2010 Final
Lower Owens River Project
Annual Report

February 2, 2011

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1.0 LOWER OWENS RIVER PROJECT INTRODUCTION

The Lower Owens River Project (LORP) is a large-scale habitat restoration project in Inyo County, California being implemented through a joint effort by the Los Angeles Department of Water and Power (LADWP) and Inyo County (County). The LORP was identified in a *1991 Environmental Impact Report* (EIR) as mitigation for impacts related to groundwater pumping by LADWP from 1970 to 1990. The description of the project was augmented in a *1997 Memorandum of Understanding* (MOU), signed by LADWP, County, California Department of Fish and Game (CDFG), California State Lands Commission (SLC), Sierra Club, and the Owens Valley Committee. The MOU specifies the goal of the LORP, timeframe for development and implementation, and specific actions. It also provides certain minimum requirements for the LORP related to flows, locations of facilities, and habitat and species to be addressed.

The overall goal of the LORP, as stated in the MOU, is as follows:

> "The goal of the LORP is the establishment of a healthy, functioning Lower Owens River riverine-riparian ecosystem, and the establishment of healthy, functioning ecosystems in the other physical features of the LORP, for the benefit of biodiversity and Threatened and Endangered Species, while providing for the continuation of sustainable uses including recreation, livestock grazing, agriculture and other activities."

LORP implementation included release of water from the Los Angeles Aqueduct (LAA) to the Lower Owens River, flooding of approximately 500 acres in the Blackrock Waterfowl Management Area (BWMA), maintenance of several Off-River Lakes and Ponds, modifications to land management practices, and construction of new facilities including a pump station to capture a portion of the water released to the river.

The LORP was evaluated under CEQA resulting in the completion of an EIR in 2004.

1.1 Monitoring and Reporting Responsibility

Section 2.10.4 of the Final LORP EIR states that the County and LADWP will prepare an annual report that includes data, analysis, and recommendations. Monitoring of the LORP will be conducted annually by the Inyo County Water Department (ICWD), LADWP and the MOU consultant, Ecosystem Sciences (ES) according to the methods and schedules described under each monitoring method as described in Section 4 of the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008).

Specific reporting procedures are also described under each monitoring method. The MOU requires that the County and LADWP provide annual reports describing the environmental conditions of the LORP. LADWP and the County are to prepare an annual report and include the summarized monitoring data collected, the results of analysis, and recommendations regarding the need to modify project actions as recommended by the MOU consultant, ES. This LORP Annual Monitoring Report describes monitoring data, analysis, and recommendations for the LORP based on data collected during 2010. The development of the LORP Annual Report is a collaborative effort between the ICWD, LADWP, and the MOU Consultant. Personnel from these entities participated in different sections of the report writing, data collection, and analysis.

The 2007 Stipulation & Order also requires the release to the public and representatives of the Parties identified in the MOU a draft of the annual report. The 2007 Stipulation & Order states in Section L:

> "LADWP and the County will release to the public and to the representatives of the Parties identified in the MOU a draft of the annual report described in Section 2.10.4 of the Final LORP EIR. The County and LADWP shall conduct a public meeting on the information contained in the draft report. The draft report will be released at least 15 calendar days in advance of the meeting. The public and the Parties will have the opportunity to offer comments on the draft report at the meeting and to submit written comments within a 15 calendar day period following the meeting. Following consideration of the comments submitted the Technical Group will conduct the meeting described in Section 2.10.4 of the Final LORP EIR."

Generally, LADWP is the lead author for a majority of the document and is responsible for overall layout, and content management. Specifically, LADWP wrote: Sections 1.0 Introduction; 2.0 Hydrologic Monitoring; 3.0 Seasonal Habitat Flow; and 4.0 Land Management, 6.0 Landscape Vegetation Mapping, 8.0 Indicator Species Habitat Assessment and Avian Surveys, and 9.0 LORP Fishing Creel Census.

Section 7.0 Site Scale Vegetation Assessment and Landform Elevation Mapping and Section 10.0 Fish Habitat Monitoring along with Adaptive Management Recommendations were written by Ecosystem Sciences.

Section 9.0, Weed Control was authored by the Inyo County Agricultural Commission. ICWD was the lead author for the water quality portion of the Seasonal Habitat Flow Section and the 5.0 Rapid Assessment Survey.

As described in the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008), copies of the annual monitoring report will be distributed to the other MOU parties (CDFG, SLC, Sierra Club, and the Owens Valley Committee) and made available to the public.

This document represents the reporting requirements for the LORP Annual Report for 2010.

1.2 2010 Monitoring

2010 was the third year of monitoring for the LORP. The monitoring that was conducted included:

- Seasonal Habitat Flow Flooded Extent and Water Quality (May and June 2010)
- Assessment of River Flow Gains and Losses (September 2010)
- Rapid Assessment Survey (August 2010)
- Hydrologic Monitoring (throughout 2010)
- Land Management (throughout 2010)
- Weed Monitoring and Treatment (growing Season 2010)
- Delta Habitat Assessment

In addition the following were included in the 2010 LORP monitoring efforts:

- Streamside Monitoring for Woody Species Regeneration and Other Riparian (September 2010)
- Site Scale Vegetation Assessment and Landform Elevation Mapping
- Creel Census (September 2010)
- Landscape Vegetation Mapping
- Indicator Species Habitat Assessment and Avian Surveys
- Fish Habitat Monitoring

The enclosed CD contains an electronic version of this report and the chapter appendices.

2.0 HYDROLOGIC MONITORING

2.1 River Flows

On July 12, 2007, a Court Stipulation & Order was issued requiring LADWP to meet specific flow requirements for the LORP. From the issue date through September 2010, LADWP has been in compliance with the flow requirements outlined in the Stipulation & Order and are listed below:

1. Minimum of 40 cubic feet per second (cfs) released from the Intake at all times.
2. None of the in-river measuring stations has a 15-day running average of less than 35 cfs.
3. The mean daily flow at each of the in-river measuring stations must equal or exceed 40 cfs on 3 individual days out of every 15 days.
4. The 15-day running average of the in-river flow measuring stations is no less than 40 cfs.

On July 14, 2009, 6 of the 10 original temporary in-river measuring stations were taken out of service, while the LORP Intake, Mazourka Canyon Road, Reinhackle Springs, and Pumpback Stations remained in service.

The flow data graphs show that LADWP was in compliance with the Stipulation & Order, from October 2009 to September 2010, for the 4 in-river stations (see Hydrological Appendix 1).

2.1.1 Web Posting Requirements

The Stipulation & Order also outlined web posting requirements for the LORP data. LADWP has met all the posting requirements for the daily reports, monthly reports, and real time data.

Daily reports listing the flows for the LORP, Blackrock Waterfowl Management Area (BWMA) wetted acreage, and Off-River Lakes and Ponds depths are posted each day on the Web at <http://www.ladwp.com/ladwp/cms/ladwp009121.jsp>.

Monthly reports summarizing each month and listing all of the raw data for the month are posted to the Web at <http://www.ladwp.com/ladwp/cms/ladwp009817.jsp>.

Real time data showing flows at the Intake, Owens River at Mazourka Canyon Road, Owens River at Reinhackle Springs, and Pumpback Station are posted to the Web at <http://www.ladwp.com/ladwp/aqueduct/showAqueductMap.ladwp?contentId=LADWP_AQUERTD_SCID> and click on the 'Lower Owens River Project' link.

2.1.2 Measurement Issues

LORP in-river flows are measured using Sontek SW acoustic flow meters. All of the Sontek SW meters along the LORP are mounted on the bottom of the river channel. These devices are highly accurate and final records for the LORP generally fall within normal water measurement standards of +/- 5%.

Any factors which change the levels or velocities in the river also affect the accuracy of the Sontek meters. Seasonal changes such as spring/summer vegetation growth causing water levels to increase and velocities to decrease are one such factor. Another factor is sediment build-up. As a band of sediment builds up on or near the measuring station section, the water levels of the section can increase or velocities can be shifted--both of which affect the accuracy of the Sontek meters. In order to account for these environmental changes, LADWP manually meter flows at all of the stations along the LORP to check the accuracy of the meters. Each time a current metering is done, a 'shift' is applied to the station to take into account the difference in flow determined by the current metering. If a fundamental change in the flow curve is observed then a new index is created from the current metering data and downloaded to the meter. All of the meters on the LORP are calibrated at a minimum of once per month, per the 1997 Stipulation & Order, to maintain the accuracy of the meters.

A commentary on each station along the LORP follows:

LORP Intake

Measurement Devices: Langemann Gate and WaterLOG H-350XL Bubbler System

The Langemann Gate regulates and records the flow values at the Intake. This has had very good accuracy and reliability as long as the gate does not become submerged (submergence may be possible at higher flows such as when the seasonal habitat flows are released). In case of submergence, the WaterLOG H-350XL was installed as a back up to the Langemann Gate measurement. The WaterLOG H-350XL is a bubbler system that uses pressurized air to measure stage, which is applied to a rating curve. The bubbler system could possibly allow for an accurate measurement of stage even in silt/sediment conditions. However, any system of water measurement using stage must be calibrated through the full range of flows and in similar seasonal conditions in order for measurements to be accurate. Also, due to the low slope of the river channel in the LORP, velocities in the river are extremely low causing large fluctuations in stage as conditions in the river channel go through the normal seasonal cycles of vegetation activity and dormancy in the summer and winter respectively.

The bubbler was not used for the 2010 seasonal habitat flow since there was not sufficient data to calibrate the bubbler for flows exceeding approximately 120 cfs as seen this year. Starting on June 28, when the Intake flows were set to 125 cfs, the downstream water level at the LORP Intake Langemann Gate rose to a point where the gate began to be submerged and measure inaccurately. The Intake flows were estimated using a weighted average value for the day based on manual meter shots. This method was used from June 28 to July 1 (see Hydrologic Appendix 2) during the time when the Intake Langemann Gate remained submerged.

Calibrating the bubbler for seasonal habitat flows may prove to be difficult in the upcoming year and likely won't give accurate results. More data points can be collected to allow for a better flow curve to be established, but with the low slope of the upper reaches of the river causing extremely low velocities and small changes to flow conditions, due to vegetation growth or other factors, causing water depth to fluctuate, accurate measurements using stage only may not be possible.

LORP at Mazourka Canyon Road

Measurement Devices: Sontek SW Meter

This section previously consisted of two culverts, each having a Sontek SW meter placed on the bottom. Overall, this station performed well until it was replaced with a permanent flow section on May 20, 2010. The station was replaced near the existing station just downstream. This allowed for the old station to continue functioning during the construction of the permanent station. The station now utilizes a single Sontek SW flow meter in a concrete measuring section and flow measurement accuracy has been excellent.

LORP at Reinhackle Springs

Measurement Device: Sontek SW Meter

Construction of the permanent measuring station started here on December 2, 2009. During the construction process, flows were estimated by weekly manual current metering. The permanent concrete measuring station was completed on April 9, 2010. The station now utilizes a single Sontek SW flow meter in a concrete measuring section and measurement accuracy has been excellent.

LORP at Keeler Bridge

Measurement Device: Sontek SW Meter

This meter is installed in a concrete measuring section. The defined concrete section and laminar flow profile provides ideal conditions for water measurement. Also, very few sediment problems exist at this station. This station continues to operate, but permanent data is no longer recorded. This station is no longer maintained by LADWP since it is located only a short distance from the Pumpback Station and is not one of the permanent measuring stations.

LORP at Pumpback Station

Measurement Devices: Pumpback Station Discharge Meter, Langemann Gate, Weir

At the Pumpback Station flow is a calculated flow resulting from adding the Pumpback Station's electronic discharge flow meter, Langemann Gate Release to Delta, and Weir to Delta. In most flow conditions these stations have proven to be very accurate. However, during the higher flows, the Weir and/or the Langemann Gate can become submerged thus lowering the measuring accuracy of the submerged device.

2.2 Flows to the Delta

Based upon a review of the flow to Brine Pool and flow to Delta data, and after filtering out unintended spillage at the Pumpback Station to average a flow of 6 to 9 cfs, the flows to the Delta were set to the following approximate schedule (per the LORP EIR, section 2.4):

- October 1 to November 30 — 4 cfs
- December 1 to February 28 — 3 cfs
- March 1 to April 30 — 4 cfs
- May 1 to September 30 — 7.5 cfs

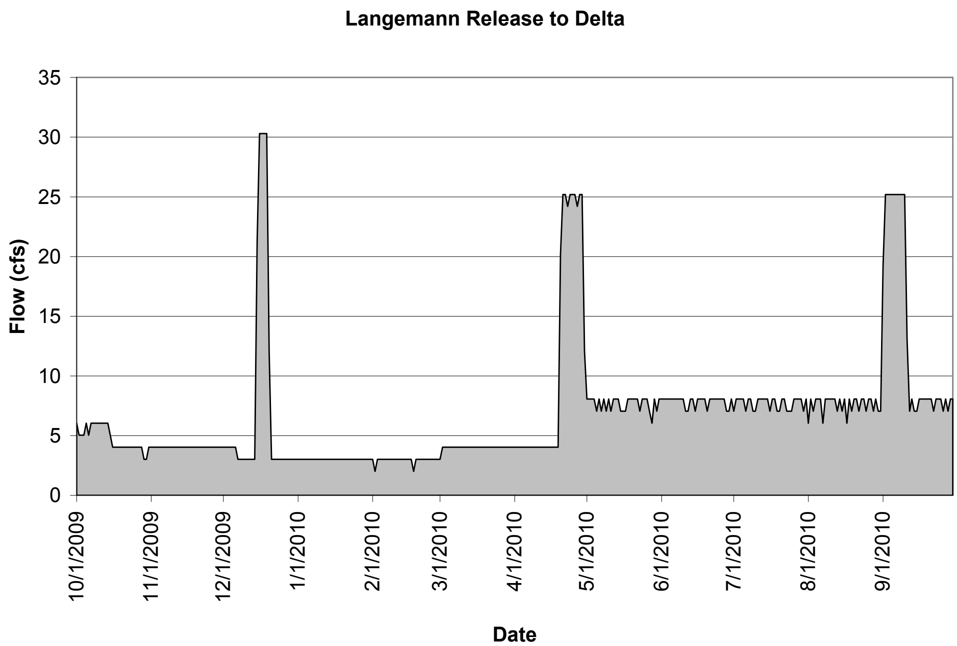
Additionally, pulse flows were scheduled to be released to the Delta (LORP EIR, section 2.4):

- Period 1: March-April — 10 days at 25 cfs
- Period 2: June-July — 10 days at 20 cfs
- Period 3: September — 10 days at 25 cfs
- Period 4: November-December — 5 days at 30 cfs

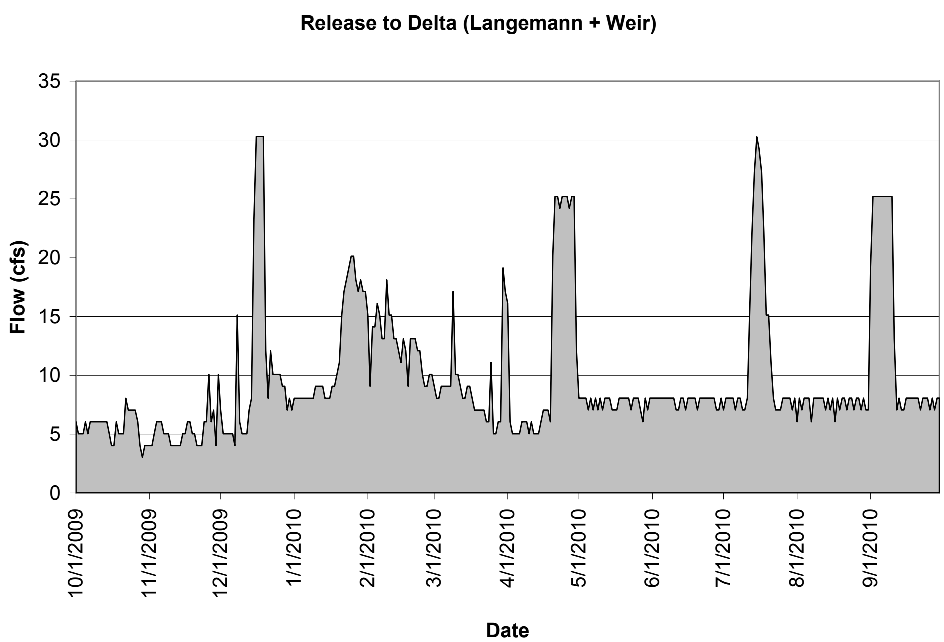
The scheduled base and pulse flows for the 2009-10 water year targeted an average of 7 cfs to the Delta. Due to unintended flows, the release to Delta was much higher than the planned 7 cfs even after excluding Delta releases during the seasonal habitat flow. Unintended flows are released to the Delta when intense rain storms cause river flows to exceed the limited maximum capacity of the Pumpback Station or when pump outages occur at the Pumpback Station. Flows over the weir are generally unintended flows and flows over the Langemann Gate are scheduled flows (see figures below).

All of the scheduled flows to the Delta were released as planned, except for the June-July Delta pulse flow, which did not occur. Due to the late seasonal habitat flow releases (from June 25, 2010 to July 6, 2010), the June-July summer Delta pulse flow was cancelled as recommended by Ecosystem Sciences.

The final October 2009 to September 2010 average flow to Delta was 9.3 cfs. The flow schedule for the October 2010 to September 2011 period will remain the same as the previous years' schedule unless adaptive management measures are proposed and implemented.



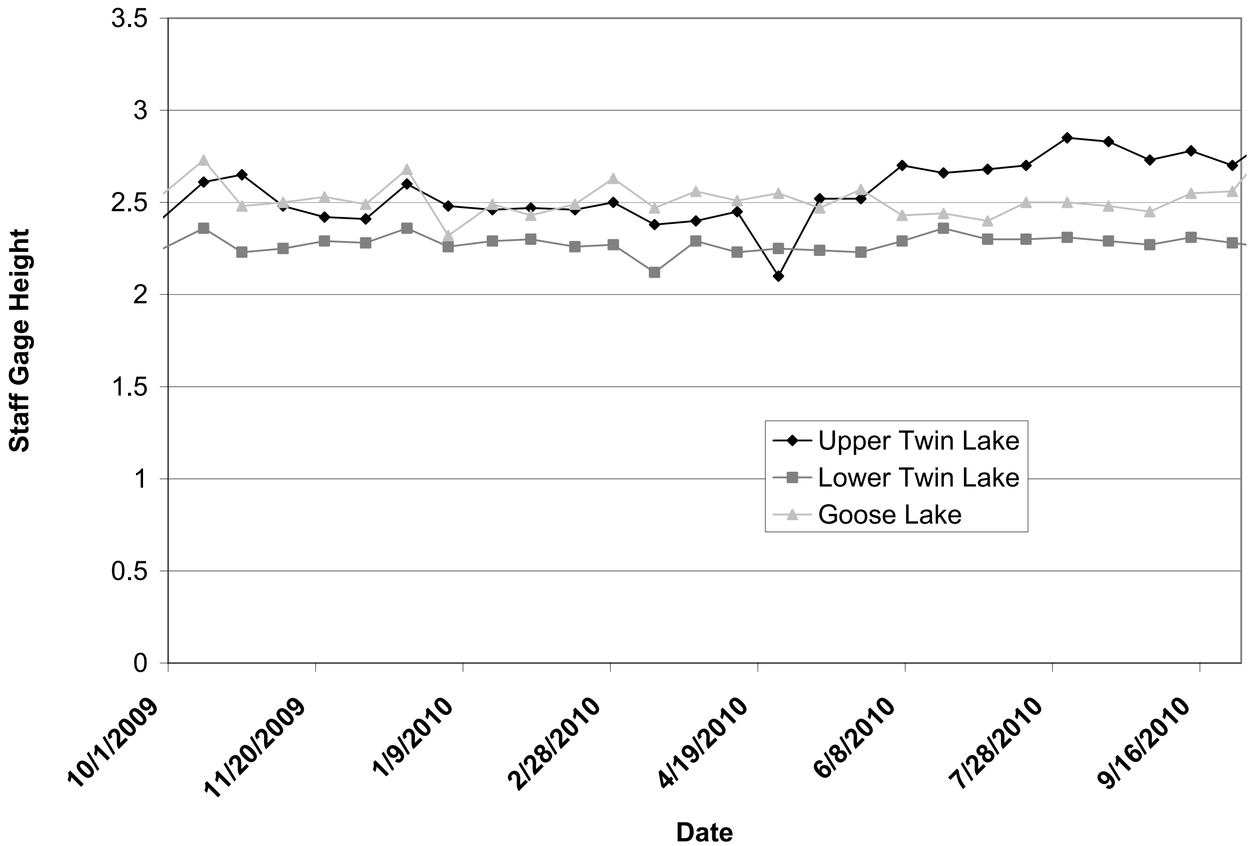
Hydrologic Monitoring Figure 1. Langemann Release to Delta



Hydrologic Monitoring Figure 2. Langemann and Weir Release to Delta

2.3 Off-River Lakes and Ponds

The BWMA and Off-River Lakes and Ponds Hydrologic Data Reporting Plan requires that Upper Twin Lake, Lower Twin Lake, and Goose Lake be maintained between 1.5 and 3.0 feet on their existing staff gauges, and that Billy Lake be maintained full (i.e., at an elevation that maintains flow from the lake). At no time during the period of October 2009 to September 2010, did any of the gages indicate below 1.5 feet.



Hydrologic Monitoring Figure 3. Off-River Lakes and Ponds Staff Gages

<u>Billy Lake</u>

Due to the topography of Billy Lake in relation to the Billy Lake Return station, whenever the Billy Lake Return station is showing flow, Billy Lake is full. LADWP maintains Billy Lake by monitoring the Billy Lake Return station to always ensure some flow is registering there. When referring to the table showing the annual summary of flows, at no time did the flow at Billy Lake Return Station fall to zero for a day (see Hydrological Appendix 3). Billy Lake Return had a minimum flow of 0.3 cfs for the year, so Billy Lake remained full for the entire year (see table below).

Hydrologic Monitoring Table 1. LORP Flows – Water Year 2009-10

Station Name	Average Flow (cfs)	Maximum Flow (cfs)	Minimum Flow (cfs)
Below River Intake	52.4	192.0	39.8
Blackrock Return Ditch	2.2	5.0	1.0
Goose Lake Return	1.1	1.8	0.7
Billy Lake Return	1.2	2.8	0.3
Mazourka Canyon Road	54.8	125.0	40.8
Locust Ditch Return	0.7	9.2	0.0
Georges Ditch Return	1.1	9.0	0.0
Reinhackle Springs	55.6	116.0	41.9
Alabama Gates Return	0.0	0.0	0.0
At Pumpback Station	51.1	76.2	37.4
Pump Station	41.4	47.9	19.2
Langemann Gate to Delta	6.8	30.3	2.0
Weir to Delta*	2.9	22.2	0.0

**Without the seasonal flow included, the average flow at the Weir to Delta was 2.5 cfs.*

Thibaut Pond

Thibaut Pond is contained completely within the Thibaut Unit of the Waterfowl Area. Each day the Thibaut Pond acreage is posted to the web in the LORP daily reports found at <http://www.ladwp.com/ladwp/cms/ladwp009121.jsp>.

Anytime the Thibaut Unit is showing wetted acreage above zero; Thibaut Pond is at 28 acres and is full. For the water year of October 2009 to September 2010, Thibaut Unit showed a wetted acreage at zero once during the summer read on July 7, 2010. During this time Thibaut Pond had a wetted area of 11 acres. The next day, flows into the Thibaut Pond area were increased and by the end of summer the read on August 17, at the Thibaut Unit, had 48 acres of wetted acreage. For the summer period, Thibaut Pond averaged 29.5 acres. The wetted acreage at Thibaut Pond varies significantly with small changes to inflows and, due to this, LADWP made an error in judgment when determining what inflows were required to maintain the 28-acre wetted area. For the upcoming year, flows into Thibaut Pond will be adjusted earlier in the season to try and avoid going below 28 acres.

2.4 Blackrock Waterfowl Habitat Area

For the 2009-10 runoff year (April 2009 to March 2010) the data collection and operations changed for the BWMA. Beginning in April 2009, flows were set based upon previous data relationships between inflows to an area and the resulting wetted acreage measurements during each of the four seasons based on evapo-transpiration (ET) rates. The waterfowl areas were also rotated beginning in the 2009-10 runoff year. The Thibaut and Winterton Waterfowl Habitat Areas were taken out of service and the Drew and Waggoner Waterfowl Habitat Areas were flooded.

The seasons are defined as:

Spring	April 16 – May 31
Summer	June 1 – August 15
Fall	August 16 – October 15
Winter	October 16 – April 15

Wetted acreage measurements are collected eight times per year, once in the middle of each season and once at the end of each season. These measurements are done by using GPS and walking the perimeter of the wetted edges of the waterfowl area. The measurement in the middle of the season counts as the average for the entire season with the data collection points at the end of each season being used as reference points (see table below).

Hydrologic Monitoring Table 2. Blackrock Waterfowl Wetted Acreage

Winterton Unit

ET Season	Read Date	Wetted Acreage	Inflow
Winter	4/1/2009	157	2.2
	4/13/2009	162	
Spring	5/6/2009	55	0.8
	5/29/2009	9	
Summer	7/9/2009	205**	3.9
	8/13/2009	158	
Fall	9/22/2009	0	0.2

Thibaut Unit

ET Season	Read Date	Wetted Acreage*	Inflow
Winter	4/8/2009	118	2.1
	4/21/2009	175	
Spring	5/8/2009	83	0.4
	5/28/2009	3	
Summer	7/9/2009	56	1.3
	8/13/2009	10	
Fall	9/24/2009	24	1.2
	10/20/2009	52	
Winter	1/15/2010	78	0.3
	4/14/2010	40	
Spring	5/4/2010	40	0.9
	6/2/2010	13	
Summer	7/7/2010	0	1.3
	8/17/2010	20	
Fall	9/16/2010	40	2

Drew Unit

ET Season	Read Date	Wetted Acreage	Inflow
Winter	4/1/2009	0	0
Spring	5/11/2009	44**	2.4
	5/26/2009	56	
Summer	7/1/2009	161**	4.8
	8/13/2009	230	
Fall	9/22/2009	252**	4.8
	10/20/2009	268	
Winter	1/15/2010	287**	2.3
	4/14/2010	262	
Spring	5/3/2010	276***	6
	6/2/2010	289	
Summer	7/7/2010	307***	6.4
	8/17/2010	313	
Fall	9/15/2010	328***	5.8

Waggoner Unit

ET Season	Read Date	Wetted Acreage	Net Inflow
Winter	4/1/2009	0	0
Spring	5/12/2009	45**	3.2
	5/27/2009	66	
Summer	7/1/2009	110**	5.5
	8/11/2009	162	
Fall	9/22/2009	165**	5.4
	10/20/2009	178	
Winter	1/15/2010	210**	1.9
	4/14/2010	178	
Spring	5/3/2010	229***	6.8
	6/1/2010	321	
Summer	7/7/2010	352***	8.5
	8/16/2010	304	
Fall	9/15/2010	312***	8

** This acreage does not include the 28 acres of the Thibaut Pond area.*
*** These measurements count towards the 2009-2010 runoff year acreage goal.*
*** These measurements count towards the 2010-2011 runoff year acreage goal.*

2.4.1 Waterfowl Results for Runoff Year 2009-10 (April 2009 to March 2010)

The wetted acreage goal for the 2009-2010 runoff year was 355 acres. The agreed upon plan called for setting the flows in the waterfowl areas based on the historical inflow and resulting wetted acreage of each area. For the Drew and Waggoner Units, the first year flows were to be set based on the history of the Winterton area.

The timing of the first on flows was delayed due to the late adoption and modifications of the new operation procedures. Flows at the Drew and Waggoner Units should have been turned on to 4 cfs beginning on April 1, per the new agreement, but were delayed and were not set until mid-April. On June 1, the beginning of the "summer" period, the flows at both Drew and Waggoner were adjusted to account for the seasonal variation in evapo-transpiration.

The low wetted acreage observed in the Drew and Waggoner areas during May caused some concern and LADWP investigated why the acreages were observed at such low levels given the flows applied to the waterfowl areas. From what LADWP personnel were able to determine, both Drew and Waggoner continued to absorb water into the soil and didn't display much standing surface water through the end of May. Due to the low wetted acreage concern, the Winterton Unit was turned on again on June 1 to supplement the acreage until the Waggoner and Drew Units were fully wetted and finished with soaking up ground water.

From the measurements at the beginning of July, both Drew and Waggoner were observed to have rapidly expanded in standing water surface area. Due to the expanded acreages in these areas, the flows to Winterton were cut in half from 6 cfs to 3 cfs in the middle of month as LADWP staff continued to observe the expansion of Drew and Waggoner through the remainder of the month.

On August 16, flows were adjusted for the fall ET season. Drew and Waggoner were set to 4.7 and 4.8 cfs and Winterton was turned off (going from 3 cfs to 0 cfs). The mid-August wetted acreage measurements totaled 392 acres, well above the goal of 355 acres.

The wetted acreage measurements taken in September and October showed slight gains in wetted acreage over the August measurements and on October 15 the flows into Drew and Waggoner were adjusted to 1.7 cfs for the winter season. During November and December no adjustments to inflows were made and no acreage reads were taken, but during January, reads of Drew and Waggoner were taken and found to have slight gains over the October reads (Drew at 287 and Waggoner at 210 for a total of 497 acres). In mid-April, the last reads of the runoff year were taken and Drew was at 262 acres, while Waggoner was at 178 acres.

For the 2009-10 Runoff Year, Drew averaged 224 acres (mid-season reads, weighted by number of days per season) and Waggoner averaged 161 acres for a total of 385 acres. This exceeded the goal of 355 acres.

2.4.2 Waterfowl Results for Runoff Year 2010-11 (April 2009 to September 2010)

The Blackrock Waterfowl acreage goal for Runoff Year 2010-11 is 475 acres.

Taking into account water use, maximum capacities, and wildlife concerns LADWP made the decision to maximize the Drew wetted acreage because it uses relatively less water than Waggoner and because it has displayed more diverse and robust wildlife. From observations during the 2009-10 runoff year, the best guess for the maximum capacity for the Drew Unit is between 290 and 300 acres, before water levels reach the point where water starts spilling back into the Blackrock Return Ditch. Due to this, the flows to the Drew Unit were set with a goal of 275 wetted acres. The remaining 200 acres were planned to be achieved through the Waggoner Unit and flows there were set with that goal in mind.

The preliminary waterfowl operation protocol calls for the previous ET-season flow vs. acreage ratios to be used in order to set new flows. However, the 2009 spring data was skewed to a very high inflow ratio due to the 'wetting up' period both Drew and Waggoner went through from mid-April through mid August last year. As such, because the seasonal ET rates of spring and fall are usually similar, the ratios from the fall of 2009 were used instead of the artificially high ratios from the spring of 2009.

Beginning April 21 the new flows were set and based on the fall 2009 ratios, resulting in a 6.6 cfs inflow to the Drew Waterfowl Area and a 7.2 cfs net inflow to the Waggoner Waterfowl Area. When the wetted perimeter was measured with GPS in the middle of the spring season, the wetted area was 276 acres for Drew and 229 acres for Waggoner (resulting in a spring total of 505 acres). At the end of spring the wetted area was 289 for Drew and 321 for Waggoner.

For the summer flows, the Drew and Waggoner areas in 2009 were also still "wetting-up" for much of the summer, but not as drastically as it had been during the spring. In order to set the flows for summer 2010, the average acreage for middle and end of summer reads were used to set the ratios (instead of using the middle only). Using the average of the two reads resulted in a 6.8 cfs flow to Drew and an 8.1 cfs net flow to Wagoner which were set on June 1. When the acreage was GPS'd on July 7, Drew came in at 307 acres while Waggoner came in at 352 acres (for a total of 659 acres). Clearly the flow ratios set for the summer were too high, but the methods to calculate the flow ratios will automatically adjust to compensate for the summer 2011 inflows.

On August 16, the fall season flows were set to a net flow of 7.2 cfs for Waggoner and a flow of 6.6 cfs to Drew. This resulted in 312 acres wetted for Waggoner and 328 acres for Drew when the GPS measurements were taken on September 15 (the mid-fall reading). Like the summer flows, the flows for fall were clearly set too high as the total wetted acreage during the fall period came in at 640 acres.

On October 16, the winter season flows were set to a net flow of 1.6 cfs for Waggoner and a flow of 2.1 cfs to Drew. The GPS for the winter season will occur in mid-January of 2011.

2.5 Assessment of River Flow Gains and Losses

This section describes river flow gains and losses for all reaches in the Lower Owens River from the Los Angeles Aqueduct (LAA) Intake to the Pumpback Station during the period of October 2009 to September 2010. The reaches referred to in this report indicate areas of river between specified permanent gaging stations. LADWP maintains the metering equipment, manages the measured flow data and verifies the accuracy of flow measurements that are used in this assessment.

An average flow of 59 cfs was released into the Lower Owens River (to maintain approximately 40 cfs total flow throughout the LORP, as required by the Stipulation & Order) during the water year 2010 of October 2009 to September 2010. A seasonal habitat flow was initiated in the Lower Owens River from the Intake to the Pumpback Station in late June and early July 2010. The habitat flows were released and gradually ramped up, over a period of days, starting on June 25, 2010. Flow releases ramped up from 48 cfs to 213 cfs at the Intake.

This section describes and displays the temporal patterns of water losses and gains in the Lower Owens River as it flows downriver between the Intake and the Pumpback Station. This analysis is an attempt at understanding flow losses and gains in the Lower Owens River so that estimates of future water requirements can be made.

2.5.1 River Flow Loss or Gain by Month and Year

Flow losses or gains can vary over time (table below). Evaporation-transpiration (ET) rates fall sharply during late fall - winter and increase dramatically during the spring - summer plant growing seasons. Thus, the river can lose water to ET during certain periods of the year and maintain or gain water during other periods of the year. December through March are winter periods with low ET that result in gains from increased flows from water stored in the shallow aquifer where groundwater levels are higher than adjacent river levels. Other incoming winter water sources such as local sporadic runoff from storms could also result in flow increases.

Hydrologic Monitoring Table 3. Average Monthly River Flow Losses/Gains

From Intake to Pumpback Station during 2009 and 2010.

	Month	Flow (cfs)	Acre-Feet-Per-Day
2009	OCT	-3	-6
	NOV	+3	+6
	DEC	+7	+15
2010	JAN	+13	+25
	FEB	+12	+24
	MAR	+7	+13
	APR	+4	+9
	MAY	-7	-14
	JUN	-35*	-70*
	JUL	-41*	-82*
	AUG	-31	-62
	SEP	-18	-36
	AVG MONTH	**-7 cfs**	**-15 AcFt**

** Data influenced by the 2010 seasonal habitat flow*

The summer flow losses for June and July 2010 were influenced by the Seasonal Habitat Flow and may not be typical for predicting future losses.

For the entire river, the overall gain or loss is calculated by subtracting Pumpback Station outflow from inflows from the Intake and augmentation spillgates. Inflows from the Intake were 37,914 acre-feet, inflows from augmentation spillgates were 4,587 acre-feet, and outflows from the Pumpback Station were 37,016 acre-feet. This yields a loss of 5,485 acre-feet for the year, a daily average of approximately 7.6 cfs between the Intake and the Pumpback Station. Water loss during the 2009-10 water year (October 2009 to September 2010) represents about 13% of the total released flow from the Intake and augmentation spillgates into the river channel.

For the year, the river lost an average of 7.6 cfs compared to an average loss of 12 cfs last year and 18 cfs for the first year and a half of operations. Also, the amount of water lost as a percentage of released flows (Intake and augmentations) dropped from 26% for the first year and a half to 20% for last year and to 13% for the current year. The lower losses could be the result of less water being lost to the shallow groundwater table as the shallow aquifer fills. Another contribution could be the lower than normal precipitation of the two previous years compared to the most recent year. It is still unclear whether the lower loss trend will continue or has stabilized.

2.5.2 Flow Loss or Gain by River Reach During the Winter Period

From December 2009 to March 2010, an average flow of 42 cfs was released into the Lower Owens River from the Intake. An additional 4 cfs was provided from augmentation ditches, for a total accumulated release of 47 cfs. The average flow that reached the Pumpback Station was 57 cfs, an increase of 10 cfs during this period. During the winter, ET is low and any “make water” coming into the river is additive. Part of the “make water” was probably stored during earlier periods in subsurface aquifers and may also be a result of higher winter season precipitation.

The river reach from the Intake to the Mazourka Canyon Road gaging station had no gains (0 cfs) (even under winter conditions), while the reach from Mazourka Canyon Road to the Reinhackle gaging station gained 5 cfs and Reinhackle to the Pumpback Station gained 5 cfs (see table below). A water “gaining” reach, during harsh winter conditions, can benefit an ecosystem in many ways. Incoming water, especially if it is subsurface, tends to increase winter river water temperatures, reduces icing effects, increases dissolved oxygen, when water surface ice is melted by increasing the re-aeration rate, and adds nutrients.

Hydrologic Monitoring Table 4. Winter Flow Losses/Gains, December 2009 to March 2010

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake*	42	N/A	N/A
Mazourka	47	-0	-0
Reinhackle	52	+5	+5
Pumpback	57	+5	+10

Note: All numbers are rounded to the nearest whole value

* The following augmentation stations are added
  2 cfs added at the Blackrock Return Ditch
  1 cfs added at the Goose Lake Return
  1 cfs added at the Billy Lake Return

2.5.3 Flow Loss or Gain by River Reach During the Summer Period

During the summer period of June 2010 to September 2010, all river reaches lost water. The effects of ET are evident from the high total flow loss (-31 cfs) between the Intake to the Pumpback Station. Summer flow losses were 41 cfs higher than conditions during the winter season. The largest flow losses occurred at the Reinhackle to the Pumpback Station reach (-18 cfs) (see table below).

Hydrologic Monitoring Table 5. Summer Flow Losses/Gains, June 2010 to September 2010

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake*	70	N/A	N/A
Mazourka**	70	-4	-4
Reinhackle	65	-10	-14
Pumpback	47	-18	-31

Note: All numbers are rounded to the nearest whole value

* The following augmentation stations are added
  2 cfs added at the Blackrock Return Ditch
  1 cfs added at the Goose Lake Return
  1 cfs added at the Billy Lake Return

** The following augmentation station is added
  2 cfs added at the Locust Ditch Return
  3 cfs added at the Georges Ditch Return

3.0 SEASONAL HABITAT FLOW REPORT

3.1 Purpose of the Seasonal Habitat Flow

The goal of the LORP, as stated in the MOU:

> "The goal of the LORP is the establishment of a healthy, functioning Lower Owens River Riverine-Riparian ecosystem, and the establishment of healthy, functioning ecosystems in the other physical features of the LORP, for the benefit of biodiversity and Threatened and Endangered Species, while providing for the continuation of sustainable uses including recreation, livestock grazing, agriculture and other activities."

The MOU requires that flow and land management be used in conjunction to "create and maintain, to the extent feasible, diverse natural habitats consistent with the needs of the 'habitat indicator species.' "

The purpose of the seasonal habitat flow, as described in the MOU, is to create a dynamic equilibrium for riparian habitat, the fishery, water storage, water quality, animal migration, and biodiversity, which results in resilient productive ecological systems. The MOU outlines flow regimes for seasonal habitat flows. For average to above average runoff years, the flow regime includes releasing 200 cubic feet per second (cfs) into the Lower Owens River. For below average runoff years, the flow regime includes a reduction from 200 cfs to as low as 40 cfs in general proportion to the forecasted runoff in the watershed (MOU 1997, Section II, page 12).

Seasonal habitat flows are "to be of sufficient frequency, duration and amount, and will be implemented in order to (1) minimize the quantity of muck and other river bottom material that is transported out of the Riverine-Riparian system, but will cause this material to be redistributed on floodplains and terraces within the Riverine-Riparian system and the Owens River Delta for the benefit of the vegetation; (2) fulfill the wetting, seeding, and germination needs of riparian vegetation, particularly willow and cottonwood; (3) recharge the groundwater in the streambanks and the floodplain for the benefit of wetlands and the biotic community; (4) control tules and cattails to the extent possible; (5) enhance the fishery; (6) maintain water quality standards and actions; and (7) enhance the river channel" (Hill and Platts 1995).

The MOU specifies that the amount of seasonal annual habitat flow be set by the Standing Committee, "subject to any applicable court orders concerning the discharge of water onto the bed of the Owens Lake and in consultation with California Department of Fish and Game (CDFG) and to be based on the Lower Owens Riverine-Riparian ecosystem element of the LORP Plan which will recommend the amount, duration and timing of flows necessary to achieve the goals for the system under varying hydrologic scenarios" (MOU 1997, Section II, page 12).

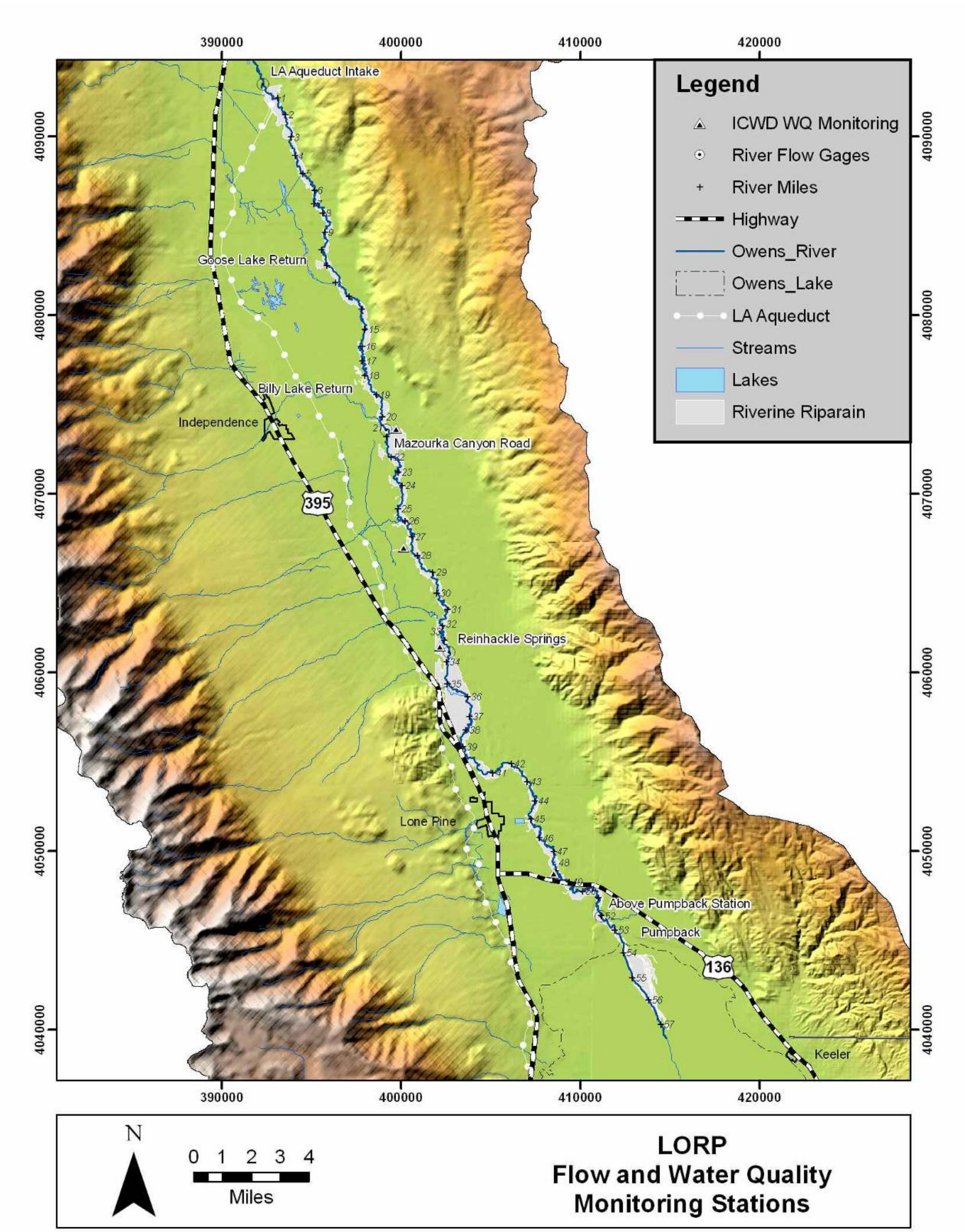
3.2 Hydrologic Infrastructure

Automated flow monitoring in the Lower Owens River occurred at four locations from the gated release at the Los Angeles Aqueduct (LAA) Intake to the Pumpback Station, upstream of the Delta. Flow is also monitored in six spillgate ditch tributaries. Seasonal Habitat Flow Table 1 lists the flow monitoring stations. Seasonal Habitat Flow Figure 1 displays the locations of the flow monitoring stations. Additional detailed information, including descriptions of base flow monitoring and flow measuring stations can be found in Section 4.3.1 of the *LORP Monitoring, Reporting, and Adaptive Management Plan* (Ecosystems Sciences 2008).

Seasonal Habitat Flow Table 1. Measuring Stations with Altitude Values

STATION NAME	ALTITUDE (m)
***LAA Intake**	**1,164**
Above Blackrock Ditch Return	1,159
Goose Lake Return	1,154
Billy Lake Return	1,144
***Mazourka Canyon Road**	**1,140**
Locust Ditch Return	1,143
Georges Return Ditch	1,124
***Reinhackle Springs**	**1,119**
Alabama Gates	1,117
***Above Pumpback Station**	**NA**
***Pumpback Station**	**1,098**

**** In-river stations***



Seasonal Habitat Flow Figure 1. Flow Gaging and Water Quality Monitoring Stations

3.3 Hydrographic Analysis

3.3.1 Seasonal Habitat Flows

Flows in the Lower Owens River and its tributaries, including return ditches, are monitored by LADWP's automatic and manual metering equipment. Flows are reported by the LADWP website 2-3 days after the date. Flow data are presented in Seasonal Habitat Flow Appendix 1. The maximum 24-hour average flow released from the LAA Intake of 209 cfs was reached on June 30. Maximum flows at other measuring stations on the Owens River were on July 5 (125 cfs) at Mazourka, July 9 (116 cfs) at Reinhackle, and on July 15, 2010 above Pumpback Station (76 cfs). Flows returned to normal base flow conditions at all stations by July 20, 2010. Seasonal Habitat Flow Appendix 2 displays the River flow (daily averages not peak measurements) by measuring station and river mile for each day.

3.3.2 LORP Inflows

Just before the high flow release, the LORP inflows were 48 cfs at the Intake with an additional 12 cfs added down river at various augmentation points. The seasonal habitat flows were scheduled to be released at the Intake as described below. Note that the flow change is not exactly as scheduled as the Langemann Gate was set high in order to meet or exceed the prescribed seasonal habitat flow, the peak flow that occurred can be found in the table below.

Seasonal Habitat Flow Table 2. Prescribed Flow Change

Date	Time (a.m.)	Prescribed Flow Change (from/to)
June 25	10:00	48 to 56 cfs
June 26	10:00	56 to 70 cfs
June 27	10:00	70 to 90 cfs
June 28	10:00	90 to 125 cfs
June 29	10:00	125 to 156 cfs
June 30	10:00	156 to 200 cfs
July 1	10:30	200 to 147 cfs
July 2	10:00	147 to 118 cfs
July 3	10:00	118 to 94 cfs
July 4	10:00	94 to 75 cfs
July 5	10:00	75 to 60 cfs
July 6	10:00	60 to 48 cfs

3.3.3 Flow Peaks and Travel Times

The time for the peak 209 cfs flow to move down the LORP was approximately 16 days from the Intake to the Pumpback Station. Based on previous studies, the velocities averaged well under 1 ft/sec during the flushing flows. A schedule of the peaks and travel times taken at the Lower Owens River measuring stations is presented in the following table.

Seasonal Habitat Flow Table 3. Flow Peaks and Time Schedule

Station	Begin Peak	Peak Flow (24-hour average cfs)	Travel Time from Intake	Distance (miles)
Intake	June 30 at 10 a.m.	209	--	--
Mazourka	July 5 at 12 p.m.	125	6 days, 2 hours	24
Reinhackle	July 9 at 11 a.m.	116	10 days, 1 hour	13
Above Pumpstation	July 15 at 11 p.m.	76	16 days, 13 hours	21

The travel time for the 2010 seasonal habitat flows to move from the Intake to the Pumpback Station increased from previous seasonal habitat flows. In 2008, the total travel time was eight days; while in 2009, the travel time was 13 days, with 2010 increasing by three additional days.

3.4 Flooded Extent Mapping

Aerial digital imagery taken from multiple helicopter flyovers and ground surveys of the LORP study area were used to map the base flow flooded extent and peak flow during the seasonal habitat flow. These data were used to derive the amount of area flooded (expressed in acres), the types of landforms flooded when the peak high flow occurred at the various monitoring plots during the seasonal habitat flow. These methods are described below. Note that flow measurements discussed through the remainder of Section 3 are daily averages not peak measurements unless otherwise stated.

3.4.1 Site Scale - Plot Mapping Analysis Methods

Aerial digital video was taken at base flow (year-round flow of equal to or greater than 40 cfs) prior to initiation of the seasonal habitat flow and when the peak occurred in the various river reaches. LADWP staff used a geo-referenced *FLIR Systems* stabilized digital video camera mounted on the LADWP helicopter (Seasonal Habitat Flow Figure 2), which allowed for geo-referencing of video frames in geographic space. The helicopter flights generally progressed from south to north beginning with Owens Lake and followed the Lower Owens River channel north to the LAA Intake. The helicopter's altitude, bearing, and angle of view were recorded on the video and are viewable onscreen and varied depending on weather conditions and width of the floodplain. During the helicopter flights, staff captured high quality digital still frames that aided in the mapping process. Still frame digital images of plots were taken using a *Canon Powershot* digital camera. These photos were used during the digitizing process as they often had better resolution than the digital video.

Six helicopter flights were performed from June 8 to July 27. On June 8, prior to initiation of habitat flows, a helicopter flight recorded the base flow conditions. Video from days that represent the peak flow in the various reaches (Seasonal Habitat Flow Table 4) were used to map the seasonal habitat flow event. The aerial video imagery was used to digitize flooded extent in *ArcView 9.3*. Base flow and seasonal habitat flow flooded extent were digitized on screen, side-by-side with the digital video imagery. Additionally, aerial photos of the Owens Valley taken during early August 2009 were used as a background for digitizing.

Ground surveys using GPS of the peak flooded extent were performed at the five (2 kilometers in length) plots that are representative of the various Lower Owens River reaches. Section 4.2.7.2 of the *LORP Monitoring, Adaptive Management and Reporting Plan* (Ecosystems Sciences 2008) describes the five plots used in the overall monitoring of the LORP in greater detail. Plots are located in three of the four reach types (formally dry incised floodplain, wet incised floodplain, and graded wet floodplain) of the Lower Owens River (WHA 2004). The entire aggraded wet floodplain reach (which does not have site scale plot) was also surveyed using GPS. A summary of reach types can be found in Section 3.5 Reach and River-wide Analysis.

As part of the ground surveys, GPS points of the wetted extent were taken on both sides of the river channel at all of the five plots during peak flow and the aggraded wet floodplain during both peak and base flow. An effort was made to survey sites when they were close to the peak flows. It was often difficult to determine the precise day that peak flows would move through a site. Field maps depicting the study plot and fence posts were generated and brought to the field along with a Trimble GeoExplorer GPS (loaded with plot information, including river shape, transects and fencepost). LADWP personnel walked along the rivers flooded edge, mapping the flooded extent with the GPS units. In some cases there were multiple wetted edges due to oxbows and other landform features. In cases where the peak flow had passed the monitoring plot the apparent inundated area was mapped. Emergent vegetation, such as cattails and tules, were considered flooded. In late winter 2009, cross channel transects were performed on each of the five plots (Section 4.2.7.2 of the *LORP Monitoring, Adaptive Management and Reporting Plan*) the results of which were used to aid digitizing base flow wetted extent. These GPS points were used in the digitizing process to ensure that wetted extent margins were mapped correctly. On-the-ground GPS data allowed accurate identification of off-channel inundated areas that were most likely filling with water via groundwater.

Seasonal Habitat Flow Figure 2. LADWP Helicopter with Mounted FLIR Unit

Seasonal Habitat Flow Table 4. Average Daily Flow (cfs) and Date of Helicopter Flights

Date	Measuring Station				
	Intake	Mazourka	Reinhackle	Above Pumpback Station	Pumpback Station
6/21/2010	47	47	59	39	31
6/22/2010	47	46	58	41	33
6/23/2010	48	46	58	41	33
6/24/2010	49	46	58	41	33
6/25/2010	53	46	58	42	34
6/26/2010	65	46	56	42	34
6/27/2010	84	47	55	41	33
6/28/2010	114	50	55	41	34
6/29/2010	153	54	54	40	33
6/30/2010	192**	67	54	41	33
7/1/2010	173	73	55	39	32
7/2/2010*	131	91	57	39	31
7/3/2010	107	107	61	38	30
7/4/2010	85	121	67	38	30
7/5/2010	65	125	74	38	30
7/6/2010	53	112	91	37	30
7/7/2010*	48	102	101	42	34
7/8/2010	48	87	109	44	36
7/9/2010	68	80	116	46	39
7/10/2010	81	70	115	51	44
7/11/2010	81	64	112	55	47
7/12/2010	80	68	105	62	47
7/13/2010	79	76	91	69	47
7/14/2010*	80	80	82	74	47
7/15/2010	81	81	74	76	46
7/16/2010	79	81	72	76	47
7/17/2010	81	81	75	74	47
7/18/2010	79	81	77	69	47
7/19/2010	80	82	78	62	47
7/20/2010	81	82	76	55	40
7/21/2010	81	81	74	55	44
7/22/2010	80	81	72	55	47
7/23/2010	81	80	69	54	47
7/24/2010	80	80	68	53	46
7/25/2010	81	79	67	51	44
7/26/2010	80	79	66	52	44

** Date of helicopter flight with aerial video*
*** 24-hour average release was 209 cfs*

Data from the video imagery, digital photos, cross channel transects and ground surveys were used to create a total of 12 shapefiles during the digitizing process; one shapefile per plot for base flow, one shapefile per plot for the peak flow as well as one for peak and base flow of the aggraded wet floodplain.

3.4.2 Flooded Area by Plot

Flooded area is used to determine the amount of area (expressed in acres) flooded during the seasonal habitat flow. Flooded area per plot for the base flow and the peak flow (Seasonal Habitat Flow Table 5) was measured using each GIS shapefile digitized from the wetted extent data.

Seasonal Habitat Flow Table 5. Flooded Area by Plot at Base Flow and Peak Flow

Plot	Flight Date	Plot Size (Acres)	Amount Flooded (Acres)	Percent Flooded
1	6/8/2010	159.9	6.4	4.0%
1	7/2/2010	159.9	18.5	11.6%
2	6/8/2010	164.7	25.9	15.7%
2	7/4/2010	164.7	40.0	24.3%
3	6/8/2010	153.1	35.6	23.3%
3	7/7/2010	153.1	53.9	35.2%
4	6/8/2010	168.8	61.5	36.5%
4	7/14/2010	168.8	69.6	41.2%
5	6/8/2010	215.9	27.9	12.9%
5	7/16/2010	215.9	40.0	18.5%

3.4.3 Landform Types Flooded by Plot

Whitehorse Associates (WHA) mapped the landforms of the Lower Owens River in 2004 (WHA 2004). This mapping effort was performed before LORP flows were initiated, which leads to abnormally high percentage of inundation on these landforms, since these areas are now inundated at base flow. Inundation is calculated from this pre-project mapping however analysis is also performed that assesses inundation above base flow. It is also important to note that base flows are not consistent throughout the entire river, as the Lower Owens has losing and gaining reaches. Key landforms that were identified in the plots include floodplain, low terrace, and high terrace. The *ArcGIS Analysis Tool Intersect* was used to clip the landforms shapefile to each flooded extent shapefile (base flow and peak flow associated with seasonal habitat flow). The landform and the wetted extent shapefiles were used to determine the landform types that were inundated during the seasonal habitat flows. Inundated landform type acreages were summed to determine the total acreage per landform type flooded during different flows (Seasonal Habitat Flow Table 6). The percent landform type flooded per plot was derived by dividing inundated landform type by the total acres of that landform type per plot (Seasonal Habitat Flow Table 7 and 8).

3.5 Reach and River-Wide Analysis Methods

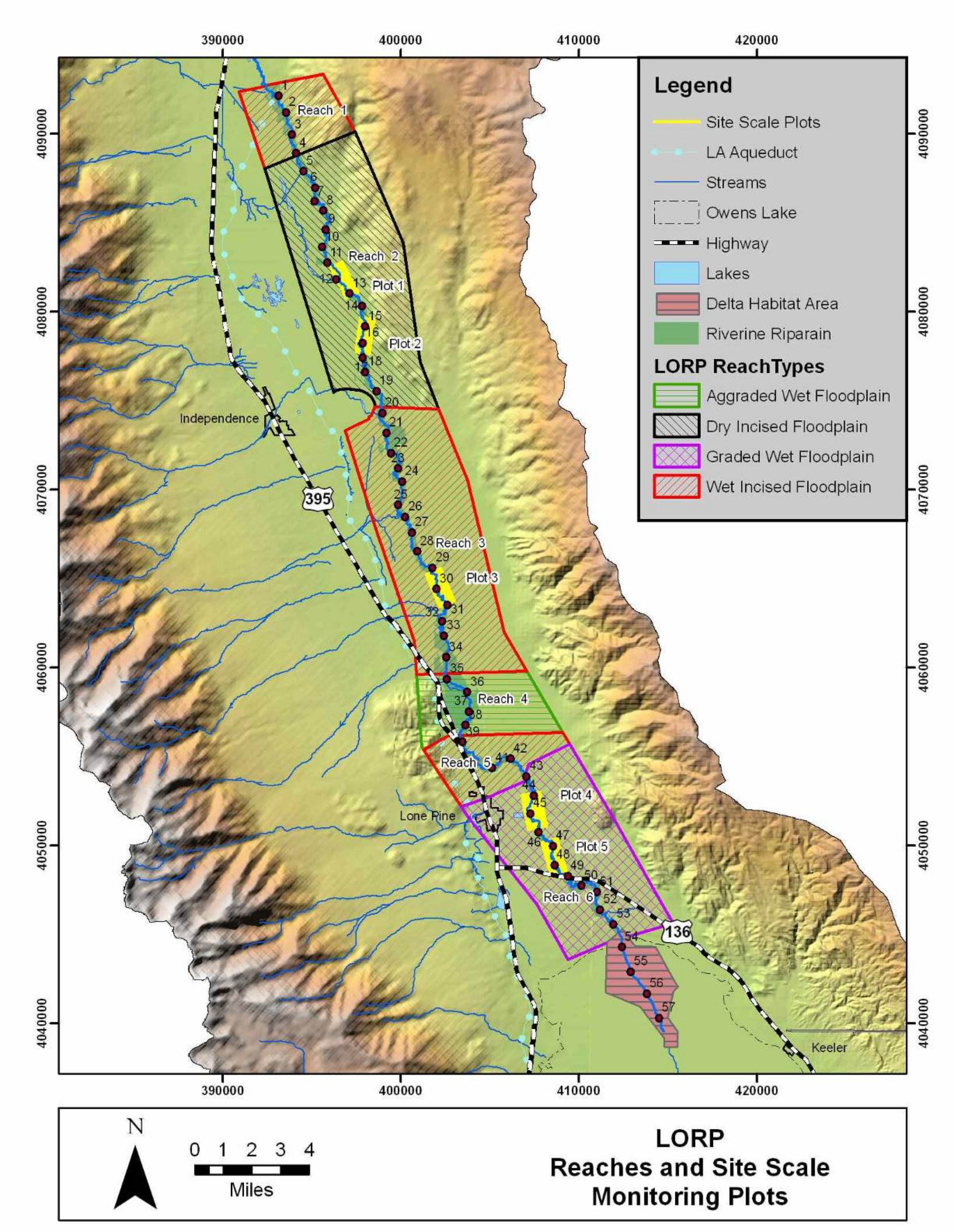
Results derived from the site scale analysis, described above, were used to extrapolate inundated conditions by reach type, and then to the entire Lower Owens River. The extrapolation of flooded area per landform for each reach type (previously dry incised floodplain, wet incised floodplain, and graded wet floodplain) was conducted for base flow and peak seasonal habitat flow. The entire aggraded wet floodplain was digitized. Lower Owens River reaches were designated and described by White Horse and Associates (WHA 2004). The six Lower Owens River reaches were assigned reach types (Seasonal Habitat Flow Figure 3); one reach type can be used to describe multiple reaches.

The formerly dry incised floodplain consists of 15.7 miles of river where the floodplain is confined within the Owens River channel. This reach had little wetland vegetation before initiation of flows. The wet incised floodplain reach type is the most common reach type; it consists of multiple reaches that contain 23.1 miles of river. The wet incised floodplain is similar to the dry incised floodplain with the floodplain confined into the Owens River channel but is often much broader, ranging from 150 to 300 feet wide. The wet incised floodplain reaches contained higher groundwater levels or sub-irrigation, which supported more wetland vegetation before the initiation of LORP flows. The third reach type (wet graded floodplain) encompasses 10.5 miles of LORP. This average stream gradient for this reach type is 0.04%, which is half the average grade of the LORP riparian area. The floodplain here is semi-unconfined. The floodplain width is highly variable, with many oxbow channels cutting through terraces. The majority of this reach consisted of wetland vegetation in 2000. The fourth reach type (aggraded wet floodplain) is the least abundant reach type in the LORP, containing 4-river miles. This reach also has about half the average stream grade of the LORP riparian area. The densely vegetated floodplain is unconfined and aggraded, with no continuous channel.

Extrapolation of flooded area per landform occurred in three of the four Lower Owens River reach types (formally dry incised floodplain, wet incised floodplain, and graded wet floodplain) (WHA 2004). The forth reach type (aggraded wet floodplain) has no site scale plots established in this reach. Inundation in the aggraded wet floodplain was evaluated over the entire reach using ground surveyed GPS data as well as aerial imagery at both base and peak flow.

Extrapolation of high flow inundation at each plot to peak flow as performed in the 2008 Seasonal Habitat Flow Report (Ecosystem Sciences 2008) was not performed because the peak flow, or very close, was captured by either the helicopter video, on the ground mapping or both. The plots were not captured at peak flow during the 2008 seasonal habitat flow.

Flooded area, for both base flow and peak flow, per reach type for Lower Owens River was extrapolated by using a plot’s (or multiple plot’s) percent landform type inundated as a multiplier. Thus, to determine a reach type’s acres inundated for each landform, the percent inundated per landform at the plot level was used as a multiplier (see percent inundated column in Seasonal Habitat Flow Tables 7 and 8); this number was multiplied by the acres per landform for each reach type to calculate total acres inundated per landform per reach type. In reach types where multiple plots occurred, such as dry incised floodplain and graded wet floodplain, the average of those plots percent inundated of each landform type were used as multipliers to extrapolate to the reach type.



Seasonal Habitat Flow Figure 3. River Reaches and Site Scale Monitoring Plots

3.6 Results and Discussion

3.6.1 Base Flow and Peak Flow Flooded Extent Mapping

Results of the analyses are presented at two different scales: the site or plot scale and the river reach/river-wide scale. The site scale section describes the results of the site scale mapping, which included digital aerial imagery mapping collected by LADWP's helicopter, digital aerial still images, and ground surveys. The variable such as percent landform type flooded per plot was derived from analysis of the site scale mapping and was used to extrapolate to the entire Lower Owens River.

Generally, results are presented by plot and base and peak flow. This year the flooding extent at base flow was GPS'd in winter of 2009 using data from cross channel transects. In previous years, the base flow flooded extent was digitized using just video and photos from helicopter monitoring. Although monitoring was performed in winter instead of spring, the additional GPS data make digitizing much more accurate. The main difference between the two seasons is in the lower reaches. In winter due to sub-irrigation or "make water" from the middle reaches, the lower reaches have a higher flow than in spring, when evaporation and transpiration are beginning to increase. To account for this difference aerial video and still photos from June 8, 2010 were reviewed when digitizing the base flow wetted extent.

3.6.2 Site Scale - Plot Analysis Results

Seasonal Habitat Flow Table 6 shows the percent flooded area per plot at base flow and peak flow levels. See Seasonal Habitat Flow Figures 4 through 9 for digitized flooded extent at base and peak flow. Plots 1 and Plot 2 in the formally dry incised floodplain reach had the lowest acreage flooded under both peak and high flow. Plot 1 had no off-channel oxbows flooded. Plot 2 had 0.23 acres of off-channel area flooded at base flow of the 25.9 acres of total flooded area which increased to 0.55 acres flooded during peak flow. Plot 2 was the only plot that experienced additional off-channel areas flooded by groundwater during peak flow. Other plots had these low-lying off-channel areas become connected to the main channel during peak flow. Plot 3 had 1.41 acres of off-channel area flooded at base flow which decreased to 1.03 during peak flow. Plot 4, in the graded wet floodplain reach, experienced the highest acreage flooded under both flows (61.5 at base, and 69.6 at peak) but had the lowest increase in flooded extent over base flow (8.1 acres). Of this inundated acreage, 2.55 acres were off-channel, which decreased to 2.15 during the peak flow. Plot 5 had the highest amount of off-channel area flooded during base flow at 5.49 acres. Half of this acreage in Plot 5 became connected to the main channel during peak flow leaving 2.89 acres unconnected to surface flow. .

The percent landform type flooded per plot varied considerably, demonstrating the range of landform types and conditions found within the Lower Owens River. For example, Plot 1, located in the formally dry incised floodplain reach type, contains narrow floodplains flanked by high terraces, experienced flooding on only 14.9% of its floodplains during base flows and 39.3% during peak flows. In contrast, Plot 4, located in the graded wet floodplain reach type, which contains a mix of floodplains and low terraces flanked by high terraces (WHA 2004), experienced flooding on 62.3% of its floodplains at base flow and 67.3% at high flows (Refer to Seasonal Habitat Flow Table 6). Plot 3 had the highest percentage of floodplain flooded of the monitoring plots, 91.8% during peak flow. Most of the flooding at peak flow occurs on the floodplain. There is some inundation of terraces adjacent to the floodplain; with the wet incised floodplain experiencing the highest inundated acreage of terraces with 12.4 acres, since most of the floodplain in this reach (91.8%) is inundated at peak flow.

Seasonal Habitat Flow Table 6. Landform Acreage Inundated

Percent of Total Landform Inundated by Plot at Base Flow and Peak Flow

Plot	Flow	Total Flooded Area (Acres)	Floodplain (Acres)	Floodplain (%)	Low Terrace (Acres)	Low Terrace (%)	High Terrace (Acres)	High Terrace (%)
1	Base	6.4	5.5	14.9%	0.0	0.0%	0.9	0.7%
	Peak	18.5	14.4	39.3%	0.0	0.0%	4.1	3.3%
2	Base	25.9	23.9	52.9%	0.0	0.0%	2.0	1.7%
	Peak	40.0	33.4	74.1%	0.0	0.0%	6.5	5.5%
3	Base	35.6	28.4	78.3%	7.1	9.6%	0.1	0.2%
	Peak	53.9	33.3	91.8%	19.5	26.3%	1.1	2.5%
4	Base	61.5	56.2	62.3%	5.4	7.6%	0.0	0.0%
	Peak	69.6	60.7	67.3%	8.8	12.5%	0.0	0.0%
5	Base	27.9	21.1	33.3%	6.8	4.8%	0.0	0.0%
	Peak	40.0	28.0	44.3%	11.9	8.4%	0.0	0.0%

3.6.3 Reach-River Wide Results

The results derived from the site scale analysis were used to extrapolate the amount of inundated acres by reach type, landforms per reach type, and to the entire Lower Owens River. River reaches responded in dynamic ways to flows, illustrating the usefulness of reach designation. Understanding the nature of these responses will aid managers in creating realistic goals and expectations for individual reaches. Acres inundated for both base flow and seasonal habitat peak flow were extrapolated from observed conditions. Flooded area per reach varied throughout the Lower Owens River as did the amount of landform flooded per reach type. Flooded area per reach and landform increased with the onset of the seasonal habitat flow, but was not consistent among reaches.

Under base flow conditions, 1,289.4 acres of Lower Owens River landforms were inundated (Seasonal Habitat Flow Table 7). The dry incised floodplain reach type experienced the smallest wetted extent of all reaches, with a total of 87 acres inundated under base flow conditions. Conversely, the wet incised floodplain reach type (Reaches 1, 3 and 5) experienced the greatest wetted extent, with 406.8 acres of floodplain and 111.9 acres of low terrace inundated. The wet incised floodplain reach type encompasses the largest amount of Lower Owens River miles with 23.1 river miles, and approximately 2,927 acres. The aggraded wet floodplain reach (Islands area) had the highest proportion of floodplain inundated at base flow with 82.8%.

Seasonal Habitat Flow Table 7. Extrapolation of Flooding Extent by Landform at Base Flow

Reach Type	Reach Numbers	Plot Numbers	Landform	Total Acres	Percent Inundated	Acres Inundated
Dry Incised Floodplain	2	1 and 2	Floodplain	223.7	33.9%	75.8
			High Terrace	925.6	1.2%	11.2
			Low Terrace	99.0	0.0%	0.0
Wet Incised Floodplain	1, 3 and 5	3	Floodplain	519.7	78.3%	406.8
			High Terrace	1,241.9	0.2%	2.7
			Low Terrace	1,165.3	9.6%	111.9
Aggraded Wet Floodplain	4		Floodplain	404.9	82.8%	335.3
			High Terrace	169.6	0.3%	0.6
			Low Terrace	590.7	28.7%	169.8
Graded Wet Floodplain	6	4 and 5	Floodplain	303.3	47.8%	144.9
			High Terrace	60.2	0.0%	0.0
			Low Terrace	454.8	6.2%	28.1
					Total	**1,289.4**

During peak flows, the flooded area per reach and landform increased considerably over base flow conditions. During peak flow the wetted extent was approximately 1,913.5 acres (Seasonal Habitat Flow Table 8). Certain reaches experienced more flooding. For example, in the wet incised floodplain reach type, over 91.8% (estimated 477.1 acres) of floodplain was inundated. Conversely, in the dry incised floodplain reach type 56.7% of floodplain (estimated 126.8 acres) was flooded at high flow. The aggraded wet floodplain (Islands area) had the highest percent inundation at peak flow of floodplain and low terrace of any reach, 91.8% and 57.1%, respectively.

Seasonal Habitat Flow Table 8. Extrapolation of Flooded Extent by Landform at Peak Flow

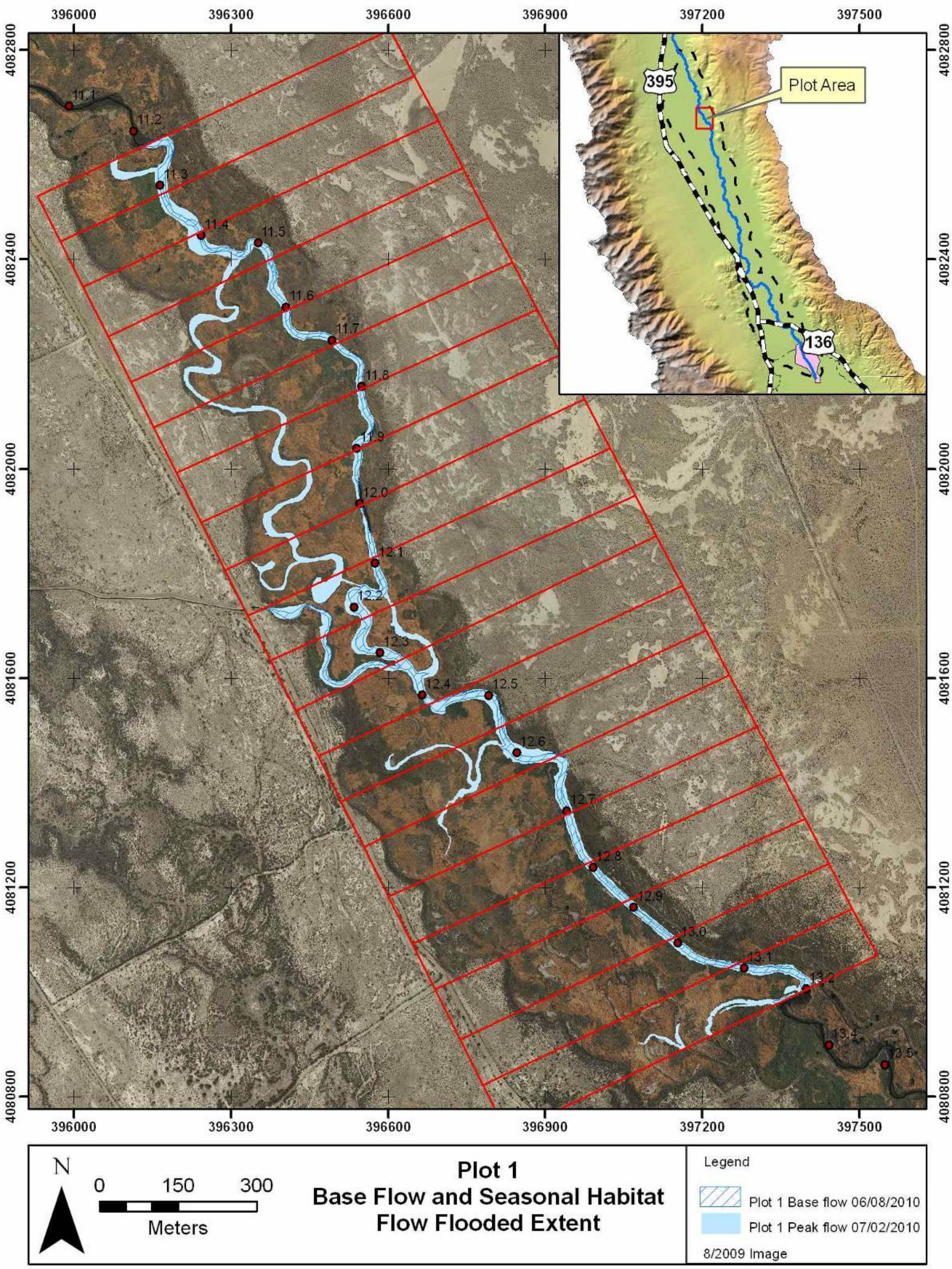
Reach Type	Reach Numbers	Plot Numbers	Landform	Total Acres	Percent Inundated	Acres Inundated
Dry Incised Floodplain	2	1 and 2	Floodplain	223.7	56.7%	126.8
			High Terrace	925.6	4.4%	40.6
			Low Terrace	99.0	0.0%	0.0
Wet Incised Floodplain	1, 3, and 5	3	Floodplain	519.7	91.8%	477.1
			High Terrace	1,241.9	2.5%	31.5
			Low Terrace	1,165.3	26.3%	306.5
Aggraded Wet Floodplain	4		Floodplain	404.9	91.8%	371.6
			High Terrace	169.6	3.1%	5.3
			Low Terrace	590.7	57.1%	337.2
Graded Wet Floodplain	6	4 and 5	Floodplain	303.3	55.8%	169.2
			High Terrace	60.2	0.0%	0.0
			Low Terrace	454.8	10.5%	47.6
					Total	**1,913.5**

For the entire Lower Owens River, approximately 626.3 additional acres were inundated as a result of the seasonal habitat flows. During the seasonal habitat flows, the floodplains and low terraces are the landforms that experienced the majority of inundation. About 78.9% of floodplains and 29.9% of low terraces in the Lower Owens River were inundated (Seasonal Habitat Flow Table 9). Most of the high terrace inundated occurred in the dry incised floodplain reach but some also occurred in the wet incised floodplain reach.

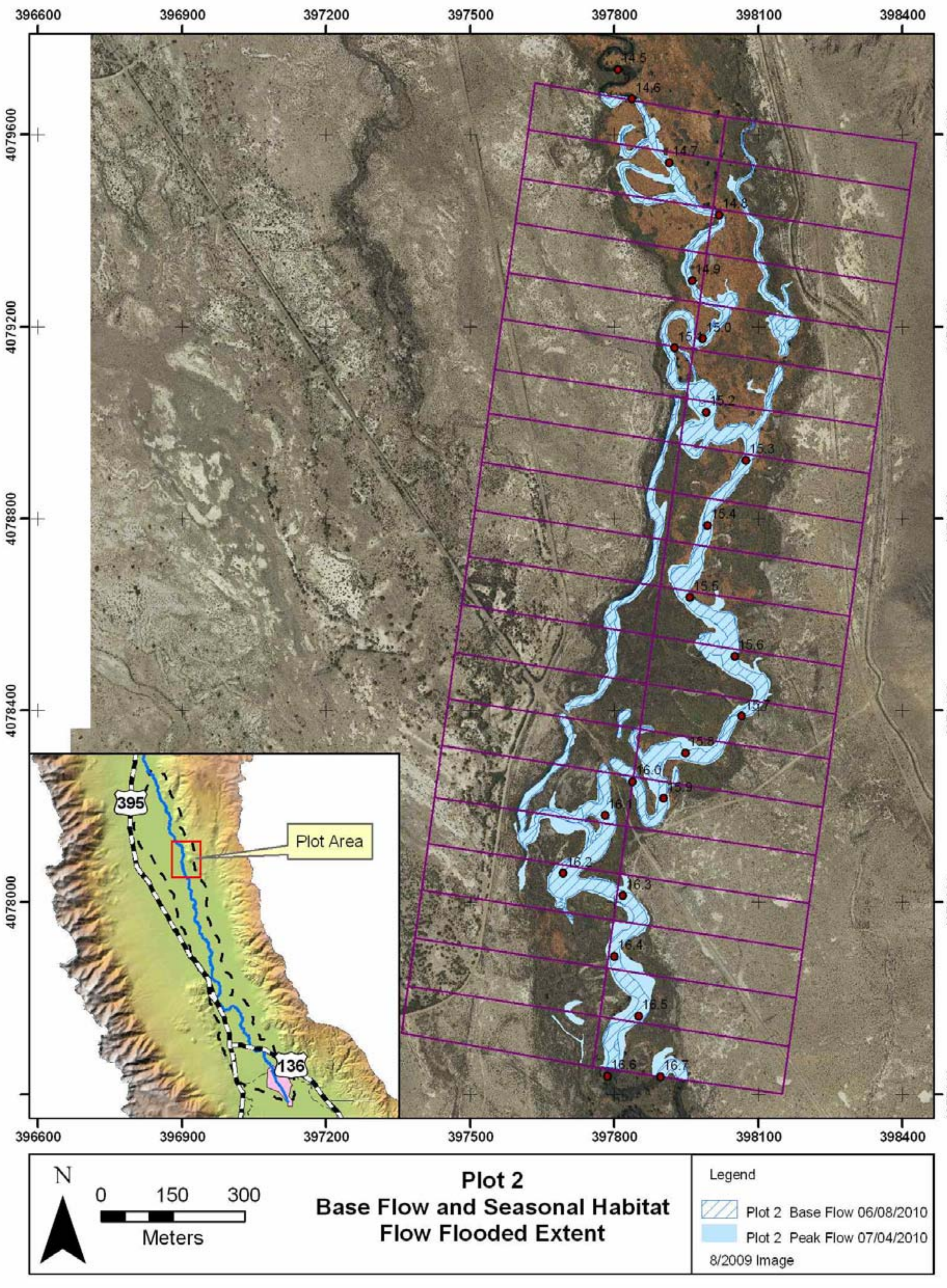
Seasonal Habitat Flow Table 9. Landform Inundation Change and Percent Landform Flooding During Peak Flow

Landform	Total Acres	Base Flow Inundated Acres	High Flow Inundated Acres	Inundated Acreage Increase	Percent of Landform Inundated During Seasonal Habitat Flow
Floodplain	1,452	962.8	1,144.8	182.9	78.9%
High Terrace	2,397	14.5	77.4	62.9	3.2%
Low Terrace	2,310	309.9	691.3	381.5	29.9%
Total	**6,159**	**1,287.2**	**1,913.5**	**626.3**	

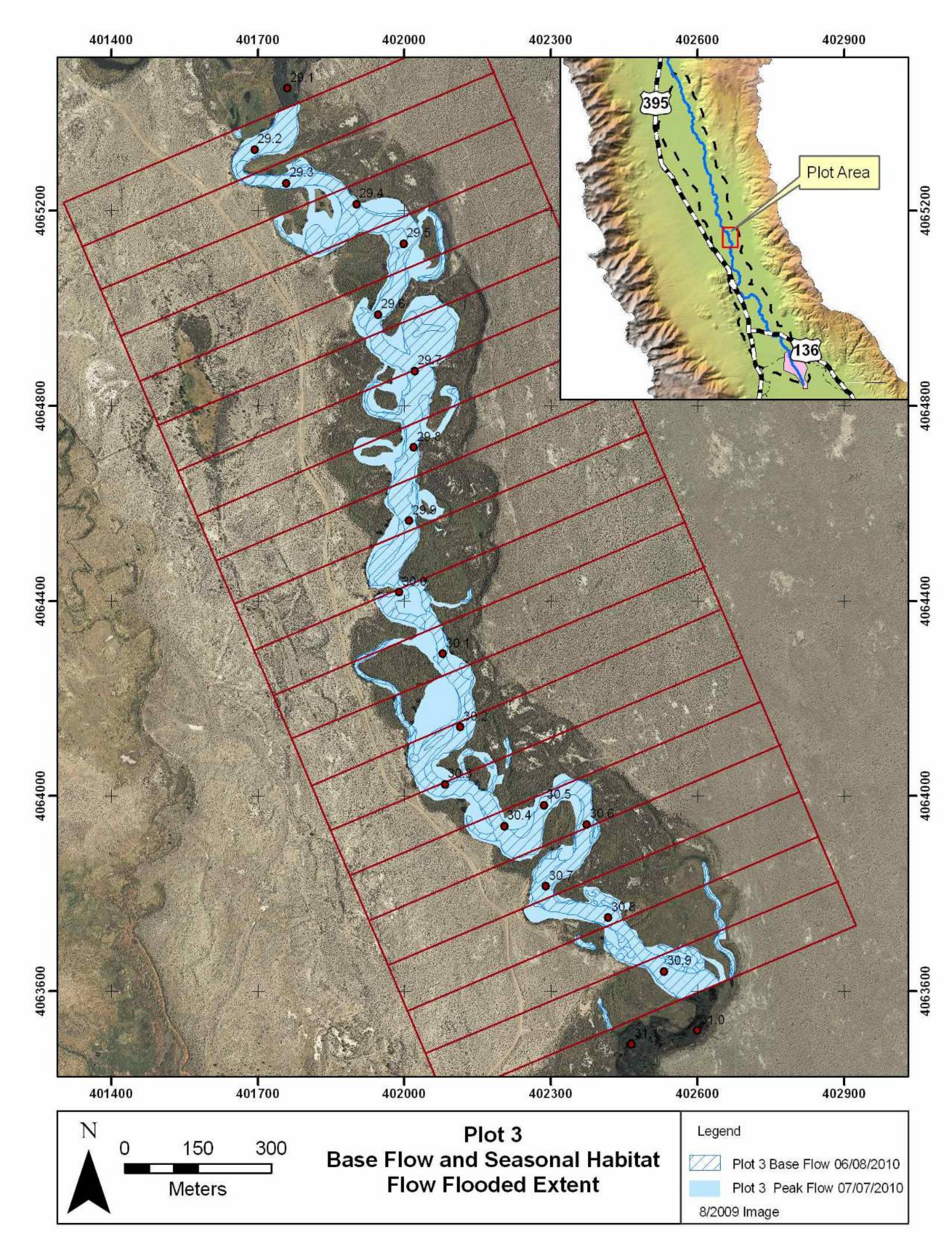
At the Intake the stage height is 3.79 feet higher at peak flow compared to base flow. The magnitude of stage height increases due to the Seasonal Habitat Flow understandably lessen as the peak flow attenuates in reaches downstream. At Mazourka measuring station (River mile 20.7) the stage height increased 1.52 feet during high flow. At Reinhackle measuring station (River mile 34) the stage height increased by 1.56 during the peak flow. The stage height during the peak flow at Keeler Bridge (River mile 48) increased by 0.71 feet from base flow measured in January and by 0.99 from base flow on June 8.



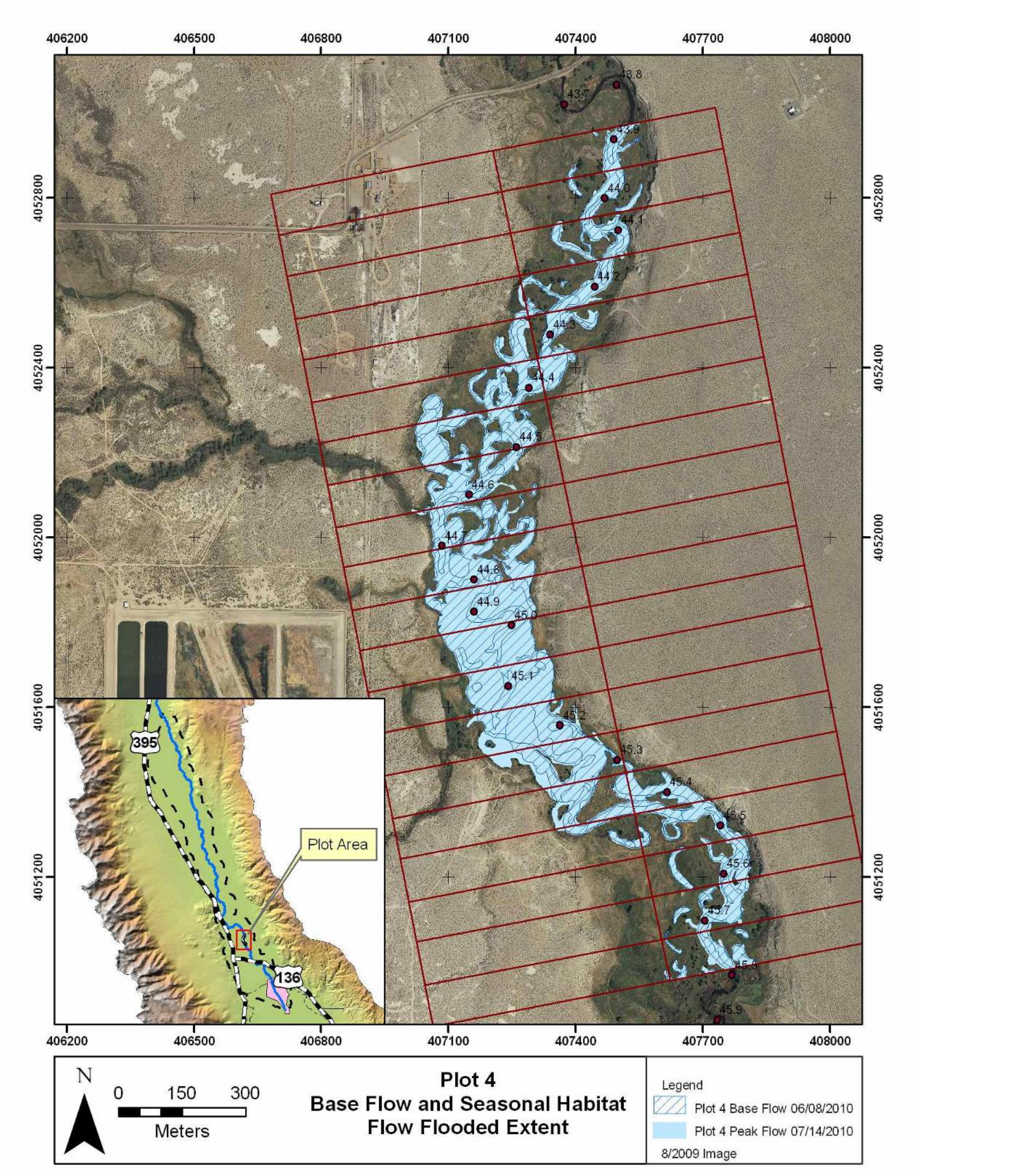
Seasonal Habitat Flow Figure 4. Plot 1 Flooded Extent



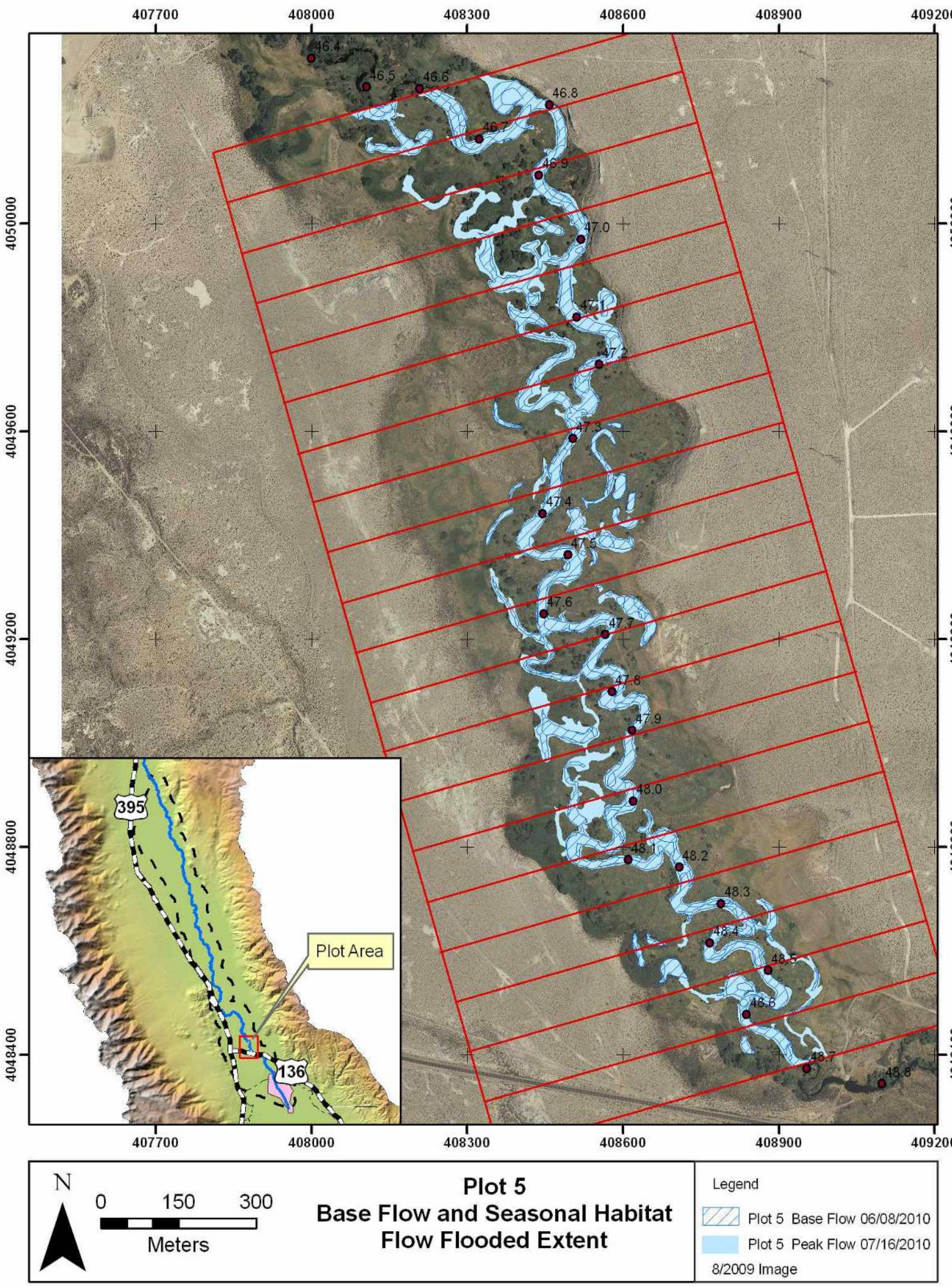
Seasonal Habitat Flow Figure 5. Plot 2 Flooded Extent



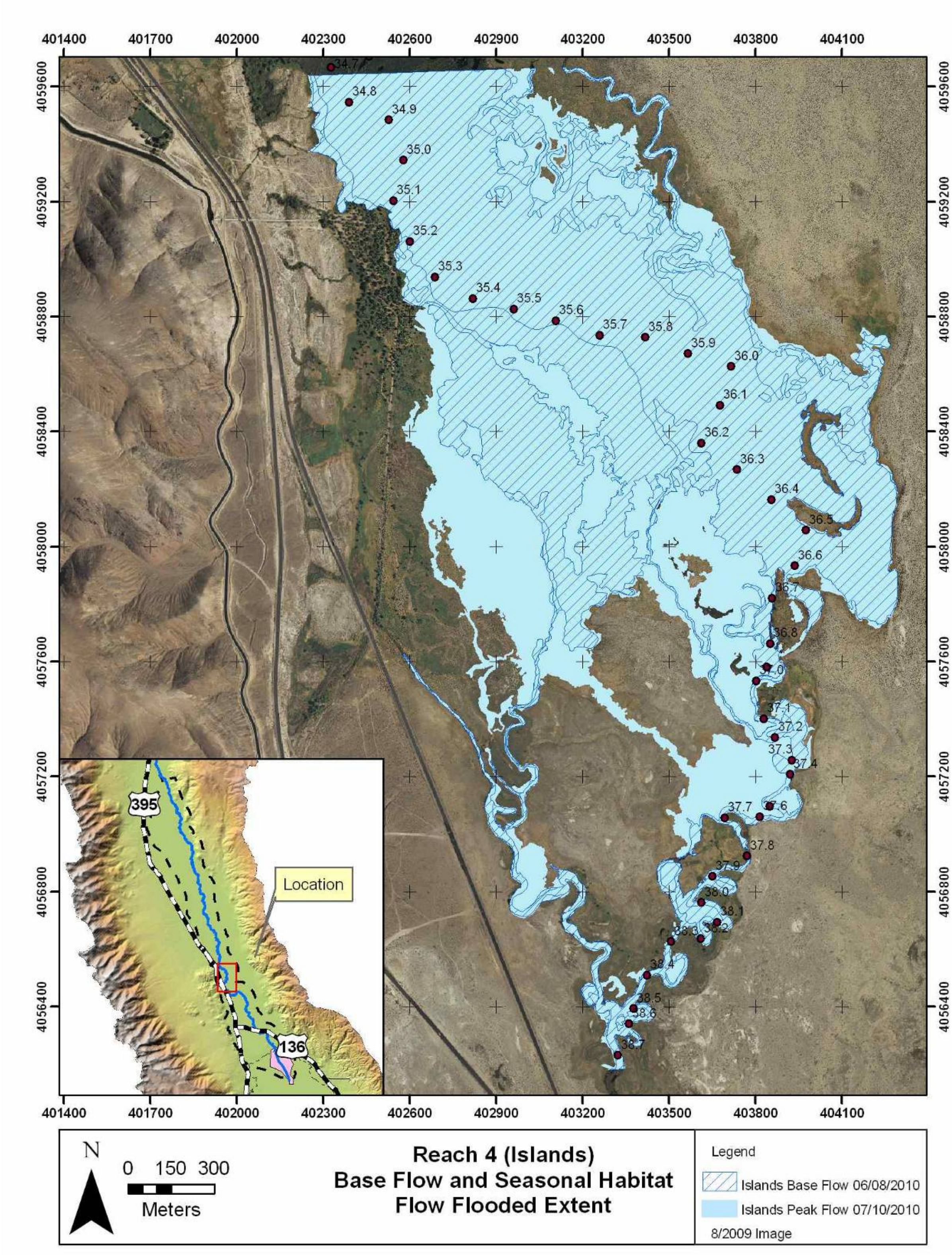
Seasonal Habitat Flow Figure 6. Plot 3 Flooded Extent



Seasonal Habitat Flow Figure 7. Plot 4 Flooded Extent



Seasonal Habitat Flow Figure 8. Plot 5 Flooded Extent



Seasonal Habitat Flow Figure 9. Aggraded Wet Floodplain Flooded Extent

3.7 Inundation Comparisons with Previous Seasonal Habitat Flows

The 2008 seasonal habitat flow peak release was 210 cfs and occurred early in the winter (flows were initiated February 13, 2008). In 2009 peak flows occurred during the growing season (initiated on May 25, 2009) but were only ramped to a 110 cfs peak due to the runoff conditions. Due to the myriad of different factors including time of year of peak flow, augmentation from Alabama gates, increased streambank vegetation biomass over time, and increased precision of inundated extent mapping, among other factors, comparisons of inundated acres among years should be made cautiously.

3.7.1 Acreage Inundated above Base Flow

In terms of available area for the recruitment of woody riparian vegetation, a more appropriate way to look at the seasonal habitat flow inundation is the difference between the base flow acreage inundated and the peak flow acreage inundated each year. The difference is the acreage where woody riparian species are most likely to germinate and grow due to the seasonal habitat flow in that year. Inundation increased approximately 626.3 flooded acres over base flow this year which is less than the 703.6 acres in 2008, an 11% decrease. Estimated inundated acres of the various landforms during 2010 are presented in Seasonal Habitat Flow Table 11 with the previous year's data for reference.

The dry incised floodplain reach experienced an estimated 80.4 inundated acres due to peak flow, which is the second lowest of the four reaches (Seasonal Habitat Flow Table 11). This reach begins four miles from the release point for the LORP flows, which allows for less attenuation of flow. Due to LORP flows, sparse upland vegetation has been replaced by dense emergent vegetation along streambanks (Seasonal Habitat Flow Figure 10). This reach was virtually dry with little wetland vegetation before LORP flow initiation. This dry incised floodplain reach appears to have higher continued growth of emergent and stream bank vegetation, which causes slowing of flow, increased water surface elevation, and increased floodplain inundation. These factors are the likely cause for the dry incised floodplain reach being the only reach that experienced higher inundation in 2010 compared to 2008.

The wet incised floodplain experienced 293.7 acres inundated acres over base flow in 2010 (Seasonal Habitat Flow Table 11) which was 8.8 acres less than the peak inundation in 2008. There was an estimated 34.9% increase in acreage inundated between the lower seasonal habitat flow of 2009 (83 cfs at Mazourka measuring station) and the 2010 flow (125 cfs at Mazourka), which is 2.9% less than the peak inundated acreage in 2008 (174 cfs at Mazourka). A decrease in peak inundated acreage appeared in the low terrace landform and an increase in floodplain flooded extent between 2008 and 2010. The majority of these changes in acreage are due to the increased accuracy of using GPS to map the flooded extent.

The aggraded wet floodplain reach experienced most of the flooding above base flow in the low terrace landform, since the majority of the floodplain is inundated at base flow. The additional 167.4 acres of low terrace and 4.7 acres of high terrace inundated compared to previous years estimates were due to the incorporation of GPS mapping for this reach.

In the graded wet floodplain, all landforms experienced a decrease in inundation over base flow compared to 2008. Some of this decrease may be accounted for by the fact that 2010 base flow GPS points were taken in winter when this reach receives substantial "make water" from gaining reaches above, thus increasing base flow inundation above previous year's springtime estimates. In addition this decrease in inundated acres is influenced by many other factors discussed previously.

Seasonal Habitat Flow Figure 10. Photopoints from Reach 2 and Reach 6

Reach 2 - Dry Incised Floodplain from ground level (left) and Reach 6 - Wet Incised Floodplain from a high terrace(right) before LORP flow initiation (top), during base flow in 2007 (middle) and during base flow in 2009 (bottom).

Seasonal Habitat Flow Table 10. Comparison of Increase in Area Inundated Over Base Flow Among Years

Reach Type	Landform	2010 Acres Flooded over Base Flow	2009 Acres Flooded over Base Flow	2008 Acres Flooded over Base Flow
Dry Incised Floodplain	Floodplain	51.0	37.9	65.5
	High Terrace	29.4	17.6	12.0
	Low Terrace	0.0	0.0	0.0
	Total	**80.4**	**55.5**	**77.6**
Wet Incised Floodplain	Floodplain	70.3	42.3	45.2
	High Terrace	28.8	19.8	53.4
	Low Terrace	194.6	128.9	203.9
	Total	**293.7**	**191.0**	**302.5**
Aggraded Wet Floodplain	Floodplain	36.4	141.7	202.5
	High Terrace	4.7	0.0	0.0
	Low Terrace	167.4	0.0	0.0
	Total	**208.5**	**141.7**	**202.5**
Graded Wet Floodplain	Floodplain	24.3	57.9	57.0
	High Terrace	0.0	0.0	0.8
	Low Terrace	19.4	31.7	63.2
	Total	**43.7**	**89.5**	**121.0**
All Reaches	**Total**	**626.3**	**477.8**	**703.6**
Peak 24 hour release was 209 cfs in 2010, 110 cfs in 2009, 210 cfs in 2008. Due to the myriad of different factors including time of year of peak flow, augmentation from Alabama gates, increased streambank vegetation biomass over time, and increased precision of inundated extent mapping, among other factors, comparisons of inundated acres among years should be made cautiously.				

3.8 Overall Findings and Conclusions

The 2010 seasonal habitat flow was timed to occur with seed release of woody riparian vegetation; which is an objective of the flow release pertinent to the MOU. This year the release of peak flows was well timed with the peak willow and cottonwood seed production, although the unusual cool spring delayed the timing of the seasonal habitat flow release.

The following is a summary of the overall findings and conclusions from the 2010 seasonal habitat flow:

- Flooding was estimated to cover approximately 1,913.5 acres within the Lower Owens River.
- There was an increase of 626.3 acres inundated above base flow conditions that provided areas for recruitment woody riparian species.
- During the seasonal habitat flow about 78.9% of floodplains and 29.9% of low terraces in the Lower Owens River were inundated.
- The time for the peak 209 cfs flow to move down the Lower Owens River was 16 days 13 hours from the LAA Intake to the Pumpback Station.

3.9 Water Quality Monitoring Data Collected During the Seasonal 2010 Habitat Flow

3.9.1 Introduction

The *Lower Owens River Final Environmental Impact Report* (EIR) (LADWP 2004) outlined a two-phase rewatering schedule for establishing 40 cubic foot per second (cfs) base flows in the Lower Owens River channel. In addition, the EIR describes seasonal habitat flows of up to 200 cfs. The principal water quality concern related to rewatering of the Lower Owens River was re-suspension of bottom sediments in the historically wetted reach from Mazourka Canyon Road to the Pumpback Station. Anaerobic organic bottom sediments, when mobilized by flows having sufficient velocity, consume dissolved oxygen in the water column and release hydrogen sulfide. These water quality conditions can result in fish kills and objectionable odors.

A monitoring plan was prepared to fulfill the Final EIR requirement for water quality monitoring (Jackson 2006) and was incorporated into the *Lower Owens River Project Monitoring, Adaptive Management and Reporting Plan* (Ecosystem Sciences 2008). This water quality monitoring plan was designed to collect the data necessary to determine if fish refuge creation was warranted at three sites in Phase 1 and 2 of establishing the 40 cfs base flow. General water quality river conditions were to be monitored for up to six months after the 40 cfs base flow had been established. Additional data was collected to describe general river water quality conditions during the habitat flow release for up to two weeks duration and for up to two weeks after the seasonal habitat flows are released. The seasonal habitat flow water quality monitoring was scheduled for the first three seasonal habitat flows. The first seasonal habitat flows were released in February and March 2008. The second seasonal habitat flows were released in late May and June of 2009. The third seasonal habitat flows were released in June-July of 2010.

Water quality data collected under the monitoring plan were incorporated into a report that covered the data collected during base flow establishment and the first seasonal habitat flow in 2008 (Jackson 2008). Monitoring extended past the originally planned six-month period of Phase 2. Data presented in a second report were collected starting in May 2009 and extended into June 2009 that cover the spring 2009 habitat flow (Jackson, 2009b). Water quality monitoring data collected during summer 2010 seasonal habitat flow are the subject of this report. *The Lower Owens River Project Monitoring, Adaptive Management and Reporting Plan* (Ecosystem Sciences 2008) prescribes habitat flow water quality monitoring in 2011, which would present a conflict with the Final EIR. The EIR specifies the water quality monitoring during the first three habitat flow releases in excess of 40 cfs.

3.9.2 Methods

Seasonal Habitat Flow Table 11 presents the water quality and fish condition thresholds originally presented in the monitoring plan (Jackson, 2006). It was found from collection of the water quality monitoring data that the threshold for dissolved oxygen in Seasonal Habitat Flow Table 13 was set much too conservatively based on the absence of observable fish stress when low concentrations of dissolved oxygen were measured. The monitoring plan allowed for the implementation of variances to the water quality thresholds in Seasonal Habitat Flow Table 13. The variances were to allow incorporation of the water quality data collected to set more realistic thresholds if necessary. The dissolved oxygen threshold was changed to 1.0 mg/L with a downward trend in the data by agreement of participants and consultants in the course of rewatering the Lower Owens River.

Monitoring was completed using Data Sonde recording instruments at Manzanar-Reward and Keeler Bridge stations and spot measurements using a Quanta multi-probe at all stations (Jackson 2009a). In the course of monitoring water quality during the summer of 2010 habitat flows the dissolved oxygen sensor on a Data Sonde at Manzanar-Reward Road failed. The turbidity sensor failed to calibrate on the Data Sonde at Keeler Bridge at the start of the program. The turbidity sensors that worked registered lower turbidity when tea colored water occurred, contrary to visual observation.

Despite the failures experienced in the recording instruments, data of adequate quantity and quality were acquired by the Quanta spot measurements and the continuous recorders and test kits to satisfy the purpose of the water quality monitoring described in the EIR. Habitat flows were released from the Lower Owens River Intake starting on June 25, 2010 and flows were returned to base flow levels at the Intake on July 7, 2010. Peak flows were released on June 30, 2010 (daily average 192 cfs). Habitat flows did not reach Mazourka Canyon Road until June 29, 2010. Habitat flows had passed the Pumpback Station by July 20, 2010. Locust and Georges Spillgates were operated during 2010 habitat flows.

Seasonal Habitat Flow Table 11. Water Quality and Fish Condition Thresholds

Constituent or Observation	Threshold
Dissolved Oxygen	1.5 mg/L and downward trend in data (Changed to 1.0 mg/L and a downward trend in data)
Hydrogen Sulfide	0.030 mg/L
Ammonia	Acute Criterion (one-hour average concentration) for Non-Salmonids (pH dependent)
Fish Conditions	The condition of fish visible at each station will be observed for evidence of stress such as excessive jumping, lying motionless near the surface, rapid gill movement, and poor coloring or body appearance. The threshold will be observance of one or more of these behaviors in several fish.

Source: LADWP, LORP Final EIR, 2004.

3.9.3 Results

Mazourka Canyon Road

Water quality data were collected manually at Mazourka Canyon Road during habitat flow releases. Those data are presented in Appendix 9. No water quality thresholds were exceeded and no fish stress was observed during habitat flows at this location. Dissolved oxygen declined about 3.2 mg/L as habitat flows passed the monitoring station but remained above 1 mg/L (1.16 mg/L). Elevated levels of tannins and lignins and electrical conductivity were measured, reaching a maximum before the peak habitat flows passed the location. Electrical conductivity reached another smaller maxima after the peak habitat flows passed the location. Water pH declined to a minimum as peak habitat flows passed Mazourka Canyon Road. The water took on a rich tea color as habitat flows passed the location. Water temperatures reached a maximum of 75.4°F during the measurement period. Maximum average daily flow was 125 cfs on July 5, 2010 at Mazourka Canyon Road during habitat flow releases (See hydrograph in Appendix 6, LADWP, 2010).

Manzanar Reward Road

Water quality data were collected manually and by continuous recorder at Manzanar Reward Road during habitat flow releases. The continuous recorder was set to read every two hours. Manual data are presented in Appendix 9 and continuous recorder data are presented in Appendix 7. The dissolved oxygen probe on the continuous recorder failed during the habitat flow release. Manual dissolved oxygen measurements were made daily as at all stations. Water quality thresholds were exceeded for 8 days during habitat flows. Fish stress was observed for 7 days.

Observations of fish stress included crayfish leaving the water, dead crayfish in the water, mosquito fish schooling in large groups adjacent to the waters edge, mosquito fish mouthing the surface, brown bullheads schooling in large numbers near the surface and mouthing at the surface for air, and carp near the surface slowly moving around. A fish kill was reported by LADWP personnel, downstream of Manzanar Reward Road and above Georges Spillgate Pond of over a dozen fish. Scavenger activity was noted around Manzanar Reward Road in the form of a few great blue herons, vultures, and crows for several days.

A substantial decline in dissolved oxygen (approximately 3.3 mg/L decline) was measured as habitat flows passed at this location. The lowest dissolved oxygen concentration measured was 0.54 mg/L (manual data). Elevated levels of tannins and lignins and electrical conductivity were measured as habitat flows passed the location. Water pH was reduced as habitat flows passed the location. The water took on a rich tea color as habitat flows passed and the water also foamed. Water temperatures reached a maximum of 76.4°F during the measurement period.

Maximum average daily flow was unknown since there is no discharge gauging station at the site. Upstream (Approximately 8.8 channel miles upstream), at Mazourka Canyon Road the maximum average daily peak flow was 125 cfs during habitat flow releases (See hydrograph in Appendix 6). Approximately 6.6 miles downstream at Reinhackle Station maximum average daily peak flow was 116 cfs. An estimated average daily peak flow of 120 cfs occurred at the Manzanar Reward location. The estimate was interpolated using channel mileage between active discharge stations.

Georges Spillgate Return and Pond

The day after dissolved oxygen dropped below 1.0 mg/L at Manzanar Reward Road, water quality measurement commenced at Georges Spillgate Return and a day later measurements began Georges Spillgate Return Pond on the Lower Owens River. Measurements were taken 3.5 feet east of the west bank of the pond by suspending the probe of the Quanta from an outstretched garden rake. The manual data collected are presented in Appendix 9. Dissolved oxygen measurements in the pond reached as low as 0.15 mg/L and never rose above 0.39 mg/L during the period of measurement. Hydrogen sulfide gas could be smelled at the location for two days. Maximum temperature in the pond during the period of measurement was 75.9°F.

Fish stress was observed as large numbers of brown bullheads (many hundreds) mouthed the surface. Large numbers of fish were jumping out of the water when the hydrogen sulfide was detected. Some fish clustered in the area where the relatively oxygen rich spillgate return water mixed with the low dissolved oxygen water of the Lower Owens River. Carp also migrated up the spillgate channel. The operation of the spillgate created an effective refuge for some of the local fish population in the pond. No dead fish were observed at the location.

Reinhackle Spring Station

Water quality data were collected manually at the Reinhackle Spring Station along the Lower Owens River during habitat flow releases. Those manual data are presented in Appendix 9. Water quality thresholds were exceeded for at least 15 days. Fish stress was observed for 7 days during habitat flows.

Fish stress observations included crayfish leaving the water, dead crayfish in the water, mosquito fish schooling in large groups adjacent to the waters edge, mosquito fish mouthing the surface, brown bullheads schooling in large numbers near the surface and brown bullheads mouthing at the surface for air. A fish kill was observed at the location. Scavenger activity was especially noticeable after the fish kill ceased with many vultures, fewer crows and some great blue herons working the area for many days.

A substantial decline in dissolved oxygen (approximately 2.6 mg/L decline) was measured as habitat flows passed the location. Dissolved oxygen levels remained below 1 mg/L at least until the end of the measuring period. The lowest dissolved oxygen concentration measured was 0.14 mg/L.

Elevated levels of tannins and lignins and electrical conductivity were measured as habitat flows passed the location. The water took on a rich tea color as habitat flows passed. Water temperatures reached a maximum of 74.9°F during the measurement period. Maximum average daily flow was 116 cfs on July 9, 2010 at this location (See Appendix 6).

Keeler Bridge

Water quality data were collected manually and by continuous recorder at Keeler Bridge during habitat flow releases. The continuous recorder was set to read every two hours. Manual data are presented in Appendix 9 and continuous recorder data are presented in Appendix 3. The continuous recorder was located on the east side of the discharge measurement structure out of the main current and consistently read lower dissolved oxygen levels than the manual reads made in midstream from the center of the footbridge. Water quality thresholds were not exceeded at any time during habitat flows at this location. No fish stress was observed at any time during habitat flows.

A substantial decline in dissolved oxygen (approximately 3.6 mg/L decline) was measured as habitat flows passed the location. Dissolved oxygen levels remained well above 1 mg/L, however. The lowest dissolved oxygen concentration measured was 1.63 mg/L. Elevated levels of tannins and lignins and electrical conductivity were measured as habitat flows passed the location. The water took on a rich tea color as habitat flows passed. Water temperatures reached a maximum of 74.3°F during the measurement period. Maximum instantaneous flow during water quality measurements was 75 cfs on July 13, 2010 (See Appendix 6). The smaller peak flows likely contributed to the better water quality conditions at Keeler Bridge than the stations upstream.

3.9.4 Dissolved Oxygen Decline Regression Analyses

Dissolved oxygen prediction for future habitat flow releases is a desirable capability in order to alert managers and the public to potential water quality problems and direct future water quality monitoring, if any. Lower Owens River discharge and temperature are the independent variables, and change in dissolved oxygen concentration is the dependent variables. The multiple linear regression analyses performed are documented below.

Both ambient air and water temperatures were colder in 2008 than when the 2009 habitat flows were released. Habitat flows were released in June 2010 and continued downriver into July 2010. Both ambient air and water temperatures were warmest in 2010 compared to other two habitat flows. Peak flows at the intake were 210, 104, and 192 cfs in the habitat flows of 2008, 2009, and 2010, respectively. Approximate ambient water temperature and dissolved oxygen levels as well as peak flows at water quality stations are shown for habitat flows in 2008, 2009, and 2010 in Seasonal Habitat Flow Table 14. Dissolved oxygen level declines experienced are also shown in Seasonal Habitat Flow Table 14.

Seasonal Habitat Flow Table 12. Habitat Flow Dissolved Oxygen Comparison 2008, 2009, and 2010

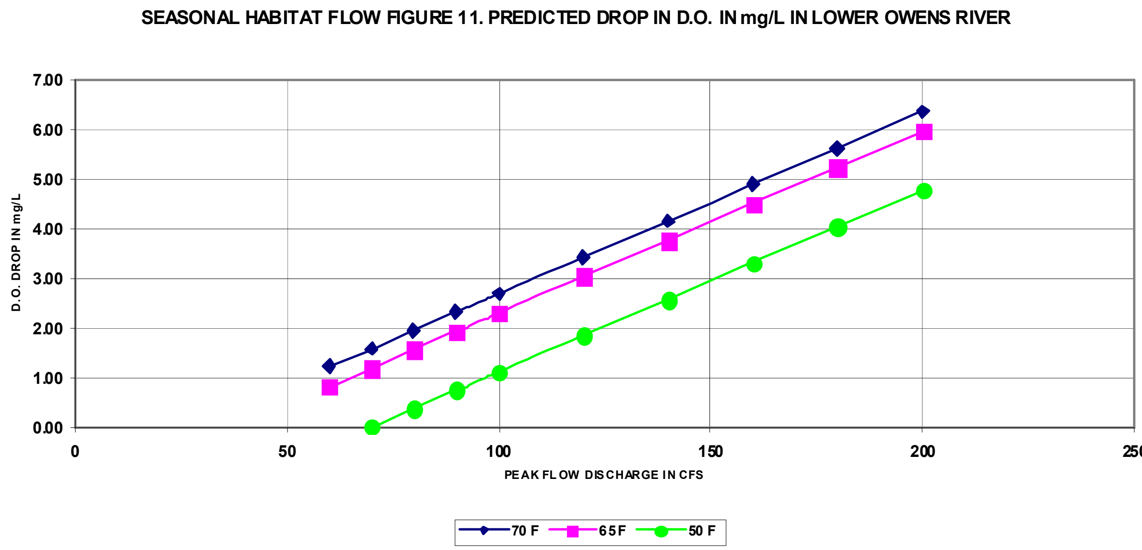
Location	2008 Q_p cfs	2009 Q_p cfs	2010 Q_p cfs	2008 T_A °F	2009 T_A °F	2010 T_A °F	2008 Ambient D.O. mg/L	2009 Ambient D.O. mg/L	2010 Ambient D.O. mg/L	2008 Delta D.O. mg/L	2009 Delta D.O. mg/L	2010 Delta D.O. mg/L
Manzanar-Reward	164	84	120(e)	48	67	72	9.0	4.2	3.8	2.5	1.5	3.3
Reinhackle Spring	171	89	116	48	64	72	9.0	4.0	2.8	4.0	1.5	2.6
Keeler Bridge	223	65	75	48	66	72	8.0	5.0	4.7	6.0	1.0	3.6

Q_p-peak flow in cfs, T_A°F- Ambient water temperature in °F, Delta D.O. – Decrease in D.O. in mg/L. (e)-estimate

A multiple linear regression analysis was performed on the data in Seasonal Habitat Flow Table 14. Ambient water temperature in Fahrenheit and peak discharge in cubic feet per second were the independent variables and the drop in dissolved oxygen concentration in milligrams per liter was the dependent variable. This multiple linear regression equation will allow prediction of dissolved oxygen decline in the future at various peak flows and temperatures in the Lower Owens River south of Mazourka Canyon Road. Seasonal Habitat Flow Table 15, below, contains the various coefficients, the constant, and the standard error of estimate and r-squared. Predicted drops in dissolved oxygen are shown in Seasonal Habitat Flow Figure 11 for three different temperatures and a range of peak flows. The peak flow rates are those experienced at the individual water quality monitoring stations and not the intake peak releases. Note that the points in the graph in Seasonal Habitat Flow Figure 11 are predicted points from the regression equation and not the original data points used in developing the regression equation.

Seasonal Habitat Flow Table 13. Change in Dissolved Oxygen Concentration Regression Equation, Coefficients, Constant, Standard Error of Estimate and R-Squared

Constant	Peak Flow (CFS)Coefficient	Temperature (F) Coefficient	Standard Error of Estimate	R-Squared
-6.502781	0.036623	0.078963	0.90	0.74

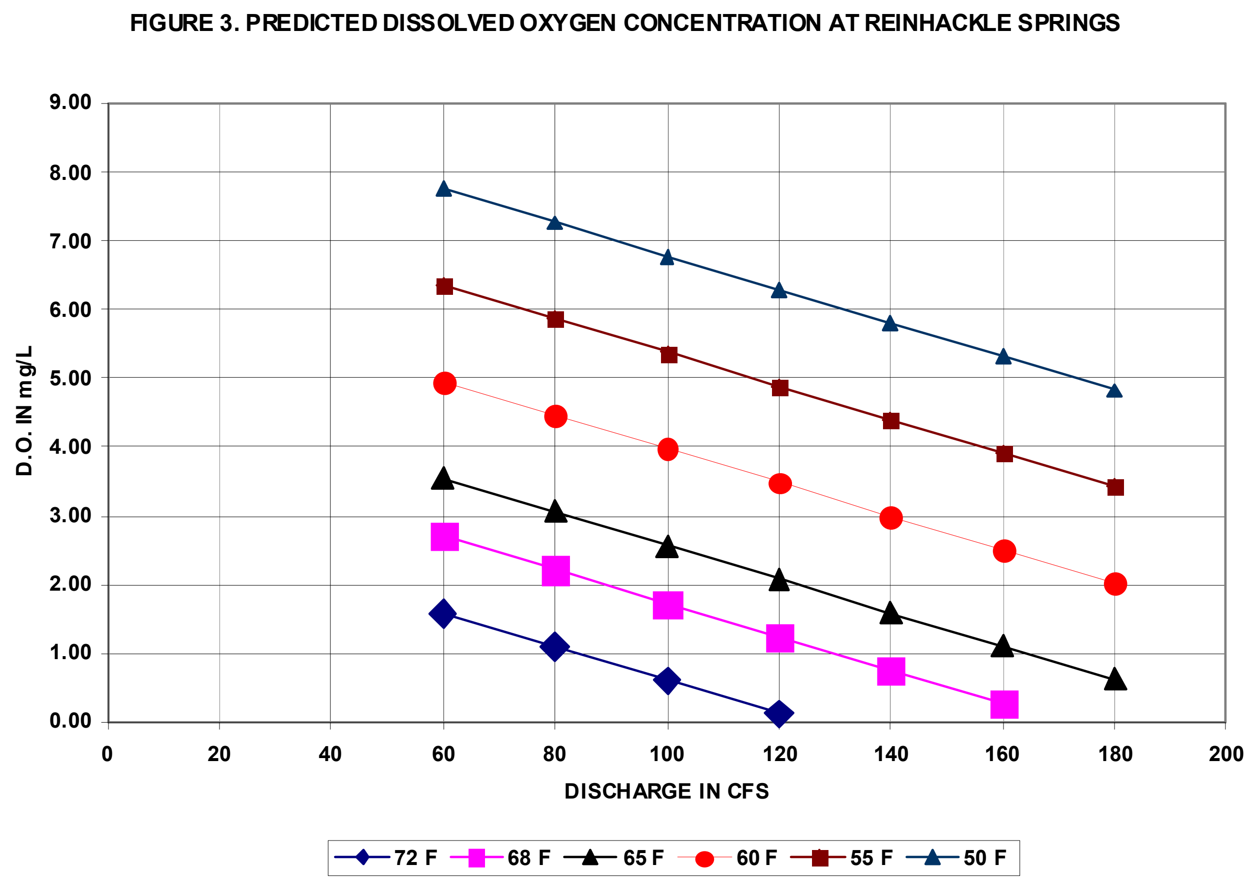


Seasonal Habitat Flow Figure 11. Predicted Drop in D.O. IN mg/L in the Lower Owens River

A second multiple linear regression equation was developed with the manual water quality data recorded in 2010 and real time discharge data from the Reinhackle Spring location (Appendix 3). The Reinhackle Spring location was chosen because of the severe water quality decline in 2010 and the complete set of data, including discharge, available. This equation predicts dissolved oxygen concentration at Reinhackle Spring given water temperature in Fahrenheit and discharge in cfs. Seasonal Habitat Flow Table 16 below, contains the various coefficients, the constant, and the standard error of estimate and r-squared. Predicted dissolved oxygen concentrations are shown in Seasonal Habitat Flow Figure 12 for selected different temperatures and a range of flows. Please note that the points in the graph in Seasonal Habitat Flow Figure 12 are predicted points from the regression equation and not the original data points used in developing the regression equation. This multiple linear regression equation is specific to the Reinhackle Spring location and predicts concentration of dissolved oxygen, not decline in dissolved oxygen concentration as in the multiple linear regression analysis above.

Seasonal Habitat Flow Table 14. Reinhackle Spring Dissolved Oxygen Concentration Regression Equation, Coefficients, Constant, Standard Error of Estimate, and R-Squared

Constant	Flow (CFS)Coefficient	Temperature (°F) Coefficient	Standard Error of Estimate	R-Squared
23.259229	-0.024404	-0.280784	0.34	0.90



Seasonal Habitat Flow Figure 12. Predicted Dissolved Oxygen Concentration at Reinhackle Springs

3.10 Summary, Conclusions, and Recommendations

All four of the primary monitoring stations (Mazourka Canyon Road, Manzanar Reward Road, Reinhackle Spring Station and Keeler Bridge) experienced substantial drops in dissolved oxygen levels as the habitat flows passed these stations in summer of 2010. Changes in other water quality parameters were also experienced. Water quality thresholds were reached at Manzanar Reward Road and Reinhackle Springs. Fish stress was observed at Manzanar Reward Road, Georges Spillgate Return Pond (where hydrogen sulfide was omitted for two days) and Reinhackle Springs. Fish kills were reported from below Manzanar Reward Road and at Reinhackle Springs.

Both ambient air and water temperatures were colder in 2008 than when the 2009 habitat flows were released. June and July 2010 habitat flows were released during the warmest water temperatures yet experienced during habitat flow releases. Daily average peak flows at the Intake were 210, 104, and 192 cfs in the habitat flows of 2008, 2009, and 2010 respectively.

Based on the water quality data collected and the regression analyses documented in this report it is possible to predict dissolved oxygen for planning habitat flows in the future. Spot measurements for a few days during future habitat flow releases at Reinhackle Springs Station can be used to check the accuracy and utility of these analyses.

Water quality monitoring has been completed for three habitat flow releases and the EIR requirement for water quality monitoring during habitat flows has been completed. Since water quality continues to degrade during the release of habitat flows under certain conditions as demonstrated in 2010, water quality monitoring could justifiably continue for tracking purposes at greatly reduced levels and cost only during those conditions expected to result in water quality degradation. It is suggested that one water quality monitoring casing be reinstalled at Reinhackle Spring flow monitoring station and one continuous recorder be installed by an LADWP hydrographer in the course of his flow measurement duties before habitat flow releases and during only those habitat flows which will be released under conditions similar to 2010. The regression equation developed for Reinhackle Spring dissolved oxygen concentration can be used to confirm that these conditions are expected. Years in which habitat peak flows or temperatures are low would not need monitoring (Similar to 2008 and 2009 habitat flow releases). The data could be acquired when an LADWP hydrographer is at the discharge monitoring site after habitat flows have passed and any trips for set up and water quality data acquisition alone would not be needed. If there is a gradual change (improvement or decline) in water quality with habitat flow conditions similar to 2010 it should be apparent in these data over time. This monitoring should be terminated if it is determined that nothing useful is being acquired.

3.11 References

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3.12 Seasonal Habitat Flow Appendices

Appendix A. Manual Water Quality Data, Graphs

Note: Gaps in the data on the graphs have several causes:

1. When no data was taken
2. When the data was eliminated according to our quality assurance-quality control procedures

Table A1. Dates of Habitat Flow Passage for Each Water Quality Measuring Station

Station	Start	Peak	Finish
Mazourka Canyon Road	6-28-10	7-5-10	7-11-10
Manzanar-Reward Road	ND	ND	ND
Reinhackle Spring Station	7-3-10	7-9-10	7-16-10
Keeler Bridge	7-7-10	7-13-10	7-20-10

Appendix B. Continuous Recorder Water Quality Data,

Note: Gaps in the data on the graphs have several causes:

1. When no data was taken-the instrument was removed for maintenance and calibration
2. When the data was eliminated according to our quality assurance-quality control procedures
3. A probe on the instrument failed

Appendix C. Habitat Flow Hydrographs at Water Quality Monitoring

Appendix D. CD of Water Quality Data, Excel Format

4.0 LAND MANAGEMENT

Introduction

The land use component of the Lower Owens Report Project (LORP) Plan is composed of project elements related to livestock grazing management. Under the land management program, the intensity, location, and duration of grazing is managed through the establishment of riparian pastures, forage utilization rates, and prescribed grazing periods (described in Section 2.8.1.3 and 2.8.2 LORP EIR 2004). Other actions include protection of rare plant populations, establishment of off-river watering sources (to reduce use of the river and off-river ponds for livestock watering) and the monitoring of utilization and rangeland trend throughout the leases to ensure that grazing rates maintain the long-term productivity.

Grazing management plans developed for the LORP leases modified grazing practices in riparian and upland areas on seven Los Angeles Department of Water and Power (LADWP) leases in order to support LORP goals. The seven leases within the LORP planning area are: Intake, Twin Lakes, Blackrock, Thibaut, Islands, Lone Pine, and the Delta. LORP-related land use activities and monitoring that took place in 2010 are presented by lease, in Section 4.8, LORP Ranch Leases.

4.1 Utilization

The *Land Management Plan* developed as part of the LORP Plan identifies grazing utilization standards for upland and riparian areas. Utilization is defined as the percentage of the current year's herbage production consumed or destroyed by herbivores. Grazing utilization standards identify the maximum amount of biomass that can be removed by grazing animals during specified grazing periods. LADWP has developed height-weight relationship curves for native grass and grass-like forage species in the Owens Valley using locally-collected plants. These height-weight curves are used to relate the percent of plant height removed with the percent of biomass removed by grazing animals. Land managers can use this data to document the percent of biomass removed by grazing animals and determine whether or not grazing utilization standards are being exceeded. Utilization data collected on a seasonal basis (mid- and end-points of a grazing period) will determine compliance with grazing utilization standards, while long-term utilization data will aid in the interpretation of range trend data and will help guide future grazing management decisions.

The calculation of utilization (by transect and pasture) is based on a weighted average. Therefore, species that only comprise a small part of available forage contribute proportionally less to the overall use value than more abundant species.

4.1.1 Riparian & Upland Utilization Rates and Grazing Periods

Under the LORP Land Management Plan, livestock are allowed to graze in riparian pastures during the grazing periods prescribed for each lease (see Sections 2.8.2.1 through 2.8.2.7 LORP EIR 2004). Livestock are to be removed from riparian pastures when the utilization rate reaches 40% or at the end of the grazing period, whichever comes first. The beginning and ending dates of the lease-specific grazing periods may vary from year-to-year depending on conditions such as climate and weather, but the duration remains approximately the same. The grazing periods and utilization rates are designed to facilitate the recruitment and establishment of riparian shrubs and trees.

In upland pastures, the maximum utilization allowed on herbaceous vegetation is 65% annually if grazing occurs only during the plant dormancy period. Once 65% is reached all pastures must receive 60 continuous days of rest for the area during the plant "active growth period" to allow seed set between June and September. If livestock graze in upland pastures during the active growth period (that period when plants are "active" in putting on green growth and seed). Maximum allowable utilization on herbaceous vegetation is 50%. The utilization rates and grazing periods for upland pastures are designed to sustain livestock grazing and productive wildlife through efficient use of forage. Riparian pastures may also contain upland habitat. If significant amounts of upland vegetation occur within a riparian pasture or field, upland grazing utilization standards will also apply to these upland habitat types. Livestock will be removed from a riparian pasture when either the riparian or the upland grazing utilization standards are met. Typically riparian utilization rate of 40% is reached before 65% use in the uplands occurs. Because of this pattern, utilization is not quantitatively sampled in adjacent upland areas, but use is assessed based on professional judgment. If utilization appears greater than 50% then utilization estimates using height weight curves will be implemented on the upland areas in the riparian field.

4.1.2 Utilization Monitoring

Monitoring methodologies are fully described in Section 4.6.2 of the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008).

Utilization is compliance monitoring and involves determining whether the utilization guidelines set forth in the grazing plans are being adhered to. Similar to precipitation data, utilization data alone cannot be used to assess ecological condition or trend. Utilization data is used to assist in interpreting changes in vegetative and soil attributes collected from other trend monitoring methods.

Utilization monitoring is conducted annually. Permanent utilization transects have been established in upland and riparian areas of pastures within the LORP planning area. An emphasis has been placed on establishing utilization monitoring sites within riparian management areas. Each monitoring site is visited prior to any grazing in order to collect ungrazed plant heights for the season. Sites are visited again approximately mid-way through the grazing period (mid-season) and again at the conclusion of the grazing period (end-of-season).

Utilization estimates are conducted on all range trend transects if there is an adequate amount of the key forage species (Alkali sacaton, saltgrass, etc…). Some range trend sites have been burned or are found in the previous dry reach section of the Owens River and are absent of perennial grasses, therefore no utilization data is available. There are additional utilization transects not associated with range trend sites. These are designated as spatial utilization transects and will be read annually as long as they represent typical use in a pasture. If they fail to be representative (e.g. fire, flooding, and change in grazing patterns) they will be temporarily or permanently abandoned.

Watershed Resources staff will update each lessee with their mid-season and end-of-season utilization results for each year. During that time the lessee will also be provided with next years target utilization stubble heights for riparian and upland management areas. This will allow LADWP and the lessees to communicate and make grazing management changes as needed in order to meet LORP goals.

Target stubble heights have been calculated for each transect and pasture on a given lease and distributed to each lessee, to allow compliance with the set utilization standards. To calculate target stubble heights, ungrazed plant heights are collected after the end of the growing season to allow the plants to reach maximum production before the grazing season begins. The ungrazed heights are then averaged by species and transect in order to calculate the stubble heights that will meet the utilization standards for each field. The resulting calculated stubble heights are based on the same height/weight curves used in the mid- and end-of-season utilization calculations. The target stubble height information is provided to the lessees so that they may monitor utilization on their lease throughout the grazing season.

All of the end-of-season utilization data are presented in table format in Section 5.9 results of land use by lease.

4.2 Range Trend

4.2.1 Overview of Monitoring and Assessment Program

Monitoring was conducted at key areas within riparian and upland management areas. Areas not identified as irrigated pasture, riparian management areas, or springs and seeps are considered upland management areas. Monitoring and assessment of key sites in riparian and upland management areas includes utilization and range trend monitoring.

The 2010 range trend data examines differences compared to baseline conditions on the ranch leases before and after the implementation of the LORP. Baseline monitoring was conducted on six leases (Twin Lakes, Blackrock, Thibaut, Islands, Lone Pine, and Delta) from 2002 to 2007. All range trend monitoring conducted after 2007 is considered to be post-implementation monitoring.

A description of monitoring methods, data compilation and analysis techniques can be found in the *2008 LORP Monitoring, Adaptive Management and Reporting Plan*. Descriptions of the range trend monitoring sites and their locations on the leases can be found in the individual lease monitoring narratives and maps in this section.

These standards are not expected to be met precisely every year because of the influence of annual climatic variation, livestock distribution and the inherent variability associated with techniques for estimating utilization. Rather, these levels should be reached over an average of several years. If utilization levels are consistently 10% above or below desired limits during this period then adjustments should be implemented (Holecheck and Galt, 2000; Smith et al., 2007).

Range trend monitoring involves the quantitative sampling of the following attributes: nested frequency of all plant species, canopy cover estimates for herbaceous plant species, line intercept sampling for shrub canopy cover, estimates for ground cover, shrub density, and age classification. Photo documentation of the site conditions is included as part of range trend monitoring.

Range trend monitoring at permanent transects provides quantitative data to determine the state of monitoring sites relative to baseline conditions and how a given site compares to the desired plant community. The desired plant community can be one of several plant communities that may occupy a site or one that has been identified through a management plan to best meet the plan's objective for the site. The desired plant community must protect the site as a minimum and may be described as dynamic, changing through time, or within a range of variability (Bedell, 1988). Until site-specific objectives are established, the desired plant community, which will serve as the benchmark for evaluating condition, will be the "reference plant community" described in the ecological site description for a site. The reference plant community is the historic climax or potential plant community described for each ecological site.

Ecological site descriptions are a tool developed by USDA Natural Resource Conservation Service (NRCS) that can be used to assist in management decisions. Ecological sites are distinct units distinguished between one another by significant differences in potential vegetation composition or production between soils (NRCS, 2003). Ecological site descriptions are represented spatially as soil map units, developed from soil survey data in the Owens Valley.

Soil surveys in the area were conducted by NRCS and the final data can be found in the *Soil Survey of Benton-Owens Valley Area, California, Parts of Inyo and Mono Counties* (USDA NRCS, 2002). Vegetation data used to develop the ecological site descriptions were collected by LADWP between 1984 and 1994. This vegetation data is also referred to as "baseline" as described in the *Green*

Book for the 1991 Agreement Between the County of Inyo and the City of Los Angeles and its Department of Water and Power on a Long Term Groundwater Management Plan for the Owens Valley and Inyo County (LTWA). Ecological site descriptions include the expected production (pounds per-acre) for each soil map unit based on growing conditions (normal, favorable, unfavorable). Yearly growing conditions are based on annual precipitation data (October through September).

Nested frequency, cover, and shrub age classification data are presented for each lease and are presented as range trend transect data tables for each sampling transect and sampling year. To compare range trend sites to the associated reference plant community in the ecological site descriptions, the soil map unit that each transect was located on was cross-referenced to the *Soil Survey of Benton-Owens Valley Area, California*, *Parts of Inyo and Mono Counties* (USDA NRCS, 2002). The soil map unit narrative references the ecological site descriptions. The ecological site description describes the potential plant community by percent composition by dried weight of the major plant species. The potential plant community information does not set a specific percent composition for each species, but specifies an expected range of abundance of each of the major plant species by soil type and ecological site. The ecological site descriptions currently available for this region (Major Land Resource Area-29 [MLRA 29]) only provide plant species composition in terms of percent composition by relative weight. The average cover values for each plant species by transect were converted to biomass (grams per-meter squared), and then pounds per-acre using conversion factors based on locally collected data provided by Montgomery-Watson Harza. Conversion factors were not available for all plant species, particularly annual and perennial forbs. In this case, a conversion factor for another species was selected and used based on similarity of growth form and habits.

The ecological site on the LORP where the majority of land management monitoring transects are located is the Moist Floodplain ecological site (MLRA 29-20). The site describes axial-stream floodplains. Moist Floodplain sites are dominated by saltgrass (*Distichlis spicata* [DISP]) and to a lesser extent alkali sacaton (*Sporobolus airoides* [SPAI]) and beardless wildrye (*Leymus triticoides* [LETR]). Only 10% of the total plant community is expected to be composed of shrubs and the remaining 10% forbs. This ecological site does not include actual river or stream banks. Stream bank information is available from the rapid assessment survey (RAS) reports presented in Section 5.0 of this document. During the late summer of 2010, Streamside Monitoring was implemented inside each of the riparian pastures within the LORP area. These data from the first year of monitoring will be presented in this chapter of the 2010 LORP Annual Report.

Saline Meadow ecological sites (MLRA 29-2) are the second most commonly encountered ecological sites on the LORP range trend sites. These sites are located on fan, stream, lacustrine terraces, and may also be found on axial stream banks. Potential plant community groups are 80% perennial grass with a larger presence of alkali sacaton than Moist Floodplain sites. Shrubs and trees comprise up to 15% of the community while forbs are only 5% of the community at potential. Saline Bottom (MLRA 29-7) and Sodic Fan (MLRA 29-5) ecological sites were also associated with several range trend sites. These are more xeric stream and lacustrine terrace sites. Saline Bottom ecological sites still maintain up to 65% perennial grasses, the majority of which is alkali sacaton, while shrubs compose up to 25% of the plant community, and forbs occupy the remaining 10%. Sodic Fan ecological sites are 70% shrubs, primarily Nevada saltbush (*Atriplex torreyi*), with a minor component of alkali sacaton of up to 25% and 5% forbs.

A comparison of existing conditions to the reference plant community was done using the protocols outlined in the *National Range and Pasture Handbook* (NRCS, 2003) during the 2002-2007 baseline period. Sites were placed in one of four classes based on their similarity to the reference plant community: (0–25%), (26-50%), (51–75%), and (76-100%). According to Holechek et al. (2004), maintaining sites in "late seral condition" which corresponds to 51-75% similarity to the reference community will provide adequate vegetation cover for soil stability, wildlife diversity, and moderate livestock production. Maintaining sites at 76-100% of climax or site potential may maximize soil stability and returns from livestock production. With regards to the ecological site descriptions for the Owens Valley, management objectives for a given area may or may not correlate directly to high similarity indexes or different seral conditions. For example, a portion of the reference plant communities described for the Moist Floodplain ecological site allow for a species composition (dry weight) of 10% for shrubs and 80% for perennial grass; optimum wildlife habitat for a particular species might require more woody plants than allowed for and livestock production would improve with a greater percent composition of perennial grass and a decrease in shrubs. Each of these scenarios are feasible through different management prescriptions but none would reflect a high similarity to the reference plant community for the ecological site. Furthermore, due to historical or existing disturbances or the presence of nonnative species, attaining “excellent condition” or 76-100% similarity may not be feasible.

It is important to point out that reference plant communities associated with ecological sites are amalgamations of both existing reference sites and professional judgment of what the site’s potential could have been under pristine conditions. The reference plant community is a conceptual model intended to help managers gauge how a site compares to what potentially could be found on similar sites; to expect any existing location to identically match the described community would be erroneous. Estimating how similar a given site is to its potential described in the ecological site description is useful when conducting an inventory across an area but if repeat monitoring is available for the site (as it is for the LORP leases) changes over time (trend), when compared to baseline data collected at the same location, will be a more effective approach to assessing the trend of that particular key area because comparisons are made directly to the site and not between the key area and a reference plant community in an ecological site description which ultimately has no physical existence. For this reason similarity indices were not calculated in 2009 and discussions in trend will not focus on changes in similarity indices. They are presented to assist in describing the general condition of the site.

Reference plant community data is derived from annual aboveground production (dry weight). The vegetative attribute of annual production and canopy cover are very sensitive to annual growing conditions and will therefore vary in accordance to natural climatic fluctuations. Annual production and canopy cover are inappropriate attributes to interpret long-term impacts of management decisions on plant communities when compared to other plant monitoring methods such as nested frequency.

Because frequency data is sensitive to plant densities and dispersion, frequency is an effective method for monitoring and documenting changes in plant communities (Mueller-Dombois and Ellenberg, 1974; Smith et al., 1986; Elzinga, Salzer et al., 1988; BLM 1996; Heywood and DeBacker, 2007). For this reason frequency data was the primary means for evaluating trend at a given site. Based on recommendations for evaluating differences between summed nested frequency plots (Smith et al., 1987 and Mueller-Dombois and Ellenberg, 1974), a Chi-Square analysis with a Yate’s correction factor was used to determine significant differences between years. Analysis compared 2010 data to the prior sampling period (2009). If there were significant differences, 2010 results were compared to all sampling events during the baseline period to determine if results in 2010 were ecologically significant or remained within the typical range of variability observed for that particular site.

During the preproject period, a range of environmental conditions were encountered including “unfavorable” growing years when precipitation in the southern Owens Valley was less than 50% of the 1970-2009 average, “normal” years, when precipitation was 50-150% of average, and “favorable” conditions when precipitation was greater than 150% of average. Many of the monitoring sites responded to the variability in precipitation during the baseline period. This provided the

Watershed Resources staff an opportunity to sample across a broad amplitude of ecological conditions for these sites which contributed to a robust baseline dataset. Data from the Lone Pine rain gauges are used to determine the growing conditions for each sampling year on the Islands, Lone Pine, and Delta Leases. Precipitation data from Independence are used for the Thibaut and Blackrock Leases, and data from the Intake will be used for the Intake, Twin Lakes and northern portion of the Blackrock Leases. Precipitation data is located in the Land Management Appendix 2.

4.3 Irrigated Pastures

Monitoring of irrigated pastures consisted of Irrigated Pasture Condition Scoring following protocols developed by the (NRCS, 2001). Irrigated pastures that score 80% or greater are considered to be in good to excellent condition. If a pasture rates below 80%, changes to pasture management will be implemented.

All irrigated pastures were monitored in 2010. Pastures that scored 80% or below will be monitored in 2011. The results of the monitoring will be presented in a table format by lease in Section 4.9. Irrigated pasture condition scoring for all pastures will take place again in 2013.

4.4 Fencing

The LORP EIR identified approximately 44 miles of new fencing to be built in the project area to improve grazing management and help meet the LORP goals. The new fencing consisted of riparian pastures, upland pastures, riparian exclosures, rare plant exclosures, and rare plant management areas. Fence construction began in September 2006 and was completed in February 2009 with the total fence miles constructed being approximately 50 miles. The fence construction that was completed in January and February of 2009, took place on the Twin Lakes, Blackrock, and Lone Pine Leases. A portion of the boundary fence (1.5 miles) between the Twin Lakes and Blackrock Leases was replaced. The Blackrock Lease has two 0.25-acre rare plant exclosures built in the Robinson and Little Robinson Pastures and two riparian exclosures were constructed in the White Meadow Riparian and Wrinkle Riparian Fields. An additional fence in the White Meadow Field was also constructed due to the grazing prescriptions placed on the Winterton Unit of the Blackrock Waterfowl Management Area during periods of flooding. The Lone Pine Lease had a drift fence constructed just north of U.S. Highway 136 on the east side of the river. This fence was constructed by the lessee with materials provided by LADWP.

4.5 Rare Plants

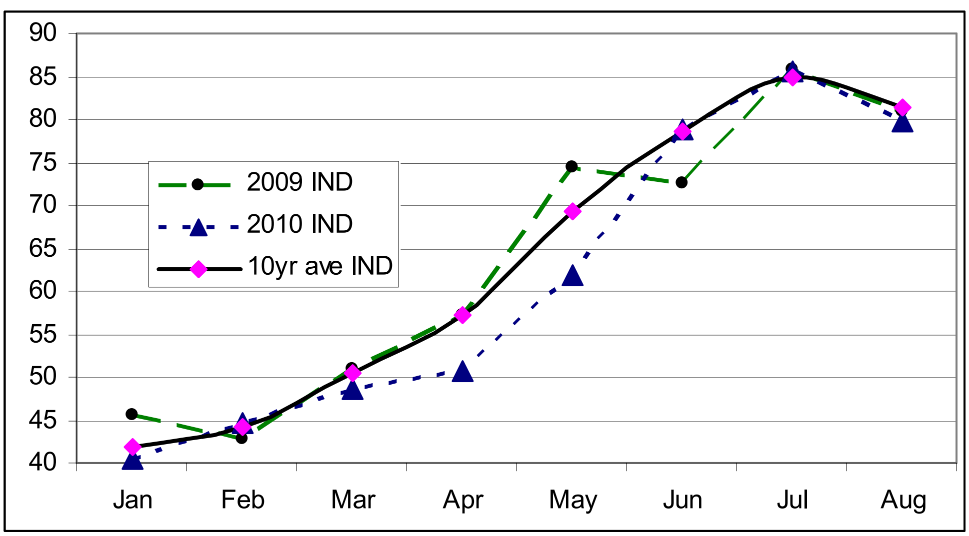
Baseline data for the LORP rare plant trend plots was collected in 2009. The first year post implementation data was collected in 2010. There are 15 trend plots within the LORP located in four rare plant populations on two separate ranch leases (Blackrock and Thibaut Leases). Target species are Owens Valley checkerbloom (*Sidalcea covillei*) and Inyo star-tulip (*Calochortus excavatus*). *S. covillei* is a state endangered species, endemic to the Owens Valley that occurs in alkali meadows. *C. excavatus* is not a state or federally listed species but is a Species of Special Concern. A mesic species, *C. excavatus* occurs in alkaline meadows and seeps transitioning into chenopod scrubland. These plots will be monitored for five years to evaluate population trends. If trends are static or suggest that grazing is beneficial the exclosure fencing will be removed following the fifth year of monitoring. In contrast, if trends in data support that exclosures are needed to protect these populations of *S. covillei*, then LADWP will construct additional exclosures (or a practical variation thereof) and monitoring will continue as needed.

4.5.1 Rare Plant Monitoring Methods

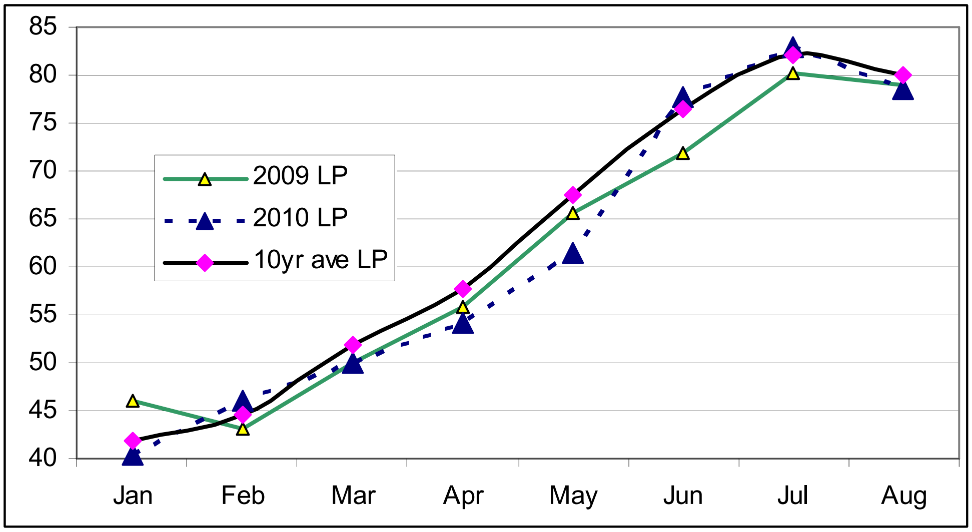
The LORP rare plant trend plots were established inside and outside exclosures by sinking a piece of rebar into the earth and taking a GPS point of the location. The plots were relocated using a hand-held GPS unit and a metal detector. Two 50-meter measuring tapes were used to delineate the plot into four sections with a radius of 3.62 meters. Target species were marked with a pin flag to aid in accurately identifying all individuals within the plot. Photos were taken in all cardinal directions depicting the plot area containing flagged plants. One measuring tape was then attached to the rebar in the center of the plot to record the distance of individuals within a radius of 3.62 meters. A compass was used to record the bearing of individuals from the center of the plot. The bearing and distance from the center of the plot is utilized in subsequent years to relocate individual plants. Data on recruitment, persistence, size of individuals, and flowering and seed presence were collected.

4.6 Discussion Range Trends in 2010

Because of the heterogeneity associated within the LORP area, it is not realistic to present broad summaries of changes in plant community dynamics across entire landscapes. This report concentrates discussion to the lease level within the context of pasture and ecological site. Land Management Table 1 provides a generalized overview of differences in frequency from 2010 data compared to 2009 results. Seasonal precipitation in 2010 was above average during the cool season for all three measuring locations (Intake, Independence, and Lone Pine) and slightly below average for the fifth consecutive year in Independence and Lone Pine, and for the fourth consecutive year at the Intake (Appendix 2). Results from Land Management Table 1 indicate that 2010 was fairly static in that most differences between years remained within ranges previously observed for the site. The lack of change between 2009 and 2010 occurred despite receiving an above average amount of cool season precipitation (October-March) and no major departures in livestock utilization on nearly all transects in 2010. One explanation for the relatively static trend is that during the 2010 early growing season (March-May), monthly mean temperatures were substantially cooler than the 10-year average. Cool season precipitation in 2009 was either average or below average for the three measuring stations yet trend increased or remained static on most transects. Mean monthly temperatures were warmer in 2009 and cooler in June which would have made conditions more favorable for plant growth.



Land Management Figure 1. 2009, 2010, and 10-Year Average for Mean Monthly Temperatures from January to August, Independence



Land Management Figure 2. 2009, 2010, and 10-Year Average for Mean Monthly Temperatures from January to August, Lone Pine

Most changes in the 2010 trend occurred on the Moist Floodplains sites, however, most of the transects sampled were also located on Moist Floodplains. Saltgrass decreased on seven Moist Floodplain sites, one of those decreased outside of typical parameters for the transect; however, that same transect is in the Islands and has been partially flooded since the return of flows to the Lower Owens River. Only bassia or fivehorn smotherweed (*Bassia hyssopifolia,* [BAHY]) appeared to take advantage of the wet cool season precipitation increasing on eight sites. The increase was well beyond historic ranges on four of those sites, all of which were on the dry incised floodplain referred to in this report as the former dry-reach and mapped as Reach 2.

Land Management Table 1. Significant Changes from 2009 to 2010 in Frequency
For selected species across all transects, grouped by ecological sites.

	INCREASE	DECREASE
Moist Floodplain = 39 sites		
DISP	0	7 (*1*)
ATTO	3 (*1*)	1
SPAI	3 (1)	2
BAHY	8 (*4*)	2
Saline Meadow = 13 sites		
DISP	1	1
ATTO	nc	nc
SPAI	3	2
BAHY	nc	nc
Sodic Fan = 4 sites		
DISP	nc	1
ATTO	nc	nc
SPAI	1	nc
BAHY	nc	nc
Saline Bottom = 4 sites		
DISP	nc	1
ATTO	nc	nc
SPAI	nc	nc
BAHY	nc	nc
Sandy Terrace = 1 site		
DISP	nc	nc
ATTO	nc	nc
SPAI	nc	nc
BAHY	nc	nc
Total Number of Transects =61	19	17

nc=no change Numbers indicate number of sites where a significant change between 2009 and 2010 occurred, numbers within parentheses indicate number of sites whose change in 2010 ranged outside of the historic range of variability observed during prior sampling periods.

In 2009, results on the former dry reach section of the Lower Owens River indicated that there had been some differences when compared to the baseline period but to call these differences a change in trend with only one data point would be difficult to support. With a second year of data to substantiate changes observed in 2009 several trends appear to be emerging within the dry reach section.

There is a distinct trend of percent bare ground decreasing over time on all twelve transects; several decreases in bare ground have exceeded 75% (Land Management Table 1). Inversely, litter has increased on all twelve transects with swings similar to those seen with bare ground. Many of the sites experienced several large increases in bassia cover and frequency (Land Management Tables 3 and 4). The first event occurred in the spring and summer of 2007, unfortunately sampling of live cover of herbaceous plants and frequency was not conducted that year. The second large pulse occurred in the spring and summer of 2010 where both frequency and cover increased dramatically on most transects. As bassia begins to decompose and lay down above the soil surface, percent litter gradually increases. This gradual increase in litter seen in the dataset is misleading. The protocol definition for litter requires dead vegetative material to be prostrate above the soil surface and the definition for "standing dead" only applies to woody perennial plants. Therefore, bassia eludes detection when monitoring until the material finally lies down. In reality, litter is high and not dissimilar to live cover estimates of bassia. Litter will likely remain high into the future in response to high bassia production in 2010. There were no distinguishable patterns in frequency and cover data between the three burned and nine unburned sites.

Land Management Table 2. Bare Ground and Litter Cover (%)

From sampling periods between 2003 to 2010 along Dry Incised Floodplain transects.

		2003	2004	2005	2006	2007	2009	2010
BLKROC_10	Bare Ground	32	44			39	25	13
	Litter	63	51			60	75	87
BLKROC_11	Bare Ground	35	37			34	22	19
	Litter	49	57			63	76	78
BLKROC_14	Bare Ground	75	92			84	6	3
	Litter	23	7			12	94	96
BLKROC_15	Bare Ground	22	32	36		30	9	5
	Litter	75	67	61		69	91	94
BLKROC_16	Bare Ground	38	47	51		44	33	19
	Litter	59	50	48		55	66	79
BLKROC_17	Bare Ground	39	47	50		38	41	32
	Litter	59	53	50		56	59	65
THIBAUT_04	Bare Ground	12	11			16	0	0
	Litter	87	88			84	100	100
THIBAUT_05	Bare Ground	15	34	32		24	6	2
	Litter	75	66	62		75	94	98
THIBAUT_06	Bare Ground	19	28	41		41	20	10
	Litter	76	71	61		59	80	87
THIBAUT_07	Bare Ground	94	97	97		94	20	5
	Litter	5	3	3		5	80	95
TWINLAKES_04	Bare Ground	33	34			47	16	3
	Litter	64	63			48	84	97
TWINLAKES_06	Bare Ground				27	20	10	0
	Litter				68	74	89	100

Shaded rows were burned in the winter of 2007

Land Management Table 3. Bassia Cover (%)

Based on ocular estimates within quadrats from 2003 to 2010 along dry incised floodplain transects.

Transect_Name	2003	2004	2005	2009	2010
BLKROC_10	1	1		2	1
BLKROC_11	3	1		1	1
BLKROC_14	5	2		1	51
BLKROC_15	0	0	0	3	13
BLKROC_16	0	0	0	3	6
BLKROC_17					0
THIBAUT_04	1	1			22
THIBAUT_05	3	0	1	0	5
THIBAUT_06		0	0	7	30
THIBAUT_07	3	1	2		51
TWINLAKES_04	5	1	0	3	8
TWINLAKES_06				2	3

Shaded rows were burned in the winter of 2007

Land Management Table 4. Changes in Bassia Frequency

On transects located within the dry incised floodplain between years 2002 and 2010.

Transect_Name	2002	2003	2004	2005	2009	2010
BLKROC_10	0	3	64		47	24**
BLKROC_11	0	42	38		59	44*
BLKROC_14	0	14	67		2	71
BLKROC_15		6	2	17	23	35
BLKROC_16		3	7	4	17	40**
BLKROC_17		0	0	0	0	5
THIBAUT_04	0	2	30		0	58**
THIBAUT_05	0	19	9	42	2	29**
THIBAUT_06	0	2	1		10	88**
THIBAUT_07		12	34	37	0	95**
TWINLAKES_04	0	6	41		15	24
TWINLAKES_06					22	29

** indicates a significant difference, α≤0.1,*
*** indicates changes beyond all previous sampling events.*
Shaded rows were burned in the winter of 2007

Land Management Table 5 points towards an increase in mature and decadent Nevada saltbush (ATTO) densities on BLKROC_10, BLKROC_15, BLKROC_16, BLKROC_17, THIBAUT_04, THIBAUT_07 and TWINLAKES_06, particularly after 2005, which coincide with the return of water to the river in December, 2006. The three sites which were burned in 2007 did not respond in any consistent pattern. Canopy cover taken from line intercept data further supports the trend of ATTO benefiting from the rewatering of the Lower Owens (Land Management Table 6.). Nine out of the twelve transects have shown an increase in ATTO canopy beginning in 2007 and continuing into 2010.

Land Management Table 5. Shrub Densities of Mature and Decadent ATTO Totals
From 2002 to 2010 along dry incised flood plain transects.

Transect_Name	2002	2003	2004	2005	2006	2007	2009
BLKROC_10	4	7	5			62	130
BLKROC_11	13	29	65			61	47
BLKROC_14						17	227
BLKROC_15		25	49	25		45	53
BLKROC_16		11	22	10		59	70
BLKROC_17		21	26	17		91	90
THIBAUT_04	4	20	10			73	56
THIBAUT_05		5		6		3	0
THIBAUT_06		3	2	2		4	2
THIBAUT_07		2				2	37
TWINLAKES_04	15	27	14			14	31
TWINLAKES_06					19	33	73

Shaded rows were burned in the winter of 2007

Land Management Table 6. Line Intercept Cover (%) for Nevada Saltbush Canopy
From 2003 to 2010 along dry incised floodplain transects.

Transect_Name	2003	2004	2005	2006	2007	2009	2010
BLKROC_10	3	5			16	53	60
BLKROC_11	14	17			18	19	19
BLKROC_14	9	0			10	27	34
BLKROC_15	25	15	19		33	35	40
BLKROC_16	6	3	5		17	44	44
BLKROC_17	38	6	6		28	38	69
THIBAUT_04	10	7			35	47	48
THIBAUT_05	1	1	0		1	0	0
THIBAUT_06	1	1	2		11	2	2
THIBAUT_07	1	1	1		5	15	17
TWINLAKES_04	14	22			11	18	16
TWINLAKES_06				5	11	50	67

Shaded rows were burned in the winter of 2007

In summary, the presence of water both in the river and the rising water table beneath the adjacent floodplains have enabled Nevada saltbush canopy, and to a lesser extent density, to steadily increase. During average to above average precipitation in late winter and spring, following successful germination, bassia is similarly able to capitalize on the shallow water table beneath the floodplain. Surface litter has increased substantially on most sites. Range trend datasets on three sites, which were burned, have not differed from sites that were not burned.

These changes, which have occurred in the last three years, have been gradual and have not necessarily moved the general area any closer to the potential described for Moist Floodplains. However, in 2000, prior to rewatering, 234 acres of Reach 2 or the dry incised floodplain were mapped as barren. These barren areas shifted in 2010 to 34% rabbitbrush/Nevada saltbrush scrub, 37% bassia, and 25% of the same areas remaining barren. An occupation of barren areas by bassia is a positive change, in that, small mammal habitat increases, as well as, the additions of organic material into soils in the form of litter, which will assist in future successional changes. Nevada saltbush canopies are increasing and are not negatively influenced by bassia. Large increases in Nevada saltbush canopy will reduce bassia canopy. Cover data of the eight Nevada saltbush sites, (THIBAUT_07, BLKROC_10, BLKROC_16, BLKROC_14, THIBAUT_04, BLKROC_15, BLKROC_17, TWINLAKES_06), have steadily increased since 2007.

Bassia canopy can be reduced in two ways: either through burning or allowing Nevada saltbush canopies to increase. Fire will provide a temporary reduction of bassia with the trade off of losing Nevada saltbush canopy and density, and a loss of organic material inputs into the "A horizon." The result of a burn will be basically a "resetting" of the system. In sites where there is no perennial grass understory there will be no perennial grasses after the burns. Bassia is an aggressive, deep rooted, ruderal species which will likely out-compete any seeded perennial grasses in the same areas. Bassia plants, once accessing the shallow water table, can easily reach heights of five feet by June of the same summer when both sacaton and saltgrass are just entering their maximum growth periods. The second approach in controlling bassia is to permit native shrubs to gradually out-compete the plant. This approach will improve soils and provide wildlife habitat at the same time.

4.7 Streamside Monitoring for Woody Species Generation

Monitoring riparian conditions, especially woody species development, is essential to determining progress toward LORP goals within riparian areas. Existing vegetation monitoring transects are primarily located away from stream banks. As a consequence, the MOU Consultants made an adaptive management recommendation in 2009 to include additional monitoring along stream banks within the LORP to pick up information on woody recruitment that was otherwise being missed. The approach evaluates vegetation and bank attributes within a 3-meter wide belt extending from the summer base flow water's edge into the adjacent riparian area. Additional information on riparian development near the river's edge will aid in evaluating the effectiveness of LORP management strategies and will provide insight to successes of the project and identify areas for improvement. This streamside monitoring effort will be conducted twice a year for the next three years, and then once annually at three year intervals until the completion of all project monitoring in 2022. These procedures were designed to be completed mid- to late summer/early fall and in the spring, corresponding with livestock rotation. The first three years of monitoring are designed to establish initial conditions and determine initial ecological response to natural and induced influences. Following this introductory period, sampling at three year intervals allows vegetation and stream banks time to respond. In some cases, the period may be extended because of slower recovery rates.

4.7.1 Streamside Monitoring for Woody Species Generation Methods

The streamside monitoring protocol used on the LORP was designed to provide managers with measurable long-term trend monitoring of riparian vegetation, woody species presence and recruitment, and condition of the stream bank. A multi-disciplinary team including LADWP, lessees, and the MOU consultants selected one designated monitoring area (DMA) on each side of the river within each riparian pasture and exclosure in each ranch lease. Monitoring procedures are compatible with accepted methods tested over time by the Bureau of Land Management and the U.S. Forest Service.

Representative DMAs were located within identified riparian complexes and in reaches of the river that are representative of larger areas. These riparian complexes were identified on the basis of their overall geomorphology, substrate characteristics, stream gradient and associated water flow features, and general vegetation patterns. They were also selected based on their sensitivity to management influences and feasibility of being monitored and measured over time. As such, they will have the potential to respond and demonstrate measurable trends in condition resulting from changes in management activities influencing stream channels and riparian vegetation (e.g., stream flows, plant competition, limited grazing, invasive species, and channel changes). In addition, representative DMAs were not selected near bridges, culverts, tributary confluences, at water gaps or locations intended for livestock concentration, or areas where riparian vegetation and stream bank conditions are a result of site-specific impacts (such as flow measurement stations, or along fences where use is not representative of the riparian area).

Reference DMAs were also selected within exclosures or other control areas to obtain reference data useful for identifying potential condition and for establishing initial desired condition objectives for a similar riparian complex.

After each DMA was selected, a line transect was established along the water's edge, on each side of the stream that extends approximately 110 meters (361 feet). Each transect was named according to lease, transect number, and side of the river in which it occurred, using "*a*" for the west side and "*b*" for the east side (e.g., Islands_Belt1a, Lone Pine_Belt2b). Staff measured vegetation composition and bank condition along each line transect, as well as woody species presence, condition, and use; in 40 quadrats, measuring 0.5 meters by 3 meters, along each transect. The upstream and downstream limits of the 3-meter wide survey area were recorded with GPS units and were used to draw a polygon of the survey area later analyzed using repeat aerial imagery. Photographs were taken at the beginning, middle, and end of the transects (quadrats 1, 20, and 40) in four directions: upstream, downstream, toward the water, and toward the bank from the water's edge. Additional photos were taken if necessary to document specific site conditions or to demonstrate trends across sites (e.g., wildlife use, vegetation communities).

Each transect began a random number of meters (1-10) upstream of the start point and were run in an upstream direction. (These random numbers were generated electronically prior to conducting field work.) The monitoring frame was placed with a 0.5-meter side along the wetted edge of the 40 cfs summer base flow and the 3-meter sides perpendicular to the stream channel. The monitoring frames were spaced approximately 2.5 meters apart (by pace) so that 40 sampling points occurred along each transect. At each sampling point, an ocular evaluation of bank condition, for the 0.5-meter band bordering the water's edge, was recorded as either barren, vegetated, broken/actively eroding, root stabilized, or litter. In addition, five point intercepts along each 0.5-meter edge (12.5 centimeters apart) were recorded for ground cover. Ground cover attributes were recorded as vegetation by species, litter, wood (>1 centimeters), dung, fine/silty soil, sandy soil, gravelly soil, cobble, or water. The total number of sample points for bank condition was 40 and ground cover was 200.

Methods for recording woody species presence, recruitment, and condition within the LORP are modified from Winward (2000). Within each 0.5 by 3-meter quadrat, the number of woody riparian obligates (such as cottonwoods [*Populus sp.*] and willows [*Salix sp.*]) rooted in the frame were recorded and age classed as seedling, juvenile, mature, decadent, or dead. (If stems immediately outside the frame were determined to be connected to those inside the plot, age class for the entire plant was recorded.) The same information was recorded for woody species that intersected the vertical projection of the quadrat that were not rooted within the plot; these individuals were recorded as canopy cover. Woody shrubs such as saltbush (*Atriplex lentiformis ssp. torreyi*) and rabbitbrush (*Ericameria nauseousus*) were not recorded if they were found in the frame, as upland shrub recruitment in the riparian corridor is not a goal of the LORP.

In addition to the number and age class of rooted and canopy cover, evidence of woody species use was recorded in terms of browsing, highlining, or presence of antler rubs. Field staff also noted the presence of additional impacts to woody species. For the complete protocol used in this effort, specific guidelines for age classing, and field data sheets, please refer to Land Management Appendix 4. In addition to data collected in the field, riparian vegetation of both the monitoring belts and the area of the wetted-channel contained within the belts were mapped using digitized and orthorectified, 2009 color aerial-photography (0.09 $meter^2$ resolution) in *ArcGIS*. Using "head's-up" digitizing methods, vegetation communities within the individual belts and the channel were classified into one of the following classes: marsh, wet-meadow, woody vegetation, or open water and the most dominant species for each class listed. Further, barren depositional areas within the channel were labeled "stream bar." Field data and notes were additionally used to assist in the classification. Lastly, the relative area for each class was calculated using *ArcGIS*.

4.7.2 Results From Streamside Monitoring for Woody Species Generation

LADWP Watershed Resources staff conducted streamside monitoring on 32 transects within the LORP in September 2010. A map and site description of each transect is provided below by ranch lease. This discussion provides general site observations including bank condition and point intercept summary data for ground cover along the wetted edge of the 40 cfs summer base flow. It also includes information on species encountered while sampling the banks and woody species noted as rooted or canopy cover in the 40 quadrat frames per transect. If relevant, this information also describes any use to these woody species that may be occurring from livestock or other wildlife. There was no statistical analysis run on this data, as it provides baseline information for the LORP Streamside Monitoring effort and no statistical trend has yet been established. Also included in this section is area covered by woody vegetation along each 3-meter wide belt, as well as area of open water and vegetation within the wetted portion of the channel.

4.7.3 General Trends in Streamside Monitoring

LADWP Watershed Resources staff conducted streamside monitoring on 32 transects within the LORP in September 2010. Of these, one site (LonePine_Belt2a) yielded recruitment of desirable woody species. Land Management Tables 7 and 8 (below) show desirable woody species noted in quadrat frames as rooted or canopy cover at all sites, as well as sites that showed use of these individuals by livestock or other wildlife.

Land Management Table 7. Streamside Monitoring (Rooted)

Table 1. 2010 LORP Streamside Monitoring (Rooted)		Narrowleaf Willow (SAEX)					Goodding's Willow (SAGO)					Red Willow (SALA3)					Desert Olive (FOPU)					Wood's Rose (ROWO)					Woody Use				Desirable Woody					
	Site Name	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Browsing	High Lining	Antler Rubs	Other	Total Seedlings	Total Juvenile	Total Mature	Total Decadent	Total Dead	**Total desirable (no decadent/dead)**
Rooted	TWN_Belt1a																														0	0	0	0	0	**0**
	TWN_Belt1b			1																											0	0	1	0	0	**1**
	TWN_Belt2a																														0	0	0	0	0	**0**
	TWN_Belt2b																														0	0	0	0	0	**0**
	BLK_Belt1a			1					2																						0	0	3	0	0	**3**
	BLK_Belt1b																														0	0	0	0	0	**0**
	BLK_Belt2a																														0	0	0	0	0	**0**
	BLK_Belt2b																														0	0	0	0	0	**0**
	BLK_Belt3a																														0	0	0	0	0	**0**
	BLK_Belt3b								4																		x				0	0	4	0	0	**4**
	BLK_Belt4a																														0	0	0	0	0	**0**
	BLK_Belt4b								2																						0	0	2	0	0	**2**
	BLK_Belt5a																														0	0	0	0	0	**0**
	BLK_Belt5b		2	23					1																						0	2	24	0	0	**26**
	BLK_Belt6a							1																							0	1	0	0	0	**1**
	BLK_Belt6b																														0	0	0	0	0	**0**
	BLK_Belt7a		4	21																											0	4	21	0	0	**25**
	BLK_Belt7b								1																						0	0	1	0	0	**1**
	Thibaut_Belt1a								1																						0	0	1	0	0	**1**
	Thibaut_Belt1b																														0	0	0	0	0	**0**
	Islands_Belt1a		1						1																						0	1	1	0	0	**2**
	Islands_Belt1b																														0	0	0	0	0	**0**
	Islands_Belt2a								3																						0	0	3	0	0	**3**
	Islands_Belt2b																		1												0	0	1	0	0	**1**
	Lone Pine_Belt1a										1													5		1					0	0	0	0	1	**0**
	Lone Pine_Belt1b			14																											0	0	14	0	0	**14**
	Lone Pine_Belt2a								1	1		1																			1	0	1	1	0	**2**
	Lone Pine_Belt2b													2		1															0	0	2	0	1	**2**
	Delta_Belt1a			7																											0	0	7	0	0	**7**
	Delta_Belt1b		1	31	1	1					1																				0	1	31	1	2	**32**
	Delta_Belt2a								1																						0	0	1	0	0	**1**
	Delta_Belt2b																														0	0	0	0	0	**0**
Total		0	8	98	1	1	0	1	17	1	2	1	0	2	0	1	0	0	1	0	0	0	0	5	0	1					**1**	**9**	**123**	**2**	**5**	133

Land Management Table 8. Streamside Monitoring (Canopy)

Table 2. 2010 LORP Streamside Monitoring (Canopy)		Narrowleaf Willow (SAEX)					Goodding's Willow (SAGO)					Red Willow (SALA3)					Desert Olive (FOPU)					Wood's Rose (ROWO)					Woody Use				Desirable Woody					
	Site Name	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Seedling	Juvenile	Mature	Decadent	Dead	Browsing	High Lining	Antler Rubs	Other	Total Seedlings	Total Juvenile	Total Mature	Total Decadent	Total Dead	Total desirable (no decadent/dead)
Canopy	TWN_Belt1a																														0	0	0	0	0	**0**
	TWN_Belt1b																														0	0	0	0	0	**0**
	TWN_Belt2a																														0	0	0	0	0	**0**
	TWN_Belt2b																														0	0	0	0	0	**0**
	BLK_Belt1a			1					8																						0	0	9	0	0	**9**
	BLK_Belt1b			1					1																						0	0	2	0	0	**2**
	BLK_Belt2a								2																						0	0	2	0	0	**2**
	BLK_Belt2b																														0	0	0	0	0	**0**
	BLK_Belt3a								12		3																	x			0	0	12	0	3	**12**
	BLK_Belt3b								28		2																				0	0	28	0	2	**28**
	BLK_Belt4a								12					6																	0	0	18	0	0	**18**
	BLK_Belt4b								8																						0	0	8	0	0	**8**
	BLK_Belt5a																														0	0	0	0	0	**0**
	BLK_Belt5b			21					5																						0	0	26	0	0	**26**
	BLK_Belt6a								5																		x				0	0	5	0	0	**5**
	BLK_Belt6b																														0	0	0	0	0	**0**
	BLK_Belt7a		7	34																											0	7	34	0	0	**41**
	BLK_Belt7b								12					1																	0	0	13	0	0	**13**
	Thibaut_Belt1a								2																						0	0	2	0	0	**2**
	Thibaut_Belt1b																														0	0	0	0	0	**0**
	Islands_Belt1a								4		4																x				0	0	4	0	4	**4**
	Islands_Belt1b								3																						0	0	3	0	0	**3**
	Islands_Belt2a								16	1									4	1	1										0	0	20	2	1	**20**
	Islands_Belt2b								14																						0	0	14	0	0	**14**
	Lone Pine_Belt1a								5		6													6							0	0	5	0	6	**5**
	Lone Pine_Belt1b			8					4																						0	0	12	0	0	**12**
	Lone Pine_Belt2a								17																						0	0	17	0	0	**17**
	Lone Pine_Belt2b													15		1															0	0	15	0	1	**15**
	Delta_Belt1a			8																											0	0	8	0	0	**8**
	Delta_Belt1b			87							1																				0	0	87	0	1	**87**
	Delta_Belt2a								2	1																					0	0	2	1	0	**2**
	Delta_Belt2b																														0	0	0	0	0	**0**
Total		0	7	160	0	0	0	0	160	2	16	0	0	22	0	1	0	0	4	1	1	0	0	6	0	0					**0**	**7**	**352**	**3**	**18**	**359**

4.7.4 Streamside Monitoring Summary and Conclusions

LADWP Watershed Resources staff surveyed 32 transects in 16 locations along the Lower Owens River in September 2010. Of these, one site (LonePine_Belt2a) yielded recruitment of desirable woody species; including the presence of one red willow seedling. BLK_Belt5b, BLK_Belt7a, Islands_Belt1a, and Delta_Belt1b had 1-4 juvenile narrowleaf willow, and BLK_Belt6a also had 1 juvenile Goodding's willow present. These individuals occurred largely where there was an established riparian corridor already in place and did not necessarily occur on point bars, as might be expected in most river systems. These juveniles are likely surviving recruits from the first few years following LORP implementation, but are not a product of the present year.

Most banks in surveyed areas were vegetated or covered with litter, so there were not a lot of open areas in which recruitment could occur. This is positive in the respect that banks along the Lower Owens River are not barren and have become dominated by many desirable wetland obligates since implementation of the LORP (e.g., rushes, sedges, grasses). (There were a few remnant saltcedar located along the bank, but there was very little weedy encroachment within the surveyed belts and no pepperweed noted at any location.) Total bare ground cover at the water's edge averaged only 11% across all sites based on point intercept data. Much of the bare ground that was noted was located beneath mature tree willows with a direct seed source readily available, but woody recruitment was not observed in these areas during this monitoring effort. However, recruitment was observed during the RAS in similar situations.

Wildlife use was apparent at many of the sites, particularly by elk, raccoons, and Owens Valley Vole; demonstrated primarily by scat, paw prints, and remnants of food. Broken/eroding banks were only apparent at a few sites due to livestock or wildlife use or sloughing on the outside bends of the river, and overall, these issues were not significant. Instead, what seemed to be a more notable detriment to recruitment was competition from tules and cattails along the wetted edge. Tules/cattails not only occupied much of the wetted edge in their vegetated state, but also as standing dead and roots in the soil column, providing substantial competition and leaving little room for the recruitment of other species. Also, the 40 cfs base flow did not always correspond with the historic bank of the Lower Owens River. More specifically, the wetted edge was often a meter or more from the historic bank/terrace, with tules encroaching into much of this lower lying area (an area that could potentially support woody species if not already occupied). The presence of cattails was more apparent in the upper reaches (Twin Lakes to Islands sites) and tules were more dominant in the lower reaches (BLK_Belt7 south to the Delta sites). It was common to see a combination of both in the middle reaches of the river.

The increasing encroachment of cattails and tules into the wetted channel may be linked with decreasing woody recruitment in the LORP. While 2010 was the first year that the LORP Streamside Monitoring effort was performed, Rapid Assessment Data from 2008, 2009, and 2010 suggest a downward trend in woody recruitment sites within the LORP. More specifically, LORP RAS data indicated that there were 211 recruitment sites documented along the river in 2008, 70 in 2009, and only 27 in 2010. While it is too early to see an apparent trend from the 2010 Streamside Monitoring data alone, the decreasing number of recruitment sites observed during the LORP RAS is consistent with data from this year's preliminary streamside data. It will be useful to pair qualitative RAS observations with more quantifiable streamside monitoring data in future years.

In 2010, LADWP released a 200 cfs seasonal habitat flow for the first time since the LORP was implemented. This seasonal habitat flow was appropriately timed with seed fly of desirable woody species to optimize recruitment along the banks of the Lower Owens River. A 200 cfs seasonal habitat flow is the maximum allowable flow released to the LORP and should have produced the best possible conditions for woody recruitment in the system. However, while the 200 cfs flow created the largest wetted extent for seed dispersal to date, there still was very little recruitment occurring in response. Willows and cottonwoods produced significant amounts of viable seed, yet the seeds either did not germinate, succumbed to competition after taking root, or were not documented during monitoring. (Watershed Resources Staff have observed willows within tule/cattail stands outside of this monitoring effort. These willows can only be observed from higher ground and/or when they reach a height beyond the surrounding tules and cattails, indicating that they have persisted beyond the seedling stage.) In addition, cattail and tules possibly acted as a filter during the seasonal habitat flows and could have trapped much of the available seed within the channel. As a consequence, these seeds may not have reached the limited open areas along the banks. This impact of cattail/tule encroachment on woody species recruitment is further discussed in the 2010 LORP Seasonal Habitat Flow Report. Future monitoring should provide insight to some of these questions regarding woody recruitment within the LORP.

While it is still early in the successional process of river restoration, the LORP has yielded some very positive results. The river supports excellent wildlife populations (Section 8), a very good fishery (Section 9 and 10), and abundant desirable riparian vegetation (Section 3, 6, and 7). Based on the 2010 Streamside Monitoring effort, woody recruitment is occurring slowly along the Lower Owens River as should be expected in a desert river system. Grazing prescriptions and other land management actions are working well as evidenced by bank stability. The Lower Owens River is not expected to provide and maintain large galleries of riparian trees and is expected to respond very slowly to woody riparian establishment.

4.8 LORP Ranch Leases

The following sections are presented by ranch lease. The discussion will include an introduction describing the lease operations, pasture types, a map of the lease, and utilization results from 2010, a summary of range trend results at the lease level and a presentation of range trend results by transect and presentation of Streamside Monitoring results at the lease level. The tables refer to plant species by plant symbol. Refer to Appendix 1, which contains a list of the plant species, scientific names, common names, plant symbol, and functional group assignment for species encountered on the range trend transects. Appendix 3 contains photos for all monitoring transects.

4.8.1 Intake Lease (RLI-475)

The Intake Lease is used to graze horses and mules employed in a commercial packer operation. The lease is comprised of three fields: Intake, Big Meadow Field and East Field (approximately 102 acres). The Intake Field contains riparian vegetation and an associate range trend transect. The Big Meadow Field contains upland and riparian vegetation; however, it is not within the LORP project boundaries. There are no utilization or range trend transects in the Big Meadow Field due to a lack of adequate areas to place a transect that would meet the proper range trend/utilization criteria. Much of the meadow in the Big Meadow Field has been covered with dredged material from the LORP Intake. The East field consists of upland and riparian vegetation. The Big Meadow and Intake Fields were not used by livestock during the construction of the Intake structure which lasted until the 2008-09 grazing season. There are no irrigated pastures on the Intake Lease. There are no identified water sites needed for this pasture and no riparian exclosures planned due to the limited amount of riparian area within the both pastures.

One new range trend/utilization transect was placed in the Intake Field (Stewart_01) at the end of grazing season during range trend data collection in August. Baseline range trend data was taken at that time and ungrazed plant heights for the 2010 grazing season were collected. The East Field was not grazed by livestock in the 2009-10 grazing season and no utilization estimates were made for the pasture.

End of Grazing Season Utilization for Field and Transects on the Intake Lease, RLI-475, 2010

Intake Field	20%	*STEWART_01	20%
**Riparian Utilization, 40%*			

Summary of Utilization

Utilization for the Intake Lease in 2010 was well below the allowable 40% utilization standard.

Summary of Range Trend Data and Conditions

Monitoring site photos are presented in Appendix 3 – Section 1. STEWART_01 is located in the riparian Intake Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The site was sampled for the first time in 2009. The site appears stable with both alkali sacaton (SPAI) and saltgrass (DISP) abundant on the site. The site showed little change from 2009 to 2010. Nevada saltbush (ATTO) frequency did increase yet canopy cover for the same species decreased slightly. There was a significant decrease in frequency of bassia on the site in 2010.

Frequency (%), STEWART_01

Life Forms	Species	2009	2010
Annual Forb	COMAC	0	5
Perennial Forb	GLLE3	2	3
Perennial Graminoid	DISP	133	134
	JUBA	11	8
	SPAI	47	46
Shrubs	ATTO	4	11*
	ERNA10	2	0
Nonnative Species	BAHY	18	4**

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs STEWART_01

Life Forms	Species	2009	2010
Annual Forb	COMAC	0	1
Perennial Forb	GLLE3	T	T
Perennial Graminoid	DISP	18	23
	JUBA	T	T
	SPAI	11	9
Nonnative Species	BAHY	T	T

Cover (%) Shrubs STEWART_01

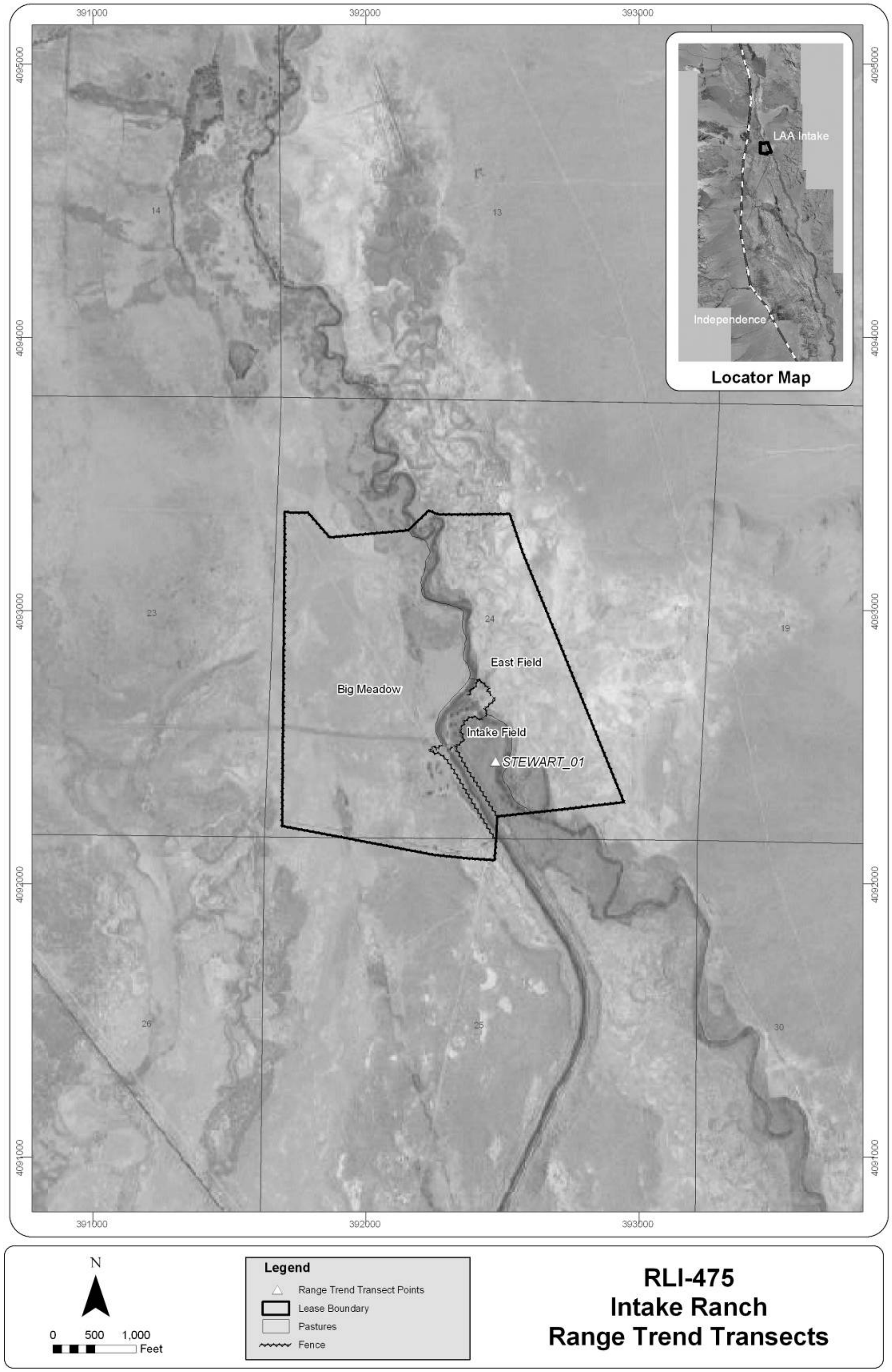
Species Code	2009	2010
ATTO	7.6	6.4
ERNA10	0.2	0.5
Total	7.7	6.9

Ground Cover (%) STEWART_01

Substrate	2009	2010
Dung	1	1
Litter	73	50
Standing Dead	T	1
Bare Ground	26	50

Shrub Densities and Age Classes STEWART_01

	ATTO		ERNA10	
Age Class	2009	2010	2009	2010
Seedling	16	0	0	0
Juvenile	3	35	0	0
Mature	15	15	0	2
Decadent	2	0	1	0
Total	36	50	1	2



Land Management Figure 3. Intake Lease RLI-475, Range Trend Transects

4.8.2 Twin Lakes Lease (RLI-491)

The Twin Lakes Lease is a 4,912-acre cow/calf operation situated just south of the LAA Intake. It includes a reach of the Owens River that lies mainly north of Twin Lakes, which is located at the southern end of the lease. Of the 4,912 acres, approximately 4,200 acres are used as pastures for grazing; the other 712 acres are comprised of riparian/wetland habitats and open water. In all but dry years, cattle usually graze the lease from late October or early November to mid-May.

There are four pastures on the Twin Lakes lease within the LORP boundary: Lower Blackrock Riparian Field, Upper Blackrock Field, Lower Blackrock Field, and the Holding Field.

<u>Summary of Utilization</u>

The Lower Blackrock Riparian, Upper Blackrock Riparian, and Lower Blackrock Fields contain both upland and riparian vegetation. The Holding Field contains only upland vegetation. There are no irrigated pastures on the Twin Lakes Lease. Range trend and utilization transects exist in all fields except the Holding Field.

The following tables present the summarized utilization data for each pasture, for the transects in each field, and by species for each transect for the current year.

End of Grazing Season Utilization for Fields, Transects and Species on the Twin Lakes Lease, RLI-491, 2010

Field	Utilization	Transect	Utilization	DISP	SPAI
Lower Blackrock Field	0%	BLKROC_37	0%	No use	No use
		BLKROC_FIELD_04	0%	No use	No use
		TWINLAKES_02	0%	No use	No use
		TWINLAKES_05	na	No use	No use
Lower Blackrock Riparian Field*	6%	BLKROC_RIP_07	3%	3%	
		TWINLAKES_03	14%	14%	
		TWINLAKES_04	0%		
		TWINLAKES_06	0%		
Upper Blackrock Field*	26%	BLKROC_RIP_05	26%	24%	31%
		BLKROC_RIP_06	38%	38%	39%
		BLKROC_RIP_08	38%	25%	70%
		INTAKE_01	13%	5%	20%
Holding Field		No Transect			

**Riparian Utilization, 40%*

<u>Summary of Utilization</u>

The Lower Blackrock Field and Lower Blackrock Riparian Field had very little to no use during the grazing season. This was due to a wet spring that produced adequate amounts of annuals as well as an increased palatability of perennial shrubs. Abundant forage combined with readily available standing water in playa slicks, allowed the cattle to stay in the uplands and surrounding hills for much of the grazing season. Cattle were moved to the Lower Blackrock Field prior to shipping in May. However, utilization was concentrated in areas along Blackrock ditch and Upper Twin Lakes where flooding in Drew Slough produced green forage. Grazing in the Upper Blackrock Field is not typical for this lease. This can only occur in years with abundant spring green-up. In a normal or below normal cool season precipitation year moving livestock to the Lower Blackrock Riparian Field and Lower Blackrock Field early in the grazing season will ensure that the 40% utilization standard will not be exceeded. The utilization transect TWINLAKES_05 was not sampled because it was totally inundated with water.

Summary of Range Trend Data and Conditions

There are eight range trend sites on the Twin Lakes Lease. Monitoring site photos are presented in Appendix 3 – Section 2. The Moist Flood Plain ecological sites are distributed between two sites (TWINLAKES_04 and TWINLAKES_06) in the historical dry reach which have not received any significant river flows prior to late 2006. TWINLAKES_03 is also in the dry reach section but has clearly benefited from a shallower water table than the other two sites, both prior and following return flows to the river. The mean similarity index during the baseline period for TWINLAKES_03 was 64%, while TWINLAKES_04 and TWINLAKES_05 were 4% and 19%, respectively. The Saline Meadow sites; TWINLAKES_05 was 42% and INTAKE_01 was 75%. Currently TWINLAKES_05 was submerged as part of the Drew Slough unit in the Blackrock Waterfowl Management Area (BWMA). The two Saline Bottom sites had a similarity index of 48% (BLKROC_37) and 49% (TWINLAKES_02).

In 2009, changes in plant frequency beyond what was observed during the baseline period were a significant increase in saltgrass on TWINLAKES_03 and INTAKE_01, a significant increase in Nevada saltbush on TWINLAKES_06, and a significant decline in rubber rabbitbrush on TWINLAKES_02 as a result of the Fort Fire in February 2009. In 2010, saltgrass returned to levels typical for TWINLAKES_03. The 2009 increased Nevada saltbush frequency on TWINLAKES_06 may have contributed to the 2010 decrease in saltgrass and sacaton frequency. The 2009 decline in rubber rabbitbrush for TWINLAKE_06 served as a release point allowing a large increase in alkali cordgrass (SPGR). The Moist Floodplain portions located on the historical dry reach, which were not already in good condition prior to returned flows, remain in poor status.

Significant Changes in Frequency for Twin Lakes Transects Between 2010 and 2009

	No Change	DISP	SPAI	ATTO	BAHY	SPGR
Moist Flood Plain						
TWINLAKE_04*	↔					
TWINLAKE_06*		↓**	↓			
TWINLAKE_03		↓		↓		
SALINE MEADOW						
TWINLAKE_05	↔					
INTAKE_01	↔					
TWINLAKE_05	na					
SALINE BOTTOM						
TWINLAKE_02						↑
BLKROC_37	↔					

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

Upper Blackrock Field

INTAKE_01

INTAKE_01 is located in the Upper Blackrock Field. The soils are mapped as Torrifluvents-Fluvaquentic Endoaquolls Complex; but the majority of the study plot is located on the adjacent soil unit, Torrifluvents, 0-2% slopes, which is associated with the Saline Meadow ecological site. Site similarity to the potential ranged during the baseline monitoring period between 71-77%, placing the site in high ecological condition. Frequency for saltgrass significantly increased in 2009 when compared to 2007 and has subsequently decreased in 2010 but remains within baseline monitoring parameters. Vegetative attributes in 2010 have stayed within previously observed limits on the transect indicating that trend appears to be static. Utilization weighted average on this transect has not had any significant change since the 2009 grazing season.

Utilization by Weighted Average and Species, INTAKE_01

	Weighted Average	DISP	SPAI
2007	44%	29%	55%
2009	19%	15%	21%
2010	13%	5%	20%

Frequency (%), INTAKE_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	0	1	0	0	0
	ATPH	0	18	5	0	0	0
	ATTR	0	0	2	0	0	0
	CHST	0	2	0	0	0	0
	CLEOM2	0	2	0	0	0	0
	CLOB	0	3	0	0	0	0
	CRCI2	0	0	7	0	0	0
	ERIAS	0	23	0	0	0	0
	ERIOG	0	5	0	0	0	0
	ERMA2	0	0	2	0	0	0
	MEAL6	0	0	10	0	0	0
Perennial Forb	MACA2	17	0	0	0	0	11
	MALAC3	0	2	1	0	0	0
	STEPH	0	18	16	0	0	0
	SUMO	3	4	4	2	2	2
Perennial Graminoid	DISP	60	54	67	52	82	59
	JUBA	14	19	15	11	11	8
	SPAI	97	117	103	105	109	118
Shrubs	ATCO	24	15	23	19	25	11*
	ATPA3	0	0	0	1	1	2
	ATTO	0	10	8	6	3	11
	ERNA10	9	22	27	26	28	17
	MACA17	0	0	0	14	18	0**
Nonnative Species	BAHY	0	0	0	0	10	10
	BRTE	0	0	1	0	0	0
	POMO5	0	3	0	0	0	0
	BRRU2	0	0	0	0	1	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs INTAKE_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	0	T	0	0	0
	ATPH	0	T	T	0	0	0
	ATTR	0	0	T	0	0	0
	CHST	0	T	0	0	0	0
	CLOB	0	T	0	0	0	T
	CRCI2	0	0	T	0	0	0
	ERIAS	0	T	0	0	0	0
	ERIOG	0	T	0	0	0	0
	ERMA2	0	0	T	0	0	0
	MEAL6	0	0	T	0	0	0
Perennial Forb	MALAC3	0	0	T	0	0	0
	STEPH	0	1	T	0	0	0
	SUMO	T	1	0	0	0	0
Perennial Graminoid	DISP	3	3	2	2	1	3
	JUBA	T	1	T	T	T	T
	SPAI	14	17	13	14	5	10
Nonnative Species	BAHY	0	0	0	0	T	T
	BRTE	0	0	T	0	0	0
	POMO5	0	T	0	0	0	0
	BRRU2	0	0	0	0	T	0

Cover (%) Shrubs INTAKE_01

Species Code	2003	2004	2007	2009	2010
ATCO	1.1	0.9	0.9	0.8	0.7
ATTO	0.8	1.3	1.6	1.0	2.3
ERNA10	1.2	3.6	3.5	4.5	2.6
SAVE4	0.0	0.0	0.3	0.2	0.0
SUMO	0.0	0.0	0.0	0.1	0.0
Total	3.1	5.8	6.3	6.5	5.6

Ground Cover (%) INTAKE_01

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	62	62	62	52	61	65
Dung	2	2	1	2	1	1
Litter	32	28	32	44	39	34
Rock	T	0	0	0	0	0
Standing Dead	0	0	3	2	1	1

Shrub Densities and Age Classes INTAKE_01

	ATCO						ATPO
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2003**
Seedling	0	8	2	1	0	0	0
Juvenile	2	21	33	12	0	0	0
Mature	1	2	10	26	35	8	1
Decadent	1	0	0	7	0	0	1
Total	4	31	45	46	35	8	2

	ATTO						ERNA10					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	0	8	0	0	0	0	2	7	0	0	0	0
Juvenile	0	3	0	0	0	3	10	12	14	1	0	0
Mature	0	4	3	1	5	14	4	16	25	9	22	9
Decadent	2	0	2	3	0	3	5	0	0	24	8	7
Total	2	15	5	4	5	20	21	35	39	34	30	16

	SAVE4						SUMO				
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	0	0	0	0	0	0	1	0	0	0	0
Juvenile	2	2	3	0	0	0	0	3	1	0	0
Mature	0	0	0	2	3	2	0	0	0	2	1
Decadent	0	0	0	1	0	0	0	0	1	0	0
Total	2	2	3	3	3	2	1	3	2	2	1

Lower Blackrock Field

TWINLAKES_02

TWINLAKES_02 is located in the Lower Blackrock Field on the Pokonahbe-Rindge Family Association soil series, which corresponds to the Saline Bottom Wetland ecological site. Presently there is no ecological site description for Saline Bottom Wetland ecological site. Referencing the site to a Saline Bottom ecological site, the similarity index ranged between 42%-62%. The site would be in a higher ecological condition if the wetland component was accounted for in the ecological site description because of the greater abundance of mesic graminoids such as *Juncus balticus* and *Spartina gracilis* present on the site, which are typically minor components on the more xeric Saline Bottom ecological site.

The transect was burned in mid-February, 2009. Shrub cover prior to the burn was moderate which resulted in a cooler burn when compared to similar areas further south in Drew Slough. Because of the cool fire, a decrease in shrub frequency, shrub cover, and shrub recruitment were observed in 2009 and 2010. Alkali cordgrass (*Spartina gracilis)* significantly increased in 2010 with little variation for remaining perennial grasses on the site. There was no utilization on this transect in 2010.

Utilization by Weighted Average and Species, TWINLAKES_02

	Weighted Average	DISP	FEAR	LECI4	SPAI	SPGR
2007	17%	25%		43%	11%	5%
2008	17%	16%	0%		30%	

Frequency (%), TWINLAKES_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	2	1	0	0	2
	CHENO	0	2	0	0	0	0
	CHHI	0	0	2	0	0	0
	CLOB	0	8	3	0	0	0
	COMAC	0	0	0	0	0	1
Perennial Forb	NIOC2	3	4	2	3	5	15*
	PYRA	0	6	2	7	9	12
	STEPH	0	3	0	0	0	0
Perennial Graminoid	DISP	75	61	65	60	73	80
	JUBA	73	96	103	78	72	72
	LECI4	0	4	16	0	0	1
	LETR5	3	4	0	0	0	0
	POSE	0	0	0	0	2	11
	SPAI	60	53	69	44	36	39
	SPGR	34	20	19	65	57	76**
Shrubs	ATTO	0	6	5	5	0	0
	ERNA10	12	28	24	27	1	0
Nonnative Species	FESTU	0	3	1	0	0	0
	POA	0	0	0	11	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs TWINLAKES_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	T	T	0	0	T
	CHHI	0	T	T	0	0	0
	CLOB	0	T	T	0	0	0
	COMAC	0	0	0	0	0	T
Perennial Forb	NIOC2	T	1	T	T	T	1
	PYRA	0	T	T	T	T	T
	STEPH	0	T	0	0	0	0
Perennial Graminoid	DISP	4	7	10	7	4	12
	JUBA	5	9	4	6	2	1
	LECI4	0	1	T	0	0	T
	LETR5	0	T	0	0	0	0
	POSE	0	0	0	0	T	1
	SPAI	9	12	11	8	5	8
	SPGR	2	1	T	5	2	5
Nonnative Species	FESTU	0	T	T	0	0	0
	POA	0	0	0	0	0	0

Cover (m) Shrubs TWINLAKES_02

Species Code	2003	2004	2007	2009	2010
ATTO	6.4	5.9	4.3	0.3	1.1
ERNA10	18.3	15.9	13.5	0.0	0.0
Total	24.7	21.8	17.8	0.3	1.1

Ground Cover (%) TWINLAKES_02

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	31	25	33	42	88	83
Dung	T	1	1	1	T	0
Litter	68	66	46	58	12	17
Rock	0	0	0	0	0	0
Standing Dead	0	0	T	9	T	T

Shrub Densities and Age Classes TWINLAKES_02

	ATTO						ERNA10				
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009
Seedling	1	194	3	2	0	0	1	6	7	0	0
Juvenile	7	17	24	23	4	2	25	46	55	25	0
Mature	0	6	8	17	1	1	15	17	19	47	0
Decadent	1	1	2	1	2	0	2	1	4	12	1
Total	9	218	37	43	7	3	43	70	85	84	1

	SAVE4		
Age Class	2003	2004	2007
Seedling	0	0	0
Juvenile	0	0	0
Mature	1	1	0
Decadent	0	0	1
Total	1	1	1

Lower Blackrock Field

BLACKROCK_37

BLACKROCK_37 is located in the Lower Blackrock Field on the Pokonahbe-Rindge Family Association soil series, which corresponds to the Saline Bottom ecological site. Referencing the site to a Saline Bottom ecological site, the similarity index ranged between 42%-62%. There were no significant changes in frequency in 2010 compared to previous sampling in 2009. There is an increase in long term trend for rubber rabbitbrush frequency and canopy cover. There was no utilization on this transect in 2010 due to amount of readily available forage produced around the edges of Drew Slough.

Utilization by Weighted Average and Species, BLACKROCK_37

	Weighted Average	DISP	FEAR	LECI4	SPAI	SPGR
2007	40%	30%			65%	
2008	9%	4%			15%	

Frequency (%),BLACKROCK_37

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	9	0	0	0	2
	ATPH	0	4	0	0	0	3
	CLEOM2	0	0	1	0	0	0
	CLPA4	0	0	0	0	0	0
Perennial Forb	CRTR5	0	0	0	9	4	0
	HECU3	0	0	2	0	0	0
	MACA2	0	0	1	0	0	3
	STEPH	0	1	6	0	0	0
	STPA4	0	0	0	12	4	0
	SUMO	0	0	4	6	13	4
Perennial Graminoid	DISP	105	72	115	112	107	110
	JUBA	10	0	0	2	0	1
	SPAI	39	15	33	34	28	29
Shrubs	ATCO	0	0	11	5	7	7
	ATTO	22	23	39	26	27	20
	ERNA10	5	1	23	17	14	17
	MACA17	0	0	0	0	0	0
	SAVE4	2	0	0	0	1	0
Nonnative Species	BAHY	0	0	13	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs BLACKROCK_37

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	T	0	0	0	T
	ATPH	0	T	0	0	0	0
Perennial Forb	CRTR5	0	0	0	T	0	0
	STEPH	0	T	T	0	0	0
	STPA4	0	0	0	1	0	0
	SUMO	T	0	0	0	0	0
Perennial Graminoid	DISP	8	6	8	7	5	3
	JUBA	T	0	0	T	0	0
	SPAI	9	6	6	5	3	4
Nonnative Species	BAHY	0	0	T	0	0	0

Cover (m) Shrubs BLACKROCK_37

Species Code	2003	2004	2007	2009	2010
ALOC2	0.0	0.7	0.5	0.0	0.2
ATCO	0.1	1.2	0.1	1.4	0.4
ATTO	5.6	6.2	2.9	2.4	2.4
ERNA10	3.8	2.9	2.8	3.3	6.5
SUMO	0.3	0.3	1.1	1.7	0.4
ATPH	0.0	0.0	0.0	0.0	0.1
Total	9.8	11.2	7.4	8.8	9.9

Ground Cover (%) BLACKROCK_37

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	57	68	73	78	86	78
Dung	1	1	2	1	T	0
Litter	22	27	23	21	14	22
Rock	T	0	T	0	0	0
Standing Dead	0	0	4	6	7	3

Shrub Densities and Age Classes BLACKROCK_37

	ATCO					ATPA3	ATTO					
Age Class	2003	2004	2007	2009	2010	2007	2002	2003	2004	2007	2009	2010
Seedling	0	0	2	0	1	0	6	50	4	0	3	5
Juvenile	14	6	12	0	1	0	0	17	32	14	0	16
Mature	2	0	9	11	7	1	6	12	13	8	9	14
Decadent	0	0	1	4	0	0	4	2	0	7	11	1
Total	16	6	24	15	9	1	16	81	49	29	23	36

	ERNA10						SAVE4		
Age Class	2002	2003	2004	2007	2009	2010	2007	2009	2010
Seedling	0	0	0	0	2	0	0	0	0
Juvenile	3	10	5	4	4	7	1	1	1
Mature	6	4	13	11	13	10	0	0	0
Decadent	0	0	0	1	2	1	0	0	0
Total	9	14	18	16	21	18	1	1	1

	SUMO						ARTR2	STPA4	ATPH
Age Class	2002	2003	2004	2007	2009	2010	2010	2010	2010
Seedling	0	0	0	1	0	0	0	0	0
Juvenile	0	1	5	5	3	0	1	1	0
Mature	3	5	4	6	6	5	0	1	2
Decadent	0	0	0	0	0	1	0	0	0
Total	3	6	9	12	9	6	1	2	2

TWINLAKES_05

TWINLAKES_05 is located in Lower Blackrock Field on the Manzanar-Division Association, 0-2% slopes soil unit which corresponds to the Saline Meadow ecological site. The transect was burned in late January 2009 and was subsequently submerged when the Drew Unit of the BWMA was flooded. Because of this, range trend sampling and utilization estimates in 2009 and 2010 were not possible.

Utilization by Weighted Average and Species, TWINLAKES_05

	Weighted Average	DISP
2007	52%	52%
2008	12%	21%

Frequency (%), TWINLAKES_05

Life Forms	Species	2002	2003	2004	2007	2009
Annual Forb	ATTR	0	156	91	0	NA
Perennial Forb	MALE3	49	60	66	61	NA
Perennial Graminoid	DISP	88	101	87	70	NA
	JUBA	0	6	8	2	NA
	LETR5	5	11	0	0	NA
	SPAI	0	0	6	0	NA
Shrubs	ATTO	17	15	45	29	NA
	ERNA10	12	30	16	18	NA
Nonnative Species	BAHY	0	18	35	0	NA

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs TWINLAKES_05

Life Forms	Species	2002	2003	2004	2007	2009
Annual Forb	ATTR	0	60	1	0	NA
Perennial Forb	MALE3	4	3	2	4	NA
Perennial Graminoid	DISP	11	13	7	12	NA
	JUBA	0	T	T	T	NA
	LETR5	T	1	0	0	NA
	SPAI	0	0	T	0	NA
Nonnative Species	BAHY	0	1	1	0	NA

Cover (m) Shrubs TWINLAKES_05

Species	2003	2004	2007	2009
ATTO	4.2	2.6	8.9	NA
ERNA10	6.5	10.2	19.0	NA
Total	10.7	12.8	27.8	NA

Ground Cover (%) TWINLAKES_05

Substrate	2002	2003	2004	2007	2009
Bare Soil	49.1	30.3	57.4	24.5	NA
Dung	3.9	1.7	1.3	2.4	NA
Litter	46.2	55.0	38.8	70.4	NA
Rock	T	0.0	0.0	0.0	NA

Shrub Densities and Age Classes TWINLAKES_05

	ATTO					ERNA10				
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2002**	**2003**	**2004**	**2007**	**2009**
Seedling	0	32	0	0	NA	0	33	14	0	NA
Juvenile	4	29	79	29	NA	0	0	16	9	NA
Mature	2	1	1	64	NA	2	5	6	14	NA
Total	6	62	80	93	NA	2	38	36	23	NA

Lower Blackrock Riparian Field

TWINLAKES_03

TWINLAKES_03 is located in the Lower Blackrock Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index during baseline period ranged between 63%-65%, placing it in good ecological condition, explained by the dominance of saltgrass on the site. Nevada saltbush is much greater than the described potential for the site. The site also lacks in diversity of perennial grasses. Frequency for saltgrass and Nevada saltbush increased between 2009-07. Saltgrass frequency was significantly higher than all previous sampling events in 2009 while in 2010 saltgrass decreased to its lowest value since monitoring has begun on the site. However, saltgrass cover remained well within the typical range for the site. Utilization was minimal for this transect with all of the utilization occurring on saltgrass.

Utilization by Weighted Average and Species, TWINLAKES_03

	Weighted Average	DISP	SPAI
2007	82%	82%	
2008	28%	25%	50%
2009	19%	19%	13%
2010	6%	68%	

Frequency (%), TWINLAKES_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	SUMO	0	0	5	11	15	2
Perennial Graminoid	DISP	145	144	141	153	163	127**
	SPAI	0	1	5	1	2	0
Shrubs	ATTO	48	0	64	18	31	10**
Nonnative Species	BAHY	0	37	27	0	26	38

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs TWINLAKES_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Graminoid	DISP	47	39	34	47	53	43
	SPAI	0	T	T	T	1	0
Nonnative Species	BAHY	0	2	1	0	1	0

Cover (m) Shrubs TWINLAKES_03

Species	2003	2004	2007	2009
ATTO	17.0	17.0	6.4	8.4
SUMO	0.0	0.1	2.4	0.6
Total	17.0	17.1	8.8	9.0

Ground Cover (%) TWINLAKES_03

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	8	8	7	11	6	11
Dung	4	5	3	3	1	T
Litter	84	64	64	86	93	89
Rock	0	5	15	0	0	T
Standing Dead	0	0	0	23	11	8

Shrub Densities and Age Classes TWINLAKES_03

	ATTO						SUMO					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	10	0	89	0	3	0	0	0	282	0	5	0
Juvenile	16	289	206	20	42	29	1	0	200	15	52	22
Mature	17	47	46	17	60	15	0	1	3	5	12	1
Decadent	4	16	9	8	0	1	0	0	0	2	0	0
Total	47	352	350	45	105	45	1	1	485	22	69	23

TWINLAKES_04

TWINLAKES_04 is located in the Lower Blackrock Riparian Field in the former dry reach. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index is poor, ranging between 4-5%. Unlike TWINLAKES_03, which has historically benefitted from a shallow water table, TWINLAKES_04 has yet to respond favorably from returned flows into the lower Owens River. The site is predominantly Nevada saltbush, inkweed, and fivehorn smotherweed. Frequency significantly increased for bassia and inkweed in 2009 and 2010 when compared to 2007, inkweed frequency in 2009 and 2010 was greater than baseline parameters (2002-04 and 2007). Inkweed cover has also substantially increased from trace amounts prior to returning flows to the river to over 37 m of canopy along the transect in 2010. The site is visited when conducting the annual LORP utilization but has not been sampled due to the absence of key forage species.

Frequency (%), TWINLAKES_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	9	0	0	0
	CHIN2	0	0	2	0	0	0
	CRCI2	0	0	3	0	0	0
Perennial Forb	SUMO	2	0	1	9	24	33
Perennial Graminoid	DISP	17	4	12	0	0	0
Shrubs	ATTO	5	8	27	18	13	9
Nonnative Species	BAHY	0	6	41	0	15	24
	DESO2	0	0	7	0	0	0
	SATR12	0	4	82	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs TWINLAKES_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	T	0	0	0
	CHIN2	0	0	T	0	0	0
	CRCI2	0	0	T	0	0	0
Perennial Forb	SUMO	T	0	0	0	0	0
Perennial Graminoid	DISP	T	T	T	0	0	0
Nonnative Species	BAHY	0	5	1	0	3	0
	DESO2	0	0	T	0	0	0
	SATR12	0	4	7	0	0	0

Cover (m) Shrubs TWINLAKES_04

Species Code	2003	2004	2007	2009	2010
ATTO	13.6	22.4	11.2	17.9	15.7
SUMO	T	T	20.0	27.3	37.2
Total	13.6	22.4	31.2	45.1	52.9

Ground Cover (%) TWINLAKES_04

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	15	33	34	50	16	3
Dung	1	2	4	2	T	0
Litter	84	64	63	48	84	97
Rock	0	0	9	0	0	0
Standing Dead	0	0	0	22	4	35

Shrub Densities and Age Classes TWINLAKES_04

	ATTO						SUMO				
Age Class	2002	2003	2004	2007	2009	2010	2003	2004	2007	2009	2010
Seedling	3	0	0	0	0	0	0	0	0	0	0
Juvenile	3	14	16	0	7	0	1	1	0	26	0
Mature	14	16	14	13	30	12	0	1	28	44	29
Decadent	1	11	0	1	1	1	0	0	0	0	0
Total	21	41	30	14	38	13	1	2	28	70	29

TWINLAKES_06

TWINLAKES_06 is located in the Lower Blackrock Riparian Field. Soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. Similarity index to the site's potential was 19% between 2006-07. As with TWINLAKES_04, the site is dominated by shrubs, invasive annual forbs, and a scant amount of perennial grasses as the understory. Because of this, and the fact that the area is inaccessible to livestock, utilization is not estimated on this site. Plant frequency in 2009 indicated a significant increase in Nevada saltbush and bassia. In 2010 saltgrass decreased to its lowest level for the site. Shrub cover for Nevada saltbush continues to increase on the site rising from 5.4 m in 2006 to 66.6 m in 2010. At the same time SUMO has decreased on the site.

Frequency (%), TWINLAKES_06

Life Forms	Species	2006	2007	2009	2010
Perennial Forb	HECU3	0	0	8	8
	SUMO	48	30	29	16
Perennial Graminoid	DISP	57	38	32	13**
	SPAI	0	0	10	0**
Shrubs	ATTO	23	20	63	71
Nonnative Species	BAHY	0	0	22	29
	SATR12	11	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs TWINLAKES_06

Life Forms	Species	2006	2007	2009	2010
Perennial Forb	HECU3	0	0	2	1
Perennial Graminoid	DISP	6	8	5	2
	SPAI	0	0	T	0
Nonnative Species	BAHY	0	0	2	3
	SATR12	5	0	0	0

Cover (m) Shrubs TWINLAKES_06

Species Code	2006	2007	2009	2010
ATTO	5.4	11.3	50.2	66.6
SUMO	30.5	44.8	14.9	13.4
Total	35.9	56.1	65.0	80.0

Ground Cover (%) TWINLAKES_06

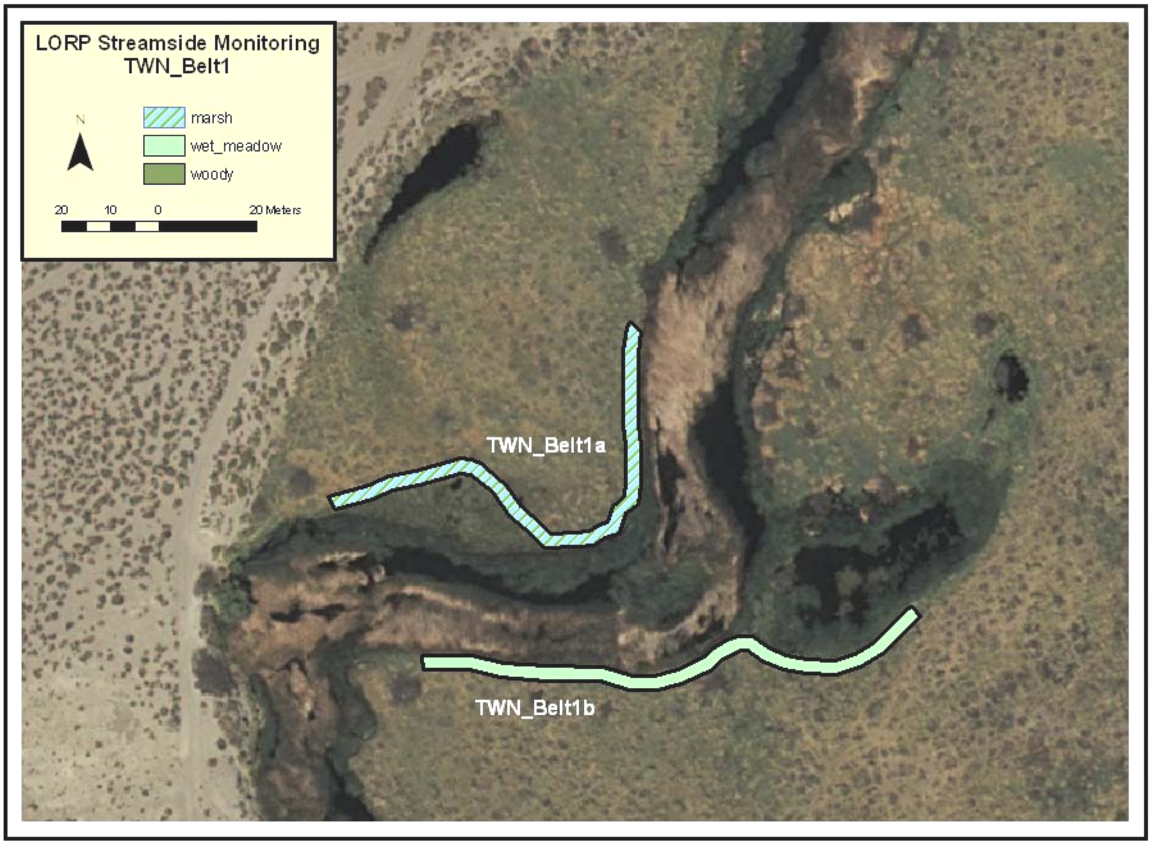
Substrate	2006	2007	2009	2010
Dung	5	6	2	0
Litter	68	74	89	100
Rock	0	0	0	0
Standing Dead	8	4	5	5
Bare Soil	27	20	10	0

Shrub Densities and Age Classes TWINLAKES_06

	ATTO			SUMO		
Age Class	**2006**	**2007**	**2009**	**2006**	**2007**	**2009**
Seedling	5	0	0	0	0	0
Juvenile	80	6	21	116	0	22
Mature	17	29	68	68	57	24
Decadent	2	4	5	0	1	1
Total	104	39	94	184	58	47

Streamside Monitoring

There were two designated monitoring areas (DMAs) located within the Twin Lakes Lease (RLI-491), one in the Upper Blackrock Field (TWN_Belt1) and one in the Lower Blackrock Riparian Field (TWN_Belt2).

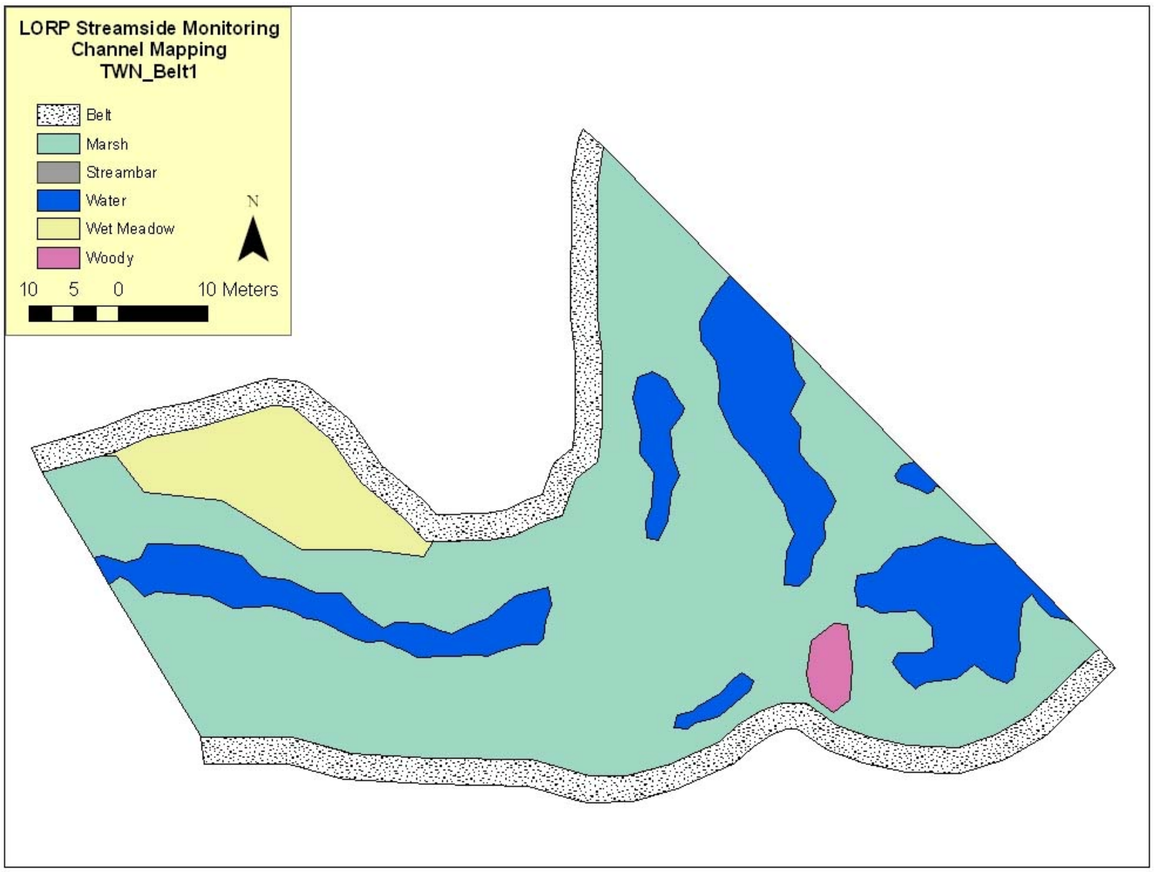


LORP Streamside Monitoring TWN_Belt1

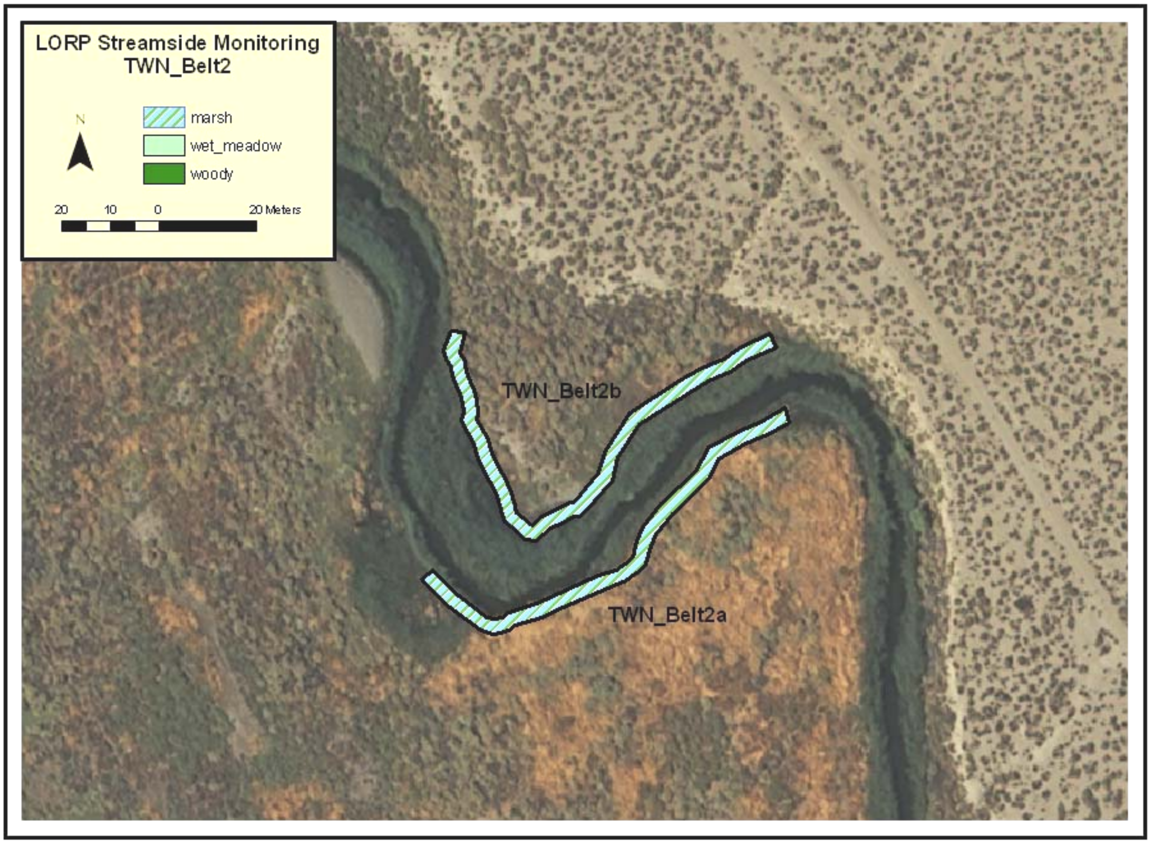
TWN_Belt1a was located just upstream of an outer bend in the river and was characterized as marsh dominated by cattails (*Typha domingensis).* There was also saltgrass (*Disticlis spicata*) present along the water's edge and in the adjacent wet meadow. Much of the bank was undefined, yet stabilized by vegetation, and soils encountered were silty and fine. According to point intercept data at the site, 37% of the transect was vegetated, 32% was occupied with litter, 27% fine/silty soil, 3% wood, and 1% dung. Species encountered at the water's edge included saltgrass, cattails, and Baltic rush (*Juncus balticus*). There was no woody recruitment along the TWN_Belt1a transect, nor were there any existing woody species already established. GIS analysis of TWN_Belt1a also showed no woody cover.

TWN_Belt1b incorporated sampling of the small peninsula on an inside bend of the river and a backwater pond. This area was characterized as wet meadow dominated by saltgrass. The water's edge was primarily dominated by cattails and tules (*Schoenoplectus acutus*), but also had some saltgrass and Baltic rush present. Litter was documented to be the most prominent ground cover, encompassing 60.5% of the sampling points on the transect. In addition, 34.5% was vegetated, 2.5% was wood, and 2.5% was fine/silty soil. Species recorded along the water's edge included tules, cattails, saltgrass, Baltic rush, alkali sacaton *(Sporobolus airoides*), and narrowleaf willow (*Salix exigua).* One mature narrowleaf willow was encountered while sampling (rooted), and this individual was clipped by a beaver. There were no other woody species present at this site, and thus no recruitment was occurring. GIS analysis of TWN_Belt1b showed no woody cover. There was evidence of raccoons and Owens Valley Vole presence at both TWN_Belt1a and TWN_Belt1b. More specifically, raccoon prints and scat were apparent on TWN_Belt1a and Owens Valley Voles and their feces were spotted on both sides of the river.

End of grazing season utilization in the Upper Blackrock Field averaged 29%. BLKROC_RIP_06 was the closest transect to TWN_Belt1; utilization at this site was 38% in May 2010. GIS analysis of the channel estimated the following: 736 m^2 open water, 308 m^2 wet meadow, 2747 m^2 marsh, and 40 m^2 woody vegetation.



LORP Streamside Monitoring Channel Mapping TWN_Belt1



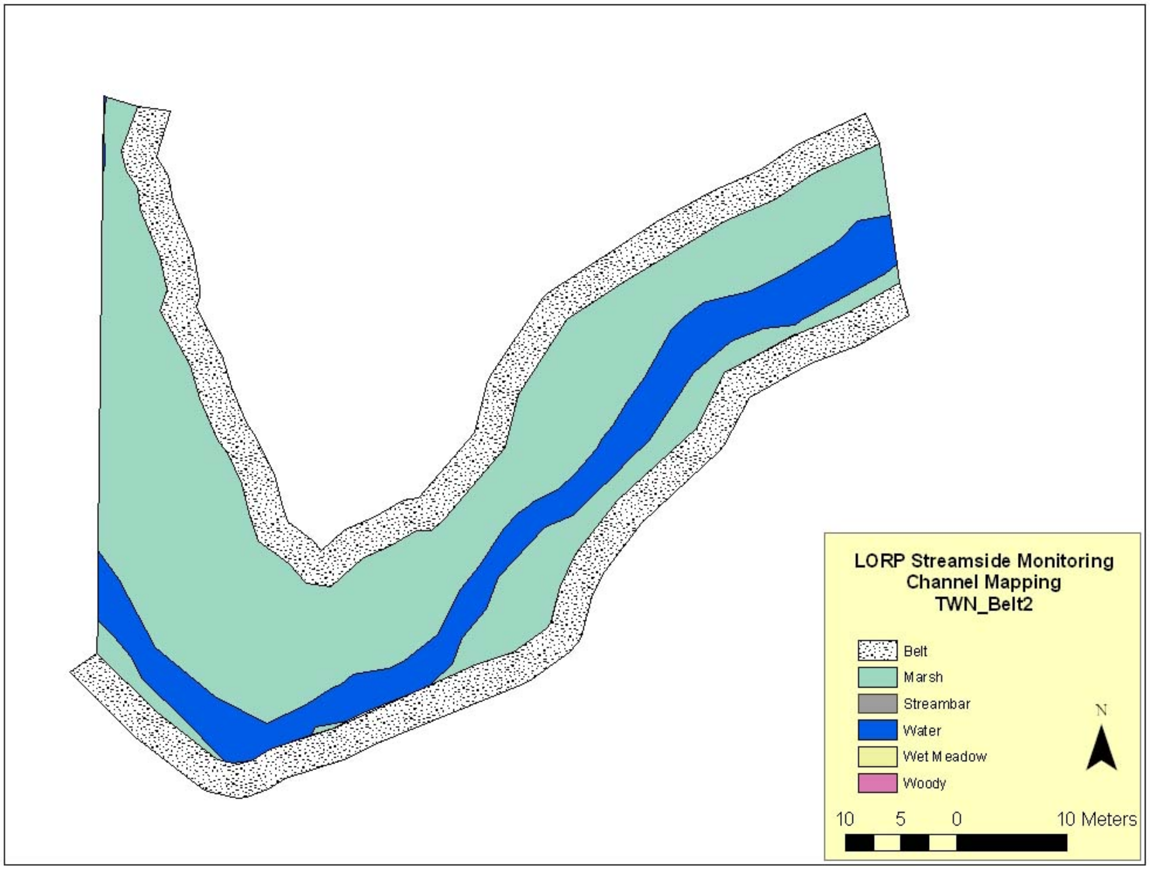
LORP Streamside Monitoring TWN_Belt2

TWN_Belt2a is located within the Lower Blackrock Riparian Field just upstream of an inside bend in the river. This area was classified as marsh along the water's edge and was dominated by cattails. The adjacent wet meadow was dominated by bassia (*Bassia hyssopifolia*) with some saltbush also present. The stream bank was intact but was generally characterized as litter covered or vegetated. Point intercept data for ground cover indicated that the site was 59% vegetated, 29.5% litter, 11% fine/silty soil, and 0.5% wood. Species encountered along the bank included cattails, saltbush, creeping wildrye (*Leymus triticoides*), salt heliotrope (*Heliotropium curassavicum),* and alkali sacaton. This site was difficult to access and maneuver along the bank with heavy bassia, cattail, and saltbush cover near the water's edge (shown in the photo below) which is typical of this reach of the Lower Owens River. There were no woody species present as rooted or canopy cover at the site. GIS analysis of TWN_Belt2a also showed no woody cover.

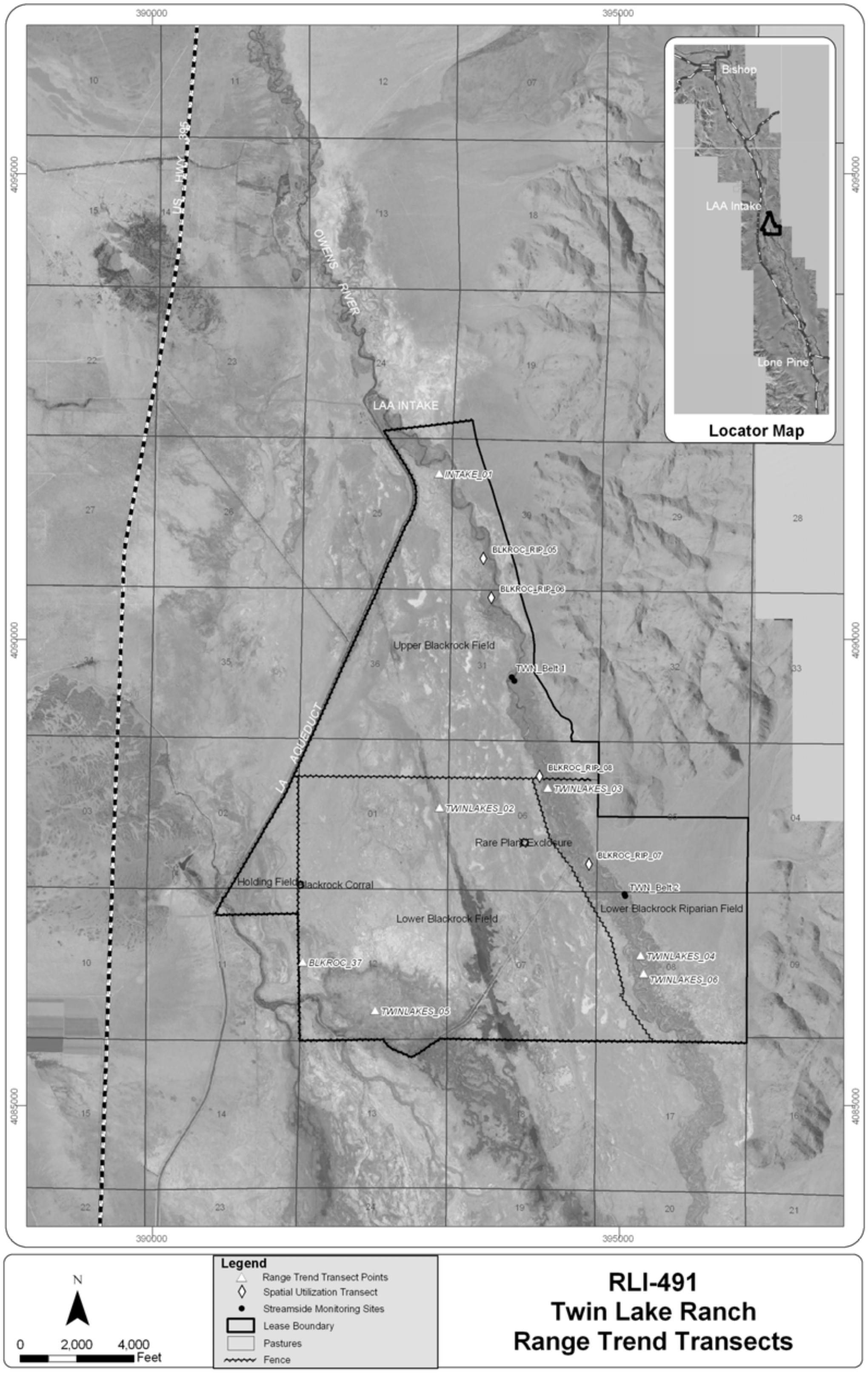
Photo demonstrating water's edge looking upstream at TWN_Belt2a (wetted channel is beneath the cattails on the right). Banks are vegetated, but dominated by bassia, saltbush, and tules, leaving little room for recruitment of desirable woody species.

TWN_Belt2b was also characterized as marsh dominated by cattails. Other dominant species along the water's edge included threesquare bulrush (*Schoenoplectus americanus*) and saltgrass. Banks were mostly characterized as litter or root stabilized and were very steep at the beginning of the transect. Point intercept data showed this transect to be 33.5% wood, 24.5% vegetated, 24.5% litter, 9% silty soil, 6.5% sandy soil, and 2% gravelly soil. Species documented along the water's edge included cattails, threesquare bulrush, saltgrass, horseweed (*Conyza coulteri),* and creeping wildrye. There were no woody species present as rooted or canopy cover across the site. GIS analysis of TWN_Belt2b also showed no woody cover. There was some evidence of jackrabbits grazing on the threesquare bulrush at the site.

End of grazing season utilization in the Lower Blackrock Field averaged 6%. BLKROC_RIP_07 was the closest transect to TWN_Belt2; utilization at this site was 3% in May 2010. GIS analysis of the wetted channel estimated the following: 321 m^2 open water and 1145 m^2 marsh.



LORP Streamside Monitoring Channel Mapping TWN_Belt2



Land Management Figure 4. Twin Lake Lease RLI-491, Range Trend Transect Locations

4.8.3 Blackrock Lease (RLI-428)

The Blackrock Lease is a cow/calf operation consisting of 32,674 acres divided into 24 management units or pastures. Blackrock is the largest LADWP grazing lease within the LORP area. The pastures/leases on the Blackrock Lease provide eight months of fall through spring grazing, which can begin any time after 60 continuous days of rest. A normal grazing season begins in early to mid-October and ends in mid-May or June.

There are twenty pastures on the Blackrock Lakes lease within the LORP boundary: South Blackrock Holding, White Meadow Field, White Meadow Riparian Field, Reservation Field, Reservation Riparian Field, Little Robinson Field, Robinson Field, East Robinson Field, North Riparian Field, Russell Field, Locust Field, East Russell Field, South Riparian Field, West Field, Wrinkle Field, Wrinkle Riparian Field, Spring Field, Wrinkle Holding, Horse Holding, and North Blackrock Holding. Twelve of these pastures are monitored using range trend and utilization. The other eight pastures are holding pastures for cattle processing or parts of the actual operating facilities.

Summary of Utilization

The following tables present the summarized utilization data for each pasture, for the transects in each pasture, and by species for each transect for the current year.

End of Grazing Season Utilization for Fields, Transects and Species on the Blackrock Lease, RLI-428, 2010

Fields	Utilization	Transect	Utilization	DISP	LETR5	SPAI
North Riparian Field*	29%	BLKROC_12	7%	14%		48%
		BLKROC_22	36%	42%		48%
South Riparian Field*	21%	BLKROC_13	26%	13%	0%	20%
		SOUTHRIP_03	7%	35%	10%	
		BLKROC_23	38%	18%		23%
White Meadow Riparian Field*	41%	BLKROC_11	41%	37%		47%
Wrinkle Riparian Field*	32%	BLKROC_18	39%	59%		18%
		BLKROC_19	14%	26%		26%
		BLKROC_20	31%	53%	45%	0%
		BLKROC_21	24%	42%		18%
Horse Holding	35%	BLKROC_09	36%	37%		35%
		HORSEHOLD_02	34%	11%		66%
Locust Field	34%	BLKROC_06	34%	14%		54%
Reservation Field	37%	BLKROC_02	36%	15%		53%
		BLKROC_03	46%	17%		67%
		BLKROC_44	45%	35%		67%
		BLKROC_49	16%	10%		22%
		BLKROC_51	33%	23%		48%
		RESERVATION_06	48%	16%		76%
Robinson Field	23%	BLKROC_04	22%	22%		21%
		ROBINSON_02	23%	11%		35%
Russell Field	39%	BLKROC_05	48%	17%		69%
		RUSSELL_02	31%	22%		40%
White Meadow Field	20%	BLKROC_01	5%	0%		81%
		BLKROC_39	0%	0%		0%
		WHITEMEADOW_03	12%	3%		22%
		WHITEMEADOW_04	0%	0%		0%
		WHITEMEADOW_05	34%	14		52
Wrinkle Field	44%	BLKROC_07	40%	37%		44%
		WRINKLE_03	48%	24%		68%
West Field	22%	WRINKLE_02	22%	25%		9%

**Riparian pastures (40% utilization standard)*

<u>Riparian Management Area</u>

Overall riparian use in all fields was low and within the allowable 40% utilization limit. The White Meadow Riparian Field was deferred from the riparian utilization standard for the 2009-2010 grazing season. This was done to promote the use of cattle, to reduce bassia (*Bassia*) litter through concentrated hoof action. Based on field observations BLKROC_11 in the White Meadow Riparian Field has responded well, indicating higher amounts of grass recruitment compared to the adjacent grazing exclosure because of livestock trampling and brush clearing activities while constructing the fenced exclosure. In 2011 a range trend transect will be placed inside the exclosure, providing quantitative data for comparison.

Upland Management Areas

Fields in the upland portions of the Blackrock Lease did not have any substantial use throughout the first portion of the 2010 grazing season. However, it was interesting to see the substantial increase in utilization at the end of the grazing season. In some cases like in the Wrinkle Field utilization went from 0% to 48% on WRINKLE_03. These increases in utilization were attributed to the lessee holding cattle in upland field while waiting to ship them to summer pasture. Even with the sudden increase in utilization, all of the upland fields did not come close the allowable utilization standard of 65%.

Summary of Range Trend Data and Condition Blackrock Lease

There are twenty-six range trend sites on the Blackrock Lease. Monitoring site photos are presented in Appendix 3 – Section 3. Fourteen are located on Moist Floodplain ecological sites. Six of these sites are located along the historical 'dry reach' of the river (BLKROC_10, 11, 14, 15, 16, and 17). The similarity index for these six sites ranged between 4-47% averaged across all sampling periods.

BLKROC_11 averaged 47% across the entire baseline period indicating the site is in fair condition. All other sites in the former dry reach averaged less than 20%, indicating the sites are in poor condition. The similarity index for BLKROC_11 is higher due to persistence of perennial grasses at the site. At other dry reach sites, there was a loss of perennial grasses on the floodplain resulting from Los Angeles Aqueduct diversions.

The similarity indices for Moist Floodplain sites, which were not dried by Aqueduct diversions, have historically received perennial flow ranged from 45-80%. Similarity indices for the eight sites located on Saline Meadow ecological sites ranged from 10-86%. With the exception of BLKROC_01 and BLKROC_02, the remaining six sites were in good to excellent condition. The three range trend sites on Sodic Fan, BLKROC_09, BLKROC_51, and BLKROC_44, have been in good condition while the one Sandy Terrace site BLKROC_49, is in fair condition. In general there have been no departures outside of the typical range of variability observed since monitoring has begun on all sites with the exception of a spike in sacaton on BLKROC_19 and increases Nevada saltbush on BLKROC_16. Therefore similarity to site potentials in 2010 are likely very similar to what was calculated during the baseline period.

Significant changes in 2010 frequency beyond what had previously been observed during the baseline period occurred on two of the 25 sites (Table 5). BLKROC_16 saw a large spike in bassia and Nevada saltbush and alkali sacaton on BLKROC_19 significantly increased outside previously observed ranges. When 2010 data were compared to 2009 results the majority of transects were static. General trends were an increase in bassia on the dry-reach sections and seven sites showing an increase in alkali sacaton with a decrease on one other site. Two sites decreased in frequency of saltgrass. Utilization has been at or below the maximum allowable use for upland and riparian pastures.

Significant Changes in Frequency for Blackrock Transects Between 2009 and 2010

	No Change	DISP	SPAI	ATTO	BAHY	LETR
Moist Flood Plain						
BLKROC_10*				↓	↓	
BLKROC_11*					↓	
BLKROC_14*					↑	
BLKROC_15*				↑	↑	
BLKROC_16*			↑	↑**	↑**	
BLKROC_17*	↔					
BLKROC_12	NA					
BLKROC_13	↔					
BLKROC_18		↓	↑			
BLKROC_19			↑**			
BLKROC_20					↑	
BLKROC_21	↔					
BLKROC_22	↔					
BLKROC_23	↔					
SALINE MEADOW						
BLKROC_01	↔					
BLKROC_02	↔					
BLKROC_03	↔					
BLKROC_04			↑			↓
BLKROC_05		↓	↑			
BLKROC_06			↑			
BLKROC_07			↓			
BLKROC_39	↔					
SODIC FAN						
BLKROC_51			↑			
BLKROC_09	↔					
BLKROC_44	↔					
SANDY TERRACE						
BLKROC_49	↔					

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

Description of Monitoring Transects by Pasture

White Meadow Riparian Field

BLKROC_10

BLKROC_10 is located in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The transect is located within the historical dry reach of the river. The similarity index has ranged between 6-25% during baseline period. Utilization estimates have not been conducted during the past three years because of the dense stands of bassia has prevented access by livestock. An increase in Nevada saltbush and bassia frequency outside baseline parameters were detected during the monitoring year 2009 but in 2010 frequency for both species decreased. Nevada saltbush continues to have a high frequency when compared to 2002-2007, which coincided with the pre-watering years. As waters raise the soil profile along the floodplain, Nevada saltbush has responded with only 2.8 m of canopy cover in 2003 to 59.7 m of cover in 2010. Shrub density for the same shrub rose from four in 2002 to 212 (excluding seedlings) in 2010. Litter on the transect has risen while bare soil has decreased which illustrated field observations that much of the standing bassia is beginning to lay down atop the soil surface. The site has not begun to show an increase in perennial grasses although sacaton has remained stable as well as the perennial forb, mallow (MALE3). Fire would not improve the site, because of the small perennial grass component in the area.

Frequency (%), BLKROC_10

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	4	0	0	0	0
	CHBR	0	2	3	0	0	0
	CHIN2	0	14	28	0	0	0
	MENTZ	0	14	0	0	0	0
Perennial Forb	HECU3	0	0	0	0	0	0
	MALE3	0	3	7	11	21	20
	SUMO	0	0	0	0	10	0
	STPI	0	0	4	0	0	0
Perennial Graminoid	DISP	0	3	0	0	0	0
	SPAI	0	12	18	18	21	22
Shrubs	ARTRW8	0	0	0	0	0	0
	ATTO	2	6	14	25	92	74*
	SAVE4	0	0	0	0	0	3
	ARTR2	0	2	0	2	2	3
Nonnative Species	AMARA	0	6	0	0	3	0
	BAHY	0	3	64	0	47	24**
	DESO2	0	0	1	0	4	0
	SATR12	0	0	48	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Table 72. Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_10

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	T	0	0	0	0
	CHBR	0	T	0	0	0	0
	CHIN2	0	2	T	0	0	0
	MENTZ	0	1	0	0	0	0
Perennial Forb	HECU3	0	0	0	T	T	0
	MALE3	0	T	T	1	4	2
Perennial Graminoid	DISP	0	T	0	0	0	0
	SPAI	0	2	1	2	3	2
Nonnative Species	AMARA	0	T	0	0	T	0
	BAHY	0	1	1	0	2	1
	DESO2	0	0	0	0	T	0
	SATR12	0	T	2	0	0	0

Cover (m) Shrubs BLKROC_10

Species Code	2003	2004	2007	2009	2010
ATTO	2.8	5.2	16.4	52.9	59.7
ERNA10	1.0	0.8	0.0	0.0	0.0
ARTR2	1.2	1.3	2.0	2.5	0.0
ATTR	0.0	0.0	0.0	0.0	2.3
Total	4.9	7.3	18.3	55.4	62.0

Ground Cover (%) BLKROC_10

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	36	32	44	39	25	13
Dung	2	1	1	2	1	0
Litter	63	63	51	60	75	87
Rock	0	0	0	0	0	0
Standing Dead	0	0	11	3	2	2

Shrub Densities and Age Classes BLKROC_10

	ATTO						ERNA10		SUMO	ARTR2
Age Class	2002	2003	2004	2007	2009	2010	2003	2004	2009	2004
Seedling	0	0	0	0	0	41	0	0	0	0
Juvenile	0	3	10	12	114	88	0	0	0	0
Mature	3	4	5	56	129	124	1	1	2	1
Decadent	1	3	0	6	1	0	0	0	0	0
Total	4	10	15	74	244	253	1	1	2	1

BLKROC_11

BLKROC_11 is located in a riparian management area in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The transect is located within the historical dry reach of the river. The similarity index has ranged between 36-64% during the baseline period. Inkweed, Nevada saltbush, and bassia frequency increased in 2009 and have subsequently stabilized with the exception of inkweed which did decrease in 2010 but remained within levels typically seen for the site. Seedling and juvenile Nevada saltbush density rose dramatically in 2010 while cover has not changed during the past three sampling periods. Perennial grass frequency did not change in 2010. The utilization grazing prescription of 40% was waived for this transect in 2009-10 in order to use the cattle's concentrated hoof action to break down the bassia and promote perennial grass growth and woody recruitment.

Utilization by Weighted Average and Species, BLKROC_11

	Weighted Average	DISP	SPAI
2009	64%	64%	65%
2010	41%	37%	47%

Frequency (%), BLKROC_11

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	2	0	0	0
	ATSES	0	5	0	0	0	0
	ATTR	0	19	7	0	2	0
	CHENO	0	1	0	0	0	0
	CHIN2	0	0	3	0	0	0
	GILIA	0	9	0	0	0	0
	MENTZ	0	2	0	0	0	0
Perennial Forb	MALE3	0	3	4	4	0	0
	SUMO	32	28	42	49	76	66
Perennial Graminoid	DISP	114	107	112	103	110	110
	SPAI	22	39	41	36	42	40
Shrubs	ATTO	37	95	101	53	70	72
	ERNA10	3	10	16	8	5	6
Nonnative Species	BAHY	0	42	38	0	59	44*

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_11

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	T	0	0	0
	ATSES	0	T	0	0	0	0
	ATTR	0	1	T	0	T	0
	CHENO	0	T	T	0	0	0
	CHIN2	0	0	T	0	0	0
	GILIA	0	T	0	0	0	0
	MENTZ	0	T	0	0	0	0
Perennial Forb	MALE3	0	T	T	T	0	0
	SUMO	5	7	0	0	0	0
Perennial Graminoid	DISP	19	16	8	12	6	12
	SPAI	6	7	3	7	5	6
Nonnative Species	BAHY	0	3	1	0	1	1

Cover (m) Shrubs BLKROC_11

Species Code	2003	2004	2007	2009	2010
ATTO	13.6	16.5	18.3	18.9	18.7
ERNA10	3.2	5.0	8.1	3.1	2.6
SUMO	10.5	4.9	13.4	16.2	6.1
Total	27.3	26.4	39.7	38.2	27.4

Ground Cover (%) BLKROC_11

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	29	35	37	34	22	19
Dung	4	7	4	3	2	T
Litter	62	49	57	63	76	79
Rock	0	1	0	0	0	T
Standing Dead	0	0	0	9	3	2

Shrub Densities and Age Classes BLKROC_11

	ATTO						ERNA10				
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2010
Seedling	11	663	26	0	0	70	0	2	0	0	1
Juvenile	11	79	422	35	0	87	0	0	14	6	1
Mature	12	29	60	52	47	52	3	2	3	2	2
Decadent	1	0	5	9	0	3	0	0	0	3	0
Total	35	771	513	96	47	212	3	4	17	11	4

	SUMO				
Age Class	2002	2003	2004	2007	2010
Seedling	2	36	21	0	29
Juvenile	4	39	97	99	47
Mature	12	24	14	67	50
Decadent	0	0	6	8	1
Total	18	99	138	174	127

BLKROC_14

BLKROC_14 is located within the historical dry reach of the Owens River in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index for this site ranged between 9 and 25% during the baseline period. The site is in poor condition when compared to its corresponding ecological site description. Nevada saltbush significantly increased in 2009 and saltgrass significantly decreased to 0 in 2009 and remained so in 2010. Because of the nearly impenetrable bassia infestations following the burns in 2008, utilization was not estimated in 2009. Nevada saltbush is increasing on the site with canopy cover increasing from 8.8 m to 34.4 m. Densities have also risen since 2007. These increases are likely a result from rewatering this portion of the Owens River. Frequency for bassia was at its highest seen on the site since 2004 (prior to the 2008 burn). Utilization was not sampled on this transect in 2009-10 due to the lack of measurable forage.

Utilization by Weighted Average and Species, BLKROC_14

	Weighted Average	DISP
2007	87%	87%
2008	9%	9%

Frequency (%), BLKROC_14

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	5	0	0	0
	CHENO	0	0	0	0	0	0
	CHIN2	0	3	3	0	0	0
Perennial Forb	HECU3	0	5	0	0	0	0
	MALE3	0	4	4	6	7	0
	SUMO	0	0	0	0	4	0
Perennial Graminoid	DISP	14	21	14	10	0	0
Shrubs	ATTO	0	4	8	11	24	27
Nonnative Species	BAHY	0	14	67	0	2	71**
	DESO2	0	0	2	0	0	0
	SATR12	0	20	90	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_14

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	T	0	0	0
	CHENO	0	T	0	0	0	0
	CHIN2	0	T	T	0	0	0
Perennial Forb	HECU3	0	T	0	0	0	0
	MALE3	0	T	T	1	1	0
	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	T	1	T	2	0	0
Nonnative Species	BAHY	0	5	2	0	1	51
	DESO2	0	0	T	0	0	0
	SATR12	0	2	4	0	0	0

Cover (m) Shrubs BLKROC_14

Species Code	2003	2004	2007	2009	2010
ATTO	8.8	0.4	10.1	27.3	34.4

Ground Cover (%) BLKROC_14

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	84	75	92	84	6	3
Dung	2	1	1	1	0	1
Litter	15	23	7	12	94	96
Rock	0	0	0	0	0	0
Standing Dead	0	0	0	3	2	0

Shrub Densities and Age Classes BLKROC_14

	ATTO				ERNA10	SUMO
Age Class	2004	2007	2009	2010	2009	2009
Juvenile	8	2	207	0	6	178
Mature	0	17	224	47	4	83
Decadent	0	0	3	1	2	3
Total	8	19	434	48	12	264

White Meadow Field

BLKROC_01

BLKROC_01 is located on an upland site in the White Meadow Field. The soils are mapped as the Division-Numu Complex, 0-2% slopes soil series, which corresponds to a Saline Meadow ecological site. The similarity index at the monitoring site has ranged between 12-18% during the baseline period. Herbaceous production for the site is much lower than potential, while shrub production is much higher than typical for a Saline Meadow site at its potential. In 1968-69 this entire area was scraped to store runoff. This type of activity significantly altered the area's ability to resemble a Saline Meadow in high ecological condition. Frequency trend was static in 2009 when compared to baseline years with the exception of the appearance of verrucose seapurslane (*Sesuvium verrucosum* [SEVE2]). Similar to 2009, the 2010 trend remained static. Utilization has been minimal on the site during the four years of sampling. However, the utilization by species was higher than it has ever been at 80% for SPAI.

Utilization by Weighted Average and Species, BLKROC_01

	Weighted Average	DISP	SPAI
2007	13%	10%	46%
2008	8%	8%	
2009	10%	11%	
2010	4%		80%

Frequency (%), BLKROC_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	HECU3	7	4	8	2	16	10
	MALE3	20	26	21	26	21	13
	PYRA	0	3	2	1	0	0
	SEVE2	0	0	0	0	16	0
Perennial Graminoid	DISP	39	59	69	52	57	49
	JUBA	27	39	35	24	21	18
	SPAI	0	4	3	4	4	4
Shrubs	ATTO	29	36	35	36	13	17
	ERNA10	65	61	57	53	52	47

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	HECU3	T	T	T	T	T	T
	MALE3	T	T	T	T	T	T
	PYRA	0	T	T	T	T	0
	SEVE2	0	0	0	0	T	0
Perennial Graminoid	DISP	1	2	1	1	1	1
	JUBA	T	1	1	1	T	T
	SPAI	0	T	T	T	T	T

Cover (m) Shrubs BLKROC_01

Species Code	2003	2004	2007	2009	2010
ATTO	12.6	3.5	12.2	3.8	4.6
ERNA10	26.1	11.4	20.6	10.5	13.2
Total	38.7	14.8	32.7	14.3	17.7

Ground Cover (%) BLKROC_01

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	71	66	83	81	86	77
Dung	1	1	1	1	1	T
Litter	30	31	16	18	14	23
Rock	0	0	0	0	0	0
Standing Dead	0	0	6	12	17	6

Shrub Densities and Age Classes BLKROC_01

	ATTO					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	3	0	1	0	2	1
Juvenile	8	11	8	5	1	2
Mature	9	29	23	11	17	19
Decadent	1	3	3	11	10	9
Total	21	43	35	27	30	31

	ERNA10					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	6	6	2	0	2	1
Juvenile	9	39	29	18	15	12
Mature	25	84	77	33	53	44
Decadent	11	22	27	45	27	31
Total	51	151	135	96	97	88

BLKROC_39

BLKROC_39 is located on an upland site in the White Meadow Field. The soils are Division-Numu Complex, 0 to 2% slopes, which corresponds to the Saline Meadow ecological site. The similarity index ranged between 55-64% during the baseline period. However, based on ocular estimates, production is far less than typical for a Saline Bottom site. The site was scraped during the wet winter of 1968-69. The loss of the 'A horizon' during this period has likely contributed to the poor productivity of the site. Frequency in 2010 did not depart from previous sampling periods and has not shifted beyond baseline frequency values. Utilization has been minimal during the past four years with no utilization in 2010.

Utilization by Weighted Average and Species, BLKROC_39

	Weighted Average	DISP
2007	9%	9%
2008	11%	11%
2009	9%	9%
2010	0%	0

Frequency (%), BLKROC_39

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	NIOC2	0	0	3	0	4	6
	SUMO	7	12	5	8	4	6
Perennial Graminoid	DISP	104	94	88	87	98	95
	JUBA	7	0	0	0	0	0
Shrubs	ALOC2	5	8	11	13	13	12
	ATCO	3	9	3	9	13	8
	ATTO	17	3	3	3	0	0
	ERNA10	0	4	0	1	0	0
	SAVE4	3	0	4	4	3	5
Nonnative Species	BAHY	0	2	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_39

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	NIOC2	0	0	T	0	T	T
	SUMO	T	0	0	0	0	0
Perennial Graminoid	DISP	3	3	3	4	3	2
	JUBA	T	0	0	0	0	0
Nonnative Species	BAHY	0	T	0	0	0	0

Cover (m) Shrubs BLKROC_39

Species Code	2003	2004	2007	2009	2010
ALOC2	0.1	0.2	0.0	0.0	1.0
ATCO	0.1	0.5	0.4	1.7	6.4
ATTO	3.4	1.9	2.4	1.3	0.0
ERNA10	0.1	0.0	0.3	0.0	0.3
SAVE4	1.4	0.0	0.1	0.0	1.2
SUMO	0.2	0.4	0.5	0.4	0.6
Total	5.3	3.0	3.6	3.5	9.5

Ground Cover (%) BLKROC_39

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	82	86	94	92	95	97
Dung	1	1	1	1	0	0
Litter	12	13	5	7	5	6
Rock	1	0	0	0	0	0
Standing Dead	0	0	0	T	2	T

Shrub Densities and Age Classes BLKROC_39

	ATCO						ATTO					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	1	0	5	2	0	0	4	10	9	0	1	0
Juvenile	1	0	2	10	0	2	0	2	11	0	0	1
Mature	0	6	1	2	1	6	5	14	9	4	6	0
Decadent	0	0	0	0	0	4	2	3	5	10	7	0
Total	2	6	8	14	1	12	11	29	34	14	14	1

	ERNA10		SAVE4					SUMO					
Age Class	**2003**	**2007**	**2002**	**2003**	**2004**	**2007**	**2009**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	0	0	0	0	0	0	0	0	0	1	1	0	0
Juvenile	1	2	0	0	0	0	0	0	0	0	4	0	0
Mature	0	1	1	6	1	1	2	1	4	4	1	2	4
Decadent	0	0	0	0	0	0	0	0	2	0	1	0	1
Total	1	3	1	6	1	1	2	1	6	5	7	2	5

Reservation Field

BLKROC_02

BLKROC_02 is located in the Reservation Field, which is designated as an upland pasture. The soils are mapped as Manzanar-Winnedumah Association, 0-2% slopes soil series, which corresponds to the Saline Meadow ecological site. The similarity index has varied widely during the baseline period ranging between 28-55%, largely because of fluctuations in alkali sacaton production. The site is dominated by shrubs and may not be able to reach site potential unless shrub densities are reduced. There was no significant change in frequency in 2010 when compared to 2007 and 2009. The general trend for the area is static. Nevada saltbush densities increased in 2003 and 2004 during a large germination event of seedlings, subsequent years indicate that survivability was low; however, total density has remained greater than 2002. Cover has remained static since 2003. Although this may seem incongruous, canopy cover is measured at the top most level and does not sample for additional plants of the same species beneath the upper canopy, therefore seedlings at the base of parent plants would remain undetected. Utilization has remained within the 65% utilization standard for upland pastures from 2007 to 2010.

Table 16. Utilization by Weighted Average and Species, BLKROC_02

	Weighted Average	DISP	SPAI
2007	64%	53%	71%
2008	30%	26%	33%
2009	42%	42%	
2010	36%	15%	53%

Frequency (%), BLKROC_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	3	0	0	0	0
Perennial Forb	GLLE3	7	2	5	4	7	8
Perennial Graminoid	DISP	53	49	55	49	55	48
	JUBA	3	11	6	6	4	8
	LECI4	0	4	1	2	2	3
	SPAI	71	95	92	91	86	78
Shrubs	ATTO	43	35	41	30	27	20
	ERNA10	12	27	13	16	22	19
Nonnative Species	BAHY	0	5	0	0	0	0
	SATR12	0	0	1	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%)Forbs, Graminoids, Sub-shrubs BLKROC_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	GLLE3	1	T	1	1	1	1
Perennial Graminoid	DISP	1	2	1	2	1	1
	JUBA	T	T	T	T	T	T
	LECI4	0	2	T	T	T	T
	SPAI	10	9	7	9	5	3

Cover (m) Shrubs BLKROC_02

Species Code	2003	2004	2007	2009	2010
ATTO	22.3	10.3	13.4	9.7	8.3
ERNA10	6.0	25.1	3.4	6.4	5.4
Total	28.3	35.4	16.9	16.1	13.7

Ground Cover (%) BLKROC_02

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	58	42	63	47	53	58
Dung	1	1	1	1	1	T
Litter	41	48	32	52	46	42
Rock	0	2	0	0	0	0
Standing Dead	0	0	5	8	13	6

Shrub Densities and Age Classes BLKROC_02

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	3	212	93	0	0	0	0	7	5	0	0	0
Juvenile	7	10	83	4	19	11	1	6	2	1	0	0
Mature	5	23	26	21	19	15	3	5	8	6	8	8
Decadent	8	5	2	10	14	6	2	5	2	3	5	4
Total	23	250	204	35	52	32	6	23	17	10	13	12

BLKROC_03

BLKROC_03 is located in the Reservation Field on the Shondow Loam 0-2% slopes soil series. The transect is on a Saline Meadow ecological site in an upland pasture. The site has ranged between 63-72% similarity to the site's potential, placing the area in good to excellent condition. The site produces large quantities of alkali sacaton. Following 2007, utilization remained below the 65% standard for upland pastures. Frequency results indicate the site has been stable over the past five monitoring periods with the exception of an increase in rubber rabbitbrush in 2009 and a subsequent decrease in 2010. Increases in frequency, cover, and density for rubber rabbitbrush have markedly risen during the past three sampling periods. As mentioned in 2009, because this site is experiencing an increase in shrub abundance while maintaining high grass cover, this area should be considered a candidate for a prescribed burn in the near future before sacaton cover starts to be replaced by even greater amounts of rubber rabbitbrush. Presently, the site is in excellent condition but not stable due to the rising abundance of woody species. Utilization has remained fairly stable for the past four years with alkali sacaton being the preferred forage.

Utilization by Weighed Average and Species, BLKROC_03

	Weighted Average	DISP	SPAI
2007	74%	71%	76%
2008	43%	23%	63%
2009	52%	41%	56%
2010	46%	17%	67%

Frequency (%), BLKROC_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	CHHI	0	18	6	0	0	0
Perennial Forb	GLLE3	0	0	0	0	1	0
Perennial Graminoid	ARPU9	0	0	0	2	0	0
	DISP	53	47	59	42	36	18
	JUBA	0	0	0	0	2	0
	SPAI	100	112	117	122	128	122
Shrubs	ATTO	0	0	0	1	2	2
	ERNA10	0	6	7	4	17	8*
Nonnative Species	LASE	0	3	3	0	0	0
	POMO5	0	2	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	CHHI	0	2	T	0	0	0
Perennial Forb	GLLE3	0	0	0	T	T	0
Perennial Graminoid	ARPU9	0	0	0	T	0	0
	DISP	5	7	2	3	1	9
	JUBA	0	0	0	0	T	0
	SPAI	35	49	23	58	31	13
Nonnative Species	LASE	0	T	T	0	0	0
	POMO5	0	T	0	0	0	0

Cover (m) Shrubs BLKROC_03

Species Code	2003	2004	2007	2009	2010
ATTO	0.0	0.0	0.3	0.0	0.0
ERNA10	1.5	1.3	5.3	9.5	9.8
Total	1.5	1.3	5.6	9.5	9.8

Ground Cover (%)BLKROC_03

Substrate	2002	2003	2004	2007	2009	2010
Bare soil	35	0	0	0	0	0
Dung	2	1	1	3	1	T
Litter	58	50	38	64	74	64
Rock	0	0	0	0	0	0
Standing Dead	0	0	0	T	T	0
Bare Ground	0	26	44	34	25	36

Shrub Densities and Age Classes BLKROC_03

	ATTO			ERNA10					
Age Class	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	0	0	0	11	0	0	0	0
Juvenile	0	0	0	0	0	9	26	13	8
Mature	2	2	3	1	3	3	36	48	30
Decadent	0	0	0	0	0	0	1	0	0
Total	2	2	3	1	14	12	63	61	38

BLKROC_44

BLKROC_44 is located in an upland site in the Reservation Field. The soils are Manzanar-Winnedumah Association, 0-2% slopes, which corresponds to the Sodic Fan ecological site. Similarity index has ranged between 62-87%. There was no significant difference between 2010 and 2009. The site is static and in good condition. Utilization has been within the upland standards of 65% or less. Manzanar-Winnedumah soils will not support large amounts of perennial grass; therefore, burns on the soil types should not occur if the goal is to increase perennial grass production. Utilization on this transect had been up and down for 2007-08. In 2009-10 it appears that utilization has stabilized with very little change to the utilization by weighted average or species.

Utilization by Weighted Average and Species, BLKROC_44

	Weighted Average	DISP	SPAI
2007	65%	57%	74%
2008	28%	20%	36%
2009	47%	34%	66%
2010	45%	35%	67%

Frequency (%), BLKROC_44

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	1	0	0	0	0
	ATSES	0	35	0	0	0	0
	CORA5	0	1	0	0	0	0
Perennial Forb	SUMO	3	7	7	8	15	15
Perennial Graminoid	DISP	104	96	104	113	114	102
	JUBA	20	14	16	7	11	0
	SPAI	80	87	83	83	82	82
Shrubs	ATTO	32	70	83	28	35	20
	ERNA10	17	30	32	10	24	32
Nonnative Species	BAHY	0	1	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_44

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	T	0	0	0	0
	ATSES	0	1	0	0	0	0
	CORA5	0	T	0	0	0	0
Perennial Forb	SUMO	T	0	0	0	0	0
Perennial Graminoid	DISP	6	7	5	7	4	2
	JUBA	T	T	T	T	T	0
	SPAI	11	13	8	7	5	3
Nonnative Species	BAHY	0	T	0	0	0	0

Cover (m) Shrubs BLKROC_44

Species Code	2003	2004	2007	2009	2010
ATTO	19.4	11.9	10.7	10.7	9.6
ERNA10	7.7	6.0	11.4	10.1	8.7
SUMO	1.4	0.9	1.8	0.2	0.6
Total	28.5	18.8	23.9	21.0	19.0

Ground Cover (%) BLKROC_44

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	36	34	48	49	45	49
Dung	2	1	1	1	1	T
Litter	35	55	49	51	54	50
Rock	0	0	0	0	0	0
Standing Dead	0	0	8	17	12	0

Shrub Densities and Age Classes BLKROC_44

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	1	942	364	0	0	0	0	0	3	0	0	0
Juvenile	6	250	146	27	0	8	5	9	4	2	0	3
Mature	13	41	29	21	39	16	4	21	23	29	26	21
Decadent	7	15	6	21	24	14	4	6	6	7	7	6
Total	27	1248	545	69	63	38	13	36	36	38	33	30

	SUMO					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	0	7	9	0	0	0
Juvenile	1	10	10	17	1	8
Mature	0	8	23	6	17	7
Decadent	0	0	1	1	1	0
Total	1	25	43	24	19	15

BLKROC_49

BLKROC_49 is located in an upland site in the Reservation Field. The soils are Mazourka Hard Substratum-Mazourka-Eclipse Complex, 0-2% slopes, which corresponds to the Sandy Terrace ecological site. The similarity index ranged between 14%-38% during the baseline period. The poor similarity index was a result of having too much saltgrass and alkali sacaton in the plant community composition. Sandy Terrace ecological sites are shrub dominant sites with low annual aboveground biomass production. The ecological site description does not account for instances with large abundances of perennial grasses. There were no significant changes in frequency values between 2009 and 2010. The decrease in saltgrass in 2010 does not significantly differ from 2003, 2007, and 2009. Utilization on this upland pasture was minimal for all four years.

Utilization by Weighted Average and Species, BLKROC_49

	Weighted Average	DISP	SPAI
2007	42%	22%	69%
2008	13%	9%	19%
2009	13%	10%	19%
2010	16%	9%	22%

Frequency (%), BLKROC_49

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ERIAS	0	3	0	0	0	0
	PSRA	0	0	2	0	1	0
Perennial Forb	MACA2	0	0	0	0	0	3
	OENOT	0	3	0	0	0	0
	STEPH	5	2	17	0	0	0
	STPA4	0	0	0	6	3	0
Perennial Graminoid	DISP	78	56	63	53	52	45
	SPAI	29	24	25	27	29	31
Shrubs	ATCO	20	15	19	21	30	24
	ATPA3	3	4	1	0	1	6
	ATTO	0	0	0	0	0	0
	ERNA10	14	10	7	4	10	16
	SAVE4	3	0	4	2	4	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_49

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ERIAS	0	T	0	0	0	0
	PSRA	0	0	T	0	0	0
Perennial Forb	OENOT	0	T	0	0	0	0
	STEPH	T	T	T	0	0	0
	STPA4	0	0	0	T	T	0
Perennial Graminoid	DISP	3	4	2	1	2	1
	SPAI	2	3	2	2	2	1

Cover (m) Shrubs BLKROC_49

Species Code	2003	2004	2007	2009	2010
ATCO	0.4	0.0	0.2	0.7	0.2
ERNA10	1.1	1.1	2.3	1.7	0.6
MACA2	0.0	0.6	0.0	0.0	0.0
SAVE4	1.0	0.6	1.9	1.4	1.2
Total	2.5	2.3	4.4	3.8	2.0

Ground Cover (%) BLKROC_49

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	76	83	93	89	90	94
Dung	1	0	0	1	0	T
Litter	15	12	6	5	10	6
Rock	3	0	0	5	0	0
Standing Dead	0	0	5	2	5	1

Shrub Densities and Age Classes BLKROC_49

	ATCO						ATPA3				ATTO
Age Class	2002	2003	2004	2007	2009	2010	2003	2004	2007	2010	2002
Seedling	0	1	2	1	1	0	0	0	0	0	0
Juvenile	0	6	11	31	6	13	0	1	6	1	0
Mature	2	10	6	5	31	13	2	1	0	0	0
Decadent	3	6	5	2	5	0	1	1	1	0	1
Total	5	23	24	39	43	26	3	3	7	1	1

	ERNA10						MACA2
Age Class	2002	2003	2004	2007	2009	2010	2004
Seedling	2	0	0	0	0	0	0
Juvenile	2	6	8	10	0	2	0
Mature	2	1	3	7	6	10	1
Decadent	0	1	0	3	2	0	0
Total	6	8	11	20	8	12	1

	SAVE4						SUMO
Age Class	2002	2003	2004	2007	2009	2010	2009
Seedling	0	0	0	0	0	0	0
Juvenile	0	3	4	3	0	4	0
Mature	0	0	1	2	1	1	1
Decadent	1	2	3	3	2	1	0
Total	1	5	8	8	3	6	1

BLKROC_51

BLKROC_51 is located in an upland site in the Reservation Field. The soils are Winnedumah Silt Loam, 0-2% slopes, which corresponds to the Sodic Fan ecological site. The similarity index for the site during baseline period ranged between 46-78%. The site has a higher grass component and lower shrub component than expected for Sodic Fan site, thus lowering the similarity index. The only significant change in frequency was an increase in sacaton. Saltgrass declined in 2010 but was not significantly less than previously observed values for the site (i.e. 2004 and 2009). Utilization has been within upland standards for the past three years.

Utilization by Weighted Average and Species, BLKROC_51

	Weighted Average	DISP	SPAI
2007	72%	64%	80%
2008	46%	29%	64%
2009	49%	26%	78%
2010	33%	23%	48%

Frequency (%), BLKROC_51

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	GLLE3	32	2	12	27	8	5
	SUMO	0	0	0	2	0	0
Perennial Graminoid	DISP	100	85	70	114	73	58
	SPAI	34	21	27	45	18	43**
Shrubs	ALOC2	0	0	0	1	0	0
	ATTO	15	56	42	38	8	3
	ERNA10	9	2	0	11	1	5

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_51

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	GLLE3	10	1	5	6	6	5
	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	12	13	7	8	5	2
	SPAI	6	6	6	6	3	5

Cover (m) Shrubs BLKROC_51

Species Code	2003	2004	2007	2009	2010
ATTO	25.9	6.2	11.8	7.9	4.6
ERNA10	2.1	0.5	4.1	4.1	3.3
SAVE4	0.0	0.0	0.4	0.3	0.0
Total	28.0	6.8	16.3	12.3	7.9

Ground Cover (%) BLKROC_51

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	31	47	60	53	49	45
Dung	2	2	1	1	0	T
Litter	42	48	34	47	51	55
Rock	0	0	0	0	0	0
Standing Dead	0	0	13	16	10	2.8

Shrub Densities and Age Classes BLKROC_51

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	1	1434	21	0	13	0	1	0	0	0	0	0
Juvenile	3	285	103	23	15	15	2	3	2	0	0	2
Mature	7	15	17	44	19	10	2	3	4	5	5	9
Decadent	11	8	25	19	14	13	0	0	0	0	0	0
Total	22	1742	166	86	61	38	5	6	6	5	5	11

	SAVE4			
Age Class	2004	2007	2009	2010
Seedling	0	0	0	0
Juvenile	1	0	0	2
Mature	0	2	2	0
Decadent	2	1	1	0
Total	3	3	3	2

Reservation Riparian Field

BLKROC_15

BLKROC_15 is in a riparian management area, located in the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The site is located on the historical 'dry reach' of the Owens and has not begun to show signs of recovery since the return of flows in December 2006. The similarity index is poor for the site ranging between 8-11%. Tamarisk slash was burned at the site in the winter months of 2008 and subsequently invaded by bassia in 2010 with frequency at its highest seen on the site. Although there were no statistically significant changes from 2010 compared to 2009 there appears to be several general trends when looking at estimates across all sampling periods. There is a disappearance of all annual forbs that is a result of the increased canopy cover of Nevada saltbush and bassia. Saltgrass has slowly decreased on the site while shrub cover has more than doubled on the site. Similar to other sites along the re-watered riparian corridor litter has increased while bare soil has decreased. There is not an adequate amount of perennial grasses on this transect to measure utilization.

Frequency (%), BLKROC_15

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATTR	0	0	16	0	0	0
	CHIN2	14	4	29	0	0	0
	ERAM2	0	0	5	0	0	0
	GITR	0	0	4	0	0	0
	LEFL2	0	0	3	0	0	0
	MEAL6	0	0	21	0	0	0
	NADE	0	0	1	0	0	0
Perennial Forb	SUMO	15	18	39	31	32	37
Perennial Graminoid	DISP	25	21	19	14	3	11
Shrubs	ATTO	48	35	80	29	47	58
	SAVE4	2	9	2	6	5	8
Nonnative Species	BAHY	6	2	17	0	23	35
	DESO2	0	3	10	0	0	0
	SATR12	0	1	2	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_15

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATTR	0	0	1	0	0	0
	CHIN2	1	T	1	0	0	0
	ERAM2	0	0	T	0	0	0
	GITR	0	0	T	0	0	0
	LEFL2	0	0	T	0	0	0
	MEAL6	0	0	1	0	0	0
	NADE	0	0	T	0	0	0
Perennial Forb	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	1	T	T	T	T	T
Nonnative Species	BAHY	T	T	T	0	3	13
	DESO2	0	T	1	0	0	0
	SATR12	0	T	T	0	0	0

Cover (m) Shrubs BLKROC_15

Species Code	2003	2004	2005	2007	2009	2010
ATTO	25.4	15.1	19.3	32.9	34.8	39.9
SAVE4	10.1	8.0	6.6	7.6	9.1	9.8
SUMO	1.8	1.2	0.9	20.3	23.7	32.2
Total	37.3	24.3	26.8	60.8	67.6	81.9

Ground Cover (%) BLKROC_15

Substrate	2003	2004	2005	2007	2009	2010
Dung	2	1	1	1	0	1
Litter	75	67	61	69	91	94
Rock	0	0	0	0	0	0
Standing Dead	0	20	27	19	5	8
Bare Ground	22	32	36	30	9	5

Shrub Densities and Age Classes BLKROC_15

	ATTO						SAVE4					
Age Class	2003	2004	2005	2007	2009	2010	2003	2004	2005	2007	2009	2010
Seedling	54	1	317	0	0	51	0	0	0	0	0	0
Juvenile	57	21	49	12	21	7	0	2	2	1	2	0
Mature	18	10	22	42	48	57	6	2	8	6	9	11
Decadent	7	39	3	3	5	4	2	1	1	3	0	1
Total	136	71	391	57	74	119	8	5	11	10	11	12

	SUMO					
Age Class	2003	2004	2005	2007	2009	2010
Seedling	8	0	278	0	0	13
Juvenile	19	20	55	19	4	3
Mature	19	7	12	32	37	43
Decadent	0	8	0	2	1	2
Total	46	35	345	53	42	61

BLKROC_16

BLKROC_16 is located in a riparian management area on the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similar to BLKROC_17, BLKROC_15, BLKROC_14, BLKROC_10 and BLKROC_11 the site is on the historical 'dry reach' of the Owens River. The similarity index is poor for the site ranging between 6-10%. The site is shrub dominated with no perennial grass component. Frequency of Nevada saltbush and bassia increased in 2010, both species exceeding what has been previously observed for the site. Resulting from the rewatering adjacent to the site, Nevada saltbush increased from 5.2 m in 2005 to 44.5 m in 2010. Litter has increased while bare soil has decreased. Utilization has not been estimated on the site because of the absence of key forage species.

Frequency (%), BLKROC_16

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	4	0	0	0	0	2
	ATTR	0	0	18	0	0	0
	CHIN2	13	16	37	0	0	0
	CRYPT	0	0	3	0	0	0
	ERAM2	0	0	0	0	0	0
	ERIOG	10	0	0	0	0	0
	ERMA2	0	11	23	0	0	0
	GITR	0	0	20	0	0	0
Perennial Forb	MACA2	0	0	59	0	0	0
	SUMO	0	0	7	0	0	1
Shrubs	ATCO	7	0	3	4	9	8
	ATTO	19	23	33	31	39	55*
	SAVE4	5	12	6	8	11	6
Non-native Species	BAHY	3	7	4	0	17	40**
	SATR12	11	41	44	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_16

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	T	0	0	0	0	0
	ATTR	0	0	T	0	0	0
	CHIN2	2	T	3	0	0	0
	CRYPT	0	0	T	0	0	0
	ERAM2	T	0	0	0	0	0
	ERIOG	0	0	0	0	0	0
	ERMA2	0	T	T	0	0	0
	GITR	0	0	T	0	0	0
Perennial Forb	MACA2	0	0	2	0	0	0
	SUMO	0	0	0	0	0	0
Nonnative Species	BAHY	T	T	T	0	3	6
	SATR12	2	1	1	0	0	0

Cover (m) Shrubs BLKROC_16

Species Code	2003	2004	2005	2007	2009	2010
ATCO	0.4	0.5	0.0	0.0	0.4	3.8
ATTO	6.5	2.9	5.2	16.8	44.2	44.5
SAVE4	11.0	10.4	9.8	13.3	12.4	14.9
Total	17.9	13.8	15.0	30.1	56.9	63.2

Ground Cover (%) BLKROC_16

Substrate	2003	2004	2005	2007	2009	2010
Dung	1	1	1	1	1	1
Litter	59	50	48	55	66	79
Rock	0	0	0	0	0	0
Standing Dead	0	21	19	2	4	5
Bare Ground	38	47	51	44	33	19

Shrub Densities and Age Classes BLKROC_16

	ATCO					ATTO					
Age Class	2003	2005	2007	2009	2010	2003	2004	2005	2007	2009	2010
Seedling	3	0	0	0	0	17	0	41	0	0	131
Juvenile	1	3	7	6	2	80	33	6	14	7	113
Mature	2	2	1	7	8	9	10	10	56	66	76
Decadent	2	0	0	0	0	2	12	0	3	4	24
Total	8	5	8	13	10	108	55	57	73	77	344

	SAVE4					
Age Class	2003	2004	2005	2007	2009	2010
Seedling	0	0	2	0	0	1
Juvenile	1	0	0	4	5	3
Mature	4	5	8	7	9	9
Decadent	2	0	0	0	0	2
Total	7	5	10	11	14	15

BLKROC_17

BLKROC_17 is located in a riparian management area on the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 3-5% for the site. Similar to other sites on the historical 'dry reach' of the Owens River, BLKROC_17 has not begun to respond from returned river flows. The site is shrub dominated (Nevada saltbush) with little to no perennial grass component. Frequency did not differ between 2009 and 2010. Canopy cover of Nevada saltbush increased substantially in 2010. No utilization estimates for the transect have been made because the site lacks key forage species.

Frequency (%), BLKROC_17

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	12	0	8	0	0	5
	ATTR	3	0	31	0	0	0
	CHIN2	13	10	40	0	0	0
	CHLE4	0	0	1	0	0	0
	CRCI2	0	0	4	0	0	0
	ERIOG	0	0	0	0	0	3
	ERWI	0	0	7	0	0	0
	GITR	0	0	32	0	0	0
	LEFL2	0	0	54	0	0	0
	MEAL6	0	0	29	0	0	0
Perennial Forb	HECU3	0	0	0	0	0	0
Perennial Graminoid	HOJU	0	0	2	0	0	0
Shrubs	ATTO	70	34	74	45	49	54
Nonnative Species	BAHY	0	0	0	0	0	5
	DESO2	0	0	6	0	0	0
	SATR12	9	10	6	0	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_17

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	T	0	T	0	0	5
	ATTR	1	0	3	0	0	0
	CHIN2	T	T	1	0	0	0
	CHLE4	0	0	T	0	0	0
	CRCI2	0	0	T	0	0	0
	ERWI	0	0	T	0	0	0
	GITR	0	0	T	0	0	0
	LEFL2	0	0	4	0	0	0
	MEAL6	0	0	1	0	0	0
Perennial Forb	HECU3	0	0	0	0	T	0
Perennial Graminoid	HOJU	0	0	T	0	0	0
Nonnative Species	BAHY	0	0	0	0	0	T
	DESO2	0	0	T	0	0	0
	SATR12	T	T	T	0	T	0

Cover (m) Shrubs BLKROC_17

Species Code	2003	2004	2005	2007	2009	2010
ATTO	37.5	5.7	5.6	28.0	37.7	69.3

Ground Cover (%) BLKROC_17

Substrate	2003	2004	2005	2007	2009	2010
Dung	1	0	1	1	0	4
Litter	59	53	50	56	59	65
Rock	0	0	0	0	0	0
Standing Dead	0	34	29	16	11	5
Bare Ground	39	47	50	38	41	32

Shrub Densities and Age Classes BLKROC_17

	ATTO						SAVE4
Age Class	**2003**	**2004**	**2005**	**2007**	**2009**	**2010**	**2010**
Seedling	723	0	201	0	0	39	0
Juvenile	497	5	18	34	18	14	1
Mature	14	4	14	76	87	62	0
Decadent	7	22	3	15	3	1	0
Total	1241	31	236	125	108	116	1

Robinson Field

BLKROC_04

BLKROC_04 is located on an upland site within the Robinson Pasture. The soil series is Manzanar Silt Loam, 0-2% slopes and is a Saline Meadow ecological site. Similarity index during the baseline period ranged between 52-74%. The site has a high diversity of perennial grasses and low shrub composition. In 2009, Baltic rush and creeping wildrye frequency significantly increased while alkali sacaton significantly decreased when compared to 2007, neither of these changes were significantly different from baseline sampling ranges (2002-2004). However, these increases were short-lived and in 2010 creeping wildrye and Baltic rush decreased to levels typically observed for the site. Alkali sacaton frequency increased while saltgrass remained static on the site. Short term trends have fluctuated with 2010 appearing to be drier than 2009 but when factored into what has previously been observed on the site, current trends remain within historic ranges. During the last three years utilization has been below the upland standard of 65%.

Utilization by Weighted Average and Species, BLKROC_04

	Weighted Average	DISP	LETR5	SPAI
2007	68%	56%	77%	83%
2008	58%	42%		75%
2009	17%	16%	27%	
2010	22%	22%		21%

Frequency (%), BLKROC_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	CHHI	0	2	0	0	0	0
	COMAC	0	23	0	0	0	3
	HEAN3	0	8	0	4	6	12
Perennial Forb	ANCA10	12	18	17	22	22	16
	HECU3	0	0	0	1	3	0
	MALE3	14	3	8	10	1	0
	PYRA	41	50	44	23	28	15*
Perennial Graminoid	CADO2	5	18	0	5	0	0
	CAREX	0	0	0	0	14	1**
	DISP	83	77	70	76	62	62
	JUBA	88	113	93	73	95	89
	LETR5	27	65	43	48	70	26**
	SPAI	70	30	73	59	27	56**
Shrubs	ALOC2	5	0	0	0	2	1
	ATTO	0	5	0	0	4	3
	ERNA10	0	3	2	2	3	2
Nonnative	BAHY	0	12	6	0	20	30
	POMO5	0	2	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	CHHI	0	T	0	0	0	0
	COMAC	0	2	0	0	0	T
	HEAN3	0	T	0	T	T	1
Perennial Forb	ANCA10	2	7	7	8	7	4
	HECU3	0	0	0	T	T	0
	MALE3	1	T	T	1	T	0
	PYRA	7	7	3	4	2	T
Perennial Graminoid	CADO2	T	T	0	T	0	0
	CAREX	0	0	0	0	1	T
	DISP	4	9	4	11	4	3
	JUBA	3	13	14	9	4	1
	LETR5	1	6	1	4	7	T
	SPAI	11	10	10	16	4	4
Shrubs	ALOC2	0	1	T	0	1	T
	ATTO	0	T	0	0	0	0
	ERNA10	T	T	0	T	0	0
Nonnative Species	BAHY	0	0	0	0	1	1
	POMO5	4	9	4	11	4	0

Cover (m) Shrubs BLKROC_04

Species Code	2003	2004	2007	2009	2010
ALOC2	0.0	0.0	0.0	0.0	0.4
ATTO	0.3	0.0	0.0	0.7	0.1
ERNA10	3.4	2.8	5.6	7.9	2.3
Total	3.6	2.8	5.6	8.6	2.9

Ground Cover (%) BLKROC_04

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	17	29	51	28	22	30
Dung	4	3	3	3	2	T
Litter	77	54	41	69	76	70
Rock	0	0	0	0	0	0
Standing Dead	0	0	0	1	1	T

Shrub Densities and Age Classes BLKROC_04

	ATTO				ERNA10					
Age Class	2002	2003	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	0	0	0	4	4	0	0	2	0
Juvenile	1	1	0	0	18	2	15	1	7	6
Mature	0	1	1	1	2	10	13	13	14	5
Decadent	0	0	0	0	0	0	0	1	1	0
Total	1	2	1	1	24	16	28	15	24	11

North Riparian Field

BLKROC_12

BLKROC_12 is located in a riparian management area in the North Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. An additional ground cover class, ponded water, was observed in 2009, evidence that the water table is rising which should contribute to future decreases in Nevada saltbush. Flows in the areas surrounding the transect have deepened the channel, wading across has now become impossible. As a result both livestock use and field crews were not able to access the site this year; therefore, no monitoring result will be presented.

BLKROC_22

BLKROC_22 is located in a riparian management area in the North Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index has been at 57% for 2006-07. There were no significant departures in frequency when compared to previous years and the site remains static. Utilization has decreased since 2007 from 72%; however, it still remained close to the 40% standard for riparian pastures in 2008-09. In 2010 it exceeded the standard by 3% increasing the overall pasture weighted average.

Utilization by Weighted Average and Species, BLKROC_22

	Weighted Average	DISP	SPAI
2007	72%	72%	75%
2008	32%	31%	35%
2009	36%	31%	61%
2010	43%	42%	48%

Frequency (%), BLKROC_22

Life Forms	Species	2006	2007	2009	2010
Perennial Forb	SUMO	3	6	2	5
Perennial Graminoid	DISP	124	111	125	132
	SPAI	4	4	3	2
Shrubs	ALOC2	4	4	10	9
	ATTO	21	7	19	20
	ERNA10	5	4	11	8
Nonnative Species	BAHY	11	0	9	1

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_22

Life Forms	Species	2006	2007	2009	2010
Perennial Forb	SUMO	0	0	0	0
Perennial Graminoid	DISP	23	18	17	20
	SPAI	3	2	3	2
Nonnative Species	BAHY	4	0	T	0

Cover (m) Shrubs BLKROC_22

Species Code	2006	2007	2009	2010
ALOC2	3.3	2.3	0.0	5.0
ATTO	11.4	9.9	9.6	5.5
ERNA10	8.0	9.1	6.9	7.0
SUMO	0.9	0.5	0.6	0.1
Total	23.6	21.9	17.1	17.6

Ground Cover (%) BLKROC_22

Substrate	2006	2007	2009	2010
Dung	3	1	2	2
Litter	53	63	70	70
Rock	0	T	T	0
Standing Dead	7	4	7	3
Bare Ground	43	36	28	28

Shrub Densities and Age Classes BLKROC_22

	ATTO				ERNA10			SUMO			
Age Class	**2006**	**2007**	**2009**	**2010**	**2007**	**2009**	**2010**	**2006**	**2007**	**2009**	**2010**
Seedling	15	0	237	15	0	2	0	11	0	2	0
Juvenile	72	14	18	117	9	4	6	5	5	4	9
Mature	19	28	27	26	18	14	18	4	2	2	1
Decadent	4	4	5	26	1	13	15	0	0	2	1
Total	110	46	287	184	28	33	39	20	7	10	11

South Riparian Field

BLKROC_13

BLKROC_13 is in a riparian management area located in the South Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity of the site to potential is high, ranging from 76-83% between 2002-2007. Plant frequency in 2010 did not differ from 2009. Creeping wildrye (LETR5) has increased since 2004. The relative abundance of creeping wildrye when compared to the total plant community is still minor with cover for the grass ranging from trace to 4%. Utilization on the transect has been at or below riparian utilization standards since implementation in 2007. This site is stable and in excellent condition.

Utilization by Weighted Average and Species, BLKROC_13

	Weighted Average	DISP	LETR5	SPAI
2007	41%	34%	45%	52%
2008	27%	20%		34%
2009	26%	33%	62%	12%
2010	10%	13%		

Frequency (%), BLKROC_13

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	0	0	1	2	7
Perennial Forb	ANCA10	7	5	11	13	13	16
	GLLE3	0	0	0	0	0	0
Perennial Graminoid	DISP	129	139	128	128	121	120
	JUBA	22	6	13	22	19	19
	LETR5	7	0	0	14	20	23
	SPAI	34	40	36	37	34	28
Shrubs	ATTO	0	12	5	8	1	5
	ERNA10	0	0	4	3	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_13

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	0	0	T	1	2
Perennial Forb	ANCA10	4	2	4	4	5	5
	GLLE3	T	0	0	0	0	0
Perennial Graminoid	DISP	29	42	22	32	23	15
	JUBA	1	T	T	T	T	T
	LETR5	T	0	0	1	4	3
	SPAI	16	12	9	10	8	3

Cover (m) Shrubs BLKROC_13

Species Code	2003	2004	2007	2009	2010
ATTO	4.0	3.1	8.7	7.6	8.1
ERNA10	0.0	0.4	2.4	2.5	2.8
Total	4.0	3.5	11.1	10.1	10.9

Ground Cover (%) BLKROC_13

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	16	17	38	34	21	19
Dung	2	6	4	7	1	1
Litter	77	57	47	59	79	80
Rock	0	0	0	0	0	0
Standing Dead	0	0	0	0	1	T

Shrub Densities and Age Classes BLKROC_13

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Juvenile	1	9	12	5	6	0	0	0	1	1	0	0
Mature	8	9	7	32	41	24	1	1	1	1	5	3
Decadent	0	0	0	2	2	0	0	0	0	0	0	0
Total	9	18	19	39	49	24	1	1	2	2	5	3

BLKROC_23

BLKROC_23 is in a riparian management area located in the South Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 78-79%. The site is in excellent condition with a minimal shrub component. Frequency values have not varied over the three sampling periods with the exception of Nevada saltbush in 2010. Utilization has remained within the 40% standard for riparian pastures.

Utilization by Weighted Average and Species, BLKROC_23

	Weighted Average	DISP	SPAI
2007	25%	22%	32%
2008	10%	6%	15%
2009	38%	47%	24%
2010	20%	19%	23%

Frequency (%), BLKROC_23

Life Forms	Species	2006	2007	2009	2010
Annual Forb	ATSES	18	0	0	0
Perennial Graminoid	DISP	139	133	139	135
	SPAI	25	28	28	24
Shrubs	ATTO	0	0	0	32
Nonnative Species	BAHY	4	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_23

Life Forms	Species	2006	2007	2009	2010
Annual Forb	ATSES	T	0	0	0
Perennial Graminoid	DISP	35	47	35	25
	SPAI	11	14	8	8
Nonnative Species	BAHY	T	0	0	0

Cover (m) Shrubs BLKROC_23

Species Code	2006	2007	2009	2010
ATTO	1.0	0.8	0.6	1.6

Ground Cover (%) BLKROC_23

Substrate	2006	2007	2009	2010
Dung	2	3	1	2
Litter	52	71	85	80
Rock	0	0	0	0
Standing Dead	0	T	T	0
Bare Ground	47	26	14	19

Shrub Densities and Age Classes BLKROC_23

	ATTO				ERNA10	
Age Class	2006	2007	2009	2010	2009	2010
Juvenile	3	0	1	4	1	1
Mature	2	7	6	5	0	0
Decadent	0	0	1	0	0	0
Total	5	7	8	9	1	1

Russell Field

BLKROC_05

BLKROC_05 is located on an upland site in the Russell Field. The soil series is Manzanar Silt Loam, 0-2% slopes. The site is a Saline Meadow ecological site. The similarity index ranged between 75-88% during the baseline period, indicating that the site is in excellent condition. Frequency results from 2010 showed a return to typical levels observed on the site, while sacaton increased to the highest frequency value observed at Blackrock_05, though not significantly greater than values sampled from 2003. All other attributes have remained static. Shrub cover (rubber rabbitbrush) and density at the study plot continues to show a gradual decline in 2010. Utilization exceeded 65% in 2007, during the past three years use has been well below the upland pasture standard of 65%.

Utilization by Weighted Average and Species, BLKROC_05

	Weighted Average	DISP	SPAI
2007	77%	73%	80%
2008	44%	25%	57%
2009	15%	15%	15%
2010	48%	17%	69%

Frequency (%), BLKROC_05

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	3	0	0	0	0
	ATSES	0	11	0	2	0	0
	CLEOM2	0	16	0	0	0	0
	COMAC	0	17	0	3	0	0
	HEAN3	3	11	0	6	0	2
Perennial Forb	PYRA	32	45	37	5	8	3
	SICO2	0	2	0	0	0	0
Perennial Graminoid	DISP	49	63	49	49	78	52**
	JUBA	7	14	14	10	10	6
	LECI4	0	0	0	0	4	0
	LETR5	0	0	0	0	0	4
	SPAI	124	125	115	123	111	131**
Shrubs	ATTO	0	2	0	0	0	4
	ERNA10	7	4	1	0	1	0
Nonnative Species	BAHY	0	0	0	11	3	0
	POMO5	0	4	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_05

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	0	0	0	0
	ATSES	0	1	0	T	0	0
	CLEOM2	0	1	0	0	0	0
	COMAC	0	1	0	T	0	0
	HEAN3	1	1	0	T	0	1
Perennial Forb	PYRA	4	5	2	T	T	4
	SICO2	0	T	0	0	0	0
Perennial Graminoid	DISP	12	13	5	20	6	12
	JUBA	T	1	2	1	T	T
	LECI4	0	0	0	0	T	0
	LETR5	0	0	0	0	0	T
	SPAI	30	47	33	58	21	17
Nonnative Species	BAHY	0	0	0	T	T	T
	POMO5	0	T	0	0	0	0.0

Cover (m) Shrubs BLKROC_05

Species Code	2003	2004	2007	2009	2010
ERNA10	7.6	6.3	2.1	0.8	0.5

Ground Cover (%)BLKROC_05

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	22	14	32	7	19	16
Dung	4	1	1	3	2	1
Litter	68	63	57	88	79	83
Rock	0	0	0	2	0	0
Standing Dead	0	0	0	0	1	T

Shrub Densities and Age Classes BLKROC_05

	ERNA10					
Age Class	2002	2003	2004	2007	2009	2010
Juvenile	1	3	4	0	0	0
Mature	4	11	9	1	1	0
Decadent	0	0	0	2	2	0
Total	5	14	13	3	3	0

Wrinkle Field

BLKROC_07

BLKROC_07 is located on an upland site in the Wrinkle Field. The soil series is Manzanar Silt Loam, 0-2% slopes soil series and is a Saline Meadow ecological site. The similarity index ranged between 79-93% during the baseline sampling period indicating the site is in excellent condition. Frequency values in 2010 did not range beyond baseline parameters. Sacaton frequency decreased in 2010 but still remains within the range typical for the site. Shrub cover and density appear to be stable on the site. Utilization has been within upland utilization standards for the past four years.

Utilization by Weighted Average and Species, BLKROC_07

	Weighted Average	DISP	SPAI
2007	47%	42%	51%
2008	27%	20%	34%
2009	26%	21%	31%
2010	40%	37%	44%

Frequency (%), BLKROC_07

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	32	0	0	0	18
	CLOB	0	9	0	0	0	6
	ERPR4	0	0	0	3	0	0
Perennial Forb	SUMO	0	0	0	0	3	0
Perennial Graminoid	DISP	70	59	71	61	75	73
	JUBA	17	6	12	1	4	6
	SPAI	92	68	64	76	84	67*
Shrubs	ATTO	5	0	0	0	0	2
	ERNA10	5	4	3	3	4	5
Nonnative Species	POMO5	0	0	0	9	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_07

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	3	0	0	0	T
	CLOB	0	1	0	0	0	1
	ERPR4	0	0	0	T	0	0
Perennial Forb	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	5	7	4	15	5	2
	JUBA	2	1	1	T	T	T
	SPAI	25	20	11	36	17	5
Nonnative Species	POMO5	0	0	0	2	0	0

Cover (m) Shrubs BLKROC_07

Species Code	2003	2004	2007	2009	2010
ATTO	0.0	0.0	0.5	0.2	0.3
ERNA10	3.6	2.9	3.0	1.9	1.6
SUMO	0.0	0.4	0.7	0.3	0.0
Total	3.6	3.2	4.2	2.3	1.9

Ground Cover (%)BLKROC_07

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	40	43	59	52	43	40
Dung	2	3	2	1	1	1
Litter	54	42	30	44	54	58
Rock	0	0	0	0	2	2
Standing Dead	0	0	0	3	1	1

Shrub Densities and Age Classes BLKROC_07

	ATTO						ERNA10					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	0	0	0	2	0	0	3	1	0	0	0	0
Juvenile	1	1	2	1	0	0	6	8	6	2	0	0
Mature	0	2	3	1	3	2	4	13	15	3	5	3
Decadent	0	0	0	1	2	0	0	1	0	3	2	2
Total	1	3	5	5	5	2	13	23	21	8	7	5

	SAVE4	SUMO			TARA
Age Class	**2004**	**2004**	**2007**	**2009**	**2007**
Seedling	0	0	0	0	7
Juvenile	1	1	4	3	0
Mature	0	3	2	3	0
Decadent	0	0	3	0	0
Total	1	4	9	6	7

Locust Field

BLKROC_06

BLKROC_06 is located on an upland site in the Locust Field. The soil series is Manzanar Silt Loam, 0-2% slopes and the ecological site is a Saline Meadow. The similarity index ranged between 73-85% during the baseline sampling period indicating the site is in excellent condition. Utilization during the past three years was within standards designated for upland plant communities, with minimal use during the last two years. Baltic rush continued to significantly decrease in 2010 to its lowest level seen on the site. Frequency for sacaton increased to it highest level since 2002. Rubber rabbitbrush densities rose precipitously in 2003. LADWP Watershed staff have noted a high abundance of young rubber rabbitbrush in the general area, placing the site as a candidate for a maintenance burn. Given current conditions, a light to moderate intensity burn would effectively eliminate the increasing amount of juvenile shrubs. Utilization has been well below the upland standards for the past three years.

Utilization by Weighted Average and Species, BLKROC_06

	Weighted Average	DISP	SPAI
2007	65%	44%	82%
2008	15%	10%	20%
2009	17%	13%	20%
2010	34%	14%	54%

Frequency (%), BLKROC_06

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	30	0	0	0	19**
	CHHI	0	8	0	0	0	0
	CLEOM2	0	3	0	0	0	0
	COMAC	0	26	0	0	0	5
Perennial Forb	ANCA10	5	4	4	2	4	2
	PYRA	19	4	0	2	1	0
Perennial Graminoid	DISP	73	80	75	77	66	70
	JUBA	17	26	37	27	13	9*
	SPAI	95	78	71	76	76	85*
Shrubs	ATTO	0	8	9	4	10	6
	ERNA10	20	19	6	8	9	14
	SAEX	0	0	0	2	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_06

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	2	0	0	0	1
	CHHI	0	T	0	0	0	0
	CLEOM2	0	T	0	0	0	0
	COMAC	0	4	0	0	0	1
Perennial Forb	ANCA10	4	1	3	1	1	T
	PYRA	1	1	T	T	T	0
Perennial Graminoid	DISP	6	9	8	9	3	2
	JUBA	T	1	4	1	1	T
	SPAI	29	33	38	32	14	6

Cover (m) Shrubs BLKROC_06

Species Code	2003	2004	2007	2009	2010
ATTO	3.3	0.7	1.0	2.1	1.3
ERNA10	17.3	9.1	9.9	9.5	9.8
SAEX	2.3	7.5	3.3	0.7	0.1
SALIX	0.0	0.6	0.0	0.0	0.0
Total	23.0	18.0	14.2	12.3	11.2

Ground Cover (%)BLKROC_06

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	35	20	30	30	32	32
Dung	2	2	1	4	3	1
Litter	61	63	58	66	65	70
Rock	0	0	0	0	0	0
Standing Dead	0	0	12	2	3	3

Shrub Densities and Age Classes BLKROC_06

	ATTO						ERNA10					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Seedling	0	1	27	7	0	0	0	6	2	2	0	0
Juvenile	3	3	9	22	4	0	19	49	44	36	4	0
Mature	1	9	3	15	39	14	26	94	52	51	90	50
Decadent	1	1	0	1	0	0	2	2	20	29	25	15
Total	5	14	39	45	43	14	47	151	118	118	119	65

	SALIX	SAVE4		SAEX				
Age Class	**2004**	**2002**	**2003**	**2002**	**2003**	**2004**	**2007**	**2010**
Seedling	0	0	0	0	0	0	0	0
Juvenile	2	0	0	0	3	3	3	0
Mature	0	1	1	0	13	8	10	8
Decadent	0	0	0	1	0	1	6	0
Total	2	1	1	1	16	12	19	8

Wrinkle Riparian Field

BLKROC_18

BLKROC_18 is a riparian management area located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index has ranged between 53-75%. Saltgrass frequency decreased significantly between 2007 and 2009 and continued to drop in 2010 to a level beyond what has been seen on the site previously. Conversely, sacaton increased beyond the historical range for the site. There were no changes for all other species. In genera, shrub cover exceeds what is expected for the site at its potential. This area would benefit from a maintenance burn. Utilization has consistently remained below the 40% riparian standard until 2010. In 2010 the utilization standard was exceeded by 6% with most of the grazing being concentrated on inland saltgrass.

Utilization by Weighted Average and Species, BLKROC_18

	Weighted Average	DISP	SPAI
2007	29%	28%	30%
2008	21%	18%	25%
2009	39%	40%	37%
2010	46%	59%	18%

Frequency (%), BLKROC_18

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	3	0	0	0	0	0
	ATTR	0	0	0	0	0	0
	CHLE4	0	0	5	0	0	0
	GITR	0	0	4	0	0	0
Perennial Forb	GLLE3	3	6	9	4	1	4
Perennial Graminoid	DISP	119	104	114	118	102	86*
	SPAI	4	16	20	12	21	37*
	TYLA	0	0	0	0	3	3
Shrubs	ATTO	33	12	24	19	20	13
	ERNA10	1	2	10	1	0	5
Nonnative Species	BAHY	14	10	45	0	0	0
	SATR12	0	0	3	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_18

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	T	0	0	0	0	0
	ATTR	0	0	T	0	0	0
	CHLE4	0	0	T	0	0	0
	GITR	0	0	T	0	0	0
Perennial Forb	GLLE3	T	2	1	T	1	T
Perennial Graminoid	DISP	33	11	12	25	18	7
	SPAI	3	8	10	9	12	5
	TYLA	0	0	0	0	T	T
Nonnative Species	BAHY	1	T	4	0	0	0
	SATR12	0	0	T	0	0	0

Cover (m) Shrubs BLKROC_18

Species Code	2003	2004	2005	2007	2009	2010
ATTO	17.0	3.5	5.5	29.1	15.2	11.1
ERNA10	4.9	2.8	3.5	5.7	4.0	5.5
Total	21.9	6.3	9.0	34.8	19.2	16.6

Ground Cover (%) BLKROC_18

Substrate	2003	2004	2005	2007	2009	2010
Dung	3	4	4	2	2	2
Litter	76	47	51	61	76	83
Rock	0	0	0	0	0	0
Standing Dead	0	2	2	3	5	1
Bare Ground	17	42	39	36	19	15
Water	0	0	0	0	3	0

Shrub Densities and Age Classes BLKROC_18

	ATTO					
Age Class	2003	2004	2005	2007	2009	2010
Seedling	582	0	487	0	13	0
Juvenile	415	110	85	77	299	31
Mature	38	37	22	87	84	81
Decadent	0	30	1	6	8	2
Total	1035	177	595	170	404	114

	SAVE4	SUMO		ERNA10					
Age Class	2010	2004	2009	2003	2004	2005	2007	2009	2010
Seedling	0	0	0	1	0	10	0	0	0
Juvenile	0	1	0	0	2	3	3	9	0
Mature	1	0	1	13	8	8	9	9	6
Decadent	0	0	0	2	0	0	3	3	3
Total	1	1	1	16	10	21	15	21	9

BLKROC_19

BLKROC_19 is located in a riparian management area in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index on the site has ranged between 71-79%. Saltgrass frequency decreased in 2010 when compared to 2009 but remained within observed ranges during previous sampling periods. Sacaton frequency rose to its highest level since sampling has begun although its contribution to the total plant community is not significant. All other plant frequencies were static compared to 2009. Shrub cover has increased over time at the site. Utilization has been minimal for all years which could be a contributing factor to the increase of shrubs on the transect.

Utilization by Weighted Average and Species, BLKROC_19

	Weighted Average	DISP	SPAI
2007	6%	9%	
2008	12%	14%	8%
2009	14%	16%	7%
2010	26%	26%	26%

Frequency (%), BLKROC_19

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	4	0	0	0	0	0
	ATTR	0	0	2	0	0	0
	CHLE4	0	0	6	0	0	0
	GITR	0	0	5	0	0	0
Perennial Graminoid	DISP	139	147	139	127	143	132
	JUBA	13	20	6	26	21	14
	LETR5	3	0	1	0	0	0
	SPAI	9	8	12	10	10	26**
Shrubs	ATTO	0	6	31	24	18	12
	ERNA10	0	3	5	0	3	3

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_19

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	T	0	0	0	0	0
	ATTR	0	0	T	0	0	0
	CHLE4	0	0	T	0	0	0
	GITR	0	0	T	0	0	0
Perennial Graminoid	DISP	44	47	45	34	26	21
	JUBA	1	T	4	T	1	T
	LETR5	0	0	T	0	0	0
	SPAI	4	4	6	7	3	5

Cover (m) Shrubs BLKROC_19

Species Code	2003	2004	2005	2007	2009	2010
ATPO	0.7	0.0	0.0	0.0	0.0	0.0
ATTO	3.6	1.5	2.9	8.8	13.6	11.8
ERNA10	2.0	2.1	0.9	1.8	3.1	4.5
Total	6.3	3.6	3.8	10.6	16.7	16.3

Ground Cover (%) BLKROC_19

Substrate	2003	2004	2005	2007	2009	2010
Dung	0	1	1	0	2	3
Litter	81	35	45	59	78	78
Rock	0	0	0	0	0	0
Standing Dead	0	3	5	4	4	3
Bare Ground	12	52	45	40	17	20

Shrub Densities and Age Classes BLKROC_19

	ATTO						ERNA10					
Age Class	2003	2004	2005	2007	2009	2010	2003	2004	2005	2007	2009	2010
Seedling	2	0	61	0	15	0	0	0	0	0	2	0
Juvenile	11	7	22	99	24	5	9	9	8	10	1	3
Mature	9	4	6	48	36	64	5	3	7	6	8	20
Decadent	1	2	0	2	5	3	6	4	2	3	5	1
Total	23	13	89	149	80	72	20	16	17	19	16	24

BLKROC_20

BLKROC_20 is located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index has ranged between 63-74% for the site. Creeping wildrye and bassia frequency continued to increase beyond baseline parameters in 2010. Nevada saltbush cover and density have steadily increased since 2005, making the area a good candidate for a maintenance burn. Utilization had been nominal during the first three sampling years. In 2010 there was a substantial increase in utilization.

Utilization by Weighted Average and Species, BLKROC_20

	Weighted Average	DISP	LETR5	SPAI
2007	3%	9%	2%	
2008	13%	13%		
2009	31%	29%	42%	14%
2010	53%	53%	45%	

Frequency (%), BLKROC_20

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATTR	0	0	7	0	0	0
Perennial Graminoid	DISP	127	147	143	126	123	123
	LETR5	18	29	30	31	59	70
	SPAI	5	4	5	5	5	0
Shrubs	ATTO	6	2	27	19	18	15
	ERNA10	0	1	1	0	3	1
Nonnative Species	BAHY	5	0	6	0	16	33*

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_20

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATTR	0	0	T	0	0	0
Perennial Graminoid	DISP	38	52	53	42	39	28
	LETR5	1	2	5	3	7	7
	SPAI	2	3	3	2	T	T
Nonnative Species	BAHY	T	0	T	0	1	1

Cover (m) Shrubs BLKROC_20

Species Code	2003	2004	2005	2007	2009	2010
ATTO	8.8	6.8	17.0	27.1	30.3	27.9
ERNA10	8.6	8.3	6.4	6.5	6.4	11.8
SAVE4	0.0	0.1	0.0	0.3	0.7	0.4
SUMO	0.1	0.0	0.0	0.0	0.0	0.0
Total	17.5	15.3	23.4	33.8	37.3	40.1

Ground Cover (%) BLKROC_20

Substrate	2003	2004	2005	2007	2009	2010
Dung	3	2	6	7	2	4
Litter	89	79	76	90	98	96
Rock	0	0	0	0	0	0
Standing Dead	0	16	15	13	18	14
Bare Ground	T	5	4	9	0	T

Shrub Densities and Age Classes BLKROC_20

	ATTO						ERNA10					
Age Class	**2003**	**2004**	**2005**	**2007**	**2009**	**2010**	**2003**	**2004**	**2005**	**2007**	**2009**	**2010**
Seedling	3	0	135	0	70	8	0	0	2	0	0	0
Juvenile	33	24	24	157	26	17	0	1	3	0	0	0
Mature	51	19	41	52	48	112	7	5	12	5	5	17
Decadent	2	5	0	9	4	7	2	3	1	5	4	2
Total	89	48	200	218	148	144	9	9	18	10	9	19

	SAVE4						SUMO		
Age Class	**2003**	**2004**	**2005**	**2007**	**2009**	**2010**	**2004**	**2007**	**2010**
Seedling	0	0	0	0	0	0	0	0	0
Juvenile	0	0	0	0	0	0	5	1	0
Mature	0	1	1	1	1	2	0	0	3
Decadent	1	0	0	0	0	0	0	0	0
Total	1	1	1	1	1	2	5	1	3

BLKROC_21

BLKROC_21 is in a riparian management area located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index has ranged between 58-68% during the baseline period. The site's shrub component is greater than what would be expected for a Moist Floodplain site at its potential. Plant frequency did not differ in 2010 from 2009. The plant frequency trend is fairly static with the exception of a period of shrub recruitment in 2005 and a steady decrease in Nevada saltbush cover. Utilization has been slowly increasing on the transect for the past four years.

Utilization by Weighted Average and Species, BLKROC_21

	Weighted Average	DISP	SPAI
2007	0%	1%	
2008	12%	12%	
2009	24%	24%	
2010	38%	42%	18%

Frequency (%), BLKROC_21

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	3	0	0	0	0	0
	ATTR	0	0	2	0	0	0
Perennial Forb	SUMO	4	0	3	0	0	0
Perennial Graminoid	DISP	135	133	142	136	130	131
	LETR5	0	2	5	5	8	6
	SPAI	1	4	3	1	4	3
Shrubs	ATTO	23	13	42	10	10	3
	ERNA10	3	1	0	1	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_21

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATSES	T	0	0	0	0	0
	ATTR	0	0	T	0	0	0
Perennial Forb	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	37	53	50	39	26	22
	LETR5	0	T	T	1	2	2
	SPAI	T	1	1	T	1	T

Cover (m) Shrubs BLKROC_21

Species Code	2003	2004	2005	2007	2009	2010
ATTO	29.4	20.2	29.0	23.7	16.8	15.7
ERNA10	2.2	4.3	3.0	8.0	1.2	0.0
SUMO	2.2	0.0	0.2	0.0	0.0	0.0
Total	33.7	24.5	32.2	31.7	18.0	15.7

Ground Cover (%) BLKROC_21

Substrate	2003	2004	2005	2007	2009	2010
Dung	1	2	2	0	3	2
Litter	93	66	75	93	87	85
Rock	0	0	0	0	0	0
Standing Dead	0	9	8	14	9	0
Bare Ground	0	22	13	7	10	13

Table 157. Shrub Densities and Age Classes BLKROC_21

	ATTO						ERNA10					
Age Class	2003	2004	2005	2007	2009	2010	2003	2004	2005	2007	2009	2010
Seedling	1	0	141	0	0	0	0	0	0	0	0	0
Juvenile	4	22	31	1	0	1	0	5	3	2	1	0
Mature	74	32	50	62	44	33	3	3	3	5	4	4
Decadent	10	18	2	7	8	9	4	0	0	1	6	0
Total	89	72	224	70	52	43	7	8	6	8	11	4

	SAVE4	SUMO					
Age Class	2009	2003	2004	2005	2007	2009	2010
Seedling	0	0	0	10	0	0	0
Juvenile	1	0	8	6	3	1	0
Mature	0	2	1	4	0	2	0
Decadent	0	1	0	0	0	1	1
Total	1	3	9	20	3	4	1

Horse Holding Field

BLKROC_09

BLKROC_09 is located on an upland site in the Horse Holding Field, on the Winnedumah Fine Sandy Loam 0-2% slopes soil unit. The transect is located on a Sodic Fan ecological site, the similarity index for the transect ranged between 56-82% during the baseline period. The decline in similarity index occurred in response to a decline in Nevada saltbush. Frequency in 2010 did not differ from the baseline period. There is a declining trend in both rubber rabbitbrush and Nevada saltbush. Utilization on the site has been within upland standards and minimal during the last four years.

Utilization by Weighted Average and Species, BLKROC_09

	Weighted Average	DISP	SPAI
2007	61%	51%	71%
2008	15%	6%	24%
2009	5%	9%	2%
2010	36%	38%	35%

Frequency (%), BLKROC_09

Life Forms	Species	2002	2003	2007	2009	2010
Annual Forb	2FORB	0	2	0	0	0
	COMAC	0	2	0	0	0
	ERAM2	0	0	2	0	0
Perennial Forb	APCA	0	0	4	0	0
	ASTER	0	0	0	0	0
	GLLE3	2	7	1	4	2
	STEPH	0	0	0	0	0
Perennial Graminoid	DISP	114	102	85	99	104
	JUBA	56	55	57	65	65
	LECI4	0	0	4	0	0
	LETR5	5	5	7	10	9
	SPAI	87	66	80	68	69
Shrubs	ATTO	34	46	16	24	15
	ERNA10	26	36	39	44	36
	MACA17	0	0	4	1	0
	PSAR4	0	3	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs BLKROC_09

Life Forms	Species	2002	2003	2007	2009	2010
Annual Forb	2FORB	0	0	0	0	0
	COMAC	0	1	0	0	0
	ERAM2	0	0	0	0	0
Perennial Forb	APCA	0	0	T	0	0
	ASTER	0	T	0	0	0
	GLLE3	T	0	T	T	T
	STEPH	0	T	0	0	0
Perennial Graminoid	DISP	11	10	11	18	4
	JUBA	1	2	2	4	1
	LECI4	0	0	T	0	0
	LETR5	1	1	T	1	T
	SPAI	16	15	18	19	8

Cover (m) Shrubs BLKROC_09

Species Code	2003	2007	2009	2010
ATTO	25.2	9.1	8.9	2.9
ERNA10	10.1	9.5	10.3	8.8
Total	35.3	18.7	19.2	11.7

Ground Cover (%) BLKROC_09

Substrate	2002	2003	2007	2009	2010
Bare Soil	8	4	5	2	4
Dung	2	1	2	1	1
Litter	83	83	93	97	95
Rock	0	0	0	0	1
Standing Dead	0	0	17	18	9

Shrub Densities and Age Classes BLKROC_09

	ATTO					ERNA10				
Age Class	**2002**	**2003**	**2007**	**2009**	**2010**	**2002**	**2003**	**2007**	**2009**	**2010**
Seedling	0	311	21	1	0	6	13	4	4	0
Juvenile	2	22	16	2	1	16	65	54	37	21
Mature	12	43	42	25	17	8	27	42	26	59
Decadent	4	4	8	17	6	8	5	23	12	9
Total	18	380	87	45	24	38	110	123	79	89

Irrigated Pastures

There are no irrigated pastures on the Blackrock Lease.

Stockwater Sites

There are five identified water sites needed for the Blackrock Lease. These sites have been located and approved for drilling and installation. The wells for three of the sites, the Reservation Riparian, North Riparian, and South Riparian Fields have been drilled and are currently being fitted for solar pumps and necessary plumbing for the troughs. The remaining two wells in the White Meadow Field and Reservation Field that have been contracted to be drilled in the fall of 2010. There are also three other stockwater sites that will be developed as part of the MOU required 1600 Acre-Foot Mitigation Projects. The “North of Mazourka Project” will provide stockwater in the Reservation Field and the “Well 368/Homestead Project” will provide stockwater in the Little Robinson Field and East Robinson Field. These mitigation projects are scheduled to be completed in 2011.

Rare Plant Trend Plot Monitoring

Little Robinson Pasture Blackrock Lease

This pasture contains a *S. covillei* population. Trend plots Little Robinson 1EX and Little Robinson 2EX occur within an exclosure; plots Little Robinson 1C and Little Robinson 2C are adjacent to the exclosure. The pasture was grazed during the 2010 season. Phenology included individuals that were vegetative to individuals that were in flower.

Little Robinson Pasture Blackrock Lease

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Little Robinson 1C	2009	*S. covillei*	0	12	28	40
	2010		1	0	45	46
Little Robinson 2C	2009	*S. covillei*	0	12	19	31
	2010		3	0	28	31
Little Robinson 1EX	2009	*S. covillei*	0	0	40	40
	2010		0	0	39	39
Little Robinson 2EX	2009	*S. covillei*	0	6	23	29
	2010		0	0	15	15

Robinson Pasture Blackrock Lease

This pasture contains a *S. covillei* population and a *C. excavatus* population. Trend plots Robinson 1EX and Robinson 2EX occur within an exclosure capturing both *C. excavatus* and *S. covillei* species for use in tracking trends of both species. Two *S. covillei* trend plots, Robinson 1C and Robinson 2C along with one *C. excavatus* trend plot, Robinson 3C are outside the exclosure within the same pasture. The pasture was grazed with end-of-season utilization at 17%. Phenology included individuals that were vegetative to individuals that had already set seed.

Robinson Pasture Blackrock Lease

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Robinson 1C	2009	*C. excavatus*	0	0	12	12
	2010		0	0	38	38
Robinson 1C	2009	*S. covillei*	0	0	6	6
	2010		0	0	2	2
Robinson 2C	2009	*C. excavatus*	0	0	0	0
	2010		0	0	2	2
Robinson 2C	2009	*S. covillei*	0	4	59	63
	2010		1	0	52	53
Robinson 3C	2009	*C. excavatus*	0	0	1	1
	2010		0	0	11	11
Robinson 1EX	2009	*C. excavatus*	0	0	2	2
	2010		0	0	11	11
Robinson 1EX	2009	*S. covillei*	0	43	35	78
	2010		17	0	36	53
Robinson 2EX	2009	*C. excavatus*	0	0	23	23
	2010		2	0	23	25

Springer Pasture Blackrock Lease

This pasture contains a *S. covillei* population. Trend plots were established but because of concerns raised by the lessee, the MOU Group decided that the planned exclosure would not be constructed. This decision was based on the concerns of the lessee and lack of data concluding that grazing is detrimental to S. *covillei*. Trend plots Springer 1EX and Springer 2EX occur within the area of the planned exclosure but are grazed; plots Springer 1C and Springer 2C are adjacent to the planned exclosure. The pasture was grazed during the 2009 season. Phenology included individuals that were vegetative to individuals that were in flower.

Springer Pasture Blackrock Lease

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Springer 1C	2009	*S. covillei*	0	74	31	115
	2010		15	0	131	146
Springer 2C	2009	*S. covillei*	0	13	24	37
	2010		3	0	49	52
Springer 1EX	2009	*S. covillei*	0	2	5	7
	2010		0	0	16	16
Springer 2EX	2009	*S. covillei*	0	23	13	36
	2010		0	0	37	37

Salt and Supplement Sites

Many of the supplement sites located on the Blackrock Lease have been in place for many years and are located in upland management areas. Some of these sites have been moved in order to adapt to the installation of new fencing. These new locations were selected as to better distribute cattle within and near the newly created riparian pastures.

Burning

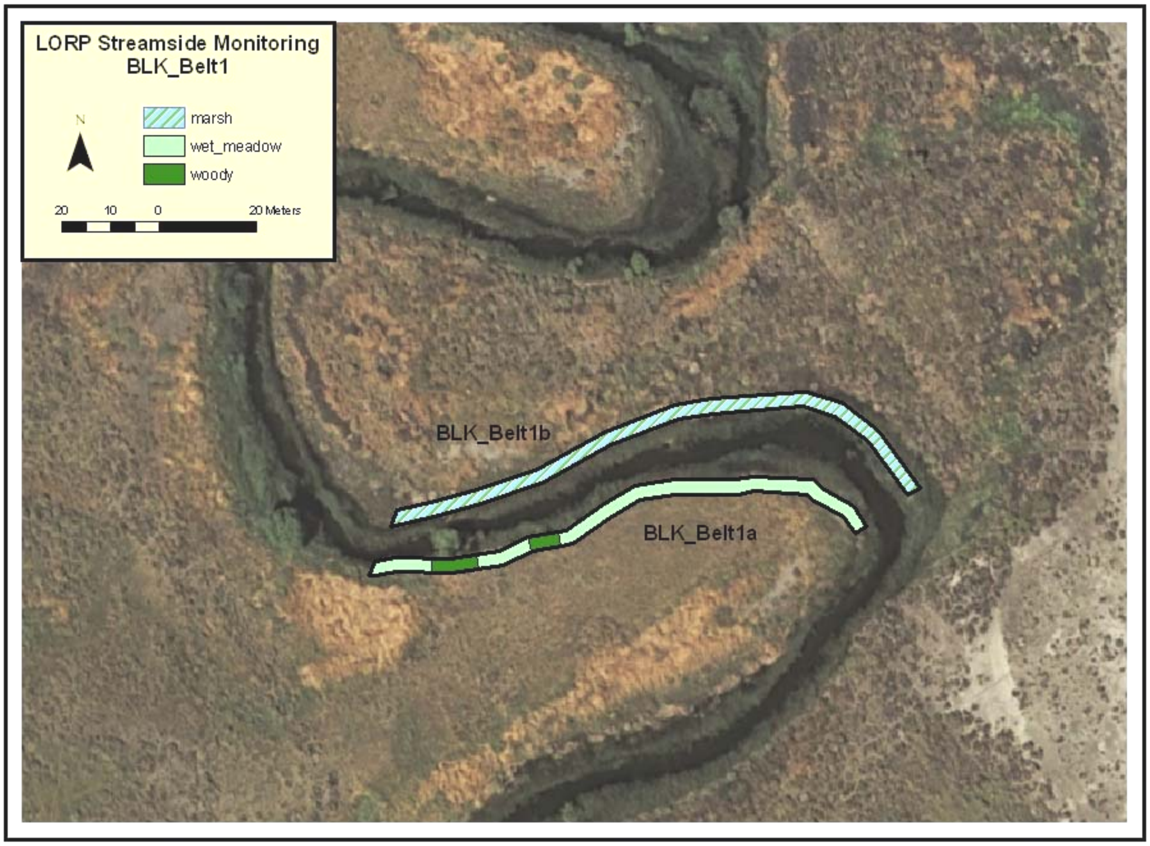
There were several prescribed burns conducted on the Blackrock Lease in 2009. The largest burn was the prescribed burn of the Waggoner Unit of the BWMA. The burn was conducted in order to remove dense stands of decadent tules and shrubs prior to flooding. The burning and subsequent flooding not only improved the area for waterfowl and shorebirds by creating open water habitat, but improved the area for grazing by production of palatable forage series.

The lessee conducted several small range burns throughout the winter that consisted of brush piles and decadent forage. All of the burns totaled approximately 20 acres and they were in sites that had a good perennial grass understory. These burns produced an increase in perennial grasses and improved the areas in which they occurred.

The Winterton Unit and continued slash pile burning along the river are planned for the Blackrock Lease in 2011. Burning of the Winterton Unit will remove the solid stands of decadent tules and cattails and also the dense shrubs on the adjacent uplands. This burn will improve grazing for the lessee and also provide improved waterfowl and shorebird habitat by creating open water areas when the site is flooded again.

Streamside Monitoring

There were 7 designated monitoring areas (DMAs) located within the Blackrock Lease; one each in the White Meadow Exclosure, the White Meadow Riparian Field, the Reservation Riparian Field, the North Riparian Field, the South Riparian Field, the Wrinkle Riparian Field, and the George's Creek Exclosure.

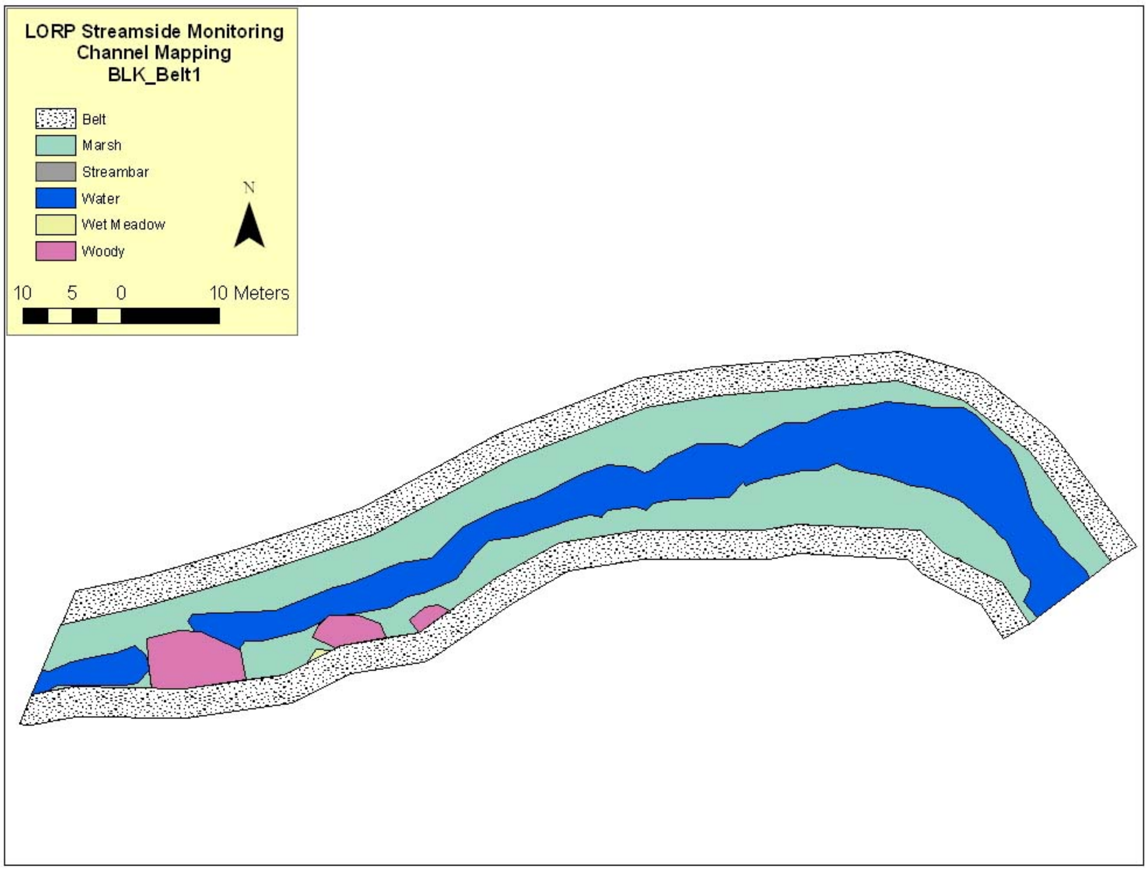


LORP Streamside Monitoring BLK_Belt1

BLK_Belt1a is located inside the White Meadow Exclosure and is characterized as wet meadow with some woody vegetation, but is dominated by creeping wildrye. The water's edge was dominated by living and dead cattails and banks were mostly observed to be covered by litter. Point intercept data showed the site to be 74.5% litter, 23.5% vegetated, and 2% fine/silty soil. There was 1 mature narrowleaf willow and 2 mature Goodding's willow (*Salix gooddingii)* rooted within sampled plots at the site. There were also 1 mature narrowleaf willow and 8 mature Goodding's willow noted as canopy cover. There was no desirable woody recruitment at the site. There were also 3 mature saltcedar (*Tamarix ramossima*) present as canopy cover. There was no apparent use of any of these species by livestock or other wildlife; however, there was evidence of Owens Valley Vole presence at the site (feces). GIS analysis estimated cover by woody species to be approximately 48 m^2 within the 3 m wide belt.

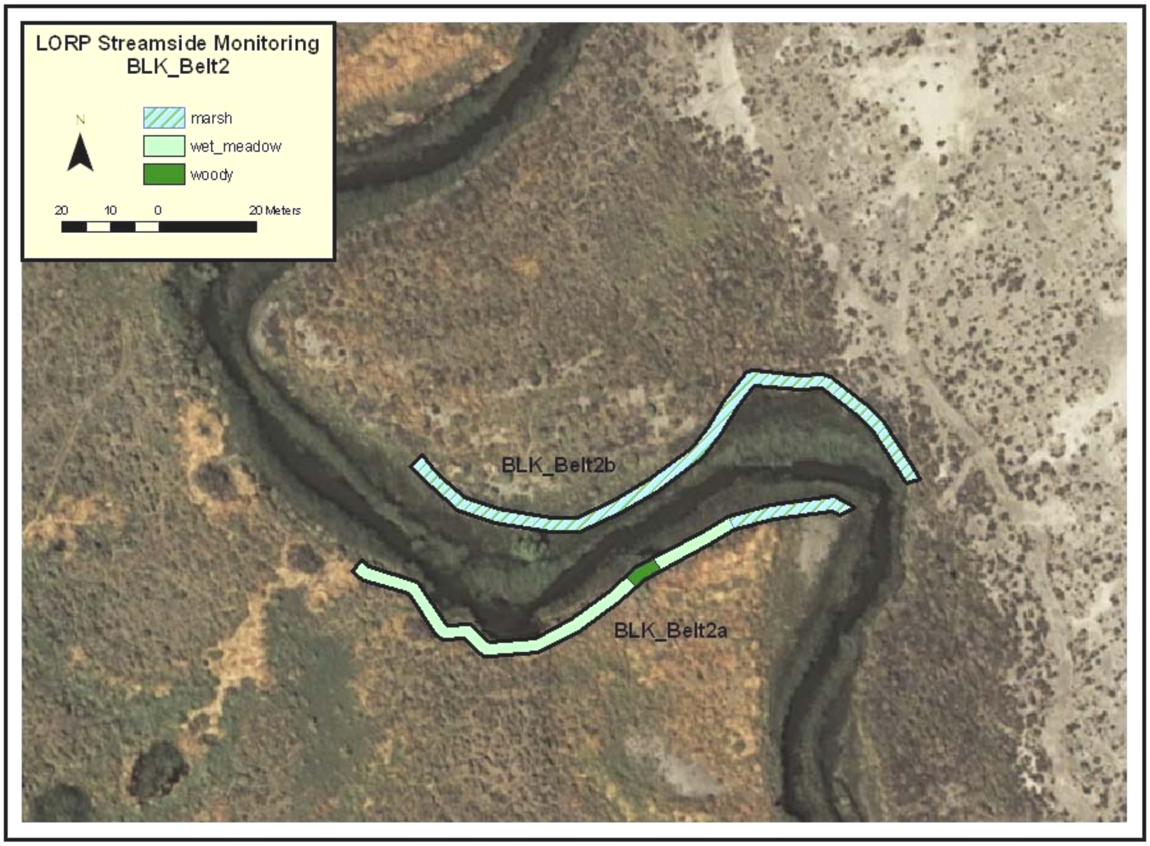
BLK_Belt1b was characterized as marsh dominated by cattails along the water's edge, and also had abundant threesquare bulrush and creeping wildrye present. The bank on this side of the river was noted as vegetated or root stabilized but also had some saltcedar slash present. Point intercept data showed this site to be 75% vegetated, 15.5% litter, 7.5% wood, and 2% fine/silty soil. Species documented along this transect included threesquare bulrush, cattails, creeping wildrye, Baltic and Torrey's rush (*Juncus torreyi)*, scratchgrass (*Muhlenbergia asperifolia*), saltgrass, and saltcedar. There was 1 mature narrowleaf willow and 1 mature Goodding's willow present as canopy cover at the site, and 1 mature saltcedar rooted in a sampled quadrat frame. There was no apparent use of any of these species by livestock or other wildlife, and no desirable woody recruitment at the site. GIS analysis did not pick up any quantifiable woody cover along this transect.

There are no utilization transects located within the White Meadow Exclosure, so data for the end of the grazing season near BLK_Belt1 was unavailable. GIS analysis of the wetted channel estimated the following: 492 m^2 open water, 2 m^2 wet meadow, 70 m^2 woody vegetation, and 706 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt1

BLK_Belt2



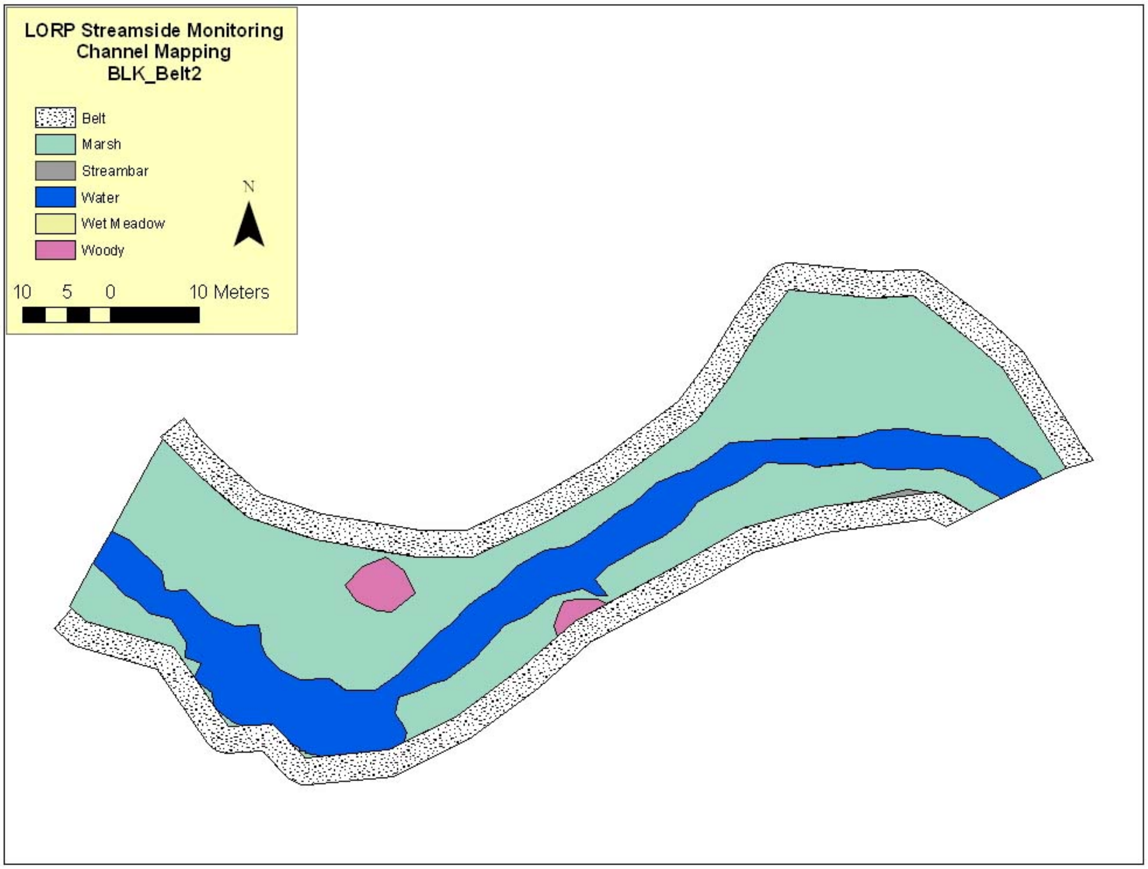
LORP Streamside Monitoring BLK_Belt2

BLK_Belt2 is located in the White Meadow Riparian Field. BLK_Belt2a is characterized as a combination of wet meadow, marsh, and woody vegetation, with cattails dominating the water's edge. The bank along this transect was observed to be primarily vegetated or litter with some root stabilized soil (shown below), which served to hold the bank intact and left little room for recruitment of other species. Point intercept data showed this site to be 42.5% litter, 27.5% vegetated, 21.5% fine/silty soil, 5% sandy soil, 2.5% wood, and 1% gravelly soil. Species documented while acquiring point intercept data included cattails, scratchgrass, threesquare bulrush, saltgrass, Baltic and Torrey's rush, salt heliotrope, and creeping wildrye. There were 2 mature Goodding's willow documented as canopy cover at this site (nothing rooted), and there was no apparent use to either of these individuals by livestock or other wildlife. However, there was evidence of Owens Valley Vole in this area (feces). The beginning of this transect was on a sparsely vegetated sand bar on the inside bend of the river, however, there was no recruitment of desirable woody species along the transect or in the immediate vicinity. Although there were no woody species picked up in the sampled plots, GIS analysis estimated cover by woody species to be approximately 20 m^2 within the 3-meter wide belt.

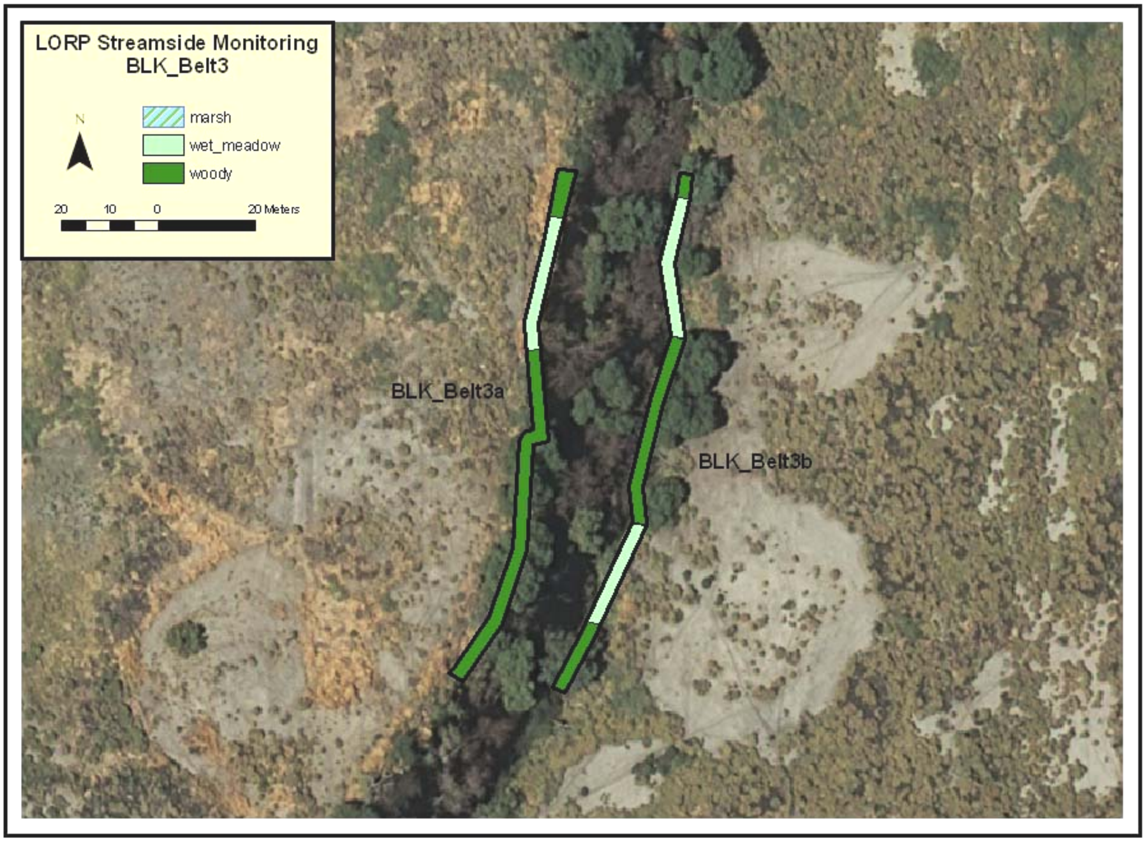
Example of root stabilized soil encountered along water's edge at BLK_Belt2a.

BLK_Belt2b was classified as marsh along the wetted edge, but was bordered by a wet meadow dominated by saltgrass and creeping wildrye. Banks were observed to be vegetated or root stabilized. Point intercept showed this site to be 82% vegetated, 11.5% litter, 4% wood, and 2.5% fine/silty soil. Species present at the water's edge included cattails, threesquare bulrush, saltgrass, creeping wildrye, scratchgrass, spikerush (*Eleocharis macrostachya*), Baltic and Torrey's rush, alkali sacaton, and foxtail barley (*Hordeum jubatum*). There were no woody species present as rooted or canopy cover across the site. GIS analysis of BLK_Belt2b also showed no woody cover.

End of grazing season utilization in the White Meadow Riparian Field averaged 41%. There is only one transect in this pasture, BLKROC_11, so utilization at this site was also 41% in May 2010. GIS analysis of the wetted channel estimated the following: 596 m^2 open water, 3 m^2 streambar, 43 m^2 woody vegetation, and 1433 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt2

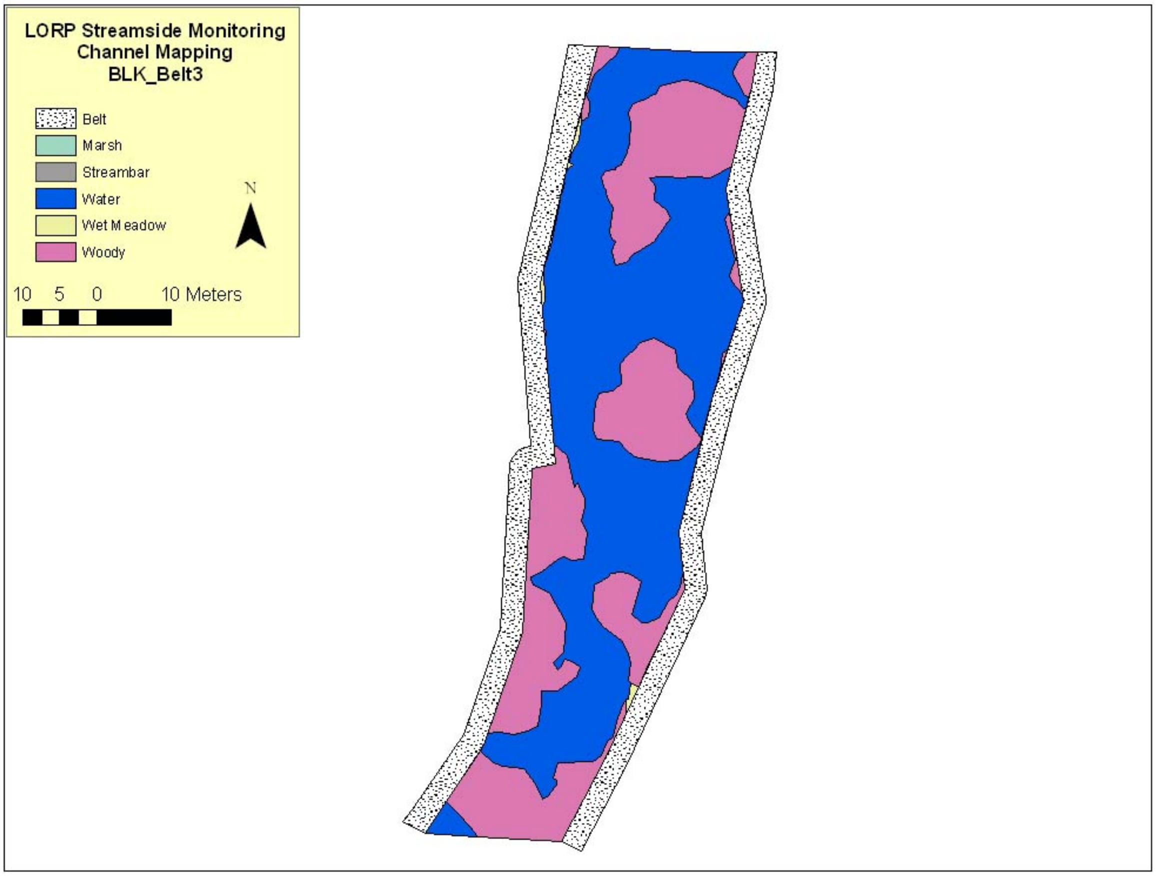


LORP Streamside Monitoring BLK_Belt3

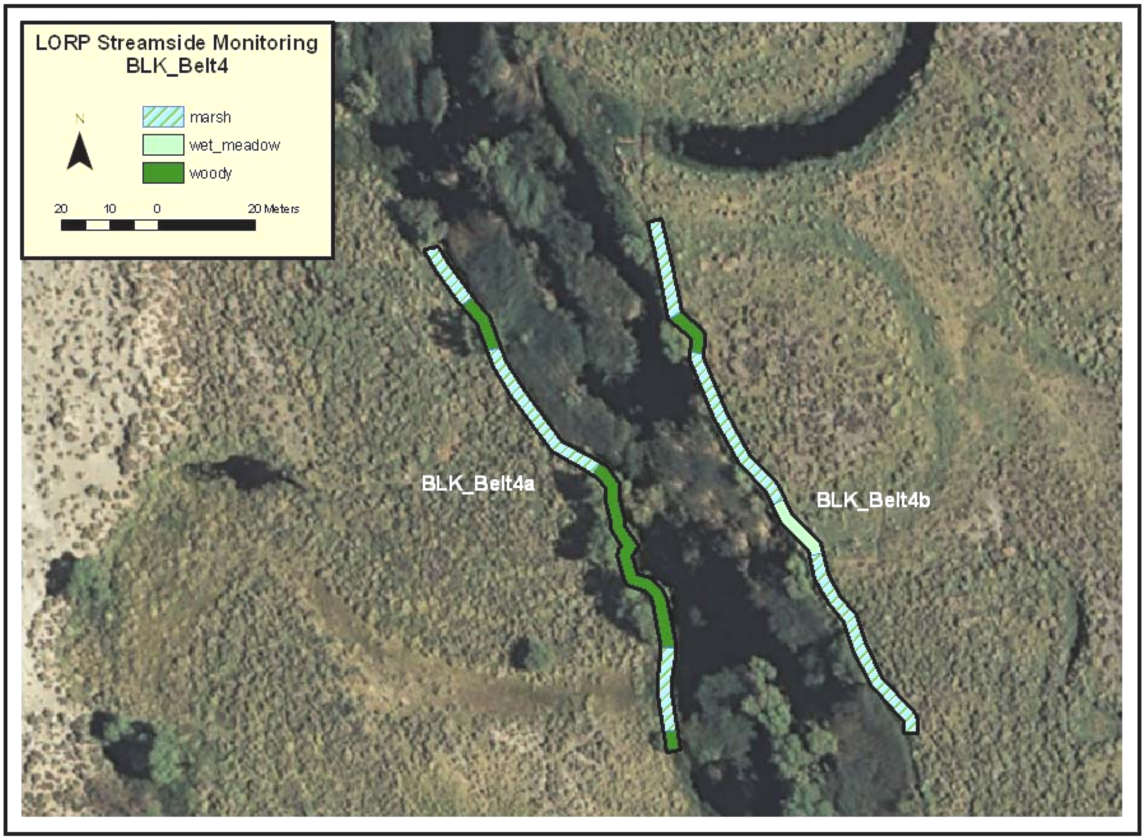
BLK_Belt3a is located in the Reservation Riparian Field in a combination of wet meadow and woody vegetation dominated by bassia, saltbush, creeping wildrye, and Goodding's willow. The bank at this site was primarily vegetated or occupied by litter, had a lot of overhanging bassia, and was very steep near the end of the transect. The site was 46.5% vegetated, 46.5% litter, 4.5% fine/silty soil, 2.5% wood. Species encountered along the water's edge included creeping wildrye, cattails, bassia, salt heliotrope, and saltbush. There were no rooted woody species found in quadrats along the sampling transect; however, 12 mature and 3 dead Goodding's willows were noted as canopy cover. Of these, slight highlining was noted on two of these mature willows (demonstrated by broken branches) which likely occurred from elk. There was also elk scat observed at the site. In addition, there were four dead Russian olive (*Elaeagnus angustifolia*) noted as canopy cover at this site. GIS analysis of BLK_Belt3 showed approximately 258 m^2 of woody cover within the 3-meter wide belt.

BLK_Belt3b was located in a wet meadow dominated by saltgrass and creeping wildrye with a large amount of woody cover. Banks on the east side of the river were also primarily vegetated or otherwise occupied with litter. This site was recorded as 48% litter, 38% vegetated, and 14% fine/silty soil. Vegetation encountered along the water's edge included cattails, saltgrass, bassia, creeping wildrye, and alkali sacaton. BLK_Belt3b had more woody species documented than its western counterpart, with 4 mature Goodding's willow rooted in the sample plots. There were also 28 mature and 2 dead Goodding's willows at this site, as well as 2 dead Russian olive. Slight browsing to woody species was noted for this site. GIS analysis estimated cover by woody species to be 180 m^2 along the 3-meter wide belt.

End of grazing season utilization data was not collected in the Reservation Riparian Field because there is too little forage to survey, so utilization rates near BLK_Belt3 were unavailable. GIS analysis of the wetted channel estimated the following: 1363 m^2 open water, 10 m^2 wet meadow, and 896 m^2 woody vegetation.



LORP Streamside Monitoring Channel Mapping BLK_Belt3

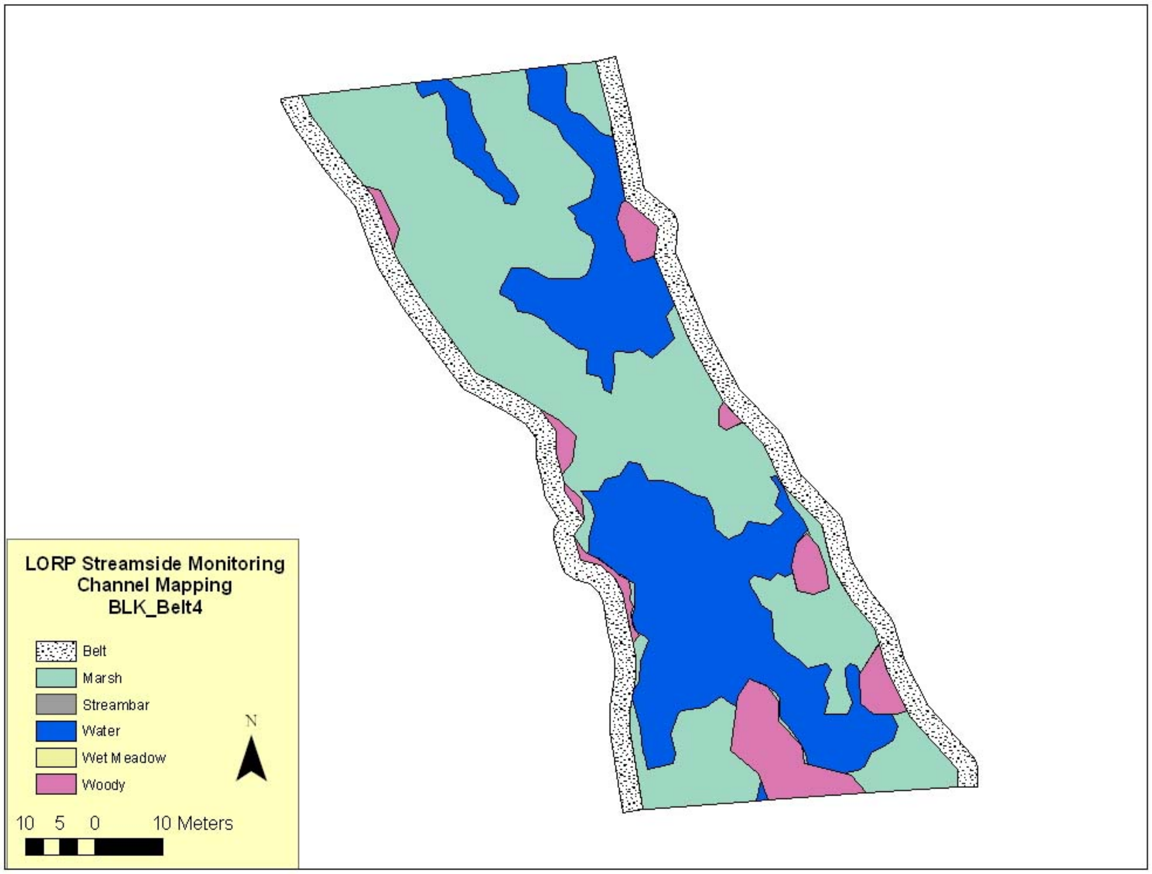


LORP Streamside Monitoring BLK_Belt4

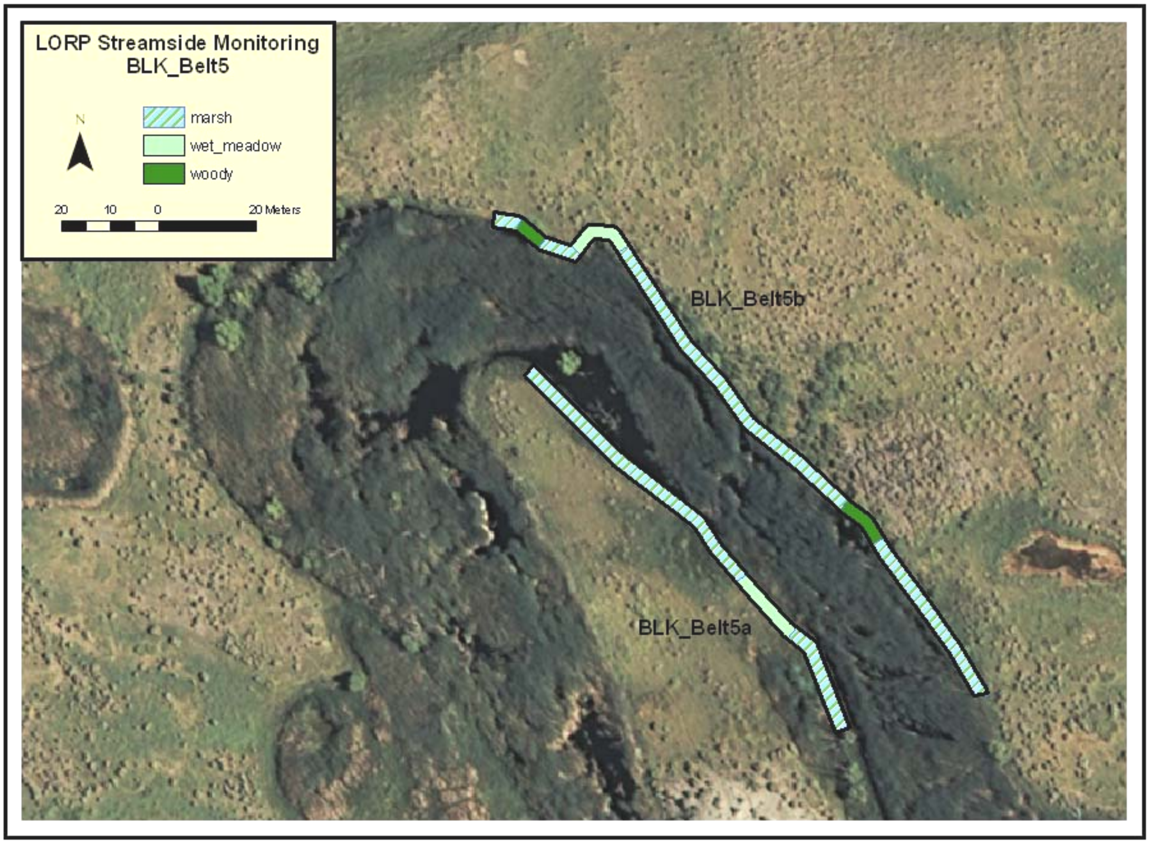
BLK_Belt4a is located in the North Riparian Field, and is characterized as a combination of woody vegetation and marsh along the water's edge with an adjacent wet meadow dominated by saltgrass and saltbush. The bank along this transect is primarily vegetated with some litter also present. Point intercept data showed the site to be 68% vegetated, 28.5 % litter, and 3.5% wood. Species encountered along the water's edge included threesquare bulrush, cattails, yerba mansa (*Anemopsis californica),* creeping wildrye, spikerush, Goodding's and red willows (*Salix laevigata*), and Baltic rush. There were 12 mature Goodding's willow, and 6 mature red willow noted as canopy cover at this site, but nothing rooted and no recruitment occurring. There was no apparent use to existing individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be 179 m^2 across the 3-meter wide belt.

BLK_Belt4b was characterized as a combination of woody vegetation, wet meadow, and marsh. Dominant species included saltgrass, creeping wildrye, and saltbush, with cattails and threesquare bulrush also occurring along the water's edge. The bank at this site was primarily vegetated with some litter, root stabilized soil, and wood also present. Point intercept data showed this site to be 67% vegetated, 21.5% litter, 9% dung, and 2.5% fine/silty soil. Species encountered while obtaining point intercept data included: threesquare bulrush, saltgrass, yerba mansa, creeping wildrye, cattails, Baltic rush, spikerush, and Goodding's willow. There were 2 mature Goodding's willows rooted in the sampled plots, and 8 mature that occurred as canopy cover. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be 30 m^2 across the 3-meter wide belt.

End of grazing season utilization in the North Riparian Field averaged 29%. SOUTHRIP_03 was the closest transect to BLK_Belt4; utilization at this site was 7% in May 2010. GIS analysis of the wetted channel estimated the following: 1422 m^2 open water, 320 m^2 woody vegetation, and 2180 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt4

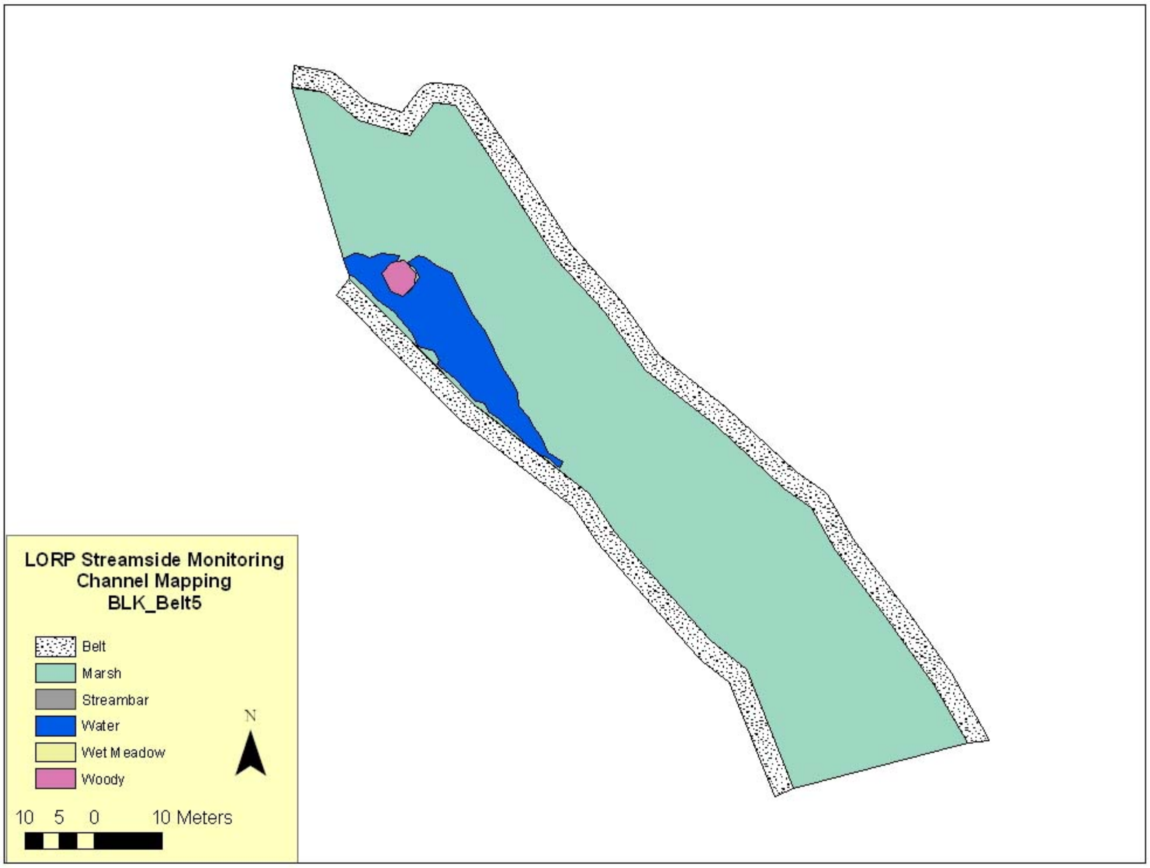


LORP Streamside Monitoring BLK_Belt5

BLK_Belt5a is located in the South Riparian Field, and is characterized as a combination of marsh and wet meadow dominated by cattails, threesquare bulrush, saltgrass, and saltbush. The bank data along this transect was recorded to be almost entirely vegetated. The point intercept data showed this site to be 74% vegetated, 24% litter, 1% dung, and 1% fine/silty soil. Species present along the transect included threesquare bulrush, saltgrass, yerba mansa, cattails, creeping wildrye, tules, and Baltic rush. There were no woody species present as rooted or canopy cover across the site. GIS analysis of this site also showed no woody cover.

BLK_Belt5b was characterized as a combination of marsh, wet meadow, and small portions of woody vegetation. Dominant species included saltgrass, threesquare bulrush, yerba mansa, tules, and cattails. The bank was primarily vegetated with some root stabilized soil in more open areas. Point intercept data showed this site to be 81% vegetated, 11.5% litter, and 7.5% fine/silty soil. Species present at the water's edge included threesquare bulrush, yerba mansa, Baltic rush, saltgrass, creeping wildrye, cattails, tules, and narrowleaf willow. There were 23 mature and 2 juvenile narrowleaf willow rooted in the sampled plots along the transect, and 21 additional mature that occurred as canopy cover. In addition, there was 1 rooted mature Goodding's willow and 5 that occurred as canopy cover at the site. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be approximately 51 m^2 within the 3-meter wide belt.

End of grazing season utilization in the South Riparian Field averaged 38%. There is only one transect in this pasture, BLKROC_23, so utilization at this site was also 38% in May 2010. GIS analysis of the wetted channel estimated the following: 246 m^2 open water, 18 m^2 woody vegetation, and 2571 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt5

BLK_Belt6

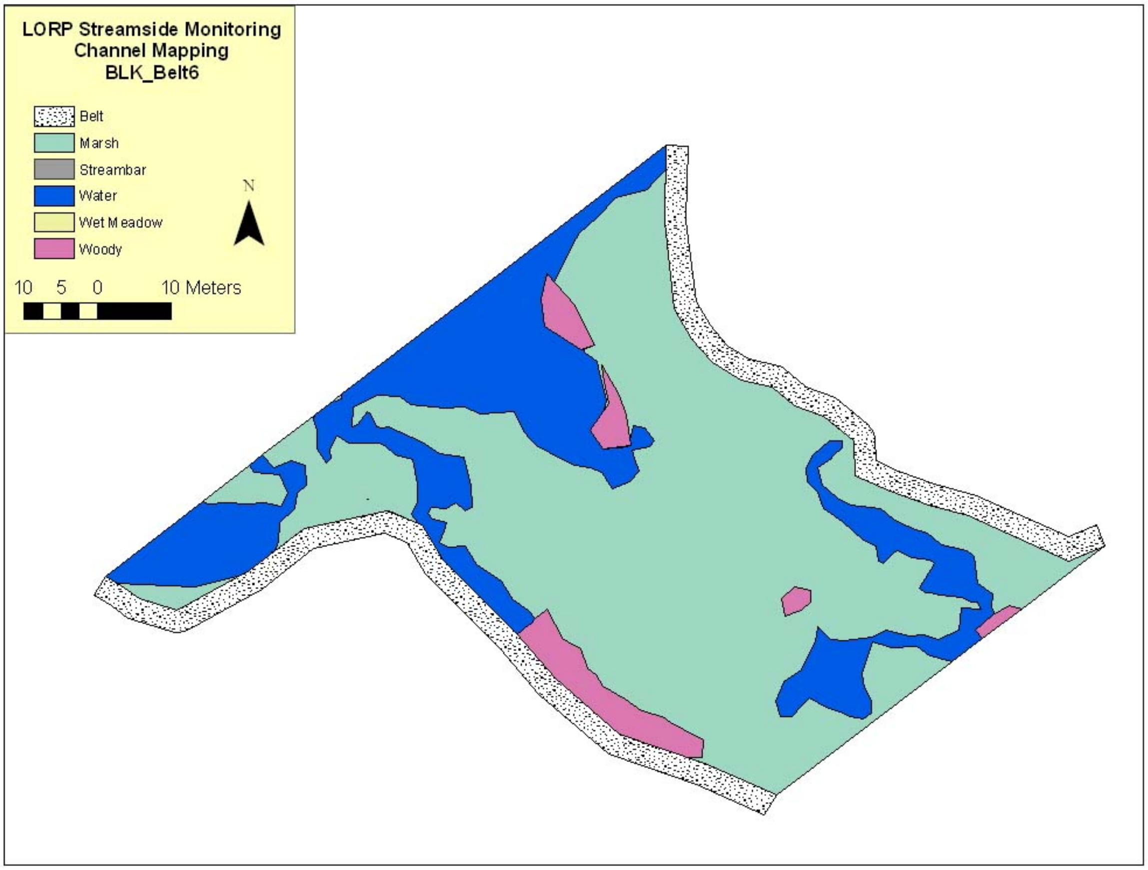
LORP Streamside Monitoring BLK_Belt6

BLK_Belt6a is located in the Wrinkle Riparian Field just upstream of an oxbow in a combination of marsh, wet meadow and woody vegetation. This area is dominated by saltgrass, with threesquare bulrush and cattails apparent along the water's edge. Banks were primarily vegetated with some litter, and at times were undefined. Point intercept data showed this site to be 52.5% vegetated, 41.5% litter, 5% fine/silty soil, and 1% wood. Species encountered along the transect included threesquare bulrush, cattails, saltgrass, Baltic rush, and yerba mansa. There was one juvenile Goodding's willow rooted in a sampled plot, and 5 mature recorded as canopy cover, which had slight browsing by elk. GIS analysis estimated cover by woody species to be approximately 42 m^2. There was also evidence of raccoon presence at this site (footprints, scat, crawdad shells, etc.); the photo below shows scat within a dead/detached Goodding's willow used by a raccoon at this site.

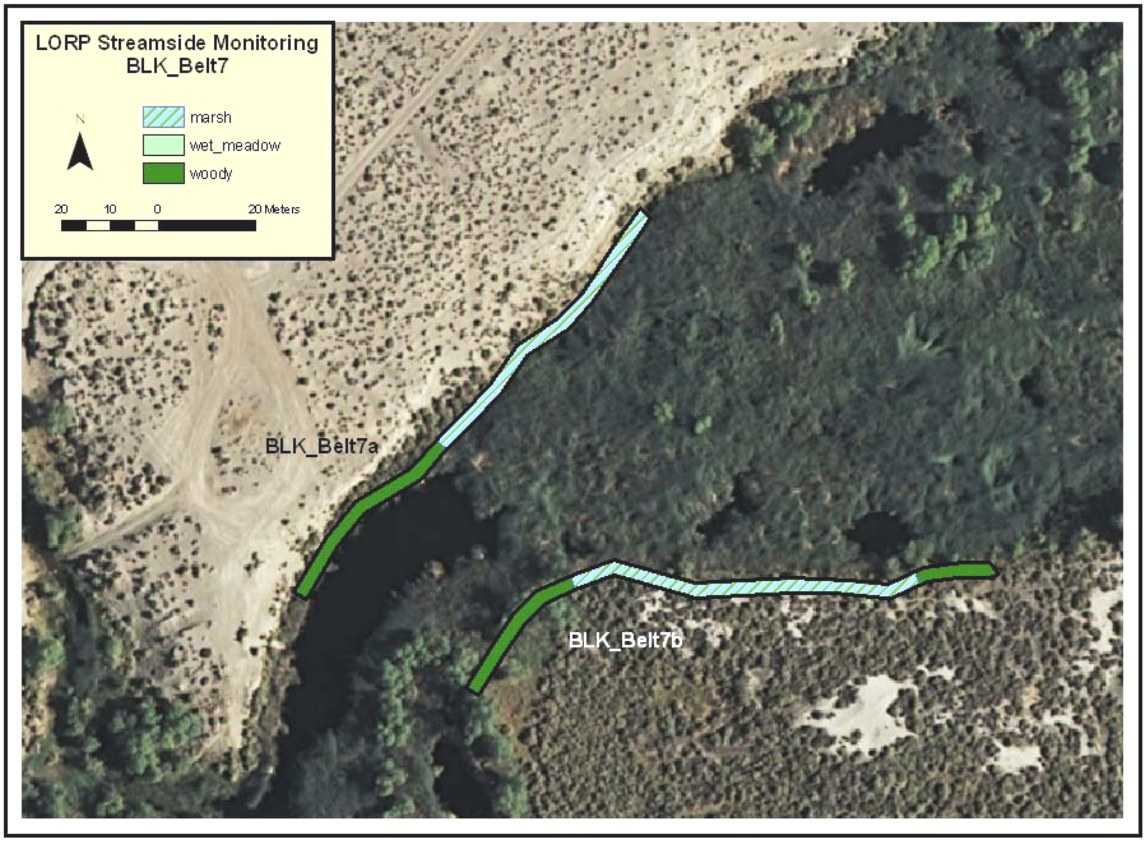
Raccoon scat inside hollowed out Goodding's willow at BLK_Belt6a.

BLK_Belt6b was classified as wet meadow/marsh and was dominated by saltgrass and cattails at the water's edge. The bank at this site is primarily vegetated or root stabilized. Point intercept data showed this site to be 52% vegetated, 40% litter, 6.5% fine/silty soil, and 1.5% wood. Species encountered along the transect included saltgrass, Baltic rush, cattails, alkali sacaton, threesquare bulrush, tules, and creeping wildrye. There were no woody species present as rooted or canopy cover across the site, and thus no woody recruitment occurring. GIS analysis of this site also showed no woody cover.

End of grazing season utilization in the Wrinkle Riparian Field averaged 32%. BLKROC_19 is the closest transect to BLK_Belt6, and utilization at this site was 14% in May 2010. GIS analysis of the wetted channel estimated the following: 1197 m^2 open water, 208 m^2 woody vegetation, and 2985 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt6



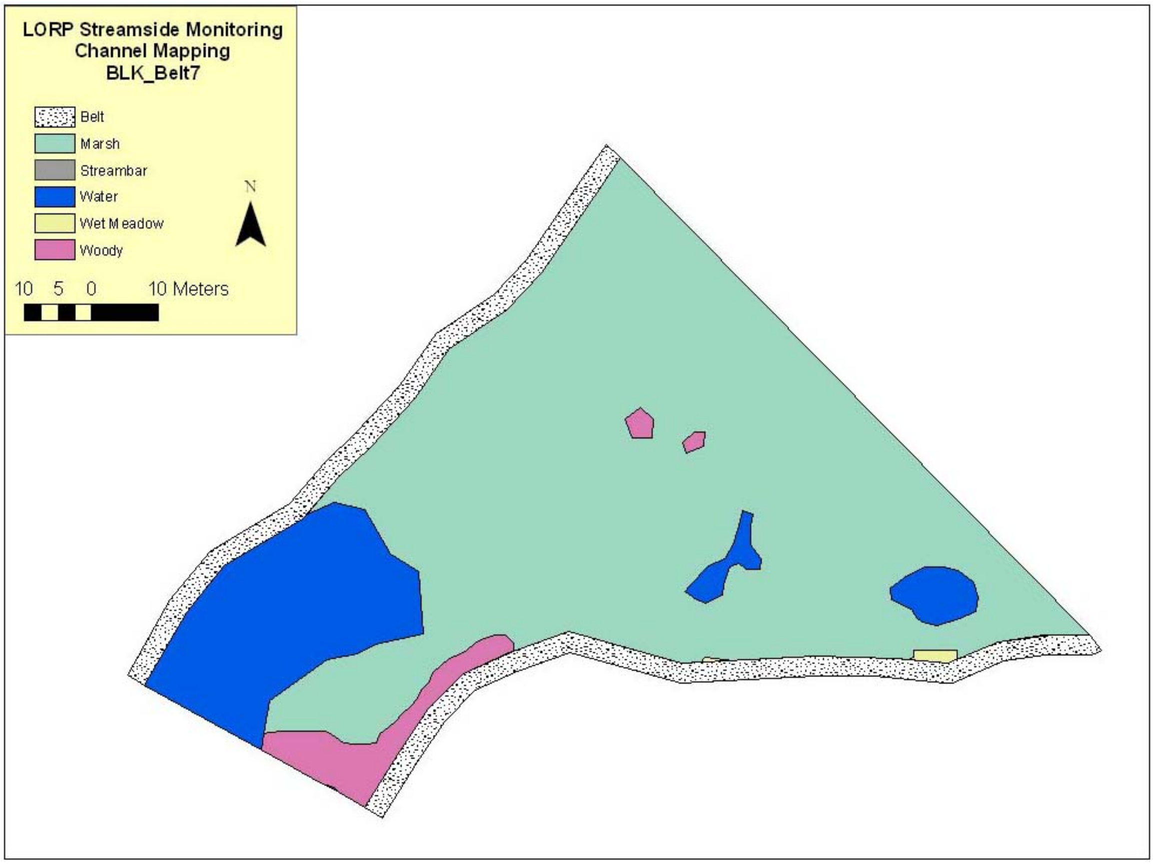
LORP Streamside Monitoring BLK_Belt7

BLK_Belt7a is located within the George's Creek Exclosure along a steep bank on the western side of the Lower Owens River. This area along the water's edge was primarily marsh with a well established corridor of narrowleaf willow (see photo below). The water's edge was also dominated by cattails. The bank in this area is primarily vegetated or litter covered. Point intercept data showed this transect to be 63% vegetated, 28% litter, 3.5% fine/silty soil, 3.5% sandy soil, and 2% wood. Species along the transect included cattails, yerba mansa, narrowleaf willow, Baltic rush, tules, greasewood (*Sarcobatus vermiculatus*), American licorice (*Glycyrrhiza lepidota)*, scratchgrass, threesquare bulrush, and saltgrass. There were 4 juvenile and 21 mature narrowleaf willow rooted in sampled quadrats along BLK_Belt7a. There were 7 juvenile and 34 mature additional narrowleaf willow recorded as canopy cover at this site. Access along the bank was difficult due to the established willow corridor, and there were many additional narrowleaf willow inundated by water that were not picked up in the sampled plots. There was no apparent use to any of these individuals by livestock or other wildlife; however, there were some slight trails established from human use (possibly fishermen or other recreationists). Still, these trails were not causing an apparent detrimental impact to the existing willows at this point in time. Although narrowleaf willow was a dominant species on this transect and was well established, there was no woody recruitment observed at this site. GIS analysis estimated cover by woody species to be approximately 131 m^2 within the surveyed belt.

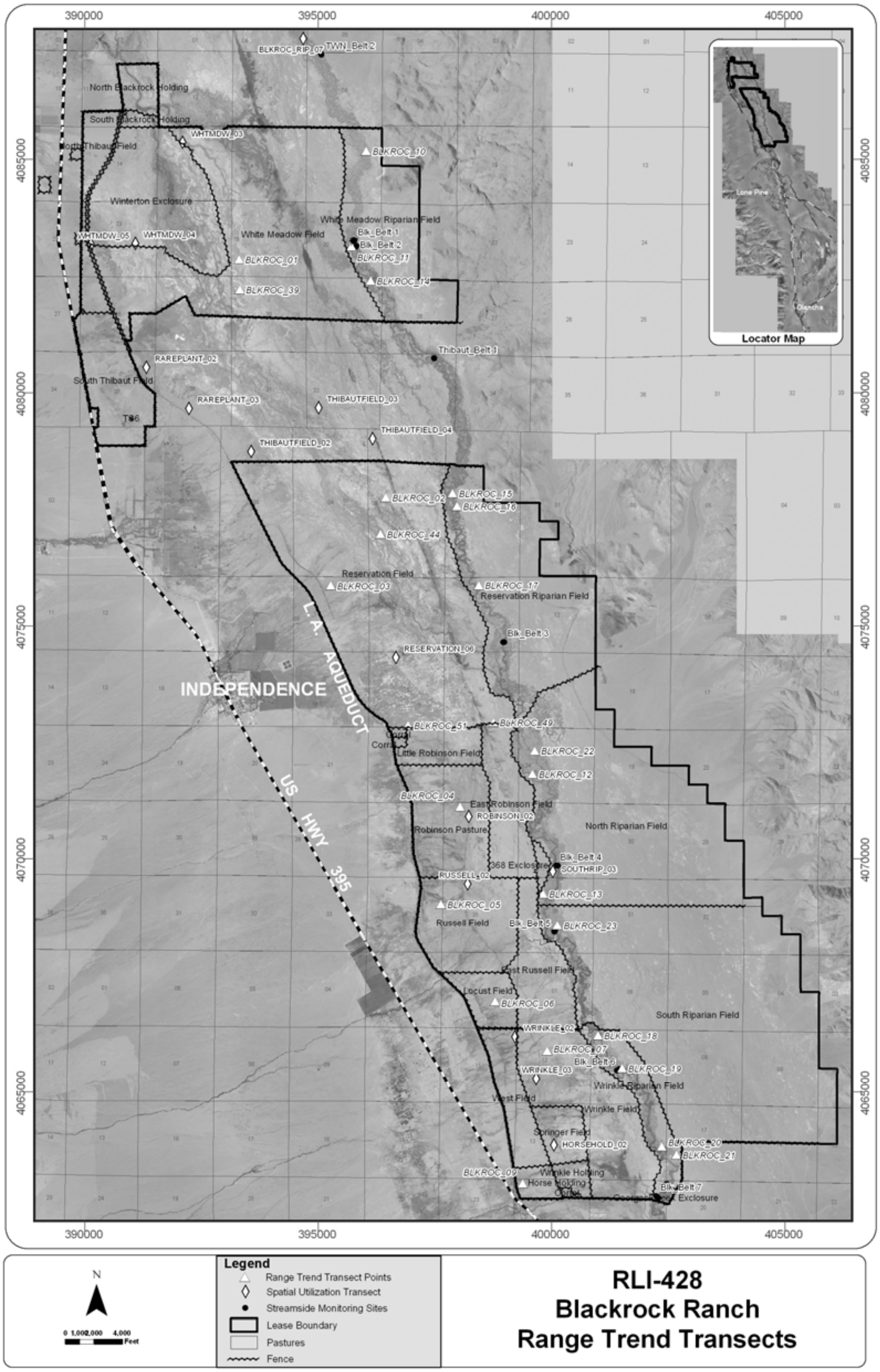
Upstream view of the beginning of transect BLK_Belt7a showing the established corridor of narrowleaf willow. Although there is a strong presence of juvenile and mature narrowleaf willow, there was no recruitment observed at this site in 2010.

BLK_Belt7b was classified as marsh and woody vegetation and was dominated by cattails and Goodding's willow along the water's edge. The bank in this area was primarily vegetated with some root stabilized soil, and had some areas that showed apparent bank sloughing. Point intercept data showed this site to be 65% vegetated, 21.5% litter, 8% fine/silty soil, and 5.5% wood. Species recorded along the water's edge included tules and cattails, yerba mansa, threesquare bulrush, creeping wildrye, Goodding's willow, Baltic rush, and saltgrass. There was 1 mature Goodding's willow rooted in a sampling plot, and 12 additional mature noted as canopy cover. There was also 1 mature red willow that was recorded as canopy cover at this site, as well as 1 mature saltcedar. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be approximately 142 m^2.

There are no utilization transects located within the George's Exclosure, so no data for the end of the grazing season near BLK_Belt7 was collected. GIS analysis of the wetted channel estimated the following: 928 m^2 open water, 13 m^2 wet meadow, 224 m^2 woody vegetation, and 4619 m^2 marsh.



LORP Streamside Monitoring Channel Mapping BLK_Belt7



Land Management Figure 5. Blackrock Lease RLI-428, Range Trend Transect Locations

4.8.4 Thibaut Lease (RLI-430)

The 5,259-acre Thibaut Lease is utilized by three lessees for wintering pack stock. The lease historically was grazed as one large pasture by mules and horses. Since the implementation of the LORP and installation of new fencing, four different management areas have been created on the lease. These areas are the Waterfowl Management Area, Rare Plant Management Area, Thibaut Field, and the Thibaut Riparian Exclosure. Management differs among these areas. The Waterfowl Management Area can be grazed every other year. The 2009-10 season was an “on grazing” year and the area was not flooded for waterfowl habitat. Water was only released to maintain Thibaut Ponds and for stockwater, with utilization standards during an “on “status being 65%. During the wetted cycle of the BWMA, the Waterfowl Management Area will revert back to a utilization standard of 40%. The irrigated pasture portion located in Thibaut Field was assessed using irrigated pasture condition scoring and the upland portions of the field were evaluated using range trend and utilization transects. The Rare Plant Field is evaluated using range trend and utilization transects. The Riparian Exclosure has been excluded from grazing for 10 years.

<u>Summary of Utilization</u>

The following tables present the summarized utilization data for each pasture, for the transects in each pasture, and by species for each transect for the current year.

End of Grazing Season Utilization for Pasture/Fields, Transects and Species on the Thibaut Lease, RLI-430, 2010

Pasture/Field	Utility	Transect	Utility	DISP	SPAI
Rare Plant Management Area	15%	RAREPLANT_02	37%	39%	34%
		THIBAUT_02	0%	0%	0%
		RAREPLANT_03	7%	6%	7%
Thibaut Field	28%	THIBAUT_03	65%	70%	60%
		THIBAUT_08	16%		34%
		THIBAUT_09	0%	0%	0%
		THIBAUTFIELD_02	31%	63%	62%
Waterfowl Management Area	20%	THIBAUT_01	10%	3%	
		WATERFOWL_02	40%	40%	
		WATERFOWL_03	21%	21%	
		WATERFOWL_04	30%	30%	
		WATERFOWL_05	0%	0%	

End-of-season use was below the 65% standard for upland pastures (Rare Plant Management Area and the Thibaut Field) and the dry cycle standard (65%) for the Waterfowl Management Area.

<u>Summary of Range Trend Data and Conditions</u>

Monitoring site photos are presented in Appendix 3 – Section 4. The three range trend sites on the Saline Meadow ecological sites were in good to excellent condition. The range trend transects in the riparian section on the Moist Floodplain ecological sites; all located in the historical dry reach of the river were in low similarity to the potential for Moist Floodplain ecological sites. The two remaining sites, THIBAUT_08 and THIBAUT_09 on the Saline Bottom ecological sites were only sampled once during the baseline period in 2007 when they were established and were from 64 and 26%, respectively.

Frequency data significantly differed in 2009 outside of baseline sampling ranges on THIBAUT_01A with an increase in Baltic rush, likely influenced by the water additions into Thibaut Ponds in this field. However, in 2010 Baltic Rush frequency decreased to levels observed prior to 2009. THIBAUT_05, one of the four range trend sites in the former dry reach continued to show an increase in native perennial herbaceous plants in 2010 with salt heliotrope increasing for the second year beyond all previous levels. These increases in pioneering species are encouraging signs that early plant succession processes have begun in these areas. Bassia frequency on the four former dry-reach riparian transects increased in 2010, three of which rose to levels greater than any other sampling period. No grazing occurred in the Riparian Exclosure. Utilization levels have been within the standards set for management area type.

Significant changes in plant frequencies for Thibaut transects between 2009 and 2010

	No Change	DISP	JUBA	ATTO	BAHY	HECU	MALE
Moist Flood Plain							
THIBAUT_04*				↑	↑**		
THIBAUT_05*					↑**	↑	↑**
THIBAUT_06*					↑		
THIBAUT_07*					↑**		
SALINE MEADOW							
THIBAUT_1A	↔		↓				
THIBAUT_02		↑	↑				
SALINE BOTTOM							
THIBAUT_08		↓					
THIBAUT_09	↔						

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

Waterfowl Management Area

THIBAUT_01A

THIBAUT_01A is located in the Waterfowl Management Area. The soils are Shondow Loam, 0-2% slopes, which corresponds to the Saline Meadow ecological site. The similarity index during the baseline period ranged between 56-75%. Variation in the similarity index was driven by changes in graminoid production with the exception of saltgrass which exceeded allowable amounts for what is described as typical for a Saline Meadow ecological site. Due to new fences, in 2007, the starting point for the original transect THIBAUT_01 was swung out to become the end point for THIBAUT_1A. Frequency, cover, ground cover and density data are presented beginning in 2007. Results from sampling in 2010 indicated that trends were static with the exception of a decrease in Baltic rush.

Frequency (%), THIBAUT_01A

Life Forms	Species	2007	2009	2010
Annual Forb	CLEOM2	0	2	0
	COMAC	0	0	1
Perennial Forb	NIOC2	16	38	38
	PYRA	13	5	2
	SUMO	11	0	0
Perennial Graminoid	DISP	140	132	137
	JUBA	12	74	49**
	LETR5	8	0	0
	SPAI	1	8	0
Shrubs	MACA17	13	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_01A

Life Forms	Species	2007	2009	2010
Annual Forb	CLEOM2	0	T	0
	COMAC	0	0	T
Perennial Forb	NIOC2	1	4	5
	PYRA	T	T	T
Perennial Graminoid	DISP	34	27	22
	JUBA	T	3	T
	LETR5	T	0	0
	SPAI	1	1	0
Shrubs	MACA17	1	0	0

Cover (%) Shrubs THIBAUT_01A

Species	2007	2009	2010
SUMO	2	0	0

Ground Cover (%) THIBAUT_01A

Substrate	2007	2009	2010
Dung	2	1	1
Litter	49	33	43
Bare Ground	49	66	56

Shrub Densities and Age Classes THIBAUT_01A

	SUMO		
Age Class	2007	2009	2010
Juvenile	17	0	0
Mature	40	0	0
Decadent	2	0	0
Total	59	0	0

Rare Plant Management Area

THIBAUT_02

THIBAUT_02 is located in the Rare Plant Management Area which will be managed as an upland pasture. The soils are Shondow Loam with 0-2% slopes, which correspond to the Saline Meadow ecological site. The similarity index varied between 91-100% during the baseline sampling due to high frequencies of DISP, SPAI, and a low shrub component. Despite the high similarity index, production at the site for the soil type appears low. Baltic rush and rubber rabbitbush frequency decreased in 2009 compared to values in 2007. In 2010 Baltic rush and saltgrass increased significantly but remained within historic parameters observed on the site. In 2010 Nevada saltbush seedlings increased from 0 to 46. Utilization on the site has varied from since 2007 from high use to no use. This is due to the random locations that are selected every year by the lessee to feed livestock.

Utilization by Weighted Average and Species, THIBAUT_02

	Weighted Average	DISP	SPAI
2007	78%	72%	85%
2009	46%	40%	50%

Frequency (%), THIBAUT_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	0	0	0	5
	ATSES	0	47	5	0	0	0
	CHENO	0	33	0	0	0	0
	CHHI	0	23	3	0	0	0
	COMAC	0	23	0	0	0	4
	CORA5	0	9	0	0	0	7
Perennial Forb	ASTRA	0	0	4	1	0	0
	GLLE3	0	7	9	3	2	2
	PYRA	5	10	3	12	8	5
	SUMO	0	1	0	0	0	0
Perennial Graminoid	DISP	155	153	154	159	151	161*
	JUBA	14	15	9	16	1	9**
	SPAI	139	132	137	140	139	136
Shrubs	ALOC2	0	0	0	0	0	5
	ATTO	0	2	10	2	3	26**
	ERNA10	7	8	13	18	8	9
Nonnative Species	BAHY	0	16	39	0	3	8

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0.0	0.0	0.0	0.0	0.0	T
	ATSES	0	1	0	0	0	0
	CHENO	0	1	0	0	0	0
	CHHI	0	1	0	0	0	0
	COMAC	0	1	0	0	0	T
	CORA5	0	T	0	0	0	T
Perennial Forb	ASTRA	0	0	0	T	0	0
	GLLE3	0	1	T	T	0	T
	PYRA	T	T	T	T	0	T
Perennial Graminoid	DISP	8	18	8	6	9	11
	JUBA	T	T	T	T	0	T
	SPAI	12	24	14	13	16	18
Nonnative Species	BAHY	0	T	1	0	0	T

Cover (%) Shrubs THIBAUT_02

Species Code	2003	2004	2007	2009	2010
ALOC2	0.0	0.0	0.0	0.0	0.4
ATTO	0.0	0.4	0.0	0.6	0.2
ERNA10	4.9	0.3	1.1	0.0	1.1
Total	4.9	0.7	1.1	0.6	1.7

Ground Cover (%) THIBAUT_02

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	41	30	63	45	78	52
Dung	8	11	6	2	1	0
Litter	34	47	26	51	22	47
Rock	0	0	0	0	0	0
Standing Dead	0	0	0	0	T	0

Shrub Densities and Age Classes THIBAUT_02

	ATTO		ERNA10					
Age Class	2004	2010	2002	2003	2004	2007	2009	2010
Seedling	0	46	0	0	0	0	0	0
Juvenile	4	4	0	5	8	0	1	9
Mature	1	3	1	9	13	7	11	12
Decadent	0	0	2	1	0	0	1	0
Total	5	53	3	15	21	7	13	21

Thibaut Pasture

THIBAUT_03

THIBAUT_03 is located in the upland Thibaut Pasture. The soils are Shondow Loam, 0-2% slopes, corresponding to the Saline Meadow ecological site. Similarity indices ranged between 71-92% during baseline sampling due to high cover of sacaton and saltgrass, and low shrub cover. Although the similarity index is high for this site, production seems lower than expected for the Saline Meadow. Saltgrass frequency increased in 2009 compared to 2007 but remained within typical range of variability observed during previous sampling periods. Saltgrass remained at similar levels to 2009 in 2010. Utilization on the site tends to be high with even though the total utilization for Thibaut Field was well below the upland standard of 65%.

Utilization by Weighted Average and Species, THIBAUT_03

	Weighted Average	DISP	SPAI
2007	78%	74%	83%
2008	65%	55%	75%
2009	37%	33%	40%
2010	65%	70%	60%

Frequency (%), THIBAUT_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATSES	0	17	0	0	0	0
	CHHI	0	2	0	0	0	0
	CORA5	0	15	2	0	0	8
Perennial Forb	GLLE3	51	26	37	34	26	28
	MACA2	0	0	0	0	0	8
	PYRA	0	0	0	0	2	0
	STEPH	3	7	13	0	0	0
Perennial Graminoid	DISP	128	147	139	121	149	146
	JUBA	15	14	5	11	9	16
	SPAI	136	141	149	133	140	137
Shrubs	ATTO	2	5	11	0	3	6
	ERNA10	12	16	36	10	5	6
	MACA17	0	0	0	7	5	0
	SAEX	0	0	0	5	0	0
Nonnative Species	BAHY	0	0	0	0	2	0
	SATR12	0	0	0	0	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATSES	0	1	0	0	0	0
	CHENO	0	T	0	0	0	0
	CHHI	0	0	0	0	0	0
	CORA5	0	T	T	0	0	1
Perennial Forb	GLLE3	11	1	6	8	1	4
	PYRA	0	0	0	0	T	0
	STEPH	T	T	T	0	0	0
Perennial Graminoid	DISP	8	14	3	16	7	6
	JUBA	T	1	T	T	T	T
	SPAI	22	34	15	23	9	10
Shrubs	ATTO	T	0	0	0	0	0
	ERNA10	1	0	0	0	0	0
	MACA17	0	0	0	T	T	T
	SAEX	0	0	0	0	0	0
Nonnative Species	BAHY	0	0	0	0	T	0
	SATR12	0	0	0	0	T	0

Cover (%) Shrubs THIBAUT_03

Species Code	2003	2004	2007	2009	2010
ERNA10	6.5	3.1	2.7	2.2	1.3

Ground Cover (%) THIBAUT_03

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	30	18	47	24	65	46
Dung	4	5	3	3	1	1
Litter	43	63	47	73	34	53
Rock	T	T	0	T	0	T
Standing Dead	0	0	1	1	1	0

Shrub Densities and Age Classes THIBAUT_03

	ATTO			ERNA10						MACA17
Age Class	2003	2004	2007	2002	2003	2004	2007	2009	2010	2010
Juvenile	1	7	0	10	14	4	2	0	3	1
Mature	0	0	1	1	6	6	10	5	9	0
Decadent	0	0	0	4	6	4	1	7	2	0
Total	1	7	1	15	26	14	13	12	14	1

THIBAUT_08

THIBAUT_08 is in an upland management area in the upland Thibaut Pasture. The soils are Division Numu Complex, 0-2% slopes, which corresponds to the Saline Bottom ecological site. The transect was first established and read in 2007. The similarity index was 64%. Saltgrass frequency in 2010 significantly decreased in 2010 when compared to values in 2009. All other species remained relatively static. Utilization on the site is low with grazing being limited by availability of stockwater and abundance of palatable forage for horses and mules.

Utilization by Weighted Average and Species, THIBAUT_08

	Weighted Average	DISP	SPAI	SPGR
2008	15%	9%	24%	
2009	8%	10%	10%	7%
2010	16%		34%	

Frequency (%), THIBAUT_08

Life Forms	Species	2007	2009	2010
Annual Forb	CORA5	0	0	2
Perennial Forb	PYRA	0	2	0
	STPA4	0	1	2
	STEX	1	0	0
Perennial Graminoid	DISP	108	122	101**
	JUBA	12	15	7
	SPAI	42	41	40
	SPGR	14	11	14
Shrubs	ALOC2	16	16	14
	ATCO	5	0	6
	ATTO	20	11	15
	ERNA10	16	22	7**
	SAVE4	4	2	2
Nonnative Species	BAHY	0	0	5

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_08

Life Forms	Species	2007	2009	2010
Annual Forb	CORA5	0	0	T
Perennial Forb	PYRA	0	T	0
	STPA4	T	T	0
	STEX	T	0	0
Perennial Graminoid	DISP	7	8	4
	JUBA	T	T	T
	SPAI	9	6	6
	SPGR	1	0	T
Nonnative Species	BAHY	0	0	T

Cover (%) Shrubs THIBAUT_08

Species Code	2007	2009	2010
ALOC2	4.0	0.0	2.4
ATTO	0.8	0.8	1.8
ERNA10	2.9	2.9	1.8
Total	7.7	3.6	6.0

Ground Cover (%) THIBAUT_08

Substrate	2007	2009	2010
Dung	3	2	T
Litter	36	19	23
Standing Dead	1	2	T
Bare Ground	61	79	76

Shrub Densities and Age Classes THIBAUT_08

	ATCO		ATTO			ERNA10		
Age Class	2009	2010	2007	2009	2010	2007	2009	2010
Seedling	0	0	0	11	3	0	2	1
Juvenile	2	0	6	0	7	14	14	8
Mature	0	0	2	8	4	6	8	10
Decadent	2	1	3	0	0	2	7	6
Total	4	1	11	19	14	22	31	25

THIBAUT_09

THIBAUT_09 is an upland management area in the Thibaut Pasture. The soils are Division-Numu Complex with 0-2% slopes, which correspond to the Saline Bottom ecological site. The transect was first established and read in 2007. The similarity index was 26% in 2007. The low similarity index resulted from the lack of alkali sacaton when compared to the site description for Saline Bottoms. Overall annual aboveground production is low for the site, likely because of soil disturbance from scraping during the high water years in the late 1960s. Frequency did not significantly differ between 2010 and 2009. Utilization was low for the site for all years sampled.

Utilization by Weighted Average and Species, THIBAUT_09

	Weighted Average	DISP
2008	9%	9%
2009	13%	13%

Frequency (%), THIBAUT_09

Life Forms	Species	2007	2009	2010
Annual Forb	2FORB	0	0	10
Perennial Forb	CRTR5	13	10	0
Perennial Graminoid	DISP	108	117	104
	SPAI	3	3	2
Shrubs	ATTO	2	2	0
	ERNA10	0	1	0
	SAVE4	0	0	1
Nonnative Species	BAHY	0	0	2

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_09

Life Forms	Species	2007	2009	2010
Annual Forb	2FORB	0	0	T
Perennial Forb	CRTR5	T	0	0
Perennial Graminoid	DISP	8	7	4
	SPAI	1	T	T

Cover (%) Shrubs THIBAUT_09

Species Code	2009	2010
ATTO	0.1	0

Ground Cover (%) THIBAUT_09

Substrate	2007	2009	2010
Dung	1	T	T
Litter	30	10	12
Rock	0	0	0
Bare Ground	70	90	88

Shrub Densities and Age Classes THIBAUT_09

	ATTO			ERNA10	SAVE4			STPA4
Age Class	2007	2009	2010	2010	2007	2009	2010	2010
Seedling	0	0	0	0	0	0	2	0
Juvenile	3	4	1	1	0	0	0	1
Mature	1	1	1	0	1	2	2	0
Decadent	0	0	0	0	1	0	0	0
Total	4	5	2	1	2	2	4	1

Thibaut Riparian Exclosure

THIBAUT_04

THIBAUT_04 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. This site is located in the historical 'dry reach' of the Owens River. Similarity indices were consistently at 3%, with community composition dominated by Nevada saltbush and nonnative bassia and Russian thistle. In 2010 frequency and cover increased on the site despite having been burned in 2008. Nevada saltbush cover expanded to 48 m from 47 m in 2009 and 10 m in 2003. Livestock are currently excluded from the Thibaut Riparian Pasture. Utilization is not measured on this site because it is located within a grazing exclosure.

Frequency (%), THIBAUT_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	15	0	0	0
	CHHI	0	7	5	0	0	0
Perennial Forb	MALE3	0	0	5	0	0	0
Shrubs	ATTO	9	13	19	37	43	48
Nonnative Species	BAHY	0	2	30	0	0	58**
	SATR12	0	10	15	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATTR	0	0	T	0	0	0
	CHHI	0	0	T	0	0	0
Perennial Forb	MALE3	0	0	T	0	0	0
Nonnative Species	BAHY	0	1	1	0	0	22
	SATR12	0	2	T	0	0	0

Cover (%) Shrubs THIBAUT_04

Species Code	2003	2004	2007	2009	2010
ATTO	10.2	6.7	34.6	46.8	48.2

Ground Cover (%) THIBAUT_04

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	8	12	11	16	0	T
Dung	0	1	1	T	0	T
Litter	0	87	88	84	100	99
Rock	0	0	0	0	0	0
Standing Dead	0	0	19	2	16	7
TARA Slash	0	0	3	1	0	0

Shrub Densities and Age Classes THIBAUT_04

	ATTO					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	0	2	0	0	0	0
Juvenile	3	6	15	3	1	0
Mature	4	17	9	39	56	30
Decadent	0	3	1	34	0	0
Total	7	28	25	76	57	30

THIBAUT_05

THIBAUT_05 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0 to 2% slopes, which corresponds to the Moist Floodplain ecological site. This site is located in the historical 'dry reach' of the Owens River. The similarity index has remained at 3% during baseline sampling. Frequency in 2009 indicated an increase salt heliotrope (*Heliotropium curassavicum* [HECU3]) and alkali mallow (*Malvella leprosa* [MALE3]) two native perennials. This increase has continued into 2010 with salt heliotrope occupying the largest amount of live plant cover on the site. The increase of these early seral forbs and the presence of some trace amounts of perennial saltgrass are encouraging signs that return flows may be initiating successional changes on the site. As with all other floodplain areas in the former dry reach, bassia covered the site in 2008. No new growth of bassia was noted in 2009 but in 2010 the plant restablished a live presence on the transect. Unlike most riparian transects in the former dry-reach section Nevada saltbush occupies a small niche in the plant community within the Thibaut_05 macroplot. Livestock are currently excluded from the Thibaut Riparian Exclosure and no utilization data was collected.

Frequency (%), THIBAUT_05

Life Forms	Species	2002	2003	2004	2005	2007	2009	2010
Annual Forb	CHHI	0	0	0	1	0	0	0
	CHIN2	0	6	3	0	0	0	0
Perennial Forb	HECU3	0	0	0	2	2	24	37*
	MALE3	0	0	0	0	0	10	28**
Perennial Graminoid	DISP	0	0	0	0	4	3	0
Shrubs	ATTO	0	7	3	4	2	1	0
Nonnative Species	AMAL	0	0	0	2	0	0	0
	BAHY	0	19	9	42	0	2	29**
	DESO2	0	0	16	6	0	0	0
	TARA	0	0	3	0	0	0	0
	SATR12	0	16	24	19	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_05

Life Forms	Species	2002	2003	2004	2005	2007	2009	2010
Annual Forb	CHHI	0	0	0	T	0	0	0.0
	CHIN2	0	T	T	0	0	0	0.0
Perennial Forb	HECU3	0	0	0	T	1	12	18
	MALE3	0	T	0	0	0	2	3
Perennial Graminoid	DISP	T	0	0	0	T	1	0
Shrubs	ATTO	0	0	0	0	0	0	0
Nonnative Species	AMAL	0	0	0	T	0	0	0
	BAHY	0	3	T	1	0	T	5
	DESO2	0	0	T	T	0	0	0
	SATR12	0	8	0	1	T	0	0

Cover (%) Shrubs THIBAUT_05

Species Code	2003	2004	2005	2007	2009	2010
ATTO	0.5	0.5	0.3	1.4	0	0
TARA	0.0	0.0	0.4	0.0	0	0
Total	0.5	0.5	0.7	1.4	0	0

Ground Cover (%) THIBAUT_05

Substrate	2002	2003	2004	2005	2007	2009	2010
Dung	2	0	1	1	1	T	T
Litter	91	75	66	62	75	94	98
Rock	0	0	0	0	0	0	0
Standing Dead	0	0	0	1	0	0	0
Bare Ground	0	15	34	32	24	6	2
TARA Slash	0	0	48	31	0	0	0

Shrub Densities and Age Classes THIBAUT_05

	ATTO					TARA	
Age Class	**2003**	**2004**	**2005**	**2007**	**2010**	**2004**	**2010**
Seedling	2	0	0	0	0	0	0
Juvenile	3	4	0	0	0	2	0
Mature	4	0	6	3	0	0	0
Decadent	1	0	0	0	0	0	0
Total	10	4	6	3	0	2	0

THIBAUT_06

THIBAUT_06 is in the Thibaut Riparian Exclosure, soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index during baseline sampling ranged between 10-16%. The site is located within the historical dry reach of the river. Tamarisk slash piles were burned at this site in 2008. As with all other floodplain areas in the former dry reach, bassia covered the site in 2008. No new growth of bassia was noted in 2009, but the site remained covered by decadent stands of this invasive weed. In 2010 bassia significantly increased to levels more than eight times greater than any previous observation. Frequency results in 2009 and 2010 indicate that return flows may be initiating changes at the site; salt heliotrope and saltgrass significantly increased compared to previous years in 2009 and remained at similar levels in 2010. Utilization is data is not collected within the exclosure.

Frequency (%), THIBAUT_06

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATRIP	0	0	1	0	0	0
	ATSES	0	3	9	0	0	0
	ATTR	5	1	3	0	0	0
	CHENO	2	0	0	0	0	0
	CHHI	0	0	4	0	0	0
	CHIN2	0	0	3	0	0	0
	GITR	0	0	5	0	0	0
	MEAL6	0	14	72	0	0	0
Perennial Forb	HECU3	1	0	0	0	51	46
Perennial Graminoid	DISP	2	2	2	3	15	14
	SPAI	2	3	3	5	4	2
Shrubs	ATTO	11	8	9	3	0	1
Nonnative Species	BAHY	0	2	1	0	10	88**
	DESO2	0	19	3	0	0	0
	SATR12	17	60	52	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_06

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	ATRIP	0	0	T	0	0	0.0
	ATSES	0	T	T	0	0	0.0
	ATTR	3	T	T	0	0	0.0
	CHENO	T	0	0	0	0	0.0
	CHHI	0	0	T	0	0	0.0
	CHIN2	0	0	T	0	0	0.0
	GITR	0	0	T	0	0	0.0
	MEAL6	0	T	7	0	0	0.0
Perennial Forb	HECU3	T	0	0	0	11	7.2
Perennial Graminoid	DISP	T	T	T	1	4	4.4
	SPAI	1	1	1	2	2	0.6
Nonnative Species	BAHY	0	T	T	0	7	30.4
	DESO2	0	T	T	0	0	0.0
	SATR12	7	3	2	0	0	0.0

Cover (%) Shrubs THIBAUT_06

Species Code	2003	2004	2005	2007	2009	2010
ATTO	0.7	1.1	1.8	11.1	1.7	2.4

Ground Cover (%) THIBAUT_06

Substrate	2003	2004	2005	2007	2009	2010
Dung	T	T	T	1	T	0
Litter	76	71	61	59	80	87
Rock	T	0	T	T	0	0
Standing Dead	0	15	3	1	0	T
Bare Ground	19	28	41	41	20	10
TARA Slash	0	13	12	19	0	0

Shrub Densities and Age Classes THIBAUT_06

	ATTO					
Age Class	2003	2004	2005	2007	2009	2010
Juvenile	2	3	0	0	0	0
Mature	3	2	2	4	2	3
Total	5	5	2	4	2	3

THIBAUT_07

THIBAUT_07 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The site is located within the historical dry reach of the Lower Owens River. Similarity index was 5% during the baseline sampling period. Slash piles were burned adjacent to the transect but not directly on the transect. Nevada saltbush cover continues to increase on the site. All frequencies were static in comparision to 2009 with the exception of bassia which rose significantly in 2010. Utilization is not collected within the exclosure.

Frequency (%), THIBAUT_07

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	2FORB	0	1	0	0	0	0
	ATSES	2	24	81	0	0	0
	ATTR	26	15	49	0	0	0
	GITR	0	0	3	0	0	0
Perennial Forb	HECU3	1	0	1	0	0	0
	MALE3	7	2	0	9	2	0
Perennial Graminoid	DISP	3	3	0	4	0	0
Shrubs	ATTO	7	16	20	8	18	17
Nonnative Species	BAHY	12	34	37	0	0	95**
	DESO2	0	15	34	0	0	0
	SATR12	16	47	45	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs THIBAUT_07

Life Forms	Species	2003	2004	2005	2007	2009	2010
Annual Forb	2FORB	0	T	0	0	0	0
	ATSES	T	T	13	0	0	0
	ATTR	8	T	2	0	0	0
	GITR	0	0	T	0	0	0
Perennial Forb	HECU3	T	0	T	0	0	0
	MALE3	T	T	0	T	T	0
Perennial Graminoid	DISP	T	T	0	T	0	0
Nonnative Species	BAHY	3	1	2	0	0	51
	DESO2	0	T	6	0	0	0
	SATR12	4	3	2	0	0	0

Cover (%) Shrubs THIBAUT_07

Species Code	2003	2004	2005	2007	2009	2010
ATTO	1.1	1.3	1.0	5.0	14.5	17.0

Ground Cover (%) THIBAUT_07

Substrate	2003	2004	2005	2007	2009	2010
Dung	2	T	T	1	T	0
Litter	5	3	3	5	80	95
Rock	0	0	0	0	0	0
Standing Dead	0	T	0	0	0	0
Bare Ground	94	97	97	94	20	5

Shrub Densities and Age Classes THIBAUT_07

	ATTO					
Age Class	2003	2004	2005	2007	2009	2010
Seedling	0	0	7	0	0	0
Juvenile	0	2	15	13	0	17
Mature	2	0	0	2	37	0
Total	2	2	22	15	37	17

Irrigated Pastures

The northern portion of the Thibaut Pasture (85 acres) comprises the area managed as irrigated pasture for the Thibaut Lease. With the completion of the new fencing for the LORP creating the Waterfowl management area located directly north, and rare plant management area located south west. A grazing corridor has been created that puts heavy pressure on the irrigated pasture. The subsequent increase in grazing pressure has negatively affected irrigated pasture condition. The negative effects are a low score of 68% due to weeds, uneven grazing, and bare spots. Conditions are not bad at this time but management actions should change in order to increase future forage conditions in the area.

LADWP watershed recourses staff recommends that livestock be moved out of the area periodically during the grazing season to allow the area to rest. This may be achieved by supplemental feeding further south in the Thibaut Field, electric fencing, or turning the livestock out in the southern end of Thibaut Field instead of the corral area. Stockwater should be available soon to make the last option more feasible. This irrigated pasture will be re-evaluated in the 2010-11 grazing season.

Stockwater Sites

There is one identified water site needed in the Thibaut Field. This site is a flowing well located in the uplands east of irrigated pastures in the Thibaut Field. This well produces sporadically through out the year, creating a small puddle area for livestock and wildlife. This is currently being retrofitted with a solar pump and plumbing for a stockwater trough. Improvements to the access roads for the stockwater site are also underway.

Rare Plant Management Area Thibaut

This pasture contains both *S. covillei* and *C. excavatus* populations. Trend plots for Rare Plant Management Area 1 and Rare Plant Management Area 4 are within an exclosure that is restricted from grazing from early March through early October per the LORP EIR during the rare plants' flowering, fruiting, and seeding period. The pasture was grazed with end-of-season utilization at 15%. Phenology included individuals that were vegetative to individuals that were in flower.

Rare Plant Management Area Pasture Thibaut Lease

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Rare Plant Management Area 1	2009	*C. excavatus*	0	0	3	3
	2010		0	0	12	12
Rare Plant Management Area 1	2009	*S. covillei*	0	9	21	30
	2010		1	0	24	25
Rare Plant Management Area 4	2009	*C. excavatus*	0	0	2	2
	2010		0	0	4	4
Rare Plant Management Area 4	2009	*S. covillei*	0	7	32	39
	2010		0	0	38	38

Salt and Supplement Sites

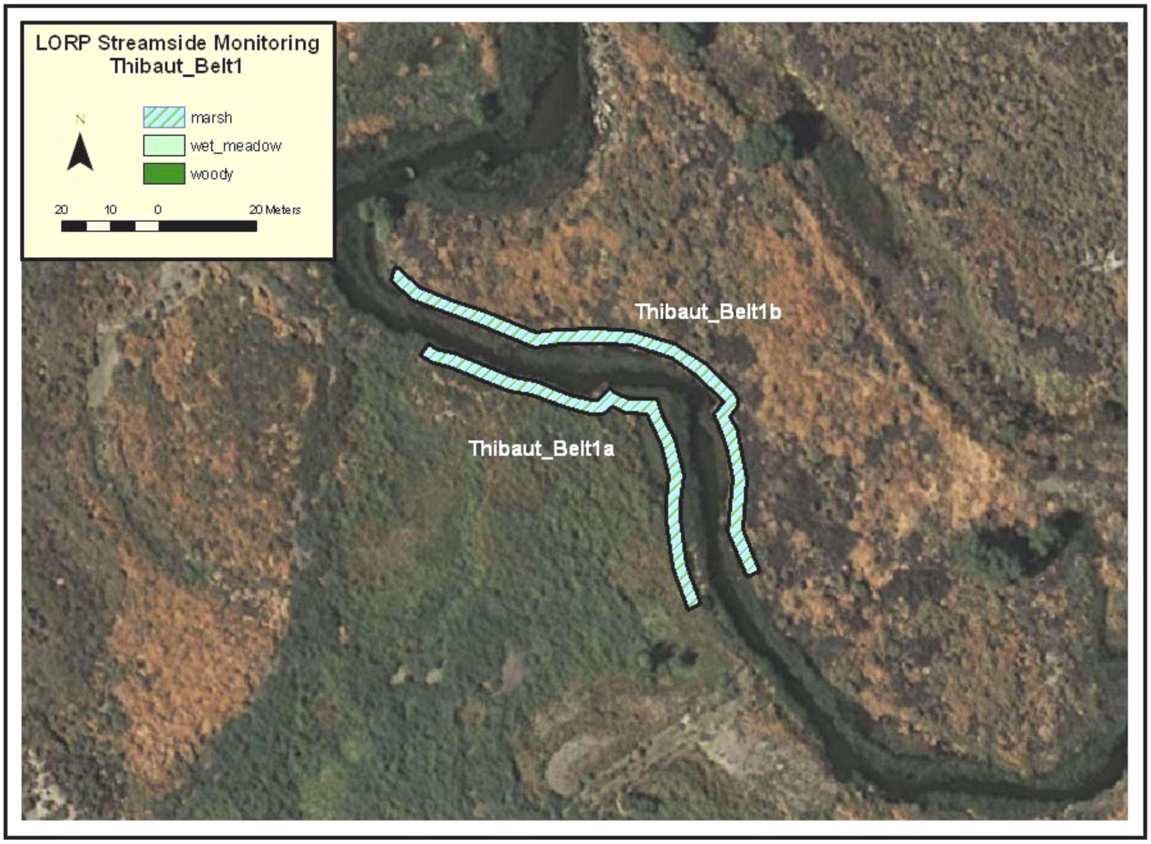
Sites are randomly picked every year during the winter to feed hay to the livestock. Hay is spread over an area using a truck or trailer pulled by a truck. Areas are rotated throughout the winter for the duration that the livestock are fed to ensure that no heavy grazing impacts occur.

Burning

There were no controlled range improvement burns on the lease during 2010. However, there may be the possibility of burning the Waterfowl Management Area to maintain open areas of water for waterfowl.

Streamside Monitoring

There is one DMA located within the Thibaut Lease which is located in the Thibaut Riparian Exclosure.

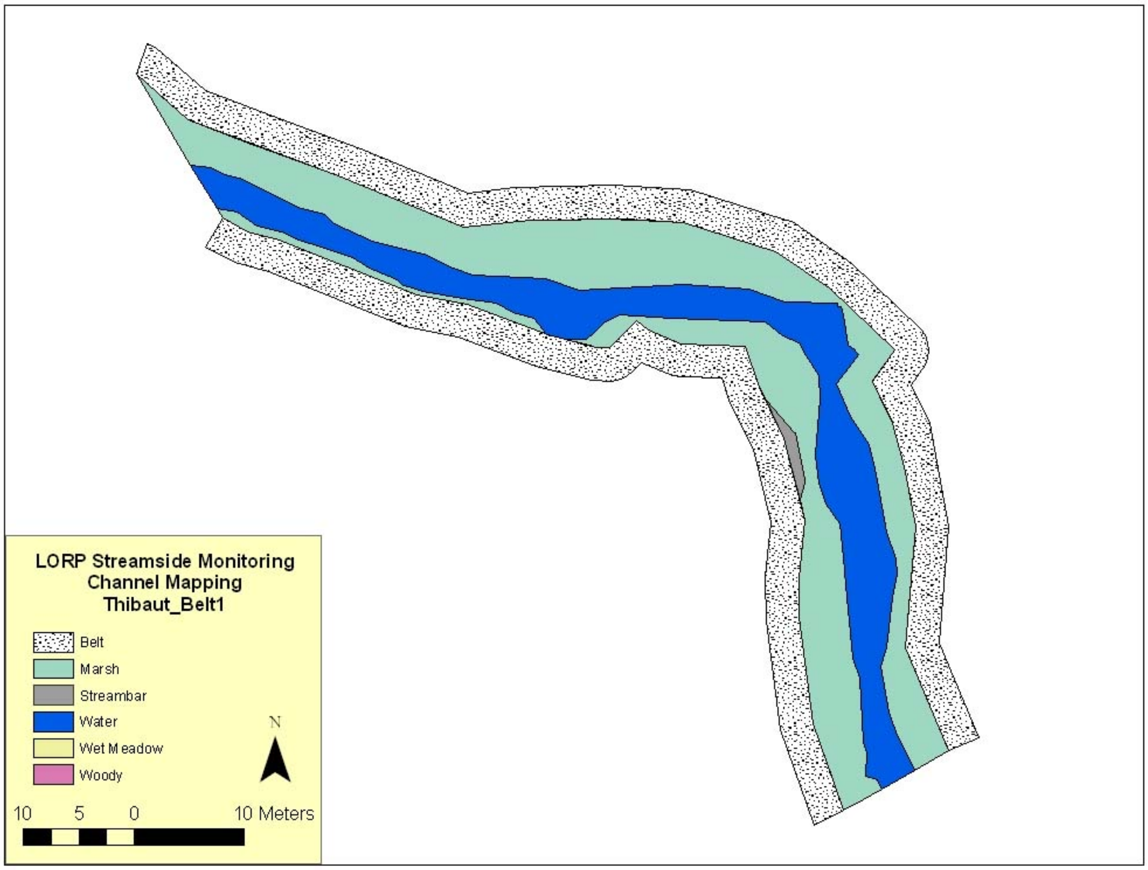


LORP Streamside Monitoring Thibaut_Belt1

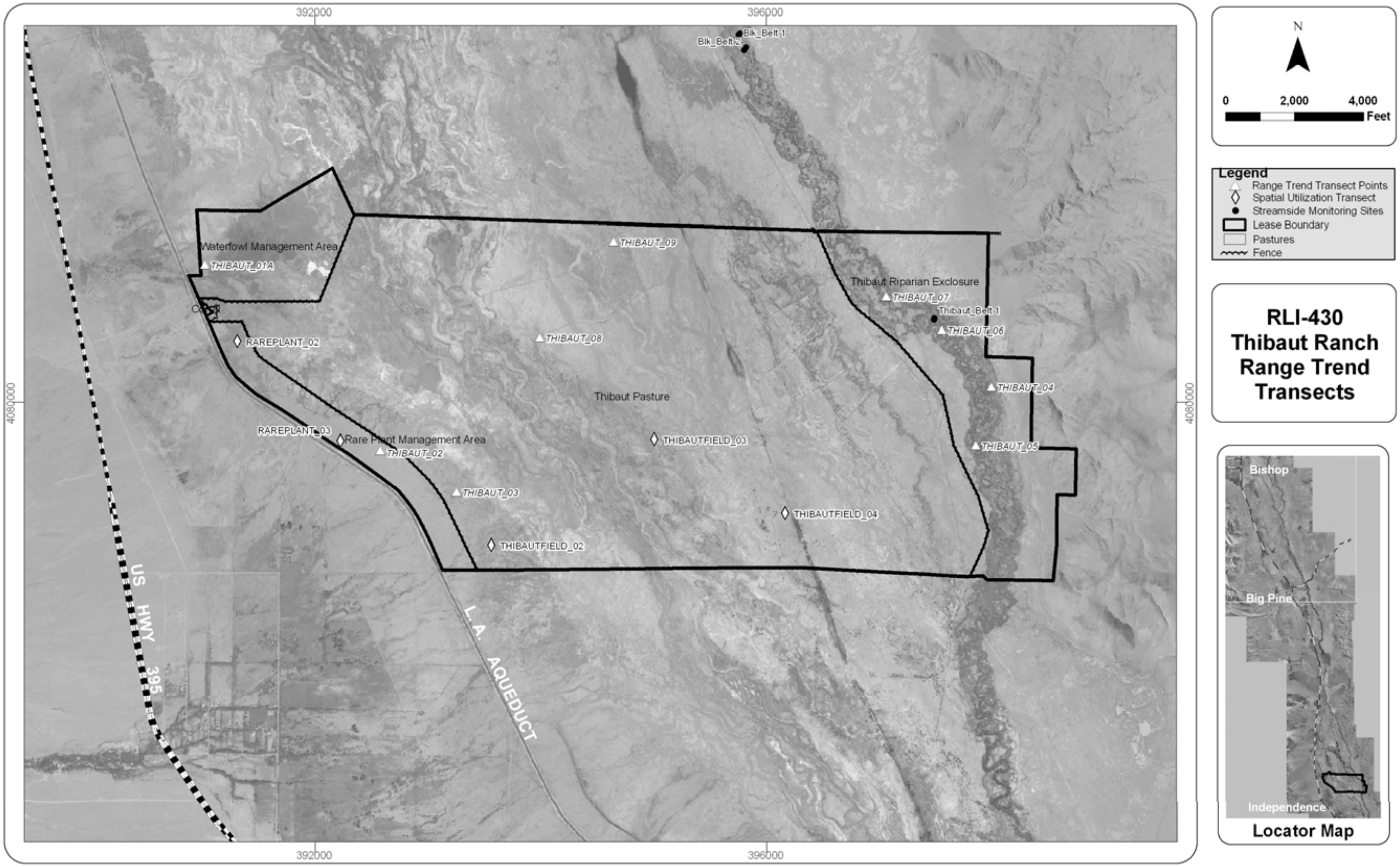
Thibaut_Belt1a was characterized as marsh dominated by cattails with some threesquare bulrush and Baltic rush also present. The adjacent meadow was dominated by bassia. The bank was primarily occupied by litter or was vegetated, but also had a portion that was barren and undefined. According to point intercept data, the water's edge was 55% litter (mostly bassia and cattails), 26.5% fine/silty soil, 16.5% vegetated, and 2% wood. Species noted along the water's edge included cattails, threesquare bulrush, Baltic rush, and saltbush. There was one mature Goodding's willow rooted within a sampled plot, and two mature present as canopy cover. There was no apparent use of these trees by livestock, elk, etc. and there was no woody recruitment at this site. Although a few Goodding's willow were recorded within the sampled plots, GIS analysis did not detect notable cover of woody species within the surveyed belt.

Thibaut_Belt1b was also characterized as marsh dominated by cattails along the bank. Banks were observed to be litter/vegetated with some barren bank also present. Point intercept data showed this transect to be 47.5% litter, 30% vegetated, and 22.5% fine/silty soil. Species documented on this transect included cattails, creeping wildrye, salt heliotrope, threesquare bulrush, and Baltic rush. There were no woody species present as rooted or canopy cover across the site and thus no recruitment occurring. GIS analysis of Thibaut_Belt1b also showed no woody cover.

There are no utilization transects located within the Thibaut Riparian Exclosure, so there is no data for the end of the grazing season near Thibaut_Belt1. GIS analysis of the wetted channel estimated the following: 330 m^2 open water, 7 m^2 streambar, and 604 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Thibaut_Belt1



Land Management Figure 6. Thibaut Lease RLI-430, Range Trend Transect Locations

4.8.5 Islands Lease (RLI-489)

The Islands Lease is an 18,970-acre cow/calf operation divided into 11 pastures. In some portions of the lease, grazing occurs year round with livestock rotated between pastures based on forage conditions. Other portions of the lease are grazed October through May. The Islands Lease is managed in conjunction with the Delta Lease. Cattle from both leases are moved from one lease to the other as needed throughout the grazing season.

There are eight pastures located with in the LORP boundary of the Islands Lease:

- Bull Field
- Reinhackle Field
- Bull Pasture
- Carasco North Field
- Carasco South Field
- Carasco Riparian Field
- Depot Riparian Field
- River Field

<u>Summary of Utilization</u>

The following tables present the summarized utilization data for each pasture, for the transects in each pasture, and by species for each transect for the current year.

End of Grazing Season Utilization for Fields, Transects and Species on the Islands Lease, RLI-489 2010

Pasture	Utility	Transect	Utility	DISP	LETR5	SPAI
Carasco Riparian Field*	0%	ISLAND_06	0%	0%	0%	0%
Depot Riparian Field*	30%	ISLAND_08	21%	8%		60%
		ISLAND_09	49%	49%		
		RIVERFIELD_09	11%	4%		25%
		RIVERFIELD_12	56%	54%	62%	
		RIVERFIELD_07	24%	24%		
River Field *	5%	ISLAND_07	na			
		ISLAND_10	28%	26%		52%
		ISLAND_11	na			
		ISLAND_12	na			
		RIVERFIELD_8	18%	18%	50%	36%

**Riparian pastures (40% utilization standard)*

Riparian Management Areas

Several of the transects (Island_07, Island_12, and Riverfield_11) were presented as *na* use although livestock have been grazing the area. Because these transects are in the prescribed burn area, utilization was not measured. However, utilization measurements will be taken for the 2010-11 grazing season.

Summary of Range Trend Data and Conditions

The similarity index has ranged between 50-73% for all Moist Floodplain sites during the baseline period. In 2010 there were no departures outside of the sampled range of values across all years; therefore, similarity indexes remain typical to what was sampled during the baseline period. The only significant departure outside of all previously observed frequency ranges occurred on Island_07 where the flooding of the site has shifted plant community composition from a saltgrass meadow to a wet marsh where saltgrass has been replaced by cattail and bullrush. Nevada saltbush frequency on Island_08 and saltgrass frequency on Island_11 significantly decreased when compared to 2009 results but both frequencies remained within the previously observed ranges prior to 2009. Although there were no significant changes in Islands_10 from 2009 to 2010 saltgrass appears to be trending upward when compared to the first two sampling periods in 2006 and 2007. Spring and summer growing conditions were less than favorable on Island_06, a Saline Meadow site. Both saltgrass and sacaton declined when compared to 2009, utilization was 0% for 2010.

Significant changes in plant frequencies for Islands transects between 2009 and 2010.

	No Change	DISP	SPAI	ATTO	BAHY
Moist Flood Plain					
ISLANDS_07		↓			
ISLANDS_08				↓	
ISLANDS_09	↔				
ISLANDS_10	↔				
ISLANDS_11		↓			
SALINE MEADOW					
ISLANDS_06		↓	↓		

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

Carasco Riparian Field South

ISLAND_06

ISLAND_06 is a riparian management area in the Carasco Riparian Field South. The soils are Manzanar Silt Loam, 0-2% slopes, which corresponds to the Saline Meadow ecological site. The similarity index for this site has been high, ranging between 82-91%. Saltgrass frequency significantly increased in 2009 beyond the range of variability observed during the baseline period but subsequently decreased in 2010 to levels typical during the last four years. Nevada saltbush and rubber rabbitbush have remained static. Utilization during the past four years has been well below the 40% threshold for riparian management areas.

Utilization by Weighted Average and Species, ISLAND_06

	Weighted Average	DISP	SPAI
2007	29%	12%	45%
2008	18%	9%	26%
2009	13%	9%	18%
2010	0%	0%	0%

Frequency (%), ISLAND_06

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Perennial Forb	GLLE3	0	4	0	1	0	0	0
	NIOC2	0	0	0	0	2	8	6
Perennial Graminoid	DISP	90	62	92	103	117	132	116*
	JUBA	5	5	5	3	5	7	7
	LETR5	0	0	0	1	2	0	0
	SPAI	105	103	105	98	104	117	76**
Shrubs	ATTO	19	9	19	7	11	7	4
	ERNA10	9	0	3	1	3	7	1

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_06

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Perennial Forb	GLLE3	0	1	0	T	0	0	0
	NIOC2	0	0	0	0	T	T	1
Perennial Graminoid	DISP	12	14	15	17	17	30	8
	JUBA	1	T	T	T	T	T	T
	LETR5	0	0	0	T	T	0	0
	SPAI	39	40	31	22	18	42	9

Cover (m) Shrubs ISLAND_06

Species Code	2003	2004	2007	2008	2009	2010
ATTO	7.6	7.3	9.5	7.9	8.9	5.4
ERNA10	1.3	2.9	1.4	2.1	2.1	0.6
Total	8.8	10.3	10.9	10.0	11.0	6.0

Ground Cover (%) ISLAND_06

Substrate	2002	2003	2004	2007	2008	2009	2010
Bare Soil	14	15	17	16	9	13	11
Dung	2	1	2	1	1	0	T
Litter	76	65	47	84	90	87	89
Rock	0	0	0	0	0	0	0
Standing Dead	0	0	1	2	4	7	1

Shrub Densities and Age Classes ISLAND_06

	ATTO							ERNA10						
Age Class	2002	2003	2004	2007	2008	2009	2010	2002	2003	2004	2007	2008	2009	2010
Seedling	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Juvenile	11	15	2	17	1	0	0	4	7	4	6	2	0	2
Mature	27	52	39	34	46	36	24	6	7	14	8	11	14	10
Decadent	6	6	6	3	5	4	6	4	9	2	6	4	6	3
Total	44	73	48	54	52	40	30	14	23	20	20	17	20	15

River Field

ISLAND_07

ISLAND_07 is a riparian management area located in the River Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index during the baseline period has ranged between 63-65%. The site is dominated by saltgrass and has been partially submerged following the return of flows to the Lower Owens River. Frequency for saltgrass significantly decreased in 2010 as the site becomes increasingly more mesic. There has been a noticeable decrease in Nevada saltbush cover and density caused by both the rising water table and surface ponding. The appearance of chairmaker's bulrush (*Schoenoplectus americanus* [SCAM6]) and broadleaf cattail (*Typha latifolia* [TYLA]) are also evidence of the site becoming increasingly hydric. Utilization was not sampled in 2010 because the area was burned in the spring of 2010.

Utilization by Weighted Average and Species, ISLAND_07

	Weighted Average	DISP	SPAI
2007	63%	63%	63%
2009	46%	46%	
2010	na	na	na

Frequency (%), ISLAND_07

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Annual Forb	COMAC	3	3	0	5	0	0	1
	HEAN3	0	0	5	0	0	0	0
Perennial Forb	FRSA	0	0	0	3	0	0	0
	HECU3	0	2	0	0	0	0	0
Perennial Graminoid	DISP	133	140	154	155	118	120	103*
	ELEOC	0	0	0	0	1	3	0
	JUBA	0	0	0	0	6	3	3
	LETR5	0	0	5	3	0	0	0
	SCAM6	0	0	0	0	19	10	14
	TYLA	0	0	0	2	18	19	21
Nonnative Species	POMO5	9	5	0	3	7	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_07

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Annual Forb	COMAC	1	T	0	5	T	0	T
	HEAN3	0	0	T	0	0	0	0
Perennial Forb	FRSA	0	0	0	T	0	0	0
	HECU3	0	T	0	0	0	0	0
Perennial Graminoid	DISP	59	51	43	67	36	43	18
	ELEOC	0	0	0	0	T	T	0
	JUBA	0	0	0	0	1	T	0
	LETR5	0	0	2	T	0	0	0
	SCAM6	0	0	0	0	3	1	T
	TYLA	0	0	0	0	10	3	3
Nonnative Species	POMO5	2	T	0	T	T	1	0

Cover (m) Shrubs ISLAND_07

Species Code	2003	2004	2007	2008	2009	2010
ATTO	7.0	0.8	0.7	0.2	0.3	0
TARA	0.3	0.0	0.0	0.0	0.0	0
Total	7.3	0.8	0.7	0.2	0.3	0

Ground Cover (%)ISLAND_07

Substrate	2002	2003	2004	2007	2008	2009	2010
Bare Soil	11	20	16	5	29	2	T
Dung	11	4	5	2	0	1	0
Litter	72	63	31	46	55	82	82
Rock	0	0	0	0	0	0	0
Standing Dead	0	0	7	0	0	4	0
Water	0	0	0	46	17	15	18

Shrub Densities and Age Classes ISLAND_07

	ATTO					ERNA10
Age Class	2002	2003	2004	2008	2010	2003
Seedling	0	3	0	0	0	0
Juvenile	5	3	0	0	0	0
Mature	3	13	0	1	2	1
Decadent	0	3	3	0	0	0
Total	8	22	3	1	2	1

ISLAND_08

ISLAND_08 is located in the Depot Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index for the site has ranged between 50%-70% during the baseline period. Nevada saltbush frequency significantly increased in 2009 as did density of Nevada saltbush (ATTO) seedlings. In 2010 Nevada saltbush significantly decreased while other plant species remained static. The spike in ATTO juveniles in 2009 had some survivability into 2010 but overall numbers declined. Utilization has been well below the allowable riparian standard for the past three years.

Utilization by Weighted Average and Species, ISLAND_08

	Weighted Average	DISP	SPAI
2007	72%	66%	79%
2008	18%	14%	23%
2009	15%	15%	15%
2010	21%	8%	60%

Frequency (%), ISLAND_08

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Annual Forb	2FORB	0	0	6	0	0	0	0
	ATTR	0	0	0	0	19	0	0
	LACO13	0	0	0	0	5	0	0
Perennial Forb	GLLE3	7	0	7	8	5	0	2
	HECU3	3	0	0	0	3	4	2
	MALE3	0	0	0	1	0	4	2
Perennial Graminoid	DISP	112	77	106	90	94	86	81
	JUBA	32	35	37	27	34	38	31
	LETR5	9	18	21	8	14	19	13
	SPAI	29	13	15	19	7	13	23
Shrubs	ATTO	19	4	7	10	28	47	24**
	ERNA10	20	15	34	24	21	25	31
Nonnative Species	POMO5	0	0	0	0	2	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_08

Life Forms	Species	2002	2003	2004	2007	2008	2009	2010
Annual Forb	2FORB	0	0	T	0	0	0	0
	ATPH	0	0	0	0	1	0	0
	ATTR	0	0	0	0	1	0	0
	COMAC	0	0	0	0	T	0	0
	LACO13	0	0	0	0	T	0	0
Perennial Forb	GLLE3	4	0	T	2	1	T	T
	HECU3	T	0	0	0	T	T	0
	MALE3	0	0	0	T	0	T	0
Perennial Graminoid	DISP	33	26	25	17	14	20	17
	JUBA	1	3	1	1	1	1	1
	LETR5	T	2	1	1	3	3	2
	SPAI	6	7	4	4	1	3	4
Nonnative Species	LASE	0	0	0	0	T	0	0
	POMO5	0	0	0	0	T	0	0

Cover (m) Shrubs ISLAND_08

Species Code	2003	2004	2007	2008	2009	2010
ATTO	8.5	5.8	5.7	8.8	6.0	6.7
ERNA10	37.5	16.0	25.9	18.1	29.8	25.1
Total	46.0	21.9	31.6	26.9	35.8	31.9

Ground Cover (%)ISLAND_08

Substrate	2002	2003	2004	2007	2008	2009	2010
Bare Soil	5	4	12	8	28	8	4
Dung	T	1	3	2	1	T	2
Litter	91	85	52	89	71	89	95
Rock	0	T	0	T	0	0	0
Standing Dead	0	0	9	21	31	18	22

Shrub Densities and Age Classes ISLAND_08

	ATTO						
Age Class	2002	2003	2004	2007	2008	2009	2010
Seedling	5	18	46	0	123	54	42
Juvenile	7	22	39	9	66	585	87
Mature	12	23	25	27	22	127	43
Decadent	0	2	3	9	6	9	13
Total	24	65	113	45	217	775	185

	ERNA10						
Age Class	2002	2003	2004	2007	2008	2009	2010
Seedling	6	2	0	0	4	5	13
Juvenile	39	59	30	4	4	35	45
Mature	39	89	64	61	23	88	106
Decadent	17	17	39	69	32	17	11
Total	101	167	133	134	63	145	175

ISLAND_09

ISLAND_09 is located in the Depot Riparian Field pasture. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index was between 63-64% during the baseline period. Species composition on the site is almost exclusively saltgrass and Nevada saltbush. Frequency has remained static over the five sampling periods. Canopy cover for Nevada saltbush decreased in 2010. Utilization initially was very high in 2007 and has since fluctuated between 34% 2008 to 49% in 2010.

Utilization by Weighted Average and Species, ISLAND_09

	Weighted Average	DISP
2007	92%	92%
2008	34%	34%
2009	50%	50%
2010	49%	49%

Frequency (%), ISLAND_09

Life Forms	Species	2006	2007	2008	2009	2010
Annual Forb	ATPH	0	0	0	0	4
Perennial Forb	SUMO	9	1	4	1	5
Perennial Graminoid	DISP	144	140	152	140	143
Shrubs	ATTO	7	9	6	11	2
Nonnative Species	BAHY	2	0	3	0	5

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_09

Life Forms	Species	2006	2007	2008	2009	2010
Annual Forb	ATPH	0	0	0	0	T
Perennial Graminoid	DISP	37	31	44	30	23
Nonnative Species	BAHY	T	0	T	0	T

Cover (m) Shrubs ISLAND_09

Species Code	2006	2007	2008	2009	2010
ATTO	8.6	7.0	6.6	9.8	5.4
SUMO	0.0	0.5	0.0	1.8	2.0
Total	8.7	7.5	6.6	11.7	7.3

Ground Cover (%)ISLAND_09

Substrate	2006	2007	2008	2009	2010
Dung	8	5	6	4	9
Litter	63	67	68	80	77
Rock	0	0	0	0	0
Standing Dead	0	0	1	3	T
Bare Ground	28	28	24	16	13

Shrub Densities and Age Classes ISLAND_09

	ATTO					SUMO				
Age Class	**2006**	**2007**	**2008**	**2009**	**2010**	**2006**	**2007**	**2008**	**2009**	**2010**
Seedling	11	0	1	0	0	6	0	0	5	0
Juvenile	25	4	1	0	4	39	22	1	6	5
Mature	28	29	23	22	15	14	24	22	32	25
Decadent	1	0	0	5	10	2	3	0	0	0
Total	65	33	25	27	29	61	49	23	43	30

ISLAND_10

ISLAND_10 is located in the Riparian River Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index during baseline period was 65%. The site is dominated by saltgrass and Nevada saltbush. There were no significant changes in frequency from 2009 to 2010. Saltgrass has significantly increased in 2010 when compared to baseline values. Shrub cover was confined to within baseline ranges and Nevada saltbush density decreased slightly in 2010. Utilization on the site has been minimal during the last two years. In February 2009, a grazing exclosure was built just north of ISLAND_10. A range trend plot will be installed and read during the next sampling period in 2011. Utilization was initially high in 2007 but, it has since significantly decreased staying well below the allowable riparian standard for the past three years.

Utilization by Weighted Average and Species, ISLAND_10

	Weighted Average	DISP
2007	63%	63%
2008	19%	19%
2009	5%	5%
2010	28%	28%

Frequency (%), ISLAND_10

Life Forms	Species	2006	2007	2008	2009	2010
Perennial Forb	CRTR5	23	18	31	30	31
	FRSA	22	11	5	17	25
Perennial Graminoid	DISP	132	124	144	149	152
	SPAI	4	2	2	2	1
Shrubs	ATTO	6	3	7	1	1

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_10

Life Forms	Species	2006	2007	2008	2009	2010
Perennial Forb	CRTR5	1	1	2	1	1
	FRSA	3	2	1	1	2
Perennial Graminoid	DISP	29	32	31	30	21
	SPAI	2	1	1	1	1

Cover (m) Shrubs ISLAND_10

Species Code	2006	2007	2008	2009	2010
ATTO	7.1	7.5	10.8	10.1	8.8
SUMO	0.0	0.2	0.0	0.1	0.8
Total	7.1	7.7	10.8	10.2	9.6

Ground Cover (%)ISLAND_10

Substrate	2006	2007	2008	2009	2010
Dung	6	5	2	1	1
Litter	75	74	84	85	85
Rock	0	1	0	0	T
Standing Dead	18	12	2	3	2
Bare Ground	19	21	13	14	14

Shrub Densities and Age Classes ISLAND_10

	ATTO					SUMO				
Age Class	**2006**	**2007**	**2008**	**2009**	**2010**	**2006**	**2007**	**2008**	**2009**	**2010**
Seedling	1	0	0	0	0	0	0	0	0	0
Juvenile	12	1	3	0	0	0	0	0	0	0
Mature	20	18	22	23	18	1	1	1	1	1
Decadent	3	4	2	8	2	0	0	0	0	0
Total	36	23	27	31	20	1	1	1	1	1

ISLAND_11

ISLAND_11 is located in the River Field Riparian pasture. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index was 64% during the baseline period. Frequency in 2009 compared to 2007 was unchanged. Saltgrass frequency decreased significantly in 2010 but was not statistically less than the lowest value during the baseline period (2006). No shrubs were present on the site. Utilization has remained below riparian pasture standards for the last four years.

Utilization by Weighted Average and Species, ISLAND_11

	Weighted Average	DISP
2007	9%	9%
2008	12%	12%
2009	44%	44%
2010	0%	0%

Frequency (%), ISLAND_11

Life Forms	Species	2006	2007	2008	2009	2010
Annual Forb	ATPH	0	0	7	4	11
	COMAC	0	0	9	5	41**
Perennial Forb	ANCA10	22	23	23	18	8*
	NIOC2	72	47	62	59	56
Perennial Graminoid	DISP	148	154	157	157	137**
	JUBA	0	0	0	4	2
Nonnative Species	SATR12	0	0	0	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs ISLAND_11

Life Forms	Species	2006	2007	2008	2009	2010
Annual Forb	ATPH	0	0	1	0	T
	COMAC	0	0	1	T	3
Perennial Forb	ANCA10	4	4	4	2	1
	NIOC2	8	4	7	6	5
Perennial Graminoid	DISP	31	32	33	28	8
	JUBA	0	0	0	T	T
Nonnative Species	SATR12	0	0	0	T	0

Ground Cover (%) ISLAND_11

Substrate	2006	2007	2008	2009	2010
Dung	1	1	T	T	T
Litter	30	38	42	37	53
Rock	T	0	0	0	0
Standing Dead	T	0	0	0	0
Bare Ground	69	62	58	63	47

Irrigated Pastures

The B and D Pastures located near Reinhackle Spring were rated in 2010 and received an irrigated pasture condition score of 90%. These pastures will not be rated again until 2012.

Irrigated Pasture Condition Scores 2007-10

Pasture	2007	2008	2009	2010
B Pasture	90%	X	X	90%
D Pasture	90%	X	X	90%

X indicates no evaluation made.

Stockwater Sites

There are two stockwater sites located 1-1.5 miles east of the river in the River Field uplands near the old highway. Currently these wells are under contract and should be drilled in 2010.

Salt and Supplement Site:

Cake blocks that contain trace minerals and protein are distributed for supplement on the lease. The blocks are dispersed randomly each time and if uneaten they biodegrade within one grazing season.

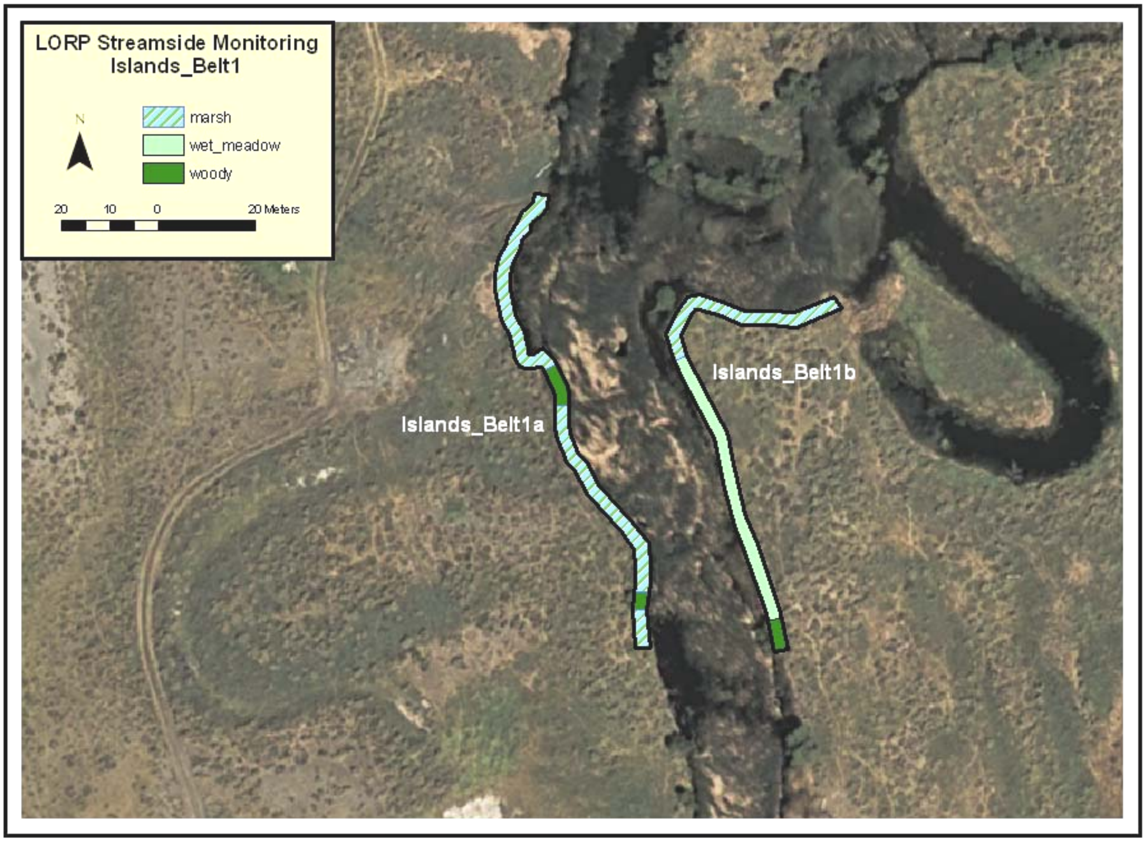
There were two supplement sites located adjacent to the Owens River, near Georges Creek during the RAS. These sites were not in the riparian area, but were on steep erodible terraces adjacent to the floodplain, and within the riparian fencing boundaries. These sites are established sites and have been used for countless years. It would not be feasible to move them and disturb a new area.

Burning

A range burn occurred in the River Field on the main meadow in 2010. The purpose of the burn was to improve approximately 200 acres of meadow to offset the loss of forage for the lessee in the Islands area that has been inundated with water since the implementation of the LORP project. The burn resulted in a positive response from the perennial grasses present and removed all of the shrubs within the burn area. The remainder of this burn project will be located in the Depot Riparian Field north of Lone Pine Pond. The approximate size of the burn will be 500 acres and it should take place in late February or early March 2011.

Streamside Monitoring

There were two DMAs located within the Islands Lease (RLI-489), one in the River Field Exclosure (Islands_Belt1) and one in the River Field (Islands_Belt2).

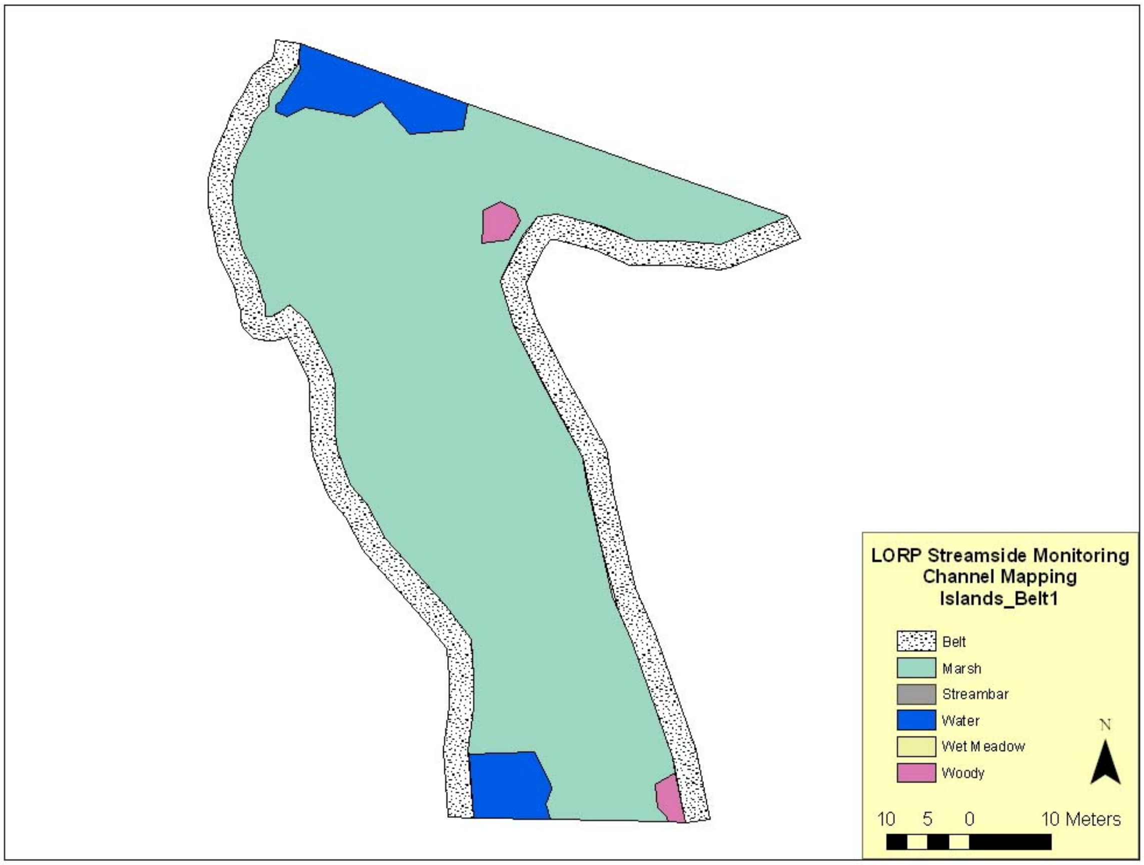


LORP Streamside Monitoring Islands_Belt1

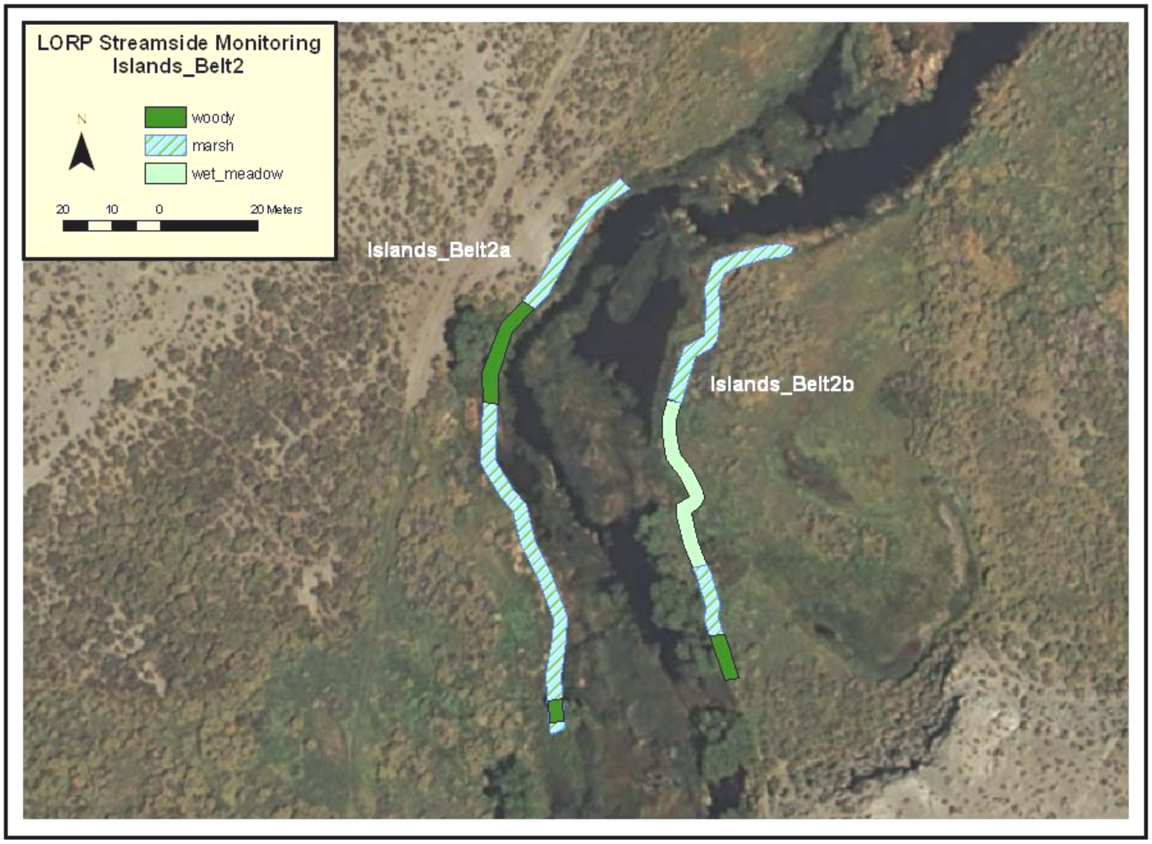
Islands_Belt1a is located in the River Field Exclosure in a combination of marsh and woody vegetation types and is adjacent to an alkali meadow. The surveyed belt was dominated by alkali sacaton, saltgrass, and saltbush with tules and threesquare bulrush along the water's edge. The bank in this area was primarily vegetated or occupied by litter, with small portions demonstrating barren or broken/actively eroding banks. Point intercept data showed this site to be 47% litter, 34% vegetated, 18% fine/silty soil, and 1% wood. Species encountered along the water's edge included threesquare bulrush, tules, cattails, yerba mansa, Goodding's willow, creeping wildrye and saltgrass. There was 1 juvenile narrowleaf willow and 1 mature Goodding's willow rooted in the sampled plots, and 4 mature and 4 dead Goodding's willow serving as canopy cover. One of these mature Goodding's willows demonstrated slight browsing by elk, and raccoon and elk scat were present at the site. There was no recruitment occurring at this site. GIS analysis estimated cover by woody species to be approximately 37 m^2 within the surveyed belt.

Islands_Belt 1b was characterized as marsh, woody, and wet meadow and was dominated by saltgrass and saltbush, with cattails and tules at the water's edge. This site presented mostly vegetated and root stabilized banks. Point intercept data showed this site to be 62.5% vegetated, 29.5% litter, 4% wood, and 4% fine/silty soil. Species present along the bank included saltgrass, tules, cattails, Baltic rush, threesquare bulrush, and creeping wildrye. There were 3 mature Goodding's willow present as canopy cover at this site, but no additional woody recruitment was occurring. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be approximately 20 m^2.

There are no utilization transects located within the Islands River Field Exclosure, so there was no data collected for the end of the grazing season near Islands_Belt1. GIS analysis of the wetted channel estimated the following: 193 m^2 open water, 32 m^2 woody vegetation, and 2,434 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Islands_Belt1



LORP Streamside Monitoring Islands_Belt2

Islands_Belt2a is located in the Depot Riparian Field and was characterized as marsh and woody vegetation and was dominated by Goodding's willow, saltbush, rabbitbrush, and saltgrass. Cattails and tules occupied most of the water's edge (see photo below). The banks in this section were primarily vegetated or barren; barren portions generally corresponded with mature Goodding's willow overstory. Point intercept data showed this transect to be 47.5% litter, 31% vegetated, 18.5% fine/silty soil, and 3% wood. Species encountered along the bank included tules, Goodding's willow, threesquare bulrush, Baltic rush, creeping wildrye, and alkali sacaton. There were 3 mature Goodding's willow documented as rooted in sampled plots and 16 mature and 1 decadent acting as canopy cover. Desert olive (*Forestiera pubescens)* was also encountered in the quadrats along this transect in which 4 mature, 1 decadent, and 1 dead were noted as canopy cover. There was no apparent use to any of these individuals by livestock or other wildlife, and there is no woody recruitment occurring at this site. GIS analysis estimated cover by woody species to be approximately 84 m^2.

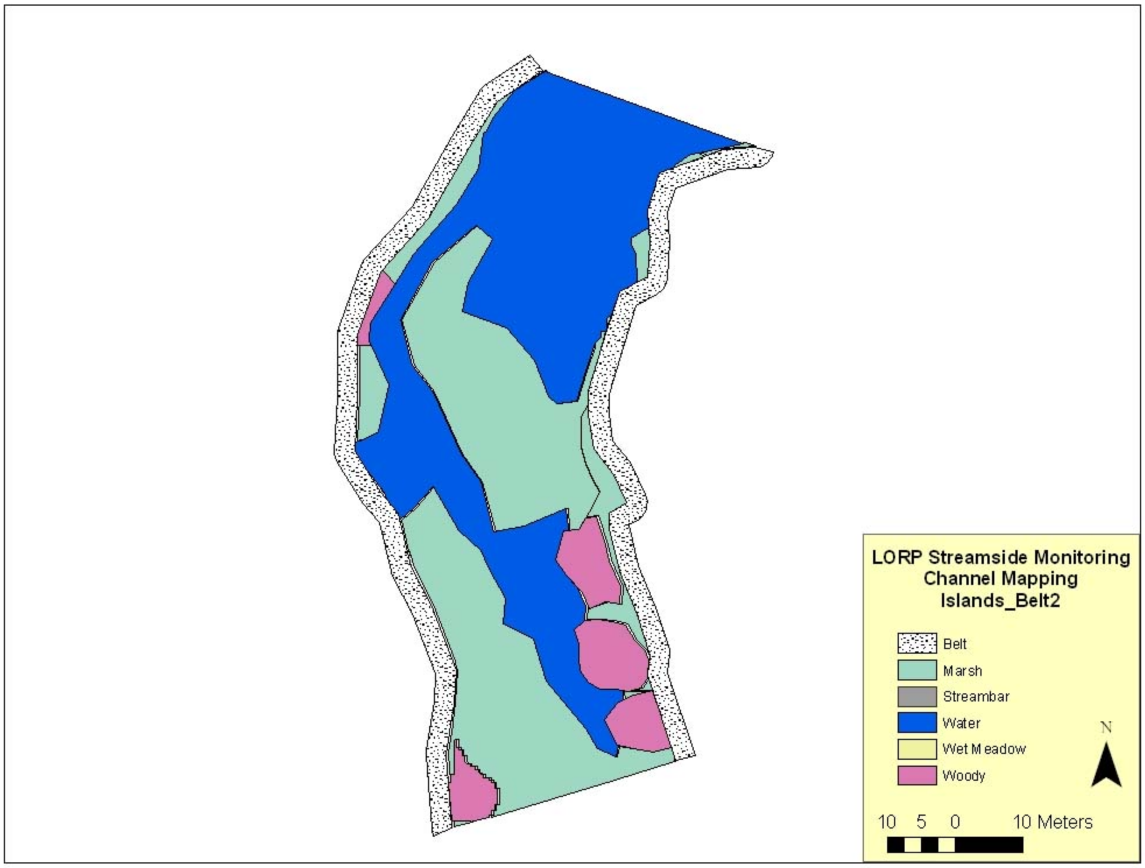
Islands_2a looking upstream from the beginning of the transect. While this site has as a well established corridor of Goodding's willow present, there was no recruitment observed at this site in 2010.

Islands_Belt 2b was characterized as a combination of marsh, wet meadow, and woody vegetation and was dominated by Goodding's willow, saltgrass, and threesquare bulrush. Similar to Islands_Belt1a, banks along Islands_Belt1b were largely vegetated or barren beneath mature Goodding's willow. Data showed this site to be 51.5% vegetated, 27.5% litter, 16.5% fine/silty soil, and 4.5% wood. Species encountered at the water's edge and recorded as point intercept data included threesquare bulrush, tules, cattails, salt heliotrope, and yerba mansa. There was 1 mature desert olive rooted within a sampled quadrat, and 14 Goodding's willow recorded as canopy cover. There were also 1 mature rooted and 2 mature canopy Russian olives present at the site. There was no apparent use to any of these individuals by livestock or other wildlife, nor is there any woody recruitment noted at this site. GIS analysis estimated cover by woody species to be 29 m^2 within the surveyed belt.

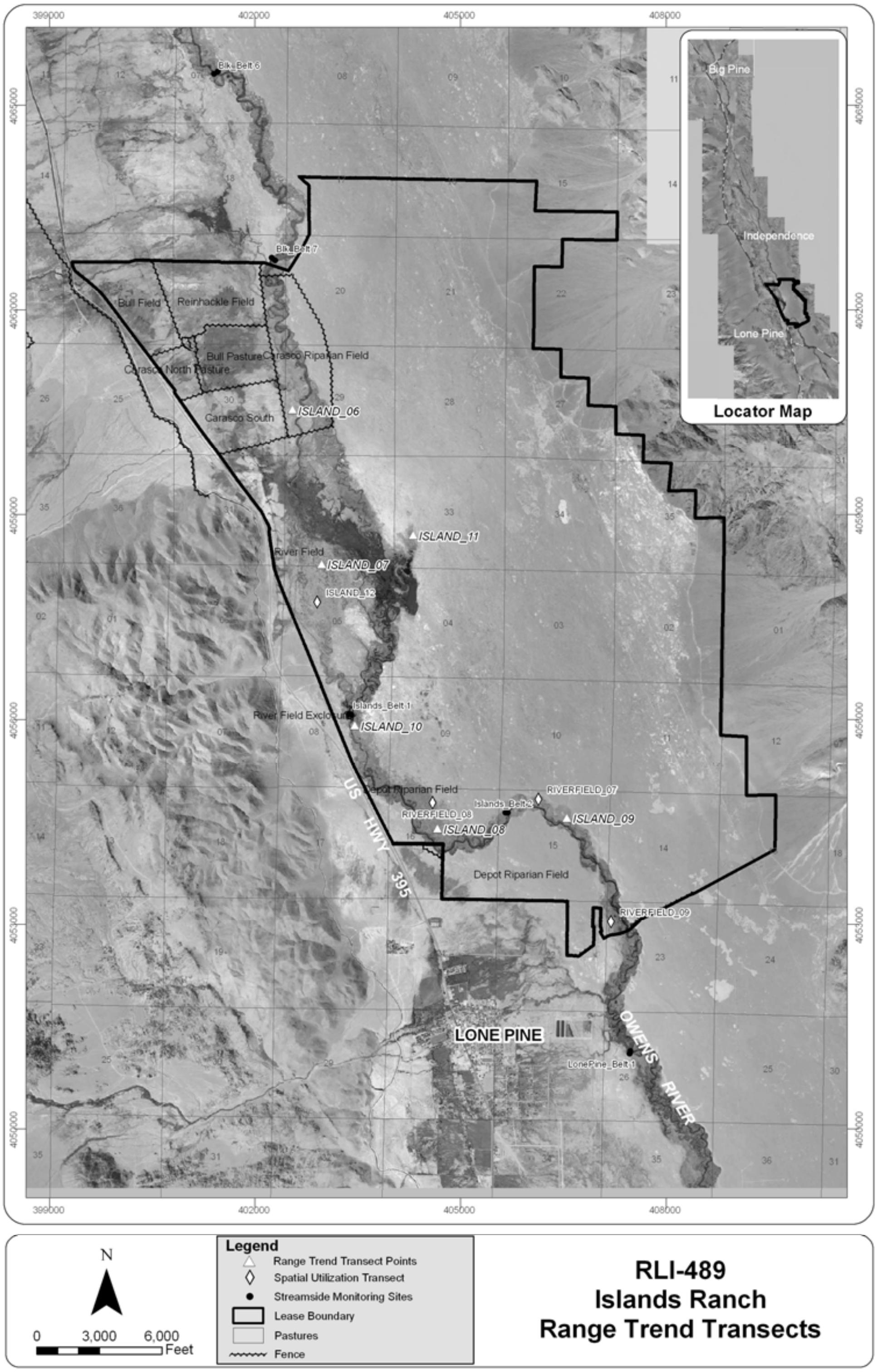
There are many mature Goodding's willow in this reach of the river that could potentially provide a seed source for recruitment (see photo below). Further, barren banks seemed to occur largely beneath the mature willow trees which could provide a rare opportunity for recruits to take hold, as the remainder of bank is largely choked with cattails and tules. However, these limited bare areas are also shaded, which limits the amount of sunlight that could reach recruits. There was no woody recruitment documented along Islands_Belt2a or Islands_Belt2b in 2010.

Overview photo of Islands_Belt2a looking downstream (northeast). Goodding's willow is well established in this reach of the Lower Owens River; however, no recruitment is occurring. Note the tule and cattail encroachment into most of the wetted channel; there is substantial competition and very little room for recruitment along the water's edge.

End of grazing season utilization in the Depot Riparian Field averaged 32%. ISLANDS_08 is the closest transect to Islands_Belt2, and utilization at this site was 21% in May 2010. GIS analysis of the wetted channel estimated the following: 1637 m^2 open water, 297 m^2 woody vegetation, and 1486 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Islands_Belt2



Land Management Figure 7. Islands Lease RLI-489, Range Trend Locations

4.8.6 Lone Pine Lease (RLI-456)

The Lone Pine Lease is an 8,274-acre cow/calf operation divided into 11 pastures and adjacent private ranch land. Grazing on the lease occurs from January 1 to March 30 and then again in late May to early June. In early June the cattle are moved south to Olancha and then driven to Forest Service Permits in Monache.

There are 11 pastures on the Lone Pine Lease located within the LORP project boundary:

East Side Pasture
Edwards Pasture
Richards Pasture
Richards Field
Johnson Pasture
Smith Pasture
Airport Field
Miller Pasture
Van Norman Pasture
Dump Pasture
River Pasture

Summary of Utilization

The following tables present the summarized utilization data for each pasture, for the transects in each pasture, and by species for each transect for the current year.

End of Grazing Season Utilization for Pastures, Transects and Species on the Lone Pine Lease, RLI-456, 2010.

Pastures	Utility	Transects	Utility	DISP	LETR5	SPAI
Johnson Pasture	63%	LONEPINE_05	63%			63%
River Pasture - Lone Pine	36%	LONEPINE_01	49%	49%	31%	54%
		LONEPINE_02	25%	65%		50%
		LONEPINE_03	37%	37%	43%	
		LONEPINE_04	32%	24%		42%
		LONEPINE_07	38%	38%		

Riparian Management Area

Utilization for the River Field was below the 40% utilization on average. Most of the noticeable browsing of riparian obligate species was noticed while conducting field work during the summer. It has been concluded that since there are not cattle present during the summer that most or all of the damage is a result of Tule Elk grazing and rutting activities.

Summary of Range Trend Data and Conditions

Baseline range trend monitoring was conducted at most sites three to four times from 2002-2007. Monitoring site photos are presented in Appendix 3. A new range trend site (LONEPINE_07) was established in 2007 and thus only two years of baseline data are available. The six riparian management area monitoring sites in the River Pasture were in high similarity compared to the desired plant community (site potential) during the baseline monitoring period. These Moist Floodplain sites had a high diversity of perennial grasses on most sites and a minimal amount of shrubs. The similarity index at the one monitoring site in an upland management area ranged from 69-77%, indicating the site is in a late seral state as compared to the site potential. Both 2009 and 2010 results did not depart from general conditions during the baseline period, indicating that the current conditions are not unlike those during the baseline period. Frequency values in 2010 compared to 2009 did not change with the exception of a decrease in saltgrass on LONEPINE_02 and alkali sacaton on LOPINE_05. The decline was still within the historical range observed during previous sampling events for both transects. Overall use was within the allowable limit for both pastures. During the RAS survey in early August there was significant browsing of woody riparian trees by Tule Elk.

Significant changes in selected plant frequencies
Lone Pine transects between 2009 and 2010.

	No Change	DISP	SPAI	ATTO	BAHY
Moist Flood Plain					
LONEPINE_01	↔				
LONEPINE_02		↓			
LONEPINE_03	↔				
LONEPINE_04	↔				
LONEPINE_06	↔				
LONEPINE_07	↔				
SODIC FAN					
LONEPINE_05		↓			

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

LONEPINE_01

This site is in a riparian management area on the west side of the Owens River, just north of Lone Pine Creek in the River Pasture. The soil series associated with the transect is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. During the baseline period from 2002-07, similarity index has ranged between 76% and 79%. Annual aboveground production at this riparian site has exceeded typical quantities found in the Moist Floodplain ecological site description. This site supports four perennial graminoid species and is dominated by saltgrass (*Distichlis spicata* [DISP]). The overall biomass of shrubs is typical for a Moist Floodplain ecological site. No nonnative species were detected at the site. Creeping wildrye (LETR) significantly increased in 2009 remained stable in 2010. All other plant frequencies did not statistically vary when compared to 2009. Shrub cover and density appears to be decreasing on this site. Utilization has been consistently high on this transect since 2007.

Utilization by Weighted Average and Species, LONEPINE_01

	Weighted Average	DISP	LETR5	SPAI
2007	80%	82%		78%
2008	42%	28%	43%	62%
2009	61%	61%		
2010	49%	49%	31%	54%

Frequency (%), LONEPINE_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	0	0	0	2	0
Perennial Forb	ANCA10	0	0	0	0	2	0
Perennial Graminoid	DISP	143	133	155	147	136	139
	JUBA	5	4	0	25	13	16
	LETR5	12	29	18	32	50	47
	SPAI	10	13	17	19	14	15
Shrubs	ATTO	2	4	7	3	3	0
	ERNA10	0	0	4	0	0	0

Life Forms	Species	2002	2003	2004	2007	2009
Annual Forb	HEAN3	0	0	0	0	2
	ANCA10	0	0	0	0	2
	GLLE3	0	0	0	0	0
Perennial Forb	MALE3	0	0	0	0	0
	DISP	143	133	155	147	136
	JUBA	5	4	0	25	13
	LETR5	12	29	18	32	50**
Perennial Graminoid	SPAI	10	13	17	19	14
	ATTO	2	4	7	3	3
	ERNA10	0	0	4	0	0
Shrubs	SUMO	3	0	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	0	T	0	T	0
Perennial Forb	ANCA10	0	0	0	0	T	0
	MALE3	0	0	T	0	0	0
	SUMO	T	0	0	0	0	0
Perennial Graminoid	DISP	53	56	54	53	46	40
	JUBA	T	1	3	1	1	1
	LETR5	5	9	3	5	15	15
	SPAI	5	4	1	5	4	2
Shrubs	ATTO	6	0	0	0	0	0
	ERNA10	1	0	0	0	0	0

Cover (%) Shrubs LONEPINE_01

Species Code	2003	2004	2007	2009	2010
ATTO	7.1	5.2	4.7	1.8	3.0
ERNA10	2.2	2.6	2.1	0.0	0.1
SUMO	0.1	0.0	0.8	0.0	0.0
Total	9.5	7.8	7.5	1.8	3.0

Ground Cover (%)LONEPINE_01

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	5	5	8	9	8	7
Dung	6	12	4	12	2	3
Litter	81	60	36	81	90	90
Rock	0	0	0	0	0	T
Standing Dead	0	0	8	10	8	7

Shrub Densities and Age Classes LONEPINE_01

	ATTO						ERNA10				
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2003**	**2004**	**2007**	**2009**	**2010**
Juvenile	0	0	0	0	0	0	1	0	0	0	0
Mature	3	10	7	7	1	4	1	0	2	0	0
Decadent	0	1	4	7	4	2	5	1	3	1	1
Total	3	11	11	14	5	6	7	1	5	1	1

	SUMO					
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**
Juvenile	1	1	3	2	0	0
Mature	1	4	2	4	2	2
Decadent	0	0	1	1	0	0
Total	2	5	6	7	2	2

LONEPINE_02

This site is in a riparian management area on the west side of the Owens River, east of the Lone Pine Dump in the River Pasture. The soil series is Torrifluvents-Fuvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. The similarity index ranged between 65% and 87% from 2002 to 2007. The site is in excellent condition. The site is grass-dominated with saltgrass comprising the bulk of the biomass. Saltgrass frequency significantly increased in 2009, outside its historic range from 2002-07 and in 2010 returned to levels typically observed on the site. No nonnative species were detected at the site. Utilization on this transect has was high in 2007 but has since declined.

Utilization by Weighted Average and Species, LONEPINE_02

	Weighted Average	DISP	LETR5	SPAI
2007	79%	75%	na	85%
2008	45%	31%	na	58%
2009	48%	38%	na	64%
2010	25%	65%		50%

Frequency (%), LONEPINE_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Graminoid	DISP	146	125	142	143	164	141**
	JUBA	9	13	20	17	14	15
	LETR5	0	0	0	3	0	1
	SPAI	65	78	65	64	52	65
Shrubs	ATTO	0	0	3	0	0	0
	ERNA10	0	1	4	3	1	2

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	0	0	0	0	0
	ATPH	0	0	0	0	0	0
Perennial Forb	ANCA10	0	0	1	0	0	0
	STEPH	0	0	0	0	0	0
Perennial Graminoid	DISP	48	52	8	60	51	18
	JUBA	1	1	0	1	1	T
	LETR5	0	0	0	0	0	T
	SPAI	23	14	9	10	11	6

Cover (m) Shrubs LONEPINE_02

Species Code	2003	2004	2007	2009	2010
ATTO	2.2	2.2	0.6	0.9	0.0
ERNA10	2.1	3.3	1.8	2.4	2.0
Total	4.3	5.5	2.4	3.3	2.0

Ground Cover (%) LONEPINE_02

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	4	5	12	8	7	10
Dung	7	5	1	9	2	2
Litter	77	70	49	83	91	88
Rock	0	0	0	0	0	0
Standing Dead	0	0	4	4	4	1
Bare Ground	0	5	12	8	7	10

Shrub Densities and Age Classes LONEPINE_02

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Juvenile	2	2	0	1	0	1	0	1	0	2	0	0
Mature	5	7	8	6	6	7	1	2	10	3	7	6
Decadent	2	2	1	0	2	0	5	10	4	3	2	0
Total	9	11	9	7	8	8	6	13	14	8	9	6

LONEPINE_03

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site.

The similarity index has ranged between 74% and 87% during sampling periods between 2002-07, indicating the site is in excellent condition. Site production has exceeded the expected based on the ecological site description in all years of sampling. The site is grass-dominated with saltgrass comprising the bulk of the biomass and creeping wildrye closely reaching the potential described for the site at 13% in 2007. Frequency for creeping wildrye increased significantly in 2009 and remained significantly higher in 2010 when compared to all sampling periods during the baseline period. There were no changes in frequency for all species between 2009 and 2010. Overall shrub cover is minimal. No nonnative species were detected at the site. This site, based on the ecological site description and frequency trends, is stable and in excellent ecological condition. Utilization on this transect tends to vary high to low alternating the years. However this seems to have no effect on the sites ecological condition.

Utilization by Weighted Average and Species, LONEPINE_03

	Weighted Average	DISP	LETR5	SPAI
2007	81%	83%	74%	81%
2008	46%	38%	25%	66%
2009	70%	72%	23%	66%
2010	37%	37%	43%	

Frequency (%), LONEPINE_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	1	0	0	0	0
	HEAN3	0	2	1	0	0	0
Perennial Forb	ANCA10	0	0	0	3	0	7
	GLLE3	12	0	7	0	5	3
	MALE3	7	3	5	2	5	3
	PYRA	7	0	0	0	0	0
Perennial Graminoid	DISP	151	148	152	152	142	137
	JUBA	39	59	52	41	43	34
	LETR5	34	33	31	34	52	48
	SPAI	9	0	10	5	4	4
Shrubs	ATTO	14	2	13	0	1	3
	ERNA10	0	0	2	0	4	1

** indicates a significant difference, α≤0.1, **≤0.0*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	1	0	0	0	0
	HEAN3	0	T	0	0	0	0
Perennial Forb	ANCA10	0	0	0	2	0	1
	GLLE3	11	0	0	2	3	1
	HECU3	0	0	0	0	0	0
	MALE3	0	0	0	0	0	T
	PYRA	0	0	0	0	0	0
Perennial Graminoid	DISP	74	73	27	77	55	35
	JUBA	1	6	0	5	1	T
	LETR5	12	9	0	15	8	7
	SPAI	3	0	11	4	2	4
Shrubs	ATTO	12	0	0	0	0	0
	ERNA10	1	0	0	0	0	0

Cover (m) Shrubs LONEPINE_03

Species Code	2003	2004	2007	2009	2010
ATTO	13.5	13.4	6.0	0.8	4.9
ERNA10	2.0	2.7	0.6	2.7	0.6
SAVE4	0.0	0.0	0.0	3.6	0.0
Total	15.5	16.1	6.6	7.2	5.5

Ground Cover (%), LONEPINE_03

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	0	0	0	4	1	0
Dung	5	8	3	6	4	4
Litter	88	67	52	90	95	96
Rock	0	0	0	0	0	T
Standing Dead	0	0	3	5	5	2

Shrub Densities and Age Classes LONEPINE_03

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	1	0	1	0	0	0	0	0	0	0	0
Juvenile	0	1	0	0	0	0	0	0	0	0	2	0
Mature	10	20	13	16	4	4	7	9	6	10	9	4
Decadent	2	4	4	4	0	6	0	1	1	2	1	0
Total	12	26	17	21	4	10	7	10	7	12	12	4

	SAVE4
Age Class	2009
Seedling	0
Juvenile	0
Mature	16
Decadent	2
Total	18

LONEPINE_04

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The transect is located at the edge of the floodplain and currently incorporates a portion of the transition zone to upland vegetation. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes at the beginning of the transect and transitions to the Mazourka-Eclipse complex, 0-2% slopes. The transition in ecological sites is from a Moist Floodplain ecological site to a Sodic Terrace ecological site. Because of the mixed soils and associated ecological sites found across the transect evaluating trend for this site will concentrate on changes on trend rather than how well the site matches ecological site descriptions.

The similarity index has ranged widely between 59% and 73% from 2002-07. Site production has generally been less than potential based on the ecological site description for a Moist Floodplain site. When compared to the Moist Floodplain ecological site description, the site has less than the expected biomass of forage species such as creeping wild rye and Baltic rush (*Juncus balticus* [JUBA]). This is explained by the transition from mesic conditions on the Moist Floodplain to more xeric conditions of the uplands which results in a decreasing abundance of creeping wildrye, Baltic rush, and riparian trees and the disproportionate amount of alkali sacaton which can better thrive in both the mesic and xeric transitional zones. The site is grass-dominated with saltgrass and alkali sacaton comprising the bulk of the biomass. The shrub component of the site is dominated by rubber rabbitbrush (*Ericameria nauseosus* [ERNA10]). As flows on the Lower Owens continue, soil moisture may rise towards the upland zone of the transect and future changes in species composition may be observed. However, frequency data indicates that there is an inverse trend, with decreasing saltgrass, and increasing alkali sacaton which is typical gradient in zones moving from wet to dry areas. No nonnative species were detected at the site. There were no changes in frequency from 2010 to 2009. End-of-season utilization at this site has decreased over the past three years.

Utilization by Weighted Average and Species, LONEPINE_04

	Weighted Average	DISP	LETR5	SPAI
2007	61%	52%	na	71%
2008	51%	43%	na	59%
2009	43%	37%	na	51%
2010	32%	24%		42%

Frequency (%), LONEPINE_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	0	1	0	0	0
	ATPH	0	29	12	0	0	10
Perennial Forb	ANCA10	5	7	8	8	7	6
	MACA2	0	0	0	0	0	2
	NIOC2	3	0	0	2	2	0
	STEPH	5	0	11	0	5	0
	SUMO	3	4	6	2	3	0
Perennial Graminoid	DISP	105	101	114	97	88	77
	JUBA	15	18	25	11	15	15
	SPAI	48	63	56	69	79	84
Shrubs	ATCO	0	0	4	0	0	0
	ATTO	0	2	0	0	0	0
	ERNA10	0	2	0	0	0	0
	MACA17	0	0	0	4	0	0
Nonnative Species	BAHY	0	0	0	0	2	0

** indicates a significant difference, α<0.1, **<0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	2FORB	0	0	0	0	0	0
	ATPH	0	3	0	0	0	T
Perennial Forb	ANCA10	2	2	0	3	1	2
	NIOC2	0	0	0	0	0	0
	STEPH	0	0	0	0	0	0
	SUMO	0	0	0	0	0	0
Perennial Graminoid	DISP	13	14	47	12	9	5
	JUBA	0	0	0	1	0	T
	LETR5	0	0	3	0	0	0
	SPAI	16	22	5	23	14	8
Nonnative Species	BAHY	0	0	0	0	T	0

Cover (m) Shrubs LONEPINE_04

Species Code	2003	2004	2007	2009	2010
ATCO	0.1	0.5	0.0	0.0	0.0
ATTO	0.0	0.0	0.0	10.0	0.2
ERNA10	2.3	2.1	4.5	1.1	1.0
SUMO	12.4	1.0	0.0	0.0	1.3
Total	14.8	3.6	4.5	11.1	2.5

Ground Cover (m), LONEPINE_04

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	33	37	51	42	42	54
Dung	5	0	1	0	1	1
Litter	53	54	35	56	57	45
Rock	0	0	0	0	0	0
Standing Dead	0	0	1	T	T	T

Shrub Densities and Age Classes LONEPINE_04

	ATCO			ATTO				
Age Class	**2003**	**2004**	**2007**	**2002**	**2003**	**2007**	**2009**	**2010**
Juvenile	0	3	1	2	4	2	0	1
Mature	1	1	2	0	1	3	4	3
Decadent	0	0	0	0	1	0	4	0
Total	1	4	3	2	6	5	8	4

	ERNA10						SUMO				
Age Class	**2002**	**2003**	**2004**	**2007**	**2009**	**2010**	**2002**	**2003**	**2004**	**2007**	**2010**
Juvenile	1	0	0	1	0	0	3	13	11	10	8
Mature	6	6	10	3	4	6	5	24	23	15	10
Decadent	0	2	0	8	0	0	0	0	0	3	2
Total	7	8	10	12	4	6	8	37	34	28	20

LONEPINE_05

This site is in an upland management area in the Winnedumah fine sandy loam, 0-2% slopes soil series which is associated with a Sodic Fan ecological site, just east of the Lone Pine Airport in the Johnson Pasture. During the baseline period this site has received irrigation water reportedly tailwater off of the Lone Pine Indian Reservation to the northwest. In 2004 the site flooded and was not sampled. An increase from 0 to 14 juvenile *Salix exigua* species in 2007 is evidence of this flooding.

The similarity index has ranged between 69% and 77% between 2002-07. Nevada saltbrush (*Atriplex torreyi* [ATTO]) has trended down over time. Frequency of saltgrass significantly increased in 2009 and decreased in 2010 to similar levels to that seen during the baseline period. There were no other significant changes on the site. End-of-season utilization on this transect has consistently remained low except for 2010.

Utilization by Weighted Average and Species, LONEPINE_05

	Weighted Average	DISP	SPAI
2007	44%	23%	49%
2008	2%	9%	0%
2009	34%	na	34%
2010	63%		63%

Frequency (%), LONEPINE_05

Life Forms	Species	2002	2003	2007	2009	2010
Annual Forb	ATSES	0	3	0	0	0
	ATTR	0	3	0	0	0
	ERPR4	0	0	3	0	0
	LACO13	0	0	5	0	0
Perennial Forb	ARLU	0	0	5	0	0
	GLLE3	36	26	49	29	37
	MALE3	15	11	16	8	0
Perennial Graminoid	ARPU9	0	0	5	0	0
	DISP	34	40	23	42	24*
	JUBA	7	4	1	0	3
	SPAI	53	69	73	77	71
Shrubs	ATTO	43	40	24	21	13
	SAEX	3	0	16	8	4
	ARTR2	0	0	0	0	2
Nonnative Species	BAHY	0	16	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_05

Life Forms	Species	2002	2003	2007	2009	2010
Annual Forb	ATSES	0	0	0	0	0
	ATTR	0	0	0	0	0
	ERPR4	0	0	0	0	0
	LACO13	0	0	T	0	0
Perennial Forb	ARLU	0	0	1	0	0
	GLLE3	13	4	21	8	4
	MALE3	T	T	T	T	0
Perennial Graminoid	ARPU9	0	0	T	0	0
	DISP	1	2	1	5	T
	JUBA	T	T	0	0	0
	SPAI	4	7	24	15	1
Shrubs	ATTO	24	0	0	0	0
	SAEX	1	0	0	0	0
	ARTR2	0	0	0	0	0
Nonnative Species	BAHY	0	T	0	0	0

Cover (m) Shrubs LONEPINE_05

Species Code	2003	2007	2009	2010
ATTO	32.8	28.9	9.6	13.2
SAEX	1.5	14.5	21.1	1.5
Total	34.4	43.3	30.8	14.7

Ground Cover (%), LONEPINE_05

Substrate	2002	2003	2007	2009	2010
Bare Soil	20	22	20	20	25
Dung	1	1	1	3	T
Litter	75	71	81	77	74.9
Rock	0	0	0	0	0
Standing Dead	0	0	0	19	11

Shrub Densities and Age Classes LONEPINE_05

	ATTO					SAEX				
Age Class	2002	2003	2007	2009	2010	2002	2003	2007	2009	2010
Seedling	11	20	0	0	0	0	0	0	0	0
Juvenile	21	30	6	0	0	0	0	14	1	0
Mature	19	44	56	27	31	1	2	7	3	15
Decadent	3	13	20	2	5	0	1	0	0	0
Total	54	107	82	29	36	1	3	21	4	15

LONEPINE_06

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This monitoring transect is located inside a riparian exclosure, constructed in February 2009. Over time the site will be used as a non-grazed reference site. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site.

The similarity index has ranged between 66% and 84% between 2003 and 2007. Site production has varied during the baseline period from above to below that expected based on the ecological site description. Compared to the potential outlined in the ecological site description, this site lacks the forb and woody riparian species component. The forage base is dominated by saltgrass and alkali sacaton. Other forage species such as creeping wild rye and Baltic rush are lacking at this site. One nonnative species, Bassia, has been detected at the site. Frequency results in 2010 indicated that trend continues to be static. The exclosure was completed in February 2009 and was minimally grazed by livestock in early January. Utilization was not estimated in 2009 and 2010 because the site is now inside a livestock grazing exclosure.

Utilization by Weighted Average and Species, LONEPINE_06

	Weighted Average	DISP	LETR5	SPAI
2007	78%	77%	na	84%
2008	42%	18%	na	66%

Frequency (%), LONEPINE_06

Life Forms	Species	2003	2004	2005	2007	2009	2010
Perennial Forb	ANCA10	0	0	0	5	3	0
Perennial Graminoid	DISP	124	136	132	149	145	147
	JUBA	0	0	0	0	0	0
	SPAI	25	28	29	16	20	16
Nonnative Species	BAHY	0	0	5	0	0	3

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_06

Life Forms	Species	2003	2004	2005	2007	2009	2010
Perennial Forb	ANCA10	0	0	0	1	0	0
Perennial Graminoid	DISP	46	27	35	55	52	28
	JUBA	0	0	0	0	0	0
	SPAI	13	14	8	3	6	4
Nonnative Species	BAHY	0	0	T	0	0	0

Cover (m) Shrubs LONEPINE_06

Species Code	2003	2004	2005	2007	2009	2010
ATTO	0.5	0.6	0.4	0.5	1.4	1.2
SUMO	0.1	0.3	0.2	0.0	0.0	0.0
Total	0.5	0.8	0.6	0.5	1.4	1.2

Ground Cover (%), LONEPINE_06

Substrate	2003	2004	2005	2007	2009	2010
Dung	12	14	18	15	3	1
Litter	75	40	62	70	93	98
Rock	0	0	0	0	0	0
Standing Dead	0	3	0	0	1	0
Bare Soil	3	13	13	15	4	1

Shrub Densities and Age Classes LONEPINE_06

	ATTO						SAVE4			
Age Class	2003	2004	2005	2007	2009	2010	2003	2005	2009	2010
Seedling	0	0	2	0	0	0	0	0	0	0
Juvenile	0	0	0	0	0	0	0	0	0	0
Mature	1	3	3	1	1	1	1	1	1	1
Decadent	2	0	0	1	0	0	0	0	1	0
Total	3	3	5	2	1	1	1	1	2	1

	SUMO			
Age Class	2003	2004	2005	2007
Seedling	0	0	0	0
Juvenile	2	0	6	0
Mature	8	5	3	1
Decadent	0	0	0	0
Total	10	5	9	1

LONEPINE_07

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This site was first established in the summer of 2007. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site.

The similarity index was 60% in 2007. Site production was similar to that expected based on the ecological site description. There is a low diversity of perennial graminoids as the only species detected was saltgrass while other forage species such as alkali sacaton and creeping wild rye are lacking on the transect but are present in the area. The biomass of forbs and riparian woody species is less than expected as compared to the desired plant community. No nonnative species were detected at the site. Baseline utilization is not available for this site since it was not established until the summer of 2007. Between 2007 and 2010 frequency has not changed significantly on the site. Ground cover remained static between the three sampling periods as well.

Utilization by Weighted Average and Species, LONEPINE_07

	Weighted Average	DISP
2008	44%	44%
2009	51%	51%
2010	38%	38%

Frequency (%), LONEPINE_07

Life Forms	Species	2007	2009	2010
Perennial Graminoid	DISP	150	157	160

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Forbs, Graminoids, Sub-shrubs LONEPINE_07

Life Forms	Species	2007	2009	2010
Perennial Graminoid	DISP	49	40	43

No shrubs present on site.

Ground Cover (%), LONEPINE_07

Substrate	2007	2009	2010
Dung	7	8	8
Litter	72	73	77
Rock	T	0	0
Bare Ground	21	19	15

<u>Irrigated Pastures</u>

The irrigated pastures within the LORP project area for the Lone Pine Lease are the Edwards, Richards, Smith, Old Place and Van Norman Pastures. All of these pastures were rated in 2007 with the exception of the Van Norman Pasture. The Van Norman Pasture was not irrigated in 2007-08 due to the irrigation water pump burning up. There was no irrigation water available for this pasture thus it could not meet the irrigated pasture evaluation criteria and was not rated. However, the remaining pastures within the project area on the lease were rated. All pastures except the Edwards and Richards Pastures met the minimum allowed score of 80%.

In 2010 the Edwards and Richards Pastures were evaluated again and both maintained good condition. The Van Norman pasture was also evaluated for the first time since the well that supplies irrigation water was repaired and received a score of 80%. It should only take several years for this pasture to improve from 80%. All irrigated pastures on the lease will be reevaluated in 2012.

Irrigated Pasture Condition Scores 2007-10

Pasture	2007	2008	2009	2010
Edwards	80	80	94	90
Richards	64	82	92	84
Van Norman	X	X	X	80
Smith	88	X	X	96
Old Place	86	X	X	90

X indicates no evaluation made

Stockwater Sites

There is one stockwater site planned for the Lone Pine Lease located in the River Pasture uplands. The approximate location is two miles east of the river on an existing playa. The contract for the well to be drilled has been awarded and the stockwater well should be completed in 2010.

Salt and Supplement Site:

There are numerous supplement sites located on the Lone Pine Lease and most occur within the floodplain. These supplement sites are going to now be rotated in an effort to keep them away from the river and decrease the amount of disturbed sites in the flood plain.

Streamside Monitoring

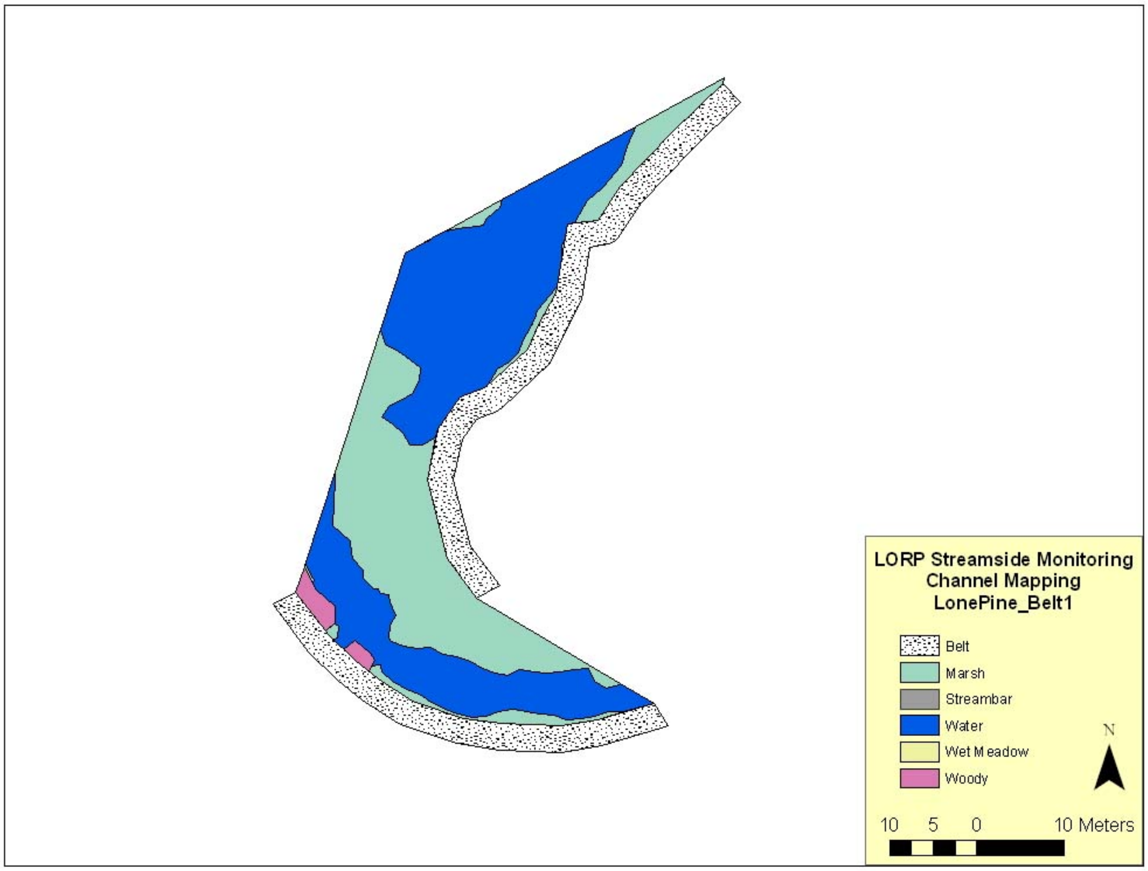
There were two DMAs located within the Lone Pine Lease (RLI-456), one in the Riverfield Riparian Exclosure (LonePine_Belt1) and one in the River Pasture (LonePine_Belt2).

LORP Streamside Monitoring Lone Pine_Belt1

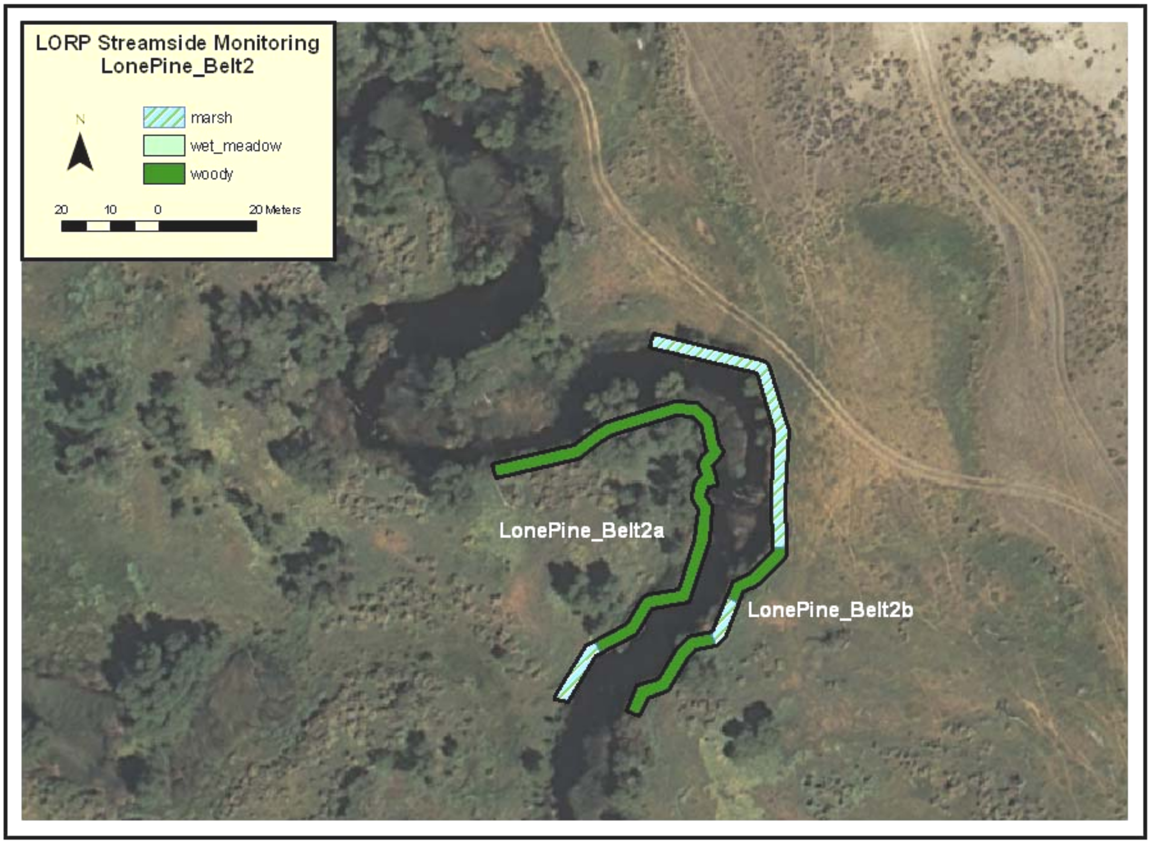
LonePine_Belt1a is located along a steep outer bend in the river in the Riverfield Riparian Exclosure. This vegetation was characterized as a combination of marsh and woody vegetation and was dominated by tules and mature Goodding's willow along most of the water's edge. This transect had to be shortened so that 40 sampling points could be taken within the exclosure; as such, quadrats were spaced approximately 1.5 meters apart instead of 2.5 m apart. Banks were largely vegetated or root stabilized (tule litter) with some broken and eroding bank as well (likely from energy dissipation rather than livestock impacts). Field data showed this site to be 54.5% vegetated, 31.5% litter, 12.5% silty/fine soil, and 1.5% wood. Tules and Goodding's willow were the only two species encountered along the water's edge. 5 mature rose (*Rosa woodsii*) were rooted in the sampled frames, and 6 mature were noted as canopy cover. Additionally, 1 dead Goodding's willow was rooted in a sampling plot, and 5 mature and 6 dead were noted as canopy cover. None of these individuals exhibited any sign of browsing, highlining, or other use, and there was no recruitment occurring at this site. GIS analysis estimated cover by woody species to be 21 m^2 within the surveyed belt.

LonePine_Belt1b is located on an inside bend of the river within the Riverfield Riparian Exclosure. This area was characterized as a combination of marsh, wet meadow, and woody vegetation and was dominated by saltgrass, alkali sacaton, tules, and cattails. Banks on this side of the river tended to be vegetated or occupied by litter. Point intercept data showed this transect to be 51% vegetated, 41% litter, 4.5% fine/silty soil, and 3.5% wood. Species encountered along the water's edge while sampling included tules, cattails, threesquare bulrush, yerba mansa, saltgrass, bassia, narrowleaf willow, and horsetail (*Equisetum sp.).* There were 14 mature narrowleaf willows rooted in the sampling frames, and 4 additional mature narrowleaf willow noted as canopy cover. There were also 4 mature Goodding's willow noted as canopy cover along this transect. There was no apparent use to any of these individuals by livestock or other wildlife, and there was no woody recruitment occurring at this site. GIS analysis estimated cover by woody species to be approximately 12 m^2.

End of grazing season utilization was not recorded within the Riverfield Riparian Exclosure in 2010, although LONEPINE_06 is located within the exclosure and is close to LonePine_Belt1. GIS analysis of the wetted channel estimated the following: 629 m^2 open water, 39 m^2 woody vegetation, and 459 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Lone Pine_Belt1

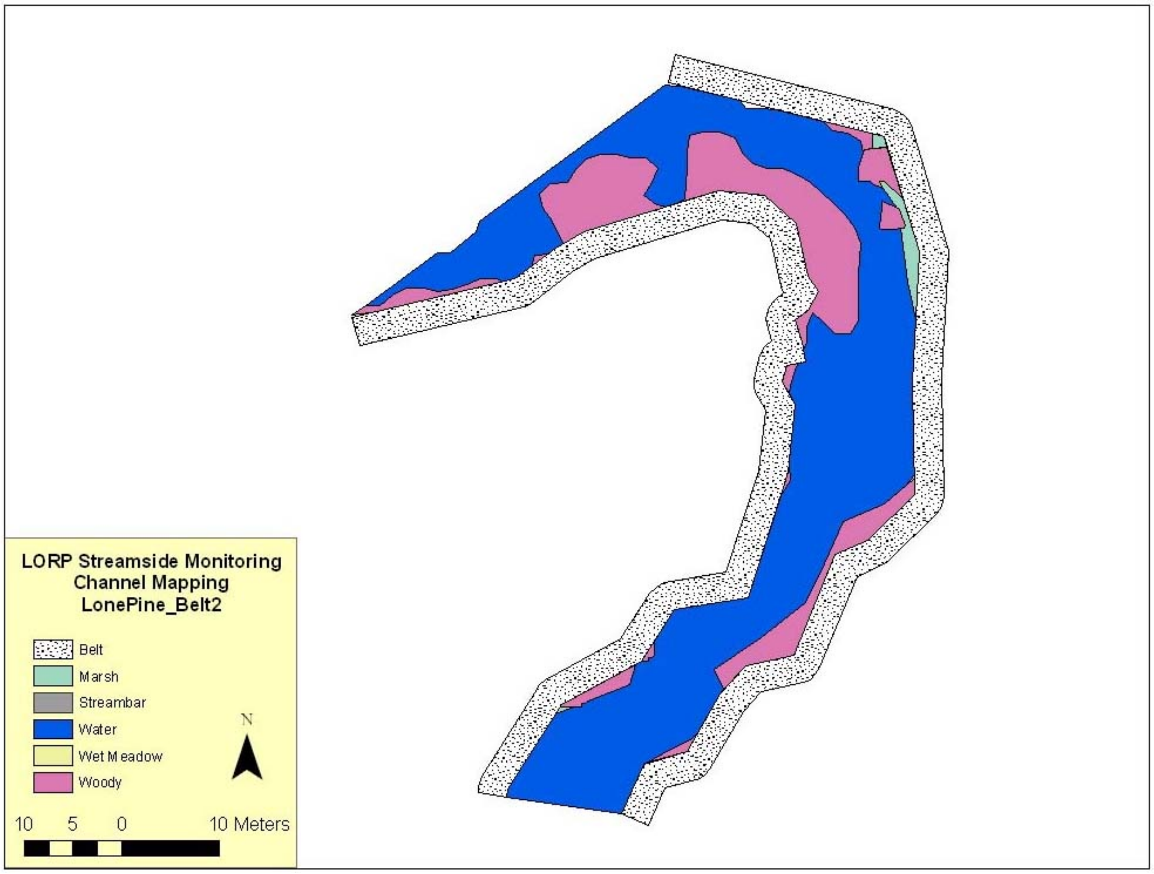


LORP Streamside Monitoring Lone Pine_Belt2

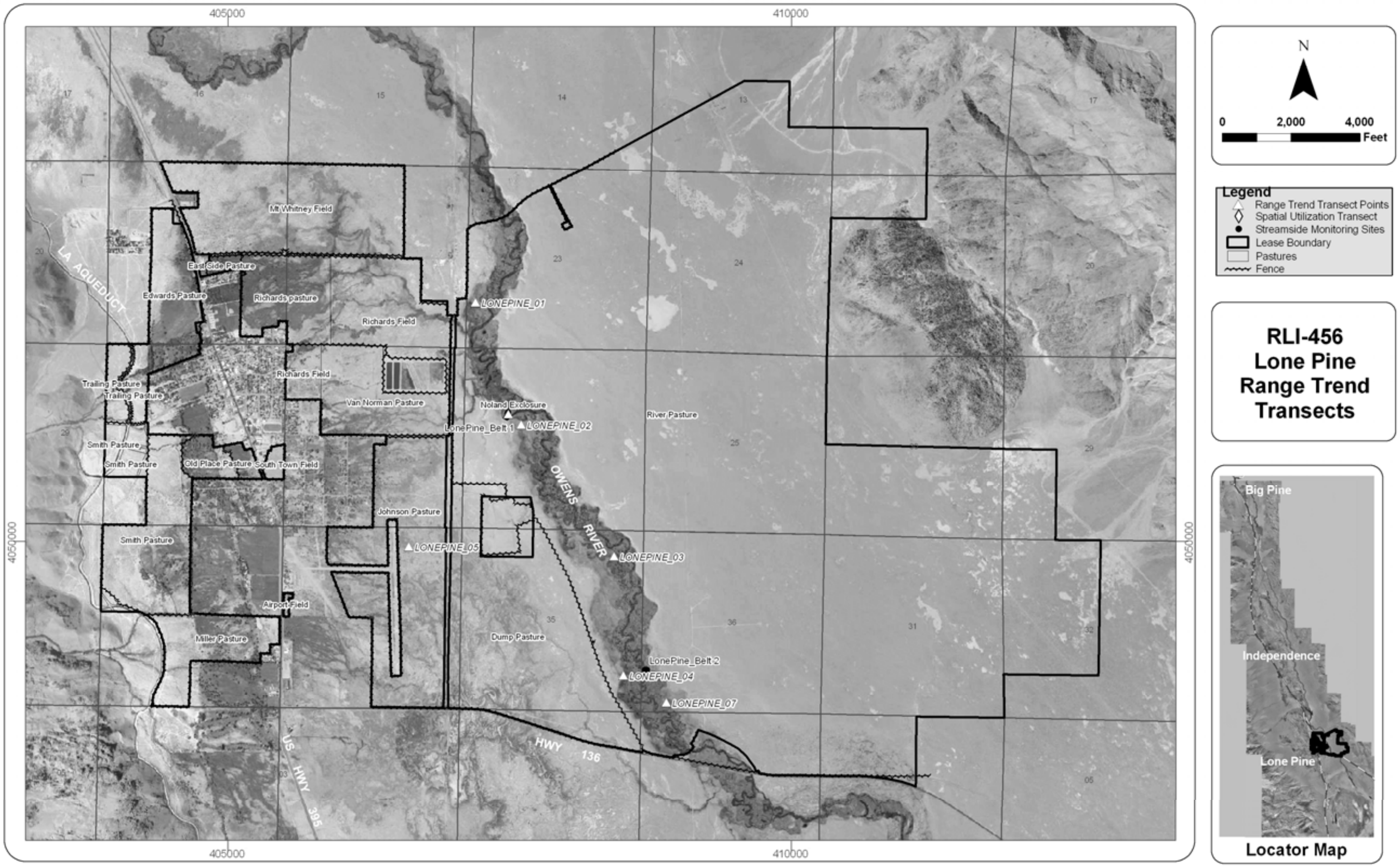
LonePine_Belt2a was characterized as primarily woody with some marsh and was dominated by saltgrass, tules, and Goodding's willow within the surveyed belt. Banks in this area showed some breaking due to livestock use, but were primarily vegetated and root stabilized. Field data showed this site to be 44% litter, 28% vegetated, 19.5% fine/silty soil, and 8.5% wood. Species documented along the water's edge included tules, threesquare bulrush, saltgrass, creeping wildrye, cattails, yerba mansa, and Baltic rush. There were 1 mature and 1 decadent Goodding's willows rooted within the sampled plots. Additionally, there was one red willow recruit rooted at this site that was the only seedling noted in the 2010 Streamside Monitoring effort across all 32 transects. There were 17 additional Goodding's willows noted as canopy cover across the site. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be approximately 325 m^2 within the surveyed belt.

LonePine_Belt2b was also characterized as a combination of marsh and woody vegetation and was dominated by saltgrass, tules, Goodding's willow. Banks were primarily vegetated or litter covered, and some exhibited broken banks due to livestock use. However, these impacts to the bank did not seem to inhibit recovery. Point intercept data showed this site to be 55.5% vegetated, 17.5% litter, 14.5% fine/silty soil, and 12.5% wood (dead red willow trunk). Species documented as cover at the water's edge included tules, threesquare bulrush, saltgrass, creeping wildrye, yerba mansa, salt heliotrope, red willow, and Baltic rush. There were 2 mature and 1 dead red willow rooted within the sampled plots, as well as 1 juvenile and 2 dead saltcedar. In addition, there were 15 mature and 1 dead red willow and 2 mature saltcedar acting as canopy cover at the site. Of these, there was evidence of browsing to some of the mature red willow on this side of the river. Although there is a seed source available at this site (red willow), there is no recruitment of desirable woody species occurring at this site. GIS analysis estimated cover by woody species to be approximately 186 m^2.

End of grazing season utilization within the River Pasture averaged 36%. LONEPINE_04 and LONEPINE_07 are both located near LonePine_Belt2; utilization for these sites was recorded as 32% and 37%, respectively in May 2010. GIS analysis of the wetted channel estimated the following: 884 m^2 open water, 286 m^2 woody vegetation, and 17 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Lone Pine_Belt2



Land Management Figure 8. Lone Pine Lease RLI-456, Range Trend Transects

4.8.7 Delta Lease (RLI-490)

The Delta Lease is a cow/calf operation and consists of 7,110 acres divided into four pastures. There are four fields located with the LORP project boundary: Lake Field, Bolin Field, Main Delta Field, and the East Field. Grazing typically occurs for 6 months, from mid-November to April. Grazing in the Bolin Field may occur during the growing season. The Delta and Islands Leases are managed as one with state lands leases.

Grazing utilization is currently only conducted in the Main Delta Field which contains the Owens River. The Lake Field is evaluated using irrigated pasture condition scoring. The East Field, located on the upland of Owens Lake, supports little in the way of forage and has no stockwater.

Summary of Utilization

The following tables present the summarized utilization data for each pasture, for the transects in each pasture, and by species for each transect for the current year.

End of Grazing Season Utilization for Fields, Transects and Species on the Delta Lease, RLI-490

Pasture	Utilization	Transect	Utilization	DISP	SPAI
Main Delta Field*	51%	DELTA_01	70%	71%	50%
		DELTA_03	71%	71%	
		DELTA_04	62%	62%	
		DELTA_05	29%	29%	
		DELTA_06	23%	23%	
		DELTA_07	49%	49%	
Bolin Field	7%	BOLIN_01	6%	6%	
		BOLIN_02	9%	9%	

**Riparian pastures (40% utilization standard)*

Riparian Management Areas

Use on the Delta Lease exceeded current management objectives in the riparian zones by 11%. For the last four years utilization on the Delta Riparian pasture has exceeded the 40% limit for riparian pastures, with 52% in 2007, 51% in 2008, 51% in 2009 and 51% in 2010. LADWP is encouraging the lessee to make changes so the utilization standard of 40% in the Main Delta Pasture will not be exceeded. To help improve livestock distribution and prevent over utilization of the Main Delta a 1-mile long drift fence was built in September of 2010. The fence is located west of the pumpback station on the north side of the Main Line Road. This fence should prevent livestock from drifting north and increasing the utilization on the Main Delta Riparian Field.

Summary of Range Trend Data and Conditions

Range trend transects on the Delta Lease are located on Moist Floodplain ecological sites. Monitoring site photos are presented in Appendix 3 – Section 7. The similarity index averaged at each transect, over the four baseline sampling periods ranged between 48-70%. All sites lack a diversity of perennial grasses, and are dominated by saltgrass. The presence of alkali sacaton appears to follow a gradient with decreasing abundance following a decrease in elevation. Soil salinity appears to increase along this same gradient as soils transition from stream deposition to lacustrine deposition from the Owens Dry Lake. Alkali sacaton and beardless wildrye are both known to not have as high a tolerance for saline soils as saltgrass (USDA, NRCS 2009). These variables may be influencing species composition on the Moist Floodplain zones on the Delta Lease.

There were no significant changes in plant frequencies between 2010 and 2009. All sites have remained static.

Significant changes in plant frequencies for Delta transects between 2009 and 2010.

	No Change	DISP	JUBA	ATTO	BAHY
Moist Flood Plain					
DELTA_01	↔				
DELTA_02	↔				
DELTA_03	↔				
DELTA_04	↔				
DELTA_05	↔				
DELTA_06	↔				
DELTA_07	↔				

*** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease, ↔=no change*

DELTA_01

DELTA_01 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index varied between 67-72% during the baseline period. The site is dominated by saltgrass with a small alkali sacaton component. The site has remained static during all six sampling periods. Utilization has consistently remained high since 2007.

Utilization by Weighted Average and Species, Delta_01

	Weighted Average	DISP	SPAI
2007	50%	46%	69%
2008	49%	46%	58%
2009	59%	61%	49%
2010	70%	71%	50%

Frequency (%), DELTA_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	ANCA10	5	12	5	7	11	9
	NIOC2	10	5	7	4	3	8
	SUMO	7	0	1	0	0	0
Perennial Graminoid	DISP	156	152	149	152	155	151
	JUBA	0	7	11	10	9	6
	LETR5	0	1	0	0	0	0
	SPAI	3	0	13	11	16	11
Shrubs	ATTO	2	5	1	5	0	0
Nonnative Species	BAHY	0	0	2	0	2	1

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_01

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	ANCA10	2	2	1	1	2	2
	NIOC2	2	1	1	T	T	T
	SUMO	1	0	0	0	0	0
Perennial Graminoid	DISP	70	66	46	60	61	39
	JUBA	0	2	T	T	T	T
	SPAI	3	2	3	2	3	2
Nonnative Species	BAHY	0	0	T	0	T	0

Cover (m) Shrubs DELTA_01

Species Code	2003	2004	2007	2009	2010
ATTO	3.1	1.8	3.9	1.1	0.2
SUMO	0.9	0.8	0.2	0.1	0.0
Total	4.0	2.7	4.1	1.2	0.2

Ground Cover (%) DELTA_01

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	5	4	22	9	3	12
Dung	6	9	13	4	5	2
Litter	81	77	47	87	92	87
Rock	0	0	0	0	0	0
Standing Dead	0	0	4	1	2	0

Shrub Densities and Age Classes DELTA_01

	ATTO					SUMO			
Age Class	2003	2004	2007	2009	2010	2003	2004	2009	2010
Seedling	7	0	0	0	0	0	0	0	0
Juvenile	3	7	3	0	1	0	0	0	0
Mature	8	8	8	10	5	3	4	1	1
Decadent	0	0	2	0	2	0	0	0	0
Total	18	15	13	10	8	3	4	1	1

DELTA_02

DELTA_02 is located in a grazing exclosure in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes which corresponds to the Moist Floodplain ecological site. Similarity index ranged between 59-66% during the baseline period. Plant frequencies in 2010 did not change when compared to 2009 and 2007. Both Nevada saltbush and rubber rabbitbrush cover appears to be trending downwards. Frequency values in 2010 did not statistically differ from the five prior sampling periods. Because the transect is now within an exclosure, utilization was not sampled in 2009-10.

Utilization by Weighted Average and Species, Delta_02

	Weighted Average	DISP	SPAI
2007	52%	48%	70%
2008	49%	49%	

Frequency (%), DELTA_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Graminoid	DISP	109	118	131	103	115	114
Shrubs	ATTO	10	13	0	0	4	8
	ERNA10	10	9	12	0	1	4
Nonnative Species	BAHY	0	3	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_02

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Graminoid	DISP	42	38	23	33	26	16
Nonnative Species	BAHY	0	T	0	0	0	0.0

Cover (m) Shrubs DELTA_02

Species Code	2003	2004	2007	2009	2010
ATTO	16.3	9.7	10.1	8.3	3.8
ERNA10	16.0	12.3	11.7	10.8	8.9
SUMO	0.4	0.0	0.0	0.0	0.0
Total	32.6	22.0	21.8	19.0	12.8

Ground Cover (%) DELTA_02

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	11	17	29	27	30	27
Dung	2	2	2	3	1	1
Litter	82	75	49	68	69	72
Rock	0	0	0	0	0	0
Standing Dead	0	0	6	2	9	7

Shrub Densities and Age Classes DELTA_02

	ATTO						ERNA10					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	23	0	11	0	0	0	0	0	0	0	0
Juvenile	0	20	6	17	0	2	2	7	2	1	0	0
Mature	6	24	24	24	4	22	9	49	46	7	9	19
Decadent	0	5	4	6	12	5	11	8	5	34	9	9
Total	6	72	34	58	16	29	22	64	53	42	18	28

DELTA_03

DELTA_03 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The site is predominantly saltgrass. Frequency values did not vary from 2007-10. Alkali sacaton was not encountered. Utilization has ranged between 19-11% since 2007.

Utilization by Weighted Average and Species, Delta_03

	Weighted Average	DISP	SPAI
2007	59%	59%	57%
2008	51%	50%	69%
2009	54%	54%	
2010	71%	71%	

Frequency (%), DELTA_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	SUMO	15	15	19	0	15	22
Perennial Graminoid	DISP	114	118	129	104	119	112
	SPAI	5	0	0	1	0	0
Shrubs	ATTO	12	13	8	0	8	8
	ERNA10	0	0	0	0	2	0
	SAVE4	0	0	10	0	0	0
Nonnative Species	BAHY	0	1	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_03

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	SUMO	4	0	0	0	0	0
Perennial Graminoid	DISP	37	38	19	36	18	13
	SPAI	4	T	0	T	0	0

Cover (m) Shrubs DELTA_03

Species Code	2003	2004	2007	2009	2010
ATTO	11.0	7.7	10.9	7.3	4.8
ERNA10	0.7	0.4	1.1	0.8	0.8
SAVE4	6.6	6.3	5.9	5.9	5.1
SUMO	17.2	5.2	3.7	9.5	11.3
Total	35.4	19.7	21.7	23.4	21.9

Ground Cover (%) DELTA_03

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	21	20	32	38	37	59
Dung	8	2	2	6	5	3
Litter	64	70	48	53	58	40
Rock	0	0	0	0	0	0
Standing Dead	0	0	3	3	6	2

Shrub Densities and Age Classes DELTA_03

	ATTO						ERNA10				
Age Class	2002	2003	2004	2007	2009	2010	2003	2004	2007	2009	2010
Seedling	0	22	0	0	0	0	0	0	0	0	0
Juvenile	3	19	16	3	23	11	0	0	0	0	0
Mature	19	26	29	28	30	27	0	2	2	2	1
Decadent	0	15	0	13	8	5	2	0	1	0	0
Total	22	82	45	44	61	43	2	2	3	2	1

	SAVE4					SUMO					
Age Class	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	0	0	0	0	2	112	0	0	0	0
Juvenile	0	0	0	0	0	15	90	58	68	20	44
Mature	2	3	1	2	1	15	73	61	17	102	87
Decadent	2	0	1	0	1	0	3	0	12	0	1
Total	4	3	2	2	2	32	278	119	97	122	132

DELTA_04

DELTA_04 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index ranged between 63-71% during the baseline period. The site has remained relatively stable since vegetative sampling began, there were no significant changes in frequency values between 2007-10. Utilization has varied for the past four years of sampling.

Utilization by Weighted Average and Species, Delta_04

	Weighted Average	DISP	SPAI
2007	66%	65%	79%
2008	44%	41%	56%
2009	56%	56%	
2010	62%	62%	

Frequency (%), DELTA_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	7	0	0	4	4
Perennial Forb	SUMO	0	7	0	0	1	0
Perennial Graminoid	DISP	139	128	150	103	115	124
	SPAI	0	5	6	0	0	0
Shrubs	ATTO	3	2	6	0	0	4

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_04

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	T	0	0	T	T
Perennial Graminoid	DISP	46	33	22	40	20	19
	SPAI	0	1	1	0	0	0

Cover (m) Shrubs DELTA_04

Species Code	2003	2004	2007	2009	2010
ATTO	3.6	2.3	3.1	5.3	6.1
SAVE4	0.3	0.6	0.2	0.2	0.9
SUMO	1.9	0.9	1.8	2.6	1.4
Total	5.9	3.8	5.1	8.1	8.3

Ground Cover (%) DELTA_04

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	19	34	54	63	57	63
Dung	6	4	3	5	7	3
Litter	62	59	26	31	35	35
Rock	0	0	0	0	0	0
Standing Dead	0	0	1	1	0	T

Shrub Densities and Age Classes DELTA_04

	ATTO						SAVE4	
Age Class	2002	2003	2004	2007	2009	2010	2003	2007
Seedling	1	2	0	0	0	0	0	0
Juvenile	1	5	2	2	3	0	0	0
Mature	5	13	13	11	13	9	1	0
Decadent	2	1	0	0	1	0	0	1
Total	9	21	15	13	17	9	1	1

	SUMO					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	0	14	0	0	0	0
Juvenile	2	11	18	3	26	5
Mature	1	10	7	3	34	21
Decadent	0	1	1	0	0	0
Total	3	36	26	6	60	26

DELTA_05

DELTA_05 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 66-72% during the baseline period. The site has remained relatively stable since vegetative sampling began and there were no significant changes in frequency values between 2007-10. Utilization in 2010 declined on the transect by 25%. Currently, there is no noticeable reason why.

Utilization by Weighted Average and Species, Delta_05

	Weighted Average	DISP
2007	50%	50%
2008	60%	60%
2009	54%	54%
2010	29%	29%

Frequency (%), DELTA_05

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	2	0	0	0	0
Perennial Forb	ANCA10	0	0	1	3	8	4
	NIOC2	7	0	2	0	0	2
	SUMO	14	2	23	19	16	20
Perennial Graminoid	CADO2	0	2	5	0	0	0
	CAREX	0	0	0	0	4	0
	DISP	155	146	163	135	144	146
	JUBA	9	9	12	13	23	23
	SCAM6	0	0	0	0	0	5
Shrubs	ATTO	0	6	5	0	1	0
Nonnative Species	BAHY	0	1	3	0	1	0
	LASE	0	10	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_05

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	HEAN3	0	T	0	0	0	0
Perennial Forb	ANCA10	0	0	T	1	1	2
	NIOC2	2	0	T	0	0	T
	SUMO	5	0	0	0	0	0
Perennial Graminoid	CADO2	0	T	T	0	0	0
	CAREX	0	0	0	0	T	0
	DISP	54	46	31	33	24	25
	JUBA	2	4	2	2	1	1
	SCAM6	0	0	0	0	0	T
Nonnative Species	BAHY	0	T	T	0	T	0
	LASE	0	T	0	0	0	0

Cover (m) shrubs DELTA_05

Species Code	2003	2004	2007	2009	2010
ATTO	6.5	3.4	4.8	5.9	6.1
ERNA10	0.0	0.0	0.6	1.2	1.0
SUMO	12.7	7.2	6.9	6.7	9.4
Total	19.2	10.6	12.2	13.8	16.6

Ground cover (%) DELTA_05

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	6	7	21	25	18	14
Dung	11	7	4	5	11	5
Litter	40	79	45	69	71	80
Rock	0	0	0	0	0	0
Standing Dead	0	0	2	3	1	2

Shrub Densities and Age Classes DELTA_05

	ATTO						ERNA10		
Age Class	2002	2003	2004	2007	2009	2010	2007	2009	2010
Seedling	0	0	0	0	0	0	0	0	0
Juvenile	0	5	0	0	0	0	6	0	1
Mature	7	10	14	9	6	13	1	2	3
Decadent	1	1	2	7	4	2	0	0	0
Total	8	16	16	16	10	15	7	2	4

	SUMO					
Age Class	2002	2003	2004	2007	2009	2010
Seedling	5	50	0	0	0	35
Juvenile	11	18	11	31	28	45
Mature	23	74	42	15	39	49
Decadent	1	2	7	21	1	4
Total	40	144	60	67	68	133

DELTA_06

DELTA_06 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 54-73% during the baseline period, this variation is a result of annual fluctuations in saltgrass production. Saltgrass frequency followed a similar decline in 2003 but has remained stable for all other sampling periods. There were no significant changes in frequency values between 2007-10 although there was a decline in saltgrass in 2010. Utilization on the transect for 2010 was 8% lower than 2009.

Utilization by Weighted Average and Species, Delta_06

	Weighted Average	DISP
2007	26%	26%
2008	50%	50%
2009	31%	31%
2010	23%	23%

Frequency (%), DELTA_06

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	0	0	5	0
Perennial Forb	ANCA10	9	5	5	7	6	10
	HECU3	9	7	8	2	0	0
	NIOC2	0	0	0	0	0	1
	SUMO	15	14	27	6	18	17
Perennial Graminoid	DISP	122	94	120	125	120	105
	JUBA	17	12	14	12	11	9
Shrubs	ATTO	3	4	0	2	2	0
	ERNA10	0	3	0	0	0	0
	SAVE4	0	1	15	0	4	3
Nonnative Species	BAHY	0	5	0	0	0	0
	XAST	0	2	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_06

Life Forms	Species	2002	2003	2004	2007	2009	2010
Annual Forb	ATPH	0	0	0	0	T	0
Perennial Forb	ANCA10	2	T	T	1	3	3
	HECU3	1	T	1	T	0	0
	NIOC2	0	0	0	0	0	T
	SUMO	8	0	0	0	0	0
Perennial Graminoid	DISP	31	16	19	16	15	12
	JUBA	1	2	1	T	T	T
Nonnative Species	BAHY	0	T	0	0	0	0
	XAST	0	T	0	0	0	0

Cover (m) Shrubs DELTA_06

Species Code	2003	2004	2007	2009	2010
ATTO	8.2	4.5	5.9	4.9	4.0
ERNA10	0.4	0.6	0.6	0.0	0.0
SAVE4	8.3	6.6	6.5	8.7	8.0
SUMO	9.4	3.9	10.6	7.0	7.6
Total	26.2	15.6	23.6	20.6	19.6

Ground Cover (%) DELTA_06

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	16	20	33	45	29	30
Dung	1	T	T	T	T	2
Litter	61	77	29	55	71	69
Rock	0	0	0	0	0	0
Standing Dead	0	0	17	9	5	6

Shrub Densities and Age Classes DELTA_06

	ATTO						ERNA10				
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2010
Seedling	0	8	0	0	1	0	0	0	0	0	0
Juvenile	0	6	3	1	2	1	2	7	0	0	0
Mature	8	8	16	10	8	4	4	1	3	1	0
Decadent	0	8	9	7	8	4	0	0	0	0	1
Total	8	30	28	18	19	9	6	8	3	1	1

	SAVE4						SUMO					
Age Class	2002	2003	2004	2007	2009	2010	2002	2003	2004	2007	2009	2010
Seedling	0	0	0	0	0	0	5	6	0	0	12	0
Juvenile	0	0	0	1	0	0	1	42	22	37	12	15
Mature	1	5	11	6	9	8	12	31	39	31	23	56
Decadent	0	2	3	4	2	1	1	17	7	1	20	3
Total	1	7	14	11	11	9	19	96	68	69	67	74

DELTA_07

DELTA_07 is located in the Delta Field, soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes which corresponds to the Moist Floodplain ecological site. The similarity index during the baseline period ranged between 35-60%, responding to declines in saltgrass production on the site. However, in 2009 saltgrass frequency significantly increased and maintained the same frequency level in 2010. In 2002-03 the site experienced a broad inkweed germination event, shown in the increase in seedling density in 2003 and subsequent survivors as juveniles. Since that period total inkweed density has increased. Utilization on the site has been typically high for the past four years. This seems to have very little impact on change to the ecologicalt site.

Utilization by Weighted Average and Species, Delta_07

	Weighted Average	DISP
2007	60%	60%
2008	54%	54%
2009	51%	51%
2010	49%	49%

Frequency (%), DELTA_07

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Forb	SUMO	32	16	15	12	15	18
Perennial Graminoid	DISP	114	93	116	102	121	121

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Forbs, Graminoids, Sub-shrubs DELTA_07

Life Forms	Species	2002	2003	2004	2007	2009	2010
Perennial Graminoid	DISP	26	17	8	11	25	11

Cover (m) Shrubs DELTA_07

Species Code	2003	2004	2007	2009	2010
SUMO	25.1	10.3	27.0	32.8	33.1

Ground Cover (%) DELTA_07

Substrate	2002	2003	2004	2007	2009	2010
Bare Soil	22	43	59	52	30	44
Dung	2	2	1	1	2	2
Litter	51	53	29	47	68	54
Rock	0	0	0	0	0	0
Standing Dead	0	0	6	12	10	3

Shrub Densities and Age Classes DELTA_07

	ATTO	SAVE4	SUMO					
Age Class	2002	2002	2002	2003	2004	2007	2009	2010
Seedling	0	0	0	422	0	1	5	0
Juvenile	0	0	7	112	7	48	32	14
Mature	1	1	17	37	27	40	46	34
Decadent	0	0	1	18	21	21	7	12
Total	1	1	25	589	55	110	90	60

Irrigated Pastures

The Lake Field is located west of U.S. Highway 395 north of Diaz Lake. This irrigated pasture was last evaluated in 2010 and received a score of 90%. This pasture will be re-evaluated in 2012.

Irrigated Pasture Condition Scores 2007-10

Pasture	2007	2008	2009	2010
Lake Field	84	X	X	90

X indicates no evaluation made.

Stockwater Sites

The Bolin Field was supposed to receive a stockwater site supplied by the Lone Pine Visitors Centers well in 2010. After a more in-depth analysis of water availability was undertaken, it was ascertained that there was not an adequate amount of water to sustain both uses. The resulting analysis has stockwater being supplied from a diversion that runs from the LAA.

Fencing

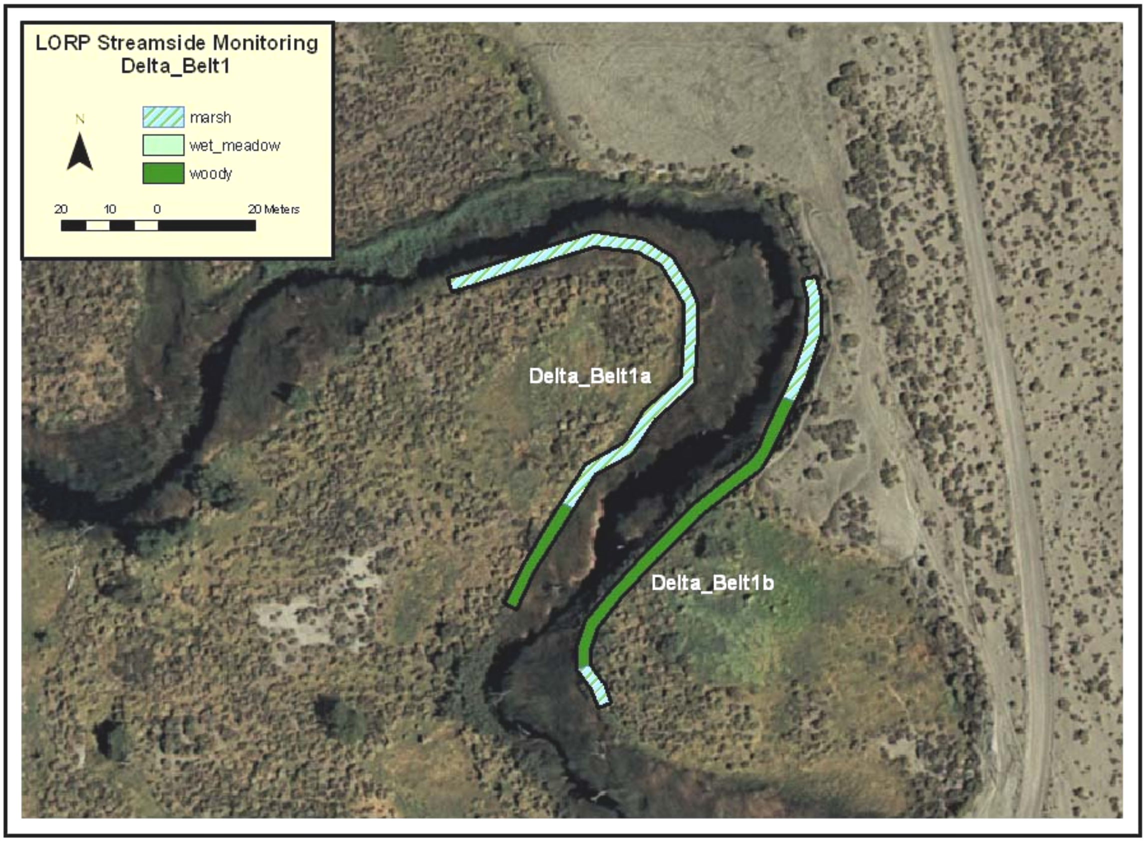
A 1-mile long drift fence was constructed in September of 2010 that begins at the Pumpback station and heads west on the north side of the main road that comes from Boulder Creek Campground. This fence was constructed by the lessee to prevent livestock from drift north while grazing the Owens Lake delta.

Salt and Supplement Sites

Cake blocks that contain trace minerals and protein are distributed for supplement on the lease. The blocks are dispersed randomly each time and if uneaten they biodegrade within one grazing season.

Streamside Monitoring

There were two DMAs located within the Delta Lease (RLI-456), one in the Main Delta Exclosure (Delta_Belt1) and one in the Delta Field (Delta_Belt2).



LORP Streamside Monitoring Delta_Belt1

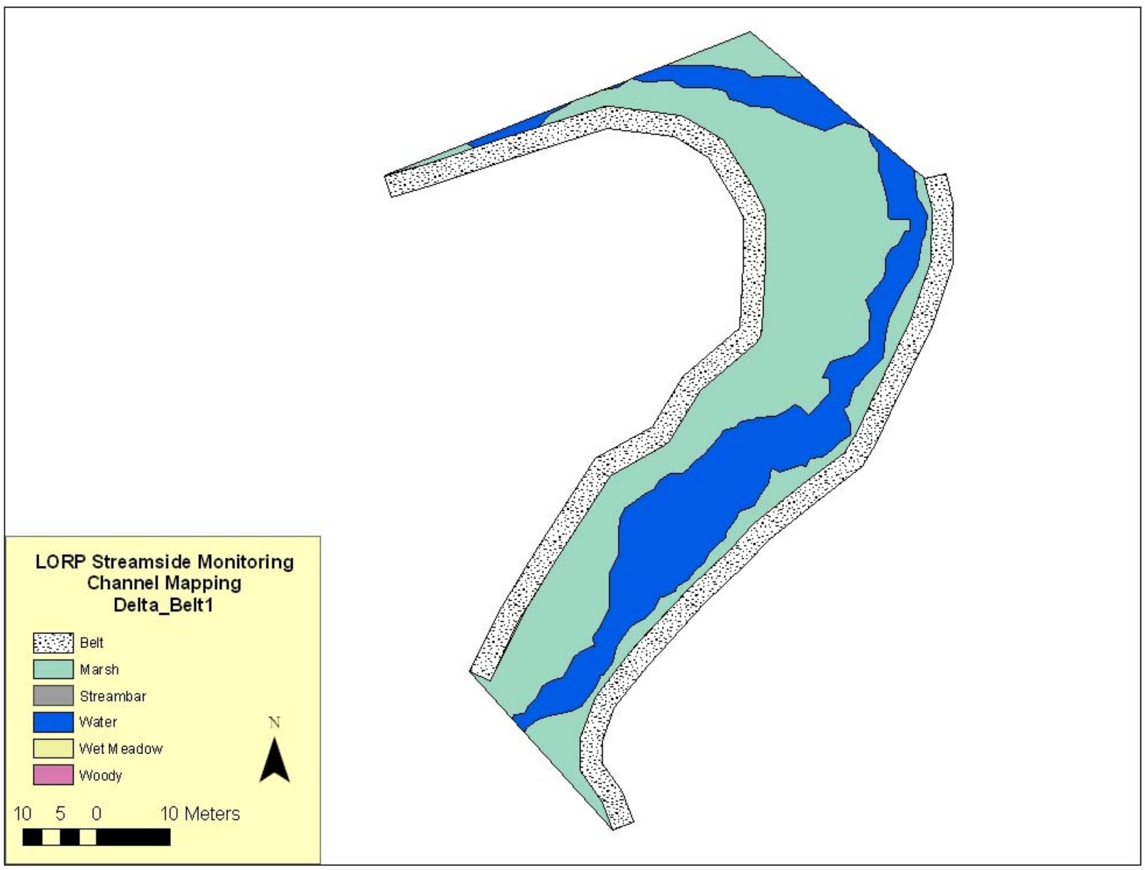
Delta_Belt1a is located in the Main Delta Exclosure and was characterized as marsh along the water's edge and was dominated by tules with some narrowleaf willow along the southern end of the transect. Banks along Delta_Belt1a were vegetated or occupied with litter, most of which was decadent/dead tules (see photos below). Point intercept data showed this site to be 41% vegetated, 58% litter, 0.5% wood and 0.5% fine/silty soil. Species encountered while acquiring this data included tules, yerba mansa, salt heliotrope, cattails, and threesquare bulrush. There were 7 mature narrowleaf willow rooted in the sampled frames, and an additional 8 mature and 1 dead narrowleaf willow serving as canopy cover at this site. While narrowleaf willow is well established at this site, there was no woody recruitment observed. There was no apparent use to any of these individuals by livestock or other wildlife. GIS analysis estimated cover by woody species to be approximately 73 m^2.

Looking downstream at Delta_Belt1a. Much of the bank in this reach of river is dominated by dead or decadent tules (lighter color along bank in photo), with live tules further out in the water. Tule encroachment provides significant competition for other species in this reach of the Lower Owens River.

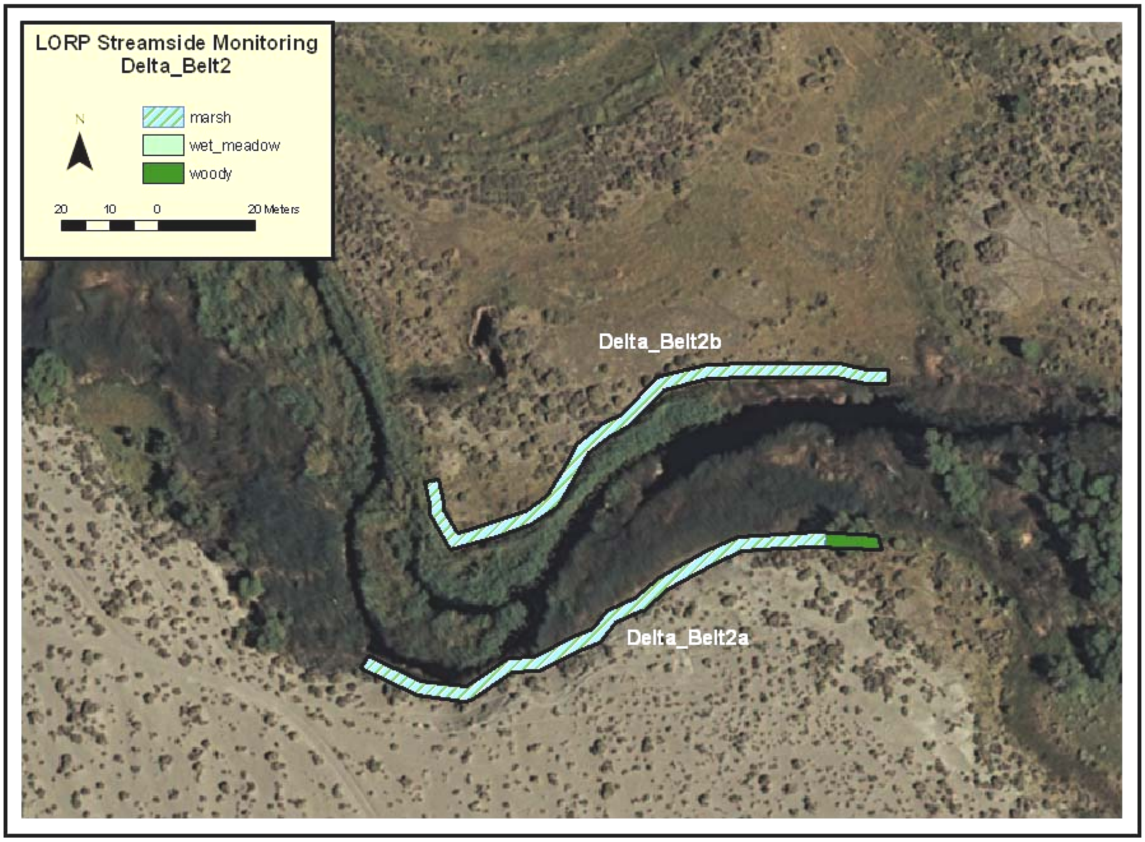
Photo capturing standing dead tules (looking toward the water) along Delta_Belt1a.

Similar to Delta_Belt1a, Delta_Belt1b was also located in the Delta Exclosure and was characterized as marsh with a well established corridor of narrowleaf willow and tules along much of the stream bank. Banks along this section of the river were primarily litter (dead tules) with some isolated vegetated and barren areas. Field data showed this site to be 61.5% litter, 17.5% vegetated, 12% wood, and 9% fine/silty soil. Species recorded at the water's edge included tules, creeping wildrye, and narrowleaf willow. As mentioned previously, there was an established corridor of narrowleaf willow along this transect, yet there is no recruitment occurring in/around any of the 40 sampled quadrats. However, there were 1 juvenile, 31 mature, 1 decadent, and 1 dead narrowleaf willow noted as rooted, as well as 1 dead Goodding's willow. In addition, there were 87 mature and 1 dead narrowleaf willow, and 1 dead Goodding's willow, serving as canopy cover at this site. There was no apparent use to any of these individuals by livestock or other wildlife, nor was there any woody recruitment noted at this site. GIS analysis estimated cover by woody species to be 216m^2 within the 3m wide sampled belt.

End of grazing season utilization data was not collected within the Main Delta Field Exclosure in 2010, although DELTA_02 is located near Delta_Belt1. GIS analysis of the wetted channel estimated the following: 717m^2 open water and 1392m^2 marsh.



LORP Streamside Monitoring Channel Mapping Delta_Belt1

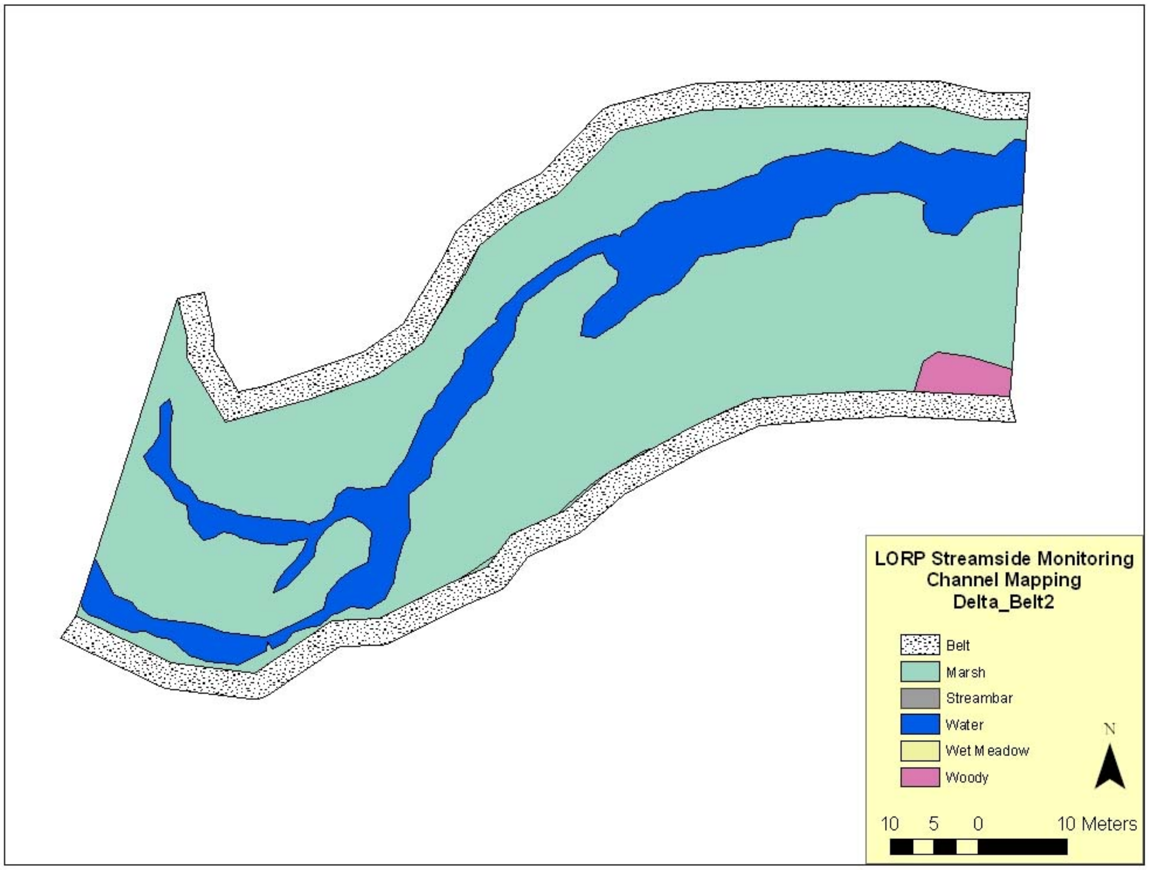


LORP Streamside Monitoring Delta_Belt2

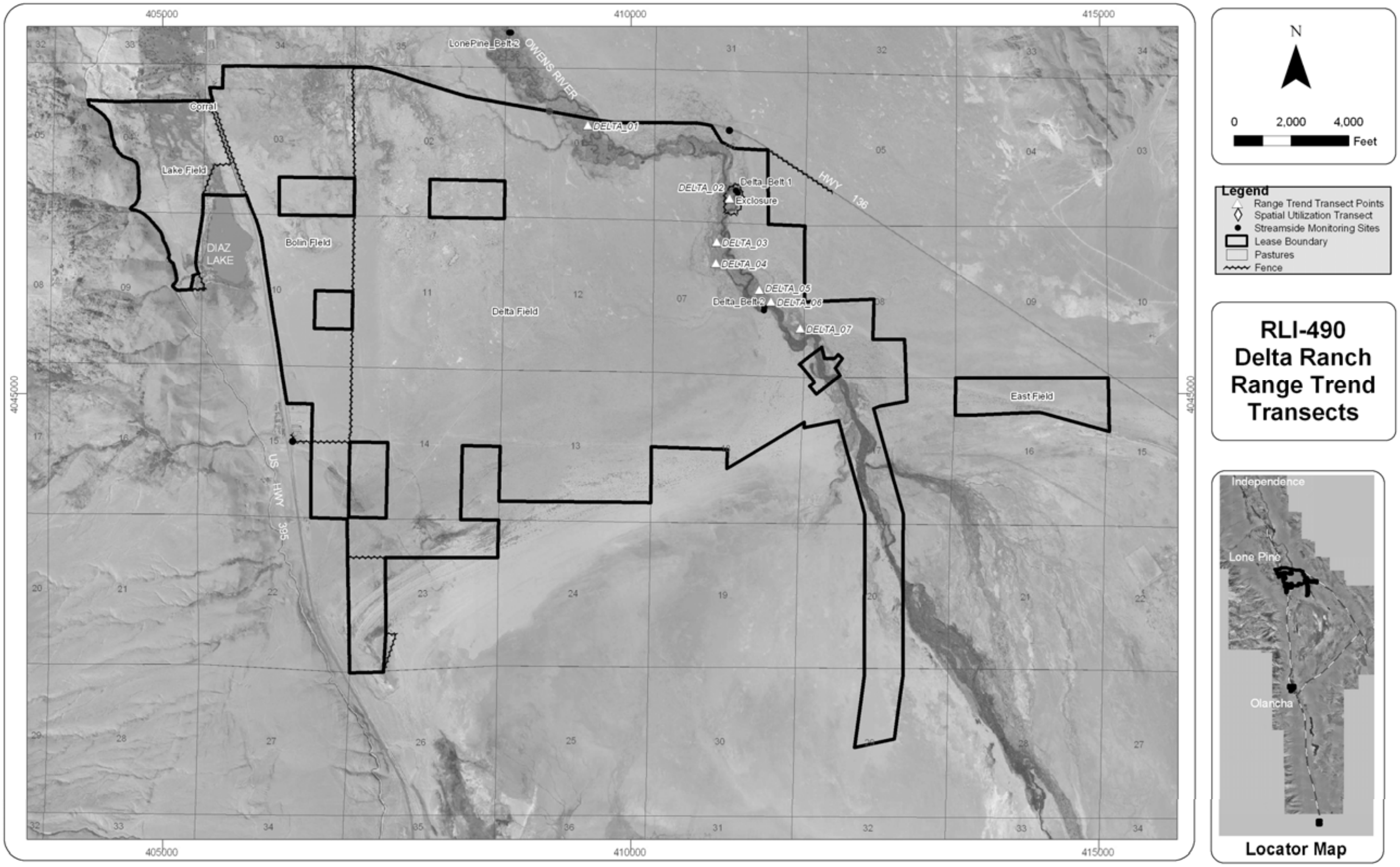
Delta_Belt2a is located in the Delta Field and was characterized as marsh with a small woody component. This transect was dominated by tules along the water's edge and some Goodding's willow also present. Banks along this transect were mostly vegetated or occupied with litter (dead tules). Point intercept data of ground cover showed the site to be 51.5% vegetated, 40% litter, 5.5% wood, and 3% fine/silty soil. Species recorded along the water's edge included tules, yerba mansa, and Goodding's willow. There was 1 mature Goodding's willow rooted within the 40 sampled frames and 2 mature and 1 decadent serving as canopy cover. There was no apparent use to any of these individuals by livestock or other wildlife, nor was there any woody recruitment noted at this site. GIS analysis estimated cover by woody species to be approximately 33 m^2 within the 3 m wide sampled belt.

Delta_Belt2b was characterized as marsh with common reed (*Phragmites australis*) and tules being the predominant species at the water's edge. Saltgrass and saltbush dominate the adjacent wet meadow. The streambank was characterized mostly as vegetated or litter. Point intercept data for ground cover at the water's edge showed this site to be 66.5% vegetated, 30.5% litter, and 3% fine/silty soil. Species documented within this included common reed, tules, saltgrass, and creeping wildrye. There were no woody species present at this site.

End of grazing season utilization within the Main Delta Field averaged 51%. DELTA_06 is located near Delta_Belt2; utilization at this site was 23% in May 2010. GIS analysis of the wetted channel estimated the following: 707 m^2 open water, 42 m^2 woody vegetation, and 2585 m^2 marsh.



LORP Streamside Monitoring Channel Mapping Delta_Belt2



Land Management Figure 9. Delta Lease RLI-490, Range Trend Transect

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5.0 Rapid Assessment Survey Report

Introduction

The Rapid Assessment Survey (RAS) documents problems or potential management issues and provides qualitative project-level feedback regarding changes within the project area (Ecosystem Sciences 2008). The RAS is a large scale monitoring project that is intended to “fill in the gaps”, and provide some level of monitoring either to project areas not covered by other long-term quantitative monitoring projects, or to ensure visits to the project area in years when other these other monitoring projects are not taking place. The 2010 RAS, conducted in the month of August, was a collaborative effort by the Inyo County Water Department (ICWD) and Los Angeles Department of Water and Power (LADWP).

Data collected during RAS is used to aid in the implementation of certain mitigation measures required under the Lower Owens River Project (LORP), to evaluate the effectiveness of particular management activities, and to inform managers developing adaptive management measures of other potential issues of management interest. Mitigation measures for which RAS data can be used are noxious weed and saltcedar control, and the evaluation of the effectiveness of the rehabilitation of project-related construction disturbance sites. Particular management activities for which RAS data can be used include evaluating the soundness of riparian fencing, riparian exclosures, and barriers limiting or controlling recreational or vehicular access. RAS data that may be useful during the development of adaptive management measures include information regarding native woody riparian recruitment and survival, beaver activity, grazing management issues, and road or recreational impacts.

5.1 Methods

5.1.1 Survey Areas

The 2010 RAS was conducted in all four of LORP management areas: Riverine-Riparian Management Area, Blackrock Waterfowl Management Area (BWMA), Off-River Lakes and Ponds and the Delta Habitat Area (DHA). RAS Figure 1 shows features of the Riverine-Riparian Management area and the DHA and RAS Figure 2 shows features of the BWMA and Off-River Lakes and Ponds.

<u>Riverine-Riparian Management Area</u>

The Riverine-Riparian Management area includes the Owens River and its floodplain extending from the Los Angeles Aqueduct Intake (Intake) in the north, to the LORP Pumpback Station in the south. The Riverine-Riparian area encompasses approximately 53 river miles. This area is divided into six reaches assigned by Whitehorse Associates (WHA) based on a combination of valley form, channel/floodplain morphology, and hydrologic variables, which influence landtype, water regimes, and vegetation types (WHA 2004). While the use of the six reach designations in this years report differs from the 2009 RAS report, however, it is consistent with the reporting associated with all other LORP projects. The four reach types identified in the LORP Riverine-Riparian area are dry incised floodplain, wet incised floodplain, graded wet floodplain, and aggraded wet floodplain. In the Riverine-Riparian Management Area, the RAS followed both sides of the Lower Owens River channel from the Intake to the Pumpback Station. Surveys were conducted in floodplain areas on both the west and east sides of the river but did not extend into adjacent upland areas. In certain areas, such as the Islands area (Reach 4), access to the river was limited by impenetrable emergent marsh vegetation in braided channels and ponded water.

Delta Habitat Area

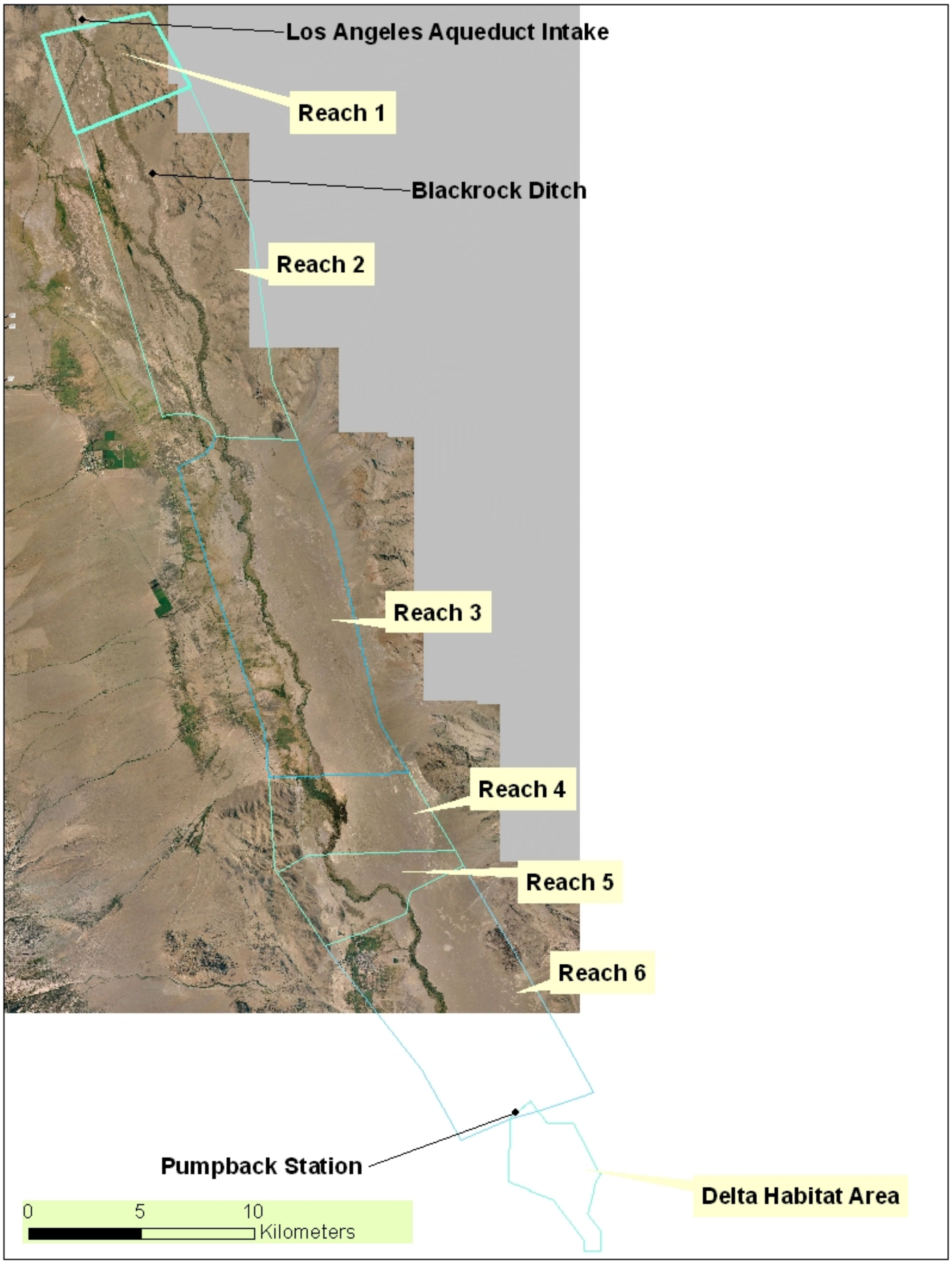
The DHA is a large wetland complex located at the delta of the Owens River at the northernmost edge of Owens Lake. The northern boundary of the DHA is located at the Pumpback Station and the southern boundary of the DHA corresponds with a transition from vegetated wetland, confined by low dunes and playa; to the broadly depressed, unconfined brine pool on the lakebed (WHA 2005). Surveys were conducted on each side of the main river channel as well as across the vegetated areas to the east. Surveys did not extend beyond the vegetated areas.

Blackrock Waterfowl Management Area

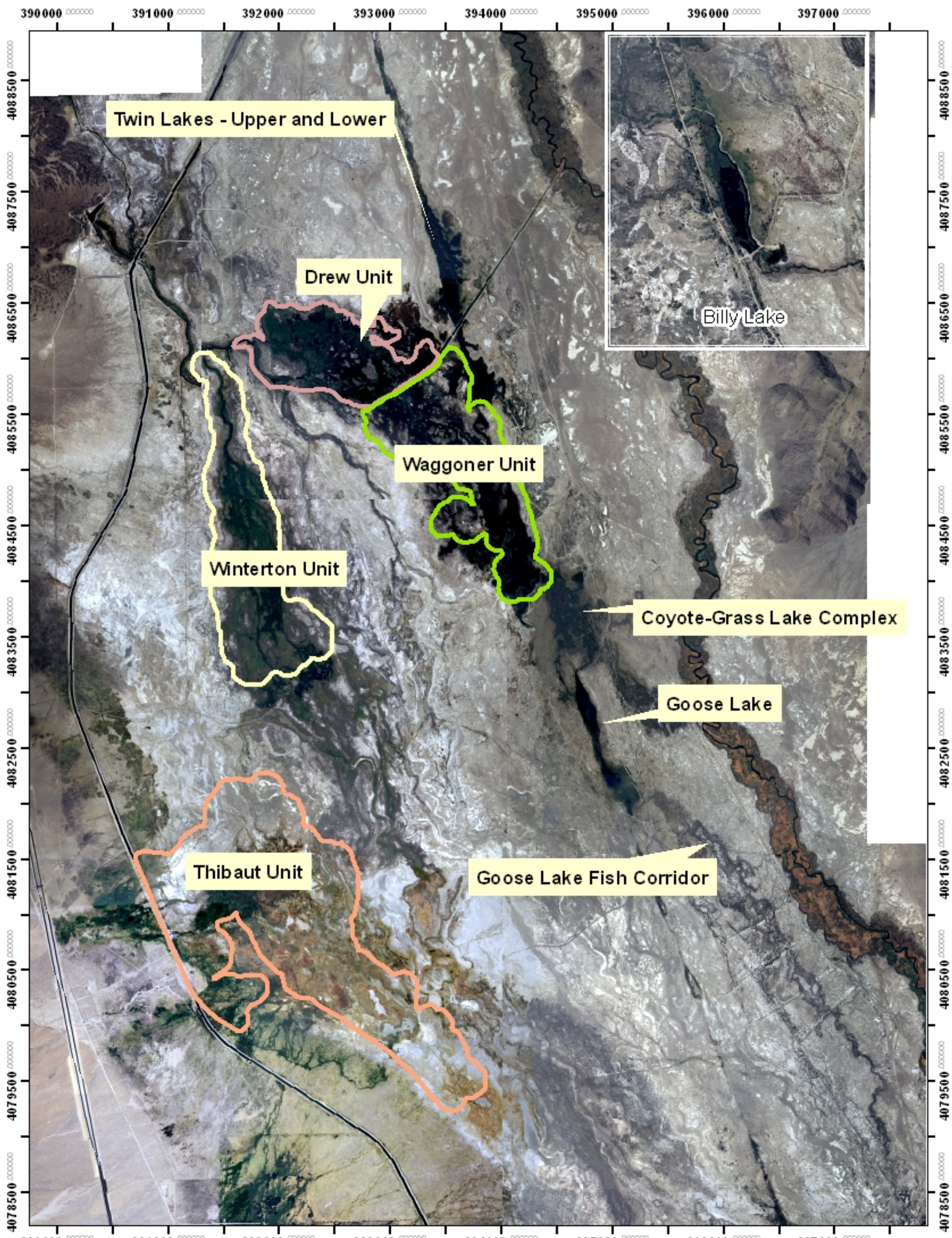
The BWMA is located south of the Intake, between the Aqueduct to the west and the Owens River to the east. The BWMA consists of four separate management units: Drew, Thibaut, Waggoner, and Winterton. The BWMA contains upland habitats as well as the managed wetland units that will undergo periodic wetting and drying cycles designed to create suitable habitats for habitat indicator species. Although not all units will be flooded each year, management problems may arise during a drying period, and therefore, all units are surveyed when conducting RAS. Because the extent of flooding in each unit will vary yearly, the exact route followed will also vary. In general, surveys followed the wetted perimeter or traversed areas subjected to periodic wetting and drying. BWMA areas that are not subject to periodic managed flooding events were not surveyed as part of the RAS.

Off-River Lakes and Ponds

The Off-River Lakes and Ponds component of the LORP is composed of a series of small lakes and ponds primarily situated along the Owens Valley fault line, and within the vicinity of the BWMA. Many of the lakes and ponds are recreational fisheries. Thibaut Ponds, which are considered part of the Off-River Lakes and Ponds, are contained wholly within the Thibaut Management Unit and will be surveyed as part of the BWMA. Other Off-River Lakes and Ponds include Upper and Lower Twin Lakes, the Coyote/Grass Lakes complex, Upper and Lower Goose Lake, and Billy Lake. The Goose Lake Fish Corridor will be included as part of the Off-River Lakes and Ponds. Under the LORP, water levels in the Off-River Lakes and Ponds are to be maintained and thus these areas will not undergo the wetting and drying cycles as will occur in the BWMA units. The survey of Billy Lake was conducted from a vehicle by driving on the dirt road that circumnavigates this small lake. Surveys for all other Off-River Lakes and Ponds were conducted on foot.



RAS Figure 1. Features of the Riverine-Riparian Management Area and the Delta Habitat Area



RAS Figure 2. Features of the Blackrock Waterfowl Management Area and Off-River Lakes and Ponds

5.1.2 Impacts Noted or Items of Interest Recorded

The following items were documented because of their importance to project managers in determining if adaptive management or mitigation measures are needed, or to evaluate the success or progress of the project or project components. The abbreviation that follows each category is the observation code used for field documentation.

1. **Beaver Activity** (BEA) - Beaver activity can include dams, tree cutting, huts, or other evidence of beaver activity such as excessive ponding of water along the river. If evidence of beaver activity was encountered, the observer noted if the activity was recent or not. This was determined by looking for fresh material on dams, fresh chew marks on trees, or fresh vegetative material on huts. In some cases a dam was not visible, but the sound of water falling over the top of the dam could be heard. If a "waterfall" was heard, it was noted as a possible beaver dam. Slow-moving water or ponded water behind a possible dam was also recorded as potential beaver activity. Beaver sometimes respond to the presence of humans by slapping their tail against the water. Any site that the beaver tail slap was heard was also documented.

2. **Fencing Problems** (FEN) - Any vandalism or damage to fences was recorded. Field personnel also noted if a particular repair should be given high priority, based on the presence of livestock in the area or the presence of other potential notable impacts. If wildlife, anglers, or other recreationists were repeatedly attempting to access a fenced portion of the river, the need for an additional access point was noted. Fence lines varying from those depicted on field maps, or open gates allowing driving access to the floodplain were also documented. The fencing associated with each grazing exclosures in the Riverine-Riparian Management area was examined to evaluate its integrity.

3. **Grazing Management** (GRZ) - Grazing management issues that were documented included the presence of livestock supplement sites in the floodplain, excessive trampling of vegetation, high-lining of vegetation, or water gaps resulting in excessive impacts. Since grazing management plans do not include grazing on the river during July and August, except with prior authorization from LADWP, the presence of livestock on the river was also recorded if encountered.

4. **Noxious Weeds** (USDA plant species code used) – In 2009, after having conducted three Rapid Assessment Surveys, Inyo County and Los Angeles Department of Water and Power Staff and consultants concluded that increases in exotic weeds were not effectively tracked by RAS, so in 2010 not all exotic weeds were recorded. Instead, field efforts were directed toward identifying and mapping specific noxious species that are of state priorities for eradication or tracking. These are California Department of Food and Agriculture (CDFA) "A"-, "B"-, or "C"- rated weedy species. Under the LORP, funding is available to treat A- and B-rated weeds. The Noxious Weed Documentation and Reporting Form were used to record sightings. The estimated number of plants was recorded using one of the following abundance categories: 1-5, 6-25, 26-100 or >100, and/or the dimensions of the infestation were estimated.

5. **Recreation** (REC) - Evidence of overnight camping or presence of fire rings. With an expectation that a Recreational Use Plan will be developed within the next year, observations related to river recreation uses were also noted.

6. **Roads** (ROAD) – In 2009, a road layer was added to the field maps. This road layer contained all existing roads within the RAS survey area that were visible on 2005 satellite imagery. Observers were directed to only note "new roads" i.e., those not present pre-project (2005) or pre-existing roads with resource impacts.

7. **Russian Olive** (ELAN) – Although Russian olive (*Elaeagnus angustifolia*) is not actively being controlled, and is not a priority for eradication at this time, managers felt that determining the level of recruitment of this species may be of management interest. Staffs were directed to note only seedling plants and not established, mature plants; as has been done during previous RAS efforts. The estimated numbers of seedlings were recorded in one of the following abundance categories: 1-5, 6-25, and 26-100 or >100.

8. **Tamarisk** (TARA) – (*Tamarix ramosissima*) – Tamarisk is the most abundant noxious weed in the project area and is seen throughout the LORP. Most of the mature plants have been recorded from 2007-2009, so in 2010 only tamarisk resprouts and seedlings were recorded. The code "TARA" was used only to note resprouts. The estimated numbers of resprouts were recorded in one of the following abundance categories: 1-5, 6-25, 26-100 or >100.

9. **Tamarisk Seedlings** (TARA_SEED) – Tamarisk seedlings or areas of tamarisk recruitment were documented along with site conditions and an estimate of area or number of seedlings. The estimated numbers of seedlings were recorded in one of the following abundance categories: 1-5, 6-25, 26-100 or >100.

10. **Tamarisk Slash** (SLASH) – Tamarisk slash in the floodplain, on the banks or in the wetted river channel.

11. **Trash** (TRASH) – Large accumulations of trash or single large items such as appliances or furniture.

12. **Wildlife** (WILDLIFE) – Use of the project area by wildlife species.

13. **Woody Recruitment** (WDY) - Native riparian woody recruitment that established after the 2010 Seasonal Habitat Flow was documented. The information recorded included the approximate number of seedlings, the height of the seedlings, site conditions, and plant identification: cottonwood or willow; tree willow or shrub willow; and species, if known. The approximate number of seedlings was recorded using one of the following abundance categories: 1-5, 6-25, 26-100, or >100. Woody species that are of particular interest include any tree willow species (*Salix goodingii* & S. *laevigata*) and Fremont cottonwood (*Populus fremontii*). Since it was often difficult to identify willow seedlings to species, observers were asked to note if the seedlings appeared to be tree willow or shrub willow seedlings (usually S. *exigua*) if species identification was uncertain.

14. **Other** (OTH) – Other unclassified items of management concern or interest were recorded as necessary. Where these data involved plants, categorical data was collected. The estimated numbers of plants were recorded in one of the following abundance categories: 1-5, 6-25, 26-100 or >100.

15. **Revisit Sites** – Specific sites from the 2009 RAS were selected to revisit by the LADWP task leader, after discussion with other task leaders with regard to the nature of the sites to be revisited. Sites from the 2009 survey that were selected to revisit included all noxious weed sites other than tamarisk, all Fremont cottonwood recruitment sites, willow recruitment sites involving multiple individuals, tamarisk recruitment sites, and roads causing potential resource impacts in meadow or floodplain areas. Where the Revisit site was the noxious weed, *Lepidium latifolium* (LELA2), tamarisk seedlings (TARA_SEED), or woody recruitment (WDY), categorical data were collected. The estimated number of plants were recorded using one of the following abundance categories: 1-5, 6-25, 26-100 or >100. Revisit sites were identified as such by applying the suffix “R” to the observation code (e.g. WDY-R).

Impacts and observations that were recorded in previous years’ RAS, but not in 2010, were: Disturbances (DIST) – Areas of construction or maintenance-related disturbance; Exotic Weeds (EXW) - It is not practical nor is it necessary to document all nonnative species, so in 2010 only (CDFA) “A”-, “B”-, or “C”-rated weedy species were recorded (see Noxious Weeds, above).

5.1.3 Field Planning and Logistics

The RAS involves on-the-ground coverage of 106 river miles in the Riverine-Riparian Management Area and several large wetland areas. An important component of efficient completion of this effort is logistical planning and the availability of trained staff. The 2010 RAS was completed in five field days, beginning August 2 and ending on August 6.

Managing the fieldwork were task leaders, Debbie House (LADWP) and Jerry Zatorski (ICWD). Task leaders arranged the crews, provided project oversight, trained personnel, and reviewed incoming field datasheets. Field staff included ten workers from LADWP, and seven from ICWD. Nate Reade of Inyo/Mono Agricultural Commissioners Office (AgComm) also participated. In 2010, the RAS involved approximately 63 person-days.

On the first day, all staff participated in a group training to review field protocols, general logistics, and safety. Staffs were issued field reference materials including guidelines for recording field observations, a revisit site table, the Eastern Sierra Weed Management Area, Noxious Weed Identification Handbooks, a key to woody species present in the LORP, RAS datasheets, a phone list containing the cell phone number for each field crew member, and Noxious Weed Reporting Forms. Task leaders assigned general survey areas to staffs of their respective agency. Staff members arranged logistics such as vehicle shuttles and meeting locations. Staff members that had not participated in the 2009 RAS were required to accompany a trained staff member for 1-3 days or until completely familiar with protocols.

Thereafter, field crews met each morning at the LADWP office in Bishop to get their assignment. Crew leaders confirmed that all GPS units were loaded with appropriate waypoint files, including river mile reference points, and the location of sites to revisit from previous surveys.

Field Procedures

The riverine-riparian survey generally followed the river's edge but the observer visually scanned the entire floodplain for potential impact areas. In some areas, observers could not walk along the river edge due to impenetrable vegetation such as large stands of *Bassia hyssopifolia*, dense saltbush, and flooded areas. Areas not accessible on foot, or observations encompassing a large geographic area were drawn on maps as opposed to walking the perimeter of the site. These areas were later digitized and incorporated into the RAS database. Surveyors covered an average of 3.0 river miles a day (up from 2.5 in 2009), but this ranged from one mile to eight miles, depending on density of brush, the number of oxbows, or other hindrances.

Field personnel initiated the survey by activating the tracking function of the GPS unit to track the entire day's course. The tracking function was set at 0.01 km sensitivity or the "normal or more frequent than normal" setting to record a point every ten meters providing a detailed record of the route traveled. A GPS point was taken for each observation recorded. GPS units were set to NAD 27 CONUS for all data collection. Each time a GPS point was taken, it was recorded on the appropriate datasheet, an observation code was assigned, and detailed notes regarding the location were recorded on the datasheet as described above. In some areas, large or extensive stands of tamarisk resprouts, tamarisk seedlings, tamarisk slash, or woody recruitment were noted. In these cases the observer drew a polygon on the field map of the affected area, took a GPS point at each end of the stand, and noted that plants were multiple and widespread, as appropriate.

Digital photographs were taken at waypoints where images would help document observations and guide field crews to sites in the future. The documentation guidelines handout specified which observation types should include photo documentation. These images were recorded in high-resolution and a date/time stamp added (if available). Observation types for which photos were requested included beaver, noxious weeds, fencing, grazing, recreation, road, tamarisk seedling recruitment sites, woody recruitment sites, wildlife (vole activity or when possible for other wildlife), and revisit sites. Photos were not required when recording Russian olive recruitment sites, slash piles, tamarisk resprouts, or trash dumpings.

5.1.4 Documentation Procedures

Two standardized datasheets were used during Rapid Assessment Surveys, the Rapid Assessment Datasheet and Noxious Weed Documentation and Reporting Form. The noxious weed forms were completed in the office.

Rapid Assessment Datasheet

The Rapid Assessment Datasheet was used to document all observations. On the Rapid Assessment Datasheet, the observer recorded the observation code (e.g., FEN), GPS point, photograph number, time of observation, compass direction the photograph was taken (if applicable), the "FID" (Field Identification - a unique identifier for revisit sites), the number of plants (if applicable), and detailed information about the observation or photograph.

Noxious Weed Documentation and Reporting Form

Any noxious weed with a California Department of Food and Agricultural rating of "A" or "B" (other than tamarisk) was documented using the Noxious Weed Documentation and Reporting Form, as well as recording observations on the Rapid Assessment Datasheet. The Noxious Weed Documentation and Reporting Forms are sent to the AgComm when completed. This documentation is used by the AgComm to locate and treat noxious weed sites (other than tamarisk) in the LORP.

5.2 Data Management and Custody

There are four types of data produced by the RAS: 1) datasheets, 2) GPS files, 3) photos, and 4) hand-annotated field maps. Each agency compiled data collected by their own staff. LADWP transmitted their data to ICWD, who, as in previous years, was charged with overall data management.

Datasheets were collected each day and checked by task leaders for completeness. Surveyors returning from the field were responsible for downloading their GPS tracks and waypoints into Mapsource (Garmin). Irrelevant tracks or waypoints were removed and the file was saved as a GDB file containing the date and observers initials in the file name. Observers using Trimble GPS units created shapefiles using ArcView. Photographs were renamed during or after download, appending the observer initials to the camera's default file name.

Track and waypoint files collected by LADWP were transmitted electronically to the ICWD. LADWP provided ICWD copies of all their photos and datasheets. ICWD entered the combined data in an Access (Microsoft) database and assigned a Document Control Number to the datasheet. Once in the database, all records were systematically reviewed for accuracy and corrections made as needed. All the original datasheets were photocopied, scanned, and will be archived at the LADWP office in Bishop.

ICWD produced a summary of the collected data and conveyed this to Ecosystem Sciences and LADWP. Noxious Weed Documentation and Reporting Forms completed by LADWP and ICWD were sent to the AgComm. ICWD staff created maps showing the location of all tamarisk including seedlings documented during RAS and data associated with the sites. These maps were provided to the ICWD tamarisk control Project Manager.

Data compilation, data analysis, and report writing took place in September and October. Office time, which involved pre-planning efforts, map generation, data entry/analysis, error checking, and report writing was estimated at 42 person-days.

5.3 Data Compilation

Access database queries were used to develop tables showing pertinent information such as the observation code type, number of plants (where applicable), side of river (east or west bank), GPS coordinates, and observer notes. An ArcGIS (ESRI) spatial database was built from the Access files, including digitized information from field maps. Additional information added to the map project included known areas of *Lepidium latifolium* infestations, based on the digitization of information provided by Nate Reade, AgComm. The observations were clipped by river reach, using WHA LORP Reach designations. The total number of observations of each type were summed by reach or project area. The number of woody recruitment and tamarisk seedlings sites in each abundance category was totaled by LORP reach or project area. A Chi-square analysis was conducted comparing the proportion of woody recruitment and tamarisk seedlings sites detected during RAS surveys 2007-2010. LADWP and ICWD staff created ArcMap documents for the project area showing locations where observations were documented. All observations are shown on the maps with unique symbols. To increase the readability of the maps, a unique identifier (FID) is only shown for certain observation types, namely beaver activity, cutbanks, fencing issues, grazing issues, *Lepidium latifolium* sites, recreation, road issues (including revisit sites), Russian olive recruitment sites, tamarisk seedling sites (including revisit sites), trash sites (large items), woody recruitment sites (including revisit sites), and other unclassified observation sites. Tables following the maps provide the FID for the corresponding map so that details associated with each observation site (such as river bank, number of plants, and observation details) can be cross-referenced. The notes for each observation provide details that can be useful in determining whether a particular site warrants mitigation, adaptive management, or contingency monitoring. The FID for the other observation types: tamarisk resprouts, tamarisk slash, and wildlife, are not shown on the maps, however this information is available in the ArcMap project database.

Noxious Weed Documentation and Reporting Forms for all *Lepidium latifolium* sites were transmitted to the (AgComm) on August 20, 2010. All sites were treated before August 27, 2010 and again in the fall. Weed infestations identified during the RAS will continue to be monitored and treated by AgComm as part of their ongoing eradication efforts.

5.4 Results

5.4.1 Summary by Observation Category

RAS Table 1 provides the total number of sites documented in 2010 for each observation type by reach or project area. The most total observations occurred in Reaches 2, 6 and 3. Tamarisk resprout sites and slash piles were the most abundant observation category type overall. Beaver activity was limited, and confined to the Riverine-Riparian Management Area, downstream of Mazourka Canyon Road. Russian olive recruitment sites, grazing management issue sites, and recreation issue sites were also minimal. Recreation sites included items such as a fire ring, tire tracks, or small trash items. Some vehicle play areas were located, especially in the Lone Pine reach, and these have caused considerable damage, but with a few exceptions, it does not appear that Off Road Vehicle users are expanding their activities into the most ecologically sensitive areas of the LORP. Of the four fencing issues documented, one was the suggestion of a walk-through, while the other involved damaged fencing that may allow unwanted livestock movement between pastures. No damage to riparian fencing that would allow vehicle access was noted.

Lepidium latifolium was the only noxious weed, (other than tamarisk), found during RAS. The 2010 RAS effort located seven previously undocumented *Lepidium* sites in the Riverine-Riparian Management area, and five sites in BWMA. The seven sites on the river represent infestations outside known areas of infestation, based on information provided by AgComm. *Lepidium latifolium* was only been detected in Reaches 2 and 3, and in the Winterton and Drew Units of the BWMA, however, new populations were documented in these areas. Road issues noted consisted of vehicle tracks in meadow habitats, rutting around existing roads, and continuing vehicular traffic on rehabilitated roads near the Intake. Tamarisk slash was most evident in the upstream reaches (Reach 1-4), and the most piles were recorded in Reach 2. Resprouting of treated tamarisk was noted in all reaches and project areas; however, was very limited in Reach 1. Tamarisk seedling sites were most numerous in Reach 2, the Drew Unit, Twin Lakes, and Goose Lake Fish Corridor. Only two trash sites with large items (couches) were observed. Woody recruitment was noted in all reaches and project areas except Reach 4. Most woody recruitment sites were observed in Reach 2. Wildlife sightings included waterbirds such as ducks, bitterns and rails, herons, egrets, and shorebirds; fish including Bluegill, Large Mouth Bass, catfish and Mosquito Fish, and other aquatic species including Bullfrog, and crayfish. Mammals noted included Raccoon, Striped Skunk, Tule Elk, wood rat, Mountain Lion (tracks). Owens Valley Voles (*Microtus californicus vallicola*) or evidence of vole activity such as runways, droppings and vegetation clippings were observed in several locations. Elk damage to willow and cottonwood was recorded Reach 6.

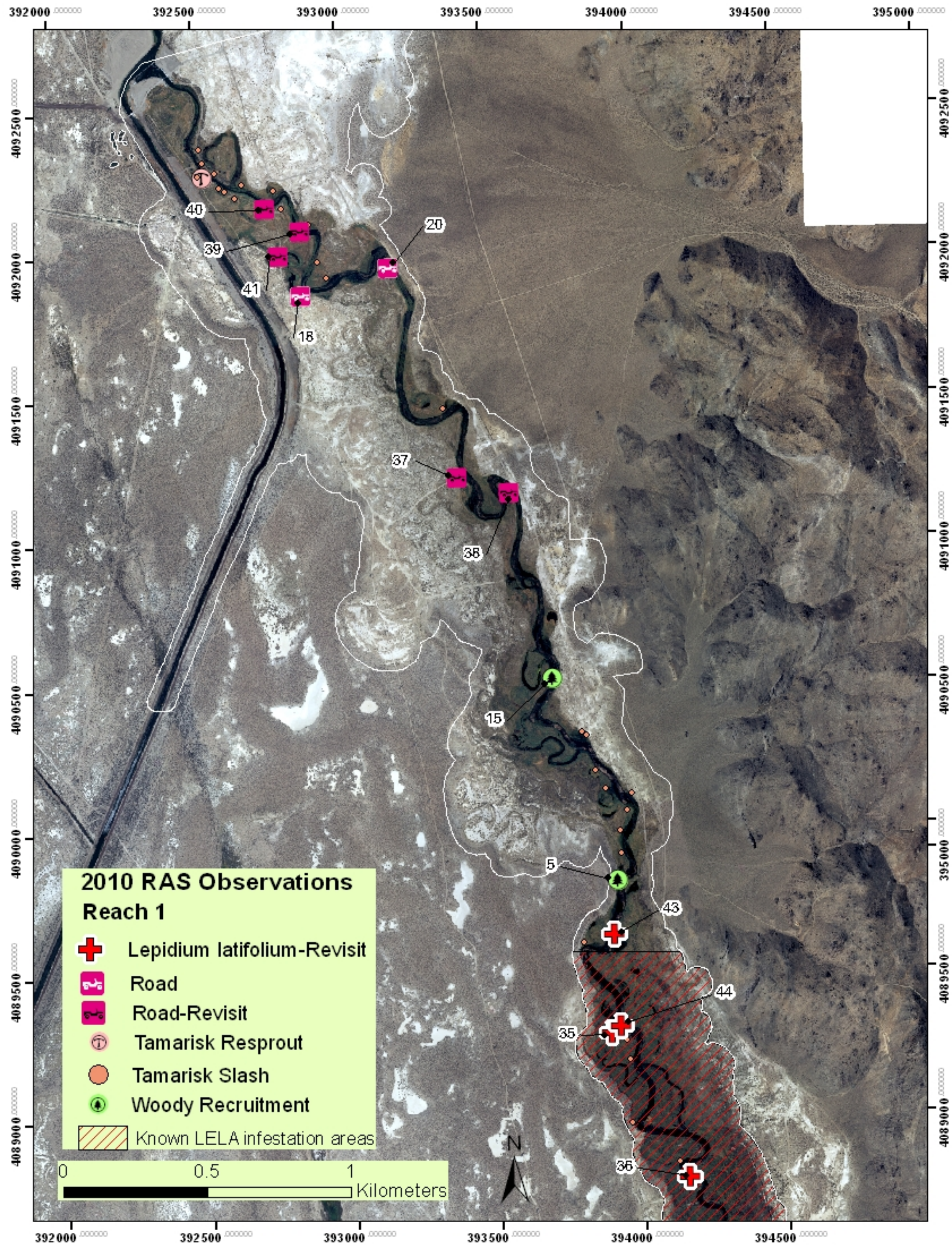
RAS Table 1. Total Number of Sites Recorded During the 2010 RAS by Observation Category Type and LORP Reach or Project Area

Observation Type	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	DHA	BWMA/ Off-River	Total Sites
Beaver Activity			2	2	1	2			7
Cutbank		3							3
Russian Olive Seedling Site		1		1	1			2	5
Fencing Issue		1	1			1		1	4
Grazing Issue		2							2
Lepidium latifolium site		6	8					5	19
Other observation		5		2		1	3	3	14
Salix exigua sprouting			2			4	2		8
Road Issue	2		4	3	1			2	12
Recreation Issue		2				1	2		5
Tamarisk Slash Pile	28	65	17	8		1			119
Tamarisk Resprout Site	1	30	41	13	34	87	26	47	279
Tamarisk Seedling Site		16	4	5		2	1	22	50
Trash Dumping					1	1			2
Woody Recruitment	2	19	4		2	2	2	4	35
Wildlife Sighting	2	19	19	4	4	16	9	13	86
Total Observations per Reach	35	169	102	38	44	118	45	99	650

5.4.2 Summary by Reach or Project Area

Reach 1

RAS Figure 3 shows the location of each RAS observation in Reach 1. Table 2 contains details associated with each observation. *Lepidium latifolium* is still present in this reach, with plants observed at the downstream end of this reach on both sides of the river. Five existing *Lepidium* sites were revisited with plants still present at four sites. No new *Lepidium* sites were found in this reach, and all existing plants are within a known *Lepidium* infestation site, as identified by the AgComm. Two new road issue locations were noted. Rutting was noted at site FID 18, possibly due to wetter conditions in this area. The other Road site (FID 20), likely represents continued use of a temporary construction road. Five road-revisit sites were in this reach. Some of the temporary roads created during pre-project channel-clearing in this reach are still receiving some vehicle use (FID 37 and 40). These temporary roads were rehabilitated by disking and seeding; however, some of these roads are continuing to receive vehicular traffic. Thus, mitigation of construction impacts has not been completely successful in this area. Road-revisit site FID 41 is a previously-existing road that is now continuously flooded as a result of LORP flows. Resource impacts were noted in 2009 and continue as motorists attempt to avoid muddy conditions. Small isolated tamarisk slash piles were noted on both the east and west side of the river. Only one tamarisk resprout site with two plants was noted. Two *Salix exigua* woody recruitment sites, supporting 1-5 plants each, were observed on the west side. Wildlife noted included Desert Wood Rat (*Neotoma lepida*) sign, unidentified ducks, and a Great Blue Heron.



RAS Figure 3. 2010 RAS Observations in Reach 1

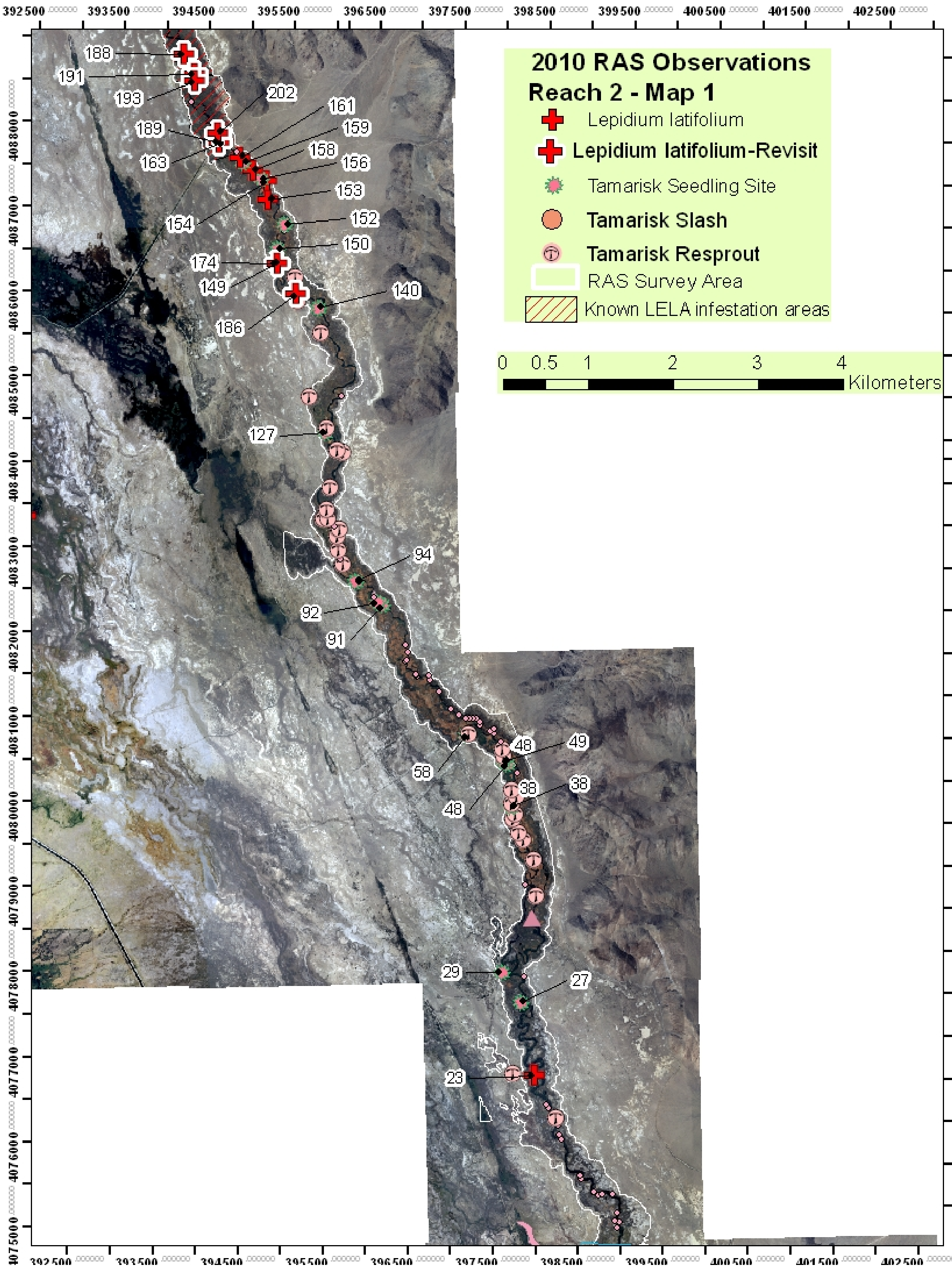
RAS Table 2. Detailed Information for Each RAS Observation – Reach 1

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Lepidium latifolium -Revisit		East	42	395443	4085894	Small patch on river
			43	393907	4089626	30x20ft dense patch of LELA, easily treatable!
			44	393926	4089306	20ft dia patch easily treatable
	26-100	West	35	393892	4089284	Plants in all stages. Plants look good and untreated and on bank.
			36	394152	4088777	No plants or signs of plant removal at this site.
Road		West	18	392866	4091864	Established ruts visible, signs of recent use. Not on map.
			20	393168	4091954	Road follows river bank from river mile 1 to 70m S of 1.1. Evidence of ATV use.
Road-Revisit		West	37	393395	4091223	Road in pic 8 is revegetating. Road in pic 9 shows signs of recent use.
			38	393574	4091165	No current use.
			39	392865	4092088	no current use
			40	392745	4092169	Road appears to have some current use, runs along river bank.
			41	392788	4092004	Orange cone visible warning of flooding. Pic 5 shows recent use on grass.
Tamarisk Slash		East	10	393980	4090114	5 small slashes on the terrace
			13	393826	4090318	9 small slashes in dry alkaline sink on the terrace 010 to 011
			14	393811	4090333	9 small slashes in dry alkaline sink on the terrace 010 to 011
			17	393350	4091463	small slash 2x4m approx. dry alkaline meadow approx. 10m from the channel
			19	392957	4091924	10m due E toward the river from the GPS point in flooded area next to the channel.
			21	392927	4091981	3x5m in dry alkaline meadow (DISP) approx. 10m from the channel
			23	392896	4092108	3x5m in flooded area adjacent to the river
			26	392778	4092229	3x5m next to standing water. Flooded
			29	392669	4092251	5x10m approx 15m from the channel
			32	392576	4092296	001 to 002 continuous pile of slash approx. 5m wide
			33	392534	4092331	001 to 002 continuous pile of slash approx. 5m wide
			34	392522	4092378	5 x 10m
		West	0	394120	4088834	4 slash piles along bank
			1	393955	4088973	6 slash piles along bank
			2	393955	4089191	5 slash piles along river bank
			3	393943	4089259	1 slash pile
			4	393802	4089602	5 slash piles near point in floodplain and near bank
			7	393939	4089908	4 piles: 5x5m, 5x5m in a pool of water, 5x5m, at point 10x3m, all on bank
			8	393935	4089986	1 5x5m pile in water on bank
			9	393960	4090057	1 5x5m pile on bank
			11	393887	4090133	1 10x15m pile. Pile is in water approx. 15m from river channel
			12	393855	4090195	2 piles, both 5x5m on bank.
			22	392875	4092063	1 5x10m pile on bank
			24	392805	4092168	1 10x10m pile on bank
			25	392646	4092206	3 piles visible from point, 1; 10x15m, 2; 20x2m, in floodplain
			27	392609	4092230	3 piles from point 4 to point 5: 2; 10x15m, 1; 15x 20m, on bank
			28	392591	4092241	3 piles from point 4 to point 5: 2; 10x15m, 1; 15x 20m, on bank
			31	392516	4092283	10x15m pile on bank
Tamarisk Resprouts	1-5	West	30	392532	4092279	2 resprouts: 1 at point, 1 10m from point.
Woody Recruitment	1-5	West	5	393926	4089813	SAEX seedlings
	1-5		15	393712	4090520	4 SAEX seedlings. Along river channel
Wildlife		West	6	393955	4089865	Wood rat droppings
			16	393443	4091146	2 ducks using pond approx. 70m N of 1.7. GBH also (pt digitized based on river miles)

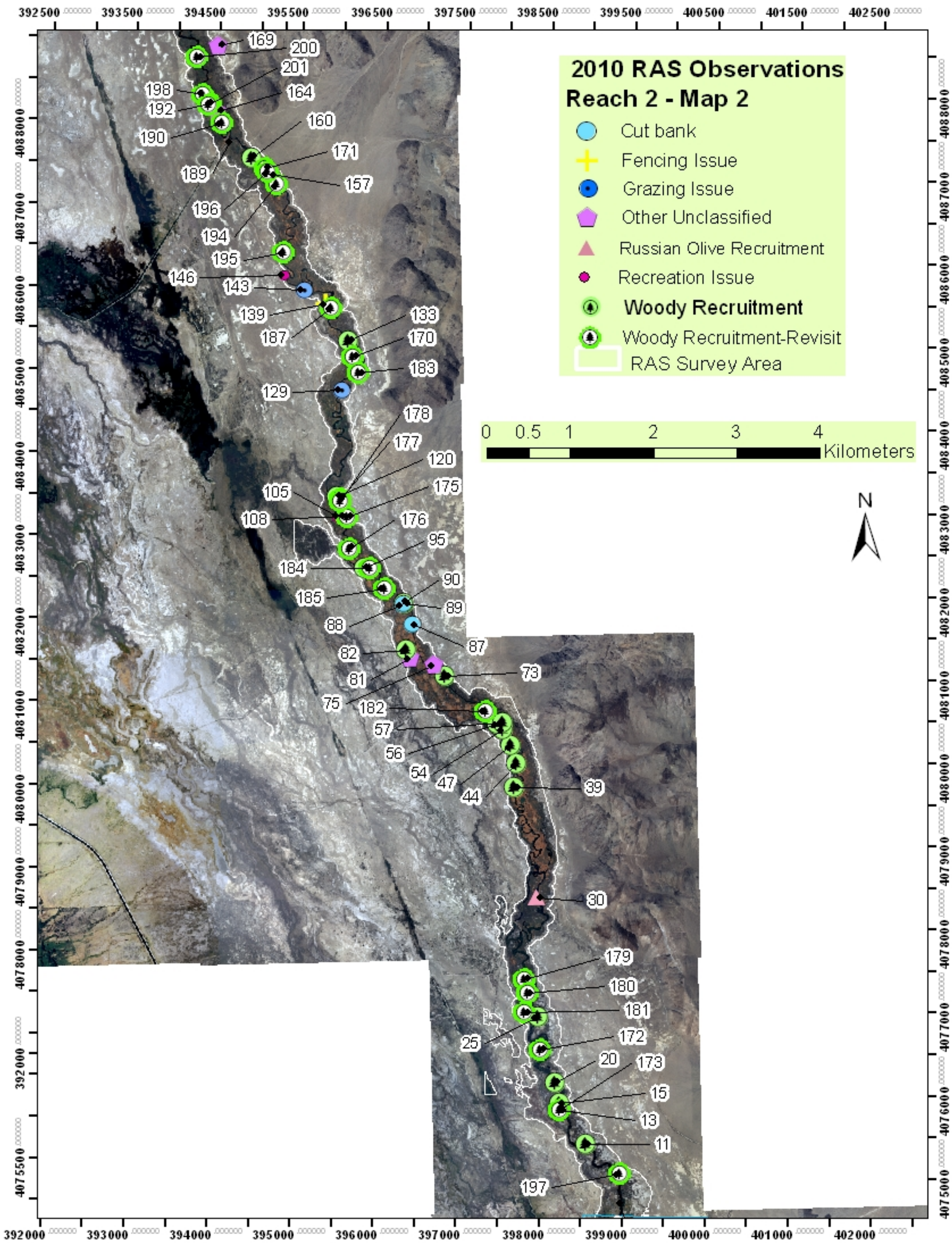
Reach 2

Due to the high number of observations in this reach, two separate maps were created. RAS Figure 4 shows the location of Lepidium sites, tamarisk resprouts, tamarisk seedlings, and tamarisk slash in Reach 2. RAS Figure 5 shows the location of cutbanks, fencing and grazing issues, other unclassified observations, Russian olive recruitment sites, recreation issue sites, woody recruitment locations, and woody recruitment revisit sites. RAS Table 3 contains details associated with each observation. During the 2008 and 2009 RAS, many stretches of the riverbank in this reach were inaccessible due to a combination of the tall dense growth of Bassia, dense saltbrush, and extensive slash piles. Slash pile burning, the disintegration of standing, decadent Bassia, and trails created by other LORP monitoring efforts created conditions allowing improved access throughout this reach in 2010.

Lepidium latifolium is still present in this reach on both sides of the river, with the majority of sites in the vicinity of the Blackrock Ditch. Five new *Lepidium* sites were found, indicating that *Lepidium* is spreading in this area. Four of these new sites (FID 153, 154, 158, 161, 163) were just downstream of the Blackrock Ditch. Another new site (FID 23) was located well downstream, on the west side of the river. One additional new point location (FID 163) will not be considered a new location, since it is within a known *Lepidium* infestation site as identified by the AgComm. Seven existing *Lepidium* sites documented during previous RAS surveys were revisited with plants still present at four sites. Sixteen tamarisk seedling sites were located, with two of these sites supporting more than 100 seedlings. Most tamarisk seedlings sites were noted as occurring on sandbars. Tamarisk slash is still widespread in this reach on both sides of the river, however due to slash-pile burning efforts; slash is less predominant in this reach as compared to that reported in 2007. Tamarisk resprouting is also evident within this reach, as 30 sites were documented. Most sites (27) involved 1-5 plants, while two sites had 6-25 and one site had 26-100 resprouts present. Three sites where cutbanks or bank sloughing is occurring were noted in Reach 2, just upstream of the Goose Lake Fish Corridor return. One cutbank site was reported to be approximately two meters high. The one fencing issue noted was the suggestion of an additional walk-through at river mile 7.8 on the west side of the river. The grazing management observations noted locations on the river that livestock were accessing water, but did not note impacts of management concern. One young Russian olive was observed and this plant was removed. A total of 19 woody recruitment sites were recorded, including 7 on the west side and 12 one the east side of the river. All seedlings supported tree or shrub willow species. One sapling, Fremont cottonwood, was documented in the Thibaut Riparian Exclosure, which has been inaccessible for the past two years. It was presumed that this plant germinated prior to 2010. Most (8) of the woody recruitment sites supported 6-25 willow seedlings, while 4 sites (FID 11, 20, 120, and 25) supported over 100 seedlings. At one of these sites (FID 11), the observer estimated that 500-1000 Gooding's Willow seedlings were present. Twenty-five woody recruitment sites observed in Reach 2 in 2009 were revisited in 2010. Sapling willows and or cottonwoods were still present at twenty of these sites. At two of the other (unclassified) observation sites (FID 164 and 169), the presence of "ideal sandbars for recruitment" were noted but no seedlings. At FID 75, the observer noted dead Bassia forming a large 2-3 foot dam. Wildlife observations in this reach included several observations of Owens Valley Voles or their sign (runways, droppings, or clippings), catfish fry, Bullfrogs, Raccoon scat, Tule Elk, ducks, and a Desert Wood Rat nest in slash.



RAS Figure 4. 2010 RAS Observations in Reach 2 – Map 1



RAS Figure 5. 2010 RAS Observations in Reach 2 – Map 2

RAS Table 3. Detailed Information for Each RAS Observation – Reach 2

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Cutbank		East	87	396626	4081812	Cut bank on east bank. Near river mile 11.9
			90	396526	4082069	Cut bank on West bank. JZ on West side also recorded this, took photo
		West	88	396523	4082051	Bank 2m high, sloughed off parts in river. 2 photos, one from west side of river (JZ), one from east side of river (CZ)
Fencing		West	139	395691	4085689	Mile 7.8 need walk-through at river. (location approx.)
Grazing Management		West	129	395839	4084653	Cross river cattle trail. Good river access.
			143	395417	4085869	Livestock access to river. Potential boat launch.
Other		East	164	394430	4088033	Ideal sand/gravel bar for recruitment/ no willows found
			169	394460	4088836	Ideal gravel bar for recruitment/ no willows found
		West	75	396885	4081315	River blocked with dead BAHY causing a 2-3ft dam
	6-25		81	396602	4081406	SAEX recruits, larger SAEX nearby. Along Goose Lake return.
	>100		108	395856	4083135	Willow recruitment? Could not positively ID seedlings.
Lepidium latifolium	26-100	East	153	395132	4087019	on bank seeding, flowering and basal rosettes. 2x3m patch
	1-5		158	394960	4087364	one in water and dead. A few basal rosettes at edge on bank.
	>100		161	394814	4087519	on bank; 7x3m long; flower and seeds
	6-25	West	23	398033	4076640	Clumps of plants growing on rotting log in river channel
	6-25		154	395120	4087239	1 patch ~4m long along water's edge
	1-5		163	394624	4087703	LELA2 on river bank with plants in all stages. Some dead plants.
Lepidium latifolium -Revisit		East	202	394569	4087812	Small 8ft patch of LELA on river
	6-25	West	174	395228	4086265	Some dead plants at point. Looks like they have been drowned. 10m to west there is a live patch. Flowering and fruiting.
	6-25		186	395443	4085894	In fruit. Does not look treated. Growing bank to cattails.
			188	394190	4088751	No plants or signs of plant removal at this site.
	26-100		189	394579	4087699	LELA2 on river bank and plants are in all stages. Some dead like they have been treated.
			191	394300	4088513	No LELA2 found. Must have been treated and removed.
			193	394302	4088425	No LELA2 at point.
Recreation		West	105	395769	4083120	River access. (Sprouts as in photos 20100803_LF (7) - 20100803_LF (9) on beach.)
			146	395190	4086048	Tracks out in brush - within 10m of river on bench
Russian Olive Seedling	1-5	East	30	398057	4078491	1 juvenile, eliminated w machete
Tamarisk Seedling	6-25	East	27	397890	4077504	Some Tara seedlings pulled (6-25)
	6-25		38	397821	4079811	Pulled 20 TARA seedlings
	6-25		94	396065	4082503	on sandy streambar with willows
	26-100		140	395690	4085729	Recently flooded sandbar. No native woody recruitment. BAHY and HECU seedlings
	1-5		150	395227	4086430	on sandy bank. Pulled
	1-5		152	395322	4086724	on sandy bank. Pulled
	1-5		156	395054	4087255	in water; photo shows slash at point 007. Pulled
	6-25		159	394844	4087462	on sandbar; one willow seedling; pulled most
	26-100		49	397752	4080342	46 seedlings on gravel bar - all pulled out. TARA slash on water edge. Vole droppings in slash, SALA mature across river
	>100	West	29	397679	4077876	Shallow water in side channel (1-8inches deep), TARA germinating, seedlings mostly 3-12 inches above water level.
	6-25		48	397786	4080321	Pulled as many as I could, 1 mature plant on bank
	>100		58	397324	4080670	Many hundreds of seedlings in old channel. Seedlings go for 100m in channel.
	1-5		91	396367	4082218	1 plant, 2m tall
	26-100		92	396313	4082250	Plants 1-3 yr old and seedlings 0.5-2m tall
	1-5		127	395749	4084269	4 plants in water - pond off river. New recruitment.
	26-100		149	395250	4086286	TARA seedlings growing in river. We pulled ~20 of the small plants along sandbar. Tallest ones = 1

RAS Table 3. Cont'd. Detailed Information for Each RAS Observation – Reach 2

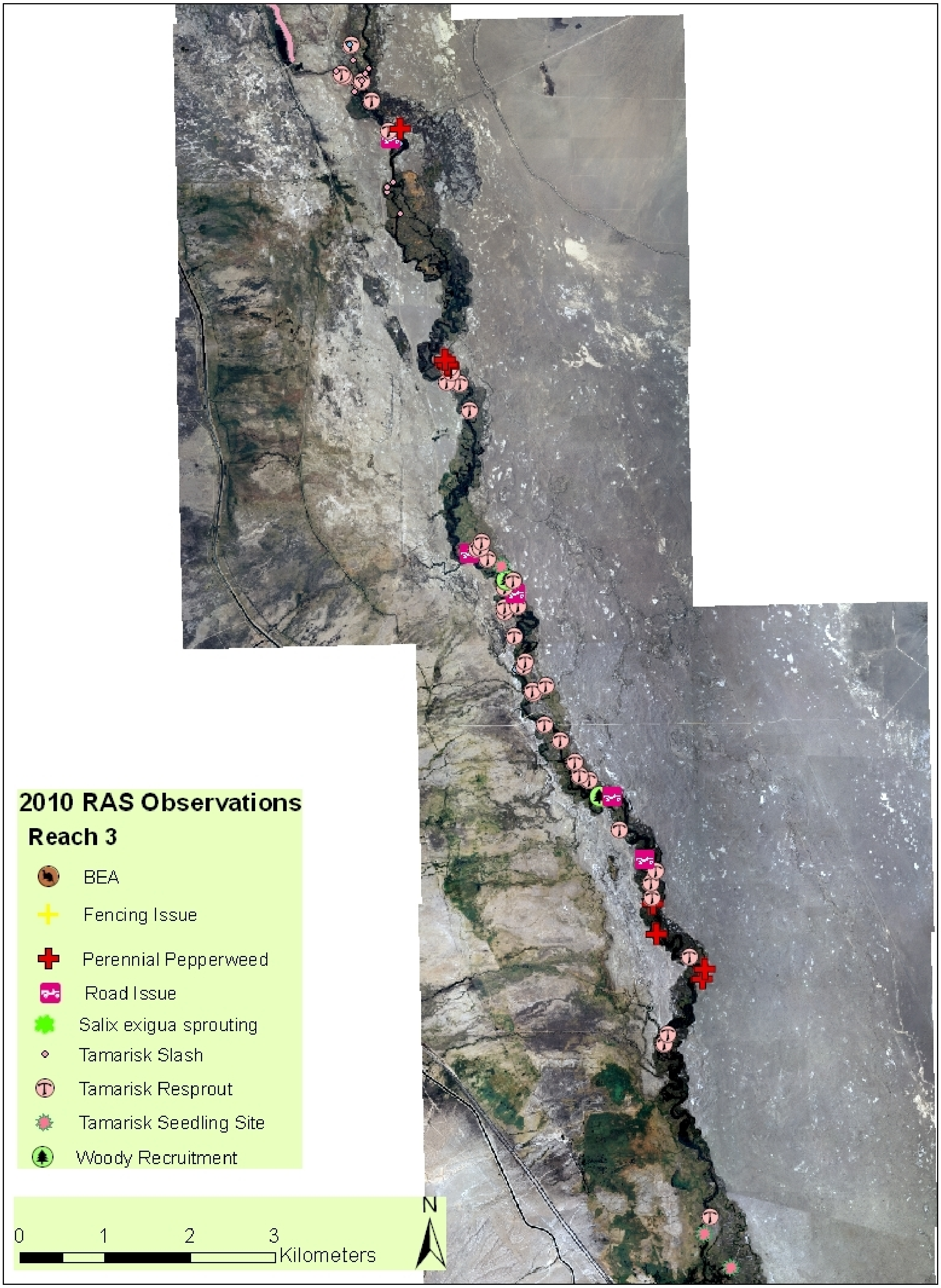
Tamarisk Slash		East	[redacted]	399000	4074898	4 piles: 15x20m, 110x15m. 2 piles are flooded, the rest are in a N-S depression on bank.
			[redacted]	398917	4075235	Tara slash on floodplain 5-10, 10' x 10' piles
			[redacted]	398706	4075255	Approx 30' x 10' on sandy point bar 5 piles along bench
			[redacted]	398315	4075935	Tara slash on floodplain approx 20' x 10'
			[redacted]	398301	4076056	Tara slash on floodplain approx 20' x 10'
			[redacted]	397935	4077811	1 slash pile in floodplain
			[redacted]	397906	4079881	Point pile
			[redacted]	397913	4080208	2 TARA slash piles on bank
			[redacted]	397872	4080303	Pile on terrace
			[redacted]	397757	4080400	Large pile on bank and into water
			[redacted]	397749	4080458	Large TARA slash pile on bank
			[redacted]	397724	4080583	large pile on bank
			[redacted]	397647	4080677	slash pile on bank
			[redacted]	397606	4080706	large slash pile
			[redacted]	397656	4080729	slash pile on terrace
			[redacted]	397483	4080775	slash piles along bank of entire finger (E-W) at mile 13.3
			[redacted]	397489	4080821	5 slash piles w/in 50m on east side
			[redacted]	397453	4080852	large pile on bank
			[redacted]	397410	4080856	large pile on bank
			[redacted]	397369	4080861	slash pile on bank
			[redacted]	397321	4080867	pile on bank
			[redacted]	397243	4080899	pile on bank
			[redacted]	397154	4080974	2 piles on bank
			[redacted]	397019	4081180	On bank
			[redacted]	396907	4081323	Intermittant slash between 580 and 581
			[redacted]	396758	4081373	on bank of oxbow
			[redacted]	396892	4081373	on bank of oxbow
			[redacted]	396753	4081381	on bank of oxbow
			[redacted]	396749	4081400	On bank of oxbow
			[redacted]	396629	4081544	Bank down to river. 3 piles 10m x 5m near riparian fencing at river mile 12.2
			[redacted]	396642	4081555	Bank. Near riparian fencing at river mile 12.2 20m x 10m pile
			[redacted]	396653	4081658	Bank. 3 piles 3 x 3m each near river mile 12.1
			[redacted]	396637	4081739	Uplands. 2 x 3m pile near river mile 12.1
			[redacted]	396281	4082301	slash in floodplain. Inhibited LETR growth.
			[redacted]	396101	4082506	in floodplain 100ft +
			[redacted]	395926	4082666	See polygon. 100 ft of loose piles
			[redacted]	395891	4082774	see polygon. Slash on terrace adjacent to bank
			[redacted]	395868	4083112	scattered piles on bank.
			[redacted]	395877	4083112	20ft of slash adjacent to bank.
			[redacted]	395832	4083153	50ft strech of slash on bank
			[redacted]	395761	4083189	small piles along bank
			[redacted]	395785	4083308	small pile on upland peninsula between river curve.
			[redacted]	395705	4083314	many small piles on bank at end of peninsula
			[redacted]	395796	4083349	large pile on bank
			[redacted]	395789	4083354	100ft of slash just above bank.
			[redacted]	395927	4084056	small pile on bank
			[redacted]	395946	4084681	small pile on bank
			[redacted]	395054	4087255	slash partially submerged
			[redacted]	394772	4087582	bank; one pile on bank; see polygon on map
		West	[redacted]	398965	4074829	Added by QC because observer indicated slash from pt 013 to here.
			[redacted]	398948	4074909	5 x 10 m in the shrub grass area ~5 m from the channel 7 piles (013-014)
			[redacted]	398973	4075013	2 x 3m on the water edge
			[redacted]	398763	4075217	7 piles in dry alkaline meadow Approx 20m from the channel 010-011
			[redacted]	398801	4075237	Added by QC because observer indicated slash from pt 010 to here.
			[redacted]	398555	4075414	Added by QC because observer indicated slash from pt 007 to here.
			[redacted]	398549	4075462	scattered very small piles (~20) on the sandbar and west meadow
			[redacted]	398338	4075886	2 x 2m along shrub 10 m from the channel
			[redacted]	398286	4076147	3-5m approx 10 m from the channel in grassy area
			[redacted]	398194	4076259	Added by QC because observer indicated slash from pt 002 to here.
			[redacted]	398172	4076305	8 small slashes in the gravelly sandy open area 002-003
			[redacted]	397975	4078895	3 TARA/willow piles in upland and a ditch.
			[redacted]	395324	4086643	Tamarisk slash
			[redacted]	394259	4088182	Big slash pile in floodplain.
			[redacted]	394297	4088447	1 big slash pile in floodplain
			[redacted]	394248	4088642	3 slash piles along bank
			[redacted]	394190	4088749	2 slash piles along bank
Tamarisk Resprouts	1-5	East	[redacted]	398077	4079183	1 resprout
	1-5		[redacted]	397964	4079419	1 resprout
	1-5		[redacted]	397913	4079510	1 resprout, chopped it down w machete but no poison
	1-5		[redacted]	397839	4079678	1 Resprout
	1-5		[redacted]	397868	4079721	Resprouts (#2)
	1-5		[redacted]	397758	4080416	TARA resprout - 1 large stump
	1-5		[redacted]	397739	4080500	TARA resprout
	1-5		[redacted]	395874	4083123	3 many branched 3 to 4 m high resprouts
	1-5		[redacted]	395877	4083130	Tara resprout close to bank.
	1-5	West	[redacted]	398279	4076148	Resprouts
	1-5		[redacted]	397773	4076681	resprouts from treated groups in the area west of the riparian fencing
	1-5		[redacted]	398103	4078758	1 TARA resprout in river and some on bank.
	1-5		[redacted]	397829	4079853	~1m -2m tall
	1-5		[redacted]	397896	4079932	2 ~1m tall
	1-5		[redacted]	397833	4080009	1-2m tall resprout. Bees love it!
	1-5		[redacted]	397350	4080684	1 mature plant 3m tall x 4m wide, flowering, possible source of seedlings from above
	1-5		[redacted]	395909	4082717	1 plant at water's edge 2m tall
	6-25		[redacted]	395866	4082872	16 plants in water off sandy bank. 1.5m. Some in flower.
	1-5		[redacted]	395858	4083039	1 plant on river edge 1.5m in flower.
	1-5		[redacted]	395697	4083247	2 plants on river edge within 5m of river. Plants 2.0m in flower.
	1-5		[redacted]	395746	4083256	2 plants on river edge on both sides of willow in flower
	1-5		[redacted]	395739	4083356	1 plants in water within 2m of river. Plants 1.5m in flower.
	1-5		[redacted]	395787	4083624	4 plants in water within 5m of river. Plants 1.0m in flower.
	6-25		[redacted]	395941	4084021	10 plants in water within 5m of river. Plants 1.5m in flower.
	1-5		[redacted]	395874	4084061	3 plants in water within 30m of point.
	1-5		[redacted]	395755	4084314	On river bank in cattails. Just S of river mile 9.1 - mature.
	26-100		[redacted]	395559	4084688	30+ plants in water - pond 20m off river. New recruitment.
	1-5		[redacted]	395714	4085435	2.5m flowering. Resprout.
	1-5		[redacted]	395445	4085820	At river bank.
	1-5		[redacted]	395430	4086104	In river 1-2m in water

RAS Table 3. Cont'd. Detailed Information for Each RAS Observation – Reach 2

Woody Recruitment	>100	East	11	398576	4075501	500-1000 black willow seedlings, clustered in small area under tree, muddy, extends S
	1-5		13	398273	4075928	Coyote willow 3 seedlings up to 5" tall on grassy bank
	6-25		15	398273	4076006	SAGO seedlings on river under tree, extends 20 m south
	>100		20	398223	4076246	SAGO seedlings under large tree 6" from water on muddy bank 400-500 seedlings, seedlings all <2 mm
	6-25		39	397820	4079815	SALA < 6", *c >6" 10 ????? SALA
			73	397016	4081182	SALA, POFR >6in but because no prior visit decided to document
	26-100		89	396536	4082068	5 SALA3 seedlings on muddy bank 2"-6" tall. Near river mile 11.8. Possibly 26-100 very small willow seedlings.
	6-25		95	396065	4082503	SAGO and SALA3 north part of sandy streambar
	>100		120	395757	4083373	Location photo
	1-5		133	395942	4085232	Tree willow seedlings Salix laevigata SALA3. Flooded muddy oxbow.
	1-5		157	395046	4087266	on plant approx. 1cm tall on small island
	1-5		160	394828	4087473	one plant on sand bar approx. 1 ft from water. Willow sp.
	>100	West	25	398037	4077047	Very small willow seedlings (less than 1cm tall) in mud under SAGO
	6-25		44	397848	4080104	SAEX seedlings, on bank near a mature SAGO. I pulled ~20 TARA.
	6-25		47	397786	4080321	SAEX & TARA seedlings in wet extent between channel and bank. 1 patch of 6-25 SAEX 10m, 130 degrees from point.
	6-25		54	397695	4080522	SAEX seedlings on bank
	6-25		56	397635	4080593	SAEX seedlings, established and new plants, on bank
	6-25		57	397695	4080596	SAGO seedlings and established plants in channel
	26-100		82	396556	4081498	SAEX some year old plants and many recruits (~40). Along Goose Lake return.
Woody Recruitment-Revisit	26-100	East	170	395990	4085045	SAGO and SAEX seedlings. 1yr old SAGO seedlings still present, some on flooded sandbar, others on sandbar on shore. Also Tara_Seed 6-25. Good recuritment and willow growth. 2-3yr old POFR also present. 6-25 new SAGO & SAEX seedlings. All <3m from river
	1-5		171	394983	4087341	one arroyo willow approx. 1.2m high; 2 SAEX approx. .7m high in water; No POFR seen
	6-25		172	398060	4076656	up to 10 red willow saplings on sandy bar
	26-100		173	398277	4075926	Site is flooded, most have been browsed
	0		175	395882	4083122	No salix seen = point off by 10m in upland
	6-25		176	395893	4082738	1 SALA3 and approx. 20 SAGO persisting in 3-6in water
	0		177	395797	4083342	0 willows. Took photo of likely spot where they were
			178	395796	4083314	In channel with TYLA, MUAS growing in approx. 3in of water.
	6-25		179	397890	4077504	Persisting at waters edge, no new recruitment
	>100		180	397920	4077342	SALA3 persisting, no new recruitment
	26-100		181	397879	4077103	yearling and older willow persisting, no new recruitment
	6-25		183	396050	4084850	on map listed as WDY_R75, in GIS its listed as WDY_R43. ~ 10 SAGO on small island w/JUBA
	26-100		198	394260	4088247	Red and SALA6 willows 1-3 m tall, no new plants
			199	394459	4087842	Bad point or on other side of river. GPS said approx. 200ft on other side
			200	394201	4088692	could not access/cut off by deep oxbow
	6-25		201	394315	4088126	Red willows 1-3m tall/ no new plants
	1-5	West	182	397489	4080736	1 3m tall POFR2
	>100		184	396144	4082498	>100 SAEX, 1 SAGO, ~23 TARA, 1 ELAN. Most in water between dry bank and Typha.
	>100		185	396307	4082249	~60 SAEX, 7 SAGO, 4 SALA3
	0		187	395740	4085643	No evidence of woody recruitment SAGO as listed. Just south of point 1.5m ELAN.
	1-5		190	394476	4087898	4 SALA3 trees 1-2m tall in river
	6-25		192	394353	4088139	11 plants look good. 3m tall and very green.
	6-25		194	395114	4087143	1 SALA3 NE of cottonwood ~10m. ~3ft. Tall + 1 TARA seedling. 1 cottonwood still present, ~6-25 SAEX still present
	0		195	395190	4086317	POFR not present. 1 small dead POFR branch found nearby.
	1-5		196	395012	4087303	1 plant present in same location. ~3ft tall + 2-3ft wide + 1 small TARA seedling
	6-25		197	398985	4075134	unable to locate any seedlings but there are tall SAGO (2-3 plt) <3' TARA, 2-3' POFR in water
Wildlife		East		398960	4074823	Duck using small pond E of river @ mile 19.9 (pt digitized based on river miles)
				398299	4076068	2 cow Elk on river
				397972	4077459	Owens Valley vole sighting in runway
				397243	4080899	Owens Valley Vole
				396970	4081261	2 Owens Valley Voles, 1 Gopher Snake
				396065	4082503	100's of catfish fry in shallow water
				395856	4083167	Owens Valley Vole droppings
				395815	4083284	woodrat nest in small TARA slash pile
				395644	4083512	flushed 4 female Mallard (or brood) from flooded grassy bar.
				395816	4083658	Bullfrog
				395966	4085117	Owens Valley Vole scat .3m from water
				395937	4085250	Scat w/crustaceans in it 1m from river
				395783	4085405	OwensValley Vole scat 1m from river
				395795	4085495	OwensValley Vole scat
				395697	4085681	Owens Valley Vole and droppings <1m from river (ran away-sorry no photo)
				395536	4085840	scat, 1m from river on bank w/crustaceans in it
				395492	4085885	Raccoon scat 1m from river on bank (w/crustaceans in it)
				395521	4085959	Approx. 100 American White Pelicans overhead
				395370	4086053	Owens Valley vole dropings and runway in DISP.

Reach 3

RAS Figure 6 shows the location of each RAS observation in Reach 3. RAS Table 4 contains details associated with each observation. Two beaver activity sites were noted, both just downstream of Manzanar Reward Road. The ponding of water was noted at one of these sites. *Lepidium latifolium* is still present in this reach, with almost all sites occurring on the east side of the river. Four new point locations were documented, including one just south of Mazourka Canyon Road, and a cluster of three sites, approximately 3 km south of Mazourka Canyon Road, on the east side of the river, indicating that *Lepidium* is spreading in this area. Four other new point locations documented are within a known area of infestation. Four existing *Lepidium* sites were revisited with plants still present at all sites. One previously existing site was not accessible. Four tamarisk seedling sites were located on the east side of the river, all with fewer than 25 seedlings. Seventeen small tamarisk slash piles were reported, primarily on the west side of the river. Forty-one tamarisk resprout sites were recorded, most involving 1-5 plants, while six sites had 6-25, and four sites had 26-100 resprouts present. The one fencing issue noted was a missing or cut strand. The gate was open; however, it is unknown if this is standard procedure for this site when livestock are not present. Four woody recruitment sites were documented, two on the east bank, and two on the west bank. One site (FID 44) supported >100 unidentified seedlings while the others supported fewer than 25 seedlings. Twenty-five woody recruitment sites documented in 2009 were revisited in 2010. Sapling willows and or cottonwoods were still present at twenty-one of these sites. One of the other (unclassified) observation sites was an area of root-sprouting *Salix exigua*. Wildlife observations in this reach included one site with Owens Valley Vole sign, various waterbirds (herons, egrets, ibis and ducks), Great Horned Owls, bass, Coyote, and Tule Elk.



RAS Figure 6. 2010 RAS Observations Reach 3

RAS Table 4. Detailed Information for Each RAS Observation – Reach 3

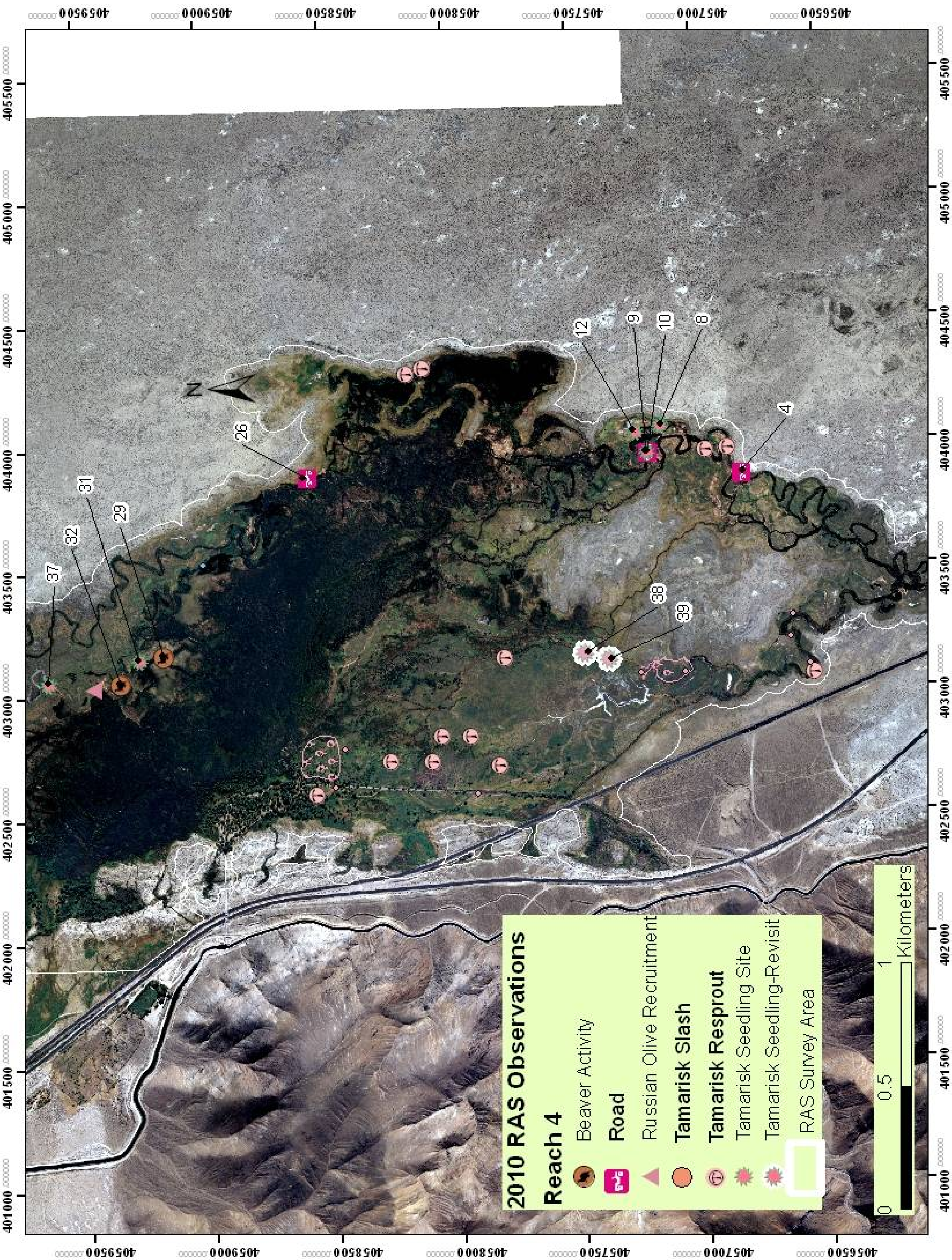
Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Beaver Activity		West	67	399629	4070897	Can hear running water south of the waypoint, water is backed up to possible beaver dam
			73	399269	4072747	Sounds like beaver dam on the left bank, can't see it dt cattails or any other beaver sign
Fencing		East	54	400074	4069039	Strand cut/missing. Gate latch needs better hold down (fence was open).
Lepidium latifolium	6-25	East	12	402694	4063307	LELA in water growing up through a slash pile. All stages of plants. Untreated.
	6-25		13	402735	4063412	LELA in water and on bank. Some treated, some very alive.
	26-100		15	402164	4063848	Plants look brown (treated or flooded?) near WDY_R59 above
	6-25		16	402132	4064198	Looks not treated, plants in fruit.
	6-25		64	399864	4070594	LELA2 growing behind willows, in water. Large TARA stump just NE of this point, along water.
	26-100		65	399854	4070606	LELA2 growing along stream channel in water. Flowering + fruiting look untreated.
	>100		66	399833	4070663	LELA2 growing with Typha. Not on riverbank. In a flooded area next to river. Many plants, flowering + fruiting. Look untreated. Next to TARA stumps and slash piles.
	1-5		81	399365	4073395	Growing on rotting log in river.
Lepidium latifolium -Revisit	6-25	East	113	402394	4063600	Plants in fruit. Some might have been flooded.
	1-5		122	402006	4065021	Plants look treated/drowned. In any case, look dead! Wild bee hive in near by SAGO CAUTION!
	26-100		124	402655	4063499	LELA2 on river bank and in channel. Plants all stages. Some plants look treated.
	>100		125	402761	4063440	new point taken this year: 001 Lela on bank of an oxbow fruiting and flowering. Untreated. Over 200 plants all stages. *new point deleted by QC
		West	102	401469	4065319	could not get to it - large channel to cross, see photo. GPS point is 20m in direction of photo, so its on the other side of the channel. It is not the river - just a very wide oxbow.
Other		West	34	400577	4067003	Instant canopy pack
	26-100		101	398784	4074414	may be root suckers, dry channel < 6" SAEX
Road		East	20	402045	4064749	Extension of known road. Vehicle tracks into wetted area.
			41	400590	4067917	vehicle tracks in meadow coming from east
		West	48	400063	4068398	2 track coming down bluff and crossing grass to river
			79	399239	4073301	Road along channel not on map but inside riparian fence
Tamarisk Slash		East		399068	4073693	4 piles, 1 at point 10x20m, 3 130degrees from point. ~10x15m, on bank and in floodplain.
				398915	4073972	2 5x10m piles on bank
		West		399333	4072406	4 small piles
				399192	4072661	Small slash pile
				399184	4072713	Small slash pile
				399263	4072777	One pile of slash on river bank
				399296	4073289	Small slash pile 5 m from river
				398835	4073854	4 x 8m along the billy return ~5m from the water. Dry ATTO Area
				398854	4073907	4 x 8m along the billy return ~5m from the water. Dry ATTO Area
				398806	4073965	3 x 15m along the billy return ~5m from the water. Dry ATTO Area
				398770	4074015	5 piles ~50 m long along billy return, 5 m from the water
				398722	4074025	6 piles ~80 m long grassy gently sloped bank. One pile in water, 2 piles up high in the bank
				398682	4074064	Scattered slash piles along the ditch and also up high in the bank
				398966	4074065	small slash pile adjacent to the river on the sand bar
				398614	4074099	4 x 4m and 2 x 8m near bank along the ditch
				399004	4074123	2 x 5m in dry shrub/BAHY area <5 m from the channel
				398818	4074218	3 small 3 x 6m on the high bank of the side channel
Tamarisk Resprouts	6-25	East		402723	4060516	7 resprouts in floodplain. Was in water with increased river flow. 2-4m tall.
	1-5			402219	4062564	3 resprouts 2-3m tall in floodplain
	1-5			402270	4062675	Resprout in flood plain. 2m tall
	1-5			402548	4063586	Resprouts (2) and new (3) plants 1.5-2.5m tall.
	26-100			402117	4064290	~30-40 TARA resprouts in general area of point 1-3m tall flowering.
	1-5			402104	4064460	1 plant ~8m SW of point, flowering. Area flooded @ TARA. More TARA resprouts 50m S .
	1-5			402175	4064594	Resprout 2m tall, flowering.
	1-5			401753	4065088	1 plant 3m tall, flowering.
	1-5			401405	4065686	1 plant 2m tall, flowers.
	1-5			401298	4065745	1 plant 2m tall, flowers.
	26-100			401250	4065899	Many plants in old oxbow. Resprouts & 1-3yr old plants.
	1-5			401083	4066161	1 plant 1.5m tall
	1-5			400892	4066351	1 plant ~2-3m tall ~10m S of point
	6-25			400783	4066721	~14 resprouts 1-2m tall, flowers. Some in dry meadow, some in marshy edge
	26-100			400921	4066807	~40 plants 1-2.5m tall. Flowers. All resprouts
	1-5			400670	4067045	resprout 3 m into water 2m tall flowers
	1-5			400693	4067092	resprout 2m tall, flowers
	1-5			400618	4067758	1.5m tall under SAGO
	1-5			400459	4067979	In wet meadow height = 1.5m
	1-5			400562	4068052	Resprout. Another TARA 25m SSW. Both about 2.5m high.
	1-5			400561	4068054	resprout 2-3m tall, flowering
	1-5			400266	4068321	Resprout
	1-5			400152	4068435	On margin of off-river pond. Height = 1m
	1-5			400191	4068447	2 plants on margin of off-river pond. Height = 2m (2nd plant on opposite bank)
	1-5			400207	4068524	On margin of off-river pond, resprout 1m height
	1-5			400102	4070075	5 TARA resprouts. 0.5-1m tall. Flowering.
	1-5			399894	4070525	3 resprouts in area cut along water's edge. ~2ft tall.
	1-5			399869	4070585	TARA resprout from one stump at this point. Resprouts ~1ft tall along water's edge.
	1-5			399224	4073391	1 2m resprout on edge of channel 240degrees from point.
	6-25			399022	4073746	Resprouts in marsh 185 degrees from point and in clump of SAEX SE from point.
	1-5			398915	4073972	1.5m tall
	1-5	West		400771	4066759	3 1-2m high resprouts on bank
	1-5			400570	4067403	2 1.5m tall TARA resprouts near bluff (100m from river)
	1-5			400458	4067684	5 2m tall resprouts on floodplain (75m from river)
	1-5			400454	4067745	1plant 2 m tall resprout on floodplain (50m from river)
	6-25			399985	4070391	9 2 to 3m tall resprouts on bank
	6-25			399837	4070415	18 2 m tall resprouts on floodplain (5 m from river)
	1-5			398722	4074025	resprouting from the center along the edge of the water. 3 resprouting around the corner (025)
				398703	4074034	Added by QC because observer indicated TARA from pt 024A to here.
	6-25			398682	4074064	resprouting along the edge of water
	26-100			398799	4074413	may not be seedlings >1' along the side channel
Tamarisk Seedling	1-5	East	1	402949	4059911	3 1-2m tall TARA_SEED.
	6-25		4	402645	4060318	All seedlings on bank of river. 0.5-2m tall.
	1-5		5	402724	4060515	5 TARA_SEED in flood plain. 1-2m tall
	6-25		46	400426	4068236	Plants in cattails 8m south of point. Plants to 1.5m height.

Table 4. cont'd. Detailed Information for Each RAS Observation – Reach 3

Woody Recruitment	1-5	East	23	401538	4065487	Recruitment on floating log CIDO, SAGO, TARA
	>100		44	400494	4068054	Leaves 2-3mm. Species? In mud bank under willow.
	1-5	West	21	401728	4065076	5 SAEX seedlings on sand bluff along river. 1=8" tall
	6-25		77	399362	4073231	Recently flooded sandbar with S.exigua, at waters edge all the way up to 5m away, 3-8in tall.
Woody Recruitment-Revisit	6-25	East	106	399346	4072712	SALA3 recruits 2-5ft tall in wetted side channel.
	6-25		107	399325	4072642	SALA3 recruits 1-4ft tall in side channel.
	26-100		108	399288	4072865	SALA3 recruits 1-4ft tall in wetted side channel.
	0		109	399461	4071866	SALA3 recruits missing, not found.
	1-5		110	399681	4071899	SALA3 recruits 1-1.5ft tall, browsed, hard to see in photo.
	>100		111	399401	4073356	SAEX plants now 1-3ft tall along wetted extent.
	1-5		114	400853	4067546	POFR 3m tall in PHAU7
	1-5		115	400766	4067479	No POFR found.
	6-25		116	400832	4067502	~ 15 SAEX saplings 1-2m tall.
	1-5		117	401768	4065430	Could only get within 26m of point. Area flooded. Atleast 3 SAGO visible. Island of meadow surrounded by Typha.
	6-25		118	402267	4063797	20 SAGO, 1 SALA6, 1 POFR2, 1 SALA3 all along river bank
	6-25		119	401224	4065775	Probably up to 25 SAGO 1.5-2.5m tall. Could only get 44m away, flooded meadow between me & SAGO.
	1-5		120	402168	4063837	3 POFR2, no SALA3 seen. Area in flooded spot with Typha & Juncus
	>100		121	400734	4066964	yes probably 100 or more SAEX 1-2m tall.
	>100		123	400896	4066661	lots of SAEX along edge of oxbow pond.
	0		126	402818	4060881	0 WDY left. Cleared out when measuring station was made.
	0		127	402806	4060896	0 WDY left. Taken out when making measuring station
	6-25		128	400391	4068264	No Reference photo in packet. Noted healthy willow on bank.
			129	400053	4068499	Best example of previous year's recruitment is SE 34m. (river willow)
	26-100		130	400077	4070194	SALA3 recruitment 1-2m tall for all plants. Area flooded with 6 inches of water. TARA recruitment in area too. ~25 plants. Pulled ~5.
			131	399883	4071832	Unable to access revisit point WDY-R_30 due to flooding. Calf-deep water surrounding point for 30m. Had to walk through water to get 30m away from point. Waders needed to access this point. Lots of oxbows.
	1-5	West	103	399808	4068617	1 cottonwood - still 2m high
	26-100		104	402688	4060574	approx. 6 SAGO <6in; 26-100 1+ SAGO's, moderate new recruitment <5 TARA seedlings (pulled)
	6-25		105	402649	4060700	6 1+ SAGO seedlings on floodplain w/1+ TARA (pulled) No new recruitment
	26-100		112	402205	4063765	Does not look to be greater than 100 plants. Approx. 10 Cottonwoods, approx. 50 willow. Did not have photo, county did this one last year
Wildlife		East		402871	4059774	Elk aural (splashing in water)
				402765	4059945	Visual of two mallards
				402661	4060002	Elk damage to SALA
				399919	4068596	Young coyote 150m to west of river.
				399960	4068961	OVV excrement on wetted finger off river at water's edge. Possible runway in photo 20100804_LF (3). Seed gathering evidence in photo 20100804_LF (2).
				399357	4073111	3 elk and obvious elk bedding down area near 20.9. 3 does and 3 juveniles
				398997	4074251	Great Blue Heron using small ditch @ mile 19.5
		West		402684	4060572	Great Egret fly-over
				402648	4060622	Great Blue Heron
				402706	4060746	White-faced ibis (4) ind. fly-over, no ibis in photo
				401226	4065523	Mallard brood in pond near bluff - connected to river by floodwater - Hen and 4 adult size young
				400942	4065924	Mallard brood - Hen and 3 young approx. 1.5 weeks old in oxbow - far from river - near bluff, photo of location
				400106	4069627	Flushed another Great Horned Owl
				400089	4069628	Photos of a Great Egret
				400110	4069824	Flushed a Great Horned Owl
				400090	4070306	Aroused sleeping bull Elk, photo of spot
				399820	4071274	2 large mouth bass 14", 1 carp 17"
				399257	4072128	4 large mouth bass 6-10", 6 carp 18"
				399247	4072938	Green Heron, black cap, cream colored neck, long yellow legs, long dark body, Mazourka

Reach 4

RAS Figure 7 shows the location of each RAS observation in Reach 4. RAS Table 5 contains details associated with each observation. Table 5 contains details associated with each observation. Two possible beaver dam sites were noted, both at the north end of the Islands area. The sound of falling water was heard, but no other impacts were noted. Two young Russian olive plants were seen at one location. Three road sites were documented, although specific impacts associated with these sites were not noted. While only 8 tamarisk slash piles sites were noted on the west side of the river, several of these observations involved more than 30 individual piles. Five tamarisk seedling sites were noted on the east side, with >100 seedlings at two of these (FID 8 and 12), and up to 100 seedlings at two other sites. Thirteen tamarisk resprout sites were recorded, most involving 1-5 plants. No woody recruitment sites were recorded in this reach. Wildlife observations in this reach included ducks and an observation noting prolific dragonflies.



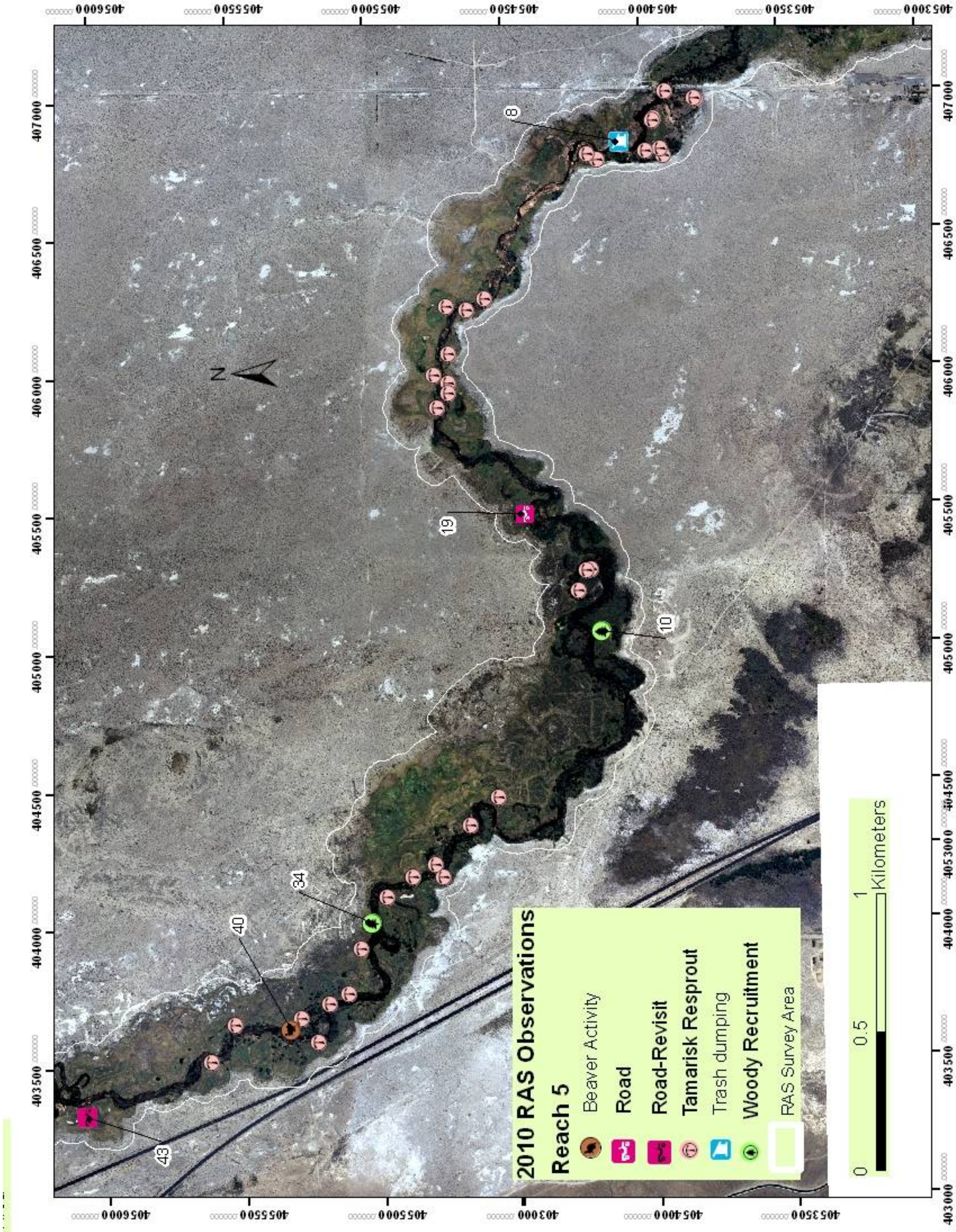
RAS Figure 7. 2010 RAS Observations in Reach 4

RAS Table 5. Detailed Information for Each RAS Observation in Reach 4

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Beaver Activity		East	29	403159	4059173	Audible running water upstream to above mentioned falls
			32	403051	4059348	Loud running water in tule patch (sounds like Haiku)
Russian Olive Seedling	1-5	East		403038	4059455	2 juvenile ELAN
Other		East		403532	4059004	2500 sf open pond
				403143	4059270	2000 sf open pond
Road		East	4	403863	4056824	Vehicle tracks leading into meadow. Tracks extend into meadow. From Bluff Rd.
			9	403948	4057204	Well established road, not on map, towards SE
			26	403874	4058580	Unauthorized road
Tamarisk Slash		West		403088	4056555	2 piles 3 x8m and 5 x 10m. Dry meadow and ATTO, 5m from the water.
				403289	4056621	in oxbow. Spread out along the oxbow. 100x10m. Some new TARA (~5ft) coming out (5~10) at the south end
				403196	4056635	in dried up pond inside the meander bend 3x10m
				403063	4057062	>30 piles in meadow spread along the channel and inland between 040-041 numerous old resprouts (see the map)
				403061	4057240	>30 piles in meadow spread along the channel and inland between 040-041 numerous old resprouts (see the map)
				402584	4057913	~30 piles scattered in the alkaline sink.
				402774	4058447	a few trees cut down in flooded grass area
				402622	4058488	028-029 approx 20 piles in dry open gallery forest
Tamarisk Resprouts	1-5	East		404305	4058109	Resprout, edge of tulle, H=1.5m (polygon to GPS pt 3)
	1-5			404284	4058173	Resprout edge of tulle H=0.5m
	1-5	West		403051	4056544	resprout ~ 6ft approx. 3m from water
	1-5			403968	4056879	TARA seedling next to well established seedlings. May be connected. Recently flooded edge
				403961	4056969	disturbed river edge. BAHY establishment ~37.4-37.5
				403134	4057390	numerous new (~6in) and old (>1ft) seedlings in water near big trees
	1-5			403130	4057797	Old resprouts from burned stumps ~5 stumps scattered
	1-5			402694	4057824	old (?) resprouts from burned stumps (x2)
	1-5			402815	4057939	old (?) resprouts from burned stumps (x3)
	6-25			402820	4058058	9 resprouts in DISP wet meadow
	1-5			402716	4058095	1 resprout
	1-5			402718	4058264	resprout approx 5 ft tall in DISP/SPAI wet meadow. Burned area. TARA resprouts are brown and dying. Some BAHY, ATSE establishment
	1-5			402592	4058567	028-029 two resprouting observed
Tamarisk Seedling	>100	East	8	404055	4057149	End polygon. Sprouts along waterline. Some additional sprouts next 150m S.
	6-25		10	403948	4057204	Sprouts at waterline (H=0.5)
	>100		12	404032	4057249	Sprouts in wet meadow; others along water line. Begin polygon.
	26-100		31	403144	4059270	Approx 30 juvenile < 1" dbh TARA
	26-100		37	403056	4059641	Abundent TARA juveniles & seedlings in saturated innerspaces between SPAI and DISP
Tamarisk Seedling-Revisit		West	38	403142	4057467	no seedling on the west side except very clumped well established TARA, numerous seedlings (>1plt) in the east side.
	26-100		39	403114	4057371	numerous juveniles (1ft-3ft) in the area (approx. 50m up and down) near cattail as well as among DISP approx. 5m from the water
Wildlife		East		403730	4058888	Hearing waterfowl
				403374	4059349	2 juvenile mallards
				402985	4059473	Prolific dragonflies
		West		402586	4059604	scat w/crustaceans (sp?)

Reach 5

RAS Figure 8 shows the location of each RAS observation in Reach 5. RAS Table 6 contains details associated with each observation. Beaver activity was noted on the east side of the river but impacts were not noted. Also on the east side, vehicle tracks in the meadow were noted. A road revisit site on the west side showed no continuing resource impacts. No tamarisk seedling sites were noted in this reach. Thirty-four tamarisk resprout sites were recorded, most involving 1-5 plants. Two woody recruitment sites were recorded, each with 6-25 seedlings observed. Wildlife observations in this reach included ducks, owls, and Great Blue Heron.



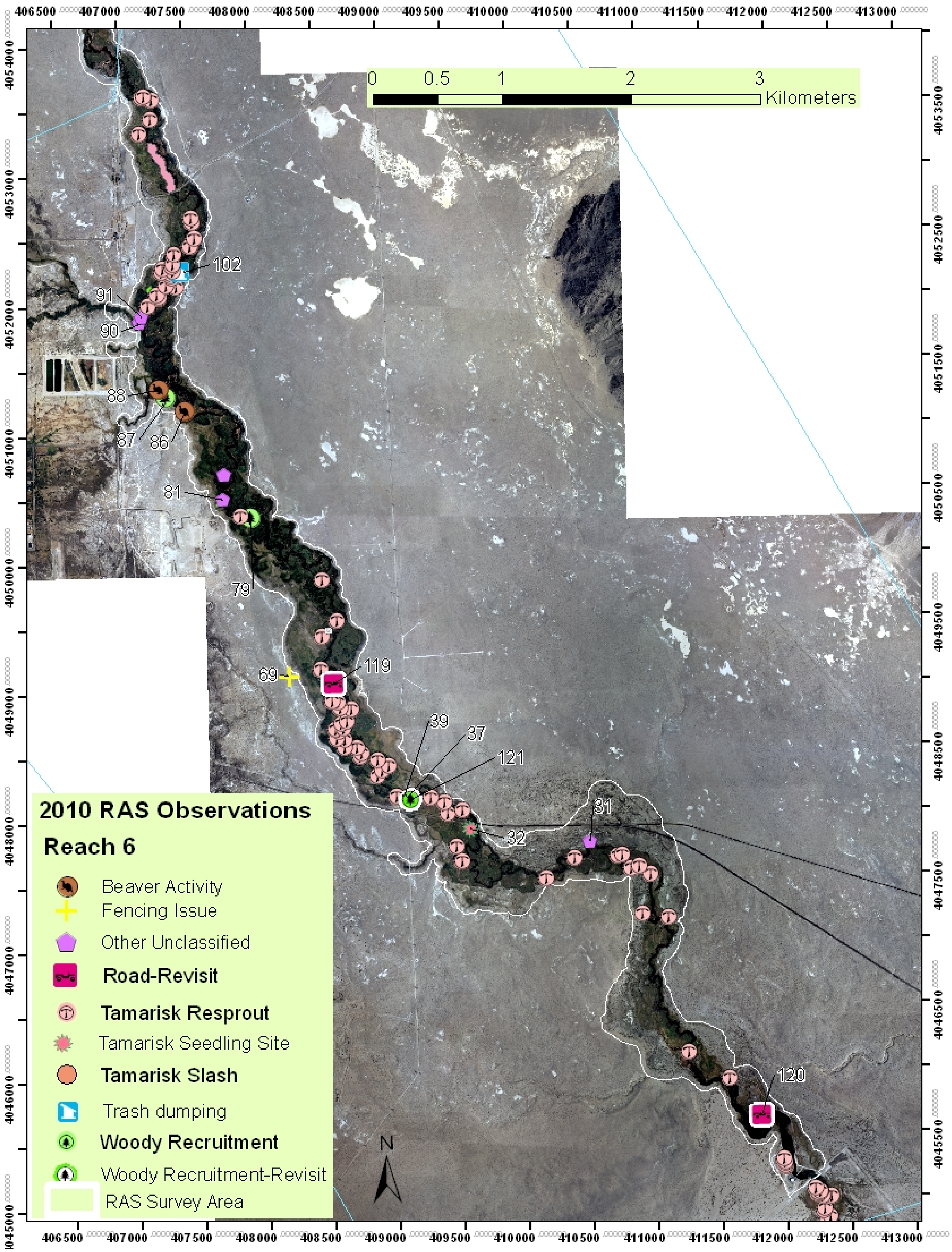
RAS Figure 8. 2010 RAS Observations in Reach 5

RAS Table 6. Detailed Information for Each RAS Observation – Reach 5

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Beaver Activity		East	40	403627	4055336	Beaver dam? A den and established runway leads towards "dam". Woodrat or OVV droppings present. Lots of holes in bank vicinity.
Road		East	19	405479	4054450	vehicle tracks in meadow
Road-Revisit		West	43	403323	4056083	road recently used, should not be a problem
Tamarisk Resprouts	1-5	East		405274	4054212	2 resprouts 2m tall. 1 at point another 20m N. Lots of GRSQ around waypoint also.
	1-5			405271	4054232	3 1.5m tall resprouts between 15 & 16. on bank
	1-5			405198	4054262	2 TARA resprouts. Lots of GRSQ nearby along oxbow
	1-5			404452	4054568	2: both 1.5m tall, in flood plain S of channel.
	1-5			406261	4054580	resprout burnt plant 2m tall, flowers
	1-5			404354	4054670	2: at point 1m tall, 130degrees, on edge of channel 2m tall.
	1-5			406237	4054718	resprout 3m tall, flowers
	6-25			405868	4054758	young plants 1-2m tall, flowering. 1 resprout 2.5m tall. GRSQ nearby
	1-5			405989	4054769	resprouted burnt plant 2m tall, flowers
	6-25			404213	4054800	6 visible from point towards 110degrees. 1-1.5m tall, between marsh and channel 3 more ~50m downstream.
	1-5			404170	4054883	2: 1.5m tall, 1m tall on bank
	1-5			403915	4055078	1 1.5m tall plant and 1 plant ~20m 215degrees, 0.5m tall, on bank.
	1-5			403753	4055123	4 resprouts between points 4 and 5 along river channel; 1 in floodplain. All plants 1-1.5m tall.
	1-5			403719	4055193	4 resprouts between points 4 and 5 along river channel; 1 in floodplain. All plants 1-1.5m tall.
	1-5			403665	4055299	1 2.5m tall, on bank
	1-5			403646	4055540	2: 1.5m tall : 15m S along river channel there are three established TARA near willow.
	1-5	West		406971	4053796	All (007-040) resprout from treated TARA
	1-5			406974	4053803	All (007-040) resprout from treated TARA
	1-5			407002	4053911	All (007-040) resprout from treated TARA
	1-5			406768	4053921	All (007-040) resprout from treated TARA
	1-5			406793	4053929	All (007-040) resprout from treated TARA
	1-5			406906	4053951	All (007-040) resprout from treated TARA
	1-5			406897	4053959	All (007-040) resprout from treated TARA
	1-5			406787	4053985	All (007-040) resprout from treated TARA
	1-5			406759	4054162	All (007-040) resprout from treated TARA
	1-5			406780	4054197	All (007-040) resprout from treated TARA
	1-5			406221	4054647	one resprout
	1-5			406063	4054714	one resprout
	1-5			405957	4054716	one resprout
	1-5			405923	4054719	Photo shows 2 resprouts from treated TARA. One is foreground, the other is background
	6-25			404167	4054772	7 plants, 2m tall
	1-5			404101	4054979	3 plants, 2m tall
	1-5			403578	4055241	1 plant, 2m tall
	6-25			403515	4055627	approx 10 plants, 1-3m tall
Trash		East	8	406820	4054077	Tan colored couch along bank. Not in water, about 5 feet from water.
Woody Recruitment	6-25	East	34	404007	4055034	SALA3 1-15cm tall plants in 40mx15m wet alkalai meadow, DISP, LETR and SCAM dominant. Pulled TARA in meadow.
	6-25	West	10	405049	4054176	approx. 20 seedlings under SAGO in dry oxbow bottom
Wildlife		East		405265	4054198	4 ducks in wider part of channel...large 6-8inch fish present too
				404626	4054225	Owl in willow in floodplain.
				405224	4054290	Panamint alligator lizard (possible) or riparian western fence lizard
				405057	4054300	Either 2 Great Blue Herons, or 1 GBH and 1 owl. "Owl" flew away, before I could identify.

Reach 6

RAS Figure 9 shows the location of each RAS observation in Reach 6. RAS Table 7 contains details associated with each observation. Two possible beaver dams were noted on the west side of the river, downstream of Lone Pine Creek. The sound of falling water was heard, but due to limited visibility in the area, no impacts were noted. A lower strand of the riparian fencing on the west side was unwound, possibly allowing young cattle to move in between the riparian pasture and adjacent uplands. A fire ring was seen adjacent to the Keeler Bridge Measuring station. No new road issues were documented, but the two road-revisit sites noted continued vehicular activity in the floodplain. Two tamarisk seedling sites were noted in this reach, both at disturbed sites upstream and downstream of the U.S. Highway 136 Bridge. Tamarisk resprouting was evident in this reach as 87 sites were recorded, most involving 1-5 plants. One discarded couch was seen on the east side of the river, below Lone Pine Narrow Gauge Road. Two woody recruitment sites were recorded on the west side, although due to the size of the seedlings observed, there is uncertainty as to the identity of the seedlings at one of these sites. Four of the observations classified as “Other” involved active *Salix exigua* recruitment sites, where recruitment appeared to be occurring by root-sprouting. Young willows persisted at the one woody recruitment site near the Keeler Bridge that was revisited. A number of wildlife were observed in this reach including Raccoon, Striped Skunk, Coyote, rails and other bird species. Most of the 16 wildlife observations noted damage to willows by Tule Elk from browsing or apparent antler rubbing. Bull, cow, and calf elk were observed in the area during the survey.



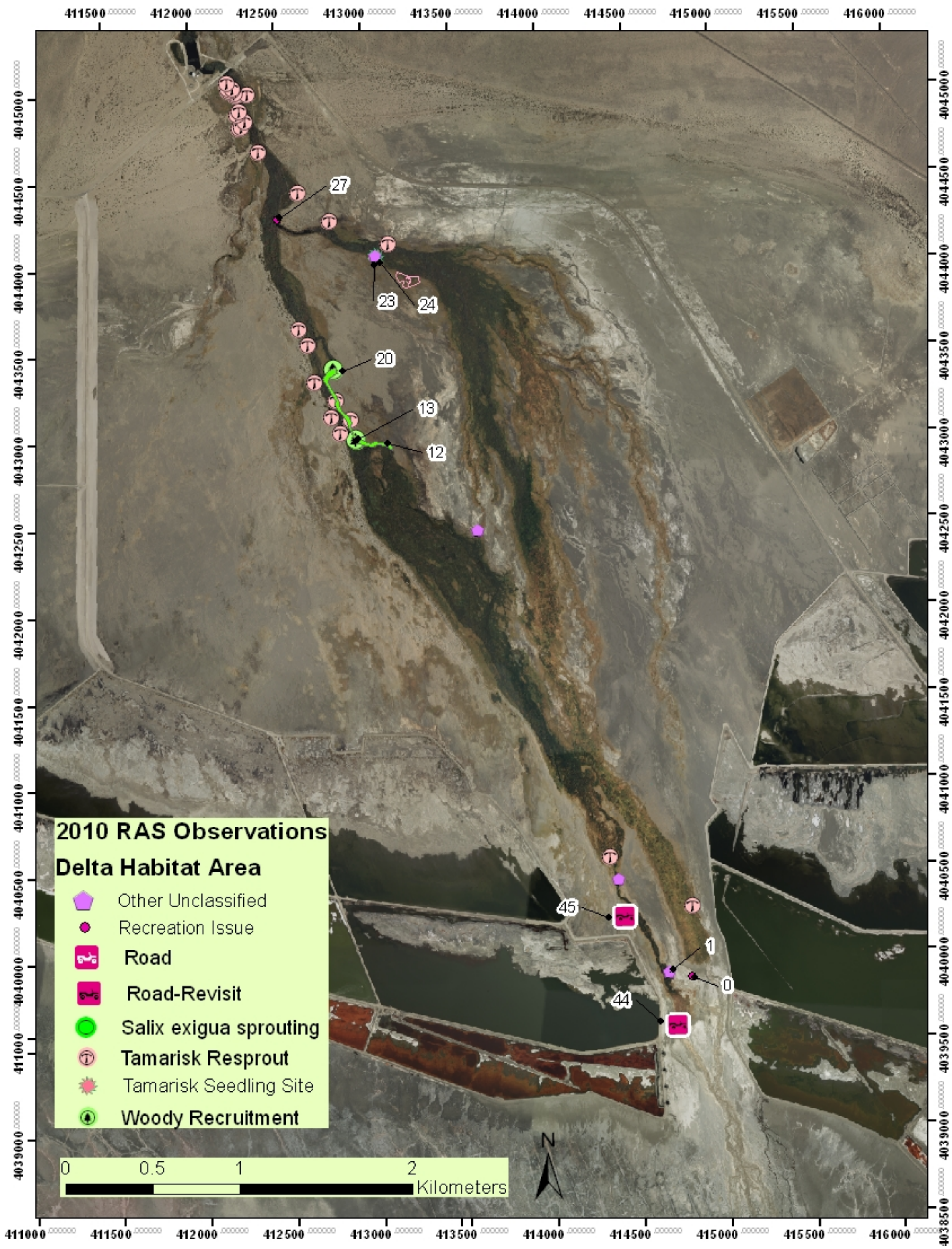
RAS Figure 9. 2010 RAS Observations in Reach 6

RAS Table 7. Detailed Information for Each RAS Observation – Reach 6

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Beaver Activity		West	86	407468	4051182	possible dam to the north ~30-40 m; hear water falling-can't see river; no obs. Problems
		West	88	407272	4051353	Falling water heard to east, cannot see river because of tall PHAU and typha
Fencing		West	69	408240	4049109	lower strand of riparian fence at walkthrough is cut or unwound. Should repair.
Other		East	31	410530	4047787	Big willow fell in river and made a small dam.
	>100	West	81	407753	4050494	Active SAEX resprout area; some browsing
	>100	West	82	407759	4050686	Active SAEX resprout resprout area being browsed by elk
	>100	West	90	407128	4051877	Active SAEX recruitment prob. By resprout; smallest plants ~ 12"
	1-5	West	91	407153	4051916	2 SAEX in grassy oxbow bench; active SAEX recruitment/ resprout area w/ many sapling age; gen area photo
Recreation		East	37	409116	4048163	1 fire ring by measuring station.
Road-Revisit		East	119	408569	4049054	Road still present. Trash and other signs of recent activity
		East	120	411807	4045646	Road is the same, has fresh tracks.
Tamarisk Slash		West		407455	4051173	Small sparse pile in on floodplain in alkali meadow (~10x3 m)
Tamarisk Resprouts	6-25	East		412338	4045012	resprouts plus few 2-3 year old plants. Plants range from 1.5-2 m tall, & flowering
	1-5	East		411571	4045936	TARA resprout in floodplain, 2m tall.
	1-5	East		411259	4046151	TARA resprout on edge of river, 2m tall.
	1-5	East		410909	4047596	4 TARA resprouts on edge of river, 1-3m tall.
	1-5	East		410774	4047690	1 resprout in floodplain, 2m tall.
	1-5	East		409550	4048060	TARA resprout on edge of river.
	1-5	East		409156	4048163	1 TARA resprout on edge of marsh, 2m tall.
	1-5	East		409121	4048165	1 TARA resprout, 2m tall. Under willow.
	1-5	East		408984	4048414	2 TARA resprouts, 1-2m tall.
	6-25	East		407419	4052146	7 TARA stumps resprouting in DISP meadow at this point. Regrowth 0.5-2m tall.
	1-5	West		412291	4044817	resprouts
	1-5	West		412304	4044822	resprouts
	1-5	West		412323	4044855	4 resprouts
	1-5	West		412276	4044893	1-2 plants resprouted
	1-5	West		412289	4044915	1-2 plants resprouted
	1-5	West		412276	4045007	1-2 plants resprouted
	1-5	West		412267	4045015	1-2 plants resprouted
	1-5	West		412235	4045033	1-2 plants resprouted
	1-5	West		412256	4045037	1-2 plants resprouted
	1-5	West		412233	4045042	1-2 plants resprouted
	1-5	West		412253	4045046	1-2 plants resprouted
	1-5	West		412222	4045074	1-2 plants resprouted
	1-5	West		411990	4045250	Area on rocks where TARA is located
	1-5	West		411989	4045258	Area on rocks where TARA is located
	1-5	West		411986	4045272	Area on rocks where TARA is located
	1-5	West		411984	4045280	Area on rocks where TARA is located
	1-5	West		411976	4045305	Area on rocks where TARA is located
	1-5	West		411128	4047193	Terrace
	1-5	West		410924	4047230	Terrace
	1-5	West		410181	4047512	Resprout - Terrace
	1-5	West		410988	4047531	Terrace
	1-5	West		410841	4047579	Channel
		West		409540	4047657	
	1-5	West		410408	4047672	Channel
	1-5	West		410743	4047676	Terrace
	1-5	West		409494	4047774	Veget. Terrace
		West		409428	4048034	
		West		409407	4048117	
	1-5	West		409304	4048162	channel
	1-5	West		409042	4048174	water edge (channel)
	1-5	West		408899	4048334	terrace resprout
	1-5	West		408928	4048376	terrace resprout
	1-5	West		408901	4048452	edge of water
	1-5	West		408771	4048487	terrace resprout
	1-5	West		408773	4048512	terrace resprout
	1-5	West		408742	4048553	terrace resprout
	1-5	West		408642	4048557	terrace resprout
	1-5	West		408644	4048617	terrace resprout
	1-5	West		408584	4048633	bank resprouts
	1-5	West		408603	4048683	terrace resprouts
	1-5	West		408576	4048702	terrace and bank
		West		408637	4048708	terrace resprouts
	6-25	West		408622	4048742	resprouts on terrace
	1-5	West		408668	4048764	resprout on terrace
	1-5	West		408708	4048857	resprout - bank
	6-25	West		408614	4048863	6 resprouts
	1-5	West		408603	4048910	resprout in oxbow (saturated)
	1-5	West		408558	4048921	On bank (resprout)
	1-5	West		408479	4049165	1 resprout to ~5' tall in meadow
	1-5	West		408493	4049419	1 resprout to ~5' tall in meadow
	1-5	West		408605	4049546	5 resprouts to 8' tall in alkali meadow
	1-5	West		408500	4049862	Resprout under a canopy of red willows ~3' high
	1-5	West		407881	4050364	one resprout in meadow among trees ~5' high
	1-5	West		407194	4052006	All (007-040) resprout from treated TARA
	1-5	West		407289	4052066	All (007-040) resprout from treated TARA
	1-5	West		407281	4052069	All (007-040) resprout from treated TARA
	1-5	West		407270	4052087	All (007-040) resprout from treated TARA
	1-5	West		407336	4052156	All (007-040) resprout from treated TARA
	1-5	West		407385	4052222	All (007-040) resprout from treated TARA
	1-5	West		407378	4052236	All (007-040) resprout from treated TARA
	1-5	West		407379	4052255	All (007-040) resprout from treated TARA
	1-5	West		407309	4052263	All (007-040) resprout from treated TARA
	1-5	West		407395	4052274	All (007-040) resprout from treated TARA
	1-5	West		407319	4052294	All (007-040) resprout from treated TARA
	1-5	West		407391	4052305	All (007-040) resprout from treated TARA
	1-5	West		407398	4052326	All (007-040) resprout from treated TARA
	1-5	West		407405	4052399	All (007-040) resprout from treated TARA
	1-5	West		407542	4052462	All (007-040) resprout from treated TARA
	1-5	West		407528	4052463	All (007-040) resprout from treated TARA
	1-5	West		407564	4052522	All (007-040) resprout from treated TARA
	1-5	West		407554	4052649	All (007-040) resprout from treated TARA
	1-5	West		407545	4052679	All (007-040) resprout from treated TARA
	1-5	West		407159	4053343	All (007-040) resprout from treated TARA
	1-5	West		407248	4053452	All (007-040) resprout from treated TARA
	1-5	West		407254	4053596	All (007-040) resprout from treated TARA
	1-5	West		407178	4053619	All (007-040) resprout from treated TARA
	1-5	West		407200	4053628	All (007-040) resprout from treated TARA
Tamarisk Seedling	1-5	East	39	409091	4048164	2 TARA seedlings, 0-2m tall.
	6-25	West	32	409602	4047909	beneath SALA overstory, saturated terrace, silty substrate
Trash		East	102	407448	4052261	Couch 150 feet from river along road that accesses river. Near river mile 44.3.
Woody Recruitment	>100	West	79	407954	4050346	Seedling of uncertain identity under mature SAGO. Trees on 10" wide area of barren muddy bank: Revisit to see if willow
	26-100	West	87	407316	4051294	Seeding under large SAGO trees and along muddy elk trail; d/t high plant diversity
Woody Recruitment-Revisit	6-25	East	121	409142	4048144	SAGO seedlings look good now 1m tall.
Wildlife		West		408584	4048631	Elk use of SALA
				408661	4048760	Elk browsing on SALA
				408682	4048820	Elk browsing SALA in several areas
				408682	4048820	Elk browsing SALA in several areas
				408614	4048864	Elk browsing - severe
				408607	4048881	Elk browsing in SALA grove
				408601	4048919	Elk browsing of SALA and POFR (lower plant in photo 3)
				408528	4048994	Heavy Elk browsing/antler scraping of willows-recent activity (0 cattle in area since early May)
				408522	4049152	family group of Ash-throated Flycatchers; mom and calf elk
				408564	4049746	Elk damage to young tree willow
				408490	4049979	Elk damage to tree willows; sev broken branches on ground; bull w/cows and calf bugling near
				408344	4049992	Family of Racoons (mom and 2 pups) moving through marsh and swimming across river
				408172	4050012	Elk damage to tree willows; several broken branches on ground
				407801	4050794	1 bull elk, ~10 cows and 2 calf, elk bedding down in alkali meadow
				407831	4051065	Clarks Nutcracker over river; very odd for August in valley; American Kestrel/Turkey Vulture
				407225	4051476	Coyote hunting at edge of marsh; virginai rails calling from marsh; lots of bull frogs
				407130	4051936	Ran from the raised tail of a Striped Skunk! Close call.

Delta Habitat Area

RAS Figure 10 shows the location of each RAS observation in the Delta Habitat Area. RAS Table 8 contains details associated with each observation. Areas of *Salix exigua* recruitment and root-sprouting were noted along the eastern side of the main channel of the river. Recreational impacts were noted along the east branch, at a fishing access site. Tire tracks on the playa noted at the south end of the delta are undoubtedly a result of dust control personnel traveling between dust control cells or to monitoring sites within the DHA. To date, tamarisk control in the DHA has been confined to the plants along the main river channel. Twenty-six tamarisk resprout sites were recorded, most with 1-5 plants, although one location noted up to 100 plants resprouting. Despite the large number of mature, untreated tamarisk in the area, tamarisk recruitment remains low, and only one site was recorded in 2010. Habitat indicator species use was observed in the DHA as 345 ducks, 70 White-faced Ibis, Virginia Rail, Killdeer, and Spotted Sandpipers were recorded during the survey of the east side of the river channel.



RAS Figure 10. 2010 RAS Observations in the Delta Habitat Area

RAS Table 8. Detailed Information for Each RAS Observation – Delta Habitat Area

Observation Type	# of plants	Bank	FID	Easting	Northing	Observation Notes
Other		East	1	414672	4039894	several channels coming off the main channel, directing flow to east -- contributing to eastward migration
				414391	4040434	standing water in side channel; first water seen at south end
				413620	4042467	Habitat photo showing small area of flooded playa
	>100		12	412942	4042987	active SAEX resprout/ recruitment area in dense wet meadow; see map
	>100		24	413063	4044058	SAEX and TARA resprout/ recruitment area in dense wet meadow
Recreation		East	0	414796	4039864	tire tracks evident on playa (driven when wet - now dry)
			27	412497	4044284	fishing access?? Vehicle traffic to E. of point in greasewood scrub. Recent tire tracks, sall trash items, cans, bottles, & fire ring
Road-Revisit		West	44	414709	4039584	has not received any traffic
			45	414418	4040219	has not received any traffic
Tamarisk Resprouts	6-25	East		414807	4040277	from point, south, many TARA resprouts in previously cut plants
	1-5			412899	4043122	4 resprouts - 4 feet tall
	1-5			412816	4043229	4 resprouts ~2 feet tall in dense meadow adjacent to marsh.
	6-25			413136	4044131	6-7 plants;1 more ~40m south at point (some small 4m to 1.5 m tall) & between this point & 004 ~5 dying plants not gps'd were approx 60m SE of 004
	6-25			412800	4044271	10 plants in vicinity of point, some seedlings & some shrubs to 2.5 m; addtnl plants ~ 40 to NE
	1-5			412618	4044438	single plant, 2.5 m tall, 2 wide
	6-25			412338	4045012	resprouts plus few 2-3 year old plants. Plants range from 1.5-2 m tall, & flowering
	1-5	West		414340	4040564	resprouts or never been treated
	6-25			412840	4043040	respouts and slash
	6-25			412787	4043135	resprouts and slash
	26-100			412695	4043341	respouts and slash
	1-5			412660	4043556	new growth
	1-5			412612	4043649	new growth
	1-5			412395	4044673	resprouts
	1-5			412291	4044817	resprouts
	1-5			412304	4044822	resprouts
	1-5			412323	4044855	4 resprouts
	1-5			412276	4044893	1-2 plants resprouted
	1-5			412289	4044915	1-2 plants resprouted
	1-5			412276	4045007	1-2 plants resprouted
	1-5			412267	4045015	1-2 plants resprouted
	1-5			412235	4045033	1-2 plants resprouted
	1-5			412256	4045037	1-2 plants resprouted
	1-5			412233	4045042	1-2 plants resprouted
	1-5			412253	4045046	1-2 plants resprouted
	1-5			412222	4045074	1-2 plants resprouted
Tamarisk Seedling	>100	East	23	413063	4044058	SAEX and TARA resprout/ recruitment area in dense wet meadow
Woody Recruitment	26-100	East	13	412924	4043002	sapling age plus new plant; dense wet meadow
	1-5		20	412803	4043407	2 SAEX from this year on higher, drier site; >100 SAEX sprouts/saplings in wet meadow next to marsh
Wildlife				414379	4040469	Virgina Rail feeding at edge of marsh near open water on main channel
				413626	4042482	small fry and/or mosquito fish in shallow side channel with open sedge
				413551	4042499	flock of 30 White-faced Ibis foraging in flooded meadow
				413394	4042525	150 Mallard, 1 Cinnamon Teal, 3 Spotted Sandpiper, 6 Killdeer, 40 more ibis flushed from shallow pond; photo of pond. Tons of fish in shallow waters around lots of recent elk activity.
				413505	4042536	Mountain Lion tracks headed toward marsh!
				412986	4042972	Pond at mile 54.8, 180 Mallard, 6 Gadwall, 8 Cinnamon Teal, Virginia Rail, Marsh Wren; Bass
		West		412708	4043385	Mallard and possible wigeons in pond area 100-200 flushed as I walked up. No picture
				412391	4044676	Mourning Dove nest

Blackrock Waterfowl Management Area and Off-River Lakes and Ponds

RAS Figure 11 shows the location of each RAS observation in the BWMA and Off-River Lakes and Ponds. RAS Table 9 contains details associated with each observation.

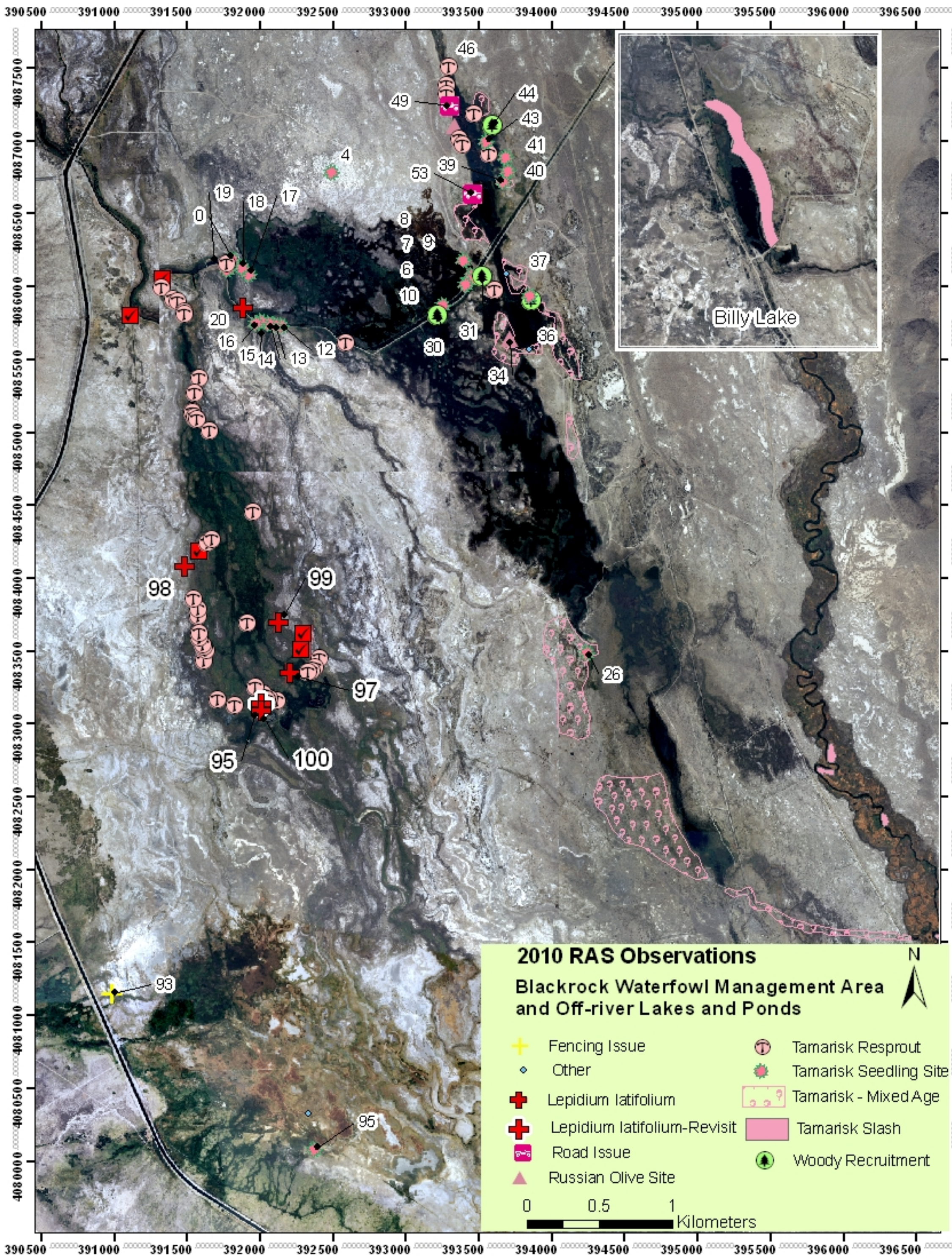
In the Drew Management Unit, one previously undocumented *Lepidium latifolium* site was located. Heavy tamarisk recruitment is occurring in the Drew Unit as many seedlings and or saplings were located. Areas of recruitment included three sites with >100 young plants, three sites with up to 100 plants, while the remaining 16 sites supported up to 25 young and or seedling tamarisk. Habitat indicator species use included sightings of a young Mallard brood, and shorebird species. Owens Valley Vole runways and droppings have also been seen in this unit during wetland avian monitoring surveys.

In the Thibaut Management Unit, a fence in disrepair was noted, a tamarisk seedling site was found, and evidence of Tule Elk activity was seen.

In the Waggoner Unit, many tamarisk plants burned during the prescribed fire in this area are resprouting. Tamarisk recruitment is also occurring, primarily along the eastern and southwestern edge of the unit as seedlings and mixed aged stands (including saplings) were noted. Some woody recruitment was seen along the Blackrock Ditch at the north end of the unit. Habitat indicator species including herons, egrets, bitterns and rails were seen during the survey.

In the Winterton Unit, four *Lepidium latifolium* sites were found. These sites are near previously known locations, so it is unclear if these are new populations or not. There are as many as nine point locations of *Lepidium* that have been documented in the Winterton Unit (see Figure). Due to the dense nature of the vegetation, and the varying topography, it is expected that finding *Lepidium* plants in this unit will be challenging. Thirty-six tamarisk resprout sites were documented, all with 1-5 plants in the area. Owens Valley Vole runways were also noted in this unit during wetland avian monitoring surveys, and Tule Elk were observed during the RAS survey.

In the Off-river Lakes and Ponds, Russian olive recruitment, some road issues, tamarisk slash, and tamarisk recruitment were noted. A Russian olive recruitment site with two seedlings was seen in the Twin Lakes area. Russian olive plants burned during the prescribed fire in this area are resprouting. Two fishing access points and associated tire tracks on meadow vegetation and soil compaction were noted at Twin Lakes. Heavy tamarisk recruitment was found at Twin Lakes, Goose Lake, and along the Goose Lake Fish Corridor. Tamarisk plants burned during the prescribed fire in this area are resprouting. Owens Valley Vole sign was seen in the Twin Lakes areas. At Billy Lake (see inset photo), 30-40 tamarisk slash piles were seen east of the lake.



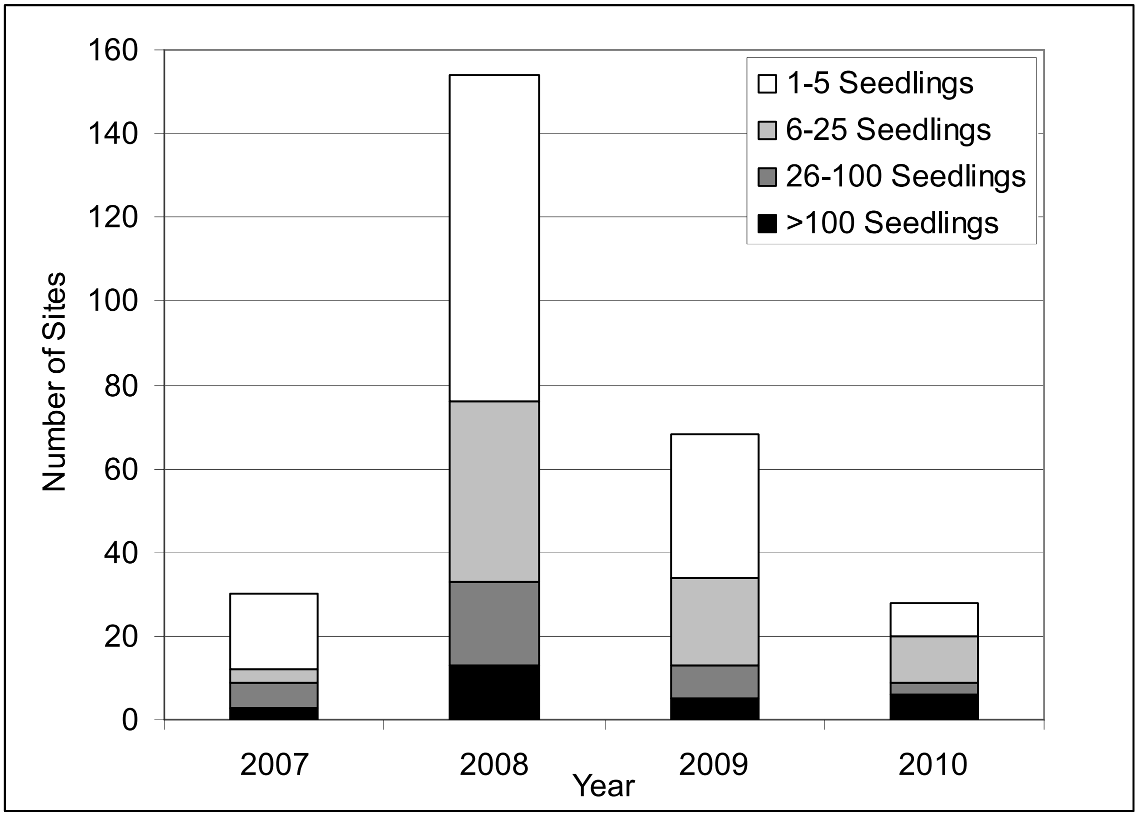
RAS Figure 11. 2010 RAS Observations in the BWMA and Off-River Lakes and Ponds

RAS Table 9. Detailed Information for Each RAS Observation
Blackrock Waterfowl Management Area and Off-River Lakes and Ponds

Management Area	Observation Type	# of plants	FID	Easting	Northing	Observation Notes
Drew	*Lepidium latifolium*		20	391879	4085855	Large patch of pepperweed
	Tamarisk Resprouts	6-25		392587	4085619	Saplings and resprouts
		6-25		391772	4086162	Seedlings and saplings
	Tamarisk Seedling	1-5	0	391807	4086195	4 TARA seedlings + 1 12.5" black willow
		1-5	4	392494	4086790	1 seedling
		>100	6	393396	4086181	Seedlings and saplings along edge of flooded area.
		6-25	7	393455	4086085	Group of TARA saplings on road edge
		1-5	8	393433	4086050	Group of TARA saplings on road edge
		26-100	9	393409	4086022	Line of saplings along road
		1-5	10	393259	4085878	TARA sapling on road edge
		26-100	12	392151	4085738	Seedlings and saplings
		1-5	13	392103	4085742	Sapling
		6-25	14	392062	4085753	Saplings
		1-5	15	392008	4085771	Saplings
		>100	16	391974	4085755	Large area of saplings
		6-25	17	391931	4086092	Seedlings and saplings
		>100	18	391883	4086136	Line of seedlings and saplings along canal
		26-100	19	391780	4086121	Seedlings and saplings
	Wildlife			392253	4086429	Mallard brood (10 - 2wk old young still in downy plumage) photo of area
				392674	4086467	4 agitated Black-necked Stilt circling me. Must be breeding here. Photo of area.
				392566	4086564	8 Least Sandpipers
				392634	4086808	2 Wilson's Snipe foraging in water + 4 agitated Black-necked Stilt
Thibaut	Fencing		91	390983	4081155	Fence in bad shape; If a cow wanted, it could get through; only 2 strands wide
	Other			392331	4080330	Four inches of water at waypoint
	Tamarisk Seedling	1-5	93	392373	4080085	Four seedlings and alot more mature plants in area
	Wildlife			391181	4080769	Elk rub
Waggoner	Tamarisk Resprouts	1-5		393611	4085984	2 resprouts
		26-100		393611	4085984	appx 100 resprouts
	Tamarisk Seedling	>100	26	394241	4083492	>100 Resprouts. Also 100 1 year-old seedlings
	Woody Recruitment	1-5	30	393219	4085804	1 SAEX seedling, <1 year 100+ 1 year old seedlings SAEX
		1-5	31	393520	4086071	2 SAEX seedlings, <1year. 50 1yr + seedlings SAEX, 6-8in tall
	Wildlife			393611	4085984	Great Blue Heron
				393611	4085984	American Bittern flew off. Missed it in photo.Took photo of habitat; White-faced Ibis
				394023	4083754	Great Egret
				394021	4083760	Black-necked Stilt
				393219	4085115	heard Sora; Northern Harrier
Winterton	*Lepidium latifolium*	6-25	98	391478	4084078	Found during wetland bird survey; in meadow with shrubs; ~1100 m north of east-west road at south end of Winterton
		26-100	97	392204	4083353	Found during wetland bird survey; near edge of flooding basin; 32 m from access road; roesettes to fruiting
			99	392124	4083692	Found during wetland bird survey
			100	392009	4083094	Found during wetland bird survey
	Lepidium latifolium -Revisit	0	95	392007	4083137	No photo available. Searched area and found NO LELA2 plants. Re-located apr. point and photographed site.
		0	96	403114	4057371	No photo available. Searched area and found NO LELA2 plants. Re-located apr. point and photographed site.
	Tamarisk Resprouts	1-5		391326	4085999	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391402	4085919	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391433	4085905	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391479	4085835	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391483	4085818	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391581	4085374	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391555	4085276	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391537	4085152	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391532	4085142	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391550	4085107	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391564	4085094	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391655	4085017	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391952	4084457	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391912	4083696	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392405	4083454	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392374	4083386	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392350	4083366	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392328	4083359	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392117	4083165	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392062	4083181	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392026	4083210	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		392044	4083168	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391967	4083258	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391826	4083127	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391708	4083172	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391615	4083435	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391632	4083509	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391618	4083534	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391607	4083550	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391586	4083597	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391586	4083623	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391576	4083745	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391577	4083786	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391543	4083864	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391635	4084243	Lots of resprouts. Mostly 1-5 plants per GPS point.
		1-5		391669	4084269	Lots of resprouts. Mostly 1-5 plants per GPS point.
	Wildlife			391931	4084293	One large bull elk within 300m, SW of GIS point along western edge of Winterton Unit.
				391874	4083347	Owens Valley Vole runways seen during wetland bird survey
Twin Lakes	Russian Olive Seedling	1-5	34	393711	4085639	2 seedling scattered among big trees/shrubs along the edge
		1-5	50	393337	4087102	Big resprouts from the burn (2)
	Other			393848	4085571	Alkali Cordgrass - SPGR
				393685	4086092	Alkali Cordgrass - SPGR
	Road		49	393299	4087243	Access point for fishing various tire tracks on vegetation/clear road/tracks toward N
			53	393460	4086640	Fishing access point. Sign of fire. Compacted.
	Tamarisk Resprouts	1-5		393567	4086916	Resprouts from the burned stumps
		26-100		393466	4087187	Resprouts from burned trees. SAGO also resprouting.
		>100		393293	4087510	Lots of older seedlings >1ft + resprouts from burns extending 100m north
		1-5		393281	4087388	Resprouts from the burn. 20m south ELAN /SAGO resprouts.
		1-5		393276	4087325	3 TARA (2 big shrubs/1 juvenile) only 3 in vicinity
		1-5		393363	4087015	2 resprouts along the edge
		1-5		393386	4086976	1 resprout along the edge (>3ft)
	Tamarisk Seedling	26-100	37	393853	4085944	Lots of 2yr seedlings (<1ft but woody)
		26-100	39	393669	4086724	Seedlings >1ft in the wetted finger ELAN/TARA are reproducing
		>100	40	393701	4086799	Lots of older seedlings/resprouts in a large wetted area
		>100	41	393690	4086891	Lots of older seedlings/resprouts in a large wetted area. 2 young POFRs in the finger
		26-100	43	393554	4087005	All around intruding fingers, TARA older seedlings (>1ft) esp. south side
	Woody Recruitment	1-5	36	393861	4085906	Young POFR, 1 among MEAL
		1-5	44	393595	4087112	~2 SAEX seedlings. Some are Aster spp. (Conyza spp?) need confirmation
	Wildlife			393614	4086130	Owens Valley Vole droppings and a tunnel
				393630	4086060	Owens Valley Vole droppings and no tunnel

5.4.3 Comparison of Woody Recruitment and Tamarisk Seedlings Sites Between Years

RAS Figure 12 shows the total number of woody recruitment sites in the Riverine-Riparian Management Area in each abundance category by survey year. The total number of woody recruitment sites observed in 2010 was comparable to 2007, but well below that observed in 2008 and 2009. RAS Table 10 shows the results of a Chi-square analysis comparing the proportion of sites in each abundance category across years. Although the total number of woody recruitment sites observed has varied yearly, the proportional abundance of observations in each abundance category has not varied significantly year-to-year.



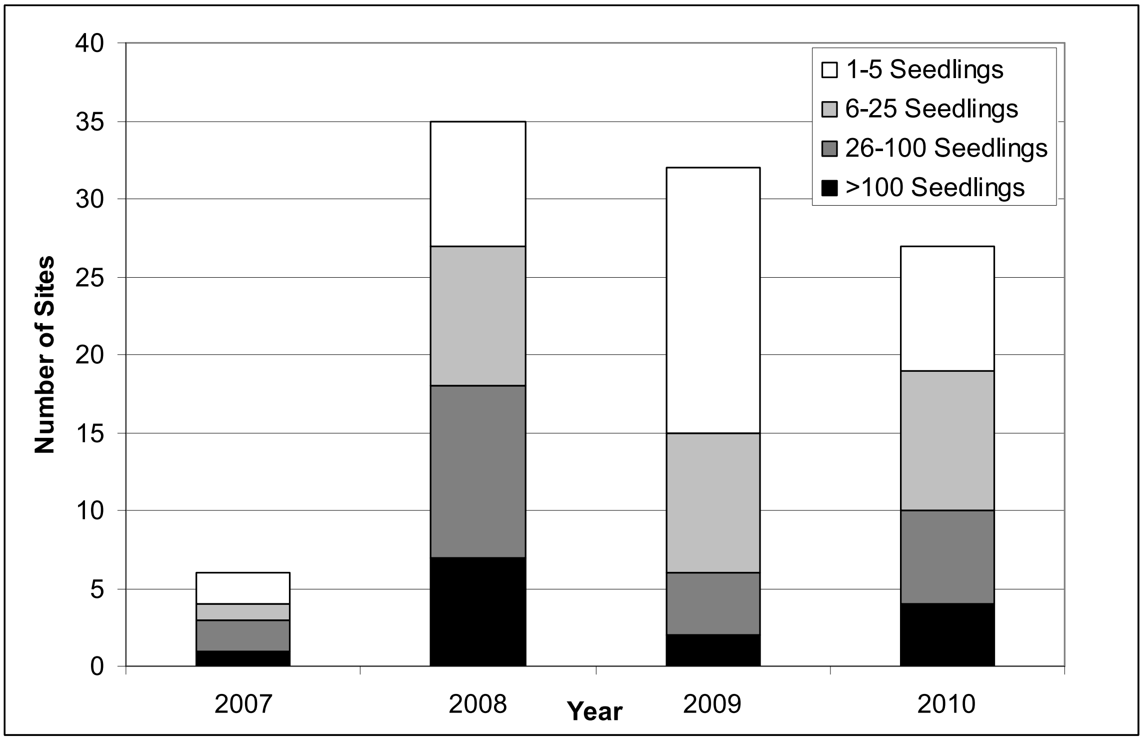
RAS Figure 12. Comparison of the Total Number of Woody Recruitment Sites per Year in the Riverine-Riparian Management Area by Abundance Category

RAS Table 10. Chi-squared Results Comparing the Proportion of Woody Recruitment Sites in Each Abundance Category Across Years

	2007		2008		2009		2010	
Seedling Abundance	Observed	Expected	Observed	Expected	Observed	Expected	Observed	Expected
1-5 Seedlings	18	*14.8*	78	*75.9*	34	*33.5*	8	*13.8*
6-25 Seedlings	3	*8.4*	43	*42.9*	21	*18.9*	11	*7.8*
26-100 Seedlings	6	*4.0*	20	*20.4*	8	*9.0*	3	*3.7*
>100 Seedlings	3	*2.9*	13	*14.9*	5	*6.6*	6	*2.7*

X = 14.1
DF=9
alpha 0.118757

RAS Figure 13 shows the total number of tamarisk recruitment sites in the Riverine-Riparian Management Area in each abundance category by survey year. The total number of tamarisk recruitment sites has been similar the last three years. RAS Table 11 shows the results of a Chi-Square analysis comparing the proportion of sites in each abundance category across years. Although the total number of tamarisk recruitment sites observed has varied yearly, the proportional abundance of observations in each abundance category has not varied significantly year-to-year.



RAS Figure 13. Comparison of the Total Number of Tamarisk Seedling Sites per Year in the Riverine-Riparian Management Area by Abundance Category

RAS Table 11. Chi-squared Results Comparing the Proportion of Tamarisk Seedling Sites in Each Abundance Category Across Years

	2007		2008		2009		2010	
Seedling Abundance	Observed	Expected	Observed	Expected	Observed	Expected	Observed	Expected
1-5 Seedlings	2	*2.1*	8	*12.3*	17	*11.2*	8	*9.5*
6-25 Seedlings	1	*1.7*	9	*9.8*	9	*9.0*	9	*7.6*
26-100 Seedlings	2	*1.4*	11	*8.1*	4	*7.4*	6	*6.2*
>100 Seedlings	1	*0.8*	7	*4.9*	2	*4.5*	4	*3.8*

X = 10.5
DF=9
alpha 0.3087

5.5 Summary of 2010 RAS Observations

Evidence of beaver activity continues to be minimal in the LORP, and confined to the more downstream reaches. Dams and ponded water are being noted, but tree damage has not been reported. The only area where a cut bank or bank erosion has been reported is in Reach 2, the “dry incised” floodplain. Russian olive plants persist in the LORP, but recruitment is limited. The locations of fencing issues will be evaluated by LADWP Watershed Resources Staff, and repaired as necessary to prevent unwanted livestock or vehicular access. *Lepidium latifolium* is spreading in Reaches 2 and 3, as nine previously undocumented sites were discovered during RAS. *Lepidium* has only been found in the Winterton and Drew Units of BWMA to date, however several patches now exist at Winteron. Most of the known patches are fairly small in size. Due to the dense, tall nature of vegetation in many of these areas, especially Reach 2, Drew and Winterton, and parts of Reach 3, small patches or non-flowering plants may be easily overlooked. AgComm is continuing their weed surveillance and eradication efforts, and RAS staffs continue to assist in the effort by detecting additional *Lepidium* locations. Although the effort among staff was not uniform, some observers noted areas of *Salix exigua* root-sprouting. These areas of root-sprouting are contributing to localized increases in woody riparian vegetation, and are likely supported by LORP flows, but may not be detected by larger-scale mapping efforts. *Salix exigua* can provide an understory and mid-story component to the woody riparian system. The total number of woody recruitment sites was less than in the previous two years, and the majority of the high abundance sites were confined to unvegetated muddy areas directly beneath large willow trees. The timing of this year’s RAS relative to the timing of the LORP Seasonal Habitat Flow may have contributed to a decrease in the number of woody recruitment sites detected this year. The 2010 Seasonal Habitat Flow occurred a full month later this year (timed with catkin readiness), as flows initiated on June 25, peak releases from the aqueduct on June 30, and a return to base flow conditions at all stations by July 20. The 2010 RAS took place a week earlier than in 2009, which should be of no consequence, except this resulted in a reduced amount of time between Seasonal Habitat Flow and RAS, as compared to previous years. The seedlings that were located were quite small – many less than 2 cm high. Thus, is it possible that some woody recruitment sites were overlooked due to the small size of seedlings as a result of the short time frame between favorable seed germination conditions created by the Seasoanl Habitat Flow and the RAS survey window. Road issues persist in Reach 1, where vehicles are still accessing some of the pre-project, channel-clearing roads that were rehabilitated after the construction activities. Other road issues involve previously-existing roads now consistently muddy and may need rerouting. Many sites involved what appeared to be single-time use by vehicles, and thus no action may be required at this time. Recreation issues were limited, however the fire ring at the Keeler measuring station may be removed. In the DHA, recreation site FID 27 may need to be further assessed, as there is a fire ring, and continuing evidence of vehicles getting stuck in loose sand at this fishing access site. Most tamarisk recruitment is taking place in Reach 2, along the Goose Lake Fish Corridor, and in the Drew and Waggoner Units of BWMA. Observations of Owens Valley Voles or sign in areas of former dry channel (Reach 2 and 3) is encouraging and indicates colonization of this portion of the river that seemingly supported little suitable under preproject conditions. Opportunistic sightings of waterbirds and larger mammal species confirm use by these groups. Elk damage to woody riparian vegetation in the riverine/riparian management area east of Lone Pine may require further evaluation.

5.6 References

Whitehorse Associates. 2004. *Lower Owens River Riparian Vegetation Inventory - 2002 Conditions.* Prepared for Los Angeles Department of Water and Power and Inyo County Water Department.

6.0 LANDSCAPE VEGETATION MAPPING

Purpose

The purpose of the Landscape Scale Vegetation Mapping is to provide managers with a landscape scale measurement of the riverine-riparian vegetation. This assessment will accurately monitor the entire project area. Landscape vegetation mapping provides information for decision making for the Seasonal Habitat Flows, Terrestrial Habitat, Riverine-Riparian Habitat, Tule/Cattail Control, Exotic/Invasive Plants, Range Condition and Recreation.

6.1 Baseline Mapping

The LORP Monitoring and Adaptive Management Plan (2008) states:

> *"Remote imagery (satellite and/or aerial photographs) will be acquired and interpreted to produce a digital vegetation/habitat map of the entire LORP area. Extensive field surveys were conducted in 2002 so that the remote imagery can be interpreted using the "photographic signatures" of the various vegetation types found on the ground. The map will be analyzed using a Geographic Information System (GIS) software to measure large-scale vegetation trends, describe habitat extent and distribution, document tule development, beaver dams, and open water areas. Remote imagery will be acquired during the growing season in the 2nd, 5th, 7th, 10th, and 15th years after initial flow releases. Imagery will be collected between June and September, dependent on weather and satellite conditions*."

Thus, in 2004, White Horse and Associates (WHA) mapped the baseline conditions of the LORP from high-resolution digital orthophotos. For a complete description please refer to the *Lower Owens River Riparian Vegetation Inventory 2000 Conditions* (WHA 2004a) and the *Blackrock Waterfowl Management Area and Vicinity Vegetation Inventory 2000 Conditions* (WHA 2004b).

6.2 Classification

The selection of the vegetation classes, or habitat types, used for the 2009 mapping effort was based on the *Lower Owens River Riparian Vegetation Inventory 2000 Conditions* (WHA 2004a) and the *Blackrock Waterfowl Management Area and Vicinity Vegetation Inventory 2000 Conditions* (WHA 2004b) vegetation classes. Nomenclature developed during that mapping effort was followed as closely as possible. Vegetation Mapping Table 1 provides a crosswalk between the two mapping efforts.

Vegetation types were distinguished by community physiognomy and species composition. Species nomenclature was adopted from Hickman (1994).

> **Marsh:** This herbaceous vegetation type occurred on saturated floodplains and in isolated depressions on terraces. Dominant plants included cattail (*Typha* spp.) and hard-stem bulrush (*Schoenoplectus acut*us). Three-square bulrush (*Schoenoplectus pungens*), salt marsh bulrush (*Schoenoplectus maritimus*), common reedgrass (*Phragmites australis*), Baltic rush (*Juncus balticus*), Parish spikerush (*Eleocharis parishii*) and yerba-mansa (*Anemopsis californica*) may also be present. Widely scattered, decadent Goodding willow (*Salix Gooddingii var. variabilis*) and red willow (*Salix laevigata*) were present in some parcels. Total vegetative cover exceeded 85%. Surfaces were typically flooded to a depth of 0 to 18 inches. Inclusions of water, reedgrass, and transitions to wet alkali meadow were common.

Wet Alkali Meadow: This herbaceous vegetation type occurred on floodplains and terraces with high water tables or areas that were sub-irrigated. Dominant plants included saltgrass (*Distichlis spicata*), creeping wildrye (*Leymus triticoides*), Baltic rush (*Juncus balticus*), beaked spikerush (*Juncus rostellata*), three-square bulrush (*Schoenoplectus pungens*), sunflower (*Helianthus* sp.), and clustered field sedge (*Carex praegracilis*). Nevada saltbush (*Artriplex lentiformis, torreyi*) and rubber rabbitbrush (*Ericameria nauseosus*) were often present. Scattered saltcedar (*Tamarix ramosissima*) and tree willow (*Salix Gooddingii* and *S. laevigata*) were present in some parcels. Total vegetative cover was typically greater than 80%.

Reedgrass: This herbaceous vegetation type occurred on floodplain and low terrace with high water table. Reedgrass (*Phragmites australis*) formed a thick monoculture. Reedgrass communities were often small and difficult to distinguish on the imagery; they were often included in marsh and wet meadow parcels.

Dry Alkali Meadow: This herbaceous vegetation type occurred on the low terrace land type with low water table and high terraces with very low water table. Saltgrass (*Distichlis spicata*) was dominant; alkali sacaton (*Sporobolus airoides*) and creeping wildrye (*Leymus triticoides*) were present. Total vegetation cover was typically greater than 50%.

Irrigated Meadow: This herbaceous vegetation type occurred on the high terrace land type along the western edge of the mapping area. Vegetation was sustained by irrigation and includes both introduced pasture grasses and native species.

Riparian Shrub (willow): This tall shrub vegetation type occurred primarily on floodplain and low terrace land types with high water table. A dense thicket of coyote willow (*Salix exigua*) dominated the overstory. Creeping wildrye (*Leymus triticoides*) and saltgrass (*Distichlis spicata*) were prominent in the understory.

Tamarisk: This tall shrub vegetation type occurred primarily on floodplain with high to low water tables and on high terrace with very low water table. A dense to open overstory canopy was dominated by tamarisk (*Tamarisk ramosissima*); Russian olive *(Elaeagnus angustifolia*), Goodding willow (*Salix Gooddingii*), red willow (*Salix laevigata*), and Fremont cottonwood (*Populus fremontii*) may be present in some parcels. Dominant low shrubs included rubber rabbitbrush (*Ericameria nauseosus*) and Nevada saltbush (*Atriplex lentiformis, torreyi*). Herbaceous vegetation was very sparse.

Riparian Forest (tree willow): This forested vegetation type occurred on saturated floodplains and terrace with low to high water tables. The prominent overstory species was Goodding willow (*Salix Gooddingii*); red willow (*Salix laevigata*). Russian olive (*Elaeagnus angustifolia*), tamarisk (*Tamarix ramosissima*), and Fremont cottonwood (*Populus fremontii*) may be present in some parcels. Hard-stem bulrush (*Schoenoplectus acutus*), Olney bulrush (*Schoenoplectus americanus*), three-square bulrush (*Schoenoplectus pungens*), common reed (*Phragmites australis*), southern cattail (*Typha domingus*), and water parsnip (*Berula erecta*) were prominent in the understory on the floodplain sites. The prominent herbaceous species were creeping wildrye (*Leymus triticoides*), saltgrass (*Distichlis spicata*), and yerba-mansa (*Anemopsis californica*) were present on the terrace sites; average total herbaceous cover was about 80%.

Riparian Forest (cottonwood): This forested vegetation type occurred on saturated floodplains and terrace with low to high water tables. The prominent overstory species was Fremont cottonwood (*Populus fremontii*) is prominent in the overstory. Hard-stem bulrush (*Schoenoplectus acutus*), Olney bulrush (*Schoenoplectus americanus*), three-square bulrush (*Schoenoplectus pungens*), common reed (*Phragmites australis*), southern cattail (*Typha domingus*), and water parsnip (*Berula erecta*) were prominent in the understory on the floodplain sites. The prominent herbaceous species were creeping wildrye (*Leymus triticoides*), saltgrass (*Distichlis spicata*), and yerba-mansa (*Anemopsis californica*) were present on the terrace sites; average total herbaceous cover was about 80%.

Rabbitbrush-NV Saltbush Series Meadow: This low shrub vegetation type occurred primarily on low terraces with low water table. These communities are transitional to rabbitbrush/NV saltbush scrub communities on the dryer sites and are transitional to Dry Alkali Meadow on the wetter side. The dominant low shrubs were Nevada saltbush (*Atriplex lentiformis, torreyi*) and rubber rabbitbrush (*Ericameria nauseosus*); greasewood (*Sarcobatus vermiculatus*) was present in some parcels. Total average shrub cover was variable, but averaged 40%. Saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), Torrey seepweed (*Sueda moquinii*), and creeping wildrye (*Leymus triticoides*) were prominent herbaceous plants; average total herbaceous cover was 50%.

Rabbitbrush-NV Saltbush Scrub: This low shrub vegetation type occurred on high terrace and eolian land types, both with very low water table. The dominant shrubs were Nevada saltbush (*Atriplex lentiformis* ssp. *torrey*i) and rubber rabbitbrush (*Ericameria nauseosus)*; the average total low shrub cover was 40%. The sparse understory was dominated by alkali sacaton (*Sporobolus airoides*), saltgrass (*Distichlis spicata*), and Torrey seepweed (*Sueda moquinii*); average total herbaceous cover was 11%.

Water: Permanently flooded aquatic habitat typically complimented by sparse obligate hydrophytes with less than 25% total cover.

Streambar: These sparsely vegetated, sandy habitats occurred in the formerly dry reach and secondary channels with intermittently flooded and low water table water regimes. Isolated Goodding willow (*Salix Gooddingii*), tamarisk (*Tamarix ramosissima*), Nevada saltbush (*Atriplex lentiformis, torreyi*), rubber rabbitbrush (*Ericameria nauseosus*), alkali sacaton (*Sporobolus airoides*), and small patches of saltgrass (*Distichlis spicata*) were common.

Barren: This sparsely vegetated type occurred on high terraces. Nevada saltbush (*Atriplex lentiformis*), rubber rabbitbrush (*Ericameria nauseosus*), alkali sacaton (*Sporobolus airoides*), and Russian thistle (*Sololá sp)* and bassia (*Bassia hyssopfolia*) were present, typically with less than 10% total vegetation cover.

Bassia: This is a new vegetation type that was not mapped in 2000 although it was described as a component of some other types. Large stands of bassia (*Bassia hyssopfolia* or fivehorn smotherweed) can be found throughout the entire length of the lower Owens River however, the majority are located in the northern reaches (2-4) of the river below the Intake. The majority of these stands are best described as impenetrable and of extremely low diversity with a percent cover of 60-90%. Species, mainly saltbush, greasewood, and Mojave seablite occur within areas mapped as bassia (inclusions) or are adjacent to the bassia canopy and are continuing to persist. These species are spectrally similar to bassia and difficult to separate on the aerial photographs. Additionally, decadent bassia from previous year's growth are present in many areas increasing the difficulty in mapping this vegetation type.

Inclusions of contrasting types are typically common in all map units. Inclusions may include gradual transitions between similar vegetation types and/or small areas of contrasting vegetation scattered within an area mapped as another vegetation type. The goal was less than 15% inclusion of any contrasting type and less than 30% inclusion of similar types.

6.3 2009 Vegetation Mapping

Digital aerial imagery was collected between August 1 and August 7, 2009, using an aircraft occupied with a multi-spectral digital camera. The imagery had a resolution of one foot in true color as a single 4-band (red, green, blue, near infra-red). These four bands were collected simultaneously with identical look angles, and were precisely registered.

The imagery was delivered as separate Geo-Tiff files with one USGS quad composed of 16 files. The files were merged together utilizing the Mosaic Tool in ERDAS, creating manageable subareas for the entire LORP. A spectral classification was performed on all of the subareas followed by a supervised classification to identify vegetation classes.

Following the classification of the subareas, the vegetation classes delineated utilizing ERDAS Imagine were converted to polygons using ArcMap 9.3, converting them from a raster to a vector file. A post-classification clean up was performed to eliminate pixel inclusion and overall roughness of the classified subareas. After completing the post-classification clean up, the similar vegetation classes were merged together creating preliminary vegetation maps.

The following is a step by step process of the specific operations used to create the LORP vegetation map:

1) Mosaic Separate Geo-Tiff Files into Manageable Subareas
2) Use Subset Tool to Create Manageable Subareas to Perform Supervised Classification
3) Collect Spectral Signatures for Supervised Classification
4) Perform Supervised Classification
5) Perform Fuzzy Convolution
6) Use ArcMap to Convert Fuzzy File from a Raster to a Vector File
7) Once in ArcMap perform Post Classification Clean Up

Vegetation Mapping Table 1. Summary of Vegetation Community Descriptions
Crosswalk between 2000 and 2009 Mapping Efforts

LOWER OWENS RIVER PROJECT RIVERINE LANDSCAPE VEGETATION MAPPING COMMUNITY DESCRIPTIONS					
Vegetation Type (Whitehorse 2004)	**Vegetation Type (LADWP)**	**Veg ID**	**Total Cover**	**Dominant sp (listed in order of dominance)**	**Inclusions/Notes**
Water	Water	1		*Lemna sp*, aquatic plants	Permanently flooded
Alkali marsh	Marsh	2	> 85%	*Typha* sp, *Schoenoplectus* sp, *JUBA*	Standing water transitioning to wet alkali meadow
Wet alkali meadow	Wet Alkali Meadow	3a	>80%	*LETR, DISP, JUBA, EURO, SCPU*	High water table, transitions to dry alkali meadow
Reedgrass	Reedgrass	3b	> 85%	*PHAU*	Standing water transitioning to wet alkali meadow
Alkali meadow	Dry Alkali Meadow	4	>75%	*DISP, SPAI, LETR*	Transitions to Rabbitbrush/NV saltbush meadow
Pasture	Irrigated Meadow	5a	N/A		
Coyote willow	Riparian Shrub (willow)	6a	N/A	*SAEX, LETR, DISP*	Shrubs with herbaceous understory
Gooding-red willow	Riparian Forest (tree willow)	7a		SAGO, SALA	Forested with herbaceous understory
Fremont cottonwood	Riparian Forest (cottonwood)	7b		POFR	Forested with herbaceous understory
Rabbitbrush-NV saltbush/saltgrass-sacaton	Rabbitbrush-NV saltbush scrub/meadow	8	40% shrub/50 % grass	*ATTO, CHNA, SPAI,DISP, SATR*	Transitions to Rabbitbrush/NV saltbush scrub
Rabbitbrush-NV saltbush assoc	Rabbitbrush-NV saltbush scrub	9	40% Shrub	*ATTO, CHNA*	Sparse understory

Vegetation Type (Whitehorse 2004)	Vegetation Type (LADWP)	Veg ID	Total Cover	Dominant sp (listed in order of dominance)	Inclusions/Notes
Tamarisk	Tamarisk	10		*TARA*	
N/A	Bassia	11		*BAHY*	
N/A	Tamarisk / Slash	12			
Barren	Barren	23			
Streambar	Streambar	24	<10%	*SAGO, TARA, ATTO, CHNA, SPAI*	Sparsely vegetated sandy
Structure	Structure	91			Intake, measuring stations, culverts, berms
Undifferentiated upland	Undifferentiated upland	99	N/A		

6.3.1 Ground-Truthing Protocol

Utilizing the preliminary maps, a set of points generated by locating the centroid of each of the polygons mapped by LADWP was provided to ICWD which spent 51 people days working on the ground truthing. A random set of 25% of the centroids in each of the vegetation type polygons were generated. ICWD personnel navigated to the random waypoint observing the vegetation community as they walked through the polygons. At the waypoint, the percent cover of the four most dominant species was noted as well as total percent cover. These data were used by LADWP to refine both the polygon boundaries and polygon labels. There were still difficulties determining some of the vegetation types thus, an additional 180-person days were spent field mapping along entire river corridor specifically examining Dry Alkali Meadow, Rabbitbrush-NV Saltbush Meadow, and Rabbitbrush-NV Saltbush scrub.

6.3.2 Accuracy Assessment

Utilizing the final maps produced following the ground truthing, a set of 10% of the polygons was randomly selected for accuracy assessment. Staff from LADWP navigated to the polygon centroid and noted if the polygon was correctly labeled. Calculations of accuracy assessment were conducted as described in the Lower Owens River Riparian Vegetation Inventory 2000 Conditions (WHA 2004a) using equations corrected by ICWD.

6.3.3 Results and Discussion

Overall results of the vegetation mapping are displayed in Vegetation Mapping Table 3. As expected, there have been technological improvements between the baseline mapping effort which was conducted using real color digital orthophotos (WHA 2004a) and the present mapping effort that was described above. The newer image is of much higher quality and the use of new software made map refinements possible. Accuracy at the conclusion of the preliminary mapping was determined to be about 71%. Eight mapped units were less than 65% accurate, this included several important vegetation communities including Dry Alkali Meadow, Wet Alkali Meadow, Rabbitbrush/NV Saltbush Scrub/Meadow, Riparian Forest (cottonwood), Riparian Shrub (willow), Tamarisk, Bassia, and Barren mapped units. The nine mapped units were greater than 80% accurate and included Marsh, Rabbitbrush-NV Saltbush Scrub, and Riparian Forest (tree willow), Tamarisk/Slash, Irrigated Meadow, Water, Streambar, Structure and Undifferentiated Upland.

Accuracy following the mapping refinements was calculated to be over 92%. The lowest level of accuracy was for the riparian shrub willow (67%). The problem was traced to several polygons that were labeled as willow which were actually tamarisk. All of these polygons were well away from the river and were missed during the initial clean up. No errors occurred on shrub willow types along the river. There were still some difficulties with polygons that lie along the continuum from Wet Alkali Meadow (88%), Dry Alkali Meadow (92%), Rabbitbrush-NV Saltbush Meadow (93%), and Rabbitbrush-NV Saltbush Scrub (95%). However, the overall results (92%) are still very good considering the complexities of these habitat types.

Vegetation Mapping Table 2. LORP Vegetation Mapping Species List

Dominant Species	Scientific Name	Common Name
ANCA	*Anemopsis californica*	Yerba mansa
ATTO	*Atriplex torreyi*	Torrey's saltbush
BAHY	*Bassia hyssopifolia*	Bassia
CAPR	*Carex praegracilis*	Clustered field sedge
CHNA	*Chrysothamnus nauseosus (Ericameria nauseosa)*	Rubber rabbitbrush
DISP	*Distichlis spicata*	Saltgrass
ELAN	*Elaeagnus angustifolia*	Russian olive
ELPA	*Eleocharis parishii*	Parish's spikerush
Helianthus sp.		Sunflower
JUBA	*Juncus balticus*	Mountain rush
ELRO	*Eleocharis rostellata*	Stout rush
Lemna sp.		Duckweed
LETR	*Leymus triticoides*	Beardless wildrye
PHAU	*Phragmites australis*	Common reed
POFR	*Populus fremontii*	Freemont cottonwood
SAEX	*Salix exigua*	Coyote willow
SAGO	*Salix gooddingii*	Goodding's willow
SALA	*Salix laevigata*	Red willow
Salsola sp.		Tumbleweed
SAVE	*Sarcobatus vermiculatus*	Greasewood
SCAC	*Schoenoplectus acutus*	Hardstem bulrush
SCMA	*Schoenoplectus maritimus*	Cosmopolitan bulrush
SCPU	*Schoenoplectus pungens*	Common threesquare
SPAI	*Sporobolus airoides*	Alkali sacaton
SUMO	*Sueada moquinii*	Mojave seablite
TARA	*Tamarix ramosissima*	Saltcedar
TYDO	*Typha domingus*	Southern cattail
Typha sp.		Cattail

6.3.4 Riverine System

There was a large increase in the number of vegetation polygons developed for the riverine area (Vegetation Mapping Table 3). There were 3,774 unique polygons developed during the 2000 mapping effort and 6,981 developed during 2009.

Also, there were several instances where the mapped extent of the predicted riparian zone from the 2000 mapping effort was too narrow. The extension of the mapping boundary to include the actual riparian influence increased the total mapped acreage from 6,554.9 acres to 6,570 acres, a difference of 15 acres.

Vegetation Mapping Table 3. Comparison of LORP vegetation change between 2000 and 2009
Changes are ranked from the vegetation type with greatest increase to greatest decrease in acreage.

Lower Owens River Project Riverine Landscape Vegetation Mapping				
Vegetation ID	**Vegetation Name**	**2000 Acres**	**2009 Acres**	**Change (10-00)**
11	Bassia	0.0	326.0	326.0
2	Marsh	769.0	1085.1	316.1
1a	Water	115.1	263.0	147.9
4	Dry Alkali Meadow	980.8	1083.8	103
9	Rabbitbrush-NV saltbush scrub	1812.4	1867.2	54.8
91	Structure	2.5	55.2	52.7
6a	Riparian Shrub (willow)	20.7	25.0	4.3
12	Tamarisk / Slash	0.0	0.8	0.8
7b	Riparian Forest (cottonwood)	5.4	5.4	0.0
5a	Irrigated Meadow	63.6	63.0	-0.6
3b	Reedgrass	27.2	24.6	-2.6
24	Streambar	23.4	8.2	-15.2
99	Undifferentiated upland	69.6	0.0	-69.6
8	Rabbitbrush-NV saltbush scrub/meadow	1264.6	1192.6	-72.0
3a	Wet Alkali Meadow	221.5	82.0	-139.5
7a	Riparian Forest (tree willow)	461.6	272.0	-189.6
10	Tamarisk	327.4	91.1	-236.3
23	Barren	390.1	125.0	-265.1
Total Acres		**6554.9**	**6570**	**15.1**
Polygons		**3774**	**6981**	**3207**

Overall the largest positive increases observed in the mapping were a 316-acre increase in the Marsh habitat type, a 148-acre increase in water, and a 103-acre increase in Dry Alkali Meadow. The appearance of the new vegetation type bassia (326 acres) is related to the notable decreases of 265 acres of Barren land and a 236-acre decrease in Tamarisk. One notable decrease in acreage which could lead to concern is the 190-acre decrease in the Riparian Forest (tree willow) type of riparian forest. Most of this decrease is a result of the improvements in mapping technology. There were large extents mapped as tree willow from the 2000 image that were not tree willow, but a combination of other vegetation types (Vegetation Mapping Figure 1a). These areas were refined in the present mapping effort because the imagery used has a much higher resolution. This resulted in a significant decrease in acreage of Riparian Forest (tree willow) and increases of Marsh, Dry Alkali Meadow, and Water (Vegetation Mapping Figure 1b).

There was also a 140-acre decrease in Wet Alkali Meadow. The loss of this acreage in many cases is a direct result of rewatering of the river. In many locations, the bottoms of historic oxbows as well as the channel itself were mapped as wet meadows. With the reintroduction of flow and the subsequent rise in the water table across the floodplain, many of these areas were either flooded or became wet enough to convert to marsh. This is illustrated in Vegetation Mapping Figures 2a-2d, which depicts the vegetation polygons from both the mapping efforts as well as the imagery. The white arrows between the figures on the left and those on the right illustrate areas where wet alkali meadow was converted to either water or marsh.

Other positive conversions that were observed during field mapping efforts are the conversion of Barren areas to Rabbitbrush-Nevada Saltbush Scrub (Vegetation Mapping Figures 3a-3d). Additionally, some Rabbitbrush-Nevada Saltbush Scrub Meadows to Dry Alkali Meadows or even Wet Alkali Meadows. As the water table within the floodplain areas has risen, the shrubs have died or are dying and grass cover has increased. These habitat conversions are making the floodplain increasingly complex and difficult to map.

6.3.5 Community Changes

Vegetation Mapping Table 4 summarizes the changes that occurred for some of the more interesting vegetation types between 2000 and 2009.

There were 115 total acres mapped as Water in 2000. Fifty percent of these areas were remapped as Water in 2009. Thirty-seven percent were mapped as Marsh. Less than 5% each were mapped as Dry Alkali Meadow, Rabbitbrush-NV saltbush scrub, Riparian forest (tree willow), or Rabbitbrush-NV saltbush meadow.

There were 768 total acres mapped as Marsh in 2000. Sixty-nine percent remained Marsh in 2009. Eleven percent was mapped as Water. Roughly 5% were mapped as Dry Alkali Meadow, Riparian forest (tree willow), or Rabbitbrush-NV saltbush meadow.

There were 222 acres mapped as Wet Alkali Meadow in 2000. Only 9% were remapped as this type in 2009. Thirty-five percent were remapped as Dry Alkali Meadow. Twenty-four percent were mapped as Marsh. Thirteen percent were mapped as Rabbitbrush-NV saltbush meadow. Less than 10% each were mapped as Wet Alkali Meadow, Water, or Riparian forest (tree willow).

There were 981 acres mapped as Dry Alkali Meadow in 2000. Fifty-four percent remained Dry Alkali Meadow in 2009. Twenty percent were mapped as Rabbitbrush-NV saltbush meadow. Fourteen percent were mapped as Marsh.

There were 461 acres of Riparian Forest (tree willow) mapped in 2000. Thirty-five percent of these areas were remapped as this type in 2009. Thirty-three percent were mapped as Marsh. Thirteen percent were mapped as Dry Alkali Meadow, and 7% were mapped as Water.

There were 327 acres of Tamarisk mapped in 2000. Twenty-six acres became Bassia. Twenty-five percent remained Tamarisk. Nineteen percent became Marsh and 17% became Rabbitbrush-NV saltbush scrub.

Vegetation Mapping Table 4. Summary of Vegetation Type Changes Between 2000 and 2009

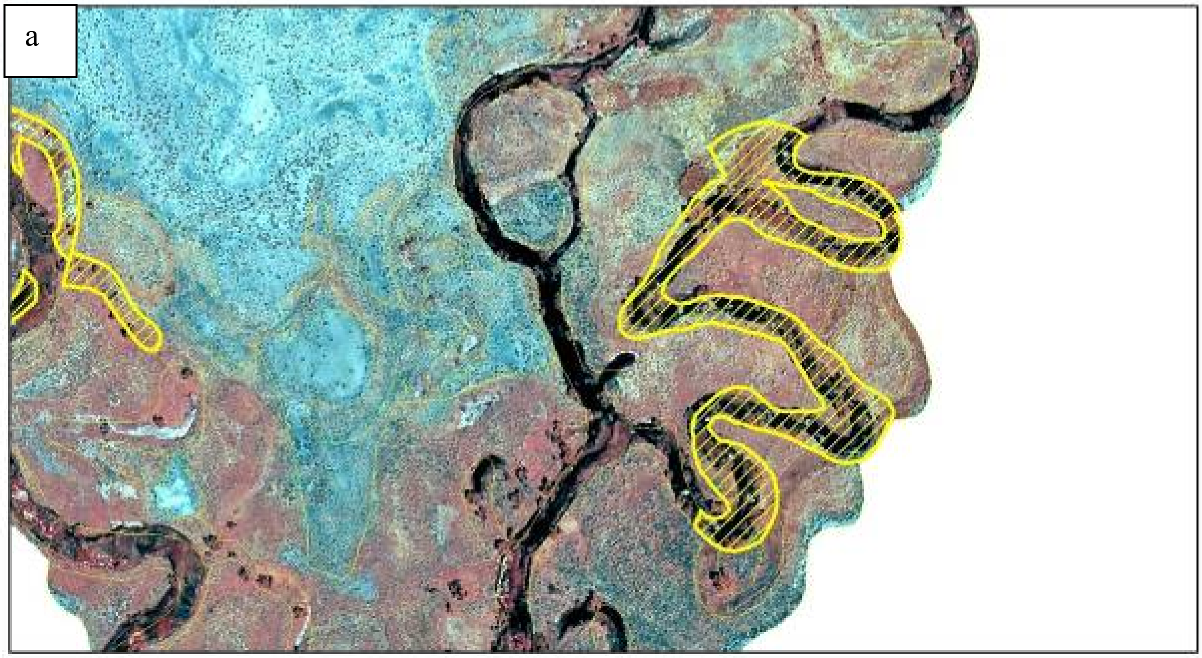
Vegetation Name			Vegetation Name			Vegetation Name		
2000	**2009**	**Acres**	**2000**	**2009**	**Acres**	**2000**	**2009**	**Acres**
Dry Alkali Meadow	Water	25.9	Water	Water	57.7	Riparian Forest (tree willow)	Water	29.9
	Marsh	132.0		Marsh	42.9		Marsh	153.0
	Wet Alkali Meadow	18.1		Wet Alkali Meadow	0.3		Wet Alkali Meadow	5.2
	Reedgrass	1.5		Reedgrass	0.3		Reedgrass	2.6
	Dry Alkali Meadow	529.4		Dry Alkali Meadow	4.1		Dry Alkali Meadow	58.1
	Irrigated Meadow	21.1		Irrigated Meadow	0.0		Irrigated Meadow	0.1
	Riparian Shrub (willow)	1.4		Riparian Shrub (willow)	0.2		Riparian Shrub (willow)	0.0
	Riparian Forest (tree willow)	18.8		Riparian Forest (tree willow)	3.1		Riparian Forest (tree willow)	162.2
	Riparian Forest (cottonwood)	1.4		Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	1.2
	Rabbitbrush-NV saltbush scrub/meadow	195.6		Rabbitbrush-NV saltbush scrub/meadow	2.1		Rabbitbrush-NV saltbush scrub/meadow	22.8
	Rabbitbrush-NV saltbush scrub	28.3		Rabbitbrush-NV saltbush scrub	4.1		Rabbitbrush-NV saltbush scrub	20.4
	Tamarisk	1.2		Tamarisk	0.0		Tamarisk	0.9
	Bassia	1.1		Bassia	0.0		Bassia	2.2
	Tamarisk / Slash	0.1		Tamarisk / Slash	0.0		Tamarisk / Slash	0.0
	Barren	3.1		Barren	0.1		Barren	1.5
	Streambar	0.0		Streambar	0.0		Streambar	0.1
	Structure	1.4		Structure	0.5		Structure	1.1
	TOTAL Acres	**980.5**		**TOTAL Acres**	**115.3**		**TOTAL Acres**	**461.2**

Vegetation Mapping Table 4. Continued, Summary of Vegetation Type Changes Between 2000 and 2009

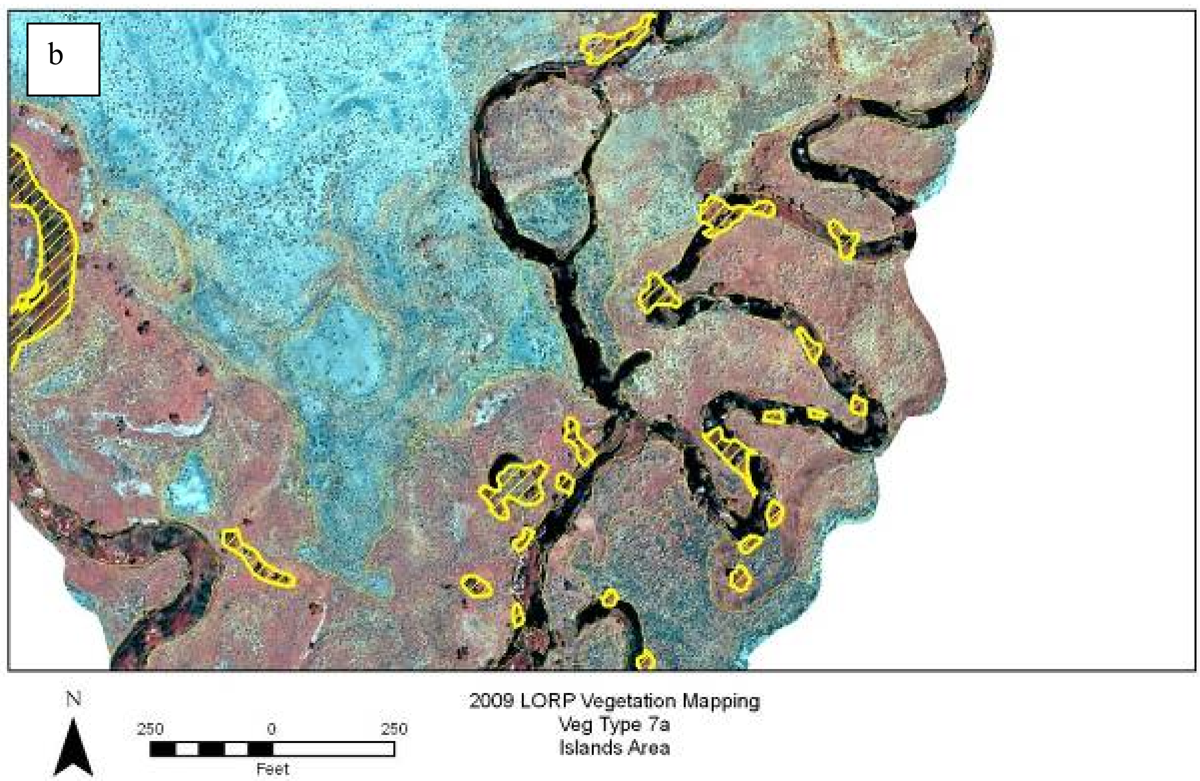
2000	2009	Acres	2000	2009	Acres	2000	2009	Acres
Tamarisk	Water	23.4	Marsh	Water	81.2	Wet Alkali Meadow	Water	15.8
	Marsh	61.2		Marsh	532.5		Marsh	53.3
	Wet Alkali Meadow	0.4		Wet Alkali Meadow	8.1		Wet Alkali Meadow	20.7
	Reedgrass	0.4		Reedgrass	2.7		Reedgrass	2.6
	Dry Alkali Meadow	4.5		Dry Alkali Meadow	52.3		Dry Alkali Meadow	77.7
	Irrigated Meadow	0.0		Irrigated Meadow	0.0		Irrigated Meadow	0.0
	Riparian Shrub (willow)	0.3		Riparian Shrub (willow)	7.0		Riparian Shrub (willow)	5.3
	Riparian Forest (tree willow)	6.9		Riparian Forest (tree willow)	39.0		Riparian Forest (tree willow)	11.4
	Riparian Forest (cottonwood)	0.3		Riparian Forest (cottonwood)	0.8		Riparian Forest (cottonwood)	0.1
	Rabbitbrush-NV saltbush scrub/meadow	6.2		Rabbitbrush-NV saltbush scrub/meadow	29.3		Rabbitbrush-NV saltbush scrub/meadow	27.9
	Rabbitbrush-NV saltbush scrub	54.2		Rabbitbrush-NV saltbush scrub	14.1		Rabbitbrush-NV saltbush scrub	6.1
	Tamarisk	80.3		Tamarisk	0.0		Tamarisk	0.3
	Bassia	84.5		Bassia	0.0		Bassia	0.0
	Tamarisk / Slash	0.1		Tamarisk / Slash	0.0		Tamarisk / Slash	0.0
	Barren	2.8		Barren	0.1		Barren	0.1
	Streambar	1.4		Streambar	0.1		Streambar	0.0
	Structure	0.3		Structure	1.4		Structure	0.4
	TOTAL Acres	**327.2**		**TOTAL Acres**	**768.5**		**TOTAL Acres**	**221.7**

Vegetation Mapping Table 4. Continued, Summary of Vegetation Type Changes Between 2000 and 2009

2000	2009	Acres	2000	2009	Acres	2000	2009	Acres
Rabbitbrush-NV Saltbush Scrub	Water	5.7	Rabbitbrush-NV Saltbush Meadow	Water	15.8	Wet Alkali Meadow	Water	15.8
	Marsh	20.4		Marsh	65.1		Marsh	53.3
	Wet Alkali Meadow	2.8		Wet Alkali Meadow	8.2		Wet Alkali Meadow	20.7
	Reedgrass	0.8		Reedgrass	5		Reedgrass	2.6
	Dry Alkali Meadow	51.1		Dry Alkali Meadow	290		Dry Alkali Meadow	77.7
	Irrigated Meadow	0.0		Irrigated Meadow	0.3		Irrigated Meadow	0.0
	Riparian Shrub (willow)	0.1		Riparian Shrub (willow)	2.1		Riparian Shrub (willow)	5.3
	Riparian Forest (tree willow)	4.3		Riparian Forest (tree willow)	21		Riparian Forest (tree willow)	11.4
	Riparian Forest (cottonwood)	0.1		Riparian Forest (cottonwood)	0.1		Riparian Forest (cottonwood)	0.1
	Rabbitbrush-NV saltbush scrub/meadow	247.9		Rabbitbrush-NV saltbush scrub/meadow	635.1		Rabbitbrush-NV saltbush scrub/meadow	27.9
	Rabbitbrush-NV saltbush scrub	1315.6		Rabbitbrush-NV saltbush scrub	200.9		Rabbitbrush-NV saltbush scrub	6.1
	Tamarisk	5.1		Tamarisk	1.7		Tamarisk	0.3
	Bassia	121.1		Bassia	12.3		Bassia	0.0
	Tamarisk / Slash	0.5		Tamarisk / Slash	0.2		Tamarisk / Slash	0.0
	Barren	22.5		Barren	1.8		Barren	0.1
	Streambar	1.4		Streambar	1.1		Streambar	0.0
	Structure	11.4		Structure	4.1		Structure	0.4
	TOTAL Acres	**1810.6**		**TOTAL Acres**	**1264.7**		**TOTAL Acres**	**221.7**



2000 LORP Vegetation Mapping
Veg Type 7a
Islands Area



2009 LORP Vegetation Mapping
Veg Type 7a
Islands Area

Vegetation Mapping Figure 1. Comparison of Riparian Forest (Tree Willow) 2000(a) and 2009(b)

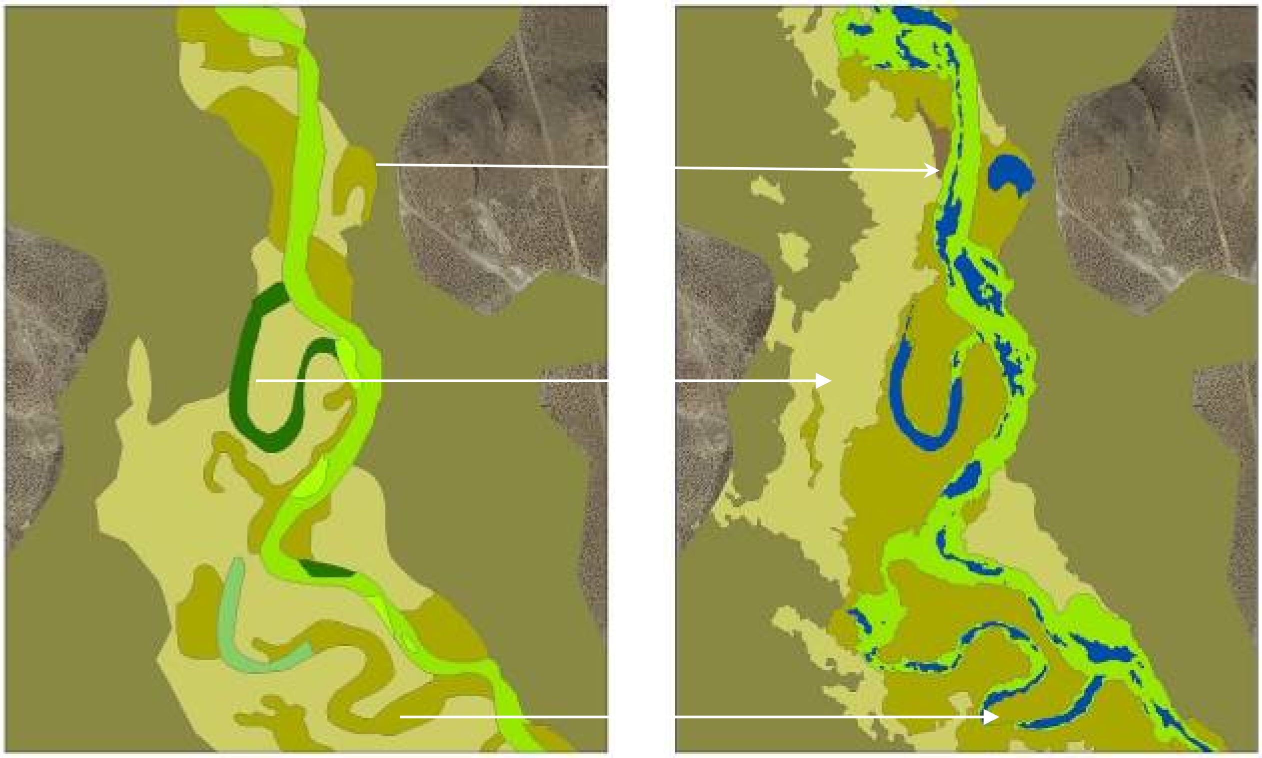


Figure 2a. 2000 Vegetation Polygons

Figure 2b. 2009 Vegetation Polygons

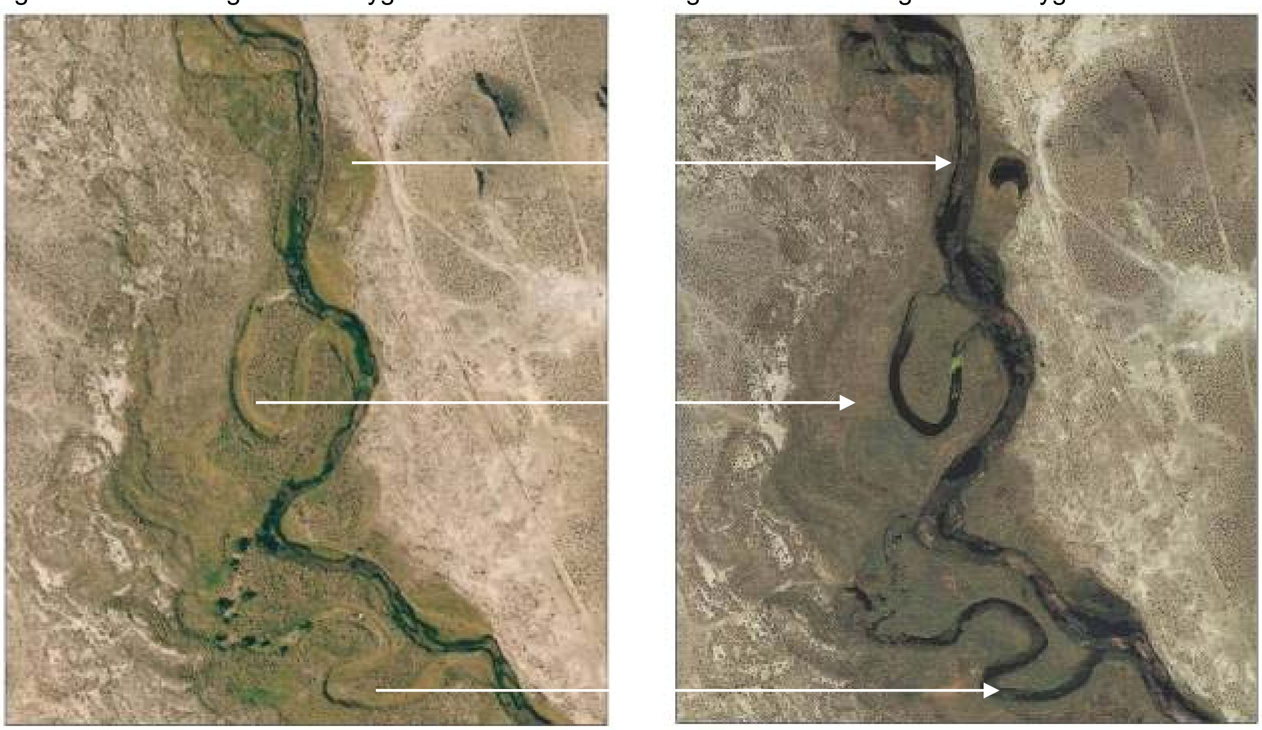


Figure 2c. 2000 LORP Image

Figure 2d. 2009 LORP Image

Vegetation Mapping Figures 2a-2d.
Vegetation Polygons and Images

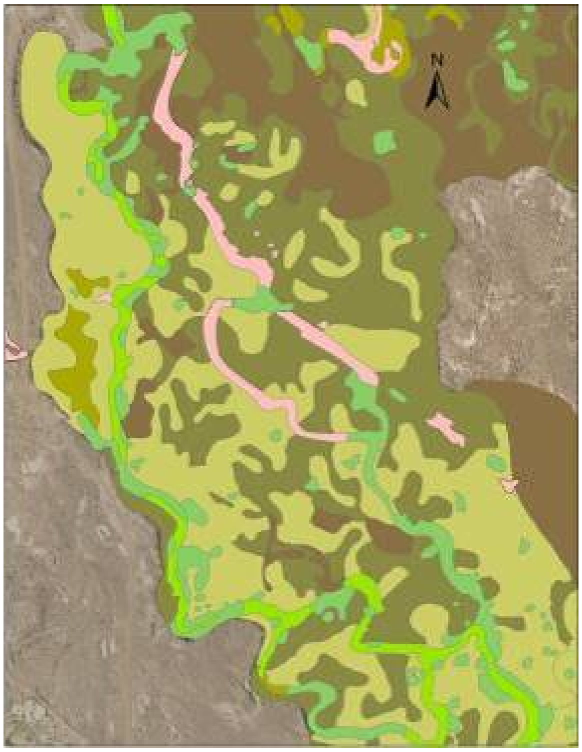


Figure 3a. 2000 Vegetation Polygons

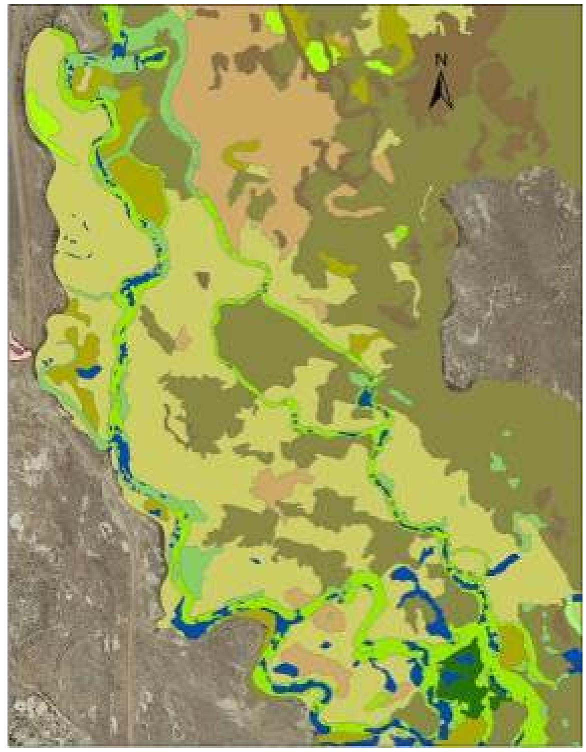


Figure 3b. 2009 Vegetation Polygons

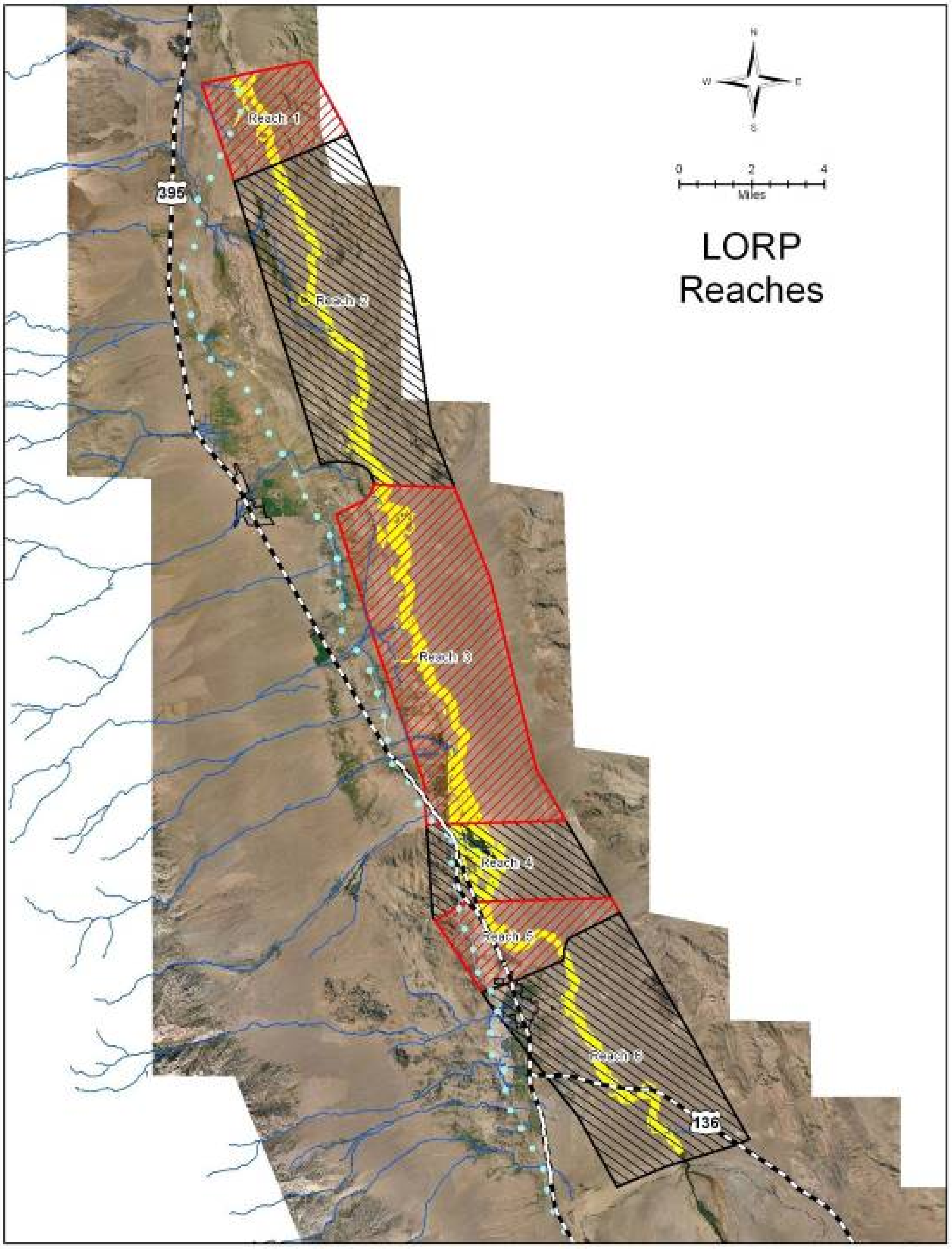
Figure 3c. 2000 LORP Image

Figure 3d. 2009 LORP Image

Vegetation Mapping Figure 3a-3d.
Vegetation Polygons and Images

River Reaches

WHA delineated the river into six distinct reaches based on the morphology of the river channel and hydrologic conditions (Vegeation Mapping Figure 4). Vegetation Mapping Table 5 illustrates the changes for each vegetation type for each reach.



Vegetation Mapping Figure 4. Lower Owens River Project River Reaches

Vegetation Mapping Table 5. Riverine Vegetation Mapping Results by Reach (acres)

Lower Owens River Project Riverine Landscape Vegetation Mapping by Reach									
Vegetation	**Reach 1**			**Reach 2**			**Reach 3**		
NAME	**2000**	**2009**	**Chng**	**2000**	**2009**	**Chng**	**2000**	**2009**	**Chng**
Water	14.9	25.4	10.5	0.0	36.8	36.8	15.6	76.6	61.0
Marsh	22.5	41.0	18.5	0.0	104.4	104.4	212.4	291.2	78.8
Wet Alkali Meadow	11.5	0.0	-11.5	0.0	0.6	0.6	74.7	53.3	-21.4
Reedgrass	6.3	0.0	-6.3	4.3	0.1	-4.2	10.5	11.1	0.6
Dry Alkali Meadow	49.9	43.3	-6.6	20.7	24.0	3.3	352.5	265.8	-86.7
Irrigated Meadow	0.0	0.0	0.0	0.0	0.0	0.0	63.6	63.4	-0.2
Riparian Shrub (willow)	0.0	0.0	0.0	0.0	0.3	0.3	5.4	9.8	4.4
Riparian Forest (tree willow)	2.6	0.2	-2.4	39.3	15.2	-24.1	145.6	89.2	-56.4
Riparian Forest (cottonwood)	0.1	0.0	-0.1	0.0	0.3	0.3	1.7	2.6	0.9
Rabbitbrush-NV saltbush scrub/meadow	112.9	83.7	-29.2	123.1	73.0	-50.1	445.1	606.0	160.9
Rabbitbrush-NV saltbush scrub	349.8	369.4	19.6	567.5	615.0	47.5	447.5	456.4	8.9
Tamarisk	0.0	0.6	0.6	275.7	52.1	-223.6	51.5	38.1	-13.4
Bassia	0.0	0.0	0.0	0.0	285.2	285.2	0.0	40.8	40.8
Tamarisk / Slash	0.0	0.3	0.3	0.0	0.6	0.6	0.0	0.0	0.0
Barren	0.0	0.5	0.5	233.7	72.4	-161.3	156.4	44.4	-112.0
Streambar	0.3	0.0	-0.3	11.1	2.8	-8.3	6.8	4.9	-1.9
Structure	0.2	7.5	7.3	0.0	0.2	0.2	2.3	4.1	1.8
Undifferentiated upland	0.0	0.0	0.0	0.0	0.0	0.0	60.2	0.0	-60.2
TOTAL Acres	**571.0**	**571.9**	**0.9**	**1275.5**	**1283.0**	**7.5**	**2051.7**	**2057.7**	**6.0**
Vegetation	**Reach 4**			**Reach 5**			**Reach 6**		
NAME	**2000**	**2009**	**Chng**	**2000**	**2009**	**Chng**	**2000**	**2009**	**Chng**
Water	36.2	56.5	20.3	9.1	23.5	14.4	39.4	44.2	4.8
Marsh	306.4	454.9	148.5	66.1	48.8	-17.3	161.6	145.0	-16.6
Wet Alkali Meadow	50.1	9.2	-40.9	17.1	7.7	-9.4	68.1	11.4	-56.7
Reedgrass	1.4	1.0	-0.4	4.4	1.4	-3.0	0.3	10.8	10.5
Dry Alkali Meadow	287.4	359.7	72.3	77.4	99.3	21.9	193.0	291.7	98.7
Irrigated Meadow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riparian Shrub (willow)	2.9	2.0	-0.9	1.4	2.7	1.3	11.0	10.2	-0.8
Riparian Forest (tree willow)	182.5	89.7	-92.8	20.3	19.8	-0.5	71.3	58.0	-13.3
Riparian Forest (cottonwood)	0.0	0.7	0.7	0.1	0.1	0.0	3.6	1.8	-1.8
Rabbitbrush-NV saltbush scrub/meadow	218.3	99.2	-119.1	145.8	153.9	8.1	219.4	176.8	-42.6
Rabbitbrush-NV saltbush scrub	128.9	148.6	19.7	56.5	40.6	-15.9	262.2	237.2	-25.0
Tamarisk	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
Bassia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tamarisk / Slash	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barren	0.0	4.6	4.6	0.0	1.2	1.2	0.0	1.9	1.9
Streambar	5.1	0.5	-4.6	0.0	0.0	0.0	0.0	0.0	0.0
Structure	0.0	0.6	0.6	0.0	0.1	0.1	0.0	42.7	42.7
Undifferentiated upland	7.6	0.0	-7.6	0.0	0.0	0.0	1.8	0.0	-1.8
	1226.8	**1227.2**	**0.4**	**398.2**	**399.1**	**0.9**	**1031.9**	**1031.9**	**0.0**

6.4 Reach Change Summaries

Reach 1

The three most common habitat types accounting for over 85% of area mapped for both years are Rabbitbrush-NV Saltbush scrub, Rabbitbrush-NV Saltbush meadow, and Dry Alkali Meadow. There was a 29-acre increase in Water and Marsh habitat types and an 18-acre decrease in Wet Alkali Meadow, Reedgrass types. Of the areas mapped as Wet Alkali Meadow in 2000, 22% were mapped as Water and 31% were mapped as Marsh in 2009. This is most likely due to increased flows in this reach. Thirty-four percent were remapped as Dry Alkali Meadow. It is likely that this change is a combination of real vegetation change and differences in classification between the years. Nine percent of the area mapped as Dry Alkali Meadow in 2000 was remapped as Water, and 19% was mapped as Marsh which is again attributable to the rewatering. Twenty-three percent was remapped as Rabbitbrush-NV Saltbush Meadow.

Reach 2

The most common habitat type accounting for over 40% of area mapped for both years is Rabbitbrush-NV Saltbush scrub. Tamarisk was replaced by Bassia as the second most common at 20% of the area mapped. Marsh replaced Barren as the third most common type. Thirty-six percent of the Dry Alkali Meadow was remapped as Dry Alkali Meadow. Twenty-nine percent were mapped as Rabbitbrush-NV Saltbush Scrub and 24% were mapped as Rabbitbrush-NV Saltbush Meadow. Bassia occupied 37% of the previously barren areas, 18% of areas previously mapped as Rabbitbrush-NV Saltbush Scrub, and 8% of the Rabbitbrush-NV Saltbush Meadow.

Reach 3

Rabbitbrush-NV Saltbush meadow replaced Rabbitbrush-NV Saltbush scrub the most common habitat type accounting for 30% of the area. Marsh increased from 10 to 14% of the area mapped. Barren areas decreased by 72%. Eleven percent of areas previously mapped as Wet Alkali Meadow were remapped as Water. Twenty percent was remapped as Marsh and 20% was remapped as Dry Alkali Meadow. Five percent was mapped as Riparian Forest (shrub willow) and 5% was mapped as Riparian Forest (Tree willow).

Reach 4

Marsh was the most common habitat type for both mapping years. However, the total area mapped as Marsh increased from 25 to 37% of Reach 4 between 2000 and 2009. Dry Alkali meadow remained the second most common habitat type and increased from 23% of the area to nearly 30%. Forty-one percent of the areas previously mapped as Wet Alkali Meadow were remapped as Marsh, 8% remapped as Water and 5% as Riparian Forest (Tree willow). Thirty-seven percent were also remapped as Dry Alkali Meadow.

Reach 5

This reach was the most static of all the areas mapped. The four most common habitat types remained Rabbitbrush-NV Saltbush meadow, Rabbitbrush-NV Saltbush scrub, Marsh, and Dry Alkali Meadow. These habitat types accounted for more than 85 % of the mapped area for both years.

Reach 6

The four most common habitat types remained the same. However, Dry Alkali Meadow became the most common, covering nearly 30% of the area mapped, increasing from 18%. Nineteen percent of the Wet Alkali Meadow was remapped as Marsh and 2% Water. Fifty-one percent was remapped as Dry Alkali Meadow.

Reach specific comparisons between 2000 and 2009 by vegetation type can be found in Appendix 1.

6.5 Historic Comparisons

Future riparian vegetation types along lower Owens River were predicted for a stream flow scenario consisting of 40 cfs base flow and up to 200 cfs annual riparian flow and described in several documents (ES 1997, WHA 1997). Predicted future vegetation types were based on: (1) results of HEC-2 hydrologic analysis performed during the 1993 controlled flow study; (2) existing landforms and vegetation types mapped from aerial photos; (3) soil types; and (4) existing vegetation and landform attributes measured along cross-channel transects.

Comparison to 1997 Predictions

Prior to 2000, wetland/riparian vegetation types were mapped on 1992 aerial photographs (WHA 1997). These maps were then used in conjunction with flow modeling to predict future vegetation conditions as a result of the project. It is difficult to make direct comparisons because the area mapped between the 1997 and the 2000 efforts which were used as our baseline for this mapping effort were not consistent. The total area mapped in 1992 was only 1,389 acres compared to 6,555 acres in 2000 (WHA 2004). Also the habitat types were considerably refined between the two efforts. Landscape Vegetation Table 5 presents the results of an attempt to reconcile the earliest efforts and predictions with the current efforts. Marsh, Wet Alkali Meadow and Reedgrass types were combined to compare with Emergent and the Riparian Shrub and two Riparian Forest types were combined to compare with the Riparian Woodland type. ‘Not applicable’ was used to denote classes that could not be compared between the two efforts. Extreme care should be taken when trying to make any conclusions between these comparisons.

Vegetation Mapping Table 6. Comparison of LORP vegetation change between 1992 and 2009

LOWER OWENS RIVER PROJECT RIVERINE LANDSCAPE VEGETATION MAPPING		
Vegetation NAME	**1992 Acres**	**2009 Acres**
Streambar	93	8
Water	31	263
Dike	3	N/A
Road	6	N/A
Emergent	292	1191
Alkali Meadow	601	1147
Riparian woodland	648	302
Tamarisk	188	92
Rabbitbrush-NV saltbush scrub	665	1867
Rabbitbrush-NV saltbush scrub/meadow	2637	1193
Not Mapped	1271	N/A
Bassia	N/A	326
Structure	N/A	55
Barren	N/A	125
	6435	**6570**

Tule Comparisons

As described above, predicted future emergent vegetation (tules) was based on a number of factors (ES 1997). Concentrations of tules along the LORP channel were predicted by river reach based upon limited modeling and very conservative analysis (Vegetation Mapping Table 6 reproduced from Tech Memo #9). From the 2009 imagery, the river channel was delineated from the Intake to the pump station (Vegetation Figures 5 and 6). The channel was then mapped as one of three habitats, Water, Marsh, or Riparian Forest (Vegetation Table 7). The Marsh area was then used to compare to the acreage predictions from 1997. In general, it was predicted that 55% of the channel was going to be tule dominated. The overall range mapped in 2009 was from 62 to 87% with an average of 77%. As expected Reach 4 (the Islands) had the greatest tule coverage.

Figure 5. River Channel and Floodplain East of Lone Pine

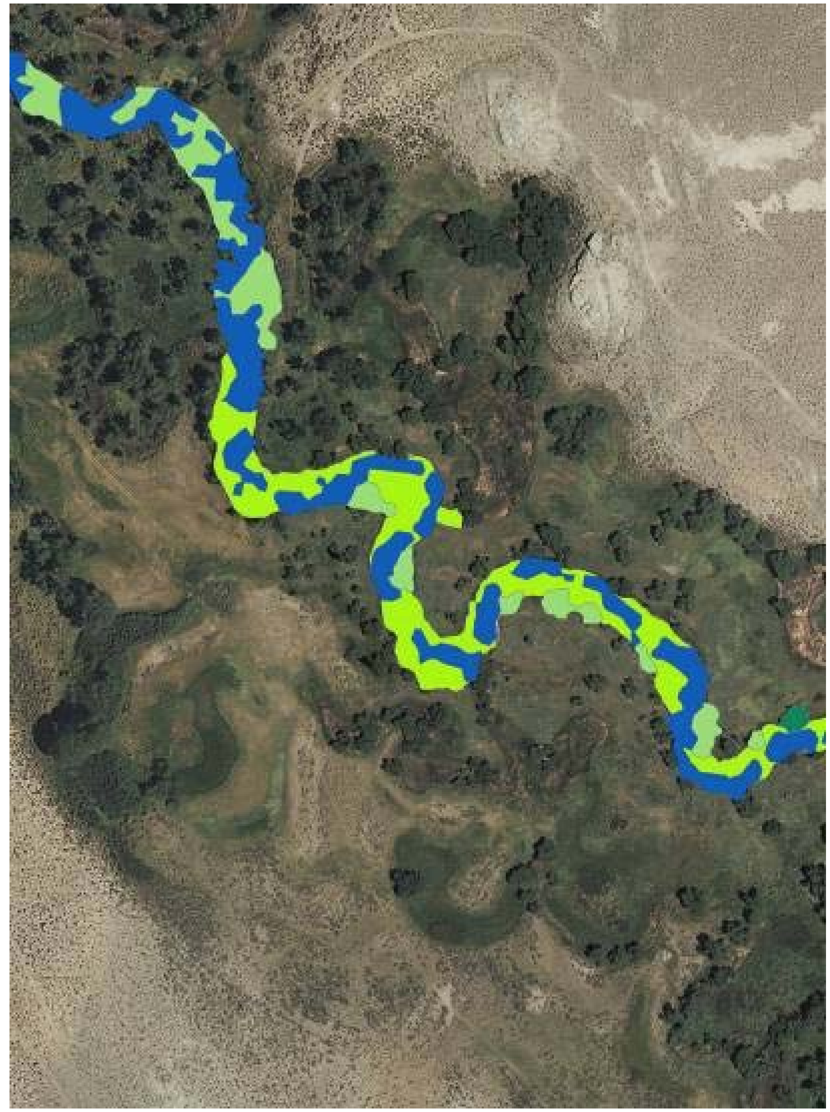


Figure 6. River Channel Delineation with Vegetation Types

Vegetation Mapping Table 7. Predicted Distribution of Tules in the Lower Owens River by Reach and Landform

REACH	TOTAL TULES (acres)	CHANNEL (acres)	LEVEE (acres)	FLOODPLAIN (acres)	OXBOW (acres)
1	6.7	3.5	1.7	0.4	0.9
2	47.0	25.8	12.2	2.8	6.1
3	75.8	41.7	19.7	4.5	9.9
4	103.9	57.0	27.0	6.2	13.5
5	37.9	20.8	9.9	2.3	4.9
6	47.4	26.1	12.3	2.8	6.2
7	30.2	16.6	7.9	1.8	3.9
TOTAL	348.9	191.5	90.7	20.8	45.4

Vegetation Mapping Table 8. Estimates of Open Water and Vegetation Along the LORP River Channel

Lower Owens River Project Riverine Landscape Vegetation Mapping							
Vegetation	Vegetation	Reach 1		Reach 2		Reach 3	
ID	NAME	Acres	Percent	Acres	Percent	Acres	Percent
1a	Water	22.1	38.1	34.5	25.6	49.4	15.8
2	Marsh	35.9	61.8	93.9	69.7	232.4	74.5
7	Riparian Forest	0.0	0.1	6.5	4.8	30.1	9.6
TOTAL Acres		**58.1**		**134.8**		**311.9**	
		Reach 4		Reach 5		Reach 6	
		Acres	Percent	Acres	Percent	Acres	Percent
1a	Water	50.1	11.6	20.1	35.5	41.0	25.6
2	Marsh	374.3	86.8	35.7	63.1	111.0	69.4
7	Riparian Forest	6.8	1.6	0.7	1.3	8.0	5.0
TOTAL Acres		**431.1**		**56.6**		**160.0**	
						Total	
						Acres	Percent
1a	Water					217.1	18.8
2	Marsh					883.3	76.6
7	Riparian Forest					52.0	4.5
TOTAL Acres						**1152.5**	

As with the comparisons made earlier in this report, care should be taken when considering the comparisons between Vegetation Mapping Tables 7 and 8. The river channel shape file used to delineate the acres in Vegetation Table 6 was not available for the 2009 mapping so there may be differences in the areas evaluated. Considering that however, the percentage of the channel that is covered with tules exceeds what was thought to be a worst case scenario (ES 1997).

6.5.1 Conclusions

Although it is likely that a number of the changes in vegetation between the two mapping efforts are likely the result in improved technology and increased level of ground mapping, there are real changes occurring within the LORP. Overall the vegetation within the Riverine component of the Lower Owens River Project vegetation mapping area is responding as would be expected. Positive aspects observed were an increase in acreage of the wetter habitat types. Some Wet Alkali Meadows quickly converted to Marsh and Dry Alkali Meadow and Rabbitbrush-Nevada Saltbush Scrub Meadow are transitioning to Wet Alkali Meadow. The total area classified as Barren land has dramatically decreased. The area of undesirable Tamarisk has also decreased. Although many of the areas previously mapped as Tamarisk are now dominated by bassia there are more desirable species are becoming established. While there may be some desire attempt to control the bassia, in time this early successional species will be replaced.

6.6 Blackrock Waterfowl Management Area (BWMA)

The BWMA is between the Los Angeles Aqueduct and the Lower Owens River riparian corridor. The southern boundary is north of Mazourka Canyon Road, about where drainage through the BWMA and the 1872 fault line intersect the Owens River riparian corridor (WHA, 2004b). The BWMA is 25,514 acres. The BWMA was divided into 7 management units: Twin Lakes (2,901 acres), Drew (827 acres), Waggoner (1,555 acres), Winterton (1918 acres), Thibaut (4,735 acres), Goose Lake (6,789 acres), and Billy Lake (6,789 acres). The first systematic mapping effort was conducted in 1997 using 1992 aerial photographs (ES 1998). During this effort 8,770 total acres were mapped including most of Drew, Waggoner, Winterton, and Thibaut Units. Field verification of this effort was limited. Additional mapping was conducted in 1998-99 using 1996 aerial photographs. The areas included in the mapping effort and descriptions of vegetation types mapped changed considerably during these early efforts making any comparisons to them difficult if not impossible. Therefore, no efforts will be made to compare the results of the 2009 mapping to these earlier efforts. The most refined mapping effort was conducted by WHA in 2004 utilizing 2000 aerial photographs. As this was the most comprehensive effort occurring prior to initiation of the LORP the 2000, results were used to for comparison purposes. Although efforts were made to maintain consistency between the riverine mapping described above and the BWMA mapping, that was not always possible as not all community types occurred in both areas. It was also not possible to utilize only those community types described in 2000 for this effort. Vegetation Mapping Table 9 provides a brief crosswalk between the 2009 vegetation types and the 2000 types. For a more complete description of the 2004 community types refer to WHA 2004b. The Billy Lake Management Unit was not mapped during this effort because of time limitation. Also, there have been very few management changes as a result of implementing the LORP that would have affected a vegetation change within this unit.

6.6.1 Classification

In addition to the vegetation classifications described above for the riverine system, several new vegetation types were identified in the BWMA. These types are described below. Additionally, there were three community types identified in 2009 that were not utilized in 2000. Bassia (34 acres) was easily identified on the new imagery and this type is described above. It was not mapped in 2000, but was noted as being present in Alkali Meadow, Alkali Flat, and the Barren vegetation types.

Riparian Forest (cottonwood was identified in the Drew Management Unit in 2009. Although it was not identified in 2000 it was likely included in the Riparian Forest (tree willow) type. Russian Olive was also not mapped in 2000. They were however, present (personal observation) and likely included with the Tamarisk that were mapped in the Thibaut Management Unit.

Because of difficulties identifying the differences in some vegetation types from the imagery, a substantial ground mapping effort followed the initial computer mapping effort. Forty people days were spent mapping the most difficult areas including Desert Sink Scrub, Great Basin Mixed Scrub, Rabbitbrush-NV Saltbush Scrub, Rabbitbrush-NV Saltbush Meadow, Dry Alkali Meadow, and Wet Alkali Meadow. This effort greatly exceeded the ground truth efforts conducted for the 2000 mapping effort.

Vegetation Mapping Table 9. BWMA Vegetation Community Descriptions

Lower Owens River Project BWMA Landscape Vegetation Mapping Community Descriptions				
Vegetation Type (Whitehorse 2004)	**Vegetation Type (LADWP)**	**Total Cover**	**Dominant Species (listed in order of dominance)**	**Inclusions/Notes**
Alkali Flat	Alkali Flat	<25%	DISP,BAHY	
Water	Water		*Lemna*, aquatic plants	Permanently flooded
Alkali marsh	Marsh	> 85%	*Typha* sp, *Schoenoplectus* sp, *JUBA*	Standing water transitioning to wet alkali meadow
Wet alkali meadow	Wet Alkali Meadow	>80%	*LETR, DISP, JUBA, EURO, SCPU*	High water table, transitions to dry alkali meadow
Reedgrass	Reedgrass	> 85%	*PHAU*	Standing water transitioning to wet alkali meadow
Alkali meadow	Dry Alkali Meadow	>70%	*DISP, SPAI, LETR*	Transitions to Rabbitbrush/NV saltbush meadow
Pasture	Irrigated Meadow	N/A		
Great Basin Mixed Scrub	Great Basin Mixed Scrub	<10%	*DISP,SPAI,ERNA,ALOC,ATCO*	
Coyote willow	Riparian Shrub (willow)	N/A	*SAEX, LETR, DISP*	Shrubs with herbaceous understory
Gooding-red willow	Riparian Forest (tree willow)		SAGO	
N/A	Riparian Forest (cottonwood)			
Rabbitbrush-NV saltbush/saltgrass-sacaton	Rabbitbrush-NV saltbush scrub/meadow	40%shrub 50% grass	*DISP, SPAI, ERNA, ATTO*	
Rabbitbrush-NV saltbush association	Rabbitbrush-NV saltbush scrub	40% Shrub 10%Grass	*DISP, SPAI, ERNA, ATTO*	Sparse understory

Vegetation Type (Whitehorse 2004)	**Vegetation Type (LADWP)**	**Total Cover**	**Dominant Species (listed in order of dominance)**	**Inclusions/Notes**
Tamarisk/Tamarisk-Alkali Flat/Tamarisk-saltgrass	Tamarisk		*TARA*	
N/A	Bassia		*BAHY*	
Desert Sink Scrub	Desert Sink Scrub	<10%grass 5% shrub	*DISP, SPAI, ERNA, ATTO*	
N/A	Russian Olive		*ELAN*	
Barren	Barren		*ATTO, ERNA, SPAI,DISP, SATR*	
Playa	Playa	<5%	*BAHY,MALE*	
N/A	Structure			culverts, berms
Cut/Fill	Cut/Fill	N/A		Berms/Pits

Alkali Flat Series: This intermittently flooded vegetation type is mostly located in lacustrine land. As the name implies, these were sparsely vegetated alkali sinks. Average total grass cover was about 25%; saltgrass (*Distichlis spicata*) was prominent. Average total forb cover was less than 15%; fivehorn smother weed (*Bassia hyssopifolia*) and annual sunflower (*Helianthus annuus*) were prominent. Shrubs and trees were typically absent. Average total vegetation cover was about 40%. Vegetation cover appeared to shrink-swell annually in response to precipitation, irrigation and water spreading. Inclusions of intermittently flooded wet alkali meadow (saltgrass-rush), desert sink scrub, and slicks were common.

Great Basin Mixed Scrub: This diverse low shrub vegetation type along the east flank of the occurred on eolian land with very low water table. Average grass cover was less than 10%; saltgrass (*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*) were prominent. Although no forbs were recorded, annual forbs were common. Average total shrub cover was about 15%; greasewood (*Sarcobatus vermiculatus*), Nevada saltbush (*Atriplex lentiformis ssp torreyi*), rabbitbrush (*Ericameria nauseosa*), iodine bush (*Allenrolfea occidentalis),* shadscale (*Atriplex confertifolia*), indigo bush (*Psorothamnus arborescens var. minutifolius*), Nevada dalea (*Psorothamnus polydenius*), Nevada ephedra (*Ephedra nevadensis*) and big sagebrush (*Artemisia tridentata),* were common, but with low cover. Although greasewood and/or shadscale were most prominent in some areas, they generally could not be distinguished from more typical areas of Great Basin mixed scrub from the aerial photos. Greasewood and shadscale were usually present in typical Great basin mixed scrub communities.

Playa Series: This mostly barren type occurred on intermittently flooded lacustrine land. Average total grass cover was less than 5%; no species were prominent. Average total forb cover was approximately 25%; fivehorn smotherweed (*Bassia hyssopfolia.*) and alkali mallow (*Malvella leprosa*) were prominent. Shrubs and trees were usually absent. Total vegetation cover was typically less than 30%. The frequency of intermittent flooding is unknown.

Desert Sink Scrub: This sparse low shrub vegetation type comprised 9,284 acres (45.4% of the BWMA. It occurred on lacustrine land with very low water table and intermittently flooded lacustrine land. Average grass cover was less than 10%; alkali sacaton (*Sporobolus airoides*) and saltgrass (*Distichlis spicata*) were prominent. Average forb cover was 5%; no species were prominent. Average shrub cover was about 5%; rabbitbrush (*Ericameria nauseosus*), shadscale (*Atriplex confertifolia*), and greasewood (*Sarcobatus vermiculatus*) were typically present, but not prominent. Average total vegetation cover was about 20%. Grass and forb cover were slightly higher in intermittently flooded land.

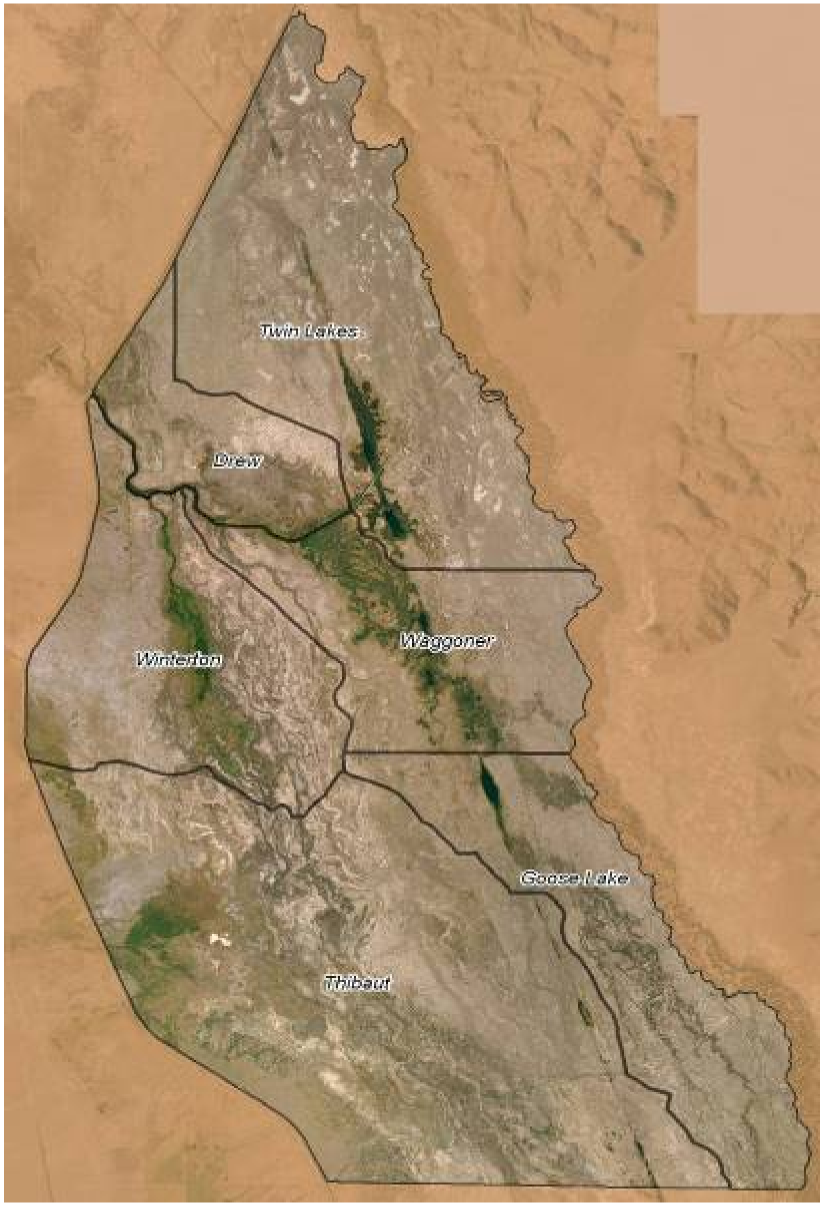
6.7 Overall Changes

The greatest observed increases were for the Rabbitbrush-NV Saltbush scrub/meadow (2,219 acres) and by Rabbitbrush-NV Saltbush scrub (1,005 acres). The greatest overall decrease was for Desert sink scrub (-3,263 acres). It is probably not a coincidence that the increase in the former offset the decrease in the latter since the composition of the three types is similar. As the flooding cycles have added water, it should follow that cover of both grasses and shrubs would increase within the Desert Sink causing conversions to the more vegetated types. This conversion is also observable in the decrease or both Playa (-713 acres) and Alkali Flats (-519 acres). While undoubtedly some of these were mapped as Barren (+290 acres), since saltgrass was present in both types, it is likely that the increase in Dry Alkali Meadow (+607 acres) and water (+266 acres) can account for the rest.

Vegetation Mapping Figure 7. Map legend for BWMA mapping

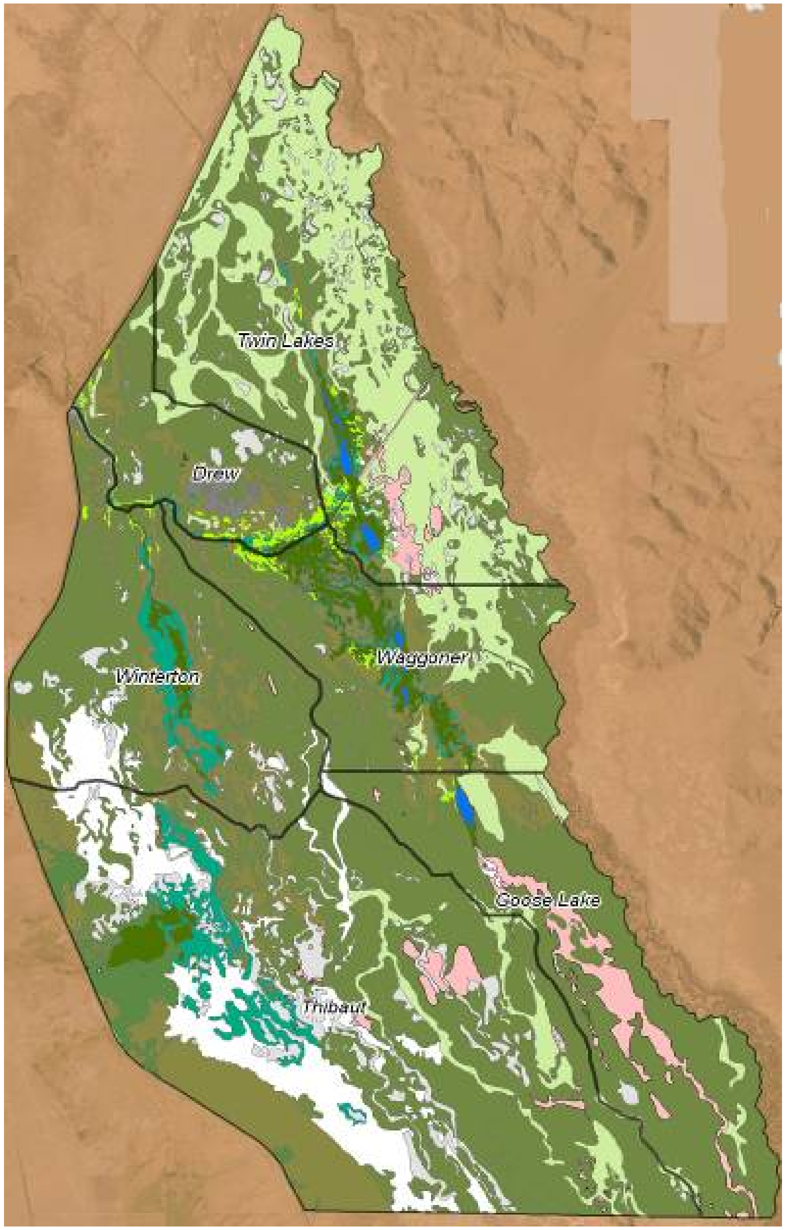
Vegetation Mapping Table 10. Overall acreage changes for the BWMA by vegetation type between 2000 and 2009

BWMA Acreage 2000 - 2009			
Vegetation Name	**2000**	**2010**	**Change**
Alkali flat	922.5	403.2	-519.3
Water	34.9	300.7	265.8
Marsh	459.9	629.8	169.9
Wet Alkali Meadow	446.0	52.2	-393.7
Reedgrass	2.3	3.0	0.7
Dry Alkali Meadow	134.9	741.5	606.6
Irrigated Meadow	210.3	165.4	-44.9
Great Basin Mixed Scrub	2090.3	2233.3	143.0
Riparian Shrub (willow)	2.1	4.8	2.7
Riparian Forest (tree willow)	17.3	24.6	7.3
Riparian Forest (cottonwood)	0.0	0.2	0.2
Rabbitbrush-NV saltbush scrub/meadow	1236.1	3455.2	2219.1
Rabbitbrush-NV saltbush scrub	491.1	1495.9	1004.8
Tamarisk	383.5	511.2	127.7
Bassia	0.0	34.2	34.2
Desert sink scrub	6469.9	3206.9	-3263.0
Russian Olive	0.0	14.3	14.3
Barren	46.3	335.2	288.9
Playa	713.4	0.0	-713.4
Structure	0.0	44.0	44.0
Cut/Fill	13.4	13.0	-0.4
TOTAL Acres	**13674.1**	**13668.7**	**-5.4**

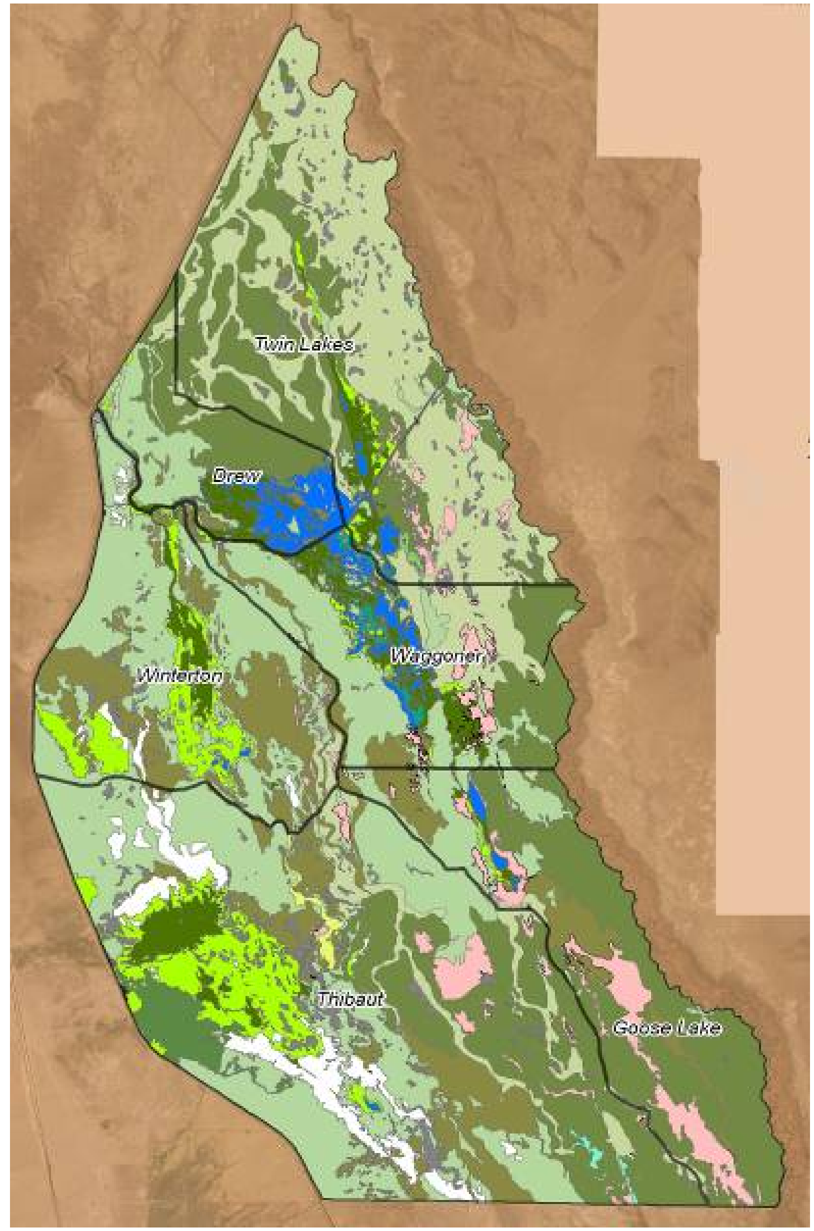


Vegetation Mapping Figure 8. BWMA on 2000 Aerial Imagery

Vegetation Mapping Figure 9. BWMA on 2009 Aerial Imagery



Vegetation Mapping Figure 10. BWMA on 2000 Aerial Imagery



Vegetation Mapping Figure 11. BWMA on 2009 Aerial Imagery

6.8 Community Changes between 2000 and 2009

Vegetation Mapping Table 11 summarizes the changes by community type between 2000 and 2009.

Water: Seventy-six percent of the areas mapped as water in 2000 were remapped as Water. Twenty-three percent were mapped as Marsh. One percent was either Riparian Shrub (willow) or Dry Alkali Meadow.

Alkali Marsh: Seventy percent of the areas mapped as Alkali Marsh were remapped as Marsh. Twenty-one percent of the area was mapped as Water. Three percent was mapped as Dry Alkali Meadow. Tamarisk and Rabbitbrush-NV Saltbush Meadow each accounted for just over one percent.

Wet Alkali Meadow: Forty-four percent of the Wet Alkali Meadow was remapped as Dry Alkali Meadow. Twenty-seven percent was mapped as Marsh. Seventeen percent were mapped as Rabbitbrush-NV Saltbush Meadow and three percent was remapped as Water. In the Management Units currently being flooded (Drew and Waggoner) 55% of the Wet Alkali Meadow was remapped as Marsh. This was also observed in Twin Lakes which is receiving water from the Drew Unit. In the non-flooded units (Thibaut and Winterton) 55% of the Wet Alkali Meadow was remapped as Dry Alkali Meadow. Theses changes are directly attributable to the project.

Alkali Meadow: Twenty-five percent of the Alkali Meadow was remapped as Marsh. Twenty-three percent was remapped as Rabbitbrush-NV Saltbush Meadow. Twenty-one percent was remapped as Water and 20% was remapped as Dry Alkali Meadow. Nearly seventy-five percent of the Dry Alkali Meadow was remapped as either Water (47%) or Marsh (26%). In Waggoner, Winterton, and Thibaut, 40% of the Alkali Meadow was remapped as Rabbitbrush-NV Saltbush Meadow.

Rabbitbrush-NV Saltbush Meadow: Thirty-four percent of the Rabbitbrush-NV Saltbush Meadow was remapped as Barren. Sixteen percent was remapped as Desert Sink Scrub. Fourteen percent was mapped as Rabbitbrush-NV Saltbush Scrub and 14% was mapped as Rabbitbrush-NV Saltbush Meadow.

Rabbitbrush-NV Saltbush Scrub: Sixty-four percent of the Rabbitbrush-NV Saltbush Scrub was remapped as Rabbitbrush-NV Saltbush Meadow. Eight percent each was remapped as Rabbitbrush-NV Saltbush Scrub and Dry Alkali Meadow.

Great Basin Mixed Scrub: Eighty-four percent of the Great Basin Mixed Scrub as remapped as Great Basin Mixed Scrub. Thirteen percent was remapped as Desert Sink Scrub. Less than 2% each was remapped as Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow.

Desert Sink Scrub: Forty-two percent of the Desert Sink Scrub was remapped as Desert Sink Scrub. Twenty-eight percent were remapped as Rabbitbrush-NV Saltbush Meadow. Fifteen percent was remapped as Rabbitbrush-NV Saltbush Scrub. Although it is likely that some of the Desert Sink Scrub was not accurately mapped in both 2000 and 2009, when examining each of the management units separately, over 65% of the Desert Sink Scrub mapped in both Goose Lake and Twin Lakes were remapped as Desert Sink and about 24% were remapped as a combination of Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow. In the four units that are undergoing periodic wetting and drying, the percent of areas remapped as Desert Sink Scrub ranged from 0 to 55%. Areas remapped as either Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow ranged from 31 to 91%.

Alkali Flat: Thirty percent of the Alkali Flat was remapped as Alkali Flat. Twenty-eight percent was remapped as Rabbitbrush-NV Saltbush Meadow. Eighteen percent was remapped as Dry Alkali Meadow and 13% was mapped as Rabbitbrush-NV Saltbush Scrub. There was no discernable pattern between any of the Management Units.

Tamarisk: Fifty-four percent of the Tamarisk was remapped as Tamarisk. Twenty-three percent was remapped as Rabbitbrush-NV Saltbush Scrub and 9% was mapped as Desert Sink Scrub.

Vegetation Mapping Table 11. Comparison of Vegetation Type Changes Between 2000 and 2009

Vegetation Name				Vegetation Name			Vegetation Name	
2000	2009	Acres	2000	2009	Acres	2000	2009	Acres
Water	Alkali flat	0.0	Alkali Marsh	Alkali flat	0.0	Wet Alkali Meadow	Alkali flat	3.9
	Water	26.4		Water	98.1		Water	14.3
	Marsh	7.9		Marsh	321.7		Marsh	119.4
	Wet Alkali Meadow	0.0		Wet Alkali Meadow	7.8		Wet Alkali Meadow	12.8
	Reedgrass	0.0		Reedgrass	0.4		Reedgrass	1.3
	Dry Alkali Meadow	0.0		Dry Alkali Meadow	14.4		Dry Alkali Meadow	198.3
	Irrigated Meadow	0.0		Irrigated Meadow	0.0		Irrigated Meadow	1.1
	Great Basin Mixed Scrub	0.0		Great Basin Mixed Scrub	0.1		Great Basin Mixed Scrub	1.4
	Riparian Shrub (willow)	0.2		Riparian Shrub (willow)	1.3		Riparian Shrub (willow)	0.2
	Riparian Forest (tree willow)	0.0		Riparian Forest (tree willow)	2.4		Riparian Forest (tree willow)	0.6
	Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.1		Riparian Forest (cottonwood)	0.0
	Rabbitbrush-NV saltbush scrub/meadow	0.0		Rabbitbrush-NV saltbush scrub/meadow	3.5		Rabbitbrush-NV saltbush scrub/meadow	76.2
	Rabbitbrush-NV saltbush scrub	0.0		Rabbitbrush-NV saltbush scrub	0.5		Rabbitbrush-NV saltbush scrub	8.5
	Tamarisk	0.4		Tamarisk	6.4		Tamarisk	1.3
	Bassia	0.0		Bassia	0.0		Bassia	0.0
	Desert sink scrub	0.0		Desert sink scrub	0.5		Desert sink scrub	2.3
	Russian Olive	0.0		Russian Olive	0.0		Russian Olive	0.0
	Barren	0.0		Barren	0.0		Barren	6.0
	Structure	0.0		Structure	2.6		Structure	0.6
	Cut/Fill	0.0		Cut/Fill	0.1		Cut/Fill	0.0
	TOTAL Acres	**34.9**		**TOTAL Acres**	**459.9**		**TOTAL Acres**	**448.3**

Vegetation Mapping Table 11. Continued, Comparison of Vegetation Type Changes Between 2000 and 2009

Vegetation Name			Vegetation Name			Vegetation Name		
2000	**2009**	**Acres**	**2000**	**2009**	**Acres**	**2000**	**2009**	**Acres**
Alkali Meadow	Alkali flat	0.0	Rabbitbrush-NV Saltbush meadow	Alkali flat	38.4	Rabbitbrush-NV Saltbush scrub	Alkali flat	5.2
	Water	27.8		Water	5.7		Water	58.7
	Marsh	33.2		Marsh	3.3		Marsh	61.2
	Wet Alkali Meadow	4.7		Wet Alkali Meadow	0.0		Wet Alkali Meadow	26.5
	Reedgrass	0.0		Reedgrass	0.0		Reedgrass	0.7
	Dry Alkali Meadow	26.7		Dry Alkali Meadow	46.1		Dry Alkali Meadow	131.6
	Irrigated Meadow	0.0		Irrigated Meadow	0.0		Irrigated Meadow	85.7
	Great Basin Mixed Scrub	3.6		Great Basin Mixed Scrub	20.7		Great Basin Mixed Scrub	20.8
	Riparian Shrub (willow)	0.0		Riparian Shrub (willow)	0.1		Riparian Shrub (willow)	0.3
	Riparian Forest (tree willow)	0.2		Riparian Forest (tree willow)	1.5		Riparian Forest (tree willow)	1.1
	Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.0
	Rabbitbrush-NV saltbush scrub/meadow	31.6		Rabbitbrush-NV saltbush scrub/meadow	98.0		Rabbitbrush-NV saltbush scrub/meadow	1102.5
	Rabbitbrush-NV saltbush scrub	1.8		Rabbitbrush-NV saltbush scrub	100.0		Rabbitbrush-NV saltbush scrub	151.0
	Tamarisk	0.1		Tamarisk	17.4		Tamarisk	34.0
	Bassia	0.0		Bassia	23.2		Bassia	6.2
	Desert sink scrub	2.2		Desert sink scrub	113.6		Desert sink scrub	20.6
	Russian Olive	0.0		Russian Olive	0.0		Russian Olive	1.3
	Barren	0.0		Barren	245.4		Barren	1.6
	Structure	2.2		Structure	0.0		Structure	17.0
	Cut/Fill	0.9		Cut/Fill	0.0		Cut/Fill	0.7
	TOTAL Acres	**134.9**		**TOTAL Acres**	**713.4**		**TOTAL Acres**	**1726.8**

Vegetation Mapping Table 11. Continued, Comparison of Vegetation Type Changes Between 2000 and 2009

Vegetation Name			Vegetation Name			Vegetation Name		
2000	**2009**	**Acres**	**2000**	**2009**	**Acres**	**2000**	**2009**	**Acres**
Great Basin Mixed Scrub	Alkali flat	0.0	Desert Sink Scrub	Alkali flat	78.4	Alkali Flat	Alkali flat	275
	Water	3.0		Water	34.7		Water	4
	Marsh	3.0		Marsh	12.8		Marsh	15
	Wet Alkali Meadow	0.0		Wet Alkali Meadow	0.4		Wet Alkali Meadow	0
	Reedgrass	0.0		Reedgrass	0.0		Reedgrass	0
	Dry Alkali Meadow	0.8		Dry Alkali Meadow	74.2		Dry Alkali Meadow	168
	Irrigated Meadow	0.0		Irrigated Meadow	0.7		Irrigated Meadow	21
	Great Basin Mixed Scrub	1750.7		Great Basin Mixed Scrub	422.6		Great Basin Mixed Scrub	9
	Riparian Shrub (willow)	0.0		Riparian Shrub (willow)	0.1		Riparian Shrub (willow)	0
	Riparian Forest (tree willow)	0.3		Riparian Forest (tree willow)	1.3		Riparian Forest (tree willow)	1
	Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0
	Rabbitbrush-NV saltbush scrub/meadow	35.6		Rabbitbrush-NV saltbush scrub/meadow	1777.7		Rabbitbrush-NV saltbush scrub/meadow	261
	Rabbitbrush-NV saltbush scrub	12.3		Rabbitbrush-NV saltbush scrub	1010.5		Rabbitbrush-NV saltbush scrub	122
	Tamarisk	10.7		Tamarisk	229.8		Tamarisk	2
	Bassia	0.0		Bassia	3.2		Bassia	0
	Desert sink scrub	268.6		Desert sink scrub	2741.0		Desert sink scrub	23
	Russian Olive	0.0		Russian Olive	8.1		Russian Olive	0
	Barren	2.0		Barren	57.4		Barren	20
	Structure	1.4		Structure	13.3		Structure	0
	Cut/Fill	0.0		Cut/Fill	0.0		Cut/Fill	0
	TOTAL Acres	**2088.6**		**TOTAL Acres**	**6466.2**		**TOTAL Acres**	**923**

Vegetation Mapping Table 11. Continued, Comparison of Vegetation Type Changes Between 2000 and 2009

Vegetation Name				Vegetation Name			Vegetation Name	
2000	**2009**	**Acres**	**2000**	**2009**	**Acres**	**2000**	**2009**	**Acres**
Tamarisk	Alkali flat	0.0	Barren	Alkali flat	0.0	Gooding Red Willow	Alkali flat	0.0
	Water	4.2		Water	21.4		Water	1.6
	Marsh	8.0		Marsh	23.6		Marsh	1.3
	Wet Alkali Meadow	0.0		Wet Alkali Meadow	0.0		Wet Alkali Meadow	0.0
	Reedgrass	0.0		Reedgrass	0.0		Reedgrass	0.0
	Dry Alkali Meadow	1.1		Dry Alkali Meadow	0.0		Dry Alkali Meadow	0.1
	Irrigated Meadow	0.0		Irrigated Meadow	0.0		Irrigated Meadow	0.1
	Great Basin Mixed Scrub	4.2		Great Basin Mixed Scrub	0.0		Great Basin Mixed Scrub	0.2
	Riparian Shrub (willow)	0.0		Riparian Shrub (willow)	0.0		Riparian Shrub (willow)	0.1
	Riparian Forest (tree willow)	5.8		Riparian Forest (tree willow)	0.0		Riparian Forest (tree willow)	10.1
	Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.0		Riparian Forest (cottonwood)	0.1
	Rabbitbrush-NV saltbush scrub/meadow	21.4		Rabbitbrush-NV saltbush scrub/meadow	0.6		Rabbitbrush-NV saltbush scrub/meadow	0.3
	Rabbitbrush-NV saltbush scrub	88.5		Rabbitbrush-NV saltbush scrub	0.7		Rabbitbrush-NV saltbush scrub	0.1
	Tamarisk	208.4		Tamarisk	0.0		Tamarisk	0.2
	Bassia	0.0		Bassia	0.0		Bassia	0.0
	Desert sink scrub	35.2		Desert sink scrub	0.0		Desert sink scrub	0.1
	Russian Olive	2.6		Russian Olive	0.0		Russian Olive	2.3
	Barren	2.4		Barren	0.0		Barren	0.0
	Structure	1.9		Structure	0.0		Structure	0.4
	Cut/Fill	0.0		Cut/Fill	0.0		Cut/Fill	0.2
	TOTAL Acres	**383.7**		**TOTAL Acres**	**46.3**		**TOTAL Acres**	**17.4**

Vegetation Mapping Table 12. Comparison of Vegetation Within the BWMA Units Between 2000 and 2009

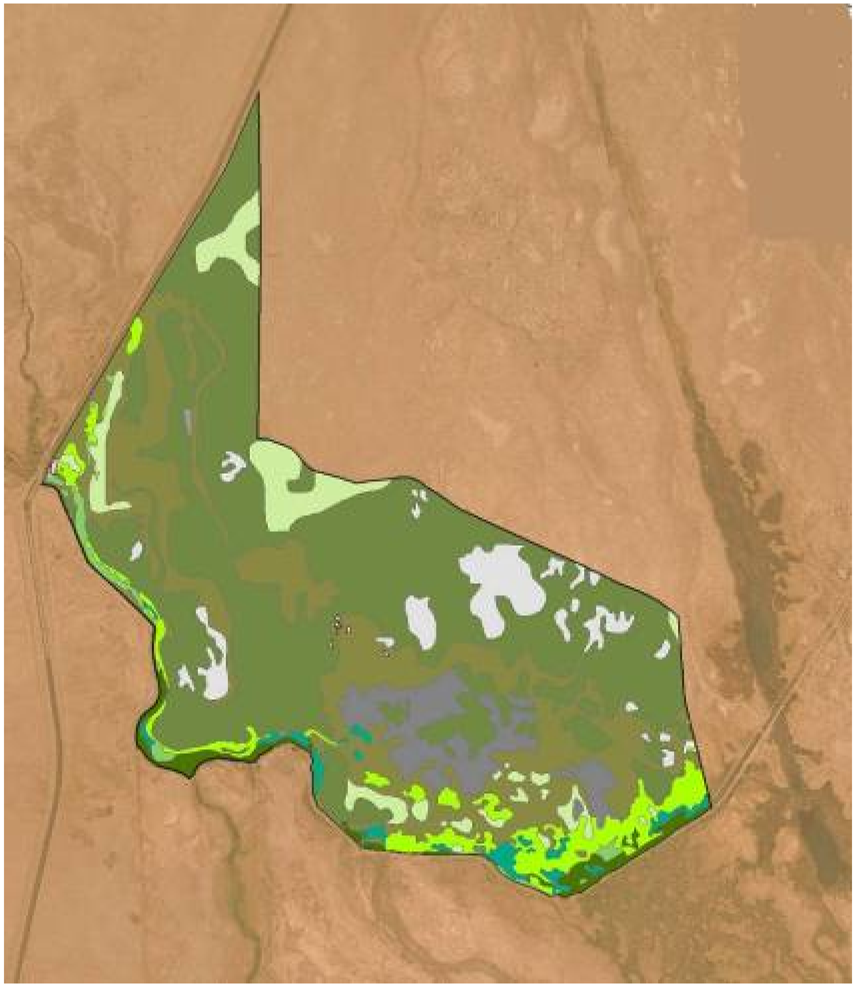
BWMA Vegetation Mapping 2010									
VEGETATION NAME	**Drew**			**Thibaut**			**Waggoner**		
	2000	**2009**	**Change**	**2000**	**2009**	**Change**	**2000**	**2009**	**Change**
Alkali Flat	0.0	0.0	*0.0*	749.5	358	*-391.1*	5.4	0.4	*-5.0*
Water	0.0	142.7	*142.7*	0.0	3.1	*3.1*	7.2	90.3	*83.1*
Marsh	21.2	103.0	*81.8*	76.5	137.8	*61.3*	214.6	188.6	*-25.9*
Wet Alkali Meadow	11.0	0.0	*-11.0*	234.1	0.5	*-233.6*	56.8	47.3	*-9.5*
Reedgrass	2.3	0.0	*-2.3*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Dry Alkali Meadow	46.5	5.1	*-41.4*	0.0	405.9	*405.9*	35.8	35.3	*-0.5*
Irrigated Meadow	0.0	0.0	*0.0*	210.3	165.4	*-44.9*	0.0	0.0	*0.0*
Great Basin Mixed Scrub	50.9	38.4	*-12.5*	247.2	272.6	*25.4*	210.8	228.2	*17.4*
Riparian Shrub (willow)	0.0	0.0	*0.0*	2.1	3.0	*1.0*	0.0	1.7	*1.7*
Riparian Forest (tree willow)	8.4	7.2	*-1.1*	3.6	1.4	*-2.2*	0.6	1.5	*0.9*
Riparian Forest (cottonwood)	0.0	0.1	*0.1*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Rabbitbrush-NV Saltbush Scrub/Meadow	70.7	217.4	*146.7*	539.2	1526.7	*987.5*	267.8	505.9	*238.1*
Rabbitbrush-NV Saltbush Scrub	125.9	26.7	*-99.2*	121.1	558.9	*437.8*	43.4	98.7	*55.3*
Tamarisk	0.7	1.6	*0.9*	89.3	121.3	*32.0*	2.6	68.3	*65.7*
Bassia	0.0	0.0	*0.0*	0.0	33.1	*33.1*	0.0	0.0	*0.0*
Desert Sink Scrub	400.9	281.3	*-119.7*	2055.6	936.1	*-1119.5*	693.5	272.5	*-421.0*
Russian Olive	0.0	0.0	*0.0*	0.0	14.3	*14.3*	0.0	0.0	*0.0*
Barren	46.3	1.2	*-45.1*	0.0	178.9	*178.9*	0.0	11.4	*11.4*
Playa	41.0	0.0	*-41.0*	406.4	0.0	*-406.4*	15.7	0.0	*-15.7*
Structure	0.0	0.5	*0.5*	0.0	17.3	*17.3*	0.0	3.4	*3.4*
Cut/Fill	0.9	1.7	*0.7*	0.0	0.0	*0.0*	0.7	0.9	*0.2*
TOTAL Acres	**826.6**	**826.9**	***0.3***	**4734.9**	**4734.8**	***-0.1***	**1554.9**	**1554.3**	***-0.6***

Vegetation Mapping Table 12. Continued, Comparison of Vegetation Within the BWMA Units Between 2000 and 2009

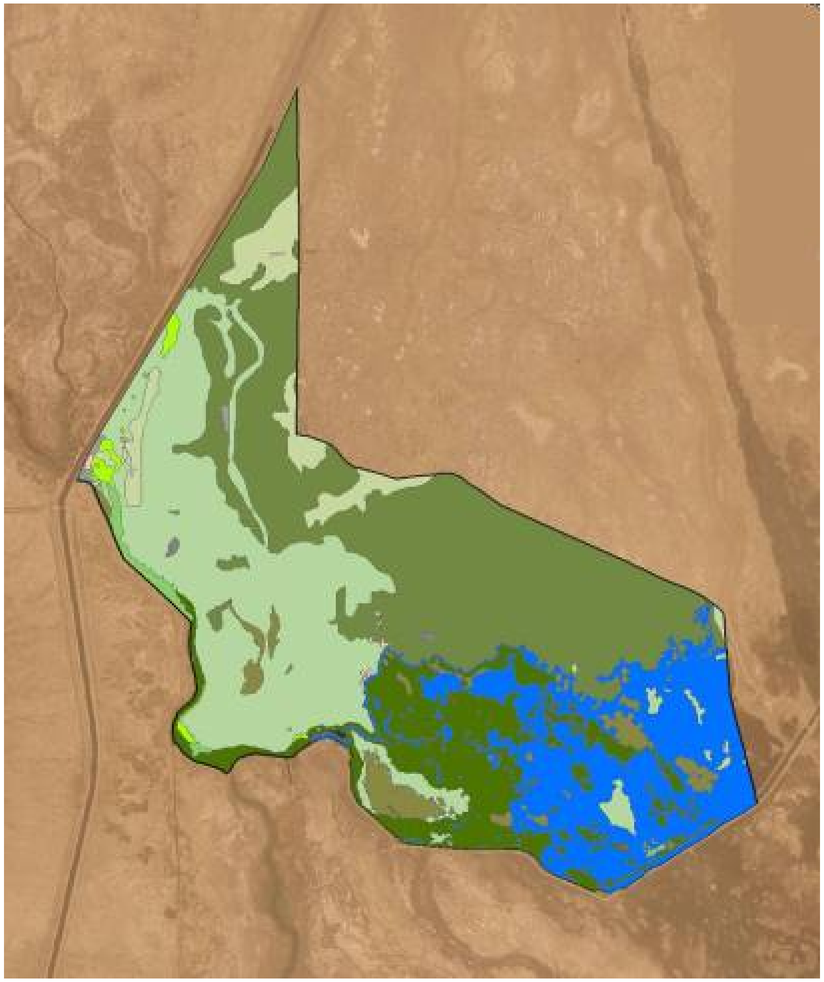
BWMA Vegetation Mapping 2010									
Vegetation	Winterton			Goose Lake			Twin Lakes		
NAME	2000	2009	Change	2000	2009	Change	2000	2009	Change
Alkali Flat	145.3	44.5	*-100.8*	16.3	0.0	*-16.3*	5.9	0.0	*-5.9*
Water	0.0	7.3	*7.3*	9.6	16.3	*6.7*	18.1	40.9	*22.8*
Marsh	55.8	82.1	*26.3*	8.9	16.1	*7.2*	83.0	102.3	*19.2*
Wet Alkali Meadow	110.0	0.0	*-110.0*	0.0	0.0	*0.0*	34.1	4.5	*-29.6*
Reedgrass	0.0	3.0	*3.0*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Dry Alkali Meadow	13.7	242.2	*228.5*	5.2	11.4	*6.2*	33.8	41.7	*7.9*
Irrigated Meadow	0.0	0.0	*0.0*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Great Basin Mixed Scrub	0.0	31.1	*31.1*	125.9	36.9	*-89.1*	1455.5	1626.3	*170.7*
Riparian Shrub (willow)	0.0	0.0	*0.0*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Riparian Forest (tree willow)	0.0	0.3	*0.3*	0.0	1.7	*1.7*	4.7	12.4	*7.7*
Riparian Forest (cottonwood)	0.0	0.1	*0.1*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Rabbitbrush-NV Saltbush Scrub/Meadow	233.2	899.8	*666.6*	86.4	235.0	*148.6*	38.8	70.4	*31.6*
Rabbitbrush-NV Saltbush Scrub	199.6	535.2	*335.6*	0.0	244.7	*244.7*	1.1	31.7	*30.6*
Tamarisk	2.8	16.8	*14.0*	216.7	236.1	*19.4*	71.4	67.1	*-4.2*
Bassia	0.0	1.1	*1.1*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Desert Sink Scrub	1062.0	0.0	*-1062.0*	1255.5	936.6	*-318.9*	1002.4	780.5	*-221.9*
Russian Olive	0.0	0.0	*0.0*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
Barren	0.0	27.3	*27.3*	0.0	1.4	*1.4*	0.0	114.9	*114.9*
Playa	83.5	0.0	*-83.5*	14.9	0.0	*-14.9*	151.8	0.0	*-151.8*
Structure	0.0	16.4	*16.4*	0.0	0.6	*0.6*	0.0	5.7	*5.7*
Cut/Fill	11.7	10.4	*-1.3*	0.0	0.0	*0.0*	0.0	0.0	*0.0*
TOTAL Acres	**1917.6**	**1917.5**	***-0.1***	**1739.4**	**1736.8**	***-2.6***	**2900.7**	**2898.4**	***-2.3***

Vegetation Mapping Figure 12. Drew Unit in 2000

Vegetation Mapping Figure 13. Drew Unit in 2009



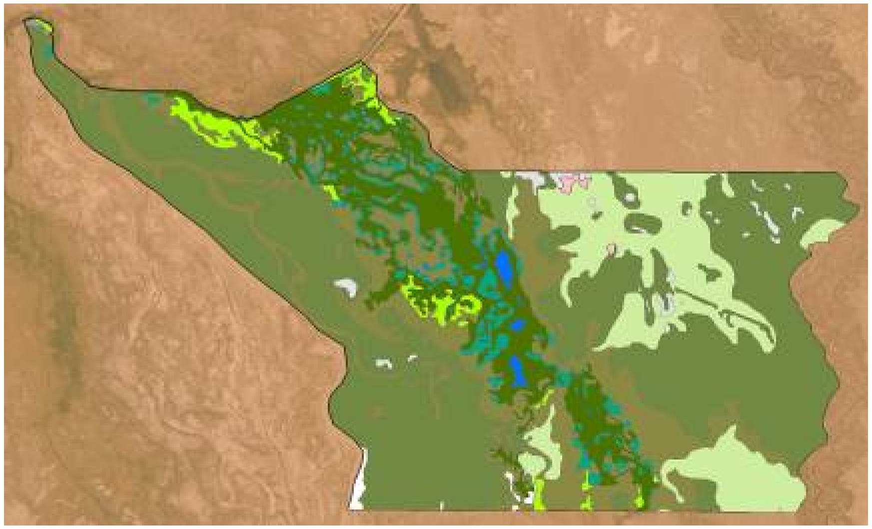
Vegetation Mapping Figure 14. Vegetation Types in Drew Unit 2000



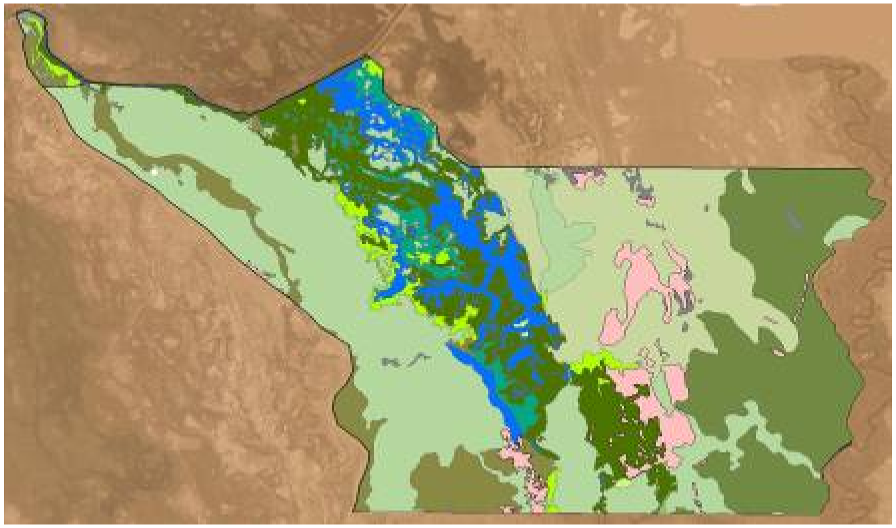
Vegetation Mapping Figure 15. Vegetation Types in Drew Unit 2009

Vegetation Mapping Figure 16. Waggoner Unit 2000 Aerial Imagery

Vegetation Mapping Figure 17. Waggoner Unit 2009 Aerial Imagery



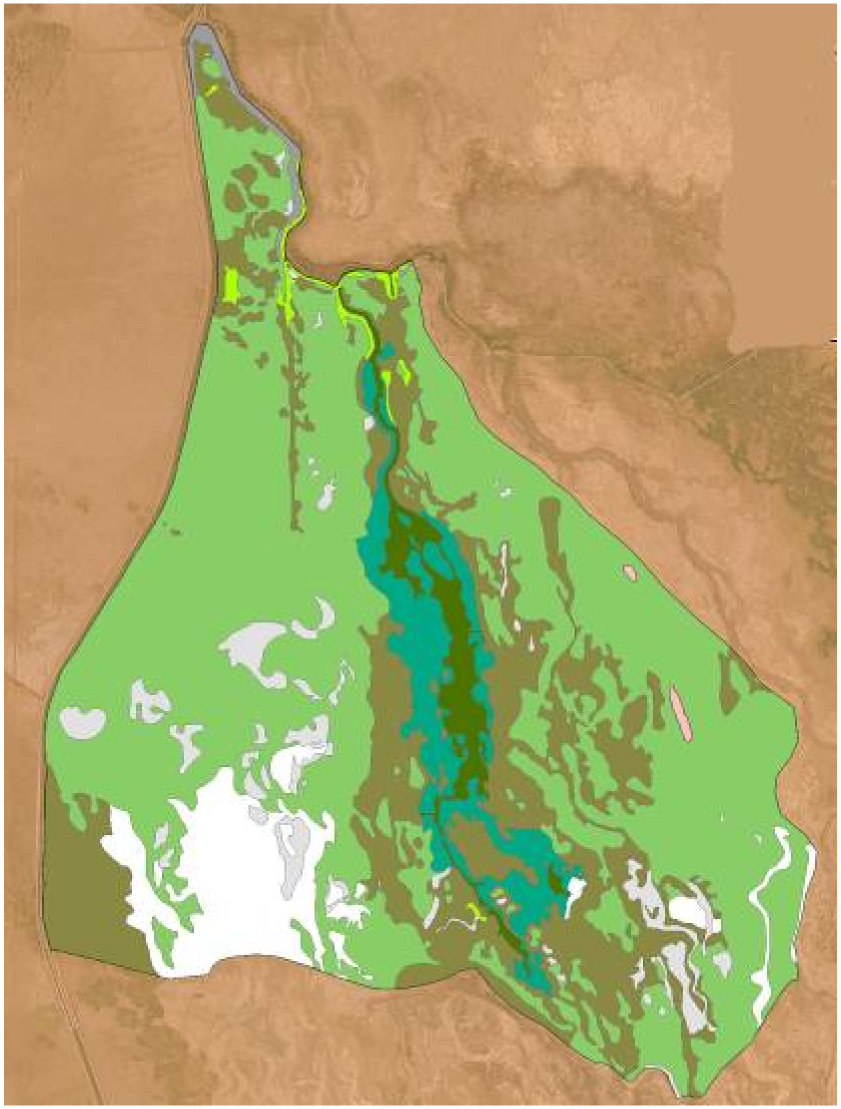
Vegetation Mapping Figure 18. Waggoner Unit Vegetation Types 2000



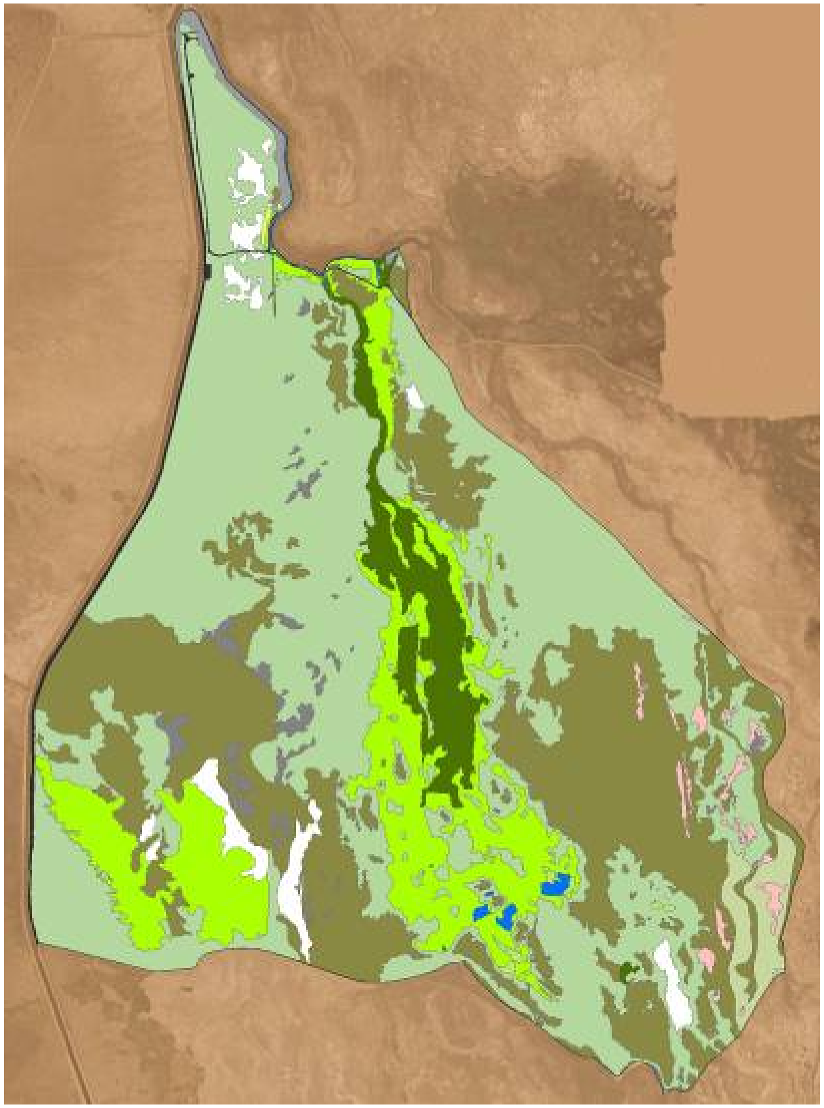
Vegetation Mapping Figure 19. Waggoner Unit Vegetation Types 2009

Vegetation Mapping Figure 20. Winterton Unit 2000 Aerial Imagery

Vegetation Mapping Figure 21. Winterton Unit 2009 Aerial Imagery



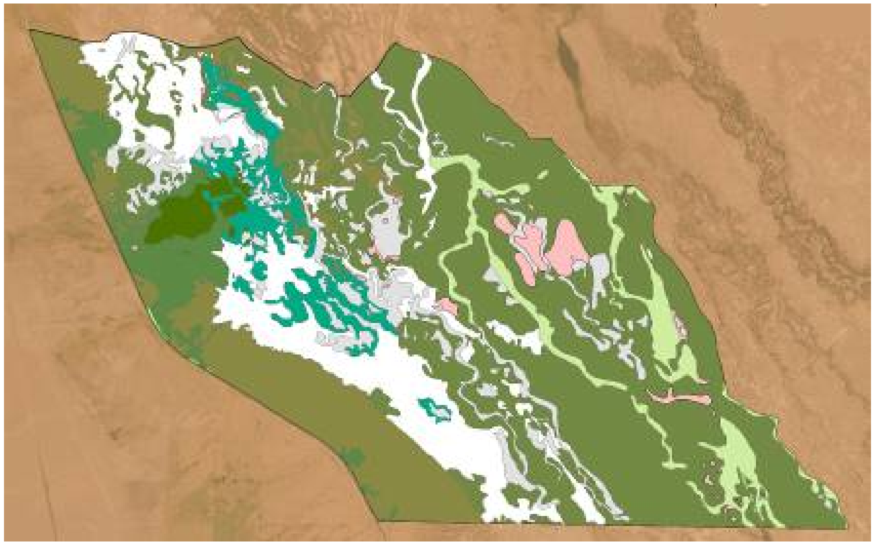
Vegetation Mapping Figure 22. Winterton Unit Vegetation Types 2000



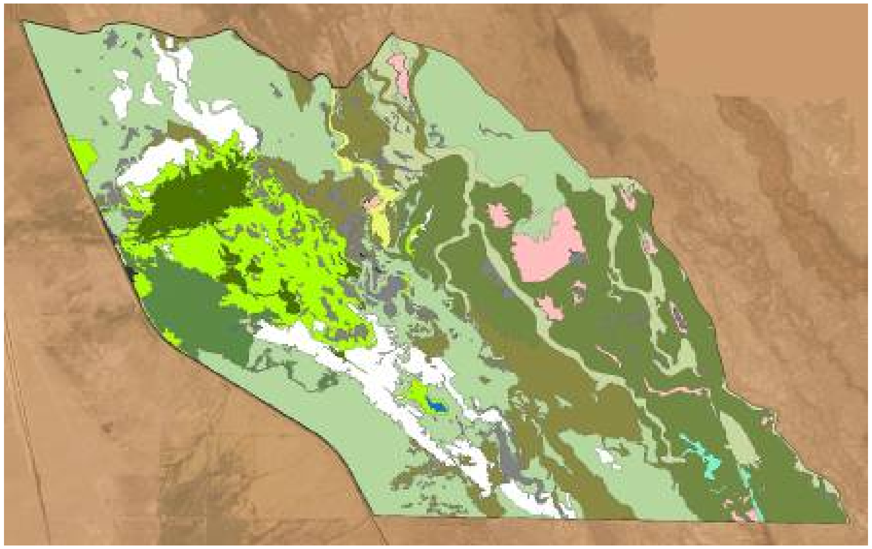
Vegetation Mapping Figure 23. Winterton Unit Vegetation Types 2009

Vegetation Mapping Figure 24. Winterton Unit 2000 Aerial Imagery

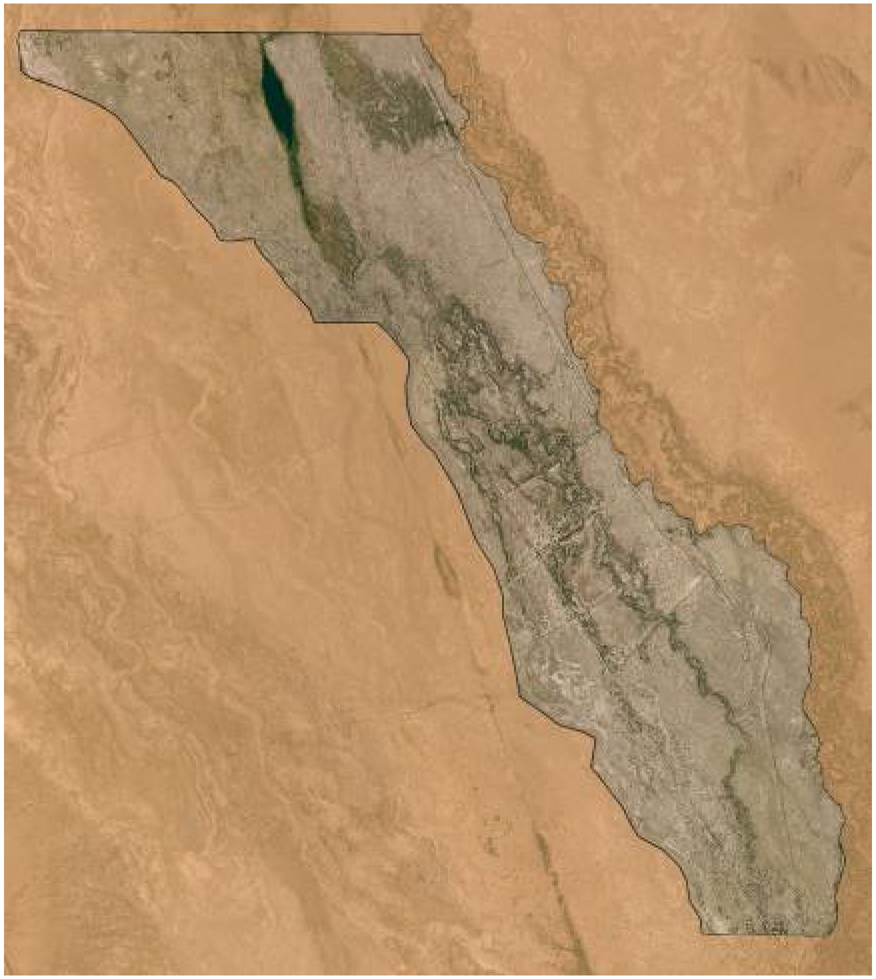
Vegetation Mapping Figure 25. Winterton Unit 2009 Aerial Imagery



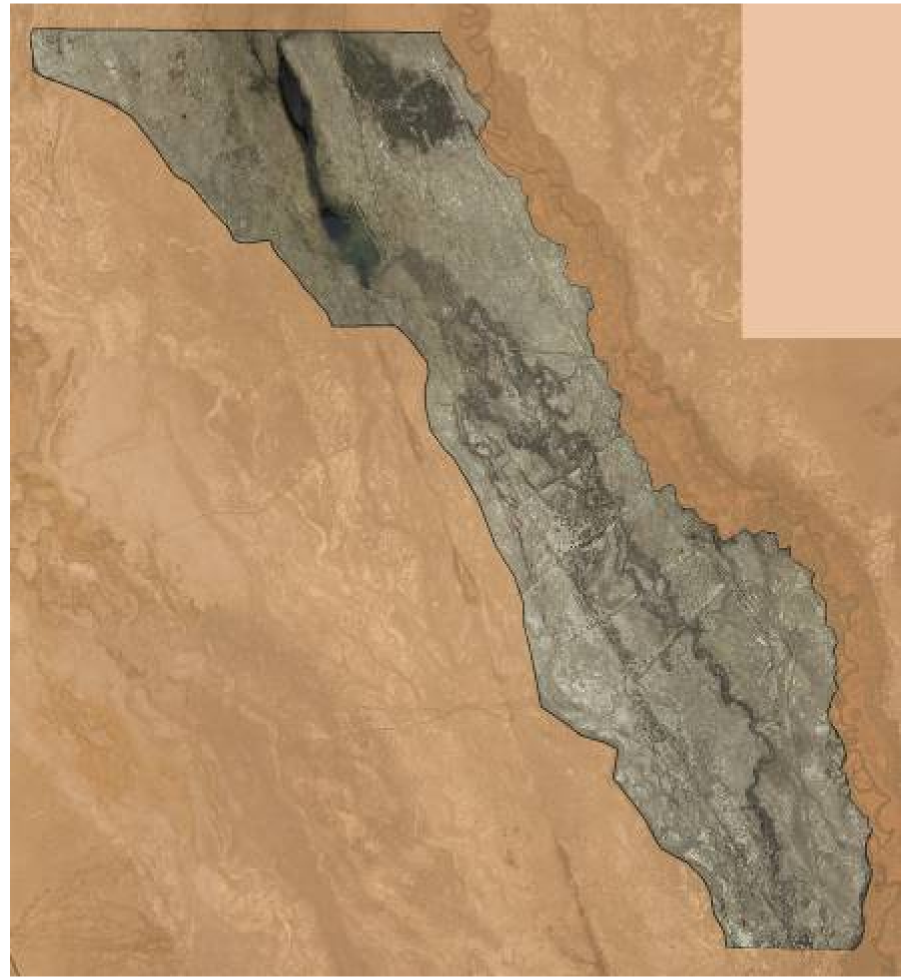
Vegetation Mapping Figure 26. Thibaut Unit Vegetation Types 2000



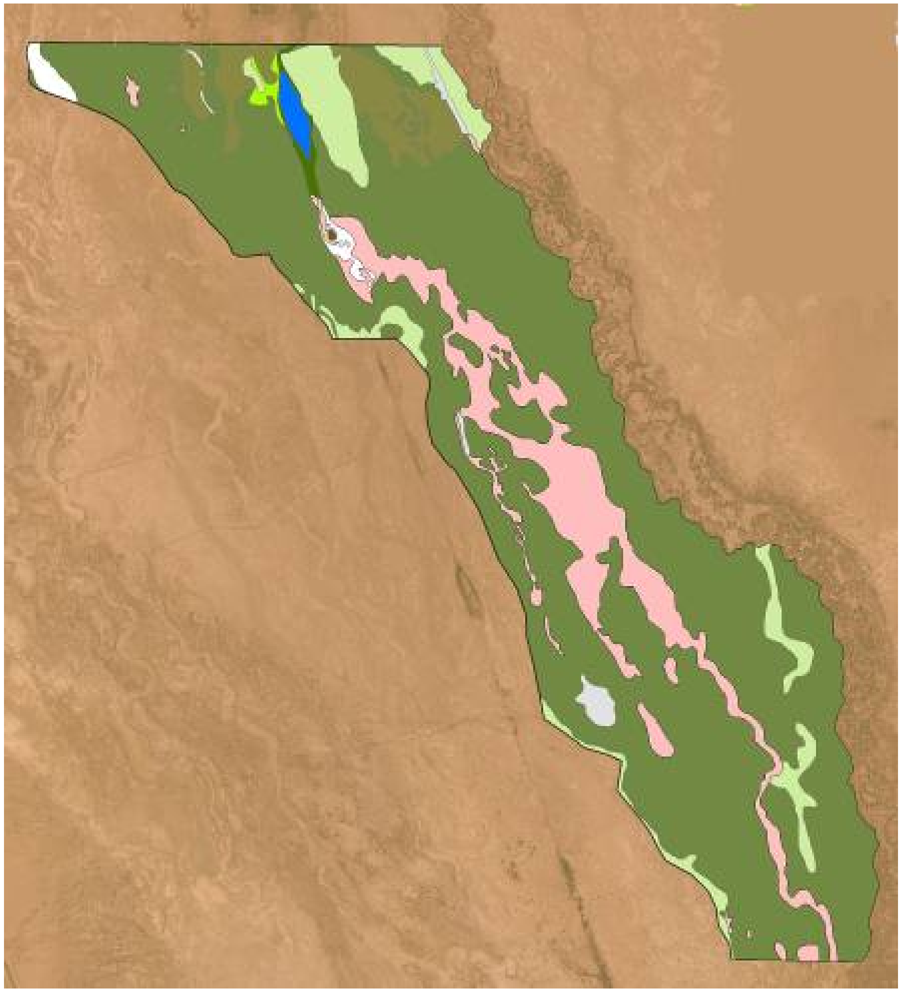
Vegetation Mapping Figure 27. Thibaut Unit Vegetation Types 2009



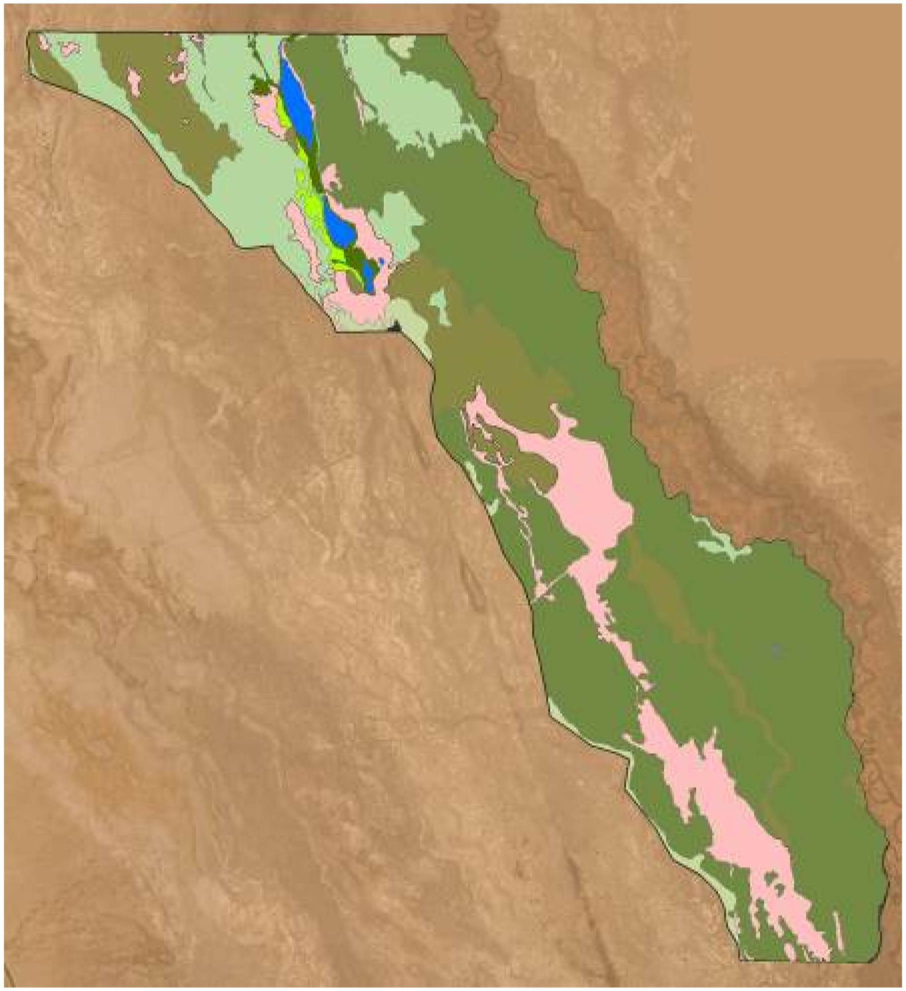
Vegetation Mapping Figure 28. Goose Lake 2000 Aerial Imagery



Vegetation Mapping Figure 29. Goose Lake 2009 Aerial Imagery

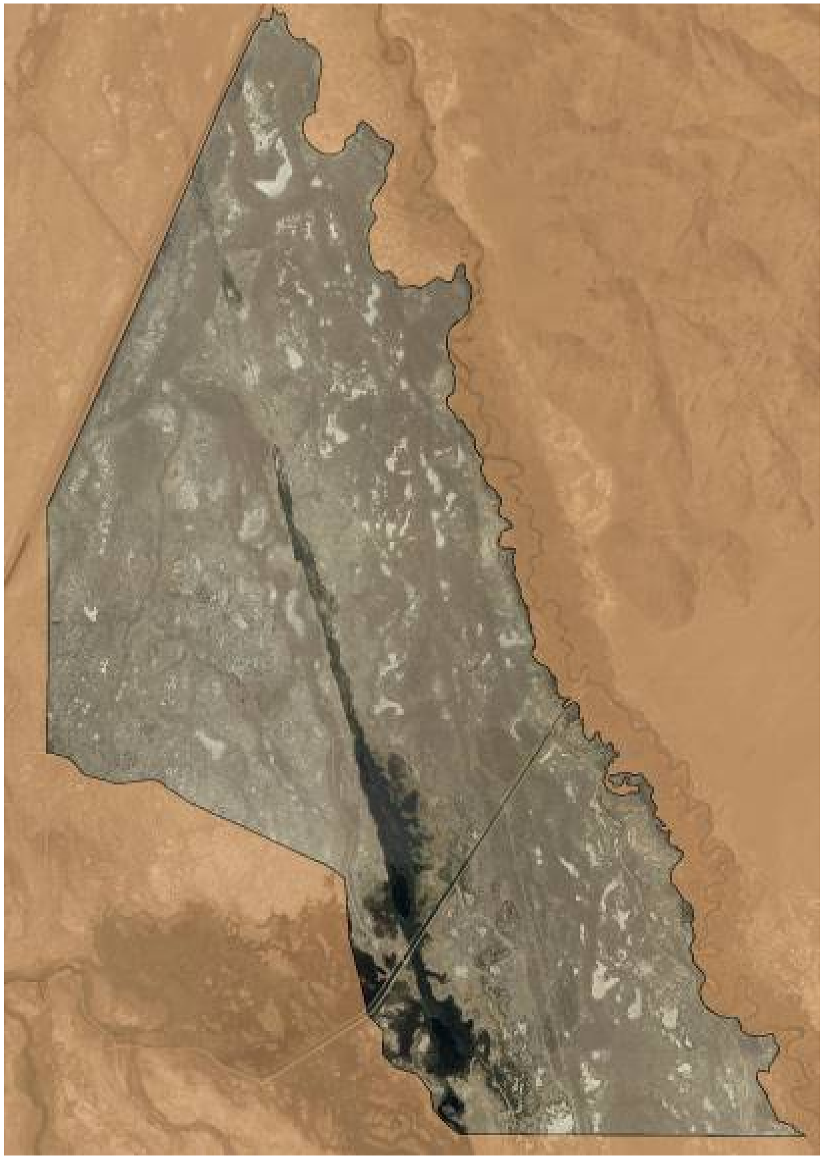


Vegetation Mapping Figure 30. Goose Lake Vegetation Types 2000

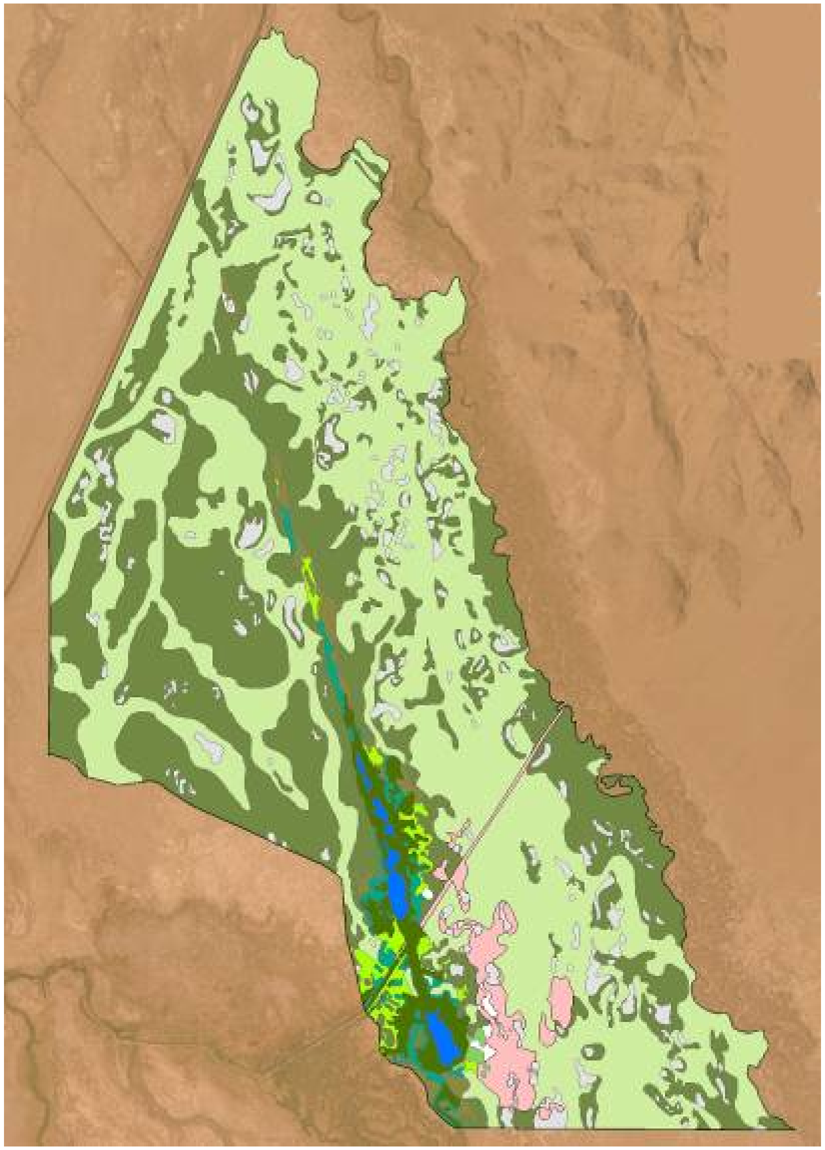


Vegetation Mapping Figure 31. Goose Lake Vegetation Types 2009

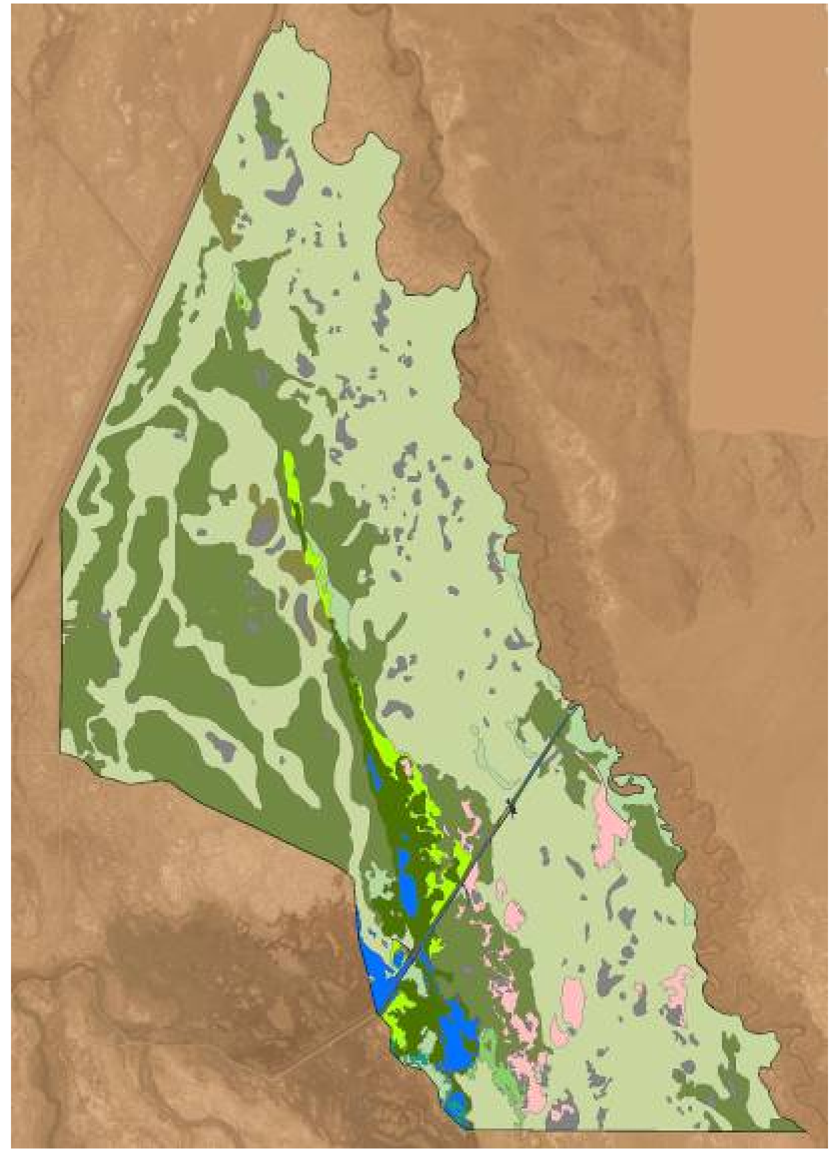
Vegetation Mapping Figure 32. Twin Lakes 2000 Aerial Imagery



Vegetation Mapping Figure 33. Twin Lakes 2009 Aerial Imagery



Vegetation Mapping Figure 34. Twin Lakes Vegetation Types 2000



Vegetation Mapping Figure 35. Twin Lakes Vegetation Types 2009

6.9 Management Unit Changes

Water releases into the BWMA began in April of 2007. The first two management units that were flooded were Thibaut and Winterton. During the first year of the LORP (July 2007 to March 2008) the requirement was to maintain approximately 290 flooded acres. The average flooded acreage for the two areas totaled 477 acres for the July 2007 to March 2008 period. For 2008-2009 the flooded acreage requirement increased to 430 acres and the average area flooded was 515 acres. During this period the acreage flooded within the Winterton Unit ranged from 37 to 225 acres. The acreage flooded in the Thibaut Unit ranged from 43 to 658 acres.

During the late summer of 2008 the area of open water within Thibaut and Winterton decreased to less than 50%. This triggered a management change requiring the Drew and Waggoner Units to be put into service and Thibaut and Winterton being taken out of service.

In the late fall and early winter of 2008 fire lines were built around Drew and Waggoner Units. A total of approximately 1,000 acres of these units was burned in the winter of 2008-2009 to prepare them for flooding in the spring.

In April 2009 the Drew and Waggoner areas began being flooded. The goal for total average wetted acreage was 355 acres. Because these areas took much longer than anticipated to saturate and provide enough wetted acreage to meet the goals for the year, Winterton was turned back on for part of the summer of 2009. Drew and Waggoner attained expected wetted acreages around mid-August and Winterton was again taken out of service. The aerial photography utilized for this mapping effort was flown the same week the Winterton unit was shut off.

During spring of 2009 the area flooded in Drew was 44 acres increasing to 161 acres in the summer and 252 acres by fall. In August and September 2010 when the mapping was being ground-truthed, the flooded acreage of Drew was 320 acres. The Waggoner Unit had 45 acres flooded in the spring, 110 acres in the summer, and 165 acres in the fall. Winterton had 205 acres flooded in the summer of 2009. In August and September 2010 when the mapping was being ground-truthed, the flooded acreage of Waggoner was 310 acres.

Drew
As described above this unit was burned in the winter of 2008-2009 and flooded in the spring of 2009. These actions resulted in tremendous changes in the Drew Unit. Burning reduced the Desert sink scrub and Rabbitbrush-NV Saltbush Scrub. Flooding the area increased the area of Water and Marsh. The rise in water table began drowning intolerant shrubs which increased the area of Rabbitbrush-NV Saltbush Meadow.

Waggoner
Changes in the Waggoner Unit are similar to those described for Drew above. There were decreases in Desert Sink Scrub and Playa and increases in Rabbitbrush-NV Saltbush Meadow and Water. The area of open water decreased in this unit to close to 50% during the 2010 growing season and it is likely that this unit will be taken out of service in 2011.

Winterton
The degree in variability in the flooding of the Winter Unit had to have had some effect on the vegetation. Varying inflows and variation in flooded acreage and the fact that the unit was taken out of service about the time the imagery was acquired make generalizations difficult. There was a substantial decrease in Desert Sink Scrub. There were increases in both Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow that nearly equal this loss.

Thibaut
The variation in flooded acreage in the Thibaut Unit changed a great deal when the unit was in service this is mainly due mainly to its topography. The area is very flat with slight undulations which create very shallow pool areas and only small changes to inflows new pool areas were created or dried up causing large variations in the wetted acreage measurements which had to have had an effect on the vegetation. There was a substantial decrease in Desert Sink Scrub. There were increases in both Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow that nearly equal this loss.

Goose Lake
In the Goose Lake Unit there was a substantial decrease in Desert Sink Scrub and a decrease in Great Basin Mixed Scrub. The increases in both Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow that nearly equal these losses. There are no other substantial changes within the unit which is not surprising since there have been few management actions that would result in changes to vegetation.

Twin Lakes
There was a substantial decrease in Desert Sink Scrub. The increases in Great Basin Mixed Scrub, Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow nearly equal this loss. The decrease in Playa and Alkali Flat are offset by the increase in Barren, Water, and Marsh.

Management Unit specific comparisons between 2000 and 2009 by vegetation type can be found in Vegetation Mapping Appendix 2.

6.9.1 Conclusions

There were over 40 people day spent on the ground mapping in the BWMA during the 2009 campaign, this in addition to improved mapping technology and increased field efforts are likely the main reason for some of the “changes” observed in the Desert Sink, Rabbitbrush-NV Saltbush Scrub and Rabbitbrush-NV Saltbush Meadow vegetation types which account for nearly half of the identified changes in the BWMA. A majority of the areas mapped as Desert Sink, Rabbitbrush-NV Saltbush Scrub, and Great Basin Mixed Scrub are not in areas that would really be expected to be affected by the project. The early mapping efforts could only predict where an effect may happen. Now that data exists that can illustrate the area of effect, future mapping efforts should only focus within these areas. This would result in a substantial reduction in time and effort to assess changes within the project area that can be attributed to the project.

The dynamic nature of management of the BWMA will continue to provide challenges in future mapping efforts. At this point it appears the flooding cycles will last between two and five years. This means that during future efforts some units will be either wetting or drying and will have either just recently been burned or being prepared for burning.

Overall implementation of the BWMA has had a number of positive benefits. There is a measurable increase in Water, Marsh, Dry Alkali Meadow, and Rabbitbrush-NV Saltbush Meadow types within the project area. The decrease in Wet Alkali Meadow is a result of flooding in Drew and Waggoner, and drying of Winterton and Thibaut.

However, a note of concern is that even with treatment of Tamarisk occurring within the BWMA, between 2000 and 2009, the area mapped increased in every management unit.

6.10 References

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Whitehorse Associates (WHA). 2004c. *LORP Delineation, Prediction and Assessment of Wetland/Riparian Resources*. Report to LADWP and Inyo County.

7.0 LOWER OWENS RIVER PROJECT SITE SCALE VEGETATION ASSESSMENT

The vegetation of the Lower Owens River has changed drastically between Baseline (2001-2002)[1] and 2010 conditions. Transect analysis revealed 21 vegetation types that fall into 5 complexes, compared to 22 vegetation types in 6 complexes at Baseline. The vegetation types and complexes were crosswalked to other scales and classification systems. Vegetation types disappeared and were added to the system over that period. Many changes occurred between and among vegetation types. Areas dominated by the baseline Tamarisk Complex were replaced with the 2010 Fivehorn Smotherweed Complex (*Bassia*). The most common species were saltbush and saltgrass at baseline and in 2010. Notable species that declined in dominance include Russian thistle, tamarisk, and Goodding's willow. Notable species that increased in dominance include cattail, creeping wildrye, and smotherweed. The most common vegetation type in 2010 was Cattail-Willow Wetland. The diverse wet meadow vegetation types increased between Baseline and 2010. The decline in cover of Willow Woodlands is likely a result of tree willows being more frequently included in other vegetation types. Smotherweed and associated species appear to have replaced disturbed areas formerly dominated by tamarisk and Russian thistle. These areas appear to be undergoing successional processes. By almost any measure, the study area became more diverse between baseline and 2010. More dominant species occurred throughout the study area (80 species at baseline, 93 in 2010). Average patch length (an inverse measure of complexity) decreased from 19.2 m at baseline to 13.8 in 2010. Three baseline vegetation types had more than 30 dominant species; five of the 2010 vegetation types had more than 30 species. The most diverse baseline vegetation type had 39 dominant species; the most diverse vegetation type in 2010 had 54 dominant species. The average number of dominant species per baseline vegetation type was 17.3; the average number for dominant species for 2010 vegetation types was 22.5. Five baseline vegetation types had a Shannon's Diversity Index values above 2.0 with a high of 2.9; eleven vegetation types had Shannon's Diversity Index values above 2.0 with a high of 3.4. The Smotherweed Complex and Saltgrass types had the lowest diversity measures. The Smotherweed complex increased its percent cover the most; tamarisk declined the most. Canopy cover increased across most vegetation types. Bare ground decreased. Vegetation groundcover increased. Mapping results and transect results indicate similar trends. The ecosystem is recovering quickly due to management actions, but disturbed and degraded areas remain and are undergoing successional processes.

Introduction

This report contains the methods and results of the 2010 site scale vegetation monitoring for the LORP. The 2010 monitoring consisted of transect, subplot and mapping efforts. Results are presented separately, as they are designed to provide managers with several tools by which to examine the ecosystem.

7.1 Site-Scale Sampling Protocols

This section includes excerpts from baseline methods provided in the Lower Owens River Monitoring and Adaptive Management Plan as well as an update that describes current methodology changes.

7.1.1 Monitoring and Adaptive Management Plan Methods

The following sections are excerpts from the Lower Owens River Monitoring and Adaptive Management Plan. Landform elevation data was collected by LADWP but is not included in this report. The riparian hardwood mapping was not practical or economical given the revised methods,

[1] Ecosystem Sciences 2008; Risso 2007.

time, and budget available. This portion of the study may be done at a later time, if needed. Any changes from the methods included below are detailed in the 2010 Monitoring Year Methodology Changes and Details section below. Only small edits (e.g. figure numbers, small clarifications in parentheses) were included in this section.

Site Scale Vegetation Assessment

<u>Monitoring Purpose</u>

Site scale (scale of site ~ 1:10000, sites mapped at 1:2000 scale, refined at 1:500 scale) vegetation assessment methods and protocols are composed of vegetation transects, subplots, landform and vegetation community type mapping. Site Scale Vegetation Assessment and Landform Elevation Modeling are designed to inform decision making for the following adaptive management areas (see Section 3.7.1 of MAMP): Seasonal Habitat Flows, Terrestrial Habitat, Riverine-Riparian Habitat, Tule/Cattail Control, Range Condition and Recreation. The methods and protocols were designed to inform LORP managers about riparian conditions at a larger scale (finer resolution) than the existing Green Book and White Horse Associates[2] community type mapping efforts, which were performed at the landscape scale. The landscape scale vegetation monitoring effort operates on a coarse scale, informing managers about broad changes in the entire riverine-riparian landscape. The site-scale vegetation methods will be able to detect more subtle changes in vegetation in response to restoration actions. This data will enable managers to analyze changes in community composition and structure, patch dynamics, wetland indicator status, both reach and community type diversity and several other measures. The objective of landform and elevation modeling is to establish the baseline geomorphic landforms and height above water surface elevation as they relate to riparian vegetation to determine future changes in riparian vegetation and geomorphology. The vegetation transect data, subplot data, landform and elevation data and community type mapping all occur at five 2 km study plots established along the Lower Owens Riverine-Riparian corridor (Site Scale Figure 1).

Site Scale Table 1. (Table 4.13 of MAMP). Reaches, number of reference plots, river miles and river kilometers of the LORP Riverine-Riparian Area

Reach	# of Reference Plots	Miles	km
1.Intake to Mazourka Canyon Road (dry reach)	2	20.7	33.3
2. Mazourka Canyon Road to Islands	1	12.8	20.6
3. Islands (wetland reach)	0	5.1	8.2
4. Islands to South of Lone Pine	1	7.6	12.2
5. Lone Pine Station Road to the Pumpback Station	1	7.1	11.4
Lower Owens River	5	53.3	85.7

[2] Whitehorse Associates 2004.

Baseline Data Collected

Vegetation Transect Data

- Vegetation patch species composition and structure - dominant species ranked within six structural levels,
- Length of vegetation patch
- Collected at 21 transects in each of the five Riverine-Riparian study plots.

Subplot Data

- Canopy cover for each species in 2 m x 2 m plots (changed to 1 m x 1 m)
- Ground cover in 2 m x 2 m plots(changed to 1 m x 1 m)

Vegetation Mapping Data

- Aerial extent of vegetation communities
- Map units are ≥ 4 m^2 (2 m x 2 m) mapped at five 2 km study plots

Methods

Study Design and Site Selection

Site scale vegetation monitoring consists of vegetation transect and subplot sampling, landform and elevation modeling and vegetation community mapping efforts. These fine scale sampling techniques occur at five 2 km plots in four of the five reaches of the Riverine-Riparian Area (Site Scale Table 1, Site Scale Figure 1). The study plots were selected to be representative of each reach, encompassing the range of vegetative, geomorphic and environmental conditions, especially the upper reaches which were dry and the lower river reaches which were wetted to one degree or another prior to implementation of the LORP well as grazing management approaches in the Lower Owens River.

For example, two reference plots are 50% inside a grazing lease and 50% outside the lease to enable managers to examine grazing effects on the restoration project. It was determined that because the Islands reach is a short (8.2 km) section of river composed of a vast, complex wetland with numerous channels creating access problems, more useful data would be produced by placing a second study plot in the dry reach (Reach 1). The dry reach is four times larger than the islands and will likely respond more dynamically to management actions than the Islands reach. The data were designed to detect change within areas that managers have the ability to effectively manage through flow and land management.

Protocol

Transect Sampling

The purpose of the vegetation transect data is to work in conjunction with mapping and other sampling efforts to describe the riparian vegetation communities of the Lower Owens Riverine-Riparian Area. Therefore, transects were sampled at the same site locations as the site scale mapping and subplots. Study sites are aligned with the river channel. Because of the meandering nature of the Lower Owens River, it was logistically practical and more scientifically meaningful to have all transects within each plot parallel to one another. Sites are 2 km in length and transects occur every 100 m within each site (21 transects over 2,000 m). Each transect extends away from both sides of the wetted area of the channel through the riparian zone toward the upland zone. Transects extend laterally (perpendicular) from the center axis of the site to the edge of the riparian vegetation and encompassing the entire historic floodplain (as judged by examination of aerial photography). Fence posts were installed at what appeared to be the edge of the riparian vegetation (or the top of the terrace), to mark the outer end of each transect. Each fencepost was labeled according to site and transect. GPS locations of each fence post were recorded. Site Scale Figure 2 shows the transect layout of Plot 1.

Along each transect, determine via a modified line-intercept method[3] the area covered by unique plant communities. Rank dominant species by estimated percent cover within each community patch (sample unit) in each of the 6 vegetation layers (upper canopy, lower canopy, high shrub, low shrub, high grass/herb, low grass/herb). Record the three species with the highest estimated canopy cover in each layer as dominant, 1st sub-dominant and 2nd sub-dominant. A minimum of 5% canopy cover (within the community patch) is required in order for a species to be eligible for inclusion. Species are recorded by their 4-letter acronyms. Record dominant and sub-dominant species within the same layer in order of dominance and separated within each layer by dashes (-); separate structural layers by slashes (/). Measure the length of the transect segment that travels through each patch using a sonar range finder or measuring tape. Utilize fencepost locations, maps, compass, and GPS units to facilitate navigation. Take digital photographs of sampling locations when appropriate. A graphical depiction of a portion of transect 17 in plot 5 is shown in Site Scale Figure 3 to illustrate the method.

<u>Subplot Sampling</u>

Establish a series of 2 m x 2 m subplots (*changed to 1 m x 1 m*) to provide more detailed information about vegetation communities. After transect data have been collected, randomly select five communities from the sampled patches using accepted methods (e.g., random number generation). Establish a subplot at each of these randomly selected communities. Locate subplots adjacent to the transect line (sharing one 2 m side – *changed to 1 m*) in the center of a community (Figure 4.5 of MAMP). Subplots will share their downstream edge with the transect on which they are located.

Within each subplot, record canopy cover for each species. Canopy cover is a percentage of the 2 m x 2 m (changed to 1 m x 1 m) area covered by each species when viewed from above. To understand this estimate, it is best to imagine a 2 m x 2 m column extending from the quadrat upwards through the canopy. Because several structural layers may exist, the cover percentages may collectively total more than 100%. For example, a willow may have 90% canopy cover in a plot, with a rush having 70% canopy cover in that same plot. To be considered for inclusion in canopy cover estimates herbaceous plants must be rooted within the subplot, while trees and shrubs need not be rooted within the plot. Record species using their 4-letter acronyms and a percent cover estimate (to the nearest whole percentage). Determine ground cover for each subplot. Unlike canopy cover estimates, ground cover estimates always total 100%. Divide ground cover into litter, rock (≥ 3 cm in diameter), bare ground, downed wood (≥ 2 cm in diameter), vegetation, manure and other (specify). Take digital photographs of sampling locations when appropriate.

<u>Site Scale Mapping</u>

Site Scale Mapping methods roughly follow those developed for Rush Creek in the Mono basin by Kauffman et al.[4] In the field, identify all vegetation plant communities (patches) ≥ 4 m^2 and map their boundaries on a Mylar sheet placed over a digital aerial photograph (scale:1:2000). Use multiple aerial photographs to map each site. Perform vegetation community type mapping at all five of the LORP 2 km riverine-riparian plots. For each mapped patch (≥4 m^2) determine and label on the map the dominant species in the tallest layer (overstory) and the understory (if possible). In the lab, scan and fit together into a mosaic the field maps drawn on Mylar sheets using Adobe Photoshop and import them into ESRI's ArcView. Overlay the scanned field maps over the digital aerial photographs and properly align them. Use this layer in Arcview as a guide from which to digitize shape files for all communities mapped. Generate associated attribute tables for each shape.

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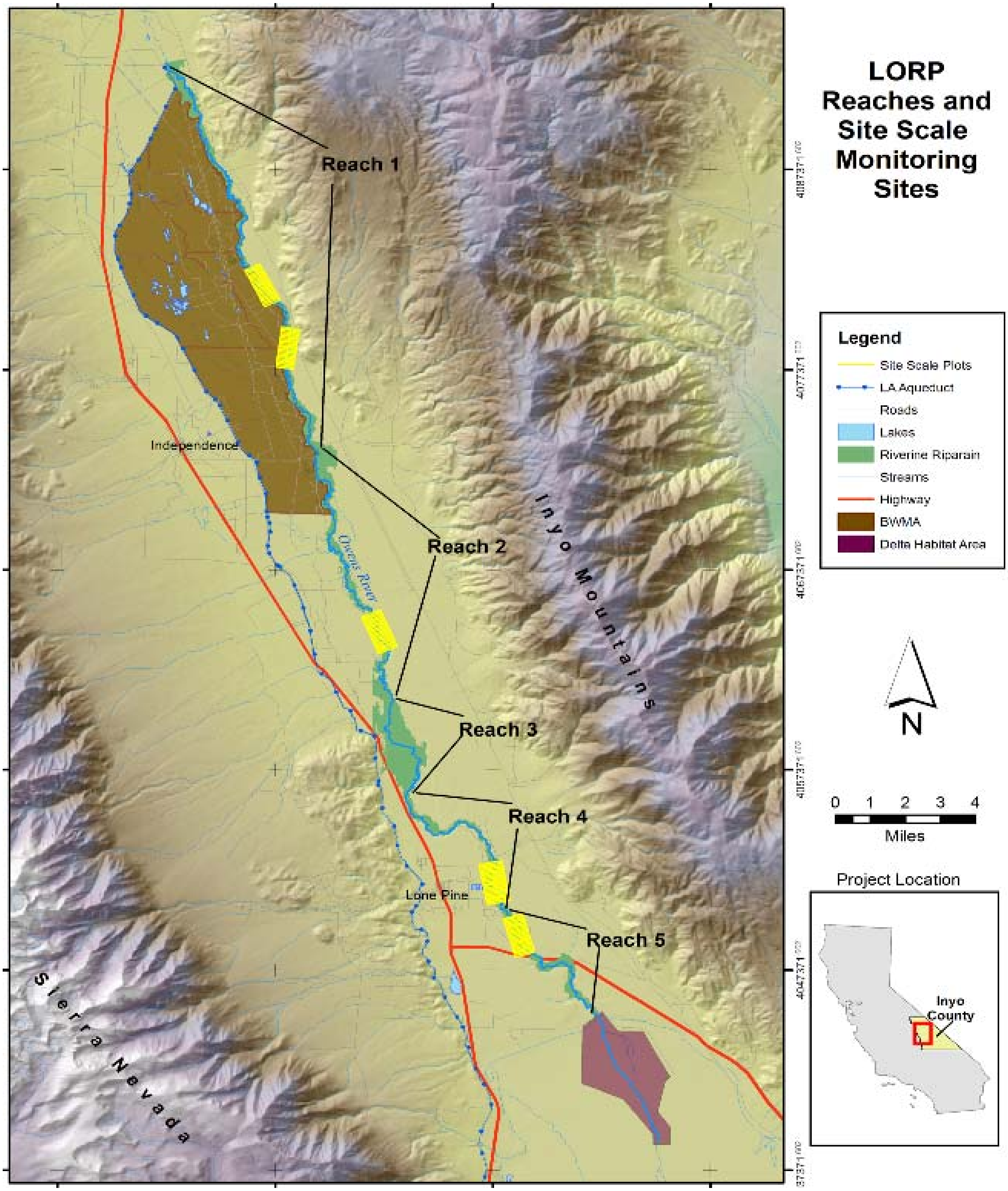
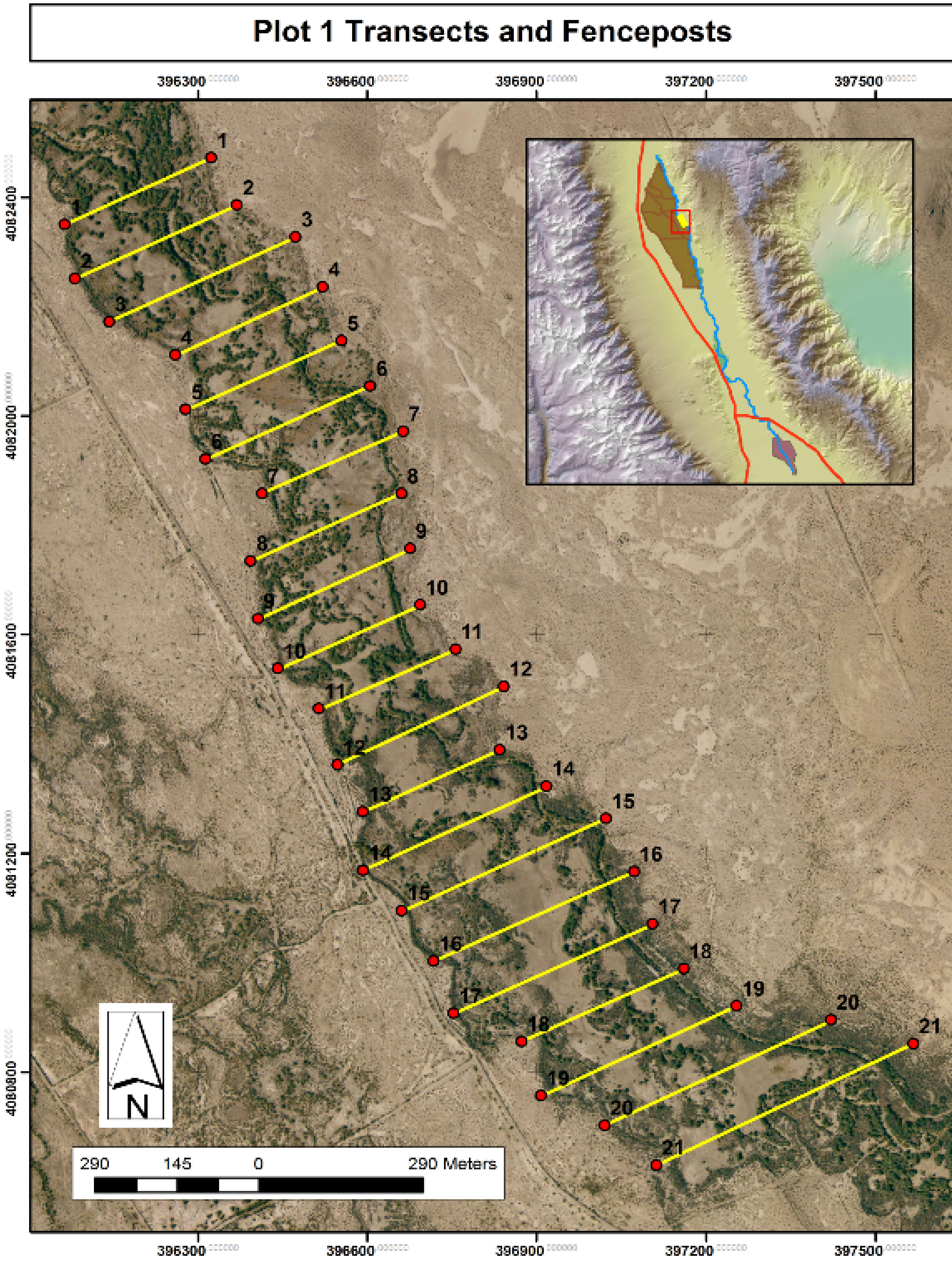
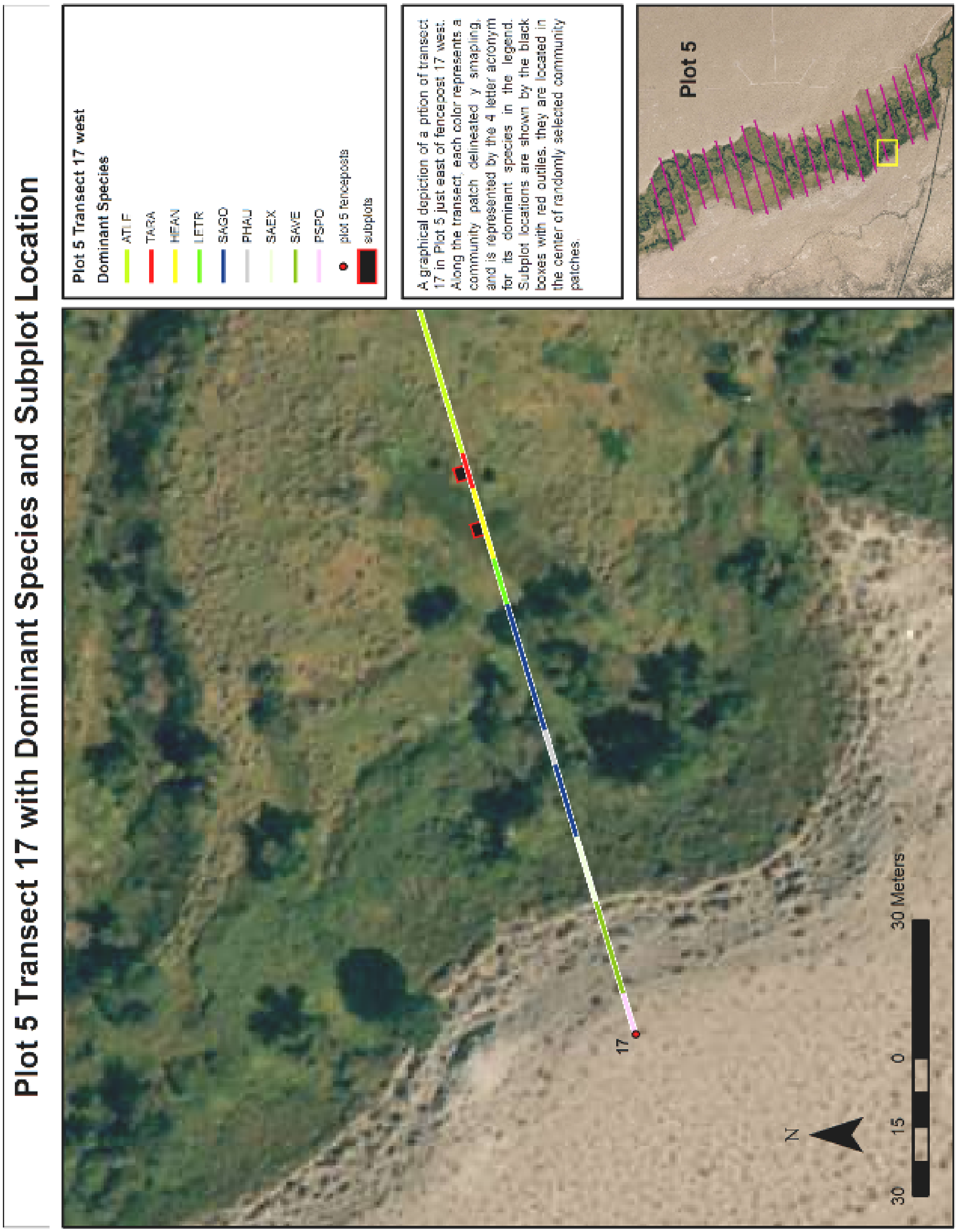
[3] Winward 2000
[4] Kauffman et al. 2000.



Site Scale Figure 1. Map with Plot Locations and Reaches



Site Scale Figure 2. Transect Layout at Site 1



Site Scale Figure 3. Plot 5 Transect 17

Sites

Study Design and Site Selection

Site scale vegetation monitoring consists of vegetation transect and subplot sampling, landform and elevation modeling and vegetation community mapping efforts. These fine scale sampling techniques occur at five 2 km plots in 4 of the 5 reaches of the Riverine-Riparian Area (Site Scale Table 1, Site Scale Figure 1). The study plots were selected to be representative of each reach, encompassing the range of vegetative, geomorphic and environmental conditions, as well as grazing management approaches in the Lower Owens River. For example, two reference plots are 50% inside a grazing lease and 50% outside the lease to enable managers to examine grazing effects on the restoration project. It was determined that because the Islands reach is a short (8.2 km) section of river composed of a vast, complex wetland with numerous channels creating access problems, more useful data would be produced by placing a second study plot in the dry reach (Reach 1). The dry reach (dry prior to base flow introduction) is four times larger than the Islands reach and will likely respond more dynamically to management actions than the Islands reach. The data were designed to detect change within areas that managers have the ability to effectively manage through flow and land management.

Frequency

Perform a site scale vegetation assessment in the second year after flow implementation, as significant changes in the vegetation communities of the Lower Owens River can be expected with the introduction of water to the system, especially in the dry reach. After the second year, perform site scale vegetation assessments every year that new aerial or satellite imagery is acquired for the project area. If new imagery is not acquired during the life of the project, then perform site scale vegetation assessments in years 2, 5, 7, 10, and 15.

Data Analysis and Reporting

Statistical Applications

Error check the raw transect data entered into an Excel spreadsheet. The Excel transect data spreadsheet consists of species ranked by dominance within each of six structural levels for each patch sampled.

Data Management

Technical staff will enter transect and subplot data into Microsoft Excel. Enter the landform elevation data into AutoCAD. Enter mapping data into Arcview GIS, creating shape files and populate attribute tables. Record the name of the staff entering the data on the original field form. The technical staff entering the data will be responsible for reviewing and correcting any data transcription errors.

Transform the raw transect data spreadsheet into a matrix of values recognizable by PC-ORD (or another appropriate statistical software program). Then import the matrix into the software program for analysis. The matrix consisted of ranked species scores for each community patch measured. Assign a ranked score to each species in each transect patch sampled as follows: dominant species = 3, 1st subdominant = 2, 2nd subdominant =1. Assign these ranked scores at each of the six structural levels. All non-dominant species receive zeros, which will result in a high number of zeros in the data set. To find groups with the strongest species associations (community types) use hierarchical agglomerative cluster analysis. The basic idea behind this method is to find the two entities (rows or transect patches) that are the closest to each other in species-space, merge them and then find the next two closest entities, merge them and so on until there is eventually one group. The cluster analysis will group the patch data into community types, which can then be crosswalked to any classification system desired, including those used by White Horse Associates, the Green Book or Holland (Calveg).

Enter vegetation subplot data into an excel spreadsheet and then error check. Summarize these data to provide more detail on the vegetation communities delineated through the transect data analysis.

Reporting

Staff will submit a report following data collection and analysis in each monitoring year. The MOU Consultant will review and compile this information and present it along with adaptive management recommendations to ICWD and LADWP management by the first of November of each monitoring year.

7.2 2010 Monitoring Year Methodology Changes and Details

In the 2010 monitoring year, several small changes were made to the methodology to reflect technological advancements and improvements in mapping and GIS technology and reflect budget and practical constraints. Several pertinent changes and clarifications are described below. In addition, the specific methods and tools used are described in more detail than what was provided in the MAMP.

7.2.1 Handheld GPS Integrated Handheld Units

The baseline method used a combination of map and compass, fence posts, and GPS units for navigation; sonar range finders and/or a tape measure to determine distances; paper field data sheets for recording data, and hand input of the data into Excel spreadsheets. The 2010 effort exclusively utilized Trimble Juno handheld units with integrated GPS technology to accomplish all of these tasks.

7.2.2 Transect Methodology

Prior to going into the field, transects and fence posts were loaded into handheld data loggers with integrated GPS (Juno Handhelds). The process can then be summarized by the following:

1) a data dictionary was constructed that included fields for all the pertinent data,
2) communities were given sequential numbering by an automated process,
3) species codes were populated using dropdown lists for each structural layer,
4) indicator variables for open water and bare ground were recorded, and
5) photos and notes were entered as needed. Using the integrated GPS, field technicians navigated to the transect in the field.

Points were taken at the end of each community (with a minimum 2 m sample unit). At each point, the ranked dominant species and indictor variables were recorded on the handheld. That data was later downloaded into ArcGIS using Pathfinder Office software. Points that could not be reached in the field (e.g. the end of a cattail patch where it meets the wetted channel), were recorded on handhelds off each transect with photos and descriptions. These points were then rectified in GIS at a later time. This method saved large amounts of time, as it enabled one person to record transect data (the previous method required two people) and did not require hand data entry, which could introduce increased error during data entry. However, the data required processing in GIS, as technicians recorded points heading both toward the river and away from the river, often in multiple directions on each transect. This process consisted of the following steps:

1) The raw field data was error checked for acronym accuracy.
2) Fields were added to record the data, plot, transect and community numbers and to create a unique identifier for each vegetation patch.
3) Because field technicians recorded points both moving east and moving west, points were moved to the eastern edge of all patches, so that at each point the data described the patch extending to the west from each point.
4) A line file was then created from the point file using Hawth's tools extension
5) The length of the line was determined using the xtools extension.
6) The line file and the point file were joined and then exported so that the final products contained all data and information in both shapefiles.

The attribute tables were exported from ArcMap into Microsoft Excel. The software program PC-ORD [5]was chosen for the analyses. The raw transect data, which was composed of species ranked by dominance within each of six structural levels for each patch sampled, was converted into a matrix of values recognizable by the PC-ORD software package using Microsoft's Excel. Ranked scores were assigned to each species in each transect patch sampled as follows: dominant species = 3, first subdominant = 2, second subdominant = 1. These ranked scores were assigned to dominant species within each of 6 structural levels. All non-dominant species received zeros. The transect data set suffered from many of the common problems that species-based community data sets generally encounter, including non-normal distributions and a large number of zeros (97.1%).

The data matrix was originally composed of 2,933 transect patches (stands) x 93 dominant species. The sites that were devoid of species were removed. These sites were eventually classified as barren ground or open water cover types based on indicator variables. Because the analysis was species based and focused on community structure and composition, removal of these sites did not affect results. The final matrix used for the cluster analysis was 2,728 transect patches x 93 dominant species. An outlier analysis based on standard error distances from the grand mean revealed none. No transformations were performed.

7.2.3 Hierarchical Agglomerative Cluster Analysis

Hierarchical agglomerative cluster analysis was used to find groups of vegetation patches with the strongest species associations (vegetation types). The basic idea behind this method is to find the two entities (original vegetation samples) that are the closest to each other in species-space, merge them by combining their attributes, and then find the next two closest entities, merge them, and so on until there is eventually one group[6] . Sorrenson's (Bray-Curtis) distance measure was chosen because its use of a proportional coefficient based on the ratio of shared abundance to total abundance fit the grouping goal of defining vegetation types by dominant species. Ward's (Orloci's) linkage method was chosen both because it is a space-conserving method and its intuitive basis in the minimization of the error sum of squares. Examination of the dendrogram revealed a satisfactory structure (chaining = 1.72).

The result of the cluster analysis was a dendrogram. Dendrograms are visual representations of the clustering procedure. Depending on study objectives, the number of groups desired is either

[5] McCune and Medford (1999)
[6] McCune and Grace (2002).

pre-defined or is determined by examination of the dendrogram structure. The dendrogram is "pruned" or "trimmed" at the appropriate place to delineate the desired number of groups. If the number of groups is not pre-determined, often visual examination of a dendrogram is sufficient to decide where to prune the tree and create the most meaningful groups. For example, the existence of long tails (long horizontal lines) on the dendrogram are often used as an indicator of a good pruning point. The baseline data examined scenarios with between 10 and 35 vegetation types, and determined that the study area contained 22 vegetation types; therefore we targeted 20-25 as the number of possible vegetation types in the 2010 analysis. To determine where to trim the dendrogram to produce the most useful and meaningful number of groups (vegetation types), two tools were employed: Indicator Species Analysis and the examination of the baseline and proposed 2010 vegetation types. Because of the nature of a restoration project like the LORP, we anticipated that whole vegetation types may have disappeared and new vegetation types may have appeared, so there was no predefinition of vegetation communities or even the number of communities. After examination of Indicator Species Analysis results and possible community composition, we determined there were 21 distinct vegetation types. Once the number of groups (vegetation types) was determined, a second hierarchical agglomerative cluster analysis was performed on the vegetation types to determine relationships between the communities and diversity measures within the determined vegetation types. The matrix for the second cluster analysis was populated with the mean ranked dominance scores for each species within each vegetation type.

7.2.4 Indicator Species Analysis

Indicator Species Analysis was used to provide more information about the quality of the different grouping scenarios, and provide information as to which species are the best indicators of each community. Indicator Species Analysis is a species data specific procedure developed by Dufrene and Legendre[7]. ISA is based on the Indicator Value (IV). IV scores (% of perfect indication) are based on a combination of relative abundance and relative frequency of each species within each group, using the following formula:

$$IV_{kj}=100(RA_{kj} \times RF_{kj})$$

Where IV=Indicator Value RA=Relative Abundance and RF= Relative Frequency

High IV scores indicate that species are both loyal to that group (rarely occur in other groups) and frequent within that group (are present in most patches within the group). Therefore, well grouped patches would have species with high IV scores. Each species receives a p-value derived from a monte-carlo randomization. The observed values were compared to values derived from 1000 shuffles of the data, in which group membership was reassigned. The null hypothesis of the significance test was that the maximum indicator value (IV_{max}) observed was no larger than would be expected by chance.

7.2.5 Vegetation Type Summary Statistics

Cover for each vegetation community type was tabulated and analyzed for the combined five study plot area. Cover was also summarized for non-vegetative cover types open water and bare ground. Percent cover for a vegetation type was calculated as the sum of patch lengths of that type, divided by the total length of all transects sampled multiplied by 100. Totals were then made for each complex and crosswalked to the Whitehorse (2004)[8] and 2010 LORP Annual Report on Landscape Scale Vegetation mapping.

[7] Dufrene and Legendre (1997)
[8] Whitehorse 2004.

7.2.6 Diversity Measures

Species diversity within and between vegetation types was examined through several metrics. Utilizing the transect data set composed of the mean dominance scores for each vegetation type, PC-ORD was used to calculate a series of diversity measures utilizing both vegetation types as the unit and also for each species that occurred as a dominant species. Within each vegetation type, species richness (S), evenness as measured by Shannon's Equitability Index (E_H), and Shannon's Diversity Index (H') were examined. Species richness was defined as the number of species that appeared in the ranked dominance scores within all of the samples within each vegetation type. Shannon's Diversity Index accounts for both abundance and evenness of the species present. The proportion of species *i* relative to the total number of species (p_i) was calculated, and then multiplied by the natural logarithm of this proportion ($\ln p_i$). The resulting product was summed across species, and multiplied by -1:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Shannon's Equitability Index (E_H), often termed evenness, was calculated by dividing H' by H_{MAX} [which I defined as ln(S)] and was calculated as such:

$$E_H = H' / H_{MAX}$$

Where E_H= Shannon's Equitability Index, H'= Shannon's Diversity Index, and H_{MAX} = ln(S) where S= species richness Shannon's Equitability Index assumes a value between 0 and 1 with 1 being complete evenness.

7.2.7 Site-Scale Mapping

The use of handheld units enabled the transect data to be available during the sampling period; therefore the transect data could be used to inform the mapping effort. The method was further refined to reflect this data availability. After transect data became available (post processing described above), it was overlaid on the 2009 sub-meter aerials. The first map was then created using the transect data to inform which spectral signatures were associated with each dominant species. In addition, during the transect data collection, additional points, pictures, and notes on field maps were recorded. Because the map was generated using 2010 transect data we term the maps 2010, even though it was mapped over a 2009 aerial. This meant that for all polygons intersecting one of the 105 transects, polygon labels were taken from direct observation in the field. All of these resources were utilized to create the first site scale map. This map was then checked in the field and further modified based on field data points.

7.2.8 Site-Scale Mapping Accuracy Assessment

The goal of the Site Scale Mapping Accuracy Assessment was to examine the overall accuracy of the LORP 2010 Site Scale Vegetation mapping for the five plots and improve the accuracy of the final product. Points were selected randomly within the each plot's draft Site Scale vegetation type shapefile. Accuracy Assessment points were randomly selected within ArcMap using a combination of Hawth's Tools and ESRI's Sampling Design Tool (See SubPlot Methodology below for more detail). Vegetation type accuracy was assessed in the field using the data collected during the subplot analysis. At each subplot, the dominant species of the entire patch (not just the 1 m x 1 m subplot) were recorded in the field. These species were checked against the polygon labels. If the dominant species were correct, the polygon was considered accurate. If the dominant species were correct, but sub-dominant species were missing, the sub-dominant species were added to the polygon label and the polygon was considered correct. If the dominant species were not correct, or omitted, the label was changed and the polygon was considered incorrect. Within the subplot data dictionary field technicians assigned a "0" (default value) if the dominant species were accurate and a "1" if they were not. If the vegetation type was incorrect, field technicians noted the correct dominant species and the polygon data was updated when the technician returned to the office.

7.2.9 Subplot Methodology

The baseline subplot data points were located along transects at five randomly selected communities in each transect. The results of the data collection were not available at the time of subplot collection; therefore all patches were treated equally. This resulted in the common community types being sampled frequently (oversampled) and the rare community types being sampled infrequently (under sampled). To remedy this problem, the polygons were selected using a stratified random approach in an effort to obtain more even sample sizes. Within each plot, patches were first temporarily classified into one of the 24 cover types defined by the baseline mapping, based on the Indicator Species Analysis. Within these cover classes; polygons were then randomly selected within each cover class in ArcMap using Hoth's Tools extension, with an effort to obtain an even number of samples throughout all cover types. Within the randomly selected polygons, a sampling point was randomly selected using the Sampling Design Tool. To avoid ecotones, the points located within 2 m of the edge were moved closer to the interior of the polygon when possible. Lastly, these points were transferred to the handheld data logger, maps were created, and a data dictionary was developed for the subplot data collection. This data dictionary is a digital data sheet contained within the handheld. Mapping verification and subplot sampling were performed at the same time for purposes of efficiency. A total of 498 points were assessed within the 5 plots. Subplot points were intersected with the final map, assigning each point a 2010 mapping unit. The data was then summarized for each community type. Canopy cover and groundcover estimates for each vegetation type were estimated at the 5-plot scale from data collected at transect subplots. Percent canopy (all species combined) and groundcover estimates for each vegetation type were derived from the mean of percent canopy or cover values for all subplots located within that cover type.

7.2.10 Species Name and Acronyms and Descriptions

This effort utilizes the names and acronyms as documented by the Jepson Flora Project: *Index to California Plant Names* (ICPN). Several species changed their name, genus, or both between the baseline collection and the 2010 monitoring effort. These name changes, along with species lists and reference to old and new names is contained in the *Site Scale Vegetation Handbook*.

7.3 Results and Discussion

With implementation of major water and land management actions in the LORP between baseline and 2010 conditions, the vegetation responded with widespread changes in species dominance between and within vegetation types and vegetation complexes.

7.3.1 Transect Data

The transect data follows a repeatable method of data collection and analysis that remains flexible in presenting results and comparison to other efforts (e.g. Landscape Mapping Effort). It revealed subtle shifts in species dominance within previously observed baseline communities, as well as described new communities not observed during the baseline monitoring.

7.3.2 Vegetation Types and Complexes

The cluster analysis and ISA revealed 21 vegetation types in the 5-plot study area. With the addition of two additional cover types for Barren Ground and Open Water, a total of 23 cover types were attributed to all the transect data. The Barren Ground cover type includes areas with no water and no live vegetation; therefore areas covered in decadent plant material with no live vegetation are included in this cover type. The vegetation types were further grouped into five complexes. By examining the differences between the baseline vegetation types and complexes and the 2010 vegetation types and complexes, several clear differences can be seen (Site Scale Tables 2 and 3).

We utilized the Indicator Value (one statistic from ISA) average p-values and number for species with p-values below the .05 level as measures of goodness of fit. The baseline analysis[9] evaluated 25 different community grouping scenarios and determined that the best grouping contained 44 species with p-values below .05 and had a mean p-value across all species of 0.15 (22 vegetation types). The 2010 analysis revealed 21 different vegetation types that contained 53 species with p-values below .05 and a mean p-value across all species of 0.14, indicating similar or better statistic evidence that the results are valid. The dendrogram indicates the relationship between vegetation types and complexes, and reveals that the data reduction performed in both years resulted in a little more than 55% information remaining (Site Scale Figures 4 and 5).

As anticipated, there were new vegetation types identified in 2010 that did not appear under baseline conditions (e.g. Salt Heliotrope, Common Mallow, and Saltbush Monoculture), and the disappearance of some vegetation types found at baseline (e.g. Greasewood/Russian Thistle, Tamarisk/Saltbush and Tamarisk Cuttings/Saltbush). There were also several shifts in species dominance within vegetation types. For example, the baseline Greasewood – Saltbush Scrub vegetation type changed from a community where Greasewood was the most dominant species to Saltbush-Greasewood-Seepweed community where Saltbush and Seepweed are the more dominant. Changes in depth to groundwater and land management may explain this change. Another example is the Sunflower Wet Meadow; wild licorice was the second most dominant species in baseline, but the thirteenth most dominant species in 2010. This vegetation type was one of the most diverse types observed at baseline (30 dominant species), but much more diverse in 2010 (54 dominant species). This means that more diverse Sunflower Wet Meadow patches have led to changes in species dominance and frequency. A further discussion of diversity measures is included below.

The treatment of tamarisk within the study area has had a profound effect on the vegetation types. Baseline vegetation included before treatment (Tamarisk/Saltbush) and immediately after treatment (Tamarisk Cuttings/Saltbush) vegetation types, while 2010 vegetation included an entire complex of still disturbed and invaded, but recovering vegetation types (Smotherweed Complex). These areas are frequently characterized by the prevalence of smotherweed (*Bassia hysopifolia*), but also include areas where salt heliotrope and common mallow have begun to establish themselves. Saltbush has also flourished and created species-poor monoculture stands in these areas.

The vegetation types of the Willow Wet Meadow Complex remained stable with the addition of the Common Reed type into this complex. Common Reed was its own complex at baseline, as it was species isolated. It was closest to the Willow Wet Meadow complex at baseline. With the management changes, this vegetation type has now been integrated into the Willow complex. The Emergent Wetland Complex maintained the same two vegetation types as baseline in 2010, with some species dominance shifts. Because this complex is now newly established in the upper reaches (plots 1 and 2) of the study area following dewatering it has changed community composition. The driest of the complexes, the Saline Scrub Complex, has remained relatively stable, with changes in species dominance. The Fivehorn Smotherweed (*Bassia*) vegetation type was removed from this complex with the addition of the Smotherweed complex.

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[9] Risso 2007.

Site Scale Table 2. Baseline Vegetation Types and Complexes

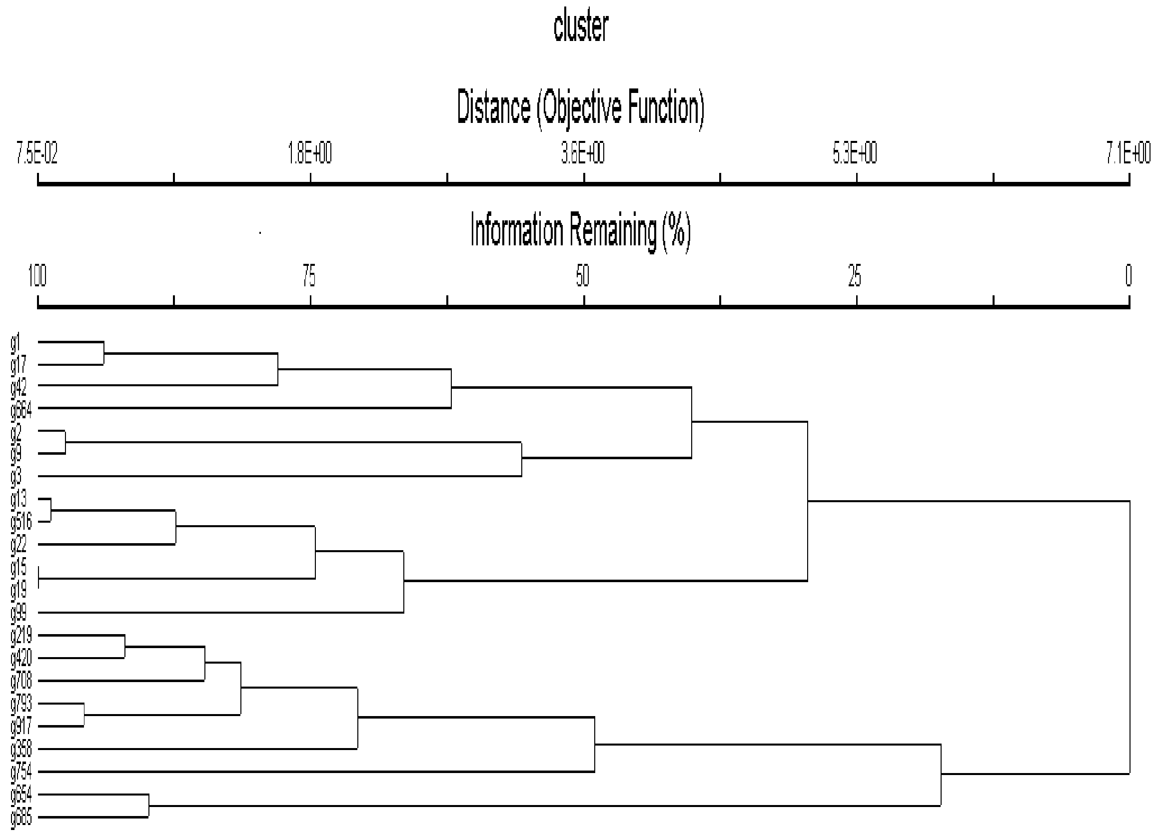
The 22 vegetation types delineated by this study fall within six vegetation complexes.

Willow/Wet Meadow Complex	**Saline Scrub Complex**
Goodding's Willow Woodland	Shadscale Scrub
Coyote Willow/Saltgrass Riparian Shrubland	Greasewood-Seepweed-Shadscale Scrub
Chairmaker's Bullrush-Saltgrass Wet Meadow	Greasewood-Saltbush Scrub
Sunflower-Licorice Wet Meadow	Greasewood-Russian Thistle Scrub
Wildrye-Saltgrass Meadow	Smotherweed-Mixed Shrubland
Baltic Rush-Saltgrass Wet Meadow	
	Saltbush/Saltgrass Scrub Complex
Emergent Wetland Complex	Saltbush-Saltgrass Scrub Meadow
Bull Rush-Cattail-Willow Wetland	Rabbitbrush-Saltbush-Saltgrass Scrub Meadow
Willow-Cattail-Rush Wetland	Seepweed-Saltbush/Saltgrass Scrub Meadow
	Alkali Sacaton-Saltgrass Meadow
Tamarisk Complex	Saltgrass Meadow
Tamarisk-Saltbush Woodland	
Saltbush-Russian Thistle Scrub	**Common Reed Complex**
Tamarisk Cuttings-Saltbush Scrub	Common Reed-Coyote Willow/Yerba Mansa

Site Scale Table 3. 2010 Vegetation Types and Complexes

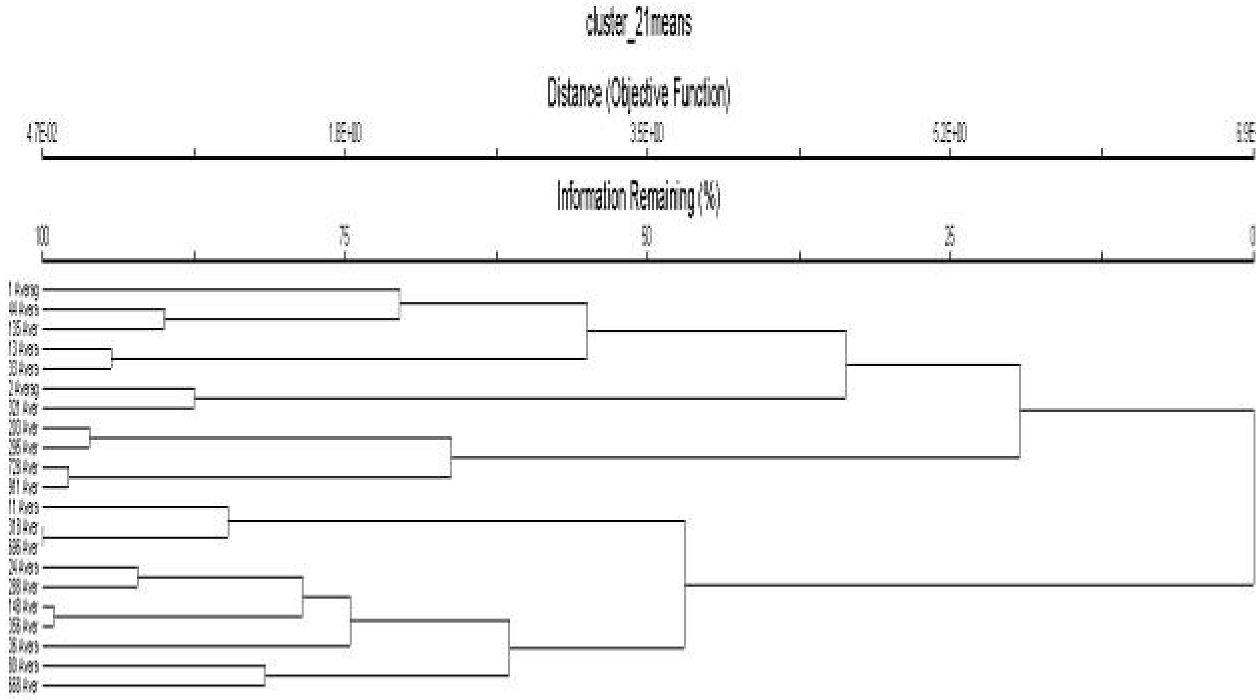
The 21 vegetation types delineated by this study fall within five vegetation complexes.

Willow/Wet Meadow Complex	**Saline Scrub Complex**
Goodding's Willow Riparian Woodland	Shadscale Scrub
Coyote Willow-Saltgrass Riparian Shrubland	Greasewood-Seepweed-Shadscale Scrub
Chairmaker's Bullrush-Yerba Mansa Wet Meadow	Saltbush-Greasewood-Seepweed Scrub
Sunflower Wet Meadow	Saltbush-Seepweed-Saltgrass Scrub Meadow
Wildrye-Saltgrass Meadow	
Baltic Rush-Saltgrass Wet Meadow	**Alkali Scrub-Meadow Complex**
Common Reed	Saltbush-Saltgrass Scrub Meadow
	Saltbush-Rabbitbrush-Alkali Sacaton Scrub Meadow
Smotherweed Complex	Saltgrass Meadow
Fivehorn Smotherweed	
Salt Heliotrope	
Common Mallow	**Emergent Wetland Complex**
Saltbush-Smotherweed-Russian Thistle Scrub	Bulrush-Cattail-Willow Wetland
Saltbush Monoculture	Cattail-Willow Wetland



Site Scale Figure 4. Cluster of Baseline Vegetation Types Dendrogram

The vegetation types delineated and described in this study appear on the left of the dendrogram, represented by a code number (this code may be found in Site Scale Table 3). As the dendrogram is read left to right, the two closest groups in species space are merged first, the centroids are adjusted and then the closest of the new groups is merged and so on until eventually only two groups remain. These two most general groups are Dry/Xeric and Wet/Mesic, and each contains three complexes. As the dendrogram is read left to right, information lost as the groups are merged. The amount of information remaining is shown on a percentage scale of Information remaining. The Distance (Objective Function=E) is the sum of the error sum of squares from each centroid to the items in that group. Labels represent an appropriate characterization for the agglomerated vegetation types represented by the line below the label. The Vegetation Complex level was determined by trimming the dendrogram at the dashed line with slightly more than 50% of the information remaining.



Site Scale Figure 5. Cluster of 2010 Vegetation Types Dendrogram

The above figure represents the dendrogram for the cluster of the 2010 transect data. All elements are similar to Site Scale Figure 4.

7.3.3 Five Plot Area Results

For clarity in this report, the results of all 5 plots were summed together to summarize the overall change. Changes and descriptive statistics can be generated for each plot as management questions dictate need.

7.4 Dominant Species Comparison

A basic metric for change between baseline and the 2010 monitoring year is the overall dominant species over all vegetation types over all plots (Site Scale Table 4). The two most dominant species were Torrey's saltbush (ATLE: *Atriplex lentiformis ssp. Toreyii*) and saltgrass (DISP: *Distichlus spicata*) in both monitoring years, and remained relatively constant over these years. However, many other species exhibited very large changes in dominance. For example, the most notable species declines between baseline and 2010 include: Russian Thistle (SATR: *Salsola tragus*), which declined from fourth highest ranked species with a score of 0.43 (baseline) to the eighteenth ranked species with a dominance score of 0.08 in 2010; saltcedar declined from rank 6, 0.33 dominance score to rank 38, with a dominance score of .01 in 2010; and Gooding's willow (SAGO: *Salix gooddingii*) declined from rank 8, dominance score of 0.31 to tenth ranked with a dominance score of 0.22 in 2010. Notable increases include: bush seepweed (SUNI: *Suaeda nigra*) which increased from rank 9, dominance score of 0.26 to rank 3 and dominance score of 0.40; cattail increased from rank 11 and dominance score of 0.21 to rank of 4 and a dominance score of 0.39; creeping wildrye (LETR:*Leymus triticoides*) increased from rank 10, dominance score of 0.24 to rank 5, dominance score of 0.35, and smotherweed (BAHY: *Bassia hyssopifolia*) increased from rank 22, dominance score of 0.05 to rank 9, dominance score of 0.24. In general, native and desirable species are increasing, and the non-native and undesirable species are declining. Two notable exceptions to this rule are that smotherweed increased and Goodding's willow declined.

The smotherweed has likely replaced much of the lost saltcedar and Russian thistle, while the willow suffered from some decline in the river channel where they persisted in drier conditions, but have been flooded by the increase in water level.

Table 4. Species with the Highest Overall Mean Dominance Score Over all Sampled Patches

Baseline			2010		
Rank	Species*	Dom. Score	Rank	Species*	Dom. Score
1	DISP	1.19	1	DISP	1.22
2	ATLE	1.01	2	ATLE	0.82
3	ERNA	0.44	3	SUNI	0.40
4	SATR	0.43	4	TYDO	0.39
5	SPAI	0.37	5	LETR	0.35
6	TARA	0.33	6	SPAI	0.35
7	SAVE	0.33	7	ERNA	0.30
8	SAGO	0.31	8	SAVE	0.29
9	SUNI	0.26	9	BAHY	0.24
10	LETR	0.24	10	SAGO	0.22
11	TYDO	0.21	11	ANCA	0.21
12	JUBA	0.18	12	ATCO	0.20
13	ATCO	0.17	13	SCAM	0.19
14	SCAM	0.17	14	JUBA	0.18
15	ANCA	0.16	15	GLLE	0.14
16	GLLE	0.11	16	SCAC	0.12
17	SCAC	0.08	17	HECU	0.11
18	SAEX	0.07	18	SATR	0.08
19	TARA Cuttings	0.07	19	SAEX	0.07
20	PHAU	0.06	20	HEAN	0.07

**Species are abbreviated using 4-letter acronyms according to the Index to California Index of Plant Names. Full index of species and acronyms can be found in the Site-Scale Vegetation Handbook.*

7.5 Vegetation Types and Cover Characteristics

Although interpreting changes in vegetation type cover and characteristics can be complex considering changes occur within and among vegetation types. Some vegetation types can easily be compared between baseline and 2010; for example, the Cattail-Willow Wetland type increased from 6.2% of the study area at baseline to 9.8% of the study area in 2010, where it was the most frequent vegetation type. However, with all of the vegetation type changes, the species composition of each community has changed as well, as some species have become more or less dominant as well as new species occurring in vegetation types. For example, an additional nine species appeared as dominants within the Cattail-Willow Wetland type in 2010. The other emergent wetland type Bulrush-Cattail Willow Wetland, increased in cover by only 0.8% between baseline and 2010. This indicates that the management actions have benefitted cattail wetlands over bulrush (tule) wetlands.

There were other notable changes in the Willow/Wetland types. Wet meadow (some of the most species diverse vegetation types) increased their cover between baseline and 2010 – including Sunflower Wet Meadow (+1.4%), Coyote Willow (+0.3%), Chairmaker's Bulrush (+0.6%) and Wildrye-Saltgrass (+2.7%), but two declined – Baltic Rush (-0.3%) and Gooding's Willow Wetland (-3.7%) declined. The decline in the Willow woodland is not likely due to one factor, but rather several factors including changes in understory dominance, which distributed some of the willow areas to other vegetation types due to strong species associations (eg. Cattail – Willow Wetland) and mapping improvements (less lumping). Overall, the data does not indicate that the number of tree willows in the LORP area has declined; the total number of patches containing tree willows (SAGO and SALA2 combined) was 221 at baseline and 242 in 2010.

The decline and disappearance of the Tamarisk complex and the appearance of the Smotherweed complex are related but not a direct relationship. Tamarisk and Russian thistle dominated vegetation types in the upper reaches (plots 1 and 2) were treated and subsequently disappeared from the study area (Site Scale Table 7). Tamarisk does appear as a component of a few vegetation types, but was not a major component of the 2010 vegetation survey. However, smotherweed (*Bassia*) and saltbush often form monocultural stands in these recovering areas. It appears that after several years of strong smotherweed annual growth, successional processes are operating that include the colonization of formerly smotherweed patches by other species. Some of the areas classified as barren ground were not bare soil, but large patches where only decadent smotherweed material was so dense that there were no living species. The saltbush patches were very dense monocultures. Often in areas with higher water tables, Common mallow and salt heliotrope are present beneath live or dead smotherweed. These areas formed new vegetation types not present at baseline.

7.5.1 Diversity Measures

In the simplest terms and by almost any measure, the study area was more diverse in 2010 than at baseline. More dominant species occurred throughout the study area (80 species at baseline, 93 in 2010). Average patch length (an inverse measure of complexity) decreased from 19.2 m to 13.8 m (Site Scale Tables 5 and 6). A related measure, the number of patches containing live vegetation, increased from 2,091 at baseline to 2,933 in 2010. Three baseline vegetation types had more than 30 dominant species; five of the 2010 vegetation types had more than 30 species. The most diverse baseline vegetation type had 39 dominant species; the most diverse vegetation type in 2010 had 54 dominant species. The average number of dominant species per baseline vegetation type was 17.3; the average number for dominant species for 2010 vegetation types was 22.5. Five baseline vegetation types had a Shannon's Diversity Index values above 2.0 with a high of 2.9; eleven vegetation types had Shannon's Diversity Index values above 2.0 with a high of 3.4.

However, not all 2010 vegetation types had high diversity. Vegetation types in the Smotherweed Complex were generally the lowest, including Fivehorn Smotherweed (dominant species (S) = 7, Shannon's Diversity Index (H') = 0.7) and Saltbush Monoculture (S=1, H' = 0.0). Another community with very low diversity was Saltgrass Meadow (S=4, H'=0.1), which is a near monoculture.

Site Scale Table 5. Baseline Vegetation Types Cover, Patch Length, and Diversity Measures for All Plots

Code	Vegetation Type	Cover (%)	Mean Length (m)	S	E	H′
15	Alkali Sacaton/Saltgrass Meadow	11.1	22.8	28	0.6	1.9
9	Saltbush/Russian Thistle Scrub	9.7	23.3	15	0.6	1.5
2	Greasewood/Russian Thistle Scrub	8.8	21.7	14	0.4	1
13	Saltbush/Saltgrass Scrub Meadow	8.3	22.6	11	0.5	1.2
17	Greasewood/Seepweed-Shadscale Scrub	6.4	23.2	15	0.7	1.9
654	Willow/Cattail-Rush Wetland	6.2	24.2	20	0.5	1.5
19	Rabbitbrush-Saltbush/Saltgrass Scrub Meadow	6.1	19.9	24	0.7	2.1
219	Goodding's Willow Woodland	5.7	14.6	39	0.7	2.4
99	Saltgrass Meadow	5.3	19.5	6	0.1	0.3
22	Tamarisk/Saltbush Woodland	4.7	14	14	0.5	1.3
685	Bull Rush-Cattail-Willow Wetland	4.1	28.5	10	0.6	1.3
1	Greasewood-Saltbush Scrub	4.1	25.9	6	0.6	1
664	Shadscale Scrub	3.3	23.7	15	0.7	1.9
3	Tamarisk Cuttings-Saltbush Scrub	3	20.9	3	0.7	0.8
420	Baltic Rush-Saltgrass Wet Meadow	2.5	14.4	30	0.7	2.5
516	Seepweed-Saltbush/Saltgrass Scrub Meadow	2.1	18.6	12	0.6	1.6
917	Wildrye-Saltgrass Meadow	2	10.9	21	0.6	1.8
24	Barren Ground	1.7	9	N/A	N/A	N/A
42	Smotherweed-mixed shrubland	1.2	18.8	12	0.7	1.8
708	Chairmaker's Bullrush-Saltgrass Wet Meadow	1.2	8.4	21	0.6	1.9
754	Common Reed-Coyote Willow/Yerba Mansa	0.9	15.5	15	0.7	1.9
793	Coyote Willow/Saltgrass Riparian Shrubland	0.8	10.9	19	0.8	2.3
358	Sunflower-Licorice Wet Meadow	0.7	9.6	30	0.9	2.9
23	Open Water	0.2	12.6	N/A	N/A	N/A
	Averages	4.2	19.2	17.3	0.6	1.7

Site Scale Table 6. 2010 Vegetation Types Cover, Patch Length, and Diversity Measures for All Plots

Code	Vegetation Type	Cover (%)	length	S	E	H'
2	Cattail Willow Wetland	9.8	12.8	29	0.3	1.2
318	Saltbush-Rabbitbrush-Alkali Sacatone Meadow	9.3	14.6	33	0.6	2.1
696	Saltbush-Rabbitbrush Scrub Meadow	9.0	14.3	28	0.6	1.9
728	Saltbush-Greasewood-Seepweed scrub	8.6	25.2	11	0.6	1.5
11	Saltgrass Meadow	8.2	14.3	4	0.1	0.1
203	Greasewood-Seepweed-Shadscale Scrub	6.4	15.6	22	0.6	1.9
13	Saltbush-Smotherweed-Russian Thistle Scrub	6.1	24.7	12	0.6	1.4
33	Saltbush Monoculture	5.5	28.6	1	0.0	0.0
321	Bulrush-Cattail Willow Wetland	4.9	17.4	13	0.5	1.3
911	Saltbush-Greasewood-Seepweed Scrub Meadow	4.8	13.1	19	0.7	2.0
356	Wildrye-Saltgrass Wet Meadow	4.7	8.2	41	0.6	2.3
1	Fivehorn Smotherweed	3.0	18.2	7	0.4	0.7
295	Shadscale Scrub	2.6	19.1	20	0.7	2.2
23	Open Water	2.3	8.0	N/A	N/A	N/A
24	Baltic Rush-Saltgrass Wet Meadow	2.2	9.7	27	0.7	2.2
22	Barren Ground	2.1	10.0	N/A	N/A	N/A
36	Sunflower Wet Meadow	2.1	8.9	54	0.9	3.4
148	Goodings Willow Riparian Woodland	2.0	8.2	26	0.6	2.0
288	Chairmakers Bulrush-Yerba Mansa Wet Meadow	1.8	6.8	35	0.6	2.0
135	Common Mallow	1.2	11.4	21	0.7	2.1
668	Coyote Willow Riparian Shrubland	1.2	9.3	30	0.8	2.6
44	Salt Heliotrope	1.1	7.7	23	0.7	2.0
80	Common Reed	0.9	10.4	16	0.7	1.8
	Average	4.3	13.8	22.5	0.6	1.7

7.5.2 Complex Change from Baseline

Because of the intricate dynamics of change within and between vegetation types, we examined the changes at the complex level between baseline and 2010 (Site Scale Table 7). Although there were some changes in complex composition (e.g. Common Reed was included in 2010 Willow/Wet Meadow complex), this provides a broad metric for the changes occurring in the LORP riverine area. With the inclusion of the Common Reed vegetation type, the Willow/Wet Meadow complex saw a 1% increase in cover, mostly from an increase wet meadow, rather than from increased willow communities. As expected with the reintroduction of flow from the Intake, Emergent Wetland saw a 4% increase. Although the Tamarisk complex loss and Smotherweed complex changes appear directly related, there was some shifting between complexes of some vegetation types. However, the former Tamarisk areas appear to be going through a successional process as they recover from the eradication efforts and fire. These processes include colonization and competition which result in changes in species composition and diversity.

The slight decrease in Saline Scrub and Saltbush/Saltgrass complexes is proportionally small compared to their total percent cover within the study area. Although only increasing by 2.1%, the increase in open water represents a 1,150% increase. Although the Barren ground complex increased by 0.4% cover, much of this area was covered in decadent smotherweed material from recent annual growth.

Site Scale Table 7. Change in Complex Percent Cover between Baseline and 2010

Baseline	Complex	2010	Change
12.9	Willow/Wet Meadow	14.9	2.0
0.9	Common Reed	0	-0.9
10.3	Emergent Wetland	14.6	4.3
17.4	Tamarisk	0.0	-17.4
0.0	Smotherweed	17.0	17.0
23.8	Saline Scrub	22.4	-1.4
32.9	Saltbush/Saltgrass Scrub	26.5	-6.4
0.2	Open water	2.3	2.1
1.7	Barren Ground	2.1	0.4

7.6 Change in WHA (Landscape Cover Types) from Baseline

In order to allow comparison between other monitoring efforts, the site-scale vegetation types for both baseline and 2010 efforts were crosswalked to the Whitehorse (2004) and LADWP 2010 Landscape Scale Mapping effort for the 2010 Annual Report (Site Scale Table 8). The results indicate an increase in Water, Marsh, Wet Alkali Meadow (rush/sedge), Dry Alkali Meadow, Riparian Shrub (willow), Alkali Scrub and Barren ground. There was a decrease in Riparian Forest, Alkali Scrub/Meadow and Tamarisk. There was no change in Reedgrass.

Site Scale Table 8. Crosswalk between Baseline, Whitehorse Associates (2004) and 2010 Site-Scale Vegetation Communities

Baseline Vegetation Communities	Whitehorse Associates (2004)	2010 Vegetation Communities
Open Water	Water	Open Water
Common Reed-Coyote Willow/Yerba Mansa	Reedgrass	Common Reed
Willow/Cattail-Rush Wetland	Marsh	Cattail-Willow Wetland
Bull Rush-Cattail-Willow Wetland		Bulrush-Cattail-Willow Wetland
Sunflower-Licorice Wet Meadow	Wet Alkali meadow (rush/sedge)	Sunflower Wet Meadow
Chairmaker's Bullrush-Saltgrass Wet Meadow		Chairmaker's Bullrush-Yerba Mansa Wet Meadow
Baltic Rush-Saltgrass Wet Meadow		Baltic Rush-Saltgrass Wet Meadow
	Irrigated meadow	
Alkali Sacaton-Saltgrass Meadow	Dry alkali meadow	Saltbush-Rabbitbrush-Alkali Sacatone Scrub Meadow
Saltgrass Meadow		Saltgrass Meadow
Wildrye-Saltgrass Meadow		Wildrye-Saltgrass Meadow
Coyote Willow/Saltgrass Riparian Shrubland	Riparian Shrub (willow)	Coyote Willow/Saltgrass Riparian Shrubland
Goodding's Willow Woodland	Riparian Forest (willow)	Goodding's Willow Riparian Woodland
	Riparian Forest (cottonwood)	
Rabbitbrush-Saltbush/Saltgrass Scrub Meadow	Alkali scrub/meadow	Saltbush-Saltgrass Scrub Meadow
Saltbush/Saltgrass Scrub Meadow		
Seepweed-Saltbush/Saltgrass Scrub Meadow		Saltbush-Seepweed-Saltgrass Scrub Meadow
Greasewood-Saltbush Scrub	Alkali scrub	Saltbush-Greasewood-Seepweed Scrub
Greasewood/Seepweed-Shadscale Scrub		Greasewood-Seepweed-Shadscale Scrub
Shadscale Scrub		Shadscale Scrub
Tamarisk Cuttings/Saltbush Scrub	Disturbed Alkali Scrub*	Saltbush Monoculture
Saltbush/Russian Thistle Scrub		Saltbush-Smotherweed-Russian Thistle Scrub
Greasewood/Russian Thistle Scrub		
Smotherweed-mixed shrubland		Common Mallow
		Salt Heliotrope
		Fivehorn Smotherweed
Tamarisk/Saltbush-Russian Thistle	Tamarisk	None
Tamarisk/Saltbush Woodland		
Barren Ground	Barren	Barren Ground
	Streambar	
	Structure	

**= not originally part of Whitehorse (2004) effort. However the Landscape scale vegetation mapping performed by LADWP for the 2010 Annual Report added a Bassia cover type to the Whitehorse legend. This category corresponds to the Disturbed Alkali Meadow cover type*

Site Scale Table 9. Comparison between Baseline and 2010 Percent Cover of Whitehorse (2004) Mapping Units

Baseline	WHA (2004)	2010	Change
0.2	Water	2.3	2.1
0.9	Reedgrass	0.9	0.0
10.3	Marsh	14.6	4.3
4.4	Wet Alkali Meadow (rush/sedge)	6.1	1.7
18.4	Dry Alkali Meadow	22.2	3.8
0.8	Riparian Shrub (willow)	1.2	0.4
5.7	Riparian Forest	2.0	-3.7
16.5	Alkali Scrub/meadow	13.9	-2.6
13.8	Alkali Scrub	17.6	3.8
22.7	Disturbed Alkali Scrub	17.0	-5.7
4.7	Tamarisk	0.0	-4.7
1.7	Barren Ground	2.1	0.4

7.7 Subplot Data

Subplot data was merged and summed by vegetation types. Vegetation types exhibited differences in canopy cover and ground cover between baseline and 2010 (Site Scale Table 10 and11). In general, canopy cover increased between baseline and 2010. For example, 9 vegetation types in 2010 exhibited canopy cover values greater than 100%. Only two baseline mapped vegetation types achieved canopy cover values greater than 100% (Coyote Willow/Saltgrass Riparian Shrubland and Wildrye-Saltgrass Meadow). Gooding's Willow Riparian Woodland, Coyote Willow/Saltgrass Riparian Shrubland, and Wildrye-Saltgrass Meadow exhibited the greatest canopy cover achieving averages over 120%. Conversely, upland vegetation types generally have low canopy cover. Greasewood-Seepweed-Shadscale scrub and Shadscale Scrub exhibit this trend as both types average less than 40% canopy cover. When interpreting canopy cover values, the sampling timing must be considered and results viewed within this context. Canopy cover values were recorded over two years between June and August during baseline; canopy cover was recorded over one season between July and September in 2010.

Bare ground values exhibit an inverse relationship with canopy cover. Vegetation types with high canopy cover values exhibit little bare ground, while vegetation types with low canopy cover values exhibit high bare ground values (Site Scale Tables 10 and 11). Areas with high canopy cover exhibited high vegetation and litter groundcover values. Downed wood was not a large ground cover estimate in 2010. Only one vegetation type achieved a downed wood value over 10%, Gooding's Willow Riparian Woodland. Litter ground cover values ranged from 7% to 58%. The Common Mallow vegetation type contained the most litter, 58%. Generally, litter occurred in every vegetation type. Vegetation ground cover values ranged from 12% to 87%. Emergent wetland and meadow complexes exhibited the highest vegetation ground cover. Vegetation types within the Willow/Wet Meadow Complex exhibited the highest vegetation ground cover values. Chairmaker's Bullrush-Yerba Mansa Wet Meadow and Sunflower Wet Meadow exhibited the highest vegetation ground cover values, 87% and 74% respectively.

7.8 Mapping Results

Distributed over five vegetation plots, 976 acres of vegetation adjacent to the Lower Owens River was mapped. Maps containing visual comparisons between baseline and 2010 conditions at multiple scales are located in Appendix A. The 976 acres were divided into 21 vegetation types and two cover types (Barren and Open Water) (Site Scale Table 12). Vegetation types are distributed throughout the Lower Owens, depicting a gradient of xeric to aquatic with certain types thriving in recently disturbed areas. For example, Fivehorn Smotherweed dominates Plot 1, an area that is recovering from Tamarisk eradication and fire. Saltbush-Greasewood-Seepweed Scrub is the most abundant vegetation type occupying 13.4 percent of the mapped area (Site ScaleTable 12). Common Mallow is the least abundant vegetation type, which is a vegetation type that did not occur during baseline mapping. Several native riparian communities dominate the Lower Owens River. For example, Cattail-Willow Wetland covers over 10% of the mapped area.

Mapping results from 2010 indicate that changes have occurred within the Lower Owens River's adjacent vegetation communities since baseline conditions. Notably, some vegetation types were lost (or eradicated) while new ones emerged. Additionally, some communities exhibited changes in community structure, in which the dominance of species shifted since baseline vegetation mapping occurred. Site Scale Table 13 summarizes the changes in vegetation types compared to baseline conditions.

Of the vegetation types that occurred in 2010 and during baseline conditions, Saltbush-Saltgrass Scrub Meadow exhibited the greatest change in extent, experiencing a 76 acre increase over baseline conditions (Site Scale Table 13). Conversely, Gooding's Willow Woodland exhibited a decrease in extent of 51 acres (Site Scale Table 13). Several Vegetation types that occurred during the baseline effort did not occur during the 2010 Site Scale Mapping. These are Tamarisk-Saltbush Woodland (-88 acres) and Tamarisk Cuttings - Saltbush Scrub (-1.9 acres). Other vegetation types mapped during baseline occurred in 2010, but with a shift in species. For example, Chairmaker's Bullrush-Saltgrass Wet Meadow covered 9.1 acres during baseline mapping, while in 2010 Chairmaker's Bullrush-Yerba Mansa Wet Meadow covered 11.2 acres. Such subtle shifts were common throughout the system. Another subtle shift in vegetation type occurs with Common Reed. Baseline data indicates that Common Reed occurred with Coyote Willow and Yerba Mansa (Common Reed-Coyote Willow-Yerba Mansa) and covered 13.7 acres. In 2010 Common Reed did not occur with a co-dominant species but covered 8.8 acres. Vegetation types that experienced a subtle shift in species are presented next to each other in Site Scale Table 13.

Site Scale Table 10. Baseline Vegetation Type Canopy Cover and Ground Cover

Code	Vegetation Type	n	Canopy Cover	Bare Ground	Downed Wood	Litter	Vegetation
			mean	mean	mean	mean	mean
793	Coyote Willow/Saltgrass Riparian Shrubland	7	113	13	9	45	33
917	Wildrye-Saltgrass Meadow	17	102	6	4	28	60
754	Common Reed-Coyote Willow/Yerba Mansa	6	99	1	0	65	32
358	Sunflower-Licorice Wet Meadow	7	95	5	3	36	25
219	Goodding's Willow Woodland	43	93	9	5	36	39
708	Chairmaker's Bullrush-Saltgrass Wet Meadow	8	87	10	0	45	45
420	Baltic Rush-Saltgrass Wet Meadow	21	84	6	1	31	48
19	Rabbitbrush-Saltbush/Saltgrass Scrub Meadow	35	71	18	4	43	31
99	Saltgrass Meadow	24	70	10	2	40	38
22	Tamarisk/Saltbush Woodland	35	67	7	6	60	24
654	Willow/Cattail-Rush Wetland	20	63	4	2	26	34
15	Alkalai Sacatone-Saltgrass Meadow	57	61	29	2	28	37
685	Bull Rush-Cattail-Willow Wetland	10	57	1	5	28	22
13	Saltbush/Saltgrass Scrub Meadow	42	50	18	4	47	27
516	Seepweed-Saltbush/Saltgrass Scrub Meadow	16	44	53	1	21	17
42	Smotherweed-mixed shrubland	5	37	50	0	31	18
17	Greasewood/Seepweed-Shadscale Scrub	24	30	64	1	17	13
9	Saltbush/Russian Thistle Scrub	43	25	35	4	47	11
1	Greasewood-Saltbush Scrub	17	17	58	4	33	5
664	Shadscale Scrub	13	12	90	0	5	4
3	Tamarisk Cuttings-Saltbush Scrub	16	7	24	30	40	7
2	Greasewood/Russian Thistle Scrub	31	6	75	2	19	4
24	Barren Ground	19	1	72	1	26	1
23	Open Water	0	NA	NA	NA	NA	NA

Site Scale Table 11. 2010 Vegetation Type Canopy Cover and Ground Cover

Code	Vegetation Type	N	Canopy Cover	Bare Ground	Downed Wood	Litter	Vegetation
			Mean	Mean	Mean	Mean	Mean
148	Goodding's Willow Riparian Woodland	35	129	6	16	23	52
668	Coyote Willow/Saltgrass Riparian Shrubland	21	128	8	2	24	64
356	Wildrye-Saltgrass Meadow	33	122	6	5	18	70
80	Common Reed	21	111	3	2	25	52
2	Cattail-Willow Wetland	49	107	1	2	9	57
288	Chairmaker's Bullrush-Yerba Mansa Wet Meadow	17	107	1	0	10	87
24	Baltic Rush-Saltgrass Wet Meadow	17	105	6	4	12	70
318	Saltbush-Rabbitbrush-Alkali Sacatone Scrub Meadow	26	103	19	3	19	56
36	Sunflower Wet Meadow	11	102	2	0	18	74
696	Saltbush-Saltgrass Scrub Meadow	49	98	9	2	22	65
321	Bulrush-Cattail-Willow Wetland	19	89	0	1	11	68
11	Saltgrass Meadow	26	87	14	4	14	62
44	Salt Heliotrope	7	84	21	0	29	50
1	Fivehorn Smotherweed	14	84	9	0	37	49
135	Common Mallow	3	82	5	0	58	37
33	Saltbush Monoculture	9	77	30	10	38	21
728	Saltbush-Greasewood-Seepweed Scrub	57	76	23	7	43	27
13	Saltbush-Smotherweed-Russian Thistle Scrub	15	67	25	10	37	27
911	Saltbush-Seepweed-Saltgrass Scrub Meadow	8	52	46	3	22	24
203	Greasewood-Seepweed-Shadscale Scrub	38	38	68	1	19	12
295	Shadscale Scrub	15	34	73	0	7	12
22	Barren Ground	8	2	69	9	20	1
23	Open Water	0	NA	NA	NA	NA	NA

Site Scale Table 12. Vegetation Types per Plot, Total and Percent of Mapped Area

Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Total	%
Saltbush-Greasewood-Seepweed Scrub	43.3	69.4	6.5	5.5	6.3	**131.0**	**13.4**
Saltbush-Saltgrass Scrub Meadow	1.2	3.1	42.4	21.2	55.0	**122.9**	**12.6**
Cattail-Willow Wetland	7.4	24.4	30.1	31.3	7.3	**100.5**	**10.3**
Greasewood-Seepweed-Shadscale Scrub	4.1	17.1	44.1	14.2	13.4	**92.9**	**9.5**
Saltgrass Meadow	0.6	0.8	2.2	23.0	46.5	**73.0**	**7.5**
Saltbush-Rabbitbrush-Alkali Sacatone Scrub Meadow	1.3	0.6	24.3	13.1	13.7	**53.0**	**5.4**
Saltbush-Smotherweed-Russian Thistle Scrub	46.3	2.6	0.5	1.2	0.0	**50.6**	**5.2**
Saltbush Monoculture	23.1	23.6	0.5	0.0	0.2	**47.4**	**4.9**
Wildrye-Saltgrass Meadow	0.4	0.0	4.1	10.0	26.9	**41.4**	**4.2**
Fivehorn Smotherweed	29.7	7.2	0.0	0.1	0.0	**36.9**	**3.8**
Bulrush-Cattail-Willow Wetland	0.0	0.7	2.6	20.3	12.0	**35.6**	**3.6**
Shadscale Scrub	1.0	0.0	0.3	12.6	16.1	**29.9**	**3.1**
Open Water	1.9	3.9	6.7	9.2	6.2	**27.9**	**2.9**
Goodding's Willow Riparian Woodland	0.3	1.7	3.0	3.3	14.9	**23.3**	**2.4**
Barren Ground	1.9	13.5	1.7	2.1	0.6	**19.9**	**2.0**
Saltbush-Seepweed-Saltgrass Scrub Meadow	0.0	0.3	13.6	1.4	3.4	**18.7**	**1.9**
Coyote Willow/Saltgrass Riparian Shrubland	0.0	0.0	0.0	6.5	12.1	**18.6**	**1.9**
Sunflower Wet Meadow	1.5	0.0	0.0	3.2	9.8	**14.5**	**1.5**
Chairmaker's Bullrush-Yerba Mansa Wet Meadow	0.0	0.3	4.7	5.1	1.1	**11.2**	**1.1**
Baltic Rush-Saltgrass Wet Meadow	0.7	0.0	1.0	5.9	1.4	**9.0**	**0.9**
Common Reed	0.2	0.0	1.3	4.2	3.1	**8.8**	**0.9**
Salt Heliotrope	0.6	4.5	0.0	0.0	0.0	**5.1**	**0.5**
Common Mallow	3.3	1.0	0.0	0.0	0.0	**4.3**	**0.4**
Total	**168.8**	**174.7**	**189.6**	**193.3**	**249.8**	**976.2**	**100.0**

As described above, vegetation types in 2010 and from baseline conditions were lumped into complexes. The differences, or changes that occurred in the Lower Owens River, between 2010 and baseline conditions are more evident, or easily understood, when viewed at the complex level. Similar to the vegetation types analysis various complexes occurred during baseline conditions that did not occur during 2010 and vice versa. Most notable amongst the complexes that occurred during both efforts is the increase in the Emergent Wetland Complex (58 acres) and Saline Scrub Complex (62 acres).

Site Scale Table 13. Vegetation Type Change 2010 - Baseline Conditions

Name	Baseline	2010	Change
Alkali Sacaton-Saltgrass Meadow	78.5	0.0	-78.5
Baltic Rush-Saltgrass Wet Meadow	**9.5**	**9.0**	**-0.5**
Barren Ground	**17.7**	**19.9**	**2.2**
Bull Rush-Cattail-Willow Wetland	**16.4**	**35.6**	**19.2**
Cattail-Willow Wetland	**61.4**	**100.5**	**39.1**
Chairmaker's Bullrush-Saltgrass Wet Meadow	**9.1**	**11.2**	**1.9**
Common Mallow	*0.0*	*4.3*	*4.3*
Common Reed	**13.7**	**8.8**	**-4.9**
Coyote Willow-Saltgrass Riparian Shrubland	**9.2**	**18.6**	**9.4**
Fivehorn Smotherweed	**0.6**	**36.9**	**36.3**
Goodding's Willow Woodland	**74.0**	**23.3**	**-50.7**
Greasewood-Russian Thistle Scrub	65.4	0.0	-65.4
Greasewood-Saltbush Scrub	42.9	0.0	-42.9
Greasewood-Seepweed-Shadscale Scrub	**71.7**	**92.9**	**21.1**
Open Water	**17.6**	**27.9**	**10.3**
Other	0.2	0.0	-0.2
Rabbitbrush-Saltbush-Saltgrass Scrub Meadow	109.6	0.0	-109.6
Salt Heliotrope	*0.0*	*5.1*	*5.1*
Saltbush-Greasewood-Seepweed Scrub	*0.0*	*131.0*	*131.0*
Saltbush-Rabbitbrush-Alkali Sacatone Scrub Meadow	*0.0*	*53.0*	*53.0*
Saltbush-Saltgrass Scrub Meadow	**46.9**	**122.9**	**76.0**
Saltbush-Seepweed-Saltgrass Scrub Meadow	**6.1**	**18.7**	**12.6**
Saltbush-Russian Thistle Scrub	89.3	0.0	-89.3
Saltbush-Smotherweed-Russian Thistle Scrub	*0.0*	*50.6*	*50.6*
Saltbush Monoculture	*0.0*	*47.4*	*47.4*
Saltgrass Meadow	**91.2**	**73.0**	**-18.2**
Shadscale Scrub	**30.4**	**29.9**	**-0.5**
Sunflower-Licorice Wet Meadow	**11.5**	**14.5**	**3.0**
Tamarisk-Saltbush Woodland	88.0	0.0	-88.0
Tamarisk Cuttings-Saltbush Scrub	1.9	0.0	-1.9
Wildrye-Saltgrass Meadow	**14.7**	**41.4**	**26.7**

***(Bold Text = Vegetation Types mapped in 2010 and Baseline,** Black Text = Baseline Vegetation types not present in 2010**,** Italics Text = 2010 Vegetation Types not mapped during Baseline. Vegetation types with subtle shifts in dominant species were compared for ease of interpretation.

The Tamarisk Complex from baseline conditions does not exist within the five plots mapped in 2010, exhibiting a 179 acre decrease. Open water increased 10 acres over baseline conditions. Additionally, smotherweed increased in extent over baseline conditions. Smotherweed occurred during baseline efforts but was not as dominant as it is in 2010. Thus, the Smotherweed Complex exhibited 144 acre increase over baseline conditions.

Site Scale Table 14. Vegetation Complex Change (2010 Conditions - Baseline Conditions)

Complex	Baseline Sum	2010 Sum	Change 2010 - Baseline
Barren Ground	**17.7**	**19.9**	**2.2**
Common Reed Complex	14.5	0.0	-14.5
Emergent Wetland Complex	**77.8**	**136.1**	**58.3**
Open Water	**17.6**	**27.9**	**10.3**
Other	0.2	0.0	-0.2
Saline Scrub Complex	**211.1**	**272.6**	**61.5**
Saltbush/Saltgrass Scrub Complex	**332.4**	**248.9**	**-83.5**
Smotherweed Complex	*0.0*	*144.2*	*144.2*
Tamarisk Complex	179.2	0.0	-179.2
Willow/Wet Meadow Complex	**127.1**	**126.7**	**-0.4**

***(Bold text = Vegetation Types mapped in 2010 and Baseline,** Black Text = Baseline Vegetation types not present in 2010, Italics Text = 2010 Vegetation Types not mapped during Baseline.

To match existing efforts within the Lower Owens River Project vegetation types were cross walked to WHA vegetation types. WHA Vegetation types were used for the Landscape Scale Vegetation mapping effort for the LORP. Site ScaleTable 15 depicts the changes between baseline conditions and 2010 using WHA vegetation Types. All vegetation types experienced a change compared to baseline conditions. The largest increase in extent occurred in Alkali Scrub. This vegetation type increased 100 acres over baseline conditions. This increase is likely due to the increase in saltbush and seepweed dominance (e.g. the conversion of tamarisk/saltbush areas to saltbush areas) and the reclassification of vegetation types into new complexes. Notable decreases occurred within the Tamarisk (-90 acres) and Riparian Forest (-50 acres) vegetation types (Site ScaleTable 15). Marsh expanded in extent, experiencing a 58 acre increase over baseline conditions (Site ScaleTable 15). Dry Alkali Meadow lost roughly 17 acres between baseline and 2010, while Riparian Shrub increased 10 acres over that same period.

Site Scale Table 15. WHA Vegetation Type Change (2010 Conditions - Baseline Conditions)

WHA - Vegetation Types	Baseline Total	2010 Total	Change (2010 - Baseline)
Alkali Scrub	145.1	253.9	108.8
Alkali Scrub Meadow	162.6	141.7	-21.0
Barren	17.7	19.9	2.2
Disturbed Alkali Scrub	155.3	144.2	-11.1
Dry Alkali Meadow	184.4	167.3	-17.1
Marsh	77.8	136.1	58.3
Other	0.2	0.0	-0.2
Reedgrass	14.5	8.8	-5.8
Riparian Forest (willow)	74.0	23.3	-50.7
Riparian Shrub (willow)	8.4	18.6	10.2
Tamarisk	90.0	0.0	-90.0
Water	17.6	27.9	10.3
Wet Alkali Meadow (rush/sedge)	30.0	34.6	4.6

7.8.1 Accuracy Assessment

Overall accuracy of the draft Site Scale Vegetation map was 85% (Site Scale Table 16). Incorrect land cover polygons were hand edited in *ArcView 9.3*. Additionally, trends observed throughout the Site Scale Mapping Accuracy Assessment were used to improve the accuracy of the final product. Trends observed include:

1. Accurately identifying willow/cottonwood understory is problematic using only aerial photographs. Data from transect and subplot analysis enabled technicians to accurately assign willow/cottonwood understory to non-sampled patches.

2. Errors were common in Plots 1 and 2 where dead BAHY and SATR were dominant. The dead vegetation obscures understory growth and hinders accurate delineation of communities. We expect this to change as these areas continue to evolve following tamarisk cutting\eradication and fire.

3. Inclusions are common. For example, the increased water within the system since the baseline data was collected has had a significant impact on vegetation communities adjacent to the Lower Owens River. Thus, areas that were once dominated by DISP now include JUBA and other wetter vegetation types. Thus, DISP patches remain a common vegetation type, but these areas are now mixed with JUBA, SCAM and BOMA.

Once the errors and trends were understood, each plot's shapefile was hand edited and updated. Thus, the final shapefile for the Lower Owens River Site Scale Mapping exceeds the 85% accuracy noted during the assessment, with overall accuracy estimated to be over 90%.

Site Scale Table 16. Accuracy Assessment Results

Plot	N	Correct	Accuracy
1	100	88	88%
2	95	82	86%
3	105	93	89%
4	100	79	79%
5	98	83	85%
Total	**498**	**425**	**85%**

7.9 References

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8.0 INDICATOR SPECIES HABITAT ASSESSMENT AND AVIAN SURVEYS

Introduction

The Lower Owens River Project (LORP) will benefit wildlife through the creation, maintenance, or enhancement of natural habitats within the project area. These natural habitats are expected to be consistent with the needs of selected habitat indicator species. During the initial development of LORP documents, habitat indicator species lists were developed for each of the four different LORP management areas: Delta Habitat Area (Delta), Riverine-Riparian Management Area, Blackrock Waterfowl Management Area (BWMA), and Off-River Lakes and Ponds. Habitat indicator species were said to "represent the range of habitat conditions that are desired to be achieved" for each of the four components of the LORP (Ecosystem Sciences 2002 and 2008).

The availability of habitats consistent with the needs of these indicator species is being assessed through the use of the California Wildlife Habitat Relationship (CWHR) system (California Department of Fish and Game-CIWTG 2008). Avian surveys of the riverine and wetland areas are also being conducted as a direct measure of wildlife use as well as habitat indicator species response to the project elements.

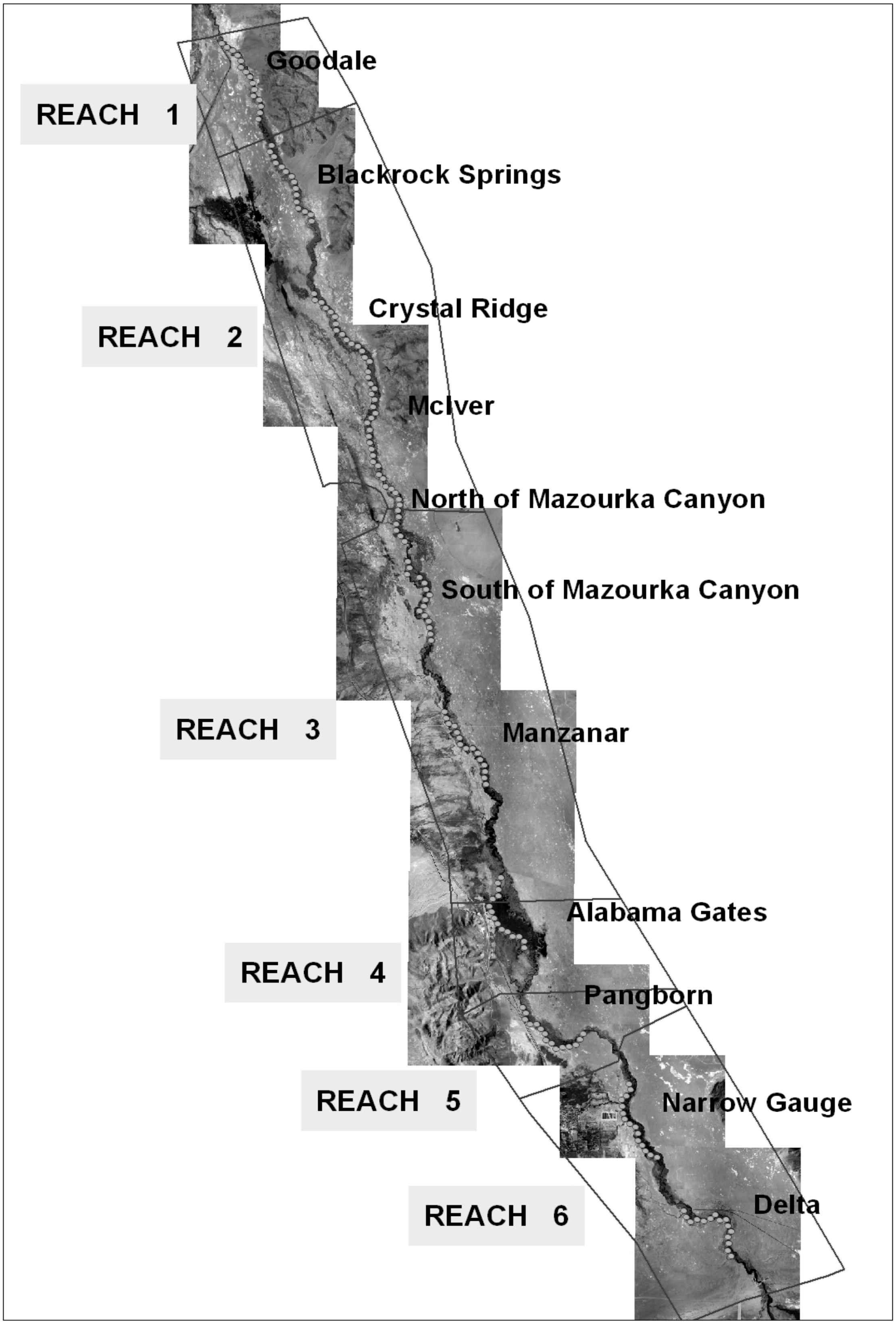
In 2010, breeding bird surveys were completed in the Riverine-Riparian Management Area, while surveys for migratory, wintering and breeding species were completed in the BWMA. In addition, the entire Riverine-Riparian Management Area and the BWMA were evaluated using CWHR to determine habitat suitability for the various indicator species. This section addresses bird use of the Riverine-Riparian area and BWMA project components, and the analysis of habitat suitability for the avian indicator species and the Owen's Valley Vole in these areas. Suitability of LORP habitats for the fish indicator species will be addressed in another section.

8.1 Riverine-Riparian Avian Surveys

Preproject baseline bird surveys of the Riverine-Riparian management area were completed in 2002 and 2003. Point Reyes Bird Observatory (PRBO) established the survey routes and methodology, and conducted these baseline surveys, with some field assistance from Los Angeles Department of Water and Power (LADWP) staff. Results from the 2002 monitoring year were presented in Riparian Bird Monitoring and Habitat Assessment in Riverine-Riparian Habitats of the Lower Owens River Project (Heath and Gates 2002). Budget constraints prevented analysis and documentation of the 2003 monitoring results by PRBO; however, the 2003 data will be incorporated into this report. The surveys conducted in 2010 are the first post-implementation bird surveys in the Riverine-Riparian management area. LADWP staff managed the project, and field surveys were conducted by LADWP biologists Debbie House and Chris Allen, and Inyo County Water Department (ICWD) Field Program Coordinator Jerry Zatorski.

8.1.1 Survey Sites

In 2002, PRBO established 165 point count stations along 11 survey routes within the LORP project area. Each survey route consisted of 15 point count stations. LADWP staff utilized PRBO's detailed notes describing each point location to re-establish routes. Changes to point survey locations in the LORP area were made along the Crystal Ridge and Alabama Gates routes. Along the Crystal Ridge route, the river, which was once established in this region, did not follow the channel as expected, but instead followed a channel over 200 meters to the east. As a result, four survey points ended up well away from the river channel, and thus were moved east to the river bank. In the Alabama Gates area, two survey points were no longer accessible due to the formation of deep channels. These survey points were relocated as close as was possible to the previous survey points. Temporary flagging was placed at each point count station to aid in relocation during surveys.



Indicator Species Figure 1. LORP Reach Boundaries and Bird Monitoring Routes

LORP Reaches

The LORP Riverine-Riparian Management Area has previously been divided into six reaches, based on landform type. These different landform types support varying plant communities, and are expected to respond differently to LORP flow and land management actions (WHA 2004a). Reach designations assigned by Whitehorse Associates (WHA) were based on a combination of valley form, channel/floodplain morphology, and hydrologic variables which influence landtype, water regimes and vegetation types (WHA 2004b). The four reach types identified in the LORP riverine/riparian area are dry incised floodplain, wet incised floodplain, graded wet floodplain, and aggraded wet floodplain. Existing point count stations were assigned to one of the six LORP reaches for consistency with other LORP monitoring reports. Indicator Species Figure 1 shows the reach boundaries and bird monitoring routes and a brief description of each reach follows.

Reach 1

Reach 1 (incised wet floodplain) extends from the Los Angeles Aqueduct (LAA) Intake downstream 3.9 miles. All 15 point count stations of the Goodale route fall within Reach 1. In this reach, the river and vegetated floodplain are generally confined to the river channel. Although this reach is considered part of the former "dry reach", the reach supported some marsh and dry alkali meadow vegetation prior to project implementation due to leakage and sub-irrigation from the LAA. A small stand of willows (*Salix* spp.) exists near the Intake, otherwise only isolated tree willows occur in this reach.

Reach 2

Reach 2 (dry, incised floodplain) is a 15.7-mile reach extending from approximately two river miles upstream of the Blackrock Ditch, south to near Billy Lake Return Ditch. A total of 55 point count stations lie within Reach 2, including all points along the Blackrock Springs, Crystal Ridge, and McIver routes, and the 10 northern points on the North of Mazourka Canyon route. Under preproject conditions, Reach 2 was sparsely vegetated, and the channel was mostly dry. The upper 1.3 miles of floodplain in this reach supported patchy dry alkali meadow and reedgrass (*Phragmites australis*), the middle 5.3 miles supported scattered saltcedar or tamarisk (*Tamarix ramosissima*), and the lower 9.1 miles supported tamarisk and a few tree willows. Isolated Fremont cottonwoods (*Populus fremontii*) occur in this reach and numerous Russian olive trees (*Elaeagnus angustifolia*) existed in the saturated channel upstream of Billy Lake return.

Reach 3

Reach 3 (wet, unconfined floodplain) is a 14.9-mile reach that extends from the area north of Billy Lake Return ditch south to the northern boundary of the Islands area near the Alabama Gates. A total of 41 point count stations lie within Reach 3, including the 6 southernmost points on the North of Mazourka Canyon route, all points along the South of Mazourka Canyon and Manzanar routes, and the five northern points of the Alabama Gates route. The floodplain varies from 150 to 300 feet wide and is relatively unconfined in some areas. Persistent low flows existed in this reach under preproject conditions and the area was densely vegetated. Woody riparian vegetation was more abundant than more upstream reaches and marsh vegetation dominated the channel. Low terraces supported dry alkali meadow and Rabbitbrush-Nevada saltbush scrub/meadow vegetation, while high terraces supported Rabbitbrush-Nevada saltbush scrub.

Reach 4

Reach 4 (wet, unconfined, and aggraded floodplain) is a 4-mile reach that includes the area known as the Islands and extends from approximately the Alabama Gates south to where two branches of the river channel reconverge. The nine southernmost point count stations along the Alabama Gates route fall within Reach 4. This reach lacks a continuous identifiable channel. The floodplain varies from 700 to 1600 feet wide and is heavily vegetated. The low terraces supported dry alkali meadow, Rabbitbrush-Nevada saltbush scrub/meadow and tree willows. Several seeps along the west side of the area support wetland vegetation.

Reach 5

Reach 5 (wet, incised floodplain) is a 4.3-mile reach that extends from the southern edge of the Islands area south to abandoned railroad bridge crossing north of Lone Pine Narrow Gauge Road. All 15 point count stations of the Pangborn route lie within Reach 5. The floodplain varies from 150 to 250 feet wide and was densely vegetated preproject. Woody riparian vegetation, primarily tree willow, and marsh dominated the channel. Low terrace areas supported Rabbitbrush-Nevada saltbush scrub/meadow and dry alkali meadow while high terrace areas supported Rabbitbrush-Nevada saltbush scrub.

Reach 6

Reach 6 (wet, graded floodplain) is a 10.5-mile reach that extends from the abandoned railroad bridge downstream to the LORP pumpback station. The Narrow Gauge and Delta routes lie within Reach 6 for a total of 30 point count stations in this reach. The floodplain in this reach is relatively flat, and the river is semi-unconfined. Floodplain width was described as highly variable, ranging from 150 to 700 feet. Marsh, wet alkali meadow, and riparian forest occur along the river channel, while low terraces supported Rabbitbrush-Nevada saltbush scrub/meadow and dry alkali meadow. High terraces supported scrub/meadow transitioning to Rabbitbrush-Nevada saltbush scrub.

8.1.2 Vegetation Assessment

The vegetation community types within a 100-meter radius circle around each point count station were determined using ArcMap vegetation mapping shapefiles. This was done for preproject conditions using the 2000 vegetation mapping data and for 2010 conditions using the 2010 mapping data (based on 2009 aerial images). The acreage of each habitat type was determined by reach and the percent change from 2000 to 2009 was calculated. Some vegetation categories used for mapping were combined into one for the graphical presentation of change. For example, the acreages for the two riparian tree categories (cottonwood and willow) were combined with the acreage for riparian shrub into a single “riparian” category.

Habitat Photos

In 2010, four photos were taken at each point count station in order to document local vegetation conditions. One photo was taken facing each true cardinal direction: North, South, East, and West. These digital photos were archived for potential future use.

8.1.3 Point Count Surveys

Three surveys of each route were conducted between May 15 and June 29, 2010, at approximately two week intervals. Surveys began within 30 minutes of local sunrise and were completed within 4-5 hours. In order to minimize the effect of time of day on detection rates, the order in which each route was conducted was alternated between visits. Bird species were recorded using the variable circular plot method, employing the following distance bands: <50 m, 50-75 m, 75-100 m and >100 m. The activity the birds were engaged in and the habitats birds were sighted in was also recorded. Bird activity categories used were singing, calling, foraging, perching, flying (one place to another within the habitat), flying over (not using habitat), flushed, and breeding. If breeding activity was noted, the specific evidence of breeding was also noted, such as the presence of a nest, an adult carrying food or nesting material, or the presence of dependent young or a family group. Habitat types used follow those being used for vegetation mapping of the LORP Riverine/Riparian Management Area and included water, marsh, wet alkali meadow, dry alkali meadow, riparian (willow or cottonwood), Rabbitbrush-Nevada saltbush scrub and scrub/meadow and barren.

8.1.4 Data Analysis

Data Management

Bird survey data from 2010 was entered into an Access database. Data from 2002 and 2003 were recoded from the existing Excel spreadsheets and moved into the Access database. Data entry and data entry verification was performed by LADWP staff.

Total Mean Landbird and Waterbird Richness and Abundance

The total number of species and individuals detected at each point and each sampling year were summed. Species were placed into the general categories of “landbird” or “waterbird” for presentation. Landbirds included all species in the orders Galliformes, Falconiformes, Columbiformes, Cuculiformes, Strigiformes, Caprimulgiformes, Apodiformes, Coraciiformes, Piciformes, and Passeriformes. Waterbirds included all species in the orders Anseriformes, Gaviiiformes, Podicipediformes, Pelicaniformes, Ciconiiformes, Gruiformes, and Charadriiformes. The summed values were then divided by the number of point count stations per reach to provide the mean species richness and abundance per reach. This calculation included all migrant and nonbreeding species, but excluded flyovers and detections more than 100 meters from the observer. This data is presented to provide information regarding overall use of the project area by bird species; however, no statistical analysis was conducted on this dataset.

Breeding Bird Species Diversity, Richness and Mean Number of Individuals

Data analysis generally followed that described in Heath and Gates but was more inclusive. Data analyzed included species detected up to 100 meters from the observer, but excluded detections greater than 100 meters from an observer, since including detections of birds beyond this distance may result in double-counting of individuals. Species groups eliminated included aerial insectivores: swallows (Hirundinidae), swifts (Apodidae) and nightjars (Caprimulgidae), and seasonal migrants. All flyovers were also eliminated from analysis since these birds did not appear to be using the habitat. The 2002, 2003, and 2010 data were filtered and analyzed in the same manner.

The total detections of each species were summed by survey point over the three surveys for each year. The mean number of breeding individuals per survey point and year was then calculated. Breeding bird species diversity was calculated from the summed detections using a transformation of the Shannon’s diversity index denoted N_1 as described in Heath and Gates. Species diversity indices take into account species richness (total number of species) and evenness (relative abundance). The Shannon diversity index has a range of 0 to 1. The transformation expresses diversity in terms of the number of species and is more easily interpreted as compared to the Shannon diversity index. Species richness was determined by summing the total number of species detected at each survey point over the three surveys.

Data was log-transformed prior to statistical analysis. Statistical analyses were performed using SigmaStat 3.5. One-way Analysis of Variance (ANOVA) was used to determine if species diversity, richness, or mean number of individuals differed among sampling years in each of the six river reaches.

Breeding Status

The breeding status was determined for all species encountered in 2010. The criteria used to assess breeding status was the same used by Heath and Gates and was as follows:

> Confirmed breeding: Birds on territory all three surveys, nest material carry, nest found, fecal sac carry, distraction display, food carry, feeding fledglings, independent juveniles with adults (family groups).
>
> Probable breeding: Territorial behavior more than once at same location, singing noted on two or more visits, courtship behavior.
>
> Possible breeding: Territorial behavior or singing noted only during one survey.
>
> No evidence of breeding: Includes seasonal migrants, species not known to breed in the Owens Valley, or species in the LORP project area for which no breeding activity has been observed.

Habitat Indicator Species Diversity, Richness and Mean Number of Individuals

There are 19 avian habitat indicator species for the LORP Riverine/Riparian area (Indicator Species Table 1). Detections of these species were summed by reach. Detections of habitat indicator species were analyzed in the same manner as described for total breeding bird species diversity, richness and mean number of individuals. Only those habitat indicator species suspected or confirmed to be breeding on the LORP were included in the analysis. The total detections of each habitat indicator species were summed by survey point over the three surveys for each year. The mean number of breeding individuals for each indicator species per survey point and year was then calculated. Breeding species diversity was calculated from the summed detections using a transformation of the Shannon's diversity index N_1. Species richness was determined by summing the total number of habitat indicator species detected at each survey point over the three surveys.

Data was log-transformed prior to statistical analysis. Statistical analyses were performed using SigmaStat 3.5. Due to the lack of normality in the data, a nonparametric test, the Kruskal-Wallice one-way ANOVA on ranks was used to determine if species diversity, richness, or mean number of individuals differed among sampling years in each of the six river reaches.

Indicator Species Table 1. Avian Habitat Indicator Species for LORP Riverine/Riparian Management Area

Common Name	Scientific Name
Wood Duck	*Aix sponsa*
Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea herodias*
Northern Harrier	*Circus cyaneus*
Red-shouldered Hawk	*Buteo lineatus*
Swainson's Hawk	*Buteo swainsoni*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Yellow-billed Cuckoo	*Coccyzus americanus*
Long-eared Owl	*Asio otus*
Belted Kingfisher	*Megaceryle alcyon*
Nuttall's Woodpecker	*Picoides nuttallii*
Willow Flycatcher	*Empidonax traillii*
Warbling Vireo	*Vireo gilvus*
Tree Swallow	*Tachycineta bicolor*
Marsh Wren	*Cistothorus palustris*
Yellow Warbler	*Dendroica petechia*
Yellow-breasted Chat	*Icteria virens*
Blue Grosbeak	*Passerina caerulea*

Habitat Use

Habitat use data was compiled for all species and also separately for Habitat Indicator Species only. Chi-squared goodness-of-fit test was used to determine if birds used habitats out of proportion to their availability. Habitat availability was determined by calculating the total acreage of each habitat type within the 100-meter radius circle around each point. Habitat use calculations were limited to bird species detected within 100 meters of the observer and flyovers were eliminated from analysis. The expected species use of a habitat was assumed to be proportional to the availability of each habitat. Bonferonni confidence intervals were calculated for each habitat type to determine which specific habitats were used disproportionately.

8.1.5 Results

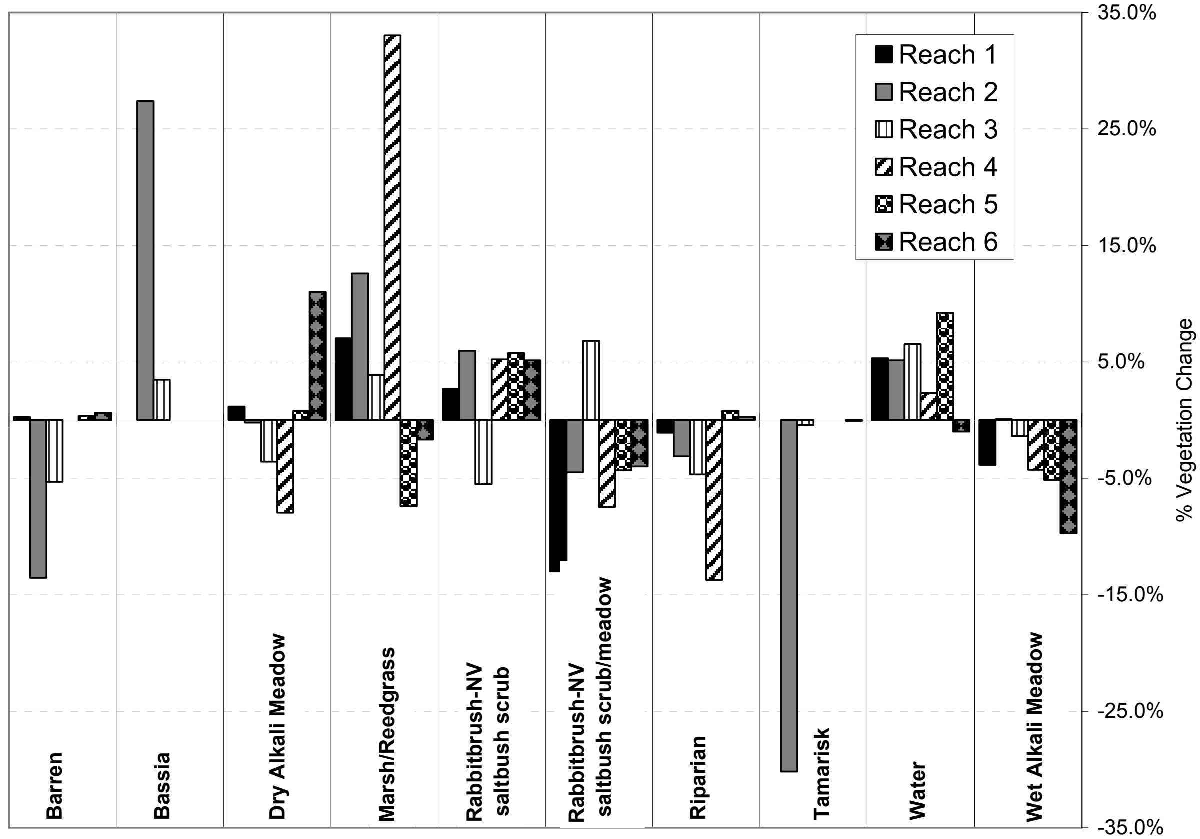
Vegetation Assessment

Indicator Species Table 2 shows the acreage of each mapped vegetation type within a 100-meter radius circle around each point count station summed by reach for 2000 and 2009. Indicator Species Figure 2 shows the percent change in vegetation types by reach between 2000 and 2009.

Indicator Species Table 2. Vegetation Type around each Point Count Station by Reach for 2000 and 2009

	Reach 1			Reach 2			Reach 3			Reach 4			Reach 5			Reach 6			Total Acreage	
LORP Vegetation Community	**2000**	**2009**	**%Δ**	**2000**	**2009**	**%Δ**	**2000**	**2009**	**%Δ**	**2000**	**2009**	**%Δ**	**2000**	**2009**	**%Δ**	**2000**	**2009**	**%Δ**	**2000**	**2009**
Barren		0.3	0.3%	67.6	18.5	-13.5%	19.2	3.4	-5.3%			0.0%		0.3	0.3%		1.3	0.6%	86.8	23.7
Bassia			0.0%		103.6	27.4%		10.2	3.5%			0.0%			0.0%			0.0%	0.0	113.9
Dry alkali meadow	21.7	20.4	1.2%	6.8	6.2	-0.2%	46.0	35.0	-3.6%	18.3	13.0	-8.0%	9.5	10.7	0.8%	35.3	57.3	11.0%	137.7	142.6
Irrigated meadow			0.0%			0.0%	0.1		0.0%			0.0%			0.0%			0.0%	0.1	0.0
Marsh	13.5	21.3	8.8%		49.6	13.1%	49.8	59.5	3.5%	9.4	38.5	33.0%	19.6	14.0	-7.4%	32.5	27.4	-2.3%	124.8	210.3
Rabbitbrush-NV saltbush scrub	29.3	28.7	2.7%	127.8	154.4	6.0%	45.6	28.8	-5.5%		4.5	5.2%	3.4	8.7	5.7%	33.9	44.0	5.1%	240.0	269.2
Rabbitbrush-NV saltbush scrub/meadow	47.7	28.2	-13.0%	29.5	13.4	-4.5%	80.1	99.2	6.8%	7.9	2.2	-7.4%	31.8	29.6	-4.3%	54.0	45.3	-4.0%	251.0	218.0
Reedgrass	2.1		-1.8%	1.9		-0.5%	1.4	2.5	0.4%			0.0%	0.7	0.7	0.0%		1.3	0.6%	6.1	4.6
Riparian Forest (cottonwood)			0.0%		0.3	0.1%	0.0	1.2	0.4%			0.0%	0.0		0.0%	1.0	0.2	-0.4%	1.0	1.6
Riparian forest (tree willow)	1.4	0.1	-1.1%	19.2	7.7	-3.2%	38.9	23.0	-5.3%	32.0	22.9	-13.7%	9.2	9.5	-0.2%	15.0	14.0	-0.4%	115.7	77.1
Riparian Shrub (willow)			0.0%		0.1	0.0%	1.2	1.8	0.2%	0.0		0.0%	1.2	2.1	1.0%	0.7	2.9	1.1%	3.0	6.8
Streambar			0.0%	0.2	1.3	0.3%	0.2	0.1	0.0%	1.3		-1.6%			0.0%			0.0%	1.7	1.4
Structure		1.3	1.3%		0.1	0.0%	0.2	0.9	0.2%			0.0%			0.0%			0.0%	0.2	2.3
Tamarisk			0.0%	113.9	3.4	-30.2%	1.2		-0.4%			0.0%			0.0%	0.1		0.0%	115.3	3.4
Tamarisk / Slash		0.2	0.2%		0.2	0.1%			0.0%			0.0%			0.0%			0.0%	0.0	0.4
Undifferentiated upland			0.0%			0.0%			0.0%	4.4		-5.5%			0.0%	1.3		-0.6%	5.7	0.0
Water	0.7	6.3	5.3%		19.4	5.1%	3.1	22.2	6.5%		2.0	2.3%	3.5	11.8	9.2%	9.9	7.8	-1.0%	17.2	69.6
Wet alkali meadow	4.6		-3.8%		0.3	0.1%	11.2	7.0	-1.4%	5.9	2.8	-4.3%	5.0	0.8	-5.1%	21.8	1.9	-9.7%	48.7	12.7
Total Mapped Acreage	121.1	107.0		366.7	378.4		298.4	294.7		79.2	85.7		83.9	88.2		205.5	203.4			

Changes in acreage of some of the vegetation types can be explained by the differences in mapping efforts between years, as described in Landscape Vegetation Mapping (Section 6). In Reach 1, LORP flows have resulted in an increase in the amount of open water habitats and marsh vegetation, and a decrease in Rabbitbrush-Nevada saltbush scrub/meadow. In Reach 2, barren land and tamarisk have declined, largely replaced by the nonnative annual five-horned smotherweed (*Bassia hyssopifolia*) and Rabbitbrush-Nevada saltbush scrub. Open water and marsh have increased in this reach also. In Reach 3, barren, dry alkali meadow and scrub have decreased, while water, marsh and scrub/meadow have increased. The most notable change in Reach 4 is the substantial increase in marsh. In Reach 5, the amount of open water has increased while the amount of marsh has decreased. In Reach 6, dry alkali meadow increased while wet alkali meadow decreased. This was the only reach where open water areas did not increase. Apparent decreases in riparian vegetation, especially tree willow are likely due to differences in mapping efforts as opposed to real decreases in riparian cover, as further described in the Landscape Vegetation Mapping section.



Indicator Species Figure 2. Percent Change in Vegetation Type by Reach Between 2000 and 2009

Total Mean Landbird and Waterbird Richness and Abundance

Indicator Species Table 3 presents the total detections of all bird species summed over all reaches for the two baseline years and for 2010. The breeding status for bird species detected in 2010 is also shown in this table. A total of 105 species were detected in the Riverine/Riparian Management Area in 2010. Breeding was confirmed for 35 species, considered probable for another 12 species, and possible for an additional 16 species. Forty-two of the 105 species detected were migrant or transient species, or those not known to breed in the project area. The most abundant species in the Riverine/Riparian Management Area are Red-winged Blackbird, Song Sparrow, Common Yellowthroat, Western Kingbird, Western Meadowlark, Bewick's Wren, Mourning Dove, Brown-headed Cowbird and Ash-throated Flycatcher. Fifteen of the 19 avian habitat indicator species were seen during surveys, and breeding activity was observed for ten of these in the LORP project area. Indicator Species for which breeding activity was observed included Wood Duck, Least Bittern, Great Blue Heron, Northern Harrier, Virginia Rail, Sora, Nuttall's Woodpecker, Tree Swallow, Marsh Wren and Blue Grosbeak. No breeding activity was observed for the following Habitat Indicator Species: Swainson's Hawk, Belted Kingfisher, Willow Flycatcher, Warbling Vireo, Yellow-breasted Chat, Yellow Warbler. Habitat Indicator Species not detected during baseline surveys, but seen in 2010 were Wood Duck and Tree Swallow. Red-shouldered Hawk, Yellow-billed Cuckoo and Long-eared Owl have not been detected during breeding bird surveys in any year.

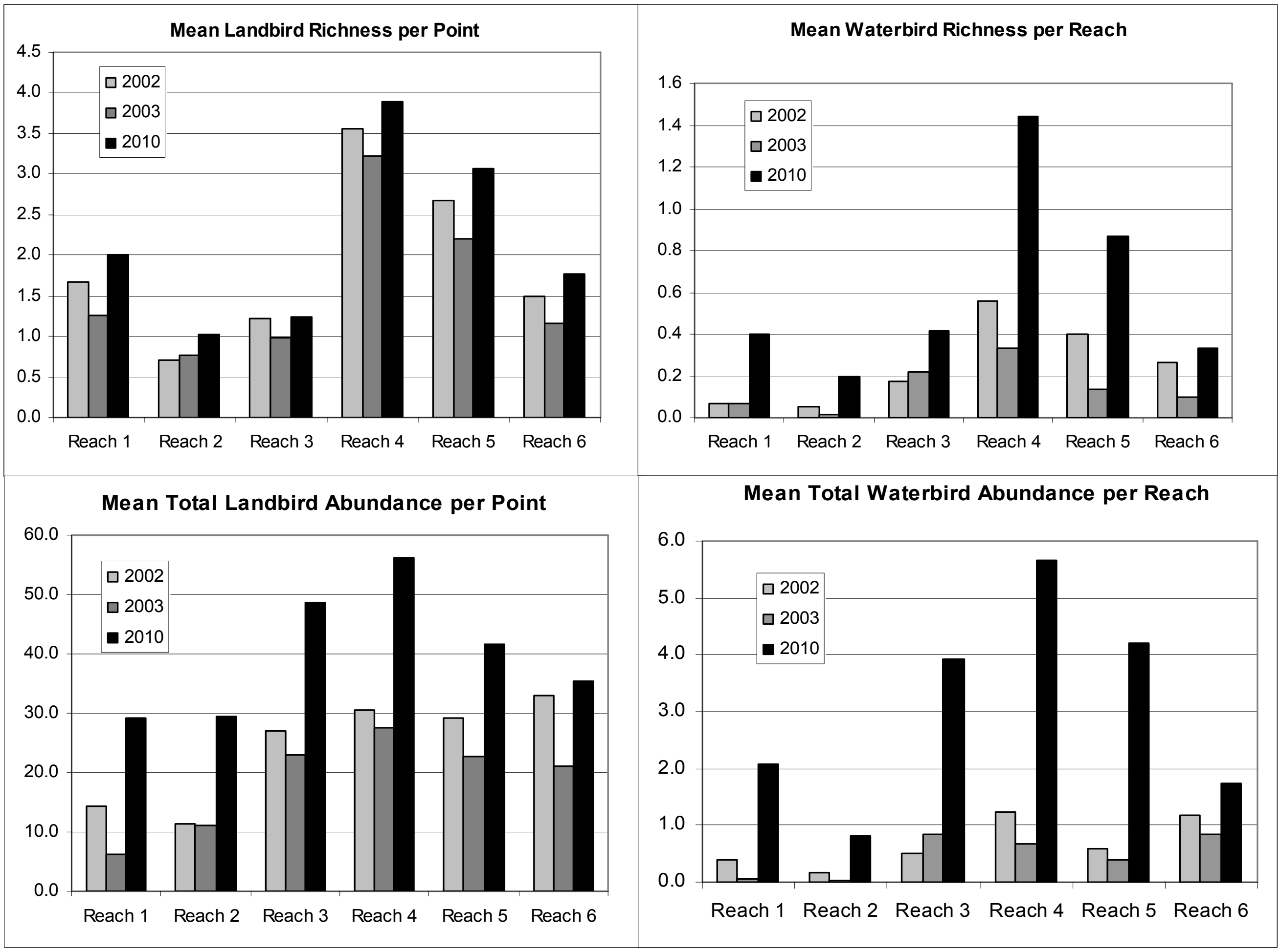
Indicator Species Table 9. Total Bird Species Detections and 2010 Breeding Status

Common Name		2002	2003	2010	2010 Breeding Status
Wood Duck	***Aix sponsa***	**0**	**0**	**18**	**Confirmed**
Gadwall	*Anas strepera*	8	5	43	Confirmed
Mallard	*Anas platyrhynchos*	13	7	97	Confirmed
Cinnamon Teal	*Anas cyanoptera*	1		13	Confirmed
Green-winged Teal	*Anas crecca*		1	3	Possible
Unidentified Teal	*Anas* spp.		2		
California Quail	*Callipepla californica*	3	29	66	Confirmed
Chukar	*Alectoris chukar*	1			
Pied-billed Grebe	*Podilymbus podiceps*	1		16	Confirmed
American White Pelican	*Pelecanus erythrorhynchos*			5	No Evidence
Double-crested Cormorant	*Phalacrocorax auritus*			1	No Evidence
American Bittern	*Botaurus lentiginosus*		1	5	Possible
Least Bittern	***Ixobrychus exilis***	**0**	**0**	**1**	**Possible**
Great Blue Heron	***Ardea herodias***	**7**	**3**	**34**	**Probable**
Great Egret	*Ardea alba*			22	No Evidence
Snowy Egret	*Egretta thula*	2		14	No Evidence
Green Heron	*Butorides virescens*	1	1	13	Possible
Black-crowned Night-Heron	*Nycticorax nycticorax*	3			No Evidence
Turkey Vulture	*Cathartes aura*	9	5	2	No Evidence
Northern Harrier	***Circus cyaneus***	**4**	**9**	**6**	**Confirmed**
Swainson's Hawk	***Buteo swainsoni***	**0**	**0**	**1**	**No Evidence**
Red-tailed Hawk	*Buteo jamaicensis*	3		3	Confirmed
American Kestrel	*Falco sparverius*	29	26	34	Confirmed
Virginia Rail	***Rallus limicola***	**10**	**1**	**20**	**Probable**
Sora	***Porzana carolina***	**1**	**1**	**6**	**Probable**
American Coot	*Fulica americana*	2	3	9	Possible
Killdeer	*Charadrius vociferus*	35	45	61	Probable
American Avocet	*Recurvirostra americana*			9	Confirmed
Spotted Sandpiper	*Actitis macularius*			4	No Evidence
Unidentified Dowitcher	*Limnodromus* spp.		1		
Wilson's Snipe	*Gallinago delicata*	7	2	8	Confirmed
California Gull	*Larus californicus*	1			No Evidence
Eurasian Collared-Dove	*Streptopelia decaocto*			12	Possible
Mourning Dove	*Zenaida macroura*	94	268	245	Confirmed
Greater Roadrunner	*Geococcyx californianus*		3		
Great Horned Owl	*Bubo virginianus*	2		10	Confirmed
Lesser Nighthawk	*Chordeiles acutipennis*	52	7	16	Probable
Common Nighthawk	*Chordeiles minor*	6	5	11	Probable
Black Swift	*Cypseloides niger*			2	No Evidence
White-throated Swift	*Aeronautes saxatalis*	45		5	No Evidence
Black-chinned Hummingbird	*Archilochus alexandri*	2	1	5	Possible
Costa's Hummingbird	*Calypte costae*			2	No Evidence
Unidentified Hummingbird	Family Trochilidae		4	2	
Belted Kingfisher	*Megaceryle alcyon*	**1**	**0**	**0**	
Ladder-backed Woodpecker	*Picoides scalaris*	4		1	Probable
Nuttall's Woodpecker	***Picoides nuttallii***	**45**	**22**	**27**	**Confirmed**
Northern Flicker	*Colaptes auratus*	38	56	110	Confirmed
Unidentified Woodpecker sp.	Family Picidae		4	1	
Olive-sided Flycatcher	*Contopus cooperi*	5		4	No Evidence
Western Wood-Pewee	*Contopus sordidulus*	23		47	No Evidence
Willow Flycatcher	***Empidonax traillii***	**3**	**1**	**4**	**No Evidence**
Hammond's Flycatcher	*Empidonax hammondii*			4	No Evidence
Gray Flycatcher	*Empidonax wrightii*			5	No Evidence
Dusky Flycatcher	*Empidonax oberholseri*			3	No Evidence
Western Flycatcher	*Empidonax difficilis/occid.*	2		1	No Evidence
Unidentified Empidonax Flycatcher	*Empidonax* spp.			3	
Black Phoebe	*Sayornis nigricans*	17	11	21	Possible
Say's Phoebe	*Sayornis saya*	19	10	7	Probable
Ash-throated Flycatcher	*Myiarchus cinerascens*	187	129	220	Confirmed
Cassin's Kingbird	*Tyrannus vociferans*			1	No Evidence
Western Kingbird	*Tyrannus verticalis*	279	218	326	Confirmed

Common Name		2002	2003	2010	2010 Breeding Status
Loggerhead Shrike	*Lanius ludovicianus*	62	66	94	Confirmed
Cassin's Vireo	*Vireo cassinii*		1	6	No Evidence
Warbling Vireo	***Vireo gilvus***	**8**	**0**	**7**	**No Evidence**
Western Scrub-Jay	*Aphelocoma californica*		1		
Pinyon Jay	*Gymnorhinus cyanocephalus*	5	3		
Black-billed Magpie	*Pica hudsonia*	49	45	32	Confirmed
Common Raven	*Corvus corax*	9	22	40	Confirmed
Horned Lark	*Eremophila alpestris*		1		
Tree Swallow	***Tachycineta bicolor***	**0**	**0**	**8**	**Possible**
Violet-green Swallow	*Tachycineta thalassina*	31		4	No Evidence
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	22	6	54	Possible
Bank Swallow	*Riparia riparia*			14	Possible
Cliff Swallow	*Petrochelidon pyrrhonota*	30	7	46	Confirmed
Barn Swallow	*Hirundo rustica*	1		27	Confirmed
Unidentified Swallow	Family Hirundidae		1		
Bushtit	*Psaltriparus minimus*	2			No Evidence
Bewick's Wren	*Thryomanes bewickii*	186	149	279	Confirmed
House Wren	*Troglodytes aedon*	13	29	39	Confirmed
Marsh Wren	***Cistothorus palustris***	**38**	**51**	**44**	**Probable**
Blue-gray Gnatcatcher	*Polioptila caerulea*	71	35	8	Possible
Yellow-breasted Chat	***Icteria virens***	**0**	**0**	**1**	**No Evidence**
American Robin	*Turdus migratorius*	3	4	5	Confirmed
Northern Mockingbird	*Mimus polyglottos*	124	62	103	Confirmed
Le Conte's Thrasher	*Toxostoma lecontei*	20	20	9	Confirmed
European Starling	*Sturnus vulgaris*	39	39	115	Confirmed
Cedar Waxwing	*Bombycilla cedrorum*		1		
Phainopepla	*Phainopepla nitens*		3		
Orange-crowned Warbler	*Oreothlypis celata*			5	No Evidence
Lucy's Warbler	*Oreothlypis luciae*			1	No Evidence
Yellow Warbler	***Dendroica petechia***	**31**	**3**	**34**	**No Evidence**
Yellow-rumped Warbler	*Dendroica coronata*	2		10	No Evidence
Black-throated Gray Warbler	*Dendroica nigrescens*			1	No Evidence
Townsend's Warbler	*Dendroica townsendi*			2	No Evidence
Black-and-white Warbler	*Mniotilta varia*			1	No Evidence
MacGillivray's Warbler	*Oporornis tolmiei*	3		2	No Evidence
Common Yellowthroat	*Geothlypis trichas*	206	134	360	Confirmed
Wilson's Warbler	*Wilsonia pusilla*	39	2	308	No Evidence
Unidentified Warbler	Family Parulidae			2	
Spotted Towhee	*Pipilo maculatus*	108	69	61	Confirmed
Brewer's Sparrow	*Spizella breweri*	4	9		
Black-throated Sparrow	*Amphispiza bilineata*	72	80	2	Probable
Sage Sparrow	*Amphispiza belli*	14	20	23	Probable
Savannah Sparrow	*Passerculus sandwichensis*	1	1	8	Possible
Song Sparrow	*Melospiza melodia*	185	177	461	Confirmed
White-crowned Sparrow	*Zonotrichia leucophrys*			1	No Evidence
Unidentified Sparrow	Family Emberizidae		3		
Western Tanager	*Piranga ludoviciana*	10		28	No Evidence
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			1	No Evidence
Black-headed Grosbeak	*Pheucticus melanocephalus*		1	4	No Evidence
Blue Grosbeak	***Passerina caerulea***	**20**	**27**	**30**	**Probable**
Lazuli Bunting	*Passerina amoena*	10		6	No Evidence
Red-winged Blackbird	*Agelaius phoeniceus*	786	597	2126	Confirmed
Western Meadowlark	*Sturnella neglecta*	207	162	287	Confirmed
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	40	16	18	Possible
Brewer's Blackbird	*Euphagus cyanocephalus*	48	22	12	Possible
Great-tailed Grackle	*Quiscalus mexicanus*	14	2	1	No Evidence
Brown-headed Cowbird	*Molothrus ater*	238	140	243	Confirmed
Unidentified Blackbird	Family Icteridae		1		
Bullock's Oriole	*Icterus bullockii*	16	9	43	Confirmed
Cassin's Finch	*Carpodacus cassinii*		4		
House Finch	*Carpodacus mexicanus*	10	5	16	Possible
Lesser Goldfinch	*Spinus psaltria*	1	1	1	No Evidence
Unidentified Bird	Class Aves		25		
Total Bird Detections - Riverine/riparian surveys		3743	2937	6642	

habitat indicator species are indicated in bold-faced type

Indicator SpeciesFigure 3 shows the mean total landbird and waterbird abundance and richness per point by reach and year. Landbird species richness has increased slightly in all but Reach 3. Waterbird richness has increased in all reaches. Landbird abundance has increased in all reaches, and is highest in Reaches 3 and 4. Waterbird abundance has also increased in all reaches and is highest in Reaches 3, 4 and 5.



Indicator Species Figure 3. Mean Total Landbird and Waterbird Abundance and Richness per Point by Reach and Year

Breeding Bird Species Diversity, Richness and Mean Number of Individuals

Indicator Species Table 4 provides the mean breeding bird abundance, diversity and richness per reach and monitoring year. A discussion of the results by reach follows.

Indicator Species Table 4. Mean Breeding Bird Abundance, Diversity and Richness per Reach and Monitoring Year

	Mean Abundance				Mean Species Diversity				Mean Species Richness		
LORP Reach	2002	2003	2010		2002	2003	2010		2002	2003	2010
REACH 1	4.4	2.0	**8.7		4.52	3.24	*5.65		5.7	3.7	**7.9
REACH 2	3.4	3.5	**9.3		4.53	4.46	**6.12		5.5	5.9	**8.7
REACH 3	8.9	7.7	**15.6		7.98	7.47	8.31		10.7	9.6	**12.9
REACH 4	10.1	9.1	*18.7		9.32	8.11	5.53		12.3	10.9	**11.3
REACH 5	9.2	7.6	**13.0		8.44	7.91	**10.87		11.4	9.9	*14.3
REACH 6	10.0	7.1	*11.0		8.25	6.61	7.78		11.2	8.8	*11.0

*2010 > 2003 **2010 > 2002 and 2003

Habitat Indicator Species Diversity, Richness and Mean Number of Individuals

Indicator Species Table 5 provides the mean breeding bird abundance, diversity and richness per reach and monitoring year for habitat indicator species. The only statistically significant increase in these values was seen in habitat species abundance in Reach 3, and diversity in Reach 2, while numerical increases in the abundance, diversity and richness of habitat indicator species use was seen in all LORP reaches except Reach 6.

Indicator Species Table 5. Mean Breeding Bird Abundance, Diversity and Richness per Reach and Monitoring Year of Habitat Indicator Species

	Mean Abundance HIS				Mean Species Diversity HIS				Mean Species Richness HIS		
LORP Reach	2002	2003	2010		2002	2003	2010		2002	2003	2010
REACH 1	0.2	0.2	0.3		1.00	1.00	1.06		0.5	0.3	0.7
REACH 2	0.1	0.1	0.3		1.04	0.99	*1.25		0.3	0.3	0.8
REACH 3	0.3	0.3	**0.6		1.22	1.12	1.35		0.8	0.6	1.0
REACH 4	0.4	0.3	0.9		1.33	1.00	1.63		0.9	0.6	1.4
REACH 5	0.3	0.2	0.5		1.20	1.00	1.38		0.7	0.5	1.1
REACH 6	0.3	0.3	0.1		1.14	1.13	1.10		0.7	0.6	0.4

*2010 > 2003 **2010 > 2002

Reach 1 Breeding Bird Results

Indicator Species Table 6. Total Breeding Birds per Year – Reach 1

A total of 30 breeding species and 431 individuals were detected in Reach 1 in 2010 (Indicator Species Table 6). The most abundant species were Red-winged Blackbird, Western Meadowlark and Mourning Dove. Breeding bird abundance and species richness were significantly higher in 2010 than preproject conditions (Indicator Species Table 4). Breeding bird diversity was significantly higher than in 2003. In this reach, notable increases were observed in the number of Red-winged Blackbirds, Song Sparrows and Mourning Dove. Waterfowl, absent during preproject surveys, were observed using Reach 1, and one Cinnamon Teal brood was seen in 2010. Other waterbird species not seen during baseline surveys, including Least Bittern, Great Blue Heron and Killdeer were also observed in this reach in 2010. Habitat Indicator Species observed in Reach 1 in 2010 included Least Bittern, Great Blue Heron, and Marsh Wren.

Common Name	2002	2003	2010
Gadwall			10
Mallard			6
Cinnamon Teal			1
California Quail		4	
American Bittern		1	
Least Bittern			**1**
Great Blue Heron			**8**
Northern Harrier	**4**	**6**	
Virginia Rail	**6**		
Killdeer			5
Mourning Dove	3	17	33
Northern Flicker	1	1	5
Black Phoebe			2
Say's Phoebe	3	4	1
Ash-throated Flycatcher	4	2	1
Western Kingbird	2		5
Loggerhead Shrike	3	5	7
Black-billed Magpie	1		
Northern Rough-winged Swallow			2
Cliff Swallow	19	4	22
Barn Swallow	1		16
Bewick's Wren	4	2	5
House Wren	1		
Marsh Wren		**2**	**3**
Blue-gray Gnatcatcher	1		
Northern Mockingbird	15	9	12
Le Conte's Thrasher	4		
European Starling			12
Common Yellowthroat	29	10	38
Brewer's Sparrow		1	
Black-throated Sparrow	4	3	
Sage Sparrow	3	4	
Savannah Sparrow			1
Song Sparrow	1		19
Red-winged Blackbird	58	5	150
Western Meadowlark	38	6	42
Yellow-headed Blackbird			2
Brewer's Blackbird	1		1
Brown-headed Cowbird	12	5	10
Bullock's Oriole			2
House Finch	1	2	9
Total Breeding Birds Per Year	**219**	**93**	**431**

Reach 2 Breeding Bird Results

Indicator Species Table 7. Total Breeding Birds per Year-Reach 2

A total of 49 breeding species and 1,582 individuals were detected in Reach 2 in 2010 (Indicator Species Table 7). The most abundant species were Red-winged Blackbird, Song Sparrow and Bewick's Wren. Breeding bird abundance, diversity, and species richness were significantly higher in 2010 than preproject conditions (Indicator Species Table 4). In this reach, notable increases were observed in the number of Red-winged Blackbirds, Song Sparrows, Common Yellowthroat, Bewick's Wren, and Western Kingbird. Blue-gray Gnatcatchers and Black-throated Sparrows were less abundant in 2010 than preproject. Habitat Indicator Species observed in this reach included Wood Duck, Great Blue Heron, Northern Harrier, Virginia Rail, Nuttall's Woodpecker, Marsh Wren, and Blue Grosbeak.

Common Name	2002	2003	2010
Wood Duck			**4**
Gadwall			3
Mallard			13
Cinnamon Teal			1
California Quail	2	13	38
American Bittern			1
Great Blue Heron			**6**
Green Heron	1		6
Northern Harrier		**1**	**3**
Red-tailed Hawk			2
American Kestrel	7	5	15
Virginia Rail	**2**		**1**
American Coot			3
Killdeer	7		5
Mourning Dove	29	98	83
Greater Roadrunner		1	
Great Horned Owl			1
Lesser Nighthawk	13	1	6
Common Nighthawk		1	6
Black-chinned Hummingbird		1	3
Ladder-backed Woodpecker	2		
Nuttall's Woodpecker	**14**	**3**	**9**
Northern Flicker	1	10	28
Black Phoebe	5	3	5
Say's Phoebe	4	2	3
Ash-throated Flycatcher	68	50	55
Western Kingbird	30	5	71
Loggerhead Shrike	7	12	28
Black-billed Magpie	4	3	5
Common Raven	1	4	9
Horned Lark		1	
Northern Rough-winged Swallow			3
Barn Swallow			3
Bushtit	2		
Bewick's Wren	87	68	120
House Wren		5	5
Marsh Wren	**2**	**7**	**12**
Blue-gray Gnatcatcher	39	23	2
American Robin	2	1	
Northern Mockingbird	7	9	3
Le Conte's Thrasher	14	17	9
European Starling		1	12
Common Yellowthroat	8	10	95
Spotted Towhee	83	54	41
Brewer's Sparrow	1	8	
Black-throated Sparrow	65	76	2
Sage Sparrow	11	16	20
Song Sparrow	10	7	172
Blue Grosbeak	**10**	**15**	**20**
Lazuli Bunting			1
Red-winged Blackbird	27	5	555
Western Meadowlark	17	24	28
Brewer's Blackbird	2	11	
Brown-headed Cowbird	31	13	56
Bullock's Oriole		1	7
House Finch	9	2	3
Total Breeding Birds Per Year	**624**	**587**	**1582**

Reach 3 Breeding Bird Results

Indicator Species Table 8. Total Breeding Birds per Year-Reach 3

A total of 53 breeding species and 1,927 individuals were detected in Reach 3 in 2010 (Indicator Species Table 8). The most abundant species were Red-winged Blackbird, Song Sparrow and Bewick's Wren. Breeding bird species abundance and richness were significantly higher in 2010 than preproject conditions. In this reach, notable increases were observed in the number of Red-winged Blackbirds, Song Sparrows, and Common Yellowthroat. Habitat Indicator Species observed in this reach included Wood Duck, Great Blue Heron, Northern Harrier, Virginia Rail, Nuttall's Woodpecker, Tree Swallow, Marsh Wren, and Blue Grosbeak.

Common Name	2002	2003	2010
Wood Duck			**10**
Gadwall	4	5	14
Mallard	1	3	29
Cinnamon Teal			8
Green-winged Teal		1	2
California Quail		8	9
Pied-billed Grebe	1		4
American Bittern			2
Great Blue Heron	**4**	**3**	**14**
Green Heron		1	7
Northern Harrier		**2**	**1**
Red-tailed Hawk	1		
American Kestrel	2	9	9
Virginia Rail	**1**	**1**	**5**
Sora		**1**	
American Coot	2	2	5
Killdeer	8	15	27
American Avocet			5
Spotted Sandpiper			1
Mourning Dove	44	75	66
Greater Roadrunner		2	
Great Horned Owl			6
Lesser Nighthawk	16	1	10
Common Nighthawk	4	3	
Ladder-backed Woodpecker	2		
Nuttall's Woodpecker	**10**	**8**	**10**
Northern Flicker	14	13	36
Black Phoebe	3	2	4
Say's Phoebe	3	1	0
Ash-throated Flycatcher	50	39	77
Western Kingbird	74	62	110
Loggerhead Shrike	28	31	28
Black-billed Magpie	21	15	3
Common Raven	4	9	6
Tree Swallow			**4**
Northern Rough-winged Swallow	2		9
Bank Swallow			6
Cliff Swallow	8	3	16
Barn Swallow			3
Bewick's Wren	49	48	87
House Wren	1	2	7
Marsh Wren	**13**	**11**	**16**
Blue-gray Gnatcatcher	12	7	2
American Robin		1	
Northern Mockingbird	45	12	36
Le Conte's Thrasher	2	1	
European Starling	4	9	25
Common Yellowthroat	85	54	128
Spotted Towhee	15	12	18
Brewer's Sparrow	3		
Black-throated Sparrow	3	1	
Sage Sparrow			3
Savannah Sparrow		1	1
Song Sparrow	68	78	143
Blue Grosbeak	**6**	**10**	**9**
Lazuli Bunting	2		
Red-winged Blackbird	263	270	691
Western Meadowlark	73	59	110
Yellow-headed Blackbird		4	9
Brewer's Blackbird	6		
Great-tailed Grackle	1	1	1
Brown-headed Cowbird	89	60	77
Bullock's Oriole	4		15
House Finch			3
Lesser Goldfinch			
Total Breeding Birds Per Year	**1051**	**956**	**1927**

Reach 4 Breeding Bird Results

Indicator Species Table 9. Total Breeding Birds per Year - Reach 4

A total of 40 breeding species and 516 individuals were detected in Reach 4 in 2010 (Indicator Species Table 9). The most abundant species was Red-winged Blackbird. Breeding bird abundance was higher than that observed in 2003 only, primarily due to an increase in the number of Red-winged Blackbirds. Diversity showed a numerical, but not statistical decrease as compared to preproject surveys. Breeding bird species richness was significantly higher in 2010 than preproject conditions (Indicator Species Table 4). Habitat Indicator Species observed in this reach included Great Blue Heron, Virginia Rail, Sora, Nuttall's Woodpecker, Tree Swallow, and Marsh Wren.

Common Name	2002	2003	2010
Gadwall			5
Mallard		1	13
Cinnamon Teal			1
California Quail	1	1	3
Pied-billed Grebe			3
American Bittern			2
Great Blue Heron	**1**		**1**
American Kestrel	5	2	
Virginia Rail			**6**
Sora	**1**		**4**
Killdeer	2	3	1
Spotted Sandpiper			1
Wilson's Snipe	6	2	8
Mourning Dove	5	14	13
Lesser Nighthawk		1	
Common Nighthawk	1	1	2
Ladder-backed Woodpecker			1
Nuttall's Woodpecker	**1**	**2**	**1**
Northern Flicker	9	11	11
Black Phoebe		4	
Ash-throated Flycatcher	7	4	12
Western Kingbird	22	23	19
Loggerhead Shrike	3	3	3
Black-billed Magpie	5	12	7
Common Raven		1	2
Tree Swallow			**1**
Northern Rough-winged Swallow	1		1
Bank Swallow			3
Cliff Swallow	3		6
Bewick's Wren	15	1	4
House Wren	2	10	5
Marsh Wren	**8**	**6**	**11**
Blue-gray Gnatcatcher	7	2	1
American Robin		2	5
Northern Mockingbird	9	5	
European Starling	14	12	9
Common Yellowthroat	17	16	22
Savannah Sparrow			1
Song Sparrow	11	10	26
Lazuli Bunting	1		1
Red-winged Blackbird	66	66	286
Western Meadowlark	16	15	9
Yellow-headed Blackbird	9	4	
Brewer's Blackbird	14	2	
Great-tailed Grackle	1		
Brown-headed Cowbird	11	11	5
Bullock's Oriole	3	2	
House Finch			1
Total Breeding Birds Per Year	**277**	**249**	**516**

Reach 5 Breeding Bird Results

Indicator Species Table 10. Total Breeding Birds per Year - Reach 5

A total of 45 breeding species and 638 individuals were detected in Reach 5 in 2010 (Indicator Species Table 10). This reach had the highest mean species diversity and richness of all six LORP reaches. The most abundant species was Red-winged Blackbird. Breeding bird species abundance and richness were significantly higher in 2010 than preproject conditions (Indicator Species Table 4). Species richness was significantly higher in 2010 than 2003 only. Habitat Indicator Species observed in this reach included Wood Duck, Great Blue Heron, Virginia Rail, Nuttall's Woodpecker, Tree Swallow, and Marsh Wren.

Common Name	2002	2003	2010
Wood Duck			**3**
Gadwall	2		9
Mallard	1	2	17
Cinnamon Teal			2
Green-winged Teal			1
California Quail		2	14
Pied-billed Grebe			8
Great Blue Heron	**1**		**5**
Black-crowned Night-Heron	1		
American Kestrel	6	3	6
Virginia Rail			**4**
Killdeer	3	4	5
American Avocet			4
Spotted Sandpiper			1
Wilson's Snipe	1		
Eurasian Collared-Dove			12
Mourning Dove	5	21	18
Great Horned Owl	1		2
Lesser Nighthawk	7		
Common Nighthawk	1		
Nuttall's Woodpecker	**4**	**1**	**5**
Northern Flicker	2	9	23
Black Phoebe			2
Say's Phoebe	1	1	1
Ash-throated Flycatcher	21	11	21
Western Kingbird	36	42	37
Loggerhead Shrike	13	1	7
Western Scrub-Jay		1	
Black-billed Magpie	11	5	11
Common Raven	1	1	4
Tree Swallow			**3**
Northern Rough-winged Swallow	3	2	39
Bank Swallow			
Cliff Swallow			2
Barn Swallow			2
Bewick's Wren	12	14	24
House Wren	4	3	9
Marsh Wren	**5**	**7**	**1**
Blue-gray Gnatcatcher	6	2	1
Northern Mockingbird	12	13	11
European Starling	10	10	16
Common Yellowthroat	28	20	37
Spotted Towhee	9	3	2
Black-throated Sparrow			
Savannah Sparrow	1		3
Song Sparrow	25	35	51
Blue Grosbeak	**2**	**1**	
Lazuli Bunting	1		1
Red-winged Blackbird	114	70	138
Western Meadowlark	20	18	28
Yellow-headed Blackbird	3	3	2
Great-tailed Grackle	9		
Brown-headed Cowbird	33	30	37
Bullock's Oriole	7	4	9
House Finch		1	
Lesser Goldfinch	1	1	
Total Breeding Birds Per Year	**423**	**341**	**638**

Reach 6 Breeding Bird Results

Indicator Species Table 11. Total Breeding Birds per Year - Reach 6

A total of 46 breeding species and 1,001 individuals were detected in Reach 6 in 2010 (Indicator Species Table 11). The most abundant species were Red-winged Blackbird, Western Kingbird and Western Meadowlark. Species richness and abundance was significantly higher in 2010 than 2003 only. There has been no significant change in breeding bird diversity as compared to preproject conditions (Indicator Species Table 4). Habitat Indicator Species observed in this reach in 2010 included Wood Duck, Northern Harrier, Virginia Rail, Sora, Nuttall's Woodpecker, Marsh Wren, and Blue Grosbeak.

Common Name	2002	2003	2010
Wood Duck			**1**
Gadwall	2		2
Mallard	11	1	19
Cinnamon Teal	1		
California Quail		1	2
Pied-billed Grebe			1
Great Blue Heron	**1**		
Black-crowned Night-Heron	2		
Northern Harrier			**2**
Red-tailed Hawk	2		1
American Kestrel	9	7	4
Virginia Rail	**1**		**4**
Sora			**2**
American Coot		1	1
Killdeer	15	23	18
Spotted Sandpiper			1
Eurasian Collared-Dove			
Mourning Dove	8	43	32
Great Horned Owl	1		1
Lesser Nighthawk	16	4	
Common Nighthawk			3
Black-chinned Hummingbird	2		2
Nuttall's Woodpecker	**16**	**8**	**2**
Northern Flicker	11	12	7
Black Phoebe	9	2	8
Say's Phoebe	8	2	2
Ash-throated Flycatcher	37	23	54
Western Kingbird	115	86	84
Loggerhead Shrike	8	14	21
Black-billed Magpie	7	10	6
Common Raven	3	7	19
Northern Rough-winged Swallow	16	4	
Bank Swallow			5
Cliff Swallow			
Barn Swallow			3
Bewick's Wren	19	16	39
House Wren	5	9	13
Marsh Wren	**10**	**18**	**1**
Blue-gray Gnatcatcher	6	1	2
American Robin	1		
Northern Mockingbird	36	14	41
Le Conte's Thrasher		2	
European Starling	11	7	41
Common Yellowthroat	39	24	40
Spotted Towhee	1		
Savannah Sparrow			2
Song Sparrow	70	47	50
Blue Grosbeak	**2**	**1**	**1**
Lazuli Bunting	6		3
Red-winged Blackbird	258	181	306
Western Meadowlark	43	40	70
Yellow-headed Blackbird	28	5	5
Brewer's Blackbird	25	9	11
Great-tailed Grackle	3	1	
Brown-headed Cowbird	62	21	58
Bullock's Oriole	2	2	10
House Finch			
Lesser Goldfinch			1
Total Breeding Birds Per Year	928	646	1001

Habitat Use

Indicator Species Table 12 shows the results of Chi-square analysis of habitat use data for Habitat Indicator Species and all species combined, and Indicator Species Table 13 shows the number of observations of each Habitat Indicator Species by habitat type. Higher X^2 values indicate greater deviation from the expected values, in this case the expected number of observations, based on the acreage of habitat type available. The habitats preferentially used by Habitat Indicator Species were marsh and riparian (Indicator Species Table 12). All waterbird indicator species were observed using marsh (Indicator Species Table 13). All observations of Marsh Wren were in marsh habitat. Riparian habitats attracted the greatest number of indicator species. Water and wet alkali meadow were used in proportion to their availability by indicator species. The majority of all bird observations combined were of species using riparian vegetation. Marsh, riparian and wet alkali meadow habitats were used out of proportion to their availability when considering observations of all species and all available habitats.

Indicator Species Table 12. Chi-square Analysis of Habitat Type and Habitat Indicator Species Bird Observations

	HIS				All Species			
Habitat	Obs	Exp	χ^2	Sign	Obs	Exp	χ^2	Sign
Marsh	60	29.4	31.9	+	1079	806.0	92.4	+
Dry Alkali Meadow		19.9	19.9	-	45	546.4	460.1	-
Riparian	56	11.9	162.4	+	1901	327.7	7554.4	+
Barren/Streambar		3.5	3.5	-	10	96.2	77.2	-
Phragmites		0.6	0.6	-	1	17.4	15.5	-
Rabbitbrush/saltbush scrub and scrub/meadow	9	68.1	51.3	-	579	1867.1	888.7	-
Water	18	9.7	7.0	NS	170	266.6	35.0	-
Wet Alkali meadow	2	1.8	0.0	NS	191	48.6	417.8	+
Total	145		276.6		3976		9541.1	

Indicator Species Table 13. Habitat Indicator Species Bird Observations and Habitat Type

Indicator Species	**Marsh**	**Riparian**	**Scrub and scrub/meadow**	**Water**	**Wet Alkali meadow**
Wood Duck	4	1		11	
Least Bittern	2				
Great Blue Heron	11	8	3	5	1
Northern Harrier	2	1	2		
Swainson's Hawk			1		
Virginia Rail	11				
Sora	3			2	
Nuttall's Woodpecker		12			
Willow Flycatcher		3			
Warbling Vireo		5			
Tree Swallow	5	1	1		1
Marsh Wren	22				
Yellow Warbler		15			
Yellow-breasted Chat		1			
Blue Grosbeak		9	2		
Total Observations	**60**	**56**	**9**	**18**	**2**

8.1.6 Summary of Riverine/Riparian Bird Surveys

Changes in bird species abundance, diversity and richness were detected in the LORP Riverine/Riparian management area as compared to baseline. Bird species abundance was significantly higher in 2010 than both baseline years in all reaches except Reach 6. Bird species diversity was significantly higher than either baseline year only in Reaches 2 and 5, while species richness was higher in all reaches except Reaches 5 and 6. Use of LORP by habitat indicator species has increased only slightly, leading to numerical but not statistically significant changes. Reach 6 was the only reach that showed numerical decreases in all indices with regard to use by habitat indicator species.

Change in mean species richness without a concomitant change in species diversity indicates that although more species are using LORP, these species are not yet abundant enough to affect species diversity values significantly. The dominant breeding species were in general, more abundant in 2010, possibly indicating more productive habitats that can support a greater number of individuals. The main habitat changes that have likely influenced bird use have been an increase in the acreage of marsh and open water. Marsh is used heavily by the dominant breeding species: Red-winged Blackbird, Song Sparrow and Common Yellowthroat. Thus, the expanded and possibly higher-quality marsh acreage may explain increases seen in these species. New open water areas attracted waterbirds, which, while not abundant, contributed to increases in species richness. While willow recruitment is occurring on LORP, the new recruitment is not of a sufficient height or acreage at this time to support additional riparian dependent species. Many of the habitat indicator species are riparian dependent species, therefore increased populations would not be expected at this time. Detections of waterbird indicator species such as Wood Duck and Great Blue Heron was greater than preproject probably due to the increase in open water habitats. These general breeding bird surveys will not be effective at tracking use of LORP by indicator species whose season of use is other than summer, such as Belted Kingfisher, or by potential breeding species more difficult to detect such as Yellow-billed Cuckoo, Long-eared Owl, or Willow Flycatcher.

8.2 Blackrock Waterfowl Management Area Avian Surveys

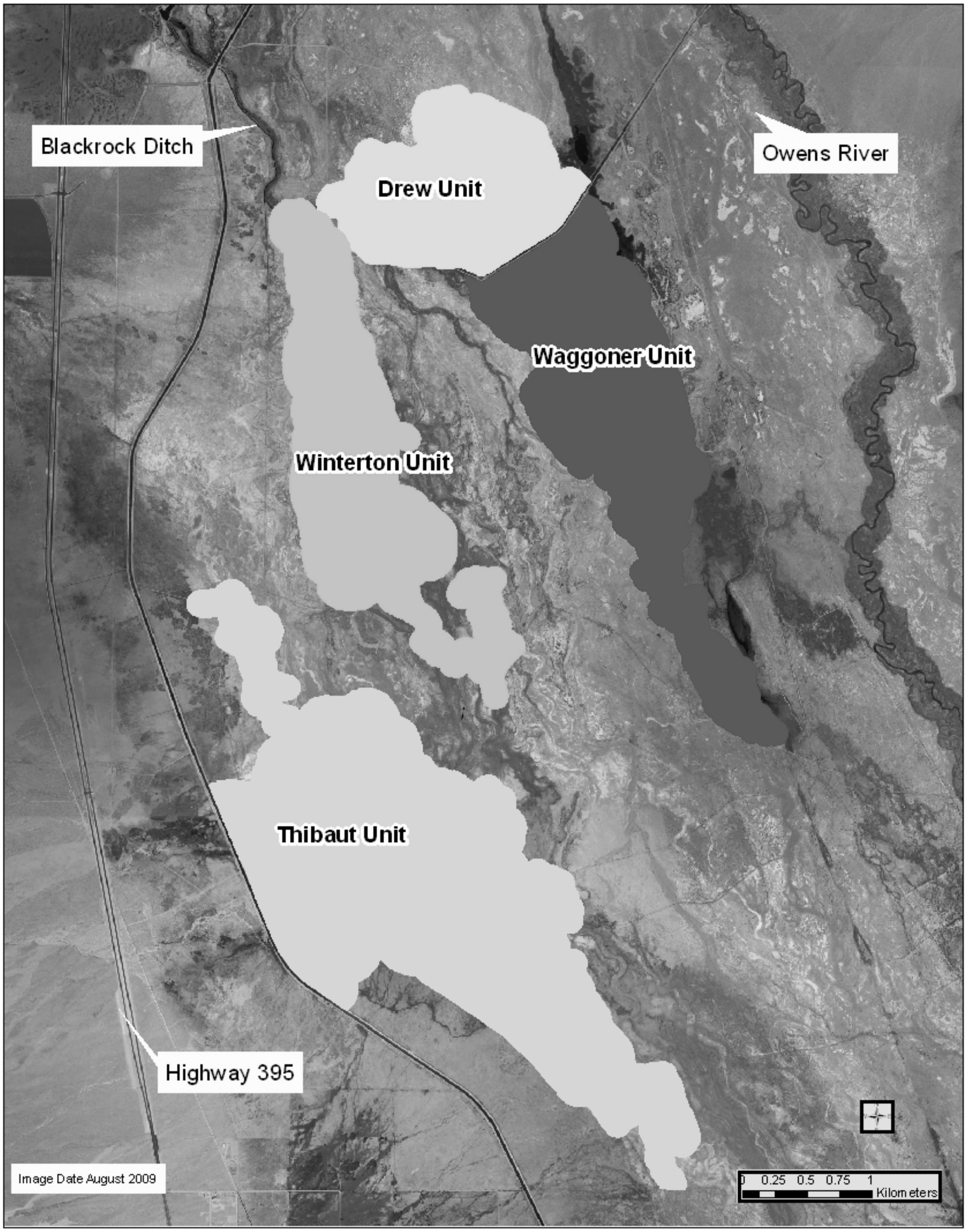
Introduction

Systematic bird surveys are being conducted in the BWMA in order to document bird species use, habitat associations, and when possible, breeding status. Bird survey data can be used to better understand the response of bird species including Habitat Indicator Species, to changing habitat conditions in the project area. The Habitat Indicator Species in the BWMA include all resident, migratory, and wintering waterfowl, wading birds, shorebirds, rails and bitterns, Northern Harrier, Osprey, and Marsh Wren. Baseline surveys were conducted in the BWMA from spring 2002 to early 2003, and again in 2004. Surveys conducted in 2010 represent the first LORP post-implementation bird surveys in the BWMA. In 2010, LADWP staff managed the project, and field surveys were conducted by LADWP Watershed Resources Specialists Debbie House and Chris Allen, and ICWD Field Program Coordinator Jerry Zatorski.

The BWMA is composed of four separate management units: Drew, Thibaut, Waggoner, and Winterton (Indicator Species Figure 4). Under LORP, LADWP is required to flood up to 500 acres in order to provide habitat consistent with the needs of indicator species. The specific amount of flooded acreage to be maintained in any one year is dependent upon the percent forecasted run-off. When runoff is forecasted to be 100% or more of average annual runoff, 500 acres are to be flooded at any given time. When the runoff forecast is 50-99% of the average annual, water supplied to the BWMA will be reduced in general proportion to forecasted runoff, with the specific acreage to be maintained set by the Standing Committee (Ecosystems Sciences 2008) in consultation with the California Department of Fish and Game. In dry years (<50% annual average runoff), water will still be provided to BWMA, with the amounts and target acreage set by the Standing Committee. In dry years, the LORP Ecosystem Management Plan (Ecosystem Sciences 2002) recommends releases only to the Thibaut Unit.

8.2.1 Habitat Indicator Species

LORP Technical Memo #15 *Resource Management in the Blackrock Waterfowl Habitat Area* (Tech Memo) provides a list of Habitat Indictor Species for BWMA. This list is supposed to help guide wildlife resource management in the BWMA. This list includes species that occur in the area on a regular basis, although they may be rare or uncommon. The Tech Memo states that the list could be expanded or contracted depending on the frequency of occurrence or level of abundance that is considered appropriate. The BWMA has attracted a larger suite of waterbirds than perhaps anticipated, such as grebes, terns, and gulls. These species are responding to the actions taken under LORP, and thus will be included in the species summaries grouped with other Habitat Indicator Species. The species to be included as Habitat Indicator Species will thus be all waterbird groups including waterfowl (Family Anatidae), wading birds (Order Ciconiformes in part), grebes (Family Podicipedidae), shorebirds (Order Charadriiformes), rails (Family Rallidae) and bitterns, gulls and terns (Family Laridae), as well as the specific species identified in the Tech Memo, namely Northern Harrier, Osprey and Marsh Wren.



Indicator Species Figure 4. Location of Blackrock Waterfowl Management Units

8.2.2 Description of Management Units

Drew Unit

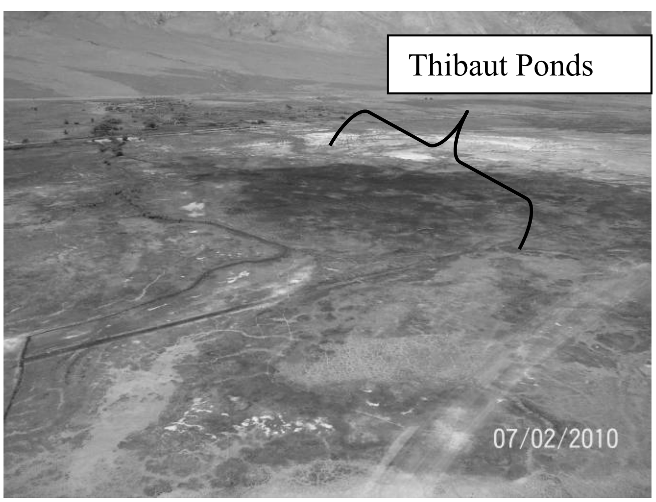
The first cycle of post-implementation flooding of the Drew Unit was initiated in April 2009. The unit continued to be in active status throughout 2010. Prior to the initiation of flooding in the spring of 2009, existing vegetation was burned in the winter of 2008-2009 to prepare the site. During 2009, the flooded acreage in this unit was initially 44 acres in the spring, increasing to 268 acres by fall. The average flooded acreage in 2009 was 185. In 2010, the flooded acreage in the Drew Unit has ranged from 262 to 328 acres with an average of 295 acres. To date, the western portion of the unit has developed more extensive marsh vegetation, with small grass-covered islands and open-water areas (Indicator Species Figure 5). The southeastern portion has remained open and probably forms the deepest water portions of the unit. The flooded area of the unit has extended well beyond that predicted, especially to the northeast where much desert sink scrub was inundated.

Indicator Species Figure 5. Aerial View of Drew Management Unit While in Active Status

Thibaut Unit

The Thibaut Unit encompasses the Thibaut Ponds in the Waterfowl Management Area, and the remainder of the unit to the south which is contained in the Thibaut Field and Rare Plant Management Area. Indicator Species Figure 6 shows the unit as it appeared in July 2010. The Thibaut Ponds (left photo) are considered part of the "Off-river Lakes and Ponds" component of LORP. As such, water is to be supplied continuously to the Thibaut Ponds. The Thibaut Ponds area was burned in the winter of 2006-2007. This management action created open water areas once flooding commenced. During the 2010 avian censuses, no open water was visible (see Indicator Species Figure 6, left photo). During baseline avian surveys of the Thibaut Unit in 2004, while much of the unit was flooded (apparently due to site irrigation), the Thibaut Ponds area was dry.

The Thibaut Management Unit was active from April 2007 through April 2009. During the 2007-2008 runoff year, between 211 and 730 acres were flooded at any one time, with the average flooded acreage at 373 acres. During the 2008-2009 runoff year, between 48 and 658 acres were flooded, with the average flooded acreage at 367 acres. By late summer of 2008, Ecosystem Sciences determined that the amount of open water within this unit and Winterton, the other active unit, had decreased to less than 50% of the flooded acreage. The unit was put into inactive status in spring of 2009. The alkali flats in this unit typically are seasonally inundated, but dry by late spring. Despite being in inactive status, intermittent flooding of the unit has occurred as various times of the year. Indicator Species Figure 6 (right photo) shows that in July 2010, the northern portion of the Thibaut Field was flooded. More extensive flooding in the Thibaut Field was noted during bird surveys in August 2010. At this time, even the southernmost alkali flat (seen in the foreground of Indicator Species Figure 6 right photo), was filled. The presence of mid-summer water while the unit is in inactive status was apparently due to irrigation releases to the pasture.



Indicator Species Figure 6. Aerial Views of Thibaut Management Unit in 2010 (Inactive Status).

The photo on the left shows the area called "Thibaut Ponds" which is in the Waterfowl Management Area. The photo on the right shows the area of the unit in the Thibaut Field, south of Thibaut Ponds.

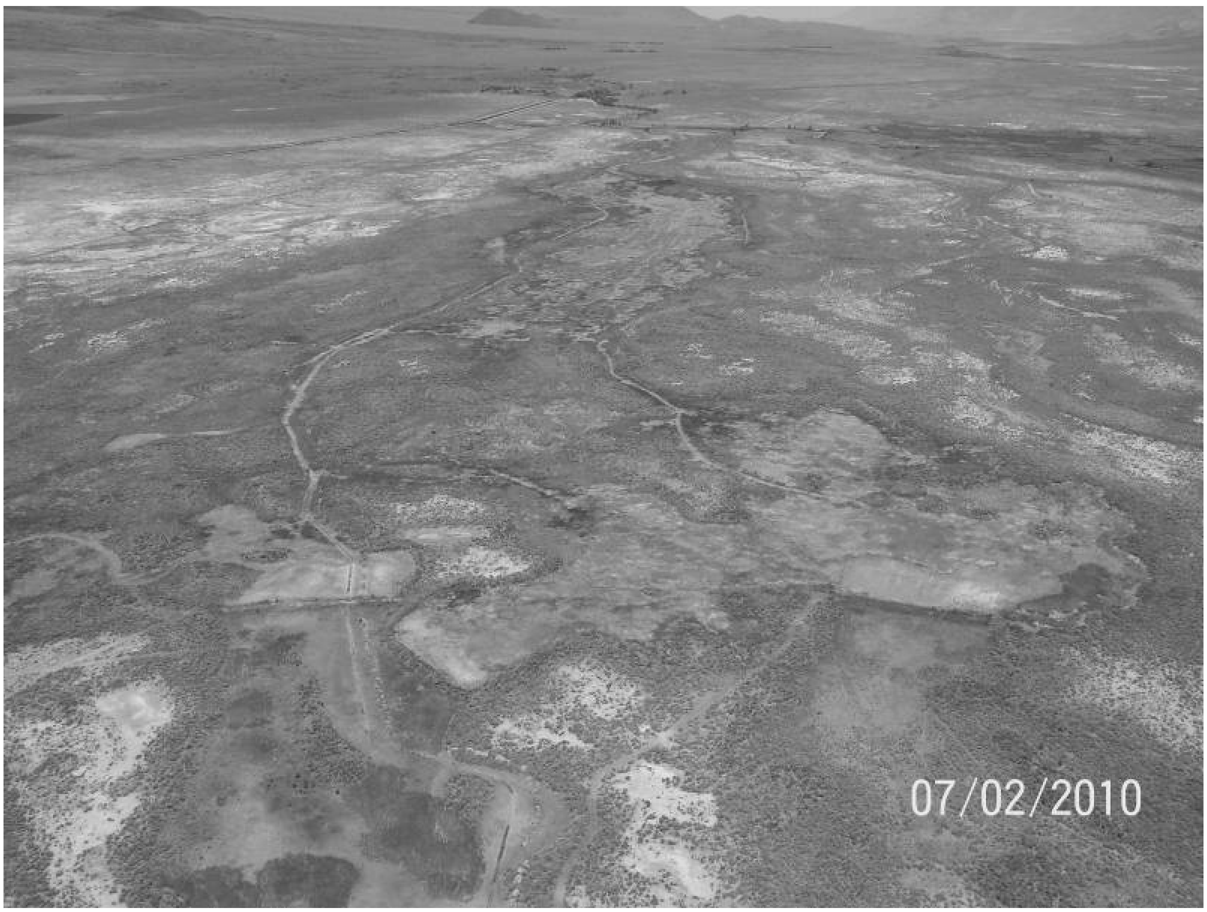
Waggoner Unit

The first cycle of post-implementation flooding of the Waggoner Unit was initiated in April 2009. The unit continued to be in active status throughout 2010 (Indicator Species Figure 7). Prior to the initiation of flooding in the spring of 2009, existing vegetation was burned in the winter of 2008-2009 to prepare the site. During 2009, the acreage flooded in this unit was initially 66 acres in the spring, increasing to 178 acres by fall. The average flooded acreage in 2009-2010 runoff year was 134. In 2010, the flooded acreage in the Waggoner Unit has ranged from 178 to 352 acres with an average of 283 acres. During the 2010 survey year, the northwest portion of the unit had saturated soils, but little standing water. Water seemed to collect in the eastern and southern portions of the unit creating open water ponds and flooded meadow habitats attracting most of the Habitat Indicator Species that were observed using the Waggoner Unit. By mid-summer of 2010, emergent vegetation had regrown to a point at which it created a barrier limiting observation of some remaining open water areas.

Indicator Species Figure 7. Aerial View of Waggoner Management Unit While in Active Status

Winterton Unit

The Winterton Unit was active from 2007-2009. During the 2007-2008 runoff year, between 19 and 160 acres were flooded at any one time, with the average flooded acreage at 97 acres. During the 2008-2009 runoff year, between 59 and 176 acres were flooded, with the average flooded acreage at 128 acres. Dry-down occurred in spring 2009, but the unit was reflooded in July and August of 2009 in order to meet the required flooded acreage for BWMA. During 2004, when baseline bird surveys were being conducted, there was a temporary water release to Winterton Management Unit in April during construction activities on the LAA. During 2010, the unit was very dry except for a very small area of flooding at the north end (Indicator Species Figure 8).



Indicator Species Figure 8. Aerial View of Winterton Management Unit in 2010 (Inactive Status)

8.2.3 Vegetation Assessment

The total acreage of each vegetation community type within each unit was determined using ArcMap vegetation mapping shapefiles. This was done for preproject conditions using the 2000 vegetation mapping data, and for 2010 conditions using the 2010 mapping data (based on 2009 aerial images). Vegetation was assessed within an area defined by the intersection of the maximum wetted extent in any one year since implementation, and the management unit boundaries as depicted in the EIR. A 100-meter buffer was added to the resulting boundary, since the EIR defined the “habitat area” of each unit as including the area 100 meters beyond the flooded extent. The total acreage of each vegetation type was then calculated by management unit. All further discussion with regard to conditions, vegetation and bird use will refer to this habitat area as defined here.

Habitat Photos

In 2010, one photo was taken at each point count station in order to document local vegetation conditions. These digital photos were archived for potential future use.

8.2.4 Avian Surveys

Preproject Baseline Surveys

Baseline surveys were conducted in 2002-2003 and in 2004. The survey schedule for the 2002-2003 baseline year was discussed and agreed upon by Ecosystem Sciences, LADWP, ICWD, and Point Reyes Bird Observatory. A total of five surveys were conducted during the first baseline year. Surveys were conducted in late-April, late-May, mid-June, mid-August, and mid-October of 2002, and at the end of January, 2003. The late-April and mid-August survey dates were selected with the purpose of detecting migrant shorebirds. The late-May and mid-June surveys were selected to detect breeding species, while the October and January dates were selected to detect migrating and wintering waterfowl species, respectively. Surveys were conducted by LADWP staff and local volunteers.

Following an evaluation of the data from the initial baseline inventory effort, LADWP staff recommended increasing the number of surveys per year in the BWMA in order to increase detection of waterfowl and shorebirds during peak spring and fall migration periods. This increased effort involved four spring surveys at two-week intervals starting the end of March/beginning of April and ending by mid-May, two surveys in June to detect or confirm breeding, and five fall surveys conducted at two-week intervals starting the first week of August and continuing to the end of September or early October. This more intensive survey schedule was followed during baseline surveys conducted in 2004, with the addition of a mid-November winter survey. Due to personnel limitations in 2004, fewer surveys were conducted in Waggoner and Drew, since they were not scheduled to be active for several years.

Post-Implementation Surveys

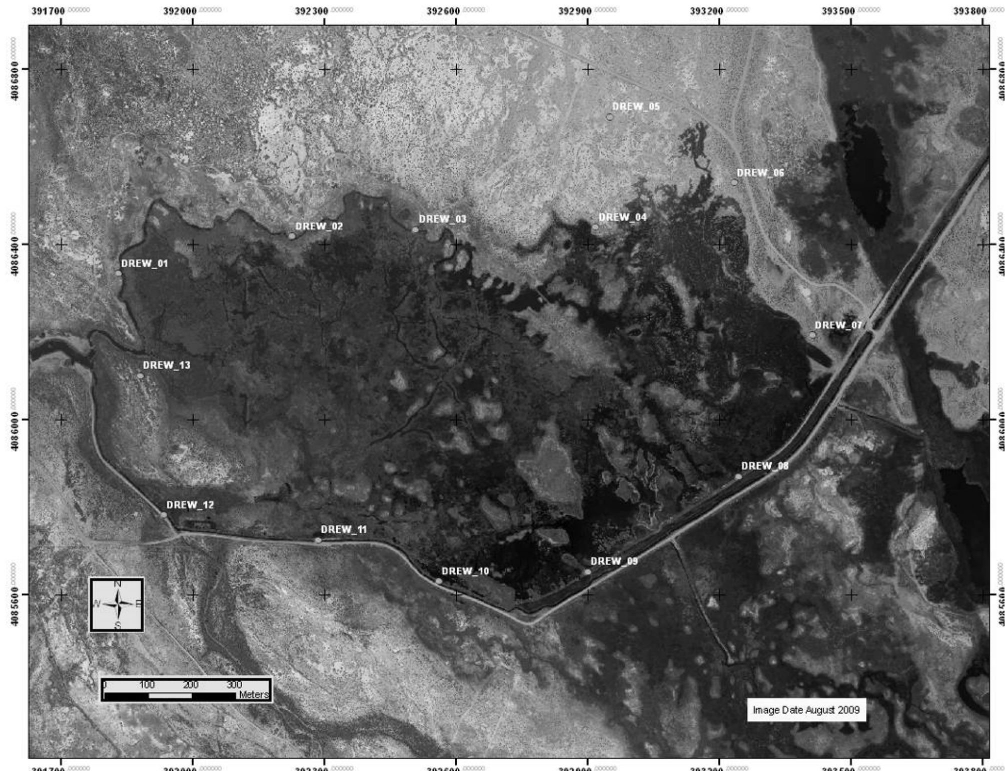
In 2010, surveys were conducted by LADWP and ICWD staff following the same schedule as in 2004, namely four spring, two summer, five fall and two winter surveys. All units were surveyed in 2010, with the active units being Drew and Waggoner. No avian surveys were specified in the annual monitoring schedule in the LORP Monitoring, Adaptive Management, and Reporting Plan (MAMP) (ES 2008) prior to 2010, therefore no data are available for when Thibaut and Winterton were in active status from 2007-2009. One early fall survey was conducted at Drew and Waggoner in 2009 to document use in the first fall after initiating flooding. The results of this survey were discussed in the 2009 LORP Annual Monitoring Report.

Survey Methodology

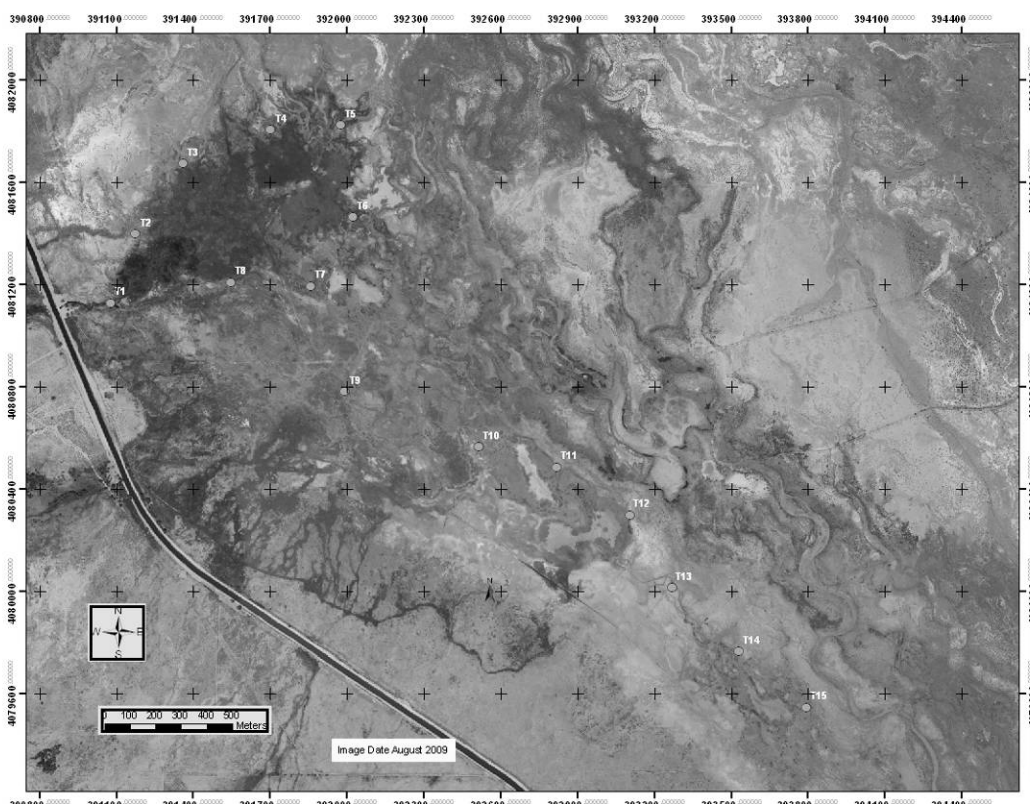
Surveys used a combined point count/area search methodology. Survey routes were established in 2002 under the guidance of Ecosystem Sciences and based on the predicted flooded extent of each unit. These survey routes were followed during baseline surveys. Prior to conducting the 2010 surveys, LADWP evaluated the routes and made modifications to the Drew, Winterton and Waggoner Routes to provide better coverage of the units, and because the flooded extent boundaries were greater than expected. The Drew route (Indicator Species Figure 9) circumnavigates the unit and in 2010 consisted of 13 point count stations. During the baseline surveys, the route covered a smaller area and consisted of eight point count stations. Due to the more extensive flooding of this unit many stations had to be moved and additional points were added to provide adequate coverage of the site. The Thibaut Route (Indicator Species Figure 10) contains 15 point count stations. The north end of the route circumnavigates the Thibaut Pond area. The remainder of the route extends southeast, bordering a series of seasonally flooded alkali flats. No changes were made to the Thibaut Route in 2010. The Waggoner Route circumnavigates the unit (Indicator Species Figure 11). Baseline surveys were conducted only along the eastern edge. Points along the western edge were added in 2010 for a total of 15 stations in this unit. The route at Winterton (Indicator Species Figure 12) follows the eastern and southwestern edge of the unit. Two additional points were added to this route in 2010.

Surveys were started within one hour of local sunrise time, and generally completed within five hours. The starting point for each route was alternated each visit. Surveys were not scheduled if heavy rain or excessive winds were predicted. Observers recorded all species observed or heard during a 5-minute period at each point count station. Observers were also instructed to record species detected between points, or individuals detected between points, if the observer was certain that the individual had not been already been recorded. The distance from the observer to each bird detected was recorded during all surveys. In addition, the activity of the bird or birds and the habitat being used at initial detection were also recorded. The activities defined were: singing, calling, flying (within the habitat), flying over (not using habitat), foraging, perching, breeding, or flushed. If the activity was recorded as "breeding", one of 10 breeding observation codes was also used to document the specific evidence of breeding seen. Examples of breeding codes include "FC" for food carry and "MC" for material carry. The breeding observations codes used are consistent with those used by Heath and Gates (2002) during baseline bird surveys in the Riverine/Riparian management area of the LORP.

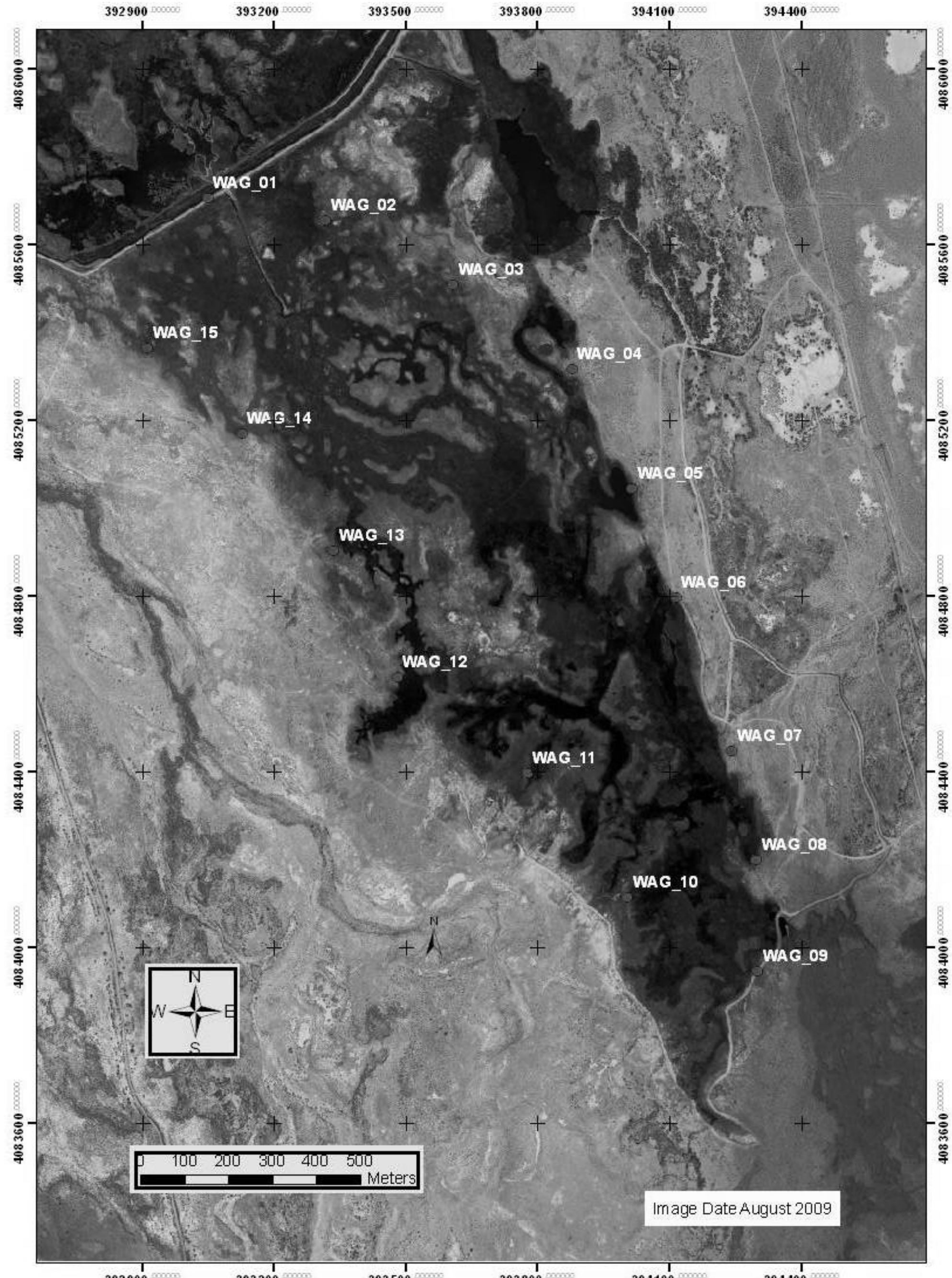
Initially (in 2002), sixteen different habitat types were defined by Ecosystem Sciences for use on this project. These habitat categories differed from those being tracked by mapping, and thus the habitat types used for documenting habitat use were changed to correspond to the vegetation mapping conducted in 2000 by WHA. In 2004 and 2010, the habitat categories used were: water, marsh, wet alkali meadow, phragmites, dry alkali meadow, riparian, rabbitbrush/Nevada saltbush scrub, desert sink scrub, mudflat, and barren. A crosswalk was developed in order to incorporate the 2002/2003 data on habitat use into the categories used in 2004 and 2010.



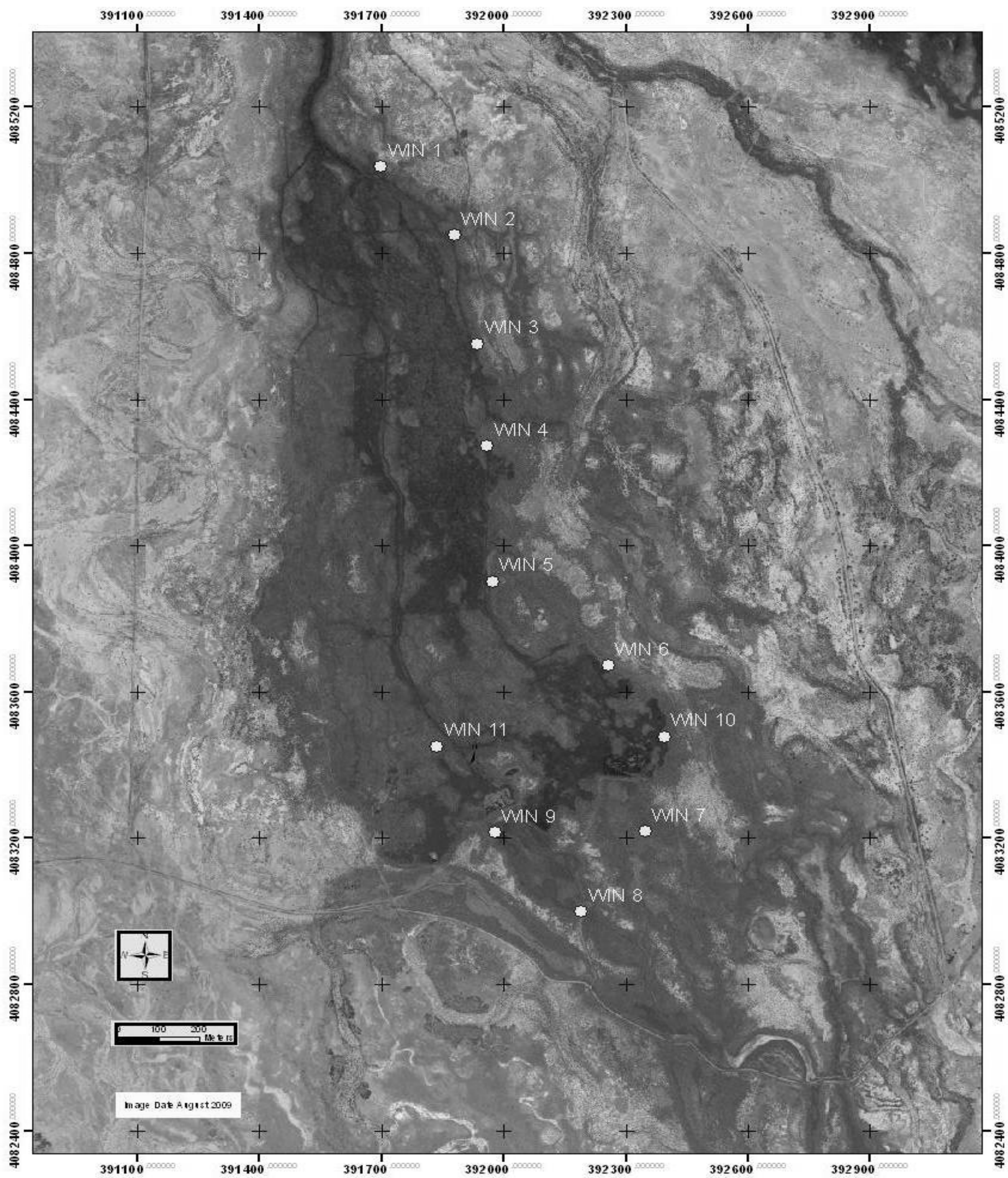
Indicator Species Figure 9. Drew Management Unit Bird Survey Stations



Indicator Species Figure 10. Thibaut Management Unit Bird Survey Stations



Indicator Species Figure 11. Waggoner Management Unit Bird Survey Stations



Indicator Species Figure 12. Winterton Management Unit Bird Survey Stations

8.2.5 Data Analysis

Bird survey data was entered into an Access database. Data entry and data verification was performed by LADWP staff. The project lead performed a final proofing of the database prior to analysis.

Bird survey data was summarized by survey and season within management units. Species richness and abundance for indicator and non-indicator species were summed by survey. Habitat Indicator Species were placed into one of five categories: waterfowl and grebes, rails and bitterns, wading birds, shorebirds, gulls/terns/cormorants/pelicans. The three specific species: Northern Harrier, Osprey and Marsh Wren, were considered separately. The total detections of each indicator species category, or specific species were summed by season and survey year. Differences in mean species diversity, richness and abundance of habitat indicator species use preproject versus active status was evaluated for the Drew and Waggoner Units using One-way Analysis of Variance (SigmaStat 3.5). Data was log-transformed prior to statistical analysis. Habitat use data for indicator species was evaluated in the active units only. The proportion of total observations in each habitat type was calculated for each indicator species group, excluding flyovers.

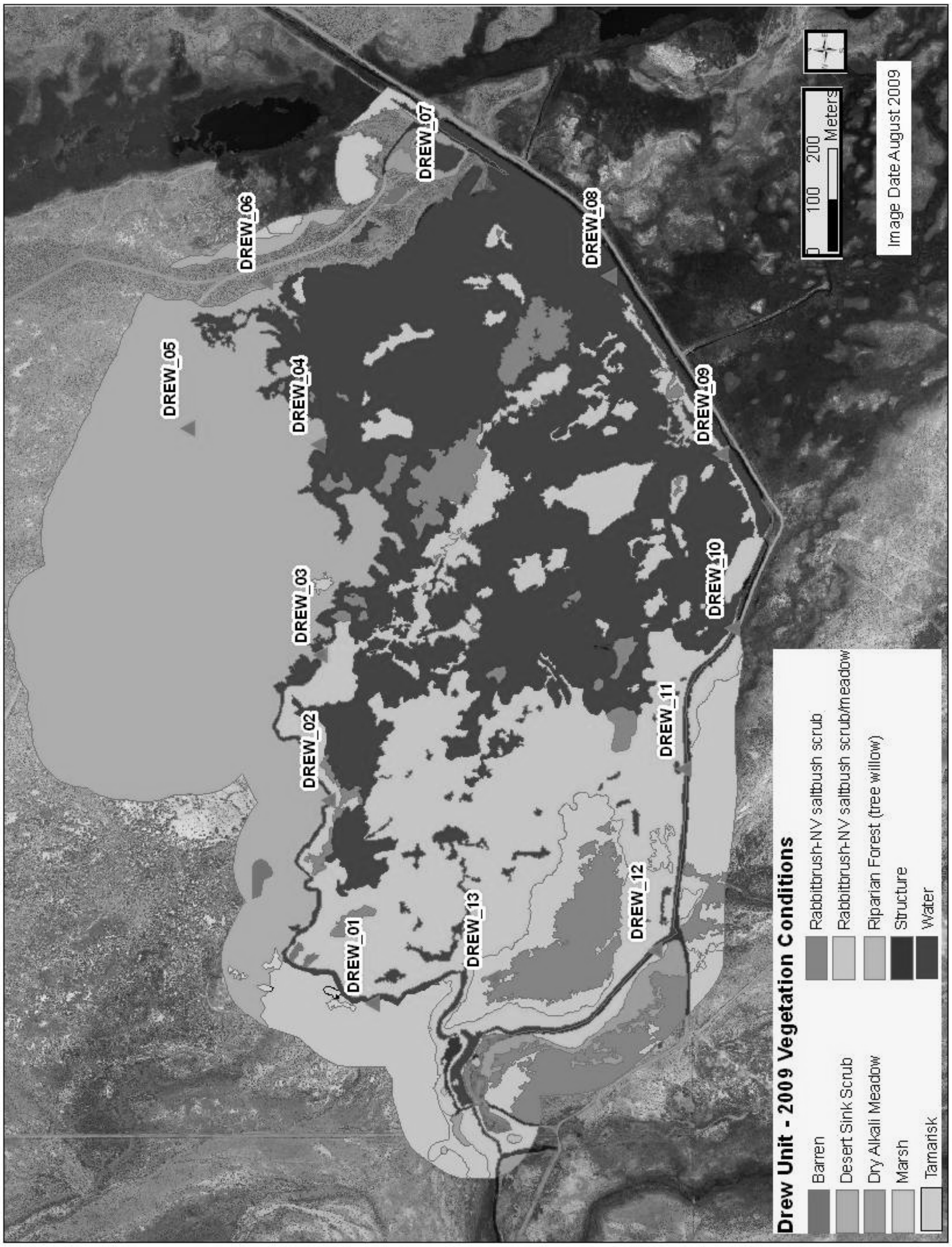
8.2.6 Results - Drew Management Unit

Vegetation Assessment

Indicator Species Table 14 shows the acreage of each vegetation type within the Drew Management Unit habitat area. Indicator Species Figure 13 shows the vegetation communities as mapped from the 2009 aerial photos and shows the bird survey stations for reference. Under preproject conditions in 2000, this unit was dominated by scrub communities. A small amount of marsh existed adjacent to the Blackrock Ditch. Water releases beginning in April 2009 created a large area of open water and marsh habitats. Open water habitat dominated the eastern part of the unit, while marsh was dominant in the western portion. Much of the large area mapped as desert sink scrub along the northeast boundary was also flooded during 2010 bird surveys. This area of flooded desert sink was used extensively by waterfowl and shorebirds.

Indicator Species Table 13. Vegetation Type within Drew Management Unit Habitat Area

Drew Vegetation – Habitat Area	2000	2009
Barren	77.3	0.8
Cut/Fill	1.1	1.4
Desert Sink Scrub	182.8	131.9
Dry Alkali Meadow	47.1	5.8
Great Basin Mixed Scrub	23.0	14.4
Marsh	21.8	103.8
Rabbitbrush-NV saltbush scrub	119.8	30.8
Rabbitbrush-NV saltbush scrub/meadow		44.9
Riparian Forest (tree willow)	2.0	0.8
Structure		3.2
Tamarisk	0.4	0.8
Water		154.5
Wet Alkali Meadow	17.6	
Total Mapped Acreage	493.0	493.2



Indicator Species Figure 13. Drew Management Unit Habitat Area Vegetation and Bird Survey Stations

Avian Use

Under preproject conditions the habitats at Drew supported primarily upland species, and bird use in terms of number of species and individuals was fairly low (Indicator Species Figure 14). The number of species and total number of individuals has increased dramatically as this unit is in active status. Drew in its flooded state has proved to be very attractive to the Habitat Indicator Species (Indicator Species Table 15), attracting a total if 43 indicator species in spring, 30 in summer, and 38 indicator species in fall. Indicator Species Table 16 provides the total detections of each indicator species category summed by season and survey year. Indicator Species Table 17 provides the results of each survey, presented by season, and grouped as Habitat Indicator Species or non-habitat indicator species. In spring 2010, all groups of habitat indicator species were detected. Rails and bitterns (primarily American Coot), waterfowl and grebes, and shorebirds were the most abundant groups. These three groups were also the most abundant during summer surveys. Eight Habitat Indicator Species were confirmed as breeding at Drew including Gadwall, Mallard, Cinnamon Teal, Ruddy Duck, Pied-billed Grebe, American Coot, American Avocet and Marsh Wren. Other indicator species suspected of breeding at Drew included American Bittern, Virginia Rail, Sora, Killdeer, and Black-necked Stilt. The most abundant non-indicator breeding species was Red-winged Blackbird. In the fall, all groups of indicator species were detected. American Coots, waterfowl, wading birds and Marsh Wren were the most abundant. Large numbers of swallows were observed foraging over Drew in the fall, as large swarms of insects were present over this unit. During the winter survey in January 2010, American Coots were again the most abundant species; however Tundra Swan and several species of ducks were present also.

Indicator Species Figure 15 shows the proportion of observations of each Habitat Indicator Species group by habitat type. Waterfowl and grebes were seen primarily in association with water and marsh. Shorebirds were observed primarily in areas classified as mudflats, which occurred amongst shrubs in the northeast part of the unit (and mapped in 2010 as Desert Sink Scrub). Wading birds were also observed in this area, as well as in marsh and water. Gulls, terns, cormorants, and pelicans were observed on mudflats or in water. Marsh Wren were observed almost exclusively in marsh. The raptor Habitat Indicator Species were observed hunting over water or marsh, or perched in willow trees along the Blackrock Ditch. An Osprey was observed in the fall of 2010 perched in a willow, clutching a large fish that it had presumably captured in Drew.

Indicator Species Table 15. Number of Habitat Indicator Species in Drew Management Unit by Season and Survey Year

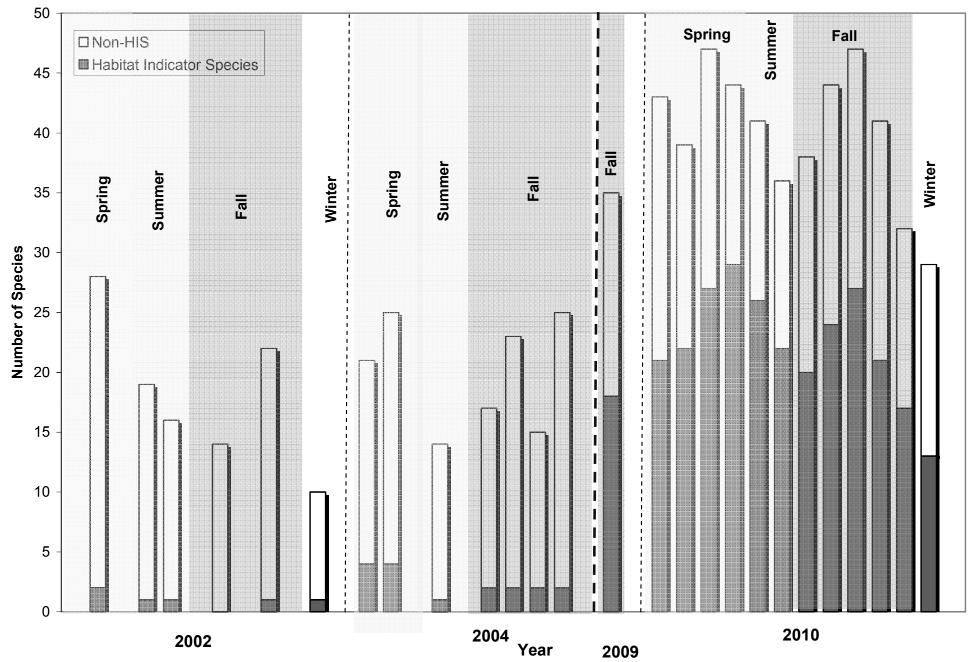
Drew	2002	2004	2009	2010
Spring	2	5		43
Summer	2	1		30
Fall	1	3	18*	38
Winter	1			14

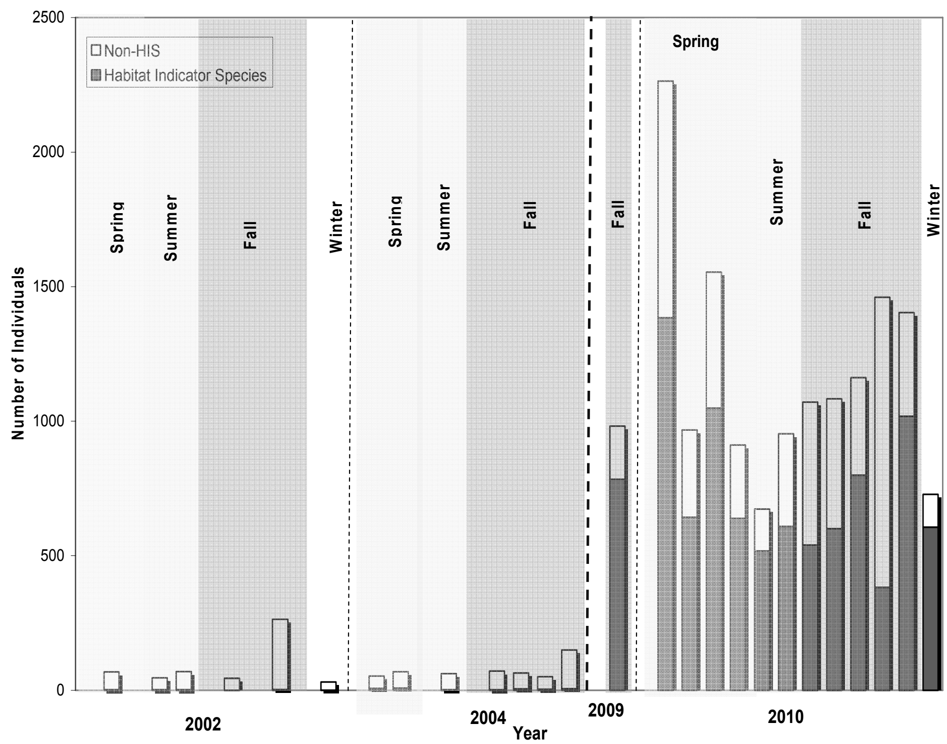
*One survey

Indicator Species Table 16 shows the mean species diversity, richness, and abundance by season for habitat indicator species under preproject conditions and during surveys while the unit in active status. Species diversity, richness and abundance are statistically higher for the Drew Unit under active status as compared to preproject conditions. Species diversity and richness has been highest in spring and summer and lowest in winter. Mean indicator species abundance has been highest in spring and fall and lowest in summer.

Indicator Species Table 16. Mean Habitat Indicator Species Diversity, Richness, and Abundance - Drew

Drew Unit	Mean Indicator Species Diversity			
	Spring	Summer	Fall	Winter
Pre-Project	2.84	1.00	1.55	1.00
Active Status	7.65	7.28	5.64	2.38
	Mean Indicator Species Richness			
	Spring	Summer	Fall	Winter
Pre-Project	3.3	1.0	1.5	1.0
Active Status	24.8	24.0	21.2	13.0
	Mean Indicator Species Abundance			
	Spring	Summer	Fall	Winter
Pre-Project	5.7	2.0	3.3	1.0
Active Status	928.8	563.5	687.5	606.0





Indicator Species Figure 14. Drew Management Unit - Number of Species and Number of Individuals before and after Flooding Initiating in Spring 2009

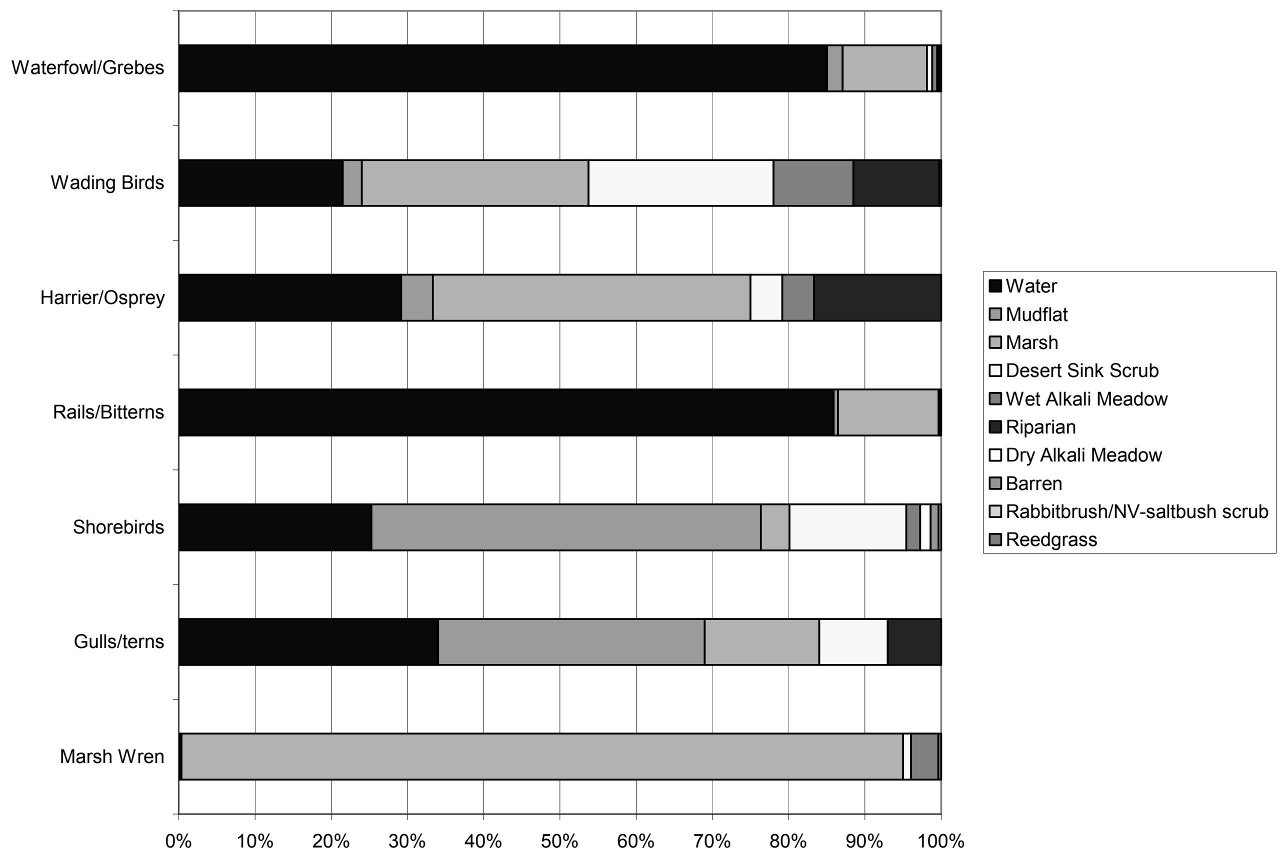
Indicator Species Table 17. Seasonal Use of Drew Management Unit by Year

Spring		**2002**	**2004**		**2010**
Habitat Indicator Species	Waterfowl and Grebes	0	3		1394
	Rails and Bitterns	1	2		1520
	Wading birds	0			57
	Shorebirds		1		663
	Gulls/Terns/Comorants and Pelicans				38
	Marsh Wren	1	4		36
	Northern Harrier		5		6
	Osprey				1
	Total HIS	2	15		3715
Non-Habitat Indicator Species		66	107		1981

Summer		**2002**	**2004**		**2010**
Habitat Indicator Species	Waterfowl and Grebes				341
	Rails and Bitterns				531
	Wading birds	2			95
	Shorebirds				135
	Gulls/Terns/Comorants and Pelicans				4
	Marsh Wren				20
	Northern Harrier	2	2		1
	Osprey				
	Total HIS	4	2		1127
Non-Habitat Indicator Species		112	59		500

Fall		**2002**	**2004**	**2009**	**2010**
Habitat Indicator Species	Waterfowl and Grebes			450	525
	Rails and Bitterns			147	2131
	Wading birds			115	254
	Shorebirds			63	95
	Gulls/Terns/Comorants and Pelicans				75
	Marsh Wren	3	12	5	246
	Northern Harrier		4	4	14
	Osprey		1		1
	Total HIS	3	17	784	3341
Non-Habitat Indicator Species		306	319	198	2839

Winter		**2003**			**2010**
Habitat Indicator Species	Waterfowl and Grebes				83
	Rails and Bitterns				495
	Wading birds				1
	Shorebirds				2
	Gulls/Terns/Comorants and Pelicans				
	Marsh Wren	1			22
	Northern Harrier				3
	Osprey				
	Total HIS	1			606
Non-Habitat Indicator Species		30			122



Indicator Species Figure 15. Proportion of Observations of Habitat Indicator Species Groups in Drew Management Unit, by Habitat Type

Indicator Species Table 18. Drew Management Unit Survey Results by Season

Drew Management Unit												
Spring	Common Name	4/27/2002	**Total 2002**	3/22/2004	4/5/2004	**Total 2004**	3/25/2010	4/8/2010	4/21/2010	5/5/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Canada Goose									1	1	1
	Gadwall						6	7	38	36	87	87
	American Wigeon						14	4			18	18
	Mallard			1	2	3	124	17	81	41	263	266
	Blue-winged Teal						3			1	4	4
	Cinnamon Teal						285	69	132	30	516	516
	Northern Shoveler						16		18	1	35	35
	Northern Pintail						14		1	2	17	17
	Green-winged Teal						61	106			167	167
	Redhead								2	4	6	6
	Ring-necked Duck						62	10	12	7	91	91
	Bufflehead						48	34	12		94	94
	Ruddy Duck						6	2	18	45	71	71
	Pied-billed Grebe						5	8	4	5	22	22
	Eared Grebe							1		1	2	2
	American White Pelican						10				10	10
	Double-crested Cormorant							1	7		8	8
	American Bittern	1	1	1	1	2			1		1	4
	Great Blue Heron						1				1	1
	Great Egret								10	2	12	12
	Snowy Egret								7		7	7
	Black-crowned Night-Heron									7	7	7
	White-faced Ibis								29	1	30	30
	Osprey									1	1	1
	Northern Harrier			1	4	5	1	1	4		6	11
	Virginia Rail							1	1	3	5	5
	Sora							3	12	10	25	25
	American Coot						597	297	329	266	1489	1489
	Semipalmated Plover								13		13	13
	Killdeer				1	1	13	23	11	17	64	65
	Black-necked Stilt							1	4	46	51	51
	American Avocet							5		31	36	36
	Greater Yellowlegs						36	27	8	20	91	91
	Western Sandpiper								5		5	5
	Least Sandpiper								281		281	281
	Short-billed Dowitcher									3	3	3
	Long-billed Dowitcher							16			16	16
	Unidentified Dowitcher						66				66	66
	Wilson's Snipe						6	4	1	3	14	14
	Wilson's Phalarope									1	1	1
	Red-necked Phalarope									22	22	22
	California Gull						2				2	2
	Black Tern									18	18	18
	Marsh Wren	1	1	4		4	8	6	8	14	36	41
	Survey and Seasonal Totals	2	2	7	8	15	1384	643	1049	639	3715	3732

Table 18. Continued, Drew Management Unit Survey Results by Season

Spring	Common Name	4/27/2002	Total 2002	3/22/2004	4/5/2004	Total 2004	3/25/2010	4/8/2010	4/21/2010	5/5/2010	Total 2010	Total All Years
	Drew Management Unit											
Non-Habitat Indicator Species	California Quail	3	3	4	3	7						10
	Turkey Vulture				2	2		1			1	3
	Sharp-shinned Hawk								1		1	1
	Red-tailed Hawk			1		1						1
	Golden Eagle						1				1	1
	American Kestrel				1	1	1		1		2	3
	Peregrine Falcon						1				1	1
	Mourning Dove								1		1	1
	Greater Roadrunner			1		1						1
	Vaux's Swift	4	4									4
	Northern Flicker				1	1	1	1			2	3
	Gray Flycatcher	2	2									2
	Black Phoebe			1	1	2	1				1	3
	Ash-throated Flycatcher	1	1									1
	Loggerhead Shrike	1	1	3		3	1				1	5
	Black-billed Magpie	1	1	1	1	2		2		1	3	6
	Common Raven	1	1	4		4	3		2		5	10
	Horned Lark	2	2						14		14	16
	Tree Swallow						194	129			323	323
	Violet-green Swallow								32		32	32
	Northern Rough-winged Swallow						12		2		14	14
	Bank Swallow						4			1	5	5
	Cliff Swallow	2	2						2		2	4
	Barn Swallow	4	4		1	1	21	18	239	12	290	295
	Unidentified Swallow	5	5				350				350	355
	Bewick's Wren			3	4	7		3			3	10
	Ruby-crowned Kinglet				1	1	1				1	2
	Blue-gray Gnatcatcher	1	1									1
	Northern Mockingbird	2	2		2	2				2	2	6
	European Starling	1	1	2	1	3	2				2	6
	American Pipit				1	1	21	3	11		35	36
	Yellow-rumped Warbler	2	2	1	2	3	30	27	28	5	90	95
	Common Yellowthroat	2	2						3	12	15	17
	Brewer's Sparrow	4	4	3	16	19		1		3	4	27
	Sage Sparrow			5	4	9	2	5		2	9	18
	Savannah Sparrow	2	2		4	4	25	8	31	3	67	73
	Song Sparrow	1	1	3	1	4	7	3	4	3	17	22
	White-crowned Sparrow	3	3	3	1	4		2	2		4	11
	Western Tanager	1	1									1
	Red-winged Blackbird	5	5	2	1	3	189	100	113	174	576	584
	Western Meadowlark	10	10	7	12	19	11	16	11	13	51	80
	Yellow-headed Blackbird	1	1					4	3	26	33	34
	Brewer's Blackbird			2		2	1		1		2	4
	Great-tailed Grackle	2	2				1	1	4	4	10	12
	Brown-headed Cowbird	1	1							11	11	12
	House Finch	2	2		1	1						3
	Survey and Seasonal Totals	66	66	46	61	107	880	324	505	272	1981	2154

Table 18. Continued, Drew Management Unit Survey Results by Season

Drew Management Unit											
Summer	2010 Breeding Status	Common Name	5/23/2002	6/21/2002	**Total 2002**	6/24/2004	**Total 2004**	6/16/2010	7/2/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	C	Gadwall						117	8	125	125
	C	Mallard						28	52	80	80
	N	Blue-winged Teal						1		1	1
	C	Cinnamon Teal						31	43	74	74
	N	Northern Shoveler						1		1	1
	N	Green-winged Teal						4		4	4
	N	Redhead						2		2	2
	C	Ruddy Duck						8	1	9	9
	C	Pied-billed Grebe						13	16	29	29
	N	Eared Grebe						15	1	16	16
	S	American Bittern							3	3	3
	N	Great Blue Heron		2	2						2
	N	Great Egret						5	16	21	21
	N	Snowy Egret						6		6	6
	N	Cattle Egret						1	1	2	2
	N	Green Heron						1		1	1
	N	Black-crowned Night-Heron						3	1	4	4
	N	White-faced Ibis						52	9	61	61
	N	Northern Harrier	2		2	2	2		1	1	5
	S	Virginia Rail						2	1	3	3
	S	Sora						5	2	7	7
	C	American Coot						146	372	518	518
	S	Killdeer						10	19	29	29
	S	Black-necked Stilt						48	39	87	87
	C	American Avocet						5	9	14	14
	N	Spotted Sandpiper						1		1	1
	N	Wilson's Snipe							1	1	1
	N	Wilson's Phalarope						3		3	3
	N	California Gull							2	2	2
	N	Caspian Tern						1	1	2	2
	C	Marsh Wren						9	11	20	20
		Survey and Seasonal Totals	2	2	4	2	2	518	609	1127	1133

Table 18. Continued, Drew Management Unit Survey Results by Season

Drew Management Unit											
Summer	2010 Breeding Status	Common Name	5/23/2002	6/21/2002	**Total 2002**	6/24/2004	**Total 2004**	6/16/2010	7/2/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	N	California Quail	1		1						1
	N	American Kestrel						1	2	3	3
	N	Mourning Dove						1	5	6	6
	N	Black Phoebe						1		1	1
	C	Western Kingbird	4		4	1	1	5	1	6	11
	N	Loggerhead Shrike	4	1	5	4	4		1	1	10
	N	Black-billed Magpie	1	3	4						4
	N	Common Raven	4	1	5	1	1	1		1	7
	N	Horned Lark	4	14	18						18
	N	Tree Swallow						1		1	1
	N	Violet-green Swallow	1		1						1
	N	Northern Rough-winged Swallow							1	1	1
	N	Cliff Swallow		1	1				47	47	48
	N	Barn Swallow		1	1						1
	N	Unidentified Swallow	1		1						1
	N	Bewick's Wren				1	1				1
	N	Northern Mockingbird	3	6	9	8	8				17
	N	European Starling	1	1	2						2
	N	Yellow-rumped Warbler	1		1						1
	S	Common Yellowthroat	1	12	13	6	6	6	8	14	33
	N	Wilson's Warbler	1		1						1
	N	Spotted Towhee				1	1				1
	N	Brewer's Sparrow	3		3	2	2	1		1	6
	N	Black-throated Sparrow		3	3						3
	S	Savannah Sparrow						3	6	9	9
	C	Song Sparrow				3	3	5	7	12	15
	N	Blue Grosbeak	1	1	2	14	14				16
	C	Red-winged Blackbird	5	9	14	6	6	69	228	297	317
	C	Western Meadowlark	4	8	12	11	11	4	3	7	30
	S	Yellow-headed Blackbird						25	13	38	38
	N	Brewer's Blackbird		4	4						4
	C	Great-tailed Grackle						31	20	51	51
	S	Brown-headed Cowbird	3	3	6	1	1	2	2	4	11
	N	House Finch	1		1						1
		Survey and Seasonal Totals	44	68	112	59	59	156	344	500	671

Table 18. Continued, Drew Management Unit Survey Results by Season

	Drew Management Unit																	
Fall	Common Name	8/18/2002	10/10/2002	**Total 2002**	8/18/2004	8/30/2004	9/13/2004	9/27/2004	**Total 2004**	8/27/2009	**Total 2009**	8/9/2010	8/24/2010	9/7/2010	9/24/2010	10/5/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Greater White-fronted Goose													19			19	19
	Gadwall									86	86	10	15	12	34	75	146	232
	American Wigeon									205	205		36		3		39	244
	Mallard									159	159	20	15	19	16	18	88	247
	Cinnamon Teal											56	32	31	16		135	135
	Northern Shoveler														5	2	7	7
	Northern Pintail															3	3	3
	Green-winged Teal												4	2	5		11	11
	Redhead													6			6	6
	Bufflehead															1	1	1
	Ruddy Duck											6	1	4	2	1	14	14
	Pied-billed Grebe											11	15	11	2		39	39
	Eared Grebe												2	2		13	17	17
	American White Pelican															1	1	1
	Double-crested Cormorant											1	10	3	12	16	42	42
	American Bittern											2	1		1		4	4
	Least Bittern									1	1							1
	Great Blue Heron									2	2	2	6	4	2	1	15	17
	Great Egret									12	12	18	6	31	2		57	69
	Snowy Egret													5			5	5
	Black-crowned Night-Heron											1	4	2			7	7
	White-faced Ibis									101	101	67	33	66	1	3	170	271
	Osprey							1	1						1		1	2
	Northern Harrier				1	2	1		4	4	4		3	9	1	1	14	22
	Virginia Rail									1	1	2	1	1		1	5	6
	Sora									40	40	9	11	16	3	2	41	81
	Common Moorhen												3				3	3
	American Coot									105	105	250	365	404	221	838	2078	2183
	Killdeer									4	4			1			1	5
	Black-necked Stilt									3	3	57	4	1			62	65
	American Avocet									3	3			2	1		3	6
	Greater Yellowlegs									41	41		1	12	2	1	16	57
	Lesser Yellowlegs									10	10			2			2	12
	Long-billed Dowitcher											4					4	4
	Wilson's Snipe									2	2							2
	Wilson's Phalarope											5	1				6	6
	Red-necked Phalarope											1					1	1
	California Gull												10	13	1		24	24
	Black Tern											6		2			8	8
	Marsh Wren		3	3	1	3	3	5	12	5	5	12	22	119	51	42	246	266
	Survey and Seasonal Totals	0	3	3	2	5	4	6	17	784	784	540	601	799	382		3341	4145

Table 18. Continued, Drew Management Unit Survey Results by Season

	Drew Management Unit																	
Fall	Common Name	8/18/2002	10/10/2002	**Total 2002**	8/18/2004	8/30/2004	9/13/2004	9/27/2004	**Total 2004**	8/27/2009	**Total 2009**	8/9/2010	8/24/2010	9/7/2010	9/24/2010	10/5/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	California Quail		2	2		1			1									3
	Red-shouldered Hawk					1			1									1
	Swainson's Hawk									1	1							1
	Red-tailed Hawk		1	1	1			1	2						1		1	4
	American Kestrel							1	1	1	1	1	1	1			3	5
	Peregrine Falcon									1	1	1	2				3	4
	Mourning Dove					2			2	3	3	3	9		2		14	19
	Belted Kingfisher					1			1									1
	Northern Flicker							4	4						2	1	3	7
	Black Phoebe						1	4	5	5	5	2	3	1	6	6	18	28
	Western Kingbird					2	1		3				2				2	5
	Eastern Kingbird					1			1									1
	Loggerhead Shrike	3		3	2		2	1	5	2	2	2	7	3	5		17	27
	Warbling Vireo							1	1									1
	Black-billed Magpie	1	1	2														2
	Common Raven	1	5	6	3			1	4				1	2	1	1	5	15
	Horned Lark	9	33	42									11	7	115	9	142	184
	Tree Swallow						6	7	13			238		69		6	313	326
	Northern Rough-winged Swallow											32		52			84	84
	Bank Swallow							7	7	11	11	103	153	1			257	275
	Cliff Swallow				4	1			5			15	1	20		4	40	45
	Barn Swallow		34	34	14		15	6	35	8	8	2	1	84	655	203	945	1022
	Unidentified Swallow							19	19									19
	Bewick's Wren	2	3	5	7	4	6	1	18	1	1	1		2	1		4	28
	Ruby-crowned Kinglet		1	1														1
	Northern Mockingbird				2	1		1	4				1				1	5
	Sage Thrasher	1	1	2	1	1	2	1	5									7
	Le Conte's Thrasher					4			4							1	1	5
	European Starling	9	7	16				15	15				9		95		104	135
	American Pipit		1	1										1			1	2
	Orange-crowned Warbler		1	1		1			1			2		1	1		4	6
	Yellow Warbler									4	4							4
	Yellow-rumped Warbler		27	27			1		1									28
	Common Yellowthroat	7		7	13	4	2		19	2	2	5	4	10	17		36	64
	Wilson's Warbler														2		2	2
	Spotted Towhee		3	3		1		1	2									5
	Chipping Sparrow							3	3									3
	Brewer's Sparrow	5		5	7	11	3		21				3				3	29
	Black-throated Sparrow	2		2														2
	Sage Sparrow		1	1	7	1		3	11									12
	Savannah Sparrow	1	5	6		3		12	15	19	19	15	10	10	15	16	66	106
	Song Sparrow		9	9		1	2		3	2	2	23		20	15	51	109	123
	White-crowned Sparrow		80	80				20	20						16	21	37	137
	Black-headed Grosbeak	1		1														1
	Blue Grosbeak				1				1									1
	Red-winged Blackbird	2	39	41		11	4	8	23	100	100	54	154	52	39	53	352	516
	Western Meadowlark	1	4	5	4	4	2	13	23	1	1			1	2	2	5	34
	Yellow-headed Blackbird				2				2	35	35	21	91	16	6		134	171
	Brewer's Blackbird												1				1	1
	Great-tailed Grackle									2	2	11	18	10		9	48	50
	Brown-headed Cowbird				1				1									1
	House Finch		3	3				2	2						83	1	84	89
	Lesser Goldfinch					3		12	15									15
	Survey and Seasonal Totals	45	261	306	69	59	47	144	319	198	198	531	482	363	1079	384	2839	3662

Table 18. Continued, Drew Management Unit Survey Results by Season

Drew Management Unit						
Winter	Common Name	1/31/2003	Total 2003	1/26/2010	Total 2010	Total All Years
Habitat Indicator Species	Tundra Swan			7	7	7
	Gadwall			9	9	9
	Unidentified Teal			2	2	2
	Northern Pintail			2	2	2
	Ring-necked Duck			26	26	26
	Bufflehead			28	28	28
	Ruddy Duck			9	9	9
	American Bittern			1	1	1
	Great Blue Heron			1	1	1
	Northern Harrier			3	3	3
	Sora			2	2	2
	American Coot			492	492	492
	Killdeer			2	2	2
	Marsh Wren	1	1	22	22	23
	Survey and Seasonal Totals	1	1	606	606	607
Non-Habitat Indicator Species	Red-tailed Hawk	1	1	1	1	2
	Northern Flicker			1	1	1
	Black Phoebe			2	2	2
	Say's Phoebe			1	1	1
	Loggerhead Shrike			1	1	1
	Black-billed Magpie			2	2	2
	Common Raven	3	3	9	9	12
	Horned Lark	3	3			3
	Le Conte's Thrasher			1	1	1
	European Starling	1	1	5	5	6
	American Pipit			20	20	20
	Sage Sparrow			9	9	9
	Savannah Sparrow	6	6	29	29	35
	Song Sparrow	4	4	15	15	19
	White-crowned Sparrow	5	5	16	16	21
	Red-winged Blackbird	1	1	6	6	7
	Western Meadowlark	6	6	4	4	10
	Survey and Seasonal Totals	30	30	122	122	152

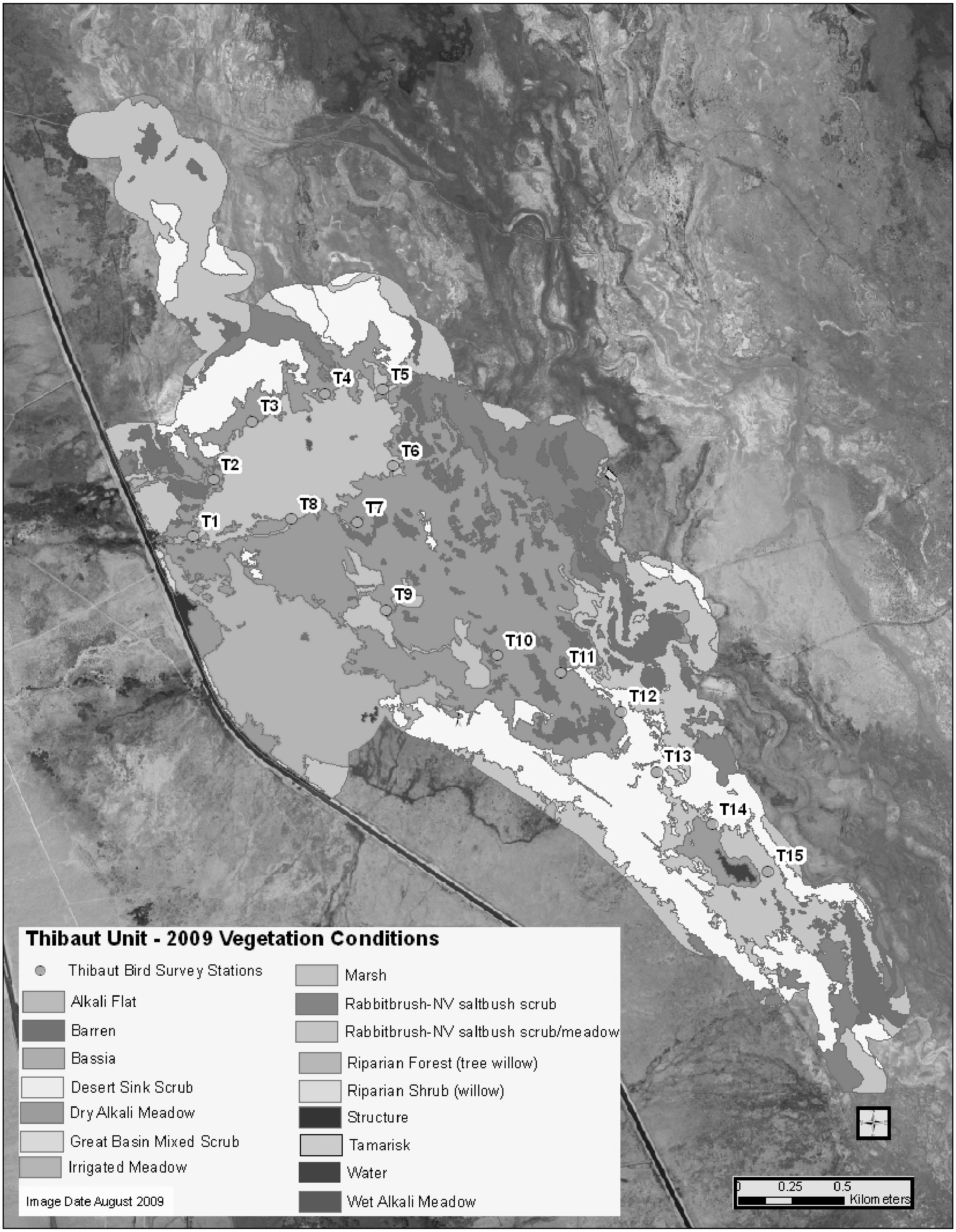
8.2.7 Results - Thibaut Management Unit

Vegetation Assessment

Indicator Species Table 18 shows the acreage of each vegetation type within the Thibaut Management Unit habitat area. Indicator Species Figure 16 shows the vegetation communities as mapped from the 2009 aerial photos and the bird survey stations for reference. Under preproject conditions in 2000, this unit was dominated by sparsely vegetated alkali flats, desert sink scrub, wet alkali meadow, and seasonally-inundated barren playa. This unit was flooded in 2007-2009. To date, no prescribed fires have been conducted at Thibaut. When mapped again in 2010, dry alkali meadow, scrub-meadow and alkali flat were the dominant vegetation types.

Indicator Species Table 19. Vegetation Type within Thibaut Management Unit Habitat Area

Thibaut Vegetation – Habitat Area	2000	2009
Alkali Flat	551.8	282.4
Barren	192.5	121.9
Bassia		2.2
Desert Sink Scrub	229.2	4.8
Dry Alkali Meadow		391.5
Great Basin Mixed Scrub		2.3
Irrigated Meadow	159.7	141.7
Marsh	76.5	137.7
Rabbitbrush-NV saltbush scrub	124.7	122.5
Rabbitbrush-NV saltbush scrub/meadow		322.7
Riparian Forest (tree willow)	1.3	1.2
Riparian Shrub (willow)	2.1	2.9
Structure		8.1
Tamarisk	6.1	1.2
Water		3.1
Wet Alkali Meadow	202.7	0.5
Total Mapped Acreage	**1546.6**	**1546.6**



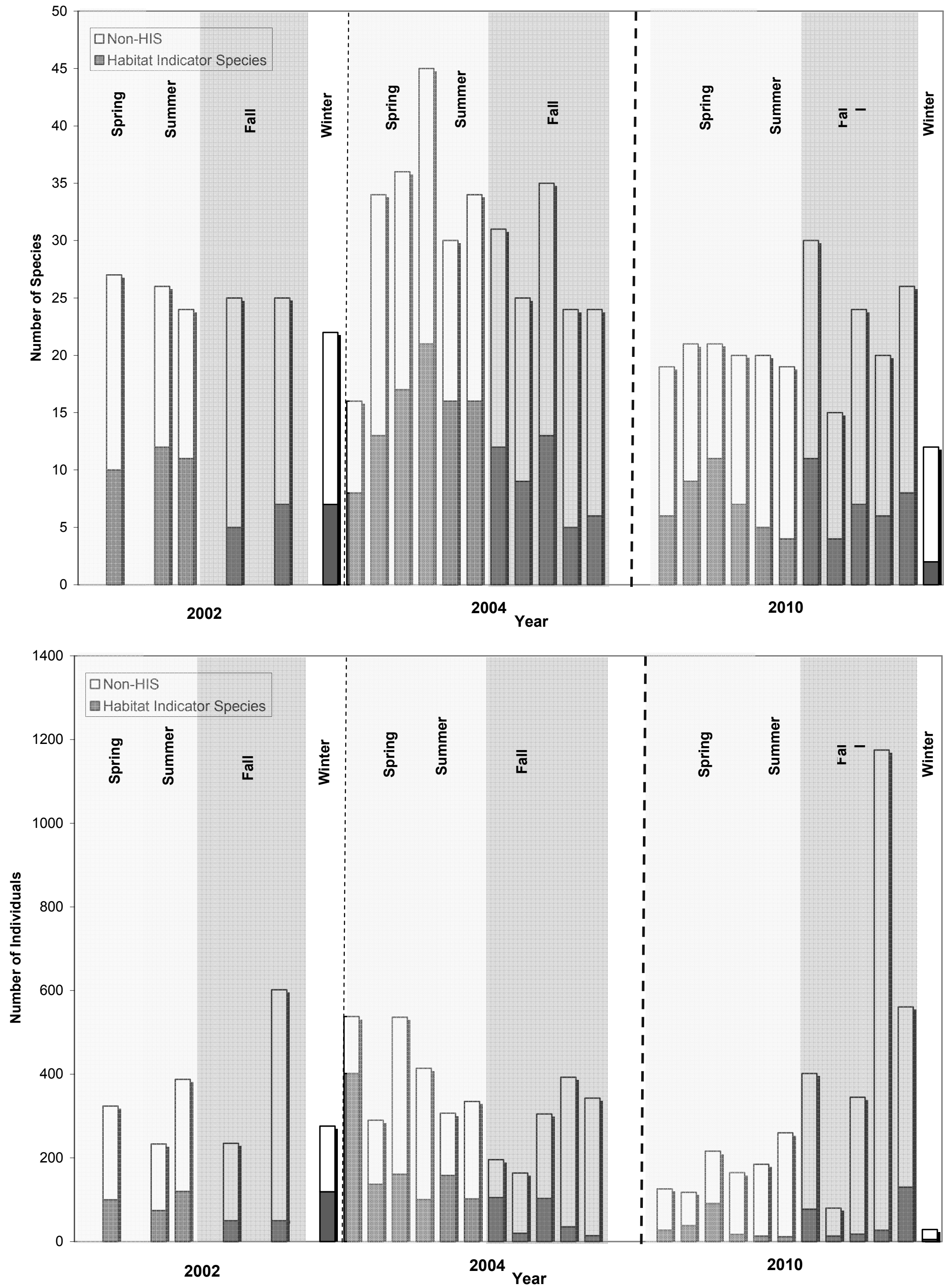
Indicator Species Figure 16. Thibaut Management Unit Habitat Area Vegetation and Bird Survey Stations

Avian Use

No data are available for the Thibaut Management Unit when it was active in 2007-2009. Thus, post-implementation data is not available to demonstrate the response of indicator species to water releases to the Thibaut Management Unit. Species richness and abundance in 2010 were comparable to baseline conditions (Indicator Species Figure 17). During baseline surveys in 2004, all parts of the unit were flooded into early fall, except Thibaut Ponds. Therefore, it is not surprising that Habitat Indicator Species use in 2004 was greater than 2010, especially in spring and summer (Indicator Species Table 19). During some of the fall 2010 survey period, the unit was again flooded with use of the irrigation allotment in the Thibaut Field. Indicator Species Table 20 provides the total detections of each Habitat Indicator Species category summed by season and survey year. Indicator Species Table 21 provides the results of each survey, presented by season, and grouped as Habitat Indicator Species or Non-habitat Indicator Species. Northern Harrier is the only Habitat Indicator Species currently confirmed to be breeding at Thibaut, however in 2004, several other Habitat Indicator Species were known to have bred at this site including Black-necked Stilt and American Avocet. A Long-billed Curlew nest was found in 2007, when the unit was active. During the 2007 LORP Rapid Assessment Survey (in August), at least 500 waterfowl, many White-faced Ibis and other indicator species were present in the unit. Due to the very limited number of observations of Habitat Indicator Species in 2010, habitat use data will not be presented.

Indicator Species Table 20. Number of Habitat Indicator Species in Thibaut Management Unit by Season and Survey Year

Thibaut	2002	2004	2009	2010
Spring	11	27		15
Summer	16	19		8
Fall	8	22		20
Winter	7			2



Indicator Species Figure 17. Thibaut Management Unit - Number of Species and Number of Individuals (partially flooded in 2004 and 2010)

Indicator Species Table 21. Seasonal Use of Thibaut Management Unit by Year

Spring		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes	7	540	56
	Rails and Bitterns	1	7	16
	Wading birds		11	9
	Shorebirds	86	211	39
	Gulls/Terns/Comorants and Pelicans		4	
	Marsh Wren	2	12	25
	Northern Harrier	4	16	28
	Osprey			
	Total HIS	100	801	173
Non-Habitat Indicator Species		224	977	452

Summer		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes	62	109	7
	Rails and Bitterns	11	10	3
	Wading birds	10	17	3
	Shorebirds	104	117	6
	Gulls/Terns/Comorants and Pelicans			
	Marsh Wren	4	3	
	Northern Harrier	3	4	6
	Osprey			
	Total HIS	194	260	25
Non-Habitat Indicator Species		427	382	420

Fall		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes	33	117	166
	Rails and Bitterns	1	9	13
	Wading birds	38	37	11
	Shorebirds	9	85	22
	Gulls/Terns/Comorants and Pelicans		1	
	Marsh Wren	14	21	41
	Northern Harrier	5	7	12
	Osprey			
	Total HIS	100	277	265
Non-Habitat Indicator Species		737	1124	1867

Winter		2003		2010
Habitat Indicator Species	Waterfowl and Grebes	108		
	Rails and Bitterns	1		
	Wading birds			
	Shorebirds	1		
	Gulls/Terns/Comorants and Pelicans			
	Marsh Wren	9		2
	Northern Harrier			3
	Osprey			
	Total HIS	119		5
Non-Habitat Indicator Species		157		24

Indicator Species Table 22. Thibaut Management Unit Survey Results by Season

Thibaut Management Unit														
Spring	Common Name	4/27/2002	**Total 2002**	3/23/2004	4/6/2004	4/20/2004	5/11/2004	**Total 2004**	3/24/2010	4/7/2010	4/27/2010	5/10/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Gadwall				10	14	6	30		2	39		41	71
	Mallard	7	7	90	14	20	13	137	2	2	2	9	15	159
	Cinnamon Teal			220	40	23	5	288						288
	Green-winged Teal			70	11		2	83						83
	Unidentified Teal			2				2						2
	American Bittern			1	1	1		3						3
	Great Blue Heron						1	1				1	1	2
	Great Egret					2	1	3			7		7	10
	Snowy Egret					1	1	2			1		1	3
	Green Heron					2		2						2
	White-faced Ibis					2	1	3						3
	Northern Harrier	4	4	4	5	5	2	16	11	11	6		28	48
	Virginia Rail			2				2		1	4	2	7	9
	Sora	1	1			1	1	2	1	1	6	1	9	12
	Semipalmated Plover						2	2			15		15	17
	Killdeer	16	16	10	7	8	13	38	2	4	1	1	8	62
	Black-necked Stilt				1	6	21	28						28
	American Avocet	8	8		18	9	12	39				1	1	48
	Greater Yellowlegs	1	1		1	8		9		6	2		8	18
	Whimbrel						2	2						2
	Long-billed Curlew	2	2		5		2	7	2				2	11
	Western Sandpiper	1	1											1
	Least Sandpiper	16	16		22	50		72						88
	Western/Least Sandpiper	42	42											42
	Long-billed Dowitcher						3	3						3
	Wilson's Snipe					3		3		3		2	5	8
	Wilson's Phalarope						8	8						8
	California Gull						3	3						3
	Black Tern						1	1						1
	Marsh Wren	2	2	3	2	6	1	12	9	8	8		25	39
	Survey and Seasonal Totals	100	100	402	137	161	101	801	27	38	91	17	173	1074

Table 22. Continued, Thibaut Management Unit Survey Results by Season

Thibaut Management Unit														
Spring	Common Name	4/27/2002	**Total 2002**	3/23/2004	4/6/2004	4/20/2004	5/11/2004	**Total 2004**	3/24/2010	4/7/2010	4/27/2010	5/10/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	Turkey Vulture			1	2			3	2				2	5
	Swainson's Hawk						1	1						1
	Red-tailed Hawk								1	1			2	2
	American Kestrel	2	2	1	2		2	5		3			3	10
	Prairie Falcon			1				1						1
	Vaux's Swift	10	10											10
	White-throated Swift	23	23											23
	Belted Kingfisher				1			1						1
	Western Wood-Pewee						1	1						1
	Gray Flycatcher											1	1	1
	Black Phoebe						1	1						1
	Western Kingbird						1	1						1
	Loggerhead Shrike				1		2	3		1			1	4
	Black-billed Magpie						1	1	1			1	2	3
	Common Raven	4	4	4	4	2	2	12	13	8	5	7	33	49
	Horned Lark	33	33		7	3	2	12	2				2	47
	Tree Swallow				4	22		26		3			3	29
	Violet-green Swallow	18	18			53	7	60				7	7	85
	Northern Rough-winged Swallow				3		3	6						6
	Bank Swallow					3	3	6						6
	Cliff Swallow	20	20			30	9	39				3	3	62
	Barn Swallow	18	18		3	24	81	108		4	1	18	23	149
	Unidentified Swallow	3	3			40		40						43
	Bewick's Wren				1	1	1	3	1	1	1		3	6
	Northern Mockingbird								1				1	1
	Le Conte's Thrasher										1		1	1
	European Starling	6	6		3	2	2	7						13
	American Pipit				1	2	2	5	4	1		1	6	11
	Yellow-rumped Warbler	1	1		12			12						13
	Common Yellowthroat	2	2			4	2	6			15	7	22	30
	Wilson's Warbler						2	2				6	6	8
	Brewer's Sparrow				1			1						1
	Sage Sparrow	1	1		2	1		3	1		1		2	6
	Savannah Sparrow	14	14	15	54	47	25	141	15	8	9	5	37	192
	Song Sparrow	1	1	3	2			5	1	3	3	1	8	14
	Unidentified Sparrow				1			1						1
	Blue Grosbeak					1		1						1
	Red-winged Blackbird	53	53	109	27	108	52	296	20	19	41	57	137	486
	Western Meadowlark	13	13	2	20	11	6	39	37	28	48	34	147	199
	Yellow-headed Blackbird				1	9	104	114						114
	Brewer's Blackbird				1			1						1
	Great-tailed Grackle					8		8						8
	Brown-headed Cowbird	2	2			4	1	5						7
	Survey and Seasonal Totals	224	224	136	153	375	313	977	99	80	125	148	452	1653

Table 22. Continued, Thibaut Management Unit Survey Results by Season

Thibaut Management Unit												
Summer	2010 Breeding Status	Common Name	5/25/2002	6/22/2002	**Total 2002**	6/11/2004	6/25/2004	**Total 2004**	6/15/2010	7/6/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	N	Gadwall		4	4	22	7	29	4		4	37
	S	Mallard	7	51	58	42	15	57	1	2	3	118
	N	Cinnamon Teal				10	10	20				20
	N	Northern Pintail					1	1				1
	N	Green-winged Teal					2	2				2
	N	American Bittern	7	1	8	2	2	4				12
	N	Least Bittern				2		2				2
	N	Great Blue Heron	3		3	1	3	4		3	3	10
	N	Great Egret	1		1							1
	N	Snowy Egret				1		1				1
	N	White-faced Ibis		6	6	7	5	12				18
	C	Northern Harrier	1	2	3	3	1	4		6	6	13
	N	Virginia Rail		3	3		4	4	3		3	10
	N	Killdeer	19	20	39	6	12	18	2		2	59
	N	Black-necked Stilt	4		4	16	18	34				38
	N	American Avocet	2		2	22	13	35				37
	N	Long-billed Curlew	5	7	12	2	1	3		1	1	16
	N	Wilson's Snipe	2	1	3	3		3	3		3	9
	N	Wilson's Phalarope	19	24	43	17	7	24				67
	N	Western/Least Sandpiper	1		1							1
	N	Marsh Wren	3	1	4	2	1	3				7
		Survey and Seasonal Totals	74	120	194	158	102	260	13	12	25	479
Non-Habitat Indicator Species	N	Turkey Vulture					10	10				10
	N	Swainson's Hawk				2	1	3	1		1	4
	N	Red-tailed Hawk							2		2	2
	C	American Kestrel		2	2		6	6		24	24	32
	N	Prairie Falcon	1		1							1
	S	Mourning Dove							4	2	6	6
	N	Black Phoebe				1		1				1
	N	Western Kingbird				2	2	4		1	1	5
	N	Loggerhead Shrike					7	7		5	5	12
	N	Warbling Vireo	1		1							1
	C	Black-billed Magpie				2		2	3	7	10	12
	N	Common Raven	7	5	12	1		1	15	36	51	64
	S	Horned Lark	14	28	42	31	82	113	4	4	8	163
	N	Violet-green Swallow					6	6				6
	N	Bank Swallow	1		1					2	2	3
	N	Cliff Swallow	5	13	18		3	3				21
	N	Barn Swallow	2		2							2
	S	Bewick's Wren							2	1	3	3
	N	Northern Mockingbird					1	1		1	1	2
	N	Le Conte's Thrasher					3	3				3
	N	European Starling	4	4	8	5	12	17				25
	S	Common Yellowthroat	12	5	17	6	3	9	24	29	53	79
	N	Wilson's Warbler	1		1							1
	N	Sage Sparrow							1		1	1
	C	Savannah Sparrow	29	55	84	33	25	58	20	10	30	172
	N	Song Sparrow		1	1	1		1				2
	N	Blue Grosbeak					1	1	1		1	2
	S	Red-winged Blackbird	64	117	181	47	56	103	31	79	110	394
	S	Western Meadowlark	17	25	42	9	7	16	62	46	108	166
	N	Yellow-headed Blackbird		9	9	7	4	11		1	1	21
	N	Brewer's Blackbird		2	2							2
	N	Great-tailed Grackle					4	4				4
	N	Brown-headed Cowbird	1	2	3	2		2	1		1	6
	N	Bullock's Oriole							1		1	1
		Survey and Seasonal Totals	159	268	427	149	233	382	172	248	420	1229

Table 22. Continued, Thibaut Management Unit Survey Results by Season

Fall	Common Name	8/15/2002	10/10/2002	Total 2002	8/5/2004	8/17/2004	9/1/2004	9/14/2004	9/28/2004	Total 2004	8/11/2010	8/23/2010	9/10/2010	9/20/2010	10/7/2010	Total 2010	Total All Years
Habitat Indicator Species	Greater White-Fronted Goose														14	14	14
	Gadwall					4				4		2			15	17	21
	Mallard		33	33	1	4	13	14		32	49		2	17	52	120	185
	Cinnamon Teal				33		31			64	9		6			15	79
	Green-winged Teal							17		17							17
	Double-crested Cormorant								1	1							1
	American Bittern		1	1				1	1	2			1			1	4
	Great Blue Heron						1			1			1			1	2
	Great Egret					2	1			3		2				2	5
	White-faced Ibis	38		38	5	1	25	2		33		6	2			8	79
	Northern Harrier	1	4	5		3	2	1	1	7	2	3	4	2	1	12	24
	Virginia Rail						1		1	2	3			1	1	5	7
	Sora				1		4			5	2					2	7
	American Coot														5	5	5
	Killdeer	4	1	5	6	1	7		2	16	1			2		3	24
	Black-necked Stilt				10	2				12	1					1	13
	Spotted Sandpiper										1					1	1
	Greater Yellowlegs						2			2				4	8	12	14
	Lesser Yellowlegs						3			3							3
	Long-billed Curlew													1		1	1
	Western Sandpiper				26					26							26
	Least Sandpiper		1	1	13					13	1					1	15
	Short-billed Dowitcher				3					3							3
	Wilson's Snipe	1	2	3	1	1	4			6							9
	Wilson's Phalarope				4					4	3					3	7
	Marsh Wren	6	8	14	2	2	9		8	21	5		2		34	41	76
	Survey and Seasonal Totals	50	50	100	105	20	103	35	14	277	77	13	18	27	130	265	642

Table 22. Continued, Thibaut Management Unit Survey Results by Season

Thibaut Management Unit																	
Fall	Common Name	8/15/2002	10/10/2002	Total 2002	8/5/2004	8/17/2004	9/1/2004	9/14/2004	9/28/2004	Total 2004	8/11/2010	8/23/2010	9/10/2010	9/20/2010	10/7/2010	Total 2010	Total All Years
Non-Habitat Indicator Species	California Quail														1	1	1
	Turkey Vulture						1	1		2		1	2			3	5
	White-tailed Kite		1	1													1
	Swainson's Hawk	1		1	1					1							2
	Red-tailed Hawk		1	1			1	1		2							3
	American Kestrel	2		2	4	4	3			11	8	6	11	1		26	39
	Prairie Falcon		1	1		1				1		2	1			3	5
	Mourning Dove						2	3	6	11	3	2		4	6	15	26
	Lesser Nighthawk				3					3							3
	Common Nighthawk	4		4			2			2							6
	Northern Flicker							1		1							1
	Willow Flycatcher								1	1	2					2	3
	Unidentified Empidonax Flycatcher	1		1													1
	Black Phoebe	2	1	3	1		2	1		4	1		2			3	10
	Say's Phoebe					1				1							1
	Ash-throated Flycatcher										1					1	1
	Western Kingbird				7					7							7
	Loggerhead Shrike	1		1	4	2	1	1	1	9	4		3	2	2	11	21
	Black-billed Magpie	2		2							1	1			2	4	6
	Common Raven	2	13	15		2	1	2		5	1	3	8	14	10	36	56
	Horned Lark	59	212	271	12	72	69	158	6	317	6	46	66	478	199	795	1383
	Tree Swallow	7		7		5	10		10	25	14		27	6		47	79
	Violet-green Swallow	15		15	1		1			2			2			2	19
	Northern Rough-winged Swallow	1		1			1			1	2					2	4
	Bank Swallow	4		4	1					1							5
	Cliff Swallow	1		1	3	1				4	5		10			15	20
	Barn Swallow		133	133		1	35	36	148	220	1		120	26	32	179	532
	Unidentified Swallow				1		12		8	21			20			20	41
	Bewick's Wren				1		1			2							2
	Sage Thrasher							1		1			1		1	2	3
	Le Conte's Thrasher				1	2		1		4							4
	European Starling	1	38	39	2	2	5		1	10					22	22	71
	American Pipit		20	20										1		1	21
	Yellow Warbler				3			1		4							4
	Yellow-rumped Warbler		5	5													5
	Common Yellowthroat	5	5	10	1	3	4	1	2	11	11			1		12	33
	Spotted Towhee								1	1							1
	Chipping Sparrow		5	5													5
	Brewer's Sparrow						3	11	3	17			3		3	6	23
	Vesper Sparrow								6	6							6
	Lark Sparrow	1		1													1
	Sage Sparrow						1		2	3			2		1	3	6
	Savannah Sparrow	5	43	48	18	25	37	31	43	154	5	1	16	6	31	59	261
	Song Sparrow	1	3	4			1		2	3							7
	White-crowned Sparrow								5	5				2	4	6	11
	Blue Grosbeak				1					1							1
	Red-winged Blackbird	63	53	116	23	13	3	98	64	201	242	1	9	594	55	901	1218
	Western Meadowlark	7	7	14	3	7	6	5	8	29	14	3	24	11	13	65	108
	Yellow-headed Blackbird					3		3		6	1	1			40	42	48
	Brewer's Blackbird		2	2													2
	Brown-headed Cowbird														5	5	5
	House Finch		9	9				2	12	14	3			2	4	9	32
	Survey and Seasonal Totals	185	552	737	91	144	202	358	329	1124	325	67	327	1148	431	2298	4159

Table 22. Continued, Thibaut Management Unit Survey Results by Season

Thibaut Management Unit						
Winter	Common Name	1/31/2003	Total 2003	1/25/2010	Total 2010	Total All Years
Habitat Indicator Species	Canada Goose	7	7			7
	Mallard	81	81			81
	Northern Pintail	2	2			2
	Green-winged Teal	18	18			18
	American Bittern	1	1			1
	Northern Harrier			3	3	3
	Killdeer	1	1			1
	Marsh Wren	9	9	2	2	11
	Survey and Seasonal Totals	119	119	5	5	124
Non-Habitat Indicator Species	California Quail	2	2			2
	White-tailed Kite	1	1	1	1	2
	Red-tailed Hawk			3	3	3
	American Kestrel			1	1	1
	Northern Flicker			1	1	1
	Black Phoebe	1	1			1
	Loggerhead Shrike	1	1	3	3	4
	Black-billed Magpie	1	1			1
	Common Raven	9	9	6	6	15
	Horned Lark	18	18			18
	Bushtit	12	12			12
	Bewick's Wren	2	2			2
	Ruby-crowned Kinglet	1	1			1
	Le Conte's Thrasher			1	1	1
	American Pipit	2	2			2
	Savannah Sparrow	14	14			14
	Song Sparrow	2	2	1	1	3
	Dark-eyed Junco			4	4	4
	Red-winged Blackbird	83	83			83
	Western Meadowlark	8	8	3	3	11
	Survey and Seasonal Totals	157	157	24	24	181

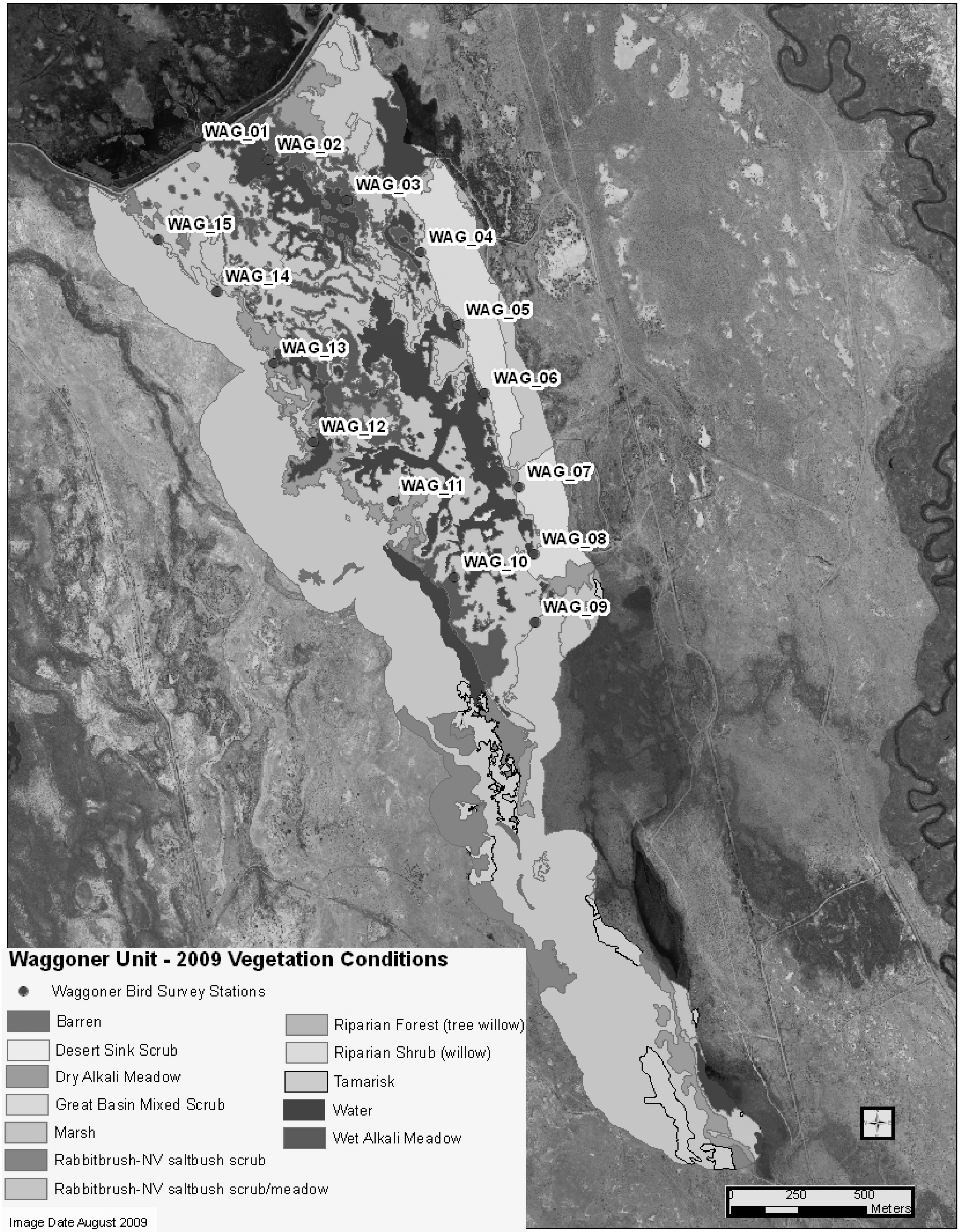
8.2.8 Results - Waggoner Management Unit

Vegetation Assessment

Indicator Species Table 22 shows the acreage of each vegetation type within the Waggoner Unit habitat area. Indicator Species Figure 18 shows the vegetation communities as mapped from the 2009 aerial photos and the bird survey stations for reference. Under preproject conditions in 2000, this unit was dominated by scrub communities and tall dense marsh. A prescribed fire followed by water releases beginning in April 2009, resulted in the development of several small open water ponds and large areas of marsh. Unlike the Drew Unit, few areas of mudflats exist. As flooding reached its maximum extent in July 2010, flooding extended beyond the berm at the southern edge of the unit. The water was then flooding areas of barren soil and scattered tamarisk, creating mudflats which attracted several species of shorebirds as well as waterfowl. Also at the south end of the unit were large areas of flooded meadow which attracted large numbers of wading birds including White-faced Ibis, Great Egret, and Great Blue Heron in the fall.

Indicator Species Table 23. Vegetation Type within Waggoner Management Unit Habitat Area

Waggoner Vegetation – Habitat Area	**2000**	**2009**
Barren	9.7	2.1
Desert Sink Scrub	269.1	1.3
Dry Alkali Meadow	32.9	44.6
Great Basin Mixed Scrub	24.7	57.0
Marsh	210.4	177.4
Rabbitbrush-NV saltbush scrub	204.7	37.6
Rabbitbrush-NV saltbush scrub/meadow		325.0
Riparian Forest (tree willow)	1.5	2.9
Riparian Shrub (willow)		0.7
Tamarisk	5.3	24.1
Water	13.6	105.2
Wet Alkali Meadow	57.6	51.7
Total Mapped Acreage	**829.5**	**829.5**



Indicator Species Figure 18. Waggoner Management Unit Habitat Area Vegetation and Bird Survey Stations

Avian Use

Under preproject conditions, the habitats at Waggoner Management Unit supported some Habitat Indicator Species due to the presence of marsh and some open water. Preproject use by indicator species included Marsh Wren, Northern Harrier, rails and low numbers of waterfowl. Species richness and abundance increased as Waggoner Management Unit was put into active status (Indicator Species Figure 19), attracting waterfowl, rails and bitterns, wading birds, and Marsh Wren. A total of 26 Habitat Indicator Species have been detected in Spring, 25 species in Summer, 40 species in Fall, and 12 species in Winter (Indicator Species Table 23). Indicator Species Table 24 provides the total detections of each Habitat Indicator Species category summed by season and survey year. Indicator Species Table 25 provides the results of each survey, presented by season, and grouped as Habitat Indicator Species or Non-habitat Indicator Species. The Waggoner Management Unit, in its flooded state, has attracted primarily waterfowl, rails and bitterns, wading birds, and Marsh Wren. Shorebird use has been less than in the Drew Management Unit. In spring of 2010, all groups of Habitat Indicator Species were detected, except Osprey. Waterfowl and grebes, rails and bitterns (primarily American Coot), and wading birds were the most abundant groups. Wading birds were the most abundant group in summer as the flooded meadow habitats at the south end attracted migrant White-faced Ibis, Great Egret, and Great Blue Herons. By summer 2010, the emergent vegetation had grown to a height that it obscured vision of some of the ponds. The numbers of American Coot and waterfowl recorded thus may be an underestimate, although waterfowl often flush, allowing enumeration; and coots are often vocal, allowing the observer to record the minimum number heard. Seven Habitat Indicator Species were confirmed as breeding at Drew including Gadwall, Mallard, Cinnamon Teal, Pied-billed Grebe, American Coot, Black-necked Stilt and Marsh Wren. Other Habitat Indicator Species suspected of breeding at Waggoner Management Unit included American Bittern, Northern Harrier, Virginia Rail, Sora, Killdeer, and Wilson’s Snipe. The most abundant non-indicator breeding species were Red-winged Blackbird and Yellow-headed Blackbird. In the fall, all groups of Habitat Indicator Species were detected except Osprey. American Coots, wading birds, waterfowl, and Marsh Wren were the most abundant indicator species groups. During the winter survey in January 2010, waterfowl and American Coots were again the most abundant groups.

Indicator Species Table 24. Number of Habitat Indicator Species in Waggoner Management Unit by Season and Survey Year

Waggoner	2002	2004	2009	2010
Spring	5	11		26
Summer	10	5		25
Fall	9	10	13*	40
Winter	2			12

**One survey*

Indicator Species Table 25. Mean Habitat Indicator Species Diversity, Richness, and Abundance - Waggoner

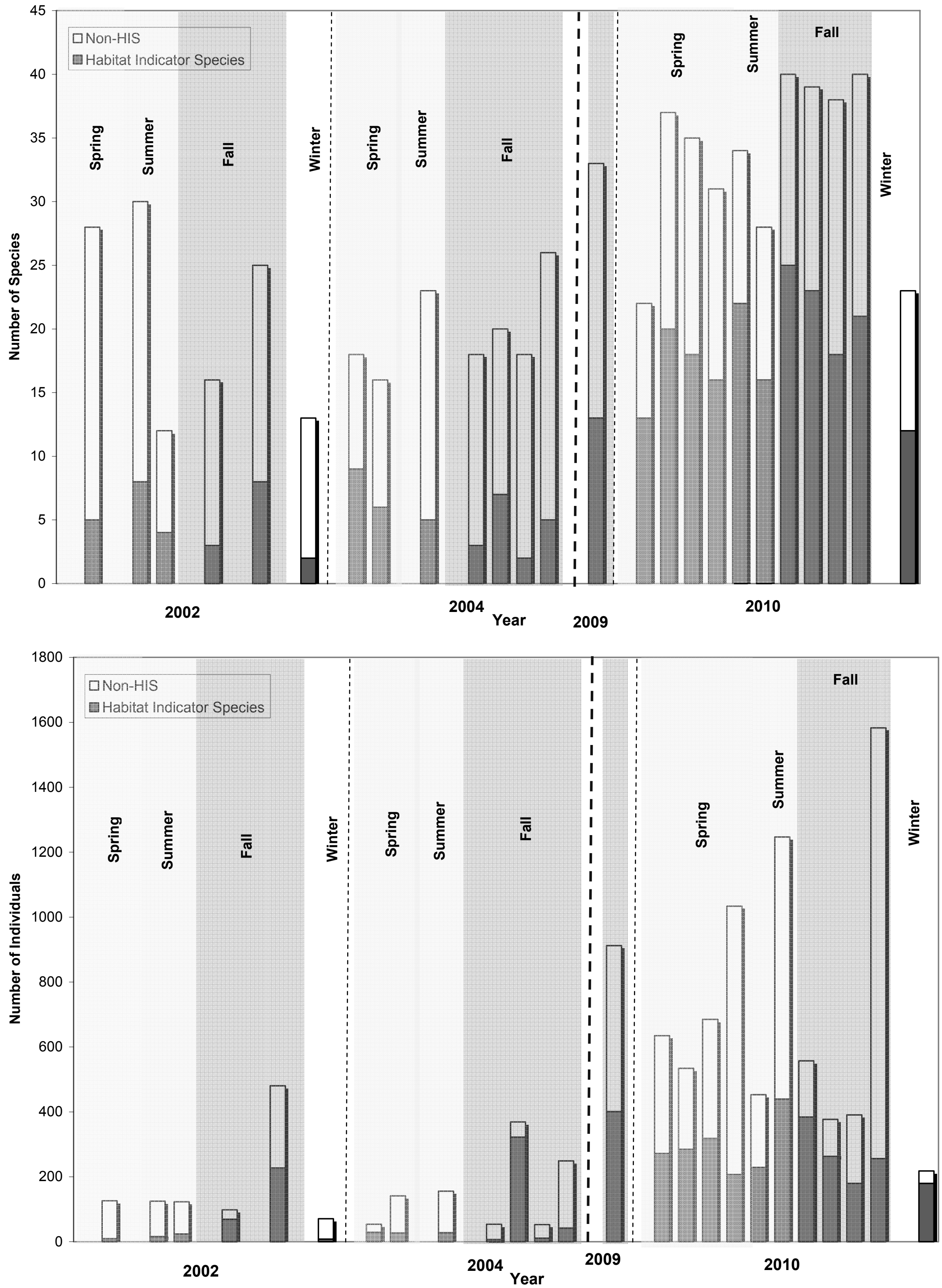
Waggoner	**Mean Indicator Species Diversity**			
	Spring	Summer	Fall	Winter
Pre-Project	5.54	3.92	1.69	1.94
Active Status	7.47	10.05	8.26	5.86

	Mean Indicator Species Richness			
	Spring	Summer	Fall	Winter
Pre-Project	6.7	5.7	4.7	2.0
Active Status	16.8	19.0	20.5	12.0

	Mean Indicator Species Abundance			
	Spring	Summer	Fall	Winter
Pre-Project	21.7	22.7	113.0	8.0
Active Status	270.8	334.5	305.8	180.0

Indicator Species Table 25 shows the mean species diversity, richness, and abundance by season for habitat indicator species under preproject conditions and during surveys while the unit in active status. Species diversity, richness and abundance are statistically higher for the Waggoner Unit under active status as compared to preproject conditions. Species diversity, richness, and abundance have been highest in summer and fall in active status.

Indicator Species Figure 20 shows the proportion of observations of each indicator species group by vegetation community. Waterfowl and grebes were seen primarily in association with water and marsh. Shorebirds were observed primarily in areas of water and wet alkali meadow (often flooded). Wading birds used marsh and flooded wet alkali meadow habitats. Double-crested Cormorants were observed primarily associated with marsh. Marsh Wren were observed exclusively in marsh. Northern Harriers were observed primarily hunting over marsh.



Indicator Species Figure 19. Waggoner Management Unit - Number of Species and Number of Individuals before and after Flooding Initiating in Spring 2009

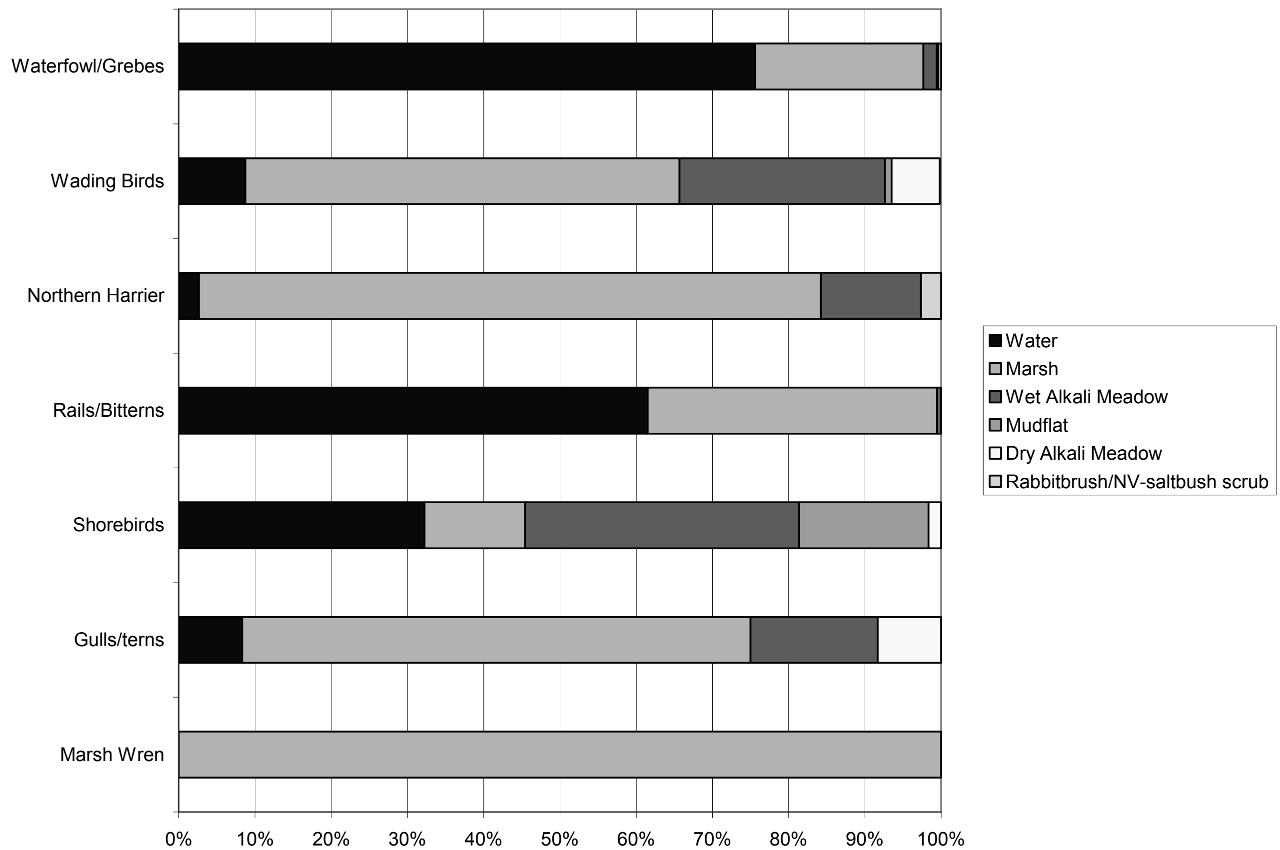
Indicator Species Table 26. Seasonal Use of Waggoner Management Unit by Year

Spring		2002	2004		2010
Habitat Indicator Species	Waterfowl and Grebes	5	16		499
	Rails and Bitterns	1	16		391
	Wading birds				84
	Shorebirds		2		37
	Gulls/Terns/Comorants and Pelicans				4
	Marsh Wren	1	12		60
	Northern Harrier	2	10		8
	Osprey				
	Total HIS	9	56		1083
Non-Habitat Indicator Species		117	139		1805

Summer		2002	2004		2010
Habitat Indicator Species	Waterfowl and Grebes	7			125
	Rails and Bitterns	3	1		168
	Wading birds	1			234
	Shorebirds	4	2		96
	Gulls/Terns/Comorants and Pelicans	2	5		3
	Marsh Wren	20	14		41
	Northern Harrier	3	6		2
	Osprey				
	Total HIS	40	28		669
Non-Habitat Indicator Species		208	128		1031

Fall		2002	2004	2009	2010
Habitat Indicator Species	Waterfowl and Grebes	2	1	181	287
	Rails and Bitterns	3	1	120	563
	Wading birds			48	287
	Shorebirds	3	8	15	124
	Gulls/Terns/Comorants and Pelicans	265	310	1	9
	Marsh Wren	21	54	31	138
	Northern Harrier	2	5	5	26
	Osprey		3		
	Total HIS	296	382	401	1434
Non-Habitat Indicator Species		283	343	511	1989

Winter		2002			2010
Habitat Indicator Species	Waterfowl and Grebes				87
	Rails and Bitterns				69
	Wading birds				3
	Shorebirds				1
	Gulls/Terns/Comorants and Pelicans				
	Marsh Wren	5			13
	Northern Harrier	3			7
	Osprey				
	Total HIS	8			180
Non-Habitat Indicator Species		63			38



Indicator Species Figure 20. Proportion of Observations of Habitat Indicator Species Groups in Waggoner Management Unit, by Habitat Type

Indicator Species Table 27. Waggoner Management Unit Survey Results by Season

Waggoner Management Unit												
Spring	Common Name	4/27/2002	**Total 2002**	3/22/2004	4/5/2004	**Total 2004**	3/25/2010	4/9/2010	4/21/2010	5/7/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Gadwall	2	2					16	77	15	108	110
	Mallard	3	3	2	8	10	19	47	37	25	128	141
	Cinnamon Teal			2		2	54	40	58	7	159	161
	Unidentified Teal				1	1						1
	Northern Shoveler							3	5		8	8
	Northern Pintail							14			14	14
	Green-winged Teal							2			2	2
	Redhead			2		2						2
	Ring-necked Duck						4	4	10	11	29	29
	Lesser Scaup						4	2			6	6
	Bufflehead			1		1	6	8		1	15	16
	Pied-billed Grebe						6	3	12	9	30	30
	Double-crested Cormorant	1	1						3	1	4	5
	American Bittern	1	1		4	4	1			11	12	17
	Least Bittern			4		4						4
	Great Blue Heron						2	1	4		7	7
	Great Egret							1	2	17	20	20
	Snowy Egret									2	2	2
	White-faced Ibis									55	55	55
	Northern Harrier	2	2	9	1	10	2	1	3	2	8	20
	Virginia Rail									1	1	1
	Sora				1	1		3	4	1	8	9
	American Coot			5	2	7	156	111	64	39	370	377
	Killdeer			2		2	3	7	9		19	21
	American Avocet							1	4		5	5
	Greater Yellowlegs							4	1		5	5
	Short-billed Dowitcher								1		1	1
	Wilson's Snipe						1	5	1		7	7
	Marsh Wren			2	10	12	14	12	24	10	60	72
	Survey and Seasonal Totals	9	9	29	27	56	272	285	319	207	1083	1148

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit												
Spring	Common Name	4/27/2002	**Total 2002**	3/22/2004	4/5/2004	**Total 2004**	3/25/2010	4/9/2010	4/21/2010	5/7/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	California Quail				2	2						2
	Red-tailed Hawk	2	2									2
	Vaux's Swift	5	5									5
	White-throated Swift	3	3									3
	Gray Flycatcher	1	1									1
	Black Phoebe	1	1	1		1						2
	Say's Phoebe						1				1	1
	Loggerhead Shrike			2		2						2
	Black-billed Magpie	2	2	1		1		2	3		5	8
	Common Raven	2	2	5	5	10	3	1	7		11	23
	Horned Lark	3	3					7			7	10
	Tree Swallow	1	1				111	96	9	14	230	231
	Violet-green Swallow	14	14					8	74	2	84	98
	Northern Rough-winged Swallow	2	2					7		26	33	35
	Bank Swallow	1	1					1		8	9	10
	Cliff Swallow	16	16					7	5	84	96	112
	Barn Swallow	7	7					10	4	37	51	58
	Bewick's Wren				1	1						1
	Ruby-crowned Kinglet								1		1	1
	Northern Mockingbird			1		1						1
	American Pipit						2	13	2		17	17
	Yellow-rumped Warbler	2	2					2		2	4	6
	Common Yellowthroat	7	7		17	17			6	3	9	33
	Brewer's Sparrow			2		2						2
	Black-throated Sparrow	2	2									2
	Sage Sparrow				3	3			1		1	4
	Savannah Sparrow	1	1	1	8	9	11	20	7	2	40	50
	Song Sparrow			4	13	17	3	1	2	1	7	24
	White-crowned Sparrow	2	2		1	1						3
	Unidentified Sparrow			2	2	4						4
	Red-winged Blackbird	26	26	6	59	65	229	65	199	593	1086	1177
	Western Meadowlark	7	7		3	3	2	6	22	11	41	51
	Yellow-headed Blackbird							1	16	38	55	55
	Great-tailed Grackle						1	2	7	5	15	15
	Brown-headed Cowbird	3	3						1	1	2	5
	Lesser Goldfinch	7	7									7
	Survey and Seasonal Totals	117	117	25	114	139	363	249	366	827	1805	2061

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit											
Summer	2010 Breeding Status	Common Name	5/23/2002	6/21/2002	**Total 2002**	6/24-25/2004	**Total 2004**	6/14/2010	7/2/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	C	Gadwall	6		6			6	8	14	20
	C	Mallard	1		1			7	34	41	42
	C	Cinnamon Teal						10	4	14	14
	N	Northern Shoveler						4		4	4
	N	Ruddy Duck							2	2	2
	C	Pied-billed Grebe						20	30	50	50
	N	Double-crested Cormorant	1		1			3		3	4
	S	American Bittern		3	3	1	1	9	4	13	17
	N	Great Blue Heron						4	8	12	12
	N	Great Egret	1		1			2	24	26	27
	N	Snowy Egret						1		1	1
	N	Green Heron							1	1	1
	N	Black-crowned Night-Heron						1		1	1
	N	White-faced Ibis						74	119	193	193
	S	Northern Harrier	2	1	3	6	6	2		2	11
	S	Virginia Rail						1		1	1
	S	Sora						8	2	10	10
	C	American Coot						24	120	144	144
	S	Killdeer		1	1			8	3	11	12
	C	Black-necked Stilt						12	33	45	45
	N	American Avocet				2	2	5		5	7
	N	Spotted Sandpiper	3		3			5		5	8
	S	Wilson's Snipe							18	18	18
	N	Wilson's Phalarope						12		12	12
	N	Ring-billed Gull	1		1						1
	N	Caspian Tern				5	5				5
	C	Marsh Wren	1	19	20	14	14	11	30	41	75
		Survey and Seasonal Totals	16	24	40	28	28	229	440	669	737

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit											
Summer	2010 Breeding Status	Common Name	5/23/2002	6/21/2002	**Total 2002**	6/24-25/2004	**Total 2004**	6/14/2010	7/2/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	N	Turkey Vulture	2		2						2
	N	Mourning Dove	1		1			2	3	5	6
	N	White-throated Swift	1		1						1
	N	Unidentified Swift sp.	2		2						2
	N	Western Wood-Pewee	1		1						1
	N	Say's Phoebe		1	1	1	1				2
	N	Ash-throated Flycatcher				1	1				1
	C	Western Kingbird		4	4	7	7		2	2	13
	S	Loggerhead Shrike	1		1	5	5	2	4	6	12
	N	Black-billed Magpie	2		2	3	3	1	1	2	7
	N	Common Raven	5	11	16	1	1				17
	N	Tree Swallow	1		1						1
	N	Violet-green Swallow	22		22						22
	N	Cliff Swallow	5		5	2	2		168	168	175
	N	Barn Swallow	1		1	1	1				2
	N	Bewick's Wren	1		1						1
	N	Blue-gray Gnatcatcher				1	1				1
	N	Northern Mockingbird		8	8	5	5				13
	N	European Starling				1	1				1
	N	Yellow-rumped Warbler	1		1						1
	N	MacGillivray's Warbler	1		1						1
	S	Common Yellowthroat	14	34	48	43	43	16	10	26	117
	N	Wilson's Warbler	2		2						2
	C	Savannah Sparrow	1	4	5	6	6	13	6	19	30
	S	Song Sparrow				5	5	4	4	8	13
	N	Blue Grosbeak				4	4				4
	C	Red-winged Blackbird	29	34	63	34	34	125	435	560	657
	S	Western Meadowlark	5	3	8	2	2	4	2	6	16
	C	Yellow-headed Blackbird	2		2			48	167	215	217
	N	Brewer's Blackbird	2		2			2		2	4
	S	Great-tailed Grackle						6	5	11	11
	S	Brown-headed Cowbird	7		7	6	6	1		1	14
		Survey and Seasonal Totals	109	99	208	128	128	224	807	1031	1367

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit																		
Fall	Common Name	8/15-16/2002	10/10-11/2002	**Total 2002**	8/18/2004	8/30/2004	9/14/2004	9/28/2004	**Total 2004**	8/28/2009	**Total 2009**	8/10/2010	8/24/2010	9/10/2010	9/21/2010	10/12/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Greater White-Fronted Goose															45	45	45
	Wood Duck												1				1	1
	Gadwall											1	1	16	9	24	51	51
	American Wigeon									120	120					1	1	121
	Mallard							1	1	11	11	16	11	12	4	46	89	101
	Cinnamon Teal									49	49	22	9	11	9		51	100
	Northern Shoveler													4			4	4
	Northern Pintail														2		2	2
	Green-Winged Teal															4	4	4
	Redhead												2	3		1	6	6
	Ring-necked Duck															5	5	5
	Bufflehead		1	1														1
	Ruddy Duck											2	5		1	2	10	10
	Pied-billed Grebe											12	3			2	17	17
	Eared Grebe		1	1						1	1				1		1	3
	American White Pelican	65	200	265		300			300									565
	Double-crested Cormorant									1	1	1	1	1	3	2	8	9
	American Bittern		1	1								3	1	2	3	1	10	11
	Great Blue Heron									13	13	4	6	4	3	4	21	34
	Great Egret									16	16	7	6	4	6	1	24	40
	Green Heron												2				2	2
	Black-crowned Night-Heron											1			1		2	2
	White-faced Ibis									19	19	92	92	15	39		238	257
	Osprey					2		1	3							1	1	4
	Northern Harrier		2	2	1	1	1	2	5	5	5	3	7	4	7	5	26	38
	Virginia Rail		1	1								4	4	1	2	1	12	13
	Sora		1	1	1				1	17	17	16	8	7	9	5	45	64
	Common Moorhen											1					1	1
	American Coot									103	103	107	71	68	77	172	495	598
	Semipalmated Plover											1					1	1
	Killdeer					1			1			4	3	1	3		11	12
	Black-necked Stilt											5					5	5
	American Avocet														15		15	15
	Spotted Sandpiper					1			1			1					1	2
	Greater Yellowlegs									15	15	4	1	1	3	9	18	33
	Lesser Yellowlegs												1				1	1
	Least Sandpiper	3		3								30		1			31	34
	Long-billed Dowitcher											14	3		14	1	32	32
	Wilson's Snipe							6	6				1			1	2	8
	Wilson's Phalarope											1					1	1
	Unidentified Shorebird species											5					5	5
	California Gull															1	1	1
	Caspian Tern					10			10									10
	Marsh Wren	1	20	21	5	7	10	32	54	31	31	27	24	25	45	17	138	244
	Survey and Seasonal Totals	69	227	296	7	322	11	42	382	401	401	384	263	180	256	351	1434	2513

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit																		
Fall	Common Name	8/15-16/2002	10/10-11/2002	**Total 2002**	8/18/2004	8/30/2004	9/14/2004	9/28/2004	**Total 2004**	8/28/2009	**Total 2009**	8/10/2010	8/24/2010	9/10/2010	9/21/2010	10/12/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	California Quail													7			7	7
	Sharp-shinned Hawk		1	1														1
	Cooper's Hawk							1	1									1
	Swainson's Hawk				1				1									1
	Red-tailed Hawk							2	2	1	1							3
	American Kestrel	1		1	1				1	3	3		1	2	1		4	9
	Peregrine Falcon													1			1	1
	Prairie Falcon													1			1	1
	Mourning Dove	1		1	2				2			2					2	5
	Greater Roadrunner	1		1														1
	Lesser Nighthawk					1			1									1
	Vaux's Swift												1				1	1
	Northern Flicker		1	1			1	3	4									5
	Black Phoebe						6	6	12	9	9			1	1		2	23
	Say's Phoebe	1		1	2	2	3	6	13	2	2							16
	Western Kingbird	3		3			2		2	1	1							6
	Loggerhead Shrike	1	2	3	2	1	1	2	6			3	8	1	2	2	16	25
	Warbling Vireo									2	2							2
	Black-billed Magpie							1	1	10	10		1	16	2		19	30
	Common Raven	3	9	12	2	4	3		9	2	2		7	1	14	4	26	49
	Horned Lark		2	2										8	9	43	60	62
	Tree Swallow	1		1		2	6	19	27			44	1	16	84		145	173
	Violet-green Swallow	1		1								3			1		4	5
	Northern Rough-winged Swallow	1		1	1				1			2	2				4	6
	Bank Swallow					6			6	114	114	1		2			3	123
	Cliff Swallow				1				1			6	12		4		22	23
	Barn Swallow		14	14			2	71	73	5	5			44	986	18	1048	1140
	Unidentified Swallow	4		4														4
	Bewick's Wren		1	1		1	2	5	8									9
	Ruby-crowned Kinglet							1	1									1
	American Robin		1	1														1
	Northern Mockingbird	2		2	6			3	9									11
	Le Conte's Thrasher												1				1	1
	European Starling		18	18	3	2	10	3	18	4	4			1			1	41
	American Pipit		6	6											5	5	10	16
	Orange-crowned Warbler						1	4	5					2			2	7
	Yellow Warbler				1	1			2	3	3	1					1	6
	Yellow-rumped Warbler		14	14				3	3							3	3	20
	Audubons Warbler															3	3	3
	Common Yellowthroat	7		7	2	17	1		20	32	32	10	3	3			16	75
	Wilson's Warbler						1		1									1
	Unidentified Warbler	1		1														1
	Brewer's Sparrow				13	1			14			1					1	15
	Vesper Sparrow														1		1	1
	Sage Sparrow							3	3						4		4	7
	Savannah Sparrow				1		1	5	7	4	4	11	6	74	11	29	131	142
	Song Sparrow		10	10		1	1	2	4	1	1	3	3	1	15	3	25	40
	White-crowned Sparrow		13	13				24	24									37
	Western Tanager									1	1							1
	Red-winged Blackbird	2	45	47	9	8		42	59	240	240	20	51	12	72	10	165	511
	Western Meadowlark		1	1									2			15	17	18
	Yellow-headed Blackbird									67	67	65	14	14	91		184	251
	Brewer's Blackbird		112	112												25	25	137
	Great-tailed Grackle									1	1							1
	Brown-headed Cowbird											1	1				2	2
	House Finch		3	3			1		1					4	21	4	29	33
	Pine Siskin							1	1									1
	Lesser Goldfinch														3		3	3
	American Goldfinch									9	9							9
	Survey and Seasonal Totals	30	253	283	47	47	42	207	343	511	511	173	114	211	1327	164	1989	3126

Indicator Species Table 27. Continued, Waggoner Management Unit Survey Results by Season

Waggoner Management Unit						
Winter	Common Name	1/31/2003	**Total 2003**	1/27/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Gadwall			52	52	52
	Mallard			7	7	7
	Green-winged Teal			3	3	3
	Ring-necked Duck			8	8	8
	Common Merganser			3	3	3
	Ruddy Duck			14	14	14
	Great Blue Heron			3	3	3
	Northern Harrier	3	3	7	7	10
	Sora			1	1	1
	American Coot			68	68	68
	Killdeer			1	1	1
	Marsh Wren	5	5	13	13	18
	Survey and Seasonal Totals	8	8	180	180	188
Non-Habitat Indicator Species	Bald Eagle			1	1	1
	Red-tailed Hawk	1	1	1	1	2
	Golden Eagle	2	2			2
	Northern Flicker	1	1	1	1	2
	Loggerhead Shrike	1	1	1	1	2
	Black-billed Magpie	1	1	3	3	4
	Common Raven	21	21	4	4	25
	Horned Lark	2	2			2
	Bewick's Wren	3	3			3
	American Pipit			8	8	8
	Savannah Sparrow			1	1	1
	Song Sparrow	11	11	5	5	16
	Unidentified Sparrow			1	1	1
	Red-winged Blackbird	18	18	4	4	22
	Western Meadowlark	2	2	8	8	10
	Survey and Seasonal Totals	63	63	38	38	101

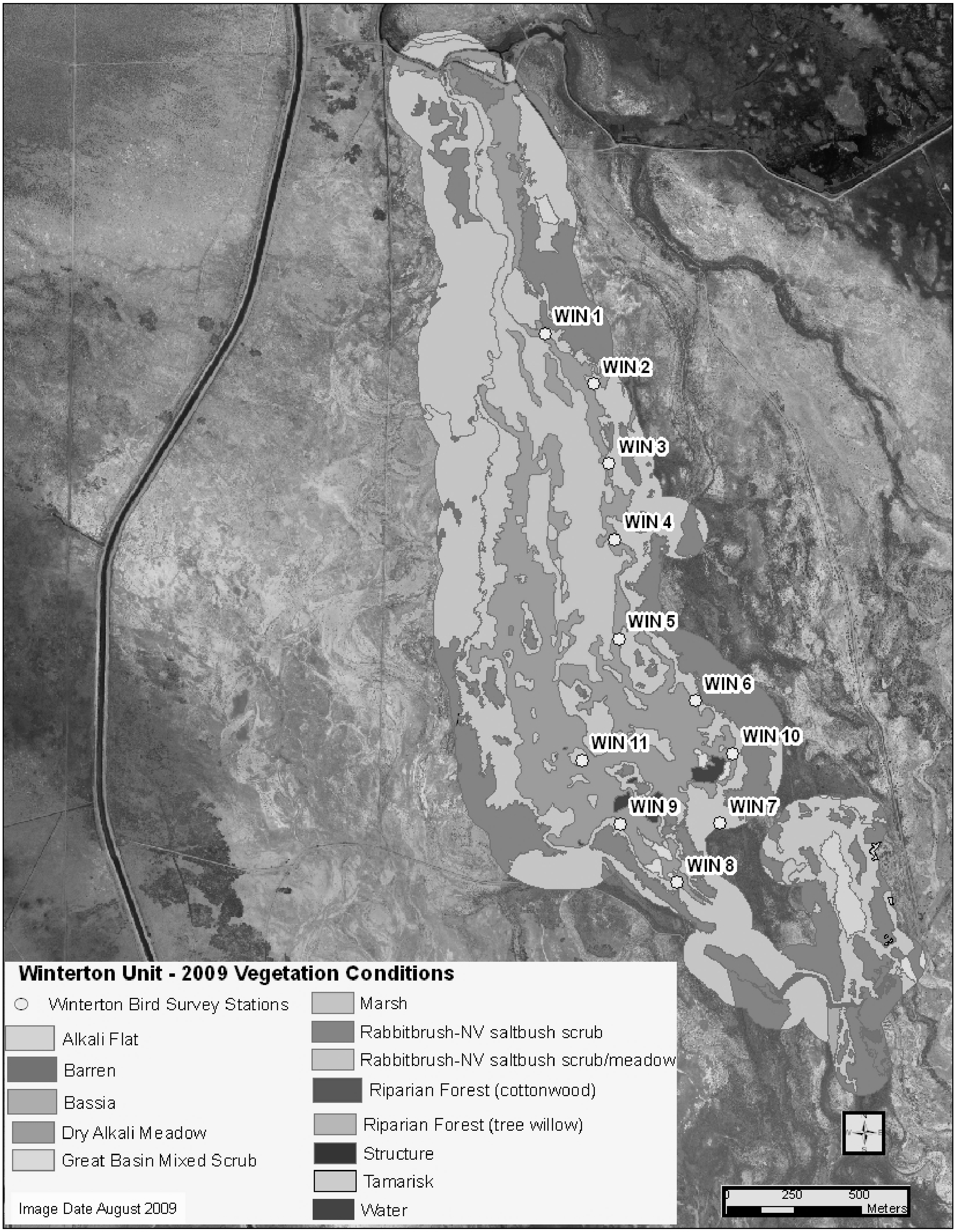
8.2.9 Results - Winterton Management Unit

Vegetation Assessment

Indicator Species Table 26 shows the acreage of each vegetation type within the Winterton Management Unit habitat area. Indicator Speices Figure 21 shows the vegetation communities as mapped from the 2009 aerial photos and the bird survey stations. Under preproject conditions in 2000, this unit was dominated by dry scrub communities and wet alkali meadow. This unit was flooded in 2007-2009. To date, no prescribed fires have been conducted at Winterton Management Unit. When mapped again in 2010, rabbitbrush-NV saltbush scrub/meadow was the dominant vegetation type, along with rabbitbrush-NV saltbush scrub and dry alkali meadow. Dense marsh vegetation is at the center of the unit. A small area of open water existed at the southern end of the unit when mapped because of supplemental releases in July/August 2009 conducted to meet BWMA flooded acreage requirements.

Indicator Species Table 28. Vegetation Type within Winterton Management Unit Habitat Area

Winterton Vegetation – Habitat Area	2000	2009
Alkali Flat	6.5	8.0
Barren	26.4	5.4
Bassia		1.6
Desert Sink Scrub	281.7	0.0
Dry Alkali Meadow	7.8	157.7
Great Basin Mixed Scrub		1.1
Marsh	57.6	84.1
Rabbitbrush-NV Saltbush scrub	267.9	167.5
Rabbitbrush-NV saltbush scrub/meadow		323.0
Reedgrass		2.6
Riparian Forest (cottonwood)		0.1
Riparian Forest (tree willow)	0.5	0.4
Structure		1.3
Tamarisk		0.6
Water		5.1
Wet alkali Meadow	110.0	
Total Mapped Acreage	**758.5**	**758.5**



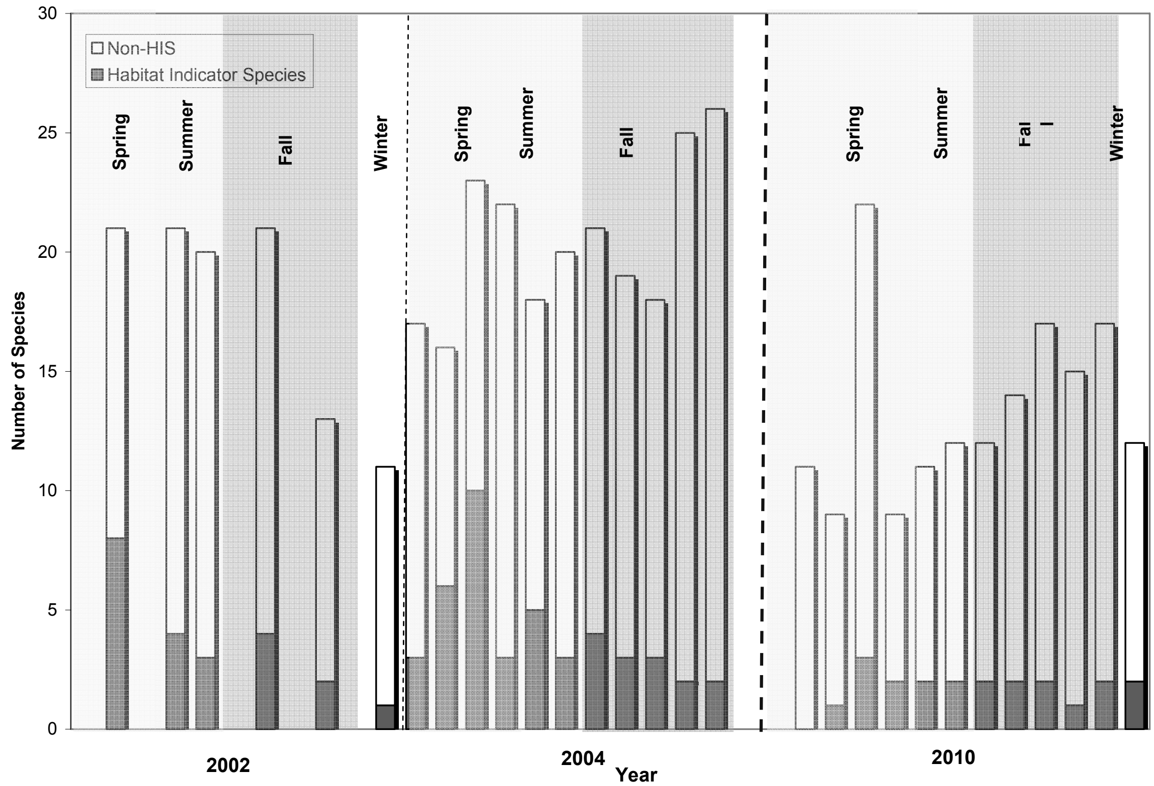
Indicator Species Figure 21. Winterton Management Unit Habitat Area Vegetation and Bird Survey Stations

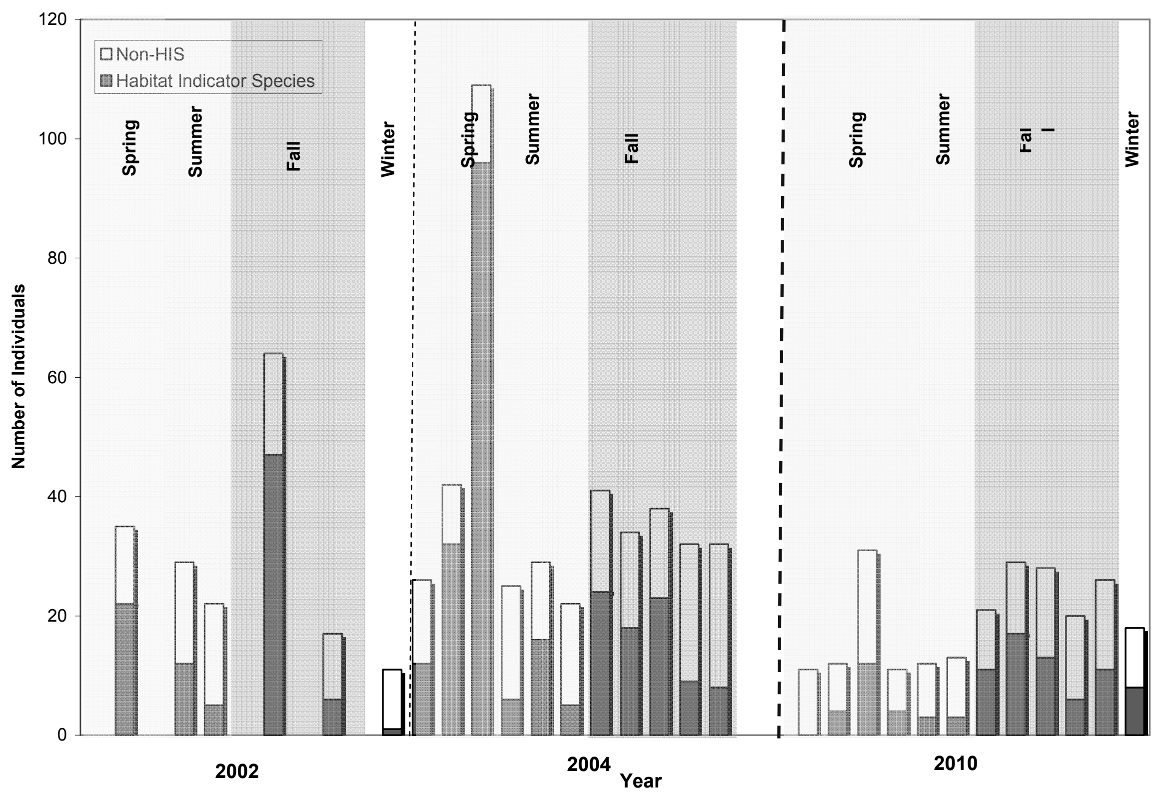
Avian Use

No data are available for the Winterton Management Unit when it was active in 2007-2009. Thus post-implementation data is not available to demonstrate the response of Habitat Indicator Species to releases to the Winterton Management Unit. Anecdotal reports suggest that the open water ponds at the southern end of the unit, when active, attracted waterfowl. Species richness and abundance in 2010 were comparable to baseline conditions (Indicator Species Figure 22). Few Habitat Indicator Species have been seen in this unit (Indicator Species Table 27). Indicator Species Table 28 provides the total detections of each Habitat Indicator Species category summed by season and survey year. Indicator Species Table 29 provides the results of each survey, presented by season, and grouped as Habitat Indicator Species or Non-habitat Indicator Species. During baseline surveys in spring 2004, the temporary water release to the unit in April attracted migrating waterfowl. Otherwise, waterfowl detections in this unit have been minimal. Northern Harriers are typically always seen at Winterton Management Unit; however, detections of other Habitat Indicator Species have been sporadic. Northern Harrier is the only Habitat Indicator Species currently breeding at Winterton Management Unit. Due to the very limited number of observations of Habitat Indicator Species in 2010, habitat use data will not be presented.

Indicator Species Table 29. Number of Habitat Indicator Species in Winterton Management Unit by Season and Survey Year

Winterton	2002	2004	2009	2010
Spring	8	11		4
Summer	6	5		3
Fall	5	4		3
Winter	1			2





Indicator Species Figure 22. Winterton Management Unit - Number of Species and Number of Individuals (limited flooding in 2004 and 2010)

Indicator Species Table 30. Seasonal Use of Winterton Management Unit by Year

Spring		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes	13	104	9
	Rails and Bitterns	4	2	
	Wading birds		2	1
	Shorebirds	3	4	
	Gulls/Terns/Comorants and Pelicans			
	Marsh Wren		10	1
	Northern Harrier	2	24	9
	Osprey			
	Total HIS	22	146	20
Non-Habitat Indicator Species		151	462	226

Summer		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes	6		3
	Rails and Bitterns	4	7	
	Wading birds			
	Shorebirds	4	3	
	Gulls/Terns/Comorants and Pelicans		5	
	Marsh Wren			
	Northern Harrier	3	6	3
	Osprey			
	Total HIS	17	21	6
Non-Habitat Indicator Species		203	208	84

Fall		2002	2004	2010
Habitat Indicator Species	Waterfowl and Grebes			
	Rails and Bitterns	3	29	
	Wading birds	36		6
	Shorebirds			
	Gulls/Terns/Comorants and Pelicans	6		7
	Marsh Wren	2	47	
	Northern Harrier	6	6	43
	Osprey			
	Total HIS	53	82	56
Non-Habitat Indicator Species		242	894	612

Winter		2003		2010
Habitat Indicator Species	Waterfowl and Grebes			
	Rails and Bitterns			
	Wading birds			
	Shorebirds			
	Gulls/Terns/Comorants and Pelicans			
	Marsh Wren			1
	Northern Harrier	1		7
	Osprey			
	Total HIS	1		8
Non-Habitat Indicator Species		46		81

Indicator Species Table 31. Winterton Management Unit Survey Results by Season

Winterton Management Unit														
Spring	Common Name	4/27/2002	**Total 2002**	3/23/2004	4/6/2004	4/19/2004	5/10/2004	**Total 2004**	4/23/2010	4/9/2010	5/7/2010	5/26/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Gadwall					6		6						6
	Mallard	8	8	2	17	2		21			9		9	38
	Cinnamon Teal	5	5			14		14						19
	Northern Pintail					2		2						2
	Green-winged Teal				4	57		61						61
	American Bittern	1	1			1		1						2
	Least Bittern				1			1						1
	Great Egret					1	1	2			1		1	3
	Northern Harrier	2	2	6	5	9	4	24		4	2	3	9	35
	Virginia Rail	2	2											2
	Sora	1	1											1
	Killdeer	2	2		3	1		4						6
	Wilson's Snipe	1	1											1
	Marsh Wren			4	2	3	1	10				1	1	11
	Survey and Seasonal Totals	22	22	12	32	96	6	146	0	4	12	4	20	188

Indicator Species Table 31. Continued, Winterton Management Unit Survey Results by Season

Winterton Management Unit														
Spring	Common Name	4/27/2002	**Total 2002**	3/23/2004	4/6/2004	4/19/2004	5/10/2004	**Total 2004**	4/23/2010	4/9/2010	5/7/2010	5/26/2010	**Total 2010**	**Total All Years**
Non-Habitat Indicator Species	Turkey Vulture			2				2						2
	Swainson's Hawk					1		1			2		2	3
	Red-tailed Hawk									1			1	1
	American Kestrel			1				1		1			1	2
	Merlin			1				1						1
	Mourning Dove	3	3											3
	Vaux's Swift	2	2											2
	Gray Flycatcher										1		1	1
	Say's Phoebe										1		1	1
	Western Kingbird						1	1						1
	Loggerhead Shrike			2			1	3	1		4		5	8
	Black-billed Magpie			1				1						1
	Common Raven	1	1	2	2		3	7	2	1	2	6	11	19
	Horned Lark	1	1											1
	Tree Swallow									13	1	1	15	15
	Violet-green Swallow										4		4	4
	Northern Rough-winged Swallow				2	2		4						4
	Cliff Swallow										2		2	2
	Barn Swallow	3	3						1	1	52	3	57	60
	Unidentified Swallow									4			4	4
	Bewick's Wren			3	5	4	5	17		2	6		8	25
	Le Conte's Thrasher			2	2	2		6	2		7	1	10	16
	American Pipit					1		1	2				2	3
	Orange-crowned Warbler										1		1	1
	Yellow-rumped Warbler					2	1	3						3
	MacGillivray's Warbler						1	1						1
	Common Yellowthroat	5	5		1	8	7	16	3		2		5	26
	Wilson's Warbler						14	14			1		1	15
	Spotted Towhee			2		1	1	4	2		1		3	7
	Brewer's Sparrow	1	1											1
	Sage Sparrow	9	9			3	2	5	1		2	2	5	19
	Savannah Sparrow	4	4	5	5	25	4	39	4	7	1	5	17	60
	Song Sparrow	1	1	2	10	4	3	19						20
	White-crowned Sparrow			1				1						1
	Blue Grosbeak						3	3						3
	Lazuli Bunting						1	1						1
	Red-winged Blackbird	67	67	62	102	43	52	259	4		1		5	331
	Western Meadowlark	25	25	17	5	8	7	37	16	12	16	21	65	127
	Yellow-headed Blackbird	29	29		7		3	10						39
	Brown-headed Cowbird						2	2						2
	Bullock's Oriole						3	3						3
	Survey and Seasonal Totals	151	151	103	141	104	114	462	38	42	107	39	226	839

Indicator Species Table 31. Continued, Winterton Management Unit Survey Results by Season

Winterton Management Unit												
Summer	2010 Breeding Status	Common Name	5/23/2002	6/22/2002	**Total 2002**	6/10/2004	6/24/2004	**Total 2004**	6/16/2010	7/1/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	N	Gadwall								1	1	1
	N	Mallard		1	1				2		2	3
	N	Cinnamon Teal	5		5							5
	N	American Bittern		2	2	4		4				6
	C	Northern Harrier	1	2	3	3	3	6	1	2	3	12
	N	Virginia Rail	2		2	2	1	3				5
	N	Killdeer	4		4	2	1	3				7
	N	Marsh Wren				5		5				5
		Survey and Seasonal Totals	12	5	17	16	5	21	3	3	6	44
Non-Habitat Indicator Species	N	Turkey Vulture		1	1							1
	N	Swainson's Hawk		1	1							1
	N	Mourning Dove					1	1				1
	N	Say's Phoebe	1		1							1
	N	Western Kingbird		1	1		2	2				3
	C	Loggerhead Shrike	2	2	4	3	13	16	4	2	6	26
	N	Common Raven	3	1	4	2		2	4	1	5	11
	N	Horned Lark		1	1	7	2	9				10
	N	Violet-green Swallow	2		2		3	3				5
	N	Cliff Swallow		6	6							6
	N	Barn Swallow	2		2							2
	N	Unidentified Swallow		4	4							4
	S	Bewick's Wren				8	7	15	4	18	22	37
	N	Blue-gray Gnatcatcher		1	1							1
	N	Northern Mockingbird	2	5	7		3	3	1		1	11
	C	Le Conte's Thrasher	1	3	4	2	1	3	5	6	11	18
	S	Common Yellowthroat	9	8	17	17	18	35	1	1	2	54
	N	Wilson's Warbler	2		2							2
	N	Spotted Towhee				3	4	7		2	2	9
	N	Brewer's Sparrow	2		2							2
	N	Black-throated Sparrow					1	1				1
	N	Sage Sparrow	3	3	6	14	2	16				22
	S	Savannah Sparrow	3	3	6	7	9	16	1	6	7	29
	N	Song Sparrow	2		2							2
	N	Blue Grosbeak				4	4	8				8
	S	Red-winged Blackbird	57	23	80	25	21	46	3	3	6	132
	S	Western Meadowlark	25	9	34	10	6	16	10	11	21	71
	N	Yellow-headed Blackbird	7	5	12							12
	N	Brown-headed Cowbird	1	2	3	5	4	9		1	1	13
		Survey and Seasonal Totals	124	79	203	107	101	208	33	51	84	495

Indicator Species Table 31. Continued, Winterton Management Unit Survey Results by Season

Winterton Management Unit																	
Fall	Common Name	8/15/2002	10/11/2002	**Total 2002**	8/4/2004	8/16/2004	8/31/2004	9/13/2004	9/27/2004	**Total 2004**	8/25/2010	8/10/2010	9/8/2010	9/24/2010	10/4/2010	**Total 2010**	**Total All Years**
Habitat Indicator Species	Double-crested Cormorant	6		6													6
	American Bittern	3		3													3
	Great Blue Heron										6					6	6
	White-faced Ibis	36		36													36
	Northern Harrier	2	4	6	1			3	2	6	5	15	8	6	9	43	55
	Virginia Rail				2	1	3			6							6
	Sora				12	7	4			23							23
	Marsh Wren		2	2	9	10	16	6	6	47		2	5		2	9	58
	Survey and Seasonal Totals	47	6	53	24	18	23	9	8	82	11	17	13	6	11	58	193
Non-Habitat Indicator Species	California Quail													2		2	2
	Turkey Vulture														1	1	1
	White-tailed Kite								1	1							1
	Red-tailed Hawk											1		1		2	2
	Unidentified Hawk													1		1	1
	American Kestrel	3		3		1		1		2	1					1	6
	Mourning Dove	1		1	2			3	4	9		5				5	15
	Common Nighthawk				1					1							1
	Vaux's Swift							1		1							1
	Rufous Hummingbird	1		1		2				2							3
	Northern Flicker								1	1							1
	Say's Phoebe							2	1	3							3
	Western Kingbird				5	2				7		1				1	8
	Loggerhead Shrike	1	1	2	6	6	4	2	1	19	2	3	1	4	1	11	32
	Black-billed Magpie							2		2					1	1	3
	Common Raven	4	7	11				3	4	7	6	4	1	5	6	22	40
	Horned Lark		3	3	11					11			1	3	9	13	27
	Tree Swallow						26	3	3	32			12			12	44
	Violet-green Swallow	4		4	2					2							6
	Northern Rough-winged Swallow				7					7							7
	Bank Swallow				5			1		6	1					1	7
	Cliff Swallow				1		4			5		1				1	6
	Barn Swallow		3	3	1	4	64	52	238	359			38	34	34	106	468
	Unidentified Swallow	5		5			2			2	1					1	8
	Bewick's Wren	2		2	4	11	9	10	8	42	4	5	12	4	12	37	81
	Blue-gray Gnatcatcher							1		1							1
	Northern Mockingbird				1					1		1				1	2
	Sage Thrasher						2	9	3	14	1					1	15
	Le Conte's Thrasher	1	1	2	6	10	3	8	3	30	3	3	5	3	7	21	53
	American Pipit														2	2	2
	Orange-crowned Warbler						1		6	7							7
	Yellow-rumped Warbler								2	2							2
	MacGillivray's Warbler						1			1							1
	Common Yellowthroat				15	4	13	3	1	36		1				1	37
	Spotted Towhee	1		1		2	1	5	2	10					3	3	14
	Brewer's Sparrow	1		1		8	15	2	2	27							28
	Sage Sparrow	2	3	5	9	10	3	11	5	38	4		2	3		9	52
	Savannah Sparrow	3	10	13		1	1	8	10	20	5	2	2	13	7	29	62
	Song Sparrow		3	3				3	6	9			1			1	13
	White-crowned Sparrow		28	28					37	37				13	8	21	86
	Blue Grosbeak				2	1				3							3
	Lazuli Bunting					1				1							1
	Red-winged Blackbird	52	91	143	10	25		18	39	92	4	5	146	17	87	259	494
	Western Meadowlark	2	4	6		2	8	5	23	38			6	7	17	30	74
	Yellow-headed Blackbird	1		1									9			9	10
	Brewer's Blackbird	1		1													1
	Brown-headed Cowbird												3			3	3
	House Finch							1	4	5				1	2	3	8
	Pine Siskin								1	1							1
	Lesser Goldfinch	3		3									1			1	4
	Survey and Seasonal Totals	88	154	242	88	90	157	154	405	894	32	32	240	111	197	612	1748

Indicator Species Table 31. Continued, Winterton Management Unit Survey Results by Season

Winterton Management Unit						
Winter	Common Name	1/31/2003	Total 2003	1/29/2010	Total 2010	Total All Years
Habitat Indicator Species	Northern Harrier	1	1	7	7	8
	Marsh Wren			1	1	1
	Survey and Seasonal Totals	1	1	8	8	9
Non-Habitat Indicator Species	Red-tailed Hawk			1	1	1
	Northern Flicker	2	2	1	1	3
	Black Phoebe			2	2	2
	Common Raven	8	8	7	7	15
	Bewick's Wren	2	2	2	2	4
	Le Conte's Thrasher	4	4	2	2	6
	Sage Sparrow	2	2	3	3	5
	Savannah Sparrow	2	2	9	9	11
	Song Sparrow	10	10			10
	White-crowned Sparrow	5	5			5
	Red-winged Blackbird	9	9	5	5	14
	Western Meadowlark	2	2	2	2	4
	Survey and Seasonal Totals	46	46	34	34	80

8.2.10 Summary of Blackrock Waterfowl Management Area Avian Surveys

Surveys conducted in 2010 indicate that the Drew and Waggoner units are being used by Habitat Indicator Species. Overall, indicator species richness and abundance has been higher in the Drew Unit as compared to Waggoner. Drew has attracted larger numbers of ducks, coots and shorebirds, while conditions at Waggoner have attracted more wading birds. During this second year of implementation, breeding populations of habitat indicator species were also supported in these units. The Thibaut Unit also supported some indicator species in 2010 due in part to the intermittent presence of irrigation water. Open water was not evident in the Thibaut Ponds portion of the unit, and few indicator species were detected in this area, although water was supplied to this area continuously. Because no data are available for when Thibaut and Winterton were active, it is unknown how indicator species responded to management actions in these units. Knowledge of wildlife response to wetted conditions of each unit may help in developing a management plan that will provide a diversity of conditions attractive to the various Habitat Indicator Species groups. In the future, conducting surveys when units are not active is not expected to help improve management to the degree that surveying active units would. The MAMP monitoring schedule calls for avian surveys to be conducted at set time intervals. It is quite possible this could result in some units never being surveyed when active due to the resultant timing of the wet-dry cycles. To date, it appears that units may only be in active status 2-3 years during each wet cycle. As an alternative to the current monitoring schedule, it is recommended that only active units be surveyed, and surveys be conducted at least the first and second year that each unit is active. This may provide data to demonstrate the response of Habitat Indicator Species to changing vegetation and wetted extent conditions.

8.3 Indicator Species Habitat Assessment

The California Wildlife Habitat Relationship System (CWHR) is being used to evaluate the availability of habitats for LORP Habitat Indicator Species. CWHR is a software system that contains information on life history and habitats for terrestrial vertebrates in California. CWHR contains habitat suitability values for wildlife species in California vegetation communities. CWHR has been integrated with BioView, an application that translates habitat suitability values for wildlife into data that can be used in a Geographic Information System. CWHR is operated and maintained by the California Department of Fish and Game in cooperation with the California Interagency Wildlife Task Group (CIWTG).

8.3.1 Methodology

Using CWHR, suitability values can be assigned to vegetation polygons based on three variables: vegetation community type, size and stage. CWHR provides a series of descriptions for vegetation communities found throughout the state, as well as community classification crosswalks for the various classification systems used. After determining the community type, the size and stage are evaluated. “Size” refers to plant height, age or vigor, diameter at breast height, or canopy diameter, depending on the vegetation community being assessed. “Stage” refers to canopy cover. Data can be relevé, or categorical. The 2009 aerial imagery of the LORP project area, and the 2010 vegetation mapping polygons were used to assess habitats using CWHR. Vegetation community types used for LORP mapping were cross-walked to CWHR habitats. The CWHR habitat type code was then assigned to each vegetation polygon within ArcView. A size and stage class was assigned to each polygon after viewing the high resolution 2009 images, reviewing habitat photos taken at each bird monitoring station in 2010, and reviewing range trend transect data.

Indicator Species Table 30 provides the crosswalk used, and a description of the size classes and stages assigned to each polygon. The LORP vegetation types Rabbitbrush-NV saltbush scrub, tamarisk and tamarisk slash were all classified as Alkali Desert Scrub (ASC) using CWHR categories. Bassia was classified as Annual Grassland (AGS); dry alkali meadow and Rabbitbrush-NV saltbush scrub/meadow were classified as Perennial Grassland (PGS). Wet alkali meadow was equivalent to CWHR Wet Meadow (WTM) and irrigated pasture was equivalent to Pasture (PAS). Marsh and Reedgrass were classified as Fresh Emergent Wetland (FEW). All three LORP woody riparian categories (Riparian forest (tree willow), Riparian forest (cottonwood), and riparian shrub) were classified as Desert Riparian (DRI) for most wildlife species. CWHR does not list Desert Riparian as a suitable habitat for Wood Duck, Red-shouldered Hawk, Swainson’s Hawk, or Nuttall’s Woodpecker. All four are Habitat Indicator Species in the Riverine/Riparian management area, and all breed in riparian habitats in the Owens Valley. Use of DRI code for woody riparian polygons would thus have resulted in the polygons being classified as “not suitable”. In order to better represent the availability of suitable habitat for these species, a surrogate vegetation community was selected. For Wood Duck, Red-shouldered Hawk and Nuttall’s Woodpecker, riparian polygons were coded using MRI for Montane Riparian. For Swainson’s Hawk, riparian polygons were coded as VFR or Valley Foothill Riparian, which is the only riparian community for which Swainson’s Hawk is associated with in CWHR. Barren (BAR) was used for both Structures and Barren lands. Although CWHR indicates a high suitability value for Belted Kingfisher for BAR, this is only true for unvegetated banks that can be used for nesting. All polygons classified as Barren on LORP were bare upland sites. Thus, for Belted Kingfisher, all barren polygons were assigned a suitability value of “0”, indicating unsuitable. All polygons mapped as “Water” were evaluated to determine if they were in the active channel, or were off-river ponds or oxbows. Off-river sites were classified as Lacustrine (LAC). Open water polygons in the active channel were classified as Riverine (RIV). Areas mapped as “Streambar” were also classified as periodically flooded Riverine sites.

BioView was used to calculate the suitability value for each polygon, and each indicator species. For BWMA, the list of species evaluated was limited by excluding species considered casual or rare, although some of these have been encountered in the units. The output of BioView includes a separate suitability value for foraging, cover, and nesting, and both the arithmetic mean and geometric mean of the three. The arithmetic mean was used to determine habitat availability since it would demonstrate whether there was suitable habitat for foraging, cover, or nesting. The suitability value ranges from 0 – 100, "0" defined as not suitable. Low suitability is < or = to 33, medium suitability is 34 to 66, and high suitability values are 67-100.

After classification of the polygons, the Riverine/Riparian area was clipped into the six LORP reaches. The acreages of low, medium, and high suitability habitat were calculated by CWHR habitat type and indicator species. The total acreage of all low, medium and high suitability habitats was calculated by species and reach. For BWMA, habitat was evaluated within the maximum flooded extent plus 100-meter buffer. The total acreage of all low, medium and high suitability habitats was calculated by indicator species and management unit.

8.3.2 Comparison with Baseline Conditions

The availability of suitable habitat for LORP indicator species during baseline conditions (2000) and 2009 conditions was also assessed in the Riverine-Riparian Management Area. Due to time constraints, this assessment was less detailed than was completed for the assessment of current conditions. The CWHR program provides a habitat suitability value for each species and habitat type that is the geometric mean of suitability values for all stage and size classes. This value was assigned to each mapped polygon in 2000 and 2009, for comparability. Graphs were created showing the total acreage of low, medium and high suitability habitats by reach for 2000 and 2009.

Indicator Species Table 32. CWHR Habitat Classification and Crosswalk to LORP Vegetation Types

CHWR_Habitats	Habitat Description	LORP Mapped VEG_NAME
AGS	Annual Grassland	Bassia
PGS	Perennial Grassland	Dry Alkali Meadow/Rabbitbrush-NV saltbush scrub/meadow
WTM	Wet Meadow	Wet Alkali Meadow
FEM	Fresh Emergent Wetland	Marsh
FEM	Fresh Emergent Wetland	Reedgrass
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Short herb	< 12" tall at maturity
2	Tall herb	> 12.1" tall at maturity
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	2 - 9.9%
P	Open	10 - 39.9%
M	Moderate	40 - 59.9
D	Dense	> 60%

Shrub Habitats		
CHWR_Habitats	**Habitat Description**	**LORP Mapped VEG_NAME**
ASC	Alkali Desert Scrub	Rabbitbrush-NV saltbush scrub
ASC	Alkali Desert Scrub	Tamarisk
ASC	Alkali Desert Scrub	Tamarisk slash (all 4D)
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Seedling Shrubs	Seedlings
2	Young shrub	< 1% crown decadence
3	Mature shrub	1 - 24.9 % crown decadence
4	Decadent shrub	> 25 % crown decadence
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	10 - 24.9%
P	Open	25 - 39.9%
M	Moderate	40 - 59.9%
D	Dense	> 60%

Riparian Woody Vegetation		
CHWR_Habitats	**Habitat Description**	**LORP Mapped VEG_NAME**
DRI	Desert Riparian	Riparian forest (tree willow)
DRI	Desert Riparian	Riparian forest (cottonwood)
DRI	Desert Riparian	Riparian shrub (shrub willow)
SIZE_CLASSES		
Code	**Descriptor**	**Crown Diameter/DBH**
1	Seeding tree	DBH < 1"
2	Sapling tree	< 15 feet; DBH 1 - 5.9"
3	Pole tree	15 - 29.9 feet; DBH 6 - 10.9"
4	Small tree	30 - 44.9 feet; DBH 11 - 23.9"
5	Med/large tree	> 45 feet; DBH > 24"
6	Multilayer tree	A distinct layer of size class 5 trees over a distinct layer of size 4 and/or 3 trees, and total tree canopy of layers >/=60%
NOTE:	*Riparian shrub habitats will either be size class 1 or 2 only*	
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	10 - 24.9%
P	Open	25 - 39.9%
M	Moderate	40 - 59.9%
D	Dense	> 60%

Off-river wetted areas		
CHWR_Habitats	**Habitat Description**	**LORP Mapped VEG_NAME**
LAC	Lacustrine	Water
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Limnetic	Deep water beyond light penetration (no stage code)
2	Submerged	Ponds that are shallow enough to allow light penetration
3	Periodically Flooded	Unvegetaed areas that are periodically flooded
4	Shore	Water's edge with less than 2% vegetation
STAGES		
Code	**Descriptor**	**Substrate**
O	Organic	Algae, duckweed or plant material present
M	Mud	Mud substrate
S	Sand	Sandy substrate
G	Gravel/cobble	Substrate of gravel or cobble
R	Rubble/boulders	Substrate of rubble or boulders
B	Bedrock	Shouldn't be on LORP!

River		
CHWR_Habitats	**Habitat Description**	**LORP Mapped VEG_NAME**
RIV	Riverine	Water
RIV	Riverine	Streambar
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Open Water	Water greater than 2 meters in depth
2	Submerged	Area of permanent water between "open water" and shore
3	Periodically Flooded	Unvegetated areas that are periodically flooded
4	Shore	Seldom-flooded areas with < 10% vegetative cover
STAGES		
Code	**Descriptor**	**Substrate**
O	Organic	Algae, duckweed or plant material present
M	Mud	Mud substrate
S	Sand	Sandy substrate
G	Gravel/cobble	Substrate of gravel or cobble
R	Rubble/boulders	Substrate of rubble or boulders
B	Bedrock	Shouldn't be on LORP!

8.3.3 Results – Riverine-Riparian Management Area

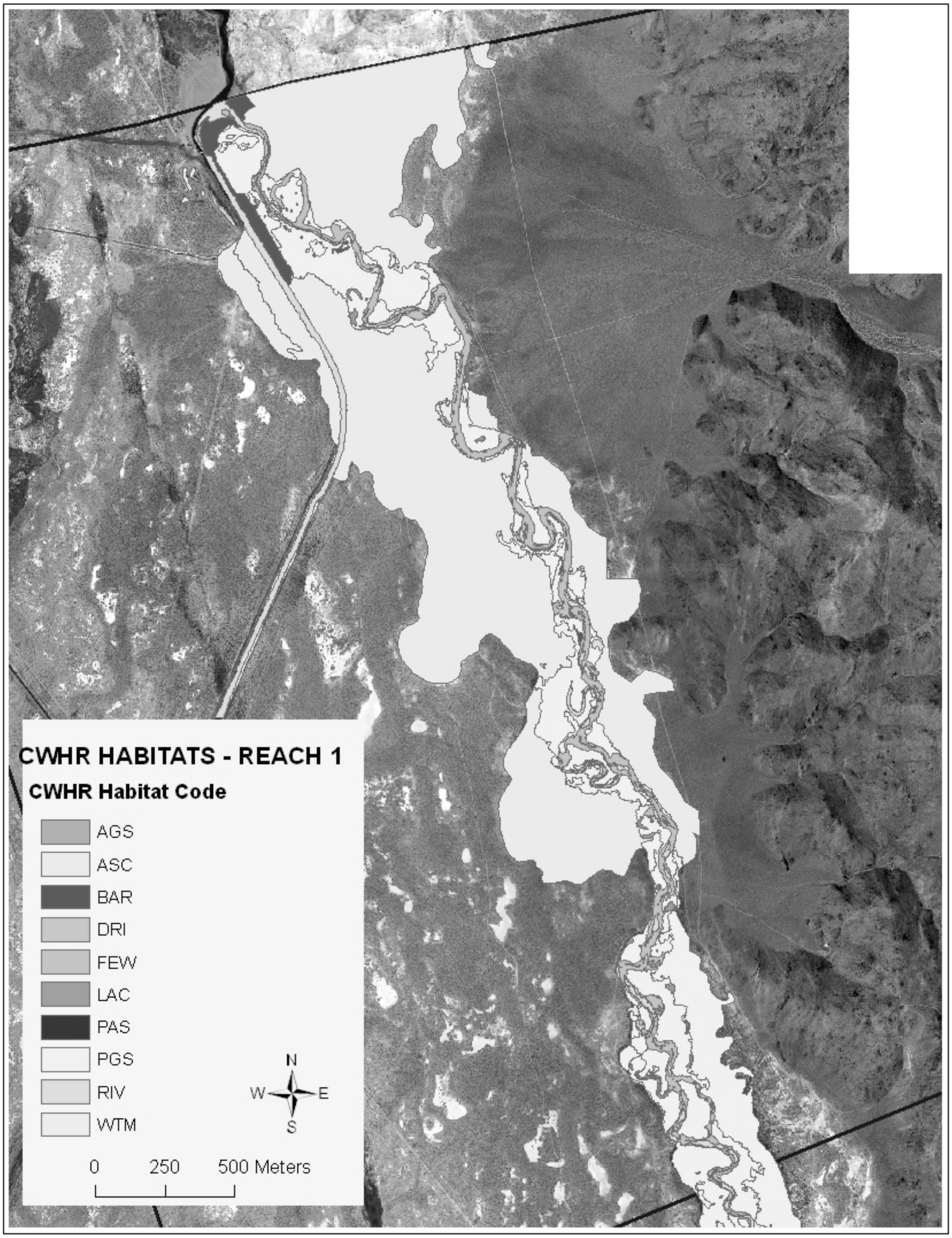
Indicator Species Table 31 shows the total acreage of each CWHR habitat by reach. Indicator Species Figures 23 and 24 show the CWHR habitats as mapped in Reaches 1 and 4, and are provided as examples. Habitats classified as Perennial Grassland (PGS) under CWHR were the most abundant in LORP area, followed by Alkali Scrub (ASC) and Fresh Emergent Wetland (FEW). Wet Meadow (WTM) and Lacustrine (LAC) habitats were the least abundant. Annual grassland habitats (AGS) (i.e. Bassia) were most abundant in Reach 2, as was Alkali Scrub and Barren lands (BAR). Desert Riparian (DRI) was most abundant in Reaches 3 and 4, as was Fresh Emergent Wetland and Riverine (RIV). Lacustrine was most abundant in Reach 3 as was Pasture (PAS) and Perennial Grassland. Wet Meadow was most abundant in Reach 3 and absent in Reach 1.

Indicator Species Table 32 shows the total acreage of suitable habitat for each indicator species by habitat type and LORP reach. In Reach 1, Perennial Grassland, Fresh Emergent Wetland and Riverine habitats provide the most acreage of suitable habitat for indicator species. Desert Riparian and Wet Meadow habitats are lacking in this reach. Reach 2 provides some suitable habitat for all indicator species, with Annual Grassland, Fresh Emergent Wetland and Perennial Grassland forming the majority of available habitat. Although Annual Grassland (Bassia) has some suitability for several indicator species in CWHR, the suitability of Bassia stands for these species is questionable. Owens Valley Vole sign has been along the river corridor in stands of Bassia - use by other indicator species may be limited. Reach 2 has more acreage of Riverine and Desert Riparian available than Reach 1. Reach 3 habitats consist of primarily Perennial Grassland and Fresh Emergent Wetland. More acres of Desert Riparian, Lacustrine and Wet Meadow are available than in Reaches 1 or 2. Reach 4 has the highest acreage of Fresh Emergent Wetland, but also provides Perennial Grassland and Desert Riparian. The most abundant habitat in Reaches 5 and 6 is Perennial Grassland, but these reaches also provide Fresh Emergent Wetland, Desert Riparian, Riverine and some Wet Meadow.

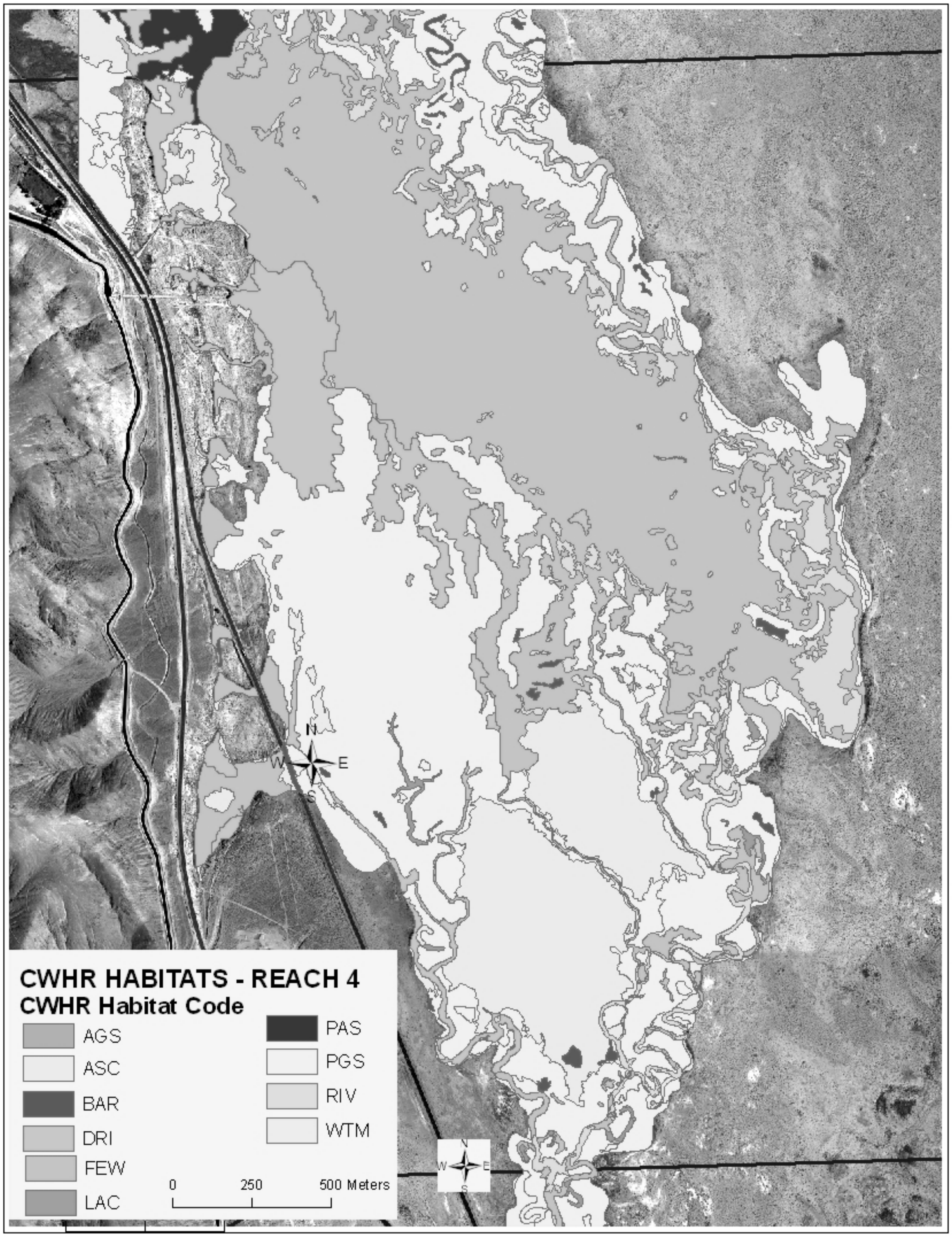
Indicator Species Figure 25 shows the total acreages of habitats classified as low, medium or high suitability, medium and high suitable habitat by indicator species and reach. Indicator Species Figure 26 provides an example of a habitat suitability map produced using ArcMap and the output of BioView. This map shows the low, medium and high suitability polygons for Wood Duck in Reach 3, in the area between Locust Return Gate and Manzanar Reward Road. Reach 1 (Figure 25) provides essentially no suitable habitat for riparian dependent species such as Yellow-billed Cuckoo, Nuttall's Woodpecker, Willow Flycatcher, Warbling Vireo, Yellow Warbler, and Yellow-breasted Chat. Reach 1 provides the most suitable habitat for Owens Valley Vole, but also provides limited acreage of medium and high suitability habitat for waterbirds and marsh-dependent species such as Virginia Rail, Sora, and Marsh Wren. The presence of low, medium and high suitability habitat for indicator species in Reach 2 is similar to Reach 1 except more Desert Riparian habitat is available for riparian dependent species. Reach 3 provides more suitable habitat for all indicator species. The greatest amount of medium and high suitability habitat is available for species which may forage in or over grassland habitats such Great Blue Heron, Northern Harrier, Tree Swallow and Owens Valley Vole. Reach 4 provides the most acreage of medium and high suitability habitats for species that primarily use marsh or Fresh Emergent Wetland habitats such as Northern Harrier, Virginia Rail, Sora and Marsh Wren. Reaches 5 and 6 provide the most suitable habitat acreage for species that use Perennial Grassland and marsh.

Indicator Species Table 33. Sum of CWHR Habitat Types by LORP Reach

CWHR Habitat Type	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Total by CWHR Habitat Type
AGS		276.8	39.2				**316.0**
ASC	350.3	609.2	287.8	148.7	40.6	264.2	**1700.8**
BAR	8.0	73.1	53.7	5.7	1.3	12.8	**154.6**
DRI	0.2	16.6	101.1	92.3	22.5	69.5	**302.3**
FEW	42.8	104.6	302.6	455.5	50.2	156.0	**1111.7**
LAC	2.3	2.2	25.6	4.8	1.9	3.5	**40.4**
PAS			91.9	1.1			**93.0**
PGS	231.2	162.9	1079.8	458.9	253.2	473.6	**2659.5**
RIV	23.9	37.1	51.1	52.2	21.6	40.6	**226.6**
WTM		0.6	24.9	8.1	7.7	11.4	**52.7**
Total acreage per reach	**658.6**	**1283.1**	**2057.8**	**1227.3**	**399.0**	**1031.7**	**6657.5**



Indicator Species Figure 23. Map of CWHR Habitats in Reach 1



Indicator Species Figure 24. Map of CWHR Habitats in Reach 4

Indicator Species Table 34. Total Acreage of Suitable Habitat for Indicator Species by Habitat Type by Reach

REACH 1

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				0.1	41.0	2.3		23.1	
Least Bittern				0.0	41.0	2.3		23.1	
Great Blue Heron		0.1		0.1	41.0	2.3	147.1	23.1	
Northern Harrier		346.9	8.0		41.0	2.3	147.1	23.1	
Red-shouldered Hawk				0.2	41.0		147.1		
Swainson's Hawk			8.0				147.1		
Virginia Rail					41.0				
Sora					41.0				
Yellow-billed Cuckoo				0.2					
Long-eared Owl				0.2			147.1		
Belted Kingfisher				0.2		2.3		23.9	
Nuttall's Woodpecker				0.2					
Willow Flycatcher				0.2					
Warbling Vireo				0.2					
Tree Swallow				0.2	41.0	2.3	147.1	23.1	
Marsh Wren					41.0				
Yellow Warbler				0.2					
Yellow-breasted Chat				0.1					
Blue Grosbeak				0.1					
Owens Valley Vole	103.8				41.0		147.1		

REACH 2

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				6.5	104.6	2.2		34.9	
Least Bittern				8.7	104.6	2.2		32.4	
Great Blue Heron	276.8			6.5	104.6	2.2	162.9	34.9	0.6
Northern Harrier	276.8	127.5	73.1		104.6	2.2	162.9	34.8	0.6
Red-shouldered Hawk	276.8			16.6	104.6		162.9		0.6
Swainson's Hawk	276.8		73.1				162.9		0.6
Virginia Rail				6.0	104.6				0.6
Sora					104.6				0.6
Yellow-billed Cuckoo				16.6					
Long-eared Owl	276.8			16.6			162.9		0.6
Belted Kingfisher				16.6		2.2		32.5	0.6
Nuttall's Woodpecker				16.6					
Willow Flycatcher				16.6					0.6
Warbling Vireo				16.6					
Tree Swallow	276.8			16.6	104.6	2.2	162.9	34.9	0.6
Marsh Wren					104.6				0.6
Yellow Warbler				16.6					
Yellow-breasted Chat				10.0					
Blue Grosbeak	276.8			11.6					
Owens Valley Vole	276.8	1.6			104.6		162.9		0.6

Indicator Species Table 34, Continued, Total Acreage of Suitable Habitat for Indicator Species by Habitat Type by Reach

REACH 3

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				28.6	302.6	25.7		51.1	
Least Bittern				54.1	302.6	25.6		51.0	
Great Blue Heron	40.6			39.6	302.6	25.6	881.5	51.1	24.9
Northern Harrier	39.2	213.1	53.7		302.6	25.6	881.5	51.1	22.6
Red-shouldered Hawk	39.2			100.8	302.6		881.5		24.9
Swainson's Hawk	39.2		53.7				881.5		24.9
Virginia Rail				34.4	302.6				24.9
Sora					302.6				24.9
Yellow-billed Cuckoo				101.1					
Long-eared Owl	39.2			101.1			881.5		24.9
Belted Kingfisher				101.1		25.6		51.0	24.9
Nuttall's Woodpecker				100.8					
Willow Flycatcher				101.1					24.9
Warbling Vireo				101.1					
Tree Swallow	39.2			101.0	302.6	25.6	881.5	51.1	24.9
Marsh Wren					302.6				24.9
Yellow Warbler				101.1					
Yellow-breasted Chat				61.3					
Blue Grosbeak	39.2			64.6					
Owens Valley Vole	39.2	1.5			302.6		881.5		24.9

REACH 4

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				12.4	479.2	4.3		53.4	
Least Bittern				60.3	479.2	4.3		53.4	
Great Blue Heron				12.4	479.2	4.3	534.1	53.4	8.1
Northern Harrier		147.2	5.7	0.4	479.2	4.3	534.1	53.4	8.1
Red-shouldered Hawk				97.6	479.2		534.1		8.1
Swainson's Hawk			5.7				534.1		8.1
Virginia Rail				8.0	479.2				8.1
Sora					479.2				8.1
Yellow-billed Cuckoo				97.2					
Long-eared Owl				97.6			534.1		8.1
Belted Kingfisher				97.6		4.3		53.4	8.1
Nuttall's Woodpecker				97.6					
Willow Flycatcher				97.6					8.1
Warbling Vireo				97.6					
Tree Swallow				97.5	479.2	4.3	534.1	53.4	8.1
Marsh Wren					479.2				8.1
Yellow Warbler				97.6					
Yellow-breasted Chat				84.8					
Blue Grosbeak				85.2					
Owens Valley Vole		1.1			479.2		534.1		8.1

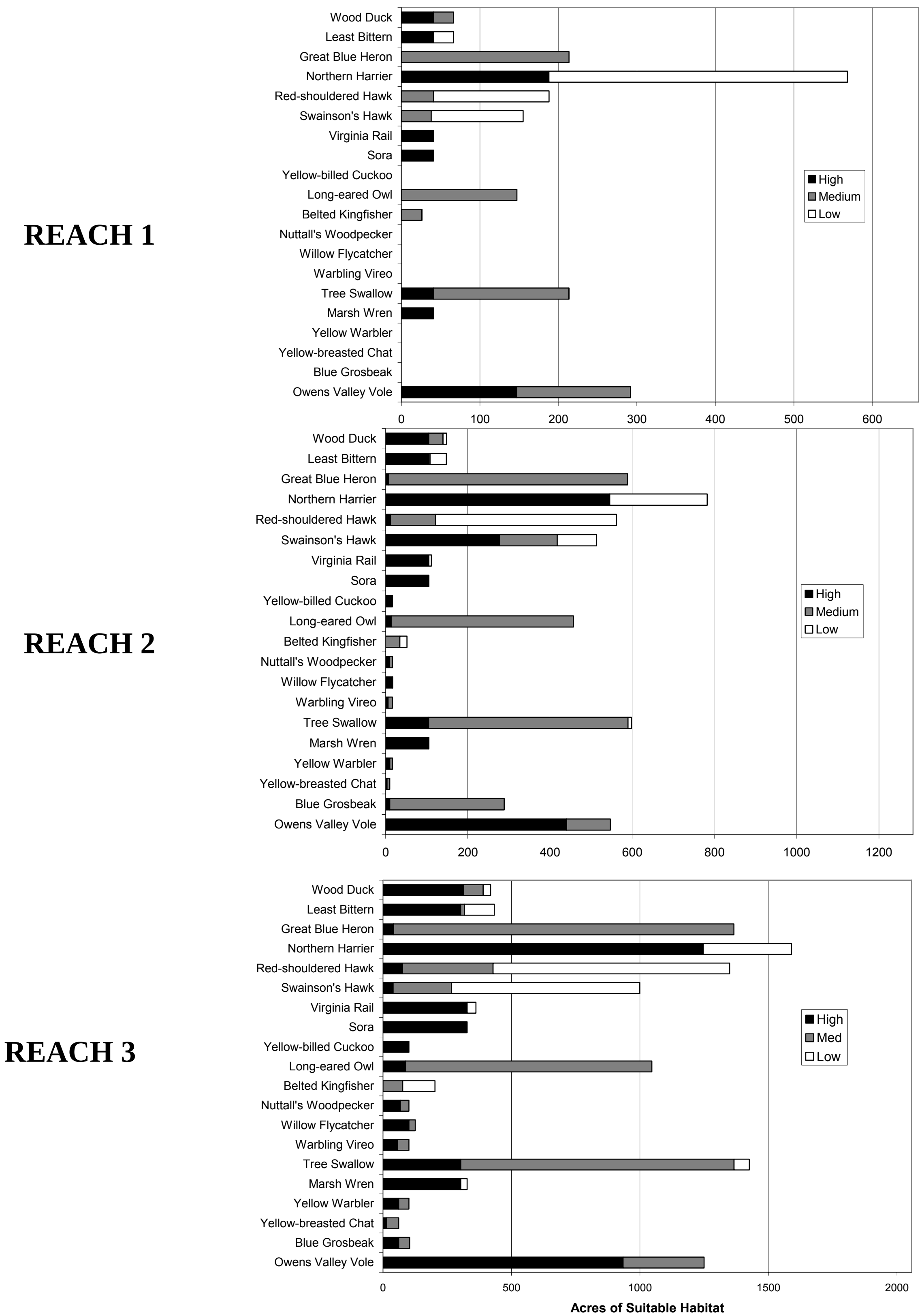
Indicator Species Table 34. Continued, Total Acreage of Suitable Habitat for Indicator Species by Habitat Type by Reach

REACH 5

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				8.2	52.2	1.9		22.7	
Least Bittern				13.4	52.2	1.9		22.7	
Great Blue Heron				8.2	52.2	1.9	254.7	22.7	7.7
Northern Harrier		35.9	1.3		52.2	1.9	254.7	22.7	7.7
Red-shouldered Hawk				22.5	52.2		254.7		7.7
Swainson's Hawk			1.3				254.7		7.7
Virginia Rail				4.4	52.2				7.7
Sora					52.2				7.7
Yellow-billed Cuckoo				22.5					
Long-eared Owl				22.5			254.7		7.7
Belted Kingfisher				22.5		1.9		22.7	7.7
Nuttall's Woodpecker				22.5					
Willow Flycatcher				22.5					7.7
Warbling Vireo				22.5					
Marsh Wren					52.2				7.7
Tree Swallow				22.5	52.2	1.9	254.7	22.7	7.7
Yellow-breasted Chat				14.3					
Yellow Warbler				22.5					
Blue Grosbeak				14.3					
Owens Valley Vole					52.2		254.7		7.7

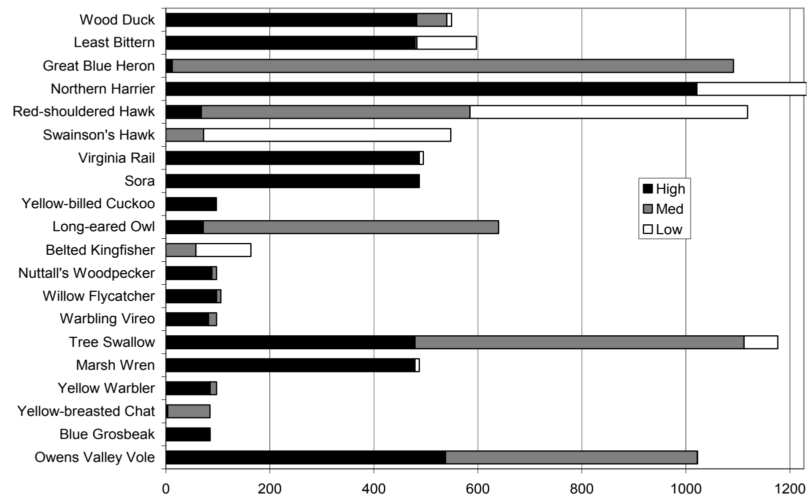
REACH 6

Species	AGS	ASC	BAR	DRI	FEW	LAC	PGS	RIV	WTM
Wood Duck				45.9	156.1	3.5		41.6	
Least Bittern				19.6	156.1	3.5		41.6	
Great Blue Heron				45.9	156.1	3.5	473.6	41.6	11.4
Northern Harrier		229.1	12.8	0.0	156.1	3.5	473.6	41.6	11.4
Red-shouldered Hawk				69.5	156.1		473.6		11.4
Swainson's Hawk			12.8				473.6		11.4
Virginia Rail				18.2	156.1				
Sora					156.1				11.4
Yellow-billed Cuckoo				69.5					
Long-eared Owl				69.5			473.6		11.4
Belted Kingfisher				69.5		3.5		41.6	11.4
Nuttall's Woodpecker				69.6					
Willow Flycatcher				69.5					11.4
Warbling Vireo				69.5					
Tree Swallow				69.5	156.1	3.5	473.6	41.6	11.4
Marsh Wren					156.1				11.4
Yellow Warbler				69.5					
Yellow-breasted Chat				23.6					
Blue Grosbeak				23.6					
Owens Valley Vole		36.4			156.1		473.6		11.4

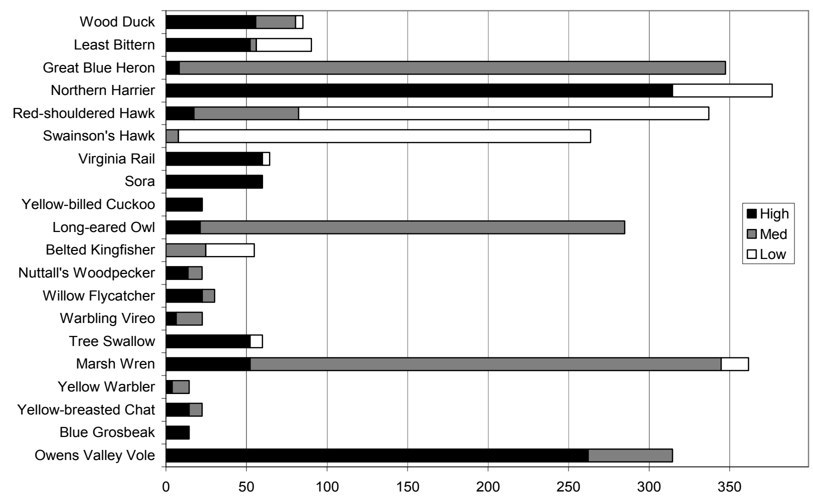


Indicator Species Figure 25. Total Acreage of Low, Medium and High Suitability Habitats for Each Habitat Indicator Species by LORP Reach

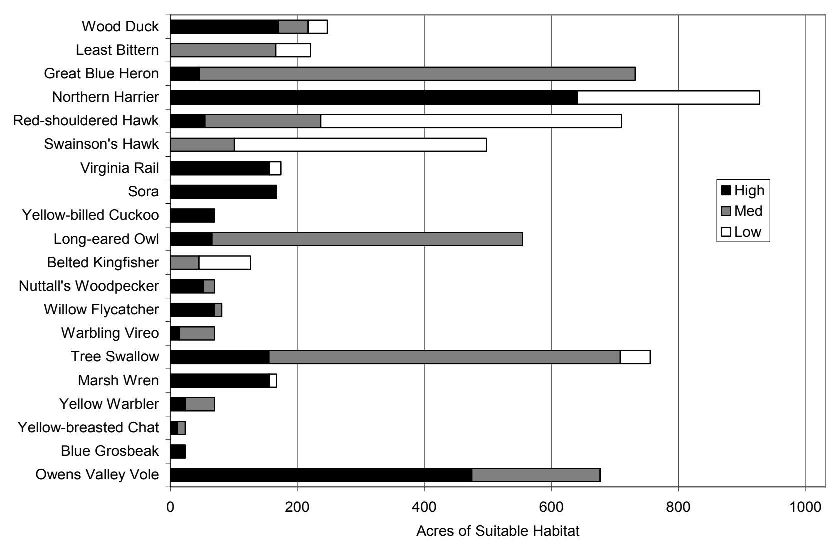
REACH 4



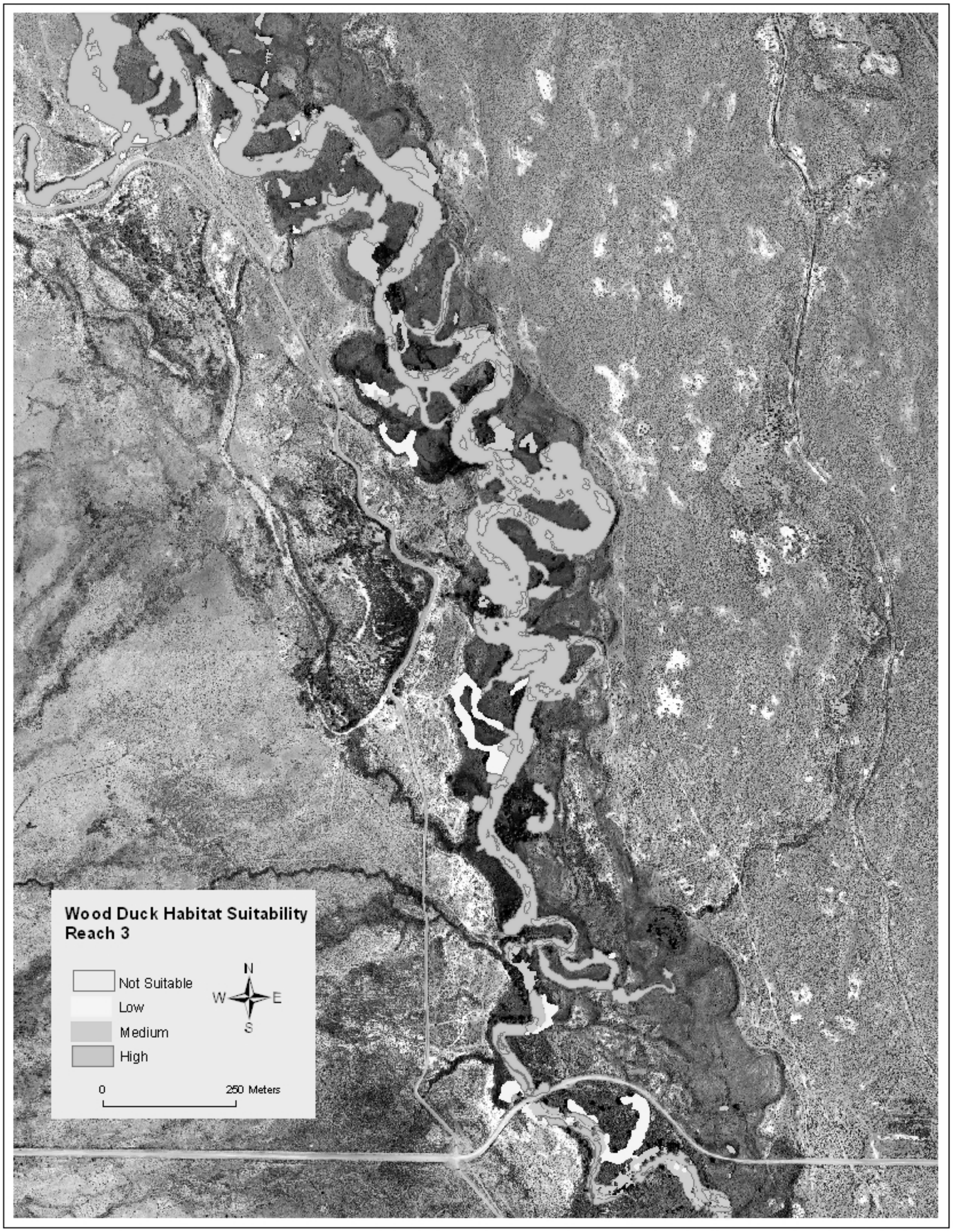
REACH 5



REACH 6



Indicator Species Figure 25. Continued, Total Acreage of Low, Medium and High Suitability Habitats for Each Habitat Indicator Species by LORP Reach

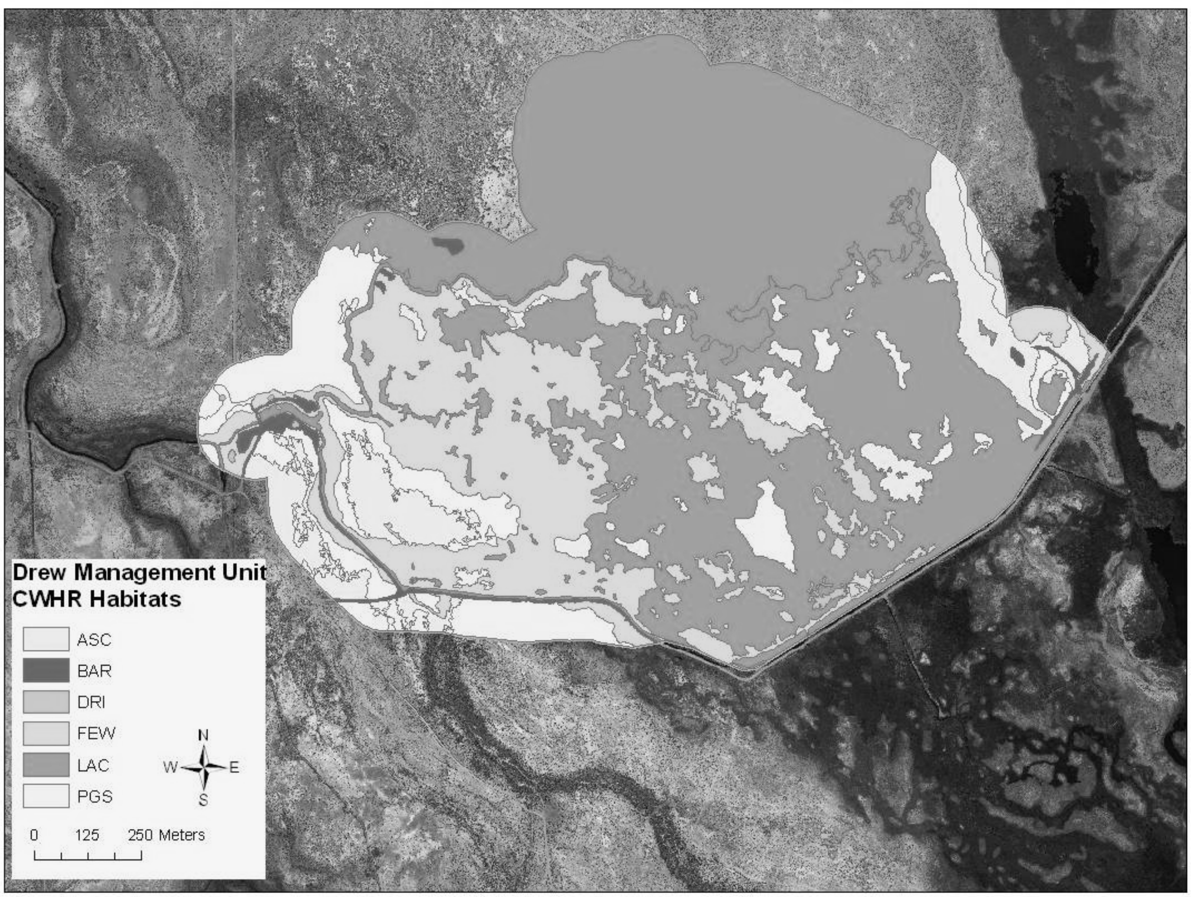


Indicator Species Figure 26. Example of Habitat Suitability Map for Wood Duck within Reach 3

8.3.4 Results - Blackrock Waterfowl Management Area

Drew Management Unit

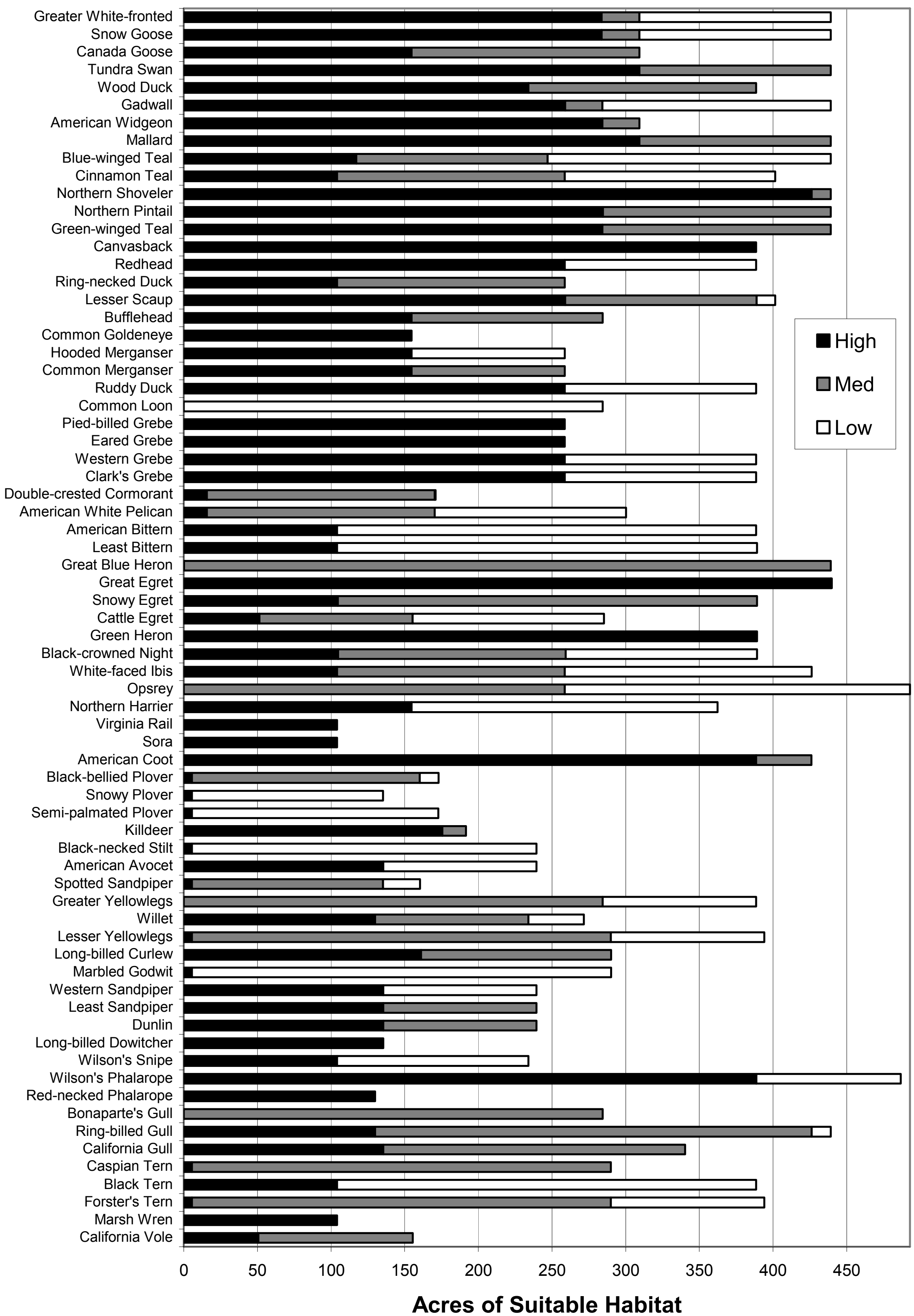
Indicator Species Figure 27 shows the distribution of CWHR habitats in the Drew Management Unit. Lacustrine habitat was abundant in this unit. Along the southeastern border, the lacustrine habitat was classified under CWHR as submerged, while the habitat along the northeast border was classified as intermittently flooded lacustrine with mud substrate, as this area was flooded to varying depths and extent while Drew has been in active status. Fresh Emergent Wetland habitat (Marsh) was more abundant in the western portion of the unit. Indicator Species Table 33 shows the total acreage of low, medium and high suitability habitat by indicator species. Based on the model output, Lacustrine, Fresh Emergent Wetland, and Perennial Grassland habitats provide most of the suitable acreage in the unit. Indicator Species Figure 28 show the proportion of the total habitat classified as low, medium or high suitability for each Habitat Indicator Species. Drew provides the greatest amount of suitable habitat for waterfowl. In general, most of the habitat for waterfowl indicator species is of high suitability. Habitat for grebes was primarily of high suitability. Habitat for bitterns consists of primarily low with lesser amounts of high suitability areas. A mix of low, medium, and high suitability habitats are available for wading birds, while habitat for rail species was overwhelmingly rated as highly suitable. Suitable habitat existed for all shorebird indicator species, but the quality varied by species. Suitable habitat for gulls and terns was abundant and generally medium to high. All available habitat for Marsh Wren was rated as high suitability, while vole habitat was rated as high and medium suitability.



Indicator Species Figure 27. CWHR Habitats in the Drew Management Unit

Indicator Species Table 35. Total Acreage of Suitable Habitat for Indicator Species – Drew Management Unit

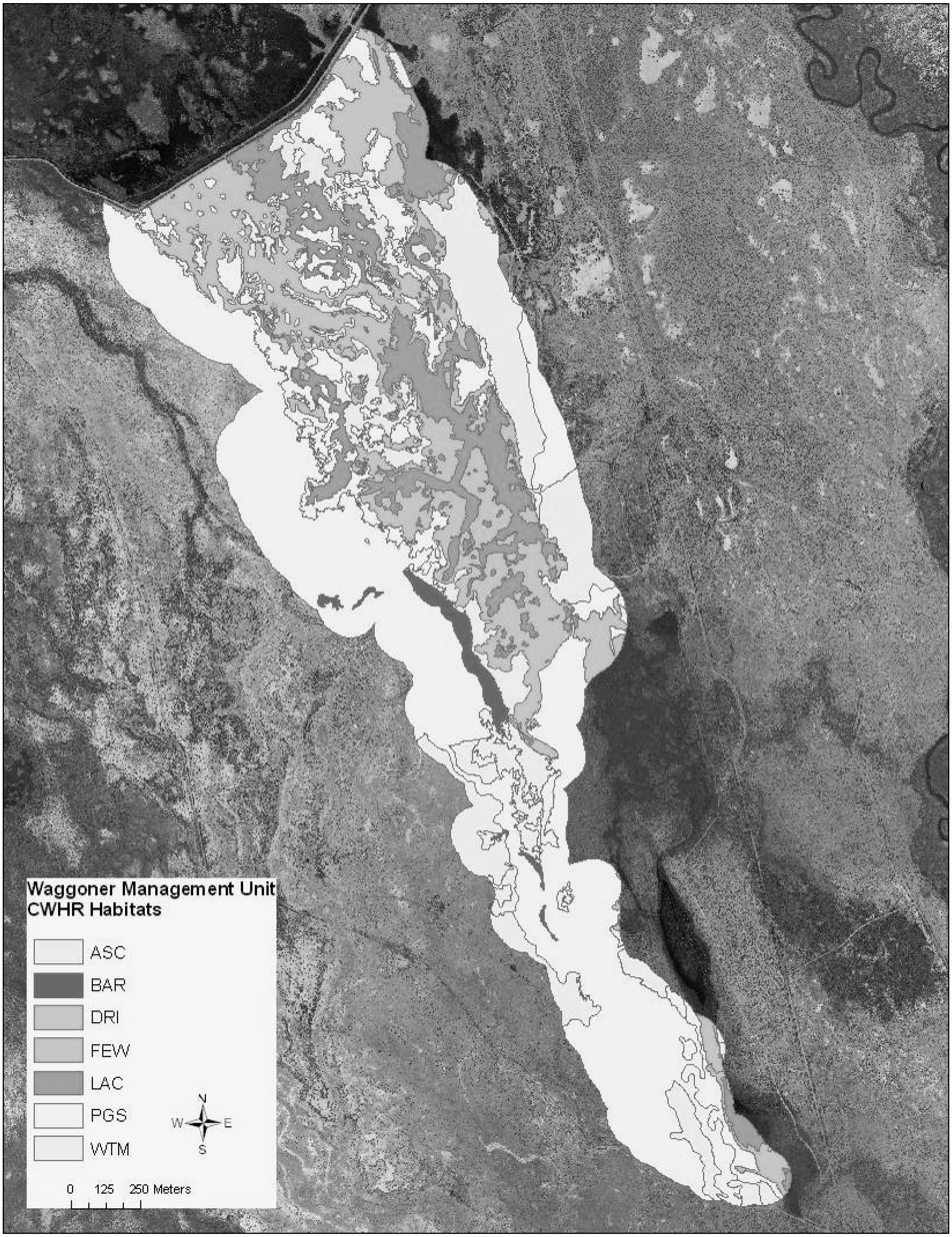
	CWHR HABITAT					
SPECIES	ASC	BAR	DRI	FEW	LAC	PGS
Greater White-fronted Goose				104.1	284.5	50.7
Snow Goose				104.1	284.5	50.7
Canada Goose				104.1	154.6	50.7
Tundra Swan				104.1	284.5	50.7
Wood Duck				104.1	284.5	
Gadwall				104.1	284.5	50.7
American Widgeon				104.1	154.6	50.7
Mallard				104.1	284.5	50.7
Blue-winged Teal				104.1	284.5	50.7
Cinnamon Teal				104.1	284.5	13.0
Northern Shoveler				104.1	284.5	50.7
Northern Pintail				104.1	284.5	50.7
Green-winged Teal				104.1	284.5	50.7
Canvasback				104.1	284.5	
Redhead				104.1	284.5	
Ring-necked Duck				104.1	154.6	
Lesser Scaup				104.1	284.5	13.0
Bufflehead					284.5	
Common Goldeneye					154.6	
Hooded Merganser				104.1	154.6	
Common Merganser				104.1	154.6	
Ruddy Duck				104.1	284.5	
Common Loon					284.5	
Pied-billed Grebe				104.1	154.6	
Eared Grebe				104.1	154.6	
Western Grebe				104.1	284.5	
Clark's Grebe				104.1	284.5	
Double-crested Cormorant		5.5	0.7		154.6	
American White Pelican		5.5			284.5	
American Bittern				104.1	284.5	
Least Bittern			0.6	104.1	284.5	
Great Blue Heron			0.1	104.1	284.5	50.7
Great Egret			0.7	104.1	284.5	50.7
Snowy Egret			0.6	104.1	284.5	
Cattle Egret			0.7	104.1	129.9	50.7
Green Heron			0.7	104.1	284.5	
Black-crowned Night Heron			0.7	104.1	284.5	
White-faced Ibis				104.1	284.5	37.7
Opsrey	47.6	5.5	0.7	104.1	284.5	50.7
Northern Harrier	47.6	5.5		104.1	154.6	50.7
Virginia Rail				104.1		
Sora				104.1		
American Coot				104.1	284.5	37.5
Black-bellied Plover		5.5			129.9	37.7
Snowy Plover		5.5			129.9	
Semi-palmated Plover		5.5			129.9	37.5
Killdeer	18.6	5.5			129.9	37.5
Black-necked Stilt		5.5		104.1	129.9	
American Avocet		5.5		104.1	129.9	
Spotted Sandpiper		5.5			129.9	25.0
Greater Yellowlegs				104.1	284.5	
Willet				104.1	129.9	37.7
Lesser Yellowlegs		5.5		104.1	284.5	
Long-billed Curlew		5.5		104.1	129.9	50.7
Marbled Godwit		5.5		104.1	129.9	50.7
Western Sandpiper		5.5		104.1	129.9	
Least Sandpiper		5.5		104.1	129.9	
Dunlin		5.5		104.1	129.9	
Long-billed Dowitcher		5.5			129.9	
Wilson's Snipe				104.1	129.9	
Wilson's Phalarope	47.6			104.1	284.5	50.7
Red-necked Phalarope					129.9	
Bonapart'es Gull					284.5	
Ring-billed Gull					104.1	284.5
California Gull		5.5			284.5	50.4
Caspian Tern		5.5			284.5	
Black Tern				104.1	284.5	
Forster's Tern		5.5		104.1	284.5	
Marsh Wren				104.1		
California Vole	0.7			104.1		50.7



Indicator Species Figure 28. Total Acreage of Low, Medium and High Suitability Habitats for Habitat Indicator Species in Drew Management Unit

Waggoner Management Unit

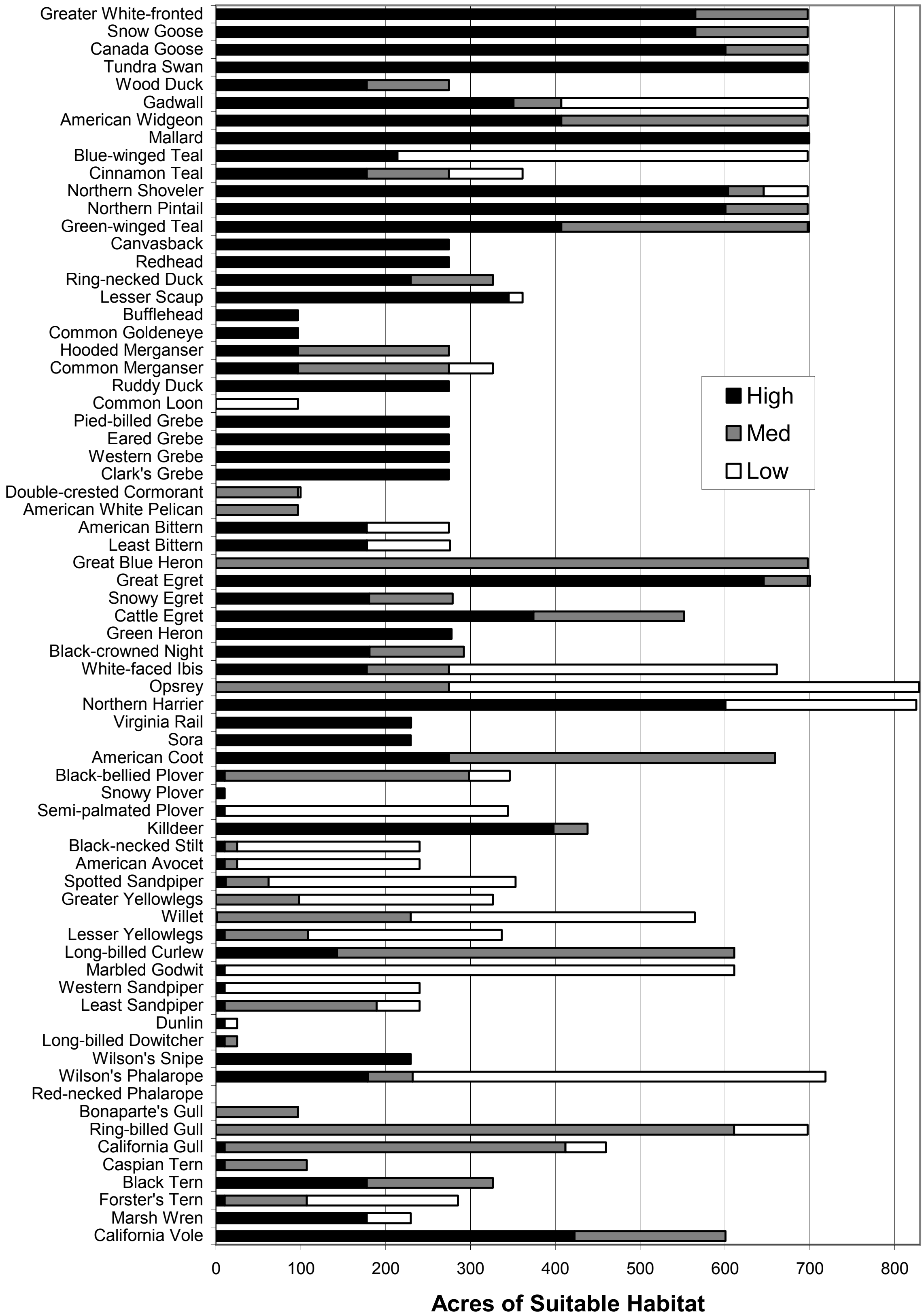
Indicator Species Figure 29 shows the distribution of CWHR habitats in the Waggoner Management Unit. This unit contained primarily Perennial Grassland, Fresh Emergent Wetland, and Lacustrine habitat. Wet Meadow was also mapped in this unit, whereas this habitat type was absent in Drew. The wetland habitats were distributed throughout the unit, while Perennial Grassland and shrub habitats were primarily along the borders of the unit. Some of the area mapped as Perennial Grassland was also intermittently flooded when bird surveys were being conducted in summer and fall 2010. Indicator Species Table 34 shows the total acreage of low, medium and high suitability habitat by indicator species. Based on the model output, Fresh Emergent Wetland, Perennial Grassland, Lacustrine, and Wet Meadow habitats provide most of the suitable acreage in the unit. Lacustrine habitat was less abundant while grassland habitats were more abundant than in the Drew Unit. Indicator Species Figure 30 show the proportion of the total habitat that was classified as low, medium or high suitability for each Habitat Indicator Species. In general, most of the habitat for waterfowl species is of high suitability. Habitat for grebes was primarily of high suitability, while the habitat available for loons was of low suitability. Habitat for bitterns consists of primarily high with lesser amounts of low suitability areas. A mix of low, medium, and high suitability habitats are available for wading birds, while habitat for rail species was primarily rated as highly suitable. Suitable habitat existed for all shorebird indicator species except Snowy Plover and Red-necked Phalarope, but the quality varied by species. As compared to the Drew Unit, there was less available habitat for shorebirds and it was of lower suitability. Suitable habitat for gulls and terns was primarily of medium to low suitability. Available habitat for Marsh Wren was rated as high and low suitability, while vole habitat was rated as high and medium suitability.



Indicator Species Figure 29. CWHR Habitats in the Waggoner Management Unit

Indicator Species Table 36. Total Acreage of Suitable Habitat for Indicator Species – Waggoner Management Unit

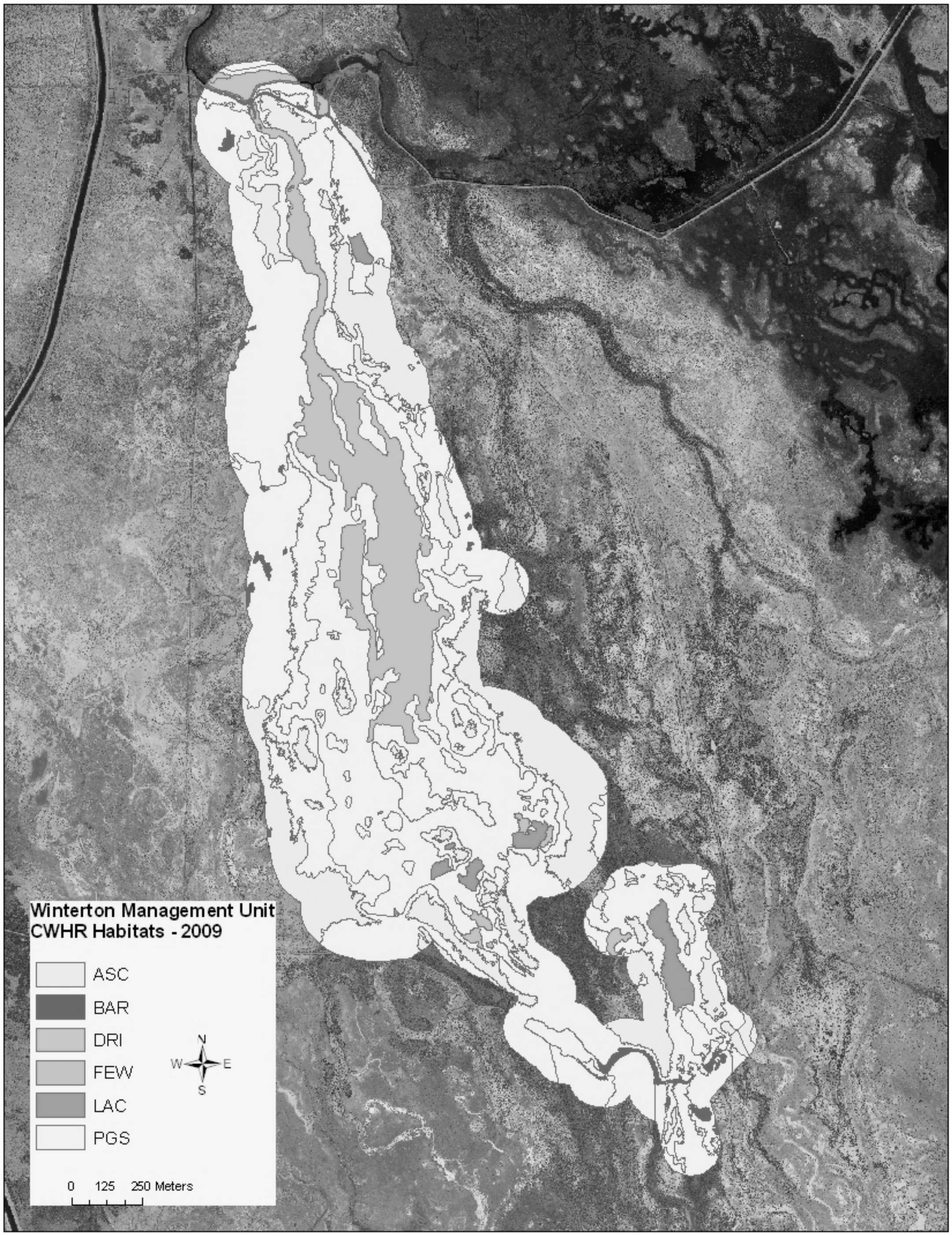
	CWHR HABITAT							
SPECIES	AGS	ASC	BAR	DRI	FEW	LAC	PGS	WTM
Greater White-fronted Goose	1.0				177.9	96.9	369.9	51.7
Snow Goose	1.0				177.9	96.9	369.9	51.7
Canada Goose	1.0				177.9	96.9	369.9	51.7
Tundra Swan	1.0				177.9	96.9	369.9	51.7
Wood Duck	1.0				177.9	96.9		
Gadwall	1.0				177.9	96.9	369.9	51.7
American Widgeon	1.0				177.9	96.9	369.9	51.7
Mallard				1.9	177.9	96.9	369.9	51.7
Blue-winged Teal	1.0				177.9	96.9	369.9	51.7
Cinnamon Teal					177.9	96.9	36.1	50.6
Northern Shoveler	1.0				177.9	96.9	369.9	51.7
Northern Pintail	1.0				177.9	96.9	369.9	51.7
Green-winged Teal	1.0			1.7	177.9	96.9	369.9	51.7
Canvasback					177.9	96.9		
Redhead					177.9	96.9		
Ring-necked Duck					177.9	96.9		51.7
Lesser Scaup					177.9	96.9	36.1	50.6
Bufflehead						96.9		
Common Goldeneye						96.9		
Hooded Merganser					177.9	96.9		
Common Merganser					177.9	96.9		51.7
Ruddy Duck					177.9	96.9		
Common Loon						96.9		
Pied-billed Grebe					177.9	96.9		
Eared Grebe					177.9	96.9		
Western Grebe					177.9	96.9		
Clark's Grebe					177.9	96.9		
Double-crested Cormorant			10.4	2.9		96.9		
American White Pelican			10.4			96.9		
American Bittern					177.9	96.9		
Least Bittern				1.3	177.9	96.9		
Great Blue Heron	1.0			0.2	177.9	96.9	369.9	51.7
Great Egret	1.0			2.9	177.9	96.9	369.9	51.7
Snowy Egret				3.0	177.9	96.9		1.1
Cattle Egret	1.0			3.1	177.9		369.9	
Green Heron				3.1	177.9	96.9		
Black-crowned Night Heron				3.1	177.9	96.9		14.4
White-faced Ibis	1.0				177.9	96.9	333.8	51.7
Opsrey	1.0	117.8	10.4	3.1	177.9	96.9	369.9	51.7
Northern Harrier	1.0	117.8	10.4		177.9	96.9	369.9	51.7
Virginia Rail				0.2	177.9			51.7
Sora					177.9			51.7
American Coot					177.9	96.9	332.7	51.7
Black-bellied Plover	1.0		10.4				45.7	1.1
Snowy Plover			10.4					
Semi-palmated Plover			10.4				332.7	1.1
Killdeer		99.4	10.4				327.0	1.1
Black-necked Stilt			10.4		177.9			51.7
American Avocet			10.4		177.9			51.7
Spotted Sandpiper			10.4	1.7			289.3	
Greater Yellowlegs					177.9	96.9		51.7
Willet	1.0				177.9	333.8		51.7
Lesser Yellowlegs			10.4		177.9	96.9		51.7
Long-billed Curlew	1.0		10.4		177.9		369.9	51.7
Marbled Godwit	1.0		10.4		177.9		369.9	51.7
Western Sandpiper			10.4		177.9			51.7
Least Sandpiper			10.4		177.9			51.7
Dunlin			10.4					14.4
Long-billed Dowitcher			10.4					14.4
Wilson's Snipe					177.9			51.7
Wilson's Phalarope	1.0	117.8			177.9	96.9	369.9	51.7
Red-necked Phalarope								
Bonapart'es Gull						96.9		
Ring-billed Gull	1.0				177.9	96.9	369.9	51.7
California Gull	1.0		10.4			96.9	337.0	14.4
Caspian Tern			10.4			96.9		
Black Tern					177.9	96.9		51.7
Forster's Tern			10.4		177.9	96.9		
Marsh Wren					177.9			51.7
California Vole	1.0				177.9		369.9	51.7



Indicator Species Figure 30. Total Acreage of Low, Medium and High Suitability Habitats for Habitat Indicator Species in Waggoner Management Unit

Winterton Management Unit

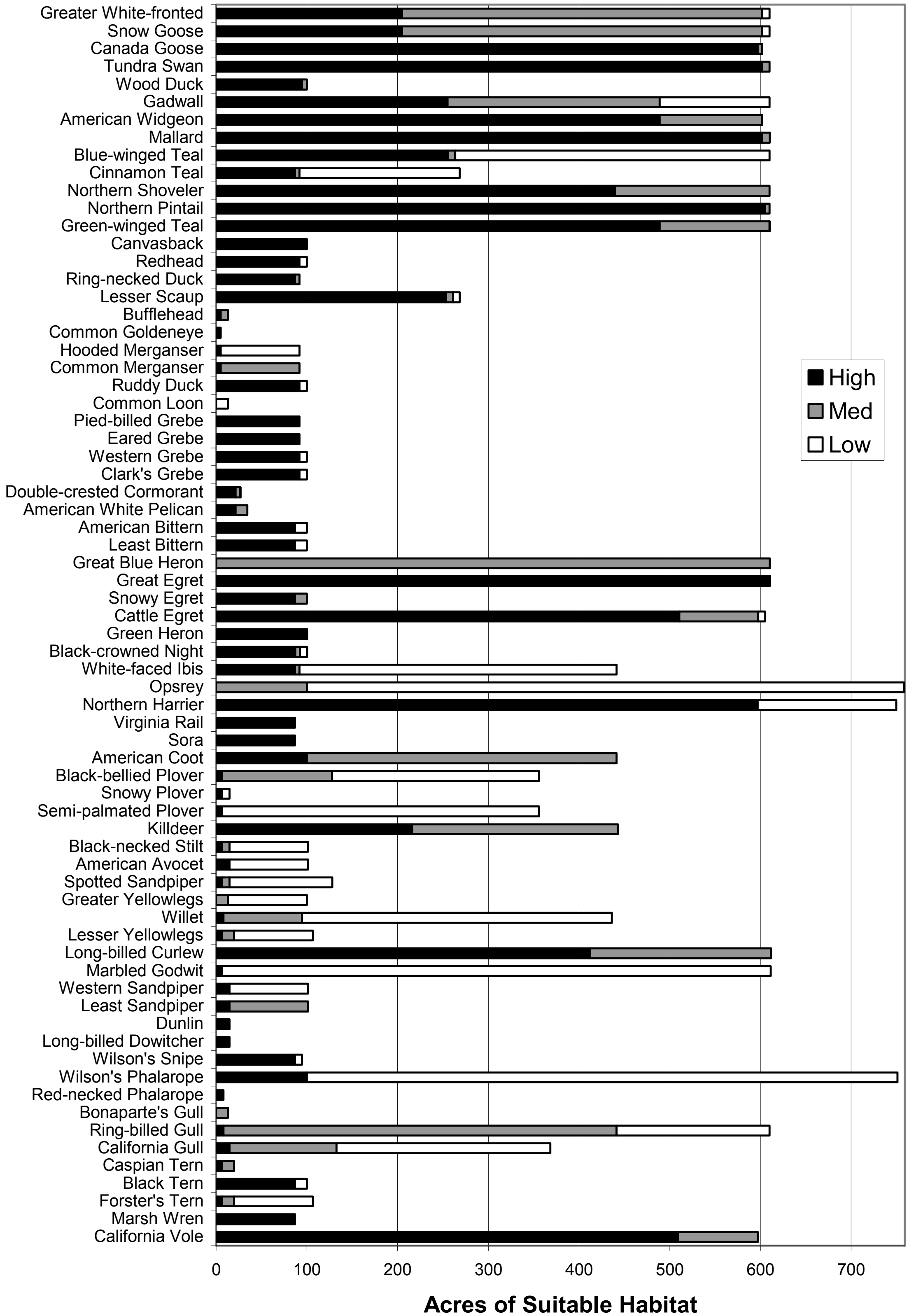
Indicator Species Figure 31 shows the distribution of CWHR habitats in the Winterton Management Unit. This unit contained primarily Perennial Grassland and Fresh Emergent Wetland. Only a small amount of Lacustrine was present, with surface water present only intermittently. Indicator SpeciesTable 35 shows the total acreage of low, medium and high suitability habitat by indicator species. Based on the model output, the Perennial Grassland and Fresh Emergent Wetland habitats provide most of the suitable acreage in the unit. Indicator Species Figure 32 shows the proportion of the total habitats that was classified as low, medium or high suitability for each Habitat Indicator Species. In general, most of the habitat that is available for waterfowl is of high suitability. The cover of perennial grassland polygons in the Winterton Unit were largely classified as moderate to dense, which is of high suitability for a number of waterfowl species for cover and nesting. The lack of surface water in this unit, since it is in “inactive” status, realistically reduces the current value of these grasslands. Little quality habitat is available for other waterbird species. Abundant high suitability habitat is currently available for Northern Harrier and California Vole. Northern Harrier is believed to have nested at Winterton in 2010, and were seen on every bird survey. Owens Valley Vole sign has been seen at Winterton also, confirming their presence.



Indicator Species Figure 31. CWHR Habitats in the Winterton Management Unit

Indicator Species Table 37. Total Acreage of Suitable Habitat for Indicator Species – Winterton Management Unit

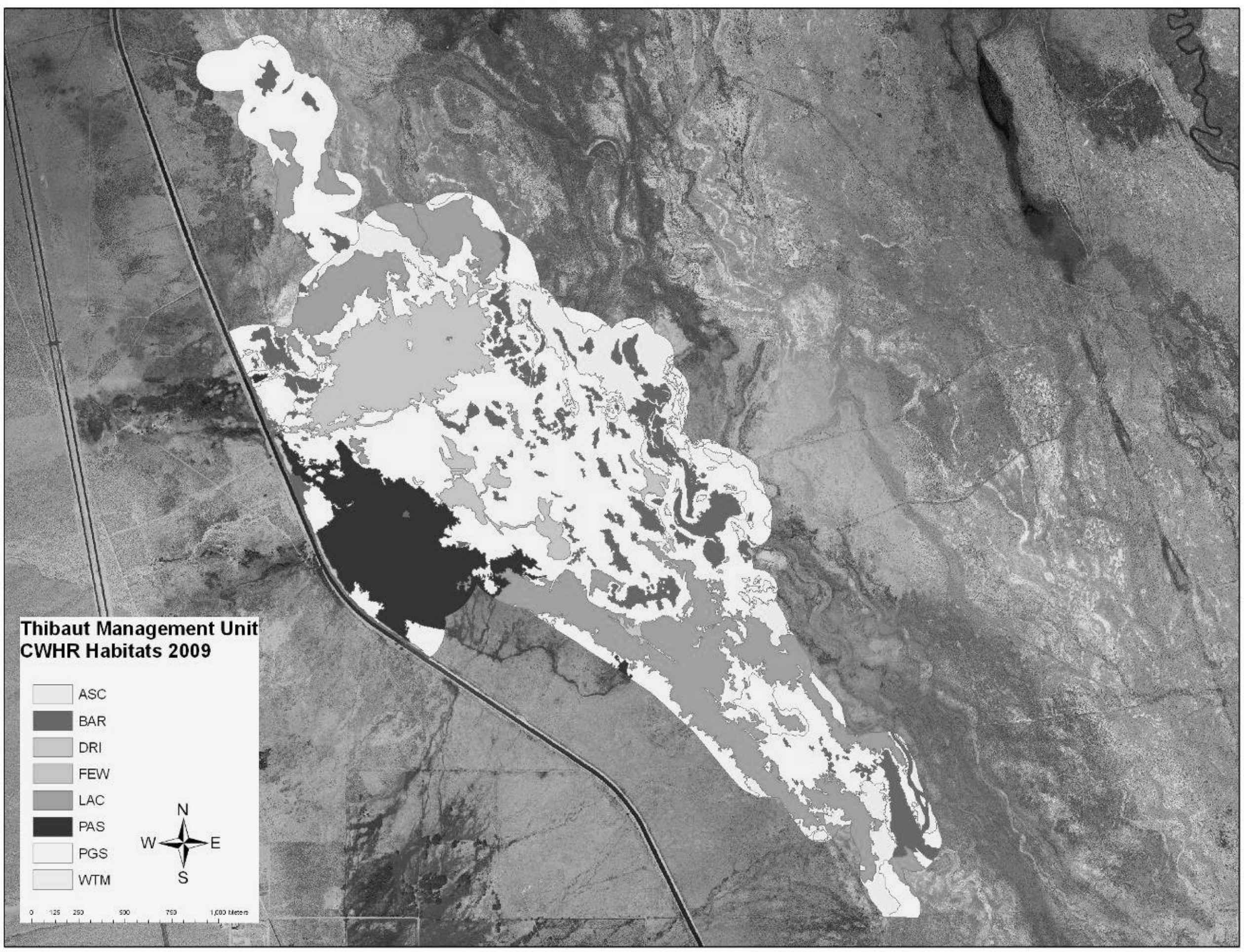
	CWHR HABITAT					
SPECIES	ASC	BAR	DRI	FEW	LAC	PGS
Greater White-fronted Goose				86.8	13.1	510.0
Snow Goose				86.8	13.1	510.0
Canada Goose				86.8	5.1	510.0
Tundra Swan				86.8	13.1	510.0
Wood Duck				86.8	13.1	
Gadwall				86.8	13.1	510.0
American Widgeon				86.8	5.1	510.0
Mallard			0.4	86.8	13.1	510.0
Blue-winged Teal				86.8	13.1	510.0
Cinnamon Teal				86.8	13.1	168.6
Northern Shoveler				86.8	13.1	510.0
Northern Pintail				86.8	13.1	510.0
Green-winged Teal			0.3	86.8	13.1	510.0
Canvasback				86.8	13.1	
Redhead				86.8	13.1	
Ring-necked Duck				86.8	5.1	
Lesser Scaup				86.8	13.1	168.6
Bufflehead					13.1	
Common Goldeneye					5.1	
Hooded Merganser				86.8	5.1	
Common Merganser				86.8	5.1	
Ruddy Duck				86.8	13.1	
Common Loon					13.1	
Pied-billed Grebe				86.8	5.1	
Eared Grebe				86.8	5.1	
Western Grebe				86.8	13.1	
Clark's Grebe				86.8	13.1	
Double-crested Cormorant		6.6			5.1	
American White Pelican		6.6			13.1	
American Bittern				86.8	13.1	
Least Bittern			0.1	86.8	13.1	
Great Blue Heron			0.4	86.8	13.1	510.0
Great Egret			0.4	86.8	13.1	510.0
Snowy Egret			0.1	86.8	13.1	
Cattle Egret			0.5	86.8	8.0	510.0
Green Heron			0.5	86.8	13.1	
Black-crowned Night Heron			0.5	86.8	13.1	
White-faced Ibis				86.8	13.1	341.4
Opsrey	141.1	6.6	0.5	86.8	13.1	510.0
Northern Harrier	141.1	6.6		86.8	5.1	510.0
Virginia Rail			0.1	86.8		
Sora				86.8		
American Coot				86.8	13.1	341.4
Black-bellied Plover		6.6			8.0	341.4
Snowy Plover		6.6			8.0	
Semi-palmated Plover		6.6			8.0	341.4
Killdeer	88.6	6.6			8.0	339.7
Black-necked Stilt		6.6		86.8	8.0	
American Avocet		6.6		86.8	8.0	
Spotted Sandpiper		6.6	0.3		8.0	113.0
Greater Yellowlegs				86.8	13.1	
Willet				86.8	8.0	341.4
Lesser Yellowlegs		6.6		86.8	13.1	
Long-billed Curlew		6.6		86.8	8.0	510.0
Marbled Godwit		6.6		86.8	8.0	510.0
Western Sandpiper		6.6		86.8	8.0	
Least Sandpiper		6.6		86.8	8.0	
Dunlin		6.6			8.0	
Long-billed Dowitcher		6.6			8.0	
Wilson's Snipe				86.8	8.0	
Wilson's Phalarope	141.1			86.8	13.1	510.0
Red-necked Phalarope					8.0	
Bonaparte's Gull					13.1	
Ring-billed Gull				86.8	13.1	510.0
California Gull		6.6			13.1	348.6
Caspian Tern		6.6			13.1	
Forster's Tern		6.6		86.8	13.1	
Black Tern				86.8	13.1	
Marsh Wren				86.8		
California Vole	0.3			86.8		510.0



Indicator Species Figure 32. Total Acreage of Low, Medium and High Suitability Habitats for Habitat Indicator Species in Winterton Management Unit

Thibaut Management Unit

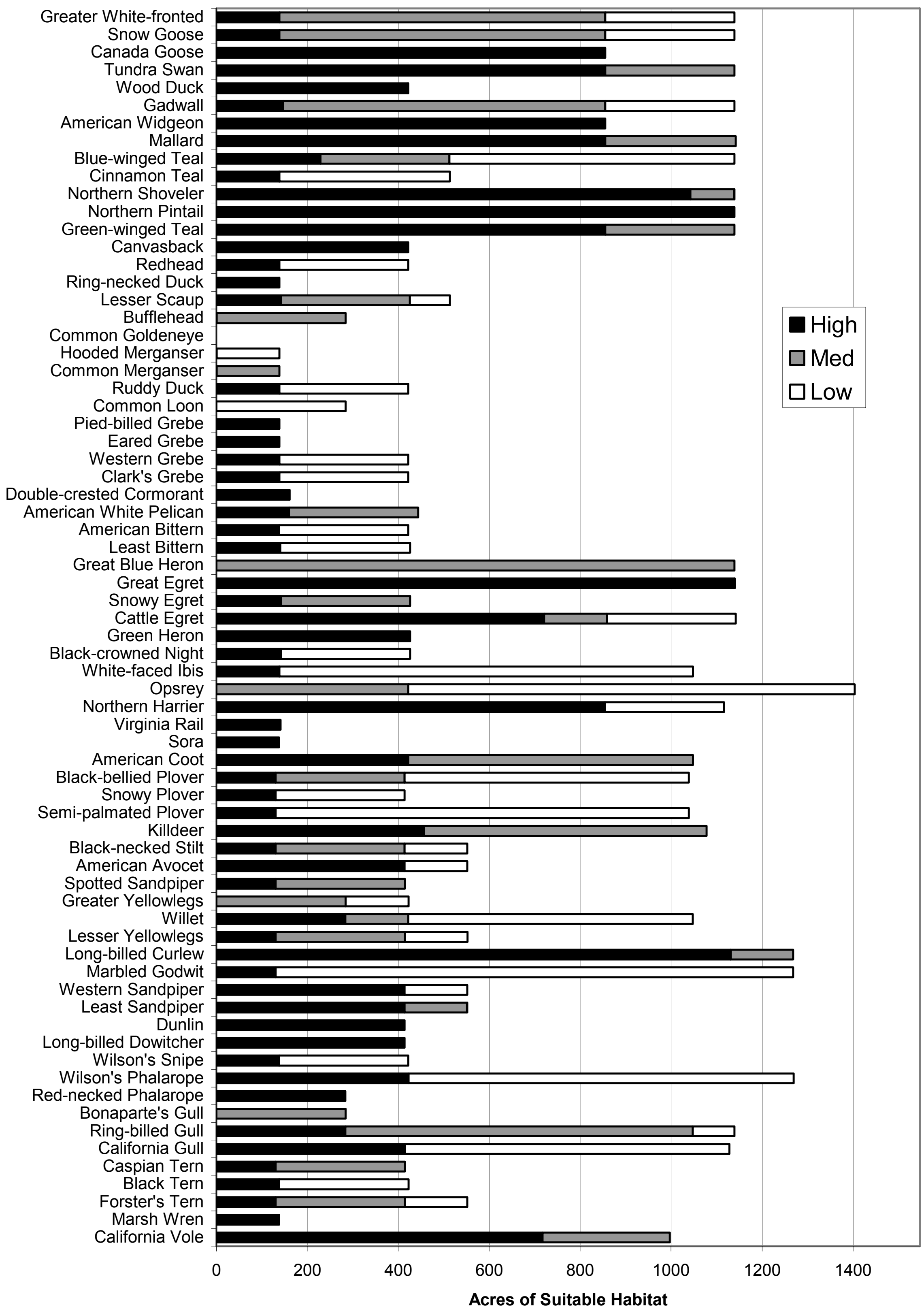
Indicator Species Figure 33 shows the distribution of CWHR habitats in the Thibaut Management Unit. This unit contains primarily Perennial Grassland, intermittently flooded Lacustrine, and Fresh Emergent Wetland. Indicator Species Table 36 shows the total acreage of low, medium, and high suitability habitat by indicator species. Based on the model output, the Perennial Grassland, Lacustrine, and Fresh Emergent Wetland habitats provide most of the suitable acreage in the unit. Indicator Species Figure 34 shows the proportion of the total habitats that were classified as low, medium or high suitability for each indicator species. This unit provides the most suitable habitat for waterfowl, (primarily dabbling duck species), wading birds, and shorebirds.



Indicator Species Figure 33. CWHR Habitats in the Thibaut Management Unit

Indicator Species Table 38. Total Acreage of Suitable Habitat for Indicator Species – Thibaut Management Unit

	CWHR HABITAT							
SPECIES	ASC	BAR	DRI	FEW	LAC	PAS	PGS	WTM
Greater White-fronted Goose				137.7	284.3		716.6	0.5
Snow Goose				137.7	284.3		716.6	0.5
Canada Goose				137.7	0.5		716.6	0.5
Tundra Swan				137.7	284.3		716.6	0.5
Wood Duck				137.7	284.3			
Gadwall				137.7	284.3		716.6	0.5
American Widgeon				137.7	0.5		716.6	0.5
Mallard			3.0	137.7	284.3		716.6	0.5
Blue-winged Teal				137.7	284.3		716.6	0.5
Cinnamon Teal				137.7	284.3		91.1	0.5
Northern Shoveler				137.7	284.3		716.6	0.5
Northern Pintail				137.7	284.3		716.6	0.5
Green-winged Teal				137.7	284.3		716.6	0.5
Canvasback				137.7	284.3			
Redhead				137.7	284.3			
Ring-necked Duck				137.7	0.5			0.5
Lesser Scaup				137.7	284.3		91.1	0.5
Bufflehead					284.3			
Common Goldeneye					0.5			
Hooded Merganser				137.7	0.5			
Common Merganser				137.7	0.5			0.5
Ruddy Duck				137.7	284.3			
Common Loon					284.3			
Pied-billed Grebe				137.7	0.5			
Eared Grebe				137.7	0.5			
Western Grebe				137.7	284.3			
Clark's Grebe				137.7	284.3			
Double-crested Cormorant		130.0	1.0		0.5			
American White Pelican		130.0			284.3			
American Bittern				137.7	284.3			
Least Bittern			3.9	137.7	284.3			
Great Blue Heron			0.1	137.7	284.3		716.6	0.5
Great Egret			1.0	137.7	284.3		716.6	0.5
Snowy Egret			3.9	137.7	284.3			
Cattle Egret			4.1	137.7	283.7		716.6	
Green Heron			4.1	137.7	284.3			
Black-crowned Night Heron			4.1	137.7	284.3			
White-faced Ibis				137.7	284.3		625.5	0.5
Opsrey	130.6	130.0	4.1	137.7	284.3		716.6	0.5
Northern Harrier	130.6	130.0		137.7	0.5		716.6	0.5
Virginia Rail			3.0	137.7				0.5
Sora				137.7				0.5
American Coot				137.7	284.3		625.5	0.5
Black-bellied Plover		130.0			283.7		625.5	
Snowy Plover		130.0			283.7			
Semi-palmated Plover		130.0			283.7		625.5	
Killdeer	43.4	130.0			283.7		620.5	
Black-necked Stilt		130.0		137.7	283.7			0.5
American Avocet		130.0		137.7	283.7			0.5
Spotted Sandpiper		130.0			283.7			0.5
Greater Yellowlegs				137.7	284.3			0.5
Willet				137.7	283.7		625.5	0.5
Lesser Yellowlegs		130.0		137.7	284.3			0.5
Long-billed Curlew		130.0		137.7	283.7		716.6	0.5
Marbled Godwit		130.0		137.7	283.7		716.6	0.5
Western Sandpiper		130.0		137.7	283.7			0.5
Least Sandpiper		130.0		137.7	283.7			0.5
Dunlin		130.0			283.7			
Long-billed Dowitcher		130.0			283.7			
Wilson's Snipe				137.7	283.7			0.5
Wilson's Phalarope	130.6			137.7	284.3		716.6	0.5
Red-necked Phalarope					283.7			
Bonaparte's Gull					284.3			
Ring-billed Gull				137.7	284.3		716.6	0.5
California Gull		130.0			284.3		713.8	
Caspian Tern		130.0			284.3			
Forster's Tern				137.7	284.3			
Black Tern				137.7	284.3			0.5
Marsh Wren				137.7				0.5
California Vole	0.4			137.7		141.7	716.6	0.5



Indicator Species Figure 34. Total Acreage of Low, Medium and High Suitability Habitats for Habitat Indicator Species in Thibaut Management Unit

8.3.5 Comparison with Baseline Conditions - Riverine/Riparian Management Area

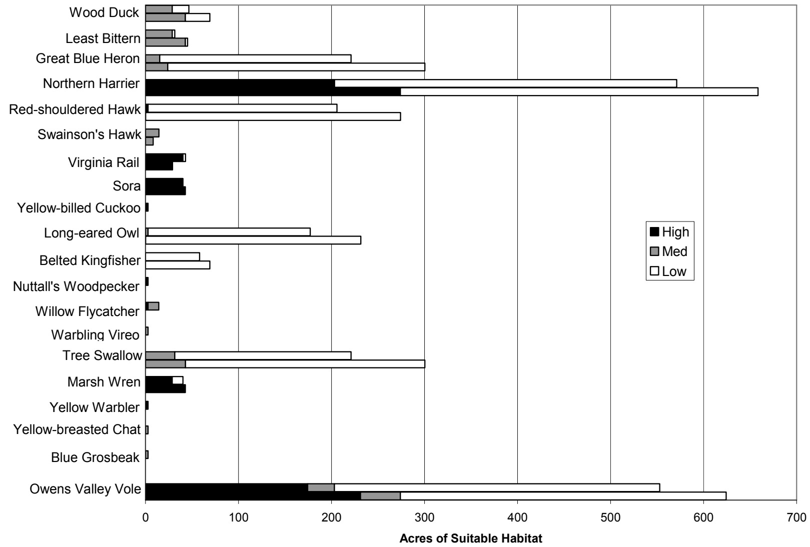
Indicator Species Table 39 provides a comparison of acreages of CWHR habitats between baseline conditions (2000) and 2009, by reach. Lands classified as Annual Grassland (AGS), which is equivalent to Bassia, were non-existent under baseline conditions. Alkali desert scrub (ASC) decreased overall, with much of this decrease occurring Reaches 2 and 3 as areas in these reaches were converted to PGS or FEW. Barren lands decreased as some were converted to Bassia. Desert Riparian showed a decrease, but as discussed in Section 6, Landscape Vegetation Mapping and mentioned previously, this decrease can be explained by the differences in mapping efforts between the two years. Fresh emergent wetland habitat type has increased, especially in Reach 2 and 4. Lacustrine habitat type increased in all reaches (except Reach 6), with the greatest acreage increase in Reach 3. Lands identified as irrigated pasture (PAS) showed an increase Reaches 3 and 4. Perennial grassland (PGS) showed the greatest increase in Reach 3, and a slight decrease in Reach 4. Riverine habitat increased in all reaches. Wet meadow decreased in all reaches, possibly replaced by FEW.

Indicator Species Table 39. Total Acreage of Suitable Habitat by Habitat Type Under Baseline (2000) Conditions and Current Conditions (2009)

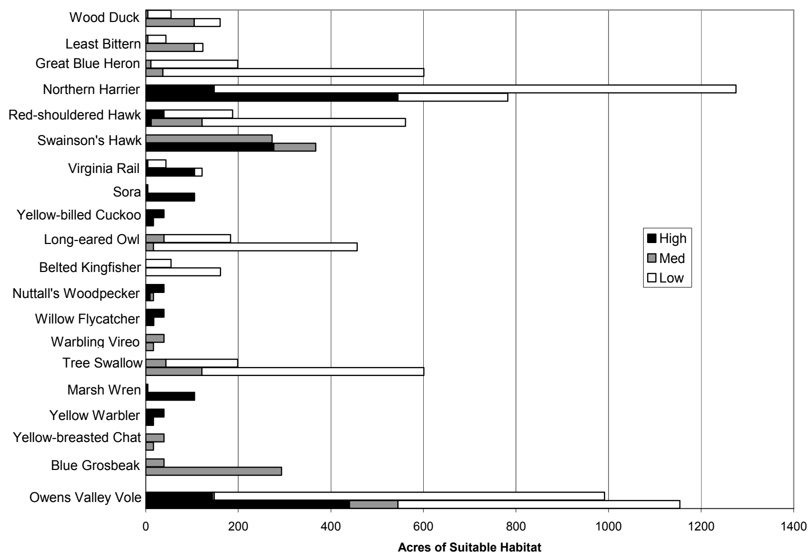
	Reach 1		Reach 2		Reach 3		Reach 4		Reach 5		Reach 6		Total by CWHR Habitat	
CWHR Habitat Type	**2000**	**2009**	**2000**	**2009**	**2000**	**2009**	**2000**	**2009**	**2000**	**2009**	**2000**	**2009**	**2000**	**2009**
AGS				276.8		39.2							0.0	316.0
ASC	349.8	350.3	843.3	609.2	559.2	287.8	136.5	148.7	56.5	40.6	264.1	264.2	2209.4	1700.8
BAR	0.2	8.0	233.7	73.1	158.7	53.7		5.7		1.3		12.8	392.6	154.6
DRI	2.7	0.2	39.3	16.6	152.7	101.1	185.3	92.3	21.9	22.5	85.9	69.5	487.8	302.3
FEW	28.7	42.8	4.3	104.6	222.9	302.6	307.8	455.5	70.5	50.2	161.9	156.0	796.1	1111.7
LAC		2.3		2.2	5.2	25.6	2.9	4.8	1.7	1.9	3.7	3.5	13.5	40.4
PAS					63.6	91.9		1.1					63.6	93.0
PGS	162.8	231.2	143.8	162.9	767.6	1079.8	505.7	458.9	223.1	253.2	412.4	473.6	2215.4	2659.5
RIV	15.2	23.9	11.1	37.1	17.2	51.1	38.4	52.2	7.4	21.6	35.8	40.6	125.1	226.6
WTM	11.5			0.6	74.7	24.9	50.1	8.1	17.1	7.7	68.1	11.4	221.5	52.7
Total acreage per reach	**571.0**	**658.6**	**1275.5**	**1283.1**	**2051.7**	**2057.8**	**1226.8**	**1227.3**	**398.2**	**399.0**	**1031.9**	**1031.7**	**6555.1**	**6657.5**

Indicator Species Figure 35 shows the difference in total acreage of suitable habitat for each indicator species under baseline conditions as compared to 2009 conditions. In Reach 1, the acreage of suitable habitat has increased for most indicator species as compared to baseline. The amount of suitable acreage for species associated with WTM, such as Virginia Rail, has shown a slight decrease. Suitable habitat for riparian dependent species such as Yellow-billed Cuckoo, Nuttall's Woodpecker, Willow Flycatcher, Warbling Vireo, Yellow Warbler, Yellow-breasted Chat and Blue Grosbeak, continues to be minimal in this reach. The acreage of high suitability habitat has increased for Northern Harrier, Marsh Wren and Owens Valley Vole. In Reach 2, the acreage of suitable habitat has increased for most indicator species as compared to baseline. Exceptions to this include Northern Harrier and most riparian dependent species. For Northern Harrier, the amount of high suitability habitat increased while decreases were seen in the loss of low suitability habitats such as BAR and ASC. Blue Grosbeak showed an increase in suitable habitat acreage due to the increase in habitats classified as AGS, or Bassia as this species is known to feed in weedy fields and annual grassland habitats. In Reach 3, the acreage of suitable habitat has increased for most indicator species as compared to baseline. Exceptions to this include riparian dependent species, Swainson's Hawk and Virginia Rail, for which the decrease in WTM accounts for decreases in suitable habitat. Northern Harrier, Virginia Rail, Sora, Marsh Wren and vole showed increases in high suitability habitats. In Reach 4, the acreage of suitable habitat increased for six of the indicator species, mainly those associated with FEW or RIV habitats. Suitable habitat remained similar or decreased for the remaining 14 species, as a result of apparent decreases in DRI, WTM and PGS. In Reach 5, low quality suitable habitat increased for three indicator species, (Great Blue Heron, Long-eared Owl, and Tree Swallow), remained similar for eight species, and decreased for nine species. For the species in which decreases in suitable acreage occurred, declines in high suitability Fresh Emergent Wetland FEW and WTM habitats account for this change. In Reach 6, the amount of suitable habitat did not increase for any of the indicator species as compared to baseline. The acreage of suitable habitat decreased for most indicator species, and remained similar for a few. The decrease in DRI and WTM habitats, along with little notable change in most other habitat categories accounts for this result.

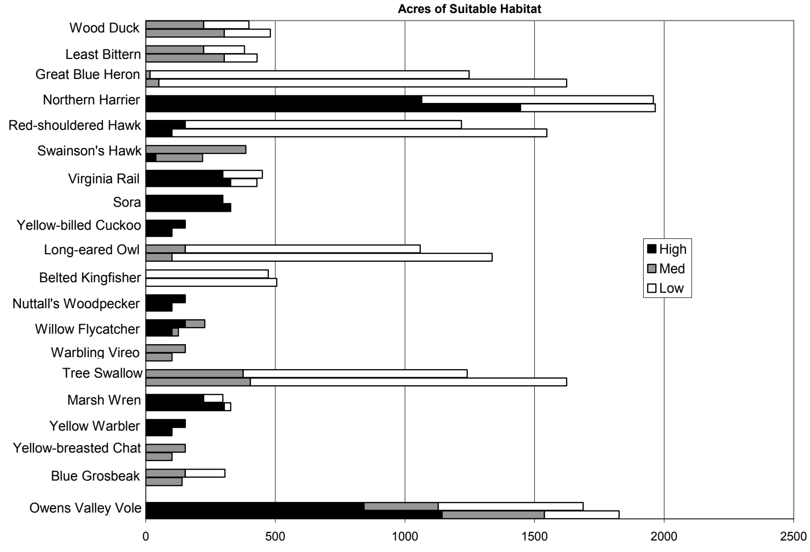
REACH 1



REACH 2



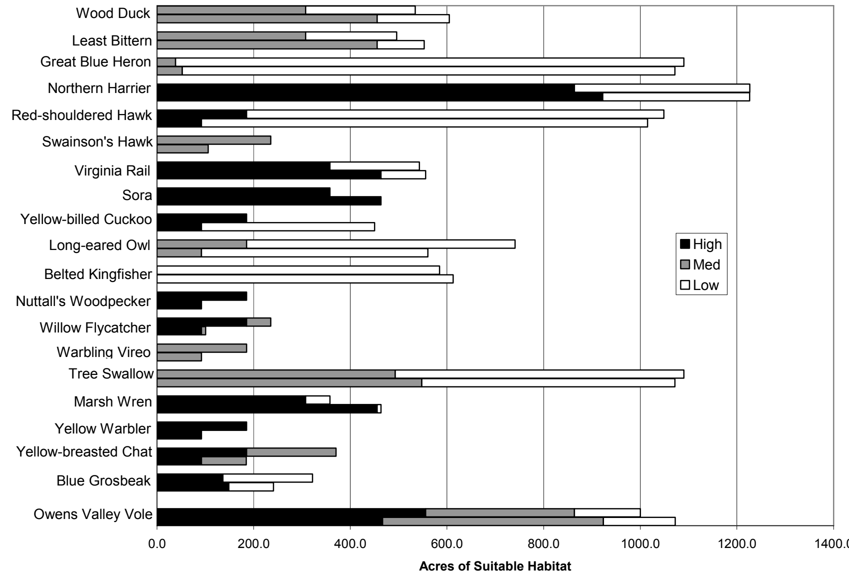
REACH 3



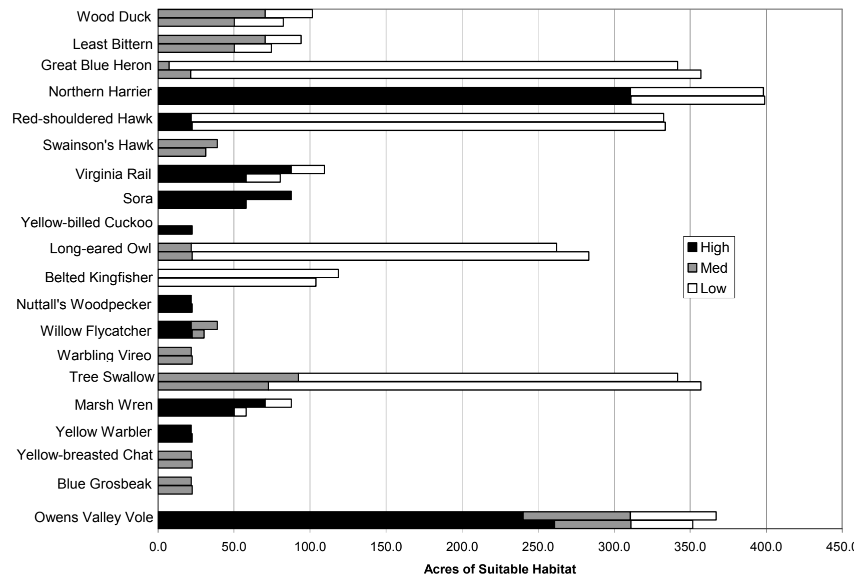
Indicator Species Figure 35. Baseline and 2009 Acreage of Suitable Habitat for Indicator Species

For each species, the top bar is 2000 acreage, and the lower bar is 2009 acreage.

REACH 4



REACH 5



REACH 6

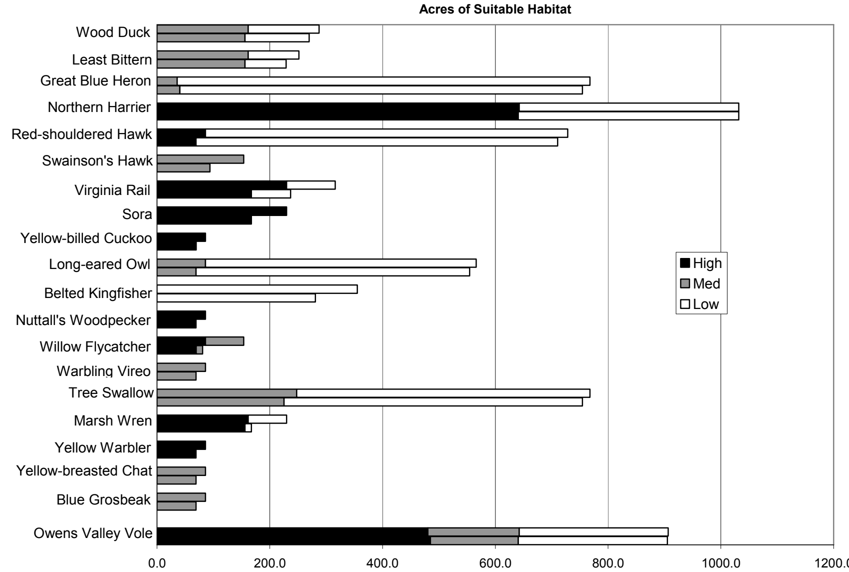


Figure 40. Continued, Baseline and 2009 Acreage of Suitable Habitat for Indicator Species
For each species, the top bar is 2000 acreage, and the lower bar is 2009 acreage.

8.3.6 Summary of Indicator Species Habitat Assessment

In the LORP Riverine/Riparian Management Area, habitat is available for all indicator species. Habitat is most abundant for species that are associated with Perennial Grassland and Fresh Emergent Wetland. Habitat is most limited for species associated with Desert Riparian and Wet Meadow. As with the use of any model, caution should be used in the interpretation of the resulting output. This model may over or under represent the suitability for some species. The alkaline meadow habitats in the Owens Valley are floristically and functionally different from other "Perennial Grassland" types in California. Suitability for wildlife species may be different than classified under CWHR. The use of riparian habitat types other than Desert Riparian for those species that CWHR does not provide suitability values for - namely Wood Duck, Swainson's Hawk, Red-shouldered Hawk and Nuttall's Woodpecker, likely resulted in a fairly accurate representation of suitable habitats on LORP, since the suitability of the riparian habitats is based primarily on the size and stage class. Other landscape factors will influence the relative suitability of individual habitat patches such as proximity to other habitat types, or habitat patch size. These factors are not taken into account with use of this system, but should be considered when interpreting results.

In the BWMA, the Drew and Waggoner units currently provide the most suitable habitat for indicator species since they are in active status. Indicator species groups for which habitats are most abundant are waterfowl and grebes, and wading birds. The Drew Unit also provides shorebird habitat, while suitable habitat for shorebirds is limited in Waggoner. For the BWMA, it is recommended that the Indicator Species Habitat Assessment be conducted only on active units. This would allow for an assessment of available habitats for indicator species when specific management actions to attract these species are being applied.

8.4 References

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Whitehorse Associates. 2004a. *Lower Owens River Project Delineation, Prediction, and Assessment of Wetland/Riparian Resources.* Prepared for Los Angeles Department of Water and Power and Inyo County Water Department.

Whitehorse Associates. 2004b. *Lower Owens River Riparian Vegetation Inventory – 2002 Conditions.* Prepared for Los Angeles Department of Water and Power and Inyo County Water Department.

9.0 FISH CREEL CENSUS

Introduction

The 2010 Lower Owens River Project (LORP) Creel Census will help track the development and health of the warm-water or game fishery in the project's ponds, lakes and river as the LORP is implemented. Creel census data will assist with the adaptive management decision making for the LORP warm-water fishery. It provides information about the abundance and distribution of game fish throughout the LORP. Fish habitat within the LORP includes the river channel, oxbows, side channels, off-river lakes and ponds, springs and artesian well ponds. The main purpose of this creel census is to evaluate the response of game fish populations to manage river flows over time and to document compliance with LORP warm-water fisheries goals (Ecosystem Sciences 2008). The creel census for determining baseline conditions was completed in 2003. Future monitoring will be conducted using the same methods that were used to establish baseline conditions and are described below.

9.1 Methods

9.1.1 Sites

The LORP area was stratified into five separate fishing areas for the creel census. Creel Census Figure 1 illustrates and describes in detail the location of these fishing areas. Four of the fishing areas are located on the Lower Owens River while the fifth covers designated off-river lakes and ponds:

Area 1 - (Owens River from the Pump Station Dam at Owens Lake upstream to the Lone Pine Station Road)

Area 2 - (Owens River from the Lone Pine Station Road upstream to the Manzanar Reward Road)

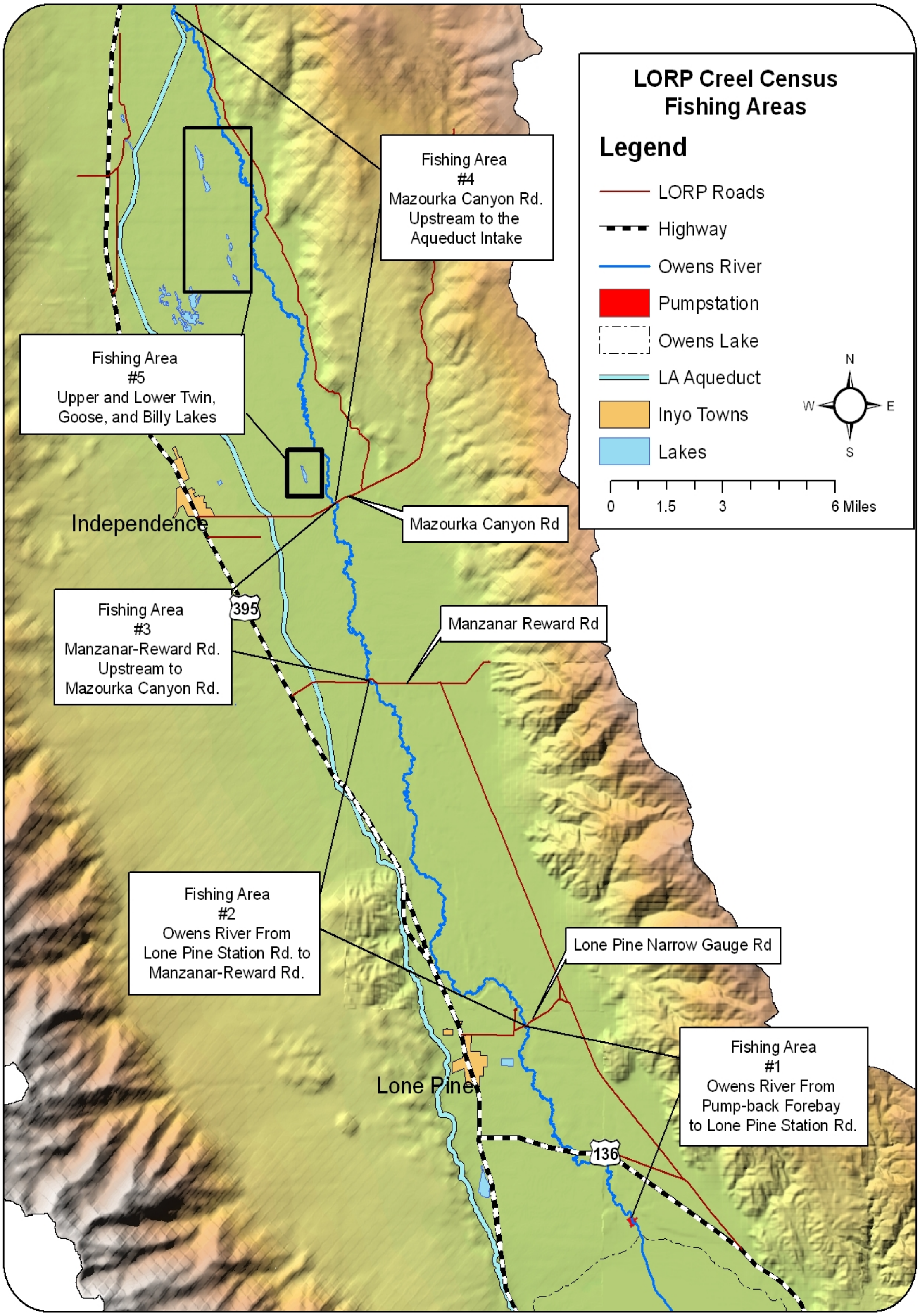
Area 3 - (Owens River form Manzanar Reward Road upstream to the Mazourka Canyon Road)

Area 4 - (Owens River from Mazourka Canyon Road upstream to the Los Angeles Aqueduct {LAA} Intake)

Area 5 - (Upper and Lower Twin, Billy and Goose Lakes)

9.1.2 Volunteers

Local fishermen were recruited to help conduct the 2010 creel census. A total of 24 volunteers were gathered and were assigned identification numbers 1 to 24. Each identification number was assigned to one of the above fishing areas. Creel Census Table 1 presents the identification numbers and assigned areas. Identification numbers 1 to 5 were assigned to Area 1, numbers 6 to 10 were assigned to Area 2, numbers 11 to 15 were assigned to Area 3, numbers 16 to 20 were assigned to Area 4, and numbers 21 to 24 were assigned to Area 5.



Creel Census Figure 1. Fishing Areas

Creel Census Table 1. Fishermen Identification Numbers and Assigned Areas

Fishermen ID Numbers	Assigned Fishing Areas
Numbers 1 to 5	Area 1, Pump Station Dam at Owens Lake upstream to the Lone Pine Station Road
Numbers 6 to 10	Area 2, Owens River from the Lone Pine Station Road upstream to the Manzanar Reward Road
Numbers 11 to 15	Area 3, Owens River form Manzanar Reward Road upstream to the Mazourka Canyon Road
Numbers 16 to 20	Area 4, Owens River from Mazourka Canyon Road upstream to the LAA Intake
Number 21	Area 5, Upper Twin Lake
Number 22	Area 5, Lower Twin Lake
Number 23	Area 5, Goose Lake
Number 24	Area 5, Billy Lake

Volunteers in Areas 1 through 4 were allowed to fish anywhere within their assigned area. In Area 5, each identification number was assigned to an individual lake. Fisherman 21 must fish Upper Twin Lake, fisherman 22 must fish Lower Twin Lake, fisherman 23 must fish Goose Lake, and fisherman 24 must fish Billy Lake.

9.1.3 Season Timing and Rules of Creel Census

The first creel census (post implementation) was conducted in the fall (September) of 2010. Each volunteer fished twice in the fall and will fish twice in the spring (during May of 2011). The first fall fishing period occurred between September 1 and September 15, 2010, with each volunteer fishing one day during this period. The second fall fishing period occurred between September 16 and September 30, 2010, with each volunteer fishing one day during this period. The first spring fishing period is from May 1 through May 15, 2011, with each volunteer fishing one day during this period. The second spring fishing period is from May 16 to May 31, 2011, with each volunteer fishing one day during this period. No census fishing can occur during any period outside of September and May.

Volunteers are limited to 3.5 hours of fishing per day during the census. The 3.5-hour period does not have to be fished all at one time, but must be done in the same day. The average time a fisherperson in the west fishes, on an average fishing day, is 3.5 hours (Bill Platts, Ecosystem Sciences, personal communication, August 18, 2010). During the census, volunteers can fish only within his or her assigned area; however, they may fish anywhere within that assigned area. Volunteers can use any type of fishing gear they wish, as long as they abide by all applicable state of California fishing rules and regulations.

9.1.4 Creel Records

Fishermen will use the Creel Census Survey Form (Creel Census Figure 2) to record fishing results. Reach number, date, identification number, number of fish caught, species of fish caught, total length (to the nearest inch), condition (good or poor), and total number of fish observed will be recorded. Fish species identification was covered during the pre-fishing meeting and in the LORP Fishing Creel Census Guide (Creel Census Appendix 1). Total length of fish was visually estimated from the tip of the nose to the end of the tail. For condition, if the fish looks healthy and shows no signs of sickness or damage, and has no lesions, the fish is listed as good condition (GC). If the fish looks unhealthy or shows signs of damage or has lesions, the fish is listed as being in poor condition (PC). Total number of fish observed (by species) while fishing will also be recorded. At the end of the second fishing period completed data sheets will be placed in the self-address stamped envelope and returned.

LORP Creel Census
Return to: Jason Morgan
300 Mandich Street
Bishop, CA 93514
Office (760) 873-0429
Cell (760) 878-8954

Reach Number:	Date:	Name:	Fisherperson's Number:

Total Number of Fish Observed

Largemouth Bass:	Smallmouth Bass:	Bluegill:	Brown Trout:
Common Carp:	Channel Catfish:	Brown Bullhead:	Other Species (Name/Number):

Fish Caught (Fishing Time 3.5 hours)

Number	Species	Length (Inches)	Condition (Good or Poor)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Creel Census Figure 2. Creel Census Survey Form

9.2 Results

Of the 24 fishermen, only 20 returned their data sheets at the time this report was written. Area 1 had 4 of the 5 volunteers return data sheets. Area 2 had 3 of the 5 volunteers return data sheets. Area 3 had all 5 volunteers return data sheets. Area 4 had 4 of the 5 volunteers return data sheets and Area 5 had all 5 volunteers return data sheets.

Overall, 20 fishermen fished 3.5 hours each for a total of 140 hours during the two fishing periods in September 2010. A total of 214 fish were caught, including 175 largemouth bass (*Micropterus salmoides)*, 30 bluegill (*Lepomis macrochirus)*, 2 brown bullhead (*Ameiurus nebulosus)*, 2 brown trout (*Salmo trutta)*, and 5 common carp (*Cyprinus carpio)* (Table 2). Overall, catch per unit effort was 1.5 fish/hour. Largemouth bass accounted for 1.3 fish/hour with an average length of 10 inches (maximum - 18 inches and minimum - 4 inches). Bluegill accounted for 0.2 fish/hour with an average size of 4 inches (maximum - 8 inches and minimum length - 3 inches). Brown bullhead and brown trout each accounted for 0.01 fish/hour. Both brown bullheads caught were 9 inches, which makes the average, maximum, and minimum length 9 inches. Brown trout had an average length of 7.5 inches and a maximum of 8 inches and a minimum of 7 inches. Common carp accounted for 0.04 fish/hour with and average length of 12 inches and a maximum length of 18 inches and a minimum of 8 inches. All fish caught were in good condition. The 20 fishermen observed 777 fish during the creel census with largemouth bass being the majority of the fish observed at 415 fish (Table 3). One smallmouth bass (*Micropterus dolomieu)*, 240 bluegill, 1 brown bullhead, 6 brown trout, and 114 common carp were also observed.

Creel Census Table 2. Overall Results for Lower Owens River Project Creel Census, September 2010

Overall	Largemouth Bass	Smallmouth Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Total
Count	175	0	30	2	2	5	214
Average Size (inches)	10	0	4	9	8	12	9
Catch/Hour	1.3	0	0.2	0.01	0.01	0.04	1.5
Maximum Length (inches)	18	0	8	9	8	18	18
Minimum Length (inches)	4	0	3	9	7	8	3

Creel Census Table 3. Number of Fish Observed During the Lower Owens River Project Creel Census, September 2010

	Period 1	Period 2	Total
Largemouth Bass	180	235	415
Smallmouth Bass	1	0	1
Bluegill	95	145	240
Brown Bullhead	0	1	1
Brown Trout	1	5	6
Common Carp	42	72	114
Total	**319**	**458**	**777**

During the first period, from September 1-15, 2010 the 20 fishermen fished 3.5 hours for a total of 70 hours. During this period they caught a total of 100 fish of which 83 were largemouth bass, 13 were bluegill, 2 were brown bullhead, 2 were brown trout, and 5 were common carp (Creel Census Table 4). Catch/hour was 1.2 for largemouth bass, 0.2 for bluegill, 0.03 for brown bullhead, 0.01 for brown bullhead, and 0.01 for common carp for a total of 1.4 fish/hour. The 20 fishermen observed 319 fish during the first period of the creel census with largemouth bass making up the majority of the fish observed at 180 fish (Creel Census Table 3). One smallmouth bass, 95 bluegill, 1 brown trout, and 42 common carp were also observed.

Creel Census Table 4. Overall Results for the First Period Lower Owens River Project Creel Census September 1-15, 2010.

Period 1	Largemouth Bass	Smallmouth Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Total
Count	83	0	13	2	1	1	100
Average Size (inches)	11	0	4	9	8	8	8
Catch/Hour	1.2	0	0.2	0.03	0.01	0.01	1.4
Maximum Length (inches)	18	0	6	9	8	8	18
Minimum Length (inches)	4	0	3	9	8	8	3

The second period, from September 16-30, 2010 the 20 fishermen again fished for a total of 70 hours. During this period they caught a total of 114 fish of which 4 were carp, 1 was a brown trout, 17 were bluegill, and 92 were largemouth bass (Creel Census Table 5). A total of 1.6 fish/hour were caught during the second period, largemouth bass were caught at 1.3 fish/hour, bluegill at 0.2 fish/hour, brown trout at 0.01 fish/hour, and carp 0.1 fish/hour. Fisherman observed 458 fish of which 235 were largemouth bass, 145 were bluegill, 1 was a brown bullhead, 5 were brown trout, and 72 were common carp (Creel Census Table 3).

Creel Census Table 5. Overall Results for the Second Period Lower Owens River Project Creel Census September 16-30, 2010

Period 2	Largemouth Bass	Smallmouth Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Total
Count	92	0	17	0	1	4	114
Average Size (inches)	10	0	4	0	7	14	9
Catch/Hour	1.3	0	0.2	0	0	0.1	1.6
Maximum Length (inches)	16	0	8	0	7	18	18
Minimum Length (inches)	4	0	3	0	7	10	3

When comparing catch per unit effort by fishing area for the first period, Area 5 had the highest at 2.0 fish/hour, Area 4 had the next highest at 1.9 fish/hour, Area 3 was next at 1.3 fish/hour, Area 2 was fourth on the list at 1.0 fish/hour, and Area 1 was last at 0.6 fish/hour (Creel Census Table 6). During the second fishing period Area 3 had the highest catch per unit effort at 2.2 fish/hour, Area 4 was next at 2.0 fish/hour, Area 5 was third with 1.0 fish/hour, Area 1 was fourth at 0.8 fish/hour and Area 2 was last at 0.3 fish/hour (Creel Census Table 7).

Creel Census Table 6. Overall Results by Fishing Area for Period 1, September 1-15, 2010

Reach 1	Largemouth Bass	Smallmouth Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Total
Count	9	0	0	0	0	0	9
Average Size (inches)	7	0	0	0	0	0	7
Catch/Hour	0.6	0	0	0	0	0	0.6
Maximum Length (inches)	12	0	0	0	0	0	12
Minimum Length (inches)	4	0	0	0	0	0	4
Reach 2	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	6	0	2	2	0	0	10
Average Size (inches)	12	0	5	9	0	0	9
Catch/Hour	0.6	0	0.2	0.2	0	0	1.0
Maximum Length (inches)	14	0	5	9	0	0	14
Minimum Length (inches)	10	0	5	9	0	0	5
Reach 3	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	21	0	1	0	0	1	23
Average Size (inches)	12	0	5	0	0	8	8
Catch/Hour	1.2	0	0.1	0	0	0.1	1.3
Maximum Length (inches)	18	0	5	0	0	8	18
Minimum Length (inches)	5	0	5	0	0	8	5
Reach 4	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	25	0	0	0	1	0	26
Average Size (inches)	9	0	0	0	8	0	8
Catch/Hour	1.8	0	0	0	0.1	0	1.9
Maximum Length (inches)	14	0	0	0	8	0	14
Minimum Length(inches)	5	0	0	0	8	0	5
Reach 5	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	22	0	10	0	0	0	32
Average Size (inches)	13	0	4	0	0	0	9
Catch/Hour	1	0	1	0	0	0	2
Maximum Length (inches)	17	0	6	0	0	0	17
Minimum Length (inches)	8	0	3	0	0	0	3

Creel Census Table 7. Overall Results by Fishing Area for Period 2, September 16-30, 2010

Reach 1	Largemouth Bass	Smallmouth Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Total
Count	8	0	2	0	0	1	11
Average Size (inches)	8	0	3	0	0	10	7
Catch/Hour	0.6	0	0.1	0	0	0.1	0.8
Maximum Length (inches)	11	0	3	0	0	10	11
Minimum Length (inches)	5	0	3	0	0	10	3
Reach 2	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	1	0	1	0	0	1	3
Average Size (inches)	12	0	5	0	0	10	9
Catch/Hour	0.1	0	0.1	0	0	0.1	0.3
Maximum Length (inches)	12	0	5	0	0	10	12
Minimum Length (inches)	12	0	5	0	0	10	5
Reach 3	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	37	0	0	0	0	1	38
Average Size (inches)	9	0	0	0	0	18	13
Catch/Hour	2.1	0	0	0	0	0.1	2.2
Maximum Length (inches)	15	0	0	0	0	18	18
Minimum Length (inches)	6	0	0	0	0	18	6
Reach 4	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	25	0	2	0	1	0	28
Average Size (inches)	9	0	6	0	7	0	7
Catch/Hour	1.8	0	0.1	0	0.1	0	2.0
Maximum Length (inches)	15	0	8	0	7	0	15
Minimum Length (inches)	4	0	4	0	7	0	4
Reach 5	**Largemouth Bass**	**Smallmouth Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Total**
Count	15	0	0	0	0	0	15
Average Size (inches)	13	0	0	0	0	0	13
Catch/Hour	1	0	0	0	0	0	1
Maximum Length (inches)	16	0	0	0	0	0	16
Minimum Length (inches)	10	0	0	0	0	0	10

Tabular results from the 2003 baseline creel census are included (Creel Census Table 8) for reference (unpublished data).

Creel Census Table 8. Baseline Creel Census Data for Lower Owens River Project May 2003

Area 1. Owens River From Pumpback Pool to the Lone Pine Station Road							
Fisher Person ID#	**Date**	**Fish Caught**	**Number Caught**	**Combined Lengths (inches)**	**Maximum Length (inches)**	**Minimum Length (inches)**	**Condition**
1	5/8/2003	Largemouth Bass	14	188	16	10	good
1	5/26/03	Largemouth Bass	14	135	13	6	good
2	5/9/2003	Largemouth Bass	13	129	13	7	good
2	5/16/2003	Largemouth Bass	18	176	14	6	good
3	5/13/2003	Largemouth Bass	3	25	9	7	good
3	5/30/2003	Largemouth Bass	6	57	14	8	good
4	5/22/2003	Largemouth Bass	16	78	10	3	good
5	5/13/2003	Largemouth Bass	7	54	11	5	good
5		Bullhead Catfish	1	9	9		good
5	5/30/2003	Largemouth Bass	3	27	12	7	good
5		Bluegill	3	19	7	6	good

Hours Fished: 31.5
Catch Rate: 3.1 fish/hour
Average Fish Length: 9.2 inches
Maximum Size: 16 inches, Minimum Size: 3 inches
Max Average Size: 11.6 inches, Minimum Average Size: 5.9 inches

Area 2. Owens River From the Lone Pine Station Road to the Manzanar-Reward Road							
Fisher Person ID#	**Date**	**Fish Caught**	**Number Caught**	**Combined Lengths (inches)**	**Maximum Length (inches)**	**Minimum Length (inches)**	**Condition**
9	5/4/2003	Largemouth Bass	4	48	14	10	good
9		Bluegill	5	14	3	2	good
9		Bullhead Catfish	3	35	13	10	good
9		Carp	1	15	15		good
9	5/18/2003	Largemouth Bass	10	84	14	6	good
10	5/12/2003	Largemouth Bass	6	73	15	10	good
10		Bluegill	2	12	6	6	good
10	5/26/2003	Largemouth Bass	5	57	12	10	good
10		Bluegill	6	43	8	6	good
6	5/4/2003	Largemouth Bass	14	151	16	5	good
6	5/19/2003	Largemouth Bass	14	154	15	6	good
7	5/7/2003	Largemouth Bass	6	72	14	10	good

Hours Fished: 24.5
Catch Rate: 3.1 fish/hour
Average Fish Length: 9.9 inches
Maximum Size: 16 inches, Minimum Size: 2 inches
Maximum Average Size: 12.1 inches, Minimum Average Size: 6.8 inches

Table 8. cont'd. Baseline Creel Census Data for Lower Owens River Project May 2003

Fisher Person ID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
Area 3. Owens River From the Manzanar-Reward Road Upstream to Mazourka Canyon Road							
12	5/5/2003	Largemouth Bass	4	30	9	5	good
12		Bluegill	9	47	6	4	good
12	5/31/2003	Largemouth Bass	3	29	12	8	good
11	5/31/2003	Largemouth Bass	7	59	12	5	good/poor
11		Bluegill	7	34	5	4	good
11		Carp	1	15	15	15	good
14	5/15/2003	Largemouth Bass	3	31	13	8	good
14	5/18/2003	Largemouth Bass	3	33	12	10	good
14		Bullhead Catfish	1	8	8	8	good
15	5/15/2003	Largemouth Bass	3	35	15	7	good
15		Bluegill	3	13	5	4	good
15	5/20/2003	Largemouth Bass	4	30	10	6	good
15		Bluegill	2	9	5	3	good
Hours Fished: 24.5 *Catch Rate: 2.0 fish/hour* *Average Fish Length: 7.5 inches* *Maximum Size: 15 inches, Minimum Size: 3 inches* *Maximum Average Size: 9.8 inches, Minimum Average Size: 6.7 inches*							

Fisher Person ID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
Area 4. Owens River From the Mazourka Canyon Road Upstream to the Intake							
No fishable water until flow introduction occurs							

Fisher PersonID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
Area 5. Upper and Lower Twin, Billy, Coyote, and Goose Lakes							
21	5/3/2003	Largemouth Bass	9	128	18	12	good
23	5/15/2003	Largemouth Bass	1	8	8	8	good
23	5/31/2003	Largemouth Bass	1	8	8	8	good
23		Bluegill	2	13	7	6	good
22	5/12/2003	Largemouth Bass	6	68	12	9	good
22	5/20/2003	Largemouth Bass	18	206	16	6	good
22		Bluegill	1	6	6	6	good
2	5/12/2003	Largemouth Bass	11	132	14	9	good
2	5/20/2003	Largemouth Bass	14	156	14	9	good
3	5/15/2003	Largemouth Bass	1	9	9	9	good
3	5/31/2003	Largemouth Bass	10	109	13	8	good
24/4	5/11/2003	Largemouth Bass	10	129	18	10	good
24/4	5/24/2003	Largemouth Bass	10	119	16	6	good
1	5/3/2003	Largemouth Bass	12	156	18	10	good
1	5/17/2003	Largemouth Bass	14	197	18	6	good
Hours Fished: 45.5 *Catch Rate: 2.6 fish/hour* *Average Fish Length: 12.0 inches* *Maximum Size: 18 inches, Minimum Size: 6 inches* *Maximum Average Size: 13.0 inches, Minimum Average Size: 8.1 inches*							

9.3 Discussion

2010 creel census results demonstrate that the LORP is developing a healthy warm-water fishery through out the entire system. Reasons for this conclusion include: areas of the LORP that were dry during the baseline creel census are now populated, the LORP is trending towards a diverse warm-water community, there are multiple age classes for each of the warm-water species, and all fish caught were in good condition.

Area 4 (LAA Intake downstream to Mazourka Canyon Road) was dry during the 2003 creel census (approximately 24 miles of river). In 2010, a little over 3 years after the LORP was implemented, the same area produced 1.93 fish/hour and three different species. This shows that fish are populating former dry sections using fish corridors and/or moving up and down the river. Overall, 5 different species were caught during the 2010 creel survey which was 1 species more than the 2003 baseline census. A smallmouth bass was also observed by one of the fishermen while fishing which brings the total up to 6 different species. Although no native species were caught it looks like the LORP is trending towards a diverse warm-water fishery.

Looking at total lengths it appears there are multiple age classes from young of the year to adults for all species except brown trout and brown bullhead. Due to lack of spawning gravel, warm water temperature, and lack of creel census data (only 2 caught) brown trout may not have multiple age classes. Creel census data on brown bullhead is also limited (only 2 caught), but habitat for this species is abundant and there should be multiple age classes.

Of the 214 fish caught 100% were reported in good condition. At this time, it appears that managed river flows and available habitat are capable of sustaining game fish populations in good condition.

Finally, three fishermen complained that fishing access was very limited due to cattails (*Typha* sp) and tules (*Schoenoplectus acutus*). The fish might be there but the fishermen can not access them. One fisherman said that in Area 2 fishing access was approximately 1%.

The May 2011 creel census will be conducted in the same manner as the September 2010 census and will be compared with baseline.

9.4 References

Ecosystem Sciences. 2008. *Lower Owens River Project Monitoring and Adaptive Management and Reporting Plan.* Prepared for Los Angeles Department of Water and Power and Inyo County Water Department. April 28, 2008.

10.0 LOWER OWENS RIVER PROJECT FISH HABITAT 2010

10.1 Report on Data Collection and Results

Monitoring Purpose

The purpose of fish habitat monitoring is to track the development of habitat conditions associated with a healthy, warm-water fishery in good condition and also track conditions for a high quality environment for native fish species (LORP MAMP 2008).

Introduction

Ecologists have for many years recognized the importance of particular fish habitat variables influencing the distribution and abundance of biota within the river channel. Zonation of biota within the longitudinal continuum has long been determined to be a fundamental feature of the lotic environment (Hynes 1970), although explanations of specific distribution patterns often remain contentious (Alstad 1982, Thorp et al. 1986). The connection between riparian zones, including surficial floodplain dynamics and ecological structure and function, has been clearly demonstrated (Descamps and Naiman 1989, Dodge 1989, Hill et al. 1991, Gregory et al. 1991). The importance of microbial transformation and transport of solutes in groundwaters has been shown in relation to plant growth nutrients for channel biotopes in streams (Stanford and Ward 1988, Ford and Naiman 1989, Valett et al. 1991); penetration of groundwaters (i.e., hyporheic zone) by amphibiotic stream biota has also been documented (Stanford and Gaufin 1988, Williams and Hynes 1974, Danielopol 1984, Stanford and Ward 1986).

These observations emphasize that the riverine ecosystem is truly four dimensional, with longitudinal (upstream-downstream), lateral (floodplain-uplands) and vertical (hyporheic-phreatic) dimensions — since these spatial dimensions are transient or dynamic over time as a consequence of relativity, temporality is the fourth dimension (Ward 1989, Hill et al. 1991). Within a given stream reach distribution and abundance of organisms form a multivariate function of the structural and functional attributes of channel (fluvial), riparian (floodplain, shoreline), and hyporheic (groundwater) habitats as they interact within time and space with the geomorphology and hydrology of the catchment.

Fish habitat monitoring tracks trends in discrete physical and biological attributes that are considered important for fish habitat such as channel type, canopy, and organic debris. These measurements provide an evaluation of the lateral component of the stream ecosystem described above. Fish habitat monitoring also focuses on stream parameters that affect fish populations on a larger scale. This is essentially the longitudinal component of the ecosystem described above. For example, the thalweg profile of the stream is monitored to evaluate changes in channel morphology, sediment deposition, and pool development. The fish habitat monitoring data is one component used in defining and determining the condition of the fishery. Fish habitat monitoring, together with results from the creel census, fish observations and site scale vegetation monitoring, will provide a more complete picture of how the stream is responding to rehabilitation efforts and the relative health of the fishery.

10.2 Methods

The sampling design for the fish habitat survey was based on Platts et al. (1983) and modified with LORP proponent groups. The monitoring effort and sampling design was developed to be robust enough to capture important habitat characteristics and trends, while also being reasonable and feasible. The sampling design was modified to account for field collection limitations and accommodate fiscal concerns and project budgets. Fish habitat variables that are measured include channel morphology (channel width, wetted width, average and thalweg depths and bank undercut), substrate, organic debris and canopy cover.

10.2.1 Sampling Sites

The Lower Owens River is organized into 5 reaches (Fish Habitat Figure 1). Representative reference sites, or plots, have been established in four of the five reaches for sampling purposes — these plots are representative of each of the reaches and represent the range of vegetative, geomorphic, and environmental conditions in the Lower Owens River (with the exception of the Islands reach, Reach 3; see Fish Habitat Figure 1). The plots also represent the range of grazing and other land management approaches along the river. Each plot is 2 kilometers in length (longitudinally) and includes the riparian zone on each side of the river corridor. The outer boundaries of each plot were determined using a Geographic Information System (GIS) by overlaying a grid onto digital aerial photographs of each of the four references reaches being monitored. The reference plots are highly sampled environments with several other concomitant monitoring efforts occurring within them.

Monitoring transects were established every 100 meters in each of the five reference sites (plots). This results in 21 transects per plot and 105 total transects. Overall plot transect extend from terrace to terrace across the entire active floodplain and river channel and are primarily used for the vegetation sampling. These overall plot transects are used for orientation during fish habitat sampling. Fish habitat transects start at the wetted edge where the plot transect intersects and then proceed perpindicular to the river channel. The fish habitat transects cross the channel perpendicular to the flow of water. Often the plot and fish habitat transects are exactly the same, while on occasion the the fish habitat transect veers away from the plot transect so it remains perpendiclar to the channel and flow. Each fish habitat transect is established in the GIS database and a GPS unit is used to locate each end of the transect in the field for sampling and measurements.

10.2.2 Fish Habitat Variables

The fish habitat field data collected includes discrete stream variables that together create site-specific aquatic habitat for fish. The fish habitat is described at each site within the Lower Owens River with a stream cross-sectional method developed by Platts et al. (1983). The habitat variables that are measured at each transect line are described below:

Channel width -- the distance along the transect line beginning at the top of bank or high water mark on one bank, and ending at the high water mark on the opposite bank, whichever is greater. Channel width is recoded to the nearest tenth of a meter.

Wetted width -- the distance from the edge of the water on one bank to the edge on the opposite bank. Wetted width is recoded to the nearest tenth of a meter.

Average and thalweg depths – average depth determines stream depth across a transect by averaging all water depths collected. Thalweg depth is recorded as the deepest point along the transect (the largest value found after taking several measurements in the deepest portions of the channel under the transect line). Depths are measured to the nearest centimeter.

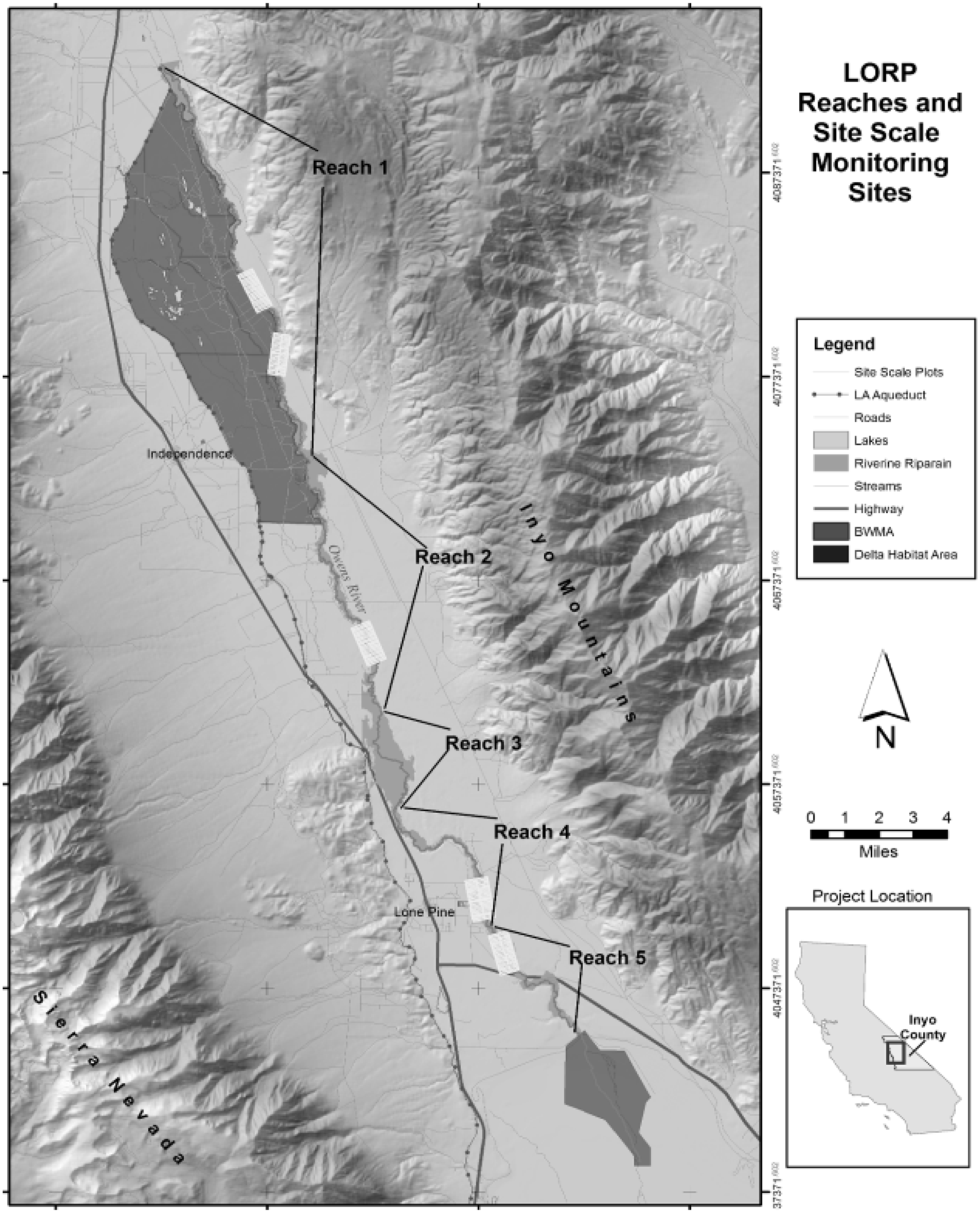
Substrate -- measures the composition of the channel substrate at one-meter increments along the transect line. At each increment the substrate composition of the stream bottom is measured. Assigned bottom materials are visually categorized into substrate classes (i.e., boulder, cobble, gravel, and fines) described by Platts et al. (1983). The individual one-meter classes of substrate are then totaled to get the amount of streambed in each of the size classes. The combined substrate widths, measured to the nearest meter, equal the total transect wetted width.

Canopy cover --measures the amount of shading a stream receives from canopy that is formed by trees and shrubs that overhang the stream at a distance greater than 30 cm above the stream surface. Canopy cover is measured as the percentage of the wetted width of a transect line covered overhead by trees and shrubs.

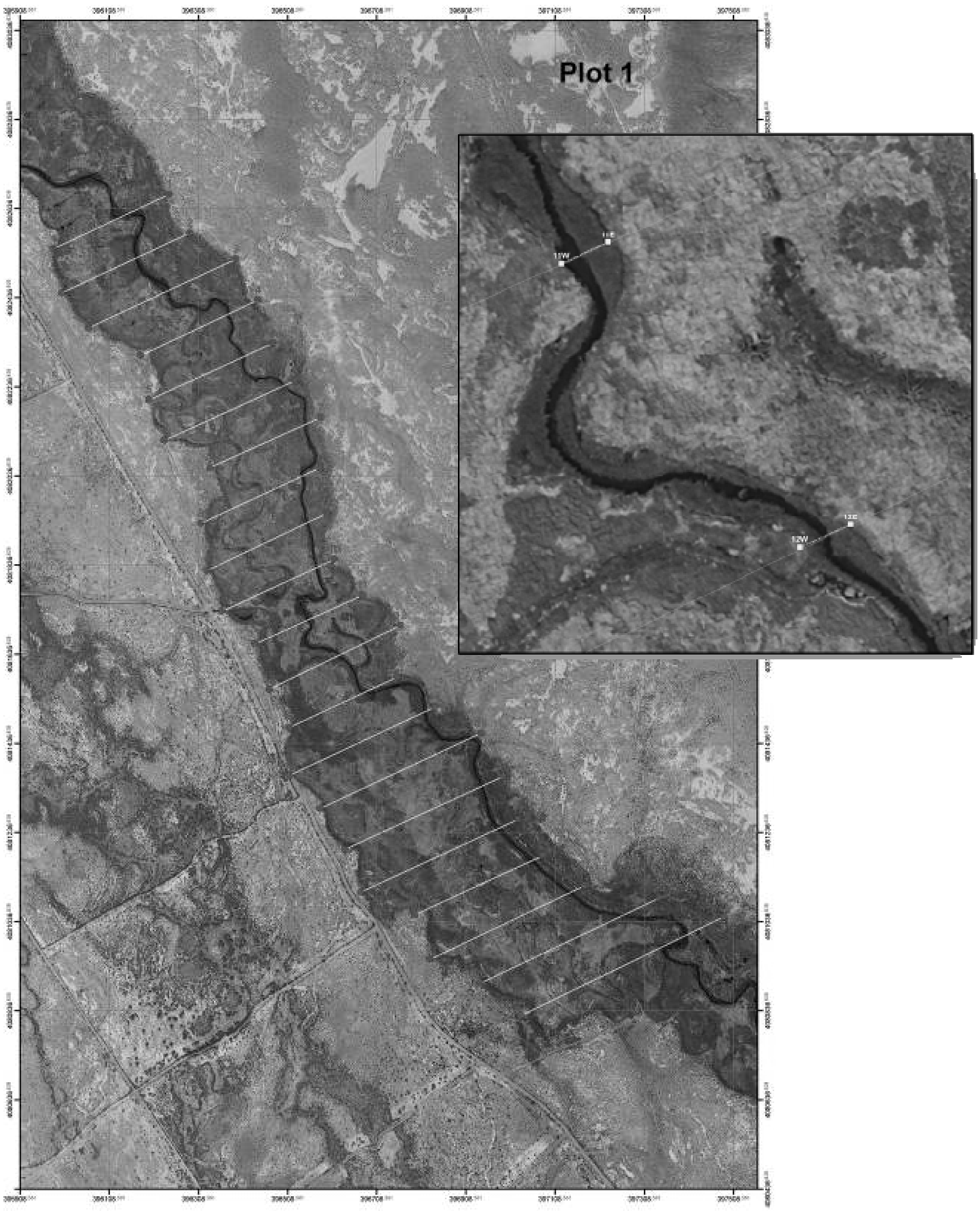
Organic debris --is mainly woody debris consisting of submerged logs, root wads, and brush in the stream channel. The amount of woody debris is measured as the percentage of the wetted width along a transect line.

Bank undercut --indicates how successfully streambanks are protected from land uses or are being modified by river flows. The bank undercut (if it exists) is measured under the transect line as the distance from the farthest point of protrusion of the bank to the farthest undercut of the bank. Water level does not influence this reading. Bank undercuts are measured to the nearest centimeter and record both left bank and right bank measurements at each transect.

Photo Points – Qualitative information is taken in the form of photos at each transect facing upstream, downstream and cross-channel. The photo points are taken on both the left bank and right bank at the intersection of the transect and the waters edge.

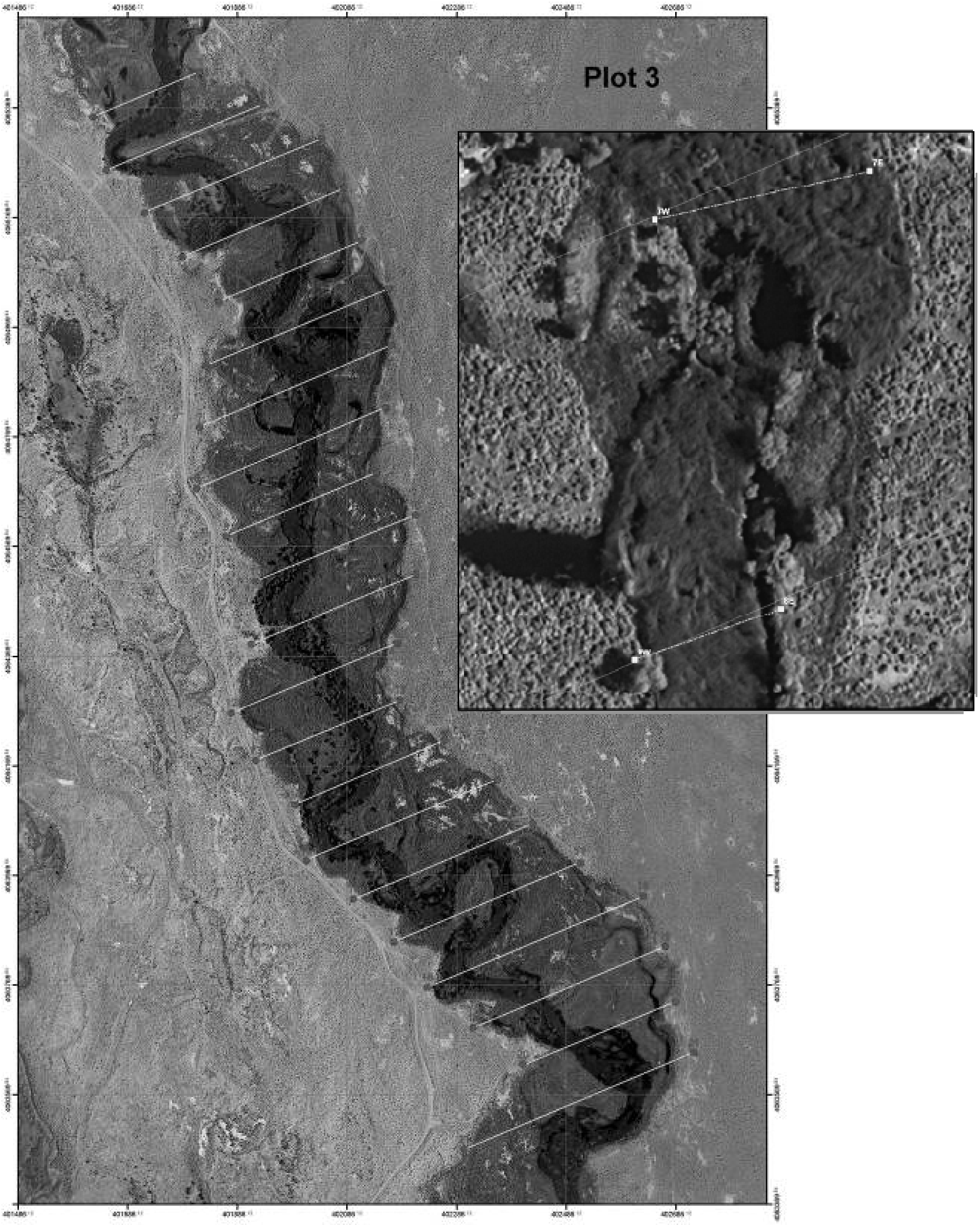


Fish Habitat Figure 1. Location of Fish Habitat Monitoring Transect Locations in the LORP



Fish Habitat Figure 2. Plot 1; and Example Fish Habitat Transects 11 and 12 (inset)

Fish Habitat Figure 3. Plot 2; and Example Fish Habitat Transects 8 and 9 (inset)



Fish Habitat Figure 4. Plot 3; and Example Fish Habitat Transects 7 and 8 (inset)

Figure 5. Plot 4; and Example Fish Habitat Transects 11, 12 and 13 (inset)

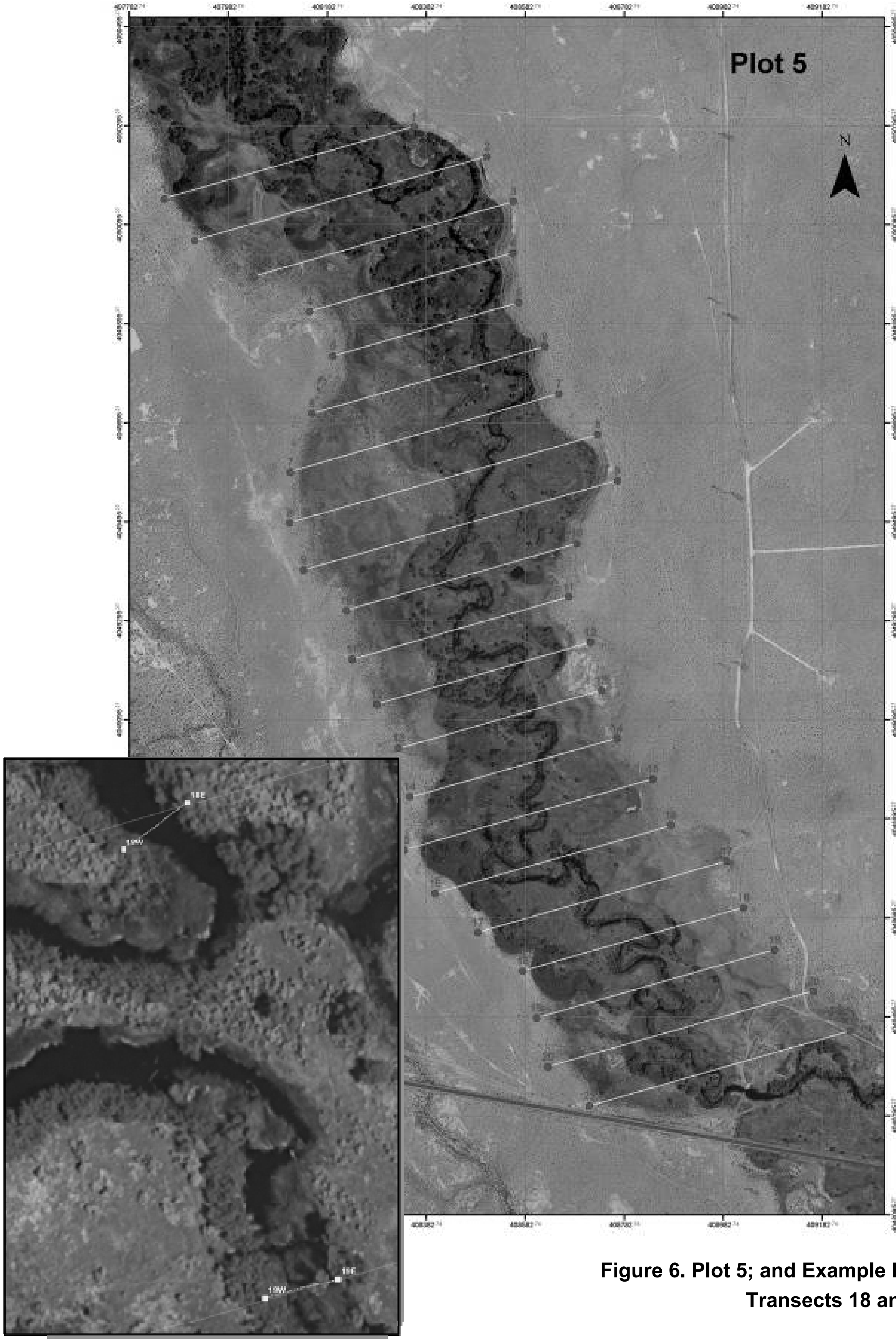


Figure 6. Plot 5; and Example Fish Habitat Transects 18 and 19 (inset)

10.3 Analysis

The baseline fish habitat data was tabulated for plots 1, 2, 3, 4, and 5 and input into a GIS database and Excel spreadsheet. Tabular and spatial data, discussed below, were reviewed for significance, and considered and juxtaposed with other concomitant monitoring efforts; including the site scale vegetation monitoring, aquatic vegetation growth and abundance, river flows, seasonal habitat flows, and the fish creel census. Simple analysis consisted of comparison of wetted width, average depth and thalweg between monitoring years. The results are discussed below.

10.3.1 Ancillary Data and Analysis

Additional data sets are available for use in refining the fish habitat variables and understanding current conditions. In 2009, LADWP completed a detailed topographic channel survey for each of the five LORP plots. The survey includes cross channel transects and landform data with discreet x, y, z values that allow for detailed inspection of channel width, wetted width, channel depths and thalweg. The spatially explicit survey data, coupled with high resolution imagery from 2009, gives a remarkable and clear indication of in-stream channel conditions, aquatic vegetation abundance and distribution, and physical channel attributes. The data also offers a comparative basis for analyses of past and future monitoring efforts.

The survey data was used in determining depths and thalwegs for the fish habitat data collection. However, the detailed data from this effort, as described above, can inform more robust understanding of instream fish habitat conditions.

10.3.2 GIS Database

A GIS database of fish habitat information has been created. The database includes all fish habitat data collected and maintains spatial consistency among the data and between monitoring efforts. The database can be utilized for additional data amalgamations and performance of spatially explicit investigations for further definition of instream conditions and fish habitat variables. These additional investigations with concomitant data include the site scale vegetation monitoring, aquatic vegetation growth and abundance, river flow and velocities, seasonal habitat flow and velocities, and the fish creel census.

10.4 Results and Discussion

The changes in fish habitat must be considered in two separate contexts: the formerly dry reaches (Plots 1 and 2) and the wetted reaches (Plots 3, 4 and 5). Prior to the flow release, no water existed in the dry reaches of the upper portions of the LORP. Thus, Plots 1 and 2 display marked changes that would be expected when reintroducing water to a dry channel. Drawing comparative conclusions based on the two monitoring years is possible, but not expressly informative for these upper reaches; almost every variable measured has changed with the reintroduction of water. The 2010 data for Plots 1 and 2 should be considered relevant data from which to monitor changes and/or trends in fish habitat variables in the future. The lower, wet reaches of the river (Plots 3, 4, 5) display more subtle changes compared to the conditions prior to the flow release. Tabulated data from this year's monitoring can be found in Tables 4-8, below.

Monitoring results show that physical changes in fish habitat between 2002 (prior to release of restoration flows) and 2010 have been subtle in the wetted reach below Mazourka Canyon

Road. The Lower Owens River is a very slow moving desert-type stream with a slight gradient and low velocity that does not create riffles, significant or extensive bank undercuts, or significant runs. Also, because this is desert stream that has downcut through lacustrine sediments, the substrate is composed of muck, silt, sand and pebbles as the largest material; gravel sized material is rare and cobble sized material is nearly non-existent. Any cobble or boulder sized material found in or along the river channel was imported to build dams and diversions.

Because the changes in habitat have been and will continue to be subtle, it is difficult to draw many conclusions from the fish habitat monitoring data. Other direct and anecdotal information and data from the LORP channel survey and other monitoring work will be useful in future years as supplemental baseline data. For example, cross channel and elevation survey data collected in 2009 to support the flow modeling exercise, combined with 2010 vegetation mapping, could inform the development of key habitat features such as depth and escapement cover. The survey data includes depth profiles in the representative reaches, and aquatic vegetation extent at a fine scale, while the site-scale vegetation mapping describes specific tule and cattail extent across the river channel. Changes in these parameters over time could also illuminate subtle fish habitat changes.

The amount of water available for restoration of the Lower Owens River was orders of magnitude below historic flows, therefore reestablishing the fishery and its habitat focused on using lesser flows in an inset channel. Early modeling indicated the flow would remain in an historic, remnant channel; however the extent of side channel, oxbow, and water table filling was under-predicted. Habitat has developed sufficiently throughout the river corridor that fish have colonized all of the formerly dry reaches, the biological corridors connecting the river and off-channel lakes and ponds, and newly formed wetted areas adjacent to the river. Reports from the creel census indicate a healthy fishery that exhibits strong year-class structure, as well as high abundance and distribution throughout the river. This indicates that at this stage of fishery development, habitat for spawning, early rearing, escapement, and adult holding do not appear to be limiting factors for warmwater species.

Overstory cover from riparian vegetation and tules was expected to be the primary escapement and rearing habitat for warmwater fish species. Tules have developed rapidly while riparian overstory will colonize at a slower rate and channel depth has created significant, but limited, pools. The influence of tules can be seen in the change in thalweg depth. The deepest part of the river channel, within each sampling reach, increased and narrowed as tules encroached.

Channel width – Baseline channel width was determined prior to introduction of flows during the 2002 data collection and was based on reasonable estimates of channel capacity at that time. Recent data collection and importantly, the detailed LORP channel survey performed by LADWP recalibrated and reestablished the channel widths throughout each plot. Therefore, a comparison to baseline data is not viable. Wetted width results were more valuable indicators of channel capacity and change.

Wetted width – The wetted widths of all plots has increased. Plots 1 and 2 increased due to the introduction of water in the dry channel and is an irrelevant factor for comparisons. Plots 3, 4, 5 all increased in wetted width extent due to establishment of baseflows and seasonal habitat flows. Plot 4, in particular, increased significantly in wetted width. This river reach exhibits a tendency for water spreading and increased wetland type habitats at the margin of the main channel, and occurs readily in conjunction with the increased baseflow and high flow events.

Fish Habitat Table 1.

Average Wetted Widths (m)		
	2002	**2010**
Plot 1	Dry	12
Plot 2	Dry	25
Plot 3	31	43
Plot 4	26	74
Plot 5	16	20

Average and thalweg depths – Depths at Plots 1 and 2 are a result of reintroduction of river flows and have no comparison to baseline conditions. The average depth of Plot 3 increased, as is consistent with the reach's channel morphology. Conversely, average depths at Plots 4 and 5 decreased slightly, as is consistent with the increased overall wetted width and water spreading over shallower channel landforms. The increase in wetted width lowered the average channel depth. However, thalweg depth increased at each plot and tended to develop larger and deeper pools, with a more defined central flow in the river channel.

Fish Habitat Table 2.

Average Depth (cm)		
	2002	**2010**
Plot 1	Dry	54
Plot 2	Dry	72
Plot 3	53	109
Plot 4	159	143
Plot 5	126	100

Fish Habitat Table 3.

Averaged Thalweg Depth (cm)		
	2002	**2010**
Plot 1	Dry	87
Plot 2	Dry	113
Plot 3	104	177
Plot 4	198	205
Plot 5	151	161

Substrate – Substrates in the LORP consist almost exclusively of fines (including sands). Other substrate categories were not found through sampling in any plot of the LORP.

Canopy cover and organic debris –Canopy cover and organic debris were measured differently in 2002 than in 2010. Instream aquatic vegetation (predominantly tules) was measured in 2002 as part of total canopy and total organic debris. The lead scientist determined that measuring tule and aquatic vegetation should not be attributed to either canopy or organic debris (see the definition of these two variables in the methods section above). Canopy cover will increase over time with the establishment and growth of woody riparian species along the riverine-riparian zone. Organic debris was measured in 2010 exclusive of aquatic vegetation or tule growth. Instream aquatic vegetation spatial distribution and abundance is measured for each transect and throughout each plot under the site scale vegetation monitoring, and is included in the channel survey results.

Bank undercut –While bank undercuts do exist in the LORP, data collection did not detect significant undercut occurrences at sampling locations.

The cumulative tabular data for each plot for the 2010 monitoring year is displayed below.

10.4.1 Data Tables for 2010 Field Data

Fish Habitat Table 4. Plot 1

PLOT	Transect	Channel Width (m)	Wetted Width (m)	Boulder Substrate (m)	Cobble Substrate (m)	Gravel Substrate (m)	Fines Substrate (m)	Avg Depth (cm)	Thalweg (cm)	Canopy Cover (%)	Organic Debris (%)	Right Bank Undercut (cm)	Left Bank Undercut (cm)
1	1	28.0	20.5	0	0	0	20.5	58.0	82.0	0	0	0	0
1	2	20.6	12.4	0	0	0	12.4	16.0	44.0	10	0	0	0
1	3	26.2	16.0	0	0	0	16	52.0	80.0	5	0	0	0
1	4	15.5	9.1	0	0	0	9.1	55.0	73.0	0	10	0	0
1	5	21.9	10.8	0	0	0	10.8	52.0	99.0	0	0	0	0
1	6	17.4	8.2	0	0	0	8.2	53.0	76.0	0	0	0	0
1	7	13.6	8.8	0	0	0	8.8	58.0	85.0	10	0	0	0
1	8	12.3	7.7	0	0	0	7.7	55.0	98.0	0	0	0	0
1	9	14.2	10.8	0	0	0	10.8	55.0	102.0	30	10	0	2
1	10	14.0	6.3	0	0	0	6.3	61.0	83.0	0	0	0	0
1	11	19.6	14.4	0	0	0	14.4	49.0	70.0	0	0	0	0
1	12	18.7	15.3	0	0	0	15.3	70.0	113.0	0	0	0	0
1	13	16.0	11.6	0	0	0	11.6	55.0	110.0	0	0	0	0
1	14	16.0	8.4	0	0	0	8.4	64.0	119.0	0	30	0	0
1	15	20.0	10.0	0	0	0	10	58.0	76.0	5	10	0	0
1	16	20.6	14.2	0	0	0	14.2	58.0	88.0	0	0	0	0
1	17	16.5	8.2	0	0	0	8.2	49.0	73.0	0	5	0	0
1	18	15.4	10.5	0	0	0	10.5	37.0	67.0	0	5	0	0
1	19	16.7	12.3	0	0	0	12.3	64.0	101.0	0	0	0	15
1	20	13.0	10.0	0	0	0	10	52.0	91.0	0	5	0	0
1	21	28.0	22.0	0	0	0	22	61.0	107.0	0	0	0	0

Fish Habitat Table 5. Plot 2

PLOT	Transect	Channel Width (m)	Wetted Width (m)	Boulder Substrate (m)	Cobble Substrate (m)	Gravel Substrate (m)	Fines Substrate (m)	Avg Depth (cm)	Thalweg (cm)	Canopy Cover (%)	Organic Debris (%)	Right Bank Undercut (cm)	Left Bank Undercut (cm)
2	1	16.7	9.0	0	0	0	9	95	120	35	0	0	0
2	2	17.0	8.9	0	0	0	8.9	43	67	5	0	0	0
2	3	12.7	10.3	0	0	0	10.3	67	91	0	0	0	0
2	4	30.0	15.4	0	0	0	15.4	67	110	0	0	0	0
2	5	19.0	15.5	0	0	0	15.5	52	94	35	20	0	0
2	6	17.0	11.0	0	0	0	11	49	76	0	10	0	0
2	7	58.0	54.0	0	0	0	54	61	104	5	10	0	0
2	8	29.0	23.6	0	0	0	23.6	58	134	40	10	0	0
2	9	29.0	24.0	0	0	0	24	67	113	0	0	0	0
2	10	27.0	23.0	0	0	0	23	88	130	0	0	0	0
2	11	35.0	29.6	0	0	0	29.6	85	119	0	0	0	0
2	12	100.0	86.0	0	0	0	86	34	125	0	15	0	0
2	13	30.0	21.5	0	0	0	21.5	76	116	5	15	0	0
2	14	20.0	16.0	0	0	0	16	76	107	0	10	0	0
2	15	19.0	16.0	0	0	0	16	91	140	0	5	0	0
2	16	37.0	32.0	0	0	0	32	83	125	0	10	0	0
2	17	37.0	31.5	0	0	0	31.5	75	110	0	15	0	0
2	18	52.0	30.0	0	0	0	30	85	113	5	15	0	0
2	19	32.0	26.0	0	0	0	26	79	130	0	10	0	0
2	20	37.0	20.7	0	0	0	20.7	80	119	0	10	0	0
2	21	35.0	29.4	0	0	0	29.4	91	122	5	10	0	0

Fish Habitat Table 6. Plot 3

PLOT	Transect	Channel Width (m)	Wetted Width (m)	Boulder Substrate (m)	Cobble Substrate (m)	Gravel Substrate (m)	Fines Substrate (m)	Avg Depth (cm)	Thalweg (cm)	Canopy Cover (%)	Organic Debris (%)	Right Bank Undercut (cm)	Left Bank Undercut (cm)
3	1	53.0	45.0	0	0	0	45	73	146	15	20	0	0
3	2	40.0	33.5	0	0	0	33.5	167	247	40	10	0	0
3	3	37.0	28.8	0	0	0	28.8	120	293	0	10	0	0
3	4	47.0	40.5	0	0	0	40.5	117	186	5	0	0	10
3	5	63.0	42.3	0	0	0	42.3	110	156	10	15	0	0
3	6	42.0	35.7	0	0	0	35.7	119	171	5	10	0	0
3	7	62.0	55.0	0	0	0	55	70	130	5	10	0	0
3	8	46.0	38.6	0	0	0	38.6	80	176	25	10	0	0
3	9	54.0	35.0	0	0	0	35	82	137	10	10	0	0
3	10	55.0	47.5	0	0	0	47.5	65	130	40	15	0	0
3	11	31.0	25.8	0	0	0	25.8	90	168	25	20	0	0
3	12	40.0	33.8	0	0	0	33.8	93	130	20	15	0	0
3	13	58.0	52.0	0	0	0	52	120	171	30	35	0	0
3	14	58.0	52.5	0	0	0	52.5	137	188	15	20	0	0
3	15	48.0	42.5	0	0	0	42.5	110	183	15	10	0	0
3	16	39.0	27.0	0	0	0	27	100	165	5	10	0	0
3	17	51.0	44.5	0	0	0	44.5	175	214	20	15	0	0
3	18	70.0	63.8	0	0	0	63.8	145	186	10	15	0	0
3	19	41.0	35.6	0	0	0	35.6	120	177	0	5	0	0
3	20	46.0	41.5	0	0	0	41.5	90	190	5	10	0	0
3	21	103.0	85.0	0	0	0	85	100	175	15	15	0	0

Fish Habitat Table 7. Plot 4

PLOT	Transect	Channel Width (m)	Wetted Width (m)	Boulder Substrate (m)	Cobble Substrate (m)	Gravel Substrate (m)	Fines Substrate (m)	Avg Depth (cm)	Thalweg (cm)	Canopy Cover (%)	Organic Debris (%)	Right Bank Undercut (cm)	Left Bank Undercut (cm)
4	1	45.0	38.0	0	0	0	38	153	201	0	10	0	0
4	2	42.0	33.0	0	0	0	33	120	165	15	15	0	0
4	3	27.0	23.0	0	0	0	23	122	171	10	5	0	0
4	4	36.0	29.0	0	0	0	29	182	253	10	5	0	0
4	5	27.0	23.0	0	0	0	23	137	220	5	15	0	0
4	6	39.0	35.0	0	0	0	35	125	201	0	5	0	0
4	7	33.0	28.5	0	0	0	28.5	113	160	0	0	0	5
4	8	49.0	45.0	0	0	0	45	120	180	10	10	0	0
4	9	85.0	75.0	0	0	0	75	185	232	5	0	0	0
4	10	48.0	36.0	0	0	0	36	200	253	0	0	0	0
4	11	274.0	262.0	0	0	0	262	153	241	0	0	0	0
4	12	195.0	183.0	0	0	0	183	150	265	0	0	0	0
4	13	209.0	201.0	0	0	0	201	195	284	0	0	0	0
4	14	150.0	141.0	0	0	0	141	140	232	0	5	0	0
4	15	214.0	204.0	0	0	0	204	167	248	45	15	0	0
4	16	88.0	76.0	0	0	0	76	95	116	10	0	0	0
4	17	38.0	31.0	0	0	0	31	79	110	40	5	0	0
4	18	36.0	32.0	0	0	0	32	195	235	0	0	0	0
4	19	29.0	25.0	0	0	0	25	80	95	0	5	0	0
4	20	30.0	21.8	0	0	0	21.8	100	167	0	15	0	0
4	21	24.0	16.0	0	0	0	16	200	274	0	10	0	0

Fish Habitat Table 8. Plot 5

PLOT	Transect	Channel Width (m)	Wetted Width (m)	Boulder Substrate (m)	Cobble Substrate (m)	Gravel Substrate (m)	Fines Substrate (m)	Avg Depth (cm)	Thalweg (cm)	Canopy Cover (%)	Organic Debris (%)	Right Bank Undercut (cm)	Left Bank Undercut (cm)
5	1	38.0	32.0	0	0	0	32	91	168	10	15	0	0
5	2	19.0	13.0	0	0	0	13	82	159	45	15	0	0
5	3	25.0	22.0	0	0	0	22	94	170	0	5	0	0
5	4	23.0	19.7	0	0	0	19.7	119	186	0	0	0	0
5	5	25.0	21.0	0	0	0	21	107	183	0	5	0	0
5	6	32.0	28.5	0	0	0	28.5	97	128	0	5	0	0
5	7	26.0	22.0	0	0	0	22	57	146	5	0	0	0
5	8	30.0	22.5	0	0	0	22.5	101	177	0	20	0	0
5	9	24.0	20.6	0	0	0	20.6	97	159	10	10	0	0
5	10	20.0	16.0	0	0	0	18.8	82	180	10	5	0	0
5	11	23.0	19.0	0	0	0	19	90	145	0	5	0	0
5	12	25.0	21.8	0	0	0	21.8	80	133	5	5	2	0
5	13	28.0	23.0	0	0	0	23	79	130	35	15	0	0
5	14	21.0	17.0	0	0	0	17	130	198	10	10	0	0
5	15	21.0	17.8	0	0	0	17.8	103	136	0	5	0	0
5	16	21.0	17.0	0	0	0	17	98	133	75	20	0	0
5	17	27.0	23.0	0	0	0	23	101	165	15	15	0	0
5	18	20.0	16.0	0	0	0	16	110	159	30	15	0	0
5	19	21.0	15.4	0	0	0	15.4	180	223	40	10	0	0
5	20	16.0	12.7	0	0	0	12.7	80	130	15	10	0	0
5	21	18.0	11.5	0	0	0	11.5	120	170	10	10	0	0

10.4.2 Qualitative Results

Photo points taken at each transect represent qualitative depictions of changes to the river channel. Photos taken at each transect facing upstream, downstream and cross channel often reveal details that are not evident through quantitative measurements. The photo points are taken on both the left bank and right bank at the intersection of the transect and wetted edge. The photos are representative of the area around the transect, and as such, are not exact viewfinder replications of the exact view frame between years.

In conjunction with the on-the-ground photos, a review of the aerial and satellite imagery between the monitoring years displays changes and details related to riverine habitat. Viewing both aerial and site images as between year ‘change pairs’ offers a visual understanding of the landscape transformations. Below is a representative selection of photo points in the LORP taken during fish habitat monitoring efforts.

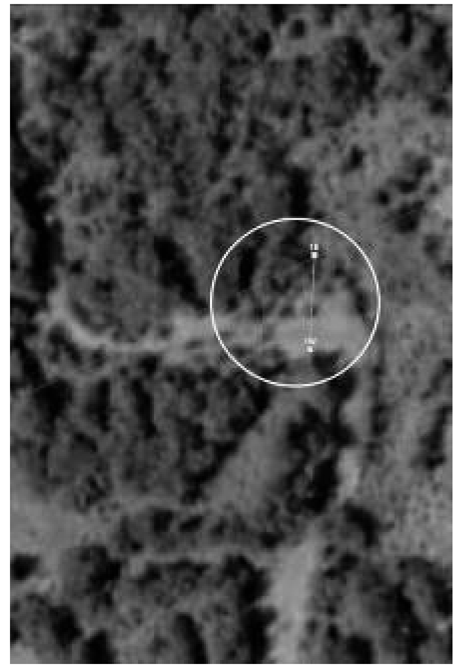
The most dramatic changes can be seen in Plots 1 and 2, which were dry reaches prior to flow reintroduction. These reaches were also part of a large scale saltcedar eradication program that was conducted in the channel prior to flow release.

10.5 Selected Photo Point Change Pairs 2002 – 2010

Plot 1 Transect 1; Facing Upstream

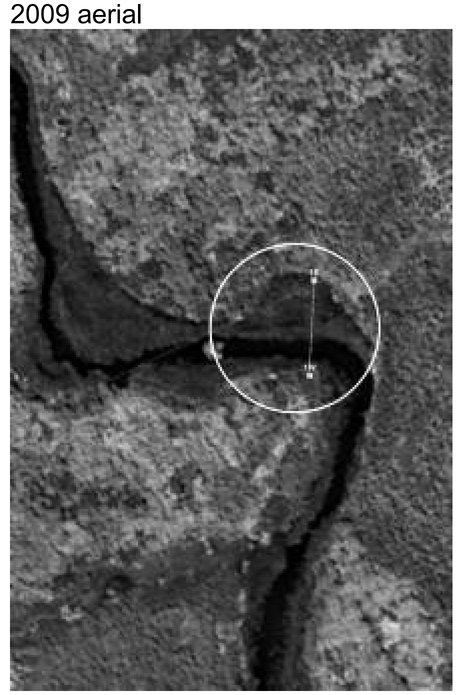
2002

2002 aerial



2010

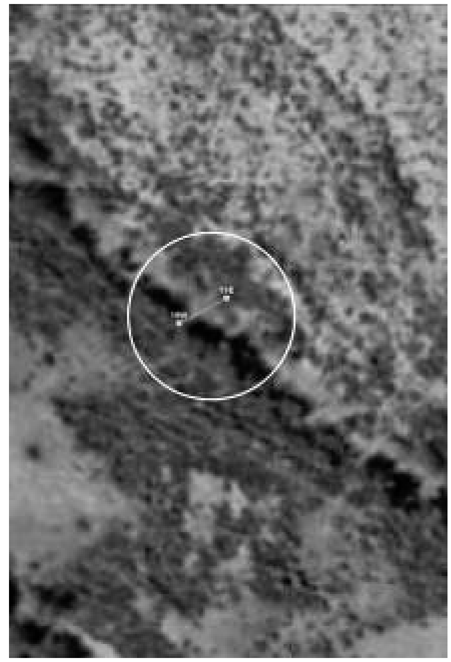
2009 aerial



Plot 1 Transect 19; Facing Upstream

2002

2002 aerial



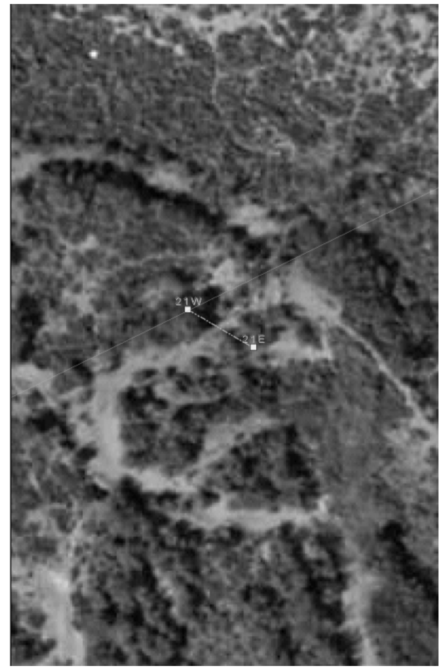
2010

2009 aerial

Plot 1 Transect 21; Facing Upstream

2002

2002 aerial



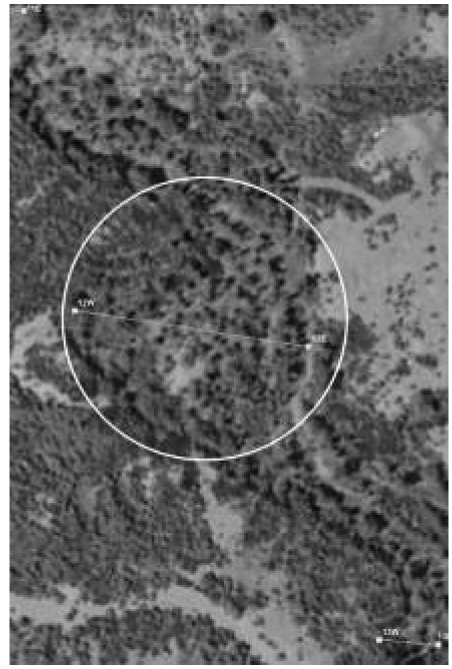
2010

2009 aerial

Plot 2 Transect 12; Facing Downstream

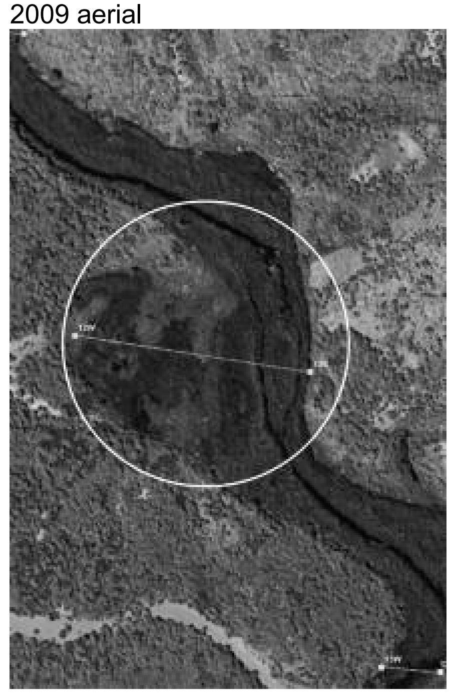
2002

2002 aerial



2010

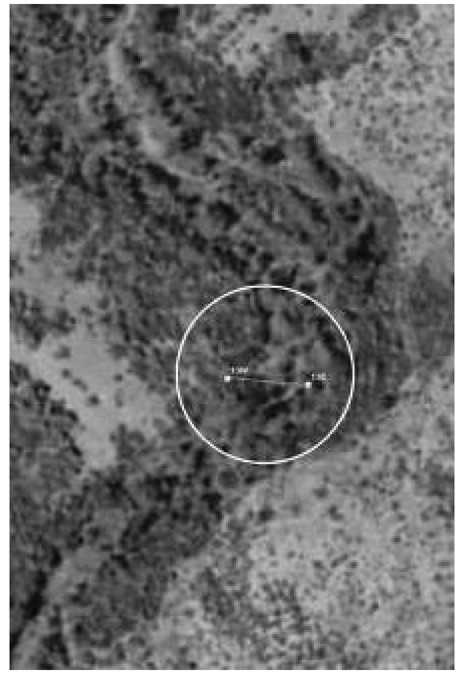
2009 aerial



Plot 2 Transect 13; Facing Downstream

2002

2002 aerial



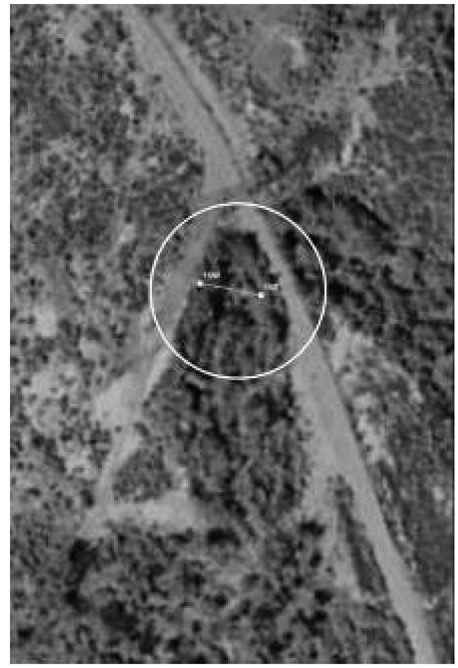
2010

2009 aerial

Plot 2 Transect 15; Facing Upstream

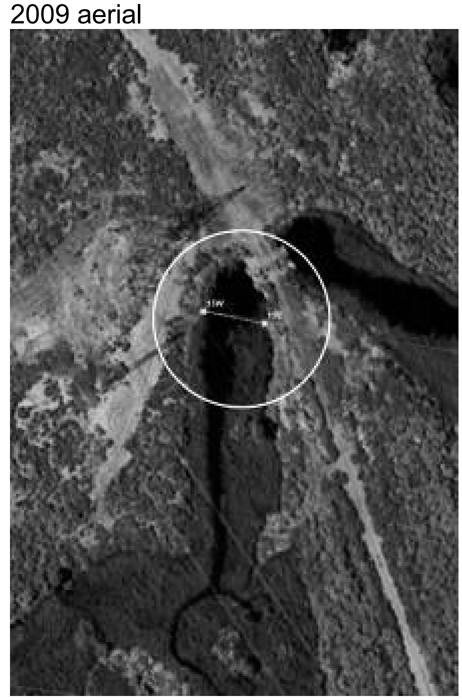
2002

2002 aerial

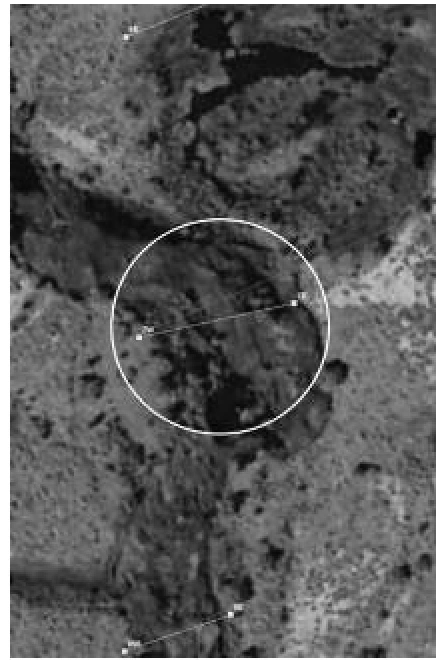
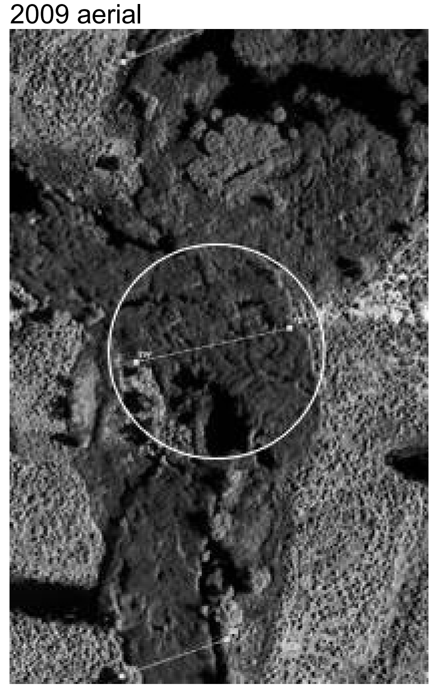


2010

2009 aerial



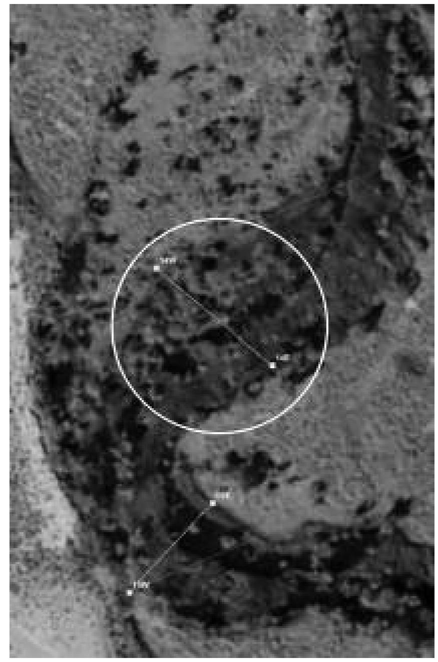
Plot 3 Transect 7; Facing Downstream

2002	2002 aerial
	
2010	2009 aerial
	

Plot 3 Transect 14; Facing Upstream

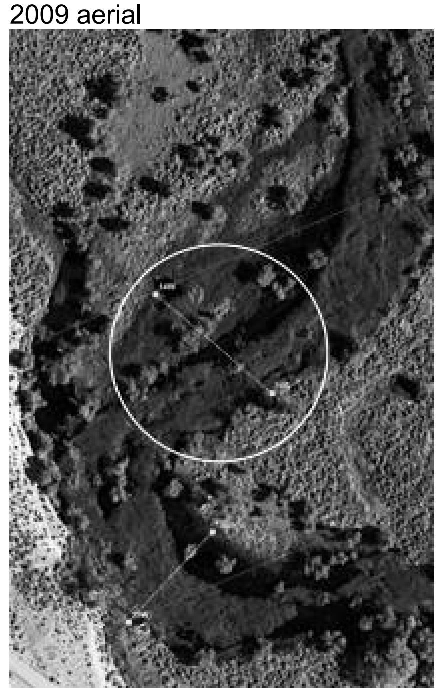
2002

2002 aerial

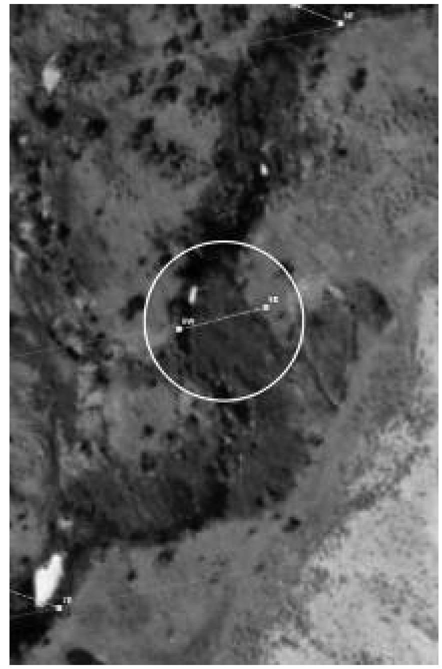
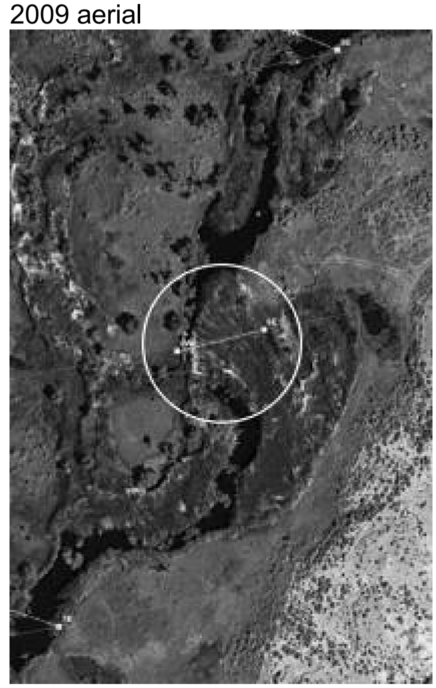


2010

2009 aerial



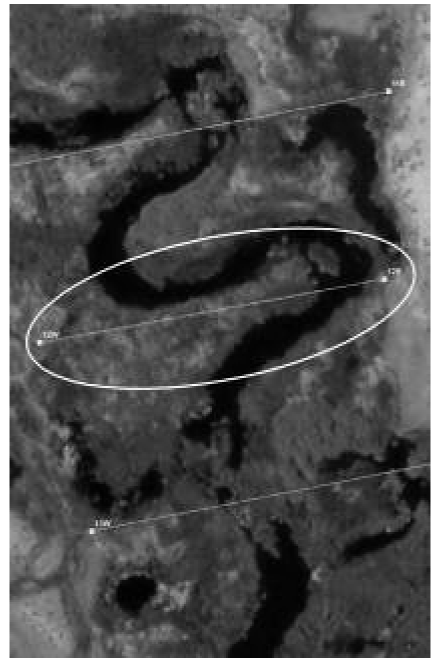
Plot 4 Transect 6; Facing Upstream

2002	2002 aerial
	
2010	2009 aerial
	

Plot 4 Transect 12; Facing Upstream

2002

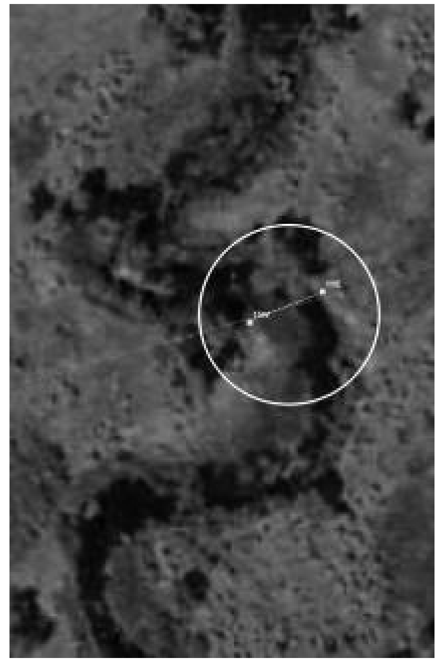
2002 aerial



2010

2009 aerial

Plot 5 Transect 15; Facing Downstream

2002 	2002 aerial 
2010 	2009 aerial 

10.6 References

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11.0 WEED CONTROL

Inyo/Mono Counties Agricultural Commissioner's Office LORP Weed Report – 2010

11.1 Background

In 2005, the Los Angeles Department of Water and Power (LADWP) and the Inyo/Mono Counties' Agricultural Commissioner's Office (AgComm) entered into a seven-year agreement (Agreement) with the goal of managing the growing threat of nonnative invasive weeds on lands owned by the City of Los Angeles (City). This Agreement provided AgComm with $150,000 per year for weed management activities outside of the Lower Owens River Project (LORP) boundaries, and $50,000 per year for weed management activities within LORP boundaries. In the spring of 2006, AgComm took over treatment of the majority of known weed sites on City-owned lands within Inyo and Mono counties, which in 2005, amounted to 23,560 gross acres.

The Agreement between LADWP and AgComm focuses on the protection of the LORP area during habitat restoration from noxious weed invasion. This will be primarily accomplished by attempting to eradicate known weed populations within the LORP area, and also by reducing the threat of new invasions by aggressively managing upstream populations. The detection component is critical to the protection of the LORP, as this region is a recovering habitat with many disturbed areas. Disturbed conditions make this area more conducive to weed establishment.

In addition to treatment, detection of new weed sites within the LORP area is a requirement of the Agreement. During certain times of the year, or during the treatment season when conditions do not permit treatment, personnel from AgComm are expected to perform detection surveys to find new sites. Several times each year surveys are conducted in areas within the LORP area, and in other areas outside the LORP where surveys have either not been previously conducted or in areas considered high risk. High risk areas would include areas near the Owens River or tributaries thereof, areas that have been disturbed, and areas where livestock or wildlife that move from place to place is present.

While protecting native habitat during the critical first stage of the lower Owens River re-watering is the paramount goal of this project, there are many other positive consequences that will result from this work. A healthy native plant habitat will support wildlife (including some threatened and endangered species), help to reduce stream bank erosion and dust, maintain healthy fire regimes, preserve the viability of open-space agriculture and conserve recreational opportunities.

As of October 2010, known weed sites on City land total 32,069 gross acres, which is more than a 36% larger land area than in the agreement. LORP sites specifically have grown 114%, from 142 gross acres to 304 gross acres. AgComm has applied for and been awarded several grants to supplement the original agreement. This has allowed AgComm to expand efforts to meet the management goals of the agreement despite the addition on newly discovered infestations.

11.2 Summary of LORP Weed Management Activities in 2010

Considerable time was spent in both survey and treatment activities in the LORP area in 2010. There were several modifications in LORP weed management strategy including increased staff, treatment method modifications, herbicide changes, and enhanced survey efforts. These adjustments will continue in 2011and possibly beyond if resources permit. The following explains the alterations in detail, followed by monitoring protocol descriptions and a general population trends discussion.

11.2.1 Increased Staff

By securing additional resources from grants and agreements, AgComm has increased the number of staff available for work in the LORP area. This augmented staff also had more hours to devote to the LORP area specifically in 2010, which more than doubled past efforts. Increased staff, for a longer period of time, allowed AgComm to make adjustments in weed management and also increased time surveying the LORP area for new populations.

11.2.2 Method of Treatment

In previous years many herbicide applications were made using ATV mounted sprayers. This method was preferred because the vast area that had to be carefully inspected to properly manage weed sites was impossible to cover with the limited staff available. Increased staffing has allowed for the use of backpack sprayers for herbicide applications, which allows for lower-volumes of herbicide use and better targeted treatments. This application method also decreases disturbance of desirable native plant species.

11.2.3 Herbicide

Data from previous years indicated that perennial pepperweed populations were becoming resistant to the primary herbicide used on LORP sites. After observing this trend, new options for herbicides effective on perennial pepperweed were researched.

Imazapyr® was selected to replace the previously used herbicide Chlorosulfuron, and encouraging results have been observed in re-growth patterns in 2010. Anecdotal evidence for other agencies corroborates the results observed in the field. When using Chlorosulfuron sites were typically re-treated two to three times per year, when using Imazapyr® most sites had very little growth requiring re-treatment at all. Definite results will not be known until populations can be re-assessed in spring 2011.

11.2.4 Enhanced Survey

Survey efforts were greatly enhanced in 2010 for several reasons. More staff and fewer re-treatment visits enabled AgComm to provide more survey hours within the LORP in 2010. Adding to these efforts were grant resources obtained by AgComm to survey the Los Angeles Aqueduct for perennial pepperweed, which helps to identify infestations with potential to spread into the LORP. RAS data also contributed several previously unknown weed sites.

All of these factors have greatly improved data quality and quantity. Updated maps have been generated (Weed Control Figures 2-5) of not only the LORP area, but areas upstream as well. One of the areas where data was previously non-existent is the Owens River between Highway 168 and Tinemaha Reservoir. Weed population data is now known for this area just upstream from the LORP, and eradication and control efforts can begin.

Determining the acreage of weed sites treated is conducted using two methods:

1) Spraying equipment is calibrated at least twice per-year. This is done by marking out one-tenth of an acre, and then covering this area with a water/dye mixture in the same way it would be sprayed if it were a solid stand of weeds. The number of gallons used is then multiplied by 10 to establish a gallon per-acre figure for every sprayer.

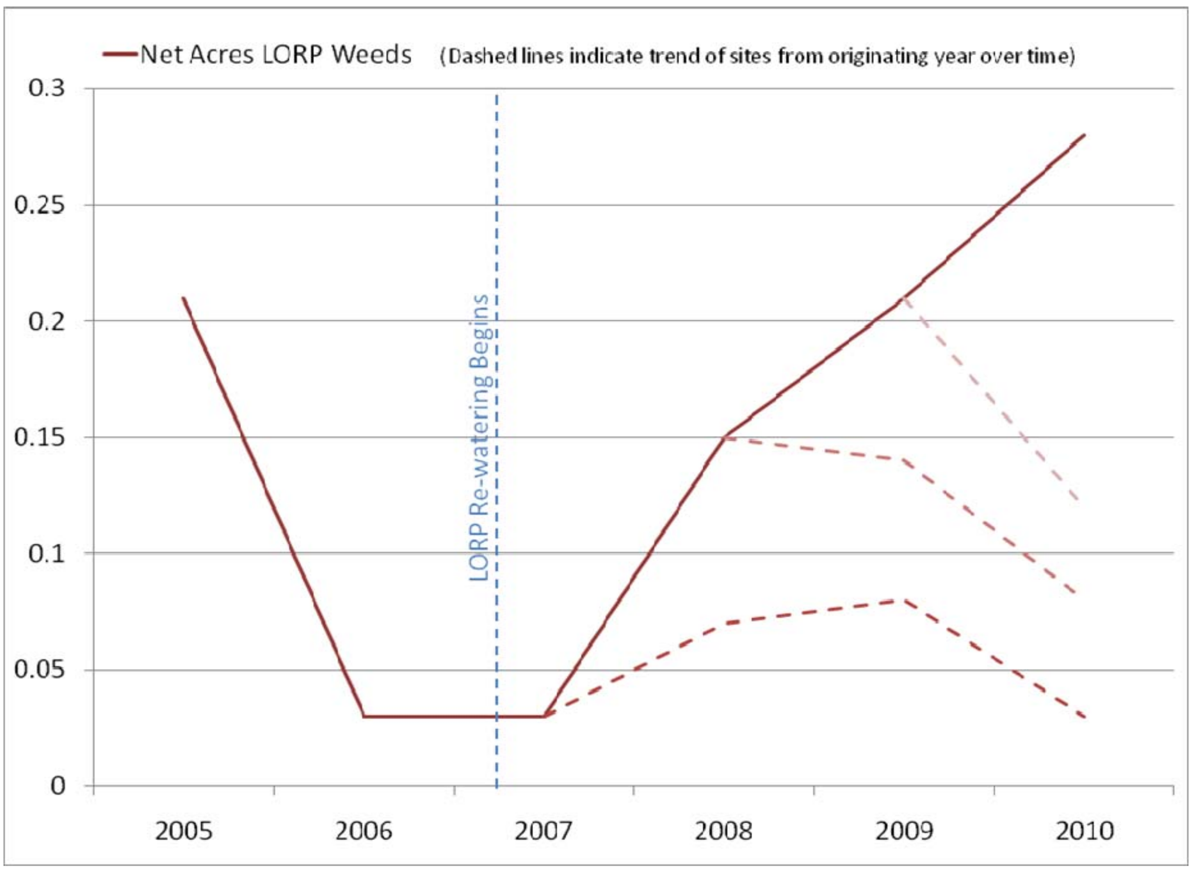
2) Daily figures are collected for sprayer usage and site number. Monitoring usage in each site and then converting usage to acreage can ascertain net acreages. These net acreages are recorded in the weed database for each site yearly to track progress over time.

The data collected from daily usage reports is collected and recorded for 100% of sites. This method has been extremely accurate in past years, and is the primary gauge of success used by AgComm when planning future strategies.

11.2.5 Weed Population Trends

Known weed infestations within the LORP boundaries grew from 289 to 304 gross acres in 2010. Within this infested area, there were .28-net acres of scattered weed infestations. Previously recorded sites declined from .21 to .12-net acres; however, 15 new sites were discovered. Because of these 15 new sites, the total known net weed population acreage increased 33% between 2009 and 2010 to .28 acres (Weed Control Figure 1).

Increased time and staff for survey efforts were probably factors in the sharp increase of new sites found. The general trend in sites within the LORP seems to have gone from static to increasing (Weed Control Table 1). The rise in new sites coincides with the re-watering of the Lower Owens River. This trend was somewhat predictable as re-watering and the initial disturbance from the LORP project increases suitable habitat for weeds.



Weed Control Figure 1. Net Weed Population

Weed Control Table 1. Site Trends

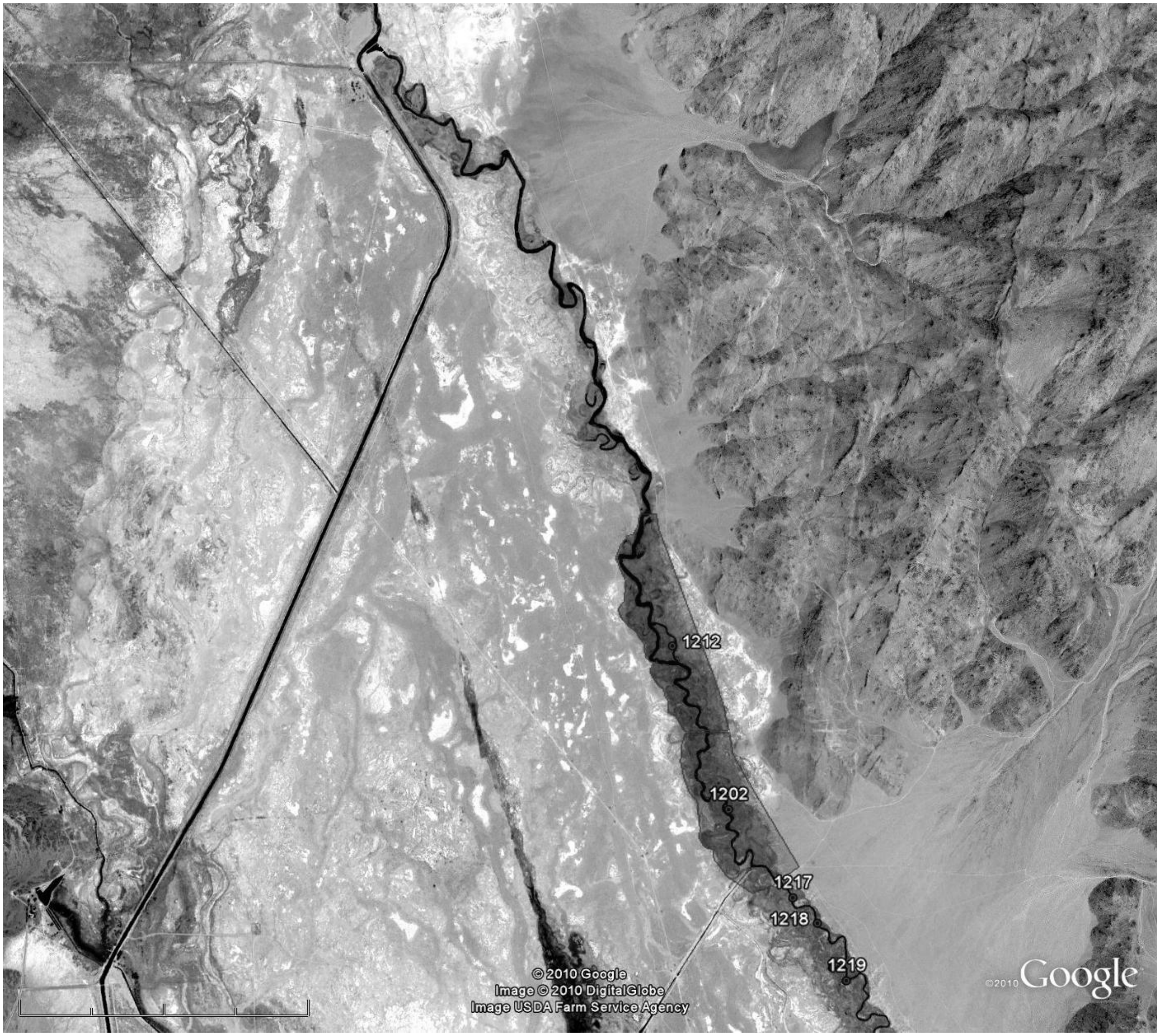
Year	Total Number of Sites	New Sites Discovered	Sites with No Growth
2002	2	0	0
2003	2	0	1
2004	3	1	1
2005	4	1	1
2006	4	0	1
2007	4	0	1
2008	12	8	1
2009	17	5	4
2010	32	15	5

The number of known sites within the LORP area grew substantially in 2010 from 17 to 32 sites. Eight new sites were discovered by AgComm in 2010 during the course of routine surveys covering 35,292 acres. In addition to these sites discovered by AgComm, seven additional populations were discovered by the LORP Rapid Assessment Survey (RAS). Additional surveys within the LORP area will be conducted throughout the winter.

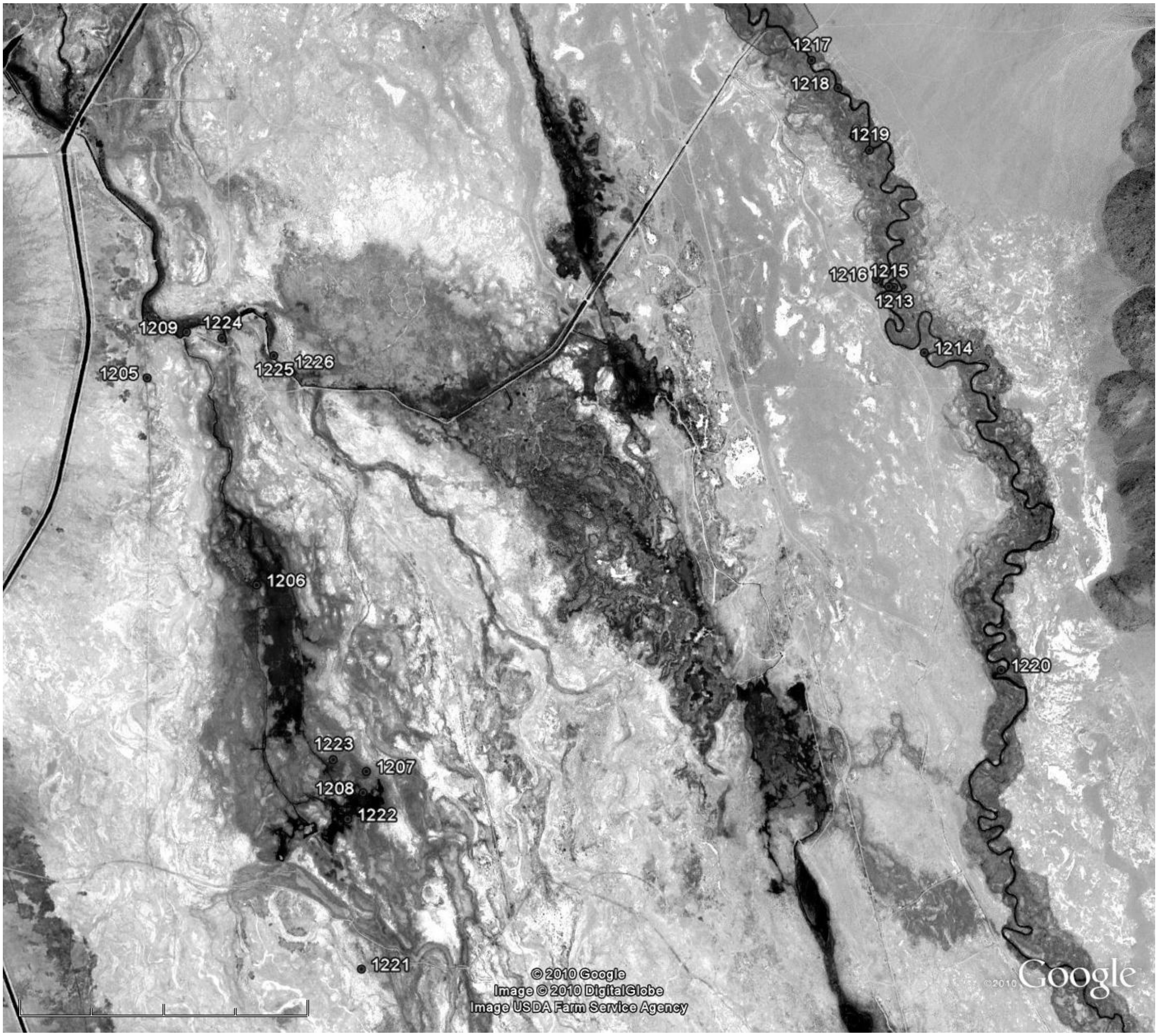
All weed locations noted in the 2009 RAS were surveyed and incorporated in management activities in 2010. Populations found during the 2010 RAS have also been included in the weed location database, have been visited twice since the RAS, and will be a part of the regular management activities in 2011.

Weed Control Table 2. 2009 Site Data - LORP Area

Site Number	Location (lat/long)	Gross Acreage	Times Visited	Net Acreage	Population Trend	Notes
1202	N 36.934412° W 118.186280°	90	3	.01	Unchanged	4 plants (10/7)
1205	N 36.913793° W 118.223304°	1	3	.01	Unchanged	5 plants
1206	N 36.899237° W 118.217790°	1	3	.01	Expanding	7 plants
1207	N 36.894251° W 118.209626°	1	3	.01	Expanding	4 plants
1208	N 36.893197° W 118.209831°	1	3	0	No Growth	Plants Absent
1209	N 36.916071° W 118.220869°	1	3	0	No Growth	Plants Absent
1212	N 36.943252° W 118.190076°	102	3	.01	Declining	8 plants (10/7)
1213	N 36.918314° W 118.176859°	1	3	.01	Declining	9 plants
1214	N 36.915051° W 118.174960°	1	3	.01	Unchanged	3 plants
1215	N 36.918349° W 118.177173°	1	2	.01	New	15 plants
1216	N 36.918728° W 118.177968°	1	2	.01	New	7 plants
1217	N 36.929658° W 118.181944°	1	2	.01	New	3 plants
1218	N 36.928276° W 118.180291°	1	2	.01	New	plants absent (10/12)
1219	N 36.925170° W 118.178338°	1	2	.02	New	plants absent (10/12)
1220	N 36.899266° W 118.170248°	1	2	.01	New	5 plants
1221	N 36.884500° W 118.209909°	1	2	.01	New	20 plants
1222	N 36.891874° W 118.210775°	1	2	.01	New	5 plants
1223	N 36.894836° W 118.211685°	1	2	.01	New	3 plants
1224	N 36.915777° W 118.218673°	1	2	.01	New	2 plants
1225	N 36.914892° W 118.215433°	1	2	.01	New	5 plants
1226	N 36.914365° W 118.214747°	1	2	.01	New	Plants absent (10/12)
1303	N 36.831962° W 118.144384°	1	2	.01	New	
1308	N 36.749339° W 118.147523°	1	3	.01	Unchanged	
1401	N 36.715251° W 118.091485°	40	3	.01	Unchanged	15 plants
1402	N 36.713190° W 118.109946°	1	3	0	No Growth	
1407	N 36.737222° W 118.106984°	1	3	.01	Unchanged	10 plants
1408	N 36.734466° W 118.106960°	1	3	.01	Unchanged	20 plants
1409	N 36.728281° W 118.100968°	1	3	0	No Growth	
1410	N 36.735863° W 118.112003°	1	3	0	No Growth	
1411	N 36.727752° W 118.098255°	1	3	.01	Unchanged	
1412	N 36.713457° W 118.113858°	1	3	.01	New	
1503	N 36.556821° W 118..054905°	44	3	.01	Declining	21 plants

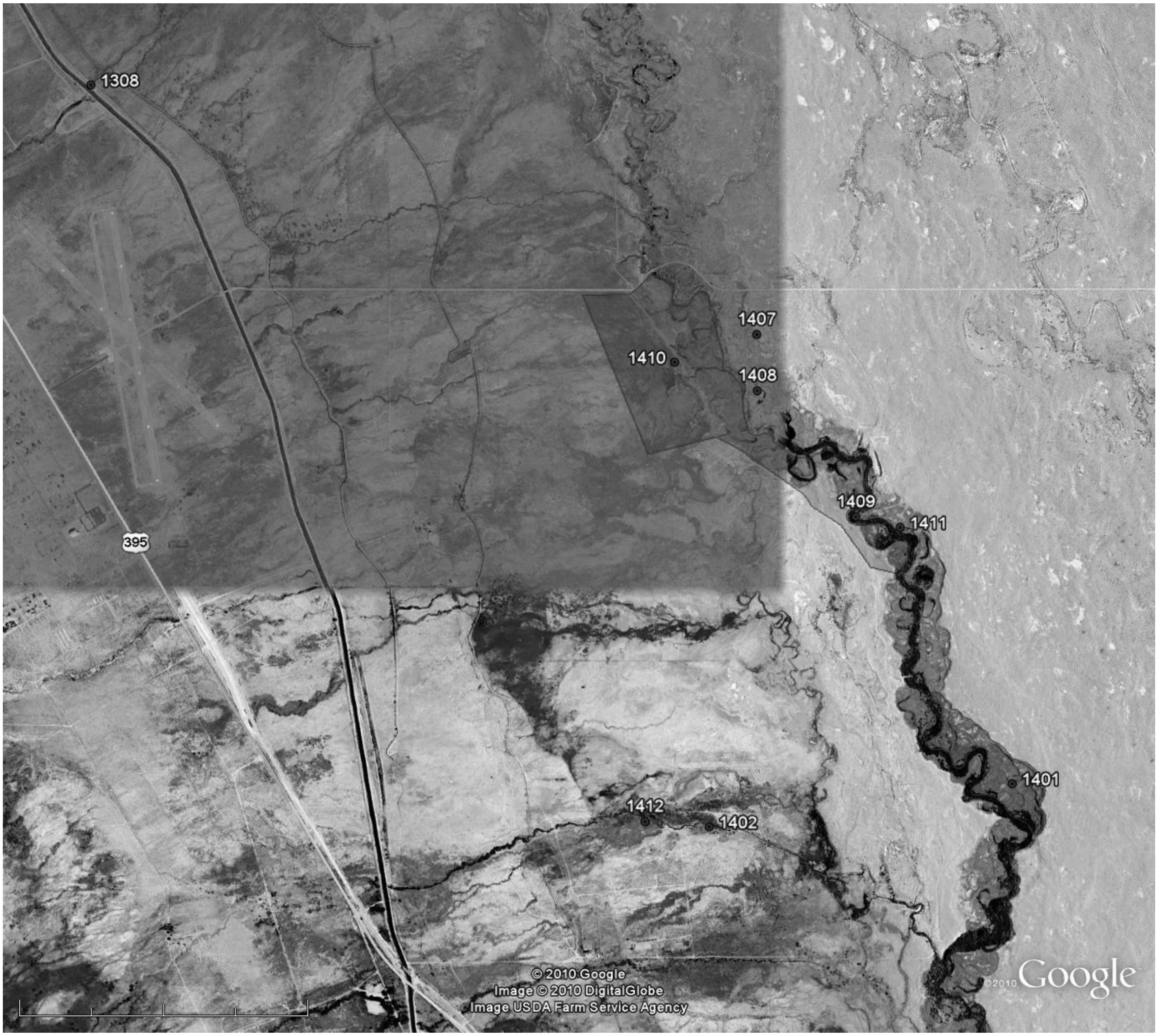


Weed Control Figure 2. Owens River, Intake to Blackrock Ditch
Sites 1217, 1218, and 1219 were newly discovered in 2010



Weed Control Figure 3. Owens River and Blackrock Area
Sites 1215-1226 were newly discovered in 2010

Weed Control Figure 4. Mazourka Canyon Road Area
Site 1303 was newly discovered in 2010



Weed Control Figure 5. Manzanar Reward Road Area
Site 1412 was newly discovered in 2010

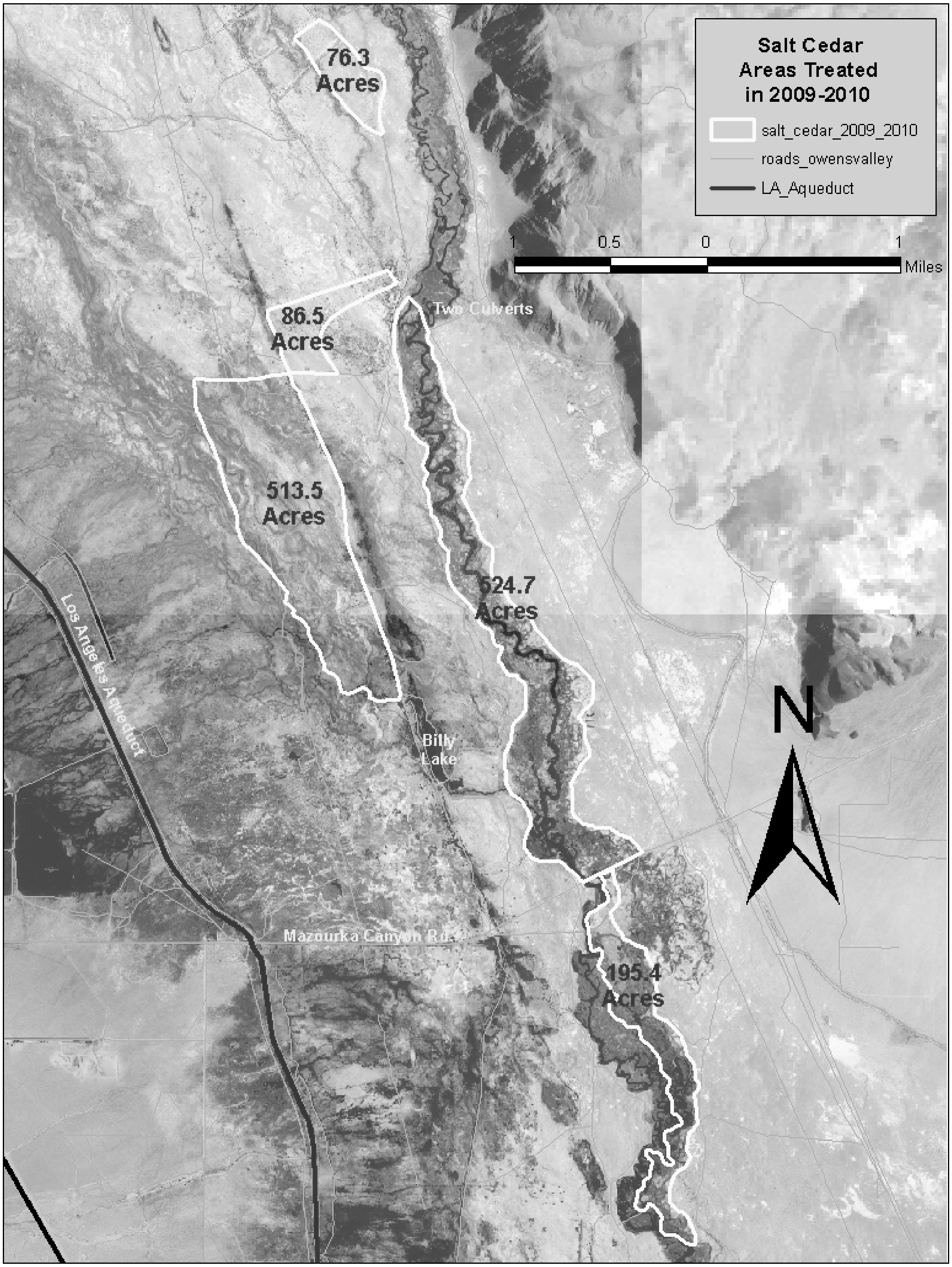
11.3 Saltcedar Report

During the 2009-2010 field season (October to March) the Inyo County saltcedar field crew consisted of seven seasonal employees, one shared employee, and one permanent employee. Working in teams of three, workers cut and treated with herbicide, approximately 480 acres of saltcedar (*Tamarix ramosissima*) at various priority areas within the boundaries of the LORP (Weed Control Figure 6). Work was focused on eradicating plants in areas north of Billy Lake in water spreading basins bordering the Billy Lake and Two Culverts Road. These spreading basins, dense with saltcedar, are reservoirs of viable seed. By cutting and treating these river adjacent basins, our long-term goal is to reduce the local seed bank and decrease the likelihood of reinfestation along the river.

Outside the north of Billy Lake area crews were guided by data received in the 2009 Rapid Assessment Survey (RAS) (Weed Control Table 3). RAS 2009 GPS waypoints were used to guide crews to tamarisk seedling sites in their work area. All of the known and discovered, recruitments, and resprout sites were treated between river-mile 16 and river-mile 20.6.

The Saltcedar Control Program is funded by annual payments from LADWP specified under the Long Term Water Agreement. The program also receives grant funding from the California Wildlife Conservation Board with matching funds provided by LADWP up to $1,500,000. As of September 2010, LADWP has provided $967,241 in matching funds to treat saltcedar in the LORP.

The Saltcedar Control Program has successfully supported the participation of the Owens Valley Conservation Camp in cooperation with California Department of Forestry and Fire Prevention (Cal Fire) and LADWP in the use of controlled burns for reducing the amount of saltcedar slash in the project areas. The Saltcedar Control Program believes that an active “controlled burn program” during the months of December through February is the safest and most cost-effective method to reduce future slash piles in the LORP.



Weed Control Figure 6. Boundaries of Areas Worked by the Inyo County Saltcedar Program in 2009-2010

Weed Control Table 3. Locations of Tamarisk Found by the RAS in 2009 and Treated by the Inyo County Saltcedar Program

LOCATION	CODE	EASTING	NORTHING	DESCRIPTION
Two Culverts	TARA_SEED	398366	4075596	TARA seedlings and juvenile in middle of river
Two Culverts	TARA_SEED	397890	4077504	Less than 1-meter height, spread for 20 meters along waters edge.
Two Culverts	TARA_SEED	397920	4077342	Approximately 6 seedlings near GPS point
Two Culverts	TARA_SEED	398391	4075517	TARA seedlings in river channel
Two Culverts	TARA_SEED	398550	4075466	1 TARA seedling on bank

12.0 ADAPTIVE MANAGEMENT RECOMMENDATIONS

Executive Summary

The roles and responsibilities for collecting, analyzing and reporting monitoring data are described in the 2008 LORP Monitoring, Adaptive Management and Reporting Plan (MAMP). The MOU Consultants reviewed LADWP's and ICWD's 2010 LORP Annual Draft Report and developed adaptive management recommendations to ensure LORP goals are met in the four Lower Owens River management areas: the Riverine-Riparian Area, Blackrock Waterfowl Management Area (BWMA), and Off-River Lakes and Ponds. These recommendations are related to and build upon the adaptive management recommendations made in 2009.

The 2010 monitoring included vegetation mapping at the landscape and site scales, fish habitat survey and fish creel census, hydrologic monitoring including flood extent, discharge, and gains and losses, rapid assessment survey, water quality, saltcedar and weed conditions, and assessment of habitat for indicator species.

The overall goal of the LORP, as stated in the MOU, is as follows: "*The goal of the LORP is the establishment of a healthy, functioning Lower Owens River riverine-riparian ecosystem, and the establishment of healthy functioning ecosystems in the other elements of the LORP, for the benefit of biodiversity and threatened and endangered species, while providing for the continuation of sustainable uses including recreation, livestock grazing, agriculture, and other activities.*"

Monitoring results, to date, indicate that the LORP is trending toward attainment of the MOU goals. The Lower Owens River supports a healthy warmwater fishery; habitat for indicator species has developed and continues to develop; biodiversity in wetlands and riverine habitats has increased; Threatened and Endangered species are using the restored habitat; grazing and other land uses are continuing, and recreational activities continue to increase.

Adaptive management recommendations are described in the sections below and are summarized in the Summary of Adaptive Management Recommendations table below. The MOU Consultants also provide recommendations for improving data collection and analysis in future monitoring. Adaptive management is intended to be responsive to new information and data in order to achieve MOU goals. Thus, monitoring itself is subject to change and improvement.

The premise of monitoring put forward in the MAMP is that monitoring must be cost effective and provide useful scientific data. Results from this year's monitoring indicate that some programs are not effective or particularly useful for decision making. Consequently, the MOU Consultant's recommendations include discontinuing some monitoring programs (e.g. fish habitat), modifying existing programs and introducing new monitoring methods (belt transects in riparian zones). The highest priority recommendation is to complete the flow modeling as recommended for the past three years.

The most pressing problem in the LORP is tule and cattail encroachment into the river channel. The colonization of tules and cattails along the river edges and in the channel has exceeded original projections by about 20 percent. Tules and cattails limit access to many river reaches and in some places have occluded the channel. Some additional control of tule and cattails to achieve more open water may be obtained with different base flows in the spring/summer and winter. The purpose of the flow modeling is to evaluate those physical conditions (depth and velocity) that may provide a reduction in tule and cattail biomass. The goal of tule and cattail control is not to eliminate tules, which would be impossible, but to create more open water throughout the river channel. Tule and cattails provide important habitat for juvenile fish, as well as improve water quality. However, the unvaried base flow of 40 cfs has created “canal” conditions ideal for tule and cattail growth.

Adaptive Management Table 1. Summary of 2010 Adaptive Management Recommendations

Management Area	Recommendation and/or Action to be Taken
Riverine-Riparian Area	• Conduct river modeling and flow analysis and provide recommendations. • LADWP develop a feasibility analysis addressing alternatives to improve the flow measuring capability of the LAA Intake Control Structure. • LADWP, ICWD and the MOU Consultants participate in a mapping conference to identify a repeatable methodology for the landscape mapping and determine how to account for error when comparing multiple years of data. • Normalize the flooding extent and inundation data for the seasonal habitat flow before extrapolating to the reach and river-wide. Perform the vegetation inundation analysis. • Re-map the landforms of the LORP to more accurately monitor seasonal habitat flow events and flooded extent. • Conduct review by the scientific team of GIS data, summarized data, map outputs and reporting for seasonal habitat flow and flooded extent. • Decrease seasonal habitat flow duration so the available water can be used to increase the peak flow on all years when the average annual flow is predicted to be from 60 to 99 percent of normal. • Discontinue River Flow Loss and Gain Report. • Conduct fisheries creel census only during spring on the years designated in the MAMP. Eliminate the fall census. • Discontinue fish habitat surveys until warranted in the future. • Follow the water quality recommendation in the MAMP and LRWQCB order and discontinue further water quality monitoring. • Spot check dissolved oxygen levels and water temperatures regularly during the 2011 seasonal habitat flow and during periods of high ambient temperature. • Modify Avian Census Surveys to be conducted during more appropriate time period for species.
Blackrock Waterfowl Management Area	• Continue draining and drying Winterton Unit to prepare for burning. • LADWP complete an analysis of reasonable alternatives to determine if there is a more feasible method to regain and maintain 28 acres of pond habitat over the life of the project in Thibaut Pond area. • Conduct avian observations and suitable habitat surveys only on active units, and at least on the first and second year that each unit is active.
Off-River Lakes and Ponds	• No adaptive management recommendations are required.
Delta Habitat Area	• LADWP continue to manage the base and pulse flows released to the DHA as they have in the past.

Adaptive Management Table 1. Cont'd, Summary of 2010 Adaptive Management Recommendations

Management Area	Recommendation and/or Action to be Taken
Rapid Assessment Survey	• LADWP, ICWD and MOU Consultants meet to re-examine the present RAS methodology, analysis and reporting procedures and to bring the survey design back to the original intention and purview of the RAS. • Exotic Weeds: leave bassia in place, do not burn or mow it, and let natural processes continue. • Fencing: conduct minimal repairs and complete upgrades. • Recreation: remove fire rings and block certain non-designated ORV use. • Roads: continue to restrict access as in previous years. Prioritize roads entering the riparian area and accessing the floodplain. • Woody Recruitment: RAS is not a comprehensive survey to monitor woody recruitment. If managers desire more systematic information on woody recruitment, then another method should be employed. Belt transects may provide needed recruitment information (see Land Management).
Land/Grazing Management	• Develop a "Rangeland Vegetation Management Plan" for the LORP to plan for and implement future rangeland burning prescriptions and needs. • Continue belt transect monitoring until the abundance of woody riparian plants eliminates the need for this monitoring. • Collect range trend transect data from all LORP exclosures. • Continue to implement the riparian forage utilization standard (40% limit) for the White Meadow Riparian Pasture.
Saltcedar and Weed Control	• Conduct a meeting between the MOU Consultants, LADWP and County representatives, and the saltcedar program director to establish goals and direction for each season prior to commencing activities. • Attenuate all future saltcedar cutting, spreading, or piling until all existing slash and piles are eliminated or addressed. • Continue with the weed program and explore additional funding venues to improve effectiveness.

12.1 Adaptive Management Recommendations

The LORP Monitoring, Adaptive Management and Reporting Plan (2008) describes the roles and responsibilities of LADWP, ICWD and the MOU Consultants scientific teams (Section 3.3) for collecting, analyzing and reporting monitoring data. Adaptive management recommendations are made by the MOU Consultants for inclusion in the LORP Annual Report to the Standing Committee. The MOU parties (through an Advisory Committee) are consulted twice during the process: first following the completion of the draft Rapid Assessment Report and then when the draft Annual Report is complete.

The MOU Consultants have reviewed the draft Annual Report chapters as provided by LADWP and ICWD. Review of the reports and adaptive management recommendations are described in this chapter and are organized by LORP management area.

The LORP Annual Report measures project performance. The report recognizes project achievements, positive trends and successes, as well as deficiencies, issues or unintended results. Ultimately, the report provides a balanced analysis that weighs current and past results with future goals in order to provide effective project guidance and shape adaptive management recommendations.

12.2 Riverine-Riparian Management Area LAA Intake

An ongoing problem with river flow management is the inability of the Langemann Gate at the LAA Intake to accurately measure high flows. When, for example, 200 cfs is required for the seasonal habitat flow the gate becomes submerged and LADWP must measure flows by hand at a measuring station just downstream of the gate. LADWP states in the 2010 Annual Report:

> "…*Starting on June 28, when the Intake flows were increased and set to 125 cfs, the downstream water level at the LORP Intake Langemann Gate rose to a point where the gate began to be submerged and measure inaccurately. The Intake flows were estimated using a weighted average value for the day based on manual meter shots. This method was used from June 28 to July 1 during the time when the Intake Langemann Gate remained submerged.*
>
> *Calibrating the bubbler for seasonal habitat flows may prove to be difficult in the upcoming year and likely won't give accurate results. More data points can be collected to allow for a better flow curve to be established, but with the low slope of the upper reaches of the river causing extremely low velocities and small changes to flow conditions, due to vegetation growth or other factors, causing water depth to fluctuate, accurate measurements using stage only may not be possible."*

The accurate measurement of continuous flow releases into the Lower Owens River at the Intake is very important. This release site helps determine whether MOU compliance is achieved for the release of the 40 cfs continuous downstream baseflow and the up to 200 cfs seasonal habitat flow. The Intake also has to adjust flows, as needed, to meet constantly changing evaporation-transpiration conditions, storm patterns, seasonal water demand changes, and channel reach gains and losses.

The main control of flow releases is dependent on the proper functioning of the LAA Intake design / Langemann Gate. This flow control structure efficiently measures and releases flows from 40 to 125 cfs. However, when released flows exceed 125 cfs, backwater changes and water surface elevation increases start flooding out the gate operating system, causing the gate to lose accurate measurement control. Thus, flow readings become undependable and other flow measurement methods have to be performed to make up for this deficiency.

Engineering improvements can be made to increase the measurement efficiency of the LAA Intake design / Langemann Gate. One method would be to increase the elevation of the measuring gate so it would function above all backwater or increasing water surface elevation effects. More efficient and less costly approaches may be more feasible than raising and reconfiguring the current design.

The preferred solution may be to continue the present flow measurement techniques after alternatives have been considered and evaluated. It is not a requirement of any legal document that LADWP improve the efficiency of the Intake, so it would be up to LADWP to determine if the efficiency of the Langemann Gate needs to be improved, and how to improve it. However, the problem is with the Langemann Gate design, and how water is managed between the Tinemaha release, the Intake Control Structure and the flow gates on the aqueduct. This is not a problem caused by the river channel. When the Intake design was modified in 2006 to accommodate and measure diversions into the historic river channel, the channel was inadequately excavated from the Intake some 10,000 feet downstream. The purpose of the excavation was to deepen the channel as part of the project construction and to allow inflow measurements with a Langemann Gate. Because the fishery has colonized and developed in the upper river today and riparian vegetation is building on the stream banks, it is not feasible to perform more in-channel excavations.

Recommendation: The MOU Consultants recommend that LADWP develop a feasibility analysis addressing alternatives to improve the flow measuring capacity of the LAA Intake Control Structure.

12.3 Flow Management

12.3.1 River Flow Assessment, Modeling and Flow Change Analysis

The justification to modify the LORP baseflow from 40 cfs to help control tules and cattails with higher flows during their growing season and lower winter flows is described in detail in this section. Our recommendation is to perform the flow modeling to determine if baseflow modifications would provide the most benefits. We have made this recommendation for the past three years- tules and cattail encroachment has increased, and further delay will only exacerbate the situation. We recommend performing the modeling work as soon as possible so that alternative flow regimes can be evaluated and a decision made to modify the baseflow before the onset of the next growing season in March if analysis shows it is feasible. The following paragraphs describe the modeling work in depth and compare the pros and cons of modeling and an empirical approach.

LORP river flows were initiated in December 2006 with a baseflow of 40 cfs. Project plans also include a seasonal pulse flow during the spring. Monitoring efforts and studies since flow initiation have furthered our knowledge and understanding of the river processes. We now have better insight and detailed information into how the river is responding to the flows. This nexus of information includes daily monitoring of river flows, analysis of flow loss and gain by river reach, flooding extent of the seasonal habitat flow, water quality measurements, instream vegetation growth, vegetation recruitment, changes to the channel, water spreading on near stream landforms and GIS mapping.

The LORP envisions a healthy, functioning riverine-riparian ecosystem over time. To achieve the biological and ecological goals specified in the MOU, it is necessary to create a functioning river, not just a channel that conveys the required flows. Currently, there are two immediate concerns related to the Lower Owens River that should be addressed through adaptive management: tule and cattail encroachment in the channel and long-term water quality. Additional issues relevant to riparian habitat conditions are important, but tule/cattail encroachment and water quality are the most immediate issues related to river flow management.

At a steady flow of 40 cfs the Lower Owens River is acquiring some undesirable characteristics. Tule and cattail encroachment is compromising open water habitat, slowing flow velocities, and inhibiting habitat diversity and recreational opportunities. Adaptive management must consider river flow adjustments that may alter tule and cattail encroachment and abundance, improve water quality conditions, and potentially provide an open channel throughout the river. However, a thorough analysis of altered flow scenarios and predicted results is the first critical step.

Adaptive management decisions on adjusting river flows must be based on careful analysis of available data related to various flow scenarios. This past year LADWP collected detailed topographic survey data on channel depth, landforms and water surface elevations. These detailed data allow for the modeling of various flow scenarios that will inform adaptive management decisions. River flow, channel velocity, and channel geometry models combined with terrain and flow modeling technology will allow three-dimensional analysis and modeling of river depths in relation to channel landforms and tule and cattail abundance and distribution.

Recommendation: The MOU Consultants recommend that a detailed report on possible flow alternatives be presented to the MOU parties prior to the 2011 seasonal habitat flows so that various management scenarios can be reviewed and discussed, and adaptive management recommendations for future flows can be agreed upon.

12.3.2 Discussion Points on River Flow Modeling, Analysis and Alternatives

River flow modeling is dependent on several inputs including stage discharge, channel geometry, adjacent landforms and elevation above water surface, channel roughness, flow velocities, and tule and cattail spatial distribution and abundance. Current, detailed data are available to accurately model flow scenarios and extrapolate from representative reaches to the whole river. Flow modeling and analysis should be done immediately to take advantage of these current data sets prior to conditions changing further.

Applicable and current data sets include:

- 2009/2010 channel surveys collected by LADWP. Highly accurate for each of the five LORP representative plots.
- Stage discharge data (volume and velocity of flow) collected by LADWP during surveys.
- 2009 high resolution imagery of the river is available for further definition of aquatic vegetation spatial distribution and abundance, landforms and adjacent channel conditions.
- 4 years of monitored flow data that defines seasonal ET rates.
- 2010 Landscape and Site Scale Mapping Data.
- 4 years of seasonal water quality data.

These data are precise and can inform accurate modeling and form a benchmark of conditions from which to model flow scenarios and measure trends toward or away from MOU goals over time. The modeling and analysis needs to be conducted immediately as tule and cattail abundance will continue to increase. Increases in tule and cattail abundance and distribution will cause further changes to channel width and depth benchmarks and the current data will become less and less reliable over time. This winter is the ideal time to conduct this analysis and form adaptive management scenarios prior to the next growing season.

12.3.3 Alternatives to Modeling and Analysis

The first alternative to conducting the river modeling and analysis using the discreet data described is to do nothing. However, not conducting analyses or considering flow or management alternatives implies there is no issue in the river channel, and that tule and cattail concentrations and abundance or future water quality concerns are not a problem. Since this is not the case, this is not a valid alternative.

The second alternative is to not model the channel and flow scenarios, disregard the abundant and high quality data sets available for analysis, and proceed with a trial and error approach. This alternative would necessitate that a range of differing flows be released into the channel and observations, largely subjective, be made. There are several problems with this alternative that make this approach invalid:

1. This approach is not reproducible. Science is premised on methods of inquiry that can be repeated. This alternative is not a repeatable method and two observers can easily come to different conclusions. Modeling is repeatable, and variables can be modified in the future if other options need to be analyzed or ecological conditions and datasets change.
2. Releasing a range of flows will be costly, and will cost considerably more than the modeling and analysis approach advocated. In order to observe a range of released flows, you must have trained personnel in the field to monitor each flow change and at the correct time that the flow change is passing any representative point over the 53 miles of river. This requires many trained field personnel, the scientific team, and LADWP operations and management personnel to be in the field over a long period of time. Personnel and mobilization costs alone will be extremely high, and the data would still need to be analyzed and considered.
3. Flow travel times are such that it would be extremely unlikely that flows could be accurately differentiated between flow changes, unless done over long intervals, to achieve stability before initiating and changing.
4. Releasing flows in this manner means that LADWP will have to dedicate thousands of acre-feet of water over and above baseflow and seasonal habitat flow commitments for the year.
5. Flow releases must stay within the bounds dictated by project mandates. Flow releases would have to stay within 40 cfs (baseflow) up to 200 cfs pulse flow. Alternative lower or higher flows could not be released or observed given the limitations imposed by the MOU, EIR and project conditions. Of course, river flow modeling can game any range of flow scenarios.

These two alternatives are not valid means for accurate consideration of flow alternatives or adaptive management plans for tule and cattail conditions and future water quality considerations.

12.3.4 Recommended Approach - River Flow Modeling

The MOU Consultants recommend that a detailed report on flow alternatives be presented to the MOU parties prior to the 2011 LORP seasonal habitat flow so that various management scenarios can be reviewed and discussed, and adaptive management recommendations for future flows can be agreed upon. Ecosystem Sciences provided a very detailed modeling methodology in a memorandum to LADWP and ICWD in 2009.

The LORP is directed by multi-objective management that emphasizes the importance of environmental quality and the need to evaluate interrelations among river flow, hydraulic, geomorphological, habitat and ecological components of the riverine-riparian systems over a range of spatial and temporal scales. State-of-the-art models provide powerful analytical tools for predicting river behavior under a variety of flow management scenarios. Many, if not most, environmental management decisions in the Owens Valley stem from modeling conditions and scenarios, including: run-off forecasting models, groundwater pumping, vegetation conditions and modeling, and the setting of initial LORP river flows based on the first HEC modeling of the river. Modeling, coupled with informed science and management considerations is a tried and tested method for a great many resource decisions currently and historically conducted throughout the Owens Valley.

River dynamics involve complex interactions among flow, channel form, riparian landforms and vegetation. The capacity to predict these interactions is essential for a variety of river management issues. To address these needs, three-dimensional models increasingly are being used by river ecologists and mangers to explore river dynamics and predict fluvial and flooded landform behavior. Advances in computational capabilities and digital terrain modeling have led to the use of these models to simulate flow in a variety of reach-scale river environments, including straight reaches, stream confluences and river bends.

First, the amount and quality of field data required for domain representation, boundary condition specification and model calibration/validation increases considerably with model sophistication. River channel and flow modeling typically requires high-resolution information on the morphology of hydraulic boundaries, which strongly influence flow behavior. The complexity of natural-river boundaries requires the collection of sufficient field data to capture all details of the boundary. We currently have a nexus of this quality data from which to model without the need for further field data collection to inform the model.

The complexity of natural rivers also complicates requirements for flow data. Advanced river flow models can predict flow in three dimensions, but generally require advanced understanding of total flow (cfs) and velocities. Fortunately, the LORP has sufficient, detailed and calibrated data throughout all reaches of the river for flow/cfs and velocities; thereby providing important information for model calibration and verification.

Third, because of the large amount of information manipulated- either during the preparation of the simulation or at the time of analyzing the model results- data pre- and post-processing procedures are as important as modeling considerations in assessing model performance. Data pre-processing is required to interpolate information at computational nodes from the surveyed data. Accurate interpolation is also necessary when extracting results during 3D modeling and application of flow scenarios. Fortunately, the channel survey data from LADWP is very accurate and interpolation will be minor and straightforward.

In order to effectively understand various river management scenarios for review and discussion and to make adaptive management recommendations for future flows, the following aspects for modeling and interpretation will be performed:

- Digital terrain modeling in GIS and CAD based on DGPS survey data.
- Flow data assessment from continuous hydro measuring stations and field measurement of stage discharge during survey data acquisition.
- Flow and flooded extent modeling; development of flow scenarios – gaming of multiple flow regimes and seasonal changes or alternatives.

- Adaptive management recommendations on adjusting river flows to improve tule management and water quality; based on careful analysis of available data and various flow scenarios.

12.3.5 Discussion

The rapid response of tule and cattail production in the first years of flows demonstrates that tule and cattails are encroaching at a rapid rate. Pre-project planning anticipated tule encroachment throughout the river corridor, and mapped the predicted tule and cattail growth by landform throughout the river. However, the rate of tule/cattail colonization on channel, levee, floodplain, and oxbow landforms is more rapid than expected, and is outpacing the establishment of willow and cottonwood vegetation that would eventually provide the shade that could help moderate tule and cattail growth.

A steady-state 40 cfs baseflow and the consequential tule and cattail encroachment may inhibit achievement of LORP goals for the riverine-riparian system. Tules provide important habitat for fish and wildlife, and while adaptive management should prioritize the control of tules, it should not aim for the complete elimination of tules, but rather to improve or maintain needed open water habitat and channel connectivity.

It is expected that by 2015 the Lahontan Regional Water Quality Control Board (LRWQCB) will establish water quality criteria for the LORP. Attaining water quality compliance for the LORP is dependent upon implementation of: (1) best management practices on grazing lands to attenuate organic and inorganic inputs; and (2) flow regimes that control, dilute, flush, and leach nutrients, organics, and bacteria/coliforms out of the system.

Reliance on the annual seasonal habitat flow to improve water quality by “flushing” the river system was never expected to be a feasible solution as the river gradient cannot generate the flow velocities needed to scour and export large amounts of accumulated organic material. Although the 200 cfs seasonal habitat flow prescribed by LRWQCB in winter 2008 did not instigate serious water quality impacts, there was little to no channel scouring. These results indicate that flow management over the long-term will have to be modified to ultimately meet water quality standards. This can be achieved by using periods of sustained higher flows over the long-term to provide a slow but steady export of organic material combined with land management that limits the input of new material into the system.

Tules occupy channel landforms when the following environmental conditions occur: (1) a shading riparian overstory (particularly tree willows and cottonwoods) is not present; (2) channel water depth is less than four to six feet; (3) light penetration into the water column is greater than three feet; and (4) high flow stream velocities are not great enough to prevent rhizome cloning.

Intervention of any of these conditions will provide better tule control for the LORP. Spring and summer flows higher than 40 cfs could likely increase water depth and flow velocities in the channel and provide an added level of control over tule encroachment. Spring and summer months are the period in which organic inputs and decomposition is highest. Higher flows during this period could also result in improved water quality through increased dilution and promote the continual export of suspended solids and organic material. Increased flow velocities will also inhibit rhizome development. Lowering winter flows to allow for higher summer flows without maybe impacting fisheries will further improve tule control by desiccating plants growing on dewatered landforms.

Adaptive management decisions on adjusting river flows to improve tule conditions and water quality should be based on careful analysis of available data and various flow scenarios. River flow, channel velocity, and channel geometry models combined with terrain and flow modeling technology will allow three-dimensional analysis and modeling of river depths in relation to channel landforms. It is likely that adaptive management of flows will be necessary for the next few years to meet the water quality compliance deadline, and a robust model using current data will be an important decision making tool. Intervention activities that promote riparian growth and overstory for shading, increased water depth during portions of the growing season, effective light penetration into the water column (shading and riparian development), and increased flow velocities are each conditions that can provide better tule/cattail control for the LORP.

12.3.6 Seasonal Habitat Flow and Flooded Extent

Seasonal habitat flows may prove to be the primary management tool used to promote riparian vegetation establishment and growth at a critical time of year for the riverine-riparian system. Seasonal habitat flow monitoring and reporting should carefully examine how flows accessed or did not access landforms that are critical to riparian development. After three years of documenting high flow events, we find that this year's report accurately describes the flow and flooding extent and provides necessary detail.

Timing the release of the seasonal habitat flow is important. Two previous years of high flow events had not captured the timing of seed drop and dispersal. The timing of this year's high flow release considered seed development and drop, weather conditions, time of year, and other ecological and climatic conditions, and then determined a schedule to begin flow releases. This was decided by field reviews throughout the entire river channel system. This year's release of the flows was timed to coincide with woody riparian seed drop. Subsequent years should include such thorough field examinations to determine the appropriate flow release date.

All LORP plots and the islands reach were field measured with GPS tracking at high flows to verify flooded extent mapping. By conducting field reconnaissance at all five plots and the islands, managers now have quality data for the entire river for the 200 cfs high flow; this is especially important given the need to extrapolate data from these plots to the entire riverine system. The plots are representative of the varying river reaches and are indicative of how high flows act throughout the river given current conditions. Field verification through direct on the ground measurement is an important part of the process. Remote imagery collected from the helicopter and the GIS analysis is greatly improved by the plot measurements. This was achieved and reported.

There have now been three years of seasonal habitat flow events. However, each event has been very different in several important aspects and need to be carefully considered when making comparisons between years. Directly comparing the three events and the flooded extent of each event is problematic and leads to inaccurate conclusions. In 2008, flows were released that achieved over 200 cfs, but these flows were released in winter, were significantly augmented by the Alabama Gates release, and flow ramping/duration occurred over a 27 day period. In 2009, flows were released that achieved 110 cfs (approximately 50% of normal), they were released in spring with no downstream augmentation, and flow ramping/duration occurred over a seven day period. In 2010, flows were released that achieved 192 cfs, they were released in summer with no downstream augmentation, and flow ramping/duration occurred over a 15-day period. Directly correlating results of flooded extent between years is problematic and may lead to confusion without explicitly stating the confounding factors. The only comparison that can be done is qualitative and must take into consideration the multiple differences in each flow scenario.

For example, on page 3-9, the 2010 report states, "*Extrapolation of high flow inundation at each plot to peak flow as performed in the 2008 Seasonal Habitat Flow (Ecosystem Sciences 2008) was not performed because the peak flow, or very close, was captured by either the helicopter video, on the* *ground mapping or both*." Excluding this analysis makes in-year comparison or between-year comparisons invalid. The comparisons presented in Table 10 are not comparing conditions under similar flows. One must normalize the flow data, as was done in 2008, if comparisons are to be made. For example, it is not scientifically valid to compare Plot 1 (Reach 2) with Plot 4 (Reach 5) when the analyzed flow in Plot 1 was 131cfs and the analyzed flow in Plot 4 was 82 cfs. In 2008, Ecosystem Sciences recognized that the mapping of flooded extent was not comparable because the flow at each plot was not the same. Like 2010, plots were field sampled and video recorded at different flows. This is why Ecosystem Sciences extrapolated to 200 cfs so that all reaches were analyzed under a similar flow. Please see pages 35 and 36 of the 2008 report for clarification. Additionally, the 2010 report needs to incorporate the flow that each plot was analyzed under in every table that presents results, as it is imperative that the reader know the flow that the plot was analyzed under- again please see the 2008 report for clarification.

Table 10 needs further detailed narrative explanation and amendments to fully explain differences among years. This table, while representative of each year, displays flooded extent comparisons without benefit of describing the fundamental difference of each flow. If the table is to remain, with added detailed narrative, then the table should include for each year: high flow/cfs; augmentation flows at Alabama gates; flow ramping rate and duration in days; season/date of flow release. Seasonality differences in each year's flow events should also discuss diurnal temperatures, vegetation growth or dormancy and the related evapotranspiration (ET) considerations throughout the river system based on these factors. Winter release would likely have the lowest ET, spring release would have increased ET, and the summer release would have the highest potential ET factor.

As mentioned above, if Table 10 is retained, then 2010 data needs to be normalized - without doing so the comparisons are statistically invalid. The 2008 results presented in Table 10 represent extrapolated/normalized results for 40 cfs baseflow compared to a 200 cfs high flow. Without normalizing the data, of course 2010 and 2008 would have different results because the plots were analyzed under different flows.

GIS is an important tool in the process of analysis and reporting. Review by the scientific team of actual GIS files and databases did not occur. This GIS files need to be reviewed in addition to the review of the summarized data, map outputs and reporting. Errors in GIS analysis are common and can lead to misinterpretation, compounded error through time, and disorganized databases.

12.3.7 Specific Comments

Normalization of data to a consistent baseflow and high flow should be done prior to extrapolating for the reach and river wide analyses. Additionally, inundated vegetation data was never presented in the report. This should be done to allow managers to see what community types are being inundated.

Section 2.3.1 states that the Intake released flows of 209 cfs. This number is also used in other places throughout the document. However, the LADWP tabulated flows in Appendix 2A and online via the website only show a flow of 192 cfs released at the Intake. This needs to be rectified to accurately reflect the high flow at the Intake for that day. Both flows are stated to be 24-hour averages. We understand the high flow to have been only 192 cfs.

Additionally, Section 2.3.1 states that river flow conditions returned to normal baseflow on July 20. However, flows did not return to normal baseflow for several months and baseflows were well above normal throughout the summer. A casual reading of the flow tables shows that the river did not return to normal baseflow conditions until mid-October. A discussion of why flows did not return to baseflow conditions is needed. Flows at the Intake returned to 48 cfs on July 20 and then ramped back up to over 80 cfs for several months.

The discussion on flow travel time should describe the difference in ramping rate and duration of the flow event when making connections or comparisons with previous years travel time. While tule, cattail and other aquatic vegetation inevitably affect travel time, the seasonal flow ramping rates, augmented flows from Alabama gates, rain events, weather conditions, time of year, reach gain and loss, and high flow release duration (number of days) all combine to affect travel time. The discussion comparing travel times between years needs to clearly express these differences.

12.3.8 Recommendations

Review by the scientific team of actual GIS files and databases should be conducted prior to the drafting of the report, in addition to the review of the summarized data, map outputs and reporting. Normalize the flooding extent and inundation data before extrapolating to the reach and river-wide. Perform the vegetation inundation analysis.

Re-mapping the landforms of the Lower Owens River and including a channel landform would significantly aid in accurately monitoring seasonal habitat flow events. This can be performed in conjunction with the flow modeling recommendation using current aerial photos and recent survey data.

12.3.9 Seasonal Habitat Flow Management

An overall objective of re-watering the Lower Owens River is to restore aquatic and riparian habitats to a healthy condition. The seasonal habitat flow, ranging from 40 to 200 cfs peak, is one of the tools to accomplish the objective. The MOU goal for the Lower Owens River is to create and sustain healthy and diverse riparian and aquatic habitats. This flow must be of sufficient frequency, duration, and amount that numerous beneficial environmental changes will take place.

No seasonal habitat flow above the 40 cfs baseflow will be released from the river Intake when the annual Owens Basin runoff is predicted to be below 50% or less of the annual average runoff. When the annual runoff is 100% or more of normal, the flow will peak at 200 cfs. Between 50 and 100% of normal, the peak flow released and the duration will be determined by the percent of the annual basin runoff. The annual average peak flow of the seasonal habitat flow is predicted to average only 150 cfs. Thus, there will be years when the peak flow of the seasonal habitat flow will be much less than 200 cfs.

The 2010 seasonal habitat flow peak would have been below 200 cfs, but it was adjusted by LADWP so that a 200 cfs peak was delivered at the Intake. This was accomplished by depressing flow duration (releasing the available water over a shorter time period) which allowed water for increasing the peak flow. Habitat flow magnitude is probably much more important than the duration of the flow period.

Three seasonal habitat flows have been released into the Lower Owens River (2008, 2009, 2010) The 2008 flow peaked at the Intake Control Structure, as mandated, at 200 cfs- the 2009 flow peaked at the required 110 cfs- and the 2010 flow peaked at 200 cfs, even though a slightly lower flow was allowable under the mandated direction.

The seasonal habitat flow patterns now being released into the Lower Owens River were designed over a decade ago. The MOU Consultants believe that it is time to modify the flow magnitudes to allow the peak flow to be increased. The peak flow for each of these years would always be 200 cfs.

As part of the river flow modeling, the MOU Consultants will submit a proposed seasonal habitat flow scenario that will cover all water years from 60 to 99% of average runoff in 10 cfs increments.

Recommendation: The MOU Consultants recommend that the seasonal habitat flow duration be decreased so the available water can be used to increase the peak flow on all years when the average annual flow is predicted to be from 60 to 99% of normal.

Recommendation: As part of the river flow modeling, the MOU Consultants submit a proposed seasonal habitat flow scenario that will cover all water years from 60 to 99% of average runoff in 10 cfs increments.

Hydrologic Monitoring

Overall the hydrology report is well done (more discussion of the data would be a welcome addition), and we do not have any comments on this monitoring task. No adaptive management recommendation is required.

Flow Gain and Losses

Lower Owens River flow gains and losses by river reach have been assessed over the past five years (2006-2010). Daily continuous flow data collected has successfully evaluated water gains or losses under different climatic conditions by river reach over enough years that future gains-losses under defined climatic conditions can be successfully predicted. Because evaporation-transportation rates have stabilized, flow gains and losses by river reach can now be determined by both past and present time periods with accuracy needed to make flow management decisions. LADWP's continuous flow data bank is easily assessable for any person or party to determine past gains or flow losses by river reach at any time it is needed.

LADWP should only be required to report on river reach gains and losses if a major climatic event or a major flood occurred that could change predictive needs. The scientific team could determine if the event was of such a magnitude that unusual circumstances were worth reporting gains and losses by river reach for the year the event occurred. Because the data are always available, any person or party can determine river reach gains and losses at any given time, if needed.

Recommendation: The MOU Consultants recommend that because the data are so readily available and knowing gains and losses by river reach is easily determined, that there is no need for LADWP to do an annual report each year on these gains and losses. If needed in the future, the analysis and reporting can be performed.

Water Quality

Water quality monitoring for baseflows and seasonal habitat flows is described in the LORP Monitoring and Adaptive Management Plan (MAMP) and was prescribed by the 2005 Lahontan Regional Water Quality Control Board (LRWQCB) Order. Baseflow water quality monitoring was completed in 2008 and 2010, and is the last year of seasonal habitat flow monitoring.

The Owens River witnessed water quality conditions during the 2010 seasonal habitat flow that applied stress to fish and other aquatic life. Even during some baseflow periods in late summer the Owens River experiences low dissolved oxygen periods in combination with high summer water temperatures. Dissolved oxygen can range as high as 11 mg/l and as low as 0.5 mg/l during spring-summer.

During the 2010 seasonal habitat flow, dissolved oxygen decreased drastically while peak flows were passing through river reaches below Mazourka Canyon Bridge. Dissolved oxygen, influenced by high water temperatures and high biological oxygen demand, decreased in the river below the

Mazourka Canyon Bridge to below 0.5 mg/l- a level that can cause fish kills. During this period, fish and other aquatic life were heavily stressed.

LORP water quality monitoring has measured a broad array of flow conditions. The initial flow was a maximum release flow of 200 cfs augmented at Alabama Gates and released in the winter. The second seasonal habitat flow was a low (<80cfs) spring flow release, and the last flow (2010) was a maximum flow released in the summer. Consequently, water quality has been monitored and assessed through all the possible seasonal habitat flow regimes that might occur in the future. Even in the worst possible temperature and dissolved oxygen conditions caused by this year's early summer flow, the fishery was stressed but survived without a documented fish kill. The fishery was unaffected by the threat of hydrogen sulfide or ammonia releases from bottom material and ponded water during high flow events, winter or spring. It can be concluded that water quality conditions under base and seasonal habitat flows are adequate to sustain a healthy warmwater fishery and other biota in the LORP. However, there is a need to track conditions that could stress fish and other aquatic life and get ahead of a possible fish kill during high flow events.

Recommendation: The MOU Consultant's recommendation is to follow the MAMP and LRWQCB order and discontinue further water quality monitoring.

Recommendation: The MOU Consultants recommend that spot checking for dissolved oxygen levels and water temperature conditions be conducted regularly during the 2011 seasonal habitat flow.

12.4 Habitat

Landscape Scale Vegetation

The report is complete and meets the obligations under the MAMP. The additions that were made between the initial report and the final significantly improve the document. Overall, the riverine-riparian mapping results make sense and reflect both expected results and the general conditions from field observations. The most important questions regarding the report are the change in wet alkali meadow from 2000-2009 in the riverine-riparian area and the overall noise in the BWMA results (there is so much change in so many types that it is difficult to separate the signal (real change) from the noise (mapping error/ differences in classification).

Riverine-Riparian General Comments/Suggestions
Aside from the small items detailed below, the largest question for the riverine-riparian concerns the area mapped as wet meadow in 2000. The document reports a loss of 139.5 acres of Wet Alkali Meadow from 2000 to 2009 (one of the most species diverse vegetation types) in Table 3. The most common community type these areas were converted to is Dry Alkali Meadow. It is suspected that areas mapped as Wet Alkali Meadow in 2000 and Dry Alkali Meadow in 2009 did not undergo real change. It is not known if this is a mapping error (either in 2000 or 2009) or it reflects real change. LADWP adequately explains the reason for the decrease in riparian forest (due to mapping techniques), which may also explain the systematic decrease in Wet Alkali Meadow across all reaches (with the exception of Reach 2, +.6 acres, Table 5).

Specific comments:
1) The decadent Bassia from past year's growth increased the difficulty of delineating the live Bassia areas.
2) Suggest adding symbology legend for Figures 2-7 in future mapping.

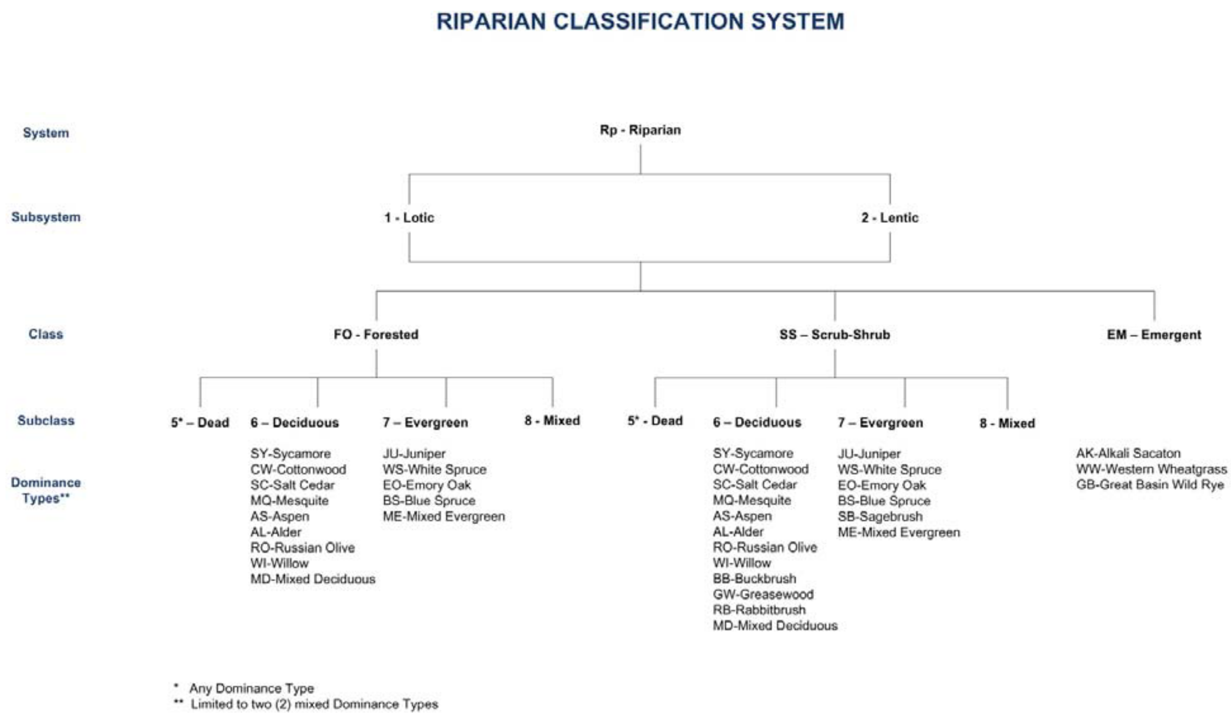
BWMA General Comments/Suggestions: As mentioned above, the level of noise in the change in mapped acreage seems very high. It is difficult to discern the signal (real change) from the noise (errors/mapping discrepancies, etc.). Was there really a 3,263 acre decrease in Desert Sink Scrub? Although this vegetation type is not the focus of management goals, it does illustrate the problem interpreting the results. Were these areas really Desert Sink Scrub, and were converted to Rabbitbrush-NV Saltbrush associations, or were they always Rabbitbrush-NV Saltbrush associations, and not accurately mapped in 2000? Given the technology advances and improved field effort performed in 2010, it appears that the 2000 conditions were incorrectly mapped. Other vegetation types present similar issues; Alkali Flat, Playa and Wet Alkali Meadow also have large changes and are difficult to explain given the management actions that have taken place. Of these, the Wet Alkali Meadow vegetation type is of the most concern (in the riverine-riparian area). In the BWMA, as with the riverine section, a large percentage (44%) of the Wet Alkali Meadow was re-mapped as Dry Alkali Meadow. These large changes/discrepancies bring into question how the results can be applied. For example, the MOU requires maintenance of a certain number of acres of open water in the Thibaut Unit. The 2000 mapping had 0 acres of open water and the 2009 mapping had 3.1 acres. It has been suggested that the Thibaut area has filled in with tules and cattails and adaptive management actions need to be taken as a result. The mapping results presented in this report indicate that there is more open water in 2009 than in 2000. Did the Thibaut unit really lose 233 acres of Wet Alkali Meadow and add 405 acres of Dry Alkali Meadow? Similarly, the changes in Barren, Alkali Flat, Rabbitbrush-NV Saltbush Scrub and Scrub/Meadow, and Desert Sink Scrub appear to be full of noise.

LADWP correctly points out that most of these “changes” occur outside of the area where any management action would take place. However, the large discrepancies make interpretation of the results difficult. It is impossible to go back in time and know if the 2000 mapping was accurate or not. However, explaining possible reasons for the discrepancies, as well as addressing the most important changes (e.g. the wet meadow and open water differences) would improve the ability of managers to apply the results of this section to adaptive management recommendations and decisions.

Landscape Scale Mapping Alternative

Mapping riparian zones is a very difficult task. Riparian zones are often confined to small areas and demonstrate dramatic changes in vegetation types (structure and composition) within small areas. Thus, even with high resolution imagery (>5m pixels) accurately mapping vegetation types, especially to the species level, is very difficult to accomplish. A workshop with the scientific team could provide clarification and guidelines for future landscape mapping, as well as improving coordination with the site scale mapping. At this workshop, the scientific team and LADWP could develop a methodology that will be followed so that subsequent Landscape and Site Scale Mapping efforts are compatible. Two topics that would be the focus of the workshop are the use of a hierarchical approach that includes delineating a life form layer and how to compare two mapping products that accounts for error in both.

The following graphic is from the USFWS’s “A System for Mapping Riparian Areas in the Western United States” and describes a hierarchical mapping methodology that incorporates a life form layer.



Adaptive Management Figure 1. Schematic of Hierarchical Riparian Mapping and Classification System (USFWS 2009)

A modified version of the USFWS's approach would be best for the Lower Owens, one in which the subsystem would be divided into water and vegetation. The next level, class, would divide the vegetation subsystem into easy to delineate life form layers such as forested, shrub/scrub, grass-dominated and emergent. Once the imagery is divided into classes the technician could mask the other classes and focus their mapping within the desired class. For example, forested could be divided into willow and cottonwood subclasses and then the dominance type defined by the trees understory and physical location (upland or wetted) and the emergent class could be divided into common reed and cattail subclasses, which also could serve as the dominance type as well. Essentially, this new methodology will hierarchically whittle down the potential dominance type, or vegetation type, to only a few possible types and thus reduce potential errors and increase overall map accuracy.

The second topic to discuss during the mapping workshop is how to account for error when comparing two datasets. WHA estimated 95% accuracy in the 2000 mapping. Thus, one must accept that at least 5% of the subsequent results are flawed. Couple the 2000 error with the estimated 92% accuracy in the 2010 landscape mapping and one can see how error can build year upon year. Are the errors in the same communities? Are the errors consistent across years? Were the errors in communities that no longer appear (i.e. Tamarisk)? Answering these questions will allow managers to understand the real trends that are occurring in the LORP.

Recommendation: The MOU Consultants recommend that the scientific team (LADWP, ICWD, MOU Consultants) participate in a mapping workshop to identify a repeatable methodology for the landscape mapping and determine how to account for error when comparing multiple years of data.

Site-Scale Vegetation

The site-scale vegetation report documents the vegetation changes between the baseline conditions (2001-2002) and 2010 conditions. There were changes at the complex, vegetation type, and species levels. Areas dominated by the baseline Tamarisk Complex were replaced with the 2010 Fivehorn Smotherweed Complex (*Bassia*). Notable species that declined in dominance include Russian thistle, tamarisk, and Goodding's willow. Notable species that increased in dominance include cattail, creeping wildrye, and smotherweed. The most common vegetation type in 2010 was Cattail-Willow Wetland. The diverse wet meadow vegetation types increased between baseline and 2010. The decline in cover of Willow Woodlands is likely a result of tree willows being more frequently included in other vegetation types.

Overall, the site-scale data do not indicate that the number of tree willows in the LORP area has declined. Tree willows were a component of 11 vegetation types, including appearing in 19% of all cattail/willow wetland patches. The total number of patches containing tree willows (red willow and black willow) increased from 221 at baseline to 242 in 2010. Results from other monitoring efforts (e.g. landscape scale mapping and RAS) that show reductions in willow cover or recruitment, are likely due to mapping and sampling issues, and not real declines in tree willow abundance. Managers must be careful to draw conclusions based on the data and sampling designs.

By almost any measure, the study area became more diverse between baseline and 2010 (see Table of Diversity Measures below). The highest diversity measures were in the wet meadow vegetation types. The Smotherweed Complex and Saltgrass type had the lowest diversity measures.

The Smotherweed Complex increased its percent cover the most; tamarisk declined the most. Canopy cover increased across most vegetation types. Bare ground decreased. Vegetation groundcover increased. Mapping results and transect results indicate similar trends. The ecosystem is recovering quickly due to management actions, but disturbed and degraded areas remain and are undergoing successional processes.

The intensity of vegetation sampling in 2010 (i.e. landscape vegetation mapping, site-scale sampling and other mapping) and the short sampling season (sampling could not start until July) created a high demand on manpower. Consequently, the mapping methods were modified from baseline due to time and budget constraints. The subplot methods were originally linked to the transect data, but were transferred to the mapping data in 2010. This enabled the subplot sampling to serve as a vehicle to refine the original mapping. This improved label accuracy. However, polygon shapes were not able to be edited through the given methodology due to budget, method and time constraints. The final product could be improved by staggering the site-scale mapping and transect sampling to different years.

Adaptive Management Table 2. Changes in Diversity Measures Between Baseline and 2010

Measure	Baseline	2010
Number of Dominant Species	80	93
Average Patch length*	19.2	13.8
Number of veg. types with more than 30 dominant species	3	5
Number of dom. species in most diverse veg. type	39	54
Ave. number of dom. Species per veg. type	17.3	22.5
Num. of veg. types with H' > 2.0	5	11
Max. H'	2.9	3.4

**this measure is inversely related to diversity*

Recommendations: The results do not indicate the need for any sweeping changes in management. Managers should consider changing the schedule of mapping to stagger the landscape mapping and the site-scale mapping efforts in different years. Rather than re-mapping both in 5 years, either the site-scale or the landscape scale mapping should be redone in 3 years. The site-scale mapping should be used to inform the landscape scale mapping effort. This would provide managers with more data points, and one effort could be used to inform the other more easily. In future site scale efforts, a map should be made from the remote imagery, then a method of groundtruthing, subplot sampling, and map refinement specifically designed to inform and improve the map (including polygon shape refinement in the field) should be employed.

Indicator Species Habitat – CWHR Analysis

We find the CWHR analysis incomplete at this time. Please review the Monitoring and Adaptive Management Plan (Ecosystem Sciences 2008) for methods and analysis direction. For an example of how to compare baseline and 2010 data, please review the Delta Habitat Area section of the 2009 LORP Monitoring and Adaptive Management Report. The following bullets address specific needs for the report.

- Provide a comparison by reach of 2010 and baseline CWHR
- Provide a guild analysis similar to the Delta Management Area Report from 2009
- Compare Avian Survey Indicator Species results with CWHR data. For example, a simple statement regarding the Great Blue Heron and its proliferation in Reach 1 could be made. No Great Blue Herons were observed in 2002 or 2003, in reach 1. In 2010, 8 Great Blue Herons were observed in Reach 1. Prior to the initiation of flow in 2006 XX acres (potentially zero acres) of suitable habitat was available to the Great Blue Heron in Reach 1. In 2010, over 200 acres of Medium Suitable habitat is available to the Great Blue Heron. This increase in available habitat resulted in 8 Great Blue Herons being observed in 2010.
- The Avian Census and CWHR reports should not be mutually exclusive. The data generated in each report is important to the other.

Indicator Species Analysis Recommendation: At this point we are unable to make recommendations on this report. Thus, we recommend revising the report and providing an updated draft once the revisions are complete.

Avian Census Surveys

The riverine-riparian area report is satisfactory, provides detailed statistical analyses, and documents the change in the LORP's avian community between baseline and 2010. Specifically, the report provides critical insight into how the riverine-riparian area is responding to land and water management, and whether or not these actions are meeting LORP goals. The Riverine Riparian Area Avian Survey meets the LORP MAMP requirements and objectives.

The Riverine Riparian Avian Census report presents interesting results. For example, the avian community within the LORP has exploded since baseline. Abundance and richness of land and water birds increased, for the most part, in all reaches. These data indicate that the habitat of the LORP is providing adequate resources to support larger populations of birds compared to baseline conditions. Conversely, the report indicates that riparian vegetation has decreased in all reaches except 5 and 6. These data indicate that land and water management in the LORP is not meeting its goal of increasing riparian habitat. No discussion of why less riparian habitat occurs in the LORP in 2010 compared to baseline. Rationale needs to be presented that describes why there is a loss of this important habitat type in the LORP (i.e. mapping methodology differences, inclusion of tree willow in the marsh community). Juxtapose the loss of riparian habitat with the results presented in

Indicator Species Table 12, in which the riparian habitat of the LORP is attracting great numbers (well above expected), of birds. When viewed in this context the results appear at odds. One could surmise that the riparian habitat of the LORP in 2010 is higher quality compared to baseline? This could be answered if the CWHR analysis was complete. The CWHR analysis was only performed for 2010 conditions. Thus, there is no way to answer the question, has the LORP riparian habitat improved?

Additionally, the Riverine Riparian Area Avian Census results should focus more on indicator species. The reader has to glean from the tables how indicator species have responded to the LORP since baseline. We summarized the indicator species data by reach in the Riverine-Riparian Area Breeding Bird table below. We also calculated the Shannon-Weiner diversity index for each reach using indicator species data. The indicator species table below indicates that breeding indicator species observations, species richness, and diversity have increased in all reaches since baseline. Such a conclusion is important to answering the question of whether the LORP is meeting its goals.

The data for the surveys performed North of Tinemaha should be removed from the report. The inclusion of the north of Tinemaha data obfuscates the LORP analysis. For example, Indicator Species Table 13 indicates that five Swainson's Hawk observations occurred within the LORP area. In reality this is not true, as these five observations occurred north of Tinemaha. Additionally, the total observations of indicator species in Table 13 are incorrect, as 68 of the potential observations were recorded in the Tinemaha reach. Remove the North of Tinemaha data and any reference to it from the report. Update all tables and figures with only LORP specific data. The inclusion of the north of Tinemaha data may be a cause of the issue stated in the paragraph above, in which inclusion of this data is inflating the actual population numbers and use of riparian habitats within the LORP.

Adaptive Management Table 3: Riverine-Riparian Area Breeding Indicator Species, Observations, Species Abundance, and Shannon-Wiener Diversity.

Reach	2002 Observations	2002 Species	2002 SW	2003 Observations	2003 Species	2003 SW	2010 Observations	2010 Species	2010 SW
1	10	2	0.67	8	2	0.56	12	3	0.82
2	28	4	1.09	26	4	1.05	55	7	1.66
3	34	5	1.39	36	7	1.62	69	8	1.9
4	11	4	0.89	8	2	0.56	23	5	1.28
5	12	4	1.24	9	3	0.68	21	6	1.7
6	30	5	1.10	27	3	0.75	13	7	1.82

Recommendation: The MOU Consultants recommend that future riverine-riparian surveys occur outside of the summer season. It is very important to the LORP that species such as the Yellow-billed Cuckoo and Willow Flycatcher are surveyed for at the appropriate time period. Such data will be invaluable to LADWP Habitat Conservation Planning.

12.5 Fishery

Creel Survey

The LORP fishing creel census helps track the development and health of the warm water fishery. The main purpose of the creel census is to evaluate the response of the game fish population to managed stream flows and resulting conditions. A second purpose is to determine fish population condition compliance with LORP goals. This census was not intended to track the status of the native fish population. Key fish species identified for the creel census centered on largemouth bass, smallmouth bass, bluegill, channel catfish, and brown trout.

Creel census data collection began in 2003 (baseline), using 24 volunteers to fish five selected areas. The 2003 creel census collected data and information only once (in May) during the year. For future creel censuses, each fisherman was programmed to seasonally fish twice (spring and fall) during the year selected and then fish twice during two seasonal periods (twice in the spring and twice in the fall). This provides 48 observations for each seasonal fishing period. The programmed fishing sites cover the complete Lower Owens River and designated Off-channel Lakes and Ponds. The LORP fishing creel census is to be conducted in years 2003, 2010, 2013, 2015, and 2018.

Warm water fish population individual age groups (except the young-of-the-year recruitment) are usually quite stable from May to September. Fall creel available fish population numbers and condition should be fairly close to spring fish population numbers and conditions. The fishing census does not analyze the status of the young-of-the-year fish recruitment until future years when they become large enough to enter the fishery. Much higher population fluctuations or changes would be expected to occur from one year to the next year, than during the 4 months between the spring and fall sampling. Therefore, a spring creel census can provide much the same information as if the same year fall creel census was conducted. Also, each spring creel census will allow an interpretation of what has transpired over the past 1 to 5 year period because of the multiple age classes in the population. The spring census, by itself, will provide the necessary information, when used in combination with the other LORP monitoring tools, to determine the health and condition of the warm water fish population over time and if LORP goals are being met.

Recommendation: The MOU Consultants recommend that starting in year 2013 and on through year 2018, that the creel census be conducted only during the spring on the years designated. The fall census should be eliminated.

Fish Habitat

The MAMP calls for completing fish habitat surveys and photo points on the Lower Owens River every three years for the life of the monitoring program. These surveys and photo points have been completed and document fish habitat conditions for 2002 and 2010. The fish habitat documentation is sufficient for current needs, and in the future, if warranted, for re-doing comparison analysis.

There are also other monitoring metrics being collected and reported on to determine if fish habitat and fish populations are meeting LORP goals. The creel census, riparian-riverine vegetation mapping, and the riparian belt streamside analysis combined will give a better analysis of fish habitat reactions to LORP management than fish habitat monitoring. Habitat information can always be collected in the future if it is needed for LORP management. However, the transect photo points should continue to be taken every fifth year (the next photo point collection would be taken in 2015) during the tenure of the monitoring program. Each photo point will be taken at the same surface point each time, at the same elevation from the surface, and with the same camera lens or a lens of identical prescription.

Recommendation: The MOU Consultants recommend fish habitat surveys be discontinued until warranted in the future.

12.6 Saltcedar and Weed Control

Saltcedar

As with previous years, the saltcedar section of the annual report lacks specific detail and accounting of efforts when compared to other reports for the LORP. Although more detail was provided this year, it is still lacks sufficient detail and justification for the work performed.

For the second year in a row, the program concentrated their work in the Billy Lake area in an effort to reduce seed sources and prevent future infestations. According to the report, work outside of this area was guided by the 2009 RAS data. They treated all of the known tamarisk recruitment and re-sprout sites, between miles 16 and 20.6. According to the Table 1, this consisted of 5 sites. The 2009 RAS reported 37 tamarisk seedling sites, with hundreds more other tamarisk sites, some of which were re-sprouts. These were spread along the entire river course, with large areas in the Islands and Lone Pine reach. The program treated tamarisk seedlings at a little over 4 of the 53 miles (7.5%) within the riverine-riparian area. These miles contained 5 of the 37 tamarisk seedling sites (13.5%) documented in the 2009 RAS.

In 2008, it was recommended that tamarisk seedling sites that occurred with woody recruitment be prioritized. These recommendations were not followed. No explanation was given in the 2009 report. In the 2009, it was recommended that the seedling sites along the river be prioritized once again. It was also requested that an explanation be provided of how adaptive management recommendations were considered and why they were or were not adopted. This past season, the program utilized RAS data, which is to be commended. However, it appears to have been a very small component of their overall effort; during their field season from October to March, they only treated 5 sites from the RAS. Although it is a positive sign that the program is beginning to utilize the data created by other efforts, it is clear that the program is not well integrated with other facets of the LORP project.

Large areas of saltcedar slash and piles are now present within the LORP from past saltcedar control activities. This spreading of slash and piling of saltcedar are causing unsightly nuisance problems. The annual increase in slash debris and piles are inhibiting the production of beneficial grasses, forbes, and brush; plus the dead masses are decreasing aesthetic values. The accumulation of saltcedar slash buildup is not yet to the magnitude that LORP goals are at risk, but, at the present rate of accumulation this unsightly condition will become a serious issue in the future. Once cut saltcedar slash has had time to harden it becomes very costly to remove or eliminate.

Each year all previous saltcedar control areas should be inspected and all new seedlings and juvenile saltcedar pulled. Because of their small size and distance between plants, these pulled plants can be spread on site. This annual control will prevent new seed sources from developing and eliminate all future needs to burn, eliminate, remove, or chip saltcedar slash. It is very important that each year all seedling and juveniles showing up along the river border be eliminated before they become too large to pull and spread, and again, force a major saltcedar control effort.

The 2010 Saltcedar report also states that the saltcedar program's position on the slash piles is to continue to create piles and to have a controlled burn program in December and January. The scientific team has repeatedly recommended chipping or masticating as a preferred option.

Given this history of incongruence between the adaptive management recommendations, the available data, and the priorities set by the saltcedar program a change in the program is necessary to ensure that the saltcedar program is well integrated with the overall goals of the LORP and is utilizing the best data available.

Recommendation: The MOU Consultants recommend that a meeting between the scientific team, LADWP and County representatives, and the saltcedar program director be conducted to establish goals and specific direction for each season prior to the commencement of activities.

Recommendation: The MOU Consultants recommend that all future saltcedar cutting, spreading, or piling be stopped until all existing slash and piles are eliminated and/or addressed.

Weed Control

The 2010 weed report is more detailed and thorough than past years. However, providing a few more details would be helpful for managers to understand the efforts of the Agriculture Commissioner's Office. For example, the report states "During certain times of year or during the treatment season when conditions do not permit treatment . . . ". Which times of year are these? It also states "several times per year surveys are conducted within the LORP . . ." Again, which times of the year? We assume that weed sites mean perennial pepperweed sites. Is this the only weed of interest that is being treated? These are relatively minor details in an otherwise adequate report.

The change from ATV to backpack sprayers is a positive one for the LORP. Less herbicide in more targeted areas with lower impact to native species are good improvements to the treatment method. The change in herbicide appears to be another positive development, but only time will tell if it will result in less retreatment. The use of RAS data is also a positive development, as the weed program is integrated with other project efforts. By treating the sites identified in the RAS, perhaps these sites will be contained before they grow to be larger problems.

The treatment of existing sites seems to be making a difference – as previously treated sites have either remained unchanged or declined in growth (with the exception of 2 sites). However, the discovery of new sites has resulted in an ever expanding number of infested acres.

In general, it appears that the weed program is functioning properly. The issue is that the weed problem is growing (more sites and more acreage) and more funding will be needed to adequately treat infestations in the future. As the 2010 report shows, although previously treated sites are generally not expanding, they still require treatment to control them. The number of sites increased from 4 in 2007, to 32 in 2010. Overall, the number of acres of actual weed-covered area treated increased from .21 to .28 acres from 2009-1020. The increased funding secured by the commission enabled retreatment of all existing sites and surveys for new sites in an effort to detect them early in their development. More funding will be needed to adequately address this important management issue in future years, and proper planning for these expenses is needed to ensure future success of the project.

Recommendation: Continue with the Weed program and explore additional funding venues to improve efficacy.

12.7 Blackrock Waterfowl Management Area

Water and Wetland Acreage Management

The Drew Unit continues to provide excellent waterfowl habitat with more than half the area still open water. On the other hand, the Winterton Unit has closed in such that vegetation cover may reach more than 50% of the area, the threshold for burning the unit, by next year. Thibaut is also choked with vegetation with very little open water left. According to the MOU, 28 acres that constitute the Thibaut Pond are not counted in the total 500 acres of wetlands, and must be maintained as ponds. This has proven impossible to do. The “pond” is too shallow to prevent tule encroachment.

The Thibaut Ponds are supported by water from the LADWP aqueduct through the east branch or the Thibaut Spillgate. The EIR considers the Thibaut Ponds as part of the off-river lakes and ponds of the LORP. The ponds are required to be kept full of water. No increase in water supply to these ponds is required by the EIR or the LORP Management Plan. The EIR states that lake surface areas in off-river lakes and ponds would not increase or decrease, and existing shoreline conditions would be maintained under proposed flows. The EIR also states that the increasing abundance of marsh vegetation could potentially degrade fish habitat, and this impact is not considered part of the LORP, but, instead is a management issue associated with ongoing practices of LADWP. Therefore, it is probably at the discretion of LADWP whether the ponds should provide the 28 acres of surface water or the occlusion by emergent vegetation is allowable.

These ponds are now chocked with emergent vegetation eliminating most of the past available surface water acreage. Open water in the EIR is considered valuable and very rare “wetland habitat” in the Owens Valley. The MOU does not count the pond wetland acreage as contributing to the 500 or less acres of wetlands required to be maintained in the Blackrock Waterfowl Management Area. The pond did, in the past, contribute 28 acres of surface water to the management area. The pond is too shallow in water depth to prevent emergent vegetation from taking over and covering the pond surface area.

Suggested alternatives to consider include, water depth increase by excavation, water control dykes to increase pond depth, chemical spraying to eliminate emergent vegetation. This feasibility report should be completed by May of 2011 and submitted to the Scientific Team for their review and comment.

Recommendation: The MOU consultants recommend continued draining and drying of Winterton for future burning.

Recommendation: The MOU Consultants recommend that LADWP complete an analysis of reasonable alternatives to determine if there is a most feasible method to regain and maintain 28 acres of pond habitat in the Thibaut Ponds area over the life of the project.

Habitat Indicator Species – CWHR Analysis

We find the CWHR analysis incomplete at this time. Please review the Monitoring and Adaptive Management Report (Ecosystem Sciences 2008) for methods and analysis direction. For an example of how to comparison baseline and 2010 please review the Delta Management Area section of the 2009 LORP Monitoring and Adaptive Management Report. The following bullets address specific needs for the report.

- Provide a comparison by unit (Thibaut, Winterton, Waggoner, Drew) of 2010 and baseline CWHR.
- Provide a guild analysis similar to the Delta Management Area Report from 2009.
- Compare Avian Survey Indicator Species results with CWHR data. For example, the creation of Lacustrine habitat in Drew has resulted in a significant increase in birds and available habitat. This should be explained in the report.
- The Avian Census and CWHR reports should not be mutually exclusive. The data generated in each report is important to the other.

Indicator Species Analysis Recommendation: At this point we are unable to make recommendations on this report. Thus, we recommend revising the report and providing an update once the revisions are complete.

Avian Census

The Blackrock Waterfowl Management Area (BWMA) report is satisfactory, provides detailed statistical analyses, and documents the change in the BWMA's avian community between baseline and 2010. Specifically, the report provides critical insight into how the area is responding to land, fire, and water management, and whether or not these actions are meeting the overall LORP goals. The BWMA Avian Survey meets the LORP MAMP requirements and objectives.

The BWMA Avian report focuses more on indicator species than the riverine-riparian area report. The indicator species tables per management area are very helpful in understanding how the avian community has responded to the management changes within each area since baseline. In general, the indicator species data demonstrates that management actions are affecting the avian community as expected. For example, inactive units (Winterton) support less abundance and diversity than active units (Drew) and recently burned and flooded units support a greater abundance and diversity of indicator species than older active units (Waggoner).

We predict that the performance of future avian related monitoring surveys in the “inactive” (being dried out) Blackrock Waterfowl Management Units (i.e., Winterton) will not improve management knowledge to the degree that the same amount of time that could be spent on surveying “active” management units. The MAMP monitoring schedule calls for avian surveys to be conducted at set time intervals during years 2, 5, 7, 10, and 15 post implementation. Therefore, it is possible that some units would never be surveyed when they are in the “active” status in a wetted cycle. Furthermore, surveys should be conducted during the first 2 years each unit is active. This will provide information regarding the suite of species and habitat indicator groups each unit can attract over a range of flooding or vegetative conditions.

Recommendation: The MOU Consultants agree with the report that only active units be surveyed, and that surveys be conducted at least the first and second year that each unit is active. It is also recommended that Thibaut Unit be analyzed to determine how to ensure open water in the Thibaut Ponds is maintained.

12.8 Off-River Lakes and Ponds

Water Level Management

The goal for the Off-River Lakes and Ponds is to maintain Upper Twin Lake, Lower Twin Lake, and Goose Lake water surface elevations between 1.5 and 3.0 feet on their existing staff gages, and keep Billy Lake full (i.e., at an elevation that maintains flow from the lake). All of the Off-River Lakes and Ponds, including Thibaut Ponds and Billy Lake were in compliance without experiencing any operational difficulties.

No adaptive management recommendations are required.

12.9 Delta Habitat Area

The Delta Habitat Area was mapped and analyzed during the 2009 Adaptive Management Process as opposed to the normal schedule in which it would have been mapped and analyzed in 2010. LADWP met their LORP obligation by providing consistent base flows coupled with seasonal habitat flows. Thus, it is not imperative to analyze the DHA again in 2010.

Recommendation: The MOU Consultants recommend that that LADWP continue to manage the base and pulse flows released to the DHA as they have in the past. No changes in DHA management are necessary at this time.

12.10 Rapid Assessment Surveys

Summary

The current Rapid Assessment Survey reflects an evolution from the original methods described it the MAMP and those employed in the first year. The method has been refined over the years based on input from LADWP, Inyo County and Ecosystem Sciences. The evolving nature makes comparisons between years somewhat difficult; the results were not designed for statistical comparisons and changes in methodology make comparisons between years more problematic. However, the survey currently provides a broad-based qualitative assessment of several management issues.

This year's RAS methods, approach, and report write-ups, greatly delayed recommendations reaching the decision makers. The present RAS approach also absorbs large amounts of time and money that could be spent on more worthy LORP efforts.

Recommendation: The MOU Consultants recommend that the city, county and MOU Consultants , re-examine the present RAS methodology and analysis reporting procedures to bring the survey back to what a RAS actually is supposed to accomplish. The MOU Consultants also recommend that this group meet in January and February of 2011 and complete an analysis and report by April 1, 2011.

Specific Management Issues

Exotic Weeds: Perennial Pepperweed remains a large problem within the LORP. The RAS aids the Weed Control Program in identifying new and tracking previously undocumented sites. This issue remains a high priority for LORP project managers. The recommendations for control and treatment of this plant are detailed in the Weed Management Section. Another noxious weed, tamarisk, is also a well known long term issue for the LORP. The RAS has aided in documentation of tamarisk re-sprout and recruitment sites. There are a large number of documented tamarisk seedlings and tamarisk re-sprout sites, which could be used to target the saltcedar control program. Although not noxious, fivehorn smotherweed (*Bassia hysopifolia*) is another plant of interest to LORP managers, as it has invaded the formerly dry reaches of the LORP. Site scale vegetation and landscape mapping clearing show the extent of bassia and that it has persisted for several years. Although bassia is not a native species, it is providing valuable services. First it occupies sites upon which saltcedar might develop. Second bassia because of its density is holding soil in place, improving water quality by buffering overland runoff, and provides habitat for small animals like mice, voles, and reptiles important in the food chain. Data from monitoring indicates an understory of herbaceous vegetation is developing under the decadent bassia; thus, plant succession is taking place.

Recommendation: The MOU Consultants recommend leaving bassia in place, not burning it or mowing it, not grazing it, and let natural process continue.
Fencing: Two breaks were reported in the riparian fence, and one in a lease fence. A pass-through was also recommended in an area receiving heavy foot traffic.

Recommendation: The fencing should be repaired in all three areas. Depending on project resources, an additional pass-through should be considered. However, unless damage is being done to the existing fence, additional pass-throughs should only be considered after all existing infrastructure has been repaired and maintained.

Recreation: As with previous years, small recreational impacts were observed in 2010. These include items like fire rings and ORV tracks and play areas. These do not appear to be threatening the most sensitive LORP resources, but these areas and activities require management.

<u>*Recommendation:*</u> Fire rings should be removed, and entrances to ORV play areas should be blocked off with rocks. Signs may be of limited utility, but managers should consider posting appropriate use signs where recreation impacts repeatedly appear.

Roads: The number of observations of new roads continued to drop in 2010 as in previous years (85 in 2007, 67 in 2008, 24 in 2009, and 12 in 2010). Notable new road use were near the, between Manzanar and Lone Pine, mostly to fishing access points.

<u>*Recommendation:*</u> Present management actions to inhibit new and existing unneeded roads appear to be working. Roads should continue to be blocked off with rocks as in previous years. Priority should be given to roads entering the riparian area and accessing the floodplain.

***Woody Recruitment**:* Woody recruitment sites were again documented throughout the LORP area. Although the number of new recruitment sites has declined since 2008, this is to be expected. Many of the geomophically appropriate sites were colonized in previous years; to expect steadily increasing or static recruitment is unrealistic. Woody recruitment is episodic and may not happen at all is some years. The RAS is not designed to be a comprehensive census of all woody recruitment sites; however, the data recorded indicates that woody recruitment and establishment are occurring within the LORP. The overall number of RAS documented woody recruitment patches established since project initiation continues to increase. The current number of recruitment sites consists of new recruitment sites established in 2010 and persisting and increasing sites from previous years. As with any natural system, not all recruitment sites will be able to establish and persist. Further, not all seedlings within each site can persist, as competition will reduce the number of seedlings that grow to maturity. Based on RAS data, seedlings are clearly surviving through multiple years; 68% of revisited woody recruitment sites were classified as persisting or increasing, while 13% were decreasing and 19% were absent. This indicates there are multiple persisting cohorts of native woody recruitment sites within the LORP.

<u>*Recommendation:*</u> As stated above, the RAS is not a comprehensive survey to monitor woody recruitment. If managers desire more systematic information on woody recruitment then another method should be employed. RAS data collected to date does not provide any indication of a major problem with woody recruitment within the LORP at this time.

12.11 Land Management

All of the LORP lessees have implemented their individual grazing plans. At this time grazing management is progressing and refinements to the plans are being made as needed. All of the fencing of riparian and upland pastures throughout the LORP has been completed.

LADWP uses controlled rangeland burning (from a Prescribed Fire Plan) as a key management tool to improve and maintain rangeland health and improve upland habitats. When justified, this tool not only increases desirable forage, but, can reduce livestock grazing pressure on riverine, riparian, and wetland habitats. During the past decade, LADWP's annual rangeland burning program has fallen short of what the Department needs to accomplish each year. Therefore, the forage base needed for both livestock and wildlife has been reduced on some grazing leases.

On a few leases there has not been adequate relief from heavy grazing on Lower Owens River bordering riparian-wetland habitats. Good rangeland vegetation condition has been successfully maintained in selected areas by past LADWP controlled burn projects. Increasing the annual acreage to gain LORP multiple use benefits should now be given a much higher priority as a management tool. Controled burning, under a Prescribed Fire Plan, can attain and maintain LORP goals more effectively and at a lower cost than most other available methods at this time.

The plan should prioritize those rangeland areas needing immediate attention to improve rangeland condition. An example would be those areas needing vegetation manipulation to reduce catastrophic effects of wildlife fire on other resources. Prioritization should also include areas where rabbit brush, saltcedar, and other invasive plants have reduced the forage base. The plan should contain an "Annual Operating Plan," at the grazing lease level, that will be updated each year.

LADWP should allocate annual funding and provide the labor and time necessary to implement the annual work load specified in the "Annual Operating Plan". Each annual plan needs to determine the area that needs to be burned the coming fire season to catch up to where LORP rangeland vegetation management needs to be. The over-all plan then needs to project future burn projects necessary to maintain desired vegetation condition over the next decade.

Belt Transects: Belt transects were introduced this year as a contingency monitoring program. Range trend transects, while numerous, were not placed in locations where direct streambank conditions can be monitored. Belt transects were placed in each riparian pasture on both sides of the river with the specific goal of measuring the development of woody riparian plant species.

Exclosures: Baseline data has not been collected from range trend transects in most LORP exclosures. Baseline data from the exclosures are necessary to measure change in non-forage plant species as indicators of biodiversity change. Exclosures also allow comparison of forage growth and condition compared to grazed areas; essentially control or reference sites against which grazing can be assessed.

12.11.1 Grazing Leases

All grazing lessees were required, during the 2010 grazing period, to abide by applicable grazing utilization standards as outlined in the Land Management and Grazing Lease Plans. All fencing required in the leases to successfully manage livestock on each lease has now either been constructed or all existing fences brought up to standard. Water developments to better control animal distribution are now in place. The lessees have had 3 years to mesh into the new management requirements for managing their livestock herds. Almost all LORP fields and pastures are abiding by upland and riparian utilization standards, other guidelines, and other requirements.

Blackrock Grazing Lease

Concentrated hoof action was used by LADWP to attempt to break up and eliminate smother weed (*Bassia*) that has taken over large areas along the river border in the White Meadow Riparian Pasture. Some or most of the weed invasion resulted from burning saltcedar slash and piles. In an attempt to eliminate smother weed stands in the pasture, intensive livestock hoof trampling action was attempted. To obtain the necessary hoof trampling effects, the vegetation forage utilization upper limit (40%) was lifted. There was no limit to the forage utilization if it was needed to obtain the necessary hoof trampling. This management action, based only on ocular observations, was not very successful. The MOU Consultants suggest that the best management tool at this time is to let the vegetative serial stages in smother weed dominated areas take their course and hopefully the problem will be corrected over time. At the present time the smother weed dominated areas are not causing any significant environmental problem.

12.11.2 Range Trend Analysis

Range Trend monitoring determines if differences in vegetation conditions occur over time as compared to base line conditions. All rangeland monitoring collected data between 2002 and 2007 is considered baseline. Range Trend analysis in all LORP grazing leases is proceeding very well and following procedures outlined in the Monitoring and Adaptive Management Plan. Because range trend, especially in upland habitats, can respond slowly to changes in land management, many years may be needed to draw trend conclusions in individual fields and pastures.

Baseline Range Trend monitoring was completed in 2002, 2003, 2004, 2005, 2006, and 2007. Post-Project Range Trend Monitoring was completed in 2008, 2009, and 2010. Future Range Trend Monitoring is programmed for 2011, 2013, 2018, and 2023. During these years, a wide range of environmental conditions occurred, including unfavorable vegetation growth years when precipitation was less than 50% of normal. The period also covered normal years and years when precipitation was way above average. The period of data collection and analysis wells covers climatic caused changes.

Range trend data collected to date has shown that positive trends are occurring in what was once the dry portion of the Owens River during pre-project times. The analysis also shows that changes in upland habitat trends may be quite slow. The 5-year interval called for after 2013 will adequately allow an analysis of range trend over the life of the project.

The MOU Consultants suggest that 2011 Range Trend monitoring be reduced (fewer, but select transects measured) in order to transfer effort to the belt transects and to collecting baseline data in exclosures.

Recommendation: The MOU Consultants recommend that a “Rangeland Vegetation Management Plan” be developed for the LORP that will plan for and implement future rangeland burning needs.

Recommendation: The MOU Consultants recommend that belt transect monitoring continue until the growth of woody riparian plants obfuscates the need for this monitoring.

Recommendation: Collect range trend transect data from all LORP exclosures.

Recommendation: The MOU Consultants recommend that the riparian forage utilization standard (40% limit) for the White Meadow Riparian Pasture again be implemented.

13.0 PUBLIC COMMENTS

13.1. LORP Annual Report Public Meeting

The LORP Annual Report public meeting was held on December 20, 2010, at the LADWP Bishop office. The following table lists those in attendance.

In Attendance		By Phone
Gene Coufal (GC)		Mark Hill (MH)
Clarence Martin (CM)		Bill Platts (BP)
Brian Tillemans (BT)		Tim Maguire (TM)
Dave Martin (DM)		Peter Vorster (PV)
Bob Harrington (BH)		
Larry Freilich (LF)		
LADWP Watershed/Hydro Staff		
Mark Bagley (MB)		
Rick Puskar (RP)		
Meredith Jabis		
Steve Parmenter (SP)		

13.2. Minutes Taken at the Public Meeting

CM calls meeting to order (10:05 am). Dave Martin is leading LORP monitoring effort on behalf of LADWP. LADWP staff will give brief overview of monitoring efforts conducted this year. We can entertain some questions here today, but submit specific or lengthy questions in writing because we have a lot to cover this morning.

DM: This was a significant monitoring year for the LORP. Staff was still taking data in October while putting this draft report together. We are under extremely tight deadlines due to our budget timeline, adaptive management review and changes, and lots of monitoring; unfortunately there is a short timeline for comments. We apologize in advance for short turnaround time; we realize there is a lot to absorb.

LADWP Staff Overview of Monitoring Efforts Conducted this Year and Related Comments

Hydrology- Eric Tillemans (ET) (Chapter 2)
Met flow requirements of stip and order. Permanent measuring stations are providing good measurements. Waterfowl area is now governed by new agreement – acreages. Better to manage this way.
<u>Questions/Comments:</u>
PV/MH/BP: Discussion on July 1, 2010, slide-- points on graph (bubbler system measuring device and problems with it/Langeman). MH/BP: It is important to get instantaneous readings- bubblers won't work.
SP: Has gain rate increased? (based on river flow gains and losses slide). ET: Gains are intrinsically linked with rainfall and are increasing; however, we have not teased out precipitation to see if this gain is increasing independently of it.
PV: Are we still getting data from Keeler Bridge? ET: Yes, but not constant record. We will use it until it wears out and will not replace it.
PV: Is there is a consistent relationship between Keeler Road and Pumpback Station? ET: Yes. PV requests data from ET. ET stated he can get graphics only, may not be able to overlay; will work on that.

Seasonal Habitat Flow Flooded Extent – Jeff Nordin (JN) (Chapter 3)
Questions/Comments:
MB: What does "flooded" mean? Groundwater vs. out of bank flow question. JN: Anything that was wet; walked waters' edge.
PV: Islands area looks to be getting biggest gain (acreage of inundation). JN: This is the smallest reach and proportionally does not add much to the system. For just the Islands (4 miles), it does proportionally have a large amount of flooded extent.
SP: Does report have definitions for high terrace, etc.? DM: These definitions can be found in WHA May 2004 report.
MB: Over 700 acres comes from the Islands area. This table does not show conditions at base flow. Do you have that? JN: Yes; Seasonal Habitat Flow Table 15. Extrapolation of Flooding Extent by Landform at Base Flow, found in report.
PV: Are post LORP landforms different from pre LORP? TM: This would take another effort of mapping the channel to show what is channel and what is floodplain.

Land Management- John Hays (Chapter 4)
Questions/Comments:
MH: Explain nomenclature of plant codes, etc. for audience.
JH: ATTO is Nevada saltbush, DISP is saltgrass, etc…
MB: Can you explain values of increase/decrease on slide?
JH: Sorry about that, these are the number of sites where changes in frequency between 2009 and 2010 occurred for a given species. The values in the parentheses are the number of sites where an increase or decrease in frequency was beyond the historic range previously seen on the site. The four increases in BAHY (*Bassyia)* were on the dry reach and the decrease in DISP (saltgrass) was on a flooded site on the Islands Lease.

Streamside Monitoring- Lori Dermody (LD) (Chapter 4)
Questions/Comments:
LF: How do these numbers compare to last year? LD: This was the first year for this sampling effort.
David Livingston: Was the one seedling noted a product of this year? Age of juveniles?
LD: Seedling was quite small, and would suspect that juveniles are product of implementation. This suggests that there is recruitment going on in the system, just not much this year.
PV: Wanted clarification on filtering effect of tules/cattails. LD: explained. Also lack of bare ground in which recruitment could occur and competition among other species. Will be interesting to track over time.
PV: Cottonwood seedlings/soils discussion with MH/BP/TM
Discussion on capability of system to host woody species. MH: Cottonwood did not seed; there was a later release than usual so seedlings may not have been obvious when we monitored in September 2010. BP: This system will not cater much to cottonwoods; cottonwoods favor gravel/cobble sites. Stable flows do not favor woody species. We will never have a large cottonwood gallery; woody recruitment in a river system will be a slow process.
MB: Unusual temperature swing this year could have influenced recruitment.

Riparian Bird Surveys- Debbie House (DH) (Chapters 5 and 8)
Questions/Comments:
BH: Is there any residual benefit of units post flooding? DH: No.
Indicator Species Habitat Assessment (CWHR)
Is suitable habitat based on the modeling you presented? (available habitat for indicator species slide). DH: Yes.

Rapid Assessment Survey
MB: What kind of road issues were noted? DH: Roads flooded/rutted, road use through meadows. Not a lot of new roads, however.

Landscape Scale Vegetation Mapping- Stu Richardson (SR) (Chapter 6)
<u>Questions/Comments:</u>
PV: 92% accuracy based on field mapping, how is this measured? SR: Yes, we sample 10% of all polygons and noted accuracy.
MB: How much of mapping effort had this confusion? SR: A small percentage, however; we had extra manpower to go back and field map those confused areas. In order to better define the wet gradient.
PV: Is what we're learning from this exercise applicable to waterfowl acreage techniques/using imagery to get waterfowl acreages? MH: CWHR based on landscape scale mapping. DM: We have not evaluated this imagery to replace walking wetted perimeter of waterfowl areas. Walk it 8 times a year. BH: Are looking into remote sensing to be used, but need something cheaper than aerial flights.

Site Scale Mapping- Tim Maguire (TM) (Chapter 7)
We are seeing shift in dominance; not really losing willows. We are seeing an increase in TYDO (cattails) and decrease in SCAC (tules) throughout the system. Could be useful pair with Streamside Monitoring in future years.
<u>Questions/Comments:</u>
MB: What characterizes increase or decrease? TM: Baseline is 2002/2003. Compare 2010 with 2002/2003.
MB: How does this transfer to arrangement in the landscape? Tim, more "communities" in 2010 than in 2003. More richness/diversity this year.

Fish Habitat Work- Mark Hill (MH) (Chapter 10)
<u>Questions/Comments:</u>
SP: Discussion on tules as a general term vs. specific species.

Creel Census- Jason Morgan (Chapter 9)
No questions or comments

Weeds- Inyo County (DM gave overview) (Chapter 11)
All RAS sites treated.
RP (IC Saltcedar)-- focused efforts in off river areas (primarily spreading areas) and Reach 2.
<u>Questions/Comments:</u>
BT: Follow up on RAS sites? RP: Currently ongoing.
CM: Where are you on funding from the Conservation Board? RP: Right now we have no outside funding. We would like to match the remaining half-million dollars.

Adaptive Management – MH (status update on 5-7 project goals)

- Riverine riparian habitat, some willow/cottonwood recruitment occurring. Healthy movement, but slow going.
- Habitat indicator species (+ response in wetlands and river)
- Warmwater fishery (+ response; off and running)
- Biomass tremendous, edge of problem
- Increase biodiversity in both plant/animal; good trend
- Maintain existing uses (range)

Adaptive Management Recommendations:
MH: On a good path. Downside: tules/cattails—75-80% covered and open water is hard to get to. Need to come up with better flow management to handle tules. Want to keep them in there to an extent as part of the system. Change base flow and change how we use seasonal habitat flow and move back tules. Need to do additional modeling before implementation. Deeper water will result in better effect on tules. (MB clarification: Tules = marsh in this discussion.)

Reductions in monitoring (MH)

- Don't need to do fish habitat as we did this year
- Don't need to continue river loss/gain report
- Water quality monitoring is supposed to end this year; will only do spot measurements during seasonal habitat flow
- Creel census to be conducted only in the spring, not fall

Additions to monitoring

- Added streamside monitoring this year.

Other Comments/Recommendations:

- Offriver lakes and ponds – no recommendations
- Thibaut – Look into options for maintaining 28 acres.
- RAS – We are off base in its use now; has become data intensive when it's supposed to be a quick assessment. Need to sit down and revisit the RAS and see how we will continue collecting data.
- Big monitoring year this year- look at data to guide direction of flow management. Shading for tule management not in the cards for several years; probably need to drown them! Greater water depth works to manage them. Survey data (LADWP) conducted last winter will help to model this.
- <u>Most substantial recommendation</u>: ES Streamflow Modeling for flow modifications for tule/cattail control. ES to conduct modeling before next spring and get back with LADWP and ICWD before April 2011.
- LADWP to develop a Baseline Vegetation Management Plan on Leases. Take a look and develop goals with respect to fire and upland veg. management.
- Saltcedar- Inyo County and LADWP to see where to go on this one.
- Bassia- MH does not recommend burning bassia because it is likely the first thing to come in as an early successional species. Recommends doing nothing to bassia at this time- let nature take its course. There are other things coming in beneath it- recommends to let this go for a few more years.

Questions/Comments:

- PV: Was there a flow increase in 2009 and 2010?
- BP: We will always have lower flow in the bottom end of the system because we lose some throughout. (evap., tules, grade, etc.)
- Discussion on modeling; will it include inflows from Alabama Gates, etc.? MH/BP: Yes.
- MB – understanding that changes in flows in tule management is about baseflow and not seasonal habitat flow. MH/BP: Yes. But need to make sure the whole system works together. BP does not want to guess without model being complete and ready. Does not want to jump to conclusions. Dropping flow in winter could be detrimental to fish and wildlife. Duration of flooding is important to change in the baseflow, not the seasonal habitat flow. MH: Seasonal flow currently is an irrigation project.
- MB: --available water discussion. "This is the same BS that we've been dealing with for 10 years!" MOU calls on Consultants to make recommendations including flows. The Court did not specify available water, it specifies required flows. Adaptive management measure in Court. "You ignore it and wonder why we get mad! Gene/Bob, you need to inform these

consultants that they need to consider this!" GC: "This just happened, Mark." BP: EIR has volume set, but nothing else that BP has seen.

- PV: What kind of duration would we need to expect for tule control? BP: There are a lot of other ways to get depths than changing flows/volume of water. Don't only consider flows. We are getting ahead of the game with this discussion; we need the modeling to show what options are available to us.
- PV: Does it make sense to inject augmentation flows from Alabama Gates?
- SP: "Reconstruct" how water gets to the river… what does that mean? MH: Lose a lot getting to river…
- MB: When discussing delivery from Alabama Gates to river, are you referring to augmenting base AND seasonal habitat flows? MH: Yes.
- PV: Is any of the data collected by school groups, etc., useful to this process? DM has not seen any of this data. BH: Those collecting data have recommended that we not use the data to guide adaptive management decisions.
- MB: What constitutes revisiting fish habitat work? BP: This would require a large event that is out of the ordinary. Will be considered in future reports.
- PV: Rangeland Management Plan? Has LADWP given you any response? BP: This is a recommendation to LADWP and they are already doing some of this; maybe we can add on. Burns have been successful in the past and can possibly be utilized more in the future for upland management.
- PV: Water quality chapter with regard to fish and BOD, COD. BP: Every seasonal habitat flow is going to be close to a fish kill- it is just going to happen; need water quality data collection to follow that. BT to PV: We have an extensive monitoring program with Lahontan; keep them well informed of what happens within the system.
- MB: Asks again for additional week for comments. CM/DM: No. Unfortunately cannot accommodate due to internal timelines and keeping progress rolling. Will try to consider late comments but cannot guarantee. If we extend comment period, there is a snowball effect; setting back timeline may result in not implementing important adaptive management measures until the following year because they may not make it into the workplan, etc.

Meeting adjourned.

13.3. California Department of Fish and Game Comments

Dave M

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Gentlemen:

The California Department of Fish and Game (Department) has reviewed the "2010 Draft Lower Owens River Project Annual Report". The Department would first like to address Los Angeles Department of Water and Power (LADWP) and Inyo County Water Department (ICWD) requirement to "direct and assist" the MOU consultant as required by Recital 13 of the LORP Post-Implementation Agreement. At the December 20, 2010 public meeting it was clear that the MOU Consultant was not aware of the May 2010 Superior Court Stipulation and Order (Case No. S1CVCV08-46888 (LORP #4)) and this lack of understanding is reflected in the LORP Annual Report. The Department requests LADWP and ICWD provide the MOU Consultant with a copy of the ruling accompanied by a letter explaining the Third and Sixth Causes of Action pertaining to setting the amount, duration, timing and ramping of seasonal habitat flow.

The Department offers the following comments, using as an organizational guide the 2010 LORP Annual Report by chapter and incorporating where applicable recommendations identified in Chapter 12, Adaptive Management Table 1.

Conserving California's Wildlife Since 1870

Chapter 2 – Hydraulic Monitoring

Chapter 2 lacks a summary, conclusions, and recommendations section. What do the findings tell us about changing rates of evapotranspiration, channel sealing, and travel time of water as the channel evolves? Do the hydrologic findings suggest additional studies are needed to better understand recommended flow management options and their effects?

Chapter 3 – Seasonal Habitat Flow Report

Are the manual water quality data presented for Georges Return (page 3-26) taken from the river, or from the return as suggested by Table 1 (page 3-2)? Location information is essential for interpreting the data.

Presentation of the dissolved oxygen regression analysis (Section 3.9.4) should include the input data points and R-squared values *directly* on the graphs. **The Department recommends raw data be included (via an appendix) to evaluate methodology validity.**

The recommendation to continue water quality monitoring (page 3-30) "...only during those conditions expected to result in water quality degradation." should also state the implied criteria for determining when monitoring will occur. **The Department recommends daily spot checking for dissolved oxygen levels during the 2011 Seasonal Habitat Flow.**

Seasonal Habitat Flow did not increase flow rates in 2010 in the lower reaches commensurate with release volume. In 2008, supplementation from the Alabama Gates was effective at providing high instantaneous flow rates in the same reach. **The Department recommendations experimentation with potential alternative release points for the Seasonal Habitat Flow to effect inundation of riparian surfaces in reaches 4-6.**

• Table 1 (page 12-2) recommendation, *"Discontinue River Flow Loss and Gain Report."* This recommendation needs clarification. Is the recommendation simply to discontinue inclusion of this information in future Annual Reports or to discontinue monitoring river flow? **The Department recommends river flows, gains and losses should continue to be monitored and reported.**

• Table 1 (page 12-2) recommendation, *"Discontinue fish habitat surveys until warranted in future."* This recommendation needs clarification; under what circumstances will surveys be considered warranted?

• Table 1 (page 12-2) recommendation, *"Follow the water quality recommendation in the MAMP and LRWQCB order…."* **The Department**

recommends the Annual Report specify exactly what is being proposed for future monitoring.

Chapter 4 – Land Management & Chapter 11 – Weed Control

The Department concurs with each of the 'Land/Grazing Management' recommendations presented in Table 1 (page 12-3). The Department is contacted by the Department of Forestry and Fire Prevention (Cal Fire) throughout the year to coordinate prescription burn plans for the LORP. Development of a LORP Rangeland Vegetation Management Plan, addressing various prescriptions including burning, would be of benefit. **The Department recommends the management plan specifically include salt cedar as a 'weed control' component.**

• Table 1 (page 12-3) recommendation, *"Conduct a meeting ... prior to commencing* [salt cedar] *activities."* **The Department concurs that a fall meeting to discuss salt cedar eradication would be a beneficial short-term goal, but may not be needed once a Rangeland Vegetation Management Plan is in place if salt cedar eradication is included.**

• Table 1 (page 12-3) recommendation, *"Attenuate all future salt cedar cutting, spreading or piling until all existing slash and piles are eliminated or addressed."* **Absent information (Chapter 11) to support this recommendation, the Department recommends salt cedar eradication continues.**

Chapter 5 – Rapid Assessment Survey Report

Similar to Chapter 2, Chapter 5, page 5-40, begins "Summary of 2010 RAS Observations" but the page is blank; no summary, conclusions or recommendations are presented.

• Table 1 (page 12-3) recommendation, "LADWP, ICWD and MOU Consultants meet to re-examine the present RAS methodology, analysis and reporting procedures...." **The Department concurs with this recommendation.**

• Table 1 (page 12-3) recommendation, *"Exotic Weeds: leave bassia in place, do not burn or mow it, and let natural processes continue."* Although *Bassia hyssopifolia* is a non-native plant, it is not defined in the MAMP as a weed, but rather is only referred to as a summer preferred forage species for elk. Additionally, Bassia is not listed by the Department of Food and Agriculture as a Class A or B noxious weed. The 2009 Annual Report, as a result of the 2008 RAS indicating dense stands of Bassia, recommended developing a study design of one or more methods.

Despite the challenges Bassia presents to RAS, the Department concurs with the recommendation to 'do nothing'. However, the 2009 and 2010

Annual Reports refer to *Bassia hyssopifolia* by several names (*i.e.*, bassia, Bassia, BAHY, smartweed, fivehorn smotherweed). **In anticipation of needing to address future adaptive management measures, for both consistency and clarity, Department recommends this species be referred to only as Bassia.**

Chapter 12 – Adaptive Management Recommendations

The 2009 Annual Report identified an increasing tule and cattail trend. Page 12-1 of the 2010 Annual Report identifies control of tules and cattails as one of the 'most pressing' LORP problems and identifies a greater than projected colonization increase. Chapter 12 hints at a recommendation, although not stated as such, to achieve additional control of tule and cattail encroachment through different spring, summer and winter base flows. **The Department is supportive of exploring base flow as a control mechanism for tule and cattail control and concurs with the justification presented in Section 12.3.1.**

• Table 1 (page 12-2) recommendation, "Conduct river modeling and flow analysis and provide recommendations." **The Department supports the concept of conducting river modeling and flow analysis and recommends LADWP, ICWD and MOU consultants meet to discuss what to model, how modeling can best be used as a tool, and whether it's the right tool. The Department would like to assist with consultant selection and the Department's Conservation Engineering Team is available to assist with model development and evaluation.**

<u>General Comments</u>

The Department recommends the Annual Report refer to specific appendices, where raw data and analyses are referenced, but not otherwise included in the body of the report. It is difficult to find some data in the appendices, and other data appears to be missing.

The Department recommends all references to "available water" be removed.

The Department recognizes the need for timely review of the LORP annual report and the subsequent time needed for the Technical Committee to consider comments and recommendations such that adaptive management measures and monitoring requirements can be incorporated into each fiscal year budget. Given that review of the LORP annual report will always be during the month of December, a period which staff availability is most limited, the Department would like to improve communication with LADWP and ICWD through a more cooperative effort throughout the year as LORP adaptive management measures are implemented. The Department would like to suggest a Spring 2011 MOU party meeting to discuss how to improve the MOU party review process.

Thank you for this opportunity to provide comments.

Sincerely,

Brad Henderson
Senior Environmental Scientist

cc:

chron
MOU Parties (via email)
Kris Vyverberg, DFG, Ecosystem Conservation Division

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JAN 26 2010
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BISHOP ADMINISTRATIVE OFFICE

14.0 GLOSSARY

BLM – U.S. Department of Interior, Bureau of Land Management

BOD – Biological Oxygen Demand

BWMA – Blackrock Waterfowl Management Area

CDFG – California Department of Fish and Game

CEQA - California Environmental Quality Act

CEQA mitigation – Measures to reduce or avoid impacts identified through the environmental impact analyses performed for an EIR or Negative Declaration

cfs – cubic feet per second

COD – Oxygen Demand

County – Inyo County

CWHR - California Wildlife Habitat Relationship System

Delta conditions - The amount of water and vegetated wetland within the Delta Habitat Area boundary existing at the time of the commencement of flows to the Delta under the LORP

ES - Ecosystem Sciences

EIR – Environmental Impact Report

ET – Evaporation transpiration

LAA – Los Angeles Aqueduct

LADWP – Los Angeles Department of Water and Power

LORP – Lower Owens River Project

MOU – Memorandum of Understanding amongst LADWP, the County, California Department of Fish and Game, State Lands Commission, Sierra Club, the Owens Valley Committee, and Carla Scheidlinger. The MOU specifies goals for the LORP, a timeframe for the development and implementation of the project, specific project actions, and requires that a LORP ecosystem management plan be prepared to guide the implementation and management of the project. It also provides certain minimum requirements for the LORP related to flows, locations of facilities, habitat and species.

RAS – Rapid Assessment Survey

SIP – State Implementation Plan *June 2004 Los Angeles Dept of Water & Power and the U.S. Environmental Protection Agency* 17-3 *Lower Owens River Project Final EIR/EIS*

SLC – California State Lands Commission

WHA – Whitehorse Associates