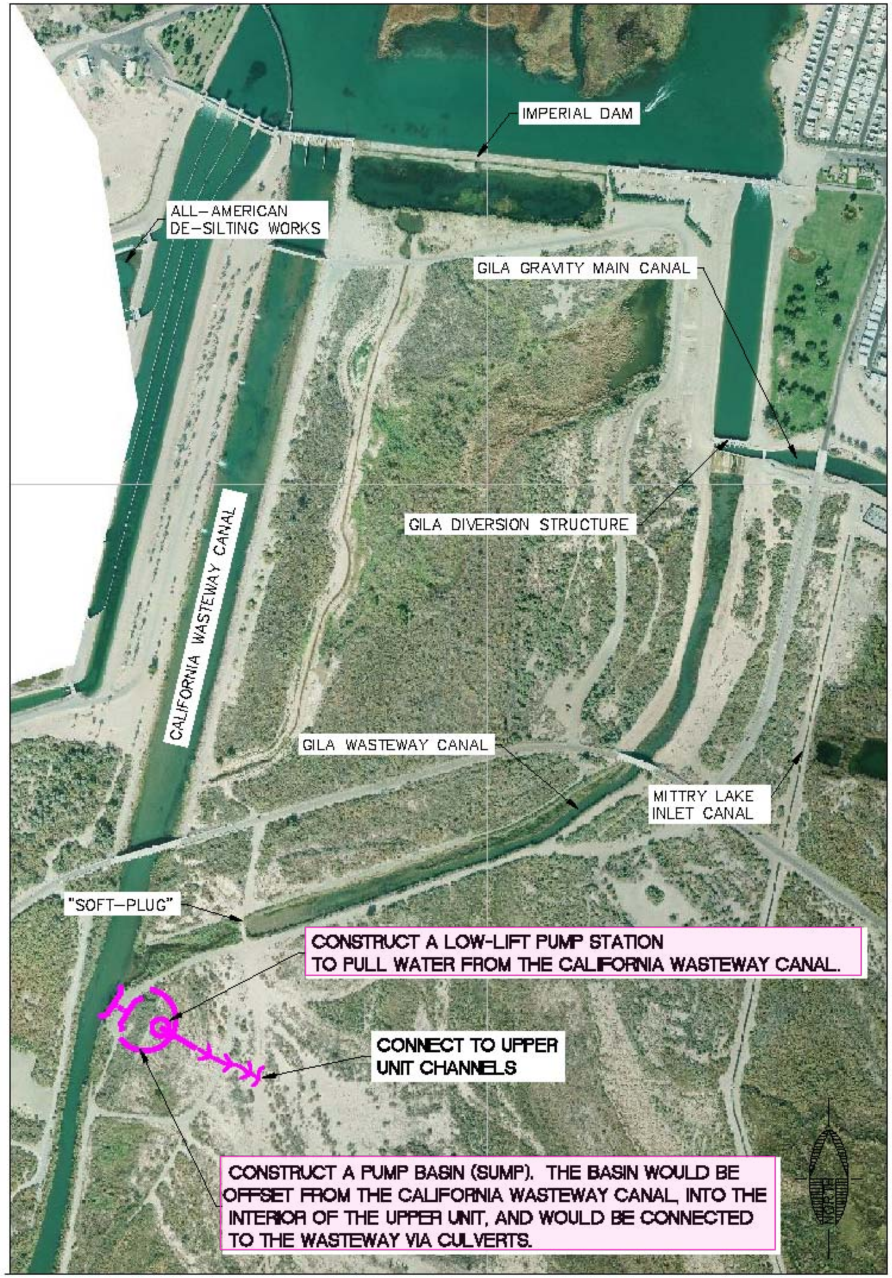
ADVANTAGES	DISADVANTAGES
• Gravity system is relatively low maintenance and utilizes existing infrastructure • Replacing the soft-plug with a permanent structure should improve sluicing operations on the Gila Wasteway Canal. • Deeper water depth within the wasteway should improve emergent vegetation management	• Lower sluice gates at the Gila Diversion Structure are not designed to meter flows or operate in conjunction with the upper control gates. May be cavitation at outlet due to high velocities . • At the design water surface elevation, there will 2.5' to 3' of water on the outlet apron located at the north end of the Gila Wasteway Canal. • USBR has concerns that increasing the water elevation in the Gila Wasteway could raise groundwater levels and potentially impact road S-24 • Water from Gila Diversion Structure may be silt laden



WATER DELIVERY OPTION – 2

Gravity Feed From a New Pipeline

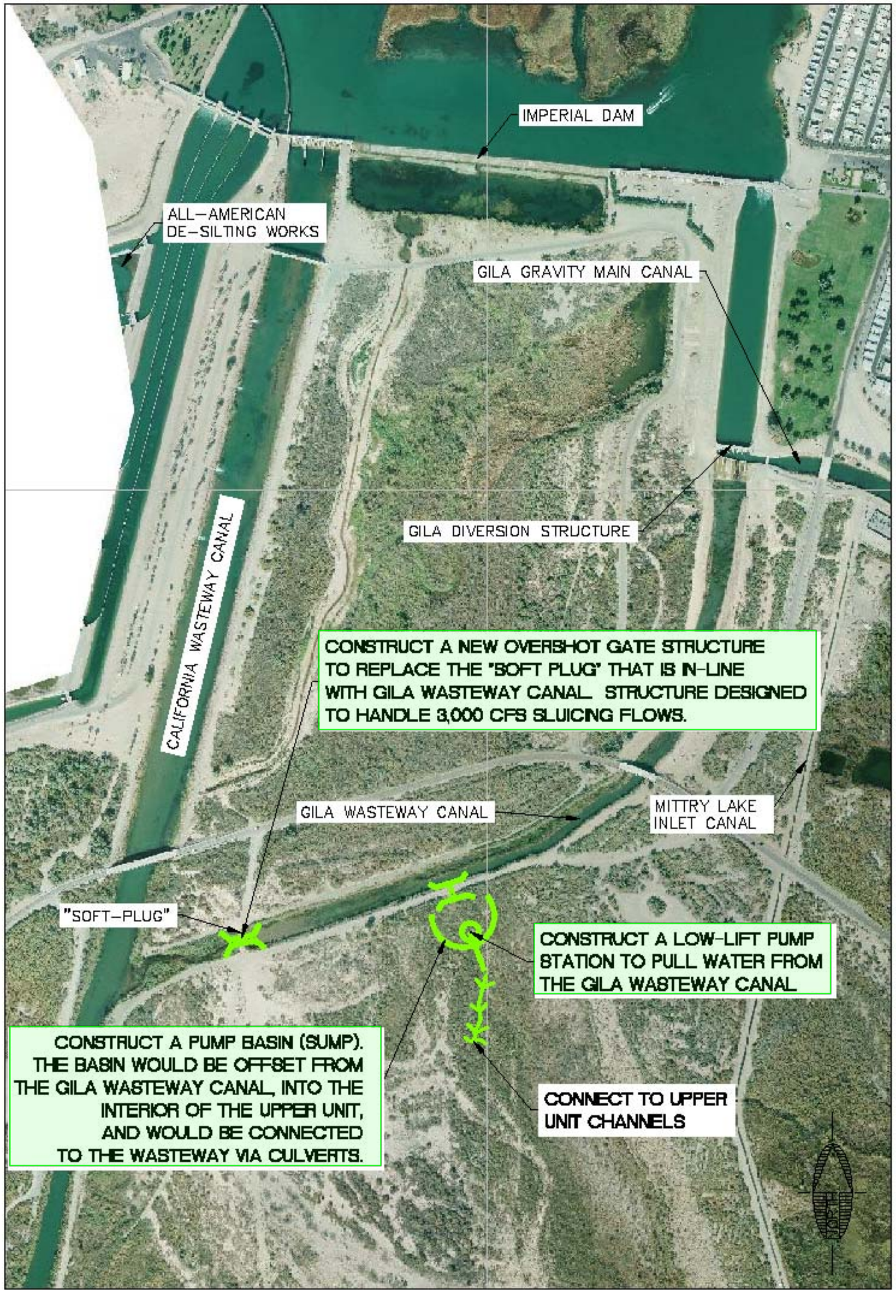
ADVANTAGES	DISADVANTAGES
• Gravity system is relatively low maintenance • Independent delivery system with limited impacts to existing dam operations • High quality water (low salinity/sediment load) at take out point • Piped system reduces evaporation/infiltration as water is conveyed to the Upper Unit (Reach 1)	• Intake structure could be effected by Quagga mussels



WATER DELIVERY OPTION – 3

Pump from the California Wasteway

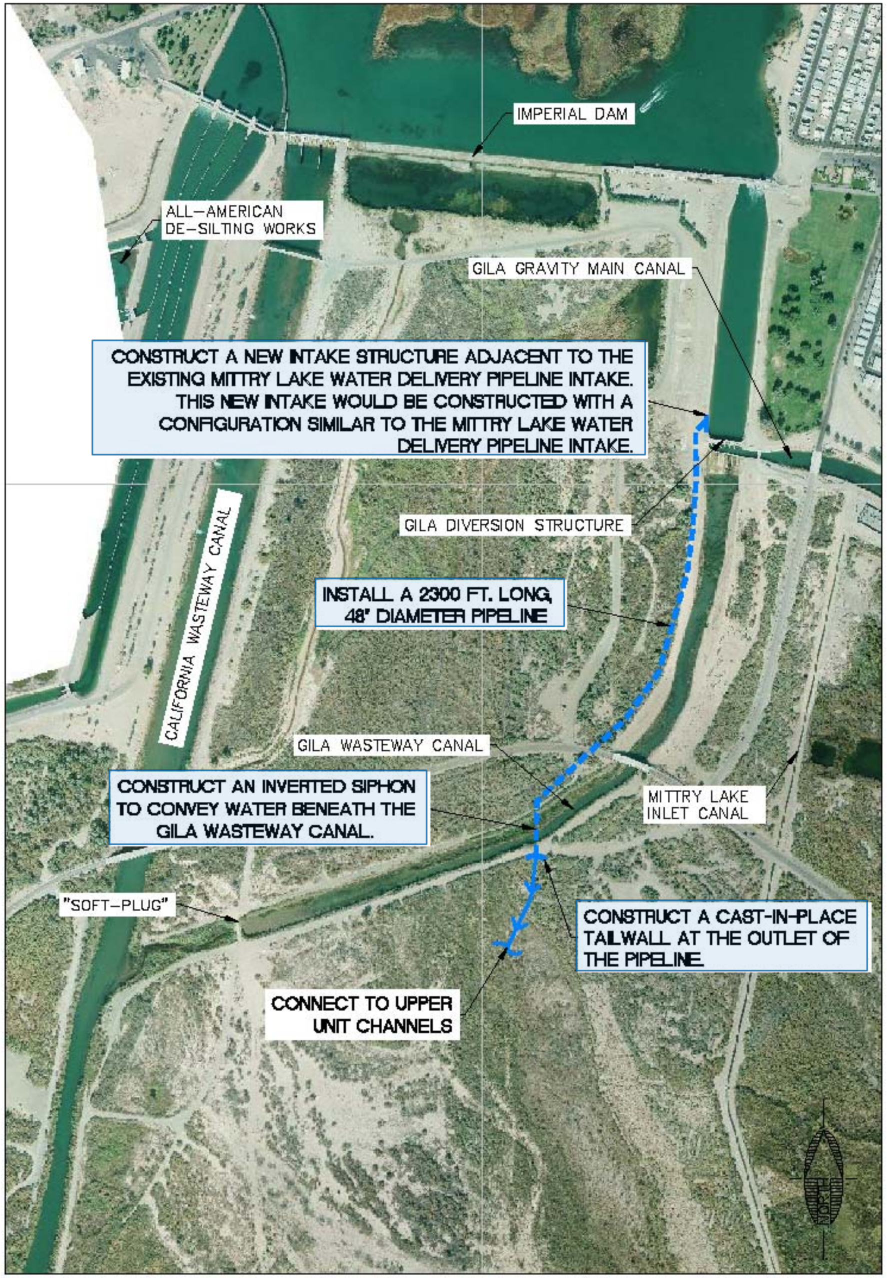
ADVANTAGES	DISADVANTAGES
• Utilizes 250-350 cfs base flow from All-American Canal De-silting Basin return flows and gate leakage from the California Wasteway Gates at Imperial Dam	• Life Cycle energy costs are significant. • Relatively maintenance intensive. • Water from California Wasteway may be silt laden. • The California Wasteway requires a 200 cfs minimum base flow to meet downstream water requirements (including the Yuma East Wetlands Project). Would be difficult to pull 100 cfs from the wasteway per USBR.



WATER DELIVERY OPTION – 4

Pump from the Gila Wasteway

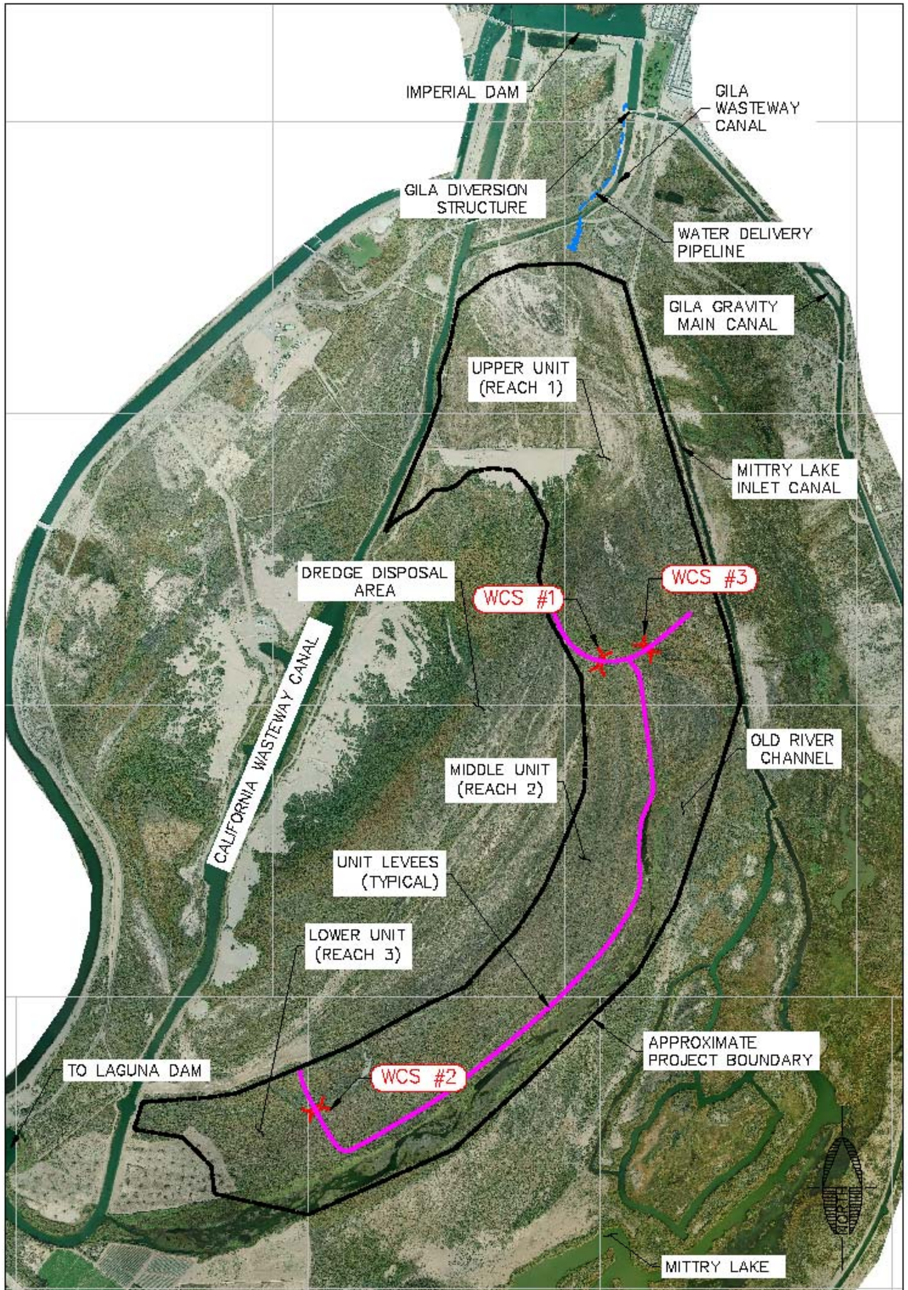
ADVANTAGES	DISADVANTAGES
• Replacing the soft-plug with a permanent structure should improve sluicing operations on the Gila Wasteway Canal.	• Life Cycle energy costs are significant. • Relatively maintenance intensive. • Water from Gila Diversion Structure may be silt laden • Lower sluice gates at the Gila Diversion Structure are not designed to meter flows or operate in conjunction with the upper control gates. May be cavitation at outlet due to high velocities . • USBR has concerns that increasing the water elevation in the Gila Wasteway could raise groundwater levels and potentially impact road S-24



PREFERRED
WATER DELIVERY OPTION – 2

Gravity Feed From a New Pipeline

- Competitive Construction Costs
  - $870,000
- Lowest Life Cycle Costs
  - $60,000
- Lowest Overall Costs
  - $930,000



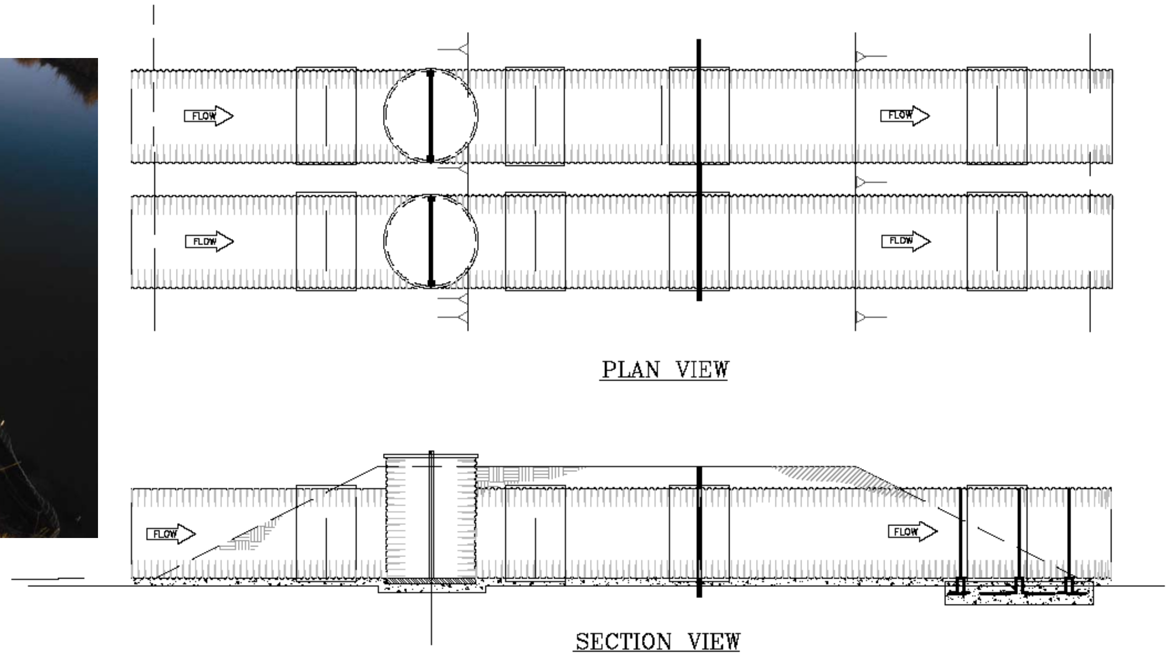
WATER CONTROL STRUCTURES (WCS)

Overview

- Three (3) structures to control water surface elevations within the new units
  - WCS#1 and #2: In-line with new units
  - WCS#3: Turn-out for the Historic River Channel Alignment
- Structure Design Criteria
  - Allow easy water elevation adjustment to meet seasonal habitat and wildlife needs
  - Low O&M critical
  - Long life cycle ideal

WATER CONTROL STRUCTURES (WCS)

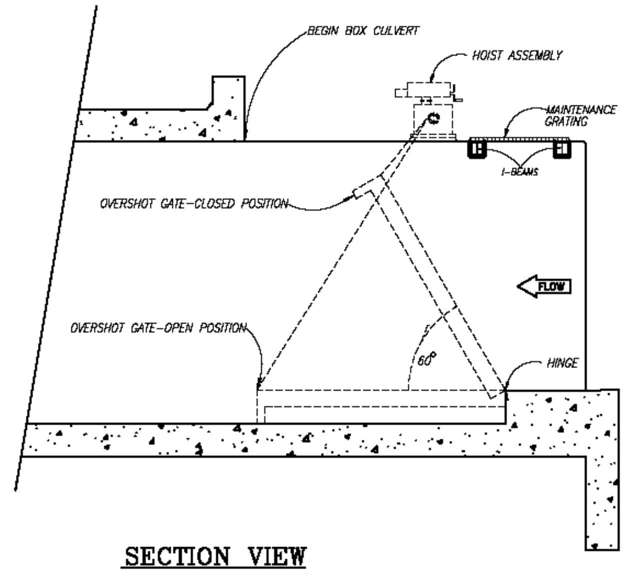
Stop-Log/Riser



ADVANTAGES	DISADVANTAGES
• Lower up-front costs	• Water elevation adjustment limited by typical board width • Stop-logs will leak • Structures may hang up debris • Water logged boards difficult to remove

WATER CONTROL STRUCTURES (WCS)

Overshot Gate

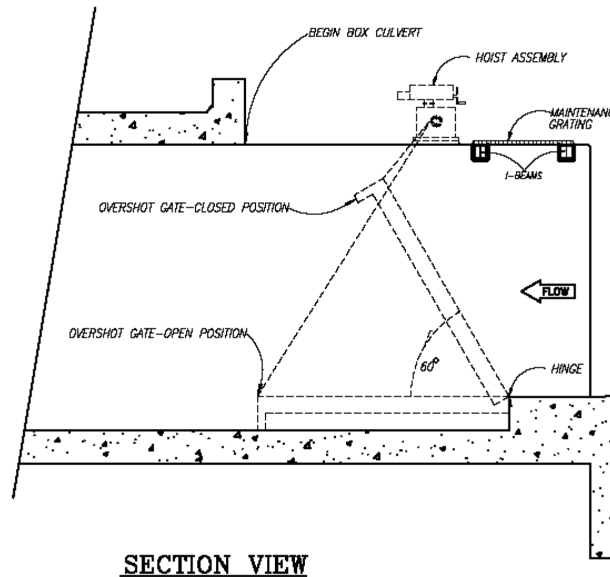


ADVANTAGES	DISADVANTAGES
• Ease of adjusting water surface elevation via geared hoist and gas powered actuator (potential to automate) • Precise water elevation control (0.25 inch increments) • Minimal leakage if J-seal and Aluminum rubbing plate installed • Gate allows surge flows and debris to pass over and carry on downstream	• Higher up front cost

PREFERRED

WATER CONTROL STRUCTURES (WCS)

