Lower Owens River Project
Annual Report

January 2017

TABLE OF CONTENTS

FIGURES AND TABLES

EXECUTIVE SUMMARY

The 2016 Lower Owens River Project (LORP) Annual Report contains the results from the tenth year of monitoring for the LORP. Monitoring results contained in this report include hydrologic monitoring, avian census monitoring for the Winterton and Thibaut Units of the Blackrock Waterfowl Management Area (BWMA), monitoring of range conditions throughout the project area, rapid assessment, weed and saltcedar management.

Hydrologic Monitoring

The hydrologic monitoring section describes flow conditions in the LORP regarding attainment with the 2007 Stipulation & Order flow and reporting requirements and 1991 Environmental Impact Report (EIR) goals. For the 2015-16 water year, which covers October 2015 to September 2016, LADWP was fully compliant with all the 2007 Stipulation & Order flow and reporting requirements. The mean flow to the Delta Habitat Area (DHA) was 9.0 cfs, achieving the required 6-9 cfs annual flow. The agreement to manage wetted acreage in the Blackrock Waterfowl Management Area (BWMA) by setting constant flows by seasons continued with generally good results. The seasonal habitat flow ramping reached a peak of 106 cfs and covered five days, before ramping down over another five days. This section also describes flow measurement issues and includes commentary on flow losses and gains through the different reaches of the Lower Owens River.

Avian Census for Winterton and Thibaut Units, Blackrock Waterfowl Management Area

The flooded acreage requirement for the Blackrock Waterfowl Management Area (BWMA) was 355 acres based on the 2015-2016 runoff year. Water was released to the Winterton and Thibaut Units in 2016 to fulfill this requirement. Avian surveys were conducted seasonally in both of these units to detect the presence or absence of LORP Habitat Indicator Species, and to provide information regarding use and preferences of these species within the management units. Results of these surveys are presented in this section.

Throughout the summer, waterfowl were more attracted to shallow flood grassland than to deeper ponds surrounded by cattails. In the fall, while shallow flood grassland still supported large numbers of waterfowl, waterfowl use in the deeper ponds began to increase. Deep ponds surrounded by cattails provide cover for migrating waterfowl, while shallow flood grassland provides food. The majority of waterfowl seen during surveys were dabbling ducks.

Spring surveys showed large numbers of wading birds in portions of Winterton, primarily a result of a mixed flock of birds roosting in the area in migration. Again, shallow basins were favored over deeper ponds. Wading birds are most abundant in late spring and early fall, and are generally absent mid-summer and winter.

Shorebirds have never been abundant at Winterton due to a lack of appropriate habitat. However, this summer, the unintended drawdown of one subunit demonstrated the value of exposed mudflats for shorebirds, with over double the number of shorebirds observed compared with previous years (2011 and 2015). Other areas that received shorebird use in spring and fall were shallow basins. Providing shallow water with limited amounts of vegetation or mudflats during peak shorebird use periods may result in higher use by this group of indicator species.

Avian data collected in 2016 indicates that preferentially flooding some areas, particularly at certain times of the year (migration, winter etc.) may result in higher use by indicator species. This approach would benefit wildlife and could be a more effective use of water resources since water delivery to the units would be geared to benefit habitat indicator species. However, more evaluation is needed in order to create habitat diverse enough to accommodate all indicator species.

Land Management

The 2016 LORP land management monitoring efforts continued with monitoring utilization across all leases, irrigated pasture evaluations, and range trend monitoring on the Blackrock and Delta leases inside the LORP management area. The LORP area is currently experiencing its fifth year of extreme drought. Effects from this are a decrease in forage production in the uplands and decreased availability of irrigation water. Impacts from the historic drought are apparent on the xeric uplands; however, steady base flows in the Lower Owens River have maintained moist floodplain meadows in good condition. Total acreages of these moist floodplain meadows continue to decrease on the Islands and lower sections of the Blackrock leases as tules and cattails continue to expand out from the river and colonize adjacent cutoff oxbows.

Pasture utilization for leases within the LORP was below the allowable levels of use established for both riparian (up to 40%) and upland (up to 65%) areas except for the Delta Lease where use exceeded 40% in the riparian pasture. Maximum allowable use in the Delta riparian pasture will be limited to 30% during the 2016-17 grazing period. If use exceeds 30% during that time the pasture will be placed into nonuse.

Irrigated pastures on the Thibaut, Islands, Delta, Lone Pine leases were evaluated in 2016. Conditions met the minimum scores with the exception of the Delta and Lone Pine leases. These lower scores and the general poorer condition of the remaining meadows are due to the limited availability of irrigation water.

Rapid Assessment Survey

A survey of the LORP area, referred to as the Rapid Assessment Survey or RAS, was conducted in August. The primary purpose of the RAS is to detect and record the locations of problems that can negatively affect the LORP. Some of these impacts require physical maintenance such as repairing damaged or cut fences, trash pickup, tamarisk slash pile removal, and herbicide treatment of noxious weeds; while other observations reflect on biological or ecological conditions. Almost 600 observations were recorded this year and a summary of these can be found in this report.

In general the RAS findings were similar to the previous year; evidence of woody recruitment is still scarce, however the majority of trees that took root in the previous year are surviving; saltcedar does not appear to be spreading except in the Off river Lakes and Ponds and in the BWMA; Perennial Pepperweed appears to be contained and confined, but persisting despite treatment; Russian Olive has somewhat expanded its range in off-river locations; beavers, or beaver evidence, was found in a number of new areas although overall beaver abundance is similar to that found last year. The most significant impact noted this year was evidence of 17 new roads forged into the LORP area.

Weed Management

Inyo/Mono Counties Agricultural Commissioner's noxious weed program staff continued their efforts to eradicate known weed populations within the LORP area and monitor for pioneer populations. Through annual surveys, herbicide treatments, and ongoing surveillance this program has largely managed to prevent the spread of Pepperweed (*Lepidium latifolium*) within the LORP. This year, 10 sites were considered eradicated, 4 new sites were discovered utilizing the Rapid Assessment Survey (RAS) survey data, and 1 new site was found with other survey procedures. Pepperweed in the LORP totaled 1.05 net acres in 2016, which represents a 0.21 acre increase over 2015.

Saltcedar

The Inyo County Water Department saltcedar field crews continued to cut and retreat approximately 400 acres of saltcedar resprouts. Each year the saltcedar crews sweep the Lower Owens River and treat resprouts, pull seedlings, and remove mature plants. This year crews covered about 89 miles of riverbank and floodplain. About 50 piles of dry slash, which had accumulated over the years, were burned in the 2015-2016 field season. This effort was assisted by the California Department of Forestry and Fire Protection and the Los Angeles Department of Water and Power. An ongoing responsibility of the Saltcedar Program, with the assistance from the LADWP, is to secure grant funding to maintain an active Saltcedar Control Program.

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, the 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 up to approximately 500 acres depending on the water year forecast 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 pumpback 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 consultants, Mr. Mark Hill and Dr. William Platts of 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 consultants, ES. This LORP Annual Report describes monitoring data, analysis, and recommendations for the LORP based on data collected during the 2016 field season (March-October). The development of the LORP Annual Report is a collaborative effort between the ICWD, LADWP, and the MOU consultants. 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. In 2016, LADWP wrote Sections 1.0 Introduction; 2.0 Hydrologic Monitoring; 3.0 Avian Census for Winterton and Thibaut Units, Blackrock Waterfowl Management Area; and 4.0 Land Management. ICWD completed Section 5.0 Rapid Assessment Survey and Section 7.0 Saltcedar Report. Section 6.0 Weed Control was authored by the Inyo/Mono Counties Agricultural Commission.

The annual report will be available to download from the LADWP website link: http://www.ladwp.com/LORP.

This document fulfills the reporting requirements for the LORP Annual Report for 2016.

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. The flow requirements 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 have 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 Below 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 2015 through September 2016, for the 4 in-river stations (see Hydrological Appendix 2).

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> under About Us → Los Angeles Aqueduct → LA Aqueduct Conditions Reports → LORP Flow Reports and click on the 'List of LORP Flow Reports' link.

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> under About Us → Los Angeles Aqueduct → LA Aqueduct Conditions Reports → LORP Monthly Reports.

Real time data showing flows at Below LORP 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> under About Us → Los Angeles Aqueduct → LA Aqueduct Conditions Reports → Real Time Data 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. Both of the Sontek SW meters located in the main channel of the LORP are mounted on the bottom of concrete sections. These devices are highly accurate and final records for the LORP generally fall within normal water measurement standards of +/- 5%.

The accuracy of the Sontek meters are affected by factors which change the levels or velocities in the river. One of those factors is seasonal changes, such as spring/summer vegetation growth, which cause water levels to increase and velocities to decrease. 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 meters flows at all of the stations along the LORP to check the accuracy of the meters. Each time current metering is performed, 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 2007 Stipulation & Order, to maintain the accuracy of the meters.

A commentary on each station along the LORP follows:

<u>Below LORP Intake</u>

Measurement Device: Langemann Gate

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 order to attempt to solve the water measurement problems when the Langemann Gate is submerged, a WaterLOG H-350XL was installed as a back up to the Langemann Gate measurement. After a few years of attempting to apply a rating curve to the level measured by the bubbler, it has been determined that the large fluctuations in stage as conditions in the river channel go through seasonal cycles are too large and unpredictable to sustain an accurate measurement using the bubbler. As such, the bubbler has been abandoned and LADWP will no longer use the bubbler as a backup device to measure flow at the Intake.

LORP at Mazourka Canyon Road

Measurement Devices: Sontek SW Meter

The station 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

The station utilizes a single Sontek SW flow meter in a concrete measuring section and measurement accuracy has been excellent.

LORP at Pumpback Station

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

At the Pumpback Station, the flow is a calculated by adding the Pumpback Station, 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 Environmental Impact Report (EIR), section 2.4):

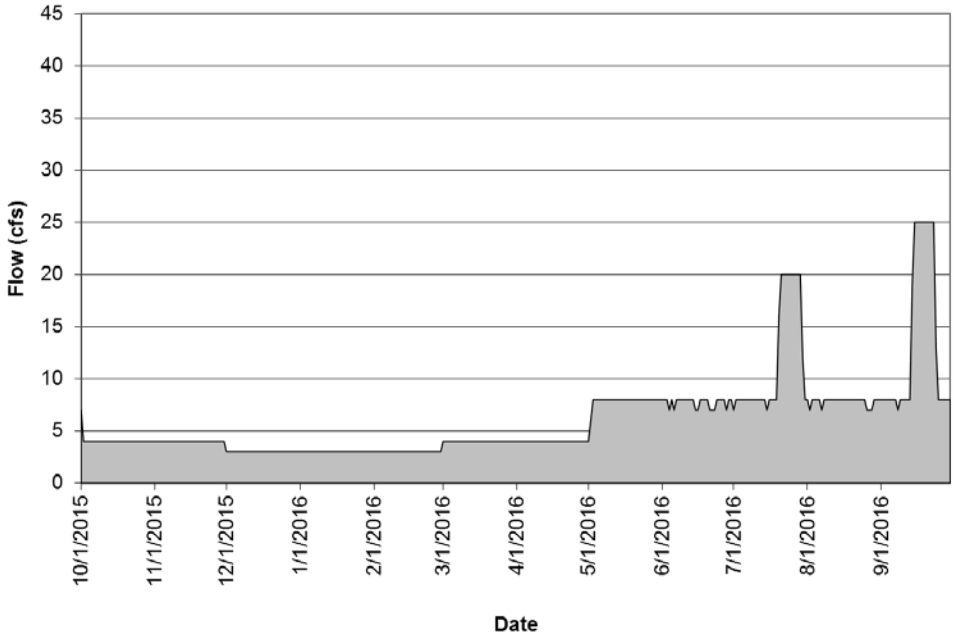
- October 1 to November 30 — 4 cfs
- December 1 to February 28 — 3 cfs
- March 1 to April 30 — 4 cfs
- May 1 to September 30 — 7.5 cfs

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

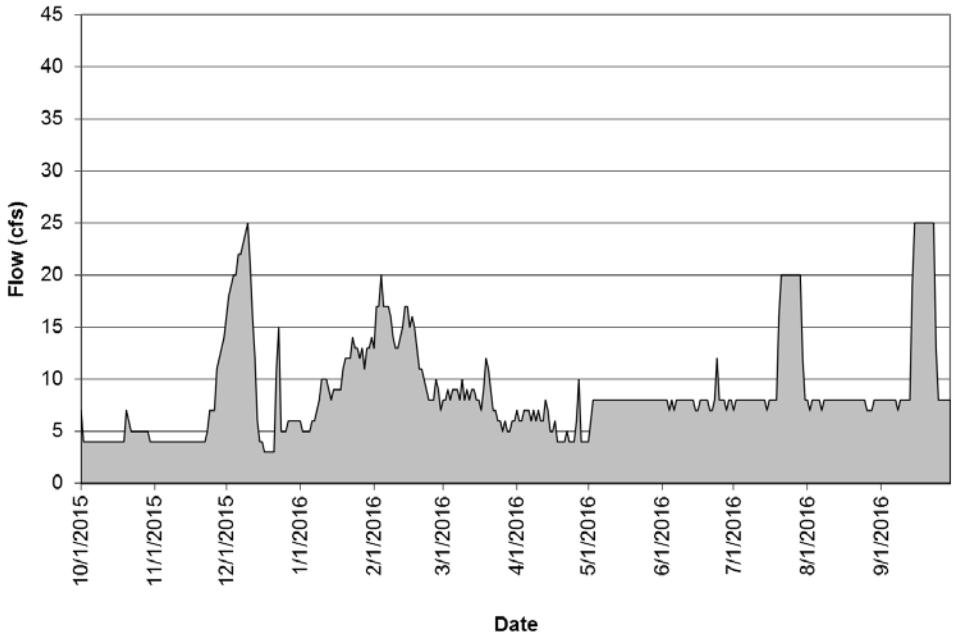
- Period 1: March-April — 10 days at 25 cfs
- Period 2: June-July — 10 days at 20 cfs
- Period 3: September — 10 days at 25 cfs
- Period 4: November-December — 5 days at 30 cfs

All of the scheduled flows to the Delta were released as planned except for the Period 4 and 1 pulse flows. These two pulse flows were cancelled due to sustained unintended flows to the Delta between November 2015 and April 2016.

The base, unintended, and pulse flows for the 2015-16 water year resulted in an average of 9 cfs flow to the Delta. Unintended flow to the Delta increased this year, mostly due to repair work on the LA Aqueduct. Unintended flows are also released to the Delta when intense rainstorms cause river flows to exceed the maximum allowed flowrate 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).



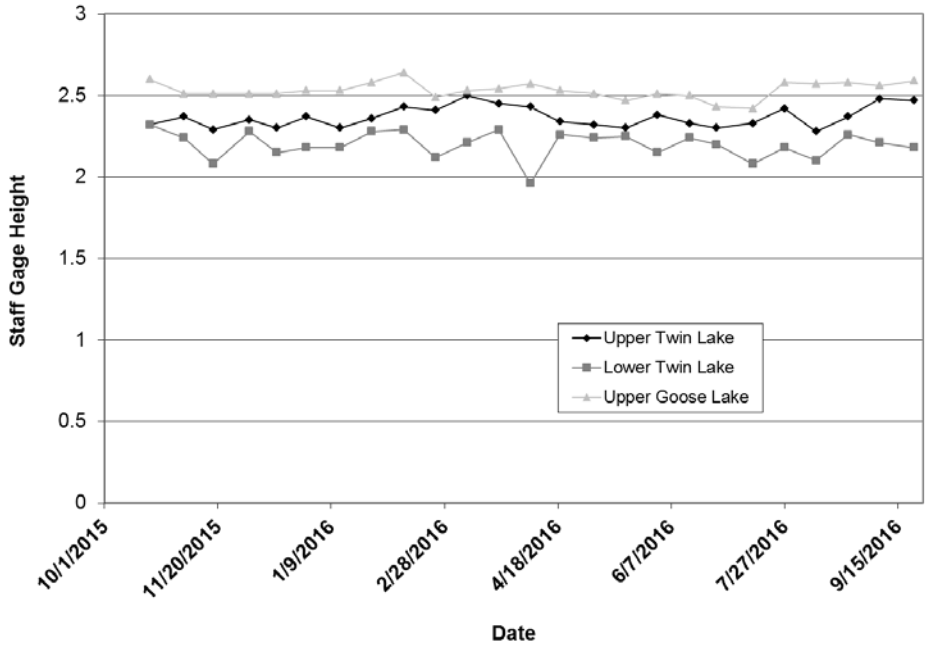
Hydrologic Figure 1. Langemann Release to Delta



Hydrologic Figure 2. Langemann and Weir Release to Delta

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 respective staff gauges, and that Billy Lake be maintained full (i.e., at an elevation that maintains outflow from the lake). All of the staff gages measured above 1.5 feet stage height for the October 2015 to September 2016 reporting period.



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

Billy Lake

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. The table in Hydrological Appendix 2 presents the annual summary of flows, and shows that at no time did the flow at Billy Lake Return Station fall to zero for a day. Billy Lake Return had a minimum daily average flow of 0.7 cfs for the year, so Billy Lake remained full for the entire year (see the following table).

Hydrologic Table 1. LORP Flows – Water Year 2015-16

Station Name	Average Flow (cfs)	Maximum Flow (cfs)	Minimum Flow (cfs)
Below River Intake	54.8	106.0	41.0
Blackrock Return Ditch	1.0	2.0	0.0
Goose Lake Return	1.0	1.9	0.5
Billy Lake Return	1.1	1.6	0.7
Mazourka Canyon Road	53.5	82.0	38.0
Locust Ditch Return	0.2	7.6	0.0
Georges Ditch Return	0.9	18.3	0.0
Reinhackle Springs	53.1	77.0	37.0
Alabama Gates Return	0.3	13.3	0.0
At Pumpback Station	50.1	71.0	32.0
Pump Station	41.2	48.0	19.0
Langemann Gate to Delta	6.2	25.0	3.0
Weir to Delta	2.7	22.0	0.0

Thibaut Pond

Thibaut Pond is contained completely within the Thibaut Unit of the BWMA. Each day the Thibaut Pond acreage is posted to the web in the LORP daily reports.

2.3 Blackrock Waterfowl Management Area

Flows for the BWMA are 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 evapotranspiration (ET) rates.

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

Up until the end of the 2012-13 Runoff Year, wetted acreage measurements were collected eight times per year, once in the middle of each season and once at the end of each season. Starting on the 2013-14 Runoff Year, only the middle of each season measurements have been collected. The end of season measurements were discontinued because they added very little information compared to the middle of season measurements and required extensive manpower for taking the measurement. The measurements are performed by using GPS and walking the perimeter of the wetted edges of the waterfowl area.

Hydrologic Table 2. BWMA Wetted Acreage

Winterton Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Spring*	5/6/2015	86	6.8
Summer*	7/10/2015	171	6
Fall*	9/15/2015	221	6
Winter*	1/15/2016	186	1.7
Spring**	5/17/2016	111	5.3
Summer**	7/11/2016	213	5.1
Fall**	9/16/2016	167	n/a

Thibaut Unit***

ET Season	Read Date	Wetted Acreage	Average Inflow
Spring*			
Summer*			
Fall*			
Winter*	1/19/2016	30	1
Spring**	5/17/2016	176	2.8
Summer**	7/8/2016	112	2.8
Fall**	9/20/2016	108	n/a

Drew Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Spring*	5/6/2015	235	0
Summer*			
Fall*			
Winter*			
Spring**			
Summer**			
Fall**			

Waggoner Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Spring*			
Summer*			
Fall*			
Winter*			
Spring**			
Summer**			
Fall**			

** These measurements count towards the 2015-2016 runoff year acreage goal.*
*** These measurements count towards the 2016-2017 runoff year acreage goal.*
**** This acreage does not include the 28 acres of the Thibaut Pond area.*

2.3.1 Blackrock Waterfowl Management Area Results for April 2015 to March 2016

The runoff forecast for runoff year 2015-16 was 36%, thus the waterfowl acreage goal for this year was 180 acres.

On April 1, 2015 the Thibaut Waterfowl Area inflow was turned off, the inflow for Drew Waterfowl Area was turned off, and the Winterton Waterfowl Area inflows were turned on to 6.6 cfs.

On May 1, 2015 the flows to Winterton were reduced to 5.6 cfs. On May 6 the wetted perimeter was measured with GPS. The wetted area was 235 acres for Drew and 86 acres for Winterton.

On June 1, 2015 the flows to Winterton were increased to 6.0 cfs. The wetted perimeter was measured with GPS in the middle of the summer season identifying a wetted area of 171 acres for Winterton.

Fall flows to Winterton remained at 6.0 cfs. When the wetted perimeter was measured with GPS in the middle of the fall season, the wetted area was 221 acres for Winterton.

On October 16, 2015 flows to Winterton were decreased to 1.6 cfs, and flows to Thibaut Waterfowl Area were increased to 0.5 cfs.

On November 22, 2015 flows to Thibaut Waterfowl Area were increased to 5 cfs from 1 cfs.

On November 24, 2015 flows to Thibaut Waterfowl Area were decreased to 1 cfs from 5 cfs.

On January 15, 2016 the Winterton wetted area was measured with GPS and was 186 acres. On January 19, the Thibaut wetted area was measured with GPS and was 58 acres.

On January 25, 2016 flows to Thibaut Waterfowl area were decreased to 0 cfs from 1 cfs.

On January 26, 2016 flows to Thibaut Waterfowl area were increased to 5 cfs from 0 cfs.

On February 11, 2016 flows to Thibaut Waterfowl area were decreased to 0 cfs from 5 cfs.

The average waterfowl wetted area for the runoff year was 234 acres, which is above the target of 180 acres.

2.3.2 Blackrock Waterfowl Management Area Results for April 2016 to September 2016

The runoff forecast for runoff year 2016-17 is 71%, so the waterfowl acreage goal for this year is 355 acres.

On April 7, 2016 the flow to Thibaut Waterfowl Area was increased from 0 cfs to 4 cfs.

On April 16, 2016 the flow to Thibaut Waterfowl Area was decreased from 4 cfs to 3.3 cfs. Also on April 16, 2016 flow to Winterton Waterfowl Area was increased from 1.6 cfs to 6 cfs.

On May 17, 2016 the wetted extent of Thibaut Waterfowl Area and Winterton Waterfowl Area were measured with GPS. Thibaut Waterfowl Area measured 204 acres, and Winterton Waterfowl Area measured 111 acres.

On June 1, 2016 flows to Thibaut Waterfowl Area were changed from 3.3 to 2.8 cfs, and flows to Winterton Waterfowl Area were changed from 6 cfs to 5.1 cfs.

On July 11, 2016 the wetted extent of Winterton Waterfowl Area was measured with GPS as 213 acres. On July 8, 2016 the wetted extend of Thibaut Waterfowl Area was measured with GPS as 140 acres.

On August 16, 2016 flows to Thibaut Waterfowl Area were changed from 2.8 cfs to 1.6 cfs. Flows to Winterton Waterfowl Area remained at 5.1 cfs.

On September 16, 2016 the wetted extent of Winterton Waterfowl Area was measured with GPS as 167 acres. On September 20, 2016 the wetted extend of Thibaut Waterfowl Area was measured with GPS as 136 acres.

The average waterfowl wetted acreage so far through fall is 315 acres, which is below the goal of 355 acres.

2.4 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 LORP Intake to the Pumpback Station during the period of October 2015 to September 2016. The reaches referred to in this report indicate areas of river between specified permanent gaging stations. 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.

2.4.1 River Flow Loss or Gain by Month and Year

Flow losses or gains can vary over time as presented in the table below. 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 also result in flow increases.

Hydrologic Table 3. Average Monthly River Flow Losses/Gains
From the Intake to the Pumpback Station during the 2015-16 Water Year

Average Monthly River Flow Losses or Gains
from Intake to Pumpback Station

	Month	Flow (cfs)	Acre-Feet-Per-Day
2015	OCT	-9	-19
	NOV	-6	-13
	DEC	+9	+17
2016	JAN	+8	+16
	FEB	+13	+26
	MAR	+9	+18
	APR	+7	+14
	MAY	-9	-19
	JUN	-29	-57
	JUL	-45	-90
	AUG	-38	-76
	SEP	-19	-38
	AVG MONTH	**-9 cfs**	**-18 AF**

For the entire river, the overall gain or loss is calculated by subtracting Pumpback Station outflow from inflows at the Intake and augmentation spillgates. Inflows from the Intake were 39,812 acre-feet, inflows from augmentation spillgates were 3,373 acre-feet, and outflows from the Pumpback Station were 36,375 acre-feet. This yields a loss of 6,811 acre-feet for the year, a daily average of approximately 9.4 cfs between the Intake and the Pumpback Station. Water loss during the 2015-16 water year (October 2015 to September 2016) represents about 16% of the total released flow from the Intake and augmentation spillgates into the river channel.

2.4.2 Flow Loss or Gain by River Reach during the Winter Period

From December 2015 to March 2016, an average flow of 42 cfs was released into the Lower Owens River from the Intake. An additional 5 cfs was provided from augmentation ditches, for a total accumulated release of 47 cfs. The average flow reaching the Pumpback Station was 57 cfs, an increase of 10 cfs during the 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 gained 2 cfs, while the reach from Mazourka Canyon Road to the Reinhackle gaging station lost 1 cfs and Reinhackle to the Pumpback Station gained 9 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 Table 4. Winter Flow Losses/Gains, December 2015 to March 2016

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	42	N/A	N/A
Mazourka	48	+2	+2
Reinhackle	49	-1	+1
Pumpback	57	+9	+10

Note: All numbers are rounded to the nearest whole value.
Calculations include augmentation and return flows in appropriate reaches, see Appendix 2 for all flows.

2.4.3 Flow Loss or Gain by River Reach during the Summer Period

During the summer period of June 2016 to September 2016, all river reaches lost water. An average flow of 74 cfs was released into the Lower Owens River from the Intake. An additional 3 cfs was provided from augmentation locations throughout the Lower Owens River. The effects of ET are evident from the high total flow loss (-33 cfs) between the Intake and the Pumpback Station. Summer flow losses were 43 cfs higher than conditions during the winter season. The largest flow losses occurred at the Reinhackle to Pumpback reach (-17 cfs) (see following table).

Hydrologic Table 5. Summer Flow Losses/Gains, June 2016 to September 2016

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	74	N/A	N/A
Mazourka	64	-13	-13
Reinhackle	61	-3	-16
Pumpback	44	-17	-33

Note: All numbers are rounded to the nearest whole value.
Calculations include augmentation and return flows in appropriate reaches, see Appendix 2 for all flows.

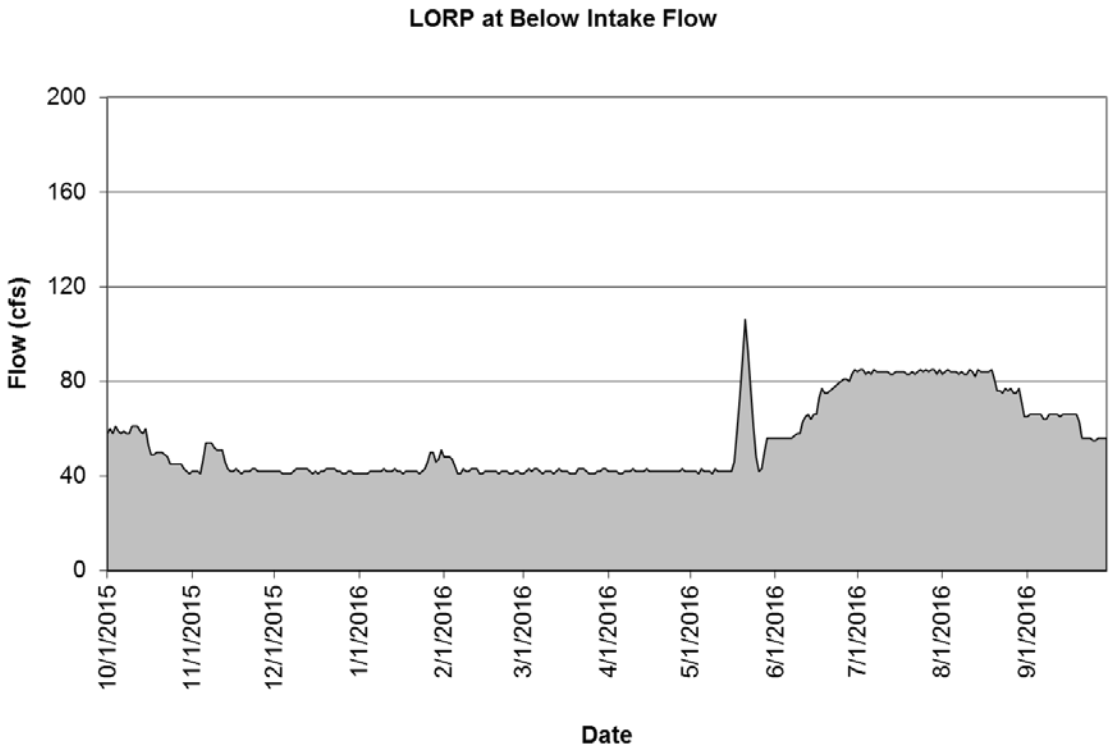
2.5 Seasonal Habitat Flow

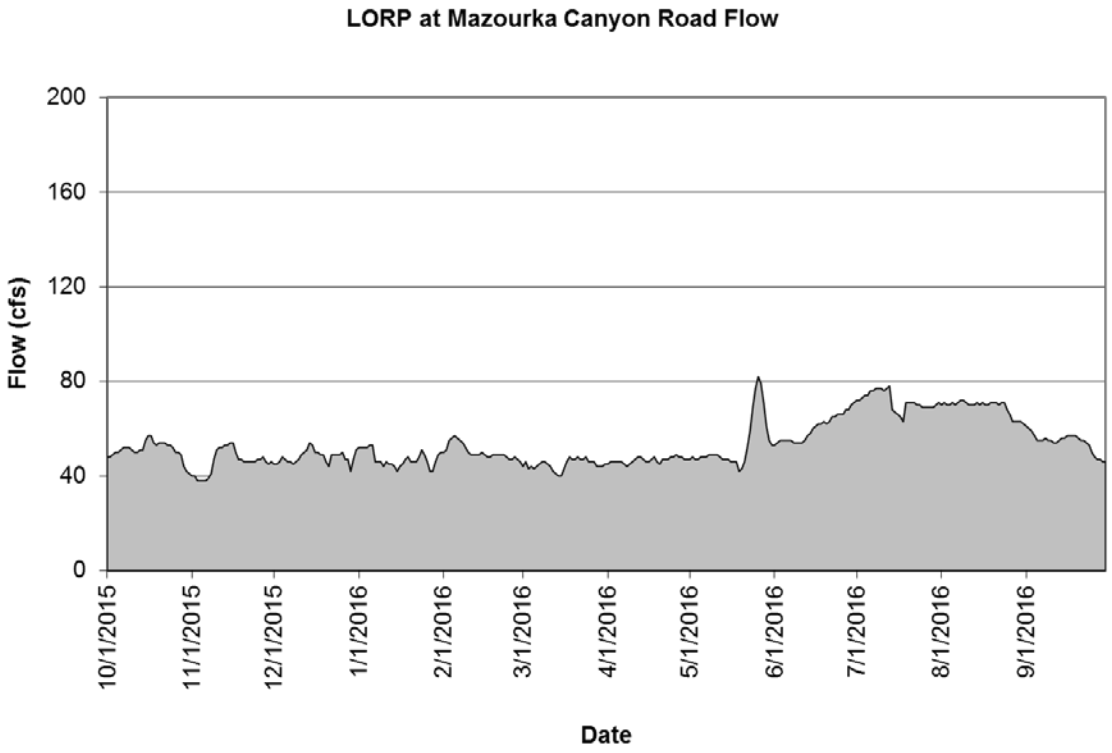
2.5.1 Seasonal Habitat Flow

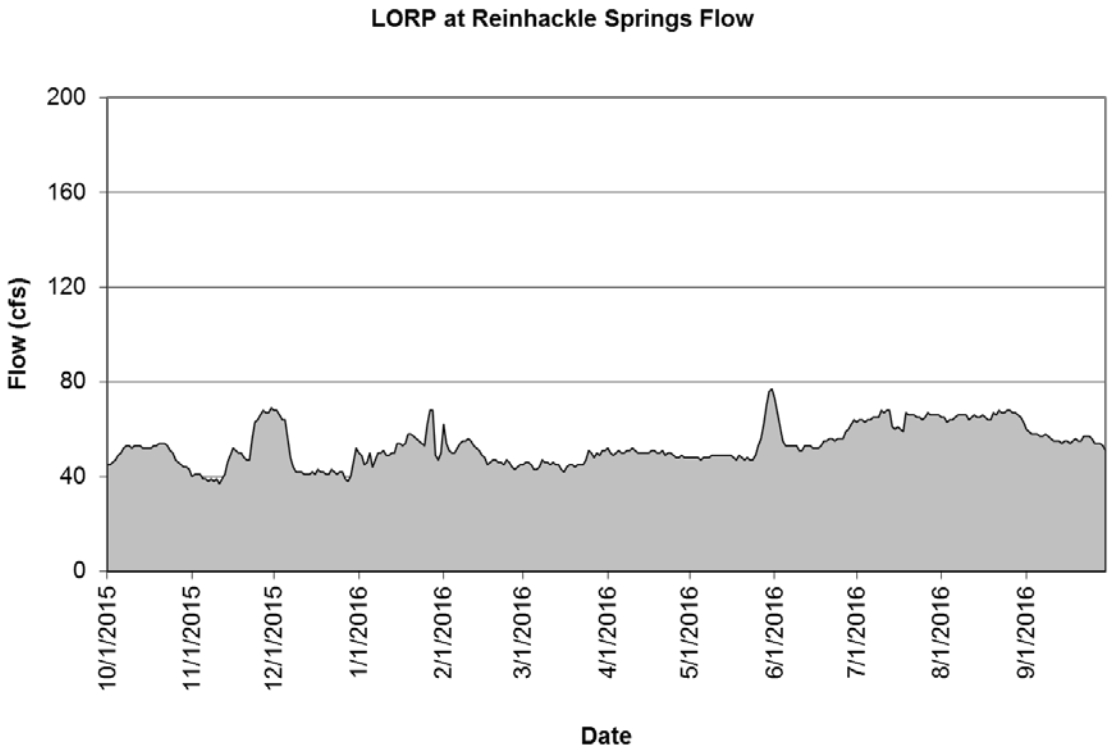
The runoff forecast for runoff year 2015-16 is 71%, and a Seasonal Habitat Flow was released from the LORP Intake in May 2016. Flows from the LORP Intake were ramped up to a peak of 106 cfs over a period of five days, before ramping down over another five days. See Appendix 2 for daily flow rates from the LORP Intake.

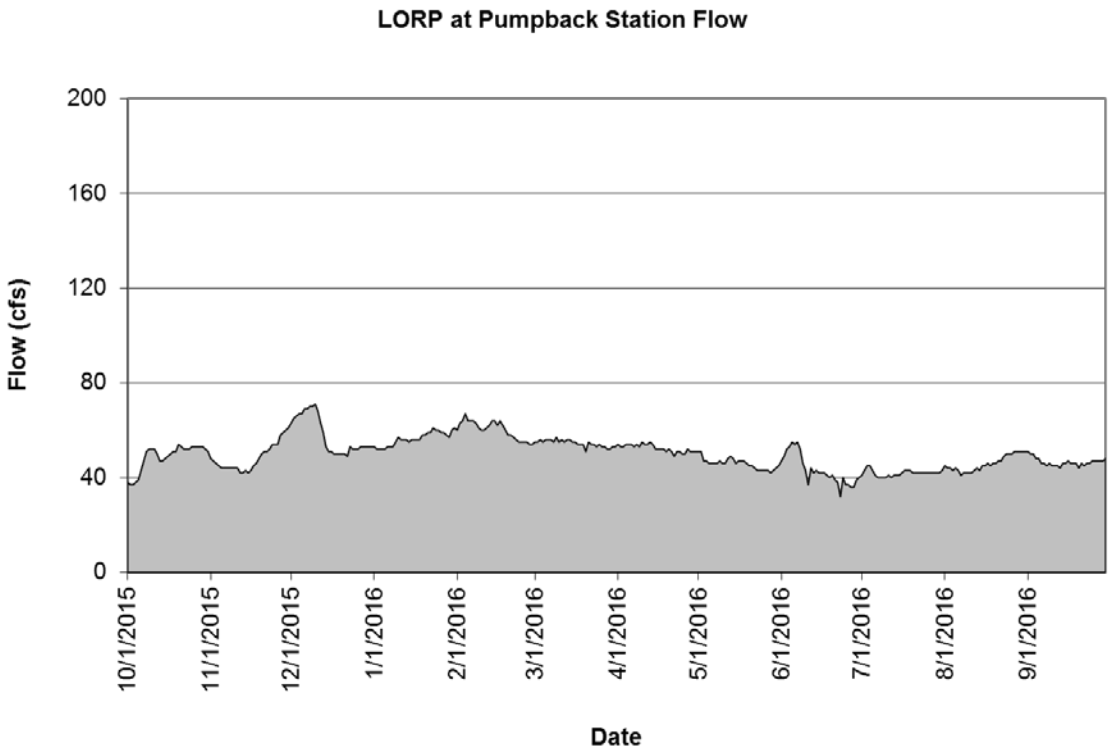
2.6 Appendices

Appendix 1. Hydrologic Monitoring Graphs






LORP at Reinhackle Springs Flow
200
160
120
80
40
0
Flow (cfs)
10/1/2015
11/1/2015
12/1/2015
1/1/2016
2/1/2016
3/1/2016
4/1/2016
5/1/2016
6/1/2016
7/1/2016
8/1/2016
9/1/2016
Date


LORP at Pumpback Station Flow
200
160
120
80
40
0
Flow (cfs)
10/1/2015
11/1/2015
12/1/2015
1/1/2016
2/1/2016
3/1/2016
4/1/2016
5/1/2016
6/1/2016
7/1/2016
8/1/2016
9/1/2016
Date

Appendix 2. River Flow Tables

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
10/1/2015	58.0	1.0	1.1	1.3	48.0	0.0	0.0	45.0	0.0	38.0	31.0	7.0	0.0	47.3
10/2/2015	60.0	1.0	1.1	1.2	48.0	0.0	0.1	45.0	6.8	37.0	33.0	4.0	0.0	47.5
10/3/2015	58.0	1.0	1.1	1.2	49.0	0.0	0.0	46.0	12.5	37.0	33.0	4.0	0.0	47.5
10/4/2015	61.0	1.0	1.1	1.2	50.0	0.0	0.0	47.0	12.2	38.0	34.0	4.0	0.0	49.0
10/5/2015	59.0	1.0	1.2	1.3	50.0	0.0	0.0	49.0	11.3	39.0	35.0	4.0	0.0	49.3
10/6/2015	58.0	1.0	1.3	1.3	51.0	0.0	0.1	50.0	4.4	43.0	39.0	4.0	0.0	50.5
10/7/2015	59.0	1.0	1.3	1.3	52.0	0.0	0.0	52.0	0.0	47.0	43.0	4.0	0.0	52.5
10/8/2015	58.0	1.0	1.2	1.3	52.0	0.0	0.0	53.0	0.0	51.0	47.0	4.0	0.0	53.5
10/9/2015	58.0	1.0	1.1	1.3	52.0	0.0	0.0	53.0	0.0	52.0	48.0	4.0	0.0	53.8
10/10/2015	61.0	1.0	1.0	1.3	51.0	0.0	0.0	52.0	0.0	52.0	48.0	4.0	0.0	54.0
10/11/2015	61.0	1.0	1.0	1.3	50.0	0.0	0.0	53.0	0.0	52.0	48.0	4.0	0.0	54.0
10/12/2015	61.0	1.0	1.0	1.4	50.0	0.0	0.0	53.0	0.0	50.0	46.0	4.0	0.0	53.5
10/13/2015	59.0	1.0	1.1	1.4	51.0	0.0	0.0	53.0	0.0	47.0	43.0	4.0	0.0	52.5
10/14/2015	58.0	1.0	1.2	1.4	51.0	0.0	0.0	52.0	0.0	47.0	43.0	4.0	0.0	52.0
10/15/2015	60.0	1.0	1.3	1.5	55.0	0.0	0.0	52.0	0.0	48.0	44.0	4.0	0.0	53.8
10/16/2015	53.0	1.0	1.3	1.5	57.0	0.0	0.0	52.0	0.0	49.0	45.0	4.0	0.0	52.8
10/17/2015	49.0	1.0	1.3	1.6	57.0	0.0	0.0	52.0	0.0	50.0	46.0	4.0	0.0	52.0
10/18/2015	49.0	1.0	1.4	1.6	54.0	0.0	0.0	53.0	0.0	51.0	47.0	4.0	0.0	51.8
10/19/2015	50.0	1.0	1.5	1.6	53.0	0.0	0.0	53.0	0.0	51.0	47.0	4.0	0.0	51.8
10/20/2015	50.0	1.0	1.5	1.6	54.0	0.0	0.0	54.0	0.0	54.0	47.0	4.0	3.0	53.0
10/21/2015	50.0	1.0	1.5	1.5	54.0	0.0	0.1	54.0	0.0	53.0	47.0	4.0	2.0	52.8
10/22/2015	49.0	1.0	1.4	1.5	54.0	0.0	0.1	54.0	0.0	52.0	47.0	4.0	1.0	52.3
10/23/2015	48.0	1.0	1.4	1.5	53.0	0.0	0.1	53.0	0.0	52.0	47.0	4.0	1.0	51.5
10/24/2015	45.0	1.0	1.4	1.5	53.0	0.0	0.1	51.0	0.0	52.0	47.0	4.0	1.0	50.3
10/25/2015	45.0	1.0	1.4	1.4	52.0	0.0	0.1	50.0	0.0	53.0	48.0	4.0	1.0	50.0
10/26/2015	45.0	1.0	1.4	1.4	50.0	0.0	0.1	47.0	0.0	53.0	48.0	4.0	1.0	48.8
10/27/2015	45.0	1.0	1.4	1.4	50.0	0.0	0.1	46.0	0.0	53.0	48.0	4.0	1.0	48.5
10/28/2015	45.0	1.0	1.3	1.4	49.0	0.0	0.1	45.0	0.0	53.0	48.0	4.0	1.0	48.0
10/29/2015	43.0	1.0	1.2	1.4	44.0	0.0	0.1	44.0	0.0	53.0	48.0	4.0	1.0	46.0
10/30/2015	42.0	1.0	1.1	1.4	42.0	0.0	0.1	44.0	0.0	52.0	48.0	4.0	0.0	45.0
10/31/2015	41.0	1.0	1.1	1.3	41.0	0.0	0.1	43.0	0.0	51.0	47.0	4.0	0.0	44.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
11/1/2015	42.0	1.0	1.1	1.3	40.0	0.0	0.1	40.0	0.0	48.0	44.0	4.0	0.0	42.5
11/2/2015	42.0	1.0	1.2	1.3	40.0	0.0	0.1	41.0	0.0	47.0	43.0	4.0	0.0	42.5
11/3/2015	42.0	1.0	1.2	1.3	38.0	0.0	0.1	41.0	0.0	46.0	42.0	4.0	0.0	41.8
11/4/2015	41.0	1.0	1.3	1.3	38.0	0.0	0.1	41.0	0.0	45.0	41.0	4.0	0.0	41.3
11/5/2015	47.0	1.0	1.2	1.2	38.0	0.0	0.2	39.0	0.0	44.0	40.0	4.0	0.0	42.0
11/6/2015	54.0	1.0	1.1	1.2	38.0	0.0	0.2	39.0	0.0	44.0	40.0	4.0	0.0	43.8
11/7/2015	54.0	1.0	1.1	1.2	39.0	0.0	0.2	38.0	0.0	44.0	40.0	4.0	0.0	43.8
11/8/2015	54.0	1.0	1.1	1.2	41.0	0.0	0.1	39.0	0.0	44.0	40.0	4.0	0.0	44.5
11/9/2015	52.0	1.0	1.1	1.2	47.0	0.0	0.1	38.0	0.0	44.0	40.0	4.0	0.0	45.3
11/10/2015	51.0	1.0	1.1	1.1	51.0	0.0	0.1	39.0	0.0	44.0	40.0	4.0	0.0	46.3
11/11/2015	51.0	1.0	1.1	1.1	52.0	0.0	0.1	37.0	0.0	44.0	40.0	4.0	0.0	46.0
11/12/2015	51.0	2.0	1.0	1.1	52.0	0.0	0.2	39.0	0.0	42.0	38.0	4.0	0.0	46.0
11/13/2015	46.0	1.0	1.1	1.1	53.0	0.0	0.2	41.0	0.0	42.0	38.0	4.0	0.0	45.5
11/14/2015	43.0	1.0	1.2	1.2	53.0	0.0	0.2	46.0	0.0	43.0	39.0	4.0	0.0	46.3
11/15/2015	42.0	1.0	1.3	1.2	54.0	0.0	0.2	49.0	0.0	42.0	38.0	4.0	0.0	46.8
11/16/2015	42.0	1.0	1.3	1.1	54.0	0.0	0.3	52.0	0.0	43.0	39.0	4.0	0.0	47.8
11/17/2015	43.0	1.0	1.3	1.1	50.0	0.0	0.8	51.0	0.0	45.0	41.0	4.0	0.0	47.3
11/18/2015	42.0	1.0	1.2	1.1	47.0	0.0	0.2	50.0	0.0	46.0	42.0	4.0	0.0	46.3
11/19/2015	41.0	1.0	1.2	1.1	47.0	0.0	0.2	50.0	0.0	48.0	44.0	4.0	0.0	46.5
11/20/2015	42.0	1.0	1.1	1.2	46.0	0.0	0.1	48.0	0.0	50.0	46.0	4.0	0.0	46.5
11/21/2015	42.0	1.0	1.1	1.2	46.0	0.0	0.1	47.0	0.0	51.0	47.0	4.0	0.0	46.5
11/22/2015	42.0	1.0	1.1	1.2	46.0	0.0	2.4	47.0	2.2	51.0	47.0	4.0	0.0	46.5
11/23/2015	43.0	1.0	1.1	1.2	46.0	3.9	15.0	56.0	7.0	52.0	47.0	4.0	1.0	49.3
11/24/2015	43.0	1.0	1.1	1.2	46.0	5.5	16.3	63.0	0.4	54.0	47.0	4.0	3.0	51.5
11/25/2015	42.0	1.0	1.1	1.2	47.0	5.5	16.6	64.0	0.0	54.0	47.0	4.0	3.0	51.8
11/26/2015	42.0	1.0	1.0	1.2	47.0	6.4	17.4	66.0	0.0	54.0	47.0	4.0	3.0	52.3
11/27/2015	42.0	1.0	1.0	1.2	48.0	7.6	17.5	68.0	0.0	58.0	47.0	4.0	7.0	54.0
11/28/2015	42.0	1.0	1.0	1.2	46.0	7.1	17.3	67.0	0.0	59.0	47.0	4.0	8.0	53.5
11/29/2015	42.0	1.0	1.0	1.2	45.0	6.0	17.5	67.0	0.0	60.0	47.0	4.0	9.0	53.5
11/30/2015	42.0	0.4	1.0	1.2	46.0	5.3	17.7	69.0	0.0	61.0	47.0	4.0	10.0	54.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
12/1/2015	42.0	0.4	1.1	1.2	45.0	4.6	17.8	68.0	0.0	63.0	47.0	3.0	13.0	54.5
12/2/2015	42.0	1.0	1.1	1.3	45.0	5.0	17.9	68.0	0.0	65.0	47.0	3.0	15.0	55.0
12/3/2015	42.0	0.4	1.1	1.3	46.0	5.6	18.1	66.0	0.0	66.0	47.0	3.0	16.0	55.0
12/4/2015	41.0	1.0	1.1	1.3	48.0	5.7	18.3	64.0	0.0	67.0	47.0	3.0	17.0	55.0
12/5/2015	41.0	1.0	1.0	1.2	47.0	4.1	14.8	64.0	0.0	67.0	47.0	3.0	17.0	54.8
12/6/2015	41.0	1.0	0.8	1.3	46.0	0.0	0.4	56.0	0.0	69.0	47.0	3.0	19.0	53.0
12/7/2015	41.0	1.0	0.6	1.3	46.0	0.0	0.8	48.0	0.0	69.0	47.0	3.0	19.0	51.0
12/8/2015	42.0	2.0	0.8	1.2	45.0	0.0	0.3	44.0	0.0	70.0	47.0	3.0	20.0	50.3
12/9/2015	43.0	1.0	1.1	1.2	46.0	0.0	0.3	42.0	0.0	70.0	46.0	3.0	21.0	50.3
12/10/2015	43.0	1.0	1.3	1.3	47.0	0.0	0.3	42.0	0.0	71.0	46.0	3.0	22.0	50.8
12/11/2015	43.0	1.0	1.4	1.3	49.0	0.0	0.2	42.0	0.0	68.0	47.0	3.0	18.0	50.5
12/12/2015	43.0	1.0	1.3	1.3	50.0	0.0	0.1	41.0	0.0	63.0	47.0	3.0	13.0	49.3
12/13/2015	43.0	1.0	1.2	1.3	51.0	0.0	0.2	41.0	0.0	59.0	47.0	3.0	9.0	48.5
12/14/2015	42.0	1.0	1.2	1.3	54.0	0.0	0.1	41.0	0.0	53.0	47.0	3.0	3.0	47.5
12/15/2015	41.0	1.0	1.0	1.2	53.0	0.0	0.1	42.0	0.0	51.0	47.0	3.0	1.0	46.8
12/16/2015	42.0	1.0	1.0	1.2	50.0	0.0	0.1	41.0	0.0	51.0	47.0	3.0	1.0	46.0
12/17/2015	41.0	1.0	1.1	1.2	50.0	0.0	0.1	43.0	0.0	50.0	47.0	3.0	0.0	46.0
12/18/2015	42.0	1.0	1.2	1.1	49.0	0.0	0.1	42.0	0.0	50.0	47.0	3.0	0.0	45.8
12/19/2015	42.0	1.0	1.2	1.1	49.0	0.0	0.1	42.0	0.0	50.0	47.0	3.0	0.0	45.8
12/20/2015	43.0	1.0	1.2	1.1	46.0	0.0	0.4	41.0	0.0	50.0	47.0	3.0	0.0	45.0
12/21/2015	43.0	1.0	1.3	1.1	44.0	0.0	0.8	41.0	0.0	50.0	47.0	3.0	0.0	44.5
12/22/2015	43.0	1.0	1.2	1.1	49.0	0.0	0.6	43.0	0.0	49.0	38.0	3.0	8.0	46.0
12/23/2015	43.0	1.0	1.3	1.1	49.0	0.0	0.3	42.0	0.0	53.0	38.0	3.0	12.0	46.8
12/24/2015	42.0	1.0	1.3	1.1	49.0	0.0	0.5	41.0	0.0	52.0	47.0	3.0	2.0	46.0
12/25/2015	42.0	1.0	1.3	1.1	49.0	0.0	0.6	42.0	0.0	52.0	47.0	3.0	2.0	46.3
12/26/2015	41.0	1.0	1.2	1.1	50.0	0.0	0.7	42.0	0.0	52.0	47.0	3.0	2.0	46.3
12/27/2015	41.0	1.0	1.2	1.2	47.0	0.0	0.9	39.0	0.0	53.0	47.0	3.0	3.0	45.0
12/28/2015	42.0	1.0	1.2	1.2	47.0	0.0	1.0	38.0	0.0	53.0	47.0	3.0	3.0	45.0
12/29/2015	42.0	1.0	1.1	1.2	42.0	0.0	0.4	40.0	0.0	53.0	47.0	3.0	3.0	44.3
12/30/2015	41.0	1.0	1.1	1.2	47.0	0.0	0.2	46.0	0.0	53.0	47.0	3.0	3.0	46.8
12/31/2015	41.0	1.0	1.1	1.2	51.0	0.0	0.2	52.0	0.0	53.0	47.0	3.0	3.0	49.3
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
1/1/2016	41.0	1.0	1.1	1.2	52.0	0.0	0.2	50.0	0.0	53.0	47.0	3.0	3.0	49.0
1/2/2016	41.0	1.0	1.1	1.2	52.0	0.0	0.2	49.0	0.0	52.0	47.0	3.0	2.0	48.5
1/3/2016	41.0	1.0	1.1	1.2	52.0	0.0	0.2	45.0	0.0	52.0	47.0	3.0	2.0	47.5
1/4/2016	41.0	0.0	1.0	1.2	52.0	0.0	0.4	46.0	0.0	52.0	47.0	3.0	2.0	47.8
1/5/2016	42.0	1.0	1.1	1.2	53.0	0.0	0.4	50.0	0.0	52.0	47.0	3.0	2.0	49.3
1/6/2016	42.0	1.0	1.3	1.2	53.0	0.0	0.3	44.0	0.0	53.0	47.0	3.0	3.0	48.0
1/7/2016	42.0	1.0	1.2	1.2	46.0	0.0	0.3	47.0	0.0	53.0	47.0	3.0	3.0	47.0
1/8/2016	42.0	1.0	1.2	1.2	46.0	0.0	0.3	50.0	0.0	53.0	46.0	3.0	4.0	47.8
1/9/2016	42.0	1.0	1.2	1.2	46.0	0.0	0.3	50.0	0.0	55.0	47.0	3.0	5.0	48.3
1/10/2016	43.0	1.0	1.2	1.2	44.0	0.0	0.3	51.0	0.0	57.0	47.0	3.0	7.0	48.8
1/11/2016	42.0	1.0	1.2	1.2	46.0	0.0	0.3	49.0	0.0	56.0	46.0	3.0	7.0	48.3
1/12/2016	42.0	1.0	1.3	1.2	45.0	0.0	0.3	49.0	0.0	56.0	46.0	3.0	7.0	48.0
1/13/2016	42.0	1.0	1.2	1.2	45.0	0.0	0.3	50.0	0.0	56.0	47.0	3.0	6.0	48.3
1/14/2016	43.0	1.0	1.2	1.2	44.0	0.0	0.3	50.0	0.0	55.0	47.0	3.0	5.0	48.0
1/15/2016	42.0	1.0	1.2	1.2	42.0	0.0	0.3	54.0	0.0	56.0	47.0	3.0	6.0	48.5
1/16/2016	42.0	1.0	1.2	1.2	44.0	0.0	0.2	54.0	0.0	56.0	47.0	3.0	6.0	49.0
1/17/2016	41.0	1.0	1.2	1.2	45.0	0.0	0.5	53.0	0.0	56.0	47.0	3.0	6.0	48.8
1/18/2016	42.0	1.0	1.2	1.2	47.0	0.0	0.9	54.0	0.0	56.0	47.0	3.0	6.0	49.8
1/19/2016	42.0	1.0	1.3	1.1	48.0	0.0	0.6	58.0	0.0	58.0	47.0	3.0	8.0	51.5
1/20/2016	42.0	1.0	1.3	1.1	46.0	0.0	0.4	58.0	0.0	58.0	46.0	3.0	9.0	51.0
1/21/2016	42.0	1.0	1.3	1.1	46.0	0.0	0.2	57.0	0.0	59.0	47.0	3.0	9.0	51.0
1/22/2016	42.0	1.0	1.3	1.2	46.0	0.0	0.2	56.0	0.0	59.0	47.0	3.0	9.0	50.8
1/23/2016	41.0	1.0	1.2	1.2	48.0	0.0	0.3	55.0	0.0	61.0	47.0	3.0	11.0	51.3
1/24/2016	42.0	1.0	1.0	1.2	51.0	0.0	0.2	54.0	0.0	60.0	47.0	3.0	10.0	51.8
1/25/2016	43.0	1.0	1.0	1.1	49.0	0.0	3.9	53.0	0.0	60.0	47.0	3.0	10.0	51.3
1/26/2016	46.0	1.0	1.0	1.1	46.0	0.0	13.6	62.0	0.0	59.0	47.0	3.0	9.0	53.3
1/27/2016	50.0	1.0	1.1	1.2	42.0	0.0	11.1	68.0	0.0	59.0	46.0	3.0	10.0	54.8
1/28/2016	50.0	0.5	1.2	1.2	42.0	0.0	5.0	68.0	0.0	58.0	47.0	3.0	8.0	54.5
1/29/2016	46.0	1.0	1.2	1.2	46.0	0.0	1.5	49.0	0.0	57.0	44.0	3.0	10.0	49.5
1/30/2016	47.0	1.0	1.2	1.2	49.0	0.0	1.2	47.0	0.0	60.0	47.0	3.0	10.0	50.8
1/31/2016	51.0	1.0	1.6	1.2	50.0	0.0	6.7	50.0	0.0	61.0	47.0	3.0	11.0	53.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
2/1/2016	48.0	2.0	1.9	1.2	50.0	0.0	12.4	62.0	0.0	60.0	47.0	3.0	10.0	55.0
2/2/2016	48.0	1.0	1.8	1.2	51.0	0.0	1.2	54.0	0.0	63.0	46.0	3.0	14.0	54.0
2/3/2016	48.0	1.0	1.6	1.2	55.0	0.0	1.0	51.0	0.0	64.0	47.0	3.0	14.0	54.5
2/4/2016	47.0	1.0	1.5	1.2	56.0	0.0	0.9	50.0	0.0	67.0	47.0	3.0	17.0	55.0
2/5/2016	44.0	1.0	1.5	1.2	57.0	0.0	0.6	50.0	0.0	64.0	47.0	3.0	14.0	53.8
2/6/2016	41.0	1.0	1.4	1.2	56.0	0.0	0.7	52.0	0.0	64.0	47.0	3.0	14.0	53.3
2/7/2016	41.0	1.0	1.4	1.2	55.0	0.0	0.6	54.0	0.0	64.0	47.0	3.0	14.0	53.5
2/8/2016	43.0	1.0	1.5	1.3	54.0	0.0	0.6	55.0	0.0	63.0	47.0	3.0	13.0	53.8
2/9/2016	42.0	1.0	1.5	1.3	52.0	0.0	0.8	55.0	0.0	61.0	47.0	3.0	11.0	52.5
2/10/2016	42.0	1.0	1.5	1.3	50.0	0.0	0.7	56.0	0.0	60.0	47.0	3.0	10.0	52.0
2/11/2016	43.0	1.0	1.5	1.2	49.0	0.0	0.8	55.0	0.0	60.0	47.0	3.0	10.0	51.8
2/12/2016	43.0	1.0	1.4	1.2	49.0	0.0	0.8	53.0	0.0	61.0	47.0	3.0	11.0	51.5
2/13/2016	43.0	1.0	1.4	1.3	49.0	0.0	0.7	52.0	0.0	62.0	47.0	3.0	12.0	51.5
2/14/2016	41.0	1.0	1.4	1.3	49.0	0.0	0.4	51.0	0.0	64.0	47.0	3.0	14.0	51.3
2/15/2016	41.0	1.0	1.3	1.4	50.0	0.0	0.3	49.0	0.0	64.0	47.0	3.0	14.0	51.0
2/16/2016	42.0	1.0	1.3	1.4	49.0	0.0	0.3	48.0	0.0	62.0	47.0	3.0	12.0	50.3
2/17/2016	42.0	1.0	1.3	1.5	48.0	0.0	0.3	45.0	0.0	64.0	48.0	3.0	13.0	49.8
2/18/2016	42.0	2.0	1.2	1.4	48.0	0.0	0.3	46.0	0.0	62.0	47.0	3.0	12.0	49.5
2/19/2016	42.0	1.0	1.1	1.4	49.0	0.0	0.3	47.0	0.0	60.0	47.0	3.0	10.0	49.5
2/20/2016	42.0	2.0	1.0	1.4	49.0	0.0	0.3	47.0	0.0	58.0	47.0	3.0	8.0	49.0
2/21/2016	41.0	1.0	0.9	1.4	49.0	0.0	0.3	46.0	0.0	58.0	47.0	3.0	8.0	48.5
2/22/2016	42.0	1.0	0.8	1.4	49.0	0.0	0.3	46.0	0.0	57.0	47.0	3.0	7.0	48.5
2/23/2016	42.0	2.0	0.8	1.4	49.0	0.0	0.4	45.0	0.0	56.0	47.0	3.0	6.0	48.0
2/24/2016	42.0	1.0	0.8	1.4	48.0	0.0	0.5	47.0	0.0	55.0	47.0	3.0	5.0	48.0
2/25/2016	41.0	1.0	0.8	1.3	47.0	0.0	0.5	46.0	0.0	55.0	47.0	3.0	5.0	47.3
2/26/2016	41.0	1.0	0.8	1.2	47.0	0.0	0.4	44.0	0.0	55.0	47.0	3.0	5.0	46.8
2/27/2016	42.0	1.0	0.9	1.2	48.0	0.0	0.3	43.0	0.0	55.0	45.0	3.0	7.0	47.0
2/28/2016	42.0	1.0	0.9	1.2	47.0	0.0	0.3	44.0	0.0	54.0	45.0	3.0	6.0	46.8
2/29/2016	41.0	1.0	0.9	1.2	46.0	0.0	0.3	45.0	0.0	54.0	47.0	3.0	4.0	46.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
3/1/2016	41.0	2.0	0.8	1.2	44.0	0.0	0.2	45.0	0.0	55.0	47.0	4.0	4.0	46.3
3/2/2016	42.0	1.0	0.8	1.2	46.0	0.0	0.2	46.0	0.0	55.0	47.0	4.0	4.0	47.3
3/3/2016	43.0	1.0	0.8	1.1	43.0	0.0	0.3	46.0	0.0	56.0	47.0	4.0	5.0	47.0
3/4/2016	42.0	1.0	0.9	1.1	44.0	0.0	0.3	45.0	0.0	55.0	47.0	4.0	4.0	46.5
3/5/2016	43.0	1.0	0.9	1.1	43.0	0.0	0.3	43.0	0.0	56.0	47.0	4.0	5.0	46.3
3/6/2016	43.0	1.0	0.9	1.2	44.0	0.0	0.3	43.0	0.0	56.0	47.0	4.0	5.0	46.5
3/7/2016	42.0	1.0	0.9	1.2	45.0	0.0	0.3	44.0	0.0	56.0	47.0	4.0	5.0	46.8
3/8/2016	41.0	1.0	1.0	1.2	46.0	0.0	0.2	47.0	0.0	55.0	47.0	4.0	4.0	47.3
3/9/2016	42.0	1.0	1.0	1.1	46.0	0.0	0.2	46.0	0.0	57.0	47.0	4.0	6.0	47.8
3/10/2016	42.0	1.0	1.0	1.1	45.0	0.0	0.2	46.0	0.0	55.0	47.0	4.0	4.0	47.0
3/11/2016	42.0	1.0	1.0	1.1	44.0	0.0	0.2	45.0	0.0	56.0	47.0	4.0	5.0	46.8
3/12/2016	41.0	1.0	0.9	1.1	42.0	0.0	0.2	46.0	0.0	55.0	47.0	4.0	4.0	46.0
3/13/2016	42.0	1.0	0.9	1.1	41.0	0.0	0.2	45.0	0.0	56.0	47.0	4.0	5.0	46.0
3/14/2016	43.0	1.0	0.8	1.1	40.0	0.0	0.2	45.0	0.0	56.0	47.0	4.0	5.0	46.0
3/15/2016	42.0	1.0	0.9	1.1	40.0	0.0	0.2	43.0	0.0	55.0	47.0	4.0	4.0	45.0
3/16/2016	42.0	2.0	0.9	1.1	43.0	0.0	0.7	42.0	0.0	55.0	47.0	4.0	4.0	45.5
3/17/2016	42.0	1.0	0.8	1.1	46.0	0.0	0.9	44.0	0.0	54.0	47.0	4.0	3.0	46.5
3/18/2016	41.0	1.0	0.7	1.2	48.0	0.0	0.4	45.0	0.0	54.0	45.0	4.0	5.0	47.0
3/19/2016	41.0	2.0	0.7	1.2	47.0	0.0	0.3	45.0	0.0	54.0	42.0	4.0	8.0	46.8
3/20/2016	41.0	1.0	0.8	1.2	47.0	0.0	0.3	44.0	0.0	51.0	40.0	4.0	7.0	45.8
3/21/2016	43.0	1.0	0.9	1.2	48.0	0.0	0.3	45.0	0.0	55.0	46.0	4.0	5.0	47.8
3/22/2016	43.0	1.0	0.9	1.2	47.0	0.0	0.2	45.0	0.0	54.0	47.0	4.0	3.0	47.3
3/23/2016	43.0	1.0	0.9	1.2	47.0	0.0	0.2	45.0	0.0	54.0	47.0	4.0	3.0	47.3
3/24/2016	42.0	1.0	1.0	1.1	48.0	0.0	0.3	47.0	0.0	53.0	47.0	4.0	2.0	47.5
3/25/2016	41.0	2.0	1.0	1.1	46.0	0.0	0.2	51.0	0.0	54.0	48.0	4.0	2.0	48.0
3/26/2016	41.0	2.0	1.0	1.1	46.0	0.0	0.3	50.0	0.0	53.0	48.0	4.0	1.0	47.5
3/27/2016	41.0	1.0	1.1	1.1	46.0	0.0	0.5	48.0	0.0	53.0	47.0	4.0	2.0	47.0
3/28/2016	42.0	1.0	1.2	1.1	44.0	0.0	0.4	50.0	0.0	52.0	47.0	4.0	1.0	47.0
3/29/2016	42.0	1.0	1.1	1.1	44.0	0.0	0.3	49.0	0.0	52.0	47.0	4.0	1.0	46.8
3/30/2016	43.0	1.0	1.0	1.1	44.0	0.0	0.2	51.0	0.0	53.0	47.0	4.0	2.0	47.8
3/31/2016	43.0	1.0	0.9	1.0	45.0	0.0	0.3	51.0	0.0	53.0	47.0	4.0	2.0	48.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
4/1/2016	42.0	2.0	0.9	1.0	45.0	0.0	0.5	52.0	0.0	54.0	47.0	4.0	3.0	48.3
4/2/2016	42.0	1.0	0.9	1.1	46.0	0.0	0.4	50.0	0.0	53.0	47.0	4.0	2.0	47.8
4/3/2016	42.0	1.0	1.1	1.2	46.0	0.0	0.4	49.0	0.0	53.0	47.0	4.0	2.0	47.5
4/4/2016	42.0	1.0	1.1	1.3	46.0	0.0	0.2	50.0	0.0	54.0	47.0	4.0	3.0	48.0
4/5/2016	41.0	1.0	1.1	1.3	46.0	0.0	0.2	51.0	0.0	54.0	47.0	4.0	3.0	48.0
4/6/2016	41.0	1.0	1.0	1.3	46.0	0.0	0.2	50.0	0.0	54.0	47.0	4.0	3.0	47.8
4/7/2016	42.0	1.0	1.0	1.2	45.0	0.0	0.4	50.0	0.0	53.0	47.0	4.0	2.0	47.5
4/8/2016	42.0	1.0	1.0	1.2	44.0	0.0	0.4	51.0	0.0	54.0	47.0	4.0	3.0	47.8
4/9/2016	42.0	1.0	1.1	1.3	45.0	0.0	0.4	51.0	0.0	53.0	47.0	4.0	2.0	47.8
4/10/2016	43.0	1.0	1.2	1.3	46.0	0.0	0.4	52.0	0.0	55.0	48.0	4.0	3.0	49.0
4/11/2016	42.0	1.0	1.2	1.4	47.0	0.0	0.3	51.0	0.0	54.0	48.0	4.0	2.0	48.5
4/12/2016	42.0	1.0	1.1	1.4	48.0	0.0	0.3	50.0	0.0	54.0	48.0	4.0	2.0	48.5
4/13/2016	42.0	1.0	1.1	1.4	48.0	0.0	0.3	50.0	0.0	55.0	47.0	4.0	4.0	48.8
4/14/2016	42.0	1.0	1.1	1.3	47.0	0.0	0.4	50.0	0.0	54.0	47.0	4.0	3.0	48.3
4/15/2016	43.0	1.0	1.1	1.3	46.0	0.0	0.1	50.0	0.0	52.0	47.0	4.0	1.0	47.8
4/16/2016	42.0	1.0	1.1	1.4	46.0	0.0	0.1	50.0	0.0	52.0	47.0	4.0	1.0	47.5
4/17/2016	42.0	1.0	1.0	1.4	47.0	0.0	0.2	51.0	0.0	52.0	46.0	4.0	2.0	48.0
4/18/2016	42.0	1.0	1.0	1.4	48.0	0.0	0.1	51.0	0.0	52.0	48.0	4.0	0.0	48.3
4/19/2016	42.0	1.0	1.0	1.3	46.0	0.0	0.1	50.0	0.0	51.0	47.0	4.0	0.0	47.3
4/20/2016	42.0	1.0	1.0	1.2	45.0	0.0	0.5	50.0	0.0	52.0	48.0	4.0	0.0	47.3
4/21/2016	42.0	1.0	1.0	1.2	47.0	0.0	0.7	51.0	0.0	51.0	47.0	4.0	0.0	47.8
4/22/2016	42.0	1.0	1.0	1.2	47.0	0.0	0.3	49.0	0.0	49.0	44.0	4.0	1.0	46.8
4/23/2016	42.0	1.0	0.9	1.2	47.0	0.0	0.1	50.0	0.0	51.0	47.0	4.0	0.0	47.5
4/24/2016	42.0	1.0	0.9	1.1	48.0	0.0	0.2	50.0	0.0	51.0	47.0	4.0	0.0	47.8
4/25/2016	42.0	1.0	0.9	1.2	48.0	0.0	0.5	49.0	0.0	50.0	46.0	4.0	0.0	47.3
4/26/2016	42.0	1.0	0.8	1.1	49.0	0.0	0.2	48.0	0.0	50.0	44.0	4.0	2.0	47.3
4/27/2016	42.0	1.0	0.8	1.1	48.0	0.0	0.1	48.0	0.0	52.0	42.0	4.0	6.0	47.5
4/28/2016	43.0	1.0	0.8	1.1	48.0	0.0	0.3	49.0	0.0	51.0	47.0	4.0	0.0	47.8
4/29/2016	42.0	1.0	0.9	1.1	47.0	0.0	0.1	48.0	0.0	51.0	47.0	4.0	0.0	47.0
4/30/2016	42.0	1.0	0.9	1.1	47.0	0.0	0.0	48.0	0.0	51.0	47.0	4.0	0.0	47.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
5/1/2016	42.0	1.0	0.9	1.1	47.0	0.0	0.1	48.0	0.0	51.0	47.0	4.0	0.0	47.0
5/2/2016	42.0	1.0	0.9	1.2	48.0	0.0	0.2	48.0	0.0	51.0	45.0	6.0	0.0	47.3
5/3/2016	42.0	1.0	1.0	1.2	47.0	0.0	0.7	48.0	0.0	47.0	39.0	8.0	0.0	46.0
5/4/2016	41.0	1.0	1.0	1.1	47.0	0.0	0.6	48.0	0.0	47.0	39.0	8.0	0.0	45.8
5/5/2016	43.0	1.0	1.0	1.1	48.0	0.0	0.4	47.0	0.0	46.0	38.0	8.0	0.0	46.0
5/6/2016	42.0	1.0	1.0	1.3	48.0	0.0	0.3	48.0	0.0	46.0	38.0	8.0	0.0	46.0
5/7/2016	42.0	1.0	1.1	1.4	48.0	0.0	0.0	48.0	0.0	46.0	38.0	8.0	0.0	46.0
5/8/2016	42.0	1.0	1.1	1.4	49.0	0.0	0.1	48.0	0.0	46.0	38.0	8.0	0.0	46.3
5/9/2016	41.0	1.0	1.1	1.4	49.0	0.0	0.1	49.0	0.0	47.0	39.0	8.0	0.0	46.5
5/10/2016	43.0	1.0	1.1	1.3	49.0	0.0	0.0	49.0	0.0	46.0	38.0	8.0	0.0	46.8
5/11/2016	42.0	1.0	1.1	1.3	49.0	0.0	0.0	49.0	0.0	46.0	38.0	8.0	0.0	46.5
5/12/2016	42.0	1.0	1.0	1.3	48.0	0.0	0.0	49.0	0.0	48.0	40.0	8.0	0.0	46.8
5/13/2016	42.0	1.0	1.0	1.3	47.0	0.0	0.0	49.0	0.0	49.0	41.0	8.0	0.0	46.8
5/14/2016	42.0	1.0	1.0	1.2	47.0	0.0	0.0	49.0	0.0	48.0	40.0	8.0	0.0	46.5
5/15/2016	42.0	1.0	1.0	1.2	47.0	0.0	0.1	49.0	0.0	46.0	38.0	8.0	0.0	46.0
5/16/2016	42.0	1.0	0.9	1.2	46.0	0.0	0.4	49.0	0.0	47.0	39.0	8.0	0.0	46.0
5/17/2016	46.0	1.0	0.9	1.2	46.0	0.0	0.0	48.0	0.0	47.0	39.0	8.0	0.0	46.8
5/18/2016	59.0	1.0	1.0	1.1	46.0	0.0	0.0	47.0	0.0	47.0	39.0	8.0	0.0	49.8
5/19/2016	73.0	1.0	1.0	1.0	42.0	0.0	0.0	49.0	0.0	46.0	38.0	8.0	0.0	52.5
5/20/2016	89.0	1.0	1.0	1.1	43.0	0.0	0.0	48.0	0.0	45.0	37.0	8.0	0.0	56.3
5/21/2016	106.0	1.0	1.0	1.0	46.0	0.0	0.1	47.0	0.0	45.0	37.0	8.0	0.0	61.0
5/22/2016	93.0	1.0	1.0	1.0	52.0	0.0	0.1	48.0	0.0	44.0	36.0	8.0	0.0	59.3
5/23/2016	77.0	1.0	1.0	1.0	59.0	0.0	0.0	47.0	0.0	43.0	35.0	8.0	0.0	56.5
5/24/2016	61.0	1.0	1.1	1.1	69.0	0.0	0.0	47.0	0.0	43.0	35.0	8.0	0.0	55.0
5/25/2016	48.0	1.0	1.1	1.1	77.0	0.0	0.1	49.0	0.0	43.0	35.0	8.0	0.0	54.3
5/26/2016	42.0	1.0	1.1	1.1	82.0	0.0	0.0	53.0	0.0	43.0	35.0	8.0	0.0	55.0
5/27/2016	43.0	1.0	1.2	1.1	79.0	0.0	0.0	56.0	0.0	43.0	35.0	8.0	0.0	55.3
5/28/2016	50.0	1.0	1.2	1.1	71.0	0.0	0.0	62.0	0.0	42.0	34.0	8.0	0.0	56.3
5/29/2016	56.0	1.0	1.2	1.1	61.0	0.0	0.0	70.0	0.0	43.0	35.0	8.0	0.0	57.5
5/30/2016	56.0	1.0	1.2	1.1	55.0	0.0	0.0	76.0	0.0	44.0	36.0	8.0	0.0	57.8
5/31/2016	56.0	1.0	1.2	1.1	53.0	0.0	0.0	77.0	0.0	45.0	37.0	8.0	0.0	57.8
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
6/1/2016	56.0	1.0	1.1	1.0	53.0	0.0	0.0	73.0	0.0	47.0	39.0	8.0	0.0	57.3
6/2/2016	56.0	1.0	1.1	0.9	54.0	0.0	0.0	67.0	0.0	49.0	41.0	8.0	0.0	56.5
6/3/2016	56.0	1.0	1.0	0.9	55.0	0.0	0.0	61.0	0.0	52.0	44.0	8.0	0.0	56.0
6/4/2016	56.0	1.0	1.0	1.0	55.0	0.0	0.0	55.0	0.0	53.0	46.0	7.0	0.0	54.8
6/5/2016	56.0	1.0	1.0	1.0	55.0	0.0	0.1	53.0	0.0	55.0	47.0	8.0	0.0	54.8
6/6/2016	56.0	1.0	1.0	1.1	55.0	0.0	0.1	53.0	0.0	54.0	47.0	7.0	0.0	54.5
6/7/2016	56.0	0.8	0.9	1.1	55.0	0.0	0.1	53.0	0.0	55.0	47.0	8.0	0.0	54.8
6/8/2016	57.0	1.0	0.9	1.1	54.0	0.0	0.3	53.0	0.0	52.0	44.0	8.0	0.0	54.0
6/9/2016	58.0	1.0	0.8	1.1	54.0	0.0	0.0	53.0	0.0	46.0	38.0	8.0	0.0	52.8
6/10/2016	58.0	1.0	0.7	1.0	54.0	0.0	0.1	51.0	0.0	43.0	35.0	8.0	0.0	51.5
6/11/2016	63.0	1.0	0.7	1.0	54.0	0.0	0.0	51.0	0.0	37.0	29.0	8.0	0.0	51.3
6/12/2016	65.0	1.0	1.0	1.0	55.0	0.0	0.0	53.0	0.0	44.0	36.0	8.0	0.0	54.3
6/13/2016	66.0	1.0	1.1	1.0	57.0	0.0	0.0	53.0	0.0	42.0	34.0	8.0	0.0	54.5
6/14/2016	64.0	1.0	1.2	1.1	58.0	0.0	0.0	53.0	0.0	43.0	35.0	8.0	0.0	54.5
6/15/2016	66.0	1.0	1.2	1.0	60.0	0.0	0.0	52.0	0.0	42.0	35.0	7.0	0.0	55.0
6/16/2016	66.0	1.0	1.1	1.0	61.0	0.0	0.0	52.0	0.0	42.0	35.0	7.0	0.0	55.3
6/17/2016	73.0	1.0	1.1	1.0	62.0	0.0	0.0	52.0	0.0	42.0	34.0	8.0	0.0	57.3
6/18/2016	77.0	1.0	1.0	1.1	62.0	0.0	0.0	53.0	0.0	41.0	33.0	8.0	0.0	58.3
6/19/2016	75.0	1.0	1.0	1.2	63.0	0.0	0.0	55.0	0.0	40.0	32.0	8.0	0.0	58.3
6/20/2016	75.0	1.0	1.0	1.1	62.0	0.0	0.0	55.0	0.0	41.0	33.0	8.0	0.0	58.3
6/21/2016	76.0	1.0	1.0	1.0	63.0	0.0	0.0	56.0	0.0	39.0	32.0	7.0	0.0	58.5
6/22/2016	77.0	1.0	0.9	0.9	65.0	0.0	0.0	56.0	0.0	38.0	31.0	7.0	0.0	59.0
6/23/2016	78.0	1.0	0.8	0.9	65.0	0.0	0.0	55.0	0.0	32.0	24.0	7.0	1.0	57.5
6/24/2016	79.0	1.0	0.7	1.0	66.0	0.0	0.0	56.0	0.0	40.0	28.0	8.0	4.0	60.3
6/25/2016	80.0	1.0	0.6	0.9	66.0	0.0	0.0	56.0	6.7	37.0	29.0	8.0	0.0	59.8
6/26/2016	81.0	1.0	0.6	0.9	66.0	0.0	0.0	56.0	10.0	37.0	29.0	8.0	0.0	60.0
6/27/2016	81.0	1.0	0.6	0.9	68.0	0.0	0.0	59.0	10.0	36.0	28.0	8.0	0.0	61.0
6/28/2016	80.0	1.0	0.7	0.9	68.0	0.0	0.0	60.0	10.0	36.0	29.0	7.0	0.0	61.0
6/29/2016	83.0	1.0	0.7	0.9	70.0	0.0	0.0	62.0	13.3	39.0	31.0	8.0	0.0	63.5
6/30/2016	85.0	1.0	0.8	0.8	71.0	0.0	0.0	64.0	5.9	40.0	32.0	8.0	0.0	65.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
7/1/2016	84.0	1.0	0.8	0.8	72.0	0.0	0.0	63.0	0.0	41.0	34.0	7.0	0.0	65.0
7/2/2016	85.0	1.0	0.8	0.9	72.0	0.0	0.0	64.0	0.0	43.0	35.0	8.0	0.0	66.0
7/3/2016	85.0	1.0	0.7	0.9	73.0	0.0	0.0	64.0	0.0	45.0	37.0	8.0	0.0	66.8
7/4/2016	83.0	1.0	0.7	0.9	74.0	0.0	0.0	63.0	0.0	45.0	37.0	8.0	0.0	66.3
7/5/2016	84.0	1.0	0.6	0.9	74.0	0.0	0.0	64.0	0.0	43.0	35.0	8.0	0.0	66.3
7/6/2016	83.0	1.0	0.7	1.0	76.0	0.0	0.0	64.0	0.0	41.0	33.0	8.0	0.0	66.0
7/7/2016	85.0	0.8	0.7	1.0	76.0	0.0	0.0	65.0	0.0	40.0	32.0	8.0	0.0	66.5
7/8/2016	84.0	1.0	0.7	1.0	77.0	0.0	0.0	65.0	0.0	40.0	32.0	8.0	0.0	66.5
7/9/2016	84.0	1.0	0.7	0.9	77.0	0.0	0.0	65.0	0.0	40.0	32.0	8.0	0.0	66.5
7/10/2016	84.0	1.0	0.7	0.9	77.0	0.0	0.0	68.0	0.0	40.0	32.0	8.0	0.0	67.3
7/11/2016	84.0	1.0	0.6	0.9	76.0	0.0	0.0	67.0	0.0	41.0	33.0	8.0	0.0	67.0
7/12/2016	84.0	1.0	0.5	0.9	77.0	0.0	0.0	68.0	0.0	40.0	32.0	8.0	0.0	67.3
7/13/2016	83.0	1.0	0.5	1.0	78.0	0.0	0.0	68.0	0.0	41.0	33.0	8.0	0.0	67.5
7/14/2016	83.0	1.0	0.5	1.1	68.0	0.0	0.0	61.0	0.0	41.0	33.0	8.0	0.0	63.3
7/15/2016	84.0	1.0	0.5	1.0	67.0	0.0	0.0	60.0	0.0	41.0	34.0	7.0	0.0	63.0
7/16/2016	84.0	1.0	0.7	0.9	66.0	0.0	0.0	61.0	0.0	42.0	34.0	8.0	0.0	63.3
7/17/2016	84.0	1.0	1.0	0.9	65.0	0.0	0.0	60.0	0.0	43.0	35.0	8.0	0.0	63.0
7/18/2016	84.0	1.0	1.1	0.9	63.0	0.0	0.0	59.0	0.0	43.0	35.0	8.0	0.0	62.3
7/19/2016	83.0	1.0	1.0	0.9	71.0	0.0	0.0	67.0	0.0	43.0	35.0	8.0	0.0	66.0
7/20/2016	83.0	1.0	1.0	0.9	71.0	0.0	0.0	66.0	0.0	42.0	26.0	16.0	0.0	65.5
7/21/2016	84.0	1.0	1.0	0.8	71.0	0.0	0.0	66.0	0.0	42.0	22.0	20.0	0.0	65.8
7/22/2016	83.0	1.0	1.0	0.8	71.0	0.0	0.0	66.0	0.0	42.0	22.0	20.0	0.0	65.5
7/23/2016	84.0	1.0	1.1	0.9	70.0	0.0	0.0	65.0	0.0	42.0	22.0	20.0	0.0	65.3
7/24/2016	85.0	1.0	1.1	1.1	70.0	0.0	0.0	65.0	0.0	42.0	22.0	20.0	0.0	65.5
7/25/2016	84.0	1.0	1.1	1.2	69.0	0.0	0.0	64.0	0.0	42.0	22.0	20.0	0.0	64.8
7/26/2016	85.0	1.0	1.0	1.2	69.0	0.0	0.0	65.0	0.0	42.0	22.0	20.0	0.0	65.3
7/27/2016	84.0	1.0	0.9	1.0	69.0	0.0	0.0	67.0	0.0	42.0	22.0	20.0	0.0	65.5
7/28/2016	85.0	1.0	0.9	0.8	69.0	0.0	0.0	66.0	0.0	42.0	22.0	20.0	0.0	65.5
7/29/2016	85.0	1.0	0.8	0.8	69.0	0.0	0.0	66.0	0.0	42.0	22.0	20.0	0.0	65.5
7/30/2016	83.0	1.0	0.8	0.8	70.0	0.0	0.0	66.0	0.0	42.0	30.0	12.0	0.0	65.3
7/31/2016	85.0	1.0	0.8	0.8	71.0	0.0	0.0	66.0	0.0	43.0	35.0	8.0	0.0	66.3
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
8/1/2016	83.0	1.0	0.7	0.9	70.0	0.0	0.0	65.0	0.0	45.0	37.0	8.0	0.0	65.8
8/2/2016	84.0	1.0	0.7	0.9	71.0	0.0	0.0	65.0	0.0	44.0	37.0	7.0	0.0	66.0
8/3/2016	85.0	1.0	0.6	1.0	70.0	0.0	0.0	63.0	0.0	44.0	36.0	8.0	0.0	65.5
8/4/2016	84.0	2.0	0.6	1.1	70.0	0.0	0.0	64.0	0.0	43.0	35.0	8.0	0.0	65.3
8/5/2016	84.0	1.0	0.6	1.1	71.0	0.0	0.0	64.0	0.0	44.0	36.0	8.0	0.0	65.8
8/6/2016	84.0	1.0	0.7	1.0	70.0	0.0	0.0	65.0	0.0	43.0	35.0	8.0	0.0	65.5
8/7/2016	83.0	1.0	0.8	1.0	71.0	0.0	0.0	66.0	0.0	41.0	34.0	7.0	0.0	65.3
8/8/2016	84.0	1.0	0.8	1.0	72.0	0.0	0.0	66.0	0.0	42.0	34.0	8.0	0.0	66.0
8/9/2016	83.0	1.0	0.9	1.0	72.0	0.0	0.0	66.0	0.0	42.0	34.0	8.0	0.0	65.8
8/10/2016	83.0	1.0	0.9	1.0	71.0	0.0	0.0	66.0	0.0	42.0	34.0	8.0	0.0	65.5
8/11/2016	85.0	1.0	0.9	1.0	70.0	0.0	0.0	64.0	0.0	42.0	34.0	8.0	0.0	65.3
8/12/2016	84.0	1.0	0.9	1.0	70.0	0.0	0.0	65.0	0.0	43.0	35.0	8.0	0.0	65.5
8/13/2016	82.0	1.0	0.9	1.0	70.0	0.0	0.0	66.0	0.0	44.0	36.0	8.0	0.0	65.5
8/14/2016	85.0	1.0	0.9	1.0	71.0	0.0	0.0	65.0	0.0	43.0	35.0	8.0	0.0	66.0
8/15/2016	84.0	1.0	0.9	1.0	70.0	0.0	0.0	65.0	0.0	45.0	37.0	8.0	0.0	66.0
8/16/2016	84.0	1.0	0.9	0.9	71.0	0.0	0.0	66.0	0.0	45.0	37.0	8.0	0.0	66.5
8/17/2016	84.0	1.0	0.9	0.8	70.0	0.0	0.0	65.0	0.0	46.0	38.0	8.0	0.0	66.3
8/18/2016	84.0	1.0	0.9	0.7	70.0	0.0	0.0	64.0	0.0	45.0	37.0	8.0	0.0	65.8
8/19/2016	85.0	1.0	0.9	0.8	71.0	0.0	0.0	64.0	0.0	46.0	38.0	8.0	0.0	66.5
8/20/2016	81.0	1.0	1.0	0.9	71.0	0.0	0.0	67.0	0.0	46.0	38.0	8.0	0.0	66.3
8/21/2016	76.0	1.0	1.0	1.0	71.0	0.0	0.0	66.0	0.0	47.0	39.0	8.0	0.0	65.0
8/22/2016	76.0	1.0	1.0	1.0	70.0	0.0	0.0	68.0	0.0	47.0	39.0	8.0	0.0	65.3
8/23/2016	75.0	1.0	1.1	1.0	71.0	0.0	0.0	67.0	0.0	49.0	41.0	8.0	0.0	65.5
8/24/2016	77.0	1.0	1.1	1.0	71.0	0.0	0.0	67.0	0.0	50.0	42.0	8.0	0.0	66.3
8/25/2016	76.0	1.0	1.0	1.0	68.0	0.0	0.0	68.0	0.0	50.0	42.0	8.0	0.0	65.5
8/26/2016	77.0	1.0	1.0	0.9	66.0	0.0	0.0	68.0	0.0	50.0	43.0	7.0	0.0	65.3
8/27/2016	75.0	1.0	0.9	1.0	63.0	0.0	0.0	67.0	0.0	51.0	44.0	7.0	0.0	64.0
8/28/2016	75.0	1.0	0.9	1.0	63.0	0.0	0.0	67.0	0.0	51.0	44.0	7.0	0.0	64.0
8/29/2016	77.0	1.0	0.9	1.1	63.0	0.0	0.0	66.0	0.0	51.0	43.0	8.0	0.0	64.3
8/30/2016	71.0	1.0	0.9	1.1	63.0	0.0	0.0	65.0	0.0	51.0	43.0	8.0	0.0	62.5
8/31/2016	65.0	0.5	0.8	1.1	62.0	0.0	0.0	63.0	0.0	51.0	43.0	8.0	0.0	60.3
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
9/1/2016	65.0	1.0	0.8	1.1	61.0	0.0	0.0	60.0	0.0	51.0	43.0	8.0	0.0	59.3
9/2/2016	66.0	1.0	0.7	1.0	60.0	0.0	0.0	59.0	0.0	50.0	42.0	8.0	0.0	58.8
9/3/2016	66.0	1.0	0.7	1.1	59.0	0.0	0.0	58.0	0.0	50.0	42.0	8.0	0.0	58.3
9/4/2016	66.0	1.0	0.7	1.1	57.0	0.0	0.0	58.0	0.0	48.0	40.0	8.0	0.0	57.3
9/5/2016	66.0	0.0	0.8	1.1	55.0	0.0	0.0	58.0	0.0	48.0	40.0	8.0	0.0	56.8
9/6/2016	66.0	0.0	0.8	1.1	55.0	0.0	0.0	57.0	0.0	46.0	38.0	8.0	0.0	56.0
9/7/2016	64.0	1.0	0.9	1.1	55.0	0.0	0.0	57.0	0.0	46.0	38.0	8.0	0.0	55.5
9/8/2016	64.0	1.0	1.0	1.1	56.0	0.0	0.0	58.0	0.0	45.0	38.0	7.0	0.0	55.8
9/9/2016	66.0	1.0	1.0	1.1	55.0	0.0	0.0	57.0	0.0	46.0	38.0	8.0	0.0	56.0
9/10/2016	66.0	1.0	1.0	1.1	55.0	0.0	0.0	56.0	0.0	45.0	37.0	8.0	0.0	55.5
9/11/2016	66.0	1.0	1.1	1.1	54.0	0.0	0.0	55.0	0.0	45.0	37.0	8.0	0.0	55.0
9/12/2016	66.0	1.0	1.1	1.1	54.0	0.0	0.0	55.0	0.0	45.0	37.0	8.0	0.0	55.0
9/13/2016	65.0	1.0	1.1	1.1	55.0	0.0	0.0	55.0	0.0	44.0	36.0	8.0	0.0	54.8
9/14/2016	66.0	1.0	1.2	1.1	56.0	0.0	0.0	54.0	0.0	46.0	27.0	19.0	0.0	55.5
9/15/2016	66.0	1.0	1.2	1.1	56.0	0.0	0.0	55.0	0.0	46.0	21.0	25.0	0.0	55.8
9/16/2016	66.0	1.0	1.2	1.1	57.0	0.0	0.0	55.0	0.0	47.0	22.0	25.0	0.0	56.3
9/17/2016	66.0	1.0	1.2	1.1	57.0	0.0	0.0	54.0	0.0	46.0	21.0	25.0	0.0	55.8
9/18/2016	66.0	1.0	1.2	1.1	57.0	0.0	0.0	55.0	0.0	46.0	21.0	25.0	0.0	56.0
9/19/2016	66.0	1.0	1.2	1.1	57.0	0.0	0.0	56.0	0.0	46.0	21.0	25.0	0.0	56.3
9/20/2016	63.0	1.0	1.2	1.1	56.0	0.0	0.0	55.0	0.0	44.0	19.0	25.0	0.0	54.5
9/21/2016	56.0	2.0	1.2	1.1	55.0	0.0	0.0	55.0	0.0	46.0	21.0	25.0	0.0	53.0
9/22/2016	56.0	1.0	1.2	1.2	55.0	0.0	0.0	57.0	0.0	45.0	20.0	25.0	0.0	53.3
9/24/2016	56.0	1.0	1.1	1.1	53.0	0.0	0.0	57.0	0.0	46.0	33.0	13.0	0.0	53.0
9/25/2016	55.0	0.5	1.1	1.1	50.0	0.0	0.0	56.0	0.0	47.0	39.0	8.0	0.0	52.0
9/26/2016	55.0	1.0	1.1	1.1	48.0	0.0	0.0	54.0	0.0	47.0	39.0	8.0	0.0	51.0
9/27/2016	56.0	1.0	1.1	1.1	47.0	0.0	0.0	54.0	0.0	47.0	39.0	8.0	0.0	51.0
9/28/2016	56.0	1.0	1.1	1.2	47.0	0.0	0.0	54.0	0.0	47.0	39.0	8.0	0.0	51.0
9/29/2016	56.0	2.0	1.0	1.2	46.0	0.0	0.0	53.0	0.0	47.0	39.0	8.0	0.0	50.5
9/30/2016	56.0	1.0	0.9	1.3	46.0	0.0	0.0	51.0	0.0	48.0	40.0	8.0	0.0	50.3
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

3.0 AVIAN CENSUS FOR WINTERTON AND THIBAUT UNITS, BLACKROCK WATERFOWL MANAGEMENT AREA

3.1 Introduction

The Blackrock Waterfowl Management Area (BWMA) component of the Lower Owens River Project (LORP) is a managed wetland area comprised of four separate management units (Drew, Waggoner, Winterton and Thibaut). Rotational flooding of the BWMA units occurs in order to provide habitat for waterfowl, shorebirds, wading birds, and other indicator species (Appendix 1).

Under the LORP, LADWP is required to flood up to 500 acres in the BWMA to provide habitat consistent with the needs of indicator species (MOU 1997). The specific amount of flooded acreage to be maintained in any one year is dependent upon the percent of forecasted runoff. The 1997 MOU specifies that approximately 500 acres of BWMA will be flooded at any given time in years of average or above-average runoff. Per the 1997 MOU, in years when the forecasted runoff is estimated to be less than average, the flooded acreage will be set by the Standing Committee in consultation with the California Department of Fish and Wildlife (CDFW).

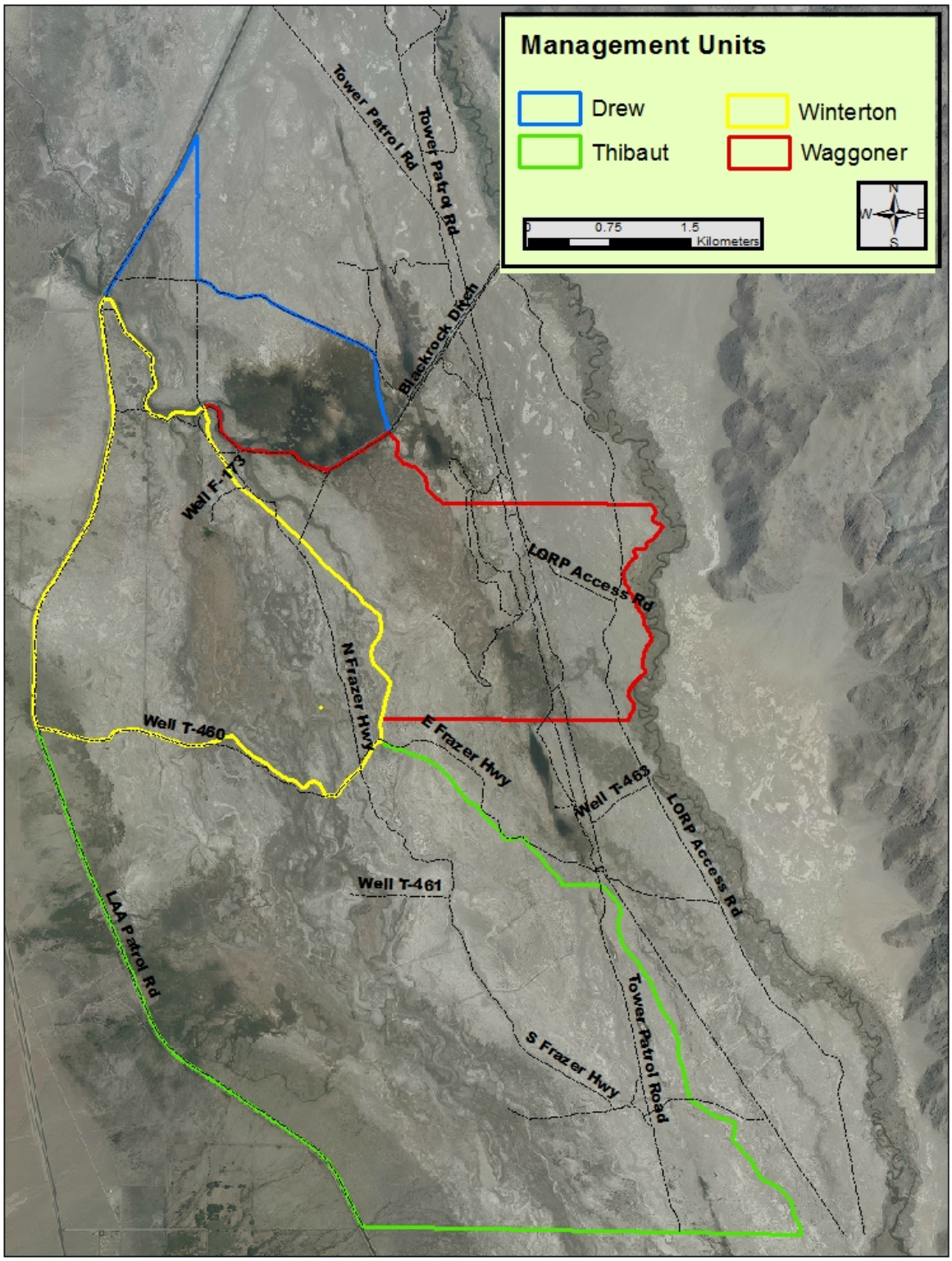
Avian surveys were conducted in order to evaluate use by these indicator species. In 2016, avian surveys were conducted by LADWP Watershed Resources Specialists Debbie House and Chris Allen and Inyo County Water Department (ICWD) Field Program Coordinator, Jerry Zatorski and Vegetation Scientist, Zach Nelson. Data compilation and reporting was completed by Chris Allen.

3.2 Study Area Description and Field and Analysis Methods

3.2.1 Survey Area

The BWMA is located near the Blackrock Springs Fish Hatchery north of Independence and is composed of four management units, all lying east of the Los Angeles Aqueduct and west of the Owens River (Avian Census Figure 1). The BWMA has historically been used for water-spreading (LORP EIR 2004). The area supports natural basins, playas, and springs, as well as constructed ditches, levees, culverts and roads.

The four units of BWMA encompass a total of 1,987 acres. Based on the 2015-2016 runoff year, the flooded acreage goal in 2016 for BWMA was 355 acres. The flooded acreage is determined quarterly by LADWP or Inyo County Water Department staff walking the wetted perimeter of each active unit (Avian Census Table 1). Water was released to the Winterton and Thibaut Units in 2016 to obtain the required acreage. The Winterton Unit continued to remain active after the initiation of water releases in April 2015. The Thibaut Unit was placed in active status in 2016. The Drew and Waggoner Units were inactive in 2016.



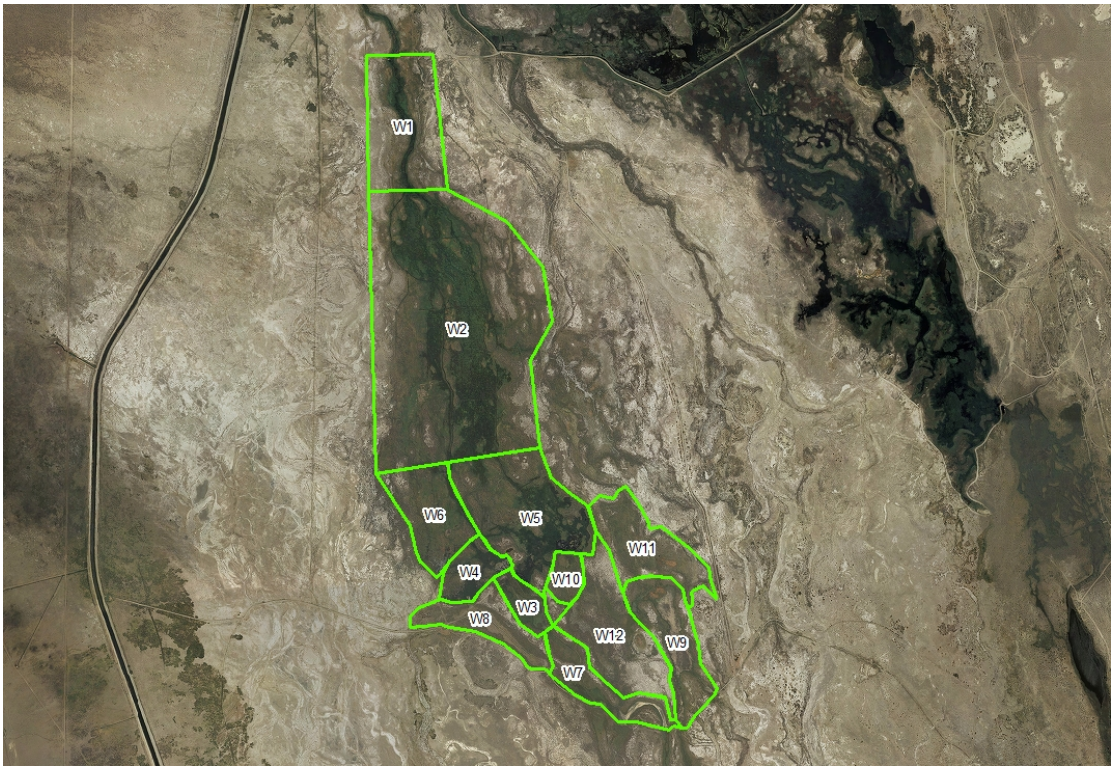
Avian Census Figure 1. Map of BWMA Management Units

Avian Census Table 1. Flooded Acreage by Unit and Season

		WINTERTON	THIBAUT
Season	**Date**	**Total Flooded Acreage**	**Total Flooded Acreage**
Winter	01/25/16	186	58
Spring	05/05/16	204	111
Summer	07/13/16	213	140
Fall	09/21/16	167	136

3.2.2 Subunit Delineation

In 2016, each management unit was subdivided into several subunits for the purpose of surveying and evaluating the effectiveness of attracting habitat indicator species in different ponds, basins, or areas within the unit (Avian Census Figures 2 and 3). Winterton and Thibaut were divided into subunits that roughly coincided with basins based on differences in topography. Habitat conditions within subunits were documented during surveys. This allowed for a better understanding and analysis of the survey results. Subunit boundaries were mapped using ArcGIS 10.3 and maps were created for use in the field.



Avian Census Figure 2. Winterton Subunits

Avian Census Figure 3. Thibaut Subunits

3.3 BWMA Habitat Indicator Species

Habitat indicator species for the BWMA were initially identified in the Lower Owens River Project Ecosystem Management Plan - Action Plan and Concept Document (Ecosystem Sciences 1997). The presence of these species was thought to indicate whether or not the desired range of habitat conditions were being achieved (MOU 1997). Habitat indicator species for BWMA include all waterfowl, wading birds, shorebirds, plus Northern Harrier, Least Bittern, rails, and Marsh Wren (Avian Census Table 2). The resident, migratory and wintering waterfowl indicator group includes all species in the Family Anatidae. Geese, swans, dabbling ducks (Anas spp.), and divers (scaup, Ruddy Duck, Bufflehead) are all included in this group. Wading birds includes species in the Family Ardeidae (egrets and herons), and Threskiornithidae (i.e. White-faced Ibis). The shorebird group includes all species in the Order Charadriiformes, exclusive of gulls and terns (Family Laridae). The MOU also identified Least Bittern and Northern Harrier, both California Species of Special Concern as habitat indicator species. Virginia Rail, Sora and American Coot are the three rail species that occur at BWMA. Marsh Wren is the only songbird species that is designated as an indicator species.

Avian Census Table 2. BWMA Habitat Indicator Species (MOU 1997)

WILDLIFE	
Resident migratory and wintering waterfowl	Least bittern
Resident, migratory and wintering wading birds	Northern harrier
Resident, migratory and wintering shorebirds	Rails
	Marsh wren

3.4 Avian Survey Methodology

Avian surveys were conducted to assess use and seasonal abundance of BWMA habitat indicator species. The following table (Avian Census Table 3) notes the survey dates by season for Winterton and Thibaut. Winterton and Thibaut units were surveyed from April through October.

All surveys were conducted as area counts with observers walking the perimeter of the flooded area and recording all species encountered. Surveys began within 30 minutes of local sunrise, and a unit was generally surveyed within 4-5 hours. Bird activity was recorded using one of the following categories: foraging, perching, calling, locomotion, flying over (not using habitat), flushed, unknown, and reproductive. If reproductive activity was noted, the specific evidence of breeding was also noted in order to allow the determination of breeding status.

Avian Census Table 3. Seasonal Survey Dates for Winterton and Thibaut Units

	Winter	Spring				Summer		Fall				
Winterton	12/2/16	4/1/16	4/18/16	5/2/16	5/17/16	6/8/16	6/22/16	8/4/16	8/17/16	8/30/16	9/13/16	9/27/16
Thibaut		4/20/16	5/4/16	5/18/16		6/9/16	6/22/16	8/5/16	8/17/16	8/31/16	9/16/16	9/28/16

Waterbird densities were compared among the subunits to evaluate if certain subunits were more attractive to particular indicator species groups. The data were formulated into a representation of bird density for each subunit. The average of all counts for each season was divided by the total wetted acre.

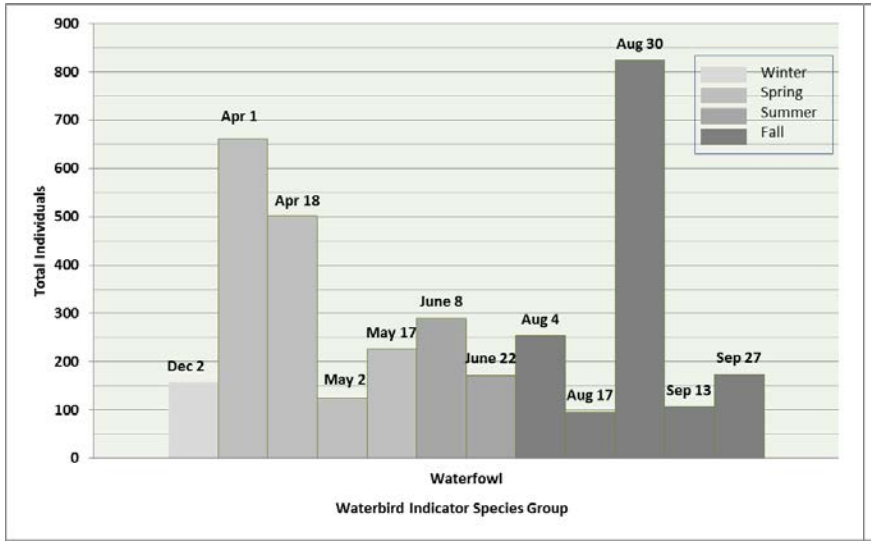
3.5 Results and Discussion

3.5.1 Avian Surveys – Winterton Unit

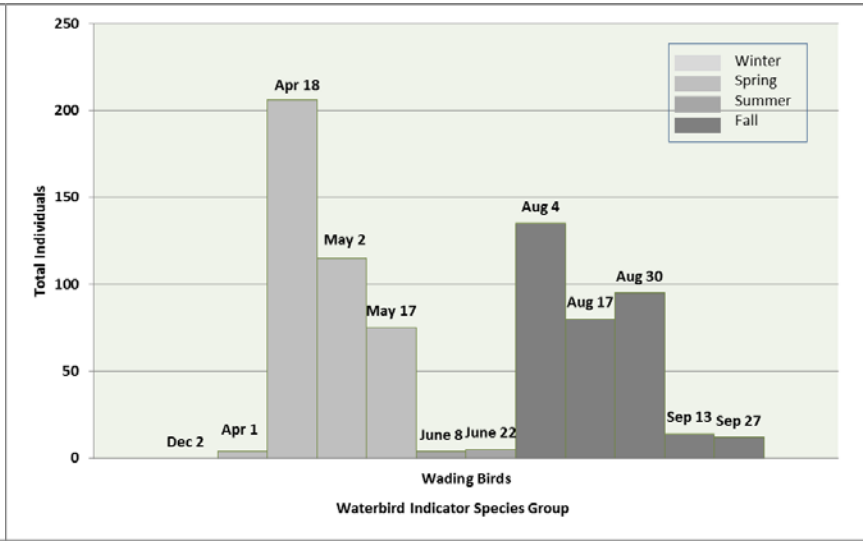
A total of 48 indicator species and 9,374 individuals were detected at Winterton during the eleven surveys in 2016 and the winter survey in 2015 (Avian Census Table 4 and Figures 4-7). Waterfowl were most abundant in the spring and fall, with the highest count occurring in fall. Wintering waterfowl numbers were low compared to counts in spring and fall. Wading birds and shorebirds were the least abundant group. Wading bird numbers were similar in spring and fall, but this group was virtually absent in late fall and winter. Spring and fall shorebird numbers were also similar, however unlike wading birds; shorebirds were present throughout the summer. More rails were counted than any other, largely due to high numbers of American Coot. Coot numbers were highest in spring and summer. Virginia Rails were detected more regularly spring through summer. Sora was most abundant in fall. Breeding was confirmed for Gadwall, Mallard, Cinnamon Teal and American Coot, and suspected for Ruddy Duck and Black-necked Stilt.

Avian Census Table 4. Winterton Subunit Counts

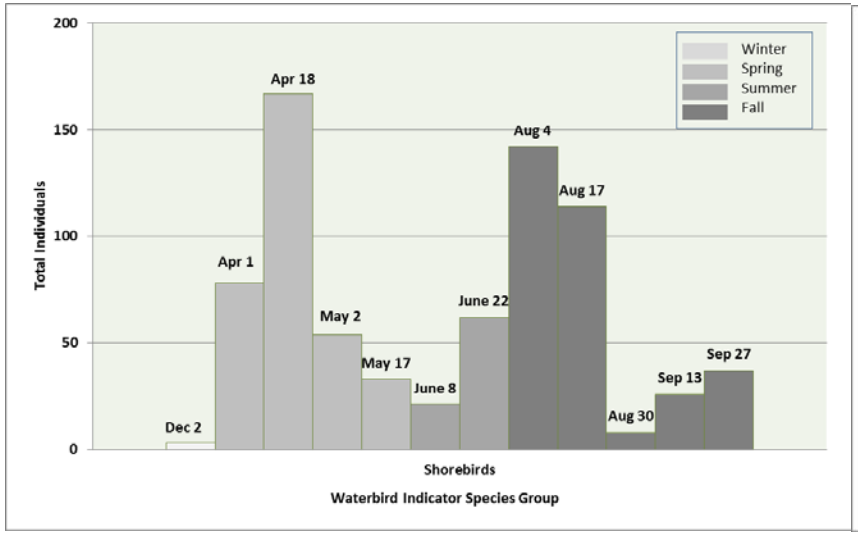
Indicator Species Group	Common Name	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	Species Total
Waterfowl	Canada Goose		2			17								19
	Wood Duck	1												1
	Gadwall	19	37	61	38	220	173	15		256	9	6	1	835
	American Wigeon			4		66	12							82
	Mallard	21	89	20	34	167	126	57	1	117		5		637
	Blue-winged Teal		8			2								10
	Cinnamon Teal	68	36	66	150	144	205	6		80				755
	Northern Shoveler		2		5	35	156	1						199
	Northern Pintail		4	1		4	8	1		6				24
	Green-winged Teal	101	9	7	182	141	78			146				664
	Unidentified Teal			40										40
	Canvasback					2								2
	Redhead					1	4							5
	Ring-necked Duck		6			11								17
	Lesser Scaup					1								1
	Bufflehead				5	39	26							70
	Common Goldeneye					1								1
	Hooded Merganser					1								1
	Ruddy Duck				41	105	75	1		2				224
Total Waterfowl per subunit		210	193	199	455	957	863	81	1	607	9	11	1	3587
Wading Birds	Great Blue Heron	5	4		2	6			1	2				20
	Great Egret	5	24	3		19	11	2		2				66
	Snowy Egret	13	2	7	1	1	5							29
	Black-crowned Night-Heron	8		5	1	5		6		3				28
	White-faced Ibis	66	121	9	2	111	109	40		139	5			602
Total Wading Birds per subunit		97	151	24	6	142	125	48	1	146	5	0	0	745
Rails	Virginia Rail	1	16	1		3	1	2						24
	Sora	6	21	7	4	15	6	1	1					61
	American Coot	83	31	125	643	1722	1225	2		194				4025
Total Rails per subunit		90	68	133	647	1740	1232	5	1	194	0	0	0	4110
Shorebird	Semipalmated Plover					9								9
	Killdeer		12	8	1	84	2	1		2	1	1		112
	Black-necked Stilt		12	17		18				12	2			61
	American Avocet					18				1				19
	Spotted Sandpiper	4		2	3	11	4			2				26
	Solitary Sandpiper					7								7
	Greater Yellowlegs		6	1	2	78	2	2		1	2			94
	Willet					4	1							5
	Lesser Yellowlegs		4	3		10	1							18
	Whimbrel		1											1
	Long-billed Curlew						2	2		1				5
	Western Sandpiper		3			15								18
	Least Sandpiper		16	1		22	93							132
	Dunlin					6								6
	Calidris sp.				10									10
	Short-billed Dowitcher		3											3
	Long-billed Dowitcher		30	20		16	24			1				91
	Wilson's Snipe		28			10				1				39
	Wilson's Phalarope				6	73				4	2			85
	Red-necked Phalarope					4								4
Total Shorebirds per subunit		4	115	52	22	385	129	5	0	25	7	1	0	745
Total Waterbirds per Subunit		401	527	408	1130	3224	2349	139	3	972	21	12	1	9187



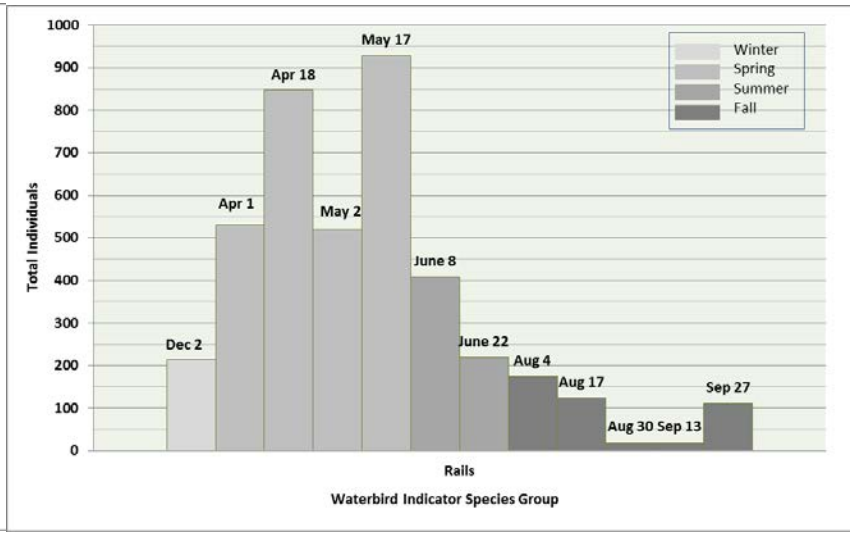
Avian Census Figure 4. Winterton Seasonal Waterfowl



Avian Census Figure 5. Winterton Seasonal Wading Birds



Avian Census Figure 6. Winterton Seasonal Shorebirds



Avian Census Figure 7. Winterton Seasonal Rails

Winterton Subunit Analysis

Use by indicator species groups varied among subunits (Avian Census Table 5). Some of the variation is a function of season and extent of flooding of subunits which is discussed below.

Avian Census Table 5. Winterton Results by Subunit

Subunit	Waterfowl	Wading Birds	Rails	Shorebirds	Total waterbirds
W1	210	97	90	4	401
W2	193	151	68	115	527
W3	199	24	133	52	408
W4	455	6	647	22	1130
W5	957	142	1740	385	3224
W6	863	125	1232	129	2349
W7	81	48	5	5	139
W8	1	1	1	0	3
W9	607	146	194	25	972
W10	9	5	0	7	21
W11	11	0	0	1	12
W12	1	0	0	0	1

Winterton Subunit W1

The most abundant indicator species group in Subunit W1 was waterfowl (Avian Census Table 5). A variety of ducks, such as Cinnamon Teal, Green-winged teal, Gadwall, and Mallard, were encountered in the channel during almost every survey, but not in large numbers. The most abundant duck in Subunit W1 was Cinnamon Teal. Due to winter use of vegetation by livestock, in the spring, the channel was fairly open with good visibility. As the growing season progressed, most of the open water became obscured by cattails, providing places for waterfowl to hide and open water for swimming and feeding. Wading bird use is generally minimal in this area; however, a high count of 92 wading birds occurred in a spring count in early May when 66 White-faced Ibis, a group of egrets, and night herons were observed roosting along the banks. Shorebirds were only seen on one survey in this area, when four migrating Spotted Sandpipers were observed in spring. During the spring and summer, the only rails found were American Coot. A Virginia Rail and a few Sora were encountered on some fall surveys.

Winterton Subunit W2

Ducks were generally observed in flight over this subunit, flying to and from small, isolated open water areas within this subunit or to other areas of Winterton. Waterfowl counts were low, given the large size of this subunit. The most abundant waterfowl species in Subunit W2 were Mallard and Cinnamon Teal. Cattails have been encroaching on open water space for the past year, so it is not unexpected for waterfowl counts to decrease. Wading bird use of this subunit was highest in spring. White-faced Ibis were observed in both spring and fall with the highest count at 81. Shorebirds were only seen in Subunit W2 in winter and early spring, with small numbers seen in small scattered depressions throughout the area.

Winterton Subunit W3

Subunit W3 attracted all four water bird indicator groups. Waterfowl were the most abundant group, of which the majority was comprised of Gadwall and Cinnamon Teal. The cattails provided cover for ducks, and the pond was shallow enough for foraging. This subunit had water present throughout the year, although the pond level varied slightly. American Coot were also abundant in spring and fall. Shorebirds were well represented here also, as seven species were observed, often foraging in the shallow flood grassland.

Winterton Subunit W4

The most numerous group was rails as American Coot were abundant in the spring. This pond attracted moderate numbers of waterfowl in spring, a large number in in the fall, but waterfowl counts were low during summer. Wading birds were almost non-existent and shorebirds counts were low. This pond maintained the same water volume throughout the year.

Winterton Subunit W5

American Coot was the most abundant species in Subunit W5. This subunit also attracted a fair amount of waterfowl, primarily in spring. Use by breeding waterfowl in summer was much lower. Flow into this subunit was inadvertently obstructed in late summer and it started drying out. As it dried, extensive mudflats formed with numerous small puddles scattered throughout and a small remnant pond remained at the low end of the subunit. This change in habitat from deep, open water pond to smaller, shallower pond and mudflats that occurred in August attracted 16 different species of shorebirds. Water flow was reestablished to the pond in September and waterfowl numbers increased again by late September. Dabbling ducks including Gadwall, Cinnamon Teal,

Green-winged Teal, and Mallard were the most abundant waterfowl present. This pond also attracted diving ducks in small numbers, primarily in late fall, winter and spring. Greater Yellowlegs were foraging throughout the pond. Subunit W5 attracted more ducks and shorebirds during this shallower phase.

Winterton Subunit W6

Large numbers of ducks were encountered during the spring and summer surveys when this subunit was flooded. Most were foraging throughout the subunit, while some were seen resting on the islands. There were a variety of species, such as Cinnamon Teal, Mallard, Gadwall, Green-winged Teal, Northern Shoveler, Ruddy Duck, Redhead, Northern Pintail, Bufflehead, and American Wigeon. A variety of shorebirds were present as well, such as Least Sandpiper, Long-billed Dowitcher, Greater Yellowlegs, Long-billed Curlew, and Willet. American Coot was the most abundant species. Herons and Egrets were not abundant in Subunit W6, but there were large numbers of White-faced Ibis.

Winterton Subunit W7

Waterfowl and wading birds were the main groups observed in Subunit W7. Waterfowl were generally seen in the broad deep canal and a few observations of waterfowl were along the narrow ditch portion. Waterfowl were the most abundant indicator species group in Subunit W7, but numbers were low. Great Egrets frequented the area in the spring and summer. Twenty one White-faced Ibis were encountered here during a fall survey. A Sora and two Virginia Rails were present during fall surveys.

Winterton Subunit W8

Subunit 8 was dry in 2016, thus, no waterbirds were present.

Winterton Subunit W9

Water did not reach W9 until summer. The pond at the north end of this subunit was the only area where broods were found in the summer and it attracted large numbers of waterfowl in the fall. During one summer survey, 13 Gadwall broods and 1 Mallard brood were encountered. A high count of 160 Gadwall and 146 Green-winged Teal were recorded during a fall survey. Mallard, Cinnamon Teal, and Northern Pintail were also present. The water level receded in this subunit in fall creating a large weedy mudflat that attracted a variety of shorebirds, but shorebird numbers decreased rapidly as the mudflat dried. A large variety of shorebirds were seen earlier when the pond was full, but in low numbers.

Winterton Subunit W10

In 2016, Subunit W10 received a small amount of water in the spring and summer, resulting in only a small area of flooding, and was dry in the fall. The only waterfowl were 9 Gadwall that were present during a summer survey. Two Black-necked Stilts, 1 Killdeer, 2 Wilson's Phalaropes, and 5 White-faced Ibis were also present during that survey. Two Greater Yellowlegs were present during a spring survey.

Winterton Subunit W11

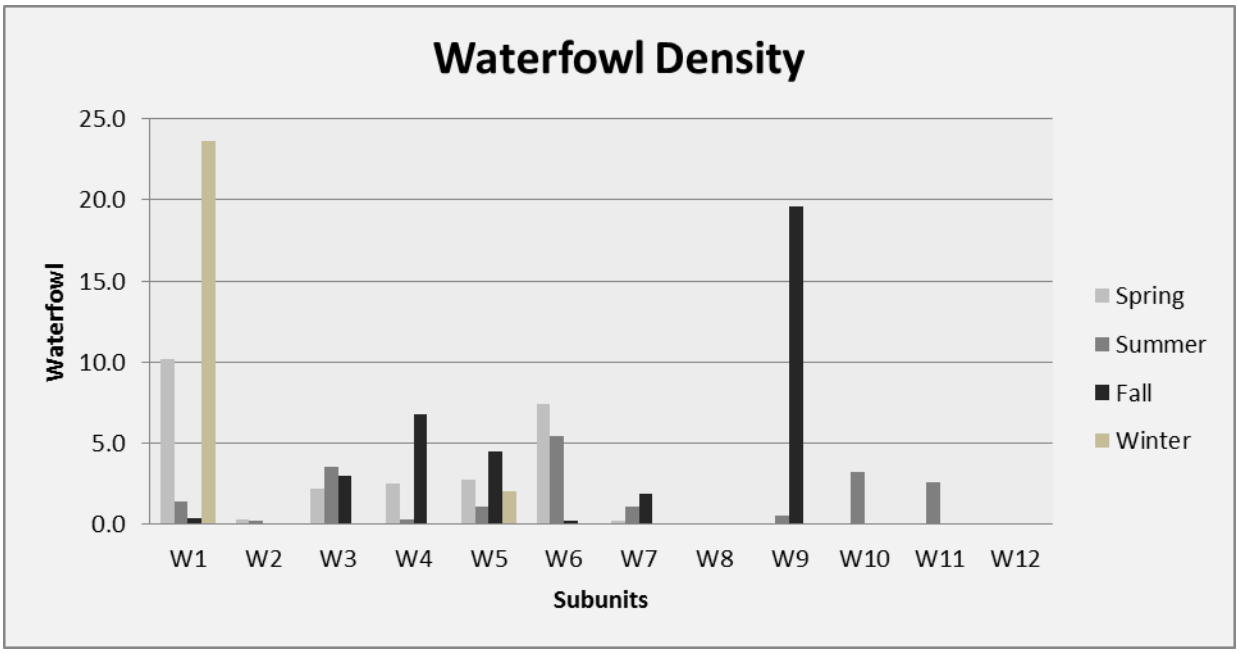
Subunit W11 was flooded during the spring and summer, but dried up by fall. While it was flooded there were a few small shallow ponds where ducks were encountered, but counts were low. There were 6 Gadwall and 5 Mallards.

Winterton Subunit W12

Subunit W12 remained dry most of the year. It received a little overflow water from Subunit W9 in early fall, and 1 Gadwall was seen.

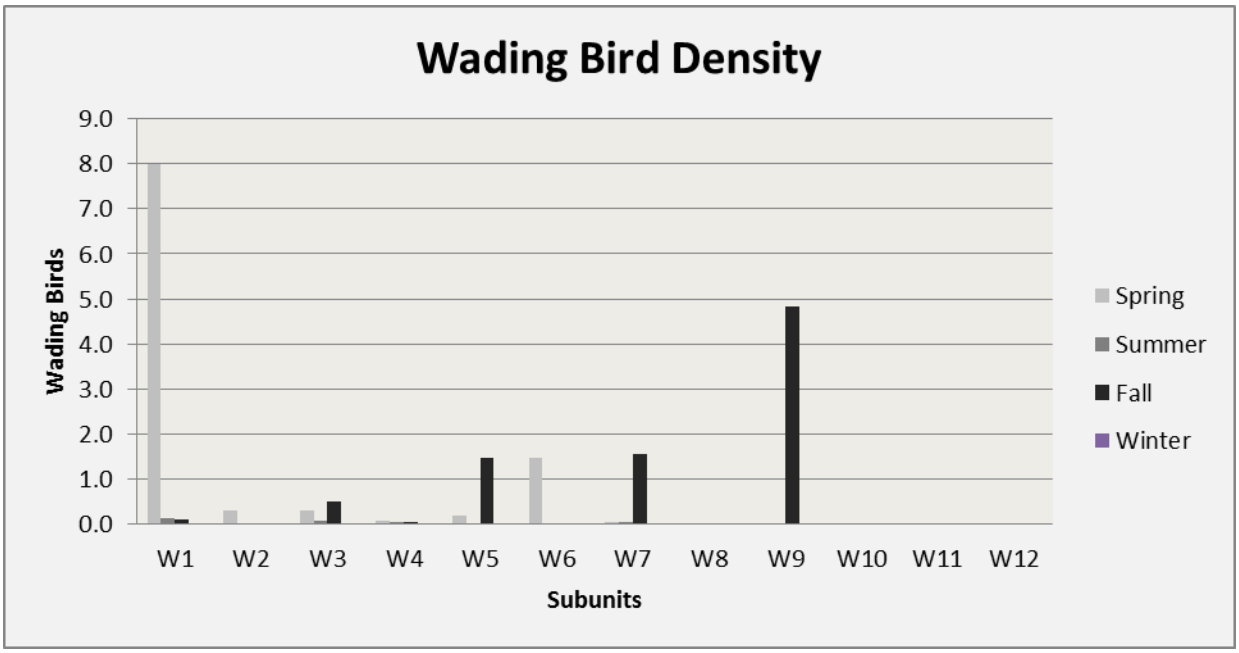
3.5.1.1 Comparison of Waterbird Densities Among Subunits

Waterbird densities were compared among the subunits to evaluate if certain subunits were more attractive to particular indicator species groups. The data were formulated into a representation of bird density for each subunit. The average of all counts for each season was divided by the total wetted extent acreage (for that season) in order to derive a value for density (birds per wetted acre).



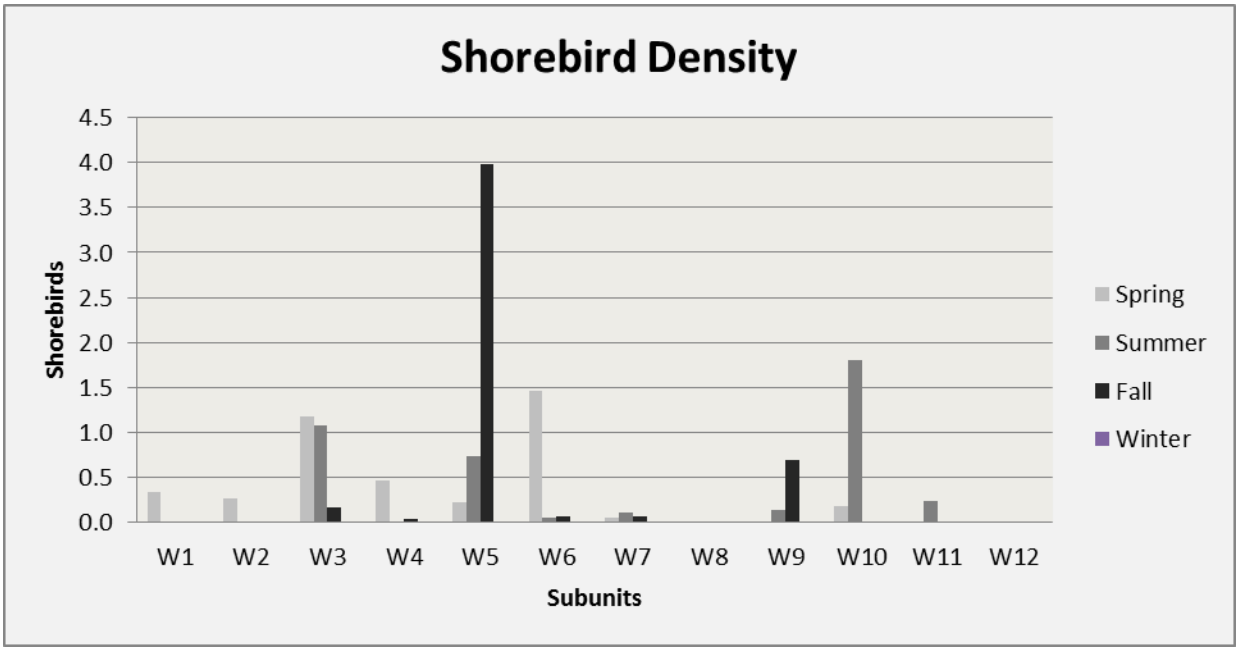
Avian Census Figure 8. Winterton Waterfowl Density

In the spring of 2016 the highest density of waterfowl was in Subunit W1 (Avian Census Figure 8). This subunit contained a narrow channel, so it had the lowest acreage of available water. The second highest density was in Subunit W6, a large shallow basin with grass and forbs scattered throughout the basin. In Subunit W6, waterfowl were dispersed fairly evenly throughout the flooded area, and feeding activity was high. In contrast, waterfowl in Subunits W3, W4, and W5 appeared to be concentrated in smaller numbers around the edge of these ponds. During the summer, again the highest density of waterfowl was using Subunit W6. This area was dry in fall, resulting in low use. The second highest densities of waterfowl were in Subunits W11 and W3. Subunit W3 was a mix of shallow flood grassland and deep water ponds, and appeared to have areas for feeding and cover. During the fall, the highest density of waterfowl was found in Subunit W9, a shallow flood weedy depression. The lower densities were found in Subunits W3, W4, and W5, deep water ponds. Subunit W6 was dry in the fall, so waterfowl were not using it. Both Subunits W9 and W6 were similar in that emerged vegetation was scattered throughout the ponds; but they differed by type of substrate. The substrate in Subunit W6 consisted of dense grassland and forbs, while the substrate in Subunit W9 consisted of mud and forbs.



Avian Census Figure 9. Winterton Wading Bird Density

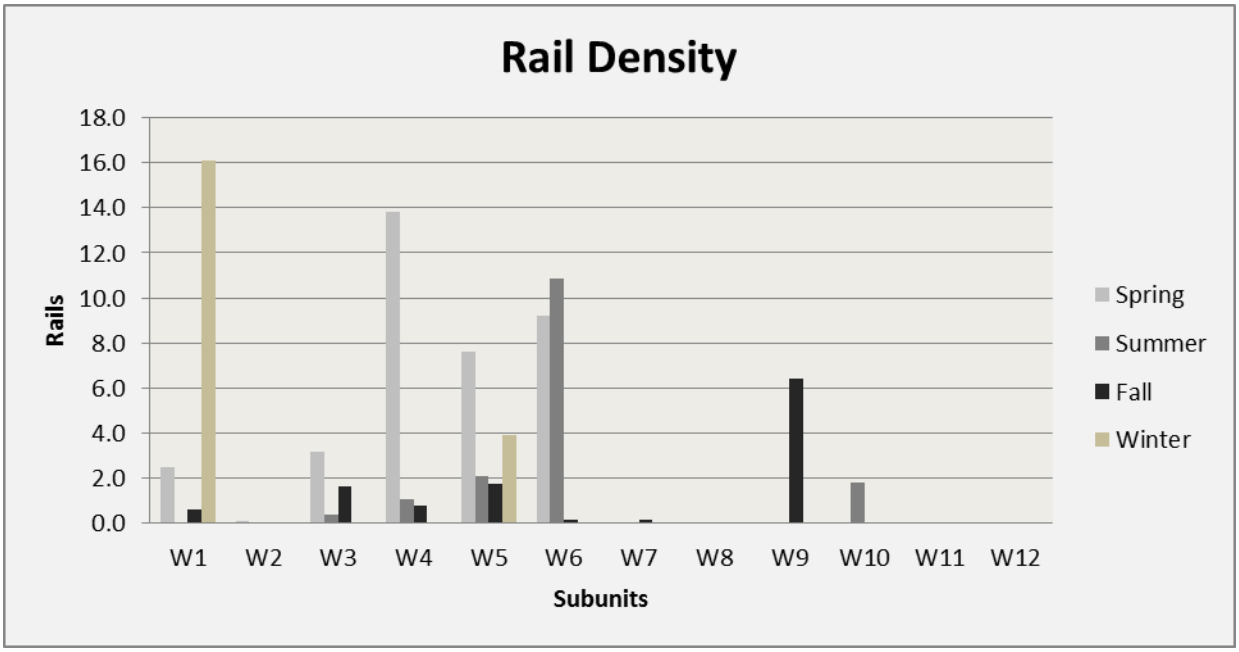
Four species of wading birds were consistently observed in Winterton throughout the spring summer and fall, Great Blue Heron, Great Egret, Snowy Egret, and White-faced Ibis. Although optimal foraging habitat appeared to be available, numbers of herons and egrets have been consistently low. However, large flocks of White-faced Ibis have been observed frequently. The highest density of wading birds during the spring of 2016 was in Subunit W1 (Avian Census Figure 9). Again, Subunit W1 is a narrow channel with low acreage of water, so the density would be high. The second highest density was in Subunit W6, large shallow flood grassland. Minnows were abundant in Subunit W6, and probably attracted the wading birds, the majority of which were White-faced Ibis. During the fall the highest density of wading birds was in Subunit W9. This subunit had the highest number of herons and egrets, which were joined by several Black-crowned Night Herons on the last count. The majority of them were encountered along the inflow channel, and southern edge of the shallow flood pond. No wading birds were seen in the winter.



Avian Census Figure 10. Winterton Shorebird Density

During the spring, the higher densities of shorebirds were in Subunits W3 and W6 (Avian Census Figure 10). Both subunits had large areas of shallow flood grassland. During the summer, shorebirds appeared to be using Subunits W3, W5 and W10. Both Subunits W3 and W10 had shallow flood grassland. Subunit W5 is typically a deep water pond, but the water flow problem discussed above resulted in a decrease in water volume in Subunit W5, and exposure of wet mudflats. The mudflats resembled shoreline surrounding the remaining ponded water. This habitat type attracted a variety of shorebirds during their peak migratory period. As the pond refilled during the fall, the mudflats became shallow flood with a dense forb cover. This type of habitat attracted

Greater Yellowlegs and Green-winged Teal. The highest density of shorebirds in the fall was in August in Subunit W5. The unplanned change in habitat and decline in pond levels resulted in more species and higher numbers of shorebirds than has been observed in Winterton in prior years. Subunit W9, which contained a shallow flood weedy depression pond, dried up in the fall, exposing a wet weedy mudflat which attracted a variety of shorebirds. As the mudflat dried shorebird use decreased significantly.



Avian Census Figure 11. Winterton Rail Density

The rail species encountered at Winterton consisted of American Coot, Virginia Rail, and Sora (Avian Census Figure 11). Typically American Coot is abundant in the Owens Valley, and is visible since it occurs on open water. In contrast, Virginia Rail and Sora are marsh birds, and are rather heard than seen. As is the case with White-faced Ibis among wading birds, whenever there are high rail counts, the majority of them are American Coot. During summer, the highest rail densities were in Subunits W4, W5, and W6. Almost all the rails encountered in these subunits were American Coot on open water. There were lower densities of rails in Subunits W1 and W3. A large number of Sora were encountered since it was predominantly marsh habitat, but the rails in Subunit W3 consisted primarily of American Coot on open water. The highest density of rails occurred in Subunit W1 in the winter. The majority of those counted were American Coot. The high density in Subunit W1 was due to a low acreage of flooded extent. The actual number of rails counted was 49. A high count of 164 was recorded for Subunit W5 in the winter; but the density was much lower because the acreage of flooded extent was more than 10 times greater than it was in Subunit W1.

3.5.1.2 Comparison of 2015 and 2016

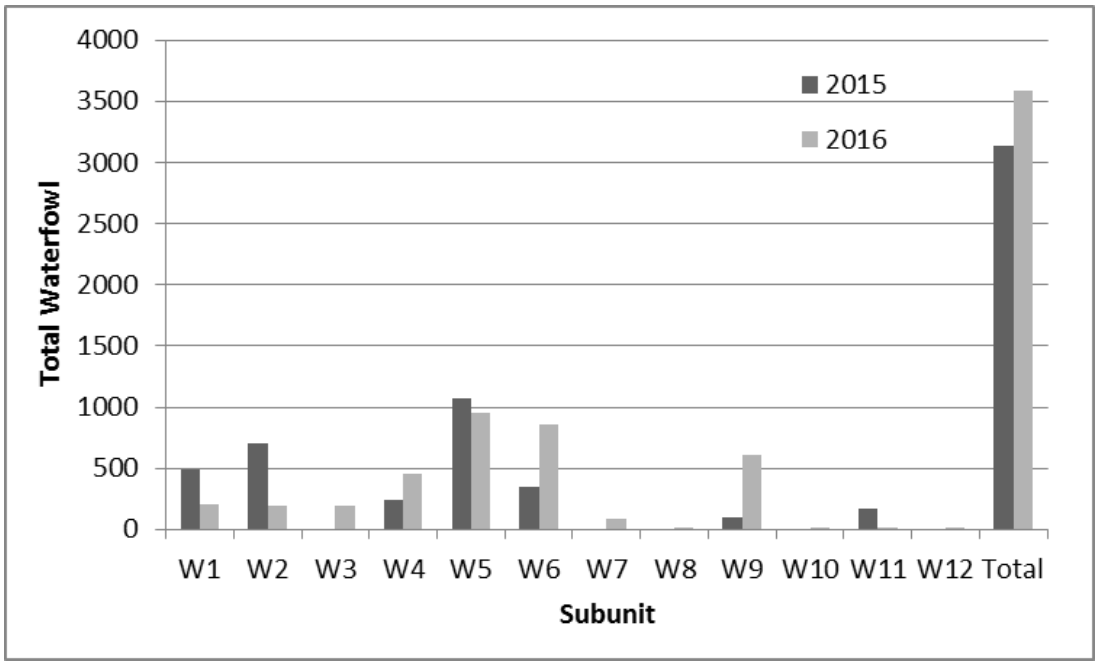
Winterton 2015 and 2016 Results

Total seasonal differences between years can be at least partly explained by the extent of flooding. At the start of the spring 2015 surveys, water releases had just begun. The extent of flooding was small initially, but increased with each survey. By the end of the spring survey period (mid-May) of 2015, Subunit W2 was flooded, but water had not spread beyond this unit. By summer 2015, the maximum flooded extent had been reached. Water has been supplied continuously to the unit so that during the spring 2016 surveys, the unit was already flooded at the time spring surveys started and areas such as Subunits W4, W5, and W6 were flooded. There were 203.5 acres of water in Winterton in the spring of 2016, and only 83.3 acres in the spring of 2015.

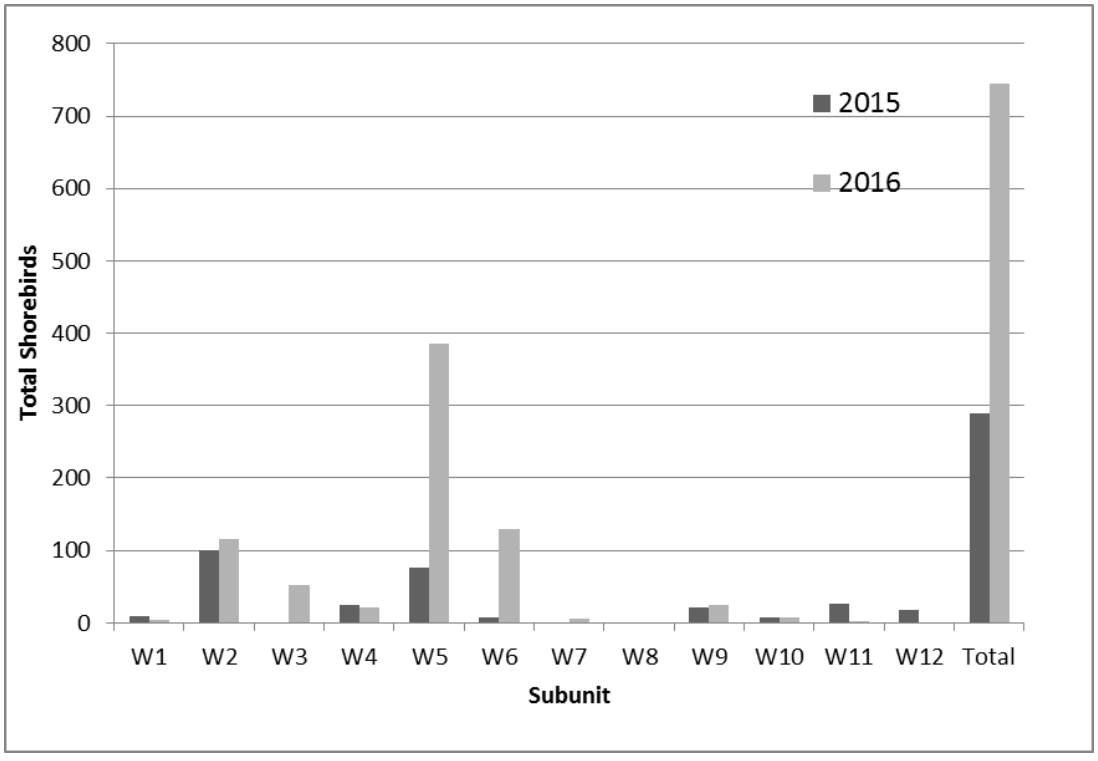
A total of 6,481 waterbirds were detected at Winterton during the ten surveys in 2015 as compared to 8,813 during 10 comparable surveys in 2016. All groups showed an increase in total numbers between 2015 and 2016 (Avian Census Figures 12-15). Waterfowl, wading birds, shorebirds and rails all showed increases in spring numbers between 2015 and 2016 (Avian Census Table 6). Summer 2016 showed an increase in numbers of waterfowl and rails primarily due to flooding of Subunit W6. Fall waterfowl numbers in 2016 were likely decreased due to the dry condition of Subunit W5 during part of fall. There were 221.0 acres of water in Winterton in the fall of 2015 and 166.5 acres in the fall of 2016. Subunit W9, which was flooded during fall 2016, although smaller than Subunit W5, was quite productive for waterfowl and also supported many waterfowl broods (Avian Census Figure 12). Wading bird numbers increased in fall 2016 as White-faced Ibis were attracted to Subunit W5 in early August while the water was retreating. They were also attracted to the shallow weedy pond in Subunit W9 throughout August. Shorebird numbers were also higher in 2016, almost exclusively due to the exposure of mudflats and the creation of shallow ponds that occurred in Subunit W5 as the water was receding in August. Rail numbers were significantly lower in fall 2016 due to the absence of the large deep pond of Subunit W5. This pond was quite attractive to coots at all times.

Avian Census Table 6. Winterton 2015 and 2016 Comparison

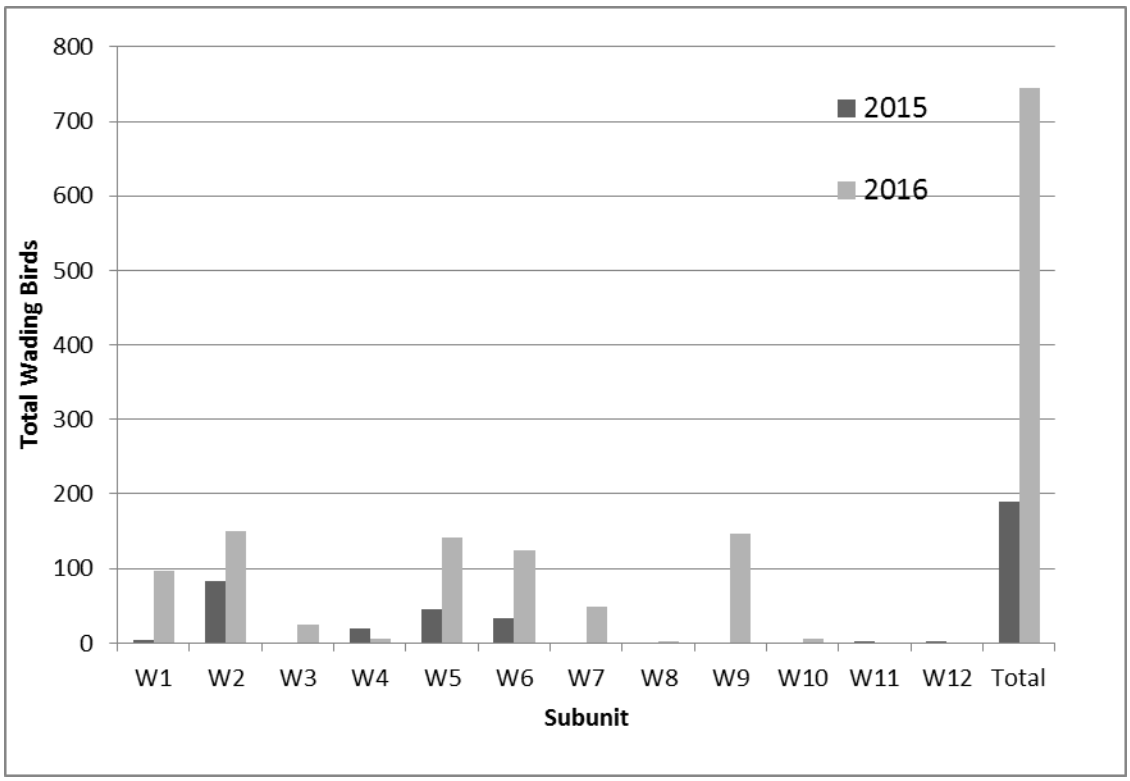
Indicator Species Group	Spring 2015	Spring 2016	Summer 2015	Summer 2016	Fall 2015	Fall 2016
Waterfowl	96	1515	89	462	2791	1452
Wading Birds	48	400	2	9	140	336
Shorebirds	41	332	59	83	186	327
Rails	25	2826	15	627	2615	444



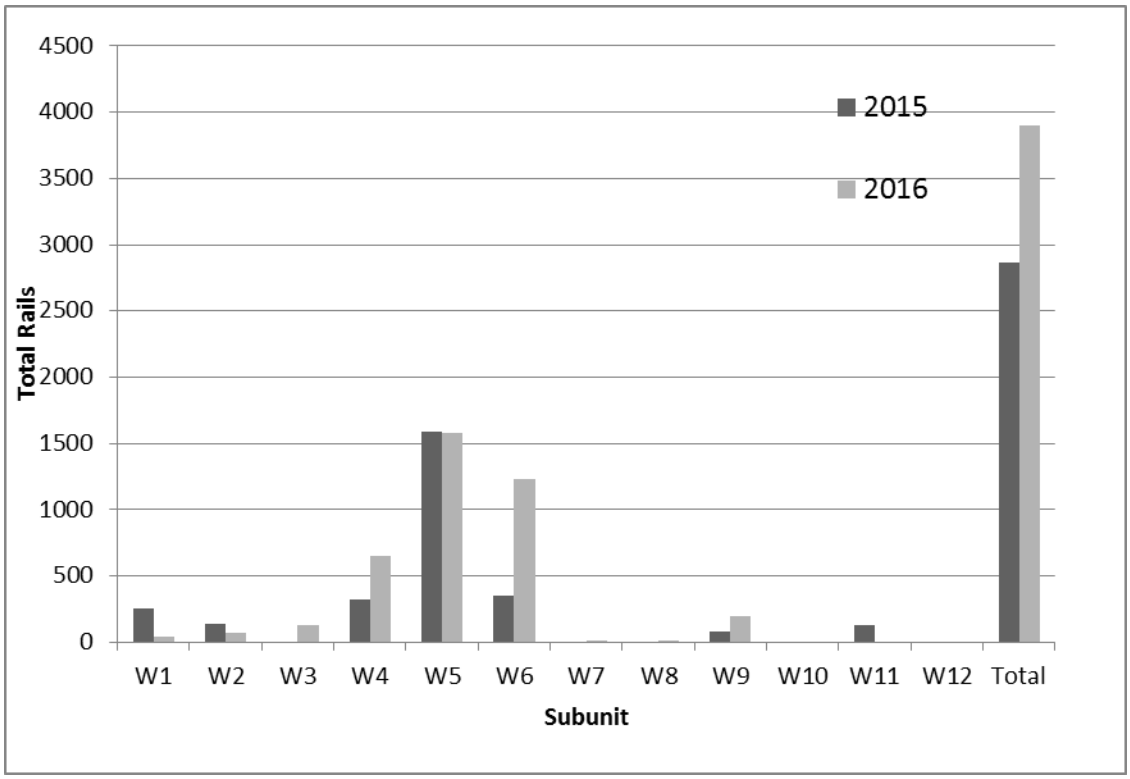
Avian Census Figure 12. Winterton 2015/2016 Waterfowl Comparisons



Avian Census Figure 13. Winterton 2015/2016 Shorebird Comparisons



Avian Census Figure 14. Winterton 2015/2016 Wading Bird Comparisons



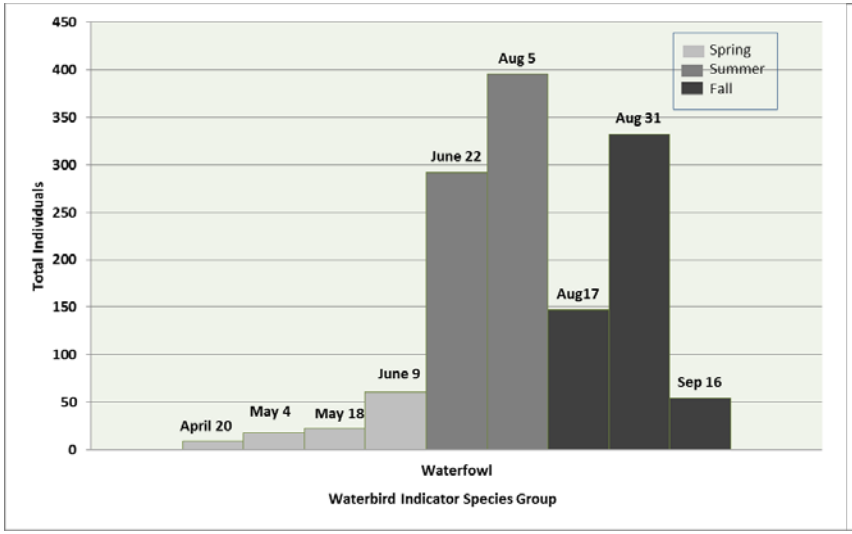
Avian Census Figure 15. Winterton 2015/2016 Rail Comparisons

3.5.2 Avian Surveys – Thibaut Unit

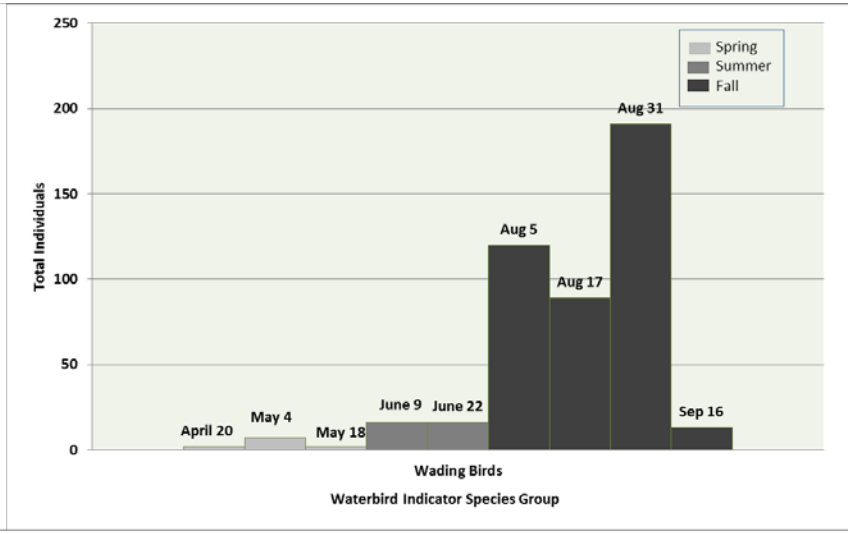
A total of 38 indicator species and 2,494 individuals were detected at Thibaut during the ten surveys in 2016 (Avian Census Table 7 and Figures 16-19). Waterfowl were most abundant in the summer and fall, and there were more in the summer than in the fall. Rails were the least abundant, and the highest counts were in the fall. Wading birds were more abundant in the fall, and shorebirds were most abundant in the spring and fall.

Avian Census Table 7. Thibaut Results by Subunit

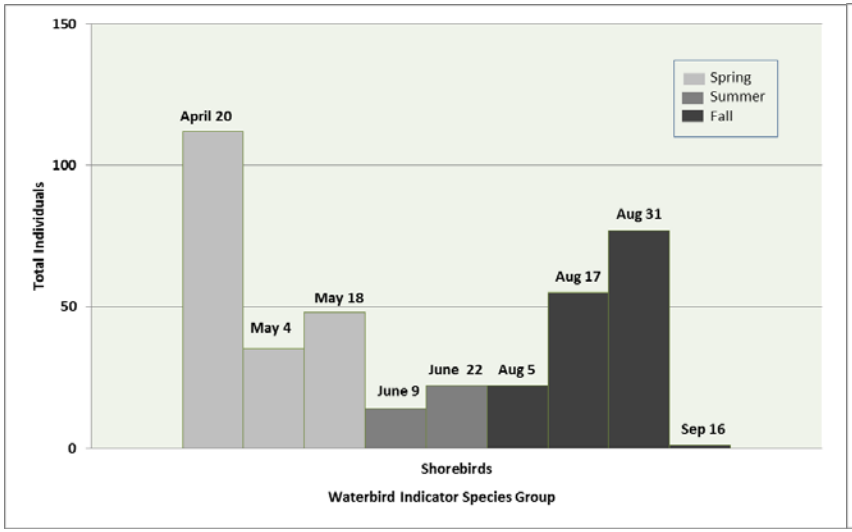
Indicator Species Group	Common Name	T1	T2	T3	T4	T5	T6	Species Total
Waterfowl	Canada Goose		1	1		2		4
	Gadwall	62	75	17	8	110		272
	American Wigeon		3			14		17
	Mallard	43	354	115	19	144	2	677
	Blue-winged Teal					8		8
	Cinnamon Teal		32	14	3	49		98
	Northern Shoveler					2		2
	Northern Pintail			4		3		7
	Green-winged Teal		25			392		417
	Ruddy Duck	4						4
Total Waterfowl per subunit		109	490	151	30	724	2	1506
Wading Birds	Great Blue Heron	1	1		1	4		7
	Great Egret	2	23	22	1	28		76
	Snowy Egret			2				2
	Black-crowned Night-Heron			2			1	3
	White-faced Ibis		67	124	25	154	6	376
Total Wading Birds per subunit		3	91	150	27	186	7	464
Rails	Virginia Rail			2	1	1		4
	Sora			10	3			13
	American Coot			5		116		121
Total Rails per subunit				17	4	117		138
Shorebird	Semipalmated Plover					3		3
	Killdeer	6	10	4	2	1	3	26
	Black-necked Stilt		5	7	8	7		27
	American Avocet	50	5	7				62
	Spotted Sandpiper	19		1				20
	Solitary Sandpiper					1		1
	Greater Yellowlegs		8	3		1		12
	Willet		1	2				3
	Lesser Yellowlegs						3	3
	Long-billed Curlew		1					1
	Western Sandpiper		20	8				28
	Least Sandpiper		31	64		2	31	128
	Short-billed Dowitcher		1					1
	Long-billed Dowitcher	2	7			1	5	15
	Wilson's Snipe	1	1	1			1	4
	Wilson's Phalarope		3	17		4		24
	Red-necked Phalarope		16	12				28
Total Shorebirds per subunit		78	109	126	10	20	43	386
Total Waterbirds per Subunit		190	690	444	71	1047	52	2494



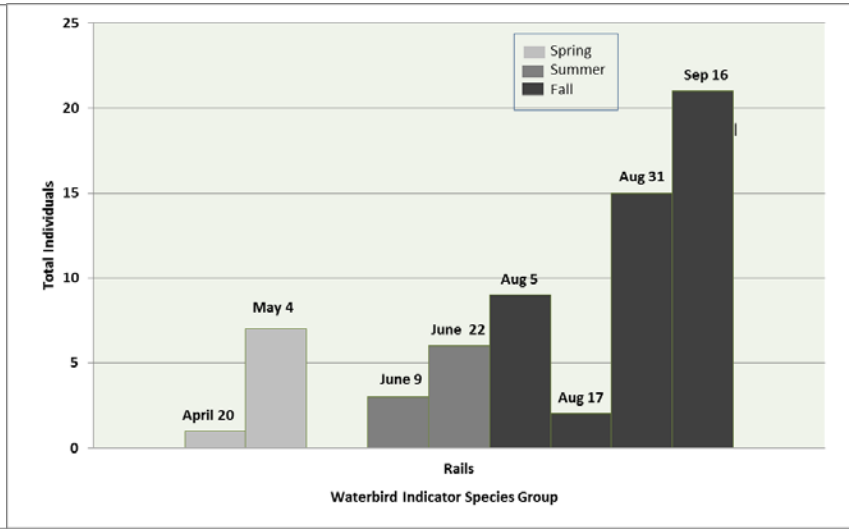
Avian Census Figure 16 Seasonal Waterfowl



Avian Census Figure 17. Seasonal Wading Birds



Avian Census Figure 18. Seasonal Shorebirds



Avian Census Figure 19. Seasonal Rails

Thibaut Subunit Analysis

Use by indicator species groups varied among subunits (Avian Census Table 8). Some of the variation is a function of season and extent of flooding of subunits which is discussed below.

Avian Census Table 8. Total Indicator Species Group Counts by Subunit

Subunit	Waterfowl	Wading Birds	Rails	Shorebirds	Total waterbirds
T1	109	3	0	78	190
T2	490	91	0	109	690
T3	151	150	17	126	444
T4	30	27	4	10	71
T5	724	186	117	20	323
T6	2	7	0	43	13

Thibaut Subunit T1

Subunit T1 was a large open water pond bordered on one side by desert scrub and on the other by inundated scrub/grassland. It was completely void of cattails. There were several small islands in the narrow end. Low numbers of waterfowl and shorebirds were present during the spring and summer. Waterfowl counts increased significantly by summer, but the pond was drained soon after, reducing the total waterfowl and shorebird count to 0 by fall. The waterfowl species were predominantly Mallard and Gadwall. A few Ruddy Ducks were present in the summer. The shorebirds consisted of American Avocet, Spotted Sandpiper, Long-billed Dowitcher, and Killdeer. American Avocet and Killdeer were the only shorebirds present in the summer. Two Great Egrets were seen in the spring, and one Great Blue Heron was seen in summer.

Thibaut Subunit T2

Subunit T2 contained a shallow open water pond surrounded by cattails and grassland. Waterfowl and shorebirds were often seen foraging within the cattails during counts. Waterfowl was the most abundant indicator species group, with the highest counts in the summer. They were seen foraging in the cattails as well as the open pond, and resting on the grassland banks. A variety of shorebirds were often scattered throughout the pond and on the shore.

Thibaut Subunit T3

Subunit T3 was predominantly mature cattail marsh, with several open water ponds, obscured from view. The marsh and ponds were bordered by inundated grassland. There were a few large shallow open water ponds extending out from the marsh into the grassland. They had the appearance of playas but lacked exposed mudflat. The Thibaut unit once attracted large numbers of shorebirds due to the availability of playa habitat. The shallow ponds in Subunit T3 appear to be what is left of the playas. Grass had grown over the mudflats and the water was too deep. Very few shorebirds where found here in 2016, but a large flock of Least Sandpipers was seen during one survey in the fall. This is the only subunit where Virginia Rails and Sora were encountered on almost every survey. They were seen on the marsh edges and in the inundated grassland.

Thibaut Subunit T4

Subunit T4 was a small mature cattail marsh with very little open water. It was bordered by grassland. The most abundant species was White-faced Ibis. Twelve were seen in the fall. Eight Black-necked Stilts were present in the spring. Seven Mallards and seven Gadwall were present in the summer. Seven Mallards were also seen in the fall. Three Cinnamon Teal and three Sora were present in the spring. Overall, only low numbers of each species were found in this subunit.

Thibaut Subunit T5

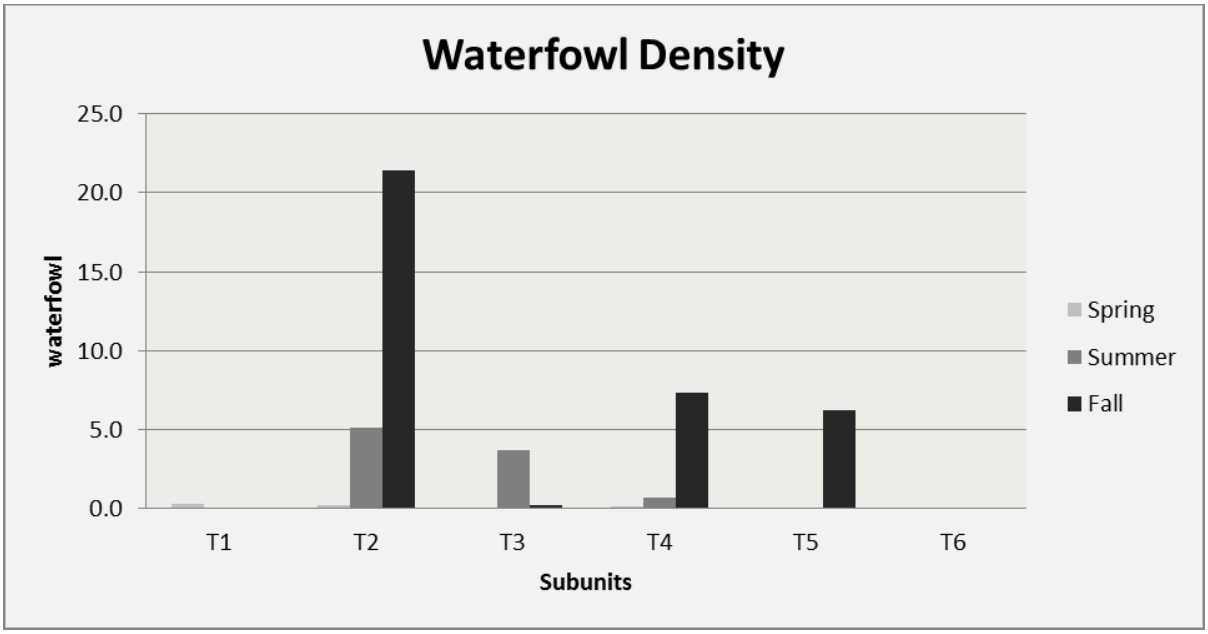
Subunit T5 was flooded in the fall, so only fall counts were done. It was a large shallow open water pond, bordered by desert scrub and scrub/grassland. A cattail stand was emerging in one end of the pond, and vegetation similar to grass tufts was scattered throughout the pond. This subunit attracted large numbers of White-faced Ibis and waterfowl. More species of waterfowl were found here than in any other unit. Ducks were observed feeding in the shallow water among the vegetation. The pond was completely exposed and did not provide any cover for waterfowl. Subunit T1 was also completely exposed but did not accommodate such large numbers of waterfowl. The difference was that Subunit T1 was a deep water pond without vegetation, while Subunit T5 was a shallow water pond with vegetation. The Winterton Subunit W6 was also a shallow water pond with vegetation, and supported large numbers of feeding waterfowl. Therefore, it appears that shallow flood vegetation is more productive than deep water ponds.

Thibaut Subunit T6

Subunit T6 was flooded in the fall also, so only fall counts were done. This basin was higher in elevation than the others, and bordered by desert scrub, so it was more difficult to fill. It only held water for one month and then went dry, so water birds were present for just one survey. The most abundant species was a flock of 31 Least Sandpipers that were present while the mudflat was still wet. There were a few other shorebirds as well, such as Lesser Yellowlegs, Long-billed Dowitcher, and Wilson's snipe. Two Mallards were also present.

3.5.2.1 Comparison of Waterbird Densities Among Subunits

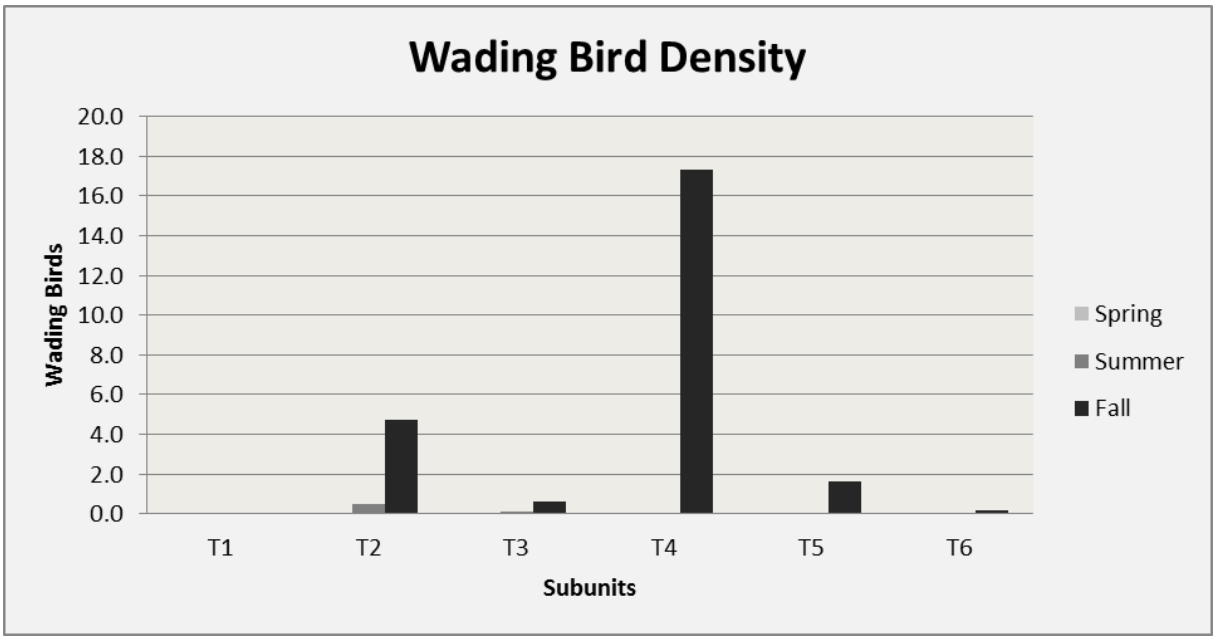
Waterbird densities were compared among the subunits to evaluate if certain subunits were more attractive to particular indicator species groups. The data were formulated into a representation of bird density for each subunit. The average of all counts for each season was divided by the total wetted extent acreage (for that season) in order to derive a value for density (birds per wetted acre).



Avian Census Figure 20. Thibaut Waterfowl Density

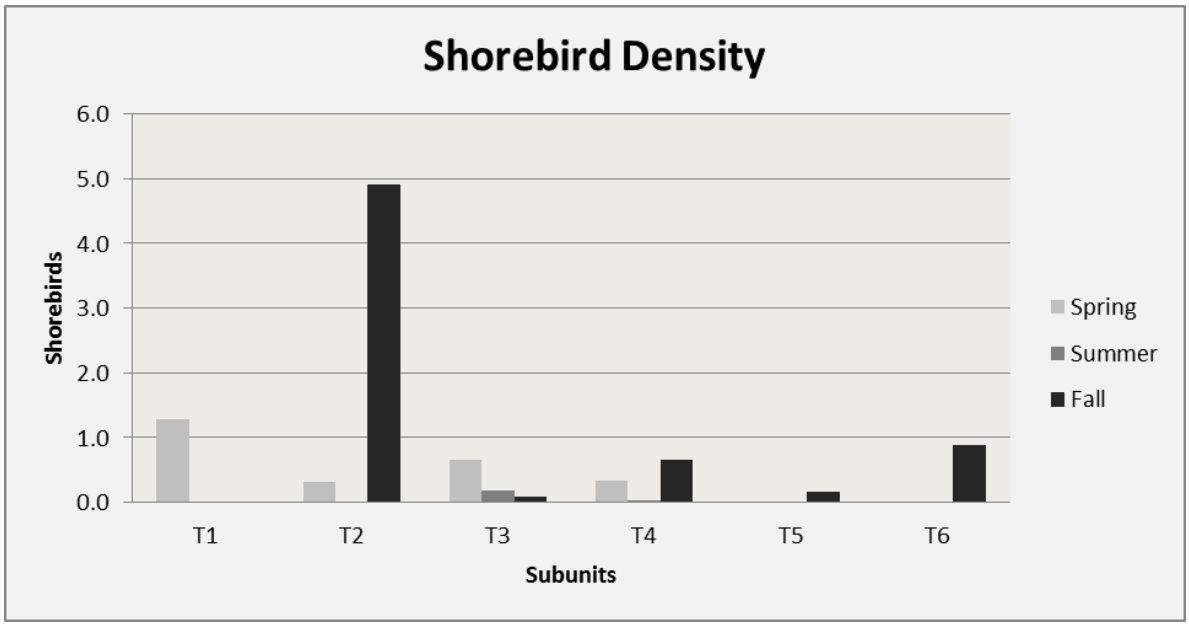
The highest density of waterfowl was in Subunit T2 in the fall. This subunit was a small shallow pond and marsh. It was shallow enough to attract a large number of waterbirds, and the cattail marsh was not too dense (Avian Census Figure 20). The adjacent inundated grassland also improved the habitat. Subunit T1, a large open water pond, had a low density of waterfowl in the spring. The pond was deep and open. It was not surrounded by cattails. During the summer, the highest density of waterfowl occurred in Subunits T2 and T3. Both of these subunits contained shallow ponds surrounded by

cattails. All spring counts were low in Thibaut, while all of the subunits had water, except for SubunitsT5 and T6.



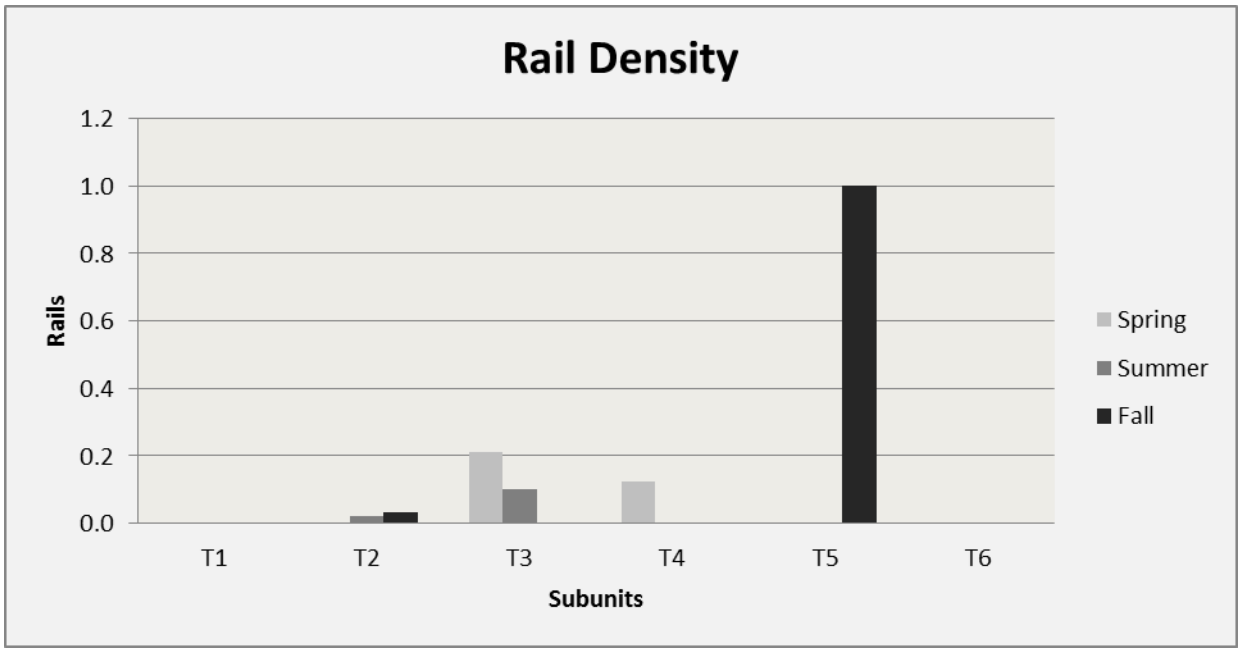
Avian Census Figure 21. Thibaut Wading Bird Density

During the spring and summer, all wading bird counts were low (Avian Census Figure 21). The highest wading bird counts occurred in the fall, with the highest density in Subunit T4. This subunit was almost entirely marsh, and had the lowest acreage of flooded extent, which accounted for the high density. In contrast, 186 wading birds were present in Subunit T5 in the fall, while only 26 were present in Subunit T4. The majority of all high counts were White-faced Ibis.



Avian Census Figure 22. Shorebird Density

The highest density of shorebirds in the spring was in Subunit T1, the large open water pond (Avian Census Figure 22). The majority were American Avocet, with a high count of 16. They were congregated in pairs along the grassy shoreline and grass islands. However, there was no evidence of breeding. The highest density was in Subunit T2 in the fall. Subunit T2 also had the largest variety of shorebird species.



Avian Census Figure 23. Rail Density

The highest rail density occurred at Subunit T5 in the fall (Avian Census Figure 23). It consisted almost exclusively of American Coot, with the exclusion of 1 Virginia Rail. During the spring the highest densities were in Subunits T3 and T4. Most of the Virginia Rails and Sora were detected in Subunit T3, the subunit with the largest expanse of mature marsh. Virginia Rail and Sora are usually associated with mature marsh. The largest numbers of American Coot are usually encountered in open water ponds.

3.5.2.2 Comparison of 2004 and 2016

Thibaut 2004 and 2016 Results

A baseline survey for Thibaut was conducted in 2004, prior to activation of the unit. That survey was the only complete survey of Thibaut prior to the 2016 survey. Thibaut was active in 2007 and 2008. However, complete surveys were not conducted during that time. Thus the only comparisons available for the Thibaut unit are between the baseline survey in 2004 and the active status survey in 2016. This analysis is complicated by the fact that the unit was partially flooded during the baseline survey and

significant numbers of water birds were encountered. Additionally, the baseline survey included the Thibaut Ponds while the 2016 survey did not. The methodology used was also different between 2004 and 2016; point counts were used in 2004, while area surveys were done in 2016. Additionally, over half of the survey points in 2004 were in the Thibaut Ponds area, the area that was not surveyed in 2016. Therefore, only differences in numbers were analyzed, not differences in area conditions. Overall, the Thibaut unit contained more playas and mudflats in 2004 and less open water ponds than in 2016.

A total of 869 water birds were encountered during the 2004 Thibaut surveys compared to 2,494 during 2016 surveys. Waterfowl, wading birds, and rails showed an increase in total numbers between 2004 and 2016 (Avian Census Figure 24). Shorebirds showed a decrease in spring and summer 2016. There were more open water ponds in 2016, and consequently more waterfowl present.

Seasonally, there was a significant increase in all four of the indicator species groups in the fall of 2016. The increase is most likely the result of the large number of dabbling ducks, White-faced Ibis and American Coots that were using T5. T5 was not flooded until late summer. Overall, there was a 187% increase in water bird use since 2004, which is impressive since habitat existed prior to the activation of the Thibaut unit.

Avian Census Table 9. Thibaut 2004 and 2016 Comparison

Indicator Species Group	Spring 2004	Spring 2016	Summer 2004	Summer 2016	Fall 2004	Fall 2016
Waterfowl	158	50	109	353	119	1103
Wading Birds	11	11	17	32	37	421
Shorebirds	202	195	117	36	86	155
Rails	2	8	4	9	7	121

Avian Census Figure 24. Thibaut 2004 and 2016 Seasonal Comparison

3.6 Discussion

Management of the BWMA is described in the 1997 MOU and the 2004 LORP EIR. These guiding documents provide a legal framework for setting the amount of acreage to be flooded each year with the Inyo/Los Angeles Standing Committee as well as a general management strategy and flooding regime for the management units. In order to maintain productivity, wetlands need to experience periodic water level fluctuations (Ducks Unlimited 2005, Locke et. al 2007). Water level manipulations are one of the most effective tools in wetland management to influence the food resources that attract wildlife (Fredrickson 1991). Continuous inundation of wetlands may lead to decreased wetland productivity and an inefficient use of water resources for wildlife benefit.

As mentioned previously, legal requirements are in place for managing BWMA that presently limit flexibility in significantly modifying its flooding regime and management strategy. However, avian census data provides useful information regarding use and preferences of LORP habitat indicator species within the management units and subunits.

As indicated in the data presented above, preferentially flooding some areas, particularly at certain times of the year (migration, winter etc.) may result in higher use by indicator species. This approach would benefit wildlife and could be a more effective use of water resources since water delivery to the units would be geared to benefit habitat indicator species.

Although not all basins were flooded all seasons, a dominant pattern observed in the data and on the ground is that waterfowl preferred shallow basins over deep water ponds, particularly for feeding. High numbers of waterfowl occurred in both deep and shallow basins (depending on season and whether they were flooded), but in the deep water ponds they were concentrated along the shallower edges, while in the shallow ponds they were more evenly distributed throughout the flooded area. Also, when both were available, waterfowl density was much higher in shallow basins than deep ponds. Deeper ponds would be beneficial to maintain at certain times of the year, such as late fall through early spring when more diving ducks are present, and in winter since they are less likely to freeze than shallow flood ponds.

The spring surveys showed large numbers of wading birds in Subunits W1 and W6. The large numbers in Subunit W1 were primarily the result of a mixed flock of birds roosting in the area in migration. Some wading birds are occasionally observed feeding in this area, and in spring 2016, the habitat may have been improved for feeding due to livestock use and flooding of adjacent meadows. Subunit W6, a shallow basin attracted the second highest density of wading birds, while Subunits W5 and W4, both deeper basins, supported low densities. Wading birds are most abundant late spring and early fall, and are generally absent mid-summer and winter.

Shorebirds have never been abundant at Winterton due to a lack of appropriate habitat. This summer, the unintended drawdown of Subunit W5 in mid-summer created a natural experiment in habitat manipulation. In previous years (2011 and 2015), surveys of Winterton recorded fewer than 300 shorebirds all year. In 2016, almost 750 shorebirds were observed, with most individuals in Subunit W5 during the period of drawdown when mudflats were exposed. The other areas that received use in fall were Subunits W9 and W3, both shallow basins. In spring, the shallow basins of Subunits W6 and W3 were also preferred, with low densities in the deeper basins of Subunits W6 and W4. Providing shallow water with limited amount of vegetation or mudflats during peak shorebird use periods may result in higher use by this group of indicator species.

American Coot is the most abundant rail species at BWMA, and their numbers cloud interpretation of use by other species. They are a common and widespread species in the Owens Valley, but are included in the list of indicator species. Consideration should be given to remove this species from the indicator species list in order to allow for other species to be more accurately represented. In particular, the high numbers of American Coot cause Virginia Rail and Sora counts to appear insignificant. Virginia Rail and Sora are not easily detected so counts are consistently low, due on part to the survey methodology. In order to accurately detect the presence of these two species, callback surveys are needed. Virginia Rail and Sora are most often hidden in dense cattail stands or wet meadows. It is difficult to manage for these two species concurrently with the other indicator species groups because Virginia Rail and Sora prefer dense cattails, or other dense marsh vegetation. More evaluation is needed in order to create habitat diverse enough to accommodate all indicator species.

3.7 Appendix 1. Winter 2015 and Spring, Summer, and Fall 2016 Indicator Species

Common Name	Scientific Name	Common Name	Scientific Name
Snow Goose	*Chen caerulescens*	Northern Harrier	*Circus cyaneus*
Ross's Goose	*Chen rossii*	Virginia Rail	*Rallus limicola*
Canada Goose	*Branta canadensis*	Sora	*Porzana carolina*
Wood Duck	*Aix sponsa*	American Coot	*Fulica americana*
Gadwall	*Anas strepera*	Semipalmated Plover	*Charadrius semipalmatus*
American Wigeon	*Anas americana*	Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*	Black-necked Stilt	*Himantopus mexicanus*
Blue-winged Teal	*Anas discors*	American Avocet	*Recurvirostra americana*
Cinnamon Teal	*Anas cyanoptera*	Spotted Sandpiper	*Actitis macularius*
Northern Shoveler	*Anas clypeata*	Solitary Sandpiper	*Tringa solitaria*
Northern Pintail	*Anas acuta*	Greater Yellowlegs	*Tringa melanoleuca*
Green-winged Teal	*Anas crecca*	Willet	*Tringa semipalmata*
Unidentified Teal	*Anas spp.*	Lesser Yellowlegs	*Tringa flavipes*
Canvasback	*Aythya valisineria*	Whimbrel	*Numenius phaeopus*
Redhead	*Aythya americana*	Long-billed Curlew	*Numenius americanus*
Ring-necked Duck	*Aythya collaris*	Western Sandpiper	*Calidris mauri*
Lesser Scaup	*Aythya affinis*	Least Sandpiper	*Calidris minutilla*
Bufflehead	*Bucephala albeola*	Dunlin	*Calidris alpina*
Common Goldeneye	*Bucephala clangula*	Calidris spp.	*Calidris spp.*
Hooded Merganser	*Lophodytes cucullatus*	Short-billed Dowitcher	*Limnodromus griseus*
Ruddy Duck	*Oxyura jamaicensis*	Long-billed Dowitcher	*Limnodromus scolopaceus*
Great Blue Heron	*Ardea herodias*	Wilson's Snipe	*Gallinago delicata*
Great Egret	*Ardea alba*	Wilson's Phalarope	*Phalaropus tricolor*
Snowy Egret	*Egretta thula*	Red-necked Phalarope	*Phalaropus lobatus*
Black-crowned Night-Heron	*Nycticorax nycticorax*	Marsh Wren	*Cistothorus palustris*
White-faced Ibis	*Plegadis chihi*		

3.8 References

Ecosystem Sciences. 1997. *Lower Owens River Project Ecosystem Management Plan, Action Plan and Concept Document.* Attachment to the 1997 MOU.

Fredrickson, L.H. 1991. *Strategies for Water Level Manipulations in Moist-Soil Systems.* Fish and Wildlife Leaflet 13.4.6.

Locke, S., C. Frentress, J. Cathey, C. Mason, R. Hirsch, and M. Wagner. 2007. *Techniques for Wetland Construction and Management*. Agrilife Extension. Texas A & M System.

Los Angeles Department of Water and Power. 1997. MOU. *1997. Memorandum of Understanding.* County of Inyo and City of Los Angeles, CA. Bishop, CA.

Los Angeles Department of Water and Power. 2004. *Lower Owens River Project Environmental Impact Report*.

Taylor, J.P. 2001. *Maintain Riparian Vegetation Structure Diversity for Birds While Averting Catastrophic Wildlife.* Friends of the Bosque Newsletter. January-February 2001. Prepared by John P. Taylor, U.S. Fish and Wildlife Service, Bosque del Apache National Wildlife Refuge.

.

4.0 LAND MANAGEMENT

4.1 Land Management Summary

The 2016 Lower Owens River Project (LORP) land management monitoring efforts continued with monitoring utilization across all leases and range trend monitoring on the Blackrock and Delta leases inside the LORP management area. Irrigated pasture evaluations were conducted on all leases in 2016. The LORP area is currently experiencing its fourth year of drought. Effects from this are a decrease in forage production in the uplands and decreased availability of irrigation water. Despite impacts from the historic drought on the uplands and irrigated pastures, steady base flows in the Lower Owens River have maintained moist floodplain trends in either a static or upward trajectory. Of the 20 sites on the floodplain on the Blackrock and Delta Leases, plant frequencies have either remained static or increased in abundance of perennial grasses, with the exception of two sites. The eight transects located on saline meadows have shown some variability in trends with five sites remaining static, one site declining in all perennial grasses found on the site, another site increasing in alkali sacaton and decreasing in saltgrass, and a third site increasing in perennial grasses. The two xeric sites (Sodic Fans) showed downward trends. Minimal to no livestock grazing occurred on these two sites.

Utilization estimates were conducted on all leases in 2015-16. Pasture utilization for leases within the LORP was below the allowable levels of use established for both riparian (up to 40%) and upland (up to 65%) areas for all leases except the Delta Lease. Due to the drought, all leases have been understocked for the past five years. Use on the Blackrock Lease was lower than most other leases in the project area, remaining well below all grazing standards. Livestock use on the Twin Lakes Lease was low in 2016. The Islands Lease has lost much of its meadow habitat in the River Field to the expanding marsh as inundation from flow augmentations for the LORP project continues. Use of the Thibaut Field on the Thibaut Lease was below the allowable upland standard. The Lone Pine Lease has recovered from the 2013 fire; the only major loss was two mature willow trees.

All irrigated pastures were monitored in 2013. Pastures that scored 80% or below were checked in 2014 but no evaluations were made due to drought conditions. No irrigated pasture evaluations were conducted in 2015 due to persistent drought conditions. With a slight increase in precipitation during the winter of 2016, irrigation proceeded as normal in most areas and irrigated pastures were evaluated in 2016.

4.2 Introduction

The land use component of this report 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 the monitoring and 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 on the leases.

Grazing management plans developed for the ranch leases in the LORP modified grazing practices in riparian and upland areas on seven LADWP leases in order to support the 40 LORP goals as described in the LORP EIR (2007). 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 2016 are presented by lease below.

4.3 Utilization

The Lower Owens River Monitoring Adaptive Management and Reporting Plan (Ecosystem Sciences 2008), 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 these data to document the percent of biomass removed by grazing animals and determine whether or not grazing utilization standards are being exceeded. 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. 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.

4.3.1 Riparian and Upland Utilization Rates and Grazing Periods

Under the Lower Owens River Monitoring Adaptive Management and Reporting Plan (Ecosystem Sciences, 2008), 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 occurs 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 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, the 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.

4.3.2 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.

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 over an average of several years, then adjustments should be implemented (Holecheck and Galt, 2000; Smith et al., 2007).

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 mid-way through the grazing period (mid-season) and again at the conclusion of the grazing period or immediately prior to the end of plant dormancy (end-of-season).

4.4 Range Trend

4.4.1 Overview of Range Trend Monitoring and Assessment Program

A description of monitoring methods, data compilation, and analysis techniques can be found in the 2008 LORP Monitoring, Adaptive Management and Reporting Plan. More detailed discussion of the Range Trend methods and considerations for interpretation can be found in previous LORP Annual Monitoring reports as well as descriptions of the range trend monitoring sites and their locations. Nested frequency and shrub cover data collected in 2016 are presented for each lease. Major departures from historic ranges of variability will be discussed at the lease level in the following sections.

Range trend monitoring for 2016 involves the quantitative sampling of the following attributes: nested frequency of all plant species and line intercept sampling for shrub canopy cover. Photo documentation of the site conditions is included as part of range trend monitoring.

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 is 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. The 2016 results were compared to all sampling events during the baseline period to determine if results

in 2016 were ecologically significant or remained within the typical range of variability observed for that particular site.

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*), plant symbol DISP and to a lesser extent alkali sacaton *(Sporobolus airoides*), plant symbol SPAI and creeping wildrye *(Leymus triticoides*), plant symbol LETR5. 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 2016 Rapid Assessment Survey (RAS) report and the Streamside Monitoring Report from 2014.

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)*, plant symbol ATTO, with a minor component of alkali sacaton of up to 25% and 5% forbs.

During the pre-project 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 differently to the variable precipitation conditions 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 are used for the Intake, Twin Lakes, and the northern portion of the Blackrock Leases.

Adaptive management recommended that a modified range trend schedule be implemented in 2012. This schedule ensures that there will be some monitoring across the landscape annually, increasing the probability of documenting the influence of significant changes in climate or management on the various ecological sites in the LORP area.

Land Management Table 1. Revised LORP Range Trend Monitoring Schedule

2016	2017	2018	2019	2020	2021
Blackrock	Thibaut	Twin Lakes	Blackrock	Thibaut	Twin Lakes
Delta	Islands	Lone Pine	Delta	Islands	Lone Pine

4.4.2 Irrigated Pastures

Monitoring of irrigated pastures consists 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 2013. Pastures that scored 80% or below were checked in 2014. No irrigated pastures were evaluated in 2015 due to persistent drought conditions but pasture condition scoring was conducted in 2016 in all irrigated pastures. This data is presented by lease (where applicable) below.

4.4.3 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. Rare plant exclosures were constructed on the Blackrock and Thibaut Leases (see Sections 2.8.1.4, 2.8.2.2, and 2.8.2.3 of the Final LORP EIR June 23, 2004). Fence construction began in September 2006 and was completed in February 2009 with the total fence miles constructed being approximately 50 miles.

No new fence construction occurred within the LORP project boundaries in 2016. Some repairs did occur along with general maintenance.

4.4.4 Discussion of Range Trend

Range Trend transects on the Delta and Blackrock leases were read in early August 2016. This is the fifth year where precipitation remains well below average, particularly during the mid-and late winter periods. Effects from the drought vary depending upon location. With regards to the two leases sampled inside the LORP project area, trends remain stable on the moist floodplain sites where water tables remain high due to steady baseflows on the Lower Owens River throughout the year. Off-river Saline Meadow locations are beginning to show impacts from the drought with declining densities of perennial grasses. Continued significant declines of Nevada saltbush along multiple locations on the former dry reach of the Lower Owens River continue while in other locations saltbush cover has stabilized for the time being.

4.5 LORP Ranch Lease Summary and Monitoring Results

The following sections are presented by ranch lease. The discussion includes an introduction describing the lease operations, pasture types, a map of the lease, utilization results from 2016, a summary of range trend results at the lease level, and a presentation of range trend results by transect when significant changes occurred. Reference to plant species by plant symbol are found in the following list of the plant species, scientific names, common names, plant symbol, and functional group assignment for species encountered on the range trend transects.

Land Management Table 2. Common Species in Range Trend Transects

Plant Code	Species Name	Common Name
ANCA10	*Anemopsis californica*	yerba mansa
ARPU9	*Aristida purpurea*	purple threeawn
ATSES	*Atriplex serenana*	bractscale
ATTO	*Atriplex torreyi*	saltbush
ATTR	*Atriplex truncate*	wedgescale saltbush
BAHY	*Bassia hysopifolia*	bassia/smotherweed
CHHI	*Chenopodium hians*	hians goosefoot
CHIN2	*Chenopodium incanum*	mealy goosefoot
CHLE4	*Chenopodium leptophyllum*	narrowleaf goosefoot
DESO2	*Descurainia sophia*	herb Sophia
DISPS2	*Distichlis spicata*	saltgrass
EQAR	*Equisetum arvense*	field horsetail

Common Species Encountered in Range Trend Transects, continued:

Plant Code	Species Name	Common Name
FOPU	*Forestiera pubescens*	stretchberry
GITR	*Gilia transmontana*	transmonte gilia
GLLE3	*Glycyrrhiza lepidota*	licorice
HECU3	*Heliotropis curvassum*	salt heliotrope
JUBA	*Juncus balticus*	Baltic rush
LASE3	*Langloisia setosissima*	Great Basin langloisia
LEFL2	*Lepidium flavum*	yellow pepperweed
LELA	*Lepidium latifolium*	broadleaf pepperweed
LETR5	*Leymus triticoides*	creeping wildrye
NADE	*Nama demissum*	purplemat
POMO5	*Polypogon monspeliensis*	annual rabbitsfoot grass
SAEX	*Salix exigua*	narrowleaf willow
SAGO	*Salix gooddingii*	Goodding's willow
SALA3	*Salix laevigata*	red willow
SAVE4	*Sarcobatus vermiculatus*	greasewood
SCAC	*Schoenoplectus acutus*	tule
SCAM	*Schoenoplectus americanus*	common threesquare
SCMA	*Schoenoplectus maritimus*	cosmopolitan bulrush
SPAI	*Sporobolus airoides*	alkali sacaton
TARA	*Tamarix ramossissima*	saltcedar
TYDO	*Typha domingensis*	southern cattail
TYLA	*Typha latifolia*	broadleaf cattail

4.5.1 Intake Lease

The Intake Lease is utilized by horses and mules. The lease, which is approximately 102 acres, is comprised of three fields: Intake, Big Meadow Field, and East Field. 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 was covered with dredged material from the LORP Intake during the implementation of

the LORP project. The East Field consists of upland and riparian vegetation. 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.

Summary of Utilization

The following table presents the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Intake Lease, RLI-475, 2016

Field	Utilization
Intake *	0%

*Riparian Utilization 40%**

Utilization for the Intake Lease in 2016 was 0%.

Summary of Range Trend Data and Conditions

Range Trend data was not collected in 2016 on the Intake Lease.

Irrigated Pastures

There are no irrigated pastures on the Intake Lease.

Stockwater Sites

There are no stock water sites on the lease. Stockwater is provided by the Owens River.

Fencing

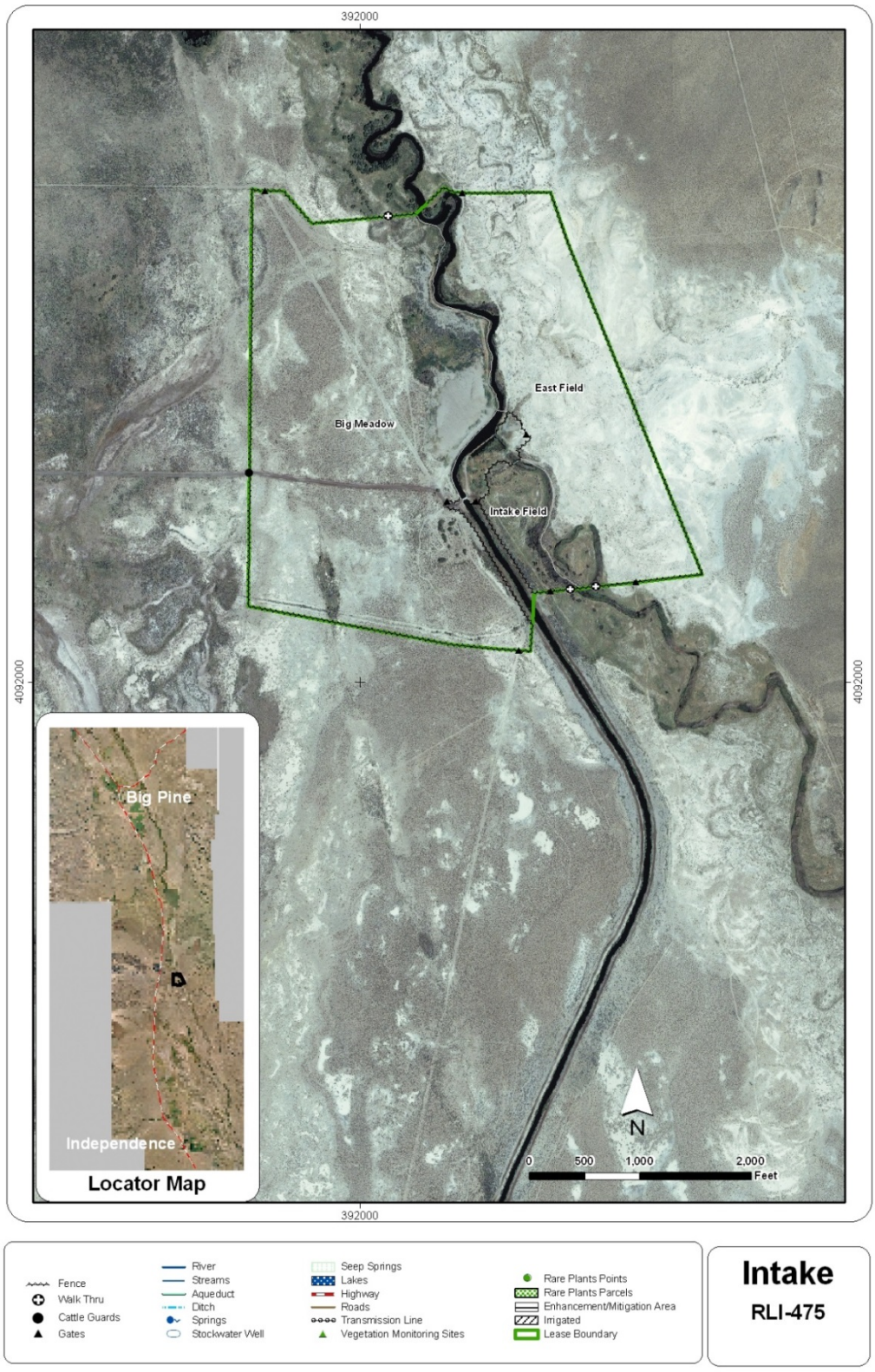
There was no new fence construction on the lease.

Salt and Supplement Sites

There are no salt and supplement sites on the lease.

Burning

No burns were conducted on the lease in 2016.



Land Management Figure 1. Intake Lease

4.5.2 Twin Lakes Lease

The Twin Lakes Lease is a 4,912-acre cow/calf operation situated just south of the Los Angeles Aqueduct 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 Twin Lakes 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. 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. 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 where livestock grazing does not occur.

Summary of Utilization

The following table presents the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Twin Lakes Lease, RLI-491, 2016

Field	Utilization
Lower Blackrock Field	1%
Lower Blackrock Riparian Field*	1%
Upper Blackrock Field*	20%

*Riparian Utilization 40%**

Riparian Management Areas

Utilization in the Lower Blackrock Riparian (1%) and Upper Blackrock Field (20%) was well below the allowable utilization for the grazing season. Much of the grazing occurred around Drew Slough early in the season and then in the adjacent riparian pastures. The Telegraph range burn located within the Upper Blackrock Field and Lower Blackrock Riparian Fields has had continued positive results. Perennial grasses in the meadows are exhibiting strong vigor and many Goodding's willow have re-sprouted after the burn. There are no recommended management changes.

Upland Management Area

Upland utilization was below the allowable standard of 65% in all fields.

Summary of Range Trend Data and Conditions

Range trend data were not collected in 2016.

Irrigated Pastures

There are no irrigated pastures on the Twin Lakes Lease.

Fencing

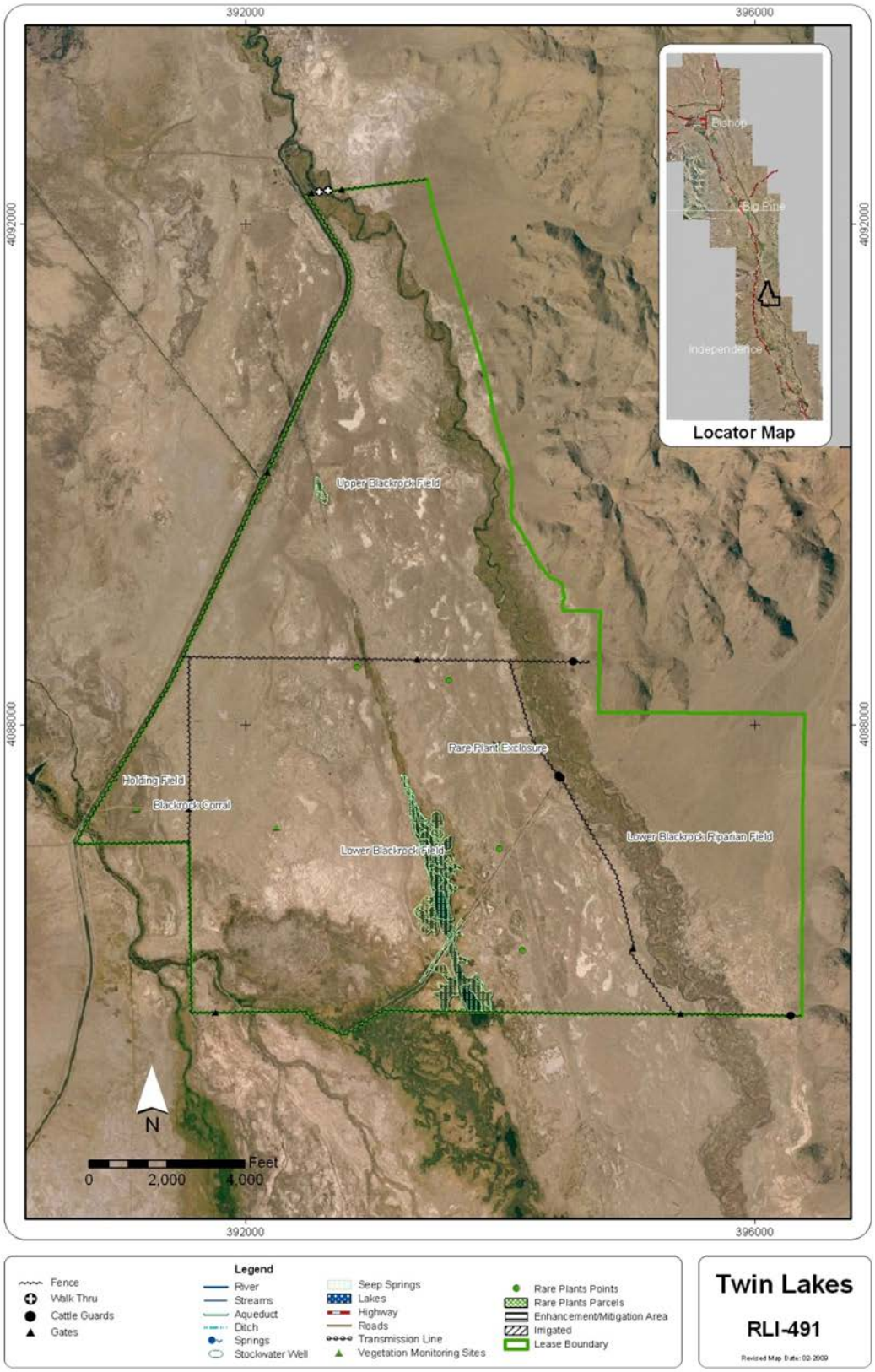
There was no new fencing constructed on the lease in 2016.

Salt and Supplement Sites

Supplement is composed of a liquid mix that is put in large tubs with rollers that the cattle consume. These tubs are placed in established supplement sites and are used every year.

Burning

No burns were conducted in 2016 on the Twin Lakes Lease.



Land Management Figure 2. Twin Lakes Lease

4.5.3 Blackrock Lease

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 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. As outlined in the lease management plans, holding pastures, traps, and corrals are not monitored because of their small size and/or their role in operations.

Summary of Utilization

The following tables present the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Blackrock Lease, RLI-428, 2016

Fields	Utilization
North Riparian Field*	23%
Horse Holding	0%
Wrinkle Riparian Field*	16%
Locust Field	32%
Reservation Field	10%
Robinson Field	4%
Russell Field	8%
White Meadow Field	12%
White Meadow Riparian Field*	16%
Wrinkle Field	8%
South Riparian Field*	0%
West Field	7%

**Riparian utilization 40% **

Riparian Management Area

Riparian grazing on the Blackrock Lease was below the allowable 40% utilization standard. While conducting utilization monitoring, Watershed Resources Staff noticed an increase in flooded and inundated meadows in the North Riparian Field. Meadow habitat has decreased and stressed the existing woody component located within the riparian area. In the White Meadow Riparian pasture and understory of perennial grass is expanding below the Nevada saltbush. A prescribed burn across the historic floodplain in the northern half of this pasture would result in a large conversion from shrubland to open meadow.

Upland Management Areas

Fields in the upland portions of the Blackrock Lease remained well below upland 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 on 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.

There are 14 moist floodplain sites on the Blackrock Lease. Eight of those sites were static in 2016 when compared to 2013. Four sites had significant increases in perennial grass frequencies, and one site decreased. Perennial shrubs decreased significantly on three sites.

There are eight saline meadow sites on the Blackrock Lease, five of which remained static in 2016. BLKROC_4 shows a general downward trend in 2016. BKROC_05 decreased in saltgrass and increased in alkali sacaton and a third site (BLKROC_03) significantly increased in sacaton.

Saltgrass significantly decreased on the two sodic fan sites on the Blackrock Lease.

Significant Changes in Frequency for Blackrock Transects Between 2013 and 2016

	No Change	DISP	SPAI	ATTO	BAHY	LETR	SUMO	JUBA
Moist Flood Plain								
BLKROC_10*	↔							
BLKROC_11*	↔							
BLKROC_14*	↔							
BLKROC_12	↔							
BLKROC_15*		↑		↓			↓	
BLKROC_17*				↓				
BLKROC_13	↔							
BLKROC_18	↔							
BLKROC_19		↑						
BLKROC_20						↑		
BLKROC_22		↑						
BLKROC_23			↓					
BLKROC_24	↔							
BLKROC_25	↔							

SALINE MEADOW								
	No Change	**DISP**	**SPAI**	**ATTO**	**BAHY**	**LETR**	**SUMO**	**JUBA**
BLKROC_01	↔							
BLKROC_02	↔							
BLKROC_03			↑**					
BLKROC_04		↓				↓**		↓
BLKROC_05		↓	↑					
BLKROC_06	↔							
BLKROC_07	↔							
BLKROC_39	↔							
SODIC FAN								
BLKROC_51		↓						
BLKROC_09		↓						

**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. Because livestock cannot access the area no utilization estimates occur at this location. 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 rise, saturating 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 and is now beginning to decline again because of excess water. Nevada saltbush density has also declined. The site has begun to show an increase in beardless wildrye (LETR) and saltgrass while sacaton has remained stable as well as the perennial forb, mallow (MALE3). Fire would not improve the site, because of the negligible perennial grass component in the area.

Frequency (%), BLKROC_10

Frequency		'02	'03	'04	'07	'09	'10	'12	'13	'14	'15	'16
Annual Forb	**ATTR**	0	4	0	0	0	0	0	0	0	0	0
	CHBR	0	2	3	0	0	0	0	0	0	0	0
	CHIN2	0	14	28	0	0	0	0	0	0	0	0
	MENTZ	0	14	0	0	0	0	0	0	0	0	0
Perennial Forb	**HECU3**	0	0	0	0	0	0	0	0	0	0	0
	MALE3	0	3	7	11	21	20	27	18	17	16	18
	SUMO	0	0	0	0	10	0	0	0	0	0	0
	STPI	0	0	4	0	0	0	0	0	0	0	0
Perennial Graminoid	**DISP**	0	3	0	0	0	0	2	7	9	10	13
	LETR5	0	0	0	0	0	0	9	12	19	21	20
	SPAI	0	12	18	18	21	22	17	18	22	21	22
Shrubs	**ARTRW8**	0	0	0	0	0	0	0	0	0	0	0
	ATTO	2	6	14	25	92	74	74	65	64	49	55
	SAVE4	0	0	0	0	0	3	0	0	0	0	0
	ARTR2	0	2	0	2	2	3	0	0	0	0	0
Nonnative Sp.	**AMARA**	0	6	0	0	3	0	0	0	0	0	0
	BAHY	0	3	64	0	47	24	2	4	2	0	0
	DESO2	0	0	1	0	4	0	0	0	0	0	0
	SATR12	0	0	48	0	0	0	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_10

Shrub Cover (m)	2003	2004	2007	2009	2010	2012	2013	2014	2015	2016
ARTR2	1.2	1.3	2.0	2.5	2.3	0.0	0.0	0.0	0.0	0.0
ATTO	2.8	5.2	16.4	52.9	59.7	51.8	46.2	37.3	39.3	38.0
ERNA10	1.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	4.9	7.3	18.3	55.4	62.0	51.8	46.2	37.3	39.3	38.0

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. Perennial grass frequency have remained stable during the last 14 years. Nevada saltbush remains higher than pre-implementation of LORP flows.

Frequency (%), BLKROC_11

Frequency	Species	2002	2003	2004	2007	2009	2010	2012	2013	2014	2015	2016
Annual Forb	**ATPH**	0	0	2	0	0	0	0	0	0	0	0
	ATSES	0	5	0	0	0	0	0	0	0	0	0
	ATTR	0	19	7	0	2	0	0	0	0	0	0
	CHENO	0	1	0	0	0	0	0	0	0	0	0
	CHIN2	0	0	3	0	0	0	0	0	0	0	0
	GILIA	0	9	0	0	0	0	0	0	0	0	0
	MENTZ	0	2	0	0	0	0	0	0	0	0	0
Perennial Forb	**MALE3**	0	3	4	4	0	0	0	0	0	0	0
	SUMO	32	28	42	49	76	66	20	10	16	15	7
Perennial Graminoid	**DISP**	113	107	112	103	110	110	105	106	101	106	103
	SPAI	22	39	41	36	42	40	29	33	32	28	29
Shrubs	**ATTO**	37	95	101	53	70	72	21	22	16	11	10
	ERNA10	3	10	16	8	5	6	0	0	0	0	0
Nonnative Sp.	**BAHY**	0	42	38	0	59	44	0	0	2	0	0

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

Cover (m) Shrubs BLKROC_11

Shrub Cover (m)	2003	2004	2007	2009	2010	2012	2013	2014	2015	2016
ATTO	13.6	16.5	18.3	18.9	18.7	28.3	27.6	16.8	12	16.7
ERNA10	3.2	5.0	8.1	3.1	2.6	1.6	1.1	0.7	0.3	0.0
SUMO	10.5	4.9	13.4	16.2	6.1	2.3	0.0	4.4	5.9	6.7
Total	27.3	26.4	39.7	38.2	27.4	32.1	28.7	39.4	18.2	23.4

BLKROC_25

BLKROC_25 is located in a riparian management area in the White Meadow Riparian Field. The transect is situated inside a grazing exclosure and runs perpendicular to BLKROC_11 with the key difference between the two sites being the area has not been grazed since 2010. 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. Frequency remains static and Nevada saltbush cover increased dramatically in 2016.

Frequency (%), BLKROC_25

Frequency	Species	2011	2012	2013	2014	2015	2016
Perennial Forb	**SUMO**	26	25	35	2	0	0
Perennial Graminoid	**DISP**	107	102	121	116	105	118
Shrubs	**ATTO**	3	4	2	1	0	0
Nonnative Species	**BAHY**	39	3	0	0	0	0

Cover (m) Shrubs BLKROC_25

Shrub Cover (m)	2011	2012	2013	2014	2015	2016
ATTO	1.2	5.8	8.0	6.4	9.4	23.6
SUMO	0.0	28.0	0.0	0.2	1.7	1.9
Total	1.2	33.8	8.0	12.8	11.1	25.5

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, in 2013 saltgrass frequency began to increase again and continued in 2016. Nevada saltbush is increasing on the site with canopy cover increasing from 8.8 m to 31.3 m. These increases are likely a result from rewatering this portion of the Owens River. With the permanently raised water table, shrub cover declined after 2014 and continued to decline in 2015 and 2016. In 2010 frequency for bassia was at its highest recorded on the site since 2004 (prior to the 2008 burn) but has subsequently dropped. Utilization was not sampled on this transect due to the lack of measurable forage.

Frequency (%), BLKROC_14

	Species	2002	2003	2004	2007	2009	2010	2012	2013	2014	2015	2016
Annual Forb	**ATTR**	0	0	5	0	0	0	0	0	0	0	0
	CHENO	0	0	0	0	0	0	0	0	0	0	0
	CHIN2	0	3	3	0	0	0	0	0	0	0	0
Perennial Forb	**HECU3**	0	5	0	0	0	0	0	0	0	0	0
	MALE3	0	4	4	6	7	0	7	10	8	13	14
	SUMO	0	0	0	0	4	0	0	0	0	0	0
Graminoid	**DISP**	13	21	14	10	0	0	7	13	20	22	28
Shrubs	**ATTO**	0	4	8	11	24	27	24	24	36	5	3
Nonnative Species	**BAHY**	0	14	67	0	2	71	3	4	12	0	0
	DESO2	0	0	2	0	0	0	0	0	0	0	0
	SATR12	0	20	90	0	0	0	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_14

Shrub Cover (m)	2003	2004	2007	2009	2010	2012	2013	2014	2015	2016
ATTO	8.8	0.4	10.1	27.3	34.4	42.8	31.3	31.6	12.3	11.5

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 2016 when compared to baseline years.

Frequency (%), BLKROC_01

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Perennial Forb	**HECU3**	7	4	8	2	16	10	4	0
	MALE3	20	26	21	26	21	13	6	1
	PYRA	0	3	2	1	0	0	0	0
	SEVE2	0	0	0	0	16	0	0	0
Perennial Graminoid	**DISP**	39	59	69	52	57	49	53	48
	JUBA	27	39	35	24	21	18	20	15
	SPAI	0	4	3	4	4	4	4	0
Shrubs	**ATTO**	29	36	35	36	13	17	12	9
	ERNA10	65	61	57	53	52	47	32	31

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

Cover (m) Shrubs BLKROC_01

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	12.6	3.46	12.15	3.81	4.55	2.95	4.7
ERNA10	26.1	11.35	20.6	10.52	13.15	12.7	15.2
Total	38.7	14.81	32.75	14.33	17.7	15.65	20

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 2016 did not depart from previous sampling periods and has not shifted beyond baseline frequency values.

Frequency (%), BLKROC_39

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Perennial Forb	**NIOC2**	0	0	3	0	4	6	0	0
	SUMO	6.8	12	5	8	4	6	4	4
Perennial Graminoid	**DISP**	104	94	88	87	98	95	85	93
	JUBA	7	0	0	0	0	0	0	0
Shrubs	**ALOC2**	5	8	11	13	13	12	14	10
	ATCO	3	9	3	9	13	8	0	0
	ATTO	17	3	3	3	0	0	4	5
	ERNA10	0	4	0	1	0	0	0	0
	SAVE4	3	0	4	4	3	5	5	6
Nonnative Species	**BAHY**	0	2	0	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_39

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ALOC2	0.1	0.2	0	0	1	0	1.7
ATCO	0.15	0.45	0.35	1.75	6.35	0	0.2
ATTO	3.35	1.9	2.4	1.28	0	0.6	1.2
ERNA10	0.12	0	0.25	0	0.3	0.3	0.8
SAVE4	1.4	0	0.1	0	1.2	0.7	1.2
SUMO	0.2	0.4	0.5	0.44	0.6	0	0.4
Total	5.32	2.95	3.6	3.47	9.45	1.6	5.4

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 2016 when compared to 2013. The general trend for the area is static. Cover has remained static since 2003.

Frequency (%), BLKROC_02

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**ATTR**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Perennial Forb	**GLLE3**	**6.8**	**2**	**5**	**4**	**7**	**8**	**7**	**11**
Perennial Graminoid	**DISP**	**52.7**	**49**	**55**	**49**	**55**	**48**	**57**	**61**
	JUBA	**3.4**	**11**	**6**	**6**	**4**	**8**	**6**	**4**
	LECI4	**0**	**4**	**1**	**2**	**2**	**3**	**3**	**2**
	SPAI	**7**	**95**	**92**	**91**	**86**	**78**	**82**	**91**
Shrubs	**ATTO**	**42**	**35**	**41**	**30**	**27**	**20**	**26**	**20**
	ERNA10	**12**	**27**	**13**	**16**	**22**	**19**	**13**	**13**
Nonnative Species	**BAHY**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
	SATR12	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

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

Cover (m) Shrubs BLKROC_02

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	22.3	10.3	13.4	9.7	8.3	9.2	7.6
ERNA10	6.0	25.1	3.4	6.4	5.4	4.9	4.2
Total	28.3	35.4	16.9	16.1	13.7	14.1	11.8

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. Frequency results indicate the site has been relatively stable over the past five monitoring periods with the exception of an increase in rubber rabbitbrush cover. Saltgrass has decreased steadily over all years. 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.

Frequency (%), BLKROC_03

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**CHHI**	**0**	**18**	**6**	**0**	**0**	**0**	**0**	**0**
Perennial Forb	**GLLE3**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**
Perennial Graminoid	**ARPU9**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**
	DISP	**53**	**47**	**59**	**42**	**36**	**18**	**14**	**16**
	JUBA	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**
	SPAI	**100**	**112**	**117**	**122**	**128**	**122**	**124**	**214****
Shrubs	**ATTO**	**0**	**0**	**0**	**1**	**2**	**2**	**0**	**0**
	ERNA10	**0**	**6**	**7**	**4**	**17**	**8**	**13**	**36**
Nonnative Species	**LASE**	**0**	**3**	**3**	**0**	**0**	**0**	**0**	**0**
	POMO5	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**

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

Cover (m) Shrubs BLKROC_03

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	0	0	0.25	0	0	0	0.6
ERNA10	1.52	1.3	5.35	9.54	9.85	16.35	17.3
Total	1.52	1.3	5.6	9.54	9.85	16.35	17.9

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 is exhibiting a downward trend on the site.

Frequency (%), BLKROC_51

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Perennial Forb	**GLLE3**	32	2	12	27	8	5	7	6
	SUMO	0	0	0	2	0	0	0	0
Perennial Graminoid	**DISP**	100	85	70	114	73	58	51	33*
	SPAI	34	21	27	45	18	43	36	38
Shrubs	**ALOC2**	0	0	0	1	0	0	3	3
	ATTO	15	56	42	38	8	3	4	4
	ERNA10	8	2	0	11	1	5	4	4
	SAVE4	0	0	0	0	0	0	2	2

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

Cover (m) Shrubs BLKROC_51

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	25.9	6.2	11.8	7.9	4.6	5.4	3.7
ERNA10	2.1	0.5	4.1	4.1	3.3	5.3	6.4
SAVE4	0.0	0.0	0.4	0.3	0.0	0.0	0.3
Total	28.0	6.8	16.3	12.3	7.9	10.6	10.4

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 only begun to show signs of recovery since the return of flows in December 2006 with a significant upsurge in saltgrass. 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. There is a disappearance of all annual forbs that is a result of the increased canopy cover of Nevada saltbush and bassia. Shrub cover has more than doubled on the site in 2013 but is now declining in 2016.

Frequency (%), BLKROC_15

Frequency	Species	2003	2004	2005	2007	2009	2010	2013	2016
Annual Forb	**ATTR**	0	0	16	0	0	0	0	0
	CHIN2	14	4	29	0	0	0	0	0
	ERAM2	0	0	5	0	0	0	0	0
	GITR	0	0	4	0	0	0	0	0
	LEFL2	0	0	3	0	0	0	0	0
	MEAL6	0	0	21	0	0	0	0	0
	NADE	0	0	1	0	0	0	0	0
Perennial Forb	**SUMO**	15	18	39	31	32	37	18	6*
Perennial Graminoid	**DISP**	25	21	19	14	3	11	24	71*
Shrubs	**ATTO**	48	35	80	29	47	58	39	16*
	SAVE4	2	9	2	6	5	8	13	17
Nonnative Species	**BAHY**	6	2	17	0	23	35	0	0
	DESO2	0	3	10	0	0	0	0	0
	SATR12	0	1	2	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_15

Shrub Cover (m)	2003	2004	2005	2007	2009	2010	2013	2016
ATTO	25.4	15.1	19.3	32.9	34.8	39.9	54.7	39.0
SAVE4	10.1	8.0	6.6	7.6	9.1	9.8	4.7	14.0
SUMO	1.8	1.2	0.9	20.3	23.7	32.2	0.0	0.0
Total	37.3	24.3	26.8	60.8	67.6	81.9	59.4	53.0

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 2010 and 2013. Canopy cover of Nevada saltbush increased substantially in 2010 and decreased slightly in 2013 and continues to decrease in 2016 there is a corresponding frequency trend for Nevada saltbush in 2016.

Frequency (%), BLKROC_17

Frequency	Species	2003	2004	2005	2007	2009	2010	2013	2016
Annual Forb	**ATSES**	12	0	8	0	0	5	0	0
	ATTR	3	0	31	0	0	0	0	0
	CHIN2	13	10	40	0	0	0	0	0
	CHLE4	0	0	1	0	0	0	0	0
	CRCI2	0	0	4	0	0	0	0	0
	ERIOG	0	0	0	0	0	3	0	0
	ERWI	0	0	7	0	0	0	0	0
	GITR	0	0	32	0	0	0	0	0
	LEFL2	0	0	54	0	0	0	0	0
	MEAL6	0	0	29	0	0	0	0	0
Perennial Forb	**HECU3**	0	0	0	0	0	0	2	3
Perennial Graminoid	**HOJU**	0	0	2	0	0	0	0	0
Shrubs	**ATTO**	70	34	74	45	49	54	52	23*
Nonnative Species	**BAHY**	0	0	0	0	0	5	0	0
	DESO2	0	0	6	0	0	0	0	0
	SATR12	9	10	6	0	3	5	0	0

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

Cover (m) Shrubs BLKROC_17

Shrub Cover (m)	2003	2004	2005	2007	2009	2010	2013	2016
ATTO	37.5	5.7	5.6	28.0	37.7	69.3	66.1	44.6
SAVE4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Total	37.5	5.7	5.6	28.0	37.7	69.3	66.1	45.0

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 and continued to increase again in 2013. Alkali sacaton frequency decreased while saltgrass remained static on the site. The site has dried out again in 2016, particularly

for key grass species. Rabbitbrush cover continues to increase on the site. The site is exposed to inconsistent runoff from upslope stockwater sources. This variability in surface water is the principle driver for the decline in perennial graminoids on the site.

Frequency (%), BLKROC_04

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**CHHI**	0	2	0	0	0	0	0	0
	COMAC	0	23	0	0	0	3	0	0
	HEAN3	0	8	0	4	6	12	0	0
Perennial Forb	**ANCA10**	11.9	18	17	22	22	16	21	16
	HECU3	0	0	0	1	3	0	0	0
	MALE3	14	3	8	10	1	0	1	0
	PYRA	41	50	44	23	28	15	18	16
Perennial Graminoid	**CADO2**	5	18	0	5	0	0	0	3
	CAREX	0	0	0	0	14	1	12	0
	DISP	83	77	70	76	62	62	65	48*
	JUBA	88	113	93	73	95	89	98	70*
	LETR5	27	65	43	48	70	26	35	16*
	SPAI	70	30	73	59	27	56	42	39
	SPGR	0	0	0	0	0	0	1	0
Shrubs	**ALOC2**	5.1	0	0	0	2	1	1	2
	ATTO	0	5	0	0	4	3	0	0
	ERNA10	0	3	2	2	3	2	6	7
Nonnative Species	**BAHY**	0	12	6	0	20	30	1	0
	POMO5	0	2	0	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_04

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ALOC2	0.0	0.0	0.0	0.0	0.4	0.0	1.5
ATTO	0.3	0.0	0.0	0.7	0.1	0.0	0.0
ERNA10	3.4	2.8	5.6	7.9	2.3	5.8	8.1
Total	3.6	2.8	5.6	8.6	2.9	5.8	9.6

North Riparian Field

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 was 57% for 2006-07. With the exception of saltgrass there were no significant departures in frequency when compared to previous years and the site remains static.

Frequency (%), BLKROC_22

Frequency	Species	2006	2007	2009	2010	2013	2016
Perennial Forb	**SUMO**	3	6	2	5	3	4
Perennial Graminoid	**DISP**	124	111	125	128	123	141*
	SPAI	4	4	3	2	5	4
Shrubs	**ALOC2**	4	4	10	9	8	7
	ATTO	21	7	19	20	7	9
	ERNA10	5	4	11	8	2	3
Nonnative Species	**BAHY**	11	0	9	1	0	0

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

Cover (m) Shrubs BLKROC_22

Shrub Cover (m)	2006	2007	2009	2010	2013	2016
ALOC2	3.3	2.3	0.0	5.0	0.0	5.2
ATTO	11.4	9.9	9.6	5.5	9.1	8.8
ERNA10	8.0	9.1	6.9	7.0	3.9	3.8
SUMO	0.9	0.5	0.6	0.1	0.0	0.0
Total	23.6	21.9	17.1	17.6	13.0	17.8

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% during the baseline period of 2002-2007. 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%. Shrub cover is steadily increasing on the meadow.

Frequency (%), BLKROC_13

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**HEAN3**	0	0	0	1	2	7	3	0
Perennial Forb	**ANCA10**	6.8	5	11	13	13	16	14	11
	GLLE3	0	0	0	0	0	0	1	0
Perennial Graminoid	**DISP**	129	139	128	128	121	120	103	95
	JUBA	22	6	13	22	19	19	0	6
	LETR5	7	0	0	14	20	23	30	20
	SPAI	34	40	36	37	34	28	23	31
Shrubs	**ATTO**	0	12	5	8	1	5	3	4
	ERNA10	0	0	4	3	0	0	3	0

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

Cover (m) Shrubs BLKROC_13

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	4.0	3.1	8.7	7.6	8.1	6.0	16.9
ERNA10	0.0	0.4	2.4	2.5	2.8	4.2	6.3
Total	4.0	3.5	11.1	10.1	10.9	10.2	23.2

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 significantly over the six sampling periods with the exception of Nevada saltbush in 2010 and a decrease in alkali sacaton in 2016.

Frequency (%), BLKROC_23

Frequency	Species	2006	2007	2009	2010	2013	2016
Annual Forb	**ATSES**	18	0	0	0	3	0
Perennial Graminoid	**DISP**	139	133	139	135	127	121
	SPAI	25	28	28	24	35	17*
Shrubs	**ATTO**	0	0	0	32	1	2
Nonnative Species	**BAHY**	4	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_23

Shrub Cover (m)	2006	2007	2009	2010	2013	2016
ATTO	1.0	0.8	0.6	1.6	1.3	1.5
ERNA10	0.0	0.0	0.0	0.0	0.2	0.6
Total	1.0	0.8	0.6	1.6	1.5	2.1

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 appear static with the exception of saltgrass which has declined to its lowest frequency value observed since monitoring began in 2002. Shrub cover (rubber rabbitbrush) and density at the study plot continues to show a gradual decline.

Frequency (%), BLKROC_05

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**ATPH**	0	3	0	0	0	0	0	1
	ATSES	0	11	0	2	0	0	0	0
	CLEOM2	0	16	0	0	0	0	0	0
	COMAC	0	17	0	3	0	0	0	3
	HEAN3	3	11	0	6	0	2	0	6
Perennial Forb	**GLLE3**	0	0	0	0	0	0	4	0
	PYRA	32	45	37	5	8	3	10	9
	SICO2	0	2	0	0	0	0	0	0
Perennial Graminoid	**DISP**	49	63	49	49	78	52	55	39*
	JUBA	7	14	14	10	10	6	9	11
	LECI4	0	0	0	0	4	0	0	0
	LETR5	0	0	0	0	0	4	4	3
	SPAI	124	125	115	123	111	131	124	119
Shrubs	**ATTO**	0	2	0	0	0	4	0	0
	ERNA10	7	4	1	0	1	0	0	0
Nonnative Species	**BAHY**	0	0	0	11	3	0	0	0
	POMO5	0	4	0	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_05

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ERNA10	7.6	6.3	2.1	0.8	0.5	0.3	0.1

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 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 remain static. Shrub cover and density appear to be stable on the site.

Frequency (%), BLKROC_07

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**ATPH**	0	30	0	0	0	19	0	3
	CHHI	0	8	0	0	0	0	0	0
	CLEOM2	0	3	0	0	0	0	0	0
	COMAC	0	26	0	0	0	5	0	0
Perennial Forb	**ANCA10**	5	4	4	2	4	2	2	2
	PYRA	118	4	0	2	1	0	0	1
Perennial Graminoid	**DISP**	73	80	75	77	66	70	69	65
	JUBA	17	26	37	27	13	9	16	7
	SPAI	95	78	71	76	76	85	80	73
Shrubs	**ATTO**	0	8	9	4	10	6	2	1
	ERNA10	20	19	6	8	9	14	9	7
	SAEX	0	0	0	2	0	0	0	0

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

Cover (m) Shrubs BLKROC_07

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	0.0	0.0	0.5	0.2	0.3	0.0	0.0
ERNA10	3.6	2.9	3.0	1.9	1.6	2.6	1.6
SUMO	0.0	0.4	0.7	0.3	0.0	0.0	0.0
Total	3.6	3.2	4.2	2.3	1.9	2.6	1.6

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. Frequency values have remained static.

Frequency (%), BLKROC_06

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**ATPH**	0	30	0	0	0	19	0	3
	CHHI	0	8	0	0	0	0	0	0
	CLEOM2	0	3	0	0	0	0	0	0
	COMAC	0	26	0	0	0	5	0	0
Perennial Forb	**ANCA10**	5	4	4	2	4	2	2	2
	PYRA	19	4	0	2	1	0	0	1
Perennial Graminoid	**DISP**	73	80	75	77	66	70	69	65
	JUBA	17	26	37	27	13	9	16	7
	SPAI	95	78	71	76	76	85	80	73
Shrubs	**ATTO**	0	8	9	4	10	6	2	1
	ERNA10	20	19	6	8	9	14	9	7
	SAEX	0	0	0	2	0	0	0	0

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

Cover (m) Shrubs BLKROC_06

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	3.3	0.7	1.0	2.1	1.3	3.1	4.6
ERNA10	17.3	9.1	9.9	9.5	9.8	6.9	8.9
SAEX	2.3	7.5	3.3	0.7	0.1	0.5	0.4
SAGO	0.0	0.0	0.0	0.0	0.0	0.0	0.7
SALIX	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total	23.0	18.0	14.2	12.3	11.2	10.5	14.5

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, in 2013 values rose to the highest seen on the site but have decreased significantly in 2016.

Frequency (%), BLKROC_18

Frequency	Species	2003	2004	2005	2007	2009	2010	2013	2016
Annual Forb	**ATSES**	3	0	0	0	0	0	0	0
	ATTR	0	0	0	0	0	0	0	0
	CHLE4	0	0	5	0	0	0	0	0
	GITR	0	0	4	0	0	0	0	0
Perennial Forb	**GLLE3**	3	6	9	4	1	4	0	0
Perennial Graminoid	**DISP**	119	104	114	118	102	86	120	104*
	SCAM6	0	0	0	0	0	0	8	12
	SPAI	4	16	20	12	21	37	17	25
	TYLA	0	0	0	0	3	3	0	4
Shrubs	**ATTO**	33	12	24	19	20	13	6	0
	ERNA10	1	2	10	1	0	5	2	0
Nonnative Species	**BAHY**	14	10	45	0	0	0	0	0
	SATR12	0	0	3	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_18

Shrub Cover (m)	2003	2004	2005	2007	2009	2010	2013	2016
ATTO	17.0	3.5	5.5	29.1	15.2	11.1	3.8	21.9
ERNA10	4.9	2.8	3.5	5.7	4.0	5.5	6.6	6.3
Total	21.9	6.3	9.0	34.8	19.2	16.6	10.4	28.2

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%. Plant frequencies are static.

Frequency (%), BLKROC_19

Frequency	Species	2003	2004	2005	2007	2009	2010	2013	2016
Annual Forb	**ATSES**	4	0	0	0	0	0	0	0
	ATTR	0	0	2	0	0	0	0	0
	CHLE4	0	0	6	0	0	0	0	0
	GITR	0	0	5	0	0	0	0	0
Perennial Graminoid	**DISP**	139	147	139	127	143	132	122	136
	JUBA	13	20	6	26	21	14	24	15
	LETR5	3	0	1	0	0	0	0	0
	SPAI	9	8	12	10	10	26	9	13
Shrubs	**ATTO**	0	6	31	24	18	12	15	8
	ERNA10	0	3	5	0	3	3	0	1

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

Cover (m) Shrubs BLKROC_19

Shrub Cover (m)	2003	2004	2005	2007	2009	2010	2013	2016
ATPO	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATTO	3.6	1.5	2.9	8.8	13.6	11.8	8.1	9.5
ERNA10	2.0	2.1	0.9	1.8	3.1	4.5	3.2	1.4
Total	6.3	3.6	3.8	10.6	16.7	16.3	11.2	10.9

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 continued to increase beyond baseline parameters in 2010 but then dropped significantly in 2013 and then increased in 2016. Nevada saltbush cover and density have steadily increased since 2005 until 2013 where a decrease in cover occurred but subsequently risen in 2016.

Frequency (%), BLKROC_20

Frequency	Species	2003	2004	2005	2007	2009	2010	2013	2016
Annual Forb	**ATTR**	0	0	7	0	0	0	0	0
Perennial Graminoid	**DISP**	127	147	143	126	123	123	118	122
	LETR5	18	29	30	31	59	70	27	52*
	SPAI	5	4	5	5	5	0	1	2
Shrubs	**ATTO**	6	2	27	19	18	15	9	1
	ERNA10	0	1	1	0	3	1	1	0
Nonnative Species	**BAHY**	5	0	6	0	16	33	0	0

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

Cover (m) Shrubs BLKROC_20

Shrub Cover (m)	2003	2004	2005	2007	2009	2010	2013	2016
ATTO	8.8	6.8	17.0	27.1	30.3	27.9	9.6	14
ERNA10	8.6	8.3	6.4	6.5	6.4	11.8	7.2	5.9
SAVE4	0.0	0.1	0.0	0.3	0.7	0.4	1.3	0
SUMO	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0
Total	17.5	15.3	23.4	33.8	37.3	40.1	18.1	20

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. Trends remain static.

Frequency (%), BLKROC_09

Frequency	Species	2002	2003	2007	2009	2010	2013	2016
Annual Forb	**2FORB**	0	2	0	0	0	0	0
	COMAC	0	2	0	0	0	0	0
	ERAM2	0	0	2	0	0	0	0
Perennial Forb	**APCA**	0	0	4	0	0	3	0
	ASTER	0	0	0	0	0	0	0
	GLLE3	1.7	7	1	4	2	1	1
	STEPH	0	0	0	0	0	0	0
Perennial Graminoid	**DISP**	114	102	85	99	104	124	106*
	JUBA	56	55	57	65	65	59	48
	LECI4	0	0	4	0	0	0	0
	LETR5	5	5	7	10	9	5	0
	SPAI	87	66	80	68	69	74	77
Shrubs	**ATTO**	34	46	16	24	15	9	7
	ERNA10	25	36	39	44	36	44	34*
	MACA17	0	0	4	1	0	0	2
	PSAR4	0	3	0	0	0	0	0

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

Cover (m) Shrubs BLKROC_09

Shrub Cover (m)	2003	2007	2009	2010	2013	2016
ATTO	25.2	9.1	8.9	2.9	0.6	3.1
ERNA10	10.1	9.5	10.3	8.8	8.8	10.2
Total	35.3	18.7	19.2	11.7	9.4	13.2

Irrigated Pastures

There are no irrigated pastures on the Blackrock Lease.

Stockwater Sites

One new stockwater well will be drilled south of Mazourka Canyon road. It will be fitted with a solar pump and necessary plumbing for the trough. The lessee will be responsible for water troughs and installation. There are also three other stockwater sites that have been developed as part of *the 1997 Memorandum of Understanding Between the City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, the Owens Valley Committee, and Carla Scheidlinger*, (MOU), which required additional mitigation (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.

Fencing

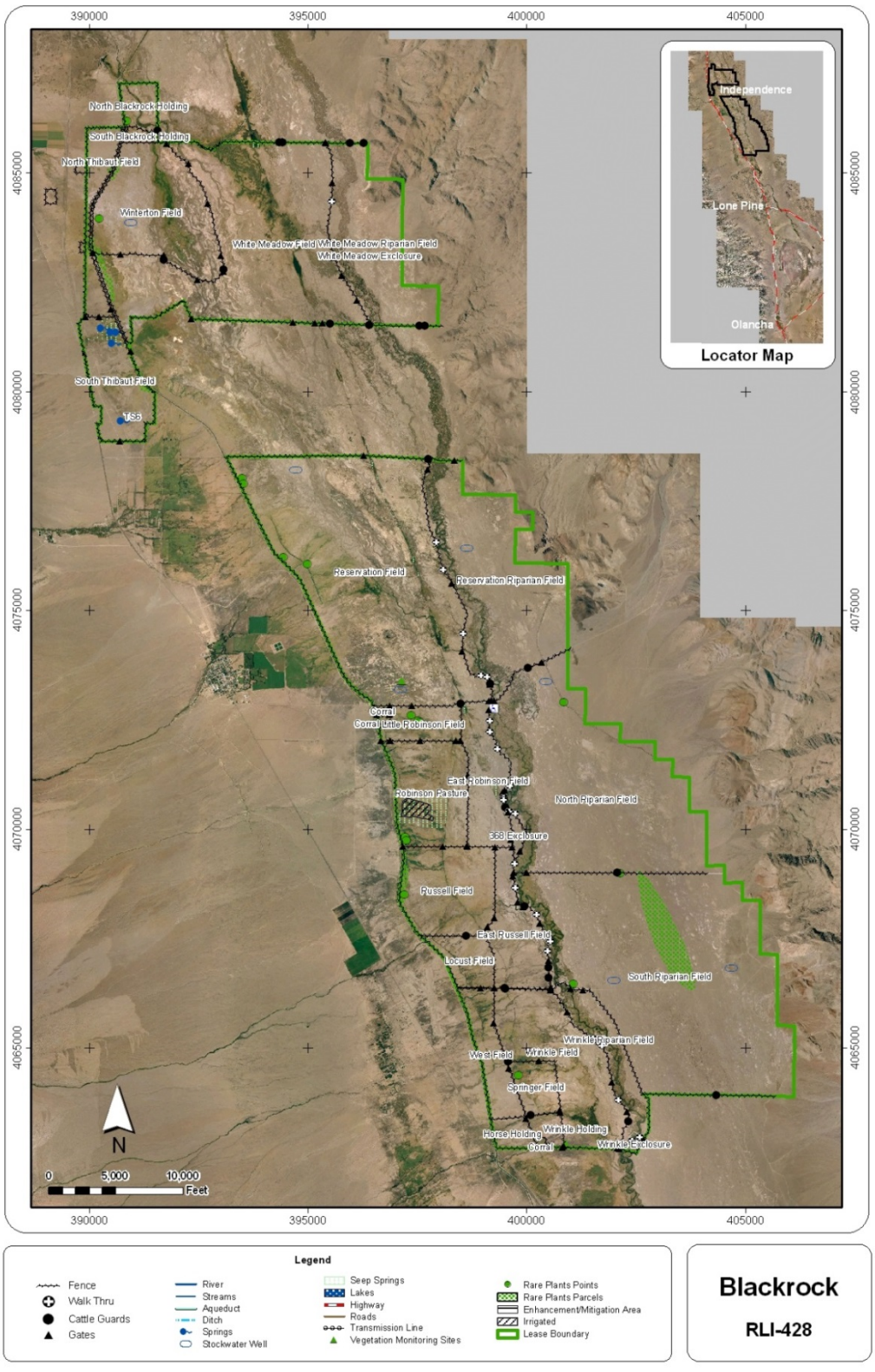
There was no new fencing constructed on the lease in 2016.

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 to better distribute cattle within and near the newly created riparian pastures. A liquid molasses protein is placed in portable feeding stations at these locations.

Burning

A range burn was conducted by LADWP of approximately 210 acres in the White Meadow Field. The burn was set up in two units northern and southern. The northern unit (50 acres) was completed in 2015. The southern unit (145 acres) was completed in 2016.



Land Management Figure 3. Blackrock Lease

4.5.4 Thibaut Lease

The 5,259-acre Thibaut Lease is utilized by three lessees for wintering pack stock. Historically, the lease 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 Blackrock Waterfowl Management Area, Rare Plant Management Area, Thibaut Field, and the Thibaut Riparian Exclosure. Management differs among these areas. The Blackrock Waterfowl Management Area can be grazed every other year. During the wetted cycle of the Blackrock Waterfowl Management Area, management has a utilization standard of 40%. While in dry cycles the utilization standard is 65%. 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 utilization transects. Range trend was not conducted on the Thibaut Lease in 2016.

Summary of Utilization

The following tables present the summarized utilization data for each field for the current year.

End of Grazing Season Utilization for Fields on the Thibaut Lease, RLI-430, 2016

Fields	Utilization
Rare Plant Management Area	25%
Thibaut Field	19%
Waterfowl Management Area	8%

**Riparian utilization 40% **

Riparian Management Areas

The riparian pasture for the Thibaut Lease has been excluded from grazing since the implementation of the LORP project. It is our recommendation that a smaller exclosure be constructed inside the riparian pasture similar to those located on the Blackrock Lease, and that livestock be permitted to utilize the pasture.

Upland Management Areas

The end-of-season use in the Thibaut Field was 19%. Use in the Rare Plant Management Area was 25%, which is well below the allowable utilization grazing standard. The Waterfowl Management Area was 8% and livestock were removed in December. Watershed Resources allowed the livestock to return in the spring to graze the Waterfowl Management Area to control tule growth.

Summary of Range Trend Data and Conditions

Range trend sampling did not occur on this lease in 2016.

Irrigated Pastures

Irrigated Pasture Condition Scores 2011-16

Pasture	2011	2012	2013	2014	2015	2016
Thibaut Field	82%	81%	78%	X	X	80%

X indicates no evaluation made

No irrigated pasture evaluations were conducted from 2014-15 due to drought conditions. The irrigated pasture in the Thibaut Field met the minimum standard of 80% in 2016.

Stockwater Sites

Stockwater is provided by the aqueduct and a stockwater well located in the Thibaut Field.

Fencing

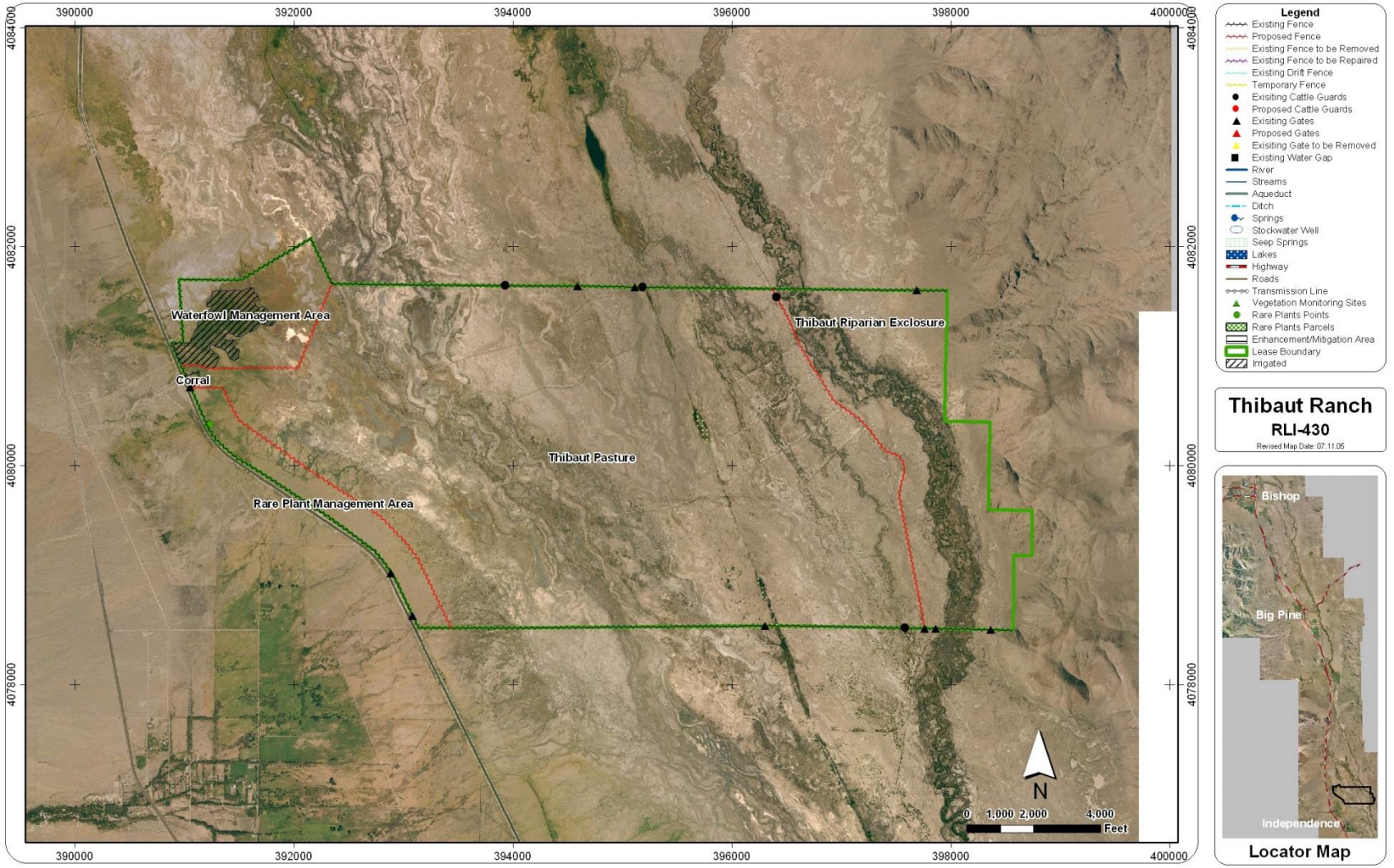
There was no new fencing on the lease in 2016.

Salt and Supplement Sites

Horses and mules are fed hay in the winter. There no established supplement sites on the lease.

Burning

There was no burning on the lease in 2016.



Land Management Figure 4. Thibaut Lease

4.5.5 Islands Lease

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 within 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

The Bull Field, Reinhackle Field, and Bull Pasture are spring dominated pastures and are evaluated based on a pasture condition score.

Summary of Utilization

The following tables present the summarized utilization data for each pasture for the current year.

End of Grazing Season Utilization for Fields on the Islands Lease, RLI-489 2016

Fields	Utilization
Carasco Riparian Field*	41%
Depot Riparian Field*	41%
Lubkin Field	34%
River Field *	15%
South Field	26%

**Riparian utilization 40%*

Riparian Management Areas

On the Islands Lease all transects were evaluated. Use in the Depot Riparian Field was 41% and the River Field was 15%. The Depot Riparian Field showed an improvement staying at the allowable riparian grazing standard. The Carasco Riparian showed a substantial increase in utilization but stayed within allowable standards. This increase in utilization is caused by the loss of the River Field meadow habitat, due to flooding.

Measurement of utilization is no longer feasible due to the complete loss of the native forage species in the River Field. The South Field received limited grazing due to the short spring green up in 2016 and was below the utilization standards.

Upland Management Areas

All upland pastures are well below the allowable 65% utilization rate.

Summary of Range Trend Data in Islands Exclosure

Range trend transects were not sampled in 2016.

Irrigated Pastures

Irrigated Pasture Condition Scores 2011-16

Pasture	2011	2012	2013	2014	2015	2016
B Pasture	X	90%	90%	X	X	88%
D Pasture	X	90%	90%	X	X	88%

X indicates no evaluation made.

The B and D Pastures located near Reinhackle Spring were rated in 2013 and received an irrigated pasture condition score of 90%. No evaluations were conducted in 2014-15 due to drought conditions. The B and D Pastures rated 88% in 2016. There are no management changes recommended.

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. These wells were drilled in 2010 and are now operational. The lessee has not yet installed the water troughs at the wells.

Fencing

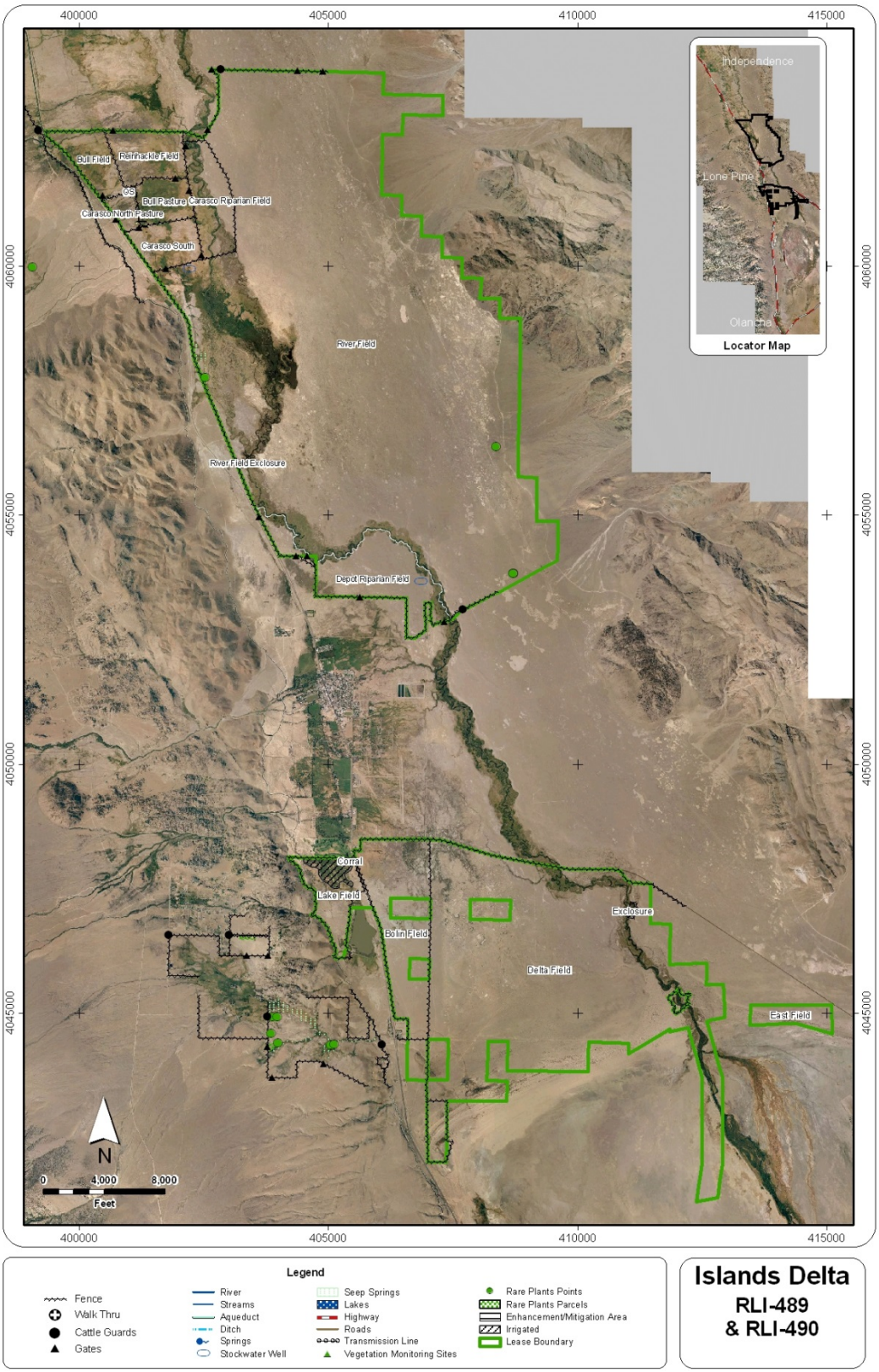
There was no new fence constructed on the lease in 2016.

Salt and Supplement Sites

Cake blocks and molasses tubs that contain trace minerals and protein are distributed for supplement on the lease. The blocks and tubs are dispersed randomly each time and if uneaten they are collected to be used in other areas.

Burning

There were no range burns conducted on the lease in 2016.



Land Management Figure 5. Islands Delta Leases

4.5.6 Lone Pine Lease

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 to Forest Service grazing allotments on the Kern Plateau.

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

Two of these pastures contain utilization and range trend transects. The remaining nine pastures/fields are irrigated pastures, holding pastures for cattle processing or parts of the actual operating facilities. As outlined in the lease management plans, holding pastures, traps, and corrals are not monitored because of their small size and/or their role in operations. Irrigated pastures are evaluated using the Irrigated Pasture Condition protocol.

Summary of Utilization

The following tables present the summarized utilization data for each pasture for the current year.

End of Grazing Season Utilization for Pastures and Fields, Lone Pine Lease, RLI-456, 2016

Pastures	Utilization
Johnson Pasture	21%
River Field - Lone Pine*	30%

*Riparian utilization 40%**

Riparian Management Area

The River Field utilization was 30%; grazing was elevated on LONEPINE_3 (45%). This is due to the location of the transect and how the cattle graze the area. It will be an ongoing process to reduce utilization on transects. Recovery from the burn in 2013 is continuing; herbaceous vegetation has recovered significantly but the recovery of tree willow is still in process.

The Johnson Pasture had limited use during spring green-up. Utilization reached 21%, below the allowable upland standard of 65%.

Summary of Range Trend Data and Conditions

Range trend transects were not read in 2016.

Irrigated Pastures

Irrigated Pasture Condition Scores 2011-16

Pasture	2011	2012	2013	2014	2015	2016
Edwards	X	X	84%	X	X	84%
Richards	X	X	84%	X	X	84%
Van Norman	X	X	84%	X	X	84%
Smith	X	X	84%	X	X	84%
Old Place	X	X	84%	X	X	76%

X indicates no evaluation made

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 the pastures were rated in 2013 and were above the required minimum irrigated pasture condition score of 80%, despite a dry year and lack of irrigation water. No evaluations were conducted in 2014-15 due to drought conditions. Irrigated pasture evaluations were conducted in 2016 and all pastures except the Old Place rated above the minimum score of 80%. The Old Place pasture needs more irrigation water and better distribution.

Stockwater Sites

One stockwater well was drilled on the Lone Pine Lease located in the River Pasture uplands, approximately two miles east of the river on an existing playa. The lessee had made an effort to install a trough but the well had a silting problem that plugged the pipes and floats. Watershed Resources staff and pump mechanics assessed the condition of the well and determined that the well was not drilled deep enough and is not operable. A new well location has been selected a quarter of a mile south of the current location and is planned to be drilled in 2017.

Fencing

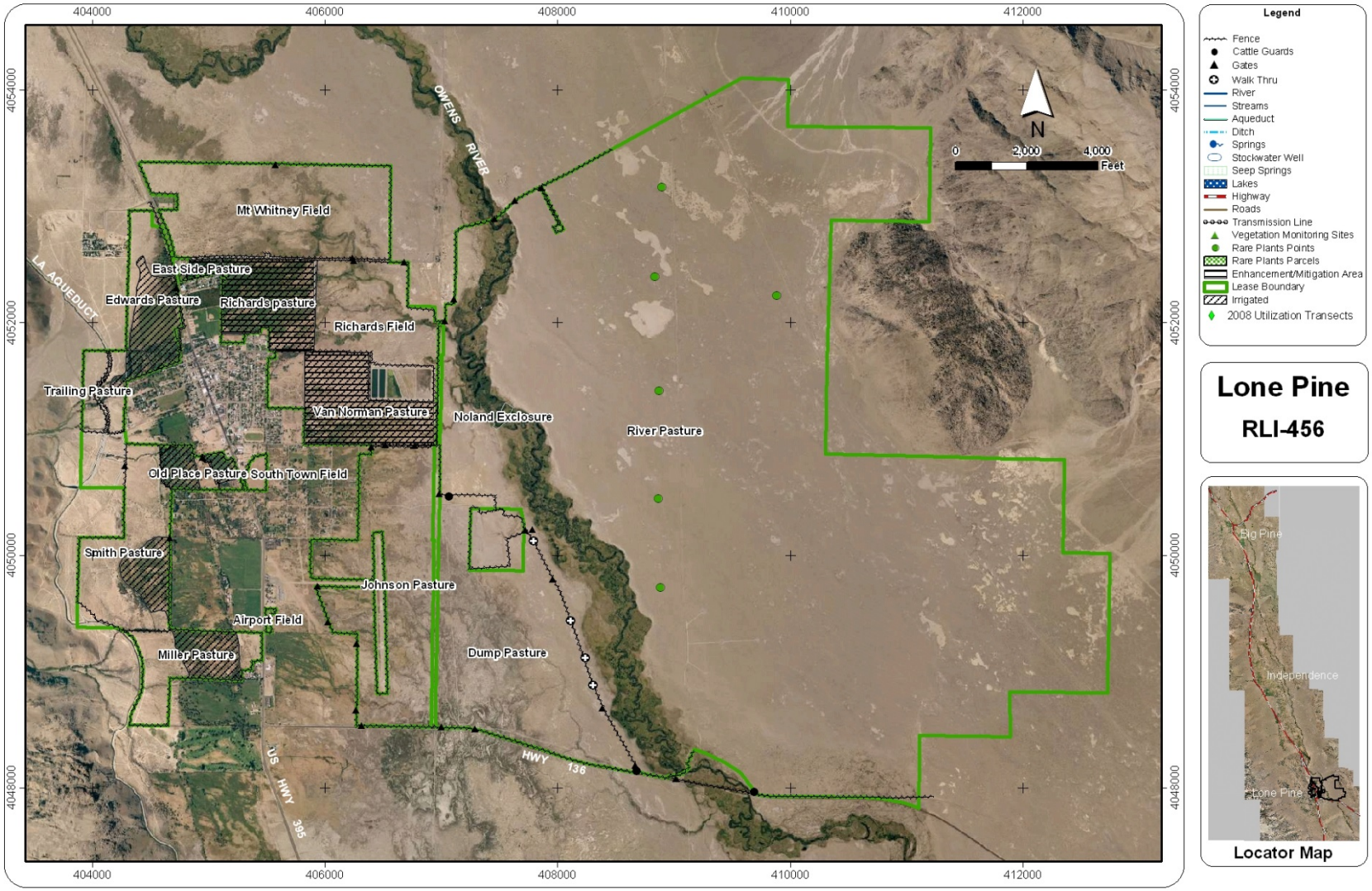
There was no new fencing constructed on the lease during 2016. Repairs have been made to the existing exclosure due to the fire in 2013.

Salt and Supplement Sites

All supplement tubs were situated outside of the flood plain.

Burning

There were no burns conducted on the Lone Pine Lease in 2016.



Land Management Figure 6. Lone Pine Lease

4.5.7 Delta Lease

The Delta Lease is a cow/calf operation and consists of 7,110 acres divided into four fields within 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 concurrently with California State Lands Commission leases.

Grazing utilization is currently only conducted in the Bolin Field and 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 field for the current year.

End of Grazing Season Utilization for Fields on the Delta Lease, RLI-490, 2016

Fields	Utilization
Main Delta Field*	49%
Bolin Field	0%

*Riparian utilization 40%**

Riparian Management Areas

End-of-season utilization in the Main Delta Field was 49%, over the allowable riparian standard of 40%. Use on all transects except for Delta_7 was well above the 40% standard (53-63%); this 49% average overall was weighted by the 20% use on Delta_7. Utilization was nearing 40% during the mid-season evaluations and the lessee was notified verbally and by letter with recommendations to move livestock prior to the end-of-season. Livestock were not moved by the lessee and utilization was exceeded in the Main Delta Field.

It is a condition of the ranch lease to follow LADWP's grazing management plans. The lessee had gone over the 40% utilization standard in the Main Delta Field in seven of the past ten years, including 2016. Additionally, other pastures within the lease had exceeded utilization standards multiple times since implementation of the grazing plans without consequence. For these reasons, LADWP will require that the Main Delta Field receive a reduction in the allowable utilization standard to 30%. This will be for the 2016-17 grazing season only if all utilization standards across the lease are upheld. If the 30% utilization standard is exceeded in 2016-17, pastures in violation will be put into nonuse.

Upland Management Areas

The Bolin Field was 0%, well below the upland grazing utilization prescription of 65%. There were some monsoonal rains in the spring that allowed for cattle to utilize spring annuals in the Bolin Field. However the spring green-up was short-lived and utilization of the uplands was minimal.

Summary of Range Trend Data and Conditions

Range trend transects on the Delta Lease are located on Moist Floodplain ecological sites. 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 2013 with the exception of a decline in saltgrass on DELTA_02 which dropped below all previous levels. This decline remains apparent from 2013 to 2016. DELTA_02 is located inside a grazing exclosure. All other transects remained fairly static with no radical departures in frequency values from the previous range of variability.

Plant Frequencies for Delta Transects Between 2013 and 2016

	No Change	DISP	JUBA	ATTO	BAHY
Moist Flood Plain					
DELTA_01	↔				
DELTA_02	↔				
DELTA_04		↑			
DELTA_05	↔				
DELTA_07		↓			

*** Sites where change extends outside historical ranges for the transect.*
α<0.1, ↑=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 eight sampling periods.

Frequency (%), DELTA_01

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
	COMAC	0	0	0	0	0	0	0	4
Annual Forb	**CORA5**	0	0	0	0	0	0	2	0
	HEAN3	0	0	0	0	0	0	0	2
Perennial Forb	**ANCA10**	5	12	5	7	11	9	10	11
	NIOC2	10	5	7	4	3	8	5	7
	SUMO	7	0	1	0	0	0	0	0
Perennial Graminoid	**DISP**	156	152	149	152	155	151	150	143
	JUBA	0	7	11	10	9	6	6	9
	LETR5	0	1	0	0	0	0	0	0
	SPAI	3	0	13	11	16	11	10	6
Shrubs	**ATTO**	2	5	1	5	0	0	0	0
Nonnative Species	**BAHY**	0	0	2	0	2	1	0	0

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

Cover (m) Shrubs DELTA_01

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	3	1.8	3.9	1.1	0.2	0.1	0.4
SUMO	1	0.8	0.2	0.1	0.0	0.0	0.0
Total	4	2.7	4.1	1.2	0.2	0.1	0.4

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 2016 did not change when compared to 2013. However saltgrass remains at a low level during the past two sampling periods (2013 and 2016). Rubber rabbitbrush cover appears to be trending downwards. Because the transect is now within an exclosure, utilization was not sampled after 2008.

Frequency (%), DELTA_02

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Perennial Graminoid	**DISP**	108	118	131	103	115	114	89	80
Shrubs	**ATTO**	10	13	0	0	4	8	8	6
	ERNA10	10	9	12	0	1	4	3	2
Nonnative Species	**BAHY**	0	3	0	0	0	0	0	0

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

Cover (m) Shrubs DELTA_02

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	16.3	9.7	10.1	8.3	3.8	11.6	6.7
ERNA10	16.0	12.3	11.7	10.8	8.9	6.6	9.7
SUMO	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.6	22.0	21.8	19.0	12.8	18.1	16.4

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, saltgrass did increase in 2016.

Frequency (%), DELTA_04

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**ATPH**	0	7	0	0	4	4	0	0
Perennial Forb	**SUMO**	0	7	0	0	1	0	5	2
Perennial Graminoid	**DISP**	139	128	150	103	115	124	116	138*
	SPAI	0	5	6	0	0	0	0	0
Shrubs	**ATTO**	3	2	6	0	0	4	0	0
	SAVE4	0	0	0	0	0	0	0	0

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

Cover (m) Shrubs DELTA_04

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	3.6	2.3	3.1	5.3	6.1	1.7	2.4
SAVE4	0.3	0.6	0.2	0.2	0.9	0.0	0.5
SUMO	1.9	0.9	1.8	2.6	1.4	1.3	0.0
Total	5.9	3.8	5.1	8.1	8.3	3.0	2.8

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.

Frequency (%), DELTA_05

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Annual Forb	**HEAN3**	0	2	0	0	0	0	0	0
Perennial Forb	**ANCA10**	0	0	1	3	8	4	7	3
	NIOC2	7	0	2	0	0	2	6	2
	SUMO	14	2	23	19	16	20	11	7
Perennial Graminoid	**CADO2**	0	2	5	0	0	0	0	0
	CAREX	0	0	0	0	4	0	0	0
	DISP	155	146	163	135	144	142	135	132
	JUBA	9	9	12	13	23	23	13	7
	SCAM6	0	0	0	0	0	5	3	0
Shrubs	**ATTO**	0	6	5	0	1	0	0	0
Nonnative Species	**BAHY**	0	1	3	0	1	0	0	0
	LASE	0	10	0	0	0	0	0	0

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

Cover (m) shrubs DELTA_05

Shrub Cover (m)	2003	2004	2007	2009	2010	2013	2016
ATTO	6.5	3.4	4.8	5.9	6.1	2.6	0.5
ERNA10	0.0	0.0	0.6	1.2	1.0	0.0	0.0
SUMO	12.7	7.2	6.9	6.7	9.4	3.2	na
Total	19.2	10.6	12.2	13.8	16.6	5.8	0.5

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. This site has remained static.

Frequency (%), DELTA_07

Frequency	Species	2002	2003	2004	2007	2009	2010	2013	2016
Perennial Forb	SUMO	32	16	15	12	15	18	9	4
Perennial Graminoid	DISP	114	93	116	102	121	121	107	82*

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

Cover (m) Shrubs DELTA_07

Shrub Cover (m)	2003	2004	2007	2009	2010	2013
SUMO	25.1	10.3	27.0	32.8	33.1	17.9

Irrigated Pastures

Irrigated Pasture Condition Scores 2011-16

Pasture	2011	2012	2013	2014	2015	2016
Lake Field	X	X	74%	X	X	76%

X indicates no evaluation made

The Lake Field is located west of U.S. Highway 395 north of Diaz Lake. This irrigated pasture was evaluated in 2016 and received a score of 76%. This is below the allowable score of 80%. The main reason of the decreased condition of this pasture is decreased coverage of water spreading over the field water due to drought conditions. Watershed Resources staff does not believe a change in management is necessary at this time.

Stockwater Sites

The Bolin Field was supposed to receive a stockwater site supplied by the Lone Pine Visitors Center's well in 2010. After a more in-depth analysis of water availability, it was determined that there was not an adequate amount of water to sustain the visitor center and provide stockwater. Stockwater is supplied from a diversion that runs from Tuttle Creek.

Fencing

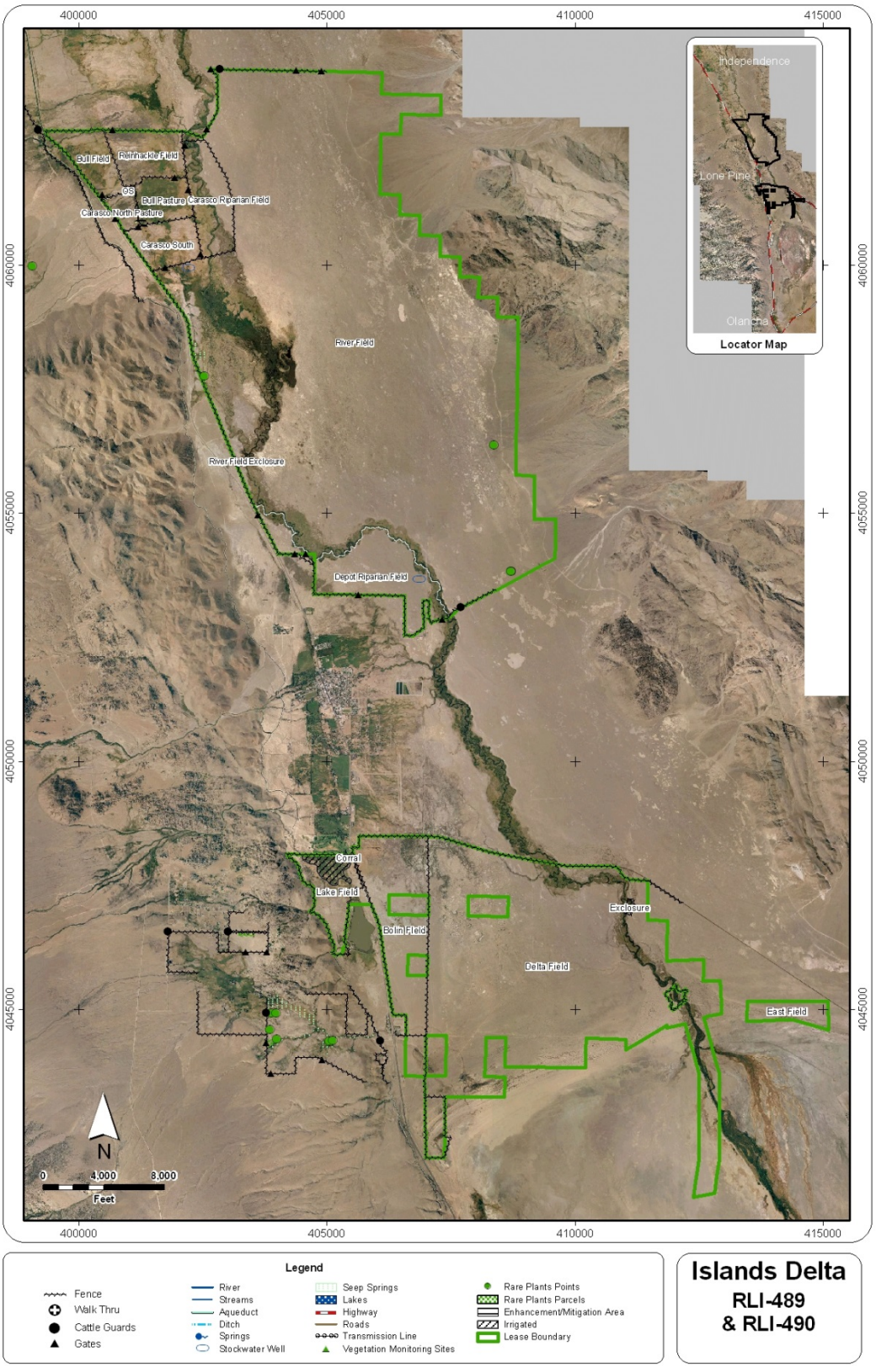
There was no new fencing on the lease for 2016.

Salt and Supplement Sites

Supplement tubs containing protein and trace minerals are used in established supplement sites. Empty tubs are collected by the lessee.

Burning

There were no burns on this lease during 2016.



Land Management Figure 7. Islands and Delta Leases

4.6 Land Management Conclusion

Utilization

Utilization on all leases continues to be consistent with grazing management plan utilization standards except the Delta lease. The Delta lessee had gone over the 40% utilization standard in the Main Delta Field in seven of the past ten years, including 2016. Additionally, other pastures within the lease had exceeded utilization standards multiple times since implementation of the grazing plans without consequence. For exceeding the riparian utilization standard for several consecutive years the Main Delta Field will be reduced to 30% utilization for the 2016-17 grazing season.

All ranch leases within the LORP project area are still destocked due to drought conditions, and will continue to graze below normal cattle numbers for 2016-17.

Range Trend

Riparian Management Areas

Range trend results point towards stable or upward trends on moist floodplain sites. The available riparian pasture forage production and health should continue to be productive. However, there are meadows inundated by the expanding back water effect of the Owens River. The greatest loss of meadow to marsh is in the Islands and to a lesser extent upstream on the lower sections of the Blackrock Lease. The effect is expanding wetland vegetation species, submerging juvenile woody recruitment, and inundating perennial grass meadows reducing, or eliminating available forage in some cases.

Upland Management Areas

Upland areas are going to continue a downward decline in production and health until there is relief from drought conditions. This will take several normal or above average precipitation years to improve conditions. There have been some monsoonal moisture events in the spring that have helped upland conditions but the hot and dry summer conditions in 2016 have decreased forage and shrub growth when compared to vegetation responses following above average monsoonal moisture in 2015 and 2014.

Irrigated Pastures

The moderate conditions of all irrigated pastures will continue due to persisting drought conditions. It will take several years of normal to above average precipitation to improve the condition of the irrigated pastures.

4.7 References

Bureau of Land Management. 1996. *Sampling Vegetation Attributes in Rangeland Analysis and Planning Guide*. BLM/RS/ST-96/002+1730. National Applied Resource Science Center, Reno, NV.

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.

Elzinga, C. L., D. W. Salzer, et al. 1988. *Measuring and Monitoring Plant Populations*. Denver, USDI, BLM.

Heywood, J. S. and M. D. DeBacker. 2007. *Optimal Sampling for Monitoring Plant Frequency.* Rangeland Ecology and Management 60: 426-434.

Holecheck, J.L., D. Galt. 2000. *Grazing Intensity Guidelines.* Rangelands 22(3): 11-14.

MOU. 1997. *Memorandum of Understanding Between the City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, the Owens Valley Committee, and Carla Scheidlinger.* Los Angeles Department of Water and Power. Bishop, Ca.

Mueller-Dombois, D. & Ellenberg, H. 1974. *Aims and Methods of Vegetation Ecology.* 547 pp. Wiley, N.Y.

National Resource Conservation Service (NRCS). 2001. *Guide to Pasture Condition Scoring.*

National Resource Conservation Service (NRCS). 2009. *The Plants Database* (http://plants.usda.gov, September 15, 2009). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Smith, S. D., S. C. Bunting, and M. Hironaka. 1986. *Sensitivity of Frequency Plots for Detecting Vegetation Change.* Northwest Science. 60: 279-286.

Smith, S. D., S. C. Bunting, and M. Hironaka. 1987. *Evaluation of the Improvement in Sensitivity of Nested Frequency Plots to Vegetation Change by Summation*. Great Basin Naturalist 47:299–307.

Smith, L., G. Ruyle, J. Maynard, W. Meyer, D. Stewart, B. Coulloudon, S. Williams, and J. Dyess. 2005. *Principles of Obtaining and Interpreting Utilization Data on Southwest Rangelands.* University of Arizona Cooperative Extension AZ1375. 10 pp.

5.0 RAPID ASSESSMENT SURVEY

Lower Owens River Project
2016 Rapid Assessment Survey

Observations

Owens River at Lone Pine near Narrow Gauge Road 2016

Lower Owens River Project
Summary of Rapid Assessment Survey Observations

A survey of the Lower Owens River Project (LORP) area, referred to as the Rapid Assessment Survey or RAS, is conducted annually beginning in August. This year, between August 3 and August 12, Inyo County staff with a representative from LADWP surveyed along the wetted edges of the water features in the LORP. These areas include the Lower Owens River, Blackrock Waterfowl Management Area (BWMA), Off-River Lakes and Ponds (OLP), and the Delta Habitat Area (DHA). The 578 observations recorded during this exercise are presented in this report.

The primary purpose of the RAS is to detect and record the locations of problems that can negatively affect the LORP. These are impacts that require physical maintenance such as repairing a damaged or cut fences, trash pickup, tamarisk slash pile removal, and herbicide treatment of noxious weeds.

Project managers and scientists also use RAS data as rough indicators of basic trends in the ecological development of the riparian and riverine environments, especially when RAS data is compiled with information gathered from other LORP studies. For example, RAS observations of woody recruitment can be considered along with river-edge belt transects, which are intended to look in greater detail at woody recruitment. The combined observations can help project managers understand how and where woody recruitment is taking place, and if it is persisting.

The observations recorded during the RAS are categorized by type and observation code in Table 1. The number of observations by impact type and LORP area are presented in Table 2.

Table 1. Catalog of impacts recorded by the RAS

Observation Code	Observation Type	Description
WDY	Woody Recruitment	This year's cohort of willow and cottonwood seedlings
TARA	Saltcedar	*Tamarisk* spp. seedlings, resprouts from previously treated plants and mature trees.
ELAN	Russian Olive	*Elaeagnus angustifolia*, seedlings and juveniles (height <1m).
NOX	Noxious Weeds	Any of twenty-one species of locally invasive plants, mainly perennial pepperweed
BEA	Beaver	Sightings or evidence of beaver in the LORP
ELK	Elk	*Cervus canadensis* ssp. *nannodes*, sightings or evidence of tule elk
FEN	Fence	Reports of damaged riparian or exclosure fencing
GRZ	Grazing	Evidence of (off-season) grazing in the floodplain.
REC	Recreational Impacts	Evidence of recreational activity and any adverse associated impacts
ROAD	Road	Previously unidentified roads, road building activities, or roads causing impacts
TRASH	Trash	Large refuse or dumping
SLASH	Slash	New piles of recently cut saltcedar slash

OBSTR	Obstructions	Obstructions to river flow
Other	Other	Other impacts

Table 2. Summary of observations collected by category and area; including Blackrock Waterfowl Management Area (BWMA); Off-River Lakes and Ponds (OLP); and the Delta Habitat Area (DHA).

Code	Observation Type	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	BWMA	OLP	DHA	Total Obs.
WDY	**Woody Recruitment**	3	2	7	0	0	0	0	3	0	15
TARA	**Saltcedar Plants (Tamarisk)**	9	88	55	18	10	12	66	65	19	342
ELAN	**Russian Olive Recruitment**	0	4	2	0	0	0	5	31	0	42
NOX	**Noxious Weeds (Lepidium)**	6	7	16	0	0	4	7	0	0	40
BEA	**Beaver**	1	1	7	2	0	1	0	0	0	12
ELK	**Elk**	0	0	1	4	6	26	9	0	6	52
FEN	**Fence**	0	2	0	0	0	0	0	0	0	2
GRZ	**Grazing**	0	2	3	1	0	0	0	0	2	8
REC	**Recreation Impacts & Use**	0	2	12	1	0	6	1	0	0	22
ROAD	**Road**	3	2	4	3	1	2	1	3	2	21
TRASH	**Trash**	1	1	5	1	0	2	2	0	0	12
SLASH*	**Slash**	0	0	0	0	0	0	0	4	0	4
OBST	**Obstructions**	0	1	0	0	0	0	0	0	0	1
OTHER	**Other**	0	1	1	0	0	0	0	3	0	5

[1] 38 of the 53 recruits discovered were clone derived narrowleaf willow (SAEX).

River-reaches and LORP units--*Table 3*

The Lower Owens River is divided up in to six river-reaches, which are defined by channel/ floodplain morphology, and hydrologic variables (Table 3, and "River-reaches and river-miles map"). For the RAS summary, these reaches offer a convenient way to describe a position on the river, and they serve as a common reference for RAS observations taken year to year. Further, individual observations in the river-riparian corridor are often referenced to the nearest tenth of a river-mile (RM). The Lower Owens River Intake is river-mile 0.0, the pumpback station is at river-mile 53.1, the Delta Habitat Area begins at river-mile 53.7, and the river recedes into the Owens Lake playa near river-mile 62.0.

When comparing the number of observations found per river-reach it is important to note that the lengths of the reaches are unequal, and that the number of observations by reach for the various categories has not been normalized to account for the different lengths of the reaches. For example, almost half of the woody recruitment observed was recorded in river-reaches 1, 2, 3, which together total just about half of river-miles in the entire river-riparian corridor. That said, it is significant that no tree willow or cottonwood recruitment was recorded below reach 3, from the Islands to the Delta.

Table 3. River reaches: comparisons of reach length, and river type.

	Percent of river length	Total River-miles (RM)	Mile Markers	Description
Reach 1	7%	4.2	0 to 4.2 RM	Wet Incised Floodplain
Reach 2	25%	15.6	4.2 to 19.8 RM	Dry Incised Floodplain
Reach 3	24%	15.1	19.8 to 34.9 RM	Wet Incised Floodplain
Reach 4	6%	3.9	35.0-38.8 RM	Aggraded Wet Floodplain
Reach 5	7%	4.2	38.8 to 43.0 RM	Wet Incised Floodplain
Reach 6	17%	10.7	43.0 to 53.7 RM	Graded Wet Floodplain
Delta Habitat Area (DHA)	13%	8.3	53.7 to 62.0 RM	Delta

Map 1. Lower Owens River Reaches/Off-River Management Units

Summary of Observations by Category

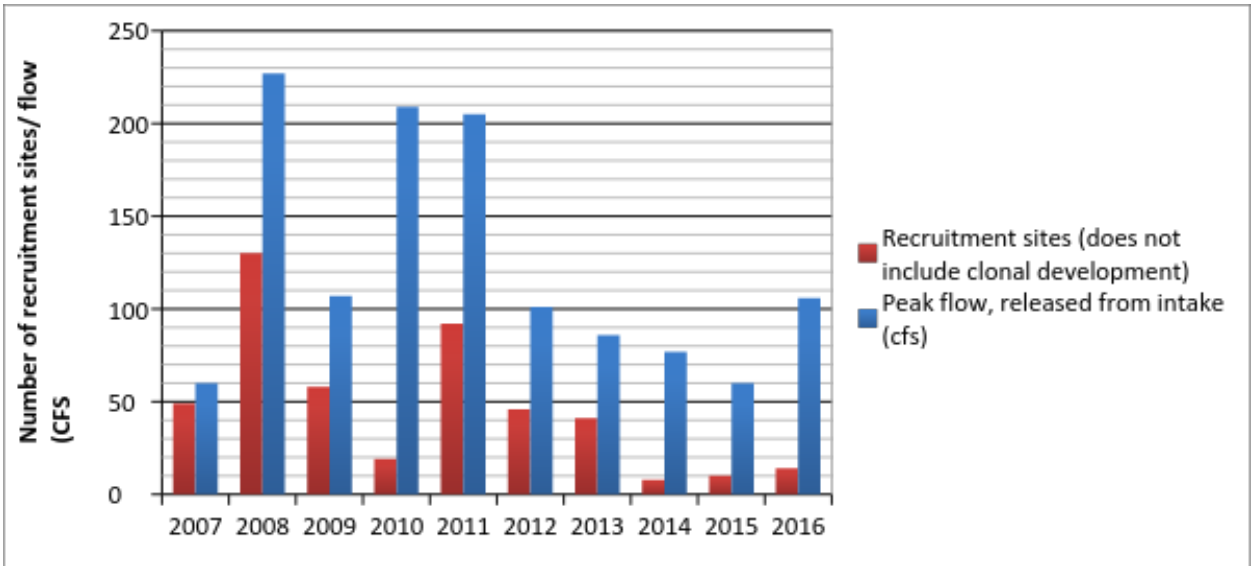
Woody Recruitment (WDY)*--Tables 4-6; Map 2; Figure 1*

Willows and cottonwood provide the vertical structural and diverse natural habitats that are essential to attracting many of the riverine/riparian avian habitat indicator species. These species are key indicators of the project's success. A focus of the RAS has been to identify areas where trees were establishing in the newly wetted areas of the LORP. RAS field staff is trained to locate, identify, and record willow and cottonwood recruits that are part of the current year's cohort. It's important to note that the recording and reporting of woody recruitment was often not consistent prior to 2011. The definition of a "woody recruit" for purposes of the RAS was not consistently handled until 2012. Prior to 2010, clonal reproduction of shrub willow (SAEX) by root sprouting was not differentiated from seed derived recruitment of tree willow, resulting in an over reporting of recruitment. In 2011, criteria were established to distinguish sexual from asexual SAEX development (SAEX recruitment ≥ 5 meters from a mature SAEX plant or stand would be considered non-clonal).

Notes:

- In 2016, observers located 10 tree willow recruits, one cottonwood recruit and four seedling SAEX recruits. This is close to the numbers observed last year.
- The majority of tree willow recruitment was located in the river-riparian corridor. The single cottonwood recruit and two other recruitment sites were found associated with an off-river lake (Map 2).

Figure 1. Seasonal habitat flow and woody recruitment observed 2007-2016



Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Recruitment sites (does not include clonal development)	49	130	58	19	92	46	41	8	10	14
Peak flow, released from intake (cfs)	60	227	107	209	205	101	86	77	60	106

There was no SHF in 2007, 2014, or 2015. The 2008 SHF was released in February. Flows shown 2013-2015 represent maximum flows released from the Intake in the mid-summer to compensate for ET losses and maintain a >40cfs flow throughout the river.

Table 4. Number of distinct non-clonal recruitment sites by species and reach

Species Code	Common Name/ Scientific Name	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	DHA	BWMA	OLP	Total
SAEX Seedling	Narrowleaf willow/ *Salix exigua*	3	1	0	0	0	0	0	0	0	**4**
SAGO	Black willow/ *Salix goodingii*	0	1	3	0	0	0	0	0	1	**5**
SALA3	Red willow/ *Salix laevigata*	0	0	4	0	0	0	0	0	1	**5**
SALIX	Tree species, hybrid, or unknown willow	0	0	0	0	0	0	0	0	0	**0**
POFR2	Fremont Cottonwood/*Populus fremontii*	0	0	0	0	0	0	0	0	1	**1**
Total number of Observations		**3**	**2**	**7**	**0**	**0**	**0**	**0**	**0**	**3**	**15**

Table 5. Plant abundance at recruitment sites

Species Code	Common Name	Abundance (number of plants per site)			
		1 to 5	6 to 25	26 to 100	>100
SAEX Seedling	Narrow leaf willow	4	0	0	0
SAGO	Black willow	4	0	1	0
SALA3	Red willow	3	1	0	0
SALIX	Hybrid or unknown	0	0	0	0
POFR2	Fremont Cottonwood	1	0	0	0

Table 6. Distribution of woody recruitment relative to landforms

Species Code	Common Name	Channel	Channel to Bank	Bank	Channel to Floodplain	Floodplain	Upland
SAEX Seedling	Narrow leaf willow	2	1	1	0	0	0
SAGO	Black willow	1	1	2	0	1	0
SALA3	Red willow	1	0	0	0	3	0
POFR2	Cottonwood	0	0	1	0	0	0

The RAS is conducted in August to be able to detect seedlings that may have germinated as the result of the annual LORP seasonal habitat flow (SHF), which is timed to accompanying willow seed-fly. Although there has not been a significant seasonal habitat flow since 2011, typically higher flows are released from the intake in mid-summer to compensate for downstream losses due to evapotranspiration. This is necessary in order to maintain a minimum 40 cfs flow throughout the river. These higher flows and resulting increase in stage especially in the upper two reaches may inundate low landforms and effect the survival of recruits.

Sites Revisited--*Map 9*

Field crews returned to specific sites where woody recruitment, new roads, and evidence of beaver were recorded in the previous year and noted the presence or absence of the subject. A total of 91 sites were revisited. The results from these revisits are found in this report in corresponding category sections.

Woody Recruitment Revisits

Table 8; Map 9

Woody recruitment sites found in 2015 were revisited in 2016. Of the 9 sites revisited 8 of last year's cohort were relocated.

Table 8. Revisit sites: persistence of woody recruitment identified in 2015 and revisited in 2016

Reach/Area	1	2	3	4	5	6	BWMA	OLP	DHA	Total
Present	-	5	1	-	-	1	0	1	-	8
Absent	-	0	0	-	-	0	1	0	-	1

Note: A survey of all recorded tree recruitment sites from 2007 to 2015 was undertaken in September 2015. This was done in order to get a perspective on the long-term persistence of tree willow and cottonwood found along the Owens River and Delta. This information is presented in the 2105 RAS report.

Saltcedar (TARA)--*Tables 8, 9, 10; Map 3*

Saltcedar (*Tamarix* spp.) is found throughout the LORP. It is the most abundant noxious weed in the project area. In 2016, TARA populations were found at 192 discrete locations on the river and at 150 off-river sites. These numbers are similar to last year's figures.

Notes:

- The total number of TARA observations in 2016 was similar to 2015. Notable was a 7% increase in River Reach 2.
- In the BWMA, Drew Winterton saw an increase in the number of high density populations. In the OLP, both Goose and Twin Lakes saw an increase in the number of high abundance populations.

Table 8. Total number of observation sites and age class of saltcedar by location in 2016

Age Class	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	DHA	BWMA	OLP	Total
Seedlings	5	34	5	0	0	2	0	4	5	**55**
Resprouts	1	15	35	8	9	6	12	7	35	**128**
Mature	3	39	15	10	1	4	7	55	25	**159**

Table 9. Saltcedar abundance by river-reach or LORP unit in 2016

Location	Abundance (number of plants per site)				
	1 to 5	6 to 25	26 to 100	>100	Total no. of sites
BWMA-Drew	13	5	1	0	**22**
BWMA-Thibaut	8	2	1	0	**12**
BWMA- Waggoner	7	1	2	2	**15**
BWMA-Winterton	12	3	2	1	**17**
Delta Habitat Area	14	4	1	0	**19**
Off River – Billy	3	1	0	0	**4**
Off River – Goose	20	4	1	4	**33**
Off River – Twin	20	6	2	5	**28**
Reach 1	9	0	0	0	**9**
Reach 2	67	18	2	1	**88**
Reach 3	48	4	3	0	**55**
Reach 4	16	2	0	0	**18**
Reach 5	9	1	0	0	**10**
Reach 6	12	0	0	0	**12**
Frequency of abundance	**258**	**51**	**15**	**18**	**342**

Table 10. Saltcedar Observations by River Reach in years 2010-2016

Year	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	River Total
2010	1	46	45	18	34	89	**233**
2011	12	88	119	57	34	40	**350**
2012	15	84	80	49	27	56	**311**
2013	11	152	88	13	17	55	**336**
2014	6	106	64	39	44	46	**305**
2015	10	95	55	20	8	16	**204**
2016	9	88	55	18	10	12	**192**

Russian Olive (ELAN)--*Table 11; Map 4*

Although Russian olive (*Elaeagnus angustifolia*) is not listed as a noxious weed in California, the California Invasive Plant Council considers this species highly invasive in riparian systems. All mature ELAN plants along the river and adjacent management units of the LORP have been

recorded in prior years. Documenting seedling or juvenile ELAN is the current focus (height less than 1 m). Most of the current recruitment is occurring in off-river sites, e.g., Drew Slough, Thibaut Ponds, Billy, Goose and Twin Lakes.

Table 11. Russian Olive (ELAN) abundance at observation sites, by LORP unit or river reach

Location	Abundance (number of plants per site)				
	1 to 5	6 to 25	26 to 100	>100	Total no. of sites
BWMA-Drew	3	0	0	0	**3**
BWMA-Thibaut	1	1	0	0	**2**
BWMA- Waggoner	0	0	0	0	**0**
BWMA-Winterton	0	0	0	0	**0**
Delta Habitat Area	0	0	0	0	**0**
Off River – Billy Lake	4	0	1	0	**5**
Off River—Twin Lake	21	0	0	0	**21**
Off River—Goose Lake	5	0	0	0	**5**
Reach 2	4	0	0	0	**4**
Reach 3	2	0	0	0	**2**
	40	**16**	**11**	**2**	**42***

*Abundance not recorded in one observation

As shown in Map 5, ELAN is concentrating primarily in the Blackrock management area, rather than spreading throughout the LORP or along the river. As illustrated in Map 5a, most of the new recruitment is occurring within or adjacent to existing ELAN sites.

Noxious Weeds (NOX)--*Table 12; Map 5*

Perennial pepperweed (*Lepidium latifolium*, LELA2) continues to be found within the LORP.

Notes:

- Forty distinct populations of LELA2 were recorded in 2016, compared to 61 in 2015.
- Eight of the 36 sites appeared to have been treated.
- LELA2 had been concentrated in the northern part of the LORP with most populations found in reaches 1 and 2 and Blackrock Waterfowl Management Area.
- Populations present along the Owens River north of the Intake are still a concern.
- More than half of the populations were found growing in or adjacent to the river channel.
- Reach 3 has gained 10 new populations. Prior reports noted that populations in reach 3 appeared stable.
- The spread of Perennial Pepperweed, from 2007-09 to 2014-15, is found in Map 5a in the LORP RAS Report section of the 2015 LORP Annual Report.
- Of the 61 LELA2 sites revisited, 40 sites were persisting, seven populations appeared extirpated, and 14 sites were inaccessible.

Table 12. *Lepidium latifolium* (LELA2) abundance at observation sites, by LORP unit or river reach

Location	Abundance categories (number of plants/location)				
	1 to 5	6 to 25	26 to 100	> 100	Total
BWMA – Winterton	1	1	1	0	3
BWMA-Drew	3	1	0	0	4
Reach 1	4	2	0	0	6
Reach 2	2	2	2	1	7
Reach 3	1	12	2	1	16
Reach 6	1	2	1	0	4
Totals	12	20	6	2	40

Beaver Activity (BEA)--*Map 6*

Beaver activity and evidence was noted at 12 locations, up one from 2015.

Notes:

- Beavers were found in reach 2 (1 heard), reach 3 (2 seen or heard), and reach 4 (one seen).
- Beaver evidence was found in reach 1, 3, 4 and 6.
- Eight sites where beaver were found in previous years were revisited; there was no evidence found at three of these locations.

Dead Fish (DFISH)

Note:

- No dead fish were recorded.

Elk--*Map 6*

Notes:

- Evidence of elk, or direct sightings, were noted at 52 locations; half were seen in reach 6.
- The majority of observations were browse or antler rub or both, but 11 animals were seen.

LORP Riparian Fence (Observation Code: FEN)--*Map 7*

Staff surveyed exclosure fencing as well as riparian pasture fences.

Note:

- Five records were made of damaged fences in the LORP.

Grazing Management (GRZ)--*Map 7*

Notes:

- Cattle feed stations were found in six locations in the floodplain.
- Individual cows were seen in reach 3 and 4.

Recreation (REC)--*Map 8*

Twenty-two discrete impacts were associated with recreation. Evidence includes litter, fire rings, pallets, trails, and off-road vehicle use impacts. Recreation evidence was most abundant near roads, and in the Lone Pine area.

Notes:

- Litter (beverage containers, shotgun shells, fishing gear) was the most frequently observed evidence of river recreation use. Some litter was likely windblown into the floodplain from the Lone Pine dump.
- Three fire rings were noted.

Roads (**ROAD)**--*Map 7*

All roads, or vehicle trails that were not present in 2005, or changes in roads were recorded. There were 21 observations—twice as many observations as last year, and almost three times more than in 2014.

- 17 roads were characterized as "New" roads, and four were considered existing.
- Most of the roads (80%) were infrequently or rarely used.
- Of the nine roads found in 2015, all but one was receiving some use.

Trash--*Map 7*

Observers were asked to record large trash items. Wire, scrap metal, and building materials were among observations recorded in 2016. These were found in 12 locations; the same number of site as in previous years.

Tamarisk Slash (SLASH) --*Map 7*

Note:

- Four piles of newly cut slash were found at Goose Lake (n=2) and Twin Lake (n=2). Six piles of tule waste, associated with tule clearing, were located in Reach 6.

River Obstructions (OBST)--*Map 7*

Note:

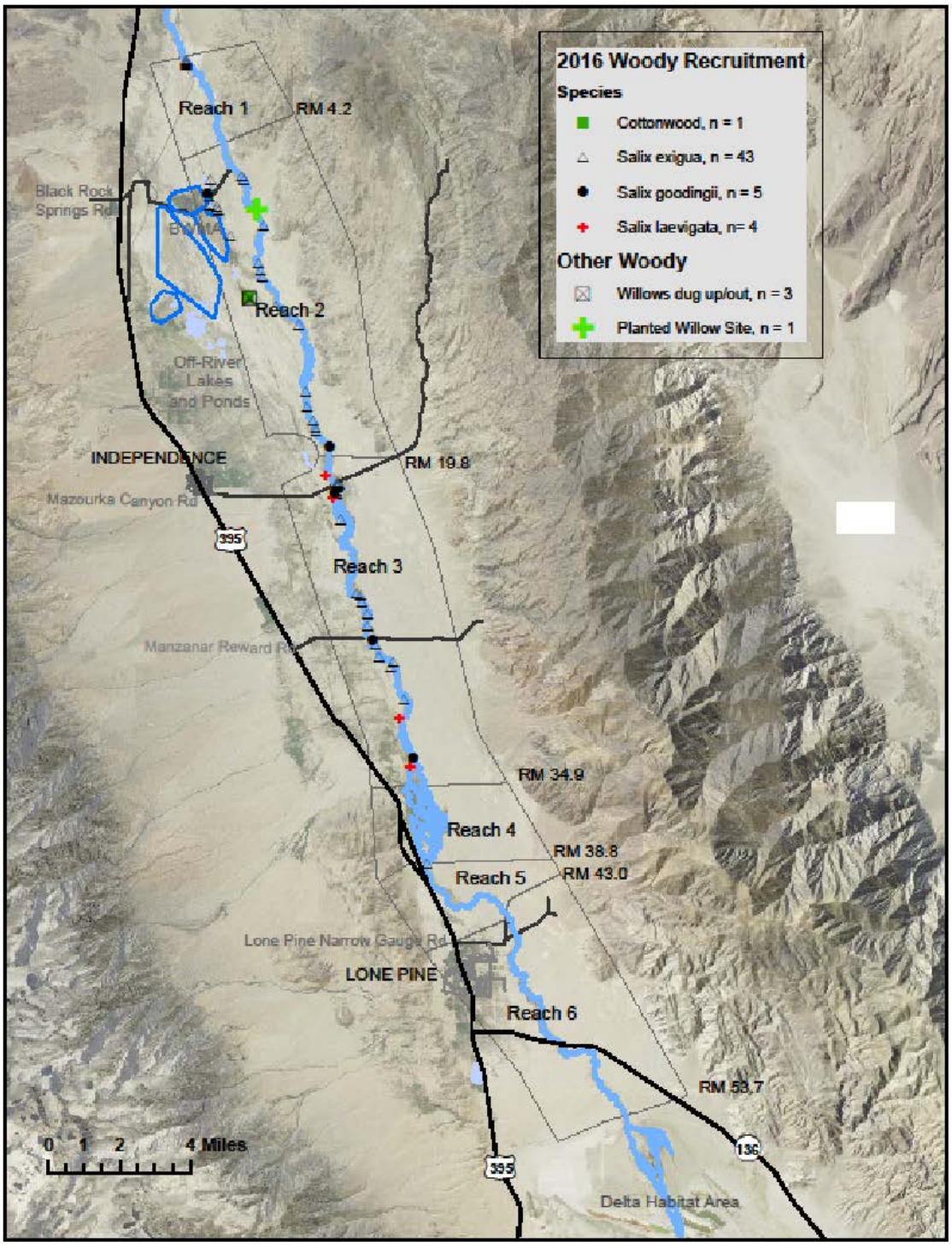
- One obstruction consisting of dead vegetation, mainly dead Bassia and cattails.

Other--*Map 7*

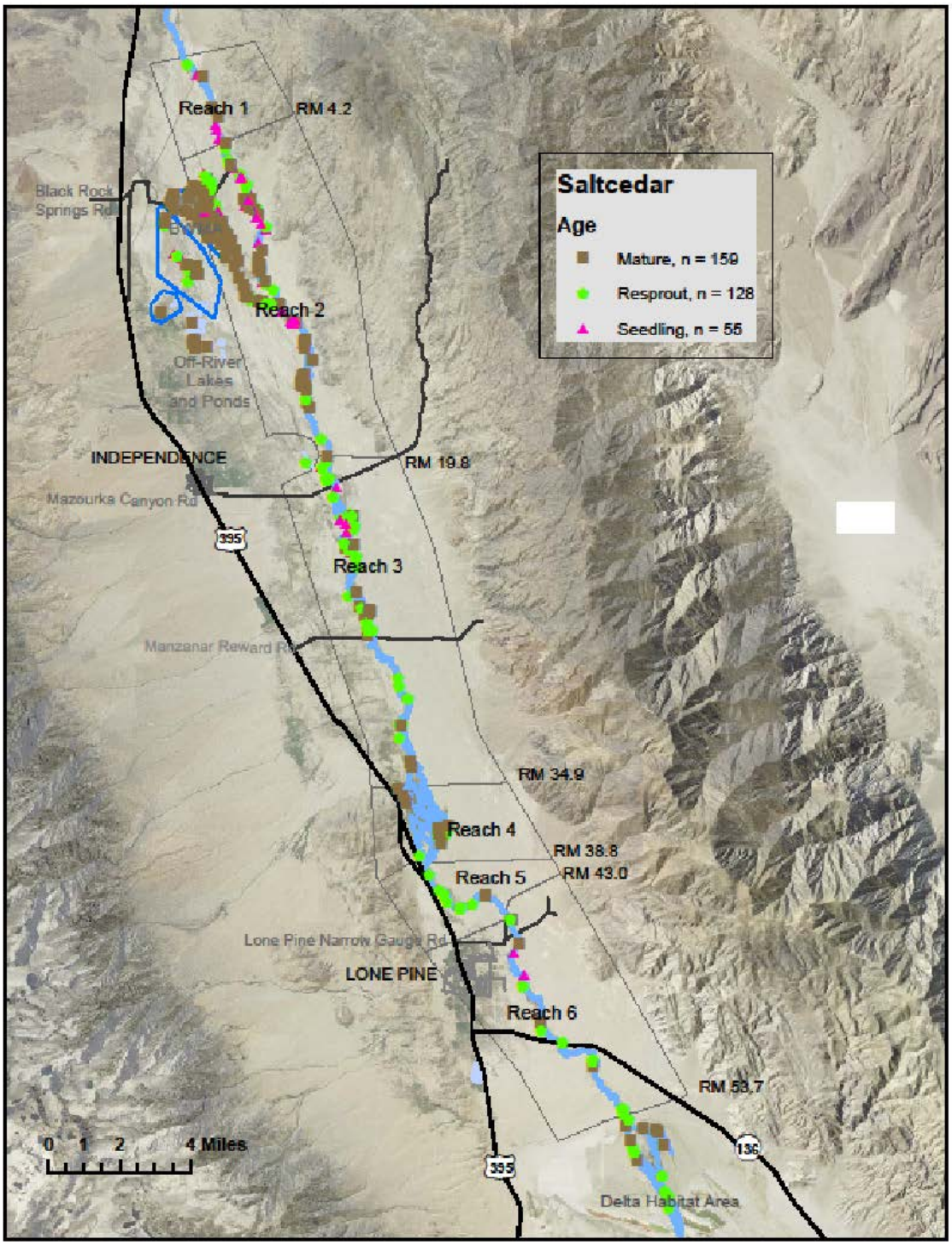
Note:

Observer noted Bassia covering large areas within Thibaut Ponds in Blackrock Waterfowl Management Area.

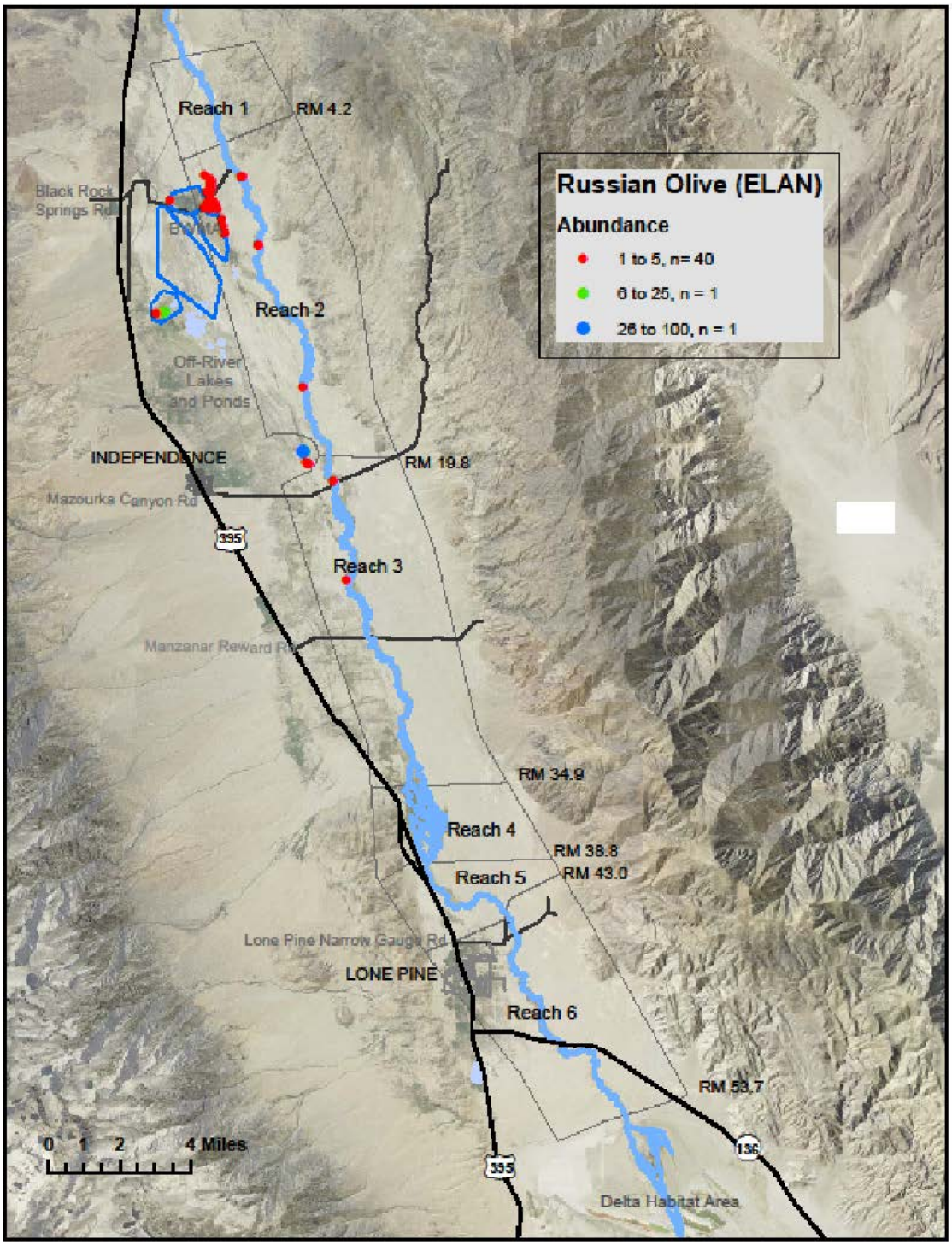
Map 2. Woody Recruitment



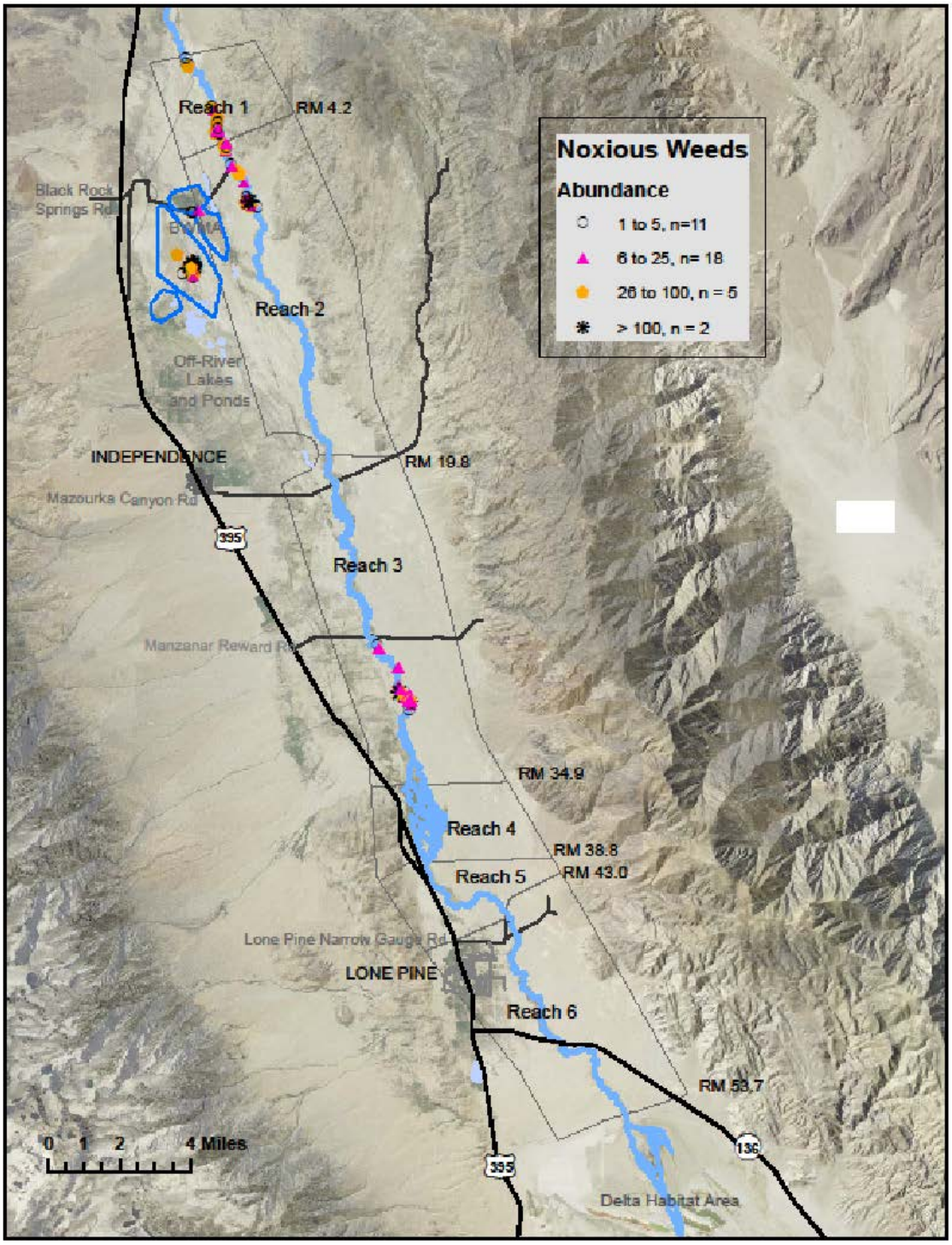
Map 3: Saltcedar



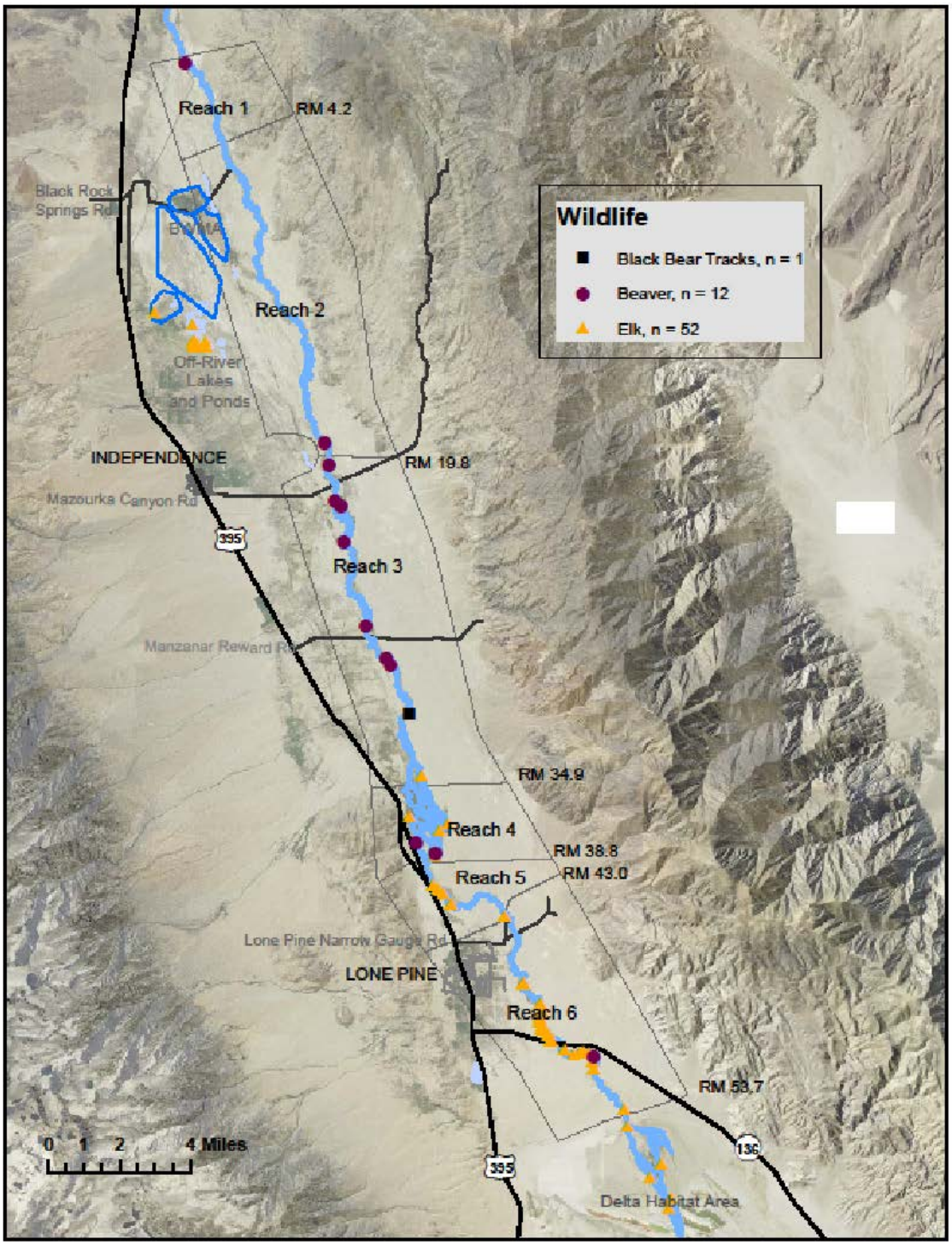
Map 4: Russian Olive Recruitment, *Elaeagnus angustifolia* (ELAN)



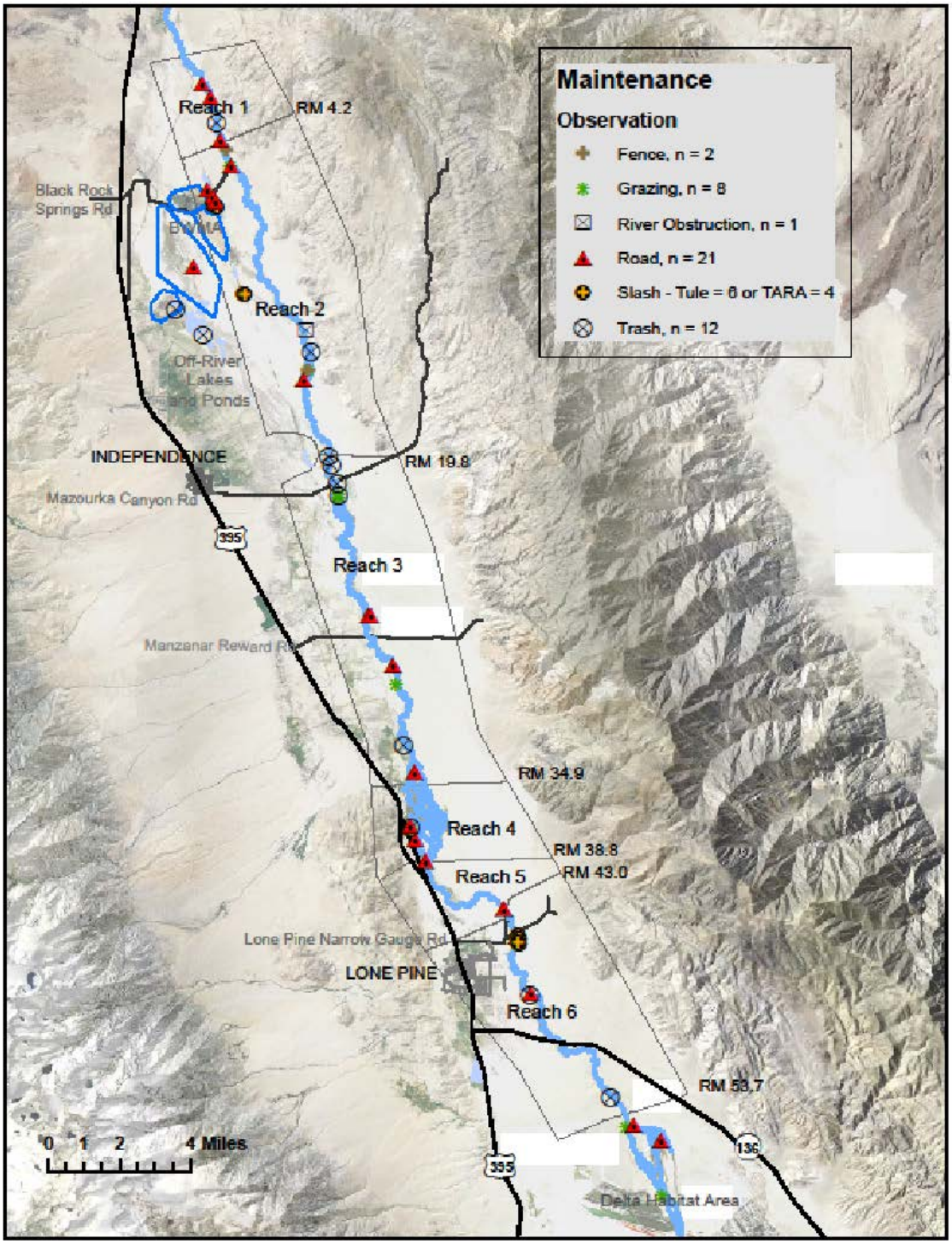
Map 5: Perennial Pepperweed, *Lepidium latifolium* (LELA2)



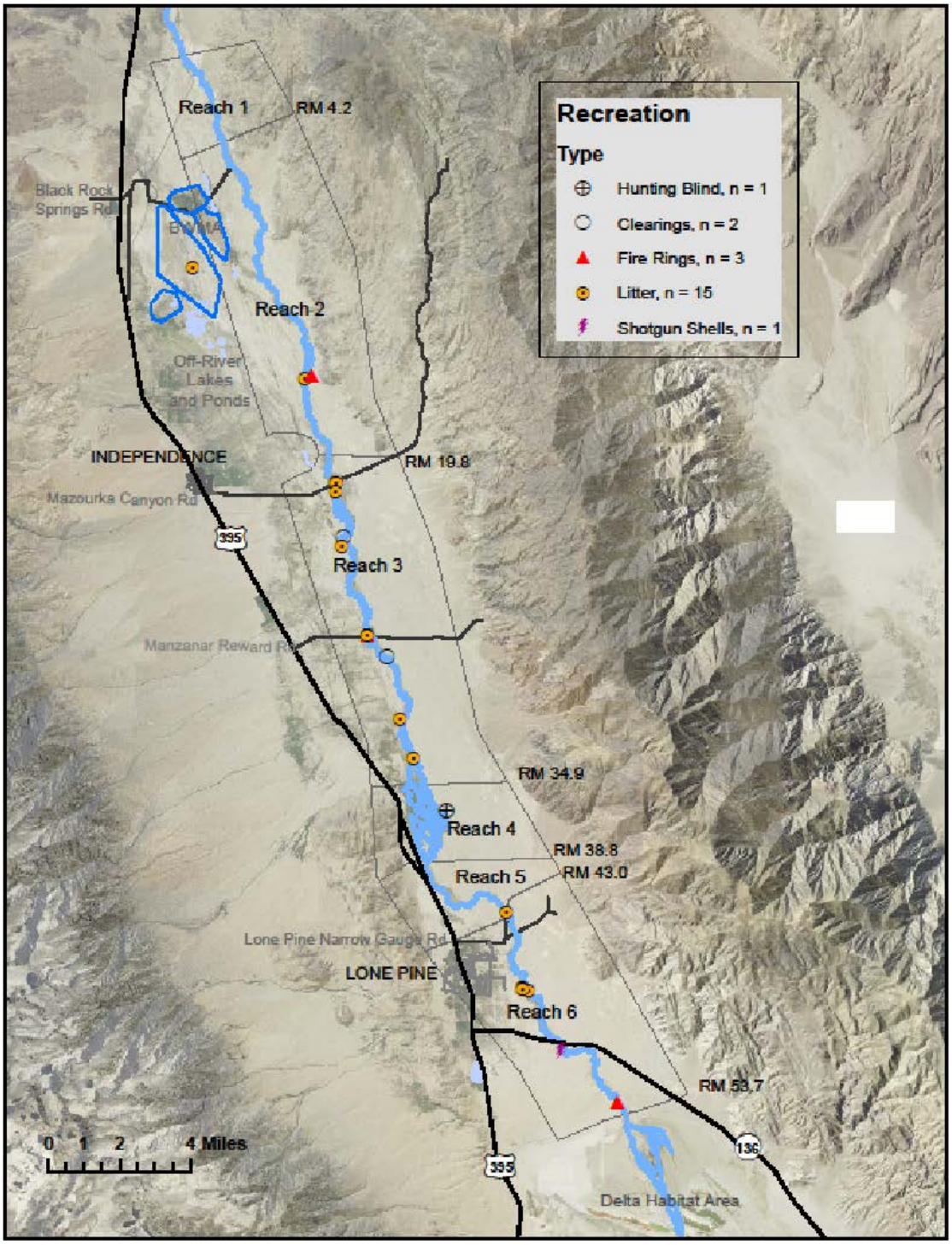
Map 6: Wildlife



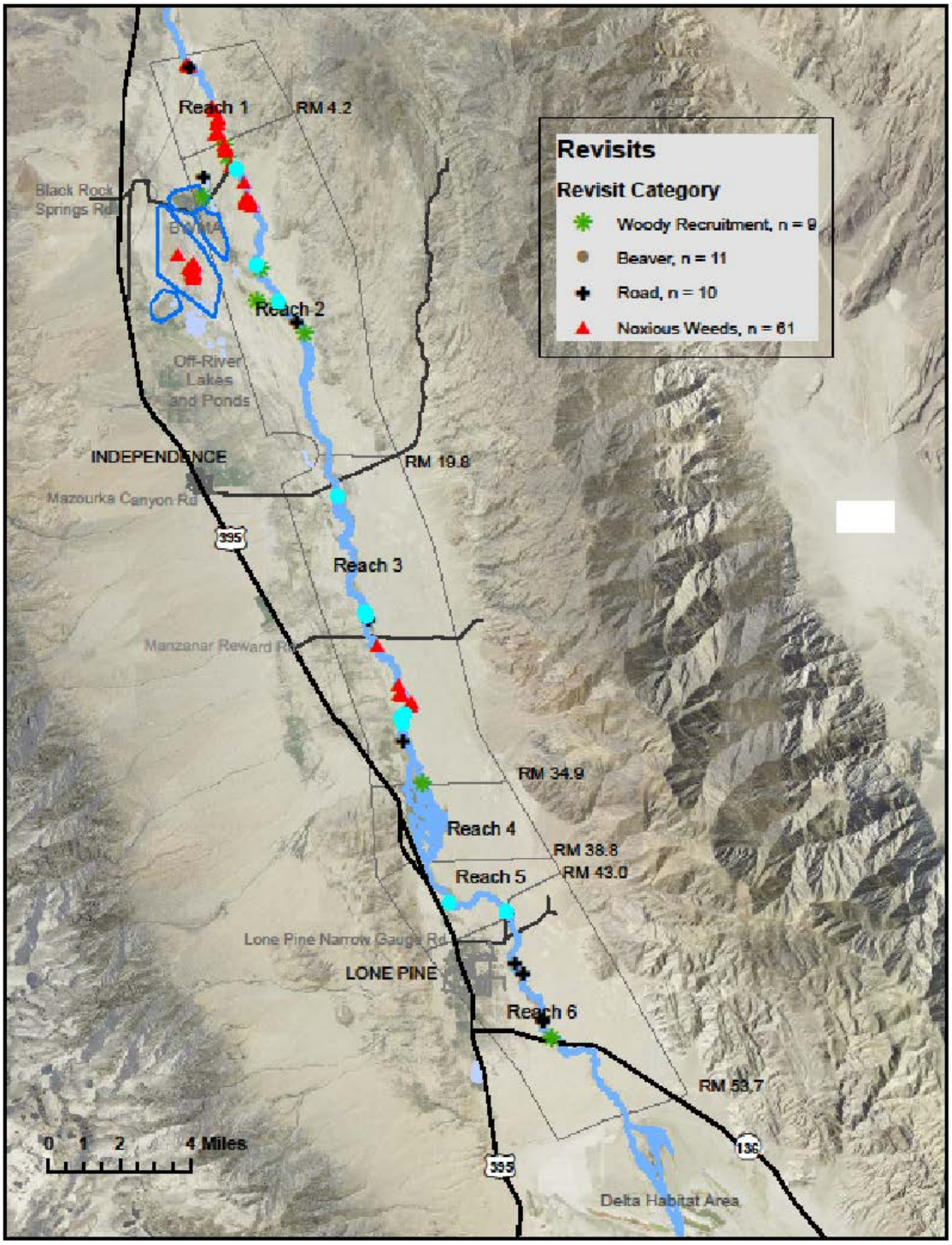
Map 7: Maintenance – Fences, Grazing, Roads, Trash, Obstructions, Bassia



Map 8: Recreation Impacts



Map 9: Revisit of 2015 Observations – Woody Recruitment, Beaver, and Roads



6.0 2016 WEED REPORT

2016 LORP Weed Report
Inyo/Mono Counties Agricultural Commissioner's Office

Introduction:

The Inyo and Mono Counties Agricultural Commissioner's Office (CAC) manages certain invasive weed infestations within the LORP project area in conjunction with The City of Los Angeles Department of Water and Power (LADWP). Target weeds for CAC management and control include California Department of Food and Agriculture (CDFA) designated weeds with a significant focus on Lepidium latifolium. Management of Lepidium latifolium is accomplished both by efforts to eradicate known weed populations within the LORP area, as well as through monitoring for pioneer populations. This program has successfully managed to prevent the widespread establishment of invasive weed populations throughout tens of thousands of acres.

While eradication of all known populations is the long-term goal, new populations will continue to establish so long as a seed source exists upstream. Thus, the detection component of the program is critical to the protection of the LORP as this region is a recovering habitat with many disturbed areas, and also because eliminating these threats early is far less costly than attempting to do so once established. Disturbed conditions make this area more conducive to weed establishment, as does increasing recreation use. In addition to the LORP area, the CAC is working on Lepidium latifolium eradication efforts along the middle Owens River from Pleasant Valley dam to Warm Springs road and the LADWP is managing invasive weeds on city owned lands including along the Owens River from Warm Springs road to the LA aqueduct intake.

While protecting native habitat is the paramount goal of this project, there are many other positive consequences resulting 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.

Summary of LORP Weed Management Activities in 2015

LORP invasive plant management during 2016 included both treatment of known sites throughout the growing season as well as ongoing survey activities to identify new infestations. All known *Lepidium latifolium* sites within the LORP area were treated. Invasive plant populations totaled 1.05 net acres, which represents a .21 acre increase over 2015. Most of this increase occurred in one location where scattered new plants found in close proximity to 12 previously identified separate sites were grouped together as one site (site 1243) for management purposes. The 12 separate sites totaled .11 net acres in 2015 and the newly aggregated site was calculated as .56 net acres. Good progress was again seen on the site near

the Winterton management unit with reduction from .5 acres in 2015 to .24 acres. All other sites continue to be small and spotty in nature, containing less than 100 plants each.

Individual sites totaled 45 in 2016, 5 new sites were discovered and 12 consolidated into 1 larger site. Of the 45 known sites, 19 sites had no plants present in 2016. After five continuous years of no growth, sites may be considered eradicated, 10 sites were considered eradicated in 2016. 4 new sites were discovered utilizing the Rapid Assessment Survey (RAS) survey data and 1 new site was found with other survey procedures.

Table 1 – Count of LORP Invasive Weed Sites

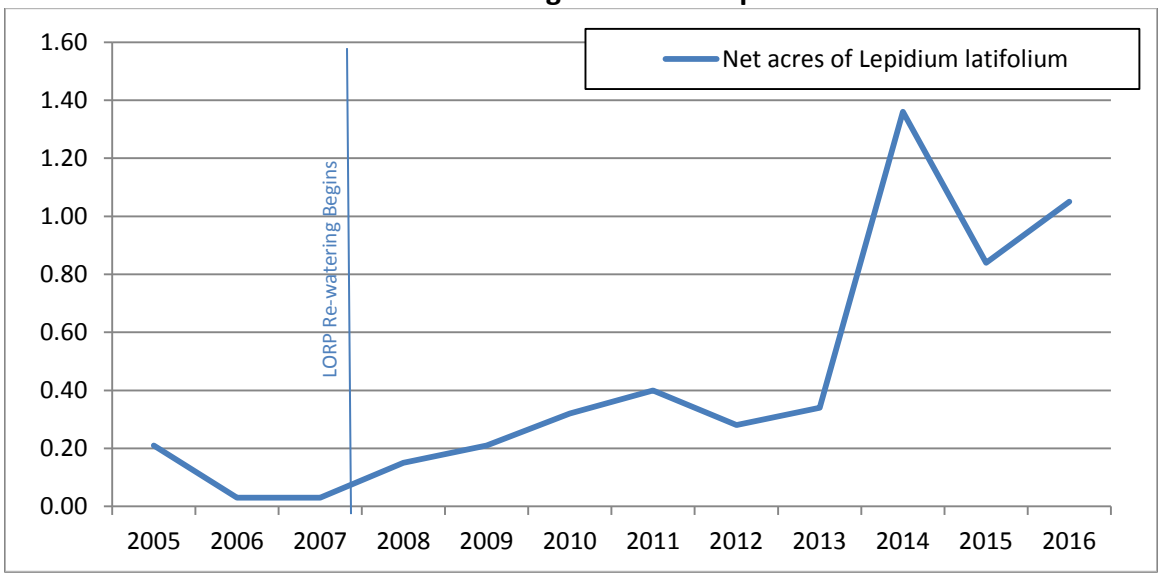
Year	Total Number of Sites	New Sites Discovered	Sites with No Growth
2002	2	0	0
2003	2	0	1
2004	3	1	1
2005	4	1	1
2006	4	0	1
2007	4	0	1
2008	12	8	1
2009	17	5	4
2010	32	15	5
2011	35	3	19
2012	38	3	19
2013	39	1	29
2014	46	7	22
2015	51	5	21
2016	**45***	**5**	**19**

*12 individual sites were combined into 1 larger site for management purposes.

Survey efforts were similar in 2016 to 2015 utilizing only one employee and surveying approximately 10,000 acres within the LORP area. Surveys included areas of known infestations, one annual survey into other areas to ensure no new populations are allowed to establish undetected, surveys based on preliminary information from agricultural operators, and surveys of areas indicated as containing new weed populations by the 2016 rapid assessment surveys (RAS).

Treatment methods utilized low-volume, directed spot treatments using selective herbicides. These applications were made on foot using backpack sprayers to mitigate damage to native plant communities within the LORP. CAC will continue to employ these methods as long as these results continue and staffing levels permit.

Chart 1 – Net Acreage of Weed Population on LORP



Management Difficulties

The most significant management difficulty continues to be maintaining adequate staffing for effective management of such a large site. The CAC was able to commit one employee to work on the LORP area during the winter/survey season and two seasonal employees during the summer growing/treatment season.

The first average water runoff year after many years of severe drought also resulted in minor management difficulties as field staff expended significant resources re-visiting sites that were found to be flooded on previous visits.

It is clear that previously discovered populations continue to decline as a result of control efforts, but new populations are steadily detected and will continue to be established so long as a significant seed source exists upstream. Detecting small invasive plant populations in the vast LORP project area early in the colonization cycle has become a difficult task to maintain. Treatment activities are most effective when plant populations are discovered early, saving resources long-term and reducing the threat of seed dispersal.

7.0 SALTCEDAR REPORT

7.0 SALTCEDAR CONTROL PROGRAM

The goal of Saltcedar Control Program is to eliminate existing saltcedar stands, to prevent the spread of saltcedar throughout the Lower Owens River and associated wetland environments, and to sustain the ecological restoration that is now occurring in the LORP.

PROGRAM BACKGROUND

Saltcedar (Tamarix ramosissima) is an invasive non-native shrub or tree that can grow to 25 feet and live up to 100 years. Given favorable conditions, a tree can grow 10 to 12 feet in one season. Saltcedar can compete with native vegetation and degrade wildlife habitat. Its presence in the southern Owens Valley has the potential to interfere with the LORP goals of establishing a healthy, functioning Lower Owens River riverine-riparian ecosystem.

References to the importance of managing saltcedar can be found in documents that guide the saltcedar program and govern the LORP:

- The LORP Monitoring, Adaptive Management, and Reporting Plan (MAMP), notes that saltcedar may increase in some areas of the river because of seed distribution with stream flows. The MAMP states that the potential risk of infecting new areas with saltcedar is considered a significant threat in all management areas

- The 1997 Memorandum of Understanding (MOU), between Inyo County, City of Los Angeles, Sierra Club, Owens Valley Committee, CA Dept. of Fish and Game and California State Lands Commission, expresses that saltcedar reinfestation in the LORP area would compromise the goal of controlling deleterious species whose "presence within the Planning Area interferes with the achievement of the goals of the LORP" (1997 MOU B. 4)

- Parties to the Long-Term Water Agreement (LTWA) recognized that even with annual control efforts saltcedar might never be fully eradicated, but that ongoing and aggressive efforts to remove saltcedar will be required. (Sec. XIV. A)

PROJECT MANAGEMENT AND STAFF

The Saltcedar Control Program is administered by the Inyo County Water Department, and managed by a Saltcedar Program Manager. Work crews are hired seasonally and consist of eight employees and one shared county employee. In addition, the California Department of Forestry and Fire Protection can provide work crews to assist in efforts to cut, pile, and burn saltcedar. In 2015-2016, the field season began in mid-October and concluded in mid-March.

METHODS

The Saltcedar Control Program personnel use chainsaws, brushcutters, herbicides, and controlled burning to treat and control saltcedar, and remove saltcedar slash in the Owens Valley.

WORK ACCOMPLISHED (Figure 1)

From October 2015-March 2016 Inyo County Water Department saltcedar field crews cut and retreated with herbicide approximately 400 acres of saltcedar resprouts, primarily in the water spreading basins. In addition, the saltcedar field crews cut and treated 35 acres at the outlet of Goose Lake.

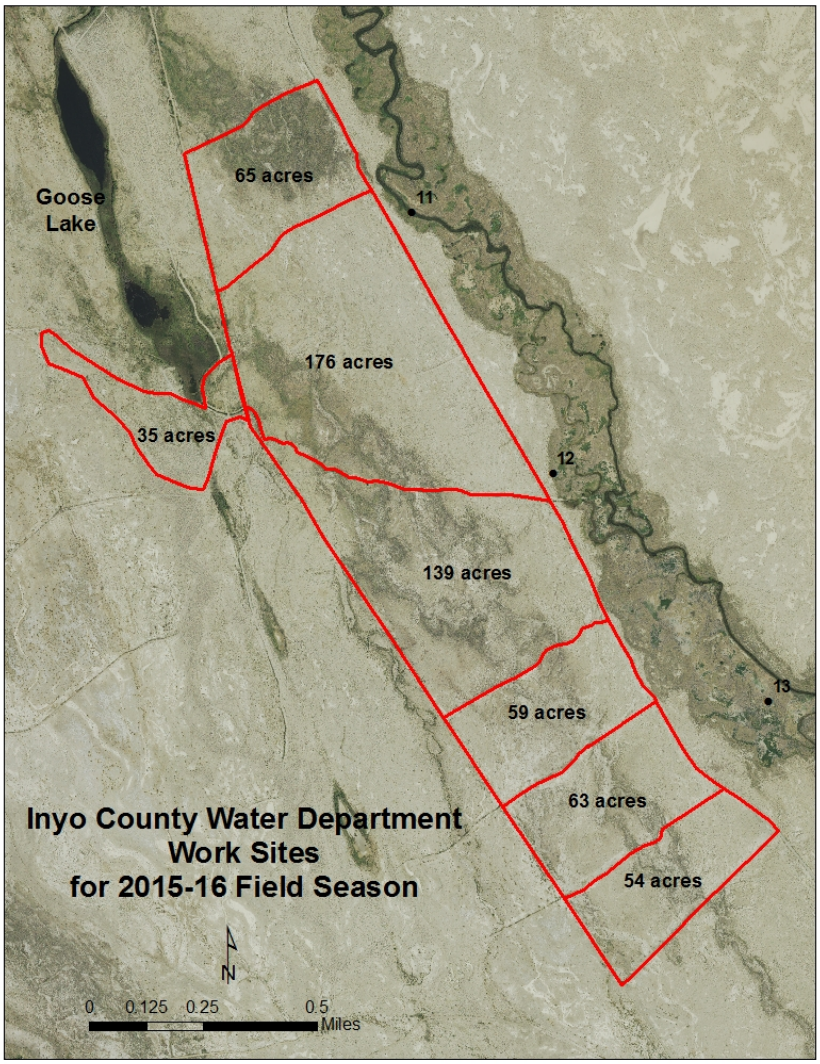
Each year the saltcedar crews sweep the Lower Owens River and treat resprouts, pull seedlings, and remove mature plants. Crews are guided to the new growth and regrowth by information obtained in the previous year's Rapid Assessment Survey. This year crews covered about 89 miles of riverbank and floodplain.

About 50 piles of dry slash, which had accumulated over the years, were burned in the 2015-2016 field season. Due to fire restrictions related to the ongoing drought the burn window was limited this field season. This effort was assisted by the California Department of Forestry and Fire Protection and the Los Angeles Department of Water and Power.

FUNDING

An ongoing responsibility of the Saltcedar Program, with the assistance from the LADWP, is to secure grant funding to maintain an active Saltcedar Control Program.

Figure 1. Saltcedar cut areas 2015-2016



Saltcedar Report
by Inyo County Water Department

8.0 ADAPTIVE MANAGEMENT RECOMMENDATIONS

2016 LORP ANNUAL REPORT

ADAPTIVE MANAGEMENT RECOMMENDATIONS

Prepared by:

Dr. William Platts, MOU Consultant

Mr. Mark Hill, MOU Consultant

Table of Contents

Summary of Adaptive Management Recommendations

The MOU Consultants' 2016 LORP adaptive management recommendations are summarized as follows:

- Implement LADWP's 2015 LORP flow management proposal.
- Hold River Summit # 2 in late summer, 2017.
- Conduct a recreational fishing census in 2018.
- Adaptive management recommendations for changes in base, SHF, and flushing flows, as outlined in 2013, 2014, and 2015, are still supported and again recommended for testing and evaluation in 2017.
- Evaluate flow recommendations to determine if they could improve water quality conditions.
- Support the OWRT and the proposed LORP Flow Enhancement and Habitat Improvement Study
- MOU Parties conduct a special "Tule-Cattail Management Workshop" in 2017.
- Release Delta Habitat Area flows from the Intake instead of the Pumpback Station.
- Release a flushing flow in April of 2017.
- Employing a remote sensing approach to bolster the frequency of flood inundation mapping in the BWMA.
- Develop a new BWMA management plan based upon seasonal wetting and drying cycles.
- Identify the most appropriate indicator species for long-term monitoring under a revised BWMA management plan.
- Open the Thibaut exclosure to grazing and construct a smaller exclosure within the larger exclosure for continued monitoring.

Adaptive Management Recommendations from 2008 to 2015

Introduction

This section summarizes significant adaptive management (AM) recommendations from 2008 to 2015 by providing a brief history and the present status of each recommendation. Past recommendation direction by the Consultants is compared to the actual adaptive management actions implemented via the MOU Party process. The intent of this brief summary is to inform anyone new to the project about changes made from monitoring and adaptive management recommendations since project implementation. This allows a general evaluation of how the MOU process developed today's LORP environmental conditions.

Both MOU Consultant's and advisors for the MOU parties stressed in the 2011 City-County Annual Report that project implementation has produced many successes, but, the implementation of adaptive management is not among them. Successful AM implementation is very important because some undesirable ecological trends and conditions have been identified that will affect LORP final success. Lower Owens River (LOR) flow management has caused some ecological stagnation and thus, potential loss of resource productivity. With these environmental conditions developing over the past few years, MOU Consultants have recommended major management changes to try and correct developing conditions.

The MOU (1997) requires that data and information be collected and evaluated so that acceptable adaptive management recommendations can be made and implemented through the AM process. Based on the analysis of available data and monitoring information (and supported through professional experience), many AM recommendations have been made. Over the past six years some AM recommendations have and have not been accepted and implemented. Because the LORP may be entering its final implementation stage, it now becomes very important that past and present AM recommendations be re-evaluated by the MOU Parties. Implementing worthy recommendations should receive acceptance and higher priority in the future management of the LORP.

The following management actions are discussed in their historic context. This will hopefully provide some understanding of how the LORP resources progressed to the condition they are in today. An interesting analysis would be to compare what the LORP conditions would be today if AM recommendations were implemented. However, insufficient time and funds for testing, monitoring, and evaluation will not allow this comparison. The fact that the LORP has produced many improvements and success should always be considered when trying to predict what would transpire if unaccepted management actions were implemented.

Lower Owens River Flow Management

Flow management planning for the LORP began twenty-three years ago, and is largely still being implemented today. The first LOR base flows were released eleven years ago in 2006 as required by the MOU (1997)[1]. The first habitat flushing flow was released nine years ago in 2008. Therefore, adequate time has passed to allow a sufficient evaluation of river status and management successes.

Early in the AM process, MOU Consultants recommended that a series of potentially favorable seasonal habitat flow (SHF) scenarios be evaluated. Once evaluated, a detailed report of the findings and resulting flow recommendations was to be delivered to MOU Parties to help in their LORP decision making. These flows would be considered for replacing flow scenarios being implemented (see Table 1 for SHF's released through the MOU process). This recommendation was not implemented (see Table 1 for SHF's that were released through MOU process).

In 2008, it was a common understanding that annual seasonal habitat flows (SHF's) would be an important management tool for establishing riparian woody vegetation and other favorable environmental conditions (i.e., water quality) in and along the LOR. MOU Consultants were cautious at that time about the probability of success from the initial flows. They cautioned that releasing only one SHF per year was never expected to be a feasible solution by itself. After the first year (2008) of SHF implementation, MOU Consultants called for adjustments in river flow releases. Different flow volumes and timing were proposed that might better control tule-cattail abundance, distribution and invasion. Flow changes that could hopefully improve water quality conditions were discussed and recommended.

MOU Consultants were optimistic in 2009 that sufficient woody recruitment was occurring throughout the LOR floodplain. Over 200 sites were observed in 2009 where woody riparian plant species (mainly

[1] MOU. 1997. Memorandum of Understanding. ICWD of Inyo and LADWP of Los Angeles, CA. Bishop, California

willow) had already established. This initial increase, which did not continue, was probably due to the abundance of bare exposed soils the first year of re-watering dry channels. Consultants followed up by stating that overall progress was being made toward attaining LORP goals in all management areas. MOU Consultants did, however, warn that LOR bordering riparian vegetation recruitment and development was being dominated and controlled by base flows only. SHF's, at this time, were having no documented or observed ecological beneficial influence and possibly no influence at all.

Table 1. SHF Peaks (cfs) and Maximum Base Flow by year and volume released at the Intake Control Station

Year	SHF Peaks	Maximum Base Flow
2008	220*	77
2009	110	84
2010	209	81
2011	208	85
Average SHF peak from 2008 to 2011 = 186 cfs		
2012	92	101
2013	58	91
2014	0	86
2015	0	78
2016	106	85
Average SHF peak from 2012 to 2016 = 51 cfs		
Average SHF peak from 2008 to 2016 = 111 cfs		

*only a flushing flow

MOU Consultants also recommended during this early period that the number of flushing flows and the volume of SHF peaks must be increased. Needed water to accomplish this increase could be made available by shortening the duration of the SHF's. This approach would have allowed all SHF's to reach a 200 cfs peak regardless of "water year" runoff predictions. SHF's limited in volume and duration, especially later from 2012 through 2016, were believed to be having no documented beneficial effect (Table 1). Because of this evaluation, changes needed in flow management were discussed many times.

In 2010, MOU Consultants again recommended modifying SHF's to increase peak flows. SHF flow duration decreases were again recommended to make water available for applying much larger flushing flow peaks. MOU Consultants recommended that all future applied flows be tested, monitored and evaluated. Serious concern was expressed that base flows would have to be modified in summer and winter to help control unwanted tule and cattail invasions.

In 2011, MOU Consultants developed a more detailed annual river flow scenario and requested MOU Party consideration and acceptance. Flow scenarios were developed that could be monitored and

evaluated to determine if they could improve LORP conditions. Also, additional down-river flow augmentation was now being recommended to determine if it would improve the recruitment and maintenance of woody vegetation. Again, MOU Consultants recommended changes in flow timing, flow duration, and flow magnitude. These recommendations were not accepted.

MOU Consultants in 2012 recommended that during any annual "Water Year" 70% of normal or more, a SHF peak of at least 200 cfs should always be released. MOU Consultants recommended a SHF peak of 200 cfs for the 2012 SHF. Instead, only a SHF peak of 89 cfs was released. MOU Consultants again emphasized that SHF's, as presently being implemented, could no longer be considered the sole management activity to try and improve river water quality or increase the recruitment and survival of riparian trees.

By 2013, MOU Consultants AM flow recommendations were becoming even more detailed. Recommendations were now calling for SHF's to be adequately augmented via Alabama Gate release waters. Augmentation was especially needed in down-river reaches because released Intake peak flows reduced dramatically in the down-river direction. Flow augmentation to increase peak habitat flows was now in its sixth year of being recommended. Recommendations were not accepted.

To increase down river flow augmentation effectiveness, the Alabama Gate flow return channel was recommended to be trained so flows could be delivered more efficiently to the LOR. A 300 cfs spring peak flushing flow was recommended for the 2014 and 2015 SHF's. This recommendation was not accepted. Flow management changes were again recommended for flow duration, flow timing, and flow magnitude. All of the above are important recommendations because currently applied base flows may not allow all MOU goals and requirements to be met. All restrictions on the Pumpback Station pump-out capability were again recommended for elimination so that recommended flows would stand a better chance of being implemented.

In 2015, Consultants recommended MOU Parties conduct a "Work Session" to review river flow AM recommendations for 2013, 2014, and 2015. The main purpose was to encourage the MOU Parties to select, or if necessary, develop their own flow scenarios for testing and evaluation. All flow assessments, to date, demonstrate that LOR flow management warrants some improvement.

Base, SHF's, and flushing flows proposed by LADWP (City) in the 2014 "River Summit" were recommended by the MOU Consultants for testing and evaluation. In summary, the MOU Consultants pushed continually each year (2008-2016) in their AM recommendations for much higher seasonal

habitat and flushing flows. Unfortunately, the MOU decision and implementation process codified much lower habitat flows. Lack of adequate testing, monitoring, and evaluation does not allow an analysis of which flow management approach would have been best for the river. We do know that years of uniform LOR low base flows has resulted in a river supporting marsh-canal type river conditions.

River Summit

In the summer of 2014 a three-day River Summit was held with all MOU Parties. The MOU Consultants had recommended a summit for several years because we had strong reservations from the inception of the project, as far back as 2007, that the designated base flow of 40 cfs and the limit of 50 cfs pumpback capacity impedes meeting LORP goals. Without the ability to alter base flows each year the river has taken on canal characteristics of vegetation choked reaches, with threats to water quality and fish health. While numerous topics related to LORP goals were discussed at the summit, the principle issue was modifying the MOU to allow for greater pumpback capacity so that larger base flows could be applied. There appeared to be some consensus at the summit for a two-year experiment to evaluate benefits of altering flows. To this end, the MOU Parties agreed to discuss the matter further. However, subsequent meetings did not result in any agreement to modify LORP flows. The MOU Consultants now assume that the codified 40 cfs base flow and 50 cfs pumpback capacity will remain in place regardless of conditions in the LORP.

Recreational Fishing

Within the first few months of introducing flows into the once dry upper LOR, Owens sucker, largemouth bass, and carp were readily observed throughout these previously dry channel reaches (personal observations). Game fish did well in newly re-watered river reaches by 2010. The MOU Consultants reported that monitoring results showed recreational fishing was trending towards meeting LORP goals. The LOR presently supports a healthy warm water recreational fishery. However, one of the most pressing problems affecting the recreational fishery is the continual encroachment of tules and cattails in and along the river channel. This heavy invasion is and will continue to impede fishing access. Average recreational fishing success to date, however, remains above 2 fish per hour of fishing.

The MOU Consultants first observed game fish and other aquatic life being heavily stressed during the 2010 SHF. Recommendations followed to better track future water quality conditions. A call to implement flow management changes needed to help prevent future fish kills was stressed. Based on available water quality data and on-site observations, the MOU Consultants predicted in 2011, that fish

kills would occur in the future. We called for major management changes needed to improve water quality. Recreational fishing will continue to meet MOU (1997) goals only if water quality conditions remain favorable.

More emphasis was placed on the need for the City and County to again evaluate all past and present AM recommendations. Especially those recommendations needed to maintain and improve the recreational fishery.

The first recreational fishing census was conducted in 2003, and again in 2010, 2013, 2014, and 2015. In 2015, the MOU Consultants recommended Inyo County (County) evaluate the census methodology to determine if a more improved and more intensive approach should now be initiated. We maintain that the recreational fishery LORP goal is being met at the present time.

Delta Habitat Flow Release Point

Early in LORP implementation (2009), the MOU Consultants believed that until it can be shown that applied habitat flows into the Delta Habitat Area (DHA) were not achieving all DHA goals, no modifications or changes to flow volume and timing should be made. We were optimistic in 2010 that LORP DHA goals would be attained. Recommendations were again made to the City to continue managing base and habitat flows as they have in the past.

Consultants later recommended the present number of applied annual habitat flows (4) be increased to 10 annual habitat flows. Discussions with City and County staff on indicator species needs resulted in the MOU Consultants withdrawing this recommendation. Instead, we supported City staff recommendations for the need to develop a new flow plan for the DHA. This flow plan has not been developed to date.

The MOU Consultants first recommended in 2011 and again in 2012, that DHA habitat flows be released from the Intake rather than the Pumpback Station. The main reason was to determine if LOR water quality conditions could be improved using this moderate additional annual flushing flow approach. We suggested that a change in flow release site could result in dual LORP benefits. DHA habitat flows would continue to meet DHA goals and a flushing-dilution effect on the LOR would hopefully assist in improving water quality conditions. We requested that the City and County determine, via monitoring and evaluation, if benefits could be gained by changing the flow release point. We also asked the City and County to determine how best to implement the change. These recommendations were reinforced

by the MOU Consultants again in their 2013 AM recommendations. These recommendations have not been accepted or properly implemented at this time.

In 2014 and 2015, Consultants again recommended DHA habitat flows be released at the Intake rather than the Pumpback Station. The City and the County were again encouraged to develop a better and more productive approach for releasing base and habitat flows into the DHA. We recommended the MOU Parties conduct a "Work Session" to review the 2013 to 2015 DHA AM flow recommendations. The purpose was to design a flow pattern to be tested, monitored and evaluated as it relates to meeting the needs of indicator species. In 2015, the MOU Consultants presented a flow plan for releasing the DHA habitat flows (3 of the flows) from the Intake. To date, these recommendations have not been accepted.

Tule and Cattail Management

In 2008, the first year of complete LORP flow implementation, the MOU Consultants were already stressing the immediate need to adjust river flows to control tule-cattail invasions. In 2009, we warned that the continued proliferation and expansion of tules and cattails in LOR riverine-riparian areas would increase. Tule and cattail invasions were already blocking fishing, boating, and recreational access as early as 2009.

In 2010, the MOU Consultants again pointed out that one of the most pressing problems in the LORP is the constant tule and cattail encroachment throughout the river channel. The uniform 40 cfs base flow was creating "canal" type river-marsh conditions. Conditions had become ideal for tule and cattail domination of the river channel. Required base flow management was identified as the main factor causing the abundance and expansion of tules and cattails. Suggestions were made to decrease winter and summer flows to hopefully slow this encroachment. By 2010, colonization of the LOR and adjacent wetlands by tules and cattails was quickly outpacing the very slow establishment of willow and cottonwood trees bordering the LOR.

In 2011 and 2012, the MOU Consultants again recommended immediate action to inhibit tule and cattail encroachment. We recommended river flow adjustments to determine their potential to buffer the continued encroachment and pushed for tule and cattail control mechanisms that could be tested and evaluated. We also stressed the need to track degraded water quality conditions caused by tule and cattail abundance and decomposition. The need to get ahead of possible future fish kills during future

high river flow events became a high priority. We recommended a MOU Party "work session" too develop management actions to better control tules and cattails. This included modifying annual river flow regimes to determine if they could influence tule and cattail development.

To date, after nine years of flow management, flows have been ineffective in controlling the invasion of tules and cattails.

Water Quality

Before LORP implementation began in 2007, the MOU Consultants alerted MOU Parties that low dissolved oxygen (DO) in the LOR would become a serious seasonal problem. The first SHF's released in 2008 and 2009, however, did not create serious observable adverse water quality conditions. No known water quality thresholds were breached in 2009 and no resulting fish stress was observed. Water quality conditions remained at livable levels. Moderate decreases in DO were becoming a concern, however, as SHF peaks passed by the Manzanar, Reinhackle, and Keeler Stations.

The MOU Consultants recommended in 2008, following the direction in the 2004 EIR[2], to establish a standard 1.0 mg/L DO exhibiting a downward trend as a threshold beyond which corrective management would be taken. This proposed threshold has been passed many times since 2008.

In 2010 the MOU Consultants first expressed concern that suspended and bed-load sediment entering the LOR via the Intake release flow could be a future problem. We emphasized the need to conduct water quality monitoring to determine any effects. DO levels and river temperature monitoring at regular intervals during all SHF's and periods of high ambient summer heat input was recommended.

The MOU Consultants in 2010, also expressed concerns that serious short and long-term water quality problems were developing. We stressed the need for changes in flow management to help the river meet future water quality standards. The following year (2011), we recommended DHA habitat flows be released from the Intake rather than the Pumpback Station. The main purpose was to evaluate if additional flushing could improve water quality conditions.

In 2011, major adjustments in river flow management to water quality conditions were again recommended. Augmentation to increase downstream SHF's peaks was recommended along with modifying peak flow duration and flow ramping rates. By 2010, and again in 2011 and 2012, SHF's were

[2] EIR. 2004. Final Environmental Impact Report (EIR) and Environmental Impact Statement (EIS), Lower Owens River Project

seriously reducing DO levels in the river during their release. In 2012, the MOU Consultants pointed out that SHF's can no longer be considered as the sole source for improving river water quality conditions. The LOR has experienced poor water quality periods over the past 40 years. Under present flow management this condition will continue in the future. In 2015, we informed the MOU Parties that, "we now have the river we are going to get", if present flow management continues. We also predicted there will be fish kills in the future.

Blackrock Waterfowl Management Area

Following the initial year (2008) of monitoring the BWMA, results indicated that frequent inflow changes in response to weekly measurements of flooded area in the wetted cells, resulted in variations in depth and wetted area that was not conducive for indicator species habitat. Hydrology is the single most important aspect of wetlands and their functions. Hydrology affects food base, species composition and richness, primary productivity, organic accumulation, and nutrient cycling. The appropriate hydroperiod for a managed or created wetland such as those in BWMA would mimic the processes of natural wetlands of the area. Historically BWMA contained small seep and spring type wetlands similar to those found throughout the Owens Valley. These wetlands have relatively constant inflows, but the water budget changes seasonally due to factors such as evapotranspiration and precipitation. The MOU Consultants recommended maintaining the hydrology of flooded cells to more closely mimic the natural hydroperiod of naturally occurring wetlands of the area. Partial drawdowns of flooded wetlands increase food availability, concentrate foods, and manage emergent vegetation. Fluctuating wetlands seasonally (in contrast to bi-weekly) increases the productivity of fringe wetlands.

In order to maintain the necessary acreage (based on the water year), and, at the same time, create the habitat values for indicator species, the following adaptive management recommendation was made:

"Bi-monthly measurement of wetted area is too frequent, leading to constant inflow modifications. Ecological processes cannot respond to such rapid fluctuations. Measurement and management of wetted area must allow for seasonal variation to achieve desired habitat values. Develop a relationship between inflow and area as Waggoner and Drew are flooded so that management is based on inflow with quarterly on-the-ground measurements of wetted area for confirmation and adjustment to maintain the wetted area in relation to the water year. Identify a method that is applicable to all the BWMA units for developing regression equations that relate wetted area to inflow volume by season. Alternatively, evaluate the use of satellite imagery to delineate wetted area".

Experience over time showed that neither a regression equation nor use of aerial imagery were feasible ways to monitor the wetlands. Monitoring focused on circumnavigating each wetland unit and taking GPS readings at water's edge. This allowed estimation of the wetted area and alteration of inflow to maintain the annual acreage requirement. Nevertheless, the method has been time consuming and, thus, costly.

By 2011 it became apparent, following avian census monitoring, that the original list of habitat indicator species (HIS) for the BWMA needed updating and the MOU Consultants recommend that the new species be added to the HIS list, but that all occurrences of the new HIS species be updated in previous year's data. Also, adding new species to the indicator species list should be done through the MOU process soliciting input from the scientific team.

By 2014, it became clear that simply meeting the annual wetted acreage requirement was not producing the best habitat for indicator species or proper wetland function. While the Drew Unit was able to meet the wetted area, its ability to provided diverse habitat had declined.

Thibaut

Thibaut is the fourth wetland unit within the Blackrock wetland management area; however, Thibaut is managed independently of the other units because of the EIR requirement to maintain the 28 acres of Thibaut ponds. The Thibaut Ponds were successfully developed by LADWP and maintained by water diverted from the aqueduct prior to the LORP. The EIR[3] goal for managing the Thibaut Ponds is to "maintain the existing waterfowl habitat area for the establishment of resident and migratory waterfowl populations".

In 2008 and 2009, the MOU Consultants recommended constructing berms to better manage inflow and burning of tules to improve open water areas. By 2010 it was recognized that managing the Thibaut unit to simply maintain 28 acres of pond did not provide suitable habitat for waterfowl and other wetland species. Consequently, we recommended analyzing alternative management strategies.

Because the pond was just too shallow to control the growth and expansion of tules with year-around flooding alone, we recommended the management plan for the Thibaut Pond be voided and revert back to the original plan and management procedures developed by LADWP. The pond must go through

[3] EIR. 2004. Final Environmental Impact Report (EIR) and Environmental Impact Statement (EIS), Lower Owens River Project

annual “dry-out” periods to continue to provide suitable habitat. Previously, under procedures developed by LADWP, water is delivered during part of the fall, all winter, and part of the spring to provide habitat for migrating and local waterfowl and shorebirds. Inflow to Thibaut is then terminated in the summer to allow drying, which has been shown to be an effective tule control technique. In 2013, LADWP initiated this management procedure, and avian census data indicates that waterfowl use exceeds that of other BWMA units.

Riparian Vegetation

The overall objective of the LORP is to establish and maintain healthy, functioning ecosystems in the four management areas of the LORP; the Lower Owens River, off-channel lakes and ponds, the BWMA, and the DHA. Flow releases and land management actions are designed to establish, enhance and maintain habitats that are consistent with the needs of the habitat indicator species, which have been defined for each of the four geographic areas of the LORP.

The flow releases and land management actions are designed to result in changes over time (trends) in the extent and quality of riparian, wetland and aquatic habitats, which will benefit the indicator species. Riparian vegetation is critical to the quality of riverine habitat by providing shading to lower stream temperatures, stream bank stability, fish and wildlife habitat in addition to indicator species habitat. Riparian vegetation is also a necessary component of the Lower Owens River food web.

Initial planning called for a base flow of 40 cfs and a seasonal habitat (freshet) flow of up to 200 cfs. Monitoring since project implementation has shown that the initial flow regime is inadequate to establish a healthy riparian system. As described in the flow section above, adaptive management recommendations to modify the flow regime have not been adopted.

Cottonwoods and willows are intolerant of established vegetation, and seedling recruitment requires barren sites newly formed by flood disturbance events and scour. Although willow species are prolific seed producers, the tiny seeds are annually released in a short interval after the spring snowmelt peak and are only viable for a few weeks. The seeds are blown or floated onto moist and barren sites left behind on exposed bars and stream banks areas. After germination, the small seedlings will only survive through the first summer of highly xeric conditions if the river stage recedes slowly enough for the root elongation to track the falling groundwater zone, which is tightly linked to the river water surface elevation. If the rate of decline following the peak in the flood hydrograph is too rapid, then seedlings

desiccate and die with resulting poor recruitment. LOR flow management to promote riparian vegetation is intended to emulate these natural conditions required for willow recruitment.

Since 2011, seasonal habitat flows have been far less than 200 cfs because of drought conditions and seasonal habitat flows do not sufficiently inundate landforms at elevations high enough above summer base flow levels. Over the past several years, the hydrograph has increased through the summer months, rather than a slow decline as would occur in natural systems.

Rapid Assessment Surveys (RAS) and belt transect monitoring have shown that riparian development of woody species (willow primarily) is overshadowed by tule growth. Flow management to date has favored the growth of tules. Although shrub willow provides important streamside habitat, the primary goal in the LORP is the establishment of riparian tree habitat. As reported last year, the number of non-clonal wood recruitment sites identified by RAS has declined significantly since 2011 as a direct correlation with declining seasonal habitat flows; from 92 sites in 2011 to 10 in 2015; seasonal habitat flows declined from 205 cfs to 0 cfs during that same period.

Regardless of the legal limitations on the management of the LORP, the MOU consultants have called for adaptive management actions each year to modify flows to advance the development of woody riparian species and to reduce tule growth.

Indicator Species

Indicator species are an integral part of the monitoring and adaptive management of the LORP, and are used to evaluate the habitat conditions for species residing in the Riverine-Riparian, Delta, Off-River Lakes and Ponds and Blackrock management areas. The Ecosystem Management Plan defines indicator species as species that indicate the presence of certain environmental conditions, seral stages or previous treatment.

Almost 20 years have elapsed since a pre-MOU group determined the Habitat Indicator Species (HIS) for each physical feature of the LORP. This HIS list was developed before there was a complete understanding how LORP management would influence changes in water, wetland, riparian and land condition. Monitoring, evaluation, and observations show that some HIS reacted very favorably to environmental changes (e.g. largemouth bass and waterfowl). Some HIS could not adapt to or occupy these changing environments (e.g. Owens tui chub and Owens pupfish). Other HIS are not effective to use as indicator species because they are rare or uncommon regionally or locally, or difficult to detect or

monitor. The list is now outdated and warrants re-evaluation to better match each HIS to each of the four physical features of the LORP.

Indicator species' habitat monitoring is designed to document changes in habitat conditions throughout the LORP. Changes in habitat for indicator species are analyzed using the California Wildlife Habitat Relationship (CWHR) system. However, monitoring has shown that a better habitat based methodology is more applicable to the LORP and the HIS than the CWHR alone. Also, results of intense avian census work by LADWP concluded that the lack of riparian habitat throughout the river corridor reflects the lack of bird diversity and richness.

Wetland habitat has resulted in significant waterfowl numbers and diversity. However, management of the BWMA wetland units must be corrected. As LADWP wrote in the 2015 annual report: "In order to maintain productivity, wetlands need to experience periodic water level fluctuations, a condition that has not occurred in BWMA due to the current static wetted acreage requirement. Water level manipulations are one of the most effective tools in wetland management to influence the food resources that attract wildlife. Continuous inundation of wetlands may lead to decreased wetland productivity and an inefficient use of water resources for wildlife benefit. Efficient use of water resources in the BWMA and maintaining wetland productivity and use by indicator species may require an alternative approach involving more seasonal manipulation of water levels and seasonal drying to control emergent vegetation".

Active Intervention

The Ecosystem Management Plan acknowledges that the LORP is a habitat-based project in which, "management of the Lower Owens River ecosystem will emphasize the "self-designing" or "self-organizing" capacity of nature to recruit species and to make choices from those species that have been introduced. Self-design emphasizes the development of natural habitat; which is called for in the MOU. Additionally, the FEIR states, "under the LORP natural habitats will be created and enhanced consistent with the needs of certain habitat indicator species through the application of appropriate flow and land management practices (FEIR p. S-1)." Again, the basis for decision making is habitat, and indicator species are used to evaluate the suitability of that habitat.

The one condition described in the Ecosystem Management Plan as well as the FEIR that could impel non-natural intervention would be the mechanical removal of tules to maintain open channel areas. It

was recognized that removal of cattails and bulrushes, if it is undertaken, could cause several incidental impacts depending upon the time of year, amount removed, and the method of removal. Cattails and bulrushes are used for nesting by various bird species and one special status species – least bittern. Mechanical removal of tules during the spring and early summer could disturb nesting birds by destroying cover and nests, altering breeding behavior, and displacing breeding pairs. Impacts can be avoided by scheduling the removal during the fall and winter months.

As described in the discussion above about riparian habitat, inadequate flow management since project implementation has not created ample riverine-riparian vegetation. Consequently, habitat for some land bird indicator species has not been attained, and water quality (temperature, dissolved and nutrient control) values have not been recognized and fisheries habitat from large woody debris is practically non-existent.

If modifications to flow management, as recommended over the years by the MOU Consultants, are not implemented, it may be necessary to use active intervention methods to meet or at least establish some trends toward riverine-riparian habitat goals. Active or non-natural interventions can be dredging as well as tule removal, planting of willow and cottonwood seeds, poles and sprouts. Other mechanical interventions would be directed at managing river flow without altering the 40 cfs base and variable seasonal habitat flow as currently codified. This could be achieved with a series of cross-channel check dams to provide instream flow management. If active interventions are implemented on a sufficiently broad level, tule biomass could be reduced and better controlled, water quality threats from organic matter accumulations reduced, and habitat for indicator species (fish and aquatic and land birds) improved.

The Inyo County Water Department (ICWD) has proposed two active interventions; the Owens River Water Trail (ORWT) and the Lower Owens River Flow Enhancement and Habitat Improvement Study. Both proposed interventions are described in this 2016 annual report.

Legal Mandates and Requirements

During 2007 and 2008, very early in LORP preparation and implementation, the MOU Consultants strongly believed that to maintain and improve LORP resources, selected restraining legal mandates and requirements would first have to be modified or eliminated. In a 2007 letter to all MOU Parties, the MOU Consultants requested that detailed inflexible river base flow not be set. Sufficient knowledge,

experience, and environmental evaluations were not yet available to allow base flows to be set in "stone".

In 2011, the MOU Consultants pushed for the elimination of the 50 cfs flow pump-out restriction at the Pumpback Station. The reason was to allow more management flexibility so higher river flows could be released when warranted. Any base, habitat, or flushing flow legal requirements interfering with LORP management flexibility was requested to be eliminated or modified. A new Stipulation and Order, however, was proposed by the MOU Consultants allowing the City to release an average annual flow of 55 cfs. All binding daily, monthly or seasonal habitat flow volumes or timing was requested for elimination so different flow scenarios could be tested and evaluated. This recommendation was also repeated in our 2012, 2013, 2014, and 2015 AM recommendations. This recommendation has not been accepted.

In 2013, the MOU Consultants again stressed that compliance restrictions were inhibiting the LORP's potential development. In 2013, the MOU Consultants, as they did in 2010, 2011, and 2012, recommended alternate ways to achieve flushing, habitat, and base flows (see Figure 1). Recommendations were not being accepted by the managing entities until requirements in the MOU (1997) and respective Stipulations and Orders dictating how the 40 cfs base flow is applied were first modified or rescinded. In 2014, a winter flushing flow with a 300 cfs peak flow release was again recommended to hopefully counter building detrimental environmental conditions. All recommendations are on hold because they require changes in legal restrictions before they can be accepted and implemented.

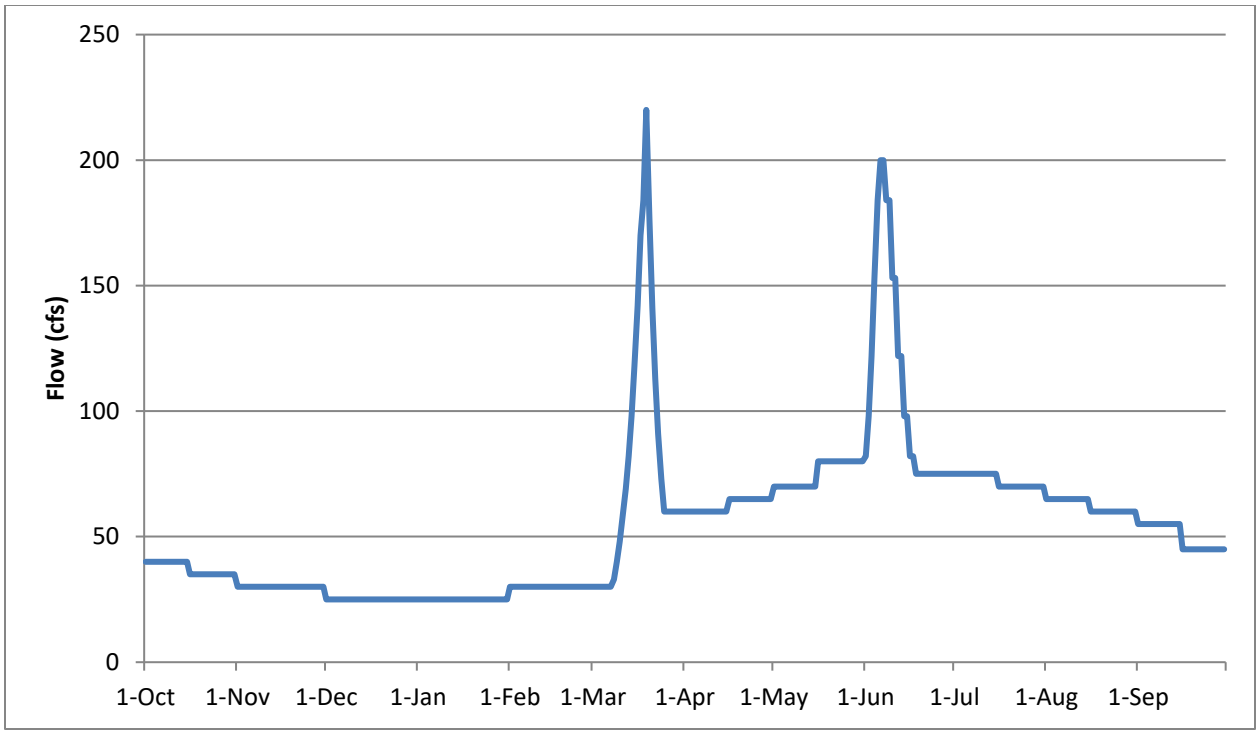


Figure 1. Proposed LORP Base and Seasonal Habitat Flow Regime

In 2014, the MOU Consultants recommended an annual flow proposal that closely followed the City's LOR flow proposal at the "River Summit" (Figure 2). We also favored this flow proposal for testing and evaluation. We called for base, habitat, and flushing flows to be implemented, monitored, and evaluated, starting in 2015. If either flow recommendation was to be rejected by the MOU Parties, then we recommended a 300 cfs spring (April) flushing flow be released in 2015. A compatible down-river flow augmentation plan was recommended to be developed by the Scientific Team. The City's 2014 flow proposal was rejected and not implemented in 2015. The river continues to be managed under 2007-2008 original guidelines. As a result, LOR future ecological conditions will be very similar to the ecological condition the river now occupies today. Until conflicting rules and regulations are modified there is not much that will be done to improve river management.

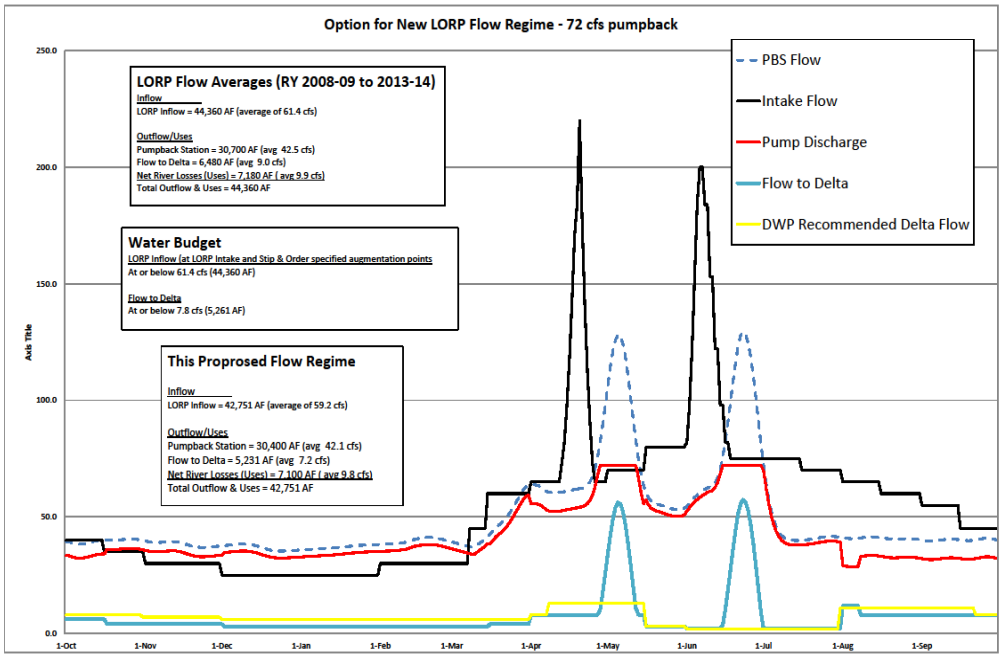


Figure 2. LADWP's flow proposal at "River Summit"

River Summit 2

MOU Parties have spent 23 years planning, implementing, and adaptively managing the LORP. Today's LOR condition demonstrates the effectiveness of this effort. The MOU Consultants have continually cautioned that if present LOR management continues, the river is not going to be much better in the future than it is today. Based on this understanding, the MOU Consultants in 2011 recommended the MOU Parties meet (Prelude to a "River Summit") and discuss present and future river flow condition and determine additional needs. An additional discussion item was to lay-out future river condition expectations. This led to the Consultants in 2013 to recommend the first "River Summit." A "River Summit" to lay-out expectations and the management direction needed to meet these expectations. This recommendation was accepted and "River Summit #1" was held in 2014.

The County and City conducted a very successful "Summit" developing a much better understanding of the issues facing the LORP. Issues such as fish kills, tule and cattail invasions, insufficient woody riparian vegetation recruitment, and a aggrading river moving to a wetland type landscape were discussed and better understood. Time did not allow sufficient discussions on expectations.

In parallel to a proposed "River Summit #2, in 2015 the MOU Consultants recommended the City and County conduct a "Monitoring and AM Workshop." The purpose was to improve the weaknesses in the LORP 2008 Monitoring and Adaptive Management Plan. This recommendation was not accepted. The MOU Consultants also recommended it was time for "River Summit #2" to be held in 2016. The main purpose would be to evaluate the status of the MOU (1997) and EIR (2004) goals, requirements and expectations. The MOU Parties would then determine how close these expectations are to being met and what management actions would be needed to meet these expectations. This recommendation was not accepted.

Land Management

Almost all grazing pastures and fields in the LORP have been continually in grazing utilization compliance since 2009. This is an important accomplishment by the lessees under such harsh series of recent drought years. Livestock grazing plans were developed in concert with lessees prior to implementation of LORP monitoring in 2008. Lessees had until 2009 to come into compliance with their grazing management plans. As a consequence of initial grazing management corrections, most of the initial plans have been modified. LADWP staff is in the process of revising and finalizing lease plans as needed.

In 2010 the MOU Consultants recommended LADWP develop a long-term burn plan as a key land management tool to maintain grazing conditions. Although a plan was written, burning has been difficult to perform given weather and air quality restrictions. LADWP will not coordinate with CDF for future range burns.

Belt transect monitoring was added to the range monitoring program in 2011-12 to better characterize the development of riparian vegetation. Belt-Plot monitoring produced valuable information. One example appears in the 2013 Annual Report. The Belt-Plot evaluations showed that summer base flows submerged 33% of all juvenile tree willows for 2 to 3 months. These conditions lead to mortality of many potential trees along the LOR. Belt-Plots also showed that the much higher summer base flow release enabled the expansion of tulles and cattails onto gravel bars, sandbars, and adjacent flood plains. This places young willows in direct competition with emergent wetland plant species and decreases future opportunities for tree willow germination on these sites. These documented assessments add to the wealth of information demonstrating that LOR flow management needs to be greatly improved.

In response to the on-going drought conditions since 2013, lessees have reduced grazing intensity so that they have all generally remained in compliance with utilization standards on riparian, upland and irrigated pastures. While there are exceptions on the Depot and Delta Main field leases, steps have been taken by LADWP staff to bring those leases into compliance.

MOU Consultants' 2016 Adaptive Management Recommendations

Recreational Fishing Evaluation

The MOU Consultants recommend a recreational fishing census be conducted in 2018.

2017 Seasonal Habitat Flow

The MOU Consultants still support implementing the City's 2015 LOR flow management proposal (Figure 2). If MOU Parties again do not want to implement the City's flow management plan, we then recommend the 2017 SHF and the spring (April) flushing flow each reach a peak flow of 300 cfs. The City, in implementing these flushing flows, would first have the authority to reduce following base flow levels to the degree necessary to meet their obligation of annual "Water Neutral" flow management.

2017 River Summit #2

The MOU Consultants again recommend "River Summit #2" be held in late summer, 2017. The main purpose would be to re-evaluate LOR ecological expectations. Ecological expectations that must be attained by the end of the LORP process would be identified. Once expectations are identified, then the Parties would determine management necessary to attain these expectations.

Lower Owens River 2017 Flow Management

Adaptive management recommendations for changes in base, SHF, and flushing flows, as outlined in 2013, 2014, and 2015, are still supported and again recommended for testing and evaluation in 2017. We again recommend implementing, monitoring, and evaluating the City's proposed annual LOR flow management plan displayed in Figure 2. These seasonal habitat flows should be initiated in 2017 and continued annually until properly evaluated by ICWD and LADWP for success, failure, no effect, or needed modifications.

Water Quality

The MOU Consultants again recommend that previous LORP AM recommended flow changes be re-evaluated by the MOU Parties. Flow recommendations showing promise would be further evaluated to determine if they could improve water quality conditions.

Tule and Cattail Management

The MOU Consultants recommend the MOU Parties conduct a special "Tule-Cattail Management Workshop" in 2017. This "Workshop" would search for and evaluate any feasible method to manage tules and cattails in the LOR. MOU Parties would consider the application of both passive and active methods that could accomplish related LORP goals and objectives. Open surface water conditions will continue to decline if present river flow management continues.

Delta Habitat Flow Release Site

The MOU Consultants again recommend the City release the previously identified DHA habitat flows from the Intake instead of the Pumpback Station. This is because the few attempts to release DHA flows from the Intake were so ineffective. Period 1 (April-May), Period 3 (September-October), and Period 4 (November-December) DHA habitat flows should be released in 2017 from the Intake as displayed in Tables 6 through 8 of the 2015 Annual Report in the Adaptive Management Chapter. We recommend the City meet their "water neutral" mandate by adjusting base flow levels as needed.

2017 Flushing Flows

The MOU Consultants recommend a flushing flow be released in April of 2017. This flow would reach a 300 cfs peak as outlined in the 2015 AM recommendations. Additional water used to implement this flushing flow would be replaced by authorizing the City to reduce base flow levels necessary to meet the Cities obligation of annual "water neutral" flow management.

Rapid Assessment Survey

Overall, the 2016 RAS results and data collected are consistent with past efforts. Woody recruitment remains low as this year's the effort recorded 15 recruitment sites. The lack of a seasonal habitat flow (SHF) and drought conditions do not create conditions conducive to recruitment. SHFs are needed to flood landforms and distribute and germinate willow and cottonwood seed. The primary noxious weed

invading the LORP, perrenial pepperweed, remains a problem. New populations of pepperweed were located in all but one river reach the first three reaches as well as the BWMA. Saltcedar remains a management issue and necessitates ongoing efforts to control its spread. According to the LORP Monitoring and Adaptive Management Plan (MAMP), RAS will continue to 2019. Previous AM recommendations were adopted to make the RAS methodology and analysis comparable through monitoring years, thus the MOU Consultants have no AM recommendations.

Active Interventions

ICWD has proposed two active LOR interventions in the 2016 annual report. The first intervention is the Owens River Water Trail, which ICWD predicts will benefit recreation and improve water quality and river habitat. Mechanical in-river excavation will clear 0.8 miles of river obstructions. Hand labor and specialized water craft will be used to open and maintain 1.75 miles of tule constricted channel. The MOU Consultants support and recommend the ORWT. We also recommend that planning identify how and where dredge spoils will be disposed of and establish a schedule for instream and out-of-stream work that does not threaten nesting waterfowl.

The second intervention proposed by ICWD is the Lower Owens River Flow Enhancement and Habitat Improvement Study. The purpose of the study it to address the problem of flow transport through the Island and organic matter accumulation. Prolific tule growth has occluded river channels on both the east and west side of the island affecting down- river flows. reducing the amount of water delivered to lower reaches of the LORP. In the past the MOU Consultants recommended LOR flow augmentation via the Alabama Gates; flows would be delivered below the Island reach via a restored bypass channel on the west side. These recommendations have not been accepted and the problem with SHF delivery to all LOR reaches continues. The MOU Consultants support and recommend the LOR flow and habitat improvement study in the island reach.

Blackrock Waterfowl Management Area

The runoff forecast for the 2016-2017 water year is 71%, thus the waterfowl acreage goal for the BWMA is 355 acres. GPS measurements taken from May through September indicate that the wetted area goal has not been met, as only 315 acres of inundated area were mapped in the Winterton and Thibaut units (Section 2.3.2 Blackrock Waterfowl Management Area results for April 2016 to September 2016). No explanation is provided in the Annual report as to why the acreage is below the goal, or how and when it

is expected to meet the required 355 acres. Presumably water management will continue through the winter to meet the goal; however, the intent is to meet the BWMA acreage near the beginning of the cycle (April-May) not in the following winter or early spring. Part of the water management difficulties may lie with the infrequent GPS measurements and not capturing peak flooded area inundation.

We recommend employing a remote sensing approach to bolster the frequency of flood inundation mapping in the BWMA. Not only will such an approach give project managers more data points from which to analyze the relationship between dedicated flow and inundated acreage, but it will also facilitate more monitoring at a cheaper cost. The process we suggest employs Landsat 8 imagery, which is provided for free. The Landsat 8 satellite images the entire earth every 16 days, which offers at least two images per month from which to map flood areas in the BWMA. Additionally, the Owens Valley, during the monitoring period (April – September) experiences long durations of cloud free days, which facilitates quality image capture. Thus, the Landsat 8 library http://landsat.usgs.gov/Landsat_Search_and_Download.php) houses ample images to use for monitoring the wetted extent in the BWMA. Landsat 8 is used extensively to map flooded areas, such as the Colorado Floods of 2013 (Chignel et al. 2013), flooding in Sri Lanka (USGS 2016) and water bodies in China. Landsat 8 has 11 bands, but b**ands 6 and 7** which covers different slices of the shortwave infrared, or SWIR, are particularly useful for telling wet earth from dry earth.

The image below depicts an unsupervised classification of water in the Thibaut and Winterton units using band 7 from a July 8th, 2016 Landsat 8 image (Figure 1). Band 7 brightness values ranged from 8067 to 25548. We used an unsupervised classification that selected pixels with a brightness value of less 10000. These pixels depict water or vegetation inundated with water (Figure 1). This method mapped 151 acres of flooded area in Thibaut and 201 acres of flooded area in Winterton (Table 1). Comparing the unsupervised classification to the GPS method revealed only a 2 acre total difference (Table 1).

Table 1. Acres Mapped using GPS and Landsat 8

BWMA Unit	Acres GPS 7/11/2016	Acres Landsat 8 – 7/08/2016	Difference
Winterton	213	201	12
Thibaut	140	150	-10
Total	353	351	2

These results indicate that using Landsat 8 imagery to map the flooded area in the BWMA is an accurate method. It is also a very cost effective method, as the imagery is free and the time it takes to perform the unsupervised classification is minimal.

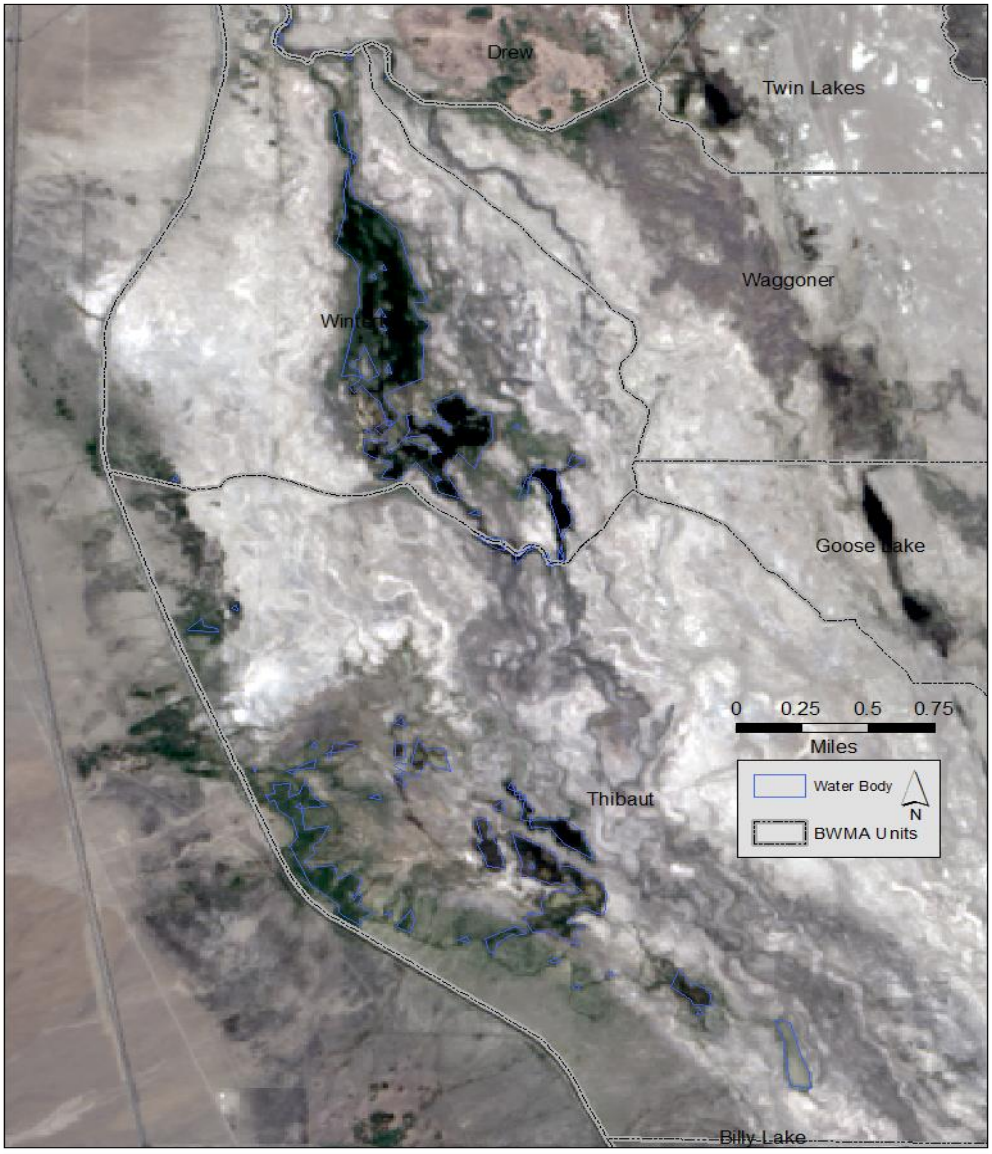


Figure 1. Blue polygons depict flooded areas in the Thibaut and Winterton Units from July 8th 2016.

Chignel, S., Anderson, R., Skach, S. and A. Weimer. 2013. Rising Water: Mapping the 2013 Colorado Floods with Landsat 8 Published on Sunday, 17 November 2013. Colorado Water Resources Team.

USGS. 2016. Landsat 8 Imagery Reveals Heavy Flooding in Sri Lanka. Accessed Nov. 10th 2016 via https://www.usgs.gov/media/images/landsat-8-imagery-reveals-heavy-flooding-sri-lanka

Current research and wetland management strategies indicate that the most appropriate management is to annually dry a wetland and seasonally flood it. Based on this latest research, in 2015 we recommended a plan that replaces both the 50% emergent vegetation standard and indefinite wetted cycles. However, the annual target acreage of up to 500 acres based on the water year should remain as the goal described in the MOU. LADWP's comments in the 2015 annual report indicated support for a plan that increases seasonal flooding cycle between units "as long as such a change would be water neutral from current practice". LADWP's basic concept is to create optimal waterfowl habitat in wetland units with seasonal flooding coinciding with spring and fall waterfowl migrations and subsequent drawdowns to occur early enough to control saltcedar and tules in the summer.

Perhaps a management strategy that would achieve more shallow flooding without compromising the acreage is to create a pulse release into an empty cell at the right time of year, while shutting off the water to an active cell – creating a draw-down that exposes the mudflats. The shallow flooding appears to be focused on wading birds in the spring and fall. Therefore, in the spring and the fall, water could be shut off from an active cell for short periods, and released into another cell to create shallow flooding, while simultaneously opening mudflat habitat for shorebirds. The MOU Consultants have not done an analysis, but this could likely be achieved without losing a large amount of acreage, as the water will persist in the flooded units for a longer period in the spring and fall.

Another option would be to have an outlet structure put in on the downstream end of the units (if possible) that could be used to release water in the spring and the fall into adjacent grasslands. Another option is to modify one of the units specifically for shallow flooding – using a series of little berms or some manipulation. It does make sense to have a water regime that varies seasonally rather than annually, as most wetlands function that way. By moving the flows up and down over the course of the year will create varied habitats, and a healthy wetland system. There is value in the deep-water habitats and the tule and cattail habitat. The need for shallow-water and mudflat habitat in the spring and fall might be achieved without losing the other habitats.

The seasonal approach to managing the Thibault Pond exemplifies the best management practice that can be applied to the other wetland units. The MOU Consultants strongly recommend the LADWP, ICWD, and CDFW work with the LORP Scientific Team to develop a new BWMA management plan based upon seasonal wetting and drying cycles.

Indicator Species

An important component of a revised BWMA management plan is a re-evaluation of appropriate indicator species. As discussed previously, not all the original indicator species are good predictors of habitat use or quality. Rapid rotation of flooding and drying wetland units will encourage greater usage of certain waterfowl species (wading and shorebirds). Some waterfowl species occur more frequently in wetlands with intermediate cover-to-water ratios whereas nesting species are found in wetlands with greater coverage of emergent vegetation, and wetland area may be the best predictor of species richness and of habitat use by individual species[4]. The MOU Consultants recommend a focused monitoring effort following implementation of a revised BWMA management plant to identify the most appropriate indicator species for long-term monitoring.

Livestock Grazing

The 5,259 acre Thibaut Grazing Lease (RLI-430) is used for wintering pack stock (horses and mules). The leases operate a horseback riding and packing services in the Sierras using horses and mules from this lease. The lease contains a large riverine-riparian exclosure (832 acres) which has been excluded from livestock grazing for over 10 years to ensure that future required riverine-riparian values would be protected. The Lower Owens River runs the length of this exclosure. The grazing lease plan calls for this exclosure to be rested a minimum of 10 years and then be evaluated to determine if this exclosure should remain non-grazed or if managed grazing could be allowed. This 10-year period is now up.

The MOU Consultants support the City's recommendation in the 2016 Annual Report that the Thibaut exclosure should now be opened to grazing by horses and mules now grazing the lease. The MOU Consultants support the City's recommendation based on the City constructing a much smaller Thibaut exclosure within the large exclosure so the goal of monitoring will still be accomplished. City watershed staff and the Consultants should determine the location, size, and fencing specifications prior to this small exclosure being constructed.

[4] Naugle, D.A. 1997. Habitat area requirements of prairie wetland birds in eastern South Dakota. PhD Dissertation, South Dakota State University.

9.0 INYO COUNTY WATER DEPARTMENT – POTENTIAL ADAPTIVE MANAGEMENT EFFORTS

The County has applied for two grants to open occluded sections of the Lower Owens River to improve flows. A proposal to the California Natural Resources Agency to create an Owens River Water Trail received a $500,030 award on July 22, 2016. The other proposal submitted to the California Wildlife Conservation Board (WCB), seeks $351,536 for a Lower Owens River Flow Enhancement and Habitat Improvement Study. The WCB make their award selection in February 2017.

The Owens River Water Trail opens up a 6.3 mile-long section of river just east of the town of Lone Pine between Lone Pine Narrow Gauge Road and Highway 136. The project benefits recreation and improves water quality and habitat. The open channel will be navigable by paddlecraft. This would be the longest section of open water available to boaters anywhere on the Lower Owens River. The river paddle trail is especially designed to accommodate boaters with disabilities. One-time mechanical excavation will be used to clear about 0.8 miles of river. Hand labor and specialized water craft will be used to open up and maintain about 1.75 river-miles of tule constricted open water to a width of at least 10'. Improvements made at the top and bottom of the water trail will allow the public easy access to the water. More information on this project can be found on the Water Department's website: http://www.inyowater.org/wp-content/uploads/2012/10/OWENS-RIVER-WATER-TRAIL-FULL-APPLICATION-20150901.pdf

The proposed Lower Owens River Flow Enhancement and Habitat Improvement Study addresses challenges in the Islands reach of the Lower Owens River north of Lone Pine and east of the Alabama Gates, where the waterway has aggraded and spread out of its channel. The Islands marsh obstructs and attenuates flow and is a prominent source of organic matter that exacerbates low oxygen conditions downstream, creating an impediment to managing flows in the lower reaches of the LORP and challenging the ability to meet habitat and water quality goals. A grant from the WCB will allow a scientific investigation into the feasibility of reactivating natural channel(s) through the Islands area. The goal is to reestablish functional ecological flows and improve water quality for the warm-water fishery, and in the process diversify the associated riverine-riparian habitat. By addressing the flow and water quality issues through the Islands, improvements both upstream and downstream can be achieved and further implemented. The study would be conducted by outside experts in fluvial geomorphology, biology, and restoration engineering who will evaluate the feasibility of several management options, prepare engineering plans, complete a California Environmental Quality Act (CEQA) analysis, and obtain necessary permits. The final product would be a CEQA-approved plan for implementation of a flow enhancement project. More information about this study proposal can be found on the Water Department's website: http://www.inyowater.org/wp-content/uploads/2012/10/INYO-COUNTY-WCB_CSFEP-Grant-Application.pdf

10.0 RESPONSE TO ADAPTIVE MANAGEMENT RECOMMENDATIONS

10.1 Response to Comments on Ecosystem Sciences'

2016 Lower Owens River Project Annual Report
Adaptive Management Recommendations
LADWP and ICWD (February 2017)

Recreational Fishing Evaluation

The MOU Consultants recommend a recreational fishing census be conducted in 2018.

LADWP: LADWP is in favor of conducting a creel census in the LORP in 2018. This will be incorporated into the 2017-2018 fiscal year LORP Work Plan, Budget and Schedule developed by Inyo County and LADWP.

IC: Agrees that a fishery survey should be conducted, but that a creel census might not be the best approach. A fisherman catch per unit effort, which is what a creel census measures, can be unduly influenced by a number of uncontrollable variables. Recent efforts were hampered by high winds and cold weather, which diminished the bite, and access to water has become more difficult due to tule encroachment.

2017 Seasonal Habitat Flow

The MOU Consultants still support implementing the City's 2015 LOR flow management proposal (Figure 2). If MOU Parties again do not want to implement the City's flow management plan, we then recommend the 2017 SHF and the spring (April) flushing flow each reach a peak flow of 300 cfs. The City, in implementing these flushing flows, would first have the authority to reduce following base flow levels to the degree necessary to meet their obligation of annual "Water Neutral" flow management.

LADWP: Any increase in the SHF above 200 cfs will not be water neutral, so no flows above 200 cfs will be released unless the MOU Parties agree to raise the pumping limitation above 50 cfs at the pump back station. The same is true for a spring flushing flow, so no spring flushing flow will occur above what is required to maintain 40 cfs in the LORP unless an agreement is made with the MOU Parties.

IC: Supports experimenting with alternative hydrographs that do not result in excessive releases of water to the Delta. The Delta has developed extensive marsh and lost tree willow under current water management and may be receiving too much water. The County looks to the MOU parties to allow a trial modification to the pumpback station capacity so that flow experiments can occur.

2017 River Summit #2

The MOU Consultants again recommend "River Summit #2" be held in late summer, 2017. The main purpose would be to re-evaluate LOR ecological expectations. Ecological expectations that must be attained by the end of the LORP process would be identified. Once expectations are identified, then the Parties would determine management necessary to attain these expectations.

LADWP: This recommendation will be taken under advisement. However, the MOU Consultants, LADWP, Inyo County, the MOU Parties and the public can discuss these issues at the public meeting that coincides with the release of the draft LORP Report each year.

IC: Since the MOU was signed, the MOU parties have met periodically to discuss LORP-related matters. Such meetings should continue to discuss the numerous issues associated with these adaptive management recommendations.

Lower Owens River 2017 Flow Management

Adaptive management recommendations for changes in base, SHF, and flushing flows, as outlined in 2013, 2014, and 2015, are still supported and again recommended for testing and evaluation in 2017. We again recommend implementing, monitoring, and evaluating the City's proposed annual LOR flow management plan displayed in Figure 2. These seasonal habitat flows should be initiated in 2017 and continued annually until properly evaluated by ICWD and LADWP for success, failure, no effect, or needed modifications.

LADWP: LADWP is in support of the City's flow management proposal discussed in recent years that was referenced in this year's Adaptive Management Recommendations. LADWP is willing to implement an alternate flow schedule as long as the new flow scenario is water neutral.

IC: Supports investigating alternative hydrographs to try to improve the health of the Lower Owens River, and encourages the MOU parties to develop an agreement that would allow testing of new flow regimes. Issues that confounded MOU party agreement on prior efforts to implement an alternative hydrograph were the need to maintain 'water neutrality', agreement on a reasonable and feasible monitoring program, and relaxation of the allowed pumping rate at the pumpback station. The parties would need to come to agreement by February 2017 in order to have water monitoring equipment deployed and other monitoring requirements in place for experiments beginning in the late fall 2017.

Water Quality

The MOU Consultants again recommend that previous LORP AM recommended flow changes be re-evaluated by the MOU Parties. Flow recommendations showing promise would be further evaluated to determine if they could improve water quality conditions.

LADWP: LADWP and Inyo County conducted water quality monitoring in 2015 in preparation of changes in flow management. These flow management changes were not supported by all MOU Parties, and therefore were not implemented. No new water quality monitoring or analysis is necessary at this time.

IC: Agrees that unless changes to river flow are agreed upon, or construction activities or an uncontrolled water release were to occur, then additional water testing is unnecessary.

Tule and Cattail Management

The MOU Consultants recommend the MOU Parties conduct a special "Tule-Cattail Management Workshop" in 2017. This "Workshop" would search for and evaluate any feasible method to manage tules and cattails in the LOR. MOU Parties would consider the application of both passive and active

methods that could accomplish related LORP goals and objectives. Open surface water conditions will continue to decline if present river flow management continues.

LADWP: No additional meeting is necessary at this time. If warranted, this issue can be further discussed among the LORP Scientific Team.

IC: No formal meeting is required at this time. The County, through its research related to the Owens River Water Trail, and its foray into experimental tule removal, is gaining knowledge that can be applied in the future. The County has also applied for a grant to investigate the feasibility of opening up a section of the "Islands" for the purpose of improving water quality and controlling tules to reestablish diverse riparian habitat. Tule encroachment and control could be discussed at an MOU party meeting if desired.

Delta Habitat Flow Release Site

The MOU Consultants again recommend the City release the previously identified DHA habitat flows from the Intake instead of the Pumpback Station. This is because the few attempts to release DHA flows from the Intake were so ineffective. Period 1 (April-May), Period 3 (September-October), and Period 4 (November-December) DHA habitat flows should be released in 2017 from the Intake as displayed in Tables 6 through 8 of the 2015 Annual Report in the Adaptive Management Chapter. We recommend the City meet their "water neutral" mandate by adjusting base flow levels as needed.

LADWP: Flow releases as described for Period 1, Period 3, and Period 4 would result in additional water lost above current conditions and would not otherwise be water neutral. LADWP will not implement adaptive manage recommendations that are not water neutral.

IC: The addition of a 20-30 cfs pulse from the Intake would be of such low energy that benefits would be minor and would impact the river only above the Islands. These upper reaches already experience regular 80-90 cfs summer flows. It is not surprising that the strategy of releasing DHA habitat flows from the Intake has been observed to be ineffective; however, that does not argue in favor of repeating this strategy.

2017 Flushing Flows

The MOU Consultants recommend a flushing flow be released in April of 2017. This flow would reach a 300 cfs peak as outlined in the 2015 AM recommendations. Additional water used to implement this flushing flow would be replaced by authorizing the City to reduce base flow levels necessary to meet the Cities obligation of annual "water neutral" flow management.

LADWP: A 300 cfs peak flushing flow would result in a substantial amount of water flowing by the pump back station and to the Delta. In order to 'replace' that water LADWP would have to reduce water going to the Delta. Any option LADWP has for reducing flows to the Delta would violate the existing Court mandated flows to the Delta and/or the Lower Owens River. As such, LADWP cannot implement the recommended spring flushing flow unless the MOU Parties agree to new flow regimes which are water neutral.

IC: Supports experimenting with additional flushing flows to improve water quality, relocate soils and create more opportunities for woody recruitment, and potentially aid in control tule. Reducing flows to

the Delta to recoup water used in these pulses should be considered, and could be supported. The County looks to the MOU parties to agree to trial of alternative flow management. Issues that confounded MOU party agreement on prior efforts to implement an alternative hydrograph were the need to maintain 'water neutrality', agreement on a reasonable and feasible monitoring program, and relaxation of the allowed pumping rate at the pumpback station. The parties would need to come to agreement by February 2017 in order to have water monitoring equipment deployed and other monitoring requirements in place for experiments beginning in the late fall 2017.

Rapid Assessment Survey

Overall, the 2016 RAS results and data collected are consistent with past efforts. Woody recruitment remains low as this year's the effort recorded 15 recruitment sites. The lack of a seasonal habitat flow (SHF) and drought conditions do not create conditions conducive to recruitment. SHFs are needed to flood landforms and distribute and germinate willow and cottonwood seed. The primary noxious weed invading the LORP, perennial pepperweed, remains a problem. New populations of pepperweed were located in all but one river reach the first three reaches as well as the BWMA. Saltcedar remains a management issue and necessitates ongoing efforts to control its spread. According to the LORP Monitoring and Adaptive Management Plan (MAMP), RAS will continue to 2019. Previous AM recommendations were adopted to make the RAS methodology and analysis comparable through monitoring years, thus the MOU Consultants have no AM recommendations.

LADWP: Comment noted, however please note that according to the LORP MAMP, the last year of Rapid Assessment Monitoring will be 2018, not 2019.

IC: Some level of surveillance is required to monitor noxious weeds and other ecological threats that if not addressed in a timely manner could degrade the project and lead to expensive future management obligations.

Active Interventions

ICWD has proposed two active LOR interventions in the 2016 annual report. The first intervention is the Owens River Water Trail, which ICWD predicts will benefit recreation and improve water quality and river habitat. Mechanical in-river excavation will clear 0.8 miles of river obstructions. Hand labor and specialized water craft will be used to open and maintain 1.75 miles of tule constricted channel. The MOU Consultants support and recommend the ORWT. We also recommend that planning identify how and where dredge spoils will be disposed of and establish a schedule for instream and out-of-stream work that does not threaten nesting waterfowl.

LADWP: LADWP is in support of ICWD obtaining grant funding to be used through the planning stage and CEQA evaluation for the Owens River Water Trail but has not yet granted authorization for implementation on City of Los Angeles property. Several issues are still unresolved including resource concerns such as placing spoils within the flood plain that can cause vegetation and potential air quality (dust) issues, permitting issues, conflicts with MOU requirements, agency responsibilities, potential financial obligations, and details in the County's Construction Plan. In order for the County to obtain these grant funds, the City must grant the County a 20 year land tenure agreement to implement, operate, and maintain this project. LADWP and ICWD continue to meet as necessary to discuss the outstanding issues.

IC: The County received a $500,030 grant from the California Natural Resources Agency to create an ORWT in the Lower Owens River east of Lone Pine. The trail provides water access for recreation in the LORP that is otherwise not available and improves river function to protect aquatic habitat. The ORWT will help meet LORP goals of establishing a healthy functioning Lower Owens River riparian ecosystem, while providing for the continuation of sustainable uses including recreation.

This grant will pay for CEQA, project design, and channel clearing; however the County cannot receive funds to accomplish this planning until LADWP provides permission for the County to use these lands under a lease agreement. Without LADWP's full cooperation these funds to implement important adaptive management and help reach LORP goals are in jeopardy.

The second adaptive management intervention proposed by ICWD is the Lower Owens River Flow Enhancement and Habitat Improvement Study. The purpose of this grant funded study is to address the lack of effective flow through the Islands. Prolific tule growth has occluded the historic east and west branches of river in the Islands area and as a result down-river flows are attenuated to the point that flushing flows are ecologically ineffective in the river's lower reaches. The study would assess the feasibility of engineering improved flows through the area; including options to direct augmented flows from the Alabama Gates directly to the lower river rather than into the Islands. If determined feasible, an improvement plan would be developed and CEQA and permitting would be completed. Implementation would proceed when additional third party funding become available.

LADWP: LADWP is in support of investigating the practical feasibility of channel excavation in the Islands to improve water conveyance. LADWP provided a letter of support for ICWD to obtain grant funds for this purpose in August 2016. If the study is funded, it will identify possible options for conducting this work, long term environmental benefits and impacts, and provide a cost analysis for a preferred alternative. Additional authorization would be required to implement any such alternative on City property.

Blackrock Waterfowl Management Area

The runoff forecast for the 2016-2017 water year is 71%, thus the waterfowl acreage goal for the BWMA is 355 acres. GPS measurements taken from May through September indicate that the wetted area goal has not been met, as only 315 acres of inundated area were mapped in the Winterton and Thibaut units (Section 2.3.2 Blackrock Waterfowl Management Area results for April 2016 to September 2016). No explanation is provided in the Annual report as to why the acreage is below the goal, or how and when it is expected to meet the required 355 acres. Presumably water management will continue through the winter to meet the goal; however, the intent is to meet the BWMA acreage near the beginning of the cycle (April-May) not in the following winter or early spring. Part of the water management difficulties may lie with the infrequent GPS measurements and not capturing peak flooded area inundation.

We recommend employing a remote sensing approach to bolster the frequency of flood inundation mapping in the BWMA. Not only will such an approach give project managers more data points from which to analyze the relationship between dedicated flow and inundated acreage, but it will also facilitate more monitoring at a cheaper cost. The process we suggest employs Landsat 8 imagery, which is provided for free. The Landsat 8 satellite images the entire earth every 16 days, which offers at least two images per month from which to map flood areas in the BWMA. Additionally, the Owens Valley, during the monitoring period (April – September) experiences long durations of cloud free days, which

facilitates quality image capture. Thus, the Landsat 8 library http://landsat.usgs.gov/Landsat_Search_and_Download.php) houses ample images to use for monitoring the wetted extent in the BWMA. Landsat 8 is used extensively to map flooded areas, such as the Colorado Floods of 2013 (Chignel et al. 2013), flooding in Sri Lanka (USGS 2016) and water bodies in China. Landsat 8 has 11 bands, but b**ands 6 and 7** which cover different slices of the shortwave infrared, or SWIR, are particularly useful for telling wet earth from dry earth.

The image below depicts an unsupervised classification of water in the Thibaut and Winterton units using band 7 from a July 8th, 2016 Landsat 8 image (Figure 1). Band 7 brightness values ranged from 8067 to 25548. We used an unsupervised classification that selected pixels with a brightness value of less 10000. These pixels depict water or vegetation inundated with water (Figure 1). This method mapped 151 acres of flooded area in Thibaut and 201 acres of flooded area in Winterton (Table 1). Comparing the unsupervised classification to the GPS method revealed only a 2 acre total difference (Table 1).

Table 1. Acres Mapped using GPS and Landsat 8

BWMA Unit	**Acres GPS 7/11/2016**	**Acres Landsat 8 – 7/08/2016**	**Difference**
Winterton	213	201	12
Thibaut	140	150	-10
Total	353	351	2

LADWP: LADWP will take this recommendation under advisement. LADWP is currently evaluating the alternative work load required to implement the MOU Consultants' recommendation above using Landsat imagery.

IC: Supports using satellite imagery to determine flooded extent and ICWD staff could be available to conduct this analysis. We would continue our practice of walking the wetted perimeter to ground truth the imagery estimates until we have confidence in the new method.

Current research and wetland management strategies indicate that the most appropriate management is to annually dry a wetland and seasonally flood it. Based on this latest research, in 2015 we recommended a plan that replaces both the 50% emergent vegetation standard and indefinite wetted cycles. However, the annual target acreage of up to 500 acres based on the water year should remain as the goal described in the MOU. LADWP's comments in the 2015 annual report indicated support for a plan that increases seasonal flooding cycle between units "as long as such a change would be water neutral from current practice". LADWP's basic concept is to create optimal waterfowl habitat in wetland units with seasonal flooding coinciding with spring and fall waterfowl migrations and subsequent drawdowns to occur early enough to control saltcedar and tules in the summer.

Perhaps a management strategy that would achieve more shallow flooding without compromising the acreage is to create a pulse release into an empty cell at the right time of year, while shutting off the water to an active cell – creating a draw-down that exposes the mudflats. The shallow flooding appears to be focused on wading birds in the spring and fall. Therefore, in the spring and the fall, water could be shut off from an active cell for short periods, and released into another cell to create shallow flooding, while simultaneously opening mudflat habitat for shorebirds. The MOU Consultants have not done an

analysis, but this could likely be achieved without losing a large amount of acreage, as the water will persist in the flooded units for a longer period in the spring and fall.

Another option would be to have an outlet structure put in on the downstream end of the units (if possible) that could be used to release water in the spring and the fall into adjacent grasslands. Another option is to modify one of the units specifically for shallow flooding – using a series of little berms or some manipulation. It does make sense to have a water regime that varies seasonally rather than annually, as most wetlands function that way. By moving the flows up and down over the course of the year will create varied habitats, and a healthy wetland system. There is value in the deep-water habitats and the tule and cattail habitat. The need for shallow-water and mudflat habitat in the spring and fall might be achieved without losing the other habitats.

The seasonal approach to managing the Thibault Pond exemplifies the best management practice that can be applied to the other wetland units. The MOU Consultants strongly recommend the LADWP, ICWD, and CDFW work with the LORP Scientific Team to develop a new BWMA management plan based upon seasonal wetting and drying cycles.

LADWP: LADWP supports, in concept, a plan for BWMA that would incorporate seasonal wetting and drying of the management units (or at least more frequent rotation among units), is water neutral from current practice, and will not pose an additional obligation including cost and resources to implement, operate, or maintain. Such a plan, however, is limited currently by legal requirements for the LORP, and more specifically with regard to the management of the BWMA. LADWP is not in support of substantial additions to infrastructure of the BWMA (berms, gates, diversion structures) that pose additional costs and resources for the City to install and maintain.

Further analysis needs to be conducted to determine water use and costs associated with various alternatives, as well as legal considerations for making changes to the management of BWMA.

IC: Both IC and LADWP see the merits of some of the Consultants recommendations, and these should be discussed at a scientific team meeting with LADWP and CDFW. This group would develop a new plan to be implemented in 2017-2018.

Indicator Species

An important component of a revised BWMA management plan is a re-evaluation of appropriate indicator species. As discussed previously, not all the original indicator species are good predictors of habitat use or quality. Rapid rotation of flooding and drying wetland units will encourage greater usage of certain waterfowl species (wading and shorebirds). Some waterfowl species occur more frequently in wetlands with intermediate cover-to-water ratios whereas nesting species are found in wetlands with greater coverage of emergent vegetation, and wetland area may be the best predictor of species richness and of habitat use by individual species[4]. The MOU Consultants recommend a focused monitoring effort following implementation of a revised BWMA management plant to identify the most appropriate indicator species for long-term monitoring.

LADWP: LADWP is in support of reevaluating the list of Habitat Indicator Species relevant to the LORP, as has been discussed in recent years. LADWP will consider revisions to current monitoring programs to better suit new or modified indicator species upon adoption of a revised species list.

IC: Inyo County proposes that LADWP, and CDFW meet to discuss options to better manage the 1500 acres of wetlands to increase wetland productivity and waterfowl diversity, while conserving water. Avian surveys and other monitoring at BWMA over time show a decline in waterfowl numbers and diversity, and an increase in emergent and weedy vegetation.

Livestock Grazing

The 5,259 acre Thibaut Grazing Lease (RLI-430) is used for wintering pack stock (horses and mules). The leases operate a horseback riding and packing services in the Sierras using horses and mules from this lease. The lease contains a large riverine-riparian exclosure (832 acres) which has been excluded from livestock grazing for over 10 years to ensure that future required riverine-riparian values would be protected. The Lower Owens River runs the length of this exclosure. The grazing lease plan calls for this exclosure to be rested a minimum of 10 years and then be evaluated to determine if this exclosure should remain non-grazed or if managed grazing could be allowed. This 10-year period is now up.

The MOU Consultants support the City's recommendation in the 2016 Annual Report that the Thibaut exclosure should now be opened to grazing by horses and mules now grazing the lease. The MOU Consultants support the City's recommendation based on the City constructing a much smaller Thibaut exclosure within the large exclosure so the goal of monitoring will still be accomplished. City watershed staff and the Consultants should determine the location, size, and fencing specifications prior to this small exclosure being constructed.

LADWP: LADWP is in favor of constructing a smaller exclosure within the Thibaut Riparian Pasture as proposed. The proposed location is provided in Section 8 of the 2016 Draft LORP Report.

Additional Comment:

Page 22, Land Management:
"LADWP will not coordinate with CDF for future range burns." This statement is incorrect; LADWP coordinates regularly with Calfire (formerly CDF) to plan and carry out prescribed burns on City property including in the LORP Planning Area. In 2014 and 2015, LADWP conducted a range burn in the White Meadow Pasture with Calfire's assistance. A portion of the Winterton Management Unit (BWMA) was prepared for burning in 2016 but conditions were not conducive to carrying out this burn. Calfire and LADWP intend to burn this unit and a new range burn unit in 2017.

Pole Planting of Tree Willow and Cottonwood
Many of the habitat indicator species for the LORP require riparian forest canopy. Due to less than expected recruitment of tree willow and cottonwood, an extensive floodplain fire in 2013, and the drowning of trees, a net loss of tree canopy has been recorded in the LORP since the project began. An effort is underway to establish groves of trees that might increase arboreal habitat and serve as a source of seed to aid recruitment. IC proposes a second year of this pilot project to assess the feasibility and effectiveness of intervening to actively develop stands of tree willow and cottonwood in the LORP. Future expansion of this project is dependent on obtaining supplemental third-party funding.

11.0 PUBLIC MEETING AND COMMENTS

11.1 LORP Annual Public Meeting

The LORP 2016 Draft Annual Report public meeting was held on December 20, 2016, at the LADWP Bishop office. The following table lists those in attendance.

2016 LORP Public Meeting

December 20, 2016

Name	Affiliation	E-Mail/Phone
Mike Prather	Audubon/Toyo Co	mprather@lonepinetv.com
Charles James	The Sheet	freelance.Charles.James@gmail.com
Deb Murphy	SierraWave	dmurphy449@outlook.com
Sally Manning	Big Pine Tribe, OVC rep	s.manning@bigpinepaiute.org
MARK BAGLEY	SIERRA CLUB	m.bagley@verizon.net
Yaney MacIver	OVC	yaney_la_maciver@icloud.com
Will Richmond	Public	Bohatch@aol.com

11.2 Public Meeting

The audio recording of the LORP 2016 Draft Annual Report public meeting is included on the enclosed disk.

11.3 LORP 2016 Draft Annual Report Comments

The comment period for the 2016 Draft LORP Report was from December 5, 2016 through January 5, 2017.

11.3.1 California Department of Fish and Wildlife

The following pages are comments received by California Department of Fish and Wildlife.

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Boulevard, Suite C-220
Ontario, CA 91764
(909) 484-0167
www.wildlife.ca.gov

***EDMUND G. BROWN, Jr.**, Governor*
***CHARLTON H. BONHAM,** Director*

January 5, 2017

James Yannotta
Los Angeles Aqueduct Manager
Los Angeles Department of Water and Power
300 Mandich Street
Bishop, CA 93514

Dr. Robert Harrington
Director
Inyo County Water Department
P.O. Box 337
Independence, CA 93526-0337

Subject: LOWER OWENS RIVER PROJECT 2016 DRAFT ANNUAL REPORT COMMENTS

Dear Mr. Yannotta and Dr. Harrington:

The California Department of Fish and Wildlife (CDFW) appreciates the opportunity to provide comments on the Lower Owens River Project (LORP) 2016 Draft Annual Report. CDFW continues to support changes to the Lower Owens River flow regime, and continues to support changing wetland management practices in the Blackrock Waterfowl Management Area to improve conditions for waterfowl and shorebirds. The following comments aim to address the goals and challenges of the LORP as discussed in the 2016 Draft Report. Specific page number references from the 2016 Draft Report are provided in parenthesis throughout this letter.

LOWER OWENS RIVER FLOWS

CDFW continues to be concerned that the current flow regime on the Lower Owens River will not result in achievement of LORP goals. CDFW continues to support changes to the flow regime for a trial period in which comprehensive monitoring would elucidate the impacts on various water quality parameters, riparian tree recruitment, and sapling survival. The 2016 seasonal habitat flow failed to substantially elevate the river base flows at the downstream flow gauging stations (2-16), presumably resulting in a failure to provide expected ecosystem benefits identified in the 2004 EIR. As CDFW stated in our 2012, 2013, 2014, and 2015 comment letters, CDFW strongly supports using higher magnitude flushing and seasonal habitat flows; releasing delta habitat flows from the intake; and potentially altering the timing and ramp down from seasonal habitat flows to enhance the recruitment of riparian trees. It is clear that the river power generated by the existing seasonal flow regime is insufficient to scour the banks or channel, and continuation of the flow regime without extensive mechanical intervention will likely result in a failure to meet LORP Goals. As stated in our January 2016 comment letter, the specific timing and magnitude of flow changes warrant further discussion by all Memorandum of Understanding (MOU) Parties.

CDFW continues to be open to considering a modification the legal documents that set the base and peak flows on the Lower Owens River. At this time, CDFW supports a temporary lifting of pumpback station restrictions in order to provide the flexibility to implement different flow recommendations.

Altering the flow regime of the Lower Owens River has been an adaptive management recommendation that CDFW has supported for several years (see Annual Report comment letters in 2012, 2013, 2014, 2015, and 2016). It is also evident that changes to Lower Owens River Flow regimes will require early consultation and planning with all MOU party representatives, and CDFW encourages Inyo County and Los Angeles Department of Water and Power (LADWP) to engage with the 1997 MOU parties regarding this, and other, topics. CDFW supports LADWP's recommendation that an MOU party meeting occur during spring or summer of 2017 to discuss this, and other, management recommendations on the LORP. It is apparent that failure to implement adaptive measures will result in a failure to meet LORP goals.

BULRUSH AND CATTAIL GROWTH

Although bulrush and cattail growth were identified as one of the main biological challenges at the 2014 LORP Summit, there appears to have been no progress on this topic. CDFW is open to discussing mechanical removal of emergent vegetative growth in conjunction with flow modification to provide the best option for a self-sustaining fluvial habitat, as described in the 1997 MOU. This challenge is increasingly important to address as the vegetation change analysis and aggrading state of the river indicate bulrush and cattail will likely increase along the Lower Owens River in the future. Methods to reduce or limit river aggradation should be investigated. Also the potential for lower winter flows to allow bulrush and cattail encroachment on the channel should be investigated before winter flows are reduced.

BLACKROCK WATERFOWL MANAGEMENT AREA

CDFW concurs with LADWP's conclusion that wetland productivity and use by habitat indicator bird species at the Blackrock Waterfowl Management Area would be improved by more seasonal manipulation of certain habitat areas, including seasonal drying to control emergent vegetation (3-30 and 3-31). The best available science strongly supports seasonal wetland management for migratory waterfowl and shorebirds (Olsen 2011, Davis 2014); in addition to increased waterfowl and shorebird use, seasonal wetland habitat management has decreased water-use at U.S. Fish and Wildlife (USFWS) and CDFW-operated wetland areas and decreased maintenance costs at these locations. Data from California's Imperial and Central Valleys indicates that perennial-flood regimes result in decreased value to migratory waterfowl and shorebirds, increased maintenance costs, and increased water loss (CDFG 2008, CWA 2015, Olsen 2011, Davis, 2014). Cost- and water- effective wetland management for waterfowl and shore birds has been implemented across California by CDFW, USFWS, and non-governmental organizations, and CDFW would like to encourage LADWP, Inyo

County, and the MOU parties to consider the implementation of similar management regimes.

CDFW appreciates LADWP organizing and implementing, with Inyo County's help, an assessment of waterfowl use within the Blackrock Waterfowl Management Area. CDFW has some concerns regarding study methodology and the assessment of habitat quality. The majority of California's shorebird and waterfowl population is migratory, and overwinters in California wetlands. Historical reports of the Owens Basin (*e.g.* Grinnell 1917) indicate that this is true of the Owens Valley as well. LADWP's seasonal survey data shows this is only partially true of the Blackrock Waterfowl Management Area, and there appears to be limited use of waterfowl during the majority of the migration period (3-9). Waterfowl and shorebird use of habitat use during fall and winter is dependent on food availability, hunting pressure, and predation (CWA 2015, Davis 2014); meeting LORP goals for waterfowl use of the Blackrock Waterfowl Management Area will require addressing the known factors that impact waterfowl abundance- specifically food availability. While the annual report includes a limited discussion on waterfowl and shorebird habitat use and forage, CDFW recommends the following be included in the analysis and interpretation to improve the content and accuracy:

- The study mentions the separation of waterfowl and shorebirds into functional guilds, which is a common method used by many studies (*e.g.* Takekawa *et al.* 2005) to account for different habitat requirements prior to determining habitat preferences. CDFW believes that a further discussion of functional guilds may be helpful in the analysis prior to discussion of water depth or foraging associations or preferences; however, the study results are informative, and CDFW supports management based studies and assessments of wildlife resources within the LORP.

- The discussion of suitable waterfowl forage is limited to the presence of Fabaceae, or "forbs" (3-30). While Fabaceae can provide high-quality forage for some waterfowl species, many other plants provide waterfowl forage (Martin and Uhler 1939), and many modern waterfowl and shorebird management methods are based on maximizing moist-soil seed production from C4 plants, as this maximizes the carbohydrates available to migrating birds. In addition, the discussion of shore bird and waterfowl habitat requirements should include a discussion of the seasonal variation of dietary and habitat needs, and how wetland management can meet those needs.

CDFW would like to re-iterate our 2016 recommendations for the Blackrock Waterfowl Management Area. Specifically, CDFW recommends the following actions to help Blackrock Waterfowl Management Area meet the goals of the 1997 MOU:

- Build a collaborative Blackrock Waterfowl Management Area team including CDFW, Inyo County, LADWP and the California Waterfowl Association to guide, fund, and implement significant adaptive management to switch largely from perennial to seasonal wetland.

- Implement science-based wetland management practices to maximize use by migratory and resident waterfowl, migratory shorebirds, and passerine birds.
- Arrange MOU party meeting to discuss changing regulations at Blackrock Waterfowl Management Area to allow a set amount of water to replace the regulatory standard of wetted acreage that currently exists.
- Develop fine-scale topographic map of the Blackrock Waterfowl Management Area to determine flow direction and current topographic fall for assessing current management capabilities.
- Modify wetland unit infrastructure to allow for efficient flood-up and drawdown activities.
- Conduct systematic waterfowl surveys three times per year (peak fall migration, overwinter, spring breeding), in accordance with CDFW protocol and validated by follow-up ground surveys to evaluate the effect of seasonal wetland management.

CDFW understands that adaptive management will require early consultation and planning with all MOU party representatives, and CDFW encourages the County and LADWP to engage with the 1997 MOU parties regarding this. CDFW supports LADWP's recommendation that an MOU party meeting occur during spring or summer of 2017.

FISHERIES SURVEY

A creel survey was scheduled for 2016 (Monitoring and Adaptive Management Plan), but was not conducted because the warm water fishery appears to be in good condition. CDFW remains concerned that the creel survey data was inappropriately used by LADWP and Ecosystem Sciences to assess the population status of the warm water fishery as the data presented in previous reports was incompletely analyzed and violated established fisheries methods (Murphy and Willis 1996). CDFW believes additional surveys are necessary before concluding that the recreational fishery is trending towards LORP goals (Adaptive Management Recommendations from 2008 to 2015, page 9).

LACK OF WOODY RECRUITMENT

The loss or riparian trees documented by the vegetation change analysis and the limited amount of tree recruitment documented in the Rapid Assessment Survey (RAS) continues to be of concern because riparian trees are "essential to attracting many of the riverine/riparian avian habitat indicator species." (5-9). The current flow regime is not capable of creating the disturbed habitat necessary for natural tree recruitment; therefore CDFW supports active intervention to create sites for tree establishment. In coordination and cooperation with grazing lease holders, CDFW supports further investigation on the potential for high density grazing in small restricted areas to create the disturbance needed to support riparian tree recruitment. In addition, current riparian trees are potentially threatened by aggradation (4-59) and interventions to maintain the river channel should be investigated and implemented.

OTHER COMMENTS

- Page 2-8: The report should explain how the daily wetted acreage of the Thibault Ponds is measured.
- Page 3-32: CDFW agrees that the American coot is not a useful indicator species, and should be analyzed separately from other rails

If you have any questions regarding this letter, please contact Nick Buckmaster at (760) 872-1110 or Nick.Buckmaster@wildlife.ca.gov.

Sincerely,

Alisa Ellsworth for

Heidi Calvert
Senior Environmental Scientist (Supervisor)

cc: Chron
Bruce Kinney, CDFW
Nick Buckmaster, CDFW

Works Cited:

California Department of Fish and Game. 2008. *Yolo Bypass Wildlife Area Land Management Plan.*

California Waterfowl Association. 2015. *Principles of Wetland Management.*

Davis, J.B., Guillemain, M., Kaminski, R.M., Arzel, C., Eadie, J.M. and Rees, E.C., 2014. Habitat and resource use by waterfowl in the northern hemisphere in autumn and winter. *Wildfowl*, pp.17-69.

Grinnell, J., 1917. *Field Notes. University of California Records*

Los Angeles Department of Water and Power. 2004. *Lower Owens River Project Environmental Impact Report.*

Martin, A.C. and Uhler, F.M., 1939. *Food of game ducks in the United States and Canada* (No. 634). US Dept. of Agriculture.

Murphy, B.R. and Willis, D.W. eds., 1996. *Fisheries techniques* (2nd ed., p. 732). Bethesda, Maryland: American fisheries society.

Olson, B.W., 2011. *An experimental evaluation of cost effective moist-soil management in the Sacramento Valley of California*. University of California, Davis.

Takekawa, J.Y., Miles, A.K., Schoellhamer, D.H., Jaffe, B., Athearn, N.D., Spring, S.E., Shellenbarger, G.G., Saiki, M.K., Mejia, F. and Lionberger, M.A., 2005. South Bay Salt Ponds Restoration Project, Short-term Data Needs, 2003-2005 Final Report. *US Geological Survey, Vallejo, CA 270pp*.