

RECLAMATION

Managing Water in the West

Planet Ranch: Potential Habitat Restoration Site

Preliminary Site Analysis and Conceptual Design



U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada

February 2005

MISSION STATEMENTS

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically safe manner in the interest of the American public.

Resources Management Office
Restoration Group

Please direct questions or comments concerning this report to:

Mr. Nathan Lenon
Bureau of Reclamation, Restoration Group
P.O. Box 61470,
Mailcode: LC -2457
Boulder City, NV 89006
Phone: 702-293-8015 Email: nlenon@lc.usbr.gov

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5
INTRODUCTION	6
Scope of Study	6
SITE INVENTORY	8
Farm Fields and Irrigation Structure	8
Soil Moisture and Potential Restoration Categories	8
Depth to Groundwater.....	9
Topography and Flooding.....	10
Cultural and Historical Resources	10
SITE ANALYSIS: RESTORATION PRIORITIES	11
Active Management Block Areas	11
CONCEPTUAL DESIGN	13
Assumptions.....	13
Restored Acres	14
Potential Downstream Habitat Protection.....	15

TABLES

	<i>Page</i>
Table 1 Restoration Potential Categories.....	9
Table 2 Acreage Totals	14
Table 3 Potential Affected Acreages on BWNWR.....	15

FIGURES

	<i>Page</i>
Figure 1 Planet Ranch: Location Map.....	7
Figure 2 Planet Ranch: Site Inventory and Analysis	16
Figure 3 Planet Ranch: Conceptual Design	17

EXECUTIVE SUMMARY

Planet Ranch was evaluated to determine the acreages and habitat types which could be created in support of the lower Colorado River Multi-Species Conservation Plan (LCR MSCP). The ranch is located on the Bill Williams River floodplain, immediately upstream and adjacent to the Bill Williams National Wildlife Refuge, which supports groundwater-dependant riparian, marsh, and mesquite habitat.

The site was analyzed to determine what opportunities and constraints exist for habitat creation. Using existing data and some basic assumptions, a conceptual design plan was developed which sought to balance the needs to maximize habitat in support of the LCR MSCP, while minimizing the risks of impacting habitat at refuge downstream. This report details the methodology and assumptions used in this assessment.

1. Potential Restored Habitat

- 1003 acres of cottonwood-willow managed for willow flycatchers
- 300 acres of mesquite
- 52 acres of marsh

2. Summary of water use calculations

- $\text{Diversion} = \text{Acreage} \times \text{Irrigation Rate}$
- $\text{Consumptive Use (CU)} = \text{Acreage} \times \text{ET Rate}$
- $\text{Water Remaining in Aquifer} = \text{Diversion} - \text{CU}$

3. Potential Habitat Protection on Bill Williams National Wildlife Refuge

- 7769 acre-feet remaining in aquifer (habitat)
- 1680 acre-feet remaining in aquifer when actively farmed for alfalfa
- 6089 acre-feet remaining beyond what ranch operation would return
- Maximum of 874 acres of cottonwood-willow
- Maximum of 42 acres of marsh
- Maximum of 331 acres of mesquite
- Total maximum of 1247 acres of downstream habitat

INTRODUCTION

Planet Ranch, located along the Bill Williams River corridor, immediately upstream from Bill Williams National Wildlife Refuge (BWNWR), falls within Reach 3 of the lower Colorado River Multi-Species Conservation Program (LCR MSCP) planning area, *See Figure 1*. The property covers approximately 8,400-acres, and is currently owned by the City of Scottsdale who has a diversionary water rights claim of 14,400 acre-feet/year for the site. Planet Ranch is divided into farm fields which are equipped with a variety of irrigation systems, such as flooding, wheel lines, and pivot and solid set sprinklers. In addition, the site houses several buildings, including residential structures used for on-site staff accommodations.

Scope of Study

The Bureau of Reclamation's (Reclamation) design objective was to produce a conceptual design which maximized the acreages of MSCP-covered habitat types, while minimizing potential for downstream impacts to groundwater-dependant riparian, marsh, and mesquite habitat on BWNWR, resulting from groundwater withdrawal at Planet Ranch for site irrigation purposes.

To accomplish this, Reclamation compared water consumption of the site's previous alfalfa production and the habitat restoration activities proposed for the site. This comparative assessment helped to determine the total acreage of downstream habitat which could be protected by converting the ranch for MSCP purposes.

To accommodate a short time-frame, the plans presented in this assessment have been based entirely upon pre-existing GIS data acquired from U.S. Fish and Wildlife Service, Water Resources Branch, as well as vegetation evapotranspiration rates (ET) for the proposed habitat types provided by the Lower Colorado River Accounting System (LCRAS). Single and multiple attribute analyses of the GIS data were used to determine the layout by habitat type based on the presently known site conditions. This assessment is a living document, which will continue to be revised as more information becomes available, or as design assumptions are modified.

PLANET RANCH

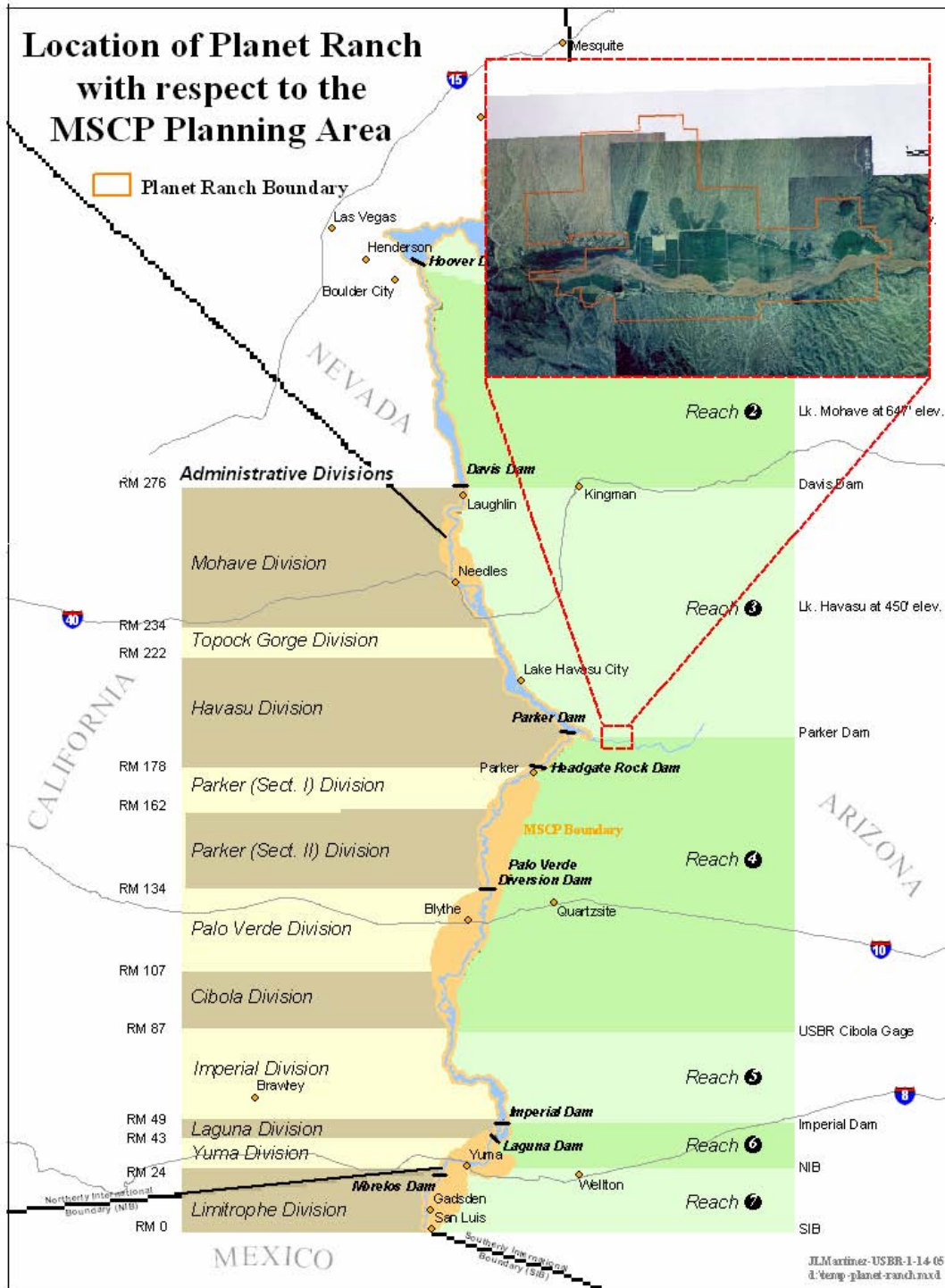


Figure 1. Location of Planet Ranch in relation to the LCR MSCP planning area.

SITE INVENTORY

Farm Fields and Irrigation Infrastructure

The farm area is currently divided into 45 fields (2205 acres), 15 of which are flood-irrigated (428 acres). Eleven production wells supply the fields. Additionally, 21 monitoring wells are located adjacent to the fields for monitoring groundwater behavior, *See Figure 2*.

Flood irrigation is the preferred method for cultivating cottonwood-willow habitat because of the difficulties with sprinkler-irrigating trees, as well as the ability to provide the requisite moist soil conditions for creating willow flycatcher habitat. Fifteen fields already have flood irrigation systems in place. The remaining thirty-one fields would need to be contoured and retrofitted with flood-irrigation systems installed. Therefore the farm fields were color coded based on existing irrigation infrastructure to provide a basis for priority ranking.

Soil Moisture and Restoration Potential Categories

Reclamation and the U.S. Fish and Wildlife Service previously collaborated¹ to determine the potential acreage of habitat that could be created at Planet Ranch, as well as an estimate of the acreage of downstream habitat that could be protected on Bill Williams National Wildlife Refuge (BWNWR) due to the water savings that would be realized through agricultural conversion to wildlife habitat.

This report categorized the ranch into three “restoration potential categories” based on a combination of depth to groundwater and soil moisture data² that was presumed to support riparian and upland habitat, *See Table 1*. This analysis focused primarily on promoting tree survival, and not necessarily on willow flycatcher habitat, as defined by the MSCP. The categories encompass the site’s existing houses and maintenance facilities, as well as the Bill Williams floodplain. In order to further narrow the current analysis to economically and logistically feasible areas, only the field areas located within these Restoration Categories were selected.

¹ Swett, J., Raulsten, B., Hautzinger, A, and S. Spiller. Planet Ranch Acquisition Issues Paper, 10/30/03-Draft.

² “Restoration Categories” based on Andersen, B.W. and P.E. Russell. July 2003. Suitability of the Planet Ranch for Revegetation with Cottonwood. Revegetation and Wildlife Management Center, Inc. Prepared for the U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service.

Table 1. Restoration Potential Categories³

Restoration Category	Criteria Depth to groundwater (ft) / Soil Moisture (%)	Acres
Category 1 (High Potential)	dtw < 10 ft with soil moisture > 2%, dtw < 10 ft with soil moisture > 5%, dtw > 10 ft and < 15 ft with soil moisture > 5%	748
Category 2 (Medium Potential)	dtw > 10 ft and < 15 ft with soil moisture > 2% dtw > 15 ft and < 30 ft with soil moisture > 5%	623
Category 3 (Low Potential)	dtw >15 ft and < 30 ft with soil moisture >2%	958
Total Acres		2329

Depth to Groundwater

Depth to groundwater⁴ measurements were grouped into approximate ranges which are considered appropriate for cottonwood and mesquite⁵. Practical considerations (groundwater within 5 feet of the surface) for the construction of marsh and backwater habitats were also assessed to limit excavation and maintenance costs.

Depth to groundwater throughout most of the site as a sole criterion is inadequate to support the desired riparian and upland habitat types (cottonwood-willow, mesquite) without an ongoing irrigation commitment, with the exception of some of the fields on the southwestern extent of the farm area (*“Restoration Category 1” displayed on Figure 2*). Fortunately, the previous analysis which combined both depth to groundwater and soil moisture, concluded that if soil moisture was high, then the trees could survive despite the greater depths to groundwater. Therefore, depth to groundwater was used primarily as a basis to evaluate potential locations for backwater and marsh habitats, as well as the riparian community that could potentially be established in the BWR floodplain, referred to as the *“Riparian Corridor”*, See *Figure 2*.

This analysis indicated that the construction of backwater habitats would not be practical because the locations where the water table is within 3 feet of the surface are within the floodplain, and would be difficult to isolate and maintain, due to the risk of flooding as well as the potential for downstream transport of non-native fish during peak flows from Alamo Dam, See *Figure 2*. Marsh habitat however could be created within, and in close proximity to, the floodplain area, which would require some amount of excavation.

³ Taken from Swett, et al. 2003.

⁴ Based on a single set of groundwater measurements taken June 2001. Supplied by Andrew Hautzinger, USFWS Water Resources Branch.

⁵ Based on Rorabaugh, J. “Developing Site Criteria for Revegetation on the Coachella and All-American canals – Advance Draft,” Yuma Projects Office, Lower Colorado Region, Bureau of Reclamation, Yuma, Arizona, 20 pp.

PLANET RANCH

Topography and Flooding

Topography was analyzed to eliminate fields and portions of field areas where flooding danger would be highest. This resulted in the elimination of field areas within the Bill Williams River floodplain⁶, as well as those within the Castaneda Wash and a second unnamed wash at the northern extent of the farm field areas. (*These areas are identified on the “topography and flooding” layer of Figure 2*).

Cultural and Historical Resources

A number of cultural and potentially historic sites exist within the property boundaries, mainly related to historical mining claims and are mostly located on the hilltops, outside of the farming area (*Government Land Office, GLO points, located on Figure 2*). Three documented cultural sites are located within the farming area, however they are outside the physical field boundaries, and therefore will not restrict habitat creation within the farm area as it currently exists (*Cultural Resources Sites, located on Figure 2*).

⁶ Based on aerial photography of conditions during the 1995 flood. Provided by Andrew Hautzinger, USFWS Branch of Water Resources.

SITE ANALYSIS: RESTORATION PRIORITIES

Active Management: Block Areas (1242 acres)

The suitable areas for habitat development were broken into “Blocks” 1 and 2. *See Figure 3.* These areas represent the highest-potential fields for restoration, while reducing flooding risks restored fields. These areas were prioritized by assigning scores to the fields based on soil moisture (*referred to as “Restoration Categories”, soil moisture layer of Figure 2*)⁷, and field irrigation type⁸.

Block 1 (207 acres)

This area is entirely within Restoration Category 1, meaning that soil moisture is high and/or the water table is high. Tree survival within this block would not be dependant on irrigation; however irrigation would still be required during the summer to provide moist soil conditions for willow flycatchers. Half of the fields are already flood irrigated; the other half would require contouring and irrigation systems. Some excavation would be required for marsh construction.

Block 2 (1035 acres)

This area is within Restoration Categories 2 and 3, meaning that soil moisture is medium to low. Depth to groundwater throughout most of this area is inadequate for cottonwoods or willows, therefore this block would have moderate to complete dependence on irrigation. More infrastructure improvements would be needed, as only a small proportion of this area is flood-irrigated.

Riparian Corridor (113 acres)

Recognizing the unique opportunity to coordinate planting and seeding techniques with ecologically-beneficial flow releases from Alamo Dam, a “Natural Riparian Corridor” was designated. This area could be managed such that:

- Very little maintenance would be required
- Additional non-diverted water could be utilized during peak-flow releases from Alamo Dam; these releases may possibly be coordinated with the seeding times for cottonwoods
- Habitat credit would expand and decline based on hydrologic conditions
- Provides unique research component unavailable anywhere else on the LCR

⁷ Category 1 received 5 points, category 2 received 2.5 points, and category 3 received 1 point.

⁸ Flooded fields received 5 points; other irrigation types received 0 points.

PLANET RANCH

Adaptive Management

- During drought, irrigation to cottonwoods and willows could be reduced to a level that will sustain them without the moist soil conditions, as a precautionary measure to downstream BWNWR
- Habitat credit would then shift from willow flycatcher to Yellow Billed Cuckoo.
- Moist soils could be re-established when hydrologic conditions improve

CONCEPTUAL DESIGN

A conceptual design of proposed habitat types and locations is presented in *Figure 3*. Water use for the site was based on an assumed 14,400 acre-foot/yr entitlement, *See Table 2*. Multiple scenarios were analyzed to maximize habitat credit in suitable areas, while maintaining the same or greater level of water returned to the aquifer as under the previous ranch operations. The calculations presented were based on the assumptions outlined below.

ASSUMPTIONS

1. Water use was calculated based on the following:

- Diversion = Acreage x Irrigation Rate
(example: 10 acres x 7 acre-feet/acre = 70 acre-feet diverted)
- Consumptive Use = Acreage x Evapotranspiration Rate
(example: 10 acres x 4 acre-feet/acre = 40 acre-feet consumed)
- Water Remaining in Aquifer = Diversion – Consumptive Use
(example: 70 acre-feet diverted – 40 acre-feet consumed = 30 acre-feet remaining in aquifer)

2. Irrigation rates were based on the following assumptions:

- Cottonwood-willow is to be managed to provide the moist soil conditions required for willow flycatcher habitat.
- Cottonwood-willow irrigation rate was based on the current watering schedule for riparian restoration plots at Beal Lake because of similarities in soil types.
- All irrigation rates are based on habitat maintenance, not for establishing habitat. There would be no irrigation requirement for mesquite once established.
- Marsh irrigation rates were estimated at 20 acre-feet/acre

3. Evapotranspiration (ET) Rates:

- ET rates were based on LCRAS⁹ ET rates for Parker/Palo Verde Area: 1999, 2000, 2002
- Mesquite ET was based on averaging mesquite low (<61%) and mesquite high (>61%) rates.

⁹ Lower Colorado River Accounting System, Demonstration of Technology. Documentation for Calendar Years 1999-2002.

RESTORED ACRES

Under these assumptions, a total of 1535 acres of habitat could be restored: (108 acres of marsh, 809 acres of cottonwood-willow, and 618 acres of mesquite).

- 52 acres of marsh
- 300 acres of mesquite
- 1003 acres of cottonwood-willow managed for willow flycatchers

Table 2. Acreage Totals

Site Totals:						
Previous Ranch Operations						
Crop	Acreage	Irrigation Rate (AF/acre)	Diversion (AF)	ET Rate (AF)	Consumptive Use (AF)	Remaining in Aquifer (AF)
Alfalfa	2400	6	14400	5.3	12720	1680
Block 1 (Proposed Habitat Restoration)						
Habitat	Acreage	Irrigation Rate (AF/acre)	Diversion (AF)	ET Rate (AF)	Consumptive Use (AF)	Remaining in Aquifer (AF)
Marsh	52	20	1040	5.9	307	733
Cottonwood/Willow	155	15	2325	4.9	760	1566
Subtotal	207		3365		1066	2299
Block 2 (Proposed Habitat Restoration)						
Habitat	Acreage	Irrigation Rate (AF/acre)	Diversion (AF)	ET Rate (AF)	Consumptive Use (AF)	Remaining in Aquifer (AF)
Cottonwood/Willow	735	15	11025	4.9	3602	7424
Mesquite	300	0	0	4.7	1410	0
Subtotal	1035		11025		5012	7424
Riparian Corridor (Proposed Habitat Restoration)						
Habitat	Acreage	Irrigation Rate (AF/acre)	Diversion (AF)	ET Rate (AF)	Consumptive Use (AF)	Remaining in Aquifer (AF)
Cottonwood/Willow	113	0	0	4.9	554	0
Subtotal	113		0		554	0
Site Totals: Habitat Restoration						
Habitat	Acreage	Irrigation Rate (AF/acre)	Diversion (AF)	ET Rate (AF)	Consumptive Use (AF)	Remaining in Aquifer (AF)
Marsh	52		1040		307	733
Cottonwood/Willow	1003		13350		4915	8989
Mesquite	300		0		1410	0
Total	1355		14390		6632	7769
Residual Water Allocations					Measurements in Acre-Feet	
Total Water Right Remaining in Aquifer (Ranch Operation)					1680	
Total Water Right Remaining in Aquifer (Habitat Restoration)					7769	
Additional Water Remaining as a Result of Habitat Restoration vs. Ranch Operations					6089	

PLANET RANCH

POTENTIAL DOWNSTREAM HABITAT PROTECTION

Table 3, presented below was modified from a previous study which determined areas of BWNWR affected and not affected by Lake Havasu, with the assumption that the areas not affected by Lake Havasu are primarily influenced by waters originating upstream in the Bill Williams River.

Table 3¹⁰. Potential acreages of habitat on BWNWR impacted by groundwater withdrawal upstream at Planet Ranch

Refuge Cover Type Description	Not Affected by Lake Havasu (acres)	Evapotranspiration Rate	Consumptive Use (acre-feet/acre)
Cottonwood-Willow Dominated (with salt cedar present)	874	4.9	4283
Mesquite Dominated	544	4.7	2557
Marsh	42	5.9	248
Total	1460		7088

The proposed habitat restoration scenario returns an additional 6089 acre-feet to the aquifer, as compared to the alfalfa farming, that amount will allow for the protection of the following acreages:

- Maximum of 874 acres of cottonwood-willow
- Maximum of 42 acres of marsh
- Maximum of 331 acres of mesquite
- Total maximum of 1247 acres of downstream habitat

¹⁰ Taken from Swett, et al. 2003.

Planet Ranch Site Inventory and Analysis

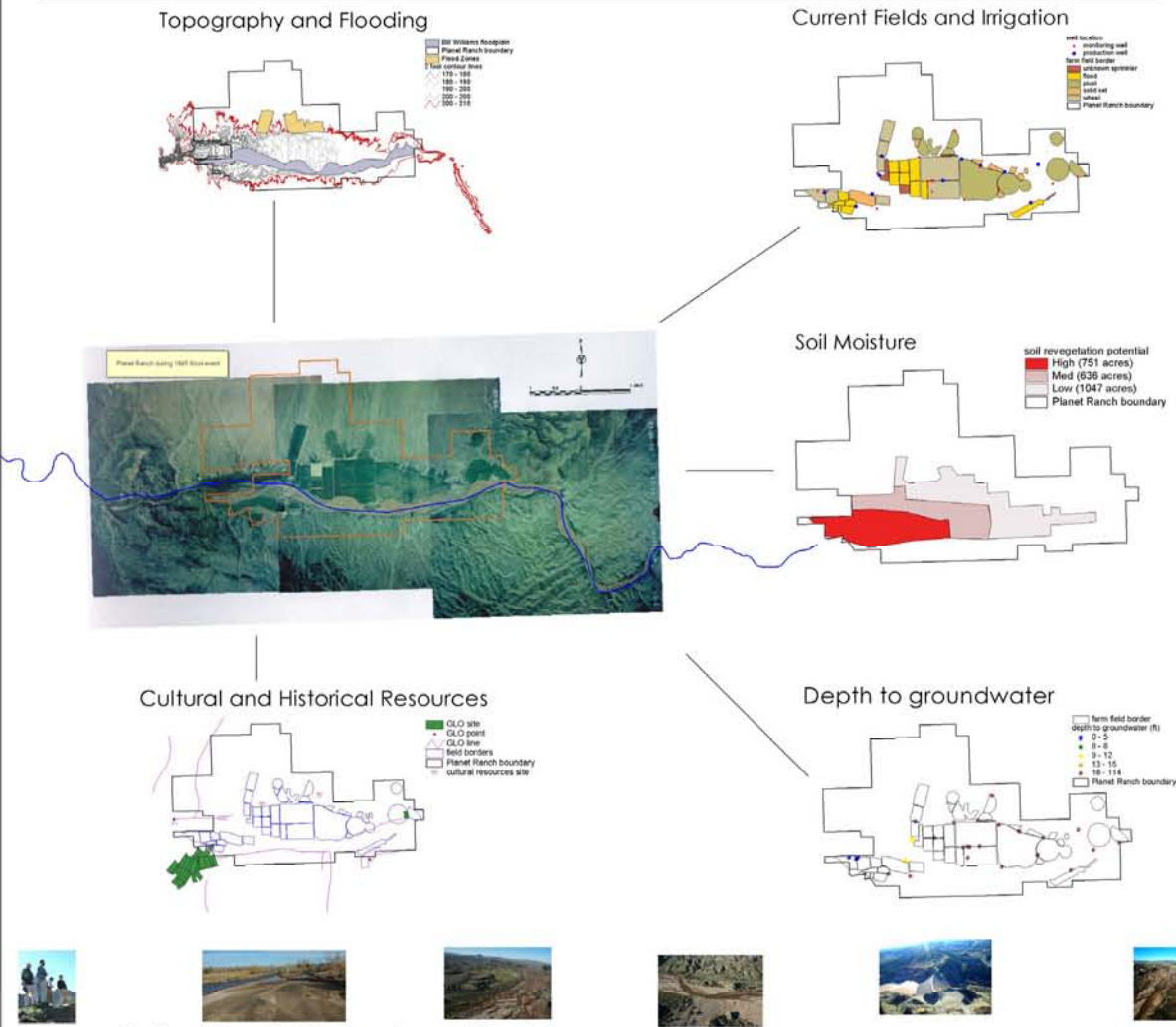
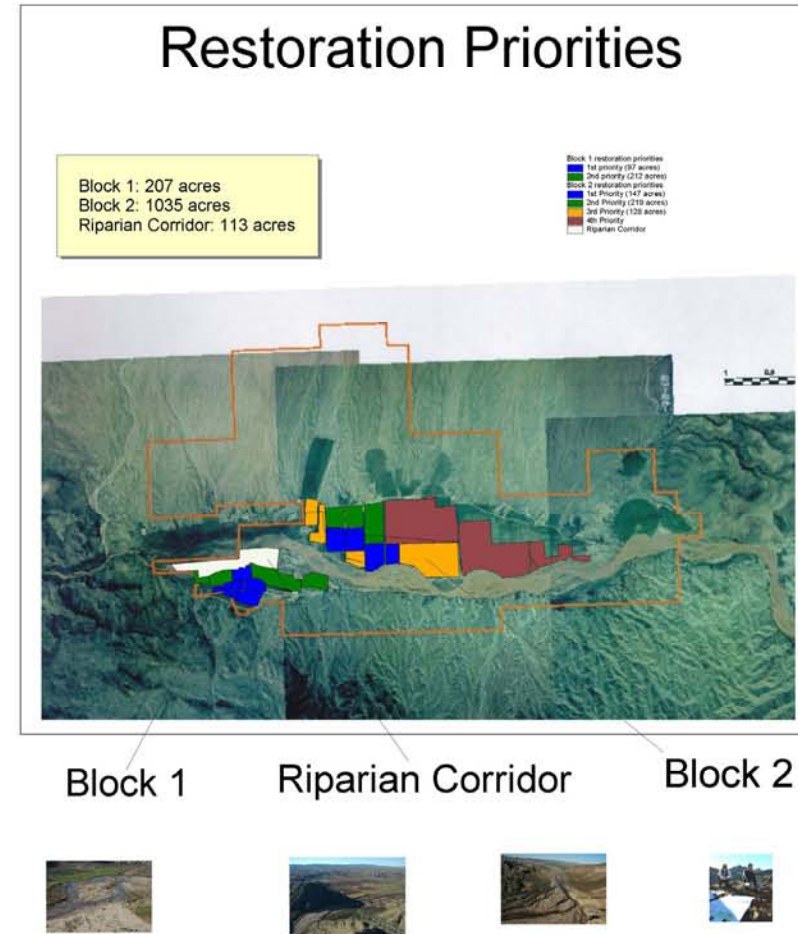
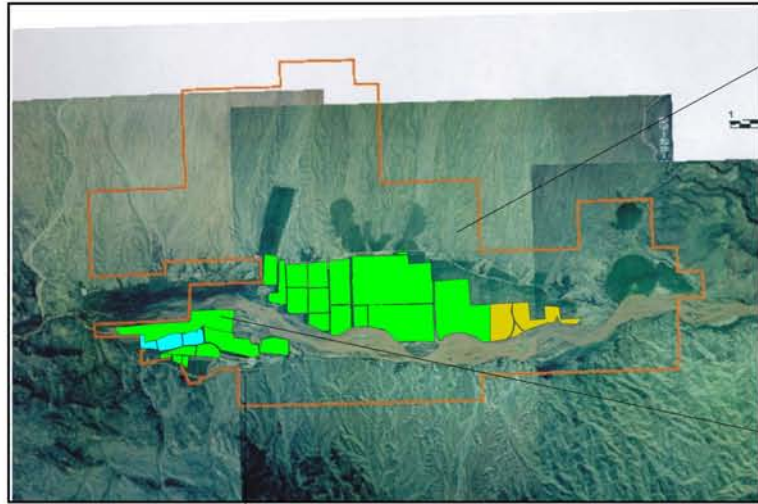


Figure 2: Planet Ranch: Site Inventory and Analysis

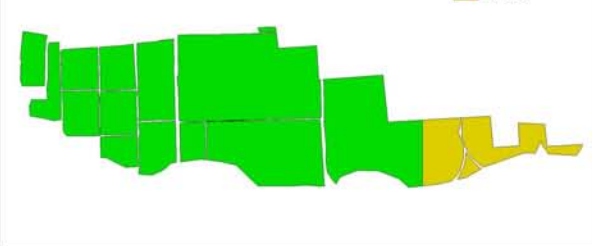
Restoration Priorities



Planet Ranch Conceptual Design

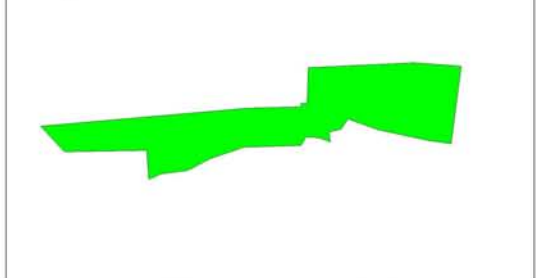


Block 2



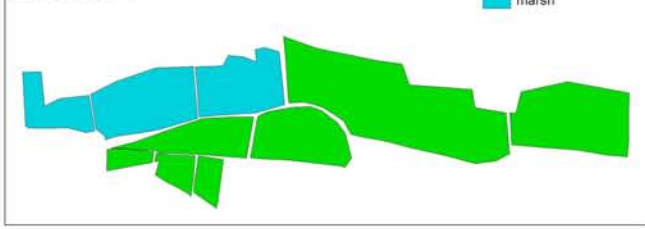
HABITAT	ACRE	DIV	CU	RETURN
cott/will	735	11025	3602	7424
mesq	300	0	1410	0
total	1035	11025	5012	7424

Riparian Corridor



HABITAT	ACRE	DIV	CU	RETURN
c/w	113	0	554	0
total	113	0	554	0

Block 1



HABITAT	ACRE	DIV	CU	RETURN
marsh	52	1040	307	733
cott/will	155	2325	760	1566
total	207	3365	1067	2299



SITE TOTALS-Ranch Operation:

CROP	ACRE	DIV	CU	RETURN
alfalfa	2400	14400	12720	1680

SITE TOTALS-Habitat Restoration:

HABITAT	ACRE	DIV	CU	RETURN
marsh	52	1040	307	733
cott/will	1003	13350	4915	8989
mesq	300	0	1410	0
TOTAL	1355	14390	6632	7769

TOTAL REMAINING IN AQUIFER: 7769 af/yr

TOTAL REMAINING IN ADDITION TO RANCH OPERATION: 6089 af/yr

POTENTIAL ACREAGE PROTECTED DOWNSTREAM:

- 874 acres of cottonwood-willow
- 42 acres of marsh
- 331 acres of mesquite

Figure 3: Planet Ranch: Conceptual Design