Overshot Gate

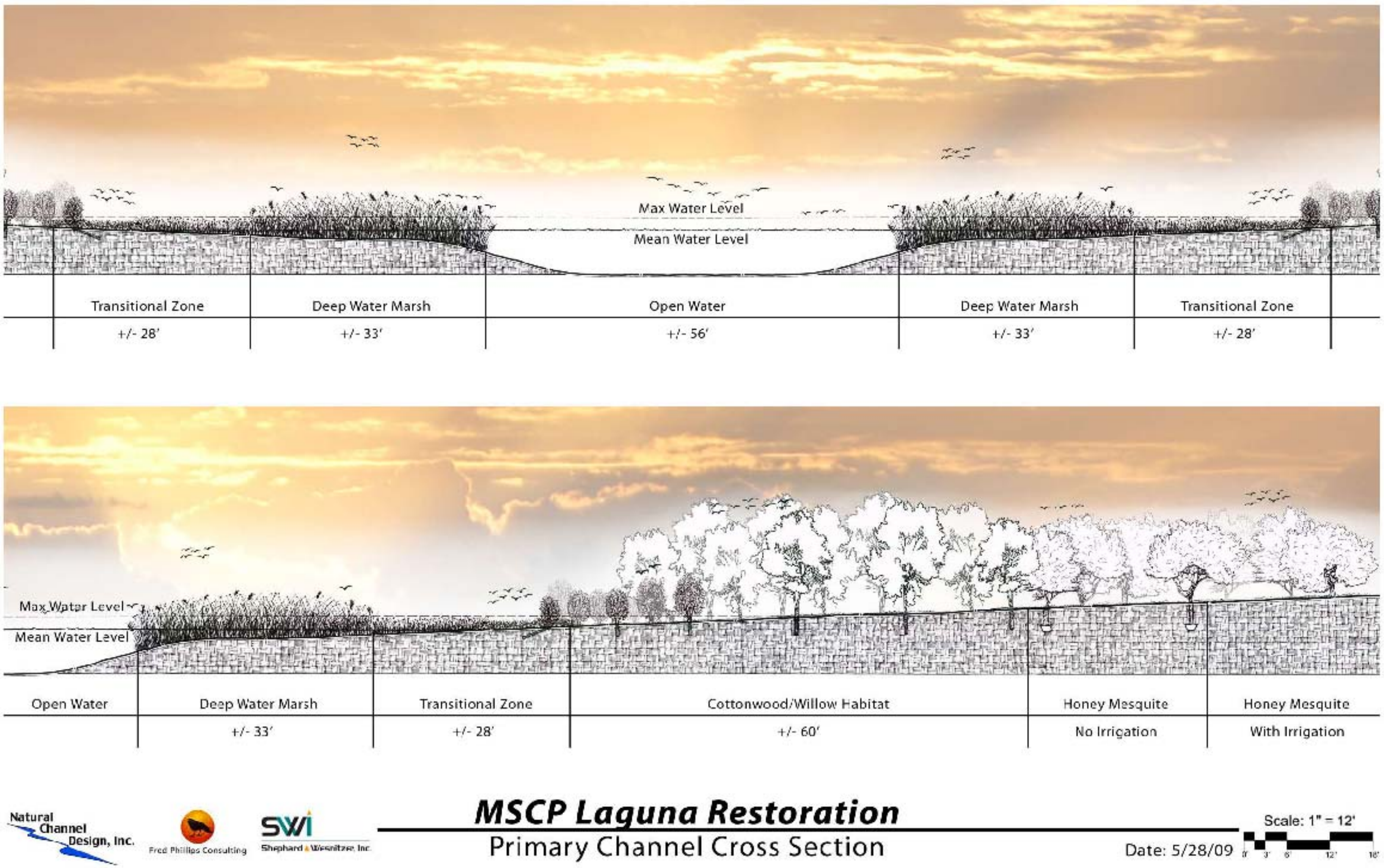


- Highest Construction Cost - $255,000 /EA.
- Lowest Life Cycle Cost - $85,000 /EA
- Competitive Overall Cost – Ease of O&M/Long Life Preferred - $340,000 /EA

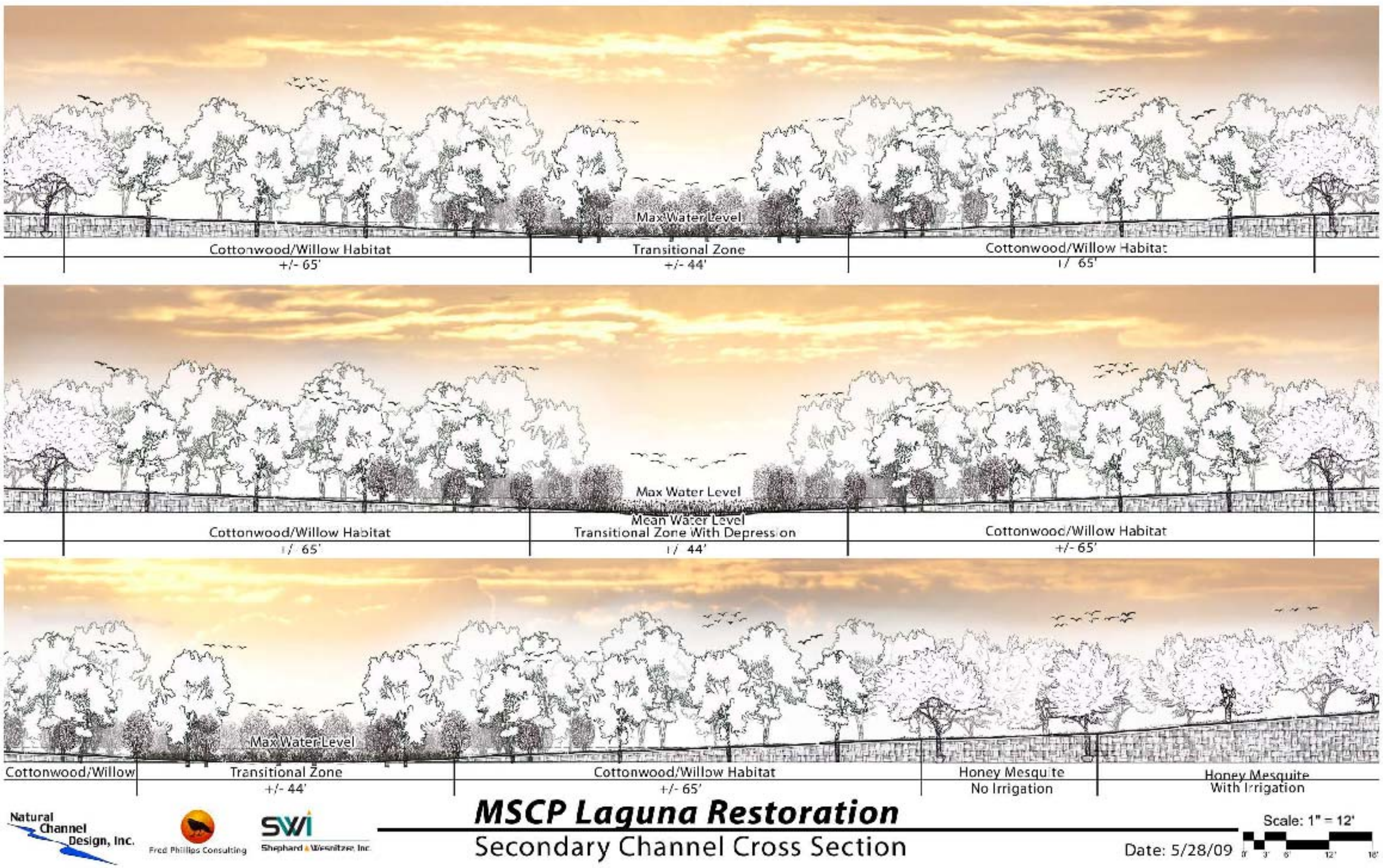
Revegetation Design Rationale

- Design includes methods that have proven to be successful in creating marsh and transitional habitats
- 15 years of experience on the LCR has provided the following insights:
  - Germination success of salt tolerant native marsh herbaceous species seeds
  - Plantings of *Anemopsis californica* have thrived in wet areas that are frequently inundated
  - Specify plug or liner plantings for the cottonwood and willow species based on salinity. Sandbar willow or honey mesquite should be planted instead of cottonwood and gooding willow if the salinity exceeds 1000 ppm.
  - In general one-gallon pot plantings of *Prosopis glandulosa* var. *torreyana* have had a higher ratio of establishment success than smaller plug plantings when planted directly into moist soils (the existing water table) with no supplemental irrigation.
  - 2 ¼" plugs of *Distichlis spicata* planted on 5' centers in moist/wet soils will establish a solid cover within one year.
  - In general plugs used for emergent marsh planting will yield much higher success than using seeds.
  - Planting all the emergent marsh species mentioned at 5' O.C. should yield a solid cover of emergent plants within 1 year of planting.
  - Weeding and maintenance of the revegetation site in the first and part of the second year of growth are critical. The second year usually transitions into an as needed basis. However, it is anticipated that maintenance will need to occur until all exotic species and phragmites are out competed by native grasses and trees.

Revegetation Design
Primary Channels



Revegetation Design
Secondary Channels



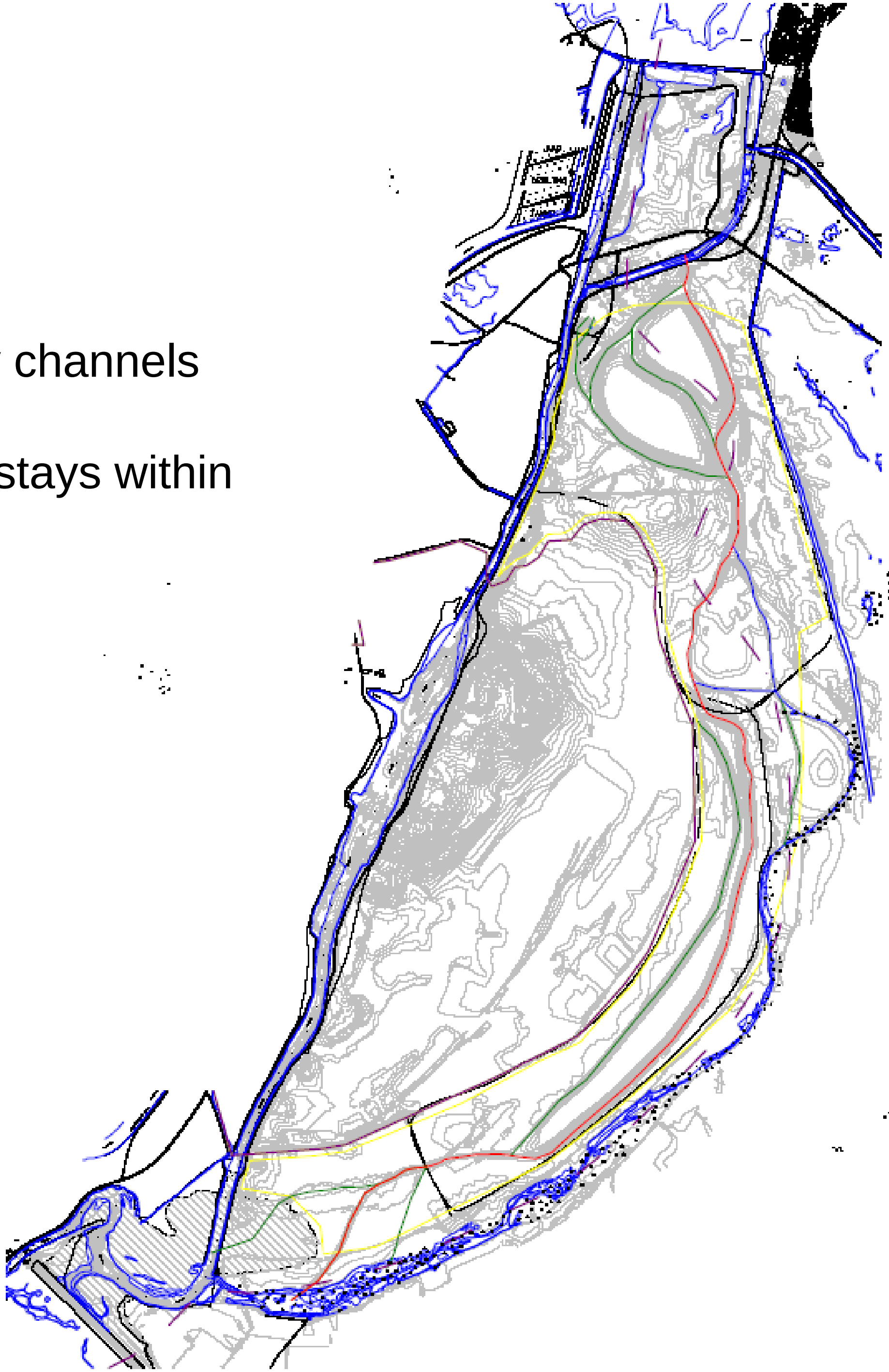
Alternative 1
Channel Plan View

- Three cells with primary and secondary channels
- Uses existing channel topography and stays within original project boundaries.

<u>Habitat</u>: 1000 acres

<u>Earthwork</u>: 760,000 cy (excavation)

<u>Estimated Cost</u>: $15.7M

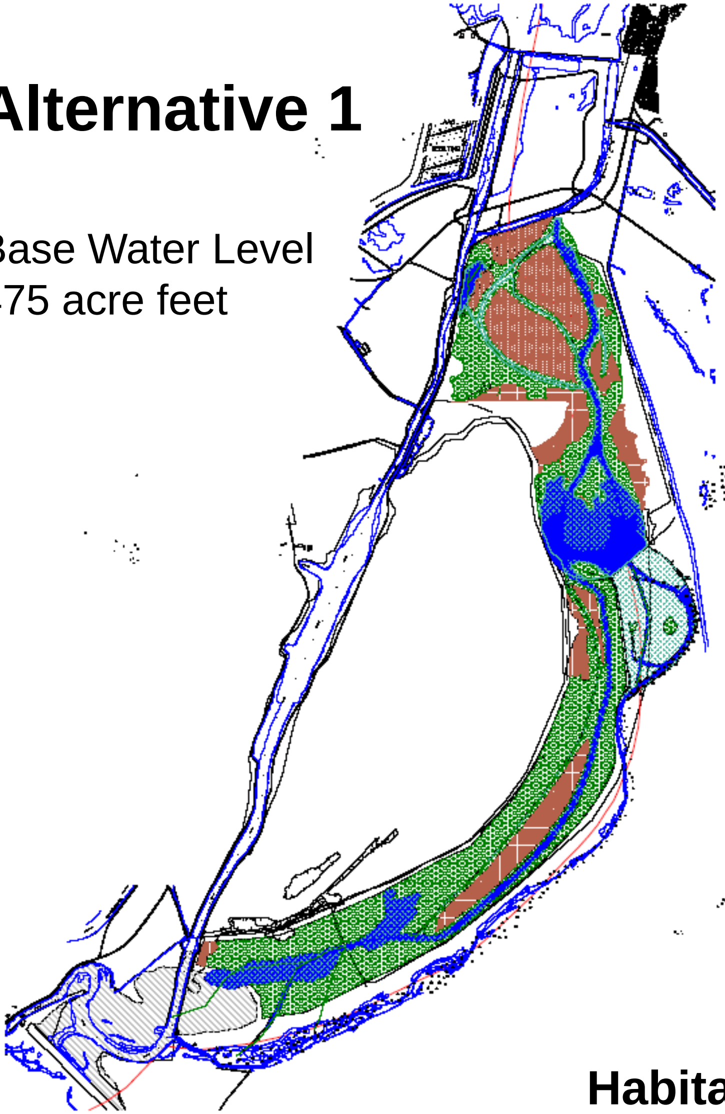


Primary Channel

Secondary Channel

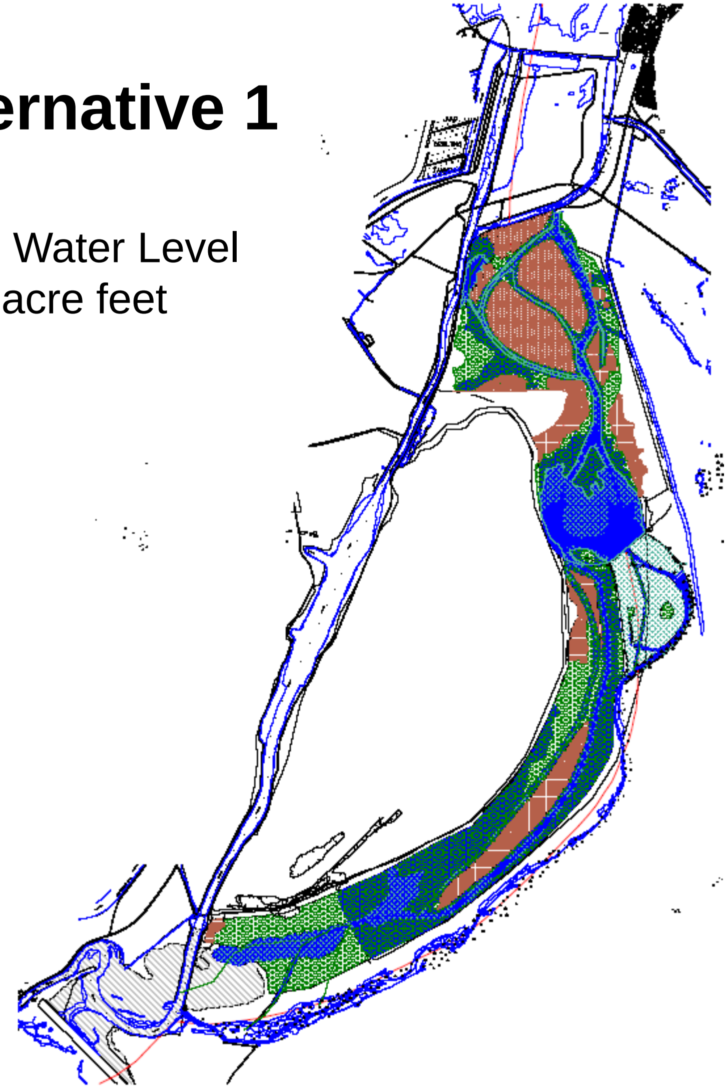
Alternative 1

Base Water Level
475 acre feet



Alternative 1

Pulse Water Level
1050 acre feet



Habitat Acreages

OPEN WATER	DEEP MARSH	TRANSITION ZONE	COTTONWOOD/ WILLOW	MESQUITE
77	162	179	306	103 (no irrigation) 181 (irrigation)

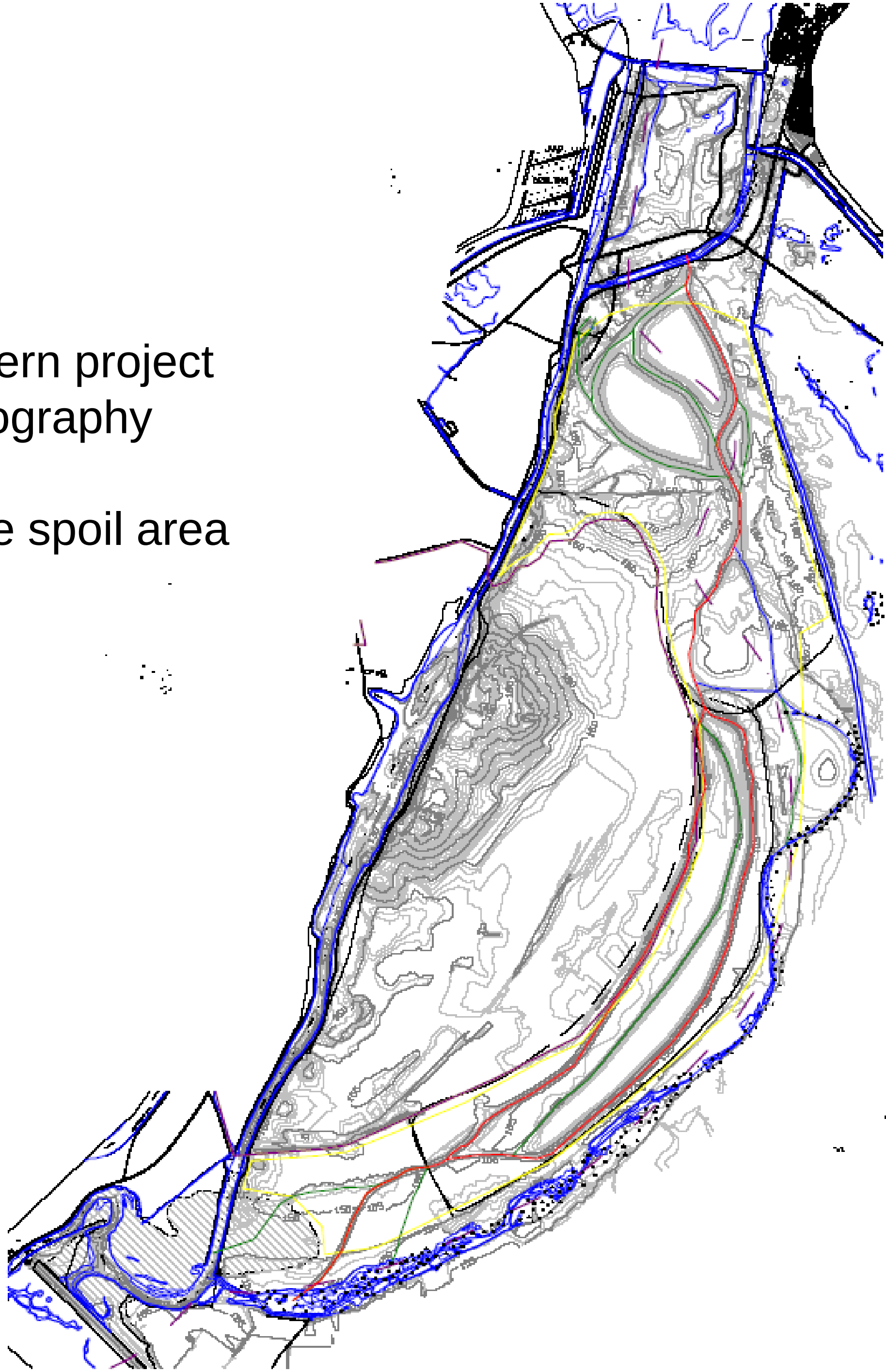
Alternative 2
Channel Plan View

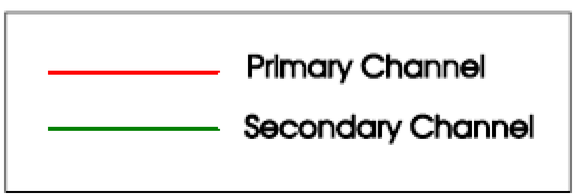
- Additional Primary Channel along western project border takes advantage of existing topography
- Extends project boundary inside dredge spoil area

<u>Habitat</u>: 1050 acres

<u>Earthwork</u>: 950,000 cy (excavation)

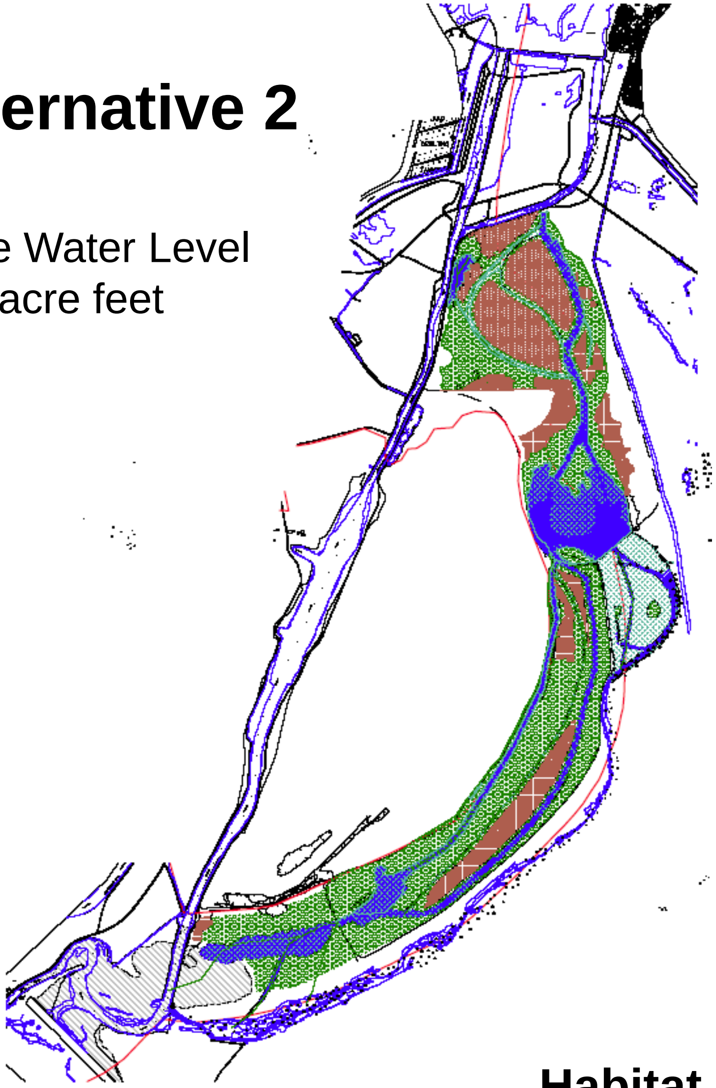
<u>Estimated Cost</u>: $18.0M





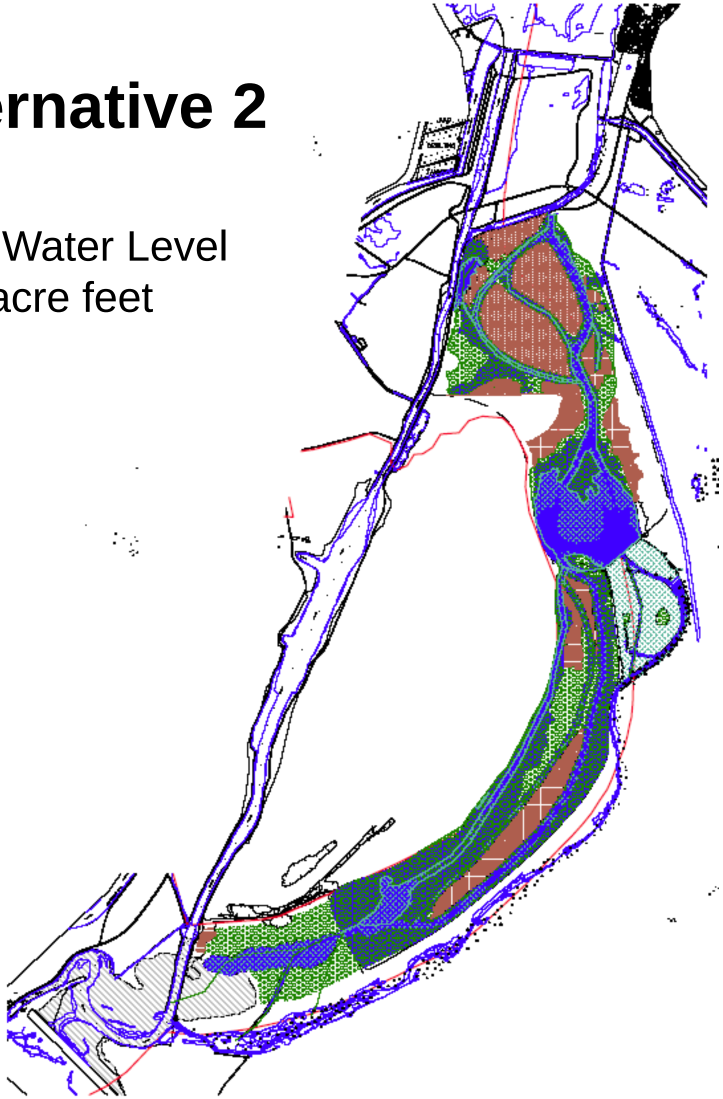
Alternative 2

Base Water Level
570 acre feet



Alternative 2

Pulse Water Level
1170 acre feet



Habitat Acreages

OPEN WATER	DEEP MARSH	TRANSITION ZONE	COTTONWOOD/ WILLOW	MESQUITE
87	167	193	312	109 (no irrigation) 181 (irrigation)

Alternative 3
Channel Plan View

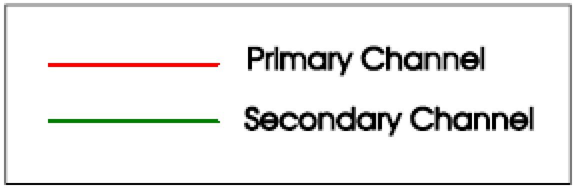
- Two additional Secondary Channels
  Take advantage of existing topography

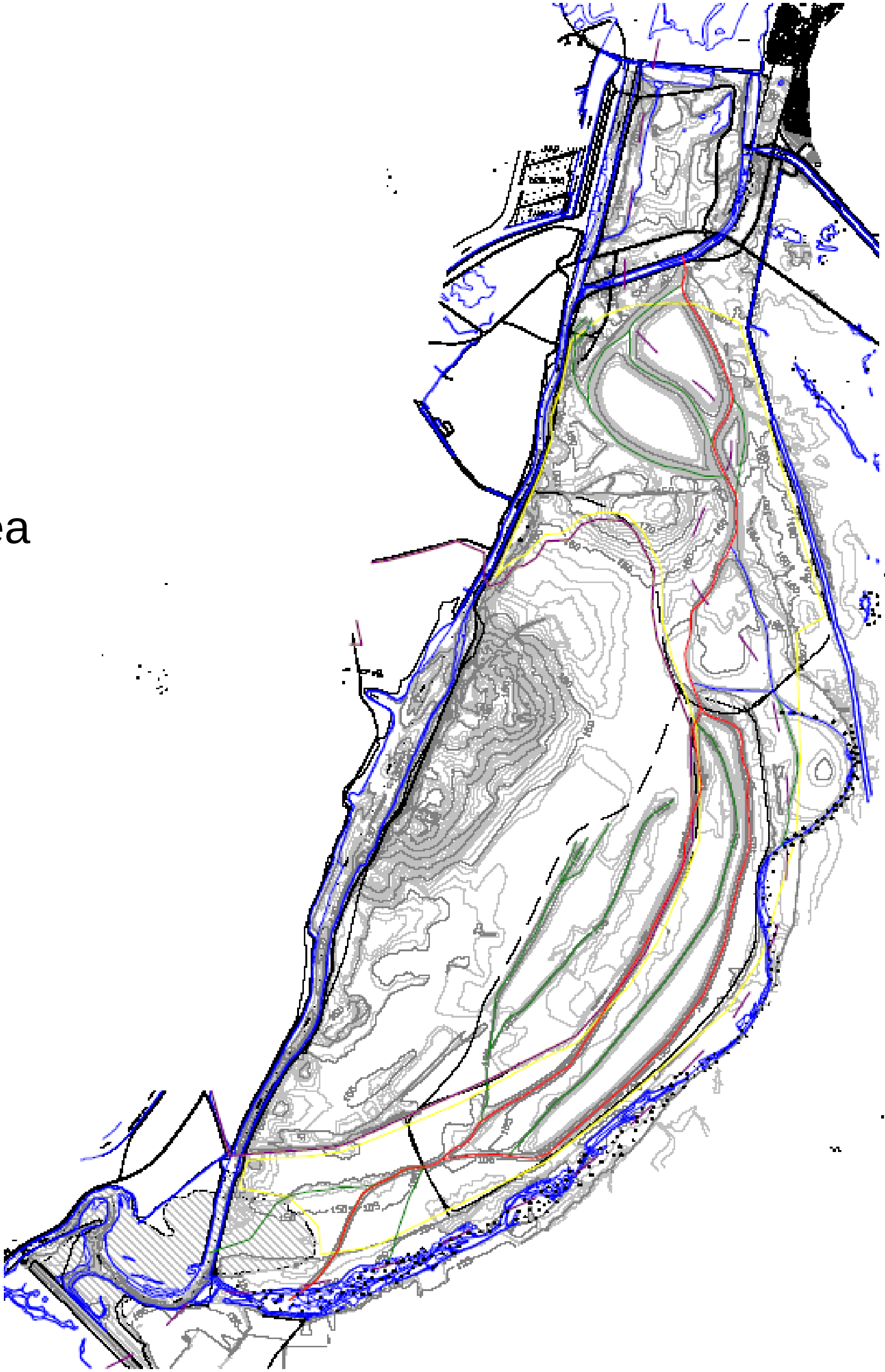
- Extends project inside dredge spoil area

<u>Habitat</u>: 1260 acres

<u>Earthwork</u>: 1,035,000 cy (excavation)

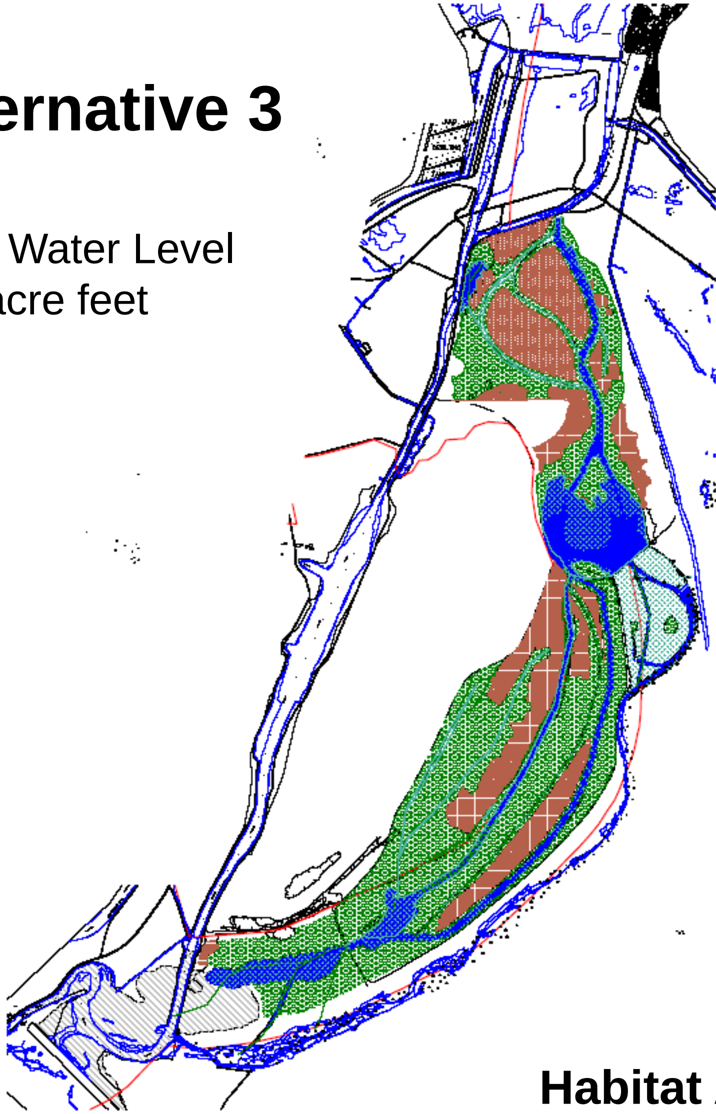
<u>Estimated Cost</u>: $20.2M





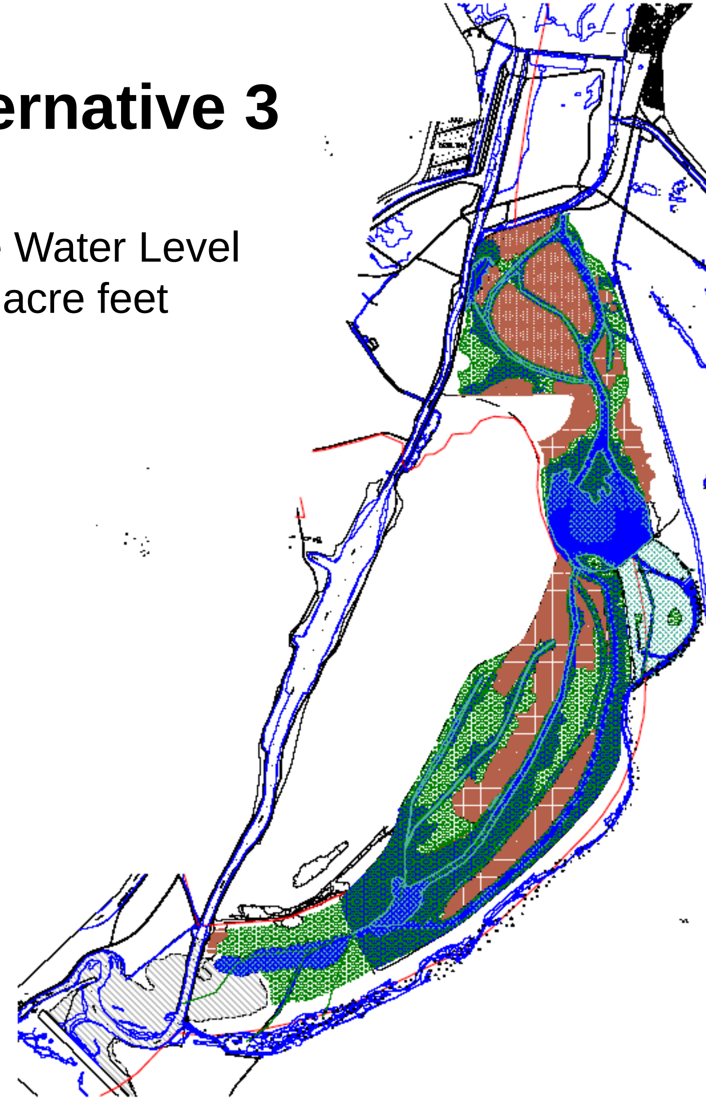
Alternative 3

Base Water Level
570 acre feet



Alternative 3

Pulse Water Level
1240 acre feet



Habitat Acreages

OPEN WATER	DEEP MARSH	TRANSITION ZONE	COTTONWOOD/ WILLOW	MESQUITE
87	169	238	401	131 (no irrigation) 234 (irrigation)

Water Budget
Conceptual Level

ALTERNATIVES	POST-DEVELOP ET/EVAP (acre-ft/yr)*	POST-DEVELOP SEEPAGE (acre-ft/yr)**	POST-DEVELOP TOTAL (acre-ft/yr)	PRE-DEVELOP ET (acre-ft/yr)*
1	5734	611	6345	5556
2	5983	1143	7126	5784
3	7149	1143	8292	6952

* Evaporation rates per Cooley, K.R., 1970, Evaporation from open water surfaces in Arizona: University of Arizona College of Agriculture, folder 159. Evapotranspiration rates for different habitat types provided by BOR (average of years 2005-2007)

** Seepage rate calculations for Reach 2 based on groundwater and soil log data for well AP-103-08. Reach 1 groundwater is at or above the proposed channel invert so seepage is assumed to be minimal.

Project Construction Cost Estimate Conceptual Level

ALT.	CLEARING, GRUBBING & BURNING	EARTHWORK	WATER DELIVERY & WATER CONTROL	RE-VEG	TOTAL	COST/ ACRE OF HABITAT
1 (1000 Acres of Habitat)	$2.0M	$8.3M (760,000 CY of Cut)	$1.6M	$3.8M	$15.7M	$15.7K/ AC
2 (1050 Acres of Habitat)	$2.1M	$10.4M (950,000 CY of Cut)	$1.6M	$3.9M	$18.0M	$17.1K/ AC
3 (1260 Acres of Habitat)	$2.5M	$11.3M (1,035,000 CY of Cut)	$1.6M	$4.8M	$20.2M	$16.0K/ AC

*Costs do not include O&M