# Lower Owens River Project
# 2021 Annual Report

*Photo courtesy of Larry Freilich, ICWD*

**January 2022**

# TABLE OF CONTENTS

## Figures and Tables

Authored by:

**The Los Angeles Department of Water and Power**
http://www.ladwp.com/LORP

**Inyo County Water Department**
http://www.inyowater.org/projects/lorp/

# EXECUTIVE SUMMARY

The 2021 Lower Owens River Project (LORP) Annual Report contains the results from the fifteenth year of monitoring for the LORP. Monitoring results contained in this report include hydrologic monitoring, monitoring of range conditions throughout the project area, saltcedar and weed management. Also included in this report are a summary of adaptive management activities implemented in 2021.

## 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 2020-21 water year LADWP was compliant with all the 2007 Stipulation & Order flow and reporting requirements. The mean flow to the Delta Habitat Area (DHA) was 7.2 cubic feet per second (cfs), within the required 6-9 cfs annual flow. An Interim Blackrock Waterfowl Management Area Plan was put in place beginning April 2021. This involves a seasonal flooding regime which includes sustained flooding from fall through mid-spring, a complete dry down during late spring, and a fixed waterfowl acreage goal of 500 acres. The seasonal habitat flow ramping reached a peak release of 56 cfs and covered two days, before ramping down over another two 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.

## Land Management

The 2021 Lower Owens River Project (LORP) land management monitoring efforts continued with utilization monitoring across all leases and range trend monitoring on the Twin Lakes and Lone Pine leases inside the LORP management area. Pasture utilization within the LORP was within the allowable levels of use established for both riparian (up to 40%) and upland (up to 65%) areas. End-of-season utilization data for LORP leases from 2010 to present is provided in Land Management Appendix 1. Irrigated pastures that scored below 80% in 2020 were revisited in the summer of 2021. Irrigated pasture scores from 2011-2021 are provided in Land Management Appendix 2 for reference.

## LORP Saltcedar Treatment

Inyo County administered the Saltcedar Control Program for City of Los Angeles lands in the Owens Valley since 1997 through funding from LADWP under the Inyo-Los Angeles Water Agreement and Wildlife Conservation Board grants. In 2017, with the retirement of the Saltcedar Program Manager and cessation of grant funding in 2016,

Inyo County suspended their saltcedar program. As a consequence, LADWP initiated a saltcedar control program to manage the species on City property including the LORP area.

In 2020-21 LADWP treated 273 acres of saltcedar in the LORP area, including:

- Goose Lake vicinity (164 treated acres)
- Area immediately adjacent to Lower Owens River (33 acres)
- Area of Homestead Site to Mazourka Canyon Rd (76 acres)

LADWP will continue to treat saltcedar re-sprouts in these areas in 2021-2022 and will continue further treatment in the Blackrock Waterfowl Management Area if feasible.

## LORP Weed Report

In recent years significant increases in perennial pepperweed (*Lepidium latifolium)* populations were detected along the Owens River and in the Blackrock Waterfowl Management Area (BWMA). Increases in net acreage of known sites, as well as dozens of new infestations were also observed.

To gain control over these observed increases in pepperweed LADWP weed eradication crews canvassed a total of 692 acres within the LORP project boundaries treating pepperweed around the Winterton and Waggoner Units in the BWMA. Treatments in both areas were conducted in early summer.

The Lower Owens River and BWMA will continue to be prioritized treatment locations during the upcoming 2022 season.

## 2020 LORP Adaptive Management Actions

Following the 2019 LORP Evaluation Report, LADWP and the County identified a series of adaptive management actions to further improve the project. During the 2020-2021 fiscal year, LADWP and the County conducted work on the following: implementation of a five-year interim flow regime in the Delta Habitat Area and related monitoring, development of a Blackrock Waterfowl Management Area Interim Management and Monitoring Plan, a tamarisk beetle study, a tree recruitment assessment, and noxious species monitoring.

### *Delta Habitat Area Interim Flow Regime and Related Monitoring*

During the 2020-2021 runoff year, the revised interim flow regime was effective at flooding key seasonal and permanent ponds in the DHA from fall through late spring, and inducing hydrologic stress on cattail stands during the growing period, as intended. Use by the Habitat Indicator Species was comparable to, or exceeded that

observed in previous years. Flow effectiveness monitoring should be continued throughout the interim management period, and the application of remote sensing techniques further explored.

*Blackrock Waterfowl Management Area Interim Management and Monitoring Plan*

Since implementation of the LORP, management of the Blackrock Waterfowl Management Area (BWMA) under guiding legal documents has created waterfowl habitat as intended, but has also resulted in considerable cattail and bulrush encroachment, reduced open water in the units, and a subsequent decline in habitat quality over time. In 2020, LADWP and the County developed a 5-year Interim Management and Monitoring Plan for the BWMA (Interim Plan) to further improve conditions for the LORP habitat indicator species. The Interim Plan proposes a seasonal flooding regime to flood a fixed 500 acres of the BWMA each year from fall to mid-spring with full dry down in the summer months, and to enhance forage for indicator species through moist soil management. The Interim Plan was finalized in April 2021 and is being implemented as adaptive management for a period of 5 years.

*Tamarisk Beetle Study*

Four salt cedar groves were revisited for the second year to observe impacts from the Northern tamarisk beetle *(Diorhabda carinulata*). In early June, no plots showed evidence of herbivory though larvae were observed on a few trees at one site (Bolin site), east of Lone Pine. In August, heavy defoliation was observed at the Bolin site and light defoliation at a site east of Goose lake. The other two sites showed no impacts from the beetle in May or August.

*Tree Recruitment*

To understand mechanisms which have permitted past and current riparian tree recruitment within the LORP riparian area, several adaptive management actions were proposed. Work to-date includes fieldwork aimed at understanding topographic, hydrologic, edaphic, and biological conditions that allowed tree establishment both prior to and post project initiation, and identifying current processes that could limit tree germination or establishment.

*Noxious Species Monitoring*

In 2021, the ICWD surveyed the Lower Owens River for Perennial Pepperweed (*Lepidium latifolium*). No major changes in distribution were noted compared to previous years with the exception of downstream spread in reach 4 on the eastern channel of the islands. Pepperweed is well established along river mile (rm) 0 to 8 from the Los Angeles Aqueduct Intake to three miles south of the Blackrock Ditch Return, east of Twin Lakes (Map Series pp 1-8). Downstream, a few detections have occurred east of

Goose Lake from rm 8 to just south of rm 12 (Map Series pp 9-12). River mile (rm) 13-16 has been free of pepperweed. Two pepperweed locations between rm 16 and 17 on the west side of the river were detected in 2020 and 2021. Rm 17-20 is free of pepperweed. One new location south of rm 20 was recorded in 2021 (Map Series p 20). The next downstream pepperweed location is between rm 25 and 26 on the east side of the river (Map Series pp 25). Rm 26-28 was free of pepperweed. The last primary infestation occurs south of Manzanar Reward Rd at rm 28 to rm 33 just upstream from Reinhackle Gauging Station Rd (Map Series pp 28-33); recently spread has been noted downstream to rm 33 in 2020 and rm 35 in 2021, along the east channel of the northern portion of the islands in reach 4. This area as mentioned last year should be the highest priority for treatment and containment (Map Series pp 28-33). Control methods are carried out by Inyo-Mono Counties Agricultural Commissioner's Office (CAC) and Los Angeles Department of Water and Power (LADWP).

# 1.0 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."

The 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 the *California Environmental Quality Act* (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 the County and LADWP will prepare an annual report that includes data, analysis, and recommendations and the 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, following the methods and schedules described in Section 4 of the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (MAMP, Ecosystem Sciences 2008).

Specific reporting procedures are also described under each monitoring method in the MAMP. The MOU also requires the County and LADWP provide annual reports describing the environmental conditions of the LORP including monitoring data, the results of analyses, and recommendations for any adaptive management. This LORP Annual Report describes monitoring data, analysis, and recommendations for the LORP based on data collected during the 2021 field season (March-October). The development of this LORP Annual Report is a collaborative effort between the ICWD and LADWP. Personnel from these entities participated in different sections of the report writing, data collection, and analysis.

The 2007 Stipulation & Order also requires a draft of the annual report be provided to the public and representatives of the Parties identified in the MOU. 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, the LADWP is the lead author for a majority of the document and is responsible for overall layout and content management. In 2021, the LADWP wrote Sections 1.0 Introduction; 2.0 Hydrologic Monitoring; 3.0 Land Management, and 4.0 LORP Saltcedar Treatment. The LADWP, Inyo County Water Department (ICWD), and the Inyo/Mono Counties Agricultural Commissioner's Office authored Section 5.0 LORP Weed Report. The LADWP and the ICWD coauthored Section 6.0 LORP Adaptive Management.

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 2021.

# 2.0 HYDROLOGIC MONITORING

## 2.1 River Flows

On July 12, 2007, a Court Stipulation & Order was issued requiring the 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, six of the ten 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 the LADWP was in compliance with the Stipulation & Order, from October 2020 through September 2021, for the four in-river stations (see Hydrologic 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 to access a list of PDFs summarizing the most current daily reports.

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.

## 2.2 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 Sontek meters measurement accuracy is affected by factors that influence river stage and flow velocity, including vegetation growth and sediment build up. 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 Sontek meters at least once per month. 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. To maintain flow measurement accuracy, all of the meters on the LORP are calibrated at least once per month following the 2007 Stipulation & Order.

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 rate 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). Because of this infrequent submergence of the Langemann Gate, a WaterLOG H-350XL was installed as a back up to measure flow and is not affected by the high seasonal habitat releases. 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

Flow at the Pumpback Station is calculated by adding the Pumpback Station flow, Langemann Gate Release to Delta flow, and Weir to Delta flow. In most flow conditions these stations have proven to be 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.

## 2.3 Flows to the Delta Habitat Area

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):

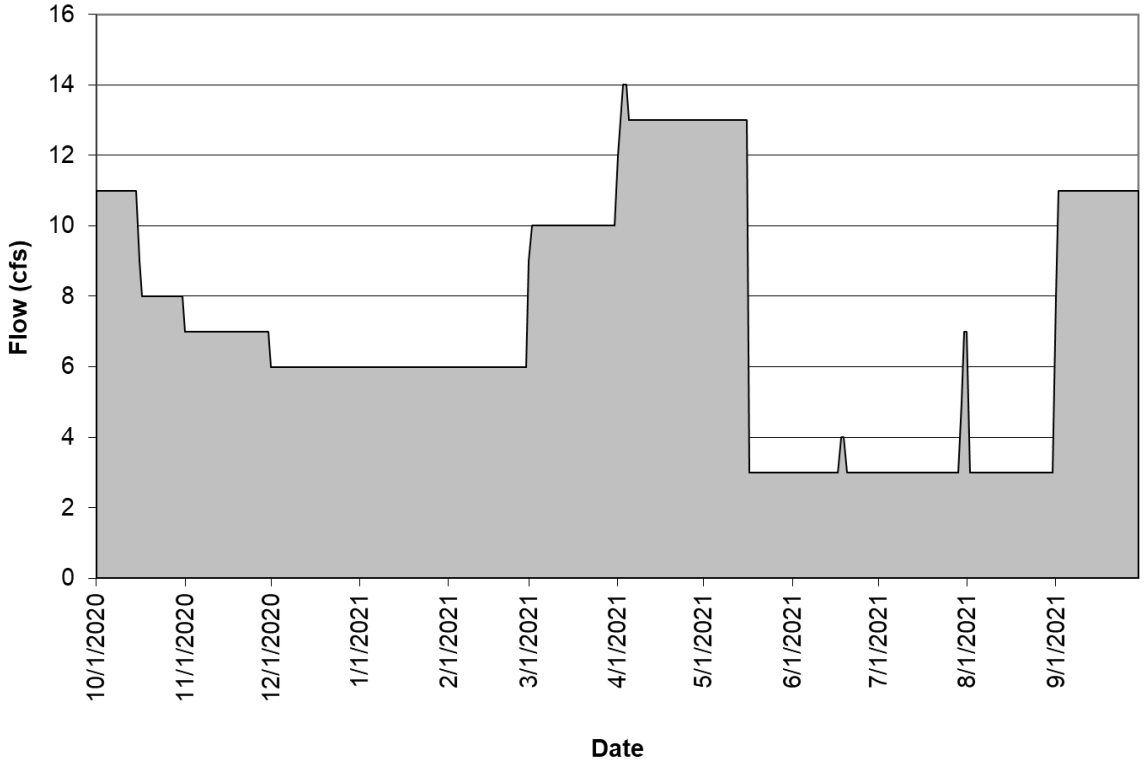
- Period 1: March - April — 10 days at 25 cfs
- Period 2: June - July — 10 days at 20 cfs
- Period 3: September — 10 days at 25 cfs
- Period 4: November - December — 5 days at 30 cfs

Through adaptive management efforts, a new Delta flow schedule was implemented in April 2020 for a 5-year trial period. This interim schedule incorporates base and pulse flows into one schedule:

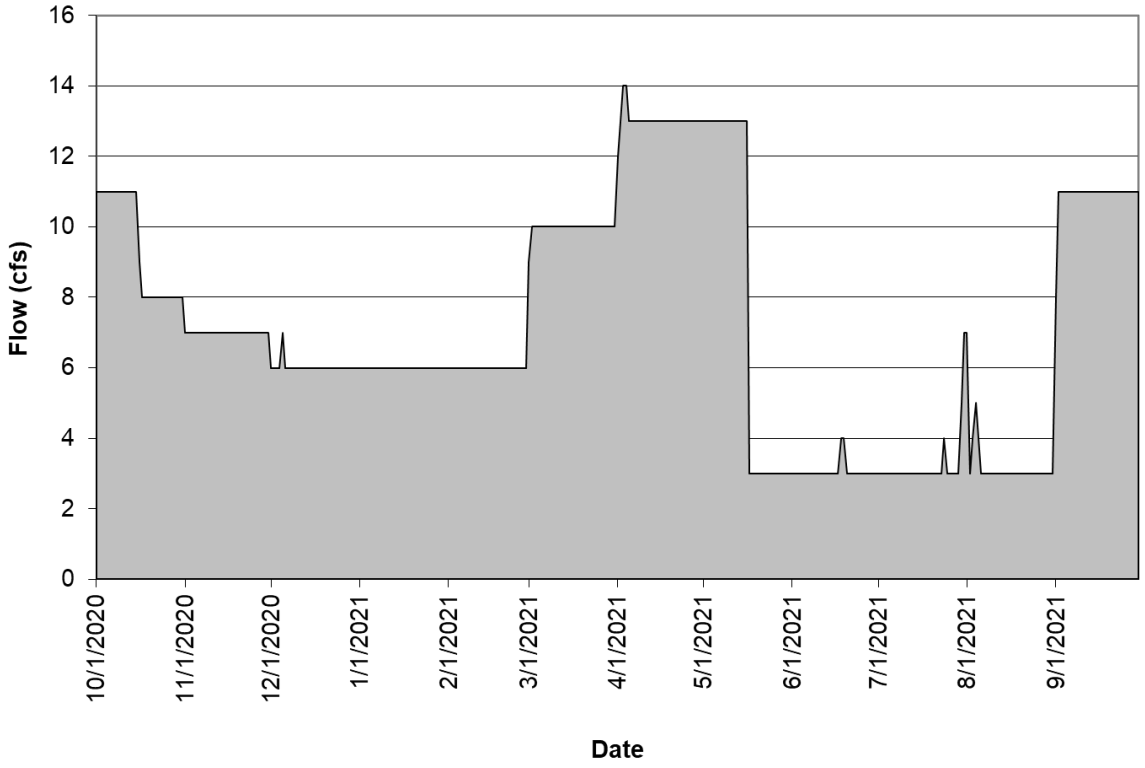
- October 1 to October 15 — 11 cfs
- October 16 to October 31 — 8 cfs
- November 1 to November 30 — 7 cfs
- December 1 to February 28 — 6 cfs
- March 1 to March 31 — 10 cfs
- April 1 to May 15 — 13 cfs
- May 16 to August 31 — 3 cfs
- September 1 to September 30 — 11 cfs

The releases for the 2020-21 water year resulted in an average flow of 7.2 cfs to the Delta.

Unintended flows are released to the Delta when 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.

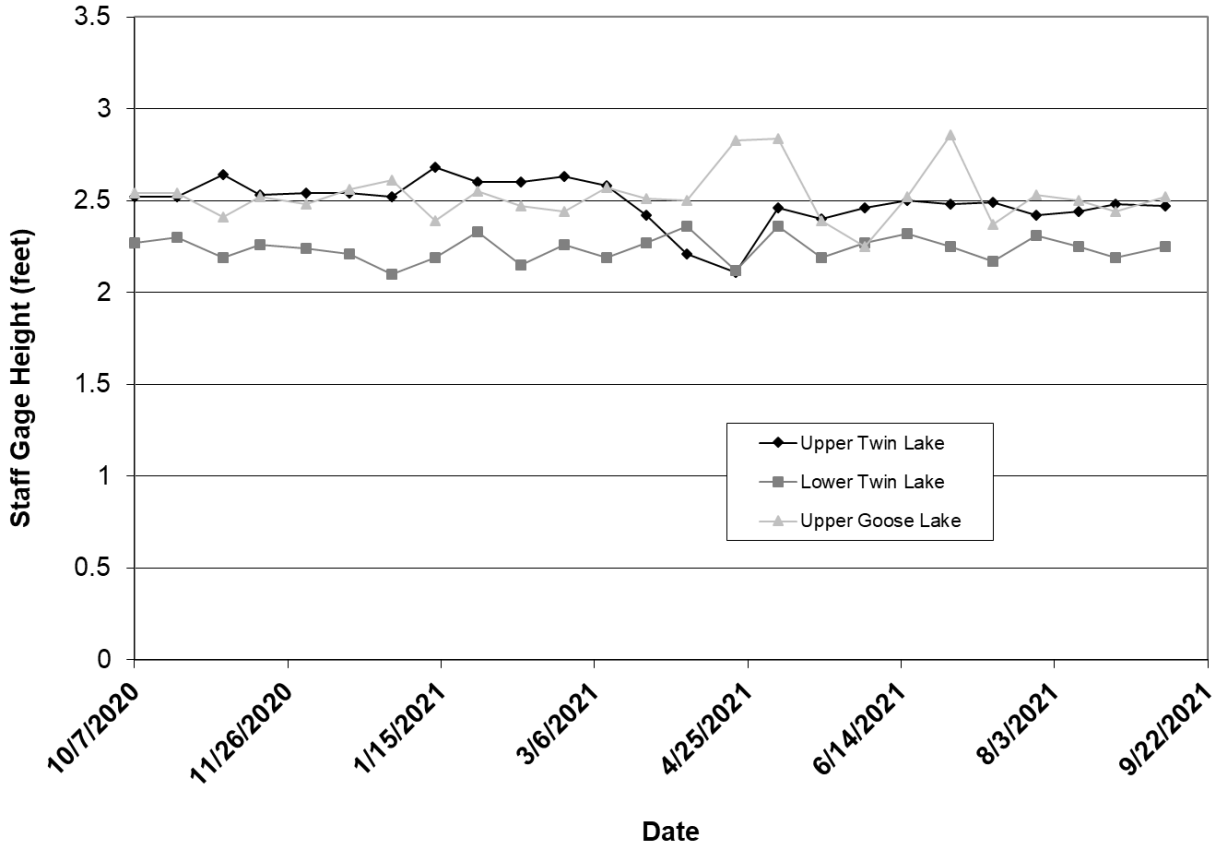



**Hydrologic Figure 1. Langemann Release to Delta**



## Off-River Lakes and Ponds

The BWMA and Off-River Lakes and Ponds Hydrologic Data Reporting Plan requires the Upper Twin Lake, Lower Twin Lake, and Goose Lake to be maintained between 1.5 and 3.0 feet on their respective staff gauges, and for Billy Lake to be maintained full (i.e., at an elevation that maintains outflow from the lake). All of the staff gages measured between 2.0 and 3.0 feet stage height for the 2020-21 water year (Hydrologic Figure 3).




## 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. The LADWP maintains Billy Lake by monitoring the Billy Lake Return station, which had a minimum daily average flow of 1.1 cfs for the year (see the Hydrologic Table 1, and Hydrologic Appendix 2).

**Hydrologic Table 1. LORP Flows – Water Year 2020-21**

| Station Name | Average Flow (cfs) | Maximum Flow (cfs) | Minimum Flow (cfs) |
|---|---|---|---|
| Below River Intake | 57 | 92 | 42 |
| Blackrock Return Ditch | 1.1 | 1.8 | 0.6 |
| Goose Lake Return | 0 | 0 | 0 |
| Billy Lake Return | 1.1 | 1.4 | 0.7 |
| Mazourka Canyon Road | 51 | 81 | 38 |
| Locust Ditch Return | 0 | 4 | 0 |
| Georges Ditch Return | 0 | 6 | 0 |
| Reinhackle Springs | 48 | 69 | 38 |
| Alabama Gates Return | 0 | 0 | 0 |
| At Pumpback Station | 47 | 55 | 36 |
| Pump Station | 40 | 48 | 26 |
| Langemann Gate to Delta | 7 | 14 | 3 |
| Weir to Delta | 0 | 2 | 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.

## 2.4 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 with 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 measurements. 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 20' | May 19, 2020 | 191 | 3.1 |
| Summer 20' | July 2020 | 244 | 4.7 |
| Fall 20' | November 2020 | 174 | 3.2 |
| Winter 20'-21' | January15, 2021 | 170 | 1.6 |
| Spring 21' | n/a | n/a | 0.0 |
| Summer 21' | n/a | n/a | 0.2 |
| Fall 21' | n/a | n/a | 1.5 |

**Thibaut Unit**

| ET Season | Read Date | Wetted Acreage | Average Inflow |
|---|---|---|---|
| Spring 20' | n/a | n/a | n/a |
| Summer 20' | n/a | n/a | n/a |
| Fall 20' | n/a | n/a | 0.2 |
| Winter 20'-21' | January 17, 2020 | 141 | 0.9 |
| Spring 21' | n/a | n/a | 0.0 |
| Summer 21' | n/a | n/a | 0.0 |
| Fall 21' | n/a | n/a | 3.6 |

**Drew Unit**

| ET Season | Read Date | Wetted Acreage | Average Inflow |
|---|---|---|---|
| Spring 20' | May 12, 2020 | 284 | 3.2 |
| Summer 20' | July 2020 | 252 | 3.7 |
| Fall 20' | November 2020 | 192 | 3.2 |
| Winter 20'-21' | January15, 2021 | 243 | 1.2 |
| Spring 21' | n/a | n/a | 0.0 |
| Summer 21' | n/a | n/a | 0.0 |
| Fall 21' | n/a | n/a | 0.0 |

**Waggoner Unit**

| ET Season | Read Date | Wetted Acreage | Average Inflow |
|---|---|---|---|
| Spring 20' | n/a | n/a | n/a |
| Summer 20' | n/a | n/a | n/a |
| Fall 20' | n/a | n/a | n/a |
| Winter 20'-21' | n/a | n/a | n/a |
| Spring 21' | n/a | n/a | n/a |
| Summer 21' | n/a | n/a | n/a |
| Fall 21' | n/a | n/a | 2.2 |

*Notes:*
*Measurements before 4/1/20 count towards the 2019-20 runoff year acreage goal.*
*Measurements after 4/1/20 count towards the 2020-21 runoff year acreage goal.*
*Thibaut wetted acreage does not include the 28 acres of the Thibaut Pond area.*
*Poor air quality delayed Inyo County from completing wetted acreage surveys for the Fall 2020 season.*

## 2.5 Blackrock Waterfowl Management Area Results for April 2020 to March 2021

The runoff forecast for runoff year 2020-21 was 74%, therefore the waterfowl wetted acreage goal was 370 acres.

On April 16, Drew Unit was set to 4.3 cfs and Winterton Unit was set to 4.8 cfs for the Spring season.

On May 19, a wetted acreage survey for the Spring season was completed. Drew Unit measured 284 acres and Winterton Unit measured 181 acres, totaling 465 acres.

On June 1, Drew Unit was kept at 4.3 cfs and Winterton Unit was set to 4.2 cfs for the Summer season.

In July, Inyo County performed a wetted acreage survey, via remote sensing, for the Summer season. Drew Unit measured 252 acres, and Winterton Unit measured 244 acres, totaling 496 acres.

On August 16, flow rates for the Fall season were set. Flow to Drew Unit was reduced from 4.3 cfs to 3.8 cfs. Flow to Winterton Unit was reduced from 4.2 cfs to 3.2 cfs.

Poor air quality prevented wetted acreage surveys from being completed in the month of September.

On October 1, flow to Thibaut Pond was turned ON and set to 1.0 cfs. The Waggoner Unit flow remained set a 0 cfs.

On October 16, flow rates for the Winter Season were set. Flow to Winterton Unit was reduced from 3.2 cfs to 1.6 cfs. Flow to the Drew Unit was reduced from 3.8 cfs to 1.0 cfs.

On November 10, Inyo County performed a wetted acreage survey, via remote sensing. Drew Unit measured 192 acres, and Winterton Unit measured 244 acres, totaling 436 acres

On December 4, flow to Thibaut Pond was changed from 1.0 cfs to 2.0 cfs.

On December 22, flow to Thibaut Pond was changed from 2.0 cfs to 1.0 cfs.

In January, wetted acreage surveys were completed for the Winter season. \Drew Unit measured 243 acres on January 12, 2021 and Winterton Unit measured 170 acres on January 15, 2021.

On March 15, flow to Thibaut Pond was changed from 1.0 cfs to 0 cfs.

The average waterfowl wetted acreage for the 2020-21 runoff year was 438 acres.

## 2.6 Blackrock Waterfowl Management Area Results for April 2021 to September 2021

In accordance with the Interim Management and Monitoring Plan, starting this year a seasonal flooding regime will be implemented. This will include sustained flooding from fall through mid-spring, a complete dry down during late spring, and a fixed waterfowl acreage goal of 500 acres.

On April 16, flows to all units were set to 0 cfs.

On September 15, flow to Thibaut Unit was set to 8 cfs, Winterton Unit was set to 6 cfs, and Waggoner Unit was set to 9 cfs.

The first wetted acreage measurement will take place in early November 2021. The second wetted acreage measurement will take place in early March 2022; the average of those measurements will be the recorded wetted acreage for the water year.

## 2.7 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 2020 to September 2021. 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.

## 2.8 River Flow Loss or Gain by Month and Year

Flow losses or gains can vary over time as presented in the table below (see Hydrologic Table 3). 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 intermittent runoff from precipitation also result in flow increases.

## Hydrologic Table 3. Average Monthly River Flow Losses/Gains From the Intake to the Pumpback Station during the 2020-21 Water Year

**River Flows Table 1. Average Monthly River Flow Losses or Gains from Intake to Pumpback Station during 2020/21 Hydro Year**

| | Month | Flow (cfs) | Acre-Feet-Per-Day |
|---|---|---|---|
| 2020 | OCT | -8 | -17 |
| | NOV | -3 | -5 |
| | DEC | +2 | +4 |
| 2021 | JAN | +6 | +11 |
| | FEB | +6 | +13 |
| | MAR | +5 | +10 |
| | APR | +2 | +4 |
| | MAY | -15 | -30 |
| | JUN | -43 | -86 |
| | JUL | -41 | -81 |
| | AUG | -33 | -66 |
| | SEP | -27 | -53 |
| | **AVG MONTH** | **-12 cfs** | **-25 AcFt** |

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 41,285 acre-feet, inflows from augmentation spillgates were 1,941 acre-feet, and outflows from the Pumpback Station were 34,156 acre-feet. This yields a loss of 9,070 acre-feet for the year, a daily average of approximately 12.5 cfs between the Intake and the Pumpback Station. Water loss during the 2020-21 water year represents about 21% of the total released flow from the Intake and augmentation spillgates into the river channel.

### 2.9 Flow Loss or Gain by River Reach during the Winter Period

From December 2020 to March 2021, an average flow of 43 cfs was released into the Lower Owens River from the Intake. An additional 2 cfs was provided from augmentation ditches, for a total accumulated release of 45 cfs. The average flow reaching the Pumpback Station was 50 cfs, an increase of 5 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 likely 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 lost an average of 3 cfs, Mazourka Canyon Road to the Reinhackle gaging station gained 1 cfs, and Reinhackle to the Pumpback Station gained 7 cfs (see Hydrologic Table 4). 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 2020 to March 2021**

| Recording Station | Average Flow (cfs) | Gain or Loss (cfs) | Accumulative (cfs) |
|---|---|---|---|
| Intake | 43 | N/A | N/A |
| Mazourka | 43 | -3 | -3 |
| Reinhackle | 43 | +1 | -2 |
| Pumpback | 50 | +7 | +5 |

*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.*

## 2.10 Flow Loss or Gain by River Reach during the Summer Period

During the summer period of June 2021 to September 2021, all river reaches lost water. An average flow of 78 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 (-36 cfs) between the Intake and the Pumpback Station. The largest flow losses occurred at the Intake to Mazourka reach (-15 cfs) (see Hydrologic Table 5).

**Hydrologic Table 5. Summer Flow Losses/Gains, June 2021 to September 2021**

| Recording Station | Average Flow (cfs) | Gain or Loss (cfs) | Accumulative (cfs) |
|---|---|---|---|
| Intake | 78 | N/A | N/A |
| Mazourka | 65 | -15 | -15 |
| Reinhackle | 55 | -11 | -26 |
| Pumpback | 45 | -10 | -36 |

*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.*

## 2.11 Seasonal Habitat Flow

The runoff forecast for runoff year 2020-21 was 55%, and a Seasonal Habitat Flow was released from the LORP Intake beginning on May 28, 2021. Flows from the LORP Intake were ramped up to a peak of 56 cfs over a period of two days, before ramping down over another two days (see Hydrologic Table 6). As flow changes are typically made at 8 a.m., the daily average flow will reflect the flow rate both before and after the flow change is made.

**Hydrologic Table 6. 2020-21 Seasonal Habitat Flow Schedule**

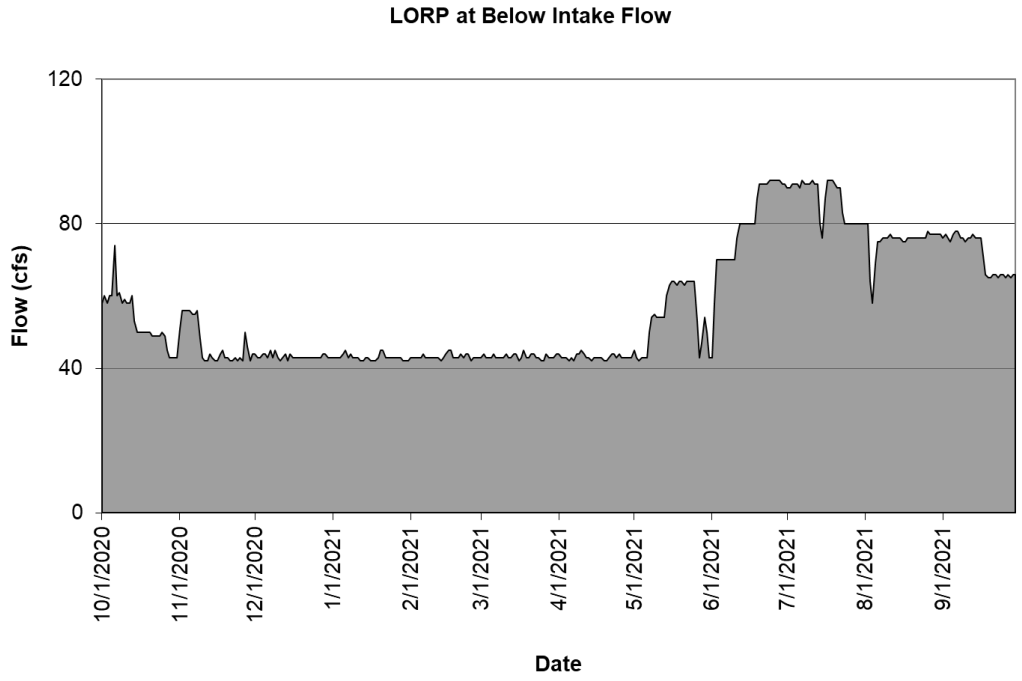
| Date | Begin Flow | Change To |
|---|---|---|
| Friday, May 28, 2021 | 43 | 50 |
| Saturday, May 29, 2021 | 50 | 56 |
| Sunday, May 30, 2021 | 56 | 45 |
| Monday, May 31, 2021 | 45 | 43 |

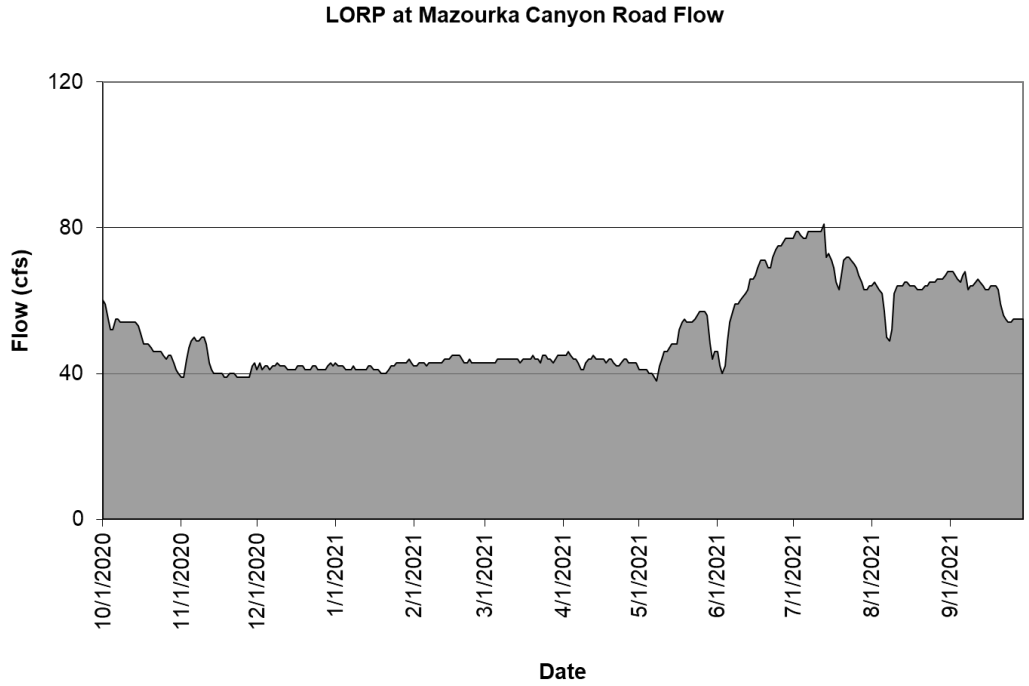
*Note: Flow changes were completed at 8:00am each day.*

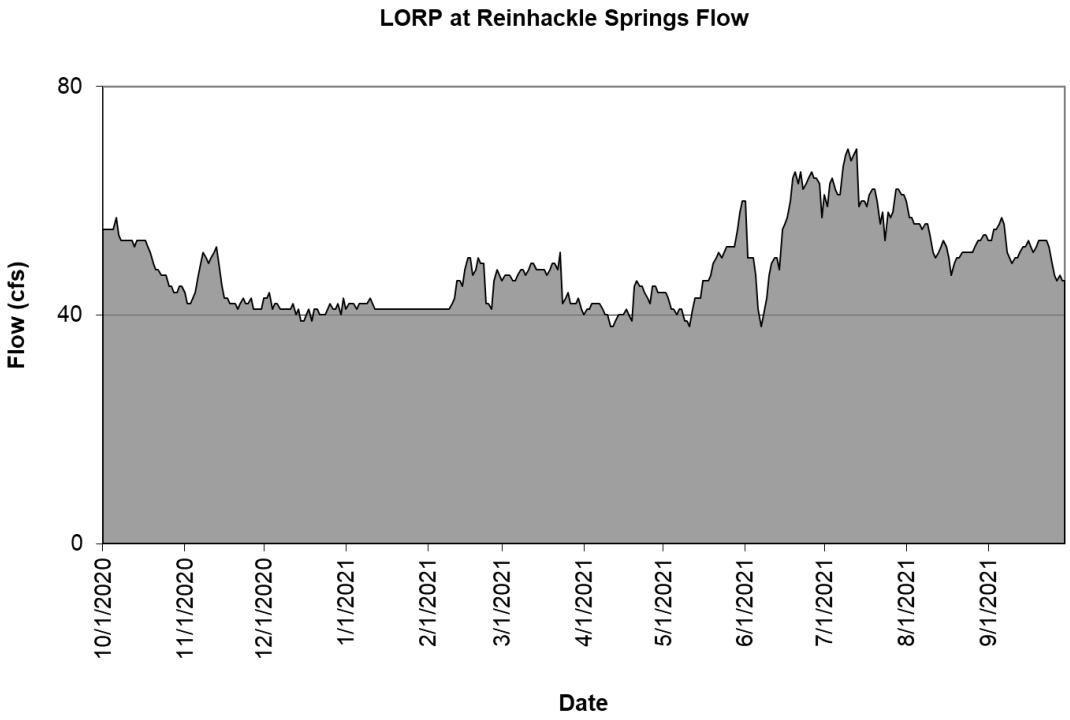
Daily flow rates from the LORP Intake are provided in Appendix 2.

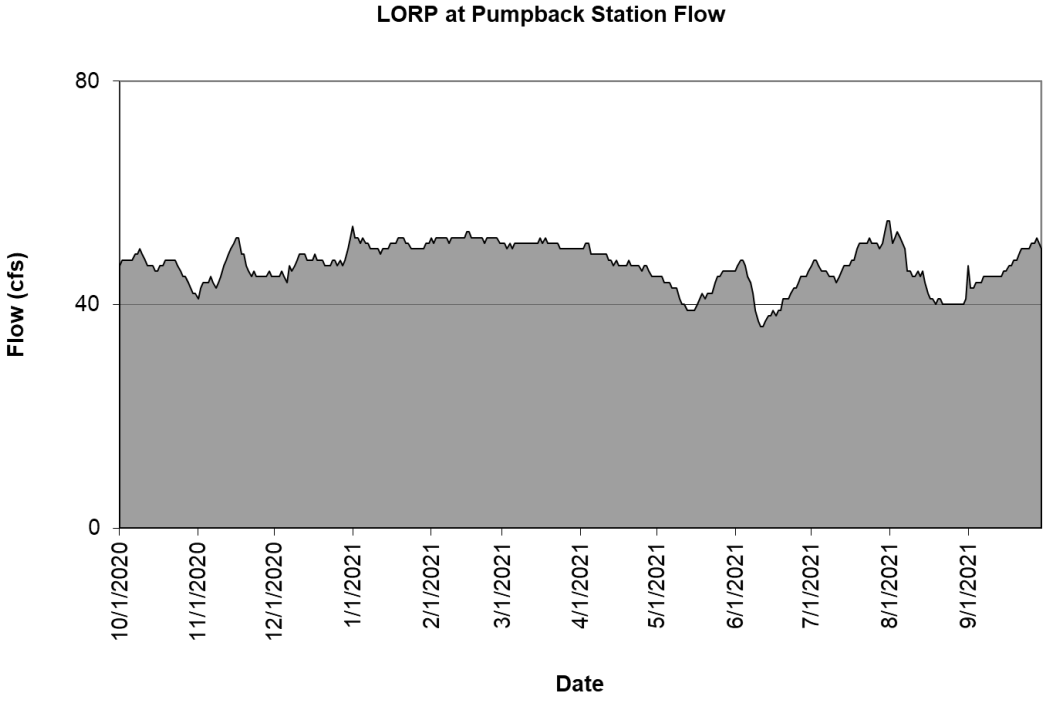
## 2.12 Appendices

### Appendix 1. Hydrologic Monitoring Graphs




LORP at Reinhackle Springs Flow
80
40
0
Flow (cfs)
10/1/2020
11/1/2020
12/1/2020
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
Date


LORP at Pumpback Station Flow
80
40
0
Flow (cfs)
10/1/2020
11/1/2020
12/1/2020
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/1/2020 | 58.0 | 1.2 | 0.0 | 0.9 | 60.0 | 0.0 | 0.0 | 55.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 55.0 |
| 10/2/2020 | 60.0 | 1.1 | 0.0 | 0.9 | 59.0 | 0.0 | 0.0 | 55.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 55.5 |
| 10/3/2020 | 58.0 | 1.1 | 0.0 | 0.9 | 55.0 | 0.0 | 0.0 | 55.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 54.0 |
| 10/4/2020 | 60.0 | 1.0 | 0.0 | 0.9 | 52.0 | 0.0 | 0.0 | 55.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 53.8 |
| 10/5/2020 | 60.0 | 1.1 | 0.0 | 1.0 | 52.0 | 0.0 | 0.0 | 55.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 53.8 |
| 10/6/2020 | 74.0 | 1.1 | 0.0 | 1.1 | 55.0 | 0.0 | 0.0 | 57.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 58.5 |
| 10/7/2020 | 60.0 | 1.1 | 0.0 | 1.1 | 55.0 | 0.0 | 0.0 | 54.0 | 0.0 | 49.0 | 38.0 | 11.0 | 0.0 | 54.5 |
| 10/8/2020 | 61.0 | 1.0 | 0.0 | 1.1 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 49.0 | 38.0 | 11.0 | 0.0 | 54.3 |
| 10/9/2020 | 58.0 | 1.1 | 0.0 | 1.0 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 53.8 |
| 10/10/2020 | 59.0 | 1.1 | 0.0 | 1.0 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 49.0 | 38.0 | 11.0 | 0.0 | 53.8 |
| 10/11/2020 | 58.0 | 1.1 | 0.0 | 1.0 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 53.3 |
| 10/12/2020 | 58.0 | 1.0 | 0.0 | 1.0 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 53.0 |
| 10/13/2020 | 60.0 | 1.0 | 0.0 | 1.0 | 54.0 | 0.0 | 0.0 | 52.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 53.3 |
| 10/14/2020 | 53.0 | 0.9 | 0.0 | 1.1 | 54.0 | 0.0 | 0.0 | 53.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 51.8 |
| 10/15/2020 | 50.0 | 1.0 | 0.0 | 1.1 | 53.0 | 0.0 | 0.0 | 53.0 | 0.0 | 46.0 | 35.0 | 11.0 | 0.0 | 50.5 |
| 10/16/2020 | 50.0 | 1.0 | 0.0 | 1.2 | 51.0 | 0.0 | 0.0 | 53.0 | 0.0 | 46.0 | 37.0 | 9.0 | 0.0 | 50.0 |
| 10/17/2020 | 50.0 | 1.4 | 0.0 | 1.3 | 48.0 | 0.0 | 0.0 | 53.0 | 0.0 | 47.0 | 39.0 | 8.0 | 0.0 | 49.5 |
| 10/18/2020 | 50.0 | 1.3 | 0.0 | 1.2 | 48.0 | 0.0 | 0.0 | 52.0 | 0.0 | 47.0 | 39.0 | 8.0 | 0.0 | 49.3 |
| 10/19/2020 | 50.0 | 0.7 | 0.0 | 1.2 | 48.0 | 0.0 | 0.0 | 51.0 | 0.0 | 48.0 | 40.0 | 8.0 | 0.0 | 49.3 |
| 10/20/2020 | 50.0 | 1.0 | 0.0 | 1.0 | 47.0 | 0.0 | 0.0 | 49.0 | 0.0 | 48.0 | 40.0 | 8.0 | 0.0 | 48.5 |
| 10/21/2020 | 49.0 | 1.1 | 0.0 | 0.9 | 46.0 | 0.0 | 0.0 | 48.0 | 0.0 | 48.0 | 40.0 | 8.0 | 0.0 | 47.8 |
| 10/22/2020 | 49.0 | 1.1 | 0.0 | 0.7 | 46.0 | 0.0 | 0.0 | 48.0 | 0.0 | 48.0 | 40.0 | 8.0 | 0.0 | 47.8 |
| 10/23/2020 | 49.0 | 1.1 | 0.0 | 0.8 | 46.0 | 0.0 | 0.0 | 47.0 | 0.0 | 48.0 | 40.0 | 8.0 | 0.0 | 47.5 |
| 10/24/2020 | 49.0 | 0.9 | 0.0 | 0.9 | 46.0 | 0.0 | 0.0 | 47.0 | 0.0 | 47.0 | 39.0 | 8.0 | 0.0 | 47.3 |
| 10/25/2020 | 50.0 | 0.8 | 0.0 | 1.0 | 45.0 | 0.0 | 0.0 | 47.0 | 0.0 | 46.0 | 38.0 | 8.0 | 0.0 | 47.0 |
| 10/26/2020 | 49.0 | 1.4 | 0.0 | 0.9 | 44.0 | 0.0 | 0.0 | 45.0 | 0.0 | 45.0 | 37.0 | 8.0 | 0.0 | 45.8 |
| 10/27/2020 | 45.0 | 1.8 | 0.0 | 0.8 | 45.0 | 0.0 | 0.0 | 45.0 | 0.0 | 45.0 | 37.0 | 8.0 | 0.0 | 45.0 |
| 10/28/2020 | 43.0 | 1.4 | 0.0 | 0.8 | 45.0 | 0.0 | 0.0 | 44.0 | 0.0 | 44.0 | 36.0 | 8.0 | 0.0 | 44.0 |
| 10/29/2020 | 43.0 | 1.2 | 0.0 | 0.9 | 43.0 | 0.0 | 0.0 | 44.0 | 0.0 | 43.0 | 35.0 | 8.0 | 0.0 | 43.3 |
| 10/30/2020 | 43.0 | 1.0 | 0.0 | 0.9 | 41.0 | 0.0 | 0.0 | 45.0 | 0.0 | 42.0 | 34.0 | 8.0 | 0.0 | 42.8 |
| 10/31/2020 | 43.0 | 1.0 | 0.0 | 0.9 | 40.0 | 0.0 | 0.0 | 45.0 | 0.0 | 42.0 | 34.0 | 8.0 | 0.0 | 42.5 |
| **Notes:** | These measurements are not on the main channel of the Ow ens 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11/1/2020 | 51.0 | 1.0 | 0.0 | 0.9 | 39.0 | 0.0 | 0.0 | 44.0 | 0.0 | 41.0 | 34.0 | 7.0 | 0.0 | 43.8 |
| 11/2/2020 | 56.0 | 1.0 | 0.0 | 1.0 | 39.0 | 0.0 | 0.0 | 42.0 | 0.0 | 43.0 | 36.0 | 7.0 | 0.0 | 45.0 |
| 11/3/2020 | 56.0 | 1.1 | 0.0 | 1.0 | 44.0 | 0.0 | 0.0 | 42.0 | 0.0 | 44.0 | 37.0 | 7.0 | 0.0 | 46.5 |
| 11/4/2020 | 56.0 | 1.1 | 0.0 | 1.0 | 47.0 | 0.0 | 0.0 | 43.0 | 0.0 | 44.0 | 37.0 | 7.0 | 0.0 | 47.5 |
| 11/5/2020 | 56.0 | 1.1 | 0.0 | 1.1 | 49.0 | 0.0 | 0.0 | 44.0 | 0.0 | 44.0 | 37.0 | 7.0 | 0.0 | 48.3 |
| 11/6/2020 | 55.0 | 1.1 | 0.0 | 1.0 | 50.0 | 0.0 | 0.0 | 47.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 49.3 |
| 11/7/2020 | 55.0 | 1.0 | 0.0 | 0.9 | 49.0 | 0.0 | 0.0 | 49.0 | 0.0 | 44.0 | 37.0 | 7.0 | 0.0 | 49.3 |
| 11/8/2020 | 56.0 | 1.3 | 0.0 | 0.7 | 49.0 | 0.0 | 0.0 | 51.0 | 0.0 | 43.0 | 36.0 | 7.0 | 0.0 | 49.8 |
| 11/9/2020 | 48.0 | 1.7 | 0.0 | 0.8 | 50.0 | 0.0 | 0.0 | 50.0 | 0.0 | 44.0 | 37.0 | 7.0 | 0.0 | 48.0 |
| 11/10/2020 | 43.0 | 1.3 | 0.0 | 0.8 | 50.0 | 0.0 | 0.0 | 49.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 46.8 |
| 11/11/2020 | 42.0 | 1.1 | 0.0 | 0.9 | 48.0 | 0.0 | 0.0 | 50.0 | 0.0 | 47.0 | 40.0 | 7.0 | 0.0 | 46.8 |
| 11/12/2020 | 42.0 | 1.0 | 0.0 | 0.8 | 43.0 | 0.0 | 0.0 | 51.0 | 0.0 | 48.0 | 41.0 | 7.0 | 0.0 | 46.0 |
| 11/13/2020 | 44.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 52.0 | 0.0 | 49.0 | 42.0 | 7.0 | 0.0 | 46.5 |
| 11/14/2020 | 43.0 | 1.1 | 0.0 | 1.0 | 40.0 | 0.0 | 0.0 | 49.0 | 0.0 | 50.0 | 43.0 | 7.0 | 0.0 | 45.5 |
| 11/15/2020 | 42.0 | 1.0 | 0.0 | 1.0 | 40.0 | 0.0 | 0.0 | 45.0 | 0.0 | 51.0 | 44.0 | 7.0 | 0.0 | 44.5 |
| 11/16/2020 | 42.0 | 1.0 | 0.0 | 1.1 | 40.0 | 0.0 | 0.0 | 43.0 | 0.0 | 52.0 | 45.0 | 7.0 | 0.0 | 44.3 |
| 11/17/2020 | 44.0 | 1.1 | 0.0 | 1.1 | 40.0 | 0.0 | 0.0 | 43.0 | 0.0 | 52.0 | 45.0 | 7.0 | 0.0 | 44.8 |
| 11/18/2020 | 45.0 | 1.1 | 0.0 | 1.0 | 39.0 | 0.0 | 0.0 | 42.0 | 0.0 | 49.0 | 42.0 | 7.0 | 0.0 | 43.8 |
| 11/19/2020 | 43.0 | 1.0 | 0.0 | 1.0 | 39.0 | 0.0 | 0.0 | 42.0 | 0.0 | 49.0 | 42.0 | 7.0 | 0.0 | 43.3 |
| 11/20/2020 | 43.0 | 1.0 | 0.0 | 1.2 | 40.0 | 0.0 | 0.0 | 42.0 | 0.0 | 47.0 | 40.0 | 7.0 | 0.0 | 43.0 |
| 11/21/2020 | 42.0 | 1.2 | 0.0 | 1.1 | 40.0 | 0.0 | 0.0 | 41.0 | 0.0 | 46.0 | 39.0 | 7.0 | 0.0 | 42.3 |
| 11/22/2020 | 42.0 | 1.1 | 0.0 | 1.1 | 40.0 | 0.0 | 0.0 | 42.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 42.3 |
| 11/23/2020 | 43.0 | 0.8 | 0.0 | 1.1 | 39.0 | 0.0 | 0.0 | 43.0 | 0.0 | 46.0 | 39.0 | 7.0 | 0.0 | 42.8 |
| 11/24/2020 | 42.0 | 1.1 | 0.0 | 1.0 | 39.0 | 0.0 | 0.0 | 42.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 42.0 |
| 11/25/2020 | 43.0 | 1.5 | 0.0 | 1.2 | 39.0 | 0.0 | 0.0 | 42.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 42.3 |
| 11/26/2020 | 42.0 | 1.2 | 0.0 | 1.1 | 39.0 | 0.0 | 0.0 | 43.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 42.3 |
| 11/27/2020 | 50.0 | 1.1 | 0.0 | 1.2 | 39.0 | 0.0 | 0.0 | 41.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 43.8 |
| 11/28/2020 | 46.0 | 1.0 | 0.0 | 1.3 | 39.0 | 0.0 | 0.0 | 41.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 42.8 |
| 11/29/2020 | 42.0 | 0.9 | 0.0 | 1.3 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 46.0 | 39.0 | 7.0 | 0.0 | 42.8 |
| 11/30/2020 | 44.0 | 1.2 | 0.0 | 1.3 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 45.0 | 38.0 | 7.0 | 0.0 | 43.3 |

**Notes:** These measurements are not on the main channel of the Ow ens 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/1/2020 | 44.0 | 1.4 | 0.0 | 1.2 | 41.0 | 0.0 | 0.0 | 43.0 | 0.0 | 45.0 | 39.0 | 6.0 | 0.0 | 43.3 |
| 12/2/2020 | 43.0 | 1.0 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 43.0 | 0.0 | 45.0 | 39.0 | 6.0 | 0.0 | 43.5 |
| 12/3/2020 | 43.0 | 0.9 | 0.0 | 0.9 | 41.0 | 0.0 | 0.0 | 44.0 | 0.0 | 45.0 | 39.0 | 6.0 | 0.0 | 43.3 |
| 12/4/2020 | 44.0 | 1.1 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 46.0 | 40.0 | 6.0 | 0.0 | 43.3 |
| 12/5/2020 | 44.0 | 1.1 | 0.0 | 1.2 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 45.0 | 38.0 | 6.0 | 1.0 | 43.3 |
| 12/6/2020 | 43.0 | 1.1 | 0.0 | 1.3 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 44.0 | 38.0 | 6.0 | 0.0 | 42.5 |
| 12/7/2020 | 45.0 | 1.2 | 0.0 | 1.3 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 43.8 |
| 12/8/2020 | 43.0 | 1.2 | 0.0 | 1.2 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 46.0 | 40.0 | 6.0 | 0.0 | 43.0 |
| 12/9/2020 | 45.0 | 1.0 | 0.0 | 1.2 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 44.0 |
| 12/10/2020 | 43.0 | 1.1 | 0.0 | 0.9 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.5 |
| 12/11/2020 | 42.0 | 1.3 | 0.0 | 0.9 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 49.0 | 43.0 | 6.0 | 0.0 | 43.5 |
| 12/12/2020 | 43.0 | 1.1 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 49.0 | 43.0 | 6.0 | 0.0 | 44.0 |
| 12/13/2020 | 44.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 40.0 | 0.0 | 49.0 | 43.0 | 6.0 | 0.0 | 43.5 |
| 12/14/2020 | 42.0 | 1.0 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.0 |
| 12/15/2020 | 44.0 | 1.4 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 39.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.0 |
| 12/16/2020 | 43.0 | 1.4 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 39.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 42.8 |
| 12/17/2020 | 43.0 | 0.8 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 40.0 | 0.0 | 49.0 | 43.0 | 6.0 | 0.0 | 43.5 |
| 12/18/2020 | 43.0 | 1.0 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.5 |
| 12/19/2020 | 43.0 | 1.2 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 39.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.0 |
| 12/20/2020 | 43.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.3 |
| 12/21/2020 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 43.0 |
| 12/22/2020 | 43.0 | 1.1 | 0.0 | 1.2 | 41.0 | 0.0 | 0.0 | 40.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 42.8 |
| 12/23/2020 | 43.0 | 1.2 | 0.0 | 1.2 | 42.0 | 0.0 | 0.0 | 40.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 43.0 |
| 12/24/2020 | 43.0 | 1.1 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 40.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.3 |
| 12/25/2020 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.3 |
| 12/26/2020 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 43.3 |
| 12/27/2020 | 43.0 | 0.9 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 43.3 |
| 12/28/2020 | 44.0 | 1.0 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 47.0 | 41.0 | 6.0 | 0.0 | 43.3 |
| 12/29/2020 | 44.0 | 0.9 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 48.0 | 42.0 | 6.0 | 0.0 | 44.0 |
| 12/30/2020 | 43.0 | 0.8 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 40.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 12/31/2020 | 43.0 | 0.9 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 43.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 45.0 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 54.0 | 48.0 | 6.0 | 0.0 | 45.3 |
| 1/2/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 1/3/2021 | 43.0 | 1.3 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 1/4/2021 | 43.0 | 1.2 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.5 |
| 1/5/2021 | 44.0 | 1.2 | 0.0 | 0.9 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.5 |
| 1/6/2021 | 45.0 | 1.2 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.8 |
| 1/7/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.3 |
| 1/8/2021 | 44.0 | 1.1 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 42.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.5 |
| 1/9/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/10/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 43.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.3 |
| 1/11/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 42.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/12/2021 | 42.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 49.0 | 43.0 | 6.0 | 0.0 | 43.3 |
| 1/13/2021 | 42.0 | 1.2 | 0.0 | 1.0 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 43.5 |
| 1/14/2021 | 43.0 | 1.3 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/15/2021 | 43.0 | 1.3 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/16/2021 | 42.0 | 1.2 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 43.8 |
| 1/17/2021 | 42.0 | 1.2 | 0.0 | 1.2 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 43.8 |
| 1/18/2021 | 42.0 | 1.1 | 0.0 | 1.2 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 43.8 |
| 1/19/2021 | 43.0 | 1.2 | 0.0 | 1.2 | 40.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.0 |
| 1/20/2021 | 45.0 | 1.1 | 0.0 | 1.2 | 40.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.5 |
| 1/21/2021 | 45.0 | 1.1 | 0.0 | 1.2 | 40.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.5 |
| 1/22/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.0 |
| 1/23/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.3 |
| 1/24/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/25/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.3 |
| 1/26/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.3 |
| 1/27/2021 | 43.0 | 1.0 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.3 |
| 1/28/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.3 |
| 1/29/2021 | 42.0 | 1.1 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 50.0 | 44.0 | 6.0 | 0.0 | 44.0 |
| 1/30/2021 | 42.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.5 |
| 1/31/2021 | 42.0 | 1.2 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.3 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/1/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.5 |
| 2/2/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 42.0 | 0.0 | 0.0 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.3 |
| 2/3/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/4/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/5/2021 | 43.0 | 1.0 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/6/2021 | 44.0 | 1.0 | 0.0 | 1.1 | 42.0 | 0.0 | 0.1 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/7/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.1 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/8/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.1 | 41.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 44.5 |
| 2/9/2021 | 43.0 | 1.0 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.8 |
| 2/10/2021 | 43.0 | 1.0 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 42.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 45.0 |
| 2/11/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 43.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 45.3 |
| 2/12/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 43.0 | 0.0 | 0.1 | 46.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.0 |
| 2/13/2021 | 42.0 | 1.0 | 0.0 | 1.1 | 44.0 | 0.0 | 0.1 | 46.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.0 |
| 2/14/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 44.0 | 0.0 | 0.1 | 45.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.0 |
| 2/15/2021 | 44.0 | 1.2 | 0.0 | 1.1 | 44.0 | 0.0 | 0.1 | 48.0 | 0.0 | 53.0 | 47.0 | 6.0 | 0.0 | 47.3 |
| 2/16/2021 | 45.0 | 1.1 | 0.0 | 1.1 | 45.0 | 0.0 | 0.1 | 50.0 | 0.0 | 53.0 | 47.0 | 6.0 | 0.0 | 48.3 |
| 2/17/2021 | 45.0 | 1.1 | 0.0 | 1.0 | 45.0 | 0.0 | 0.1 | 50.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 48.0 |
| 2/18/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 45.0 | 0.0 | 0.1 | 47.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.8 |
| 2/19/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 45.0 | 0.0 | 0.1 | 48.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 47.0 |
| 2/20/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 44.0 | 0.0 | 0.1 | 50.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 47.3 |
| 2/21/2021 | 44.0 | 1.1 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 49.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 47.0 |
| 2/22/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 43.0 | 0.0 | 0.0 | 49.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 46.5 |
| 2/23/2021 | 44.0 | 1.1 | 0.0 | 1.1 | 44.0 | 0.0 | 0.0 | 42.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 45.5 |
| 2/24/2021 | 44.0 | 1.2 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 42.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 45.3 |
| 2/25/2021 | 42.0 | 1.2 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 41.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 44.5 |
| 2/26/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 46.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.0 |
| 2/27/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 48.0 | 0.0 | 52.0 | 46.0 | 6.0 | 0.0 | 46.5 |
| 2/28/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.0 | 47.0 | 0.0 | 51.0 | 45.0 | 6.0 | 0.0 | 46.0 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/1/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.1 | 46.0 | 0.0 | 51.0 | 42.0 | 9.0 | 0.0 | 45.8 |
| 3/2/2021 | 44.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.1 | 47.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.3 |
| 3/3/2021 | 43.0 | 1.2 | 0.0 | 1.2 | 43.0 | 0.0 | 0.1 | 47.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.8 |
| 3/4/2021 | 43.0 | 1.2 | 0.0 | 1.2 | 43.0 | 0.0 | 0.1 | 47.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.0 |
| 3/5/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 43.0 | 0.0 | 0.0 | 46.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.5 |
| 3/6/2021 | 44.0 | 1.1 | 0.0 | 1.2 | 44.0 | 0.0 | 0.1 | 46.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.3 |
| 3/7/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 47.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.3 |
| 3/8/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.5 |
| 3/9/2021 | 43.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.2 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.5 |
| 3/10/2021 | 43.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.2 | 47.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.3 |
| 3/11/2021 | 44.0 | 1.3 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.8 |
| 3/12/2021 | 43.0 | 1.6 | 0.0 | 1.1 | 44.0 | 0.0 | 0.2 | 49.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.8 |
| 3/13/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 49.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.8 |
| 3/14/2021 | 44.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.3 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.8 |
| 3/15/2021 | 44.0 | 1.2 | 0.0 | 1.0 | 43.0 | 0.0 | 0.3 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.5 |
| 3/16/2021 | 42.0 | 1.2 | 0.0 | 0.9 | 44.0 | 0.0 | 0.2 | 48.0 | 0.0 | 52.0 | 42.0 | 10.0 | 0.0 | 46.5 |
| 3/17/2021 | 43.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.2 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.5 |
| 3/18/2021 | 45.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.3 | 47.0 | 0.0 | 52.0 | 42.0 | 10.0 | 0.0 | 47.0 |
| 3/19/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.5 |
| 3/20/2021 | 43.0 | 1.0 | 0.0 | 1.1 | 45.0 | 0.0 | 0.2 | 49.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 47.0 |
| 3/21/2021 | 44.0 | 0.9 | 0.0 | 1.2 | 44.0 | 0.0 | 0.2 | 49.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 47.0 |
| 3/22/2021 | 44.0 | 1.0 | 0.0 | 1.2 | 44.0 | 0.0 | 0.2 | 48.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 46.8 |
| 3/23/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 43.0 | 0.0 | 0.2 | 51.0 | 0.0 | 51.0 | 41.0 | 10.0 | 0.0 | 47.0 |
| 3/24/2021 | 43.0 | 1.1 | 0.0 | 1.3 | 45.0 | 0.0 | 0.2 | 42.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.0 |
| 3/25/2021 | 42.0 | 0.8 | 0.0 | 1.3 | 45.0 | 0.0 | 0.2 | 43.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.0 |
| 3/26/2021 | 42.0 | 1.4 | 0.0 | 1.2 | 44.0 | 0.0 | 0.2 | 44.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.0 |
| 3/27/2021 | 44.0 | 1.2 | 0.0 | 1.2 | 44.0 | 0.0 | 0.2 | 42.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.0 |
| 3/28/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 43.0 | 0.0 | 0.2 | 42.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 44.5 |
| 3/29/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 44.0 | 0.0 | 0.2 | 42.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 44.8 |
| 3/30/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 45.0 | 0.0 | 0.2 | 43.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.3 |
| 3/31/2021 | 44.0 | 0.9 | 0.0 | 1.2 | 45.0 | 0.0 | 0.2 | 41.0 | 0.0 | 50.0 | 40.0 | 10.0 | 0.0 | 45.0 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/1/2021 | 44.0 | 0.9 | 0.0 | 1.2 | 45.0 | 0.0 | 0.1 | 40.0 | 0.0 | 50.0 | 38.0 | 12.0 | 0.0 | 44.8 |
| 4/2/2021 | 43.0 | 1.2 | 0.0 | 1.2 | 45.0 | 0.0 | 0.1 | 41.0 | 0.0 | 50.0 | 37.0 | 13.0 | 0.0 | 44.8 |
| 4/3/2021 | 43.0 | 1.1 | 0.0 | 1.2 | 46.0 | 0.0 | 0.5 | 41.0 | 0.0 | 51.0 | 37.0 | 14.0 | 0.0 | 45.3 |
| 4/4/2021 | 43.0 | 1.2 | 0.0 | 1.2 | 45.0 | 0.0 | 0.3 | 42.0 | 0.0 | 51.0 | 37.0 | 14.0 | 0.0 | 45.3 |
| 4/5/2021 | 42.0 | 1.6 | 0.0 | 1.3 | 44.0 | 0.0 | 0.3 | 42.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 44.3 |
| 4/6/2021 | 43.0 | 1.1 | 0.0 | 1.3 | 44.0 | 0.0 | 0.2 | 42.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 44.5 |
| 4/7/2021 | 42.0 | 1.1 | 0.0 | 1.2 | 43.0 | 0.0 | 0.2 | 42.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 44.0 |
| 4/8/2021 | 44.0 | 1.1 | 0.0 | 1.1 | 41.0 | 0.0 | 0.4 | 41.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 43.8 |
| 4/9/2021 | 44.0 | 1.2 | 0.0 | 1.1 | 41.0 | 0.0 | 0.3 | 40.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 43.5 |
| 4/10/2021 | 45.0 | 0.9 | 0.0 | 1.1 | 43.0 | 0.0 | 0.2 | 40.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 44.3 |
| 4/11/2021 | 44.0 | 1.2 | 0.0 | 1.3 | 44.0 | 0.0 | 0.2 | 38.0 | 0.0 | 49.0 | 36.0 | 13.0 | 0.0 | 43.8 |
| 4/12/2021 | 43.0 | 1.2 | 0.0 | 1.4 | 44.0 | 0.0 | 0.2 | 38.0 | 0.0 | 48.0 | 35.0 | 13.0 | 0.0 | 43.3 |
| 4/13/2021 | 43.0 | 1.1 | 0.0 | 1.4 | 45.0 | 0.0 | 0.2 | 39.0 | 0.0 | 48.0 | 35.0 | 13.0 | 0.0 | 43.8 |
| 4/14/2021 | 42.0 | 1.1 | 0.0 | 1.4 | 44.0 | 0.0 | 0.2 | 40.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 43.3 |
| 4/15/2021 | 43.0 | 1.3 | 0.0 | 1.4 | 44.0 | 0.0 | 0.3 | 40.0 | 0.0 | 48.0 | 35.0 | 13.0 | 0.0 | 43.8 |
| 4/16/2021 | 43.0 | 0.6 | 0.0 | 1.4 | 44.0 | 0.0 | 0.3 | 40.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 43.5 |
| 4/17/2021 | 43.0 | 0.8 | 0.0 | 1.4 | 44.0 | 0.0 | 0.3 | 41.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 43.8 |
| 4/18/2021 | 43.0 | 1.0 | 0.0 | 1.4 | 43.0 | 0.0 | 0.3 | 40.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 43.3 |
| 4/19/2021 | 42.0 | 1.0 | 0.0 | 1.4 | 44.0 | 0.0 | 0.3 | 39.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 43.0 |
| 4/20/2021 | 42.0 | 0.9 | 0.0 | 1.4 | 44.0 | 0.0 | 0.4 | 45.0 | 0.0 | 48.0 | 35.0 | 13.0 | 0.0 | 44.8 |
| 4/21/2021 | 43.0 | 1.0 | 0.0 | 1.4 | 43.0 | 0.0 | 0.4 | 46.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.8 |
| 4/22/2021 | 44.0 | 1.1 | 0.0 | 1.4 | 42.0 | 0.0 | 0.3 | 45.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.5 |
| 4/23/2021 | 44.0 | 1.1 | 0.0 | 1.2 | 42.0 | 0.0 | 0.3 | 45.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.5 |
| 4/24/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 43.0 | 0.0 | 0.3 | 44.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.3 |
| 4/25/2021 | 44.0 | 0.9 | 0.0 | 1.1 | 44.0 | 0.0 | 0.3 | 43.0 | 0.0 | 46.0 | 33.0 | 13.0 | 0.0 | 44.3 |
| 4/26/2021 | 43.0 | 1.0 | 0.0 | 1.3 | 44.0 | 0.0 | 0.3 | 42.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.0 |
| 4/27/2021 | 43.0 | 1.0 | 0.0 | 1.4 | 43.0 | 0.0 | 0.4 | 45.0 | 0.0 | 47.0 | 34.0 | 13.0 | 0.0 | 44.5 |
| 4/28/2021 | 43.0 | 1.0 | 0.0 | 1.2 | 43.0 | 0.0 | 0.3 | 45.0 | 0.0 | 46.0 | 33.0 | 13.0 | 0.0 | 44.3 |
| 4/29/2021 | 43.0 | 0.9 | 0.0 | 1.1 | 43.0 | 0.0 | 0.3 | 44.0 | 0.0 | 45.0 | 32.0 | 13.0 | 0.0 | 43.8 |
| 4/30/2021 | 43.0 | 1.2 | 0.0 | 1.0 | 43.0 | 0.0 | 0.3 | 44.0 | 0.0 | 45.0 | 32.0 | 13.0 | 0.0 | 43.8 |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/1/2021 | 45.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.3 | 44.0 | 0.0 | 45.0 | 32.0 | 13.0 | 0.0 | 43.8 |
| 5/2/2021 | 43.0 | 1.3 | 0.0 | 1.0 | 41.0 | 0.0 | 0.3 | 44.0 | 0.0 | 45.0 | 32.0 | 13.0 | 0.0 | 43.3 |
| 5/3/2021 | 42.0 | 1.1 | 0.0 | 1.0 | 41.0 | 0.0 | 0.3 | 43.0 | 0.0 | 45.0 | 32.0 | 13.0 | 0.0 | 42.8 |
| 5/4/2021 | 43.0 | 1.2 | 0.0 | 1.1 | 41.0 | 0.0 | 0.3 | 41.0 | 0.0 | 44.0 | 31.0 | 13.0 | 0.0 | 42.3 |
| 5/5/2021 | 43.0 | 0.9 | 0.0 | 1.1 | 40.0 | 0.0 | 0.3 | 41.0 | 0.0 | 44.0 | 31.0 | 13.0 | 0.0 | 42.0 |
| 5/6/2021 | 43.0 | 1.1 | 0.0 | 1.1 | 40.0 | 0.0 | 0.2 | 40.0 | 0.0 | 44.0 | 31.0 | 13.0 | 0.0 | 41.8 |
| 5/7/2021 | 50.0 | 1.3 | 0.0 | 1.0 | 39.0 | 0.0 | 0.2 | 41.0 | 0.0 | 43.0 | 30.0 | 13.0 | 0.0 | 43.3 |
| 5/8/2021 | 54.0 | 1.3 | 0.0 | 1.0 | 38.0 | 0.0 | 0.4 | 41.0 | 0.0 | 43.0 | 30.0 | 13.0 | 0.0 | 44.0 |
| 5/9/2021 | 55.0 | 1.0 | 0.0 | 0.9 | 42.0 | 0.0 | 0.3 | 39.0 | 0.0 | 43.0 | 30.0 | 13.0 | 0.0 | 44.8 |
| 5/10/2021 | 54.0 | 1.2 | 0.0 | 1.0 | 44.0 | 0.0 | 0.2 | 39.0 | 0.0 | 41.0 | 28.0 | 13.0 | 0.0 | 44.5 |
| 5/11/2021 | 54.0 | 1.4 | 0.0 | 1.0 | 46.0 | 0.0 | 0.2 | 38.0 | 0.0 | 40.0 | 27.0 | 13.0 | 0.0 | 44.5 |
| 5/12/2021 | 54.0 | 1.4 | 0.0 | 1.1 | 46.0 | 0.0 | 0.2 | 41.0 | 0.0 | 40.0 | 27.0 | 13.0 | 0.0 | 45.3 |
| 5/13/2021 | 54.0 | 0.6 | 0.0 | 1.2 | 47.0 | 0.0 | 0.3 | 43.0 | 0.0 | 39.0 | 26.0 | 13.0 | 0.0 | 45.8 |
| 5/14/2021 | 60.0 | 1.0 | 0.0 | 1.2 | 48.0 | 0.0 | 0.2 | 43.0 | 0.0 | 39.0 | 26.0 | 13.0 | 0.0 | 47.5 |
| 5/15/2021 | 63.0 | 1.1 | 0.0 | 1.2 | 48.0 | 0.0 | 0.2 | 43.0 | 0.0 | 39.0 | 26.0 | 13.0 | 0.0 | 48.3 |
| 5/16/2021 | 64.0 | 1.1 | 0.0 | 1.2 | 48.0 | 0.0 | 0.2 | 46.0 | 0.0 | 39.0 | 26.0 | 13.0 | 0.0 | 49.3 |
| 5/17/2021 | 64.0 | 1.2 | 0.0 | 1.2 | 52.0 | 0.0 | 0.2 | 46.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 50.5 |
| 5/18/2021 | 63.0 | 0.9 | 0.0 | 1.2 | 54.0 | 0.0 | 0.1 | 46.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 51.0 |
| 5/19/2021 | 64.0 | 1.0 | 0.0 | 1.1 | 55.0 | 0.0 | 0.2 | 47.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 52.0 |
| 5/20/2021 | 64.0 | 0.8 | 0.0 | 1.0 | 54.0 | 0.0 | 0.4 | 49.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 52.0 |
| 5/21/2021 | 63.0 | 0.9 | 0.0 | 1.0 | 54.0 | 0.0 | 0.3 | 50.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 52.3 |
| 5/22/2021 | 64.0 | 1.3 | 0.0 | 0.9 | 54.0 | 0.0 | 0.2 | 51.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 52.8 |
| 5/23/2021 | 64.0 | 1.1 | 0.0 | 1.0 | 55.0 | 0.0 | 0.6 | 50.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 52.8 |
| 5/24/2021 | 64.0 | 1.1 | 0.0 | 1.0 | 56.0 | 0.0 | 0.4 | 51.0 | 0.0 | 44.0 | 41.0 | 3.0 | 0.0 | 53.8 |
| 5/25/2021 | 64.0 | 1.2 | 0.0 | 1.1 | 57.0 | 0.0 | 0.3 | 52.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 54.5 |
| 5/26/2021 | 53.0 | 1.2 | 0.0 | 1.1 | 57.0 | 0.0 | 0.3 | 52.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 51.8 |
| 5/27/2021 | 43.0 | 0.9 | 0.0 | 1.0 | 57.0 | 0.0 | 0.3 | 52.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 49.5 |
| 5/28/2021 | 47.0 | 1.1 | 0.0 | 0.9 | 56.0 | 2.1 | 1.7 | 52.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 50.3 |
| 5/29/2021 | 54.0 | 1.1 | 0.0 | 0.9 | 48.0 | 4.1 | 4.0 | 55.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 50.8 |
| 5/30/2021 | 50.0 | 1.1 | 0.0 | 0.9 | 44.0 | 4.4 | 4.4 | 58.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 49.5 |
| 5/31/2021 | 43.0 | 1.1 | 0.0 | 0.8 | 46.0 | 4.3 | 5.2 | 60.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 48.8 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/1/2021 | 43.0 | 1.1 | 0.0 | 1.0 | 46.0 | 3.8 | 4.6 | 60.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 48.8 |
| 6/2/2021 | 58.0 | 1.0 | 0.0 | 1.2 | 42.0 | 3.6 | 4.8 | 50.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 49.3 |
| 6/3/2021 | 70.0 | 1.0 | 0.0 | 1.2 | 40.0 | 3.5 | 4.7 | 50.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 52.0 |
| 6/4/2021 | 70.0 | 1.0 | 0.0 | 1.2 | 42.0 | 4.0 | 4.9 | 50.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 52.5 |
| 6/5/2021 | 70.0 | 1.0 | 0.0 | 1.2 | 49.0 | 1.9 | 3.2 | 47.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 53.3 |
| 6/6/2021 | 70.0 | 1.1 | 0.0 | 1.2 | 54.0 | 0.0 | 0.1 | 41.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 52.5 |
| 6/7/2021 | 70.0 | 1.2 | 0.0 | 1.2 | 57.0 | 0.0 | 0.0 | 38.0 | 0.0 | 44.0 | 41.0 | 3.0 | 0.0 | 52.3 |
| 6/8/2021 | 70.0 | 1.3 | 0.0 | 1.1 | 59.0 | 0.0 | 0.2 | 40.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 52.8 |
| 6/9/2021 | 70.0 | 1.2 | 0.0 | 1.1 | 59.0 | 0.0 | 0.2 | 43.0 | 0.0 | 39.0 | 36.0 | 3.0 | 0.0 | 52.8 |
| 6/10/2021 | 70.0 | 1.2 | 0.0 | 1.2 | 60.0 | 0.0 | 0.2 | 47.0 | 0.0 | 37.0 | 34.0 | 3.0 | 0.0 | 53.5 |
| 6/11/2021 | 76.0 | 1.2 | 0.0 | 1.2 | 61.0 | 0.0 | 0.2 | 49.0 | 0.0 | 36.0 | 33.0 | 3.0 | 0.0 | 55.5 |
| 6/12/2021 | 80.0 | 1.2 | 0.0 | 1.2 | 62.0 | 0.0 | 0.2 | 50.0 | 0.0 | 36.0 | 33.0 | 3.0 | 0.0 | 57.0 |
| 6/13/2021 | 80.0 | 1.2 | 0.0 | 1.3 | 63.0 | 0.0 | 0.1 | 50.0 | 0.0 | 37.0 | 34.0 | 3.0 | 0.0 | 57.5 |
| 6/14/2021 | 80.0 | 1.2 | 0.0 | 1.4 | 66.0 | 0.0 | 0.1 | 48.0 | 0.0 | 38.0 | 35.0 | 3.0 | 0.0 | 58.0 |
| 6/15/2021 | 80.0 | 1.2 | 0.0 | 1.3 | 66.0 | 0.0 | 0.1 | 55.0 | 0.0 | 38.0 | 35.0 | 3.0 | 0.0 | 59.8 |
| 6/16/2021 | 80.0 | 1.2 | 0.0 | 1.3 | 67.0 | 0.0 | 0.3 | 56.0 | 0.0 | 39.0 | 36.0 | 3.0 | 0.0 | 60.5 |
| 6/17/2021 | 80.0 | 1.3 | 0.0 | 1.2 | 69.0 | 0.0 | 1.4 | 57.0 | 0.0 | 38.0 | 35.0 | 3.0 | 0.0 | 61.0 |
| 6/18/2021 | 80.0 | 1.2 | 0.0 | 1.2 | 71.0 | 0.0 | 4.8 | 60.0 | 0.0 | 39.0 | 35.0 | 4.0 | 0.0 | 62.5 |
| 6/19/2021 | 87.0 | 1.2 | 0.0 | 1.2 | 71.0 | 0.0 | 4.8 | 64.0 | 0.0 | 39.0 | 35.0 | 4.0 | 0.0 | 65.3 |
| 6/20/2021 | 91.0 | 1.1 | 0.0 | 1.3 | 71.0 | 0.0 | 4.7 | 65.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 67.0 |
| 6/21/2021 | 91.0 | 1.1 | 0.0 | 1.2 | 69.0 | 0.0 | 5.1 | 63.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 66.0 |
| 6/22/2021 | 91.0 | 1.2 | 0.0 | 1.2 | 69.0 | 0.0 | 5.5 | 65.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 66.5 |
| 6/23/2021 | 91.0 | 1.2 | 0.0 | 1.1 | 72.0 | 0.0 | 5.5 | 62.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 66.8 |
| 6/24/2021 | 92.0 | 1.2 | 0.0 | 1.1 | 74.0 | 0.0 | 5.5 | 63.0 | 0.0 | 43.0 | 40.0 | 3.0 | 0.0 | 68.0 |
| 6/25/2021 | 92.0 | 1.1 | 0.0 | 1.1 | 75.0 | 0.0 | 4.8 | 64.0 | 0.0 | 43.0 | 40.0 | 3.0 | 0.0 | 68.5 |
| 6/26/2021 | 92.0 | 1.2 | 0.0 | 1.2 | 75.0 | 0.0 | 3.8 | 65.0 | 0.0 | 44.0 | 41.0 | 3.0 | 0.0 | 69.0 |
| 6/27/2021 | 92.0 | 1.2 | 0.0 | 1.2 | 76.0 | 0.0 | 4.0 | 64.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 69.3 |
| 6/28/2021 | 92.0 | 1.2 | 0.0 | 1.2 | 77.0 | 0.0 | 2.5 | 64.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 69.5 |
| 6/29/2021 | 91.0 | 1.2 | 0.0 | 1.1 | 77.0 | 0.0 | 0.4 | 63.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 69.0 |
| 6/30/2021 | 91.0 | 1.1 | 0.0 | 1.1 | 77.0 | 0.0 | 0.2 | 57.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 67.8 |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/1/2021 | 90.0 | 1.2 | 0.0 | 1.1 | 77.0 | 0.0 | 0.2 | 61.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 68.8 |
| 7/2/2021 | 90.0 | 1.2 | 0.0 | 1.1 | 79.0 | 0.0 | 0.2 | 59.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 69.0 |
| 7/3/2021 | 91.0 | 1.3 | 0.0 | 1.1 | 79.0 | 0.0 | 0.3 | 63.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 70.3 |
| 7/4/2021 | 91.0 | 1.3 | 0.0 | 1.1 | 78.0 | 0.0 | 0.1 | 64.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 70.0 |
| 7/5/2021 | 91.0 | 1.4 | 0.0 | 1.1 | 77.0 | 0.0 | 0.1 | 62.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 69.0 |
| 7/6/2021 | 90.0 | 1.4 | 0.0 | 1.0 | 77.0 | 0.0 | 0.2 | 61.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 68.5 |
| 7/7/2021 | 92.0 | 1.4 | 0.0 | 1.0 | 79.0 | 0.0 | 0.1 | 61.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 69.5 |
| 7/8/2021 | 91.0 | 1.4 | 0.0 | 0.9 | 79.0 | 0.0 | 0.2 | 66.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 70.3 |
| 7/9/2021 | 91.0 | 1.3 | 0.0 | 1.0 | 79.0 | 0.0 | 0.1 | 68.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 70.8 |
| 7/10/2021 | 91.0 | 1.1 | 0.0 | 1.1 | 79.0 | 0.0 | 0.1 | 69.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 71.0 |
| 7/11/2021 | 92.0 | 1.1 | 0.0 | 1.2 | 79.0 | 0.0 | 0.1 | 67.0 | 0.0 | 44.0 | 41.0 | 3.0 | 0.0 | 70.5 |
| 7/12/2021 | 91.0 | 1.1 | 0.0 | 1.2 | 79.0 | 0.0 | 0.5 | 68.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 70.8 |
| 7/13/2021 | 91.0 | 1.1 | 0.0 | 1.2 | 81.0 | 0.0 | 0.2 | 69.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 71.8 |
| 7/14/2021 | 80.0 | 1.1 | 0.0 | 1.4 | 72.0 | 0.0 | 0.2 | 59.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 64.5 |
| 7/15/2021 | 76.0 | 1.1 | 0.0 | 1.4 | 73.0 | 0.0 | 0.2 | 60.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 64.0 |
| 7/16/2021 | 87.0 | 1.1 | 0.0 | 1.4 | 71.0 | 0.0 | 0.2 | 60.0 | 0.0 | 47.0 | 44.0 | 3.0 | 0.0 | 66.3 |
| 7/17/2021 | 92.0 | 1.1 | 0.0 | 1.3 | 69.0 | 0.0 | 0.1 | 59.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 67.0 |
| 7/18/2021 | 92.0 | 1.2 | 0.0 | 1.3 | 65.0 | 0.0 | 0.1 | 61.0 | 0.0 | 48.0 | 45.0 | 3.0 | 0.0 | 66.5 |
| 7/19/2021 | 92.0 | 1.2 | 0.0 | 1.3 | 63.0 | 0.0 | 0.2 | 62.0 | 0.0 | 50.0 | 47.0 | 3.0 | 0.0 | 66.8 |
| 7/20/2021 | 91.0 | 1.2 | 0.0 | 1.3 | 67.0 | 0.0 | 0.2 | 62.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 67.8 |
| 7/21/2021 | 90.0 | 1.1 | 0.0 | 1.3 | 71.0 | 0.0 | 0.2 | 60.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 68.0 |
| 7/22/2021 | 90.0 | 1.2 | 0.0 | 1.2 | 72.0 | 0.0 | 0.1 | 56.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 67.3 |
| 7/23/2021 | 83.0 | 1.3 | 0.0 | 1.1 | 72.0 | 0.0 | 0.1 | 58.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 66.0 |
| 7/24/2021 | 80.0 | 1.2 | 0.0 | 1.1 | 71.0 | 0.0 | 0.1 | 53.0 | 0.0 | 52.0 | 48.0 | 3.0 | 1.0 | 64.0 |
| 7/25/2021 | 80.0 | 1.2 | 0.0 | 1.1 | 70.0 | 0.0 | 0.1 | 58.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 64.8 |
| 7/26/2021 | 80.0 | 1.2 | 0.0 | 1.1 | 69.0 | 0.0 | 0.1 | 57.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 64.3 |
| 7/27/2021 | 80.0 | 1.2 | 0.0 | 1.1 | 67.0 | 0.0 | 0.1 | 58.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 64.0 |
| 7/28/2021 | 80.0 | 1.1 | 0.0 | 1.1 | 65.0 | 0.0 | 0.4 | 62.0 | 0.0 | 50.0 | 47.0 | 3.0 | 0.0 | 64.3 |
| 7/29/2021 | 80.0 | 1.2 | 0.0 | 1.2 | 63.0 | 0.0 | 0.2 | 62.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 64.0 |
| 7/30/2021 | 80.0 | 1.2 | 0.0 | 1.2 | 63.0 | 0.0 | 0.1 | 61.0 | 0.0 | 53.0 | 48.0 | 5.0 | 0.0 | 64.3 |
| 7/31/2021 | 80.0 | 1.2 | 0.0 | 1.3 | 64.0 | 0.0 | 0.1 | 61.0 | 0.0 | 55.0 | 48.0 | 7.0 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8/1/2021 | 80.0 | 1.2 | 0.0 | 1.4 | 64.0 | 0.0 | 0.2 | 60.0 | 0.0 | 55.0 | 48.0 | 7.0 | 0.0 | 64.8 |
| 8/2/2021 | 80.0 | 1.3 | 0.0 | 1.4 | 65.0 | 0.0 | 0.2 | 57.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 63.3 |
| 8/3/2021 | 64.0 | 1.2 | 0.0 | 1.3 | 64.0 | 0.0 | 0.1 | 57.0 | 0.0 | 52.0 | 48.0 | 3.0 | 1.0 | 59.3 |
| 8/4/2021 | 58.0 | 1.2 | 0.0 | 1.1 | 63.0 | 0.0 | 0.2 | 56.0 | 0.0 | 53.0 | 48.0 | 3.0 | 2.0 | 57.5 |
| 8/5/2021 | 69.0 | 1.2 | 0.0 | 1.1 | 62.0 | 0.0 | 0.1 | 56.0 | 0.0 | 52.0 | 48.0 | 3.0 | 1.0 | 59.8 |
| 8/6/2021 | 75.0 | 1.2 | 0.0 | 1.1 | 57.0 | 0.0 | 0.1 | 56.0 | 0.0 | 51.0 | 48.0 | 3.0 | 0.0 | 59.8 |
| 8/7/2021 | 75.0 | 1.2 | 0.0 | 1.1 | 50.0 | 0.0 | 0.3 | 55.0 | 0.0 | 50.0 | 47.0 | 3.0 | 0.0 | 57.5 |
| 8/8/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 49.0 | 0.0 | 0.2 | 56.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 56.8 |
| 8/9/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 52.0 | 0.0 | 0.1 | 56.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 57.5 |
| 8/10/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 62.0 | 0.0 | 0.1 | 54.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 59.3 |
| 8/11/2021 | 77.0 | 1.2 | 0.0 | 1.1 | 64.0 | 0.0 | 0.1 | 51.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 59.3 |
| 8/12/2021 | 76.0 | 1.2 | 0.0 | 1.0 | 64.0 | 0.0 | 0.1 | 50.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 59.0 |
| 8/13/2021 | 76.0 | 1.2 | 0.0 | 1.0 | 64.0 | 0.0 | 0.1 | 51.0 | 0.0 | 45.0 | 42.0 | 3.0 | 0.0 | 59.0 |
| 8/14/2021 | 76.0 | 1.1 | 0.0 | 1.0 | 65.0 | 0.0 | 0.1 | 52.0 | 0.0 | 46.0 | 43.0 | 3.0 | 0.0 | 59.8 |
| 8/15/2021 | 76.0 | 1.1 | 0.0 | 1.0 | 65.0 | 0.0 | 0.2 | 53.0 | 0.0 | 44.0 | 41.0 | 3.0 | 0.0 | 59.5 |
| 8/16/2021 | 75.0 | 1.1 | 0.0 | 1.0 | 64.0 | 0.0 | 0.2 | 52.0 | 0.0 | 42.0 | 39.0 | 3.0 | 0.0 | 58.3 |
| 8/17/2021 | 75.0 | 1.2 | 0.0 | 1.0 | 64.0 | 0.0 | 0.2 | 50.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 57.5 |
| 8/18/2021 | 76.0 | 1.1 | 0.0 | 1.0 | 64.0 | 0.0 | 0.2 | 47.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 57.0 |
| 8/19/2021 | 76.0 | 1.2 | 0.0 | 1.0 | 63.0 | 0.0 | 0.2 | 49.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 57.0 |
| 8/20/2021 | 76.0 | 1.2 | 0.0 | 1.1 | 63.0 | 0.0 | 0.2 | 50.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 57.5 |
| 8/21/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 63.0 | 0.0 | 0.1 | 50.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 57.5 |
| 8/22/2021 | 76.0 | 1.1 | 0.0 | 1.3 | 64.0 | 0.0 | 0.1 | 51.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 57.8 |
| 8/23/2021 | 76.0 | 1.2 | 0.0 | 1.3 | 64.0 | 0.0 | 0.1 | 51.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 57.8 |
| 8/24/2021 | 76.0 | 1.1 | 0.0 | 1.3 | 65.0 | 0.0 | 0.1 | 51.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 58.0 |
| 8/25/2021 | 76.0 | 1.1 | 0.0 | 1.3 | 65.0 | 0.0 | 0.1 | 51.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 58.0 |
| 8/26/2021 | 78.0 | 1.1 | 0.0 | 1.3 | 65.0 | 0.0 | 0.0 | 51.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 58.5 |
| 8/27/2021 | 77.0 | 1.0 | 0.0 | 1.3 | 66.0 | 0.0 | 0.1 | 52.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 58.8 |
| 8/28/2021 | 77.0 | 1.0 | 0.0 | 1.3 | 66.0 | 0.0 | 0.0 | 53.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 59.0 |
| 8/29/2021 | 77.0 | 1.1 | 0.0 | 1.2 | 66.0 | 0.0 | 0.0 | 53.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 59.0 |
| 8/30/2021 | 77.0 | 1.3 | 0.0 | 1.1 | 67.0 | 0.0 | 0.0 | 54.0 | 0.0 | 40.0 | 37.0 | 3.0 | 0.0 | 59.5 |
| 8/31/2021 | 77.0 | 1.3 | 0.0 | 1.1 | 68.0 | 0.0 | 0.0 | 54.0 | 0.0 | 41.0 | 38.0 | 3.0 | 0.0 | 60.0 |
| **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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/1/2021 | 76.0 | 1.3 | 0.0 | 1.1 | 68.0 | 0.0 | 0.0 | 53.0 | 0.0 | 47.0 | 39.0 | 8.0 | 0.0 | 61.0 |
| 9/2/2021 | 77.0 | 1.3 | 0.0 | 1.2 | 68.0 | 0.0 | 0.1 | 53.0 | 0.0 | 43.0 | 32.0 | 11.0 | 0.0 | 60.3 |
| 9/3/2021 | 76.0 | 1.4 | 0.0 | 1.2 | 67.0 | 0.0 | 0.1 | 55.0 | 0.0 | 43.0 | 32.0 | 11.0 | 0.0 | 60.3 |
| 9/4/2021 | 75.0 | 1.2 | 0.0 | 1.2 | 66.0 | 0.0 | 0.1 | 55.0 | 0.0 | 44.0 | 33.0 | 11.0 | 0.0 | 60.0 |
| 9/5/2021 | 77.0 | 1.1 | 0.0 | 1.2 | 65.0 | 0.0 | 0.0 | 56.0 | 0.0 | 44.0 | 33.0 | 11.0 | 0.0 | 60.5 |
| 9/6/2021 | 78.0 | 1.2 | 0.0 | 1.2 | 67.0 | 0.0 | 0.2 | 57.0 | 0.0 | 44.0 | 33.0 | 11.0 | 0.0 | 61.5 |
| 9/7/2021 | 78.0 | 1.1 | 0.0 | 1.2 | 68.0 | 0.0 | 0.1 | 56.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 61.8 |
| 9/8/2021 | 76.0 | 1.1 | 0.0 | 1.2 | 63.0 | 0.0 | 0.1 | 51.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 58.8 |
| 9/9/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 64.0 | 0.0 | 0.0 | 50.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 58.8 |
| 9/10/2021 | 75.0 | 1.2 | 0.0 | 1.1 | 64.0 | 0.0 | 0.0 | 49.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 58.3 |
| 9/11/2021 | 76.0 | 1.1 | 0.0 | 1.1 | 65.0 | 0.0 | 0.0 | 50.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 59.0 |
| 9/12/2021 | 76.0 | 1.1 | 0.0 | 1.2 | 66.0 | 0.0 | 0.0 | 50.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 59.3 |
| 9/13/2021 | 77.0 | 1.1 | 0.0 | 1.2 | 65.0 | 0.0 | 0.0 | 51.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 59.5 |
| 9/14/2021 | 76.0 | 1.1 | 0.0 | 1.2 | 64.0 | 0.0 | 0.0 | 52.0 | 0.0 | 45.0 | 34.0 | 11.0 | 0.0 | 59.3 |
| 9/15/2021 | 76.0 | 1.2 | 0.0 | 1.3 | 63.0 | 0.0 | 0.0 | 52.0 | 0.0 | 46.0 | 35.0 | 11.0 | 0.0 | 59.3 |
| 9/16/2021 | 76.0 | 1.2 | 0.0 | 1.3 | 63.0 | 0.0 | 0.5 | 53.0 | 0.0 | 46.0 | 35.0 | 11.0 | 0.0 | 59.5 |
| 9/17/2021 | 71.0 | 0.9 | 0.0 | 1.3 | 64.0 | 0.0 | 0.0 | 52.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 58.5 |
| 9/18/2021 | 66.0 | 1.4 | 0.0 | 1.2 | 64.0 | 0.0 | 0.0 | 51.0 | 0.0 | 47.0 | 36.0 | 11.0 | 0.0 | 57.0 |
| 9/19/2021 | 65.0 | 1.6 | 0.0 | 1.2 | 64.0 | 0.0 | 0.0 | 52.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 57.3 |
| 9/20/2021 | 65.0 | 1.6 | 0.0 | 1.1 | 63.0 | 0.0 | 0.0 | 53.0 | 0.0 | 48.0 | 37.0 | 11.0 | 0.0 | 57.3 |
| 9/21/2021 | 66.0 | 1.4 | 0.0 | 1.1 | 59.0 | 0.0 | 0.0 | 53.0 | 0.0 | 49.0 | 38.0 | 11.0 | 0.0 | 56.8 |
| 9/22/2021 | 66.0 | 1.1 | 0.0 | 1.1 | 56.0 | 0.0 | 0.0 | 53.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 56.3 |
| 9/23/2021 | 65.0 | 1.2 | 0.0 | 1.1 | 55.0 | 0.0 | 0.0 | 53.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 55.8 |
| 9/24/2021 | 66.0 | 1.4 | 0.0 | 1.1 | 54.0 | 0.0 | 0.1 | 52.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 55.5 |
| 9/25/2021 | 66.0 | 1.2 | 0.0 | 1.2 | 54.0 | 0.0 | 0.1 | 49.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 54.8 |
| 9/26/2021 | 65.0 | 1.1 | 0.0 | 1.2 | 55.0 | 0.0 | 0.1 | 47.0 | 0.0 | 51.0 | 40.0 | 11.0 | 0.0 | 54.5 |
| 9/27/2021 | 66.0 | 1.2 | 0.0 | 1.2 | 55.0 | 0.0 | 0.1 | 46.0 | 0.0 | 51.0 | 40.0 | 11.0 | 0.0 | 54.5 |
| 9/28/2021 | 65.0 | 1.2 | 0.0 | 1.2 | 55.0 | 0.0 | 0.1 | 47.0 | 0.0 | 52.0 | 41.0 | 11.0 | 0.0 | 54.8 |
| 9/29/2021 | 66.0 | 1.1 | 0.0 | 1.1 | 55.0 | 0.0 | 0.0 | 46.0 | 0.0 | 51.0 | 40.0 | 11.0 | 0.0 | 54.5 |
| 9/30/2021 | 66.0 | 1.1 | 0.0 | 1.2 | 55.0 | 0.0 | 0.0 | 46.0 | 0.0 | 50.0 | 39.0 | 11.0 | 0.0 | 54.3 |

**Notes:** These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.

# 3.0 LAND MANAGEMENT

## 3.1 Land Management Summary

The 2021 Lower Owens River Project (LORP) land management monitoring efforts continued with utilization monitoring across all leases and range trend monitoring on the Twin Lakes and Lone Pine leases inside the LORP management area.

Pasture utilization within the LORP was within the allowable levels of use established for both riparian (up to 40%) and upland (up to 65%) areas. End-of-season utilization data for the LORP leases from 2010 to present is provided in the Land Management Appendix 1.

Irrigated pastures that scored below 80% in 2020 were revisited in the summer of 2021. Irrigated pasture scores from 2011-2021 are provided in the Land Management Appendix 2 for reference.

## 3.2 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 are 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 that were developed for the ranch leases within the LORP modified the grazing practices in riparian and upland areas on seven LADWP leases in order to facilitate reaching the 40 LORP goals 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 2021 are presented by lease below.

## 3.3 Utilization

The Lower Owens River Monitoring Adaptive Management and Reporting Plan (MAMP, Ecosystem Sciences, 2008) 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. 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.

### 3.3.1 Riparian and Upland Utilization Rates and Grazing Periods

Under the LORP MAMP, 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 not hinder 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.

### 3.3.2 Utilization Monitoring

Monitoring methodologies are fully described in Section 4.6.2 of the MAMP (Ecosystem Sciences, 2008).

Utilization is compliance monitoring and involves determining whether the utilization guidelines set forth in the grazing plans are being adhered to. Similar to precipitation data, utilization data alone cannot be used to assess ecological condition or trend. Utilization data is used to assist in interpreting changes in vegetative and soil attributes collected from other trend monitoring methods. Utilization data from 2010- 2021 is located in Land Management Appendix 1.

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).

## 3.4 Range Trend

### 3.4.1 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 MAMP. 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 (LADWP 2011). Nested frequency and shrub cover data collected in 2021 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 2021 involves nested frequency monitoring of all plant species and line-intercept sampling for shrub canopy cover. Photo documentation of 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 2021 results were compared to all sampling events during the baseline period to determine if results in 2021 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,* DISP), and to a lesser extent alkali sacaton *(Sporobolus airoides*, SPAI), and creeping wildrye *(Leymus triticoides*, 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 2016-18 Rapid Assessment Survey (RAS) reports 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 SPAI 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 SPAI, 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 SPAI 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 range of ecological conditions for these sites, which contributed to a robust baseline dataset bracketed by both dry and wet conditions. 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 as shown in Land Management Table 1. 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**

| 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|
| Thibaut | Twin Lakes | Blackrock | Thibaut | Twin Lakes | Blackrock | Thibaut |
| Islands | Lone Pine | Delta | Islands | Lone Pine | Delta | Islands |

### 3.4.2 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%, the pasture is evaluated again in the following year and/or changes to pasture management are implemented.

All irrigated pastures in the LORP management area that scored below 80% in 2019 were revisited in the summer of 2021. Irrigated pasture scores from 2011-2021 are provided in Land Management Appendix 2 for reference.

### 3.4.3 Fencing

New fence construction occurred in 2021 from Blackrock to Mazourka Canyon Road on the west side of the Los Angeles Aqueduct to replace the existing boundary fence. General maintenance and repairs also occurred lease dependent by lessees.

### 3.4.4 Discussion of Range Trend

Range Trend transects on the Twin Lakes and Lone Pine Leases were read in late August to early September of 2021.

Range Trend transects on the immediate floodplain where the water table is shallowest showed little influence from the current drought. Transects further from the river exhibited declines in perennial grass abundance likely as a response to the more direct impact from the drought. One positive response from the drought was that Bassia was unable to germinate in any of the areas along the river.

**Land Management Table 2. Significant changes between 2018 and 2021. Plant Frequencies (p=0.1) on the Twin Lakes Lease**

| | No Change | DISP | SPAI | HECU3 | BAHY | JUBA | SPGR |
|---|---|---|---|---|---|---|---|
| **Moist Floodplain** | | | | | | | |
| **Twinlakes_03** | | ↓ | | ↓ | ↓ | | |
| **Twinlakes_04** | | | | ↑ | ↓ | | |
| **Twinlakes_06** | | ↑ | | ↓ | ↓ | | |
| **Saline Meadow** | | | | | | | |
| **Twinlakes_02** | | ↓ | | | | ↓ | ↑ |
| **Saline Bottom** | | | | | | | |
| **Intake_01*** | | ↓ | ↓ | | | | |

**Land Management Table 3. Significant changes between 2018 and 2021 Plant Frequencies (p=0.1) on the Lone Pine Lease**

| | No Change | DISP | DESO2 | JUBA | BAHY | SPAI | SCAM6 | LETR5 |
|---|---|---|---|---|---|---|---|---|
| **Moist Floodplain** | | | | | | | | |
| **Lonepine_01** | | ↑ | | | | | | ↑ |
| **Lonepine_02** | | ↑ | | | | ↑ | | |
| **Lonepine_03** | | | | ↓ | | | | |
| **Lonepine_04** | | ↓ | | | | ↓ | | |
| **Lonepine_06** | | ↑ | | | | ↓ | | |
| **Lonepine_07** | | ↓ | | | | | | |

## 3.5 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, and a summary of range trend, utilization, and irrigated pasture results where relevant. Reference to plant species by plant symbol are found in Land Management Table 5, which includes a 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 5. Common Species in Range Trend Transects**

| USDA Plant Code | Species Name | Common Name |
|---|---|---|
| ANCA10 | *Anemopsis californica* | yerba mansa |
| ARPU9 | *Aristida purpurea* | purple threeawn |
| ATSE2 | *Atriplex serenana* | bractscale |
| ATTO | *Atriplex torreyi* | Torrey's saltbush |
| ATTR | *Atriplex truncata* | wedgescale saltbush |
| BAHY | *Bassia hyssopifolia* | fivehorn smotherweed |
| CHHI | *Chenopodium hians* | goosefoot |
| CHIN2 | *Chenopodium incanum* | mealy goosefoot |
| CHLE4 | *Chenopodium leptophyllum* | narrowleaf goosefoot |
| DESO2 | *Descurainia sophia* | herb sophia |
| DISP | *Distichlis spicata* | saltgrass |
| EQAR | *Equisetum arvense* | field horsetail |
| ERNA10 | *Ericameria nauseosa* | rubber rabbitbrush |
| FOPU2 | *Forestiera pubescens* | stretchberry |
| GITR | *Gilia transmontana* | transmontane gilia |
| GLLE3 | *Glycyrrhiza lepidota* | American licorice |
| HECU3 | *Heliotropium curassavicum* | salt heliotrope |
| JUBA | *Juncus balticus* | Baltic rush |
| LASE3 | *Langloisia setosissima* | Great Basin langloisia |
| LEFL2 | *Lepidium flavum* | yellow pepperweed |
| LELA2 | *Lepidium latifolium* | broadleaved pepperweed |
| LETR5 | *Leymus triticoides* | beardless wildrye |
| MALE3 | *Malvella leprosa* | alkali mallow |

**Common Species Encountered in Range Trend Transects, continued:**

| USDA Plant Code | Species Name | Common Name |
|---|---|---|
| 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 |
| SCAC3 | *Schoenoplectus acutus* | hardstem bulrush |
| SCAM6 | *Schoenoplectus americanus* | chairmaker's bulrush |
| SCMA | *Schoenoplectus maritimus* | cosmopolitan bulrush |
| SPAI | *Sporobolus airoides* | alkali sacaton |
| TARA | *Tamarix ramosissima* | saltcedar |
| TYDO | *Typha domingensis* | southern cattail |
| TYLA | *Typha latifolia* | broadleaf cattail |

### 3.5.1 Intake Lease

The Intake Lease (Land Management Figure 1) is utilized by horses and mules. The lease, which is approximately 102 acres, is comprised of three fields:

- Intake
- Big Meadow Field
- East Field

The Intake Field contains riparian vegetation and an associated 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 transects 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. These spoil piles now support shrubs associated with upland communities. The sandy soils and depth of the piles will likely impede any future development of a meadow plant community. 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.

Utilization

The Intake Field had no grazing in 2021.

Summary of Range Trend Data and Conditions

Range Trend data was not collected in 2021 on the Intake Lease.

Irrigated Pastures

There are no irrigated pastures on the Intake Lease.

Stockwater Sites

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

Fencing

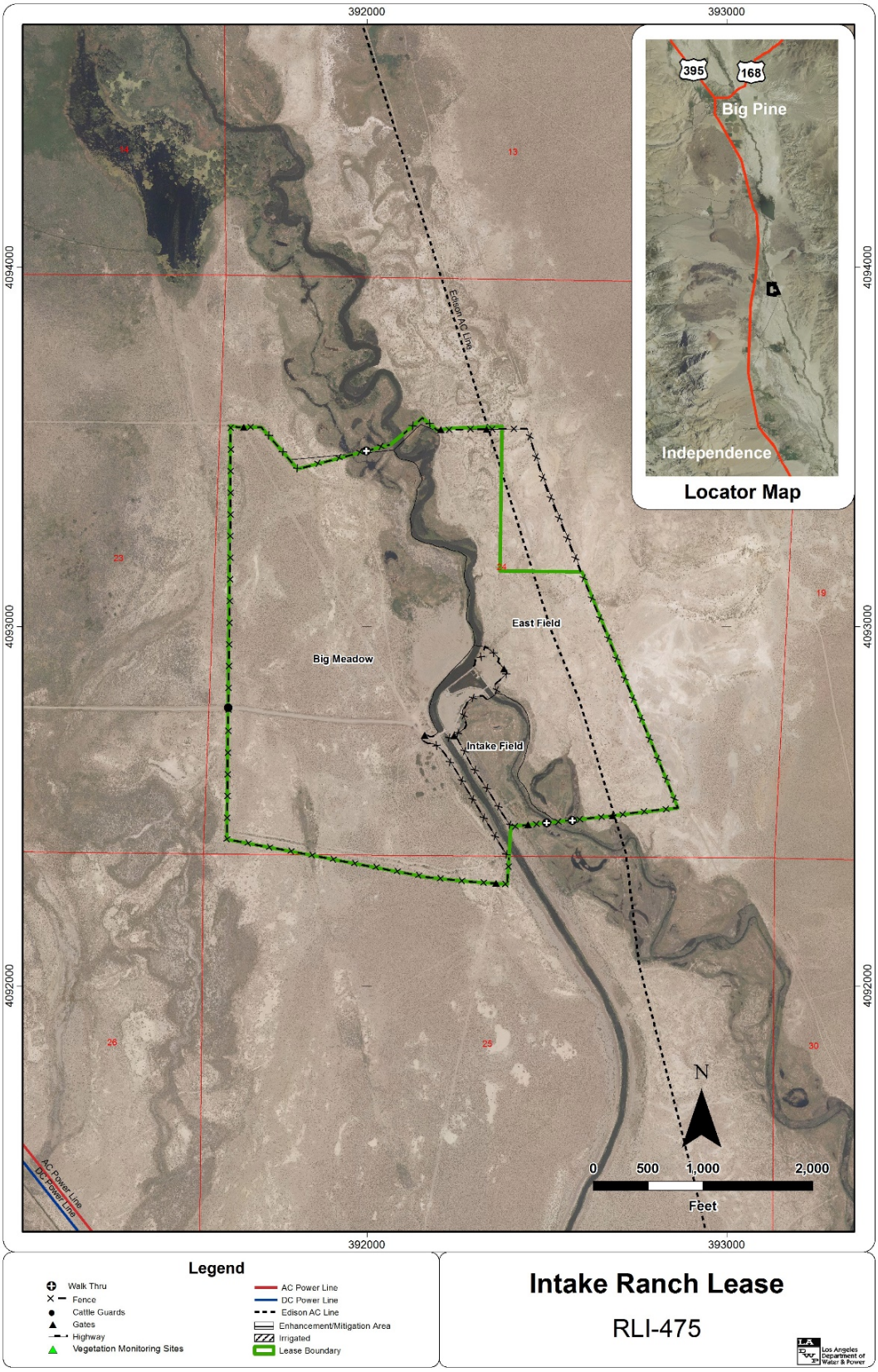
There was no new fence construction on the lease in 2021.

Salt and Supplement Sites

There are no salt and supplement sites on the lease.

Burning

No burns were conducted on the lease in 2021.




**Land Management Figure 1. Intake Ranch Lease**

### 3.5.2 Twin Lakes Lease

The Twin Lakes Lease (Land Management Figure 2) 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
- 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.

Riparian Management Areas

Utilization in the Lower Blackrock Riparian and Upper Blackrock Field was within the allowable utilization standard of 40% for the grazing season. There are no recommended management changes for the lease.

Upland Management Area

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

Summary of Range Trend Data and Conditions

Range trend transects are static or in decline on drier sites while in general on the moist-floodplain sites, trends are stable.

**Upper Blackrock Field**

**INTAKE_01**

INTAKE_01 is located in the Upper Blackrock Field. The soils are mapped as Torrifluvents-Fluvaquentic Endoaquolls Complex; but the majority of the study plot is located on the adjacent soil unit, Torrifluvents, 0-2% slopes, which is associated with the xeric Saline Meadow ecological site. Because of the xeric nature of the site, the area has been impacted from the current drought demonstrating a significant decline in

saltgrass and alkali sacaton to the lowest abundance seen on the site since monitoring began in 2002.

### Lower Blackrock Field

### TWINLAKES_02

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

This transect was burned in mid-February 2009. Shrub cover prior to the burn was moderate which resulted in a lower intensity burn when compared to similar areas further south in Drew Slough. Because of the low intensity fire, a decrease in shrub frequency, shrub cover, and shrub recruitment were observed in 2009-12 and total disappearance of shrubs on the transect continues into 2021. Alkali cordgrass increased to highest levels observed for the site while saltgrass declined compared to 2018. Utilization was minimal on the site in 2021 and has historically been very light.

### Lower Blackrock Field

### TWINLAKES_05

TWINLAKES_05 is located in Lower Blackrock Field on the Manzanar-Division Association, 0-2% slopes soil unit which corresponds to the Saline Meadow ecological site. The transect was burned in late January 2009 and was subsequently submerged when the Drew Unit of the BWMA was flooded. Because of this, range trend sampling and utilization estimates are unavailable.

### Lower Blackrock Riparian Field

### TWINLAKES_03

TWINLAKES_03 is located in the Lower Blackrock Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index during baseline period ranged between 63%-65%, placing it in good ecological condition, explained by the dominance of DISP on the site. Nevada saltbush was much greater than the described potential for the site

prior to 2013. The transect was inside the Twin Lakes burn in 2013 which reduced Nevada saltbush shrub cover to zero from 2015 to present.

The site also lacks in diversity of perennial grasses. DISP on the site has remained relatively static over time on the site until 2021 where abundance declined to the lowest level since monitoring began in 2002. Alkali sacaton has made a slight increase in abundance in 2021. Salt heliotrope (*Heliotropium curassavicum* HECU3) appeared for the first time on the site in 2018 and disappeared in 2021. Fivehorn smotherweed returned to the site again in 2018 but was absent in 2021.

**TWINLAKES_04**

TWINLAKES_04 is located in the Lower Blackrock Riparian Field in the former dry reach. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index is poor, ranging between 4-5%. Unlike TWINLAKES_03, which has historically benefitted from a shallow water table, TWINLAKES_04 has yet to respond favorably from returned flows into the Lower Owens River. The site is predominantly Nevada saltbush, inkweed, and bassia. Salt heliotrope (HECU3) dramatically increased within the site in 2018 and has since dominated a large portion of the area supplanting wildrye. Bassia frequency disappeared in 2021 on the site. Inkweed frequency in 2009 and 2010 was greater than baseline parameters (2002-04 and 2007) but dropped significantly. Nevada saltbush cover appears to be in decline on the site. There is a large population of pepperweed in the general area and has expanded on to the transect in 2021. The area was sprayed once in 2021 but would have benefitted from a retreatment later in the summer. This did not happen and overall abundance of pepperweed appears to remain unchanged. No utilization estimates exist for the site due to the absence of key forage species.

**TWINLAKES_06**

TWINLAKES_06 is located in the Lower Blackrock Riparian Field. Soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. Similarity index to the site's potential was 19% between 2006-07. As with TWINLAKES_04, the site is dominated by shrubs, invasive annual forbs, and a scant amount of perennial grasses in the understory. Plant frequency in 2009 indicated a significant increase in Nevada saltbush and bassia. Bassia disappeared until 2017 and was absent again in 2018. In 2010, DISP decreased to its lowest level for the site but has since recovered. Pepperweed is found in and around the area. Flooding in 2017 eliminated all Nevada saltbush on the site and inkweed has not been observed over the last two years of sampling.

Irrigated Pastures

There are no irrigated pastures on the Twin Lakes Lease.

Fencing

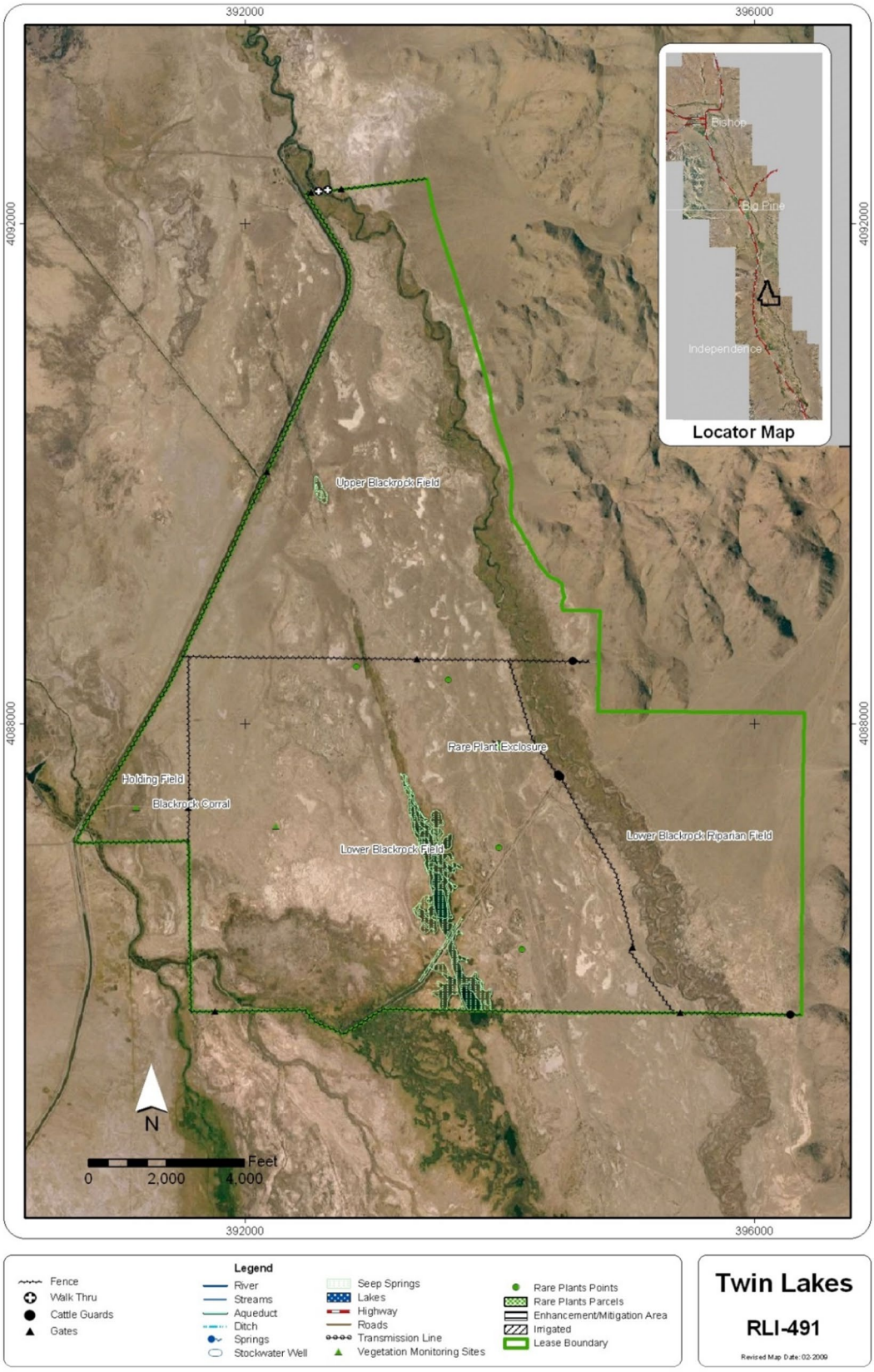
There was no new fence construction on the lease in 2021.

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 on the lease in 2021.




**Land Management Figure 2. Twin Lakes Lease**

### 3.5.3 Blackrock Lease

The Blackrock Lease (Land Management Figure 3) is a cow/calf operation consisting of 32,674 acres. 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 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
- North Blackrock Holding

Twelve of these pastures are monitored using range trend and utilization. The other eight 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.

Riparian Management Area

Riparian grazing on the Blackrock Lease was below the allowable 40% utilization standard.

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

Range Trend data was not collected in 2021 on the Blackrock lease.

Irrigated Pastures

There are no irrigated pastures on the Blackrock Lease.

Stockwater Sites

All stockwater wells are planned to be in operation before 2022.

Fencing

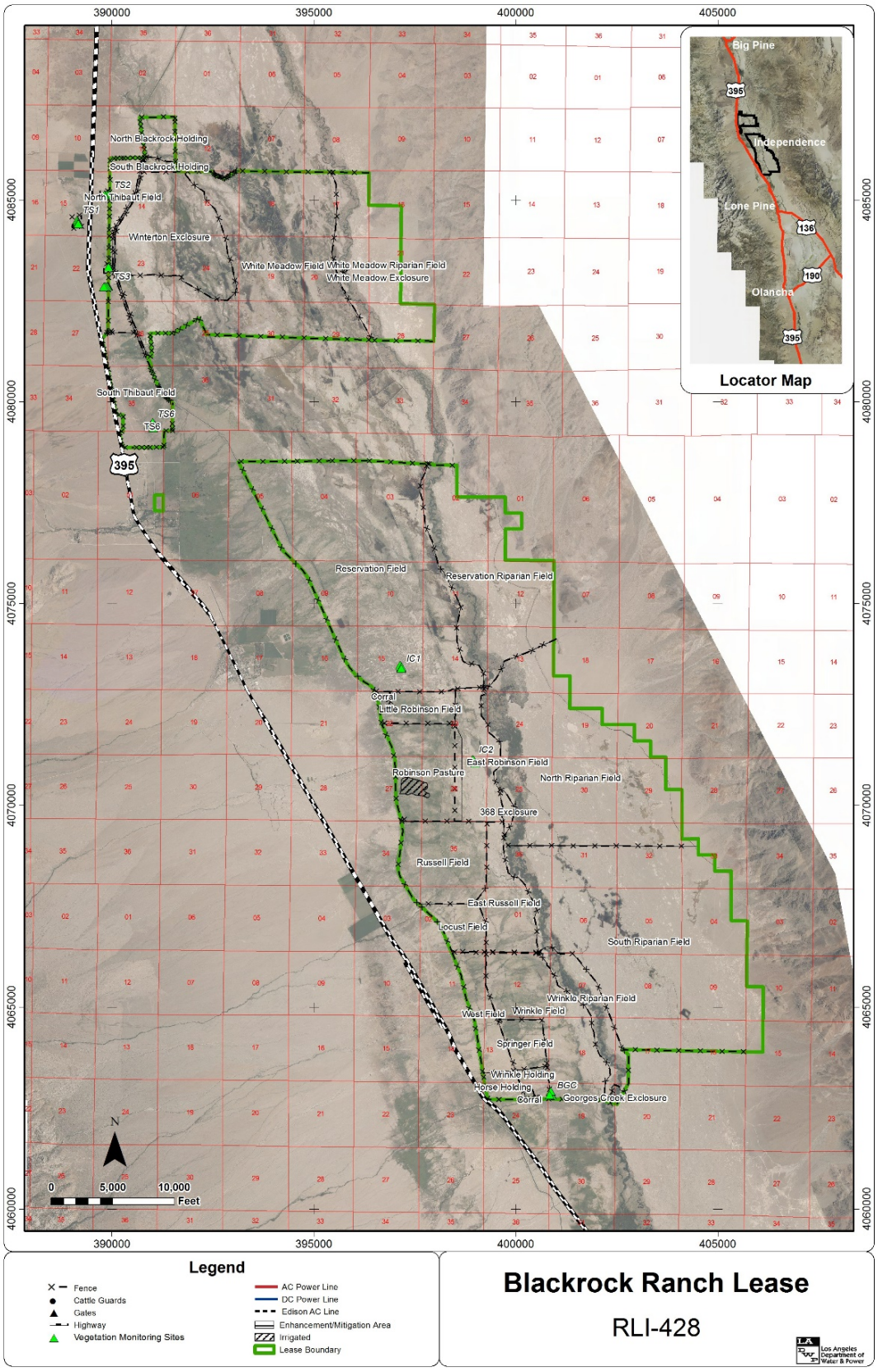
There was no new fence construction on the lease in 2021.

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. A liquid molasses protein is placed in portable feeding stations at these locations.

Burning

No burns or wildfires occurred on the lease in 2021.




**Land Management Figure 3. Blackrock Ranch Lease**

### 3.5.4 Thibaut Lease

The 5,259-acre Thibaut Lease (Land Management Figure 4) is utilized 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:

- Blackrock Waterfowl Management Area
- Rare Plant Management Area
- Thibaut Field
- Thibaut Riparian Pasture

Riparian Management Areas

The Thibaut Riparian Pasture has been excluded from grazing since the implementation of the LORP project. A grazing exclosure was constructed during the winter of 2018 (Land Management Figure 4). Livestock are now be permitted to graze the remainder of the Thibaut Riparian Pasture.

Upland Management Areas

The end-of-season use was below the allowable utilization grazing standard of 65%.

Summary of Range Trend Data and Conditions

Range Trend data was not collected in 2021.

Irrigated Pastures

Irrigated pasture evaluations were conducted in 2019. The irrigated pasture in the Thibaut Field was 72%, below the allowable score of 80% in 2019. This was due to weeds, poor irrigation practices, and spot grazing. Evaluation during the summer of 2020 showed improvement in pasture condition score (80%), due to lowering stocking levels during the growing season. The pasture was spot checked in 2021 but was not rated.

Stockwater Sites

Stockwater is provided by the Los Angeles Aqueduct and a stockwater well located in the Thibaut Field.

Fencing

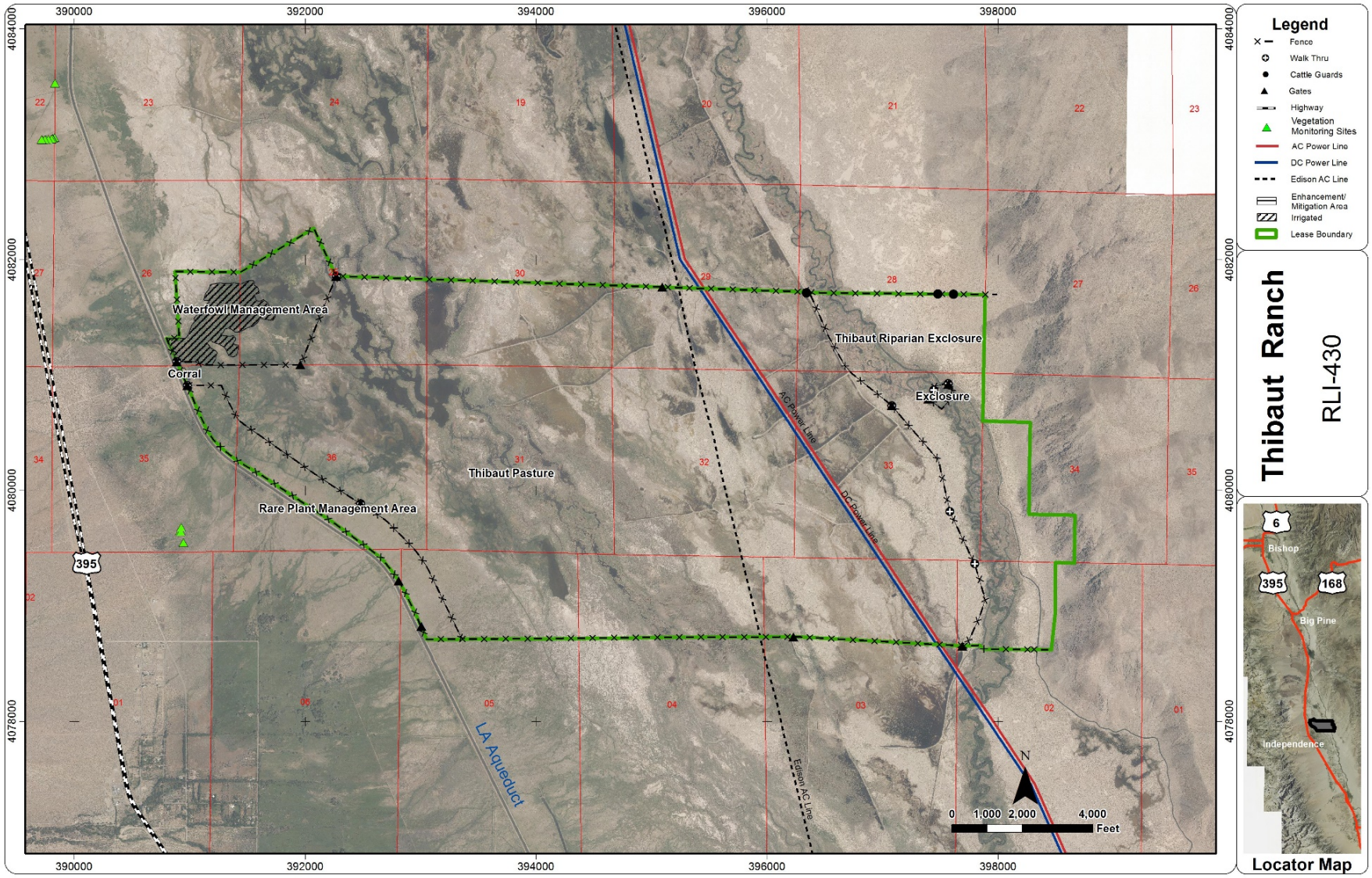
One mile of northern boundary fence was repaired after a controlled burn was conducted in 2019.

Salt and Supplement Sites

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

Burning

A prescribed burn conducted on the Blackrock lease burned a small portion of the northern part of the Thibaut lease (< 2 acres) in 2020.




**Land Management Figure 4. Thibaut Ranch Lease**

### 3.5.5 Islands Lease

The Islands Lease (Land Management Figure 5) 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, Carasco North, Carasco South, and Bull Pasture are spring dominated upland pastures.

Riparian Management Areas

All utilization transects on the Islands Lease were evaluated in 2021. Due to the continued inundation in the River Field, all of the meadows in the immediate area of the islands were flooded leaving only the southern end of the River Field for grazing. The southern portion of the Islands was below the allowable utilization standard of 40%.

Upland Management Areas

All upland pastures were well below the allowable 65% utilization rate in 2021.

Summary of Range Trend Data

Range Trend data was not collected in 2021.

Irrigated Pastures

The irrigated pastures located within the Bull Pasture and River Field each rated 86% in 2019. They will be rated again in 2022.

Stockwater Sites

There are two stockwater sites located 1-1.5 miles east of the river in the River Field uplands. These stockwater wells were drilled in 2010 and are now operational. The lessee has yet to install the water troughs at the wells.

Fencing

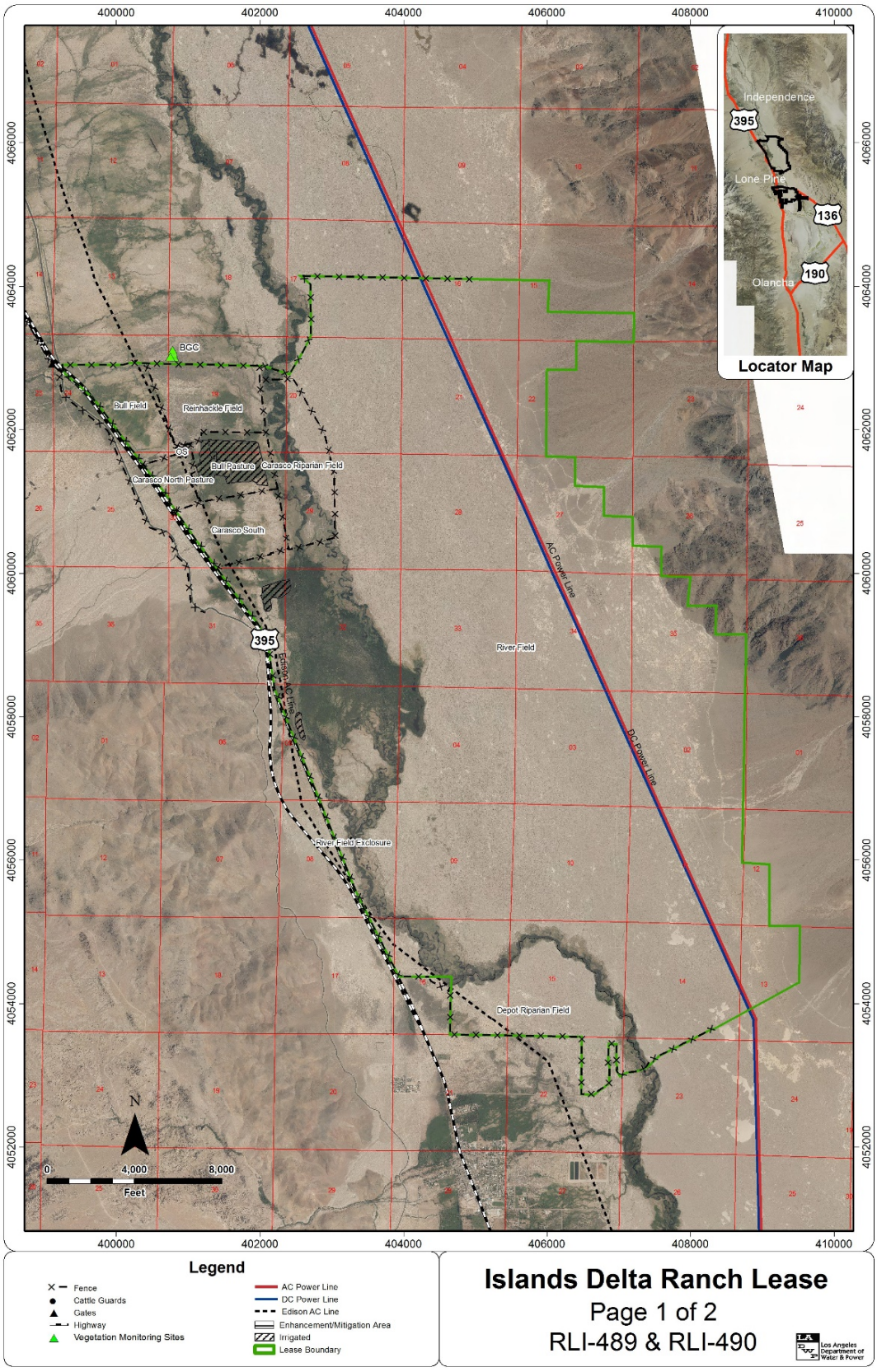
There was no new fence construction on the lease in 2021.

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

No burns occurred on the lease in 2021.




**Land Management Figure 5. Islands and Delta Ranch Leases (Islands Portion)**

### 3.5.6 Lone Pine Lease

The Lone Pine Lease Land Management Figure 6) is an 8,274-acre cow/calf operation divided into 11 pastures and adjacent private ranch land. Grazing on the lease typically 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
- Airport Field
- Edwards Pasture
- Miller Pasture
- Richards Pasture
- Van Norman Pasture
- Richards Field
- Dump Pasture
- Johnson Pasture
- River Pasture
- Smith 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.

Riparian Management Area

Utilization was within the allowable 40% utilization standard. Herbaceous vegetation has fully recovered since the wildfire in 2013. Woody riparian species are continuing to recover and many willows are re-sprouting.

Upland Management Area

Upland utilization was below the allowable standard of 65%.

Summary of Range Trend Data and Conditions

Sites further from the river exhibited negative trends as a result from the current drought. Alkali sacaton disappeared from the Lonepine_06 transect. This transect is located in a grazing exclosure.

### LONEPINE_01

This site is in a riparian management area on the west side of the Owens River, just north of Lone Pine Creek in the River Pasture. The soil series associated with the transect is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. During the baseline period from 2002-07, similarity index had ranged between 76% and 79%. Annual aboveground production at this riparian site has exceeded typical quantities found in the Moist Floodplain ecological site description. This site supports four perennial graminoid species and is dominated by DISP. The overall cover of shrubs is typical for a Moist Floodplain ecological site. No non-native species were detected at the site. Beardless wildrye significantly increased in 2009 and continues to remain stable on the site. Saltgrass increased on this site compared to 2018. Shrub cover appears to be decreasing on this site.

### LONEPINE_02

This site is in a riparian management area on the west side of the Owens River, east of the Lone Pine Dump in the River Pasture. The soil series is Torrifluvents-Fuvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. The similarity index ranged between 65% and 87% from 2002 to 2007. The site is in excellent condition. The site is grass-dominated with saltgrass (DISP) comprising the bulk of the biomass. DISP frequency significantly increased in 2009, outside its historic range from 2002-07 and in 2010-12 returned to levels typically observed on the site. DISP again increased in 2015 and then decreased in 2018 to levels typical for the site. In 2021 DISP significantly increased in abundance. Alkali sacaton (SPAI) increased slightly in 2018 and rose significantly again in 2021 but is below the range observed between 2002-13. No non-native species were detected at the site.

### LONEPINE_03

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. The similarity index had ranged between 74% and 87% during sampling periods between 2002-07, indicating the site is in excellent condition. The site is grass-dominated with DISP comprising the bulk of the biomass and creeping wildrye closely reaching the potential described for the site at 13% in 2007. Frequency for creeping wildrye (LETR) increased significantly in 2009 and remained significantly higher in 2010 when compared to all sampling periods during the baseline period. There were no changes in frequency for all forage species in 2021. Overall, following the Lone Pine Fire shrub cover is minimal. No non-native species were detected at the site. This site, based on the ecological site description and frequency trends, is stable and in excellent ecological condition.

## LONEPINE_04

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The transect is located at the edge of the floodplain and currently incorporates a portion of the transition zone to upland vegetation. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes at the beginning of the transect and transitions to the Mazourka-Eclipse complex, 0-2% slopes. The transition in ecological sites is from Moist Floodplain to a Sodic Terrace. Because of the mixed soils and associated ecological sites found across the transect evaluating trend for this site will concentrate on changes on trend rather than how well the site matches ecological site descriptions.

The similarity index had ranged widely between 59% and 73% from 2002-07. Site production has generally been less than potential based on the ecological site description for a Moist Floodplain site. When compared to the Moist Floodplain ecological site description, the site has less than the expected biomass of forage species such as LETR and JUBA. This is explained by the transition from mesic conditions on the Moist Floodplain to more xeric conditions of the uplands which results in a decreasing abundance of LETR, JUBA and riparian trees and the disproportionate amount of SPAI which can better thrive in both the mesic and xeric transitional zones. The site is grass-dominated with DISP and SPAI comprising the bulk of the biomass. The shrub component of the site is dominated by rubber rabbitbrush (*Ericameria nauseosa* [ERNA10]). As flows on the Lower Owens River continue, soil moisture may rise toward the upland zone of the transect and future changes in species composition may be observed. However, frequency data indicates that there is an inverse trend, with decreasing DISP, and increasing SPAI which is typical for gradient in zones moving from wet to dry areas. No non-native species were detected at the site. The site remained static in 2018. In 2021 there were significant declines in saltgrass (DISP) and alkali sacaton (SPAI) which is expected as the current drought is more severely impacting areas further from the river (xeric zones).

## LONEPINE_05

This site is in an upland management area in the Winnedumah fine sandy loam, 0-2% slopes soil series which is associated with a Sodic Fan ecological site, just east of the Lone Pine Airport in the Johnson Pasture. In 2004, the site flooded and was not sampled.

The similarity index has ranged between 69% and 77% between 2002-07. Nevada saltbush (*Atriplex torreyi* [ATTO]) has trended down over time. Frequency of DISP significantly increased in 2009 and decreased in 2010 to similar levels to that seen during the baseline period. In 2015, SPAI and DISP dramatically declined.

Shrub cover has also decreased significantly in 2015. This site was flooded between 2004-05. The subsequent decline in plant frequency and cover is a result of the area drying out. In 2017 the site was fully submerged with cattail present in the sampling area. Range trend transects are selected in part because they are representative of a larger area or ecological site that has been identified as important for land managers. Because of these atypical impacts to the Lonepine_05 are not representative of the Johnson Pasture as a whole, the transect was not read in 2018 or in 2021.

**LONEPINE_06**

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This monitoring transect is located inside a riparian exclosure, constructed in February 2009. This exclosure is a non-grazed reference site. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site. In the spring of 2015 the exclosure was compromised and livestock entered and grazed the exclosure. The fence has since been repaired and extended further into the river to prevent cattle reentry.

The similarity index had ranged between 66% and 84% between 2003 and 2007. Site production had varied during the baseline period from above to below the expected based on the ecological site description. Compared to the potential outlined in the ecological site description, this site lacks the forb and woody riparian species component. The forage base is dominated by DISP and SPAI. Other forage species such as LETR and JUBA are lacking at this site. One non-native species, bassia, has been detected at the site. Frequency results in 2010 were static since baseline. There was a significant decrease in salt grass in 2012. The exclosure was completed in February 2009. SPAI, following the 2013 fire was at its all-time low while in 2015, both SPAI and DISP had increased to its highest level seen. In 2021 SPAI disappeared from the transect while DISP increased.

**LONEPINE_07**

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This site was first established in the summer of 2007. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site.

The similarity index was 60% in 2007. Site production was similar to that expected based on the ecological site description. There is a low diversity of perennial graminoids as the only species detected was DISP. Other forage species such as SPAI and creeping wild rye are lacking on the transect but are present in the area. The biomass of forbs and riparian woody species is less than expected as compared to the desired

plant community. No non-native species were detected at the site. Between 2007 and 2015 frequency had not changed significantly on the site. In 2018, DISP significantly decreased but still remained inside the historical range for the transect. In 2021 DISP has further declined to its lowest level since monitoring began in 2003. The transect is located 260ft from the river and is situated on a small terrace above the floodplain. The decline in saltgrass is similar to other locations where perennial grasses away from the shallow water table have become more susceptible to the impacts of the current drought.

**LONEPINE_08**

This site is located in a riparian management area on the east side of the Owens River in the River Pasture. This site was first established in the summer of 2011. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site. The only change that had occurred has been an increase in *Scirpus americanus.* In 2018 this site was enveloped by marsh and has become inaccessible to monitor.

Stockwater Sites

LADWP plans to complete installation of the pump and storage tank during the winter of 2021-22.

Fencing

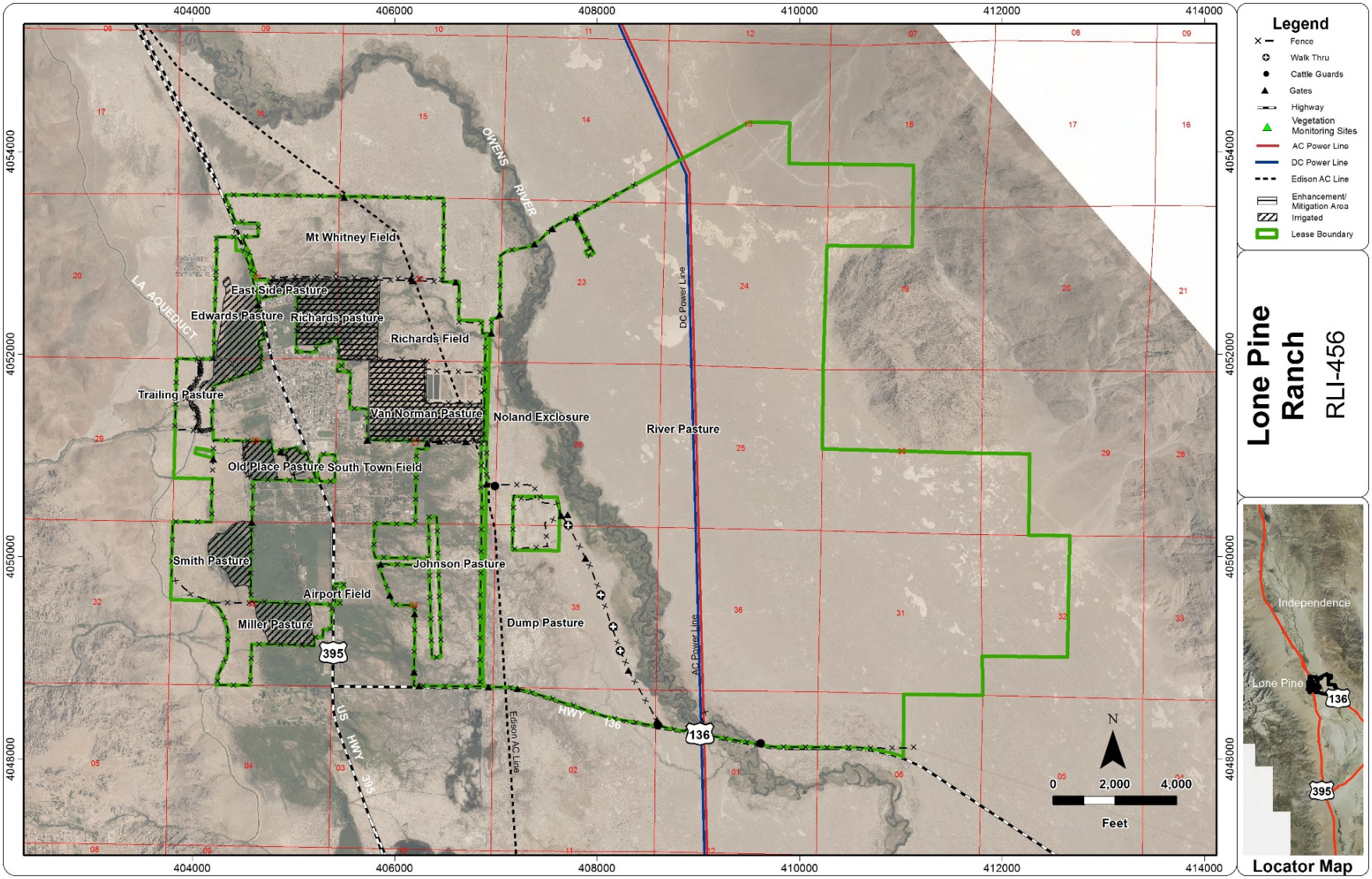
There was no new fence construction on the lease in 2021.

Salt and Supplement Sites

All supplement tubs were situated outside of the flood plain.

Burning

No burns were conducted on the lease in 2021.




**Land Management Figure 6. Lone Pine Ranch Lease**

### 3.5.7 Delta Lease

The Delta Lease (Land Management Figure 7) 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
- 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 estimates are taken 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 portion, northwest of Owens Lake, supports little in the way of forage and has no stockwater.

Riparian Management Areas

End-of-season utilization was below the allowable utilization standard of 40%.

Upland Management Areas

The upland grazing was below the allowable utilization standard of 65%.

Summary of Range Trend Data and Conditions

Range Trend data was not collected in 2021 on the Delta Lease.

Irrigated Pastures

The Lake Field is located west of U.S. Highway 395 north of Diaz Lake. This irrigated pasture was evaluated in 2019 at 86%. It will be evaluated again in 2022.

Stockwater Sites

Stockwater for the Bolin Field is supplied from a diversion that runs from Tuttle Creek.

Fencing

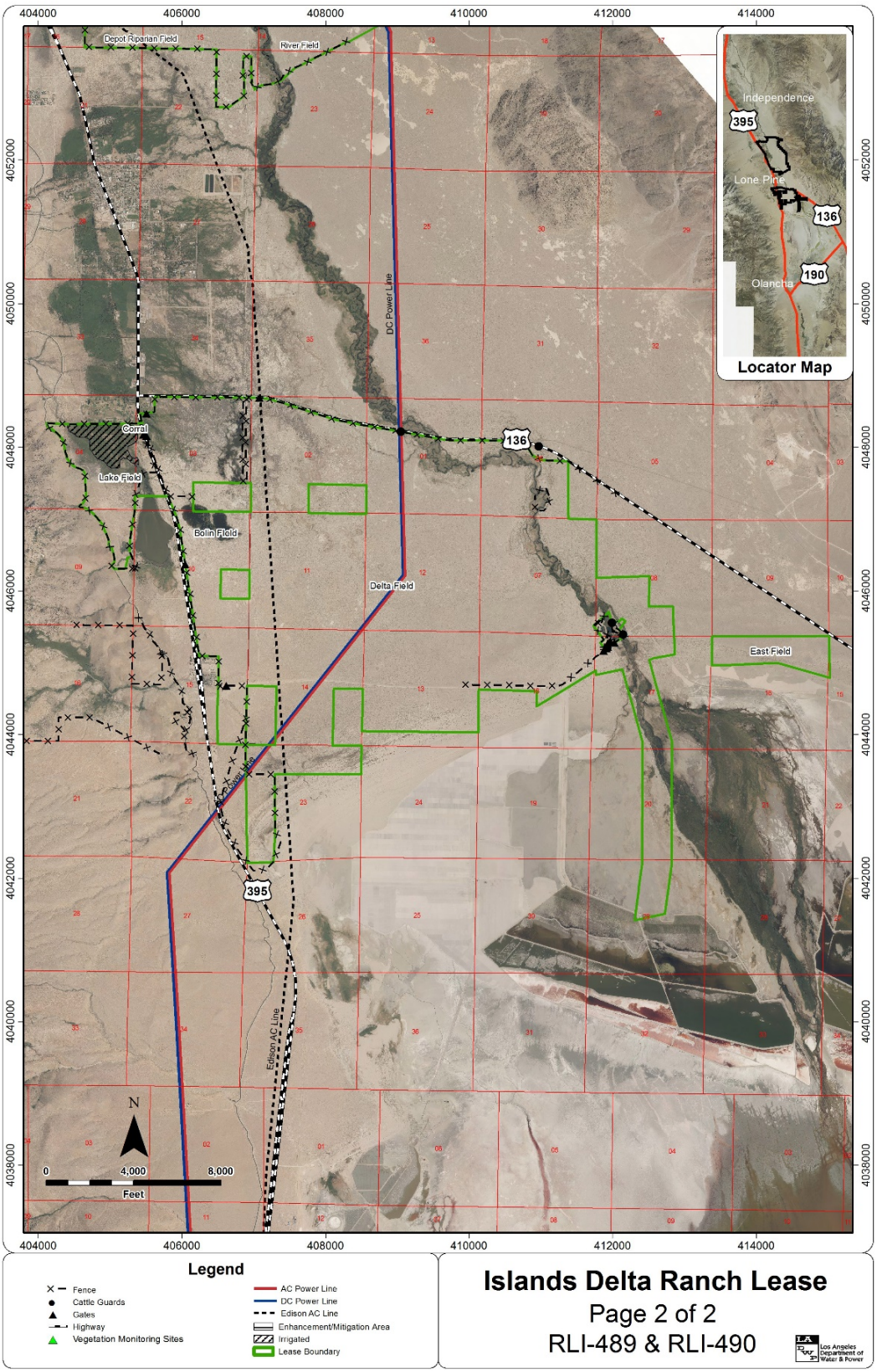
There was no new fence construction on the lease in 2021.

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

No burns were conducted on the lease in 2021.




**Land Management Figure 7. Islands and Delta Ranch Leases (Delta Portion)**

## 3.6 Land Management Summary and Conclusion

Utilization

Utilization on all leases continues to meet the grazing management plan utilization standards.

The Islands lease will continue to operate below normal stocking rates due to riparian pastures being continually inundated. Past and current flow management has perpetuated this problem beyond the Islands lease and is now affecting portions of the Blackrock lease. Continued loss of meadow habitat and stressed woody species has increased on both Islands and Blackrock leases.

Range Trend

Range trend results point towards stable or upward trends in plant frequency of saltgrass and sacaton on moist floodplain sites. On the drier sites, impacts from the drought have become apparent with declines in perennial grass abundance.

Irrigated Pastures

All irrigated pastures were evaluated in 2019. All pastures scored above 80% except Thibaut (72%). Evaluation in 2021 showed improvement to vegetation conditions due to reduced grazing pressure during the growing season. This allowed the pasture to reach the minimum pasture condition score of 80%.

## 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.

Los Angeles Department of Water and Power (LADWP). 2011. 2010 Final Lower Owens River Project Annual Report. Los Angeles Department of Water and Power, Bishop, CA. February 2. 598 pp.

Mueller-Dombois, D. & Ellenberg, H. 974. *Aims and Methods of Vegetation Ecology.* 547 pp. Wiley, N.Y.

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

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.

## Land Management Appendix 1. End of Season Utilization by Lease and Pasture, 2010-2021

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Blackrock** | Horse Holding | BLKROC_09 | 36% | 29% | 31% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 4% | 0% |
| | | HORSEHOLD_02 | 34% | | | | 0% | | | | | 0% | 0% | 0% |
| | Horse Holding Average | | 35% | 29% | 31% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 4% | 0% |
| | Locust Field | BLKROC_06 | 34% | 13% | 32% | 32% | 53% | 18% | 32% | 0% | 25% | 0% | 0% | 7% |
| | Locust Field Average | | 34% | 13% | 32% | 32% | 53% | 18% | 32% | 0% | 25% | 0% | 0% | 7% |
| | North Riparian Field | BLKROC_12 | 16% | | | | | | | | | | | |
| | | BLKROC_22 | 43% | 31% | 10% | | 21% | 20% | 23% | 20% | 12% | 9% | 0% | 19% |
| | North Riparian Field Average | | 29% | 31% | 10% | | 21% | 20% | 23% | 20% | 12% | 9% | 0% | 19% |
| | Reservation Field | BLKROC_02 | 36% | | 18% | 35% | 0% | 17% | 11% | 30% | 0% | 0% | 0% | 53% |
| | | BLKROC_03 | 46% | 53% | 27% | 33% | 12% | 13% | 13% | 11% | 3% | 0% | 6% | 4% |
| | | BLKROC_44 | 45% | | 28% | 40% | 22% | 43% | 10% | 0% | 0% | 3% | 0% | 22% |
| | | BLKROC_49 | 16% | 0% | 11% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 2% |
| | | BLKROC_51 | 33% | 41% | 39% | 44% | 15% | 30% | 16% | 12% | 26% | 0% | 28% | 23% |
| | | RESERVATION_06 | 48% | 23% | 34% | 30% | 18% | 15% | 13% | 30% | 0% | 2% | 2% | 3% |
| | Reservation Field Average | | 37% | 29% | 26% | 30% | 11% | 20% | 10% | 14% | 5% | 1% | 6% | 18% |
| | Robinson Field | BLKROC_04 | 22% | 8% | 38% | 24% | | 9% | 1% | 0% | 0% | 6% | | 35% |
| | | ROBINSON_02 | 23% | 4% | 18% | 25% | | | 7% | 0% | 0% | | 3% | 13% |
| | Robinson Field Average | | 23% | 6% | 28% | 25% | | 9% | 4% | 0% | 0% | 6% | 3% | 24% |
| | Russell Field | BLKROC_05 | 48% | 13% | 24% | 22% | 2% | 2% | 13% | 0% | 13% | 9% | 3% | 1% |
| | | RUSSELL_02 | 31% | 0% | 28% | 31% | 0% | 1% | 4% | 0% | 13% | 0% | | 6% |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Russell Field Average | | 39% | 6% | 26% | 26% | 1% | 1% | 8% | 0% | 13% | 5% | 3% | 4% |
| | South Riparian Field | BLKROC_13 | 10% | 31% | | | 15% | | 0% | 5% | 23% | | 28% | 9% |
| | | BLKROC_23 | 20% | 22% | 8% | | | 27% | 0% | 25% | 7% | 15% | 32% | 8% |
| | | SOUTHRIP_03 | 33% | 19% | | | 7% | 12% | 0% | 7% | | | | |
| | | SOUTHRIP_04 | | 20% | | | 2% | 5% | | 0% | 5% | | | 6% |
| | South Riparian Field Average | | 21% | 23% | 8% | | 8% | 15% | 0% | 9% | 12% | 15% | 30% | 8% |
| | Springer Field | BLKROC_08 | | | | | 0% | 5% | 1% | 0% | 0% | 1% | 0% | 0% |
| | Springer Field Average | | | | | | 0% | 5% | 1% | 0% | 0% | 1% | 0% | 0% |
| | White Meadow Field | BLKROC_01 | 4% | 0% | 9% | 18% | 0% | | 7% | 0% | 0% | 0% | 0% | 9% |
| | | BLKROC_39 | 0% | 0% | 0% | 0% | 0% | 3% | 0% | 0% | 0% | | 0% | 4% |
| | | WHITEMEADOW_03 | 12% | | 29% | 43% | 0% | 10% | 19% | | 4% | 2% | 9% | 23% |
| | | WHITEMEADOW_04 | 0% | 0% | 3% | 0% | 5% | 0% | 0% | 0% | 0% | 0% | 8% | |
| | | WHITEMEADOW_05 | 34% | 36% | 54% | 32% | 29% | 0% | 35% | 0% | 13% | 4% | | 6% |
| | White Meadow Field Average | | 10% | 9% | 19% | 19% | 7% | 3% | 12% | 0% | 3% | 1% | 4% | 11% |
| | White Meadow Riparian Field | BLKROC_11 | 0% | 68% | 55% | | 16% | 27% | 26% | 22% | 5% | 11% | 10% | 22% |
| | | BLKROC_14 | | | | | | | | | | | | |
| | | BLKROC_26 | | 45% | | | 18% | | | | 31% | | | |
| | | WMRIP_T2 | | | | | | | 0% | 0% | | | | |
| | | WMRIP_T5 | | | 23% | | | | 11% | 3% | | | | |
| | | WMRIP_T4 | | | 23% | | | | 44% | | 4% | | | |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WMRIP_T1 | | | 26% | | | | 12% | 27% | | | | |
| | White Meadow Riparian Field Average | | 0% | 57% | 32% | | 17% | 27% | 19% | 13% | 13% | 11% | 10% | 22% |
| | Wrinkle Field | BLKROC_07 | 40% | | 7% | 28% | 6% | 7% | 16% | 0% | 4% | 0% | 3% | 3% |
| | | WRINKLE_03 | 48% | 24% | 34% | 17% | 35% | 0% | | 0% | 9% | 7% | 6% | 0% |
| | Wrinkle Field Average | | 44% | 24% | 20% | 22% | 21% | 3% | 16% | 0% | 6% | 3% | 5% | 2% |
| | Wrinkle Riparian Field | BLKROC_18 | 46% | 48% | | | | 3% | 10% | 7% | 10% | | 31% | |
| | | BLKROC_19 | 26% | 8% | | | | 10% | 18% | 0% | 13% | 11% | | 11% |
| | | BLKROC_20 | 53% | 12% | | | | 28% | 15% | 13% | 0% | 13% | 34% | |
| | | BLKROC_21 | 38% | 6% | | | | 15% | 19% | 0% | 0% | 12% | 35% | 12% |
| | Wrinkle Riparian Field Average | | 41% | 18% | | | | 14% | 16% | 5% | 6% | 12% | 34% | 12% |
| | West Field | WRINKLE_02 | 22% | 38% | 41% | 36% | 9% | 39% | 7% | 0% | 0% | 0% | 0% | 31% |
| | West Field Average | | 22% | 38% | 41% | 36% | 9% | 39% | 7% | 0% | 0% | 0% | 0% | 31% |
| **Delta** | Bolin Field | BOLIN_02 | | | | 25% | | 5% | | | 16% | 0% | 13% | |
| | | BOLIN_01 | | | 65% | 27% | 16% | | | | 0% | 0% | 50% | 5% |
| | Bolin Field Average | | | | 65% | 26% | 16% | 5% | | | 8% | 0% | 32% | 5% |
| | Main Delta | DELTA_01 | 70% | 38% | 30% | 19% | 39% | 35% | 53% | 9% | 3% | 26% | | 13% |
| | | DELTA_02 | | | | | | | | | | | | |
| | | DELTA_03 | 71% | 12% | 45% | 26% | 50% | 8% | 59% | 12% | | 18% | 18% | 18% |
| | | DELTA_04 | 62% | 33% | 44% | 38% | 30% | 11% | 63% | 15% | 5% | 31% | 11% | 13% |
| | | DELTA_05 | 29% | 50% | 42% | 40% | 22% | 60% | 43% | 24% | 14% | 0% | 0% | |
| | | DELTA_06 | 23% | 42% | 41% | 26% | 30% | 66% | 55% | 36% | | 8% | 12% | |
| | | DELTA_07 | 49% | 51% | 58% | 36% | 49% | 63% | 20% | 13% | 21% | 14% | 13% | 7% |
| | Main Delta Average | | 51% | 38% | 43% | 31% | 37% | 41% | 49% | 18% | 11% | 16% | 11% | 13% |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dune Pasture | DELT_UP_01 | | 0% | | | | | | | 0% | 0% | 0% | 0% |
| | Dune Pasture Average | | | 0% | | | | | | | 0% | 0% | 0% | 0% |
| **Intake** | Intake | STUART_01 | 0% | | | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | Intake Average | | 0% | | | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Islands** | Carasco Riparian Field South | ISLAND_06 | | | 26% | 21% | | 5% | 41% | 3% | 0% | | 25% | 3% |
| | Carasco Riparian Field South Average | | | | 26% | 21% | | 5% | 41% | 3% | 0% | | 25% | 3% |
| | Depot Riparian Field | ISLAND_08 | 20% | 0% | 68% | 27% | 31% | 23% | 25% | 16% | 13% | 5% | 15% | 20% |
| | | ISLAND_09 | 49% | 25% | 67% | 39% | 91% | 71% | 48% | 9% | 40% | 2% | 50% | 17% |
| | | RIVERFIELD_07 | 26% | 29% | 52% | 47% | 19% | 60% | 61% | 24% | 14% | 10% | 11% | 36% |
| | | RIVERFIELD_09 | 9% | 8% | 9% | | 51% | | 15% | 27% | | | | 24% |
| | | RIVERFIELD_12 | 44% | 41% | 71% | 58% | 38% | 63% | 53% | 1% | 0% | 30% | 19% | 17% |
| | Depot Riparian Field Average | | 30% | 20% | 53% | 43% | 46% | 54% | 41% | 16% | 17% | 12% | 24% | 23% |
| | Lubkin | LUBKIN_01 | | 0% | 5% | 6% | 3% | 16% | 34% | 33% | 8% | 0% | 1% | 0% |
| | Lubkin Average | | | 0% | 5% | 6% | 3% | 16% | 34% | 33% | 8% | 0% | 1% | 0% |
| | River Field - Islands | ISLAND_07 | 0% | 0% | | 0% | 0% | | | | | | | |
| | | ISLAND_10 | 28% | 0% | 40% | 44% | 0% | 25% | 40% | 8% | 22% | 20% | 27% | 44% |
| | | ISLAND_11 | | 11% | 6% | 0% | | 7% | 0% | 0% | 3% | 1% | 1% | 4% |
| | | ISLAND_12 | 0% | 34% | 31% | 0% | 41% | 28% | | | | | | |
| | | RIVERFIELD_08 | 3% | 0% | 71% | 52% | | 34% | 0% | 5% | | 17% | 10% | |
| | | RIVERFIELD_11 | 0% | 58% | 89% | 0% | | 20% | | | | | | |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RIVERFIELD_06 | 0% | 0% | 31% | | 0% | 0% | | | | | | |
| | | ISLAND_14 | | | 81% | 20% | 48% | 49% | 67% | 0% | | | | |
| | River Field - Islands Average | | 4% | 15% | 50% | 17% | 18% | 23% | 27% | 3% | 13% | 12% | 13% | 24% |
| | South Field | ISLAND_02 | | 23% | 0% | | 0% | | 14% | | | 0% | | |
| | | ISLAND_59 | 0% | | | | 0% | 0% | 29% | | 0% | 0% | 0% | |
| | | SOUTHFIELD_02 | 7% | 24% | 19% | | 0% | 0% | 36% | | 14% | 0% | 15% | |
| | South Field Average | | 3% | 23% | 10% | | 0% | 0% | 26% | | 7% | 0% | 8% | |
| **Lone Pine** | Johnson Pasture | LONEPINE_05 | 63% | 14% | 0% | | 79% | 0% | 21% | 0% | 10% | 0% | 7% | 5% |
| | Johnson Pasture Average | | 63% | 14% | 0% | | 79% | 0% | 21% | 0% | 10% | 0% | 7% | 5% |
| | River Field - Lone Pine | LONEPINE_01 | 49% | 28% | 22% | | 38% | 42% | 26% | 26% | 37% | 39% | | 32% |
| | | LONEPINE_02 | 25% | 30% | 32% | | 30% | | 29% | 24% | 45% | 29% | | 31% |
| | | LONEPINE_03 | 37% | 52% | 63% | | 64% | 49% | 45% | 25% | 28% | 26% | 6% | 24% |
| | | LONEPINE_04 | 32% | 45% | 45% | | 20% | 40% | 29% | 26% | 47% | 20% | 40% | 20% |
| | | LONEPINE_06 | | | | | | | | | | | 13% | |
| | | LONEPINE_07 | 38% | 8% | 21% | | 0% | 19% | 25% | 13% | 20% | 5% | 33% | 21% |
| | | LONEPINE_08 | | | 42% | | 52% | 21% | 24% | 35% | 49% | | | |
| | River Field - Lone Pine Average | | 36% | 32% | 37% | | 34% | 34% | 30% | 25% | 38% | 24% | 23% | 26% |
| **Twin Lakes** | Drew Slough | BLKROC_37 | 0% | 0% | 5% | 15% | | 2% | | 5% | 16% | 3% | 6% | 12% |
| | | BLKROC_FIELD_04 | 0% | 0% | | 23% | | | | 7% | 0% | | | |
| | | TWINLAKES_02 | 0% | 4% | | 0% | 6% | | 0% | 0% | | 0% | | 0% |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TWINLAKES_05 | | | | | | | | | | | | |
| | Drew Slough Average | | 0% | 1% | 5% | 13% | 6% | 2% | 0% | 4% | 8% | 1% | 6% | 6% |
| | Lower Blackrock Riparian Field | BLKROC_RIP_07 | | 34% | 72% | | 14% | 0% | | 0% | 11% | 0% | | 0% |
| | | TWINLAKES_03 | 6% | 42% | 36% | | | | 0% | 14% | | 0% | 24% | 0% |
| | | TWINLAKES_04 | | | | | | | | | | | | |
| | | TWINLAKES_06 | | | | | | | | | | | | |
| | Lower Blackrock Riparian Field Average | | 6% | 38% | 54% | | 14% | 0% | 0% | 7% | 11% | 0% | 24% | 0% |
| | Upper Blackrock Field | BLKROC_RIP_05 | 21% | 25% | 51% | | 9% | 0% | 10% | 3% | 2% | 26% | | 19% |
| | | BLKROC_RIP_06 | 19% | 29% | 74% | | 10% | | 0% | | 56% | | 5% | 4% |
| | | BLKROC_RIP_08 | 17% | 18% | 70% | | 50% | | 69% | 27% | 61% | 66% | 18% | |
| | | INTAKE_01 | 13% | 30% | 49% | | 10% | 12% | 2% | 9% | 4% | 0% | 3% | 15% |
| | | BLKROC_RIP_09 | | | | | | 43% | | | | | | |
| | Upper Blackrock Field Average | | 17% | 26% | 61% | | 20% | 18% | 20% | 13% | 31% | 31% | 9% | 15% |
| **Thibaut** | Rare Plant Management Area | RAREPLANT_02 | 0% | | | | | 0% | | 16% | 22% | 0% | 16% | |
| | | RAREPLANT_03 | 7% | | 45% | 4% | | 8% | 15% | | | | | |
| | | THIBAUT_02 | 0% | | 34% | 36% | 29% | 13% | 34% | 11% | 7% | 0% | | 5% |

| Lease Name | Pasture Name | Transect Name | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rare Plant Management Area Average | | 2% | | 39% | 20% | 29% | 7% | 25% | 14% | 14% | 0% | 16% | 5% |
| | Thibaut Field | THIBAUT_03 | 65% | 74% | 15% | 20% | 40% | 6% | 56% | 78% | 16% | 3% | 9% | 17% |
| | | THIBAUT_08 | 4% | 0% | 14% | 0% | 0% | 1% | 7% | 2% | 0% | 8% | | |
| | | THIBAUT_09 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | | |
| | | THIBAUTFIELD_02 | 31% | 76% | 30% | 0% | 22% | | 44% | | | 0% | | 5% |
| | | THIBAUTFIELD_03 | 3% | 0% | | 5% | 0% | | 2% | 0% | | 0% | | 33% |
| | | THIBAUTFIELD_04 | 0% | 0% | 0% | 0% | 0% | | 7% | 0% | | 0% | | 1% |
| | Thibaut Field Average | | 17% | 25% | 12% | 4% | 10% | 2% | 19% | 16% | 8% | 1% | 9% | 10% |
| | Waterfowl Management Area | THIBAUT_01 | 3% | | | | 50% | 40% | 3% | 9% | 0% | 1% | 31% | 21% |
| | | WATERFOWL_02 | 40% | 30% | | | 56% | 30% | 16% | 8% | | | | |
| | | WATERFOWL_03 | 21% | 33% | | | 33% | 25% | 4% | | 7% | 0% | | |
| | | WATERFOWL_04 | 11% | 51% | | | | | | | | | | |
| | | WATERFOWL_05 | | 39% | | | | | | | | | | |
| | Waterfowl Management Area Average | | 19% | 38% | | | 46% | 32% | 8% | 8% | 3% | 1% | 31% | 21% |

# Land Management Appendix 2. LORP Irrigated Pasture Condition Scores, 2011-2021

X = Pasture not rated

| LORP Irrigated Pasture Condition Scores, 2011-2021 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lease** | **Pasture** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** |
| Thibaut | | | | | | | | | | | | |
| | Thibaut Field | 82 | 81 | 78 | X | X | 80 | X | X | 72 | 80 | X |
| Islands | | | | | | | | | | | | |
| | B Pasture | X | 90 | 90 | X | X | 88 | X | X | 86 | X | X |
| | D Pasture | X | 90 | 90 | X | X | 88 | X | X | 86 | X | X |
| Delta | | | | | | | | | | | | |
| | Lake Field | X | X | 74 | X | X | 88 | X | X | 86 | X | X |
| Lone Pine | | | | | | | | | | | | |
| | Edwards | X | X | 84 | X | X | 84 | X | X | 80 | X | X |
| | Richards | X | X | 84 | X | X | 84 | X | X | 92 | X | X |
| | Van Norman | X | X | 84 | X | X | 84 | X | X | 84 | X | X |
| | Old Place | X | X | 84 | X | X | 76 | 86 | X | 96 | X | X |
| | Smith | X | X | 84 | X | X | 84 | X | X | 94 | X | X |
| | Miller | X | X | 86 | X | X | 84 | X | X | 90 | X | X |

# 4.0 LORP TAMARISK TREATMENT

Tamarisk (*Tamarix ramosissima*), also known as saltcedar, is a non-native invasive plant that spreads rapidly in the Owens Valley where conditions are favorable for its establishment. It was introduced into the United States in the early 1800s as a windbreak and ornamental. Since that time, it has invaded most major drainage systems in the southwest, including the Owens Valley. It colonizes moist areas that have been disturbed by land clearing, grading, or other disturbances that removes native plants. Once established, tamarisk is a very hardy plant that can withstand adverse soil and weather conditions. It displaces native plants as it grows in size and reproduces, creating dense stands of tall shrubs. Tamarisk is undesirable because it threatens native plant communities and the associated wildlife. (LORP EIR 10.4.1.4)

Starting in 1997 the Inyo County Water Department administered the Saltcedar Control Program for treatment on City of Los Angeles lands in the Owens Valley. The program was funded by the LADWP under the Inyo-Los Angeles Water Agreement and was supplemented with grant funding. Additionally, the LADWP provided funds to Inyo County as required in the 2004 Stipulation and Order, the LORP EIR, and LORP Post Implementation Funding Agreement for tamarisk treatment in the LORP. In 2017, with the retirement of the Inyo County Saltcedar Program Manager and cessation of a Wildlife Conservation Board grant in 2016, Inyo County largely suspended their tamarisk program. In October 2017, the LADWP initiated a tamarisk control program to manage tamarisk on City property including the LORP. In fall of 2019 Inyo County Water Department created a Water Agreement funded part-time position to assist the LADWP in saltcedar control. The addition of this position created a synergistic relationship between Inyo and LA regarding saltcedar control. This Inyo/LA saltcedar partnership is planned to continue through 2021-2022.

During the 2020-2021 tamarisk treatment season, LADWP treated 273 acres in the LORP area (Tamarisk Figures 1-2), including:

- Goose Lake vicinity (164 treated acres).
- Area immediately adjacent to Lower Owens River (33 treated acres).
- Area of Homestead Site to Mazourka Canyon Rd (76 treated acres).

During the 2020-2021 season, 164 acres of saltcedar were treated at the Goose lake site. Saltcedar at this site consisted of dense stands of tamarisk of various sizes from seedlings to mature trees with 10-inch diameter trunks (Tamarisk Figures 3-4). This required higher intensity mowing and sawing per unit area, which resulted in lower treatment acres as compared to prior years efforts. However, total biomass per acre

was significant resulting in numerous piles of saltcedar slash having to be moved to appropriate locations for subsequent burning.

Sporadic saltcedar seedlings and saplings occur linearly along the wetted edge of the Owens River. Larger patches are also present on the flood plain and oxbow cutoffs are in close proximity to seed sources. Recent treatments have focused on cut stump methods using hand tools in areas not easily accessible by heavy equipment such as river banks and poor terrain. This type off effort continued during the 2020-2021 season with an additional 33 acres treated.

The Homestead (Additional Mitigation) Project was fully implemented in 2012. Since the initial saltcedar and Russian olive treatments in 2009-2010, both species have slowly been invading the site. Periodic hand work had been conducted over the years to maintain water conveyances but the site has not received any other significant treatment efforts since implementation. During the 2020-2021 season, it was determined it was time to re-enter the site with equipment to remove all remaining saltcedar and olive trees. Approximately 76 acres in and around the site were cleared of all size classes of saltcedar and olive trees. In addition, while gathering and stacking newly cut slash, older piles that had amassed over the years were also removed from the site. All slash was stacked at the southern end of the project polygon for subsequent burning.

The 2020-2021 control efforts consisted of cut stump treatment of larger diameter trees using a skid steer mounted turbo saw attachment (Tamarisk Figure 5), mowing of smaller diameter trees including saplings and seedlings, and hand cutting using chainsaws and pruners. Garlon 4-Ultra herbicide was applied to cut stumps using the turbo saw attachment, spray equipment mounted on side by side utility vehicles, and backpack sprayers.

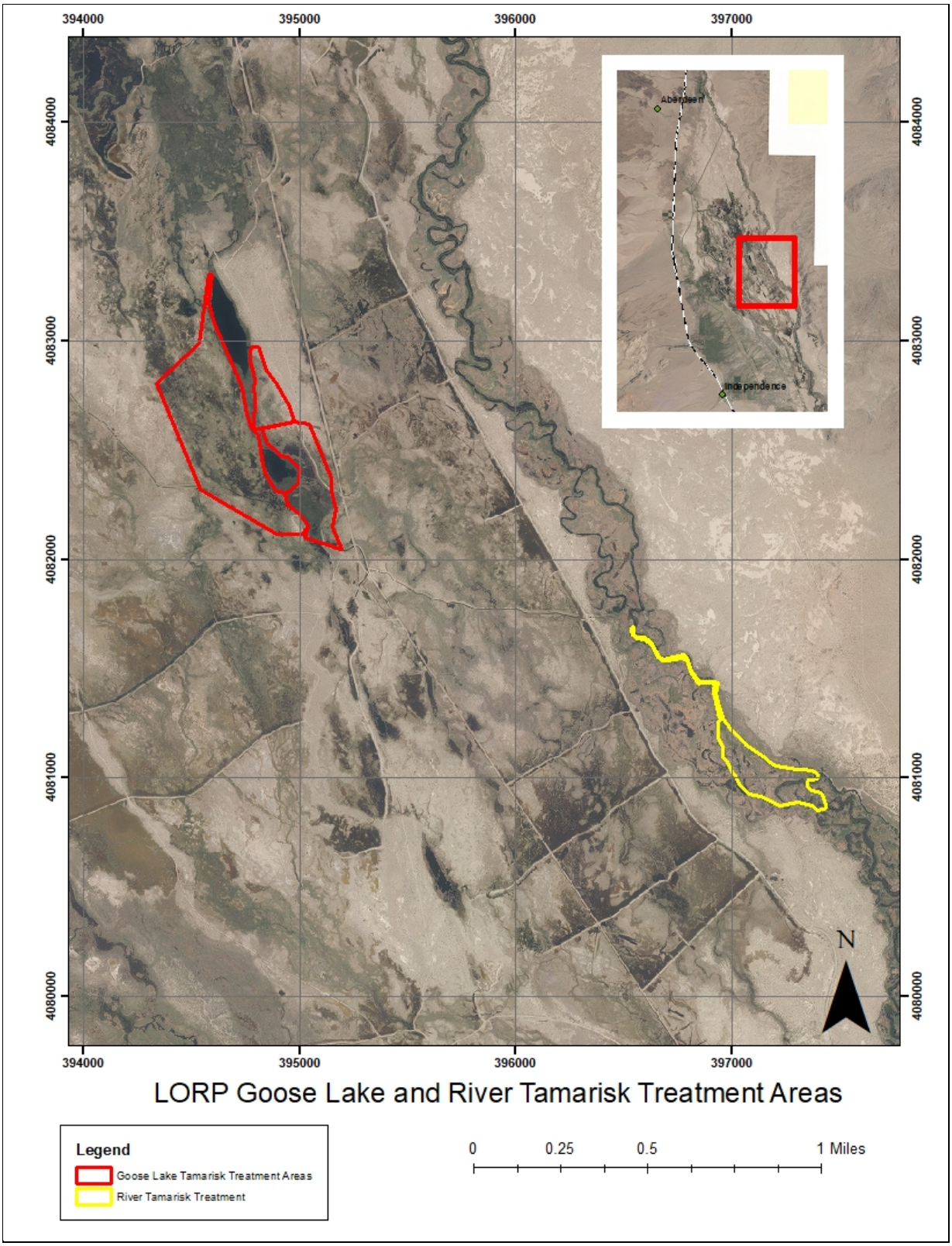
A skid steer mounted turbo saw and grapple rake attachment (Tamarisk Figure 5) was utilized to cut, gather and consolidate substantial volumes of slash into piles for burning. Approximately 200 piles measuring 10 ft. in diameter and 6 ft. tall were stacked in locations to be burned by Cal Fire. A Cal Fire Vegetation Management Plan (VMP) will be utilized to permit and coordinate burning activities. Pile burning is planned for the winter of 2021-2022.

The Tamarisk leaf beetle (*Diorhabda spp*.), a natural insect herbivore of tamarisk leaves that has been used for tamarisk control along many southwest riparian corridors, appears to have become established within the LORP area (per LADWP Watershed Resources Staff). However, the long-term effect of the beetle on LORP tamarisk populations is unknown. The landscape-level control of tamarisk through this biocontrol

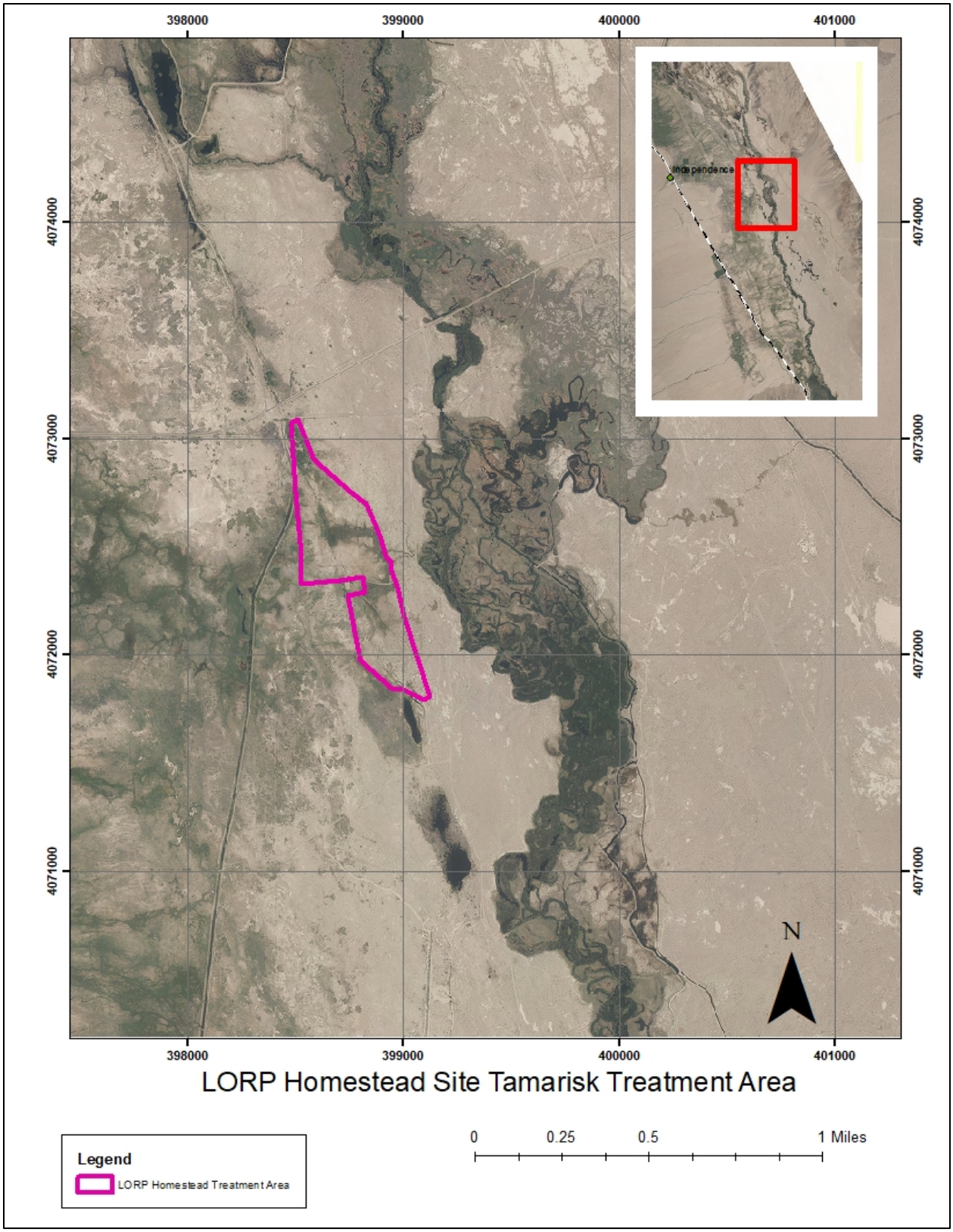
agent is a worthwhile area of study and or monitoring. Biological control of tamarisk through sustained colonization could reduce the amount of resources currently allocated to mechanical control. Staff are currently monitoring the effects of the beetle at various locations. See section 6.0 for discussion.

Tamarisk will continue to be treated within the LADWP spreading grounds from October 2021 through March 2022 using methods described above or similar. Treated acres are expected to be similar during the 2021-2022 tamarisk control season.

The LADWP has been tracking saltcedar recruitment that may have resulted from water spreading during high runoff in 2017 and 2019 and has prioritized saltcedar treatment in these areas. Priority sites for the upcoming season include around the Bishop area, and continuation of Goose Lake and Blackrock spreading areas in the LORP.




**Tamarisk Figure 1. Goose Lake and River Treatment Areas**




**Tamarisk Figure 2. Homestead Site Treatment Area**

**Tamarisk Figure 3. Pre-treatment view of the south end of the Goose Lake site.**

**Tamarisk Figure 4. Post treatment of Lower Goose Lake area. Remaining standing trees are willows.**


**Tamarisk Figure 5. Turbosaw at Lower Goose Lake used to cut tamarisk trees and grapple rake for collecting and consolidation of tamarisk slash.**

# 5.0 LORP WEED REPORT

## 5.1 LADWP and Inyo County Activities

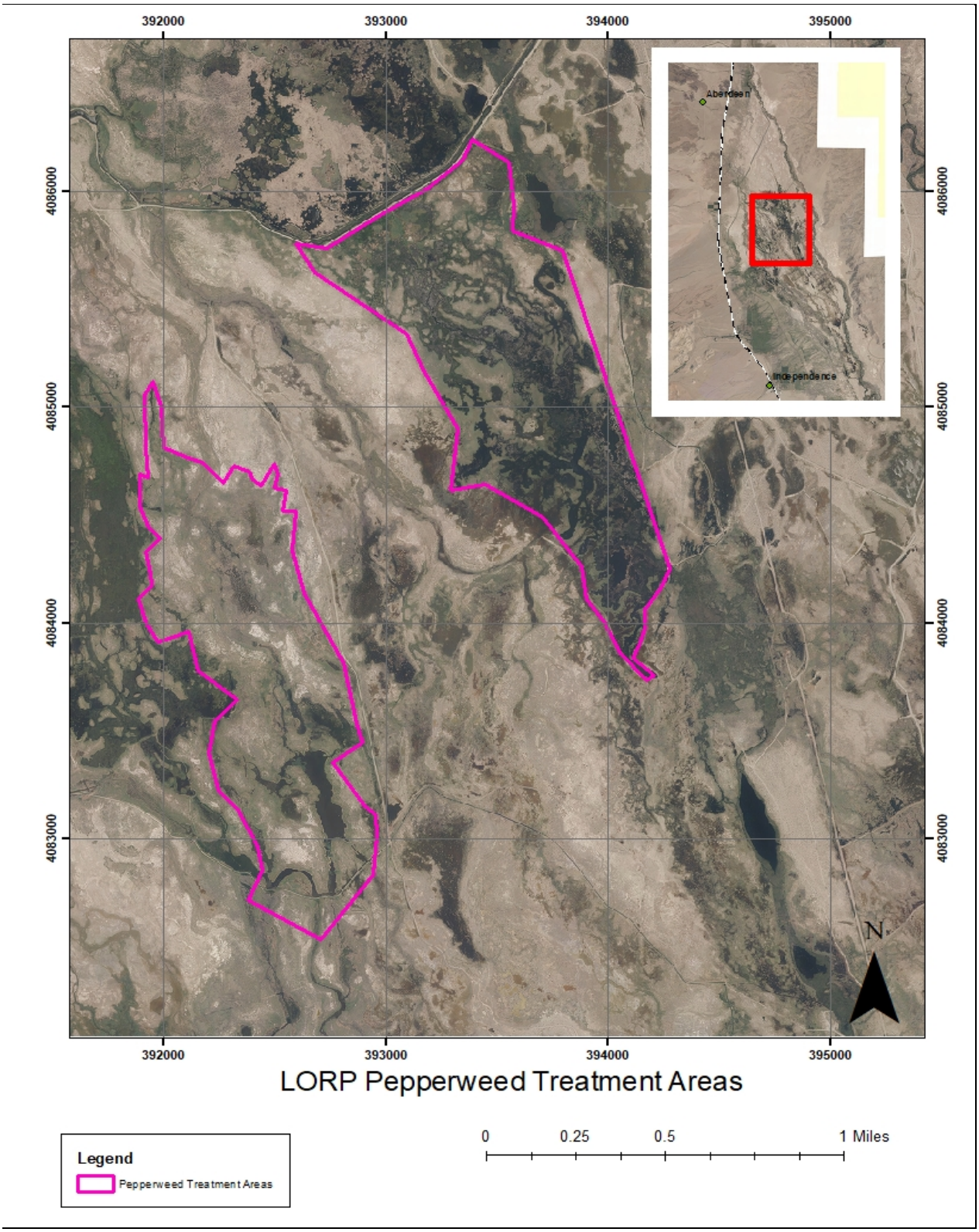
### 5.1.1 LADWP Weed Treatment

Broadleaved perennial pepperweed (*Lepidium latifolium*) (Weed Figure 1) is an ongoing species of concern for weed treatment in the LORP by the LADWP personnel in 2021. A total of 692 acres within the LORP project boundaries were canvased in the search for pepperweed (Weed Figure 2). All pepperweed populations were herbicide treated using broadcast applications from spray equipment mounted on side by side utility vehicles.

Pepperweed typically flourishes and displaces native vegetation in irrigated meadows and around the wetted extent of irrigation ditches, creeks, sloughs, rivers, water spreading basins, and some alkali meadows. On occasion pepperweed is found to exist, although in lower densities, in drier upland shrub communities. In areas occupied by cattle, the LADWP personnel have noted persistent grazing of younger pepperweed plants has reduced larger stands from developing, thus reducing seed production capabilities. To capitalize on this observation, modified grazing strategies and targeted mowing will be integrated with future strategic herbicide applications.

To gain control over observed increases in pepperweed within the Blackrock Wildlife Management Area (BWMA), crews focused their 2021 treatment efforts in the Winterton and Waggoner Waterfowl Units, treating 325 acres and 367 acres respectively. It is anticipated these areas will be treated annually for the foreseeable future.

**Weed Figure 1. Pepperweed (late season with seed)**




**Weed Figure 2. Weed treatment areas LORP 2021**

## 5.2 Inyo/Mono Counties Agricultural Commissioner's Office Weed Report

The Inyo and Mono Counties Agricultural Commissioner's Office (CAC) manages certain invasive weed infestations within the LORP project area in conjunction with the LADWP, and in coordination with the ICWD. Funds from all three agencies are used to support the effort.

Target weeds for CAC management and control include California Department of Food and Agriculture (CDFA) designated noxious weeds with a significant focus on *Lepidium latifolium* (perennial pepperweed). Management of Lepidium in the LORP is accomplished both by efforts to control and eradicate known weed populations in the area as well as monitoring for pioneer populations. This program is managed to prevent the widespread establishment of invasive weed populations throughout the 78,000 acre LORP area.

While eradication of all known weed populations in the LORP is the long-term goal of the program, new populations will continue to establish so long as a source of seed and root fragments entering the area, especially on sites where disturbance occurs. Thus, the detection component of the program is critical to the protection of the LORP's newly developing habitat--early detection is critical to limit the spread of weeds. It is far less costly to find and treat newly established infestations then to do so once establish.

In the LORP, operations and maintenance activities, flooding, wildlife activity and cattle grazing, off road vehicles and other recreational uses all create disturbances and can carry and spread weeds. A significant source of weed contamination comes from outside the LORP boundary. The middle Owens River from the Pleasant Valley Dam to the LORP Intake contains large established populations of Lepidium that can be mobilized to contaminate the Lower Owens River and LORP area. To limit spread, CAC now treats areas of extensive Lepidium populations from Pleasant Valley to Warm Springs Road as grant funding permits, and LADWP is managing invasive weeds on city owned lands including along the Owens River from Warm Springs Road to the LORP intake.

Protecting native habitat is the paramount goal of controlling weeds and maintaining a healthy native plant habitat that will support wildlife (including some threatened and endangered species), help reduce stream bank erosion, control dust, maintain healthy fire regimes, preserve the viability of open-space agriculture, and enhance recreational experiences.

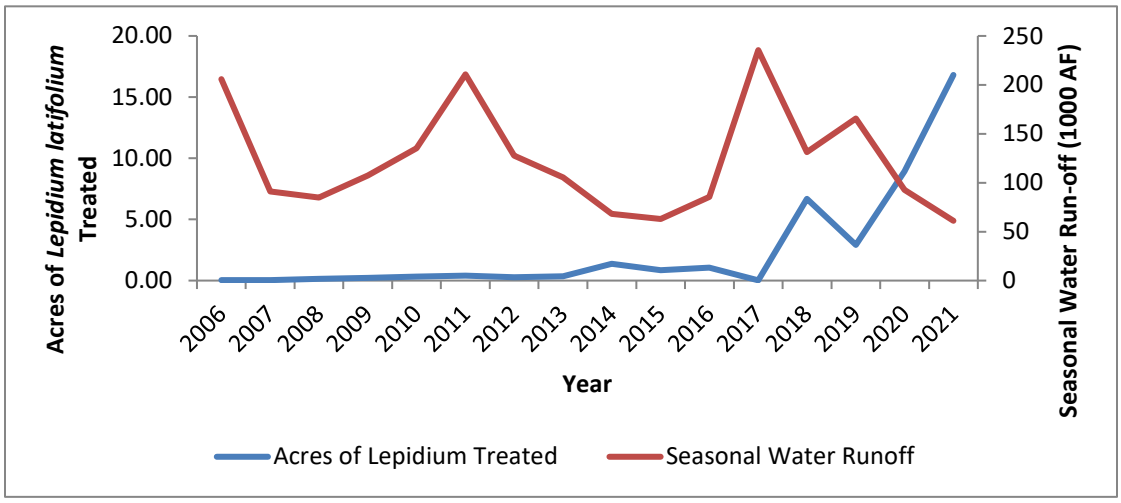
In 2021, the CAC was staffed with a Field Operations Supervisor and two seasonal field assistants. CAC staff began surveillance activities in May and treatment in June. A total of 14.34 net acres were treated this season. Weed Treatment means some sort of intervention (chemical or mechanical) has been applied to a weed population. Net acreage treated can be calculated by physically measuring the treated area or by calculating the amount of dilute herbicide applied by calibrated spray equipment.

The 2021 runoff season set a record low and was the second season in a row with below average annual runoff (see Weed Figure 3). Years with low runoff result in more of the project area accessible and treatable. In high seasonal water runoff years CAC crews cannot physically access Lepidium populations and even if the populations are accessible, often herbicides cannot be applied due to proximity to standing water or overly wet soil. In high seasonal water runoff years, this artificially lowers treatment acreage and provides time for inaccessible Lepidium populations to recover. The result in a low seasonal water runoff year is that acreage of treatment increases.

In June 2021 the CAC began treatment activities of all known Lepidium sites and new populations discovered during the 2020 season. Low-volume, directed spot treatments using the selective herbicide Telar XP were employed. Applications were made from all terrain vehicles where terrain allowed and on foot with backpack sprayers in more challenging terrain. Care was taken to minimize damage to native plant communities within the LORP. By the end of July, CAC staff had treated all known sites that were accessible and treatable for a total net treated acreage of 14.34 acres.

A second treatment of the project area was conducted in September. CAC staff returned to all known Lepidium sites and retreated any regrowth. This second treatment also included new sites identified by the 2021 ICWD Rapid Assessment Survey (RAS). A total of 2.47 total acres were treated during the second treatment.

Total net treated acreage, including initial treatment of known sites, retreatment of regrowth, and treatment of new sites identified by the RAS was 16.81 acres. Figure 1 depicts the net weed acreage trend from 2005 to 2021 and total runoff for the Owens River below Long Valley Dam. A significant increase in treated acreage of Lepidium is apparent since the flooding events of 2017 and subsequent drought years.




**Weed Figure 3. Acres of treated Lepidium within the LORP project area since 2006 and total seasonal runoff of the Owens River.**

# 6.0 ADAPTIVE MANAGEMENT

The LORP was implemented in 2006 by the LADWP and is presently managed jointly by the LADWP and Inyo County (County). Nearing the end of the LORP's prescribed 15-year monitoring program, the LADWP and the County conducted a comprehensive evaluation of the project in 2019 to assess its status with respect to the goals and requirements defined by the guiding legal documents. Through this evaluation, a series of adaptive management actions were identified and are being pursued. In 2021, the LADWP and the County conducted the following:

- Implementation of a 5-year interim flow regime in the Delta Habitat Area and related monitoring,
- Development of a 5-year Blackrock Waterfowl Management Area Interim Management and Monitoring Plan (Interim Plan), also began implementation
- Continuation of a tamarisk beetle study,
- Initiation of a tree recruitment assessment,
- Continuation of a noxious species survey and treatment.

A summary of these efforts is provided below. No new adaptive management is proposed for 2022, as the above items are multi-year commitments.

## 6.1 Delta Habitat Area Interim Flow Regime and Related Monitoring

On April 1, 2020 the LADWP initiated implementation of a revised interim flow regime in the Delta Habitat Area (DHA). The intent of the interim flow regime is to further improve habitat conditions for migrating and wintering waterfowl and shorebirds by increasing the availability of open flooded habitats in the fall, winter and spring.

There are two important differences between the original flow releases under the LORP EIR, and the revised interim flow regime. The first is that summer releases were decreased to a minimum flow of 3 cfs in order to induce hydrological stress on marsh vegetation. The intent of this change is to limit the further expansion of marsh and subsequent decreases in open water and meadow vegetation communities occurring under prior flow releases due to extensive flooding during the growing season. The second difference is lengthening and flattening of seasonal pulse flow releases. This was done to extend the period of flooding of the DHA to better match seasonal migratory patterns of habitat indicator species.

In the fiscal year 2020-2021, the LADWP and the County conducted avian surveys, photo point monitoring and an assessment of the effectiveness of the new flows in terms of flooding Delta habitats from fall through late spring, and invoking hydrologic stress on cattail

stands during the growing season. Landtype mapping will be completed at the end of the interim flow study period to evaluate longer term changes in the vegetation community.

During the 2020-2021 runoff year, and 2021 calendar year, monitoring associated with the revised interim flow regime included flow monitoring, flow effectiveness monitoring, avian surveys, and photopoint monitoring.

## Methods

*Flow Monitoring*

Releases to the DHA were monitored following methods described in the Hydrologic Monitoring section of this report. The scheduled interim flows to the Delta are released through a Langemann gate. Additional water may flow to the Delta over a weir above and beyond the scheduled interim flows. These additional flows occur when flows in the Owens River exceed the capacity of the Pumpback Station, such as during rain events, seasonal habitat flow events for the river, or during power outages of the Pumpback station.

Daily flow data (cfs) were compiled for runoff year 2019-2020 and 2020-2021. These data were graphed to allow a visual comparison of how the interim flows in 2020-2021 compared with previous release patterns.

*Effectiveness of Adaptive Management Flows*

The effectiveness of the interim flows in maintaining, and eventually improving habitat for DHA indicator species will be assessed both short-term and long-term. Short-term monitoring will be done annually and include an evaluation of the timing and extent of flooding. Long-term, the desired effect of the interim flow schedule is to halt the expansion of cattails, and over time, return the DHA to a seasonally flooded meadow-dominated system with open water ponds.

In the interest of maintaining current habitat values, and creating conditions to improve future habitat values, the following were considered when evaluating the effectiveness of the interim flows:

1) Did the summer minimum baseflow result in drying and hydrologic stress of cattails in the DHA?
2) Did the minimum summer base flow maintain water in permanent ponds serving as “control points”?
3) Did the interim flows produce flooding of existing, seasonal ponds serving as “control points” from September through early May?

During the first year of implementation of the interim flows, various methods were evaluated to determine how to monitor the short-term effectiveness of achieving the desired

conditions. The following data sources were evaluated: observations of conditions during bird surveys, weekly to twice weekly photographs of the DHA taken from a helicopter during surveillance flights of the Owens Lake Dust Control Program, and remote sensing products used for the Owens Lake Dust Control Program to determine wetness compliance.

Due to the heavily vegetated nature of the DHA, and the small size of permanent and seasonal ponds, the available remote sensing products did not reliably detect the extent of flooding, nor consistently detect small open water areas. Based on a comparison of helicopter photos, in many cases, areas classified as “wet soil” were actually flooded. The Owens Lake remote sensing products do appear to be useful in evaluating criteria 3 above, especially in combination with the aerial photos.

Criteria 1 and 2 above were assessed using the photos taken from the helicopter and at photo points. The condition of cattails was helpful in determining whether the interim flows were inducing hydrologic stress. For criteria 2, the small permanent ponds are visible in the helicopter photos, and thus these photos were reviewed to document the continuing presence during the summer drying period of minimum flow conditions.

*Avian Surveys*

Systematic avian surveys were conducted to assess use and seasonal abundance of DHA Habitat Indicator Species and non-target species. Surveys are conducted through a combined point count and area search methodology. Fixed point count stations provide the opportunity for observers to listen for the vocalization of indicator species such as bitterns and rails, or to scan surrounding habitat areas for shorebirds, wading birds or other species. At the point count stations, observers record all species seen or heard during a 5-minute period. The area search methodology involves recording all individuals seen using the habitat area, thus observers also record species detected between points, or individuals detected between points, if the observer is certain that the individual has not been already been recorded. Surveys began within 30 minutes of local sunrise, and completed within 4-5 hours. The starting point for each route is alternated each visit. 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.


**Adaptive Management Figure 1. Avian point count stations in the Delta Habitat Area.**

Avian monitoring was conducted from September 2020 through mid-May 2021 following previously established protocols and routes. There are two routes (Delta West (DW) and Delta East (DE)), and a total of 42 point count stations (Adaptive Management Figure 1). The survey schedule for the 2020-2021 fiscal year included four fall period surveys between September 1 and October 31, two winter period surveys between November 1 and February 28, and four spring surveys between March 1 and May 15 (Adaptive Management Table 1). The ten surveys during the 2020-2021 fiscal year prioritized monitoring during times of the year when flows were targeted to enhance waterbird habitat. As proposed in the 2019 LORP Evaluation Report, surveys were not conducted between mid-May and August 31 during the summer drying period of minimum flows. The new survey protocol eliminated the two surveys conducted in June, and the two early fall surveys in August. These surveys were scheduled at comparable time periods as previous surveys in order to allow comparison with prior data, however, heavy wildfire smoke caused alterations and delays in the timing of some surveys. To more easily compare with previous data, each survey was assigned a “Seasonal Survey” period name. An additional ground visit was made to the brine pool transition area on February 5, 2021. On this visit, the outflow area was walked from the end of the vegetation to approximately 1 mile downstream in order to evaluate outflow in this area and bird use.

**Adaptive Management Table 1. 2020-2021 DHA avian survey dates and seasonal survey period.**

| Season | Seasonal Survey | Delta East | Delta West |
|---|---|---|---|
| Fall | Fall 2 | **3-Sep-20** | **3-Sep-20** |
| | Fall 3 | 2-Oct-20 | 1-Oct-20 |
| | Fall 4 | 15-Oct-20 | 16-Oct-20 |
| | Fall 5 | 29-Oct-20 | 2-Nov-20 |
| Winter | Winter 1 | 9-Dec-20 | 9-Dec-20 |
| | Winter 2 | **2-Feb-21** | **2-Feb-21** |
| Spring | Spring 1 | 1-Apr-21 | 1-Apr-21 |
| | Spring 2 | 15-Apr-21 | 15-Apr-21 |
| | Spring 3 | 29-Apr-21 | 29-Apr-21 |
| | Spring 4 | 13-May-21 | 13-May-21 |

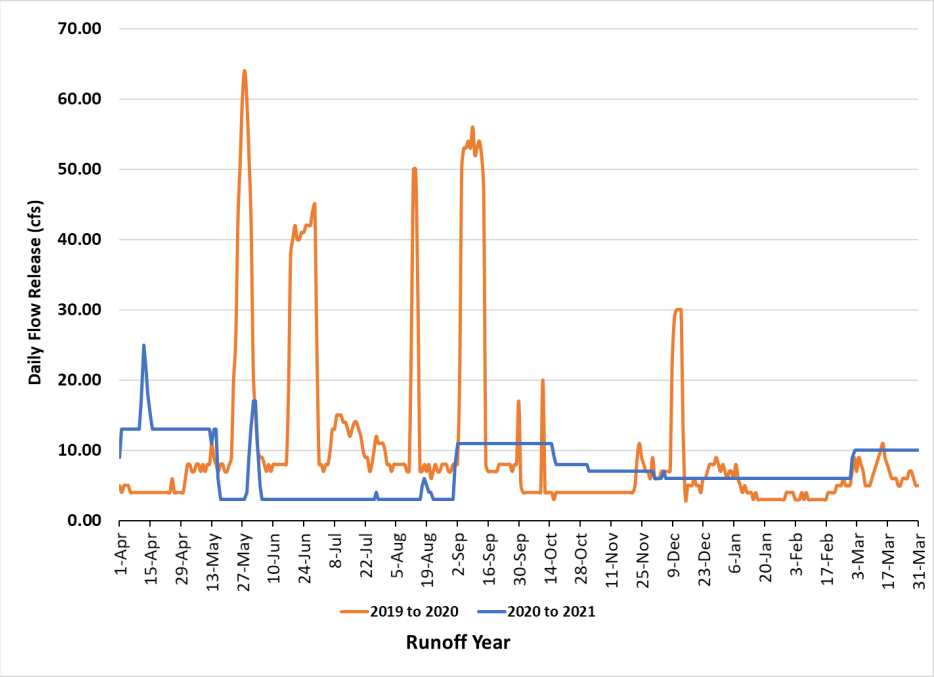
*Photopoint Monitoring*

Once each season, photos were taken at each point count station in order to document general habitat conditions. At each station, one photo was taken facing each cardinal direction, using true north.

## Results

*Flow Monitoring*

The interim flows were initiated April 1, 2020. The interim flows resulted in an overall more stable pattern of releases to DHA as compared to the previous release schedule that had more daily variability and four shorter, higher seasonal pulse flows (Adaptive Management Figure 2). The minimum summer base flow of 3 cfs was applied May 15 to August 31. The spike in flow of 17 cfs on June 2 was an additional release as a result of the seasonal habitat release to the Owens River.



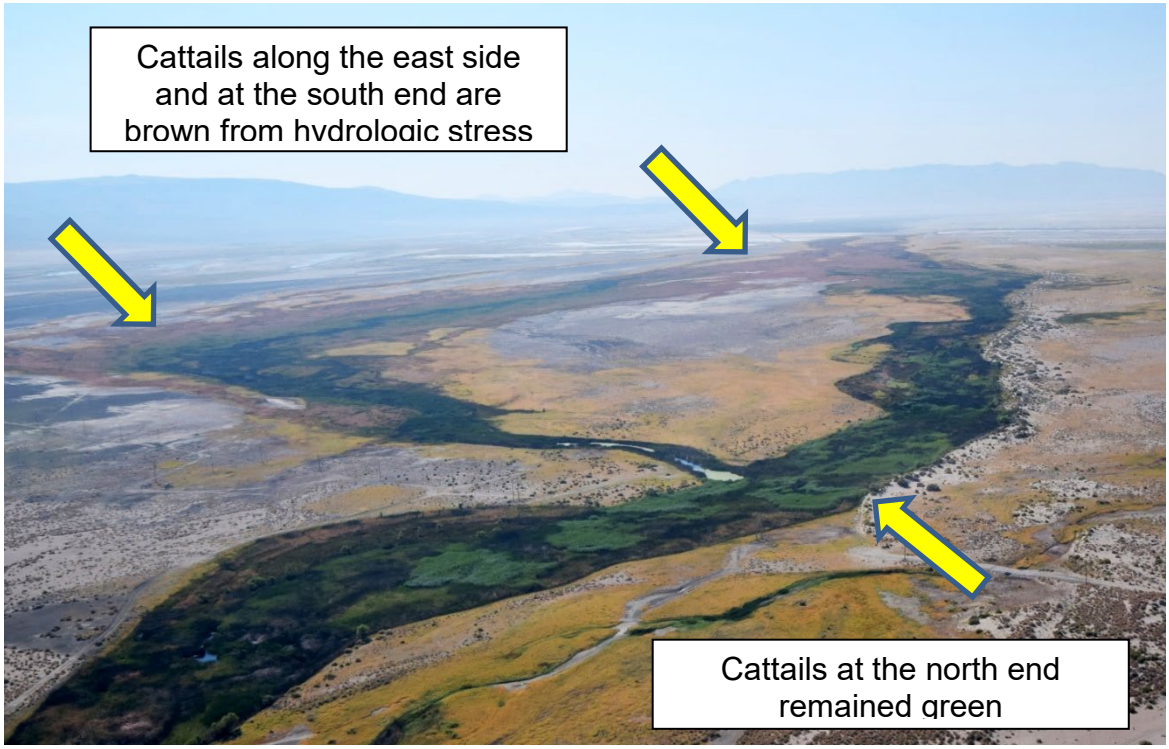

**Adaptive Management Figure 2. A comparison of flow to the DHA in runoff year 2019-2020 vs. interim adaptive management flows in runoff year 2020-2021**

*Effectiveness of Adaptive Management Flow Regime*

Habitat conditions were evaluated to determine if the interim flows were effective at meeting the three habitat and management criteria described above.

> *Criteria 1: Did the summer minimum baseflow result in drying and hydrologic stress of cattails in the DHA?*


**Adaptive Management Figure 3.** Photo taken August 16, 2019 show that all cattail stands are green due to the continuous supply of water during the growing season.




**Adaptive Management Figure 4.** Photo taken August 5, 2020 show cattail stands at the edges and the southern end of the DHA are brown due to lack of regrowth.

Adaptive Management Figures 3 and 4 are photos taken from a helicopter in August of the DHA. Figure 3 is August 2019, prior to implementation of the interim flows. Figure 4 is August 2020, in the first year of interim flows, with the application of a minimum base flow of 3 cfs. As compared to the August 2019 photo, the August 2020 image shows extensive areas of brown cattails, particularly along on the east side of the DHA, and at the south end. The cattails at the northern end of the DHA remained green through the summer as they continued to receive water throughout the growing season, and thus resprouted in early summer of 2020.

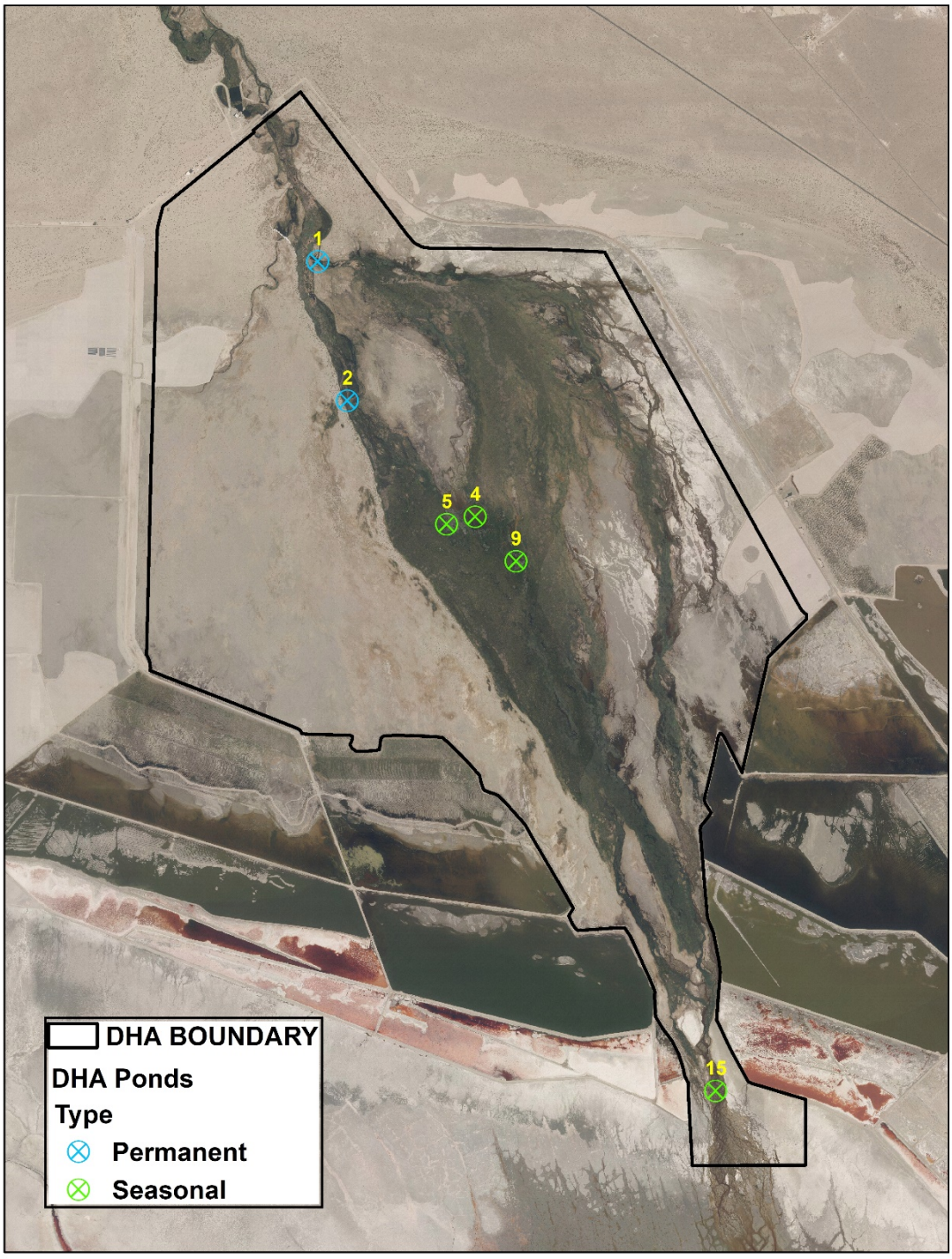
**Adaptive Management Figure 5. DE11 in August 2013. The cattails in the distance were green due to the consistent supply of water during the growing season.**

**Adaptive Management Figure 6. DE11 in September 2020. The color of the cattails indicates a lack of regrowth in 2020 as water during the growing season was limited**.

This lack of regrowth in cattails was also evident on the ground. Adaptive Management Figures 5 and 6 are photos taken at avian point count station DE11 (see Adaptive Management Figure 1 for location). Figure 5 was taken in August 2013 and the cattails in the distance are green due to annual regrowth from a continuous supply of water during the growing season under previous LORP flows. Figure 6 is the same location in September 2020. The cattails are much closer to the point count station in this photo (possibly due to expansion since 2013). The brown coloration indicates there was no regrowth in 2020, which was the desired effect of restricting releases during the growing season. Thus, based on the visual condition of cattails, the reduced summer flows prevented regrowth of cattail stands in areas of cattail expansion on the east side of the delta, and at the southern end.

*Criteria 2: Did the minimum summer base flow maintain water in permanent ponds serving as "control points"?*

Adaptive Management Figure 7 shows the permanent ponds that were monitored during the period of reduced summer flows to evaluate whether the ponds remained flooded. Not all of the ponds were always captured during flights due to visibility or lighting condition, but biweekly helicopter photos taken during the reduced summer flow period were evaluated. Representative photos from a mid-summer date of August 5, 2020, shows that permanent Pond 1 and Pond 2 remained flooded in summer (Adaptive Management Figure 8). Pond 3 is not visible in this photo, but based on the overall photo review, it too remained flooded through the summer, thus Criteria 2 was met.




**Adaptive Management Figure 7. Permanent and seasonal ponds in DHA. Not all ponds are mapped, but those typically visible on photos taken from the helicopter are shown**


**Adaptive Management Figure 8. Helicopter photo from August 5, 2020 shows that the permanent ponds 1 and 2 remained flooded during reduced summer flows.**

*Criteria 3: Did the interim flows produce flooding of existing, seasonal ponds serving as "control points" from September through early May?*

The interim flow management schedule was initiated April 1, 2020 and flows were set to 13 cfs until May 14, when they were reduced to the minimum summer flow of 3 cfs. The May 13 wetted analysis (Adaptive Management Figure 9) showed that all of the monitored seasonal ponds remained flooded. Helicopter photos from May 26, 2020 show water remaining in 4, 5, and 9, but no outflow into 15. Some water still appears present in the brine pool.

One September 1, the summer minimum base flow of 3 cfs was increased to 11 cfs. The September 14, 2020 helicopter photos and the September 15 remote sensing analysis showed that seasonal ponds 4, 5 and 9 were flooded, but that water had not yet reached the brine pool transition area, or seasonal pond 15, thus there was not yet outflow. By September 29, 2020, water was flowing into the brine pool transition area (seasonal pond 15) based on a review of helicopter photos.

A review of helicopter photos and the wetted analysis results indicate that all seasonal ponds remained flooded throughout the remainder of fall and winter (October through April).


**Adaptive Management Figure 9. Owens Lake wetness analysis for May 13, 2020 shows standing water in seasonal ponds 4, 5, 9 and the brine pool transition.**

## Avian Survey Results

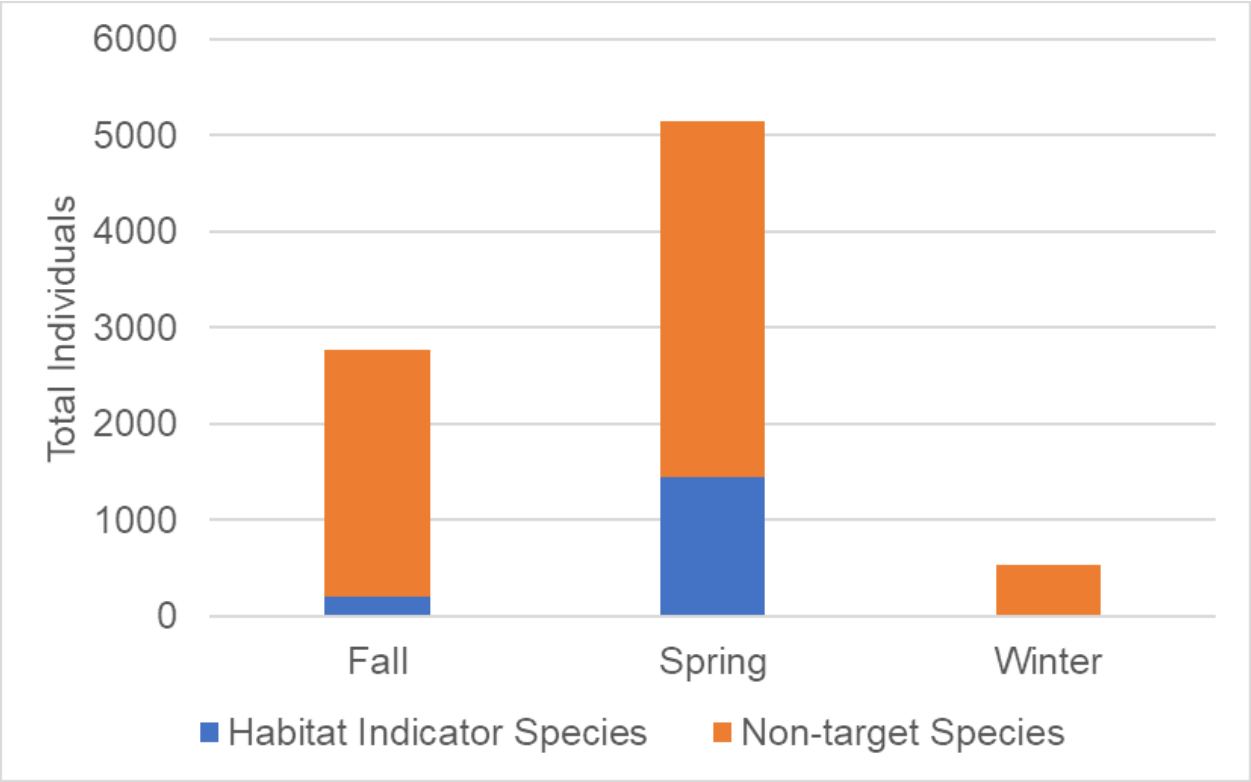
*Annual and Seasonal Totals*

The 10 seasonal surveys of the DHA recorded 8,461 birds, of which 1,658 were Habitat Indicator Species (HIS), and 6,803 Non-target species (Adaptive Management Table 2). Overall bird abundance was highest in spring and fall, and low in winter (Adaptive Management Figure 10). The highest use by all birds was observed on Seasonal Survey Spring 2 on April 15, 2021. In the fall, the highest number of HIS were observed on the Fall 2 count occurring October 1-2, 2021. Winter use within the DHA boundary by HIS was negligible, although large numbers of waterfowl were observed using DHA outflow on the supplemental survey on February 5, 2021 visit.

During the February 5 survey of the outflow area, waterfowl and shorebirds were found approximately 1.5 miles downstream of the end of the vegetated area, where the braided section of the outflow opens up to ponding and the flow enters the “brine pool” on Owens Lake. On this date, 400 Mallard, 150 Northern Pintail and 85 Snow Geese were observed feeding and bathing. Also in the vicinity were 20 Least Sandpiper and one Snowy Plover foraging on the wet playa and areas of flowing water. It is typical to see good numbers of waterfowl in this area during winter.

**Adaptive Management Table 2. Total Habitat Indicator Species and Non-target species**

| Seasonal Survey | Habitat Indicator Species | Non-target Species |
|---|---|---|
| Spring 1 | 18 | 368 |
| Spring 2 | 1322 | 2238 |
| Spring 3 | 51 | 580 |
| Spring 4 | 55 | 520 |
| Fall 2 | 173 | 243 |
| Fall 3 | 9 | 1777 |
| Fall 4 | 26 | 452 |
| Fall 5 | 1 | 265 |
| Winter 1 | 2 | 222 |
| Winter 2 | 1 | 138 |
| 2021 Total | 1658 | 6803 |




**Adaptive Management Figure 10. Seasonal abundance of birds in DHA**

*Species Composition*

Seventy-two bird species were observed using the DHA, including 17 HIS (Adaptive Management Table 3) and 72 non-target species (Adaptive Management Table 4). Waterfowl diversity was low, as only four species were observed, and primarily Mallard. Although the number of shorebird species observed was higher than for waterfowl, diversity was also rather low, and shorebird numbers dominated by Least Sandpiper. Use by wading birds and rails was limited.

DHA attracted a diverse array of non-target species (Adaptive Management Table 4). Northern Harrier are seen regularly flying over and hunting over the marsh and meadow systems. Swallows are particularly numerous in the DHA during spring and fall migration. The most abundant songbirds are marsh and grassland species including Horned Lark, Marsh Wren, Savannah Sparrow, Song Sparrow, Red-winged Blackbirds and Common Yellowthroat.

**Adaptive Management Table 3. Habitat Indicator Species Totals by Season, 2020-2021**

| Habitat Indicator Species | | Fall | Spring | Winter | Total |
|---|---|---|---|---|---|
| Waterfowl | Wood Duck | | 1 | | 1 |
| | Gadwall | | 12 | | 12 |
| | Mallard | 169 | 71 | | 241 |
| | Northern Pintail | 4 | | | 4 |
| Rails | Virginia Rail | 2 | 6 | | 8 |
| | Sora | 6 | 4 | 1 | 12 |
| | American Coot | 1 | 1 | 1 | 3 |
| Shorebirds | Semipalmated Plover | | 7 | | 7 |
| | Killdeer | 2 | 9 | | 11 |
| | Dunlin | | 2 | | 2 |
| | Least Sandpiper | 22 | 1296 | | 1318 |
| | Western Sandpiper | | 28 | | 28 |
| | Wilson's Snipe | 1 | 2 | | 3 |
| | Greater Yellowlegs | 1 | | 1 | 2 |
| Wading Birds | Great Egret | | 4 | | 4 |
| | Black-crowned Night-Heron | | 1 | | 1 |
| | White-faced Ibis | | 1 | | 1 |

## Adaptive Management Table 4. Non-target Species Totals by Season, 2020-2021

| Non-target Species | | Fall | Spring | Winter | Total |
|---|---|---|---|---|---|
| Doves | Eurasian Collared-Dove | | 2 | | 2 |
| | Mourning Dove | 5 | 2 | | 7 |
| Swifts | White-throated Swift | | 1 | | 1 |
| Gulls | California Gull | 1 | 38 | | 39 |
| Hawks and Owls | Northern Harrier | 12 | 17 | 5 | 34 |
| | Swainson's Hawk | | 2 | | 2 |
| | Red-tailed Hawk | 1 | 6 | | 7 |
| | Ferruginous Hawk | | | 1 | 1 |
| | Great Horned Owl | 2 | 2 | | 4 |
| | Short-eared Owl | 2 | 3 | | 5 |
| Woodpeckers | Northern Flicker | 7 | | 12 | 19 |
| Falcons | American Kestrel | 4 | | 1 | 5 |
| | Peregrine Falcon | 2 | | 1 | 3 |
| | Prairie Falcon | 1 | | | 1 |
| Songbirds | Olive-sided Flycatcher | | 1 | | 1 |
| | Black Phoebe | 9 | | 6 | 15 |
| | Say's Phoebe | 3 | 2 | 2 | 7 |
| | Ash-throated Flycatcher | | 2 | | 2 |
| | Western Kingbird | | 13 | | 13 |
| | Loggerhead Shrike | 10 | 10 | 10 | 30 |
| | Warbling Vireo | 1 | | | 1 |
| | Common Raven | 2 | 24 | 4 | 30 |
| | Horned Lark | 121 | 4 | 153 | 278 |
| | Tree Swallow | 53 | 1697 | | 1750 |
| | Violet-green Swallow | | 5 | | 5 |
| | Northern Rough-winged Swallow | 3 | 18 | | 21 |
| | Bank Swallow | 1 | 5 | | 6 |
| | Cliff Swallow | 42 | 70 | | 112 |
| | Barn Swallow | 1629 | 269 | | 1898 |
| | Unidentified Swallow | 11 | 5 | | 16 |
| | Marsh Wren | 182 | 294 | 89 | 565 |
| | Bewick's Wren | 6 | | 3 | 9 |
| | Blue-gray Gnatcatcher | 2 | | | 2 |
| | Ruby-crowned Kinglet | 1 | 4 | | 5 |
| | Le Conte's Thrasher | 2 | | | 2 |
| | Northern Mockingbird | | 7 | | 7 |
| | European Starling | | 1 | | 1 |
| | American Pipit | 9 | 20 | 21 | 50 |
| | House Finch | 12 | 2 | 8 | 22 |
| | Lesser Goldfinch | 6 | | | 6 |
| | Brewer's Sparrow | | 1 | | 1 |
| | Lark Sparrow | | 1 | | 1 |
| | Black-throated Sparrow | | 1 | | 1 |
| | Bell's Sparrow | | | 6 | 6 |
| | Savannah Sparrow | 39 | 214 | 66 | 319 |
| | Song Sparrow | 52 | 35 | 32 | 119 |
| | Lincoln's Sparrow | | 1 | | 1 |
| | White-crowned Sparrow | 4 | 5 | | 9 |
| | Yellow-headed Blackbird | 9 | 7 | | 16 |
| | Western Meadowlark | 49 | 22 | 13 | 84 |
| | Red-winged Blackbird | 183 | 669 | 91 | 943 |
| | Brown-headed Cowbird | | 20 | | 20 |
| | Brewer's Blackbird | 1 | 10 | | 11 |
| | Common Yellowthroat | 69 | 184 | 9 | 262 |
| | Yellow-rumped Warbler | 12 | 4 | 4 | 20 |
| | Wilson's Warbler | | 6 | | 6 |

## Habitat Use

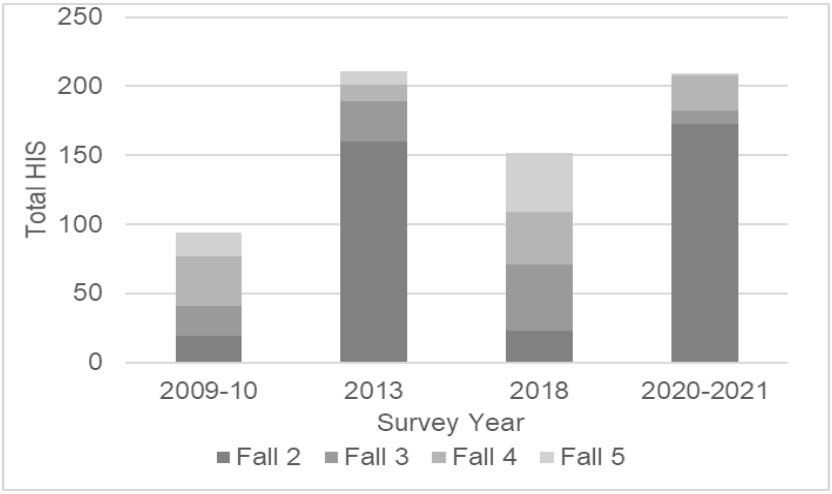
Indicator species use was primarily in open water areas (Adaptive Management Table 5) which include the unvegetated portion of the delta outflow and small open water ponds that are scattered throughout the vegetated portion of the DHA. The next most frequently used habitat type was alkali marsh; however, usage was significantly less than open water areas. The observations of HIS using alkali marsh include rails calling and waterfowl flying over the marsh (often likely flushed from small hidden ponds).

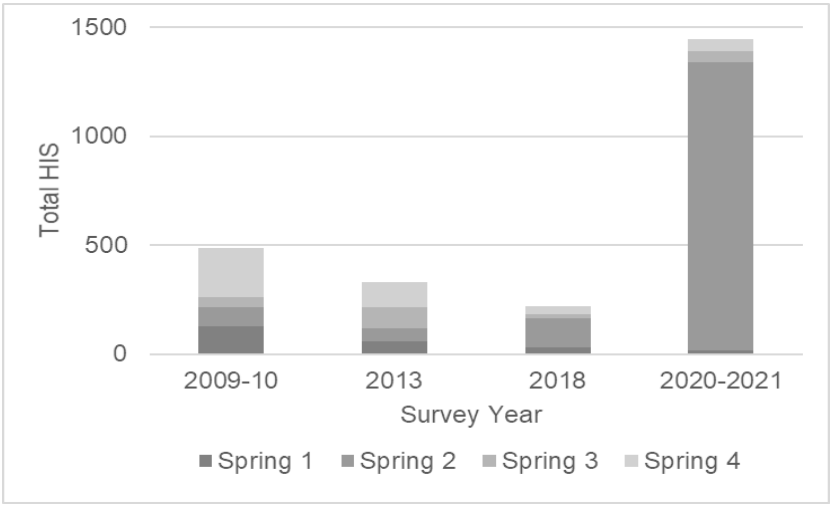
**Adaptive Management Table 5. Indicator species habitat use, 2020-2021**

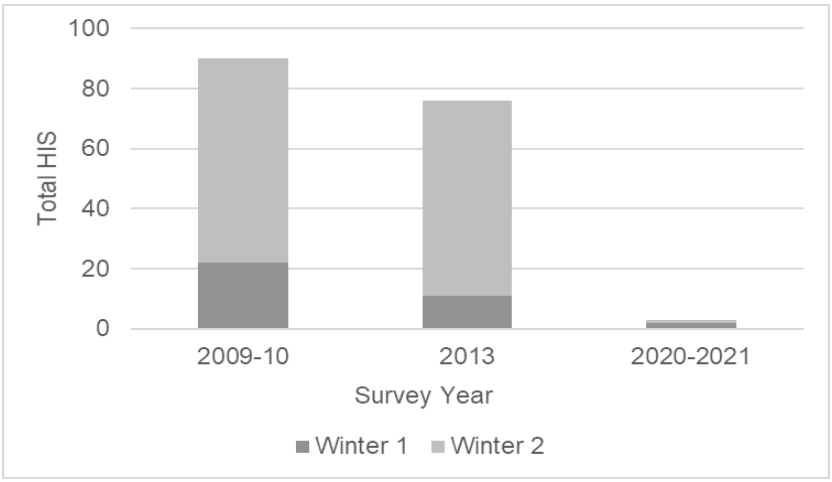
| Habitat Type | Calling | Distraction display | Flushed | Foraging | Locomotion | Nest found | Pair | Singing | Total by Habitat |
|---|---|---|---|---|---|---|---|---|---|
| Alkali marsh | 34 | | 4 | | 66 | 1 | 8 | 4 | 117 |
| Alkali meadow | 1 | | 1 | | | | 2 | | 4 |
| Parry Saltbush | | | | | | | 2 | | 2 |
| Playa | 3 | | | | 1 | | | | 4 |
| Short Marsh | | | 1 | | | | 2 | | 3 |
| Water | 8 | 1 | 27 | 2544 | 439 | | 17 | | 3036 |
| Wet Alkali meadow | 3 | | 1 | | 2 | | | 3 | 9 |
| Wet Playa | 1 | | | 7 | | | | | 8 |
| Total by behavior | 50 | 1 | 34 | 2551 | 508 | 1 | 31 | 7 | 3183 |

*Comparison With Previous Years*

Fall surveys conducted in 2020 during the first season of implementation of the adaptive management releases showed total HIS numbers similar to that recorded in 2013, and greater use than either 2009 or 2018 (Adaptive Management Figure 11). HIS numbers in spring 2021 were significantly higher than all other monitoring years. The large numbers observed in 2021 were a result of a large flock of shorebirds observed feeding in the outflow area of the DHA early in the morning. This particular morning was also saw several hundred Tree Swallows drinking from the outflow as well. Winter numbers have always been lower than other seasons, and the number of HIS observed on the two winter surveys in 2020-2021 was minimal, and well below previous years. The supplemental survey on February 5, 2021 however, demonstrated the benefit of the DHA flows to wintering waterfowl and shorebirds.




**Adaptive Management Figure 11. HIS totals per survey year, season and seasonal survey number.**

## Discussion and recommendations

*Effectiveness of Adaptive Management Flow Regime*

The adaptive management flow regime was effective at meeting the three assessment criteria used for the 2020-2021 runoff year. Cattail stands, including most of the new areas of expansion observed since LORP implementation, experienced drying and hydrologic stress during the growing season and failed to resprout in spring. With time, and mechanical action by the local elk herd and livestock, the standing dead cattails will break down. The minimum summer base flow of 3 cfs was sufficient, however, to maintain flooding of permanent ponds in the DHA. This is desirable in order to provide a sustained summer water resource for resident wildlife including game fish. Seasonal open water areas were also flooded during the fall through late spring period this first year of interim flows. Open water areas are critical for attracting habitat indicator species in the DHA.

*Habitat Indicator Species Use*

During the first year of the revised interim adaptive management flow regime in the DHA, use by HIS was maintained or exceeded that observed in previous years. Although the numbers of HIS recorded in the DHA in winter were notably less than previous data suggests, HIS do receive significant benefit from outflows from the DHA, as evidenced by winter observations of waterfowl and shorebirds downstream of the DHA far out on the Owens Lake playa. This area of the “brine pool” provides a daytime refuge for ducks and Snow Geese during the waterfowl hunting season as access is extremely difficult to impossible given the soft soils and thick mud, and would also provide protection from predation. The birds using the area are extremely wary also, and reacted to the field observer even when at least 0.5 mile away. Although this area is often referred to as the brine pool, implying hypersaline conditions, the fresh water flows from the DHA make this area fresh or brackish. As waterfowl were observed to be bathing, this strongly suggests the water was fresh. Although these birds were observed outside the boundary of DHA this year, in previous years, Snow Geese have been seen feeding at the southern end of the vegetated zone of the brine pool transition area amongst the open meadow and short marsh. Waterfowl are known to feed nocturnally, either to avoid predation, hunting pressure, or to meet all of their nutritional needs (McNeil et al. 1992), and this could be taking place in the DHA, and thus our diurnal surveys would not capture this behavior.

The diversity of HIS using the DHA is limited, and in 2020-2021 was dominated by just a few species. This may reflect the structure and composition of the habitats available in the DHA, as well as limited open water. Open water areas, including the outflow area were the habitats most used by HIS and the habitat most limited. If the adaptive management plan is effective at creating additional and larger open water ponds, increased diversity of HIS is anticipated.

*Recommendations*

Overall, the first year of monitoring indicates that the interim flows were effective at meeting short-term habitat and management objectives, and suggests they will support the long-term goal of increasing the habitat diversity of DHA by converting existing stands of cattails to meadow habitats, and creating and maintaining open water areas for HIS. Without intervention, this process could take several years. One possible short-term pilot project to try to improve habitats more quickly would be to create more opening settings around areas that flood seasonally by mowing the vegetation, including standing dead cattails. Increasing visibility and decreasing vegetation height in the immediate vicinty of ponds might enchance and attract more use now, as we wait for natural succession and ecological process to occur.

The use of remote sensing tools could be valuable and efficient means of monitoring flow effectiveness. The presence of large amounts of dense vegetation in the DHA resulted in seemingly inconsistent results using the methods used for evaluating Owens Lake wetted compliance. It is recommended that the use of remote sensing be further explored to determine if, with training of the software, it can be a reliable tool to use for evaluating the extent of flooding. For example, this initial assessment only evaluated the presence or absence of water in the seasonal ponds, but a better understanding of the extent of flooding, and how this might have changed in response to the new flow regime, or how it might vary over time, is desirable in terms of evaluating habitat conditions and flow effectiveness.

Flow effectiveness should continue to be monitored through the interim management period to determine if the results observed during the 2020-2021 runoff year are representative of what is expected long-term.

## Literature Cited

McNeil, R., Drapeau, P., and Goss-Custard, J.D.  1992. The occurrence and adaptive significance of nocturnal habits in waterfowl. Biological Reviews. https://doi.org/10.1111/j.1469-185X.1992.tb01188.x

## 6.2 Blackrock Waterfowl Management Area (BWMA) Interim Management and Monitoring

Since the LORP implementation in 2006, the Blackrock Waterfowl Management Area (BWMA) has been managed in accordance with guidance in the 1997 MOU, with up to 500 acres flooded year-round proportional to the annual runoff forecast. Since implementation, management of BWMA under this legal direction has created and maintained waterfowl habitat as intended, but has also resulted in considerable cattail and bulrush encroachment, reduced open water in the units, and a subsequent decline in habitat quality following the first year of flooding each waterfowl unit.

In 2019, the LADWP and the County evaluated the effectiveness of the year-round flooding approach defined in the 1997 MOU, and subsequently developed a 5-year Interim Management and Monitoring Plan for the BWMA (Interim Plan) in 2020 to further improve conditions for the LORP habitat indicator species. The Interim Plan proposes a seasonal flooding regime to flood a fixed 500 acres of the BWMA each year from fall to mid-spring with full dry down in the summer months, and to enhance forage for indicator species through moist soil management.

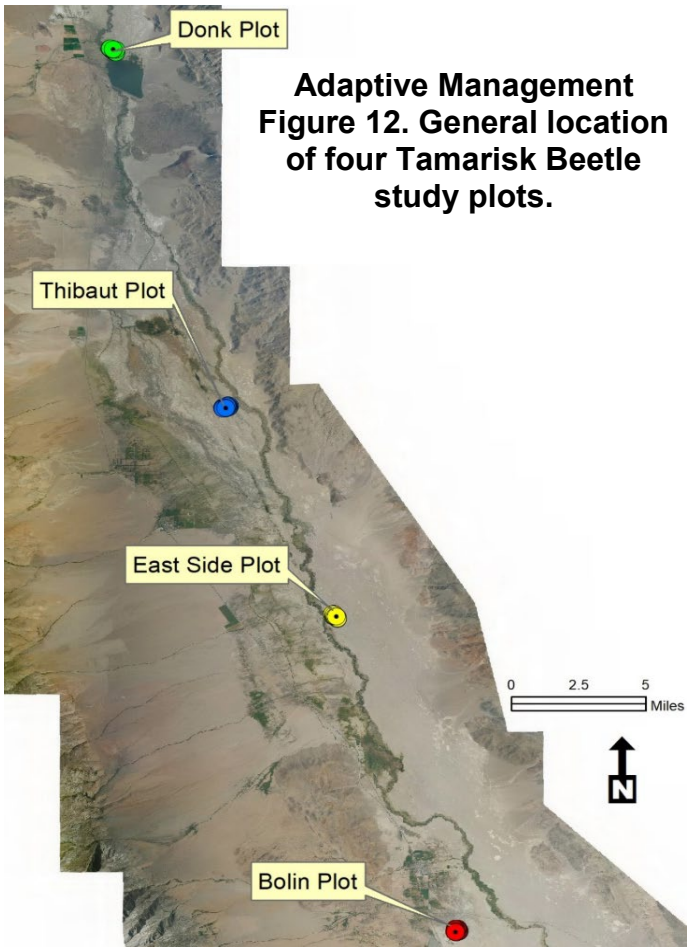
Following consultation with the MOU Parties, the LADWP and the County finalized the Interim Plan in April 2021, and the Inyo/Los Angeles Standing Committee set the BWMA flooded acreage for 2021-2022 in accordance with the Interim Plan at their May 26, 2021 meeting. The Interim Plan will be implemented as adaptive management for a period of 5 years with a sunset of April 15, 2026. The Interim Plan is included as Adaptive Management Appendix 1.

The LADWP and the County began implementation of the Interim Plan shortly thereafter, drying down the waterfowl units beginning May 2021, and conducting all necessary preparatory work in the East Winterton, Waggoner, and Thibaut Units by August 31, 2021. This also included weed treatment, disking of cattails and tules, reinforcement of berms, and upgrading flow measuring stations. Flooding of these units commenced September 15, 2021 on schedule with the Interim Plan.

The LADWP and County staff began avian surveys in late September 2021 and will be conducting 8 surveys through the fall, winter, and spring at each of the three waterfowl units. The County has also begun remote sensing work to monitor flooding of the units and to assess habitat characteristics of the cells. The LADWP and Inyo County staff will also conduct wetted extent monitoring and adjust operations as necessary to achieve the targets in the Interim Plan. Results from this monitoring will be summarized in the 2022 LORP Annual Report.

## 6.3 Tamarisk Beetle Study

The LADWP is conducting a study to track the spread of the tamarisk beetle (*Diorhabda carinulata*) and document its effectiveness in controlling saltcedar in the LORP area. A summary of the study and findings to date are provided below.




**Adaptive Management Figure 12. General location of four Tamarisk Beetle study plots.**

The Northern tamarisk beetle was originally released west of Tinemaha in 1999. This was the only site where *D. carinulata* was successfully established in California. The leaf beetle never went beyond 2km from its original release location (Pratt et al. 2019). The population was not successful because of the shorter daylengths found at the 37 parallel and latitudes further south (Dudley, 2005).

Eighteen years later, in 2017, *D. carinulata* were observed in the LORP below Manzanar Reward Road on the east side of the Lower Owens River (LADWP and County of Inyo 2017). It is not known if this population are descendants of the 1999 Tinemaha release or have arrived from another area. Once thought to only spread at a rate of 2 km/year, *Diorhabda* sp. are now spreading upwards of 24 km-50 km/year across the western U.S. (Jamison and van Riper C., III 2018; Carruthers et al. 2008). During the testing period at Tinemaha (Dudley, 2005) and immediately following the first release in 2003 in the Humboldt River basin in northern Nevada, it was thought the Northern tamarisk beetle would be restricted to north of the 38 parallel because of the shorter cumulative daylength further south which prematurely induced diapause. However, *D. carinulata* has evolved since its release in 1999. It has prolonged diapause, extending its active period resulting in increased metabolic reserves that assist with overwintering. The extended active period increases time for reproduction and an associated rise in population. These adaptations have permitted *D. carinulata* to establish further south than what was once thought possible (Bean 2012).

## Methods

During the spring of 2020, the LADWP and ICWD agreed to establish four sampling plots (Adaptive Management Figure 1) dispersed across the LORP with the objective to follow *D. carinulata* herbivory impacts to salt cedar communities. To do this, the LADWP staff adopted the Tamarisk Impact Monitoring Protocol. This is a quick sampling method which is widely used throughout the southwestern United States (Tamarisk Coalition 2013) to track *Diorhabda* sp. impacts on saltcedar over time.

Four plots containing salt cedar were established in May of 2020. Plots were selected based on tree densities and their locations in relation to the upper, middle, and lower sections of the LORP project area. The Donk plot, located outside of the LORP boundary, was chosen because the site represented one of the largest saltcedar stands in the valley, was inside the original 1999 release zone and was proximally located in relationship to other saltcedar communities in the northern portion of the Owens Valley.

## Plot Locations and Description

Moving from north to south, the Donk Plot (named after the nearby Donkey Spring) was established on the northeast side of Tinemaha. The salt cedar community was established in response to the rising and falling of Tinemaha reservoir levels.

The Thibaut Plot is situated 0.7 miles south of Goose Lake return and two miles north of Twin Culverts in a spreading basin east of the transmission line. This stand established around 1969 when the LADWP was spreading excess snowmelt runoff. The spreading basin was again flooded in 2017 which resulted in the establishment of a new stand of saplings. The older aged trees in this basin were cut approximately 8-9 years ago by the ICWD Saltcedar program. However, since then the majority of them have re-sprouted.

The East Side Plot is located 0.7 miles north of Manzanar Reward road on the east side of the Owens River. This saltcedar patch also is thought to have originated from water spreading in 1969. This area was again inundated in 2017 from water diverted into the Eclipse Canal from the Lower Owens.

The Bolin Plot is located 0.6 miles east of Diaz Lake. This area was also flooded in 1969 and again in 2017. This basin is a natural formation and the majority of saltcedar are established along the toe slope of adjacent dunes and sandy hummocks that ring the natural playas.

Each plot contained 24 tagged trees, divided into two bands, 12-13 trees inside a 0m-100m belt and 12 trees inside a 100m-200m belt. Trees were selected to be of a size where an observer could walk around the entire tree and make an accurate ocular estimate. Plots were sampled the first week of June and then revisited in late August or early September. Estimates were based on percentage categories for green foliage, brown foliage (result of

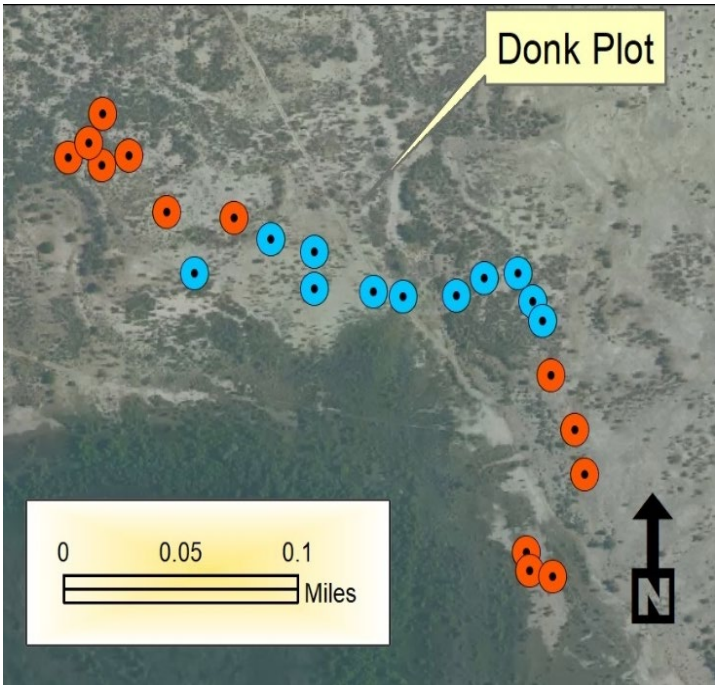
herbivory by *D. carinulata*), yellow foliage (result of leafhoppers–none observed), regrowth foliage, and dead wood. Categories were: 0%, 1%-5%, 6%-25%, 26%-50%, 51%-75%, 76%-95%, and 96%-100%. When present, number of beetle or larval infestations were estimated using the following categories: N=0, L=1-10, ML=11-50, M=51-100, MH=101-500, H=501-1000, and V=>1000.

**Results**

Results (presented north to south) of estimates of percent brown foliage estimated in late May/early June compared to estimates in late August/early September, and larval counts between both periods are presented below for each plot. Varying percentages of brown foliage is an indicator of intensity of herbivory of *D. carinulata*. Dead wood is also useful in understanding lasting impacts of herbivory and will be presented in subsequent reports as a time series develops.

Donk Plot

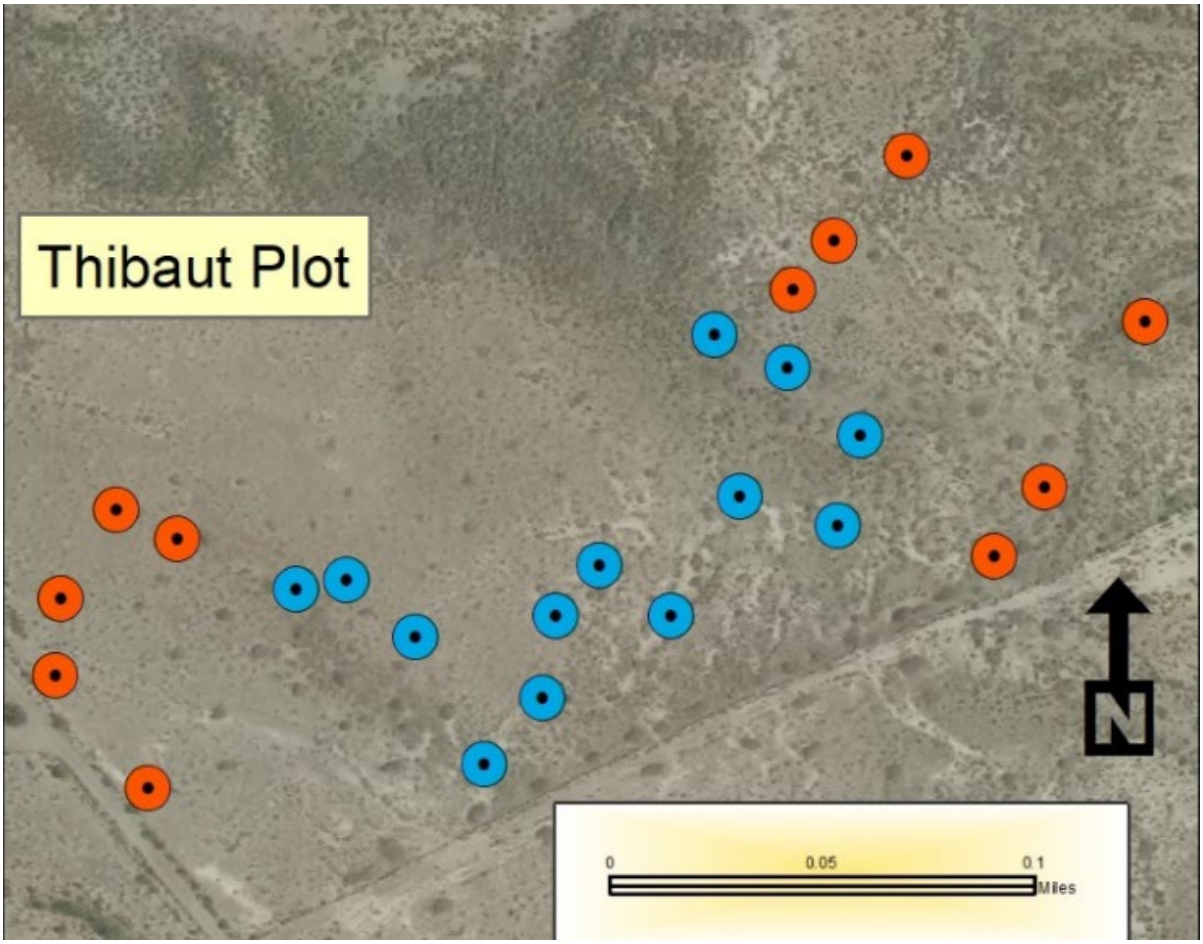
Similar to sampling in 2020, the Donk Plot in 2021 showed no browning and no larvae. The 2020 estimates of dead wood at the site were greater than the other three locations which point to possible larvae/beetle feeding in 1999.




**Adaptive Management Figure 13. Donk Plot, blue points are trees within 100m of centroid and red points are trees 100-200m of centroid**

Thibaut Plot

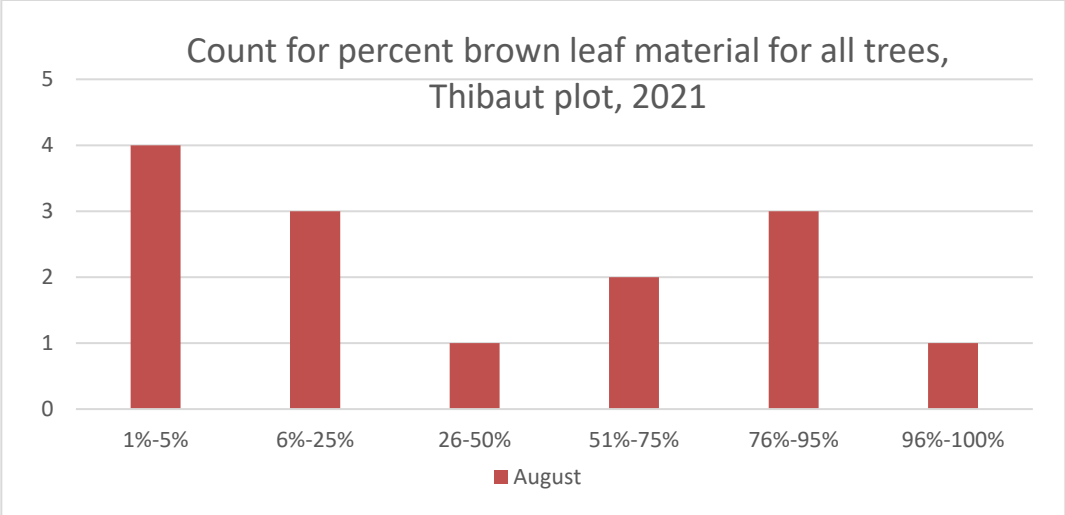
For 2021 saltcedar leaves on the Thibaut Plot were only consumed after early June thru August by *D. carinulata.* No browning of foliage was observed in early June. Larvae were observed on three trees in early June and on two trees in late August. In general, impacts were minimal on the plot.




**Adaptive Management Figure 14. Thibaut Plot, blue points are trees within 100m of centroid and red points are trees 100-200m of centroid**

**Photograph 1 July 13th, 2021, larva consuming leaf material.**

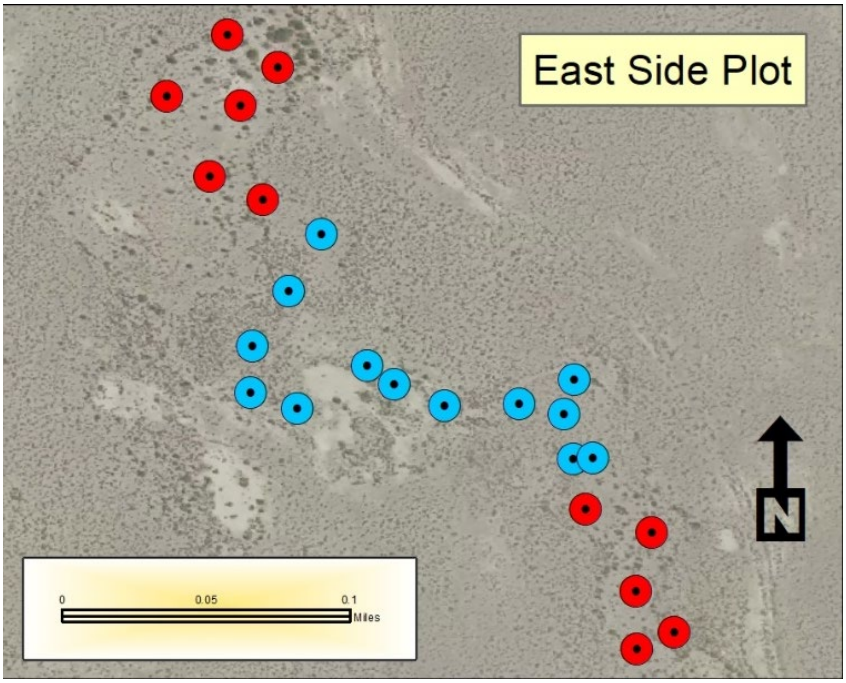
**Photograph 2 Same branch from above photo, 2 weeks later (July 27th, 2021).**




**Adaptive Management Figure 15. Thibaut Plot, Brown Foliage Estimates Early June and Late August, 2021**

East Side Plot

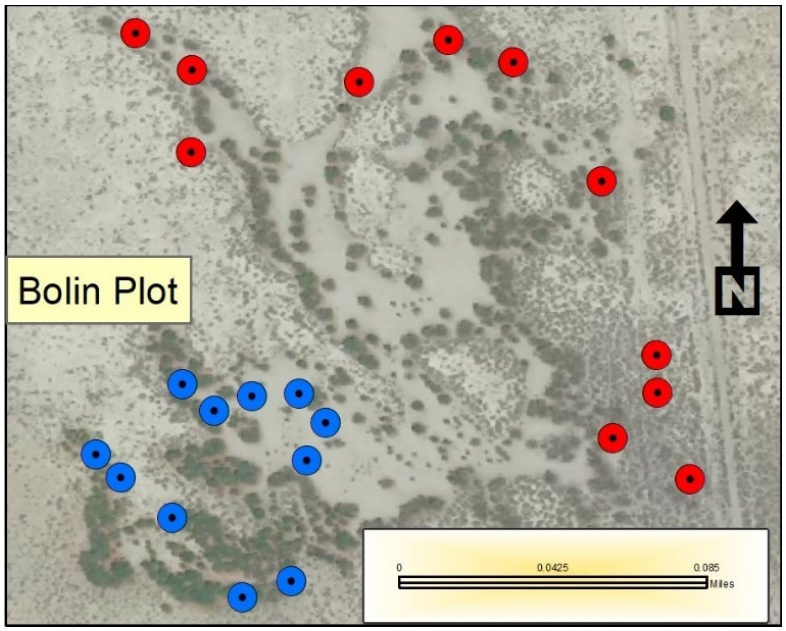
In 2021 the East Side plot did not show any browning or have any insects visible on the trees during both sampling periods in June and August.



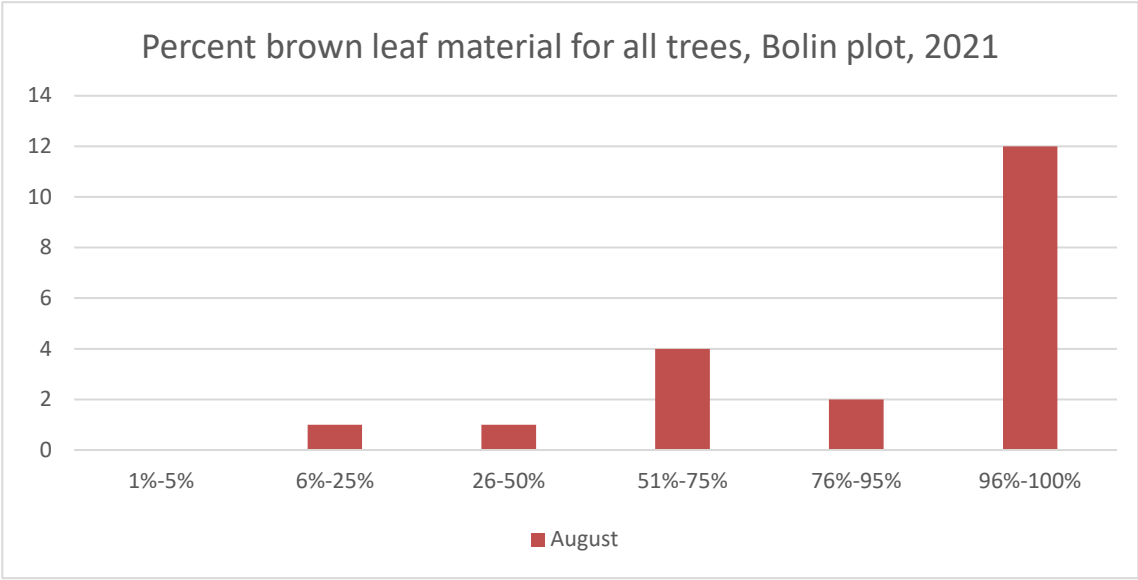

**Adaptive Management Figure 16. East Side plot, blue points are trees within 100m of centroid and red points are trees 100-200m of centroid.**

Bolin Plot

The Bolin plot showed little to no evidence of browning in early June of 2021. Four trees were observed to have larvae present in June. By August the majority of sampled trees were defoliated but no larvae were detected.




**Adaptive Management Figure 17. Bolin Plot, blue points are trees within 100m of centroid and red points are trees 100-200m of centroid.**




**Adaptive Management Figure 18. Bolin Plot, Brown Foliage Estimates Early June and Late August, 2021.**

## Conclusion

The first year for this study initiated a systematic documentation of the effects of moderate to light infestations of *D. carinulata* in the Owens Valley. Despite all plots exhibiting varying levels of use by *D. carinulata*, no evidence of mortality of tamarisk from *D. carinulata* was observed. Impacts from the beetle can vary widely from large defoliation (>100 acres) events (Hultine et. al, 2014) to limited evidence of *D. carinulata* making a lasting impact on tamarisk communities despite being present in an area for several years (Sher et al. 2014). Observations and sampling from the 2021 season showed herbivory from *D. carinulata* occurring on only two of the four plots, with major consumption on the southern plot (Bolin). This pattern was similar to what was observed last year. So far there has been no evidence of mortality from the beetle or larvae.

## References

Bean, D.W., Dalin, P. and Dudley, T.L. 2012. Evolution of critical day length for diapause induction enables range expansion of Diorhabda carinulata, a biological control agent against tamarisk (Tamarix spp.). Evolutionary Applications, 5: 511-523.

Bloodworth, Benjamin & Shafroth, Patrick & Sher, Anna & Diehl, Rebecca & Bean, Daniel & Johnson, Matthew & Hinojosa-Huerta, Osvel. (2016). Tamarisk beetle (Diorhabda spp.) in the Colorado River basin: synthesis of an expert panel.

Carruthers, R.I., DeLoach, C.J., Herr, J.C., Anderson, G.L. and Knutson, A.E. 2008. Saltcedar areawide pest management in the western USA. Areawide Pest Management Theory and Implementation. CAB International, Wallingford: 271-299.

Dudley, Tom L. 2005. Progress and Pitfalls in the Biological Control of Saltcedar (Tamarix Spp.) in North America. In: Gottschalk, Kurt W., ed. Proceedings, 16th U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 2005; 2005 January 18-21; Annapolis, MD. Gen. Tech. Rep. NE-337.

Hultine, K.R., T.L Dudley, D.F. Koepke, D.W. Bean, E.P. Glenn, and A.M. Lambert. 2014. Patterns of herbivory-induced mortality of a dominant non-native tree/shrub (Tamarix spp.) in a southwestern US watershed. Biological Invasions DOI 10.1007/s10530-014-0829-4.

Jamison, L.R., and van Riper, C., III, 2018, Population dynamics of the northern tamarisk beetle (Diorhabda carinulata) in the Colorado River Basin: U.S. Geological Survey Open-File Report 2018 – 1070, 67 p., https://doi.org/10.3133/ofr20181070.

LADWP and County of Inyo. 2017. 2017 Lower Owens River Project Annual Report. Los Angeles Department of Water and Power, Bishop, CA. February 2017. 376 pp.

Paul D. Pratt, John C. Herr, Raymond I. Carruthers, Michael J. Pitcairn, Baldo Viellgas & M. Brent Kelley (2019) Release, establishment and realised geographic distribution of *Diorhabda carinulata* and *D. elongata* (Coleoptera: Chrysomelidae) in California, U.S.A., Biocontrol Science and Technology, 29:7, 686-705, DOI: 10.1080/09583157.2019.1587739

Sher, A.A., R. Anderson, A. Henry, and R Kluvier. 2014. 2014 Watershed Wide Monitoring Annual Report. Submitted to the Tamarisk Coalition. Funded by 2014 Watershed-Wide DRRP Monitoring Contract awarded to University of Denver.

Tamarisk Coalition. Tamarisk Monitoring Protocol. Colorado Department of Agriculture, https://riversedgewest.org/sites/default/files/files/Tamarisk_Impact_Monitoring_Protocol_2013_Palisade_Insectary.pdf (2013).

## 6.4 Tree Recruitment – Spring - Summer 2021

Three adaptive management actions were proposed in the 2020 LORP Annual Report (LADWP and ICWD, 2020) and 2020-2021 LORP Workplan (LADWP and ICWD, 2021) to understand past and current riparian tree recruitment within the project area. These included:

1) Describing conditions that allowed tree establishment under pre-project settings (prior to re-watering),
2) Assessing conditions that have permitted limited recruitment since project initiation (post re-watering),
3) Identifying current biological processes that could limit tree germination or establishment.

This review summarizes work to-date (as of October 2021) on the LORP project area.

The first adaptive management recommendation, understanding historic tree recruitment, was initiated during summer 2020 and continued in 2021 with Type D vegetation transects located within the LORP reaches 2, 3, 5, and 6. The islands have been excluded from the study at present because of confounding factors altering the hydrologic regime. Methods are described in detail in the Type D – Riparian Vegetation Monitoring Annual Status Report 2020, Appendix 1: Type D Monitoring Program and studies for the Long Term Water Agreement (ICWD 2020).

Riparian transects were established perpendicular to the channel from the river (water) edge to the outer edge of the tree canopy (typically stopping at the upland terrace transition), with actual transect lengths determined by the width of the riparian tree canopy.

All plant species along the transect centerline were recorded at three tiers (<1.5m, 1.5-5m, >5m). A belt transect, 10 m wide, was delineated to record all trees within 10m of the riparian transect centerline; tree (x,y) locations were recorded along with tree diameter at breast height (dbh), tree height, and size class. Associated soils were collected along the centerline, and the fluvial surface (e.g. channel, bank, floodplain, or terrace) described. Tree core samples (2-5 per transect) were taken to obtain accurate tree ages to represent size classes encountered along the belt transect. Tree topographic elevations were recorded relative to Owens River surface water elevations for these individuals, which will be compared with hydrologic records to understand flows and therefore surface water elevation during the establishment year. This data will be analyzed this fall/winter 2021 to inform future work to be continued during the 2022 growing season. A more comprehensive analysis will be presented in the 2022 or 2023 LORP Annual Report.

The second adaptive management item involved surveying successful tree recruitment locations post-LORP implementation. To understand recent conditions (2008 - 2020) that permitted riparian tree germination and establishment, recruitment sites identified during the LORP Rapid Assessment Survey (RAS) were re-visited. At these locations, the number of recruits and their size: basal diameter and height along with presence of co-occurring vegetation species and ground substrate (e.g. bare soil, litter) were recorded along one (or several) line-point transect(s). Local environmental conditions such as: landform, tree topographic elevation relative to water surface, soil substrate, soil salinity, and patch size were also assessed (as identified in the LORP Work Plan 2020-2021).

Finally, assessing the impact of plant competition on successful tree recruitment or survival was a study topic suggested in the 2020-2021 LORP Work Plan. To appreciate the potential impact of plant competition from primarily clonal native wetland vegetation on successful tree recruitment locations on the wetted channel edge, we proposed two techniques just prior to the spring seasonal habitat flow: *i)* remove all vegetation in a patch perpendicular to the bank into the wetted floodplain, and *ii)* remove vegetation directly adjacent to established seedlings or saplings. However, spring 2020 runoff was lower than normal (approximately a 50% runoff year) so the seasonal habitat flow was not substantial enough to wet soils into the floodplain where most successful tree recruitment has been observed during the RAS. This adaptive management recommendation was therefore not applied.

Further, following assessments described above in adaptive management item #2, our initial findings suggest that plant competition is less likely implicated in recruitment processes, rather high flows appear to limit tree recruitment events; evidence for this concept will be further explained in a subsequent report.

In spring and summer 2022 we will continue environmental and biological assessments of recruitment locations, and riparian transects along the LORP. It is expected that a more

thorough analysis of findings from riparian tree recruitment work will be presented in a subsequent (2022 or 2023) annual report.

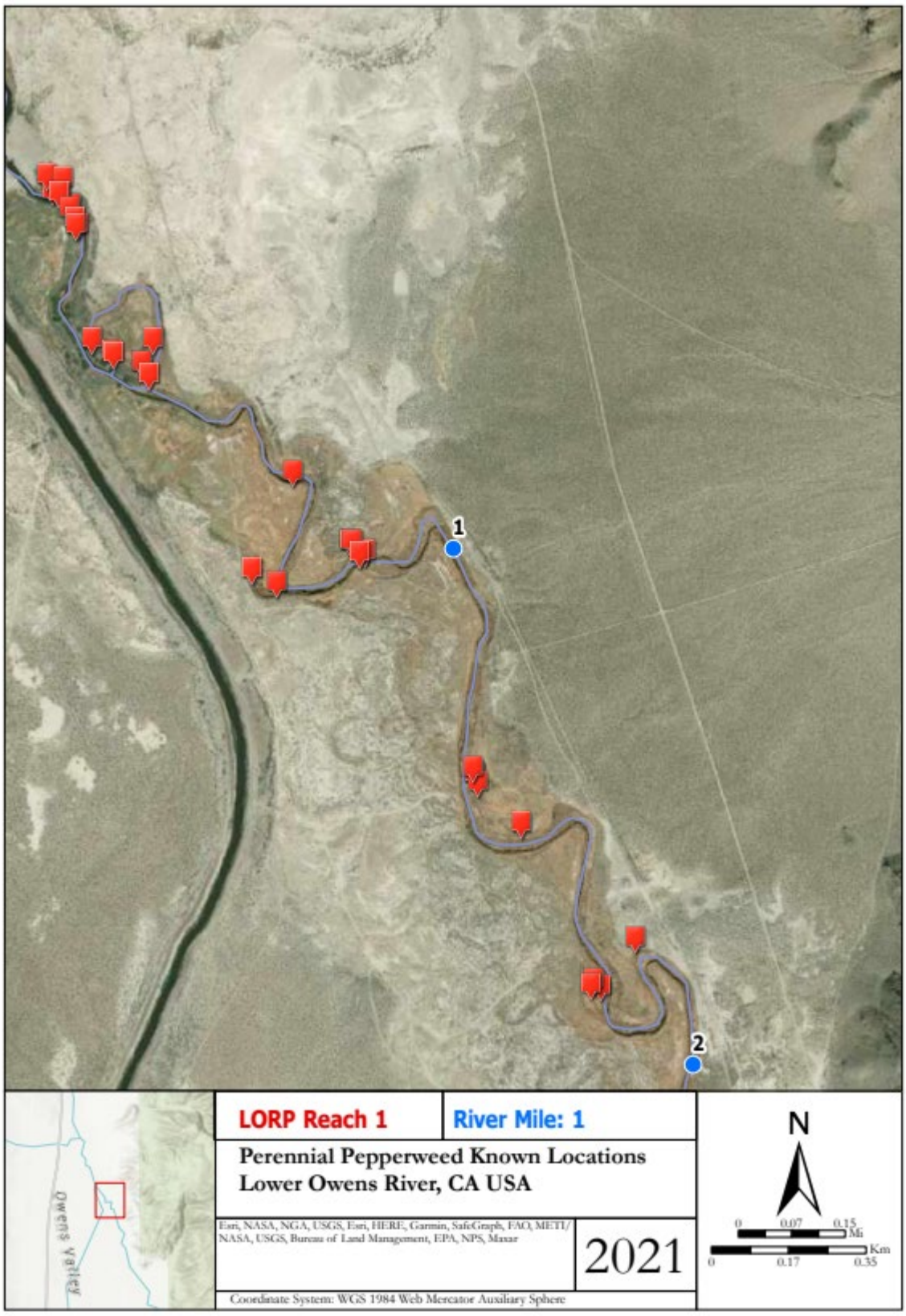
ICWD 2020. Type D - Riparian Vegetation Monitoring Annual Status Report 2020. County of Inyo, Independence, CA, 22 p https://www.inyowater.org/wp-content/uploads/2021/08/TypeD_AnnualReport_2020_08242021_FINAL.pdf

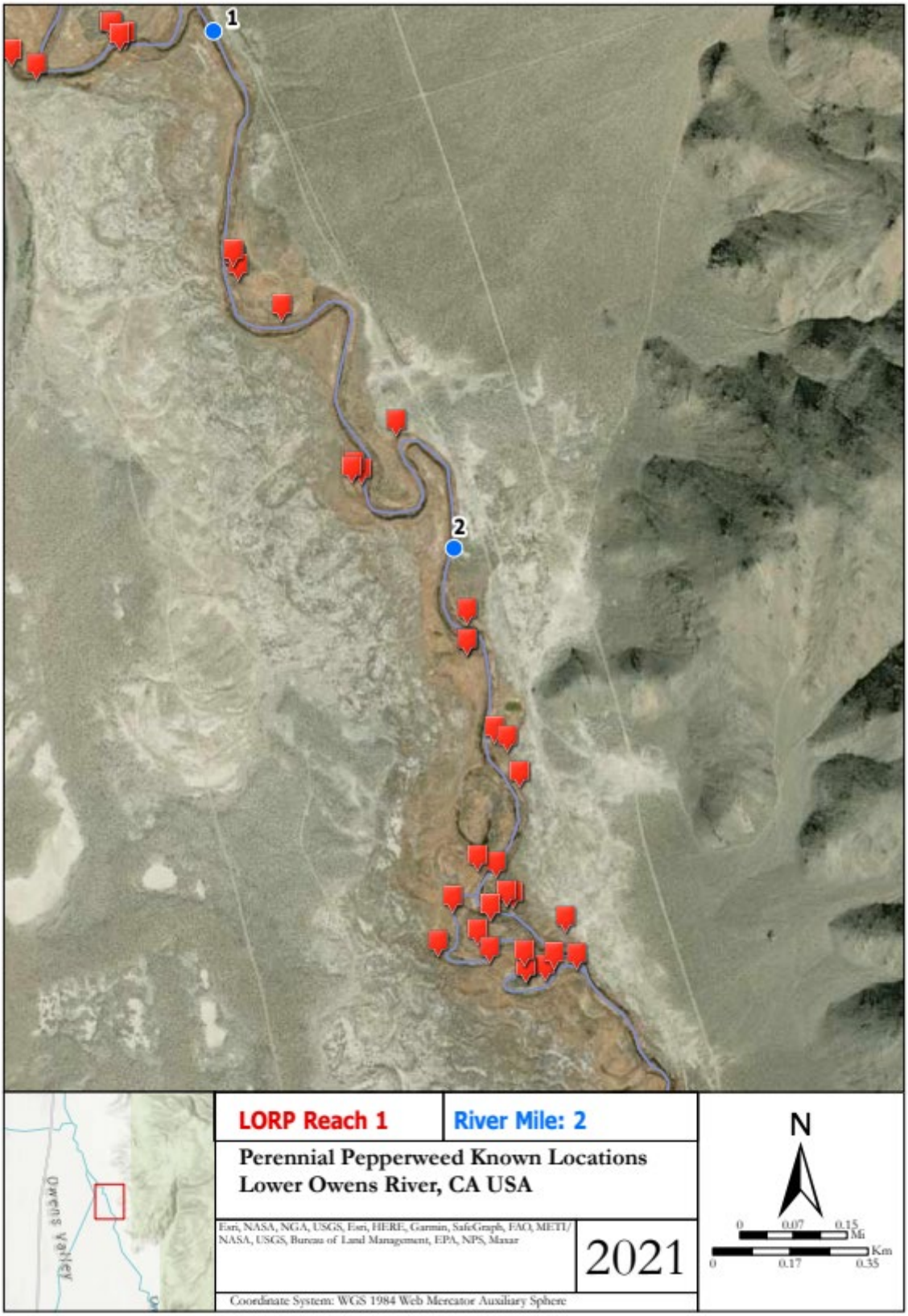
LADWP and County of Inyo. 2020. Lower Owens River Project 2020 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 155 p https://www.inyowater.org/wp-content/uploads/2021/02/2020-FINAL-LORP-ANNUAL-REPORT-rev02.22.21.pdf

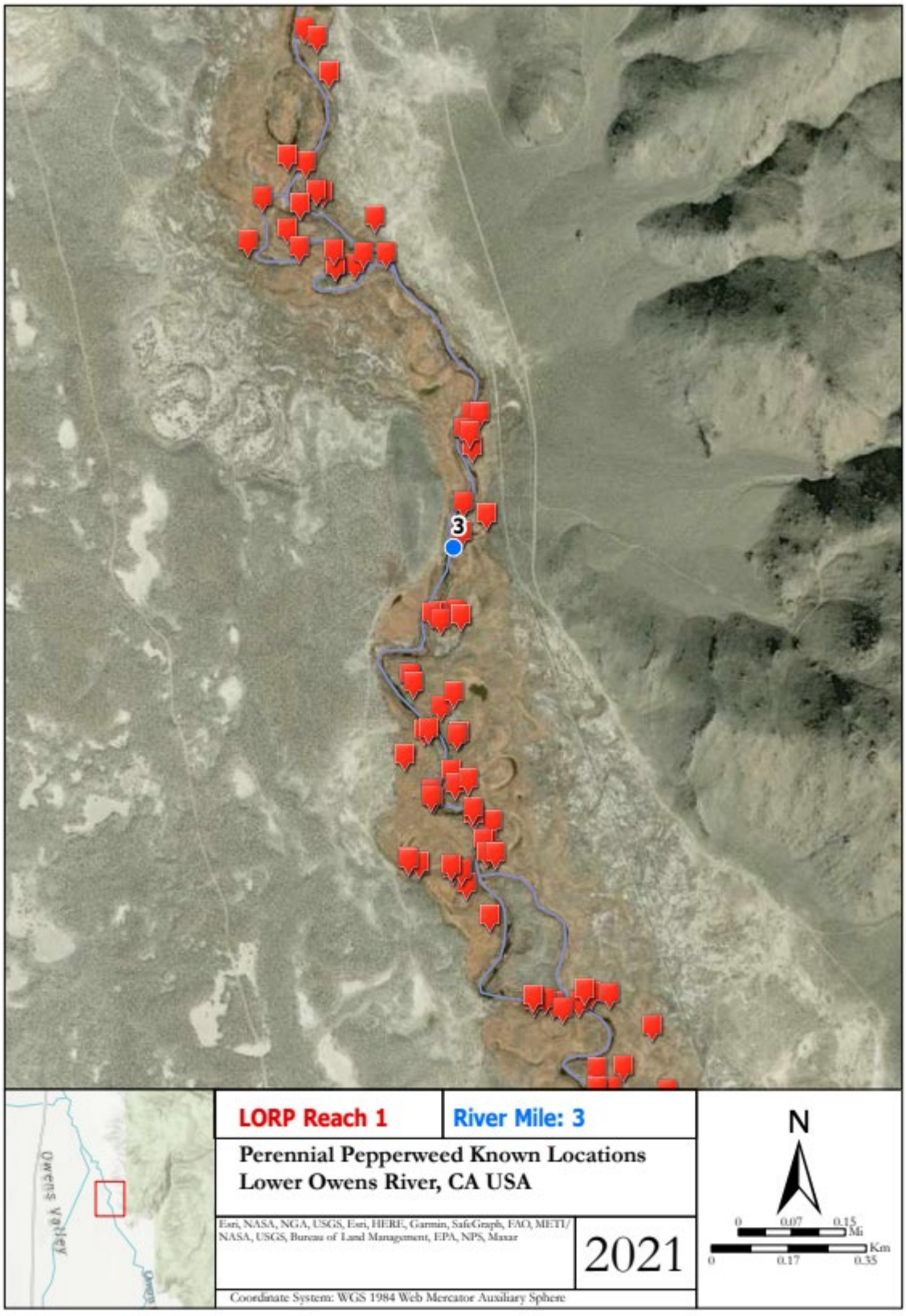
LADWP and County of Inyo. 2021. Lower Owens River Project Work Plan, Budget, and Schedule 2020-2021 Fiscal Year. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 19 p https://www.inyowater.org/wp-content/uploads/2020/06/2020-21-LORP-Work-Plan-FINAL-FINAL-20200602-_IC_LA-2.pdf

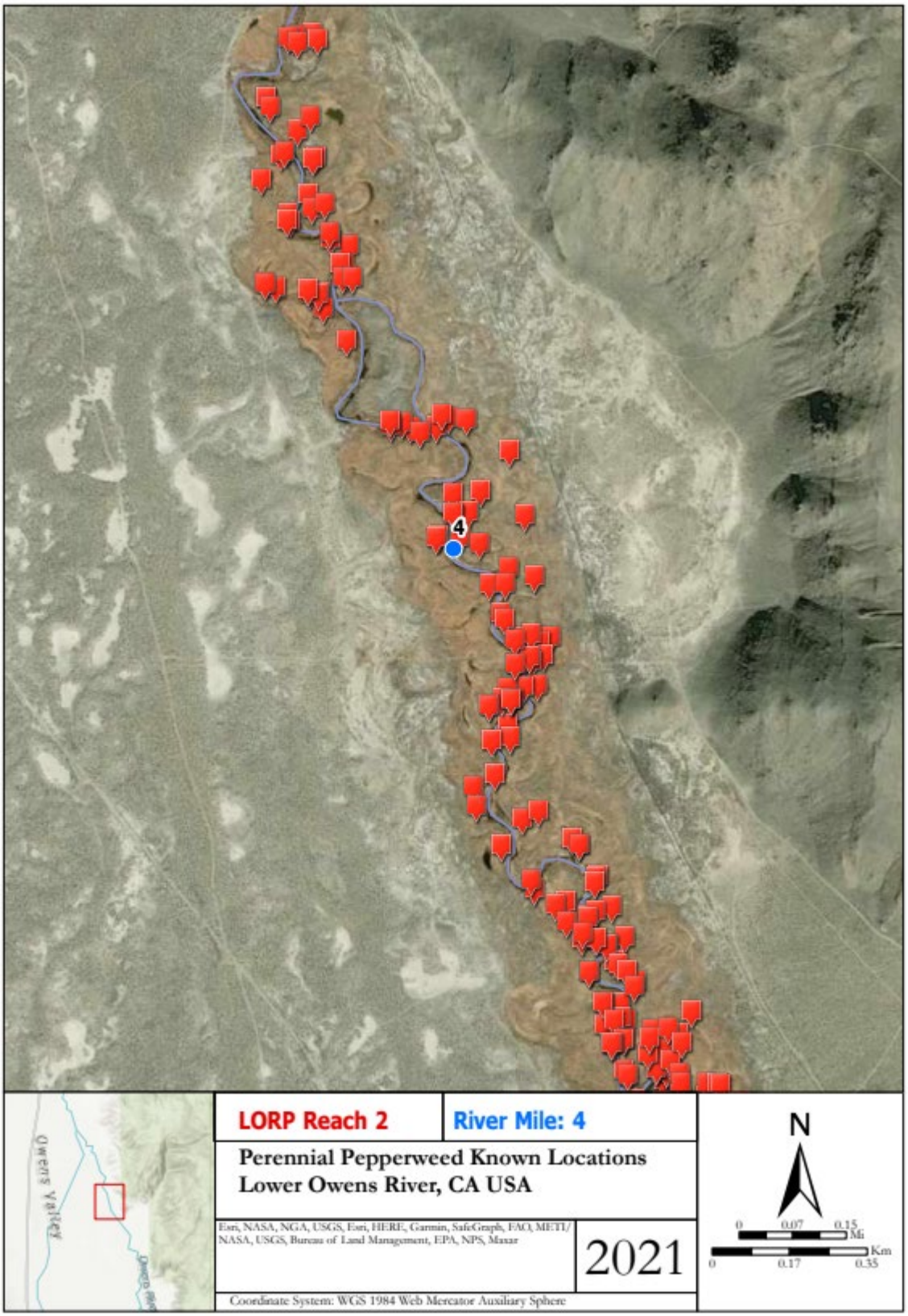
## 6.5 Noxious Species Survey and Treatment

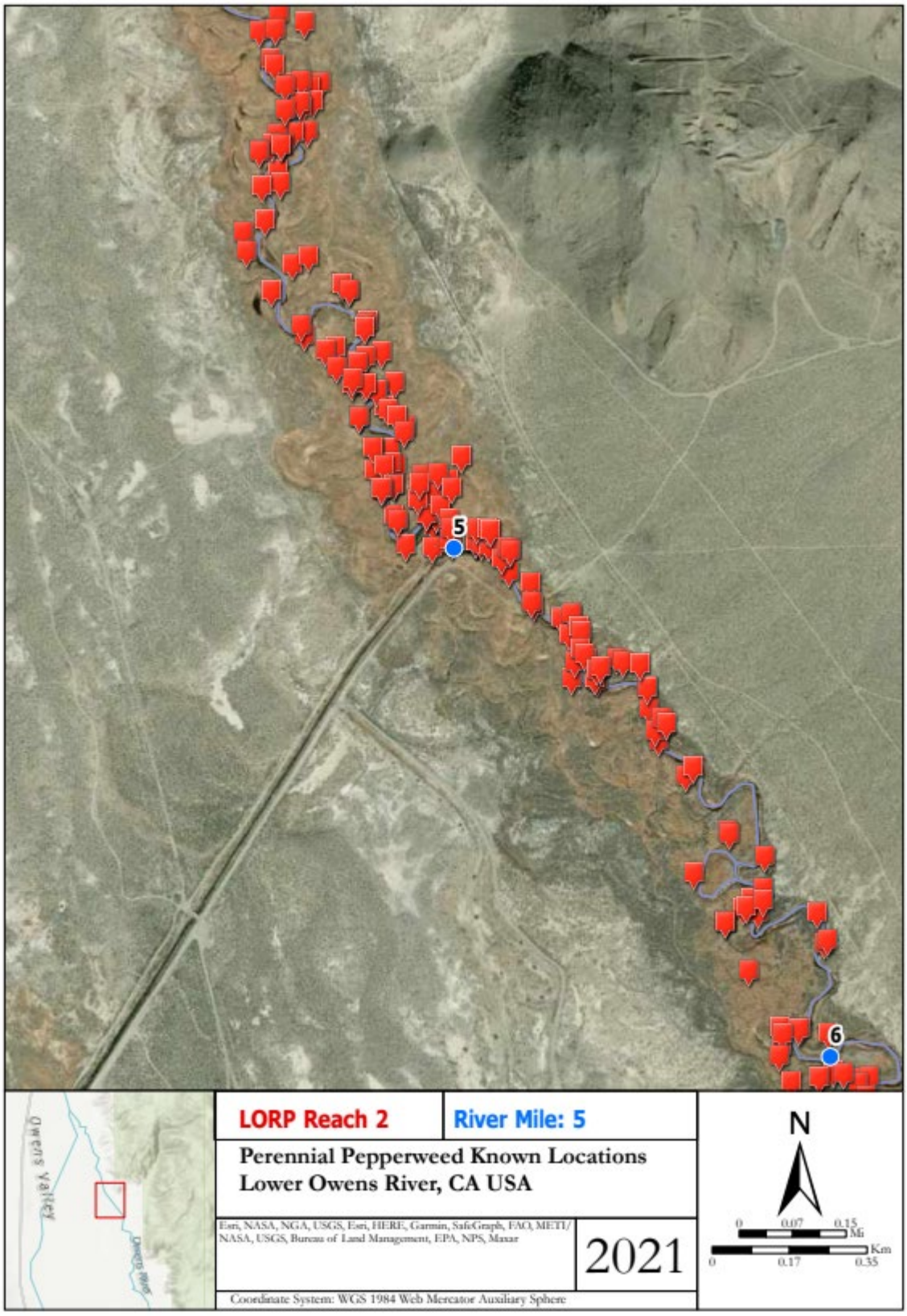
In 2021, the ICWD surveyed the Lower Owens River for Perennial Pepperweed (*Lepidium latifolium*). No major changes in distribution were noted compared to previous years with the exception of downstream spread in reach 4 on the eastern channel of the islands. Pepperweed is well established along river mile (rm) 0 to 8 from the Los Angeles Aqueduct Intake to three miles south of the Blackrock Ditch Return, east of Twin Lakes (Noxious Species Survey Map Series River Miles1 8). Downstream, a few detections have occurred east of Goose Lake from rm 8 to just south of rm 12 ((Noxious Species Survey Map Series River Miles 9-12). Rm 13-16 has been free of pepperweed. Two pepperweed locations between rm 16 and 17 on the west side of the river were detected in 2020 and 2021. Rm 17-20 is free of pepperweed. One new location south of rm 20 was recorded in 2021 (Noxious Species Survey Map Series River Mile 20). The next downstream pepperweed location is between rm 25 and 26 on the east side of the river ((Noxious Species Survey Map Series River Mile 25). Rm 26-28 was free of pepperweed. The last primary infestation occurs south of Manzanar Reward Rd at rm 28 to rm 33 just upstream from Reinhackle Gauging Station Rd (Noxious Species Survey Map Series River Miles 28-33); recently spread has been noted downstream to rm 33 in 2020 and rm 35 in 2021, along the east channel of the northern portion of the islands in reach 4. This area as mentioned last year should be the highest priority for treatment and containment (Noxious Species Survey Map Series River Miles 28-33). Control methods are carried out by CAC and the LADWP.

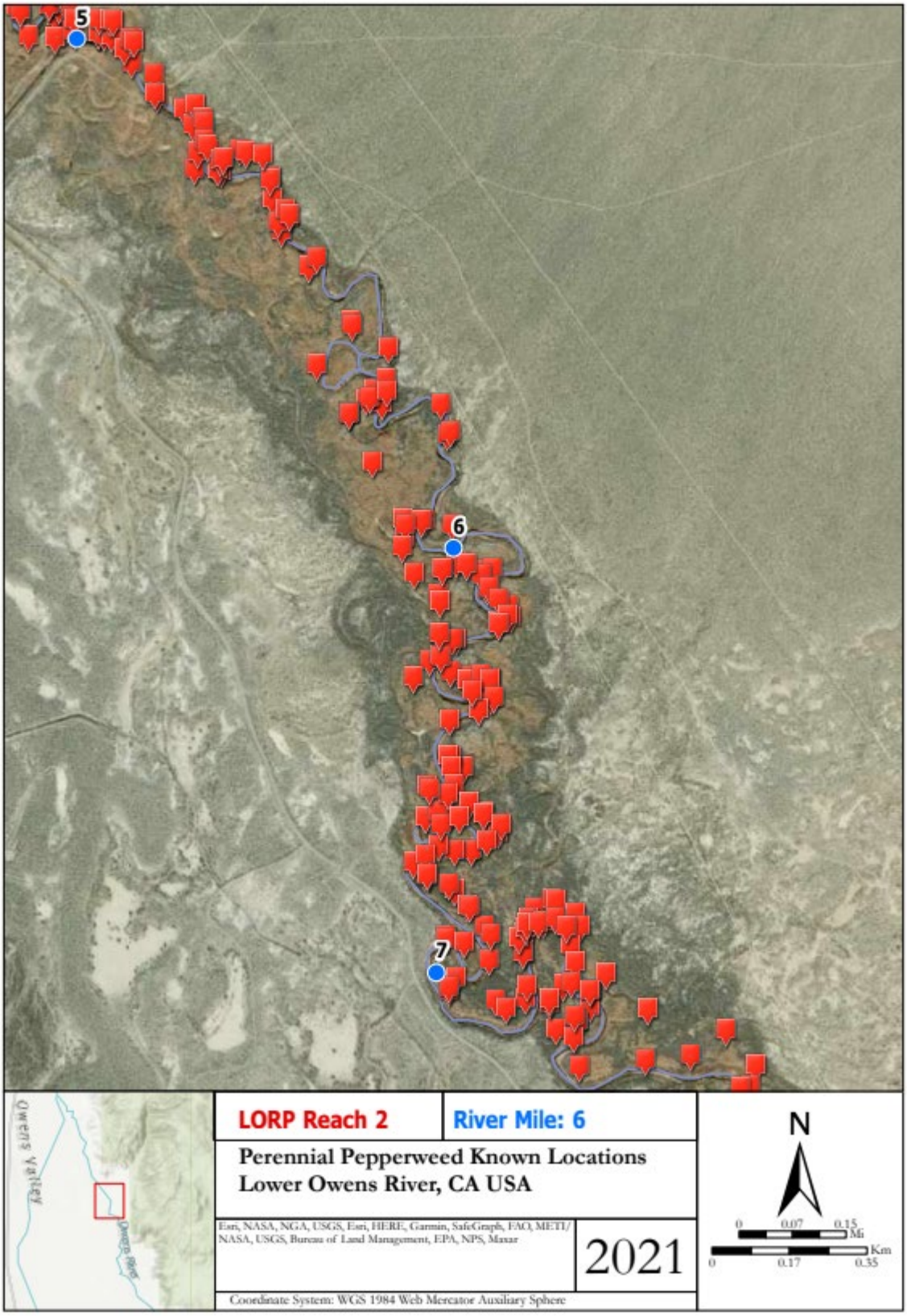

1
2
LORP Reach 1
River Mile: 1
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

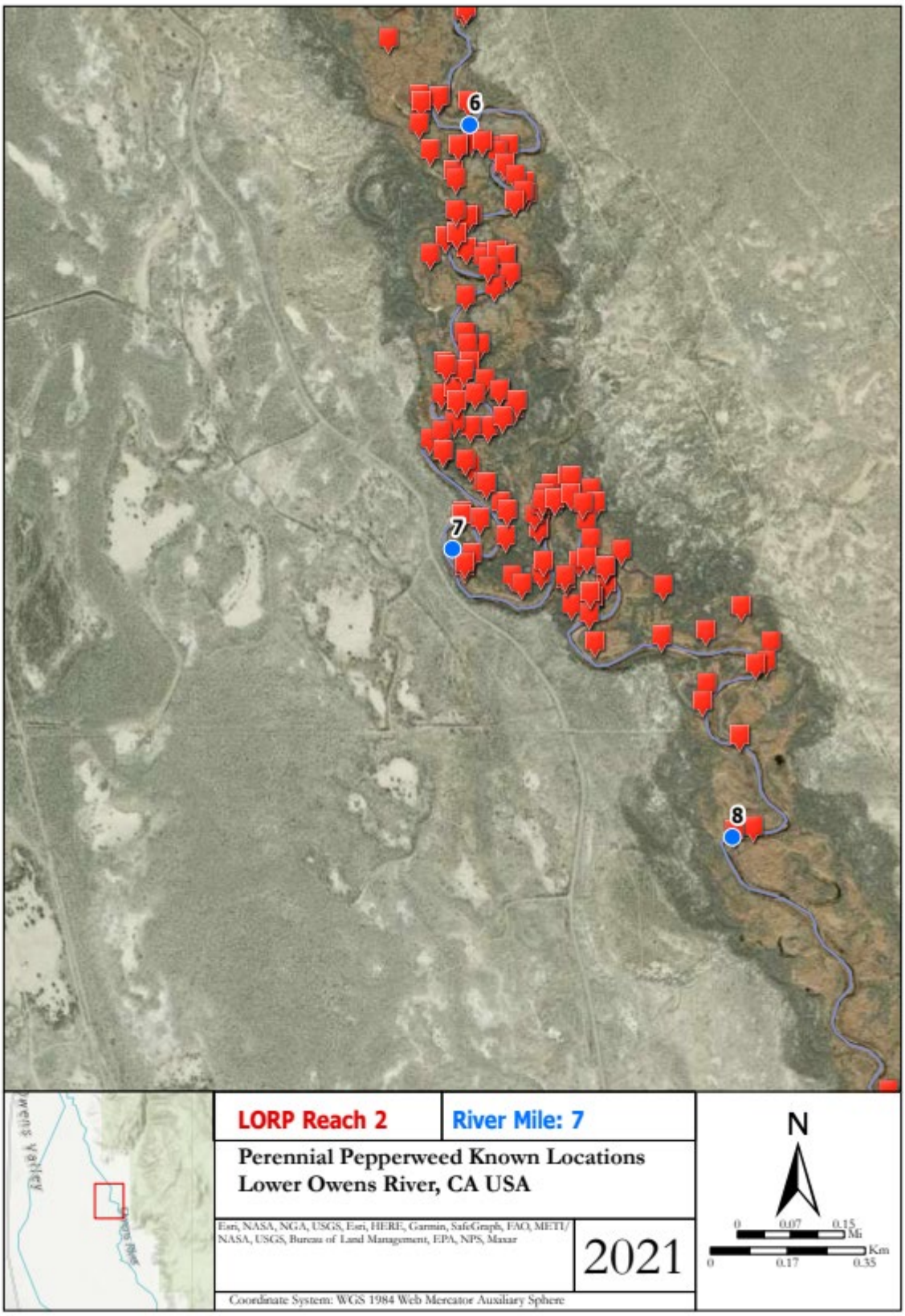

1
2
LORP Reach 1
River Mile: 2
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

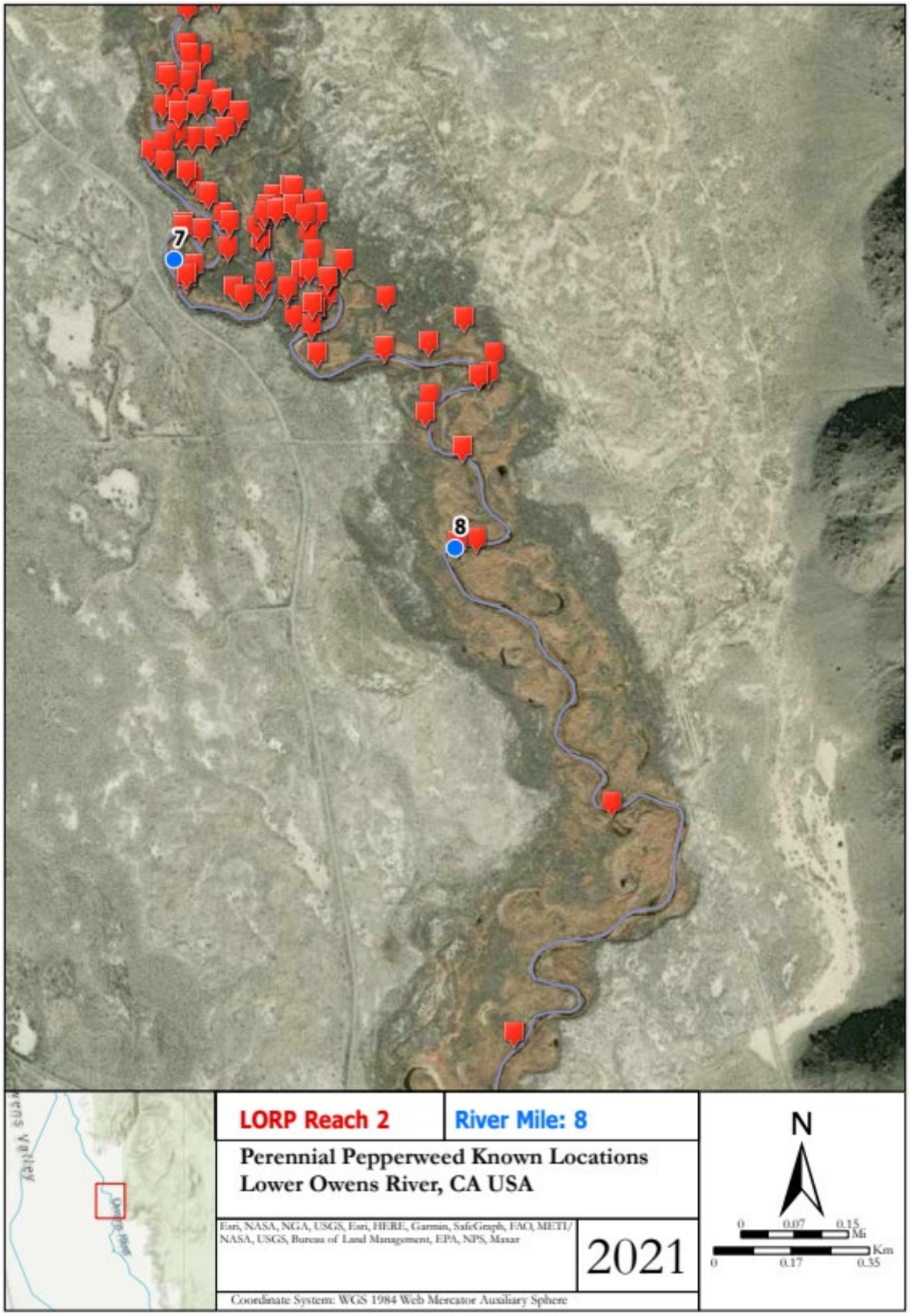

3
LORP Reach 1
River Mile: 3
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

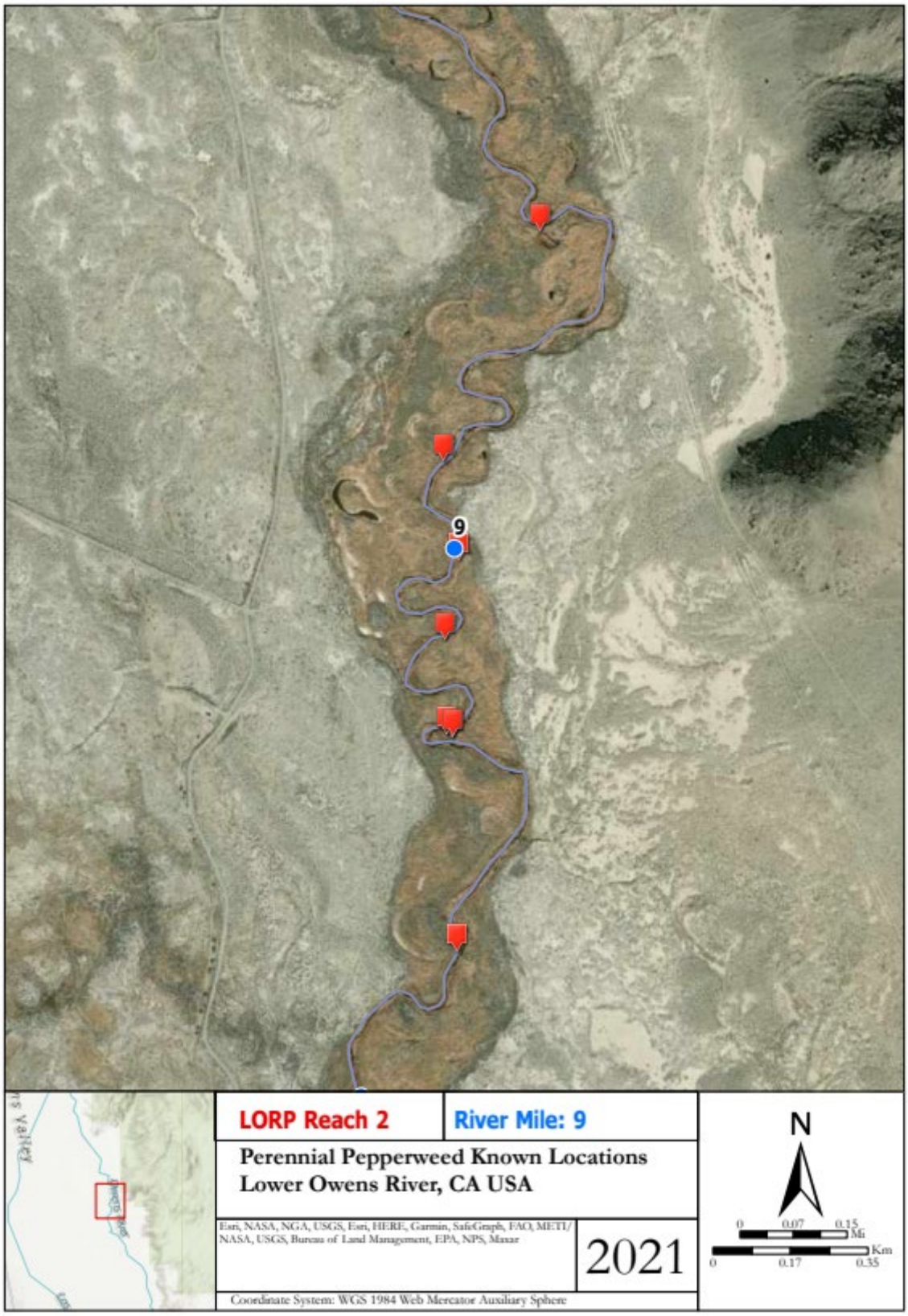

4
LORP Reach 2
River Mile: 4
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

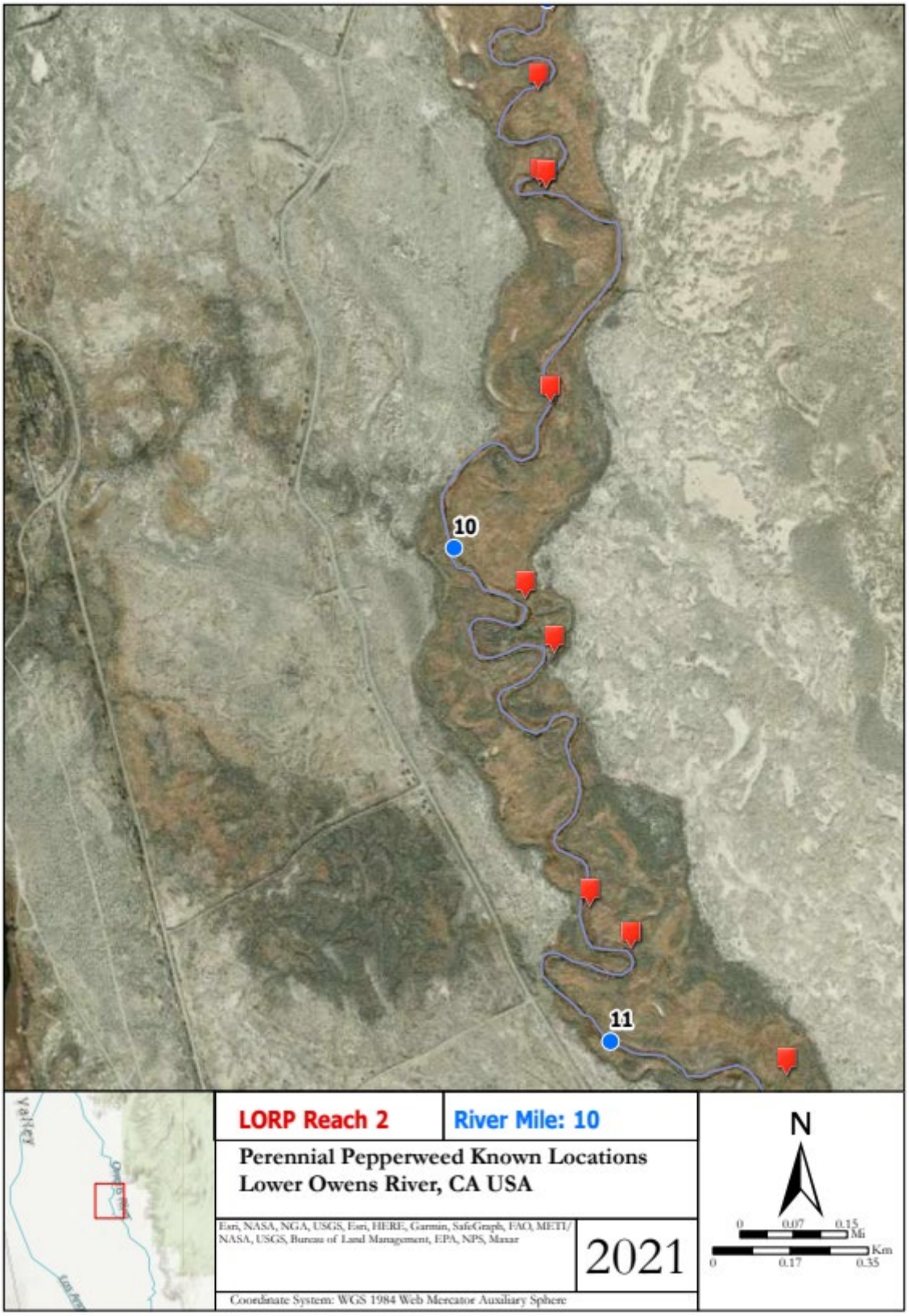

5
6
LORP Reach 2
River Mile: 5
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

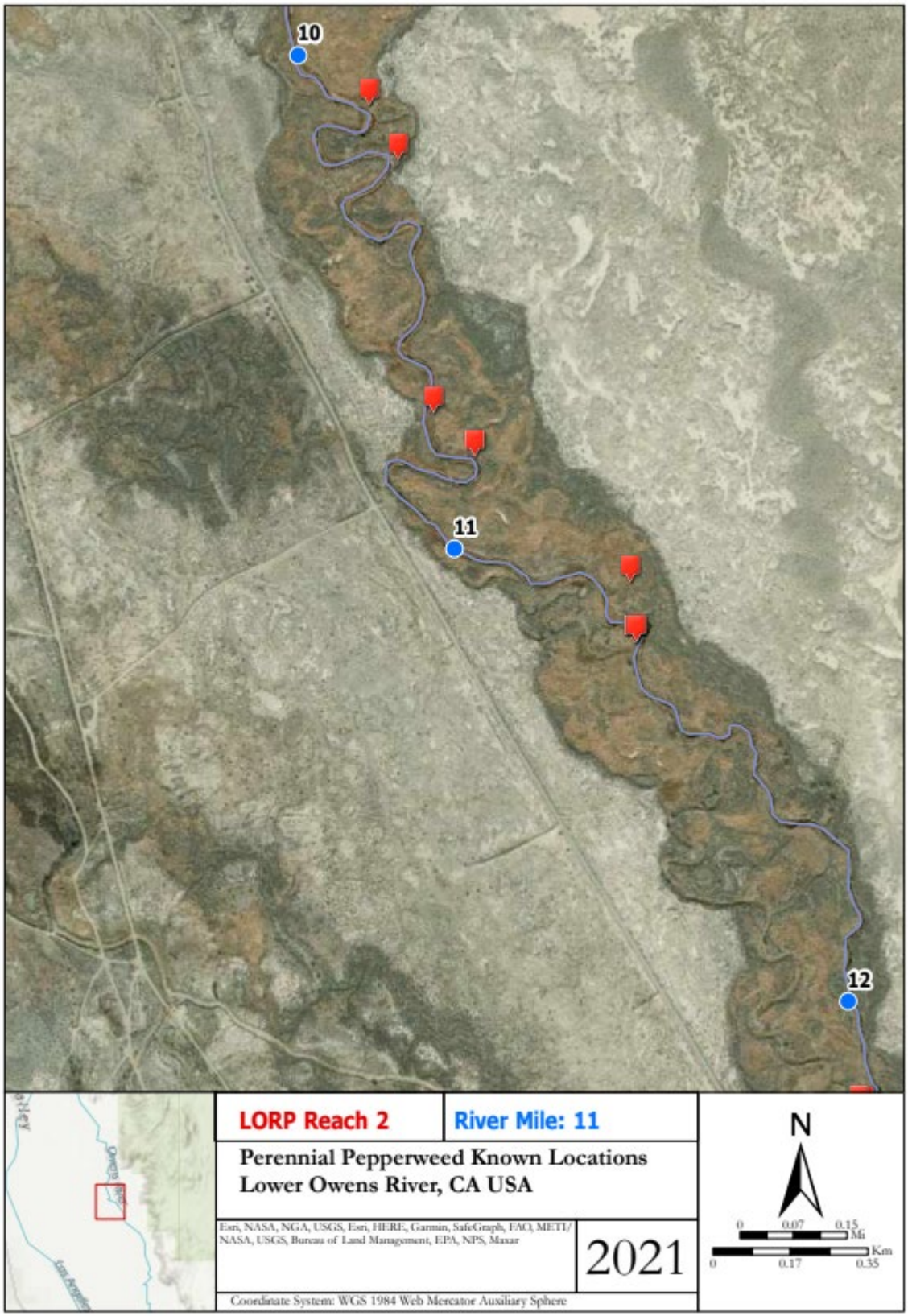

5
6
7
LORP Reach 2
River Mile: 6
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

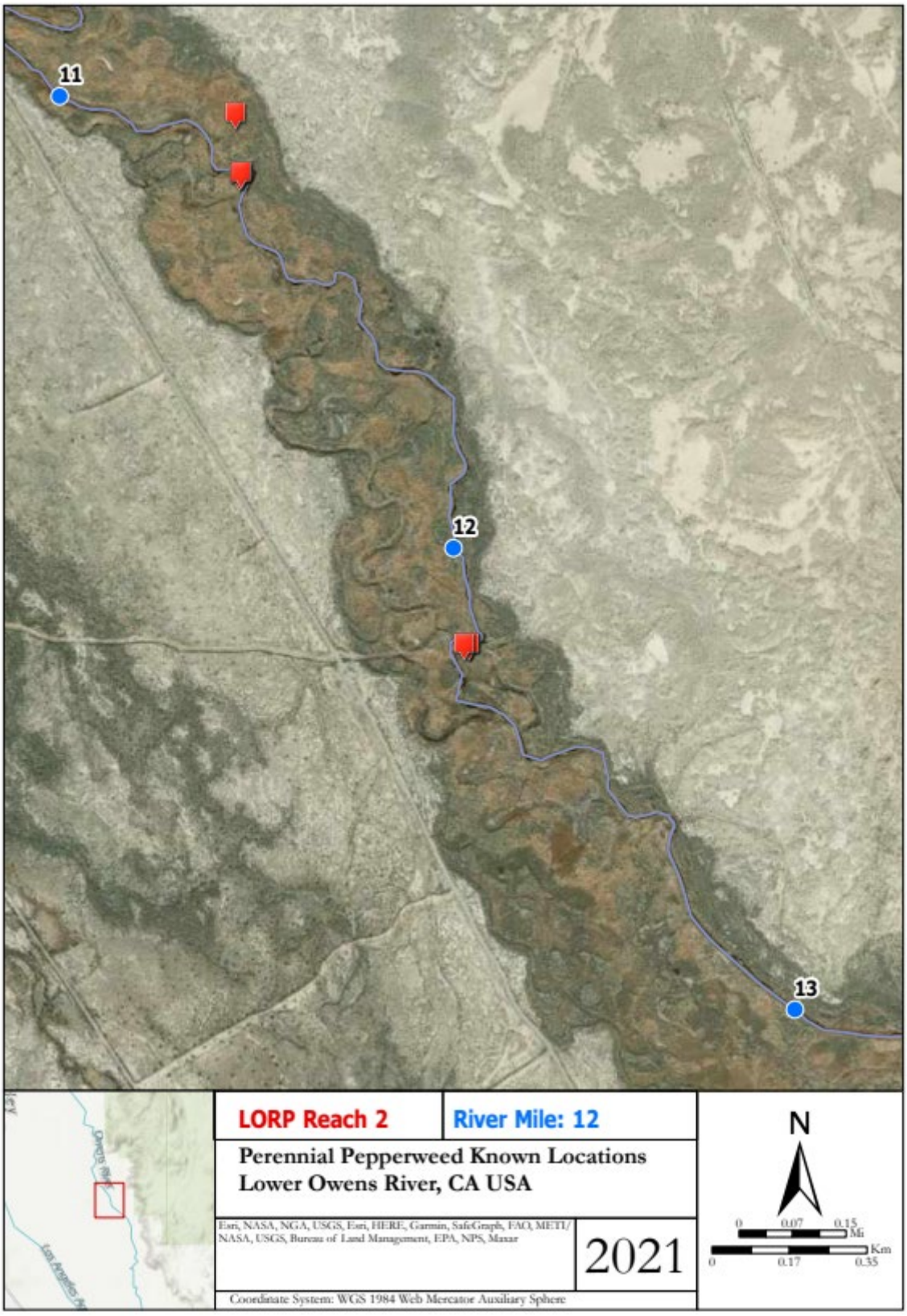

6
7
8
LORP Reach 2
River Mile: 7
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


7
8
LORP Reach 2
River Mile: 8
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


9
LORP Reach 2
River Mile: 9
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

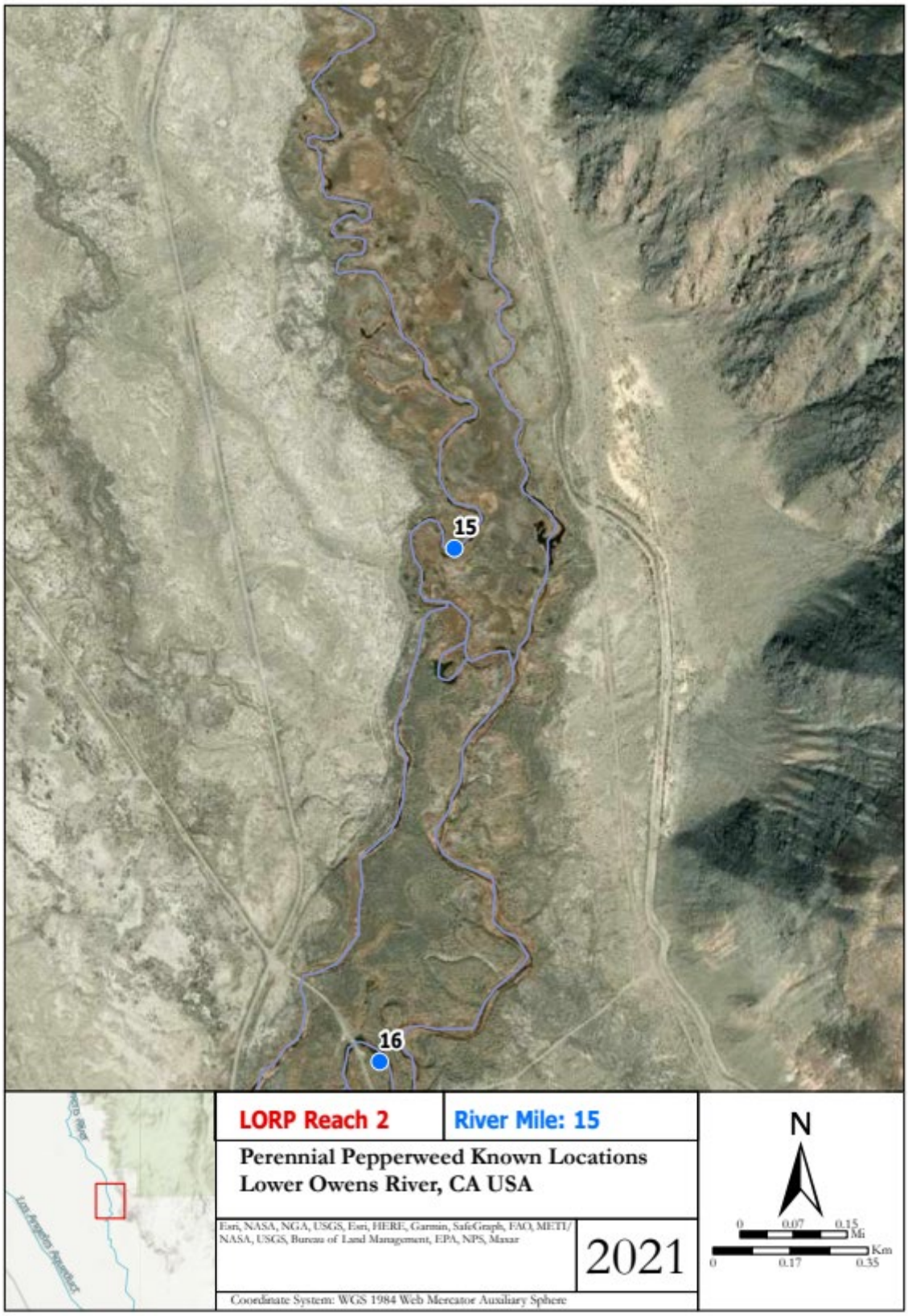

10
11
LORP Reach 2
River Mile: 10
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

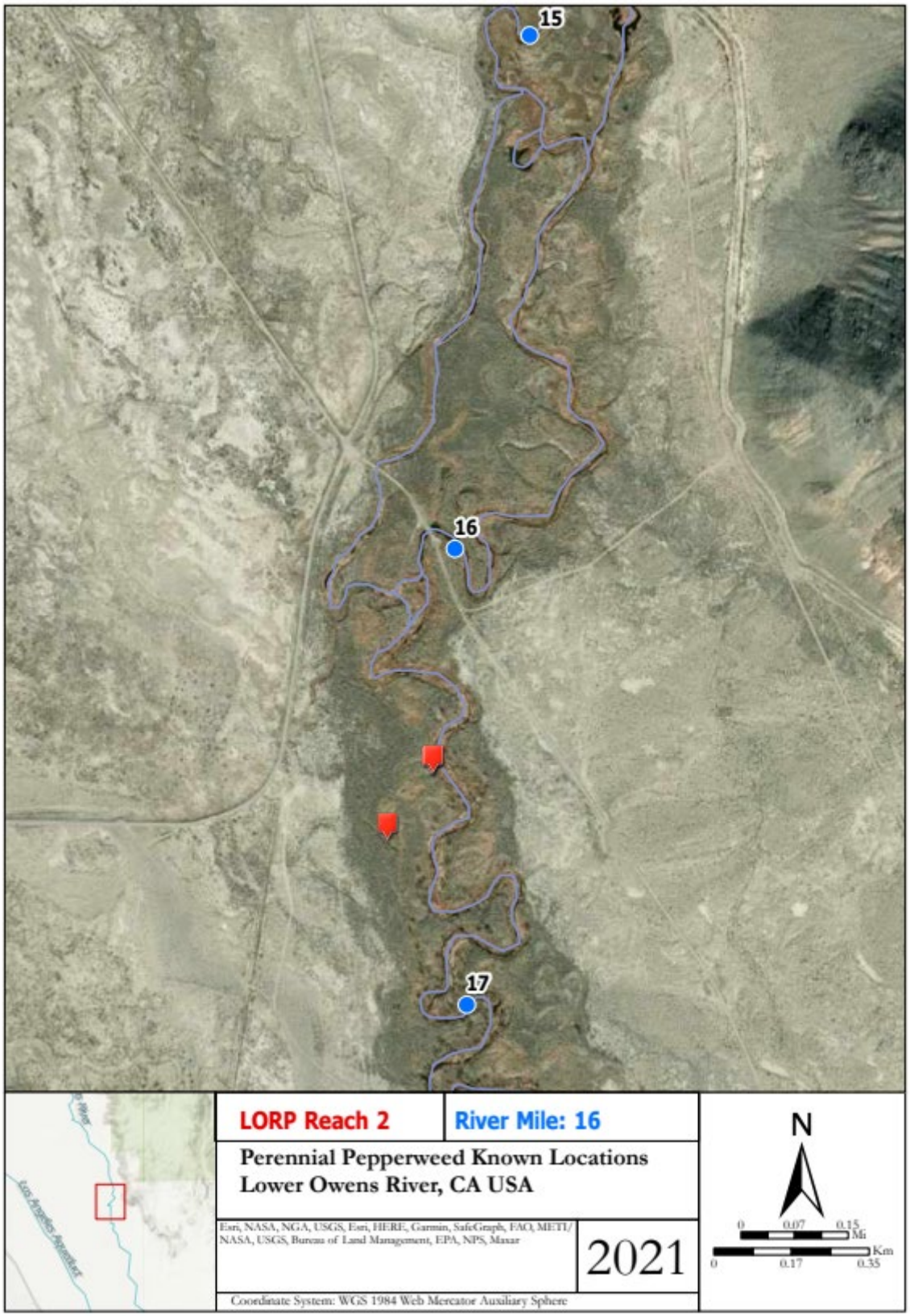

10
11
12
LORP Reach 2
River Mile: 11
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

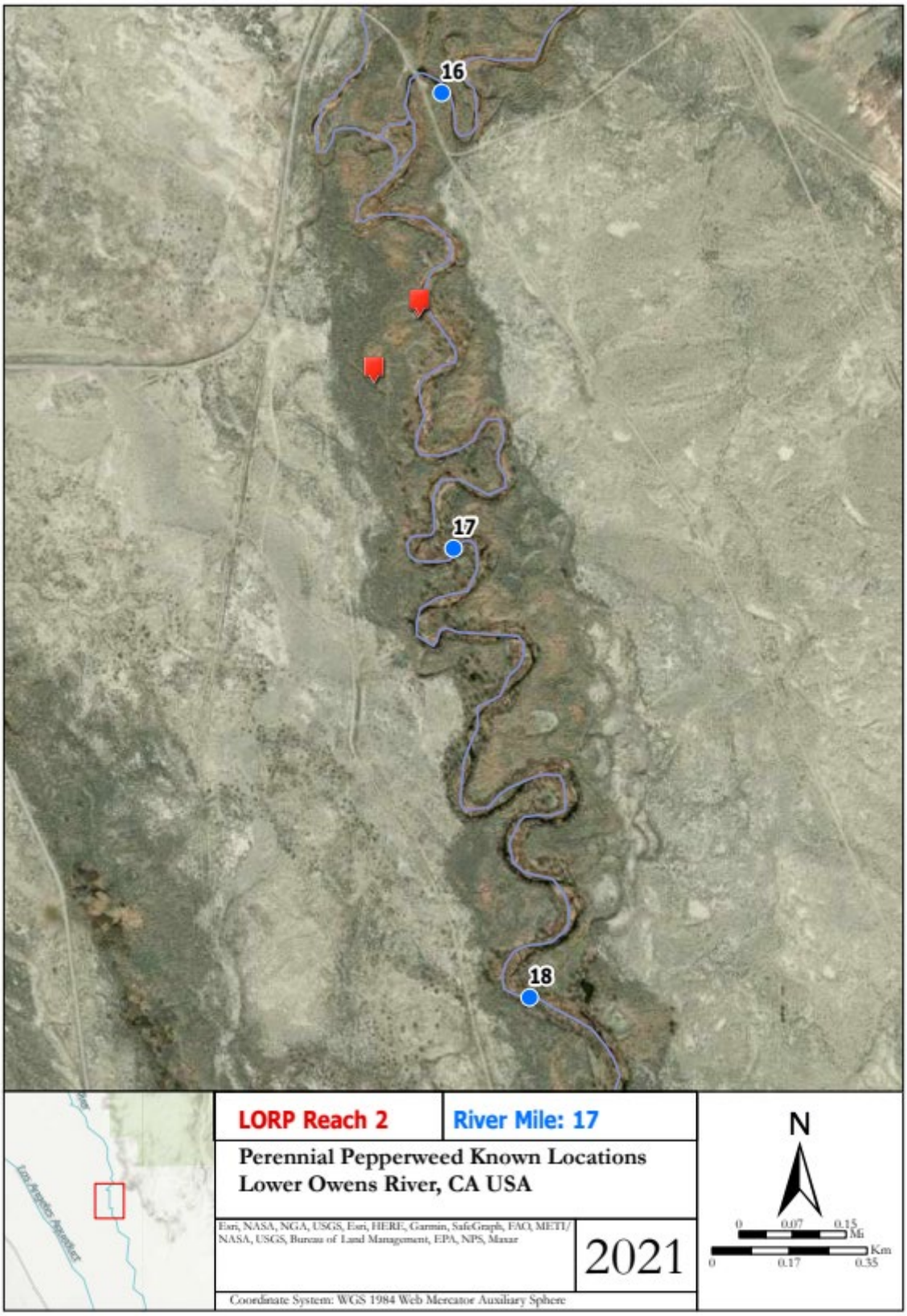

11
12
13
LORP Reach 2
River Mile: 12
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


12
13
14
LORP Reach 2
River Mile: 13
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


13
14
LORP Reach 2
River Mile: 14
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

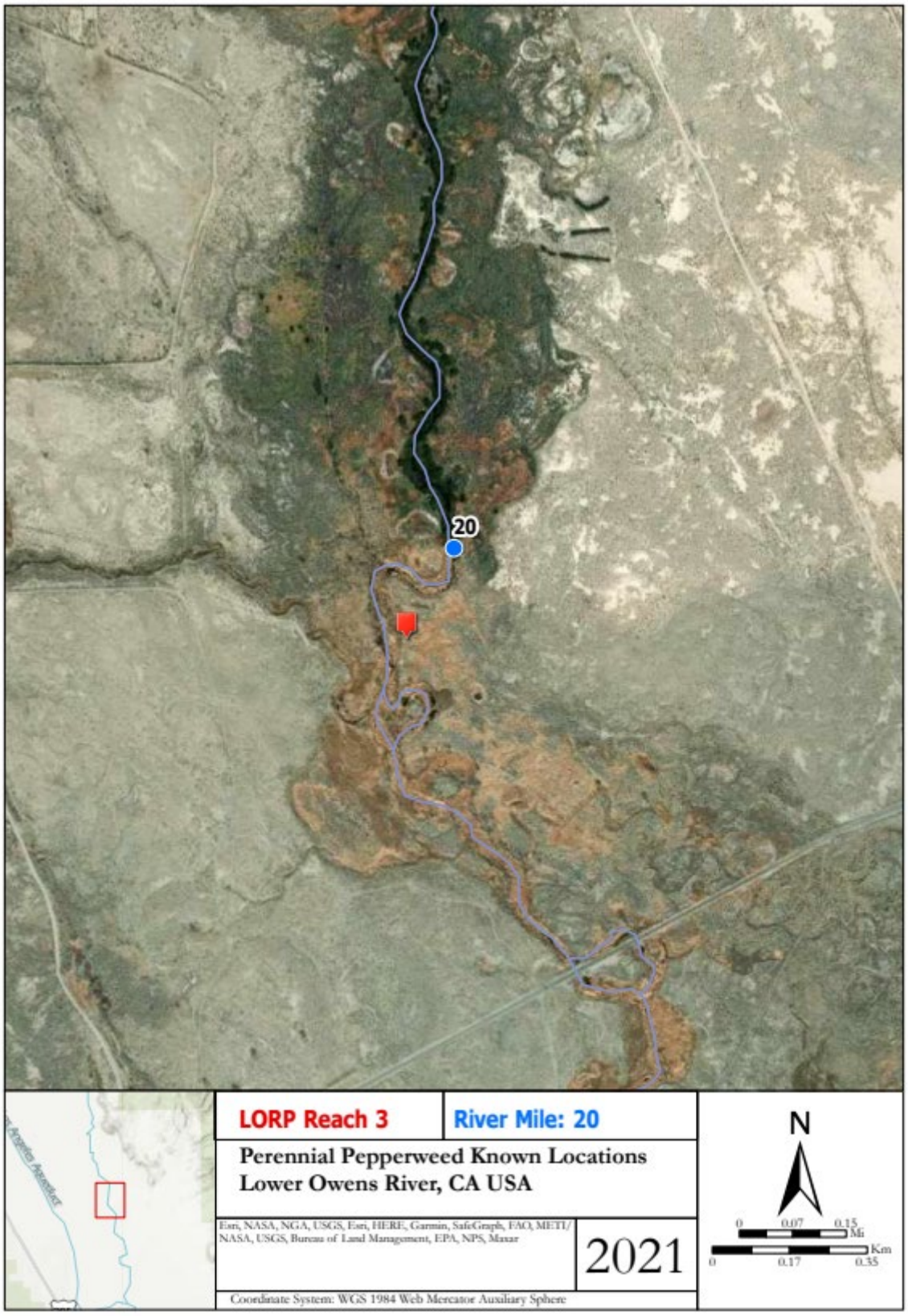

15
16
LORP Reach 2
River Mile: 15
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

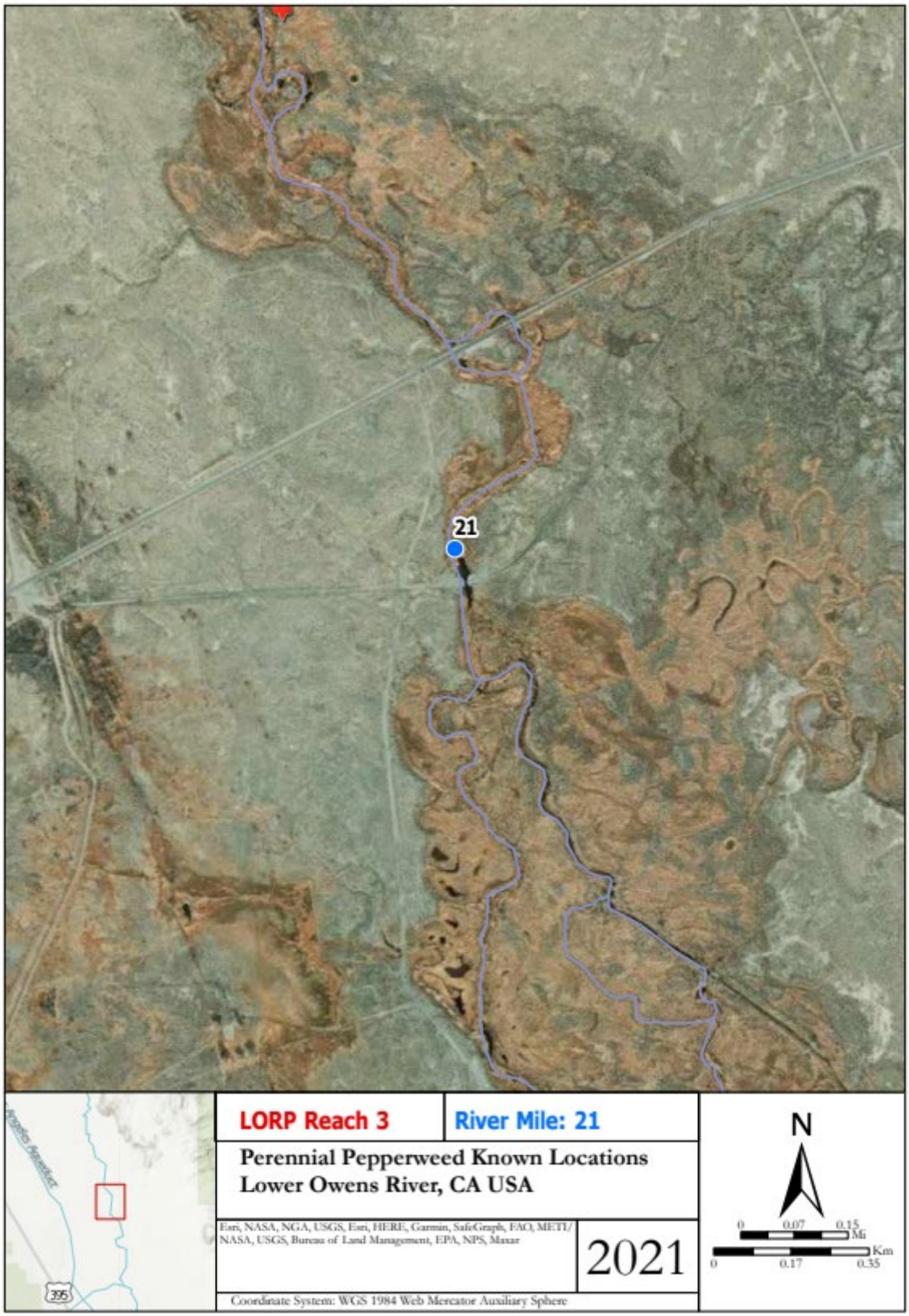

15
16
17
LORP Reach 2
River Mile: 16
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

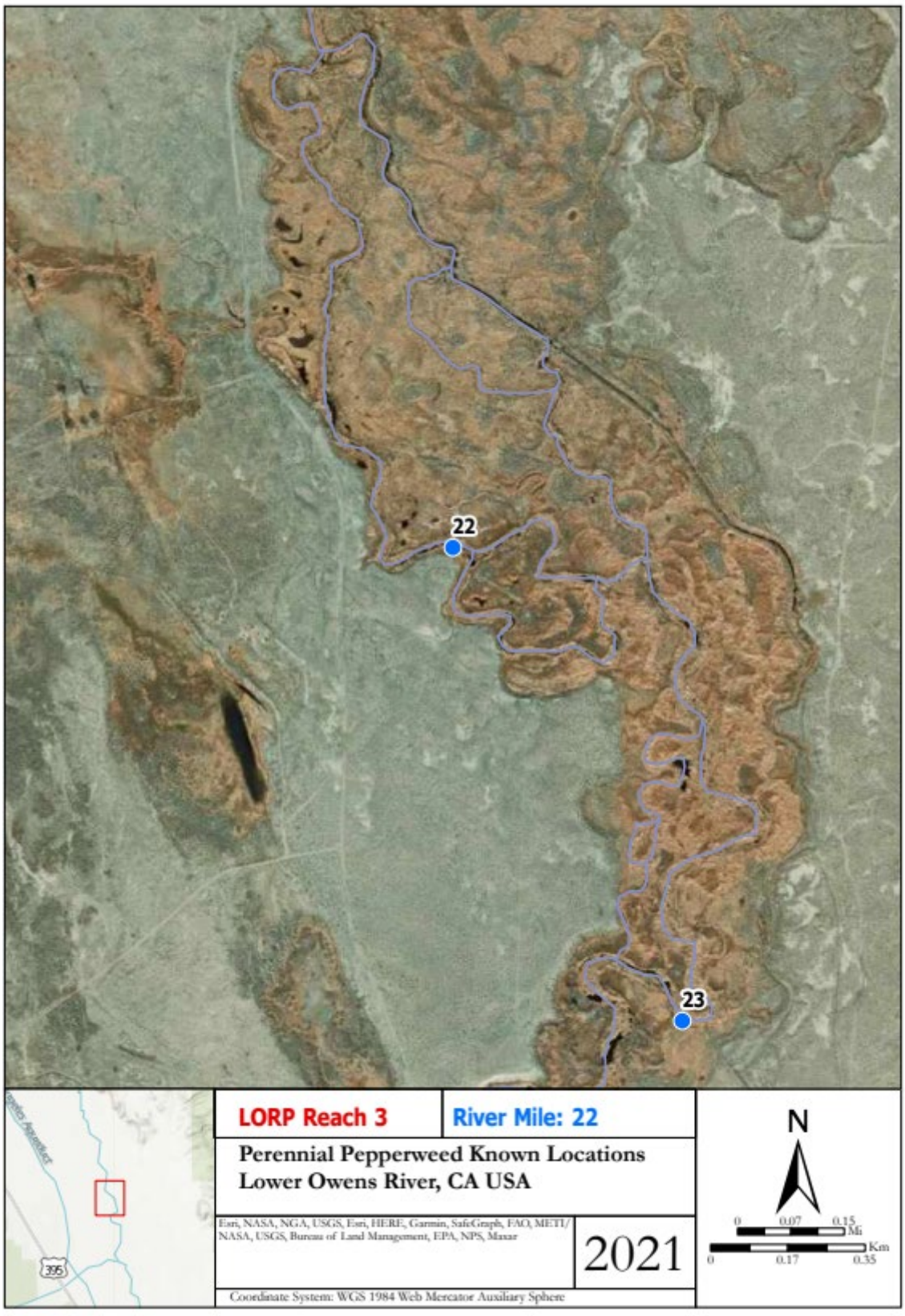

16
17
18
LORP Reach 2
River Mile: 17
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


17
18
LORP Reach 2
River Mile: 18
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


19
LORP Reach 2
River Mile: 19
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


20
LORP Reach 3
River Mile: 20
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

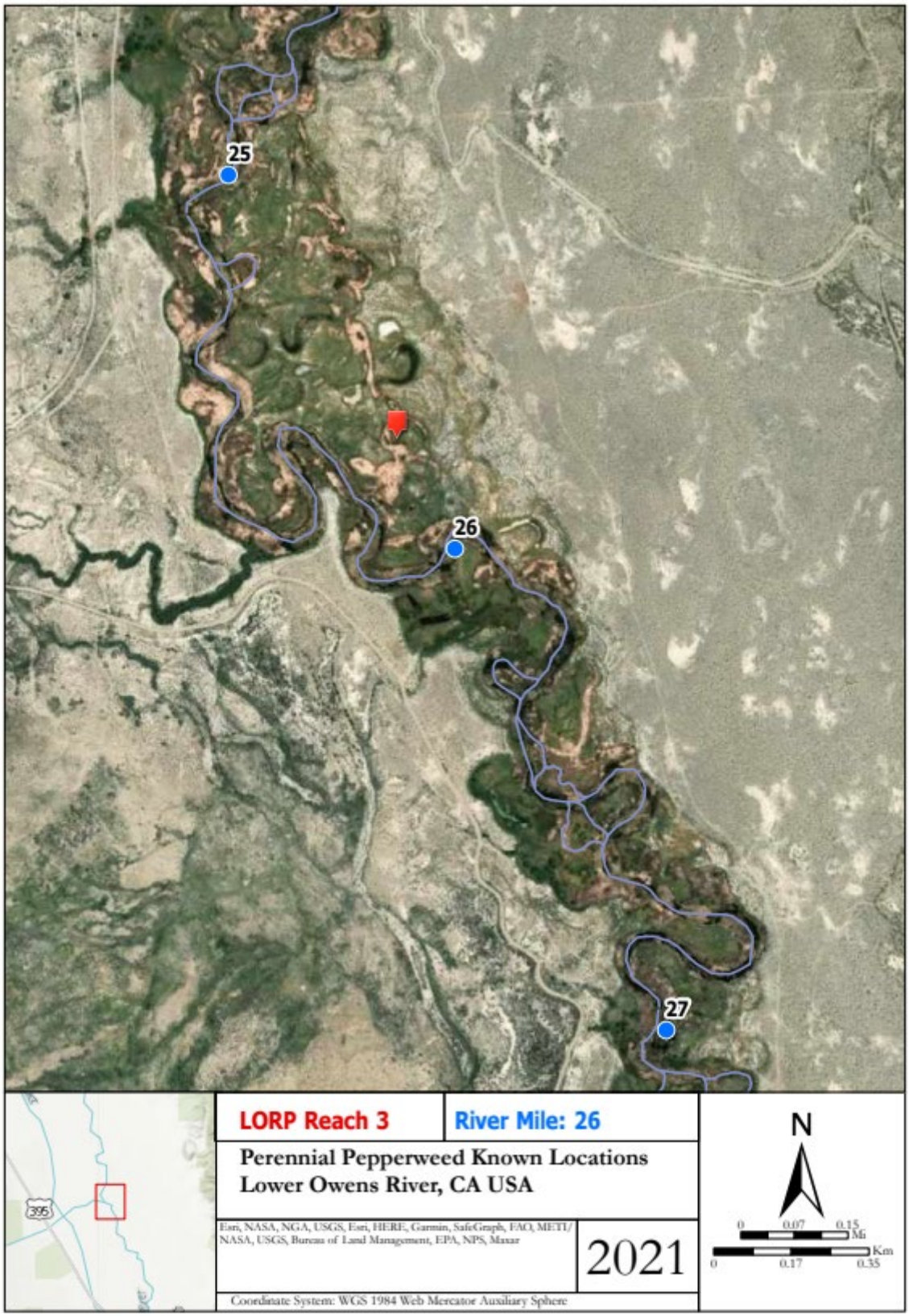

21
LORP Reach 3
River Mile: 21
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km
395

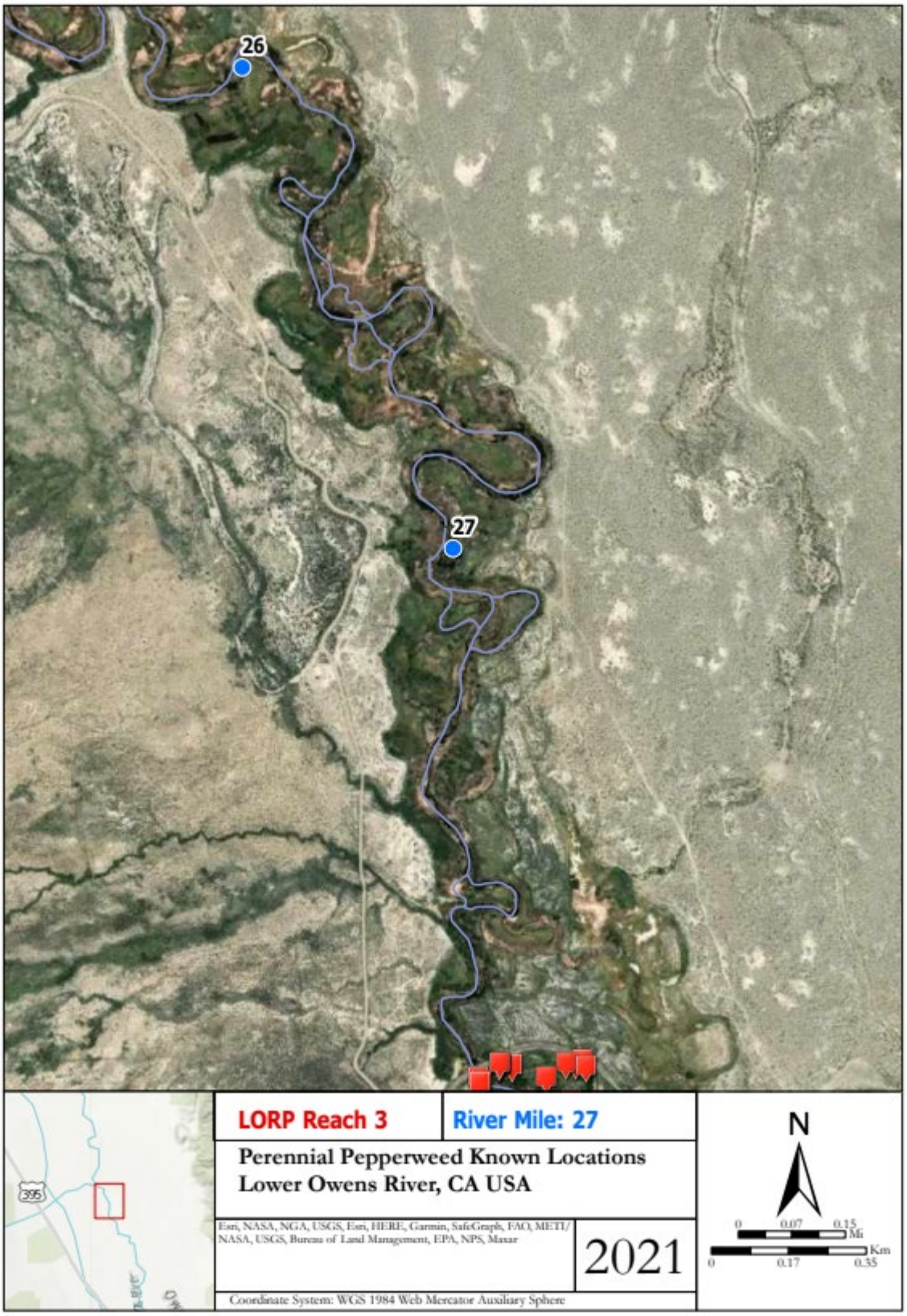

22
23
LORP Reach 3
River Mile: 22
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


22
23
24
LORP Reach 3
River Mile: 23
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

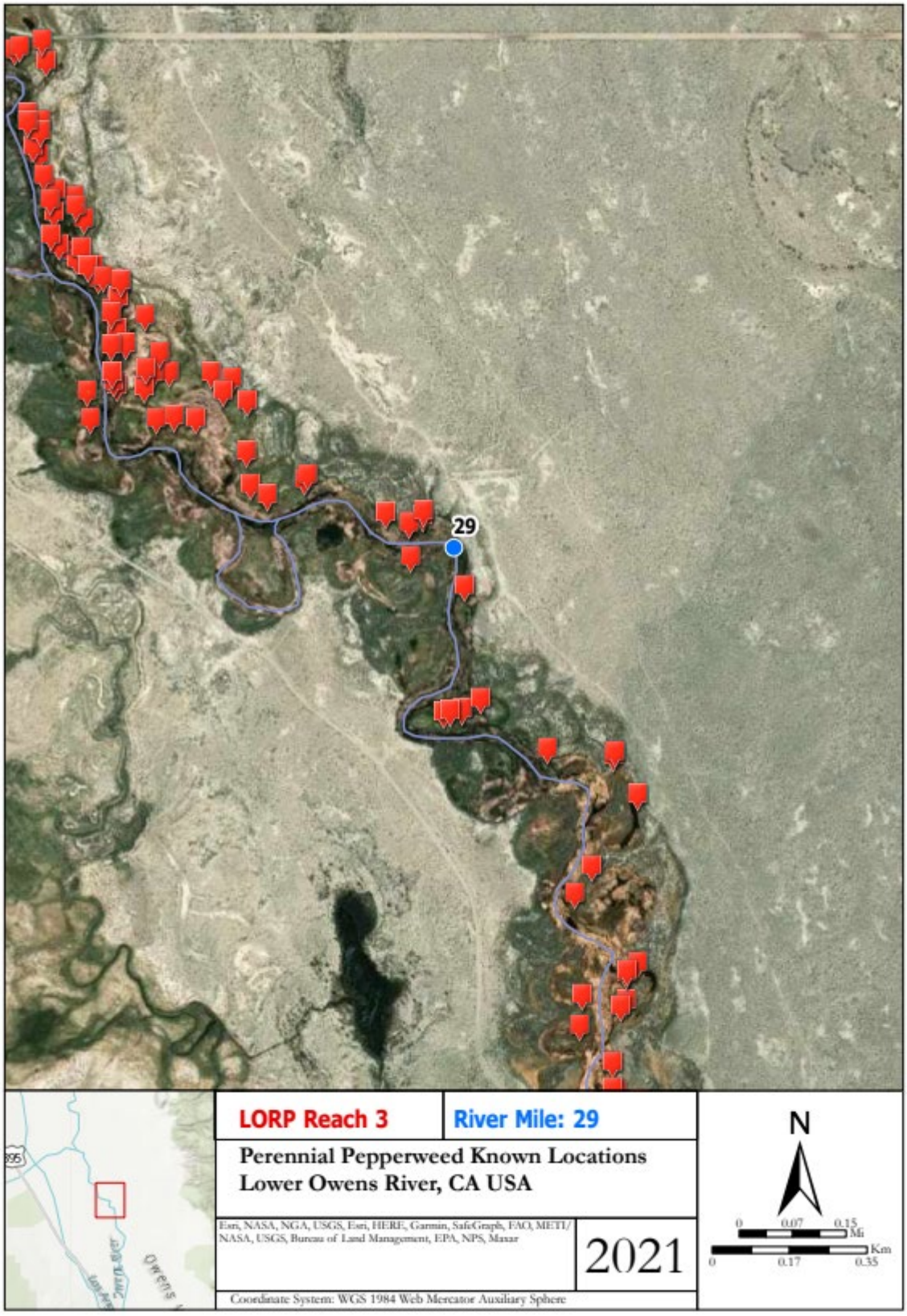

23
24
LORP Reach 3
River Mile: 24
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

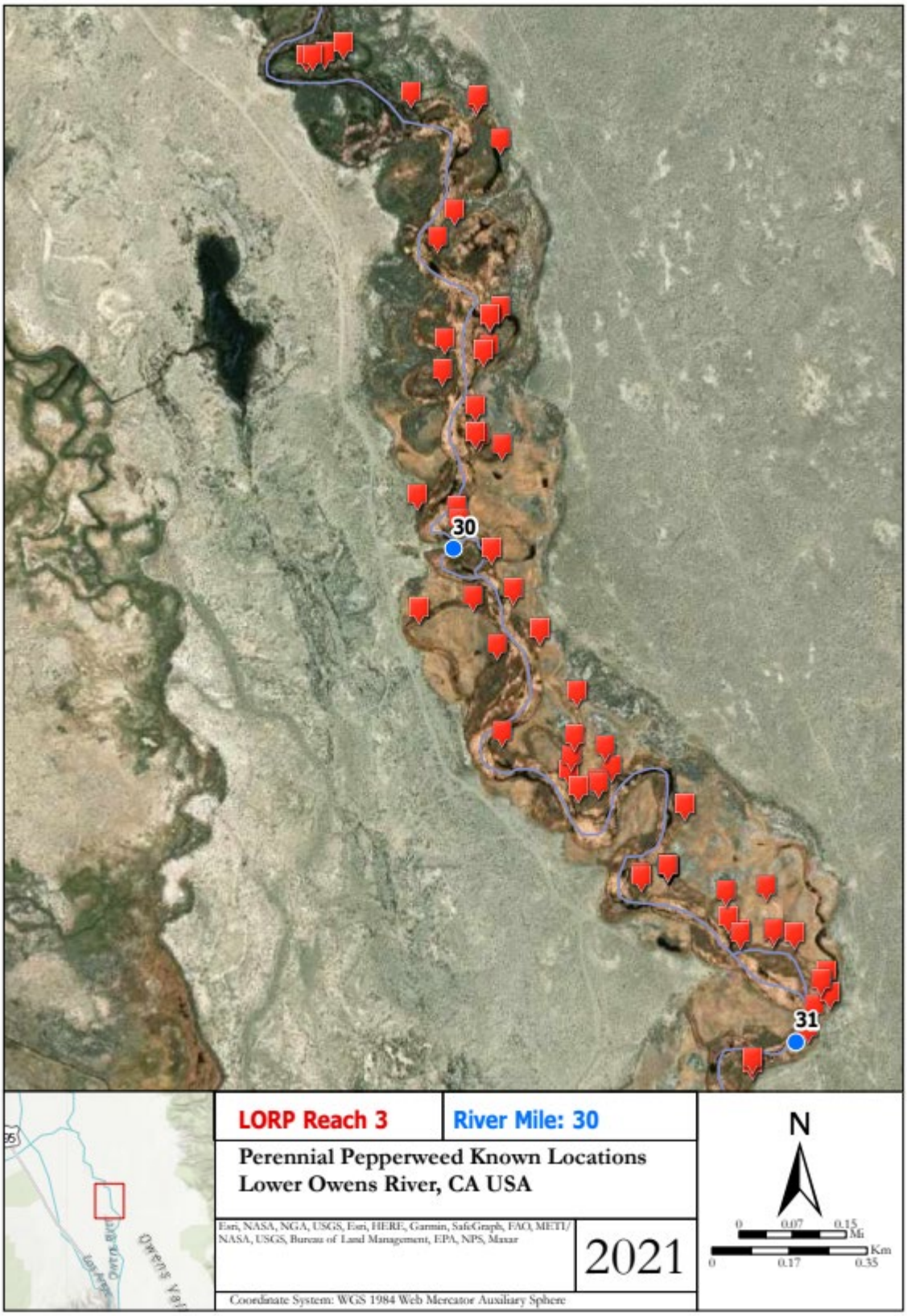

25
26
LORP Reach 3
River Mile: 25
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

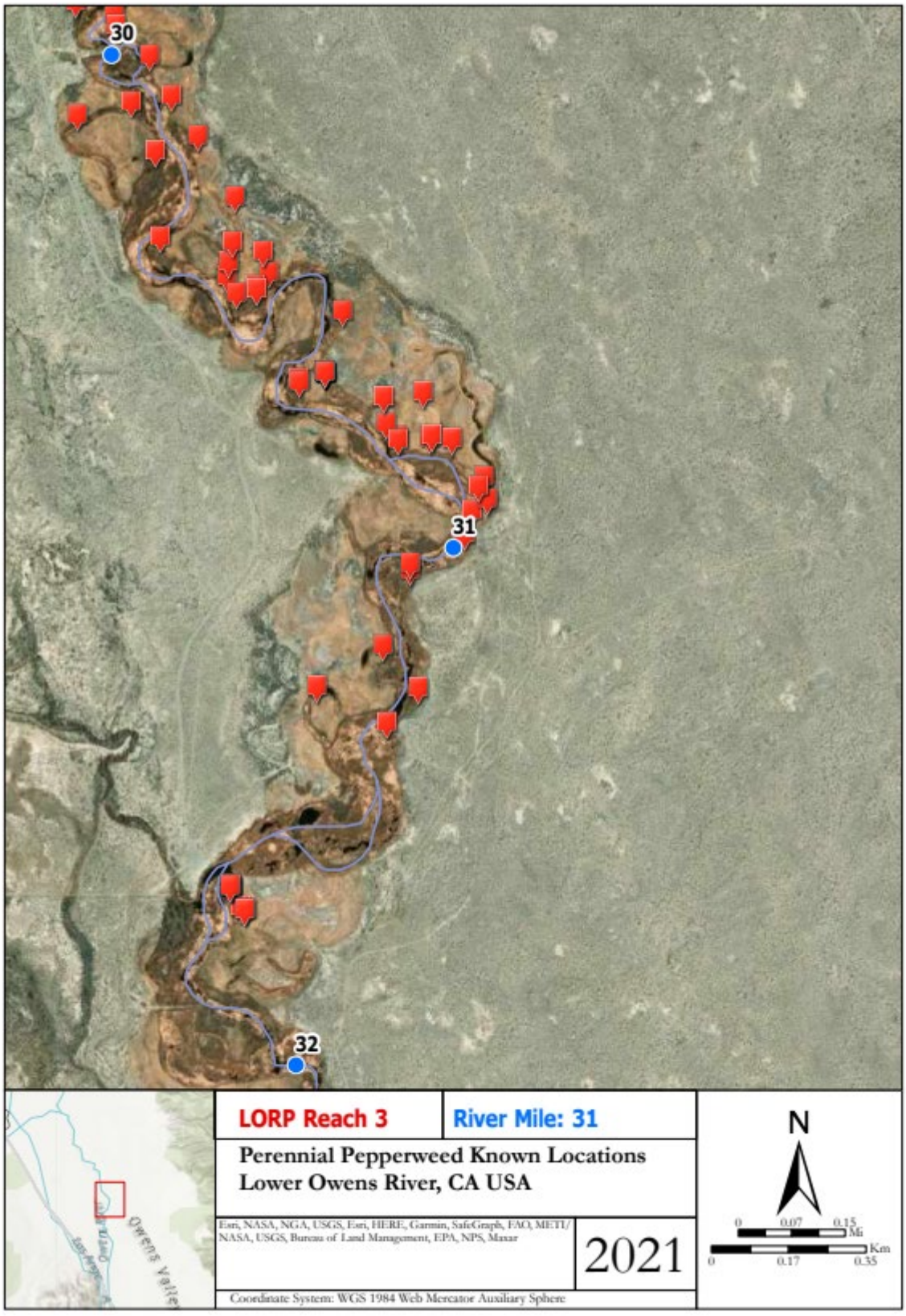

25
26
27
LORP Reach 3
River Mile: 26
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

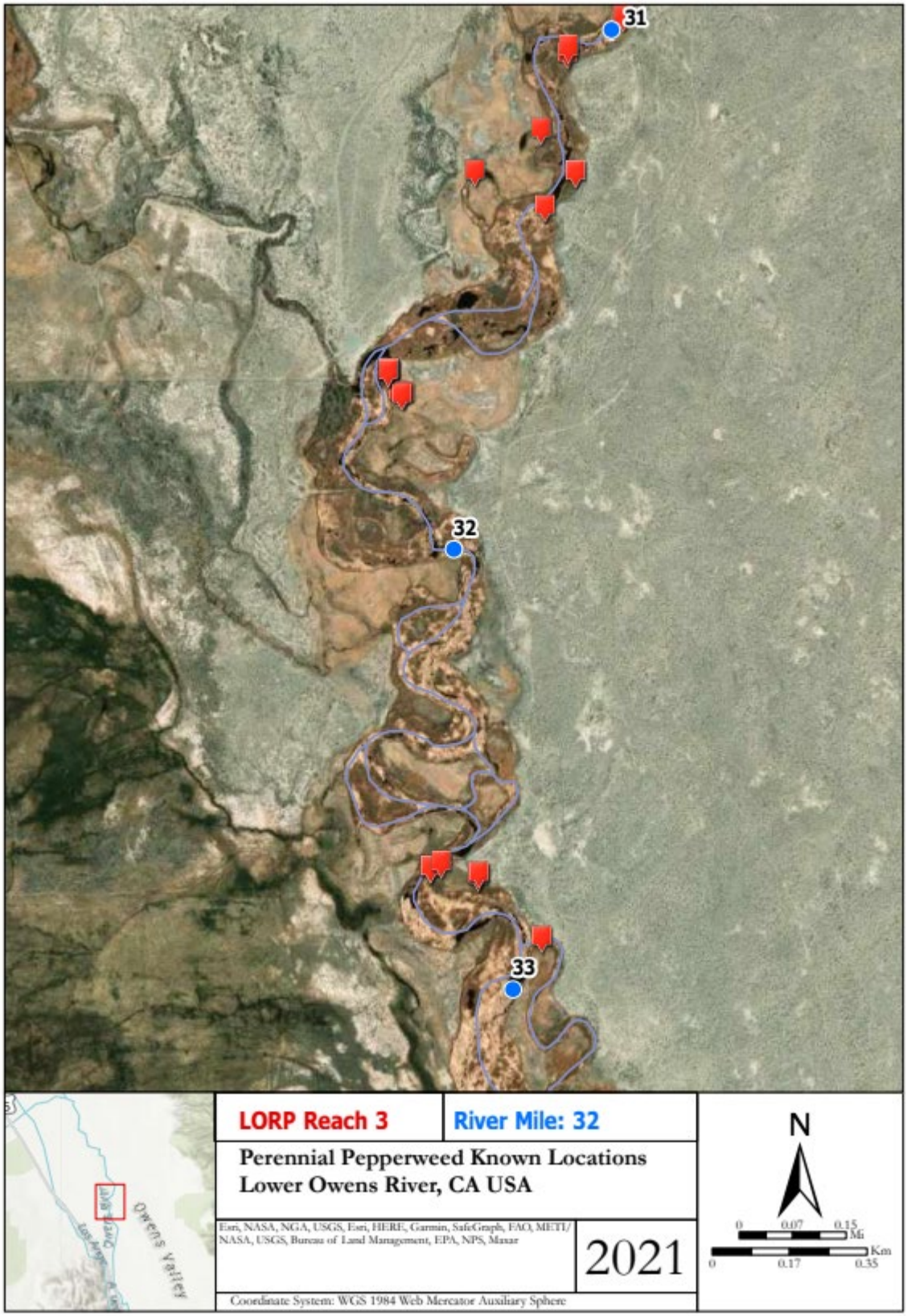

26
27
LORP Reach 3
River Mile: 27
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

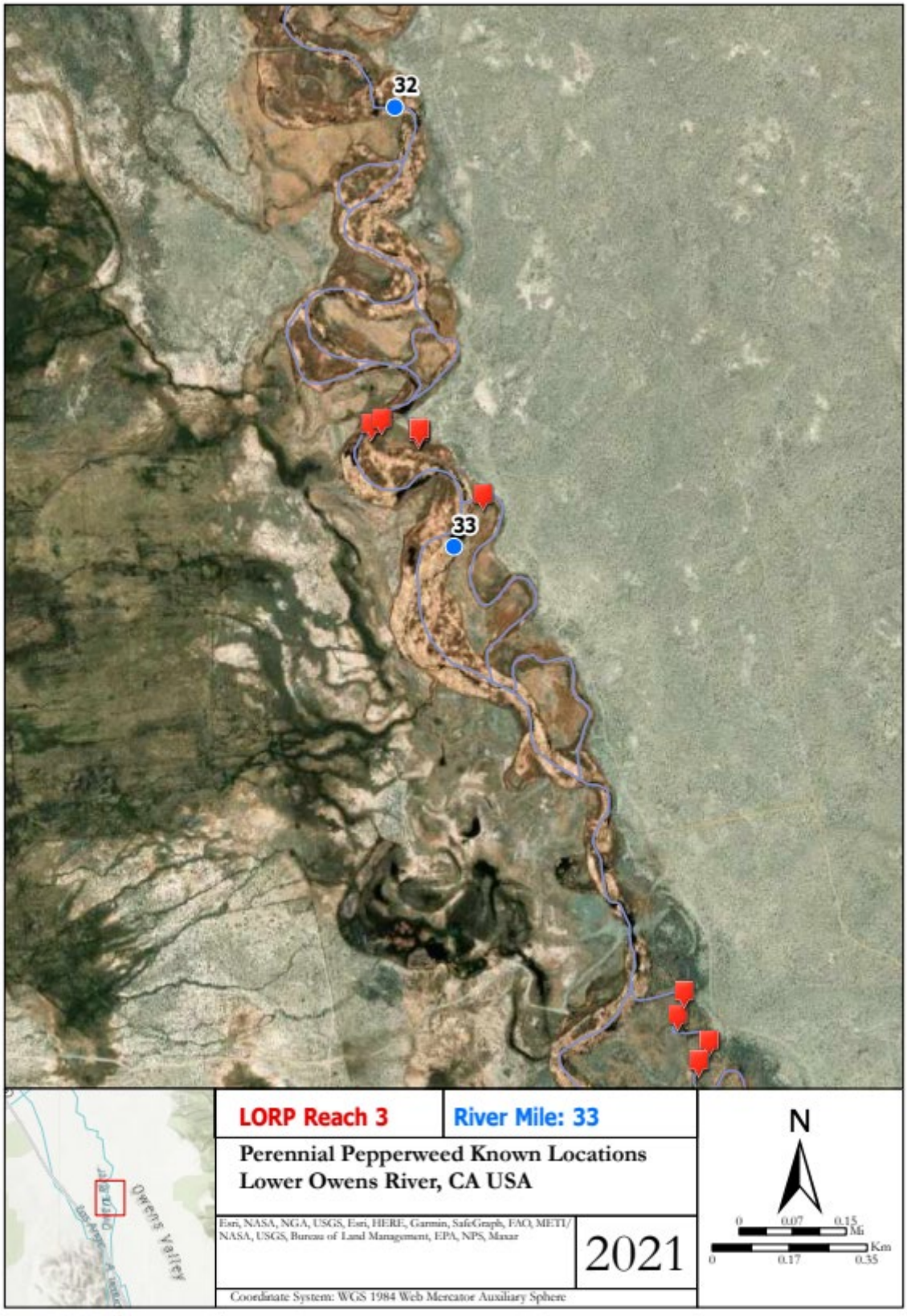

28
LORP Reach 3
River Mile: 28
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
395
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

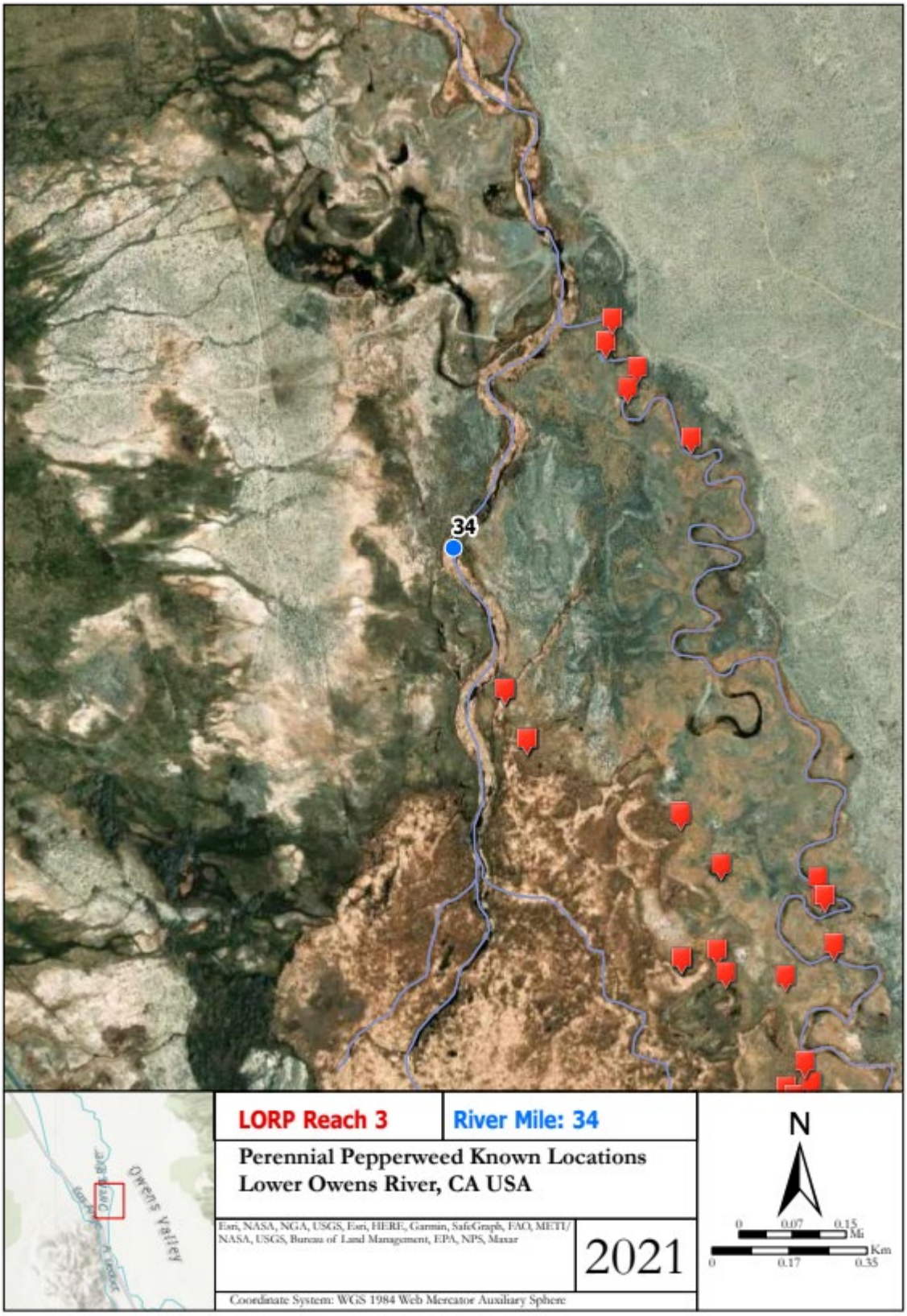

29
LORP Reach 3
River Mile: 29
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

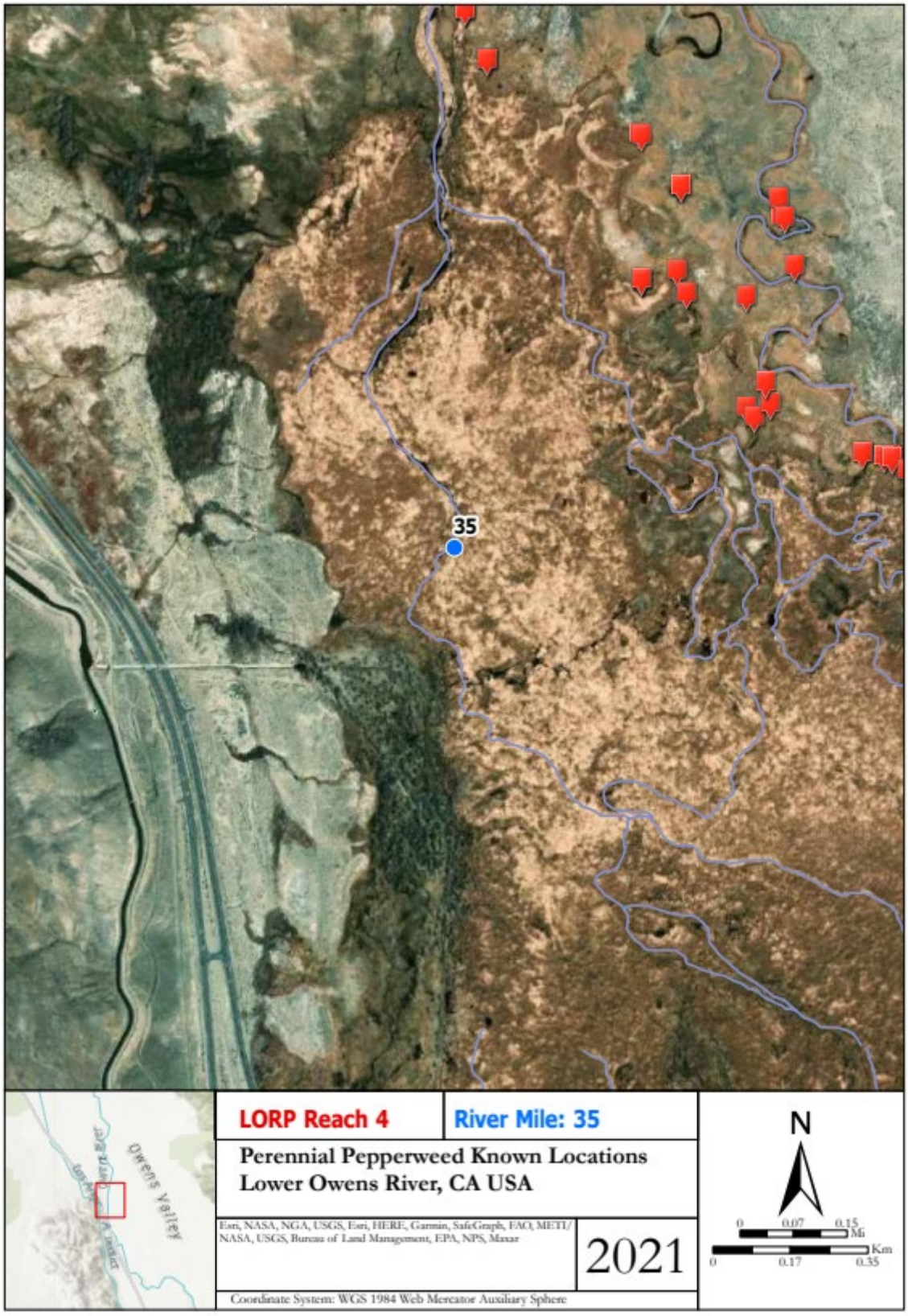

30
31
LORP Reach 3
River Mile: 30
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

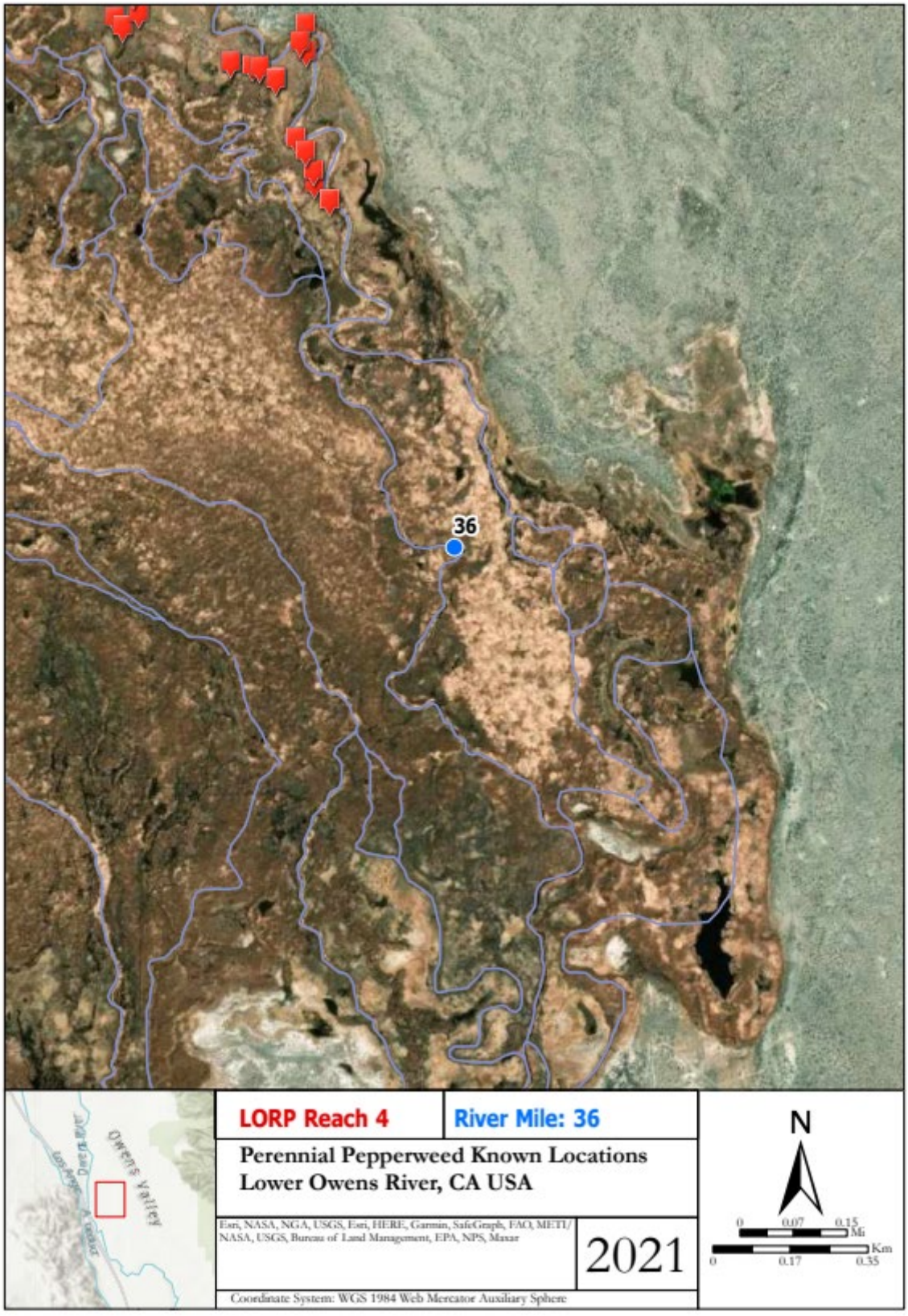

30
31
32
LORP Reach 3
River Mile: 31
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35


31
32
33
LORP Reach 3
River Mile: 32
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

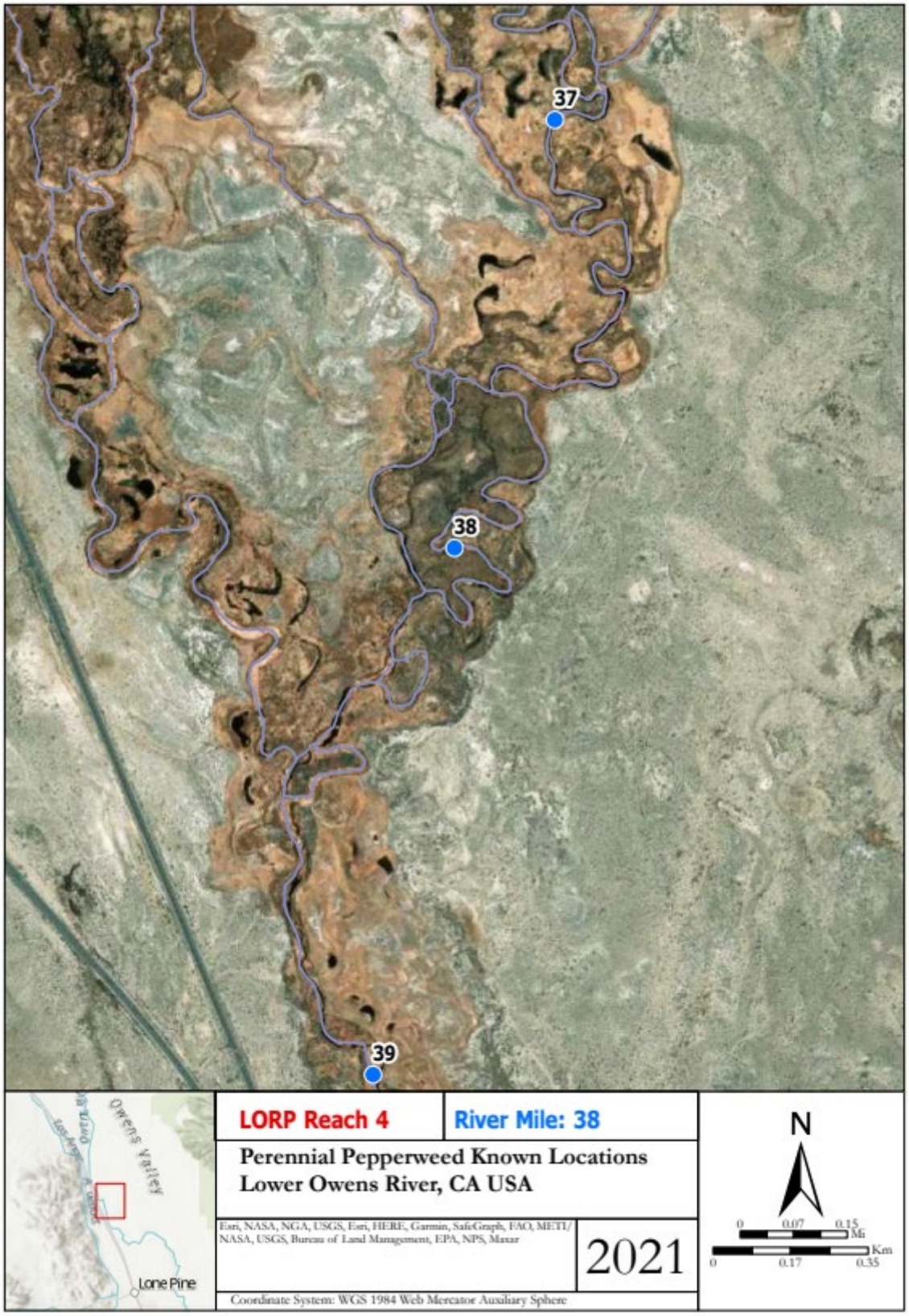

32
33
LORP Reach 3
River Mile: 33
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

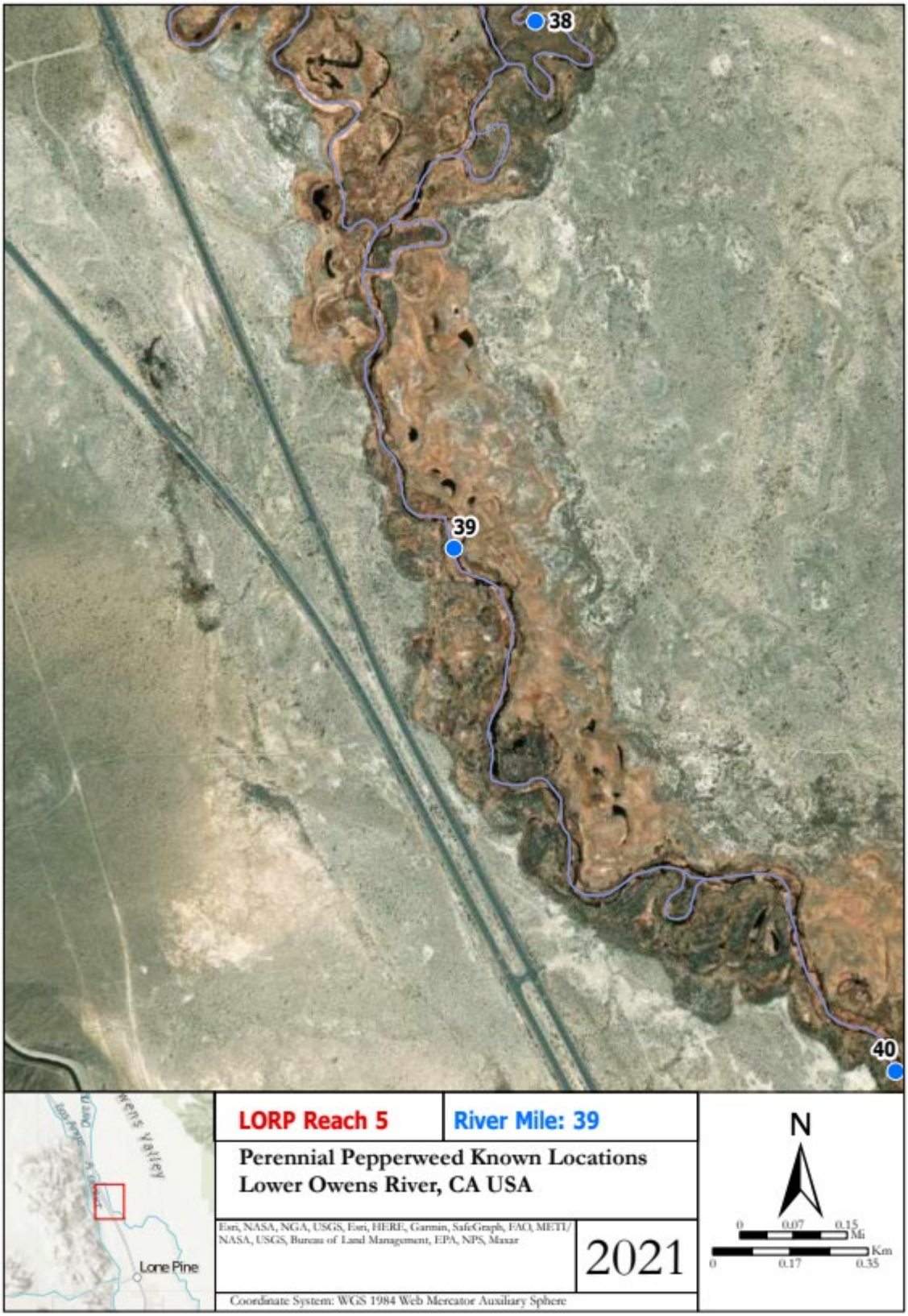

34
LORP Reach 3
River Mile: 34
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Owens Valley
N
0 0.07 0.15
Mi
Km
0 0.17 0.35

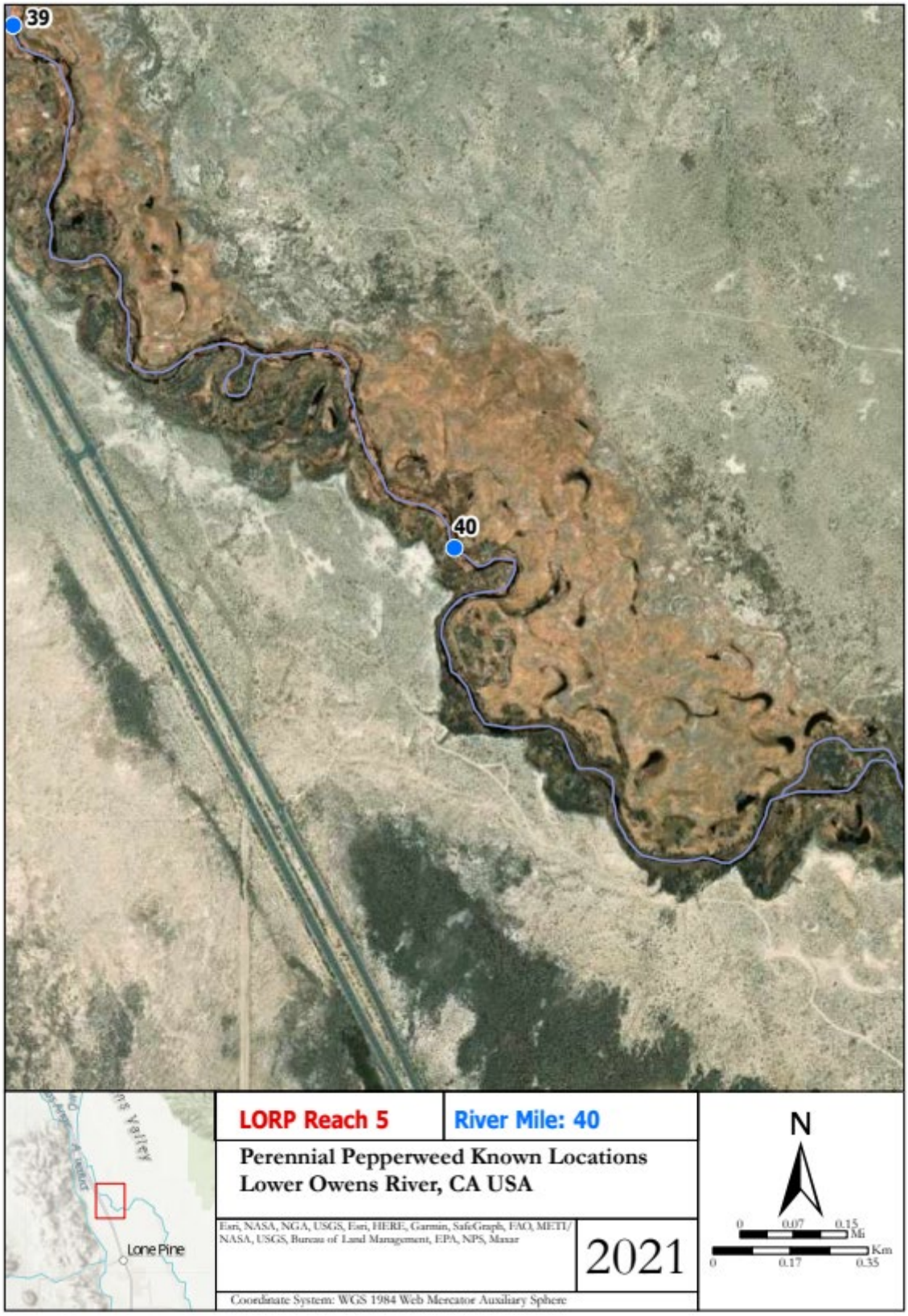

35
LORP Reach 4
River Mile: 35
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

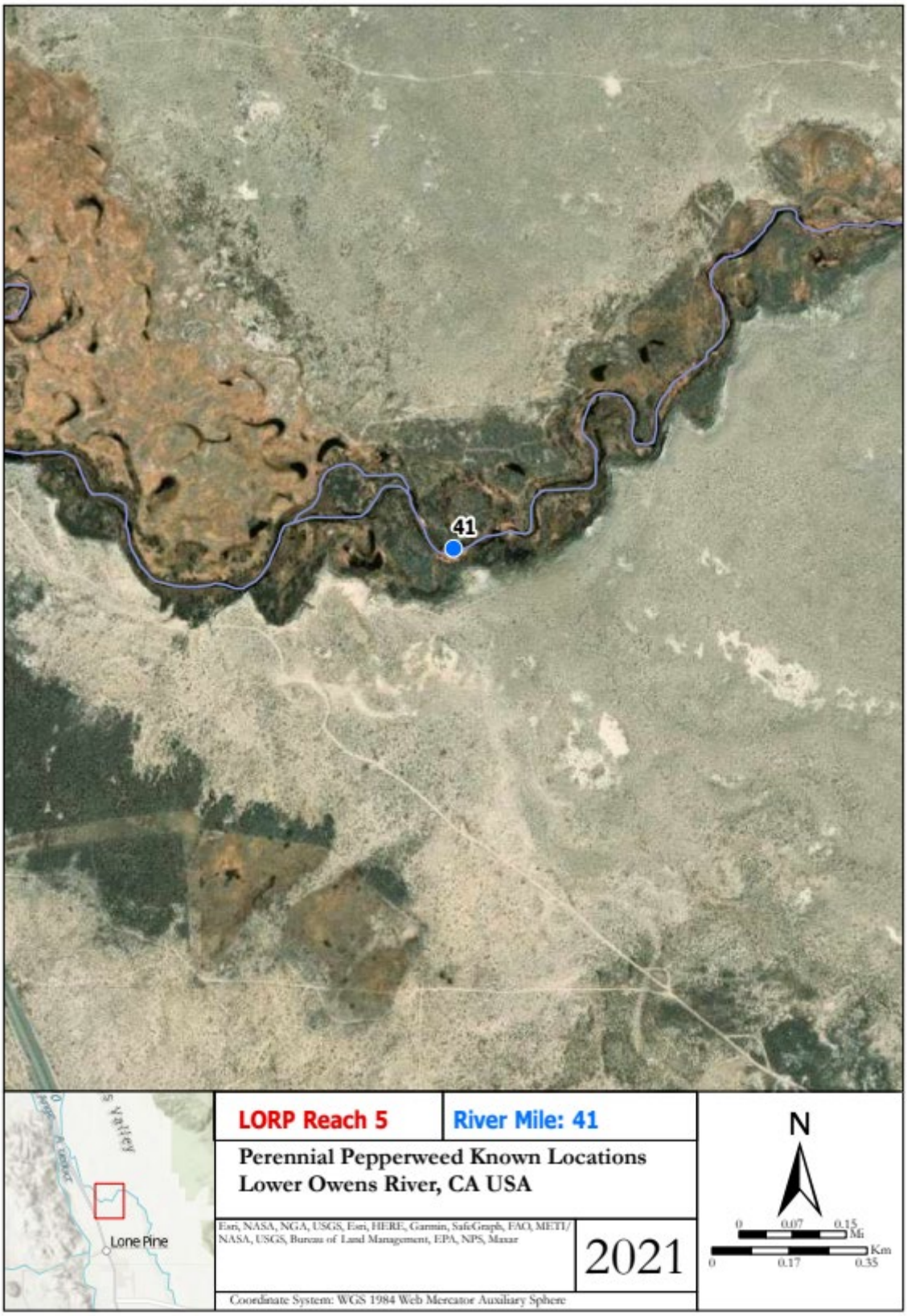

36
LORP Reach 4
River Mile: 36
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Owens Valley
N
0 0.07 0.15
Mi
Km
0 0.17 0.35


37
38
LORP Reach 4
River Mile: 37
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Owens Valley
Lone Pine
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


37
38
39
LORP Reach 4
River Mile: 38
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Owens Valley
Lone Pine
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


38
39
40
Owens Valley
Lone Pine
LORP Reach 5
River Mile: 39
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

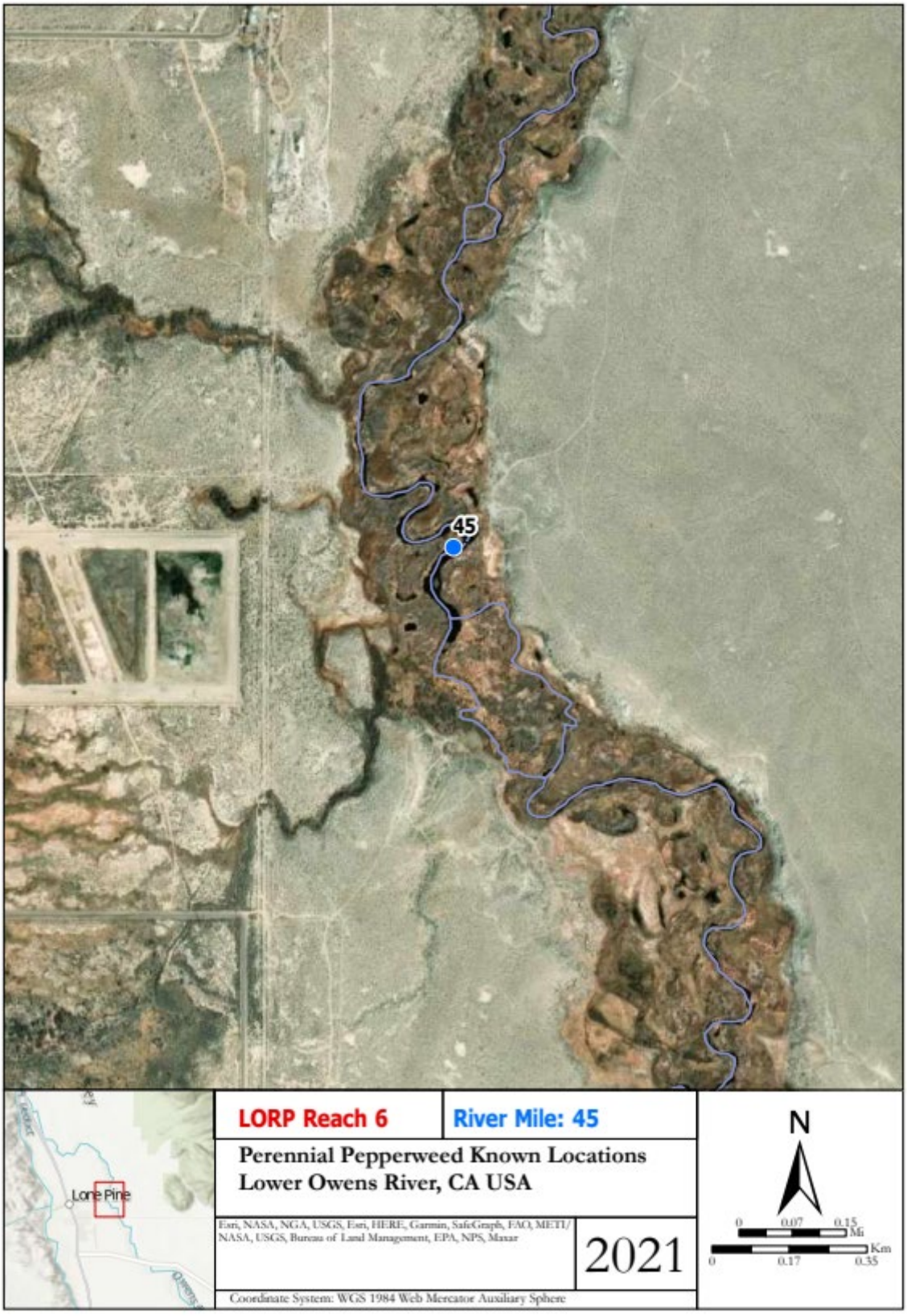

39
40
LORP Reach 5
River Mile: 40
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Lone Pine
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


41
LORP Reach 5
River Mile: 41
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Lone Pine
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

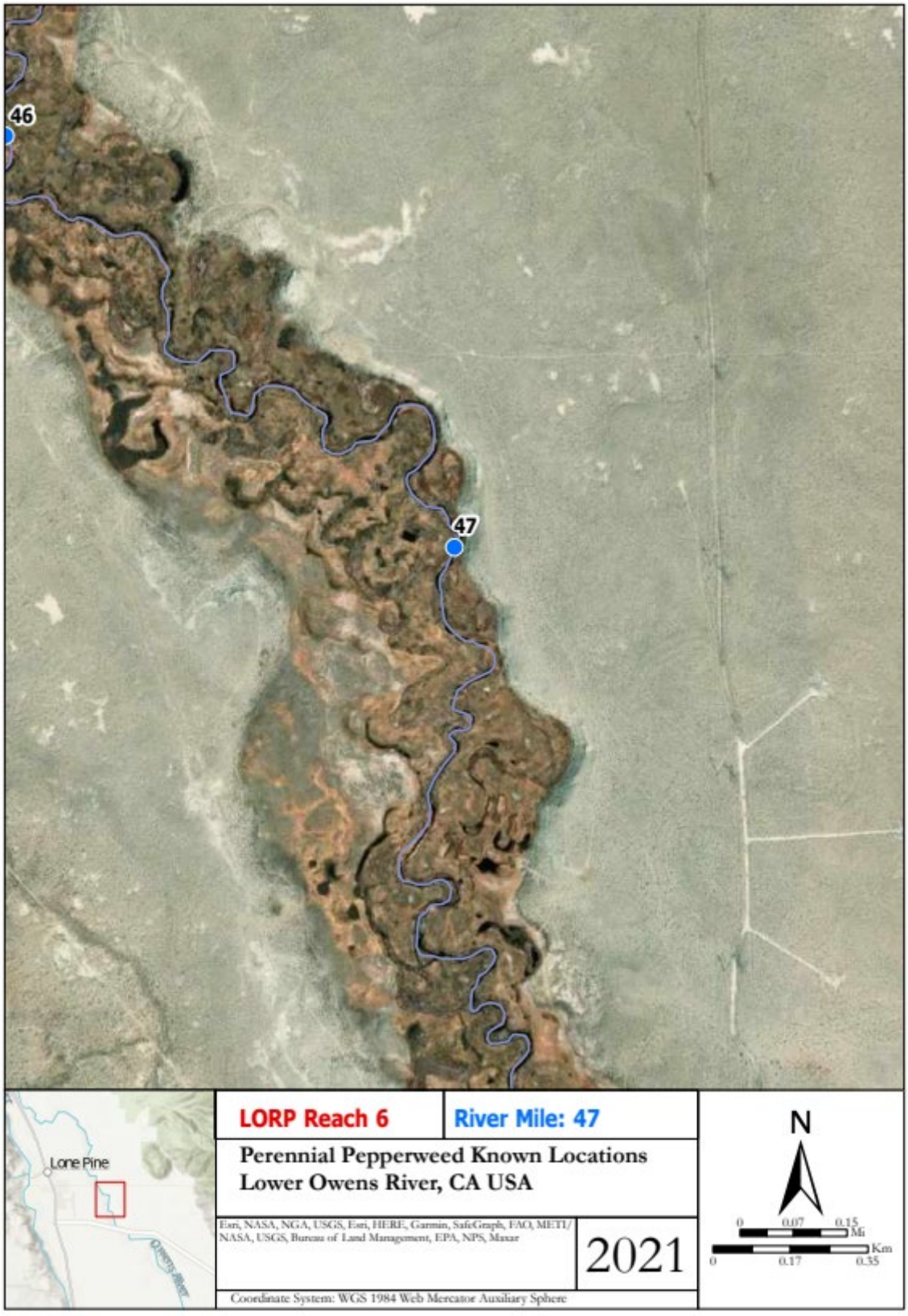

42
Owens Valley
Lone Pine
LORP Reach 5
River Mile: 42
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km

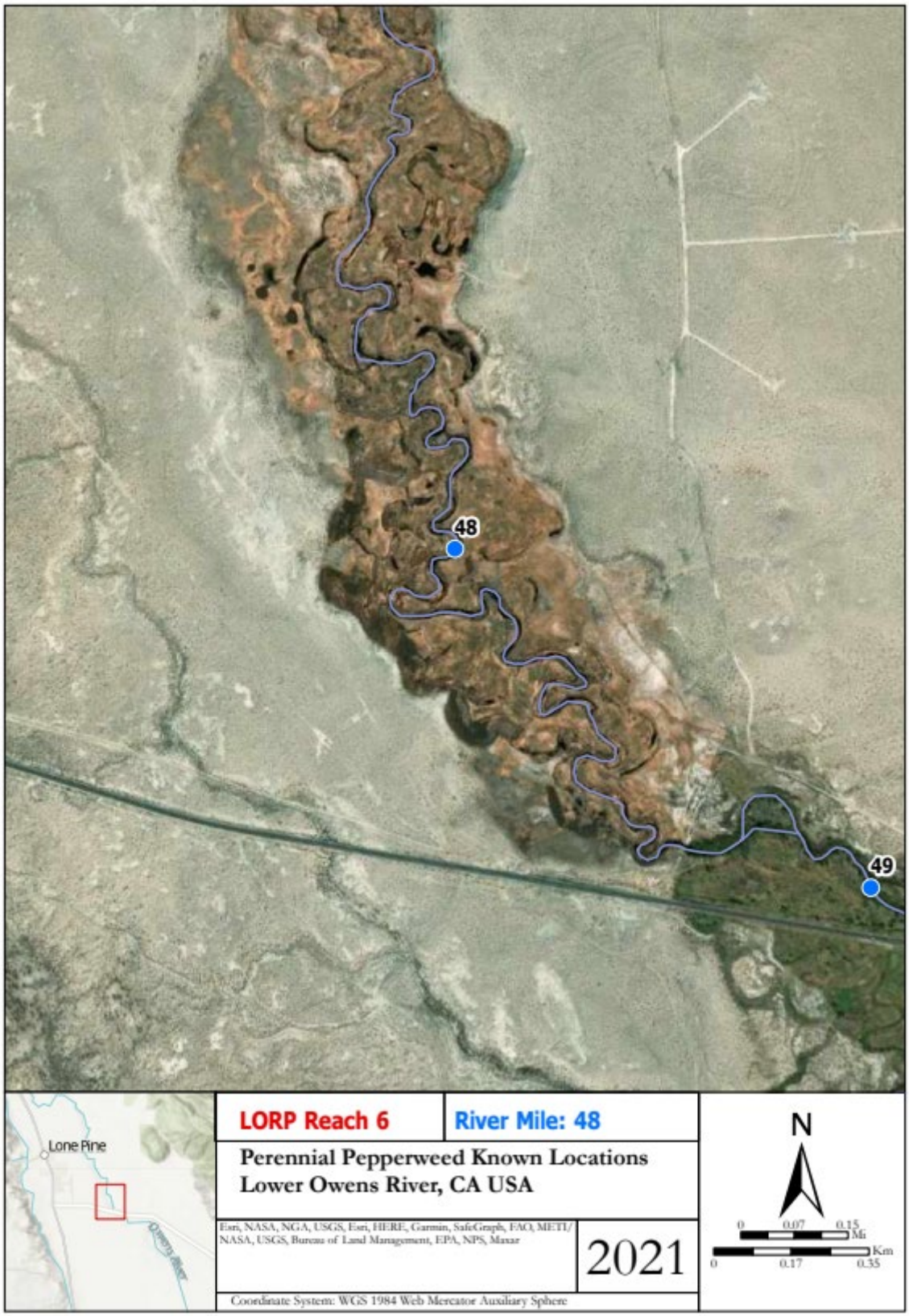

43
Valley
Lone Pine
LORP Reach 6
River Mile: 43
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

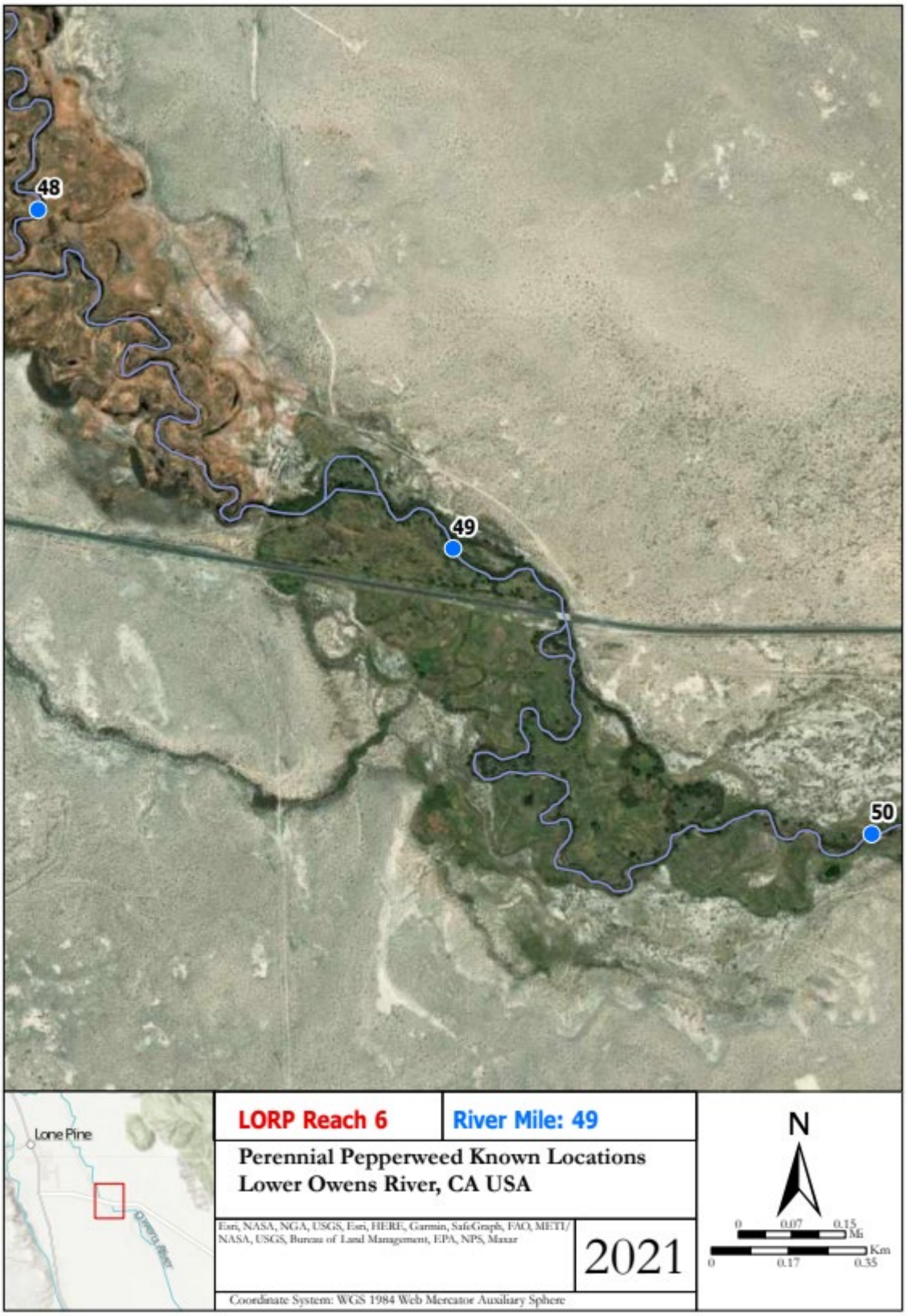

44
Lone Pine
LORP Reach 6
River Mile: 44
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


45
Lone Pine
LORP Reach 6
River Mile: 45
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


46
47
Lone Pine
LORP Reach 6
River Mile: 46
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


46
47
Lone Pine
LORP Reach 6
River Mile: 47
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km

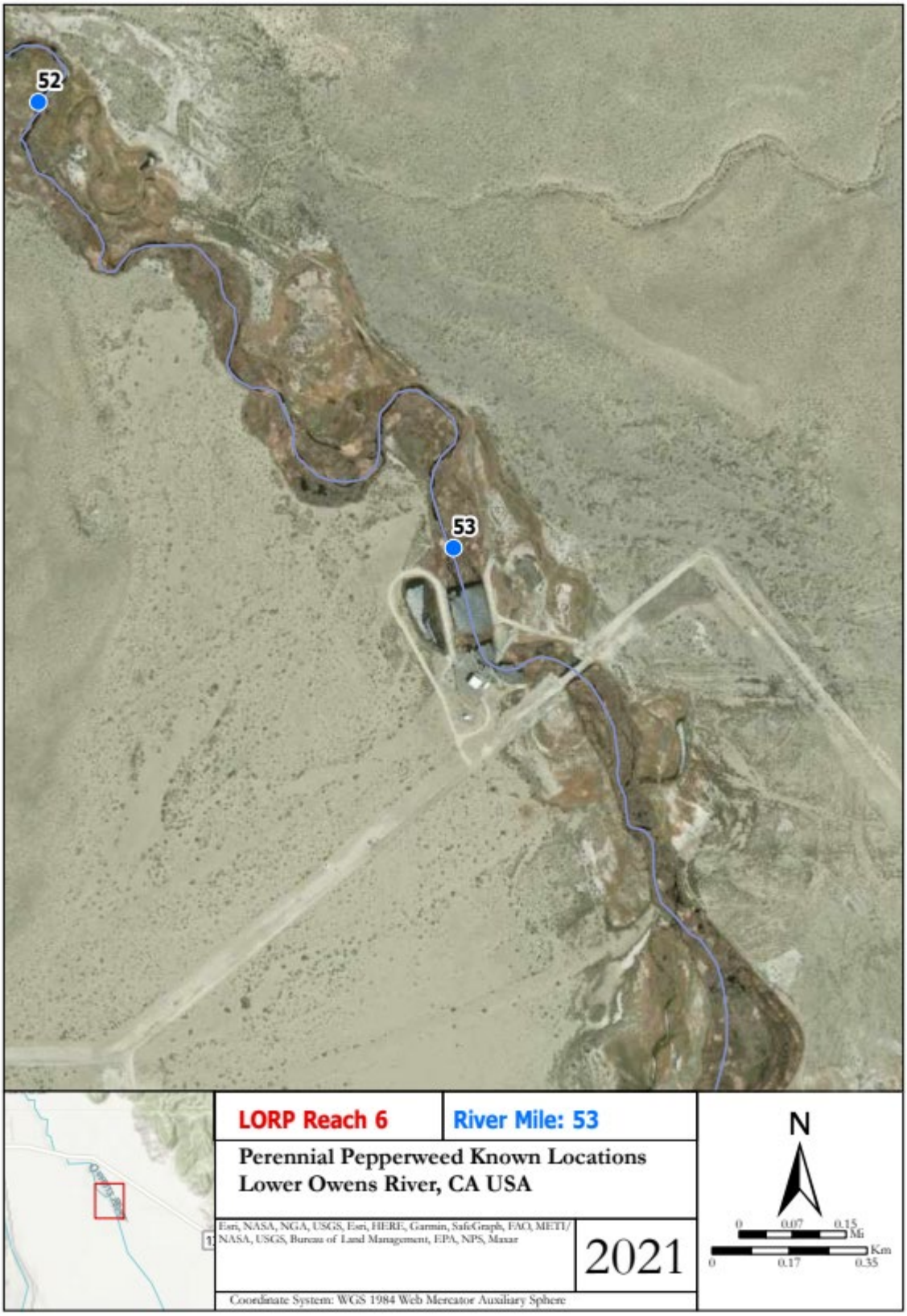

48
49
Lone Pine
LORP Reach 6
River Mile: 48
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


48
49
50
Lone Pine
LORP Reach 6
River Mile: 49
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


49
50
Lone Pine
LORP Reach 6
River Mile: 50
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15 Mi
0 0.17 0.35 Km


51
Lone Pine
LORP Reach 6
River Mile: 51
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35


52
53
Lone Pine
LORP Reach 6
River Mile: 52
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


52
53
LORP Reach 6
River Mile: 53
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0
0.07
0.15
Mi
0
0.17
0.35
Km


54
River Mile: 54
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
Km
0 0.17 0.35


55
136
River Mile: 55
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/
NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


56
River Mile: 56
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
136
N
0 0.07 0.15
Mi
0 0.17 0.35
Km


57
River Mile: 57
Perennial Pepperweed Known Locations
Lower Owens River, CA USA
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, SafeGraph, FAO, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, Maxar
2021
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
136
N
0 0.07 0.15 Mi
0 0.17 0.35 Km

# Blackrock Waterfowl Management Area
# Interim Management and Monitoring Plan

## Introduction

To improve conditions in the Lower Owens River Project (LORP) Blackrock Waterfowl Management Area (BWMA), the Los Angeles Department of Water and Power (LADWP) and Inyo County Water Department (ICWD) have worked cooperatively to develop this Interim Management and Monitoring Plan. This 5-year interim plan will be monitored and assessed both for its capacity to create desired habitat conditions, as well as to determine the suitability and sustainability of the new management approach.

The BWMA is a natural slough that historically received seasonal or periodic inundation primarily during winter and spring. In an attempt to enhance wetland habitat for waterbirds, BWMA basins have been supplied year-round water since 2007. Year-round flooding is a significant deviation from historic conditions, and application of water throughout the growing season has resulted in wetland habitats at BWMA that are often choked with cattails and bulrush at the expense of open water. This condition has been observed in other wetland locations in the Owens Valley that are supplied year-round water. Implementation of the BWMA as prescribed, initially led to increased use by wetland birds as compared to pre-project conditions. However, the value of the created habitats declined in quality over time due to excessive growth of emergent vegetation.

Under this interim plan we hope to test if operational changes improve BWMA productivity and waterbird habitat quality and limit cattail and bulrush growth. The approach to increasing habitat quality and habitat productivity is two-fold, and involves 1) seasonal flooding to control the growth of emergent vegetation thereby increasing open water habitat, and 2) implementing moist soil management techniques to enhance the growth of plant species that provide direct or indirect food resources for migratory waterbirds. At the end of the 5 years, the interim program will be evaluated and future recommendations presented.

## Background and Historical Setting

The BWMA is one of four physical features of the large scale river restoration project known as the LORP (LADWP, USEPA, and ICWD 2004). The BWMA encompasses a large natural slough with basins physically connected by channels. The basins are of low relief and punctuated in some areas by high spots that create small islands under periods of flooding. The topography, soil types (USDA-NRCS 2002) and pre-European cultural use adjacent to the current management units indicate that the area functioned as a natural wetland for several millennia. Historically, prominent sources of surface and ground water in the BWMA area included Blackrock and Little Blackrock Springs, seepage along the Owens Valley fault, and seasonal discharge from Sierra creeks

including Sawmill, Thibaut, Oak, and Independence (Whitehorse Associates 2004). Construction of the Los Angeles Aqueduct interrupted flow from these sources to the BWMA (Whitehorse Associates 2004).

The principal sources of water for the BWMA are now the Blackrock Ditch and diversions off of the Los Angeles Aqueduct. In the mid-20th century, prior to the construction of the Blackrock Ditch, aerial photography (Figure 1) indicates that the BWMA continued to function as wetlands with some limited irrigation on the Winterton Unit (LADWP 1944).

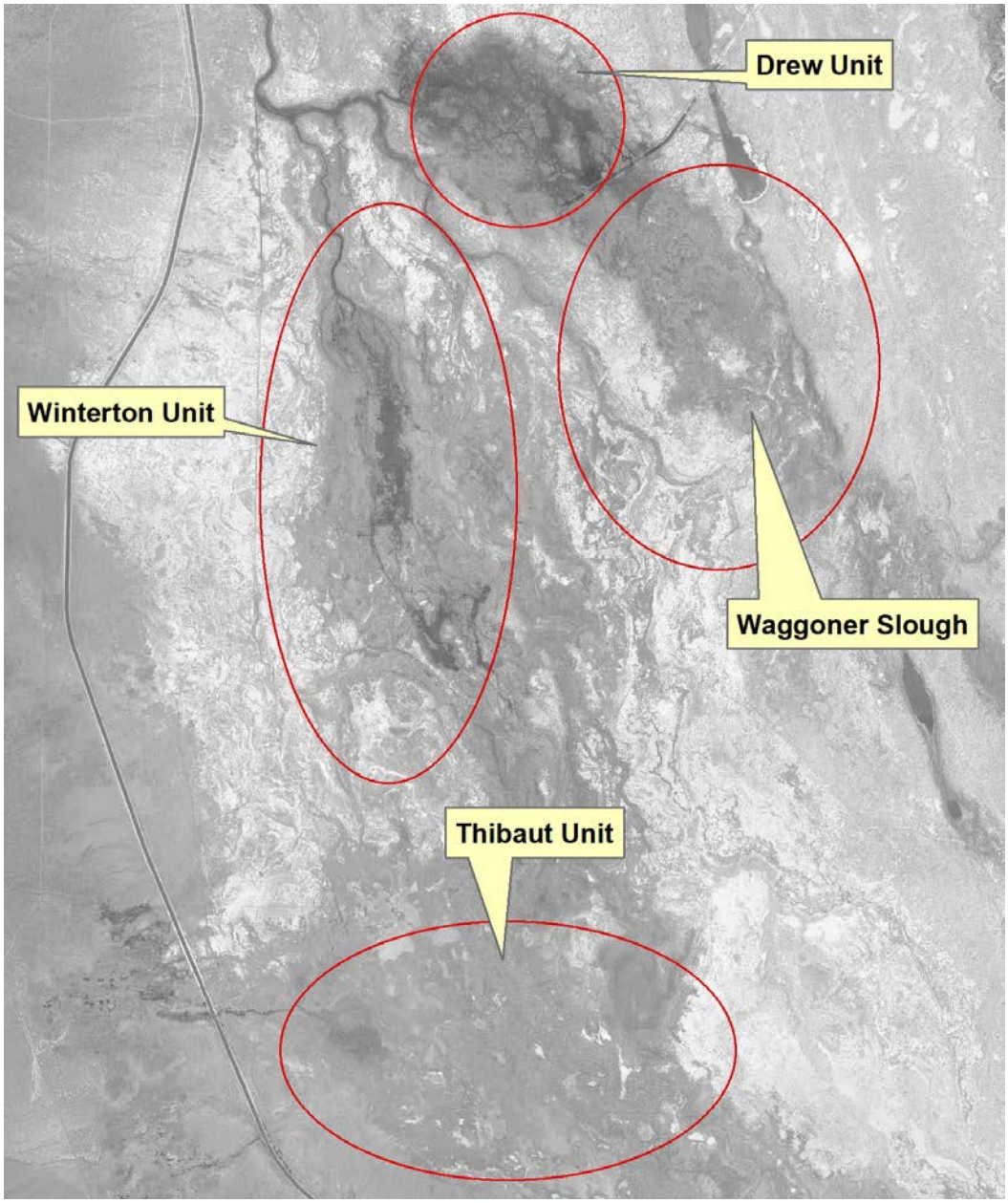



*Figure 1. Map depicting approximate locations of BWMA Units on 1944 aerial photo.*

Starting in the 1960's, water was spread in the BWMA during high runoff years and when operational needs required, such as during maintenance on the Los Angeles Aqueduct. To accomodate water spreading, LADWP has constructed dikes, levees, ditches, roads, and basins within the BWMA area.

When incorporated into the LORP, the BWMA was divided into four management units: Drew, Waggoner, Winterton, and Thibaut. All these units were mapped as marshlands in 1905 (USGS 1919) (Figure 1). Under the LORP, the primary management objective for these wetland units is to create and maintain diverse natural habitats consistent with the needs of "habitat indicator species" (MOU 1997). These species include waterfowl, wading birds, shorebirds, and marsh-dwelling species such as rails, bitterns, and Marsh Wren.

## BWMA Goals and Management Under the LORP

Since 2007, BWMA has been operated following management described in the Final Environmental Impact Report and Environmental Impact Statement - Lower Owens River Project (LORP EIR/EIS; LADWP, USEPA, and ICWD 2004), and the 1997 Memorandum of Understanding (MOU) between LADWP, the County of Inyo (County), California Department of Fish and Wildlife, California State Lands Commission, Sierra Club, and Owens Valley Committee.

The MOU describes goals sought at BWMA:

> *The goal is to maintain this waterfowl habitat area to provide the opportunity for the establishment of resident and migratory waterfowl populations as described in the EIR and to provide habitat for other native species. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for the Blackrock Waterfowl Habitat Area. These habitats will be as self-sustaining as possible.*

The MOU prescribes water management to achieve these goals:

> *Approximately 500 acres of the habitat area will be flooded at any given time in a year when the runoff to the Owens River watershed is forecasted to be average or above average. In years when the runoff is forecasted to be less than average, the water supply to the area will be reduced in general proportion to the forecasted runoff in the watershed. (The runoff forecast for each year will be DWP's runoff year forecast for the Owens River Basin, which is based upon the results of its annual April 1 snow survey of the watershed.) Even in the driest years, available water will be used in the most efficient manner to maintain the habitat. The Wildlife and Wetlands Management Plan element of the LORP Plan will recommend the water supply to be made available under various runoff conditions and will recommend how to best use the available water in dry years.*

*The amount of acreage to be flooded in years when the runoff is forecasted to be less than average will be set by the Standing Committee based upon the recommendations of the Wildlife and Wetlands Management Plan and in consultation with DFG.*

The LORP EIR/EIS refers to the MOU in describing the BWMA:

*The MOU specifies that a 1,500-acre off-river area with a mixture of pasture and wetlands be enhanced through flow and land management to benefit wetlands and waterfowl. Approximately 500 acres of the habitat area are to be flooded at any given time when runoff is forecasted to be average or above average with reductions in water supplies in less than average runoff years. The proposed flooding will increase wetland productivity and diversity, which is consistent with the approach described in the LORP Plan. The management units would be subject to periodic cycles of wetting and drying so that one to three management units would be wholly or partially flooded at any given time. Various physical improvements to existing ditches, berms, and spillgates will be necessary to manage water conveyance and flooding in the management units.*

In compliance with these directives, water has been released year-round to flood up to 500 acres of the BWMA at any given time throughout the year when runoff is forecasted to be average or above-average. Reductions in water supplies and concomitant acreages have occurred during less than average runoff years as prescribed (2009-2015, Table 1).

As part of the overall management strategy for the BWMA presented in the LORP EIR/EIS, the flooded cells were intended to be managed to "maintain the ratio of open water wetland to emergent wetland so that emergent wetlands do not exceed about 50 percent of the flooded area of any management unit" (Section 2.5.3). While there was a proposed flooding regime provided in the LORP EIR/EIS (Section 2.5.4), the BWMA has been managed since implementation to achieve required flooded acreage. Units could remain indefinitely active or inactive as long as flooding met the MOU criteria of an annual fixed amount of acreage based on the water year and the active unit remained flooded year-round (LADWP, USEPA, and ICWD 2004).

Over the last 14 years, the Waggoner Unit has been active three years, the Thibaut Unit five years, the Winterton Unit nine years, and the Drew Unit ten years (Table 1). The running average of flooded extent in all years (2007-2020) is 370 acres. Active-status (flooded) units have maintained year-round continuous flooding for a minimum of two years, with the exception of Winterton which was flooded for a single year in 2011-12. The Drew Unit, which has been used more than others, was continually flooded for six straight years As described in the LORP EIR/EIS (page 2-43), the original intent was to flood the Drew Unit only when needed to create additional acreage to meet the 500-acre MOU requirement or to better meet MOU habitat goals.

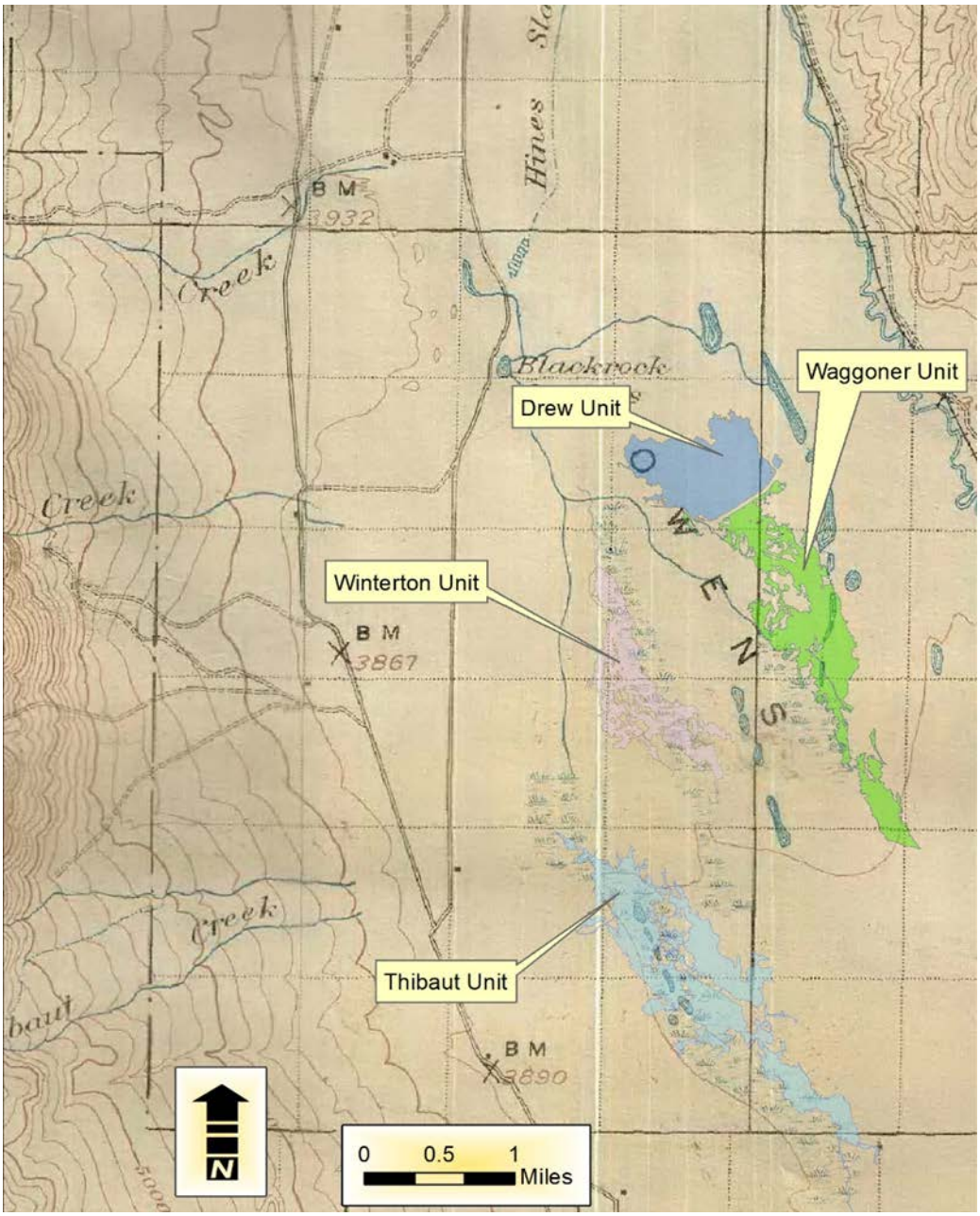



*Figure 2. BWMA Units in relation to wetlands mapped by the USGS in 1905 (USGS 1919).*

*Table 1. BWMA Flooded Acreage by Year since LORP Implementation*

| Blackrock Waterfowl Management Area | | | | |
|---|---|---|---|---|
| **Runoff Year** | **Runoff Forecast (% normal)** | **Flooded Acreage Requirement** | **Cells Flooded** | **Average Acreage Flooded** |
| 2007-2008 | 58% | 290 | Winterton and Thibaut | 477 |
| 2008-2009 | 86% | 430 | Winterton and Thibaut | 494 |
| 2009-2010 | 71% | 355 | Drew and Waggoner | 385 |
| 2010-2011 | 95% | 475 | Drew and Waggoner | 669 |
| 2011-2012 | 150% | 500 | Drew and Winterton | 480* |
| 2012-2013 | 65% | 325 | Drew | 327 |
| 2013-2014 | 54% | 270 | Drew | 308 |
| 2014-2015 | 50% | 250 | Drew | 275 |
| 2015-2016 | 36% | 180 | Winterton | 234 |
| 2016-2017 | 71% | 355 | Winterton and Thibaut | 530 |
| 2017-2018 | 197% | 500 | Winterton and Thibaut | 700+ |
| 2018-2019 | 78% | 390 | Winterton and Drew | 423 |
| 2019-2020 | 137% | 500 | Winterton, Drew, and Thibaut | 500+ |
| 2020-2021 | 74% | 370 | Winterton and Drew | TBD |

**flooded acres ranged between 372-539 acres*

## 2019 Evaluation Report

The LORP EIR/EIS (Section 2.5.4) recommended a review of BWMA flooding cycles 10 to 15 years following LORP implementation. The review is undertaken to determine if modifying the flooding regime can improve the project and bring it closer to achieving MOU goals.

The BWMA was reviewed by LADWP and Inyo County in the LORP 2019 Evaluation Report. The evaluation included a review of the effectiveness of BWMA management that has been conducted according to the year-round flooding regime prescribed in the 1997 MOU and LORP EIR/EIS. The focus of the review was on habitat indicator species use.

The evaluation concluded that continuous year-round flooding resulted in excessive and aggressive growth of emergent vegetation leading to reduced open water habitat, static water conditions, and a decrease in waterbird use. While the evaluation noted that habitat indicator species continue to use BWMA, continuous inundation has resulted in the dominance of late successional wetland vegetation and significantly reduced

suitable habitat for indicator species and migrating waterbirds. Observed ramifications of static, year-round flooding have also been discussed in detail in LORP Annual Reports (LADWP and County of Inyo 2019, 2018, 2017, 2016, 2015). The integration of seasonal flooding at BWMA was first conceptualized at the 2014 LORP River Summit.

## Actions Undertaken to Date

LADWP has implemented several approaches to address vegetation encroachment by preparing units prior to flooding. Prescribed burns were conducted in the Drew and Waggoner Units in 2009, in the Winterton Unit in 2010, and most recently in the South Winterton Unit in 2019. In 2012, approximately 100 acres of cattail and bulrush root mats on the Winterton Unit were tractor disced. These aggressive and expensive vegetation management efforts resulted in only very short-term control as subsequent year-round flooding, specifically during the growing season, erased virtually any benefits derived from the site preparation activities.

## Interim Management Plan Overview and Habitat Objectives

To address project shortcomings identified in the evaluation, LADWP and ICWD propose a five-year Interim Management and Monitoring Plan. We intend to apply an approach to wetland management used throughout the west, and although used primarily for migratory waterfowl habitat management, will also benefit shorebirds by creating more open water areas and mudflats. This approach involves managing vegetation by providing seasonal rather than year-round flooding and enhancing forage for indicator species through moist soil management. We will monitor progress and use collected data to compare the effectiveness of the new management approach against past practices.

The main components of the plan are to:

(1) Implement a seasonal flooding regime in which sustained flooding occurs from fall through mid-spring with a drawdown during the summer growing season. Units will be flooded beginning September 15th with a complete drawdown by May 1st. Seasonal flooding will enhance habitat by suppressing the growth of cattails and bulrush, and thus maintaining more open water.

(2) Discontinue varying annual flooded acreage targets based on the projected runoff, and flood a fixed 500 acres each year with ramping-up to begin September 15th and ramping-down to start after March 1$^{st}$ with complete dry down by May 1st. Wetted acreage measurements will occur on or around November 1 and March 1, with the average of those two measurements being used to determine the flooded acreage number. If the average value is above or below the 500 acre number, releases in subsequent years will be adjusted to more accurately meet the 500 acre

target. The Waggoner and Winterton Units will continue to be supplied from Blackrock Ditch and the Thibaut Unit from the Los Angeles Aqueduct, as has been past practice.

(3) On identified portions of active units and in areas where drawdown has occurred quickly, implement “moist soil management” by providing a rapid early summer ‘irrigation’ pulse of water to increase soil moisture. The objective of this irrigation release is to sustain the growth and seed set of desirable early-seral plant species that directly or indirectly provide food for migrating waterbird populations.

Effectiveness monitoring will include documenting the flooded acreage, vegetation assessments to evaluate moist soil management implementation, and waterbird surveys to determine use by indicator species.

## Habitat Objectives of Interim Plan

### Create and maintain open water habitat

Waterfowl and shorebirds primarily feed and rest in open water, mudflat, or areas of open vegetation. Wading birds will also feed in meadow, low marsh, or open cattail marsh situations. Dense homogenous stands of vegetation reduce feeding opportunities and restrict movement. Seasonal flooding in fall, winter, and spring rather than year-round is an effective way to control the growth of emergent vegetation in the Owens Valley and improve habitat management efficiency. The LORP FEIR (LADWP, USEPA and ICWD 2004) has as an objective to “maintain a ratio of open water wetlands to emergent wetlands so that emergent wetlands do not exceed 50 percent of the flooded area of any management unit” (Section 2.5.3). A 50:50 ratio of open water to emergent wetlands is consistent with the concept of the “hemi-marsh” (Weller and Spatcher 1965) where species richness and density was found to be greatest compared with other proportions of vegetative cover to open water. Wetland managers often replicate the physical appearance of hemi-marshes by intensely managing vegetation (Euliss, Jr. et al. 2008), however open water alone will not necessarily create productive conditions. Hydrologic processes of wet and dry cycles, or employing moist soil management are also needed to produce food resources for migratory birds.

### Increase wetland productivity for migratory waterbirds using moist soil management concepts

Forage availability is as important as the availability of open water to attracting and maintaining waterbird populations. Moist soil management is the management of water drawdown rate and timing in order to promote the growth of desirable plants on mudflats that will be subsequently reflooded (Mississippi River Trust et al. 2007). The ability to manipulate forage composition, production, and open water habitat through seasonal flooding is regarded as the most effective tool available to land managers in California

and elsewhere in the United States for managing migratory waterbird habitats (Fredrickson and Taylor 1982; Smith et al. 1995). Manipulating plant succession and site hydrology are the mechanisms used to reach moist-soil management objectives.

Moist soil management guidelines have been developed and implemented in other parts of the U.S., but there is limited information available for use in the Intermountain West. Plant species often cited as “target” species for waterfowl either do not occur in Owens Valley, or are weedy and undesirable here. Therefore, LADWP and ICWD will work together to experiment with different approaches and develop techniques applicable to the BWMA and develop local information and targets for desirable species. Some general information is available regarding plant foods important to waterfowl, and these accounts will be adapted to the Owens Valley to provide guidance as we evaluate moist soil management effectiveness. Moist-soil plants both occurring in the Owens Valley and reported to be of exceptional value to wildlife by the California Waterfowl Association (2020) include smartweed (*Polygonum* sp.), beggar-ticks (*Bidens* sp.), annual Atriplex (*Atriplex* spp.), and goosefoot (*Chenopodium* spp.). Spikerush (*Eleocharis* spp.), aster, and alkali bulrush (*Bolboschoenus maritimus*) are moist-soil plants that are believed to be only moderately valuable to wildlife, but may be important in localized areas; and sweet clover, river bulrush, tuberous bulrush, bermuda grass, baltic rush, jointgrass, dock, and saltgrass are generally invasive and undesirable wetland plants (California Waterfowl Association 2020). Applying moist soil management techniques to wetland areas to support a diverse array of early seral annual and perennial plant species will also benefit shorebirds and wading birds by supporting aquatic invertebrate populations.

Waterfowl generally forage in wetland habitats, consuming plant parts, aquatic or terrestrial invertebrates, crustaceans, or small fish. Swans and geese are primarily herbivorous, and feed on roots, tubers, stems and leaves of submerged and emergent aquatics. Dabbling ducks consume both animal and plant food materials, however, the diet of many species varies seasonally as animal food sources are favored during the breeding season, and plant food sources (primarily seeds) are typically consumed in greater proportion during non-breeding periods.

Wetland plant communities provide a direct or indirect source of food for waterfowl. These community types include submergent plants (rooted plants whose vegetative material is completely underwater), floating-leaved plants (both rooted and free-floating), and emergent. Submergent plants provide a direct source of food as waterfowl will consume tubers, leafy material, or seeds of some submergent plant species. Submergent plants also support macroinvertebrate production and therefore indirectly affect food resources.

Plant species that are part of the floating-leaved community include rooted species, and free-floating aquatic plants. Free-floating plants can be more accessible to waterfowl

than submergent species, however, there are only a few floating-leaved plant species that produce waterfowl food of much value (Baldasserre and Bolen 1994). Some smartweed species (*Polygonum* spp.) and a few pondweed species (especially *Potamogeton natans*) produce seeds that are of fair to good quality for waterfowl. Despite their vernacular name, free-floating aquatic plants in the family Lemnaceae, known as duckweeds, duckmeats, or bogmats (genera: *Lemma*, *Spirodela*, *Wolffiella*, and *Wolffia*) are not important waterfowl foods. These free-floating aquatic plants do however support aquatic invertebrate production, and therefore may be consumed in small quantities as waterfowl forage for aquatic invertebrates associated with these plants.

Emergent plants primarily provide cover, but some species are key food sources. Bulrushes of the leafy triangular-stemmed type such as alkali bulrush (*Schoenoplectus maritimus*) are key food producers. Other species such as hardstem bulrush (*S. acutus*), softstem bulrush (*S. tabernaemontani*), and California bulrush (*S. californicus*) produce desirable nutlets. Cattails (*Typha* spp.) are important for cover and nesting for some species, but are not a direct food source. Grass and sedges also occur in the emergent zone, and some species are highly valuable as waterfowl foods. Species in this group that occur in this region include sedges (*Cyperus* spp.), and spikerushes (*Eleocharis* spp.). Waterfowl may eat the seeds of rushes (Family Juncacae) when available, but these species are not considered highly valuable food resources. The seeds of saltgrass (*Distichlis spicata*) may also be consumed.

Differences in soil type between and within individual units combined with variation in annual climate conditions will affect how long it will take for each unit to draw down and may influence plant species compositional differences between units. Because of the presumed variability that may be encountered, flexibility in flooding, drawdowns, and site preparation for each unit will be needed. With close monitoring, more effective management strategies may be discovered such as adjusting the maximum flooded extent further into spring and starting later in the fall, or the reverse with an earlier drawdown in the spring and an earlier maximum flooded extent in the fall. If adjustments are required, 500 acres for four months will still be adhered to.

If needed in order to maintain soil moisture, a short-term irrigation pulse will be implemented. This will be a pulse flow in late spring or early summer for a maximum of two weeks across portions of active units that have shallow water depths and would benefit from a rapid flow. This irrigation set would provide needed moisture for desirable annuals to reach seed production stage.

## Maintain Appropriate Water Depths for Waterbirds

Water depth is highly predictive of waterfowl use and is a critical consideration for effective waterfowl habitat management (Isola et al. 2000, Taft et al. 2002). Water

depths greater than 25 cm limit access to food resources for dabbling ducks, shorebirds and wading birds, whereas diving birds require approximately a minimum of 25 cm (Figure 2). Recommended water depths for dabbling ducks, shorebirds and waders in flooded units in central California are between 10 cm- 25 cm (4-10 inches) (Figure 2) (Taft et al. 2002). Managing for shallower water depths such as these will also help to conserve water and ensure better irrigation during times when warranted in the early summer.

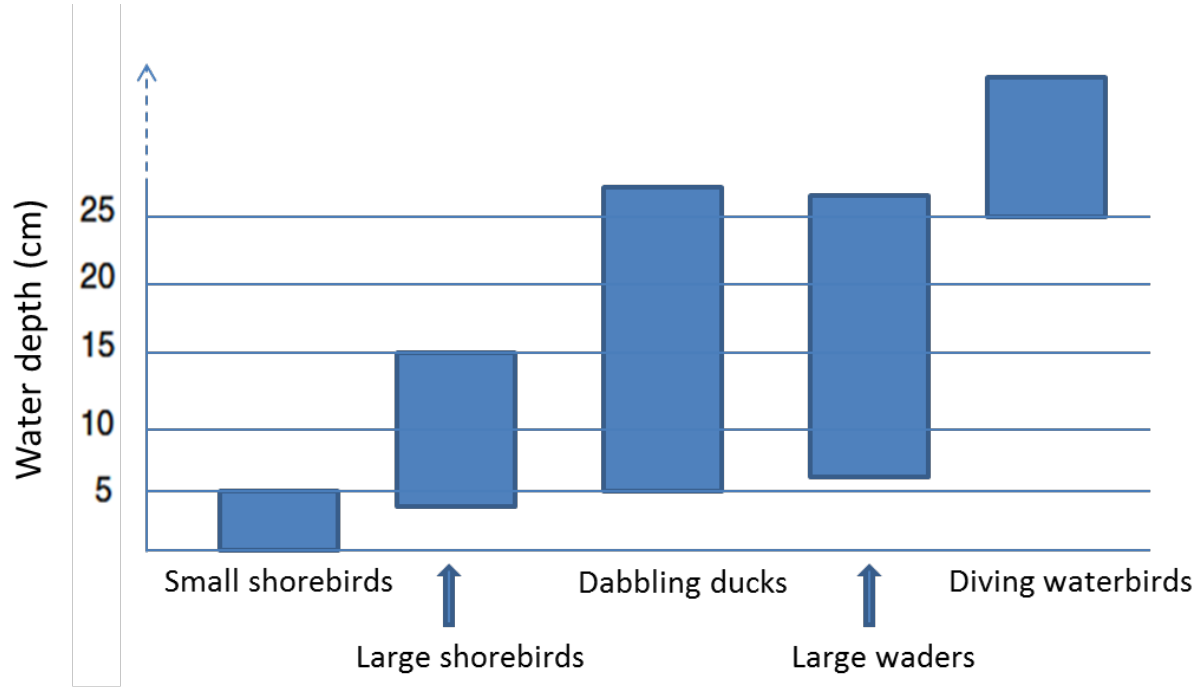



*Figure 2. Variation of water depths at foraging sites among waterbird groups Figure adapted from Ma et al (2010). Management proposed for the BWMA will target depths less than 25 cm (10 inches) preferred by shorebirds, dabbling ducks and large waders.*

This management technique was tested in the Winterton Unit in 2020. Manipulating water in shallow flooded subunits on the southeastern portion of the Winterton Unit in 2020 produced comparatively large stands of smartweed (*Polygonum sp.*) by June 15th (Figure 3). Smartweed is considered of high nutritional value for waterfowl, and is a species whose growth can be enhanced through effective water management. This water depth should provide satisfactory habitat for dabbling ducks, diving waterbirds, and waders. During the first years of implementation of the Interim Plan, active units should be evaluated to better understand the water depth variation in the units and how water depth is influencing waterbird use. In addition, opportunities to improve conditions for waterbirds by manipulating water levels and therefore depths should be considered and evaluated each August before mid-September shallow flooding.

*Figure 3. Smartweed, June 15, 2020, Winterton Unit.*

## Description of the BWMA units

### Drew Unit

The Drew Unit is located north of Blackrock Ditch and receives water from Blackrock Diversion #4. The Drew Unit is entirely within the 2,193 acre Lower Blackrock Field of the Twin Lakes Lease. The lease is typically grazed by livestock from November through mid-May. Livestock arrive in the Lower Blackrock Field in early November and are then moved to the two river pastures on this same lease. During spring, cattle are moved back into the Lower Blackrock Field and then shipped to Long Valley (Mono County) in mid-May.

The Drew Unit was burned in February of 2009 to prepare the unit for flooding. The unit has been flooded 9 out of 14 years. Table 2-14 in the LORP EIR identified 397 acres as the total management unit area for the Drew Unit (2004). The maximum acreage flooded in this unit since implementation was 334 acres in January of 2013 (Figure 4). It would be difficult to further increase acreage in the Drew Unit because additional increases in water would spill over the Blackrock Ditch berm on the south side.

The Drew Unit was dried in May 2015 and experienced extensive salt cedar (*Tamarisk ramosissima)* germination. LADWP mowed the salt cedar in late winter 2018, and the unit was then reactivated with the intent to fully submerge mowed seedlings and

eliminate them. The treatment appears to have been effective. The majority of the unit is now dominated by cattails, however.

Compared to the Waggoner and Winterton Units, colonization by cattails and bulrush tends to occur at a slower rate in the central and southern portion of the unit likely due to greater water depth. The comparatively longer duration of open water has been the primary rationale to flood this unit with greater frequency than the other three units. The northern third of the Drew Unit was originally a xeric shrub upland with aeolian sandy soils. When initially flooded, the northern portion attracted shorebirds due to its gently sloping sandy beaches interspersed with hummocky topography, but continuous flooding resulted in the formation of dense cattail marsh, eliminating shorebird habitat.

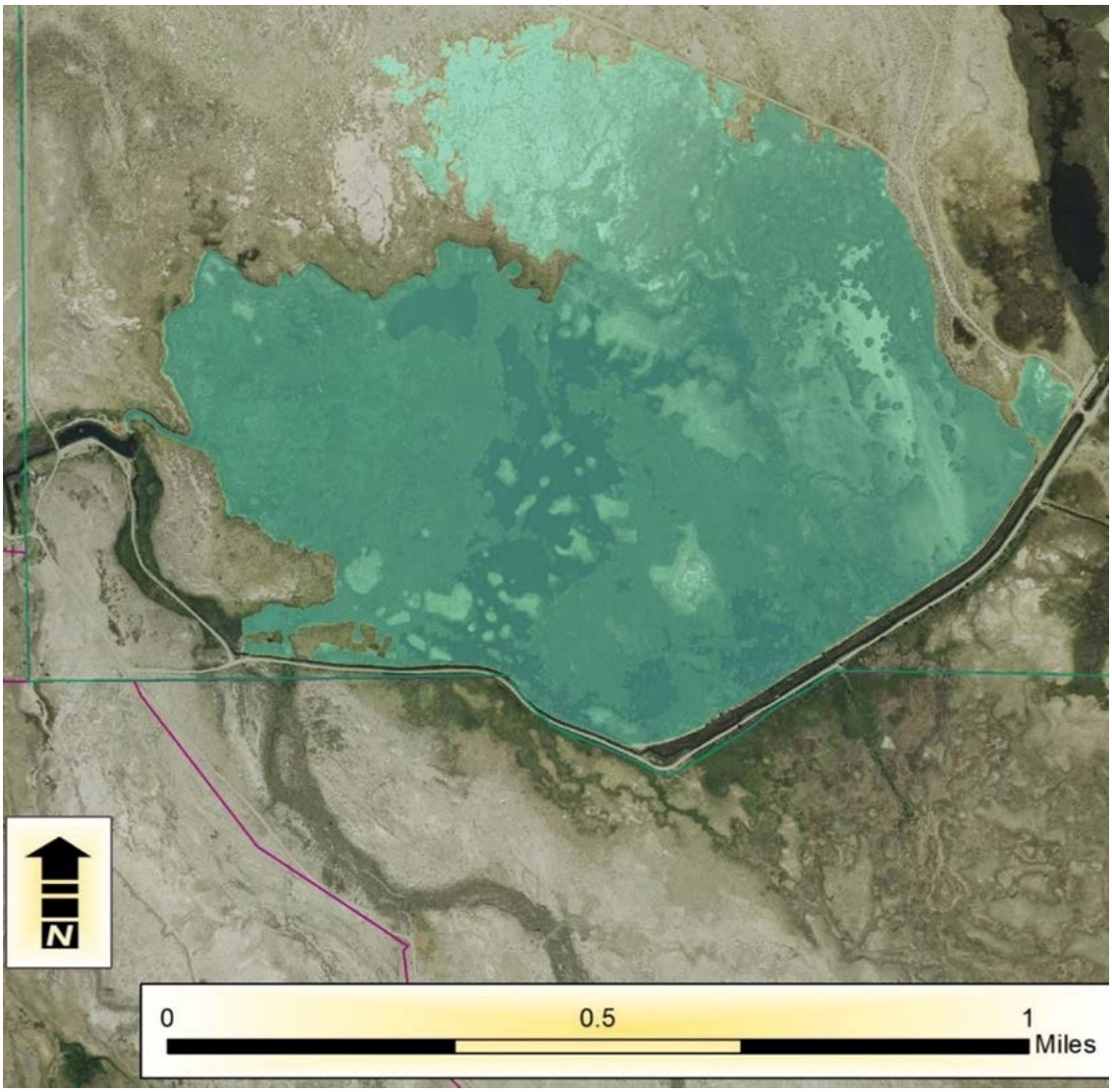



*Figure 4. Drew Unit, 330 acres, January 2013.*

The Drew Unit offers the greatest variation in water depth of any of the BWMA units, from low gradient sandy shallows in the north, to island features in the middle, to deep water toward the southern end adjoining the Blackrock Ditch.

Because of years of continuous flooding, much of the unit has been encroached upon by now dense stands of emergent vegetation (Figures 5 and 6). The deepest part of the unit, just north of the Blackrock Ditch berm, contains the most open water and is largely free of cattails and bulrush. While this deep water inhibits emergent vegetation growth, maintaining the depth is a water management challenge. The deep-water unit takes several weeks to fill and flood and is slow to dry out because of its concave shape. The Drew Unit's extended drawdown time means that saltcedar seedlings can become established before the unit dries. Therefore, the Drew Unit will not be prioritized for use in the proposed revised flooding regime.

*Figure 5. Drew Unit, northeast looking southwest, May 2010*


*Figure 6. Drew Unit, northeast looking southwest, Winter 2011*

## Waggoner Unit

The Waggoner unit is part of the 3,749 acre White Meadow Field of the Blackrock Lease. The Waggoner Unit receives water from the Blackrock Ditch. Water can be sent into the southern portion of the unit via Diversions #5, #6, #7, and #8. The LORP EIR (2004) notes 598 acres as the total management unit area for the Waggoner Unit (327 acres potential flooded area, 271 acres adjacent habitat area) (Table 2-14). This has been the least used unit in the BWMA. The unit was flooded for two consecutive years between 2010 and 2011 and flooded extent ranged between 210 and 390 acres during the two years it was active (Figure 7, Table 2). This unit is useful in that additional acreage can be gained if needed. The unit is shallow, interspersed with island features and surrounded by wet saline meadows. In 2009, due to the shallow depths across the majority of the unit, the area was rapidly colonized by cattails and bulrush by the middle of the first summer. The Waggoner Unit was flooded again during the water-spreading activities in the summer of 2017. Despite having been dry for six years, the unit was fully colonized by cattails and bulrush by the end of July in 2017. For this reason, the Waggoner Unit has not been prioritized for any site preparations for subsequent

yearlong flooding. If the unit is not flooded between June-August, it should be prioritized for discing and subsequent winter flooding. The shallow water depth should be ideal for a moist-soil management approach.

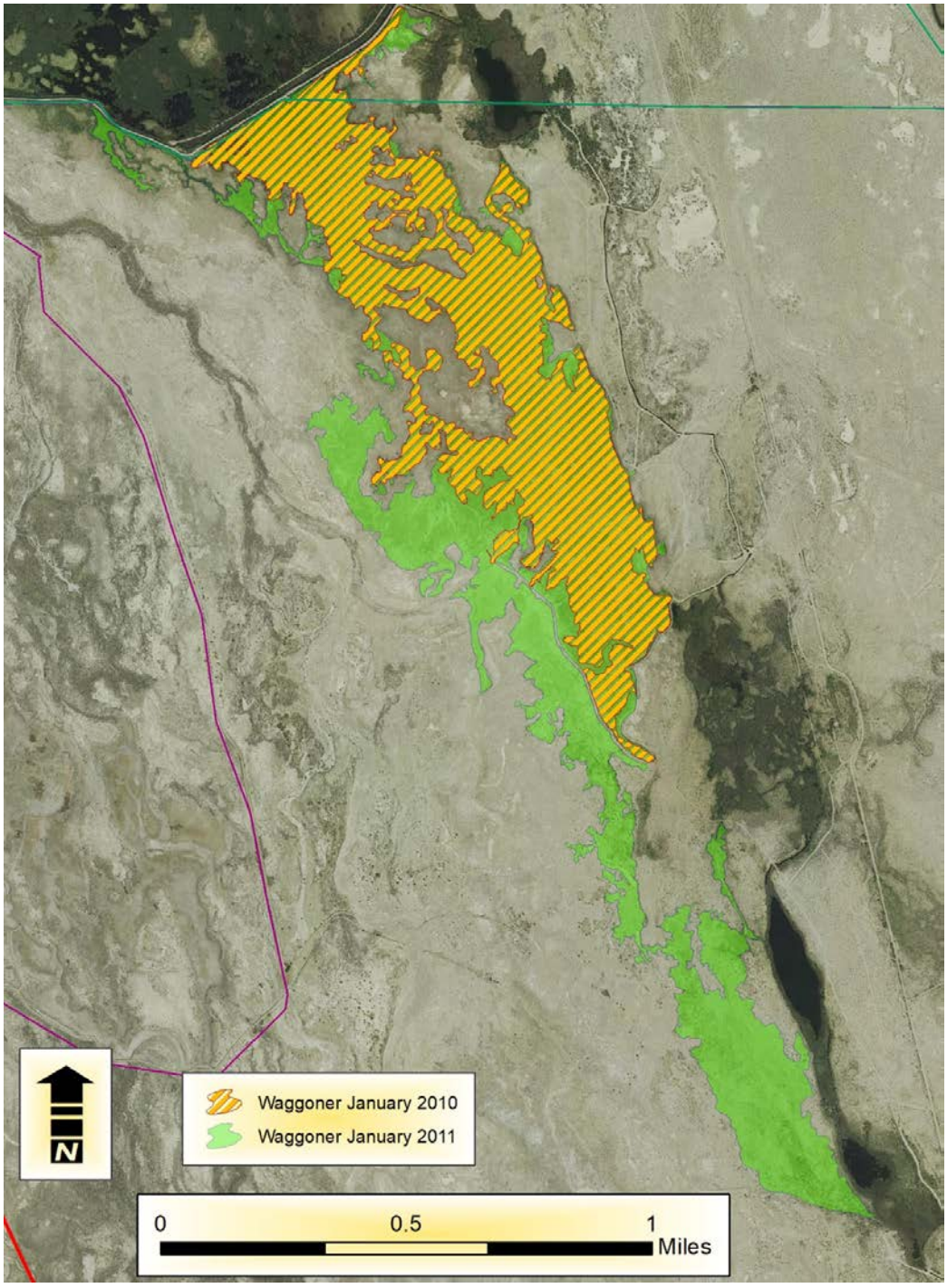



*Figure 7. Waggoner Unit flooding in January 2010 (210 acres) and January 2011 (390 acres).*

*Table 2. Measured acreages taken from active units in January from 2010 to 2020.*

| | Drew | Winterton | Waggoner | Thibaut |
|---|---|---|---|---|
| flooded ac in LORP EIR | 246 | 164 | 147 | 353 |
| Jan-10 | 333 | NA | 210 | NA |
| Jan-11 | 333 | NA | 390 | NA |
| Jan-12 | 294 | 131 | NA | NA |
| Jan-13 | 334 | NA | NA | NA |
| Jan-14 | 330 | NA | NA | NA |
| Jan-15 | 267 | NA | NA | NA |
| Jan-16 | NA | 178 | NA | 86 |
| Jan-17 | NA | 243 | NA | 494 |
| Jan-18 | NA | 200 | NA | 465 |
| Jan-19 | 285 | 99 | NA | NA |
| Jan-20 | 248 | 233 | NA | 140 |

## Winterton Unit

The Winterton Unit is located on the Blackrock Lease inside the 1,567 acre Winterton Exclosure Field. Water can be released into the Winterton Unit through Blackrock Diversion #2, Diversion #3, and Diversion #5 (Figure 8). Total management unit area was identified as 525 acres per Table 2-14 in LADWP 2004, (281 acres potential flooded area and 244 acres adjacent habitat area). Based on 13 years of measurements, the unit can flood approximately 200 acres.

The unit has been used 9 out of 14 years and is now being flooded for a sixth consecutive year. Maximum acreage was measured at 243 acres when water was released from Diversion #2 (Table 1). Most of the Winterton Unit is shallow with two deeper ponds at the lower portion of the unit. Depths of these ponds can be manipulated by a series of culverts and head gates.

The northern two thirds of the unit is very shallow and is quickly colonized by cattails and bulrush when flooded. This unit was burned in preparation for flooding in 2011 and cattails promptly recolonized by mid-summer of the first year of flooding. The unit was disced in 2015 and was again rapidly enveloped by cattails and bulrush by July of the same year (Figure 9). Similar to the Waggoner Unit, the upper 125 acres would be an optimal location for shallow flooding if discing prior to flooding, allowed to dry out during the summer, and then flooded again in the fall.

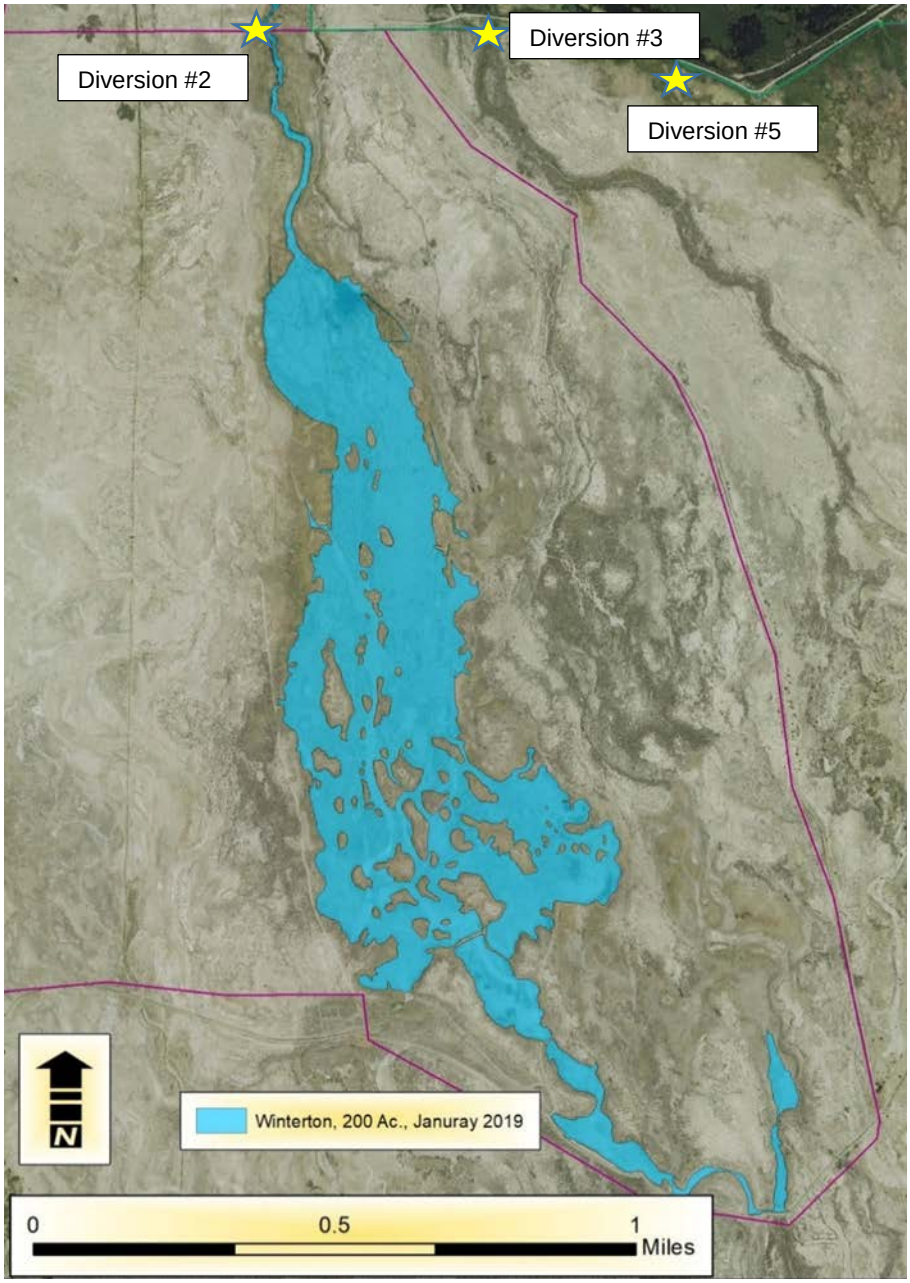



*Figure 8. Winterton Unit flooded area in January 2019 (200 acres).*

*Figure 9. Winterton Unit, September 2016, looking north. Although disced in 2015, the dark green vegetation patch is dense cattails that rapidly colonized the area following one year of continuous water application.*

## East Winterton Subunit

In January of 2020, Diversion #3 released water for approximately one month into what is called the Winterton East Unit. The flooded extent in this area was approximately 75 acres but continued to expand south after measurements were taken. Total acreage estimated at the time when water was shut off was approximately 80-85 acres. Diversion #3 was then turned off by February 1, 2020 and cattail and bulrush had not occurred in the site when evaluated in May of 2020 (Figure 10).

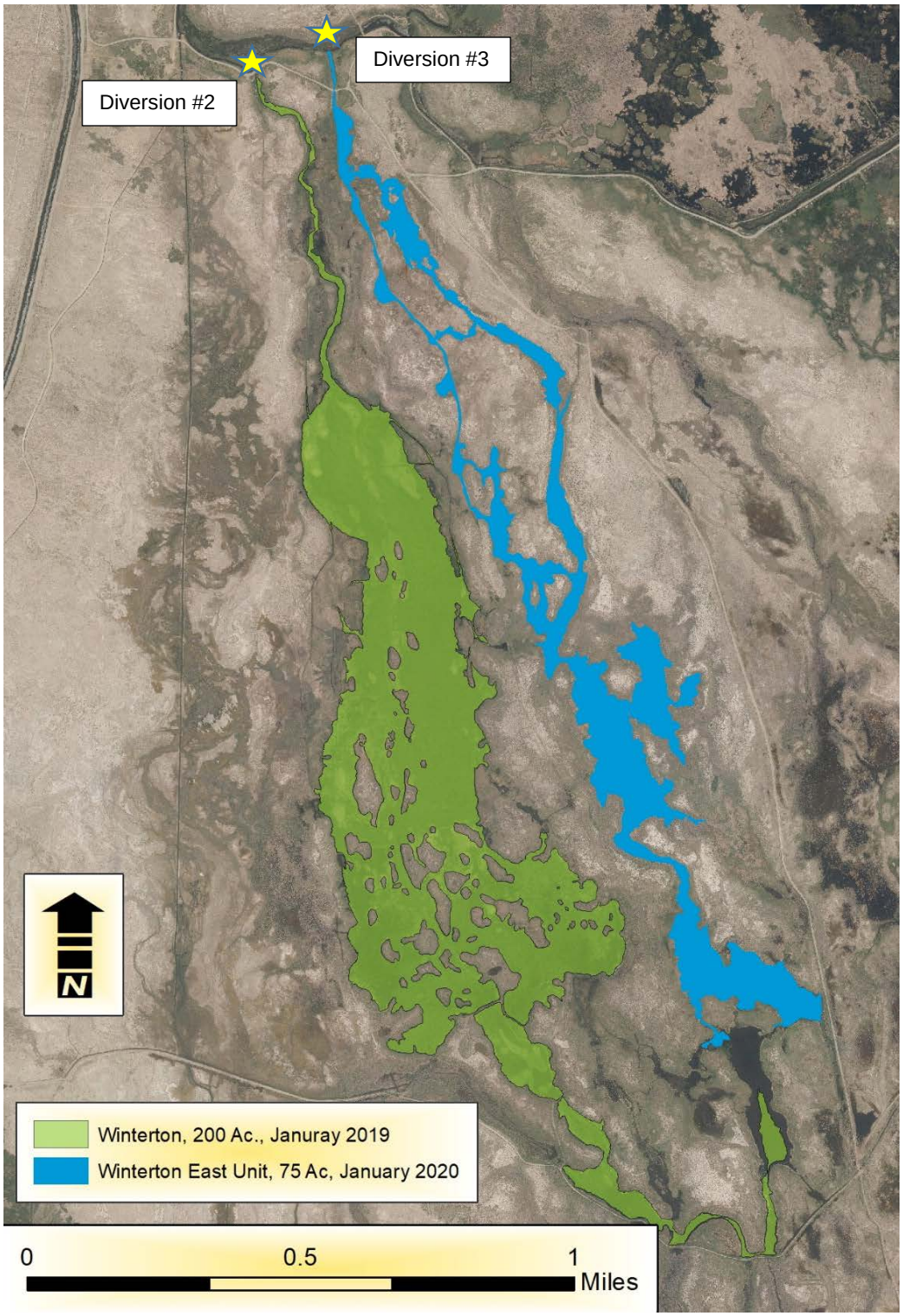



*Figure 10. Winterton East unit, January 2019 and 2020.*

## South Winterton Subunit

Accumulated water at the southern end of the main Winterton Unit can be released further south into the South Winterton Subunit (Figure 11). Flooding this open area would cover approximately 60-75 additional acres. This subunit was burned in December of 2019 in preparation to be flooded. It should not be flooded until there are assurances that the area will not receive water during the summer to prevent cattail and bulrush encroachment.

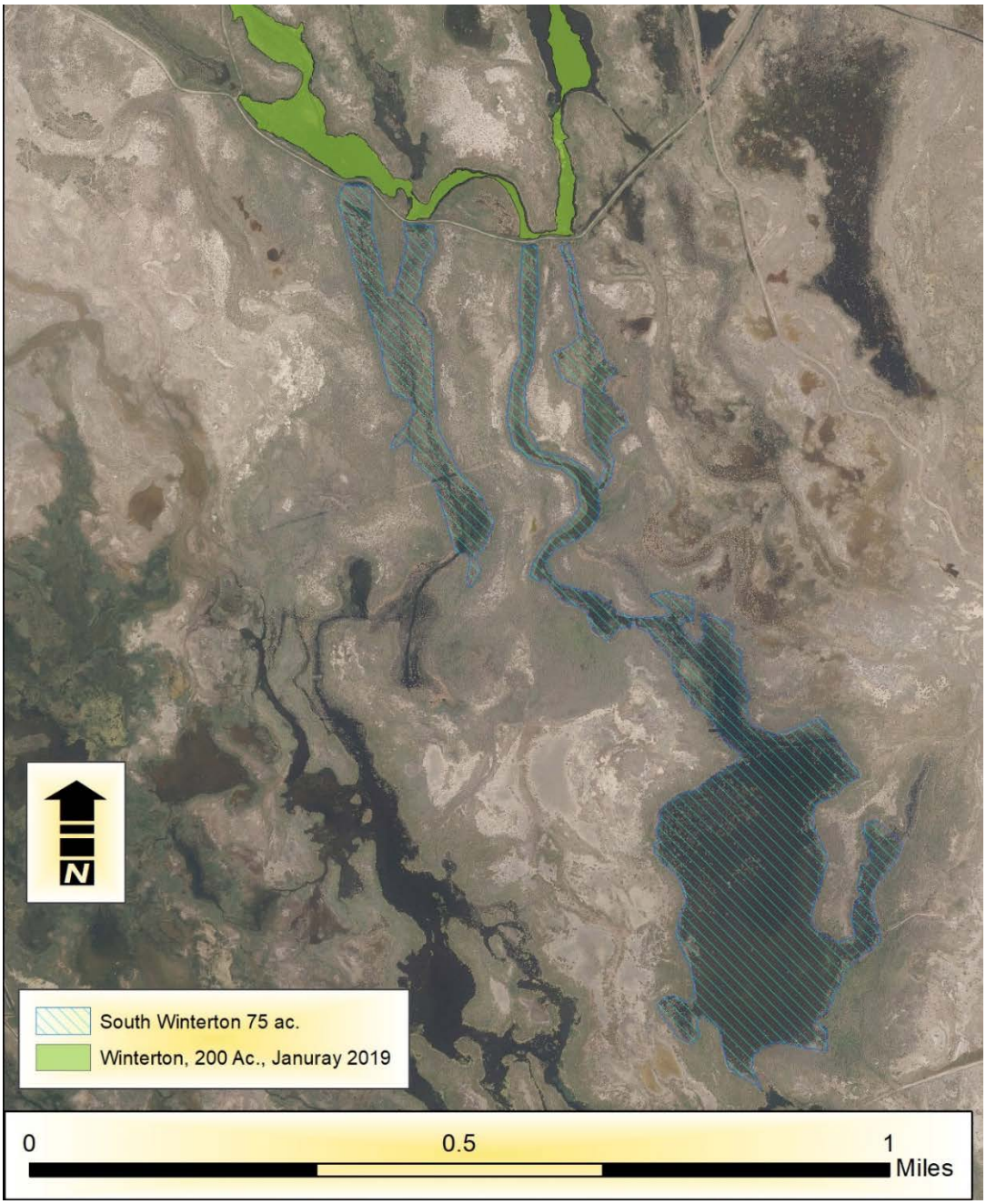



*Figure 11. South Winterton Subunit, estimated potential of 75 acres.*

The Winterton East and Winterton South Subunits should be incorporated into the future flooding regime. Utilizing these two units will create the flexibility to dry out and disc the main Winterton Unit to the north and west while still maintaining a portion of the entire Winterton Unit as active.

## Thibaut Unit

The Thibaut Unit is located on the Thibaut Lease and spans a portion of the 4,030 acre Thibaut Field. Total management unit area is noted as 1,063 acres in Table 2-14 of the LORP EIR (488 acres potential flooded area, 575 adjacent habitat area). The lease is jointly used by three pack stations to overwinter horses and mules. Animals arrive on the lease by October and typically leave in June.

The Thibaut Unit is the southernmost unit in the BWMA and historically was the largest unit with a capacity to flood to nearly 500 acres (Table 1). The unit has been used less than the Drew and the Winterton Units, being flooded 5 out of 14 years. The eastern complex of ponds have maintained open water when the unit is flooded. These ponds are reliably used by both waterfowl and shorebirds throughout the winter. In 2018, a ditch was constructed to direct flows into the aforementioned pond complex and reduce sheet flows across the saltgrass meadows on the western portions of the unit. This ditch has reduced the amount of total flooded acres but has helped maintain the large saline meadows which deteriorated when flooded prior to 2018 (Figure 12). Flows are presently directed to where they are most beneficial for migratory waterbirds.

## Livestock Grazing

All four units discussed above are situated within active grazing leases. Grazing management is guided by lease plans developed by LADWP and the lessees as part of the LORP EIR (LADWP 2004). Currently, grazing utilization for all pastures within BWMA is limited to 65%. Utilization monitoring is ongoing in each pasture and has consistently remained well below the 65% limit. Starting in June of each year, units are rested from livestock grazing for a minimum of 120 days during the growing season.

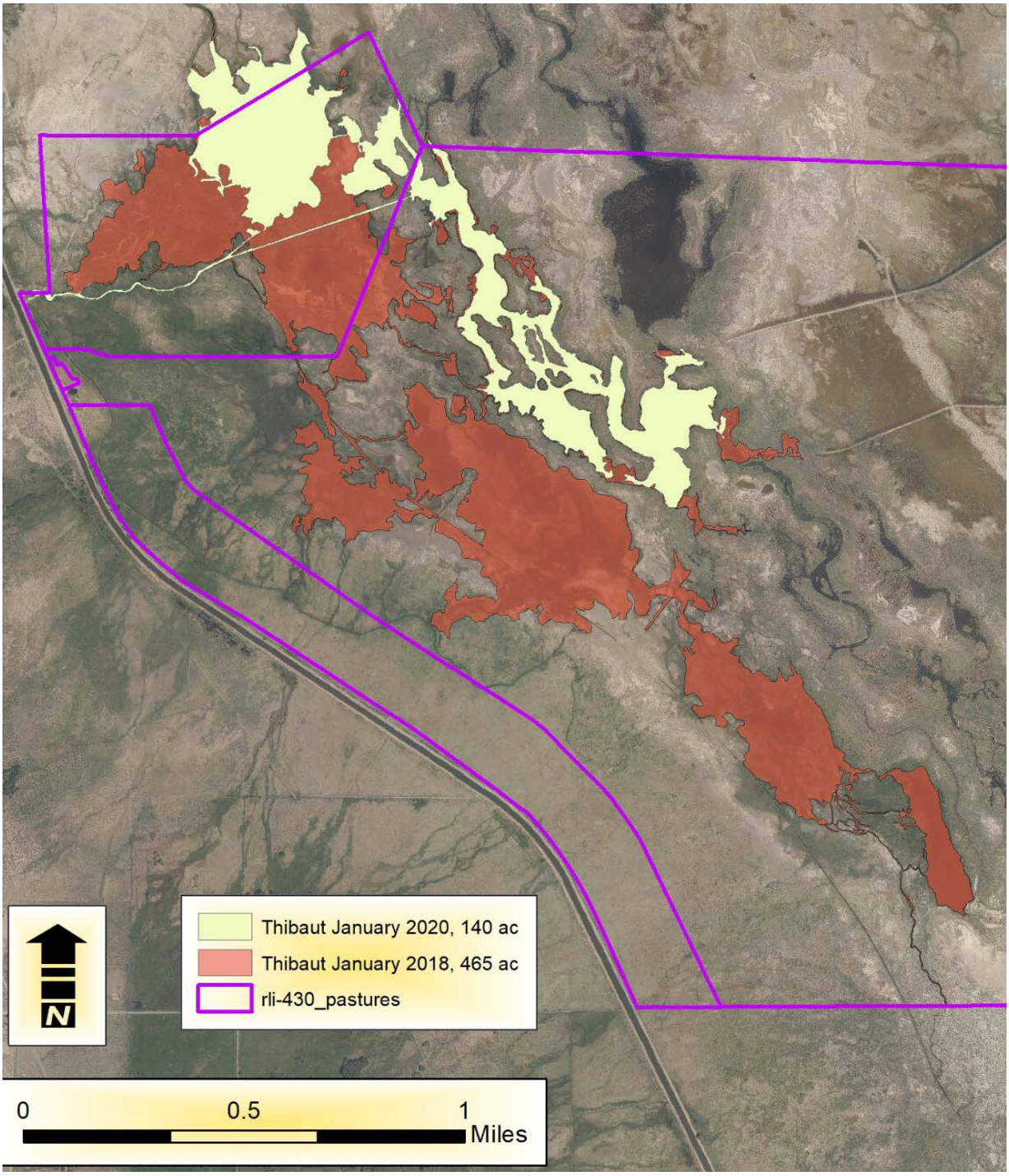



*Figure 12. Thibaut Unit, January 2018 and January 2020.*

## Proposed Interim Management Schedule

Table 3 and Figure 13 present a flooding schedule across the Winterton, Waggoner, and Thibaut Units for the five-year interim project. Acreages for flooding each unit to meet the seasonal 500-acre target during the first years will require a degree of adjustment as LADWP transitions to seasonal wetland management. (The Drew Unit may be used for water spreading in very high runoff years). Following the guidelines of moist soil measurements (Fredrickson and Taylor 1982), units should be prepared prior to initial flooding. In order to provide cover for wildlife and maintain habitat heterogeneity, when possible, portions of units will be disced while other areas containing cattails and bulrush will not be disturbed. Discing should be done to a depth of 60 cm and cattail/bulrush roots should be exposed to sunlight for two months (Gray et al. 1999). Disced units will then be flooded in mid-September and should be seasonally flooded beginning each fall for at least 2-3 years.

*Table 3. Five-year interim management flooding schedule for the BWMA. Active units will be flooded seasonally from the fall through the spring.*

| | Thibaut Unit | Waggoner | Drew | Winterton West | Winterton East | Winterton South |
|---|---|---|---|---|---|---|
| 2021-22 | Flood | Flood | Inactive | Inactive | Flood | Flood |
| 2022-23 | Flood | Flood | Inactive | Inactive | Flood | Flood |
| 2023-24 | Inactive | Flood | Inactive | Flood | Flood | Inactive |
| 2024-25 | Flood | Flood | Inactive | Flood | Inactive | Inactive |
| 2025-26 | Flood | Flood | Inactive | Flood | Inactive | Inactive |

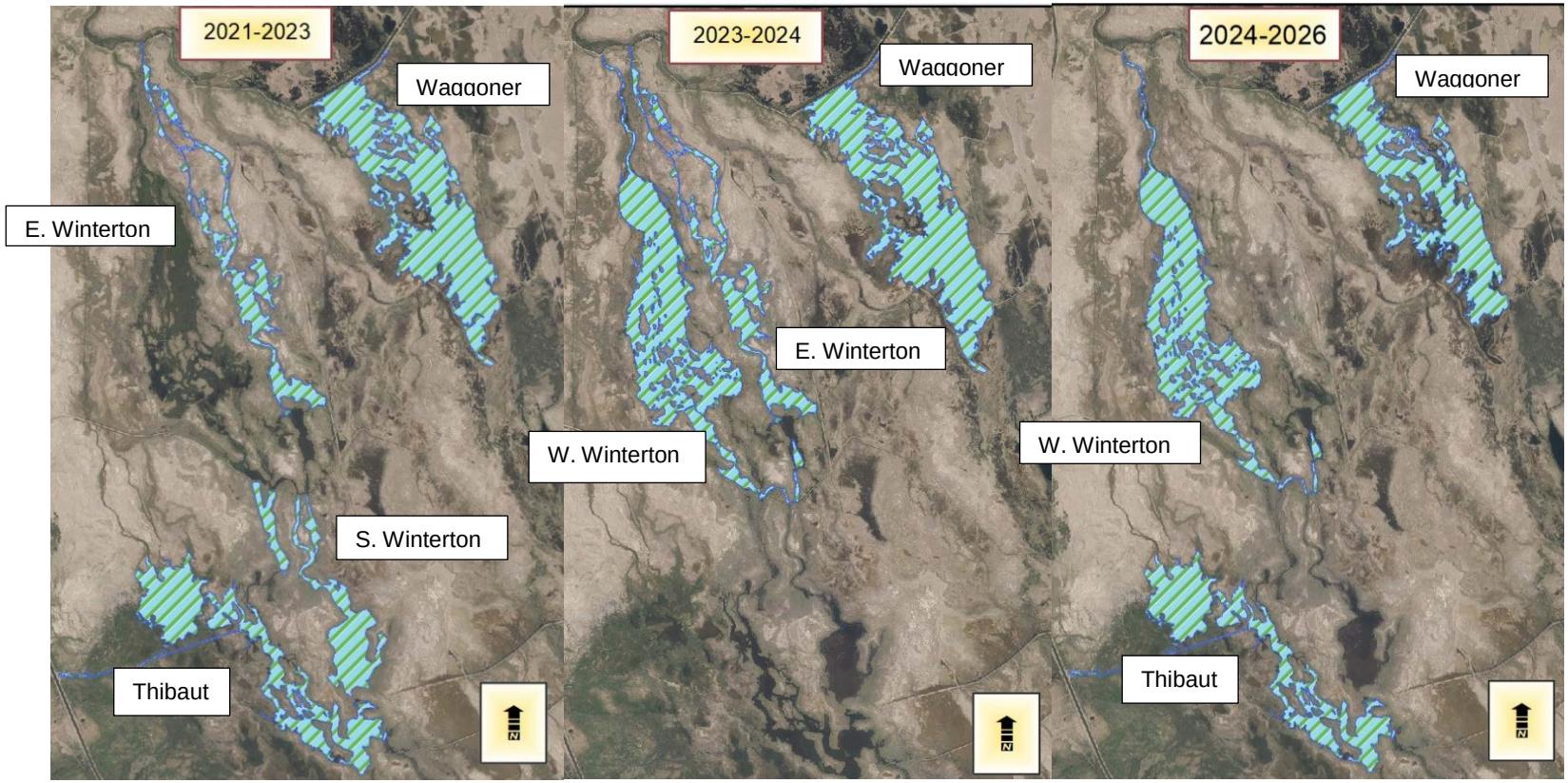



*Figure 13. Seasonal flooding schedule. 2021-2026.*

The following text and Table 4 identify actions to be implemented each year for site preparation, flooding, and associated maintenance under this Interim Management Plan.

## *Fall 2021-2022:*

Site preparations needed before flows released in Fall 2021:

- Improve Blackrock Ditch by installing a check structure that will raise elevation to ensure that flows can be released from Diversion #5 into Winterton East subunit or into Waggoner.
- Disc 70% of Waggoner Unit in the summer/fall of 2021.
- Disc middle portion of the Winterton East Unit.
- Disc bottom pond in Winterton South.
- Maintenance on Diversion #3 (Four Corners) ditch and reinforce berm on west side to ensure flows into Winterton East subunit.
- Repair berm at bottom of Thibaut Unit.

Initiate water releases on September 15th

- Release water from Thibaut Spillgate East to Thibaut Unit.
- Release water from Blackrock Ditch Diversion #8 to Waggoner Unit.
- Release water from Diversion #3 (Four Corners) and Diversion #5 to Winterton East.
- Release water from Diversion #3 (Four Corners) and Diversion #5, water will then be released from culverts at south berm of Winterton into Winterton South, flooded extent.

October: 2 days to evaluate progress of initial flooding.
November 1-4: Measure flooded extent of units.
Avian Monitoring: From September to April, eight seasonal surveys of each active unit.
Initiate draw-down all units on March 1st by shutting off diversions.
March 1st-3rd: Measure flooded extent of units.
May 1st -2nd evaluate wetted extent of four units to determine if additional irrigation release is needed.
June 15th -18th Establish line point transects in basins on each of the four active units.
July 15th Evaluate outcomes from prior year's flooding and determine if 2022-2023 flooding schedule requires changes.

## *Fall 2022-2023*

Site Prep: Possible mowing/discing in portions of Winterton East
Flood September 15th

- Release water from Thibaut Spillgate East to Thibaut Unit, flooded extent.
- Release water from Blackrock Ditch Diversion #8 to Waggoner Unit, flooded extent.
- Release water from Diversion #3 (Four Corners) and Diversion #5 to Winterton East.

- Release water from Diversion #3 (Four Corners) and Diversion #5, water will then be released from culverts at south berm of Winterton into Winterton South, flooded extent.

November 1-3: Measure flooded extent of units.
Avian Monitoring: From September to April, eight seasonal surveys of each active unit.
Draw down all units March 1st.
March 1st-3rd: Measure flooded extent of units.
May 1st -2nd evaluate wetted extent of four units to determine if additional flow release is needed.
June 15th -18th Reread line point transects in basins on each of the four active units.
July 15th Evaluate outcomes from prior year's flooding and determine if 2023-2024 flooding schedule requires changes.

### *Fall 2023-2024*

Site Prep: Disc 80% Winterton Unit

- Repair berm that bisects Winterton Unit and repair culverts along berm.

Flood September 15th:

- Release water from Blackrock Ditch Diversion #8 to Waggoner Unit, flooded extent.
- Release water from Blackrock Ditch Diversion #2 to Winterton West Unit, flooded extent.
- Release water from Diversion #3 (Four Corners) and Diversion #5 to Winterton East, flooded extent.

November 1-3: Measure flooded extent of units.
Avian Monitoring: One fall, one winter, and one spring survey of each active unit.
Draw down all units March 1st.
March 1st-3rd: Measure flooded extent of units.
May 1st evaluate wetted extent of three units.
June 15th -18th Reread and establish new line point transects in basins on each of the three active units.
July 15th Evaluate outcomes from prior year's flooding and determine if 2023-2024 flooding schedule requires changes.

### *Fall 2024-2025*

Site Prep: Evaluate Thibaut Unit for discing, disc Waggoner Unit
Flood September 15th:

- Release water from Thibaut Spillgate East to Thibaut Unit.
- Release water from Blackrock Ditch Diversion #8 to Waggoner Unit
- Release water from Blackrock Ditch Diversion #2 to Winterton West Unit, flooded extent

November 1-4: Measure flooded extent of units.
Avian Monitoring: One fall, one winter, and one spring survey of each active unit.

Draw down all units March 1st.
March 1st-3rd: Measure flooded extent of units.
May 1st evaluate wetted extent of three units.
June 15th -18th Reread line point transects in basins on each of the three active units.
July 15th Evaluate outcomes from prior year's flooding and determine if 2025-2026 flooding schedule requires changes.

### *Fall 2025-2026*

Site Prep: No prep
Flood September 15th:

- Release water from Thibaut Spillgate East to Thibaut Unit
- Release water from Blackrock Ditch Diversion #8 to Waggoner Unit
- Release water from Blackrock Ditch Diversion #2 to Winterton West Unit, flooded extent

November 1-4: Measure flooded extent of units.
Avian Monitoring: From September to April, eight seasonal surveys of each active unit.
Draw down all units March 1st.
March 1st-3rd: Measure flooded extent of units.
May 1st evaluate wetted extent of three units.
June 15th -18th Reread line point transects in basins on each of the three active units.
September - write up final evaluation of the five-year interim project.

*Table 4. Schedule for preparing/maintaining units during the interim period.*

| | Infrastructure | Discing |
|---|---|---|
| Winter 2020-Summer 2021 | • Raise elevation on Blackrock Ditch for Waggoner Diversions<br>• Repair Diversion #3<br>• Repair and install culvert Thibaut Unit | • Waggoner (approx. 150 ac)<br>• Winterton East (15 ac)<br>• Winterton South (30 ac) |
| Summer 2022 | • General maintenance of existing infrastructure | • Possible mowing/discing in portions of Winterton East |
| Summer 2023 | • Repair center berm & culverts on Winterton Unit | • Winterton (160 ac) |
| Summer 2024 | • Maintenance if needed | • Waggoner Unit (approx. 150 ac)<br>• Thibaut unit 70 ac |
| Summer 2025 | • Maintenance if needed | • None |

It is expected that seasonal withdrawal of water from the shallow units (Winterton, Waggoner, and Thibaut) will discourage emergent vegetation overgrowth. Treating emergent vegetation through tractor discing and controlled burns is expensive. It is hoped that through seasonal water management, the frequency of vegetation maintenance will be reduced. However, it is also possible that noxious weeds, including

saltcedar, will be encouraged by wet soils during the spring drawdown. Monitoring for noxious species during vegetation surveys described below will help us consider the effects of the new water regime on undesirable vegetation. Minimal to no colonization by noxious plant species has been observed over the past seven years in the 28-acre flooded portion of Thibaut Pond following seasonal draw downs initiated on March 15th.

## Effectiveness Monitoring

### Flooded Extent Measurements

The extent of flooding has been measured seasonally since the beginning of the project for the purposes of tailoring water releases and to assure the flooded acreage was in compliance with MOU guidelines. Flooded extent will continue to be measured both to confirm compliance with the Interim Plan and to help describe the effectiveness of seasonal filling and drawdown. Remote sensing will be used to take rough area estimates, and two on-the-ground surveys will be used to map more precisely the extent and location of water found above soil. Water releases will be monitored and reported annually.

### Vegetation Monitoring

Initial monitoring will consist of line-point vegetation transects and/or plots in areas expected to have the most potential to produce waterfowl foods. A second objective of monitoring is to evaluate the effectiveness of controlling the expansion of cattails and bulrush in active units. This can be mapped and quantified from a combination of satellite imagery, aerial imagery from UAV, and field training data. Seed production will be estimated on sites that are positively responding to moist-soil management following the methods proposed by Naylor et al. (2005). Evaluating the vegetative response following shallow flooding will help managers determine the following year's flooding schedule. Based on results from each summer the flooding schedule may need to be adjusted to improve forage production.

Monitoring for noxious weeds will be conducted by the Inyo Mono Agricultural Commissioner's Office and/or by ICWD or LADWP staff as part of annual LORP Work Plans during the Interim Plan period.

### Water Depths in Flooded Units

During the first years of implementation, water depth will be measured, mapped and evaluated in active units coinciding with avian surveys to better understand how water depth influences waterbird habitat use. Patterns of unit drydown will also be monitored to inform whether there are opportunities that could further benefit breeding waterfowl and their broods.

Opportunities to improve conditions for waterbirds by manipulating water levels and therefore depths should be considered each August before mid-September shallow flooding. The effectiviness of this water manipulation will be evaluated based on the spatial extent and configuration of shallow flooding, moist-soil plant production, and results of avian monitoring.

## Avian Monitoring

Avian monitoring will be conducted to evaluate the use of BWMA by the habitat indicator species during implementation of the 5-year interim program. Avian data will be collected in a manner that will allow comparison with previous data by replicating the survey periods used to date (Table 5). Eight seasonal surveys will be conducted yearly in each active unit during implementation of the Interim Plan (see Figure 13, Table 6). Adjustments will be made to the bird monitoring schedule if the flooding schedule is revised. Units will not be surveyed when dry, thus there will be fewer surveys conducted per year than current practice.

Waterbird spatial and habitat use patterns, including water depth use will be recorded.

*Table 5. Interim Management Plan Avian Seasonal Surveys*

| **Survey Period** | **Season** |
|---|---|
| End of September | Fall |
| Mid-October | Fall |
| End October | Fall |
| November/December | Winter |
| January | Winter |
| Beg of April | Spring |
| Mid April | Spring |
| End April | Spring |

*Table 6. Interim Management Plan Unit Avian Survey Schedule*

| Unit | Project Year and Survey Schedule | | | | |
|---|---|---|---|---|---|
| | 2021-2022 | 2022-2023 | 2023-2024 | 2024-2025 | 2025-2026 |
| East Winterton | X | X | X | | |
| West Winterton | | | X | X | X |
| South Winterton | X | X | | | |
| Thibaut | X | X | | X | X |
| Waggoner | X | X | X | X | X |

## Reporting

Analysis of monitoring data collected during the interim period will be provided in the LORP Annual Reports. LADWP and Inyo County will continue to host a public meeting following release of the LORP Annual Report as defined in the Final LORP EIR and the 2007 Stipulation and Order which will allow the MOU Parties and members of the public to provide comments on LORP activities, including implementation of the Interim Plan.

## References

Baldasserre, G. A, and Bolen, E. G. 1994. Waterfowl ecology and management. John Wiley and Sons, Inc. New York.

California Waterfowl Association. Principles of Wetland Management. 2020. Accessed January 20, 2021. https://www.calwaterfowl.org/wp-content/uploads/2020/12/California-Waterfowls-Wetland-Management-Guide-for-California-2020.pdf.

Euliss Jr.,, N.H., L.M. Smith, D.A. Wilcox, and B.A. Browne.l 2008. Linking ecosystem process with wetland management goals: charting a course for a sustainable future. Environmental Science and Ecology Faculty Publications. 47.

Fredrickson, L. H., and T. S. Taylor. 1982. Management of seasonally flooded impoundments for wildlife. United States Fish and Wildlife Service Resource Publication 148.

Gray, Matthew J., Richard M. Kaminski, Govinda Weerakkody, Bruce D. Leopold, and Kent C. Jensen. Aquatic invertebrate and plant responses following mechanical manipulations of moist-soil habitat. Wildlife Society Bulletin (1973-2006) Vol. 27, No. 3 (Autumn 1999), pp. 770-779.

Isola, C. R., Colwell, M. A., Taft, O.W., and Safran, R.J. 2000. Interspecific differences in habitat use of shorebirds and waterfowl foraging in managed wetlands of California's San Joaquin Valley. Waterbirds: The International Journal of Waterbird Biology Vol 23(2): 196-203.

Los Angeles Department of Water and Power (LADWP). 1944. Owens River Valley. Flown by Fairchild Aerial Surveys.

LADWP, U.S. Environmental Protection Agency (USEPA) and Inyo County Water Department (ICWD). 2004. Final Environmental Impact Report (EIR) and Environmental Impact Statement (EIS), Lower Owens River Project. Vol. 1. 409 pp. June 23.

LADWP and County of Inyo. 2019. LORP Evaluation Report Volume II. Los Angeles Department of Water and Power, Bishop, CA. February 2018. 106 pp.

Memorandum of Understanding (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. 1997. 62 pp.

Mississippi River Trust, Natural Resources Conservation Service and United State Fish and Wildlife Service. 2007. Wetland management for waterfowl handbook. Edited by Kevin D. Nelms.

Naylor, Luke & Eadie, John & Smith, D. & Eichholz, Mike & Gray, Matthew. 2005. A simple method to predict seed yield in moist-soil habitats. Wildlife Society Bulletin. 33. 1335-1341. 10.2307/3784906. Naylor et al, 2005

Smith et al. 1995. A Guide to Wetland Management in the Central Valley. California Department of Fish and Game.

Taft, O. W., M. A. Colwell, C. R. Isola, and R. J. Safran. 2002. Waterbird responses to experimental drawdown: implications for the multispecies management of wetland mosaics. Journal of Applied Ecology 39:987-1001.

Weller, M. W. and Spatcher, C. S. 1965. Role of habitat in the distribution and abundance of marsh birds. Special Report 42. Iowa State Univerisity.

Whitehorse Associates. 2004. Blackrock Waterfowl Management Area and Vicinity. Vegetation Inventory. 2000 Condition. Prepared for Los Angeles Department of Water and Power and Inyo County.

USDA-NRCS. 2002. Soil Survey of Benton-Owens Valley and Parts of Inyo and Mono Counties, CA. Published by United States Department of Agriculture, Natural Resources Conservation Service, Washington, D.C.

Ma, Z., Cai, Y., Li, B. et al. Managing Wetland Habitats for Waterbirds: An International Perspective. Wetlands 30, 15–27 (2010). https://doi.org/10.1007/s13157-009-0001-6.

# Appendix 1. Comments from MOU Parties and Response to Comments by LADWP and Inyo County

**BWMA Interim Management and Monitoring Plan Questions - Sierra Club**

***LADWP and Inyo County responses in blue***

1. The plan is not clear about this, but we assume that since the new flooding regime is proposed to start in the 2021-2022 runoff year and that you will want to start drying out the units that are usually flooded starting March 1 in order to have a dry period when the proposed discing would be done before flows are released September 15, 2021. *The first units to be flooded under the Interim Plan are East Winterton and Waggoner, which are not currently flooded. However, discing for site preparation should occur as soon as the plan is approved to ensure implementation in Fall 2021. Units that are currently flooded should also be dried down as soon as possible following plan approval to prevent saltcedar encroachment into the units.*

2. Do cattails die in 4 months (May-August) without water? in a year? longer? Or does it take the discing to a depth of 60 cm and cattail/bulrush root exposed to sunlight for two months (pg. 23)? If so, then the plan should say that all discing will be conducted between May 1 and July 15 to give the two months for exposing the roots to sunlight. *Cattails can survive a year without water and then respond to water/moisture during the next growing season, or can continue growing if the area is dry but still has moisture in the soil. The plan allows for most discing to be done for preparation up to 6 months to a year in advance to allow for scheduling and performing the work along with other work required of LADWP's Construction staff. May-July may work but also may be difficult to secure personnel if responding to heavy runoff conditions or other operational needs.*

3. The plan states that there will be 500 acres of wetland/open water at the peak in 3 to 5 of the 6 unit areas (where Winterton=3 units: east, west, south). It has the schedule of which ones will be watered in which year--Table 3. However, it doesn't say how many acres will be in each unit each year, i.e. how is the 500 acres split up across the units? The plan should tell us how many acres you expect to be wetted in each unit. *While flooded acreages can be approximated in each unit, they will likely be variable as the Interim Plan is implemented and we learn what works best in practice. Consequently, LADWP cannot commit to specific acreages by unit, but can commit 500 acres flooded annually between units. Please refer to Figure 13 in the Interim Plan to view the tentative schedule for flooding each year. LADWP presently anticipates being able to flood up to approximately 210 acres in Waggoner, 200 acres in Winterton, 85 acres in East Winterton, 75 acres in South Winterton, and 140 Acres in Thibaut under the Interim Plan.*

4. How many acre-feet of water will be used from September 15 to May 1 and how does that compare to the average acre-feet of water used for flooding the BWMA now? Is there a significant difference? Could the BWMA section of the annual LORP report include a table of the input of water each month for each unit? The plan states that 500 acres would be flooded for only four months as compared to the average of 446 acres that was flooded from 2007 to 2019 runoff years (pg 6, Table 1). It seems that much less water will be used in the proposed interim plan. *We do not know how much water will be used from September 15 to May 1, which is part*

*of the reason for this proposal being an interim plan. The change to a seasonal flooding regime will lead to recurring "wetting up" cycles which require more water than maintaining flooded acreage. The change to a seasonal flooding regime means some of the high ET periods will be avoided, which should reduce water use. How it all turns out is an unknown at this time, however the change to a fixed 500 acres every year, even in low runoff years as appears likely in 2021-22, means that water use may be higher in years when supplies are lower. Nine of the runoff years shown on page 6, Table 1 had flooding requirements under 400 acres, and four of the runoff years had flooded acreage requirements under 300 acres. The historical water use to date for the BMWA is approximately 4,000 AF per year, to return an average of about 400 acres. Under this plan, the BWMA section of the annual LORP report will continue to include flow changes and wetted acreage measurements.*

5. To maintain 500 acres of wetted land, water will need to be added from November 1 to March 1 depending upon how much evaporation there is. How will you know when to add water and who will keep track of this? LADWP or ICWD? *LADWP will estimate the amount of water to add, and use feedback from LADWP staff and the official wetted acreage measurements on November 1 and March 1 to help calibrate releases in future years. Releasing the appropriate amount of water to return 500 flooded acres will be a learning process, likely requiring adjustments over multiple years, and is another reason for the proposal being a 5-year interim plan.*

6. What impact will 4 dry months in summer have on the year-round waterfowl (mainly ducks/coots?) that may breed here and their fledglings? *Few waterbirds likely remain year-round in Owens Valley, but migrate to, or move to BWMA to breed when conditions are favorable. Over our period of record, 2016 saw the highest summer number of waterfowl and coots at BWMA (potential breeders averaging 350 ducks and 300 coots over the two surveys in June, but only observed fewer than 20 waterfowl broods. Coots were seen nesting but broods were not estimated. Species that breed early in the season (for example Mallard), may actually find improved breeding conditions if productive open water areas persist to early May. Once hatched, upland nesting waterfowl species such as Mallard and their broods can be quite mobile and move their broods in response to changing conditions. Species that breed later (late May, June and July) such as Gadwall and American Coot may not even settle and establish territories as drawdown will be complete by May 1. In short, even under conditions of continuous flooding in summer, while waterbird nesting has occurred, we do not have any evidence that BWMA has been highly productive for breeding waterfowl.*

7. Water depths are discussed at length for the Drew Unit and it has good, varied depths including a deep end. But the other units are not so deep and there is less information about their depths. Since we aren't using the Drew Unit, do we have the depths we need in the other units and if not, will there be any human efforts (dredging/bulldozing?) to create depths? *From previous discing and burning in the Winterton and Waggoner Units we have an understanding of their depths; they are fairly shallow and the <25 cm goal should be achievable in many areas. Thibaut from observation is much the same. At this point, we do not anticipate bulldozing to achieve greater depths in any unit under the Interim Plan.*

8. The Drew Unit

- Why is the Drew Unit, one of the best, being dried out for all 5 years?
  *Drew is not one of the best units. It was intended under the LORP EIR only to be used as a last resort but a portion of it tends to maintain open water longer than the other units due to its depth. However, this depth is not optimal for target species compared with what is available at the other units. Additionally, this pond becomes stagnant and requires a much longer dry down period than the other units which has encouraged an influx of salt cedar in previous years.*

- What will be the stockwater in the Drew? or will the cows just wander over to the other units for their water and be overly concentrated there. *Each of these units are fenced and held by three different lessees who will ensure existing fences are maintained and herds do not intermix. Because each of these units have periodically been dry, stockwater availability has already been addressed. The Blackrock Ditch will supply water for livestock in the Drew area as well as along Upper Twin Lake. The Winterton Unit has stockwater provided for periods when this unit is inactive. Water is available on Lower Twin, Tillemans Ditch, and Goose Lake for Waggoner when the unit is inactive. There is a stockwater well in the Thibaut Unit that has already been the primary water source when this unit is inactive.*

- Any advantage to discing the cattails now or wait until just before it's flooded again in 6 years? And will the cuttings be hauled away or left to decay where they fall? *Discing Drew could help facilitate decomposition, however discing will be prioritized in units that will receive water under the Interim Plan to optimize habitat quality and maximize open water. When units are disced, the cut material will be left onsite.*

- What will happen to the non-cattail vegetation in this unit if no water is provided for 5 years? *The only notable non-cattail vegetation in the Drew Unit are willows, Russian olive, and salt cedar. The willows should be able to survive since they are mature trees and will no longer be flooded year round.* Will it die off and be a dust bowl? *Dust emissions are not anticipated from the proposed change. Waggoner has not been flooded for the past 8 years and has not been emissive.* Will weeds move in? *The area north of Blackrock Ditch (Drew) in 2008 was a shrub dominant saline meadow that transitioned to a saline bottom site. Some weeds could move in so the area should be monitored and treated as needed to keep invasive populations under control.*

- Is habitat reclamation/mitigation needed? *No.* Will any smartweed come back if the unit is flooded in the 6$^{th}$ year? *We cannot predict this based on current information. Observing the response in the Waggoner Unit (that has not been flooded for many years) during the Interim Plan period will provide useful information regarding smartweed. As mentioned in the plan we have already seen smartweed occupy sites in the southern section of Winterton in response to small scale water management. No direct seeding occurred.*

- Will there be moist-soil management there? Are there any invertebrates in the mud that should be kept alive? I heard at least 3 frogs at the Drew Unit in shallow water. How will they survive? *The amphibians can migrate to Blackrock Ditch or across the dirt road to Upper Twin Lake. There are no plans for moist soil management in Drew unless it becomes active.*

9. Why not disc the Winterton-west Unit now instead of before flooding in 2023? *The Winterton West Unit is presently flooded.*

10. Early Summer, Soil-Moisture Wetting

- Which units will be managed for soil moisture? Will the Drew Unit be one of them? *All units except Drew will be managed for moist soil plants and waterfowl habitat. There are no plans to flood the Drew Unit as part of the Interim Plan.*

- What areas will be wetted within these units? the whole unit area? or selective parts i.e. open mud areas, open vegetation areas? *To meet the 500 flooded acre objective, the units will be wetted based on past operational knowledge of how those units have flooded. Creating a diversity of habitats will be optimal, and mudflats will accompany ramping up and ramping down periods which will also coincide with the migratory season.*

- How will the wetting be done? This looks challenging. Will "wetting" be done in the same way as flooding is done now? Are there irrigation ditches that would be watered to limit flooding, but wet the soil? Will there be any new digging of ditches for the wetting? Will the wetting be selective? i.e. in the areas that don't have cattails? In looking at the site, there are large, dense areas of cattails, tules, and fragmites especially along the Blackrock Canal/Drain. The goal is to dry those areas out and wet areas that food sources can grow or the open areas. So how do you get water beyond the cattails without wetting them as well? The Blackrock Canal/Drain is a water conveyance, but also wets the soil along it and is part of the cattail problem. *Wetting/flooding the units can be a challenge in some areas. Achieving 500 flooded acres in a short time may require releasing water from multiple diversions into a unit at once. No new ditches are planned, just maintenance of existing ditches and facilities. Additionally, there will not be complete removal of cattails in each unit. Some areas will be left to provide habitat complexity. These will survive the summer if wetted during the winter, but should not expand in the summer if not wetted.*

- What is the optimum soil moisture and timing need for germinating the desirable food species, but suppressing the tamarisk from germinating? *We are unsure of exact requirements but do not want any surface water or soils at field capacity by June 15th. This will be investigated during the Interim Plan period to inform potential long-term management. Observations in the Owens Valley indicate that later flooding and drying promotes different annuals than early season flooding and drying.*

- How will soil moisture be measured? *Response to soil moisture will be measured based on plant vigor, species composition, and abundance.*

- Who will do the monitoring? LADWP or ICWD? *Both LADWP and ICWD will conduct monitoring associated with the Interim Plan.*

- How much water will it take? *The amount of water it will take is an unknown at this time, but is likely to be similar to water use under the original BWMA plan. This will be a learning process to operate the BWMA under the proposals in the Interim Plan.*

How will the vegetation in the soil moisture areas be measured? Is that the area where transects will be established? Will there be a contingency plan e.g. seeding, if natural seeding doesn't work? What are the goals for the wetted area? *Visual estimates of seedling species composition during and after the mid-spring drawdown will be tracked and a later more thorough sampling will occur in summer where a combination of techniques will be evaluated including line intercept techniques, quadrat-based percent cover estimates and species-specific seed production estimates. The goals for the wetted area are to produce a robust annual community of moist soil plants. Ultimately, seed production in units of kg/acre can be estimated, and translated into duck-use-days (DUD), or the number of ducks that could be supported per day by one acre of habitat.*

11. At the top of page 28 it states, "Soil moisture monitoring in conjunction with monitoring for noxious species will help us consider the effect of the new water regime on undesirable vegetation." However, such monitoring is not included in the plan. It should be. If noxious species do colonize the units, there should be something in the plan that would deal with it. *Noxious weeds will be mapped and treated and the timing and rate of drawdown will be adaptively managed to favor desirable moist soil plants and minimize the regeneration of undesirable vegetation.*

12. There are trees along the road next to the Blackrock Canal/Drain—are they Elms? Some in the Drew Unit side are dead. Will those remaining survive the flooding? Woody recruitment isn't a goal of the BWMA, but should it be? It's a goal of the riverine part of the LORP. I've seen ravens, raptures, and the big egrets in the trees there. *The trees are Gooding's willow and coyote willow. These trees should not be impacted by the Interim Plan and riparian tree species will be avoided when preparing the sites for flooding. Woody recruitment is not a goal of the BWMA; the goal is to create and maintain habitat that is consistent with the needs of the habitat indicator species. This will be achieved through the Interim Plan.*

13. Do all 5 units that will be flooded in the next 5 years attract birds in all the categories i.e. resident waterfowl, migrating waterfowl, rails, waders, etc. So does the flooding plan provide all the categories of birds across the flooded units each year? *All of these waterbird groups are expected to use the units to varying degrees. The BWMA is a fairly natural slough system and not constructed ponds. We expect an increase in habitat heterogeneity over current conditions, supporting these different waterbird species.*

14. All of the other units will have 8 avian surveys done from September to April two or three years except the Winterton-west unit. The plan has Winterton-west only getting the 8 avian surveys from September to April for one year during the interim period (2025-2026). Why will there be fewer avian surveys at Winterton-west? *Thank you for pointing out this inconsistency. We have revised the Interim Plan and will conduct 8 surveys of each of the 5 units each year they are active.*

Should the new plan state that CWHR will not be used for avian monitoring? It has been mentioned many times in comment letters that it is not the best way to go. *For brevity we don't include methods and models that we don't intend to use. To clarify, CWHR was never used for avian monitoring but rather to quantify potential habitat from a vegetation map. CWHR is a lookup table relating vegetation attributes to a categorical species-specific habitat suitability score, mostly parameterized from expert opinion, and its application was intended for coarse evaluation of potential habitat in areas were wildlife hadn't been inventoried. In this plan, systematic avian surveys will allow habitat quality to be represented by measurements of food resources and waterfowl abundance.*

15. Is there anything in the old plan that should be carried over into the new plan that isn't in the plan so far? I assume the new plan will replace the current one in its entirety. *LADWP and ICWD staff have worked to develop an Interim Plan based on what has been learned from managing the project as required for 14 years since implementation. While goals of providing habitat for indicator species and annual flooded acreage requirements are being met, information gleaned from this period indicates that the project may be better managed though a seasonal flooding regime as presented. Yes, the Interim Plan is intended to supersede the current plan for 5 years while the concepts of the Interim Plan are tested.*

16. There are some misleading statements on page 7 where the main components of the plan are presented:
    - In number 1, it states, "…sustained flooding occurs from fall through spring." However, the plan expects flooded units to be dry by May 1. May 1 is less than half-way through spring, so that sentence should indicate that flooding will be through mid-spring. *Correct. Language in the plan will be amended to reflect "mid-spring."*

    - In number 2, it states that the plan is to, "…flood 500 acres each between September 15 and May 1st." However, it is clear in other parts of the plan that we should expect 500 acres to only be flooded in the four months from November 1 to March 1. The flooding will be ramping up from zero to 500 acres from September 15 to November 1 and ramping down from 500 to zero acres from March 1 to May 1. *Correct. Language in the plan will be amended accordingly.*

*LADWP and Inyo County responses in blue*

Owens Valley Committee
P. O. Box 77
Bishop, CA 93515

Dear Inyo County Water Department,

The Owens Valley Committee is generally in support of adaptive management at Blackrock Waterfowl Management Area to achieve the full potential of mitigations agreed to by the City of Los Angeles in the Long Term Water Agreement, MOU and other related agreements. We have some specific questions about the proposed changes to the Blackrock Waterfowl Management Area listed below.

We are also concerned about the evaluative process during the lifetime of the proposed adaptive management project. Recognizing that many of the concerns expressed in our questions below may have been resolved if OVC were able to be part of the development process for the BWMA Interim Management and Monitoring Plan, we request that MOU Parties, including Inyo County and LADWP, meet annually to review the data generated during the previous year of activity. This will provide an opportunity to make corrections to the plan if necessary. Secondly, we request that the MOU Parties, Inyo County, and LADWP should convene one year prior to the cessation of this Interim Plan to provide a successor plan or to determine if a return to the previous operational conditions is needed.

In the future, providing an opportunity for MOU Parties to be a part of any plan development has several positive outcomes – incorporating scientific expertise from members of the MOU Parties, streamlining the approval process by ensuring that decisionmakers' concerns are addressed to the extent possible, and providing better plans by a collaborative teamwork approach that will be able to identify problems and unintended consequences prior to plan adoption.

We had hoped to have our questions answered during the Technical Group meeting, originally scheduled ahead of the MOU meeting. Due to the Technical Group meeting being rescheduled, we are hopeful that we can focus our efforts at the MOU meeting scheduled for February 17th at 1:00 pm to better define the process that can lead to a more inclusive, constructive and collaborative adaptive management plan going forward.

Per the 2020 -2021 LORP Workplan,

---

The basic concept of the adaptive management recommendations involves transitioning from year-round flooding to seasonal flooding to increase the extent of open water and reduce the extent of cattail and bulrush, which is predicted to improve habitat quality for waterfowl and shorebirds. The plan will detail habitat

objectives, the water delivery system and vegetation management. In addition, the current monitoring program will be reevaluated with the following objectives:

1. Incorporate use of satellite imagery to document flooded acreage
2. Assess the productivity of waterfowl food plants in response to management actions
3. Assess habitat quality
4. Improve the efficiency of the avian monitoring

After the fifth year of implementation, the effectiveness of the program will be reevaluated in terms of improvements in habitat quality, ease of implementation, water use, cost, and any other management concerns. Pg 12

---

1. What is the current extent of cattails and bulrush within the project area? *Unquantified but extensive based on qualitative data and field observation. A rough estimate is that within the typical wetted extent the units, Winterton is >98% emergent vegetation, 2% open water and Drew Slough is at >90% and ~10% open water (JH).*

2. What is the current ratio of open water to wetted acreage? How will this be monitored during the time period established by the interim plan? For how many months will the ratio of 50 percent open water to emergent wetlands be maintained? *See answer to question 1. Open water strongly absorbs photon energy in the near infrared (NIR) wavelengths whereas vegetation strongly reflects NIR, thus open water will be isolated from emergent vegetation using Landsat 8 and Sentinel 2 satellite optical and thermal sensors and a series of maps throughout the annual cycle will be archived to document extent and distribution of open water over the 5-year period. Additionally, the goal is not to maintain a 50 percent open water hemi-marsh, but rather to maximize open water habitat beyond 50% to the extent feasible.*

3. What criteria is being used to determine habitat quality? *Assessing habitat quality will be an iterative process of evaluating waterbird use versus the physical parameters.*

4. In what ways is the current avian monitoring inefficient? What steps are being planned to improve it? *Improvements in avian monitoring will be to delineate "subbasins" in all areas to be flooded such that bird use can be better tied to a physical location. This process was initiated in the BWMA in 2016, but will be used to a greater extent under the Interim Plan. The physical parameters of subbasins will be evaluated in order to tie bird use to conditions, and guide future management. In addition, more detailed behavioral observations will be recorded such as use by water depth category.*

5. If the intent is to establish the benefit of seasonal flooding for the habitat indicator species (specifically, the waterfowl), shouldn't the active and non-active units all be surveyed to establish the benefit of seasonally flooded open water extents on the "hemi-wetlands"? *Surveying non-active units and comparing it to active units would probably tell us that water is good for waterbirds but not be helpful in determining how best to manage water releases to improve waterbird habitats. If, however we look at differences in use within and between the active units, evaluating differences in water depth or vegetation development, we may see patterns that will help guide future*

*management.*

6. If the effectiveness of the program is being determined based on water use over the five years, what is the current water use for the Blackrock Waterfowl Management Area? Is cost the difference between current operating costs versus those incurred for adaptive management? *The interim program will evaluate changes to BWMA productivity, waterbird habitat quality, limiting cattail and bulrush growth, in addition to the operational complexity and water use required to implement the interim program. The amount of water use in the BWMA now is approximately 4,000 AF a year, to average about 400 flooded acres. The specific cost differences between current operations and maintenance costs and those under the Interim Plan are unknown.*

> The value of the LORP as migration stopover habitat has not been explored and may be underappreciated. Point count surveys in 2010 and 2015 that started in mid-May rather than the end of May, detected significant use of the LORP by neotropical songbird migrants. A limited number of surveys during migration (late April-early May 2021) will provide an approximation on the importance of the LORP as stopover habitat for migrants traveling along the Pacific Flyway. Pg 13-14

7. The goals of the adaptive management plan focus on the impact on waterfowl. Are other habitat indicator species for the LORP going to be monitored as well, such as migratory songbirds as mentioned in the 2020-2021 Workplan? How might the planned modifications impact them? *This quote from the 2020-2021 LORP Work Plan applies to the LORP Riverine/Riparian Corridor. LADWP and ICWD will be conducting additional surveys along the river in 2021 to assess the value of the river to migrants. Avian surveys will continue to record all bird species encountered as it functions to provide a more complete picture of birds and habitats of BWMA. Survey protocols for BWMA focus on recording waterbird species use by area, and will not be appropriate to analyze trends in songbirds which are typically surveyed using fixed station point counts. The open water wetlands that will be developed under this interim plan will benefit some species groups other than waterbirds by providing additional open water and wetland/water edge habitats for feeding.*

From the LORP 2020 Annual Report

> It {Tamarisk} colonizes moist areas that have been disturbed by land clearing, grading, or other disturbances that removes native plants. Once established, tamarisk is a very hardy plant that can withstand adverse soil and weather conditions. It displaces native plants as it grows in size and reproduces, creating dense stands of tall shrubs. pg 4-1In the Winterton Blackrock Waterfowl Area, LADWP personnel treated pepperweed in the spring and again in late summer of 2020. Water drawdown in this area created moist bare ground favorable to pepperweed colonization in 2019. To control these new recruits from becoming

established crews spent four weeks in the spring strategically targeting the young plants. Crews reentered in late summer for one more week to ensure effective treatment and found their efforts largely successful as locating and treating individuals during the second go around proved more tedious. This area will continue as a treatment priority in 2021. Pg 5-1

8. The most recent annual report (2020 draft) specifically references the impact land clearing, grading and other disturbances have on native plants and the succession of salt cedar. How will LADWP and ICWD ensure that the planned discing on large stretches of the BWMA will not have the same impact? *The referenced salt cedar infestations resulted from an instance where water was flooded from mid-June to mid-August. The primary tool to prevent salt cedar colonization of treated flooded units for this project is to ensure that exposed mineral soils are not wet to field capacity from mid-June to the end of August. Drawdowns and any pulse flooding will be timed to avoid wetted soils after mid-June.*

9. With the intent to dry out the Drew Unit for the lifetime of the Interim Plan, how will LADWP and ICWD ensure that a repeat of the cycle from the 2015 drying and subsequent incursion of salt cedar does not repeat. LADWP took the steps of mowing the salt cedar in 2018, but the following activation has seen the region dominated by cattails. Does mowing increase the roughness of the wetlands and encourage submerged vegetation? *To avoid a repeat scenario, the unit should not be dried out any later than February 1st, or wait until mid-August to begin drying the unit out. In 2018, the unit was mowed with a John Deere tractor and tail dragger as well as an All-Season Vehicle (rubber tracked) and there was minimal roughness generated from the mowing. Subsequent cattail colonization occurred because of flooding during the growing season.*

10. If drawdown has already been correlated with increases in pepperweed within the BWMA, how will LADWP and ICWD monitor the site for new recruits, especially in non-active units where no monitoring needs were specified in the Adaptive Management Plan? *Active units will be heavily monitored and noxious weed locations are reported to a central geodatabase co-managed with Inyo County Ag to ensure treatment prioritization of any new infestations detected. Non-active units can be incorporated into the annual noxious weed survey of the LORP which typically occurs in August.*

From the BWMA Interim Plan

Discontinue varying annual flooded acreage targets based on the projected runoff, and flood a fixed 500 acres each year between September 15th and May 1st. Wetted acreage measurements will occur on or around November 1 and March 1, with the average of those two measurements being used to determine the flooded acreage number. Pg 7

11. Functionally, this means that 500 acres of the BWMA will be flooded between November 1 and March 1 regardless of the projected runoff. Will the water releases be increased mid-cycle if the measured extents do not meet the 500 acre requirement? *Yes, water releases will be increased or decreased as appropriate relative to the 500 flooded acre target, as we see what results turn out to be and learn how to operate in this manner.*

12. Is the intent with a November 1 survey date to ensure that equilibrium has been met within the active unit after the water releases begin on September 15? Approximately, how much time will it take for the released water to propagate across 500 acres? What criteria will be used to evaluate the program of initial flooding in October (referenced in the work plan on pg 25). *The intent of the November 1 survey date is to be one of the two measurement dates, which will be averaged together, to determine the actual flooded acreage for that runoff year. We do not know how much time it will take for 500 acres to propagate, and understand the 5-year Interim Plan will involve an operations learning period. The criteria used to evaluate the initial flooding (wetted extent) will be performed in a similar way that wetted extent has been determined in the past, by walking the perimeter with GPS units.*

13. What is the projected impact to the grazing quality within the BWMA with the switch from year-round to seasonal flooding? *When units are active, there is a buffer around the flooded unit that results in an increase in forage production caused by the lateral movement of moisture. This is particularly observable in the units that have a caliche layer (e.g., Winterton, Thibaut, and the west side of the Waggoner Unit). Because the BWMA will be flooded at a set 500 acres seasonally and the units will be rotated throughout the project area, the quantity of perennial grasses (production) is expected to increase. Forage quality is unlikely to change. The areas are dominated by alkali sacaton and saltgrass, both moderate to poor quality grasses for livestock grazing. Based on vegetation data sets from adjacent areas, shifts in species composition is unlikely to occur.*

> On identified portions of active units and in areas where drawdown has occurred quickly, implement "moist soil management" by providing a rapid early summer 'irrigation' pulse of water to increase soil moisture. … Effectiveness monitoring will include documenting the flooded acreage, vegetation assessments to evaluate moist soil management implementation, and waterbird surveys to determine use by indicator species. Pg 8

14. With only two surveys of the wetted extent of the BWMA, how will the drawdown rate of the units accurately be calculated to ensure optimal timing for the growth of desirable plants? *In the plan we have scheduled May 1st to evaluate the wetted extent of the units after water has been turned off March 1st. It may also be beneficial to evaluate the rate of drawdown before May 1st during the first week of April on units that are flooded for the first time.*

15. What criteria will be used to evaluate the wetted areas of the active units at the beginning of May

to determine if additional irrigation release is needed? Is this soil moisture, vegetation health, the wetted extent of the unit, etc.? *Criteria to be assessed includes the presence of desirable annuals, soil moisture, general plant vigor, plant stage in relation to seed set, and the ability to spread water across locations but still ensure that the areas will be dry before conditions become favorable for Tamarix sp. establishment.*

16. How will only the identified portions of the active units receive an "irrigation pulse"? Will additional canals or spillways be necessary? *No additional spillways and canals are planned during implementation of the Interim Plan to facilitate faster water conveyance onto the units. Areas that are slow to dry out or will take a long period of time to receive water will be avoided. These locations are expected to be at the bottom of the units furthest from conveyances.*

---

Moist soil management guidelines have been developed and implemented in other parts of the U.S., but there is limited information available for use in the Intermountain West. Plant species often cited as "target" species for waterfowl either do not occur in Owens Valley, or are weedy and undesirable here. Therefore, LADWP and ICWD will work together to experiment with different approaches and develop techniques applicable to the BWMA and develop local information and targets for desirable species. Pg 9

---

17. What criteria have been used to determine the moist soil management is appropriate for the Owens Valley? *The approach we will take for habitat management is two-fold and involves seasonal flooding to control the excessive growth of cattails and moist soil management to increase productivity of the basins. Seasonal flooding has been used effectively to maintain open water habitats at several sites throughout the Owens Valley including Warren Lake, Farmers Pond, and Thibaut Pond. At many locations in the Owens Valley we have observed concentrated feeding flocks of waterfowl and shorebirds in shallow water areas supporting a mix of short-lived perennials or annuals. Our objective during the 5-year interim period is to determine if and how we can replicate these conditions with targeted water application and using the concepts of moist soil management. While the application of moist soil management principles is new to the BWMA, in addition to the local anecdotal evidence, the principles have been used successfully in the West for some time. LADWP and the County will be employing methods that are well understood.*

18. When will the approaches and techniques be determined? If moist soil management techniques are required to determine if the "irrigation pulse" will occur, they must be established prior to May 1st. *Please refer to the response to question 15.*

---

Because of the presumed variability that may be encountered, flexibility in flooding, drawdowns, and site preparation for each unit will be needed. With close monitoring, more effective management strategies may be discovered such

as adjusting the maximum flooded extent further into spring and starting later in the fall, or the reverse with an earlier drawdown in the spring and an earlier maximum flooded extent in the fall. If adjustments are required, a maximum of 500 acres for four months would still be adhered to. Pg 10

19. Why has the word "maximum" been introduced? *Maximum can be removed. Plan will be revised to read "If adjustments are required, ~~a maximum of~~ 500 acres for four months ~~would~~ will still be adhered to."*

Compared to the Waggoner and Winterton Units, colonization by cattails and bulrush tends to occur at a slower rate in the central and southern portion of the unit likely due to greater water depth. Pg 13

*20.* If the intent is to increase open water extent within the BWMA, and current data suggests that greater water depth inhibits cattail and bulrush growth, then why are shallow water depths the focus of the adaptive management plan? *The absence of available surface water for cattails and bulrushes during the growing season is also an effective tool for control and is integral for moist soil management. Management proposed for the BWMA will target depths less than 25 cm (10 inches) preferred by shorebirds, dabbling ducks and large waders as discussed on page 11 of the Interim Plan. These same areas will be dry during the summer and are expected to be an effective means to controlling cattails and bulrushes.*

We look forward to your response,

Kammi Foote, President Owens Valley Committee

**BWMA Interim Plan Comments from CDFW, received via email Friday, February 19, 2021**

***LADWP and Inyo County Responses in Purple***

Hello Larry and Lori,

As requested by Inyo County (County) and the Los Angeles Department of Water and Power (LADWP) during the February 17, 2021 virtual meeting, the California Department of Fish and Wildlife (CDFW) is providing comments on the Draft Blackrock Waterfowl Management Area Interim Management and Monitoring Plan (Plan) in our roll as Trustee Agency and as a Memorandum of Understanding (MOU) Party member. The Plan was provided on February 5, 2021 to CDFW via email and the Plan was discussed in a virtual meeting with all MOU Parties on February 17, 2021.

Procedural comments:

- The Plan should discuss how, when, why and who will be making adaptive management decision (e.g., summer pulse timing and amount, draw down rate, monitoring schedules, site preparation). The Plan should also detail what method will be used to consult with the MOU Parties (e.g., meetings and reports) and the timing of consulting with the MOU Parties, including the timeline for MOU Parties to respond.

*During implementation of the Interim Plan, changes to operations may be determined to be necessary in order to meet the goal of 500 flooded acres for 4 months per year with appropriate wetting and drying periods. A slight shift in timing of flooding may be warranted to better meet habitat objectives but that is unknown at this time. Decisions on pulse flows will be guided by monitoring data collected during the interim period by LADWP and Inyo County. Any implementation practices that vary from those described in the Interim Plan will be discussed in LADWP and Inyo County's LORP Annual Report, along with findings from the plan's annual monitoring efforts. LADWP and Inyo County will continue to host a public meeting following release of the LORP Annual Report as defined in the Final LORP EIR and the 2007 Stipulation and Order. The MOU Parties are welcome to attend the public meeting and provide verbal and/or written comments on the report at that time per guidance in the 2007 Stipulation and Order.*

*Monitoring schedules and site preparation will be jointly decided upon by both LADWP and Inyo County and incorporated into annual LORP Work Plans and Budgets required under the LORP Post Implementation Agreement, which are taken to the Inyo/Los Angeles Technical Group and approved by LADWP and Inyo County's respective Boards. Under the 1997 MOU and LORP Post Implementation Agreement, LADWP consults with CDFW on recommendations for the BWMA in years that runoff is forecast to be below normal. This occurs following the release of the runoff forecast (April) and before the annual May Standing Committee meeting where the flooded acreage for the BWMA is generally set. LADWP will continue to follow this timeline and describe management recommendations for the upcoming fiscal year per the Interim Plan in their consultation letter to CDFW during the five-year implementation period.*

Technical feedback:

- The County and LADWP should identify mechanisms (such as fencing) to exclude cattle or reduce the number of cattle from the units. Cattle can compete with waterfowl for resources, specifically wetland plain foliage and seeds, as well as damage habitat and reduce the ecological value of the restoration efforts.

*One of the goals of the LORP is to provide for the continuation of sustainable uses including livestock grazing and agriculture (1997 MOU). The BWMA Units are inside large pastures (Waggoner Unit = 3749 acres, Drew Unit = 2193 acres, Winterton Unit = 1567 acres, and Thibaut Unit = 4584 acres). Excluding livestock from these pastures or even reducing the stocking rate for these pastures conflicts with the goals of the LORP Project. Livestock typically arrive onto these pastures in November and leave by May. The plan calls for full inundation by November 15$^{th;}$; forage grown from moist-soil management will be submerged by that time and will not be targeted by livestock.*

- CDFW recommends using LiDAR mapping to generate a fine-scale topographic map of the proposed units. This will allow staff to assess potential flow-paths and identify controls on wetland hydrology in the BWMA units. This will enable managers to limit water loss due to overfilling ponds and ensure timely flood-up and drawdown.

*Thank you for the recommendation. We will take this under advisement. A portion of Waggoner has been mapped with LiDAR as part of a fault mapping project and the usefulness of this data for assisting with planning could be evaluated.*

- CDFW recommends that small area (s) (totaling between ~10-20 acres) of one unit be kept inundated through July to provide breeding habitat for resident waterfowl. Waterfowl chicks tend to fledge by June and July, and therefore permanent flooding would not be necessary to provide habitat for breeding resident waterfowl.

*Few waterbirds likely remain year-round in Owens Valley, but migrate to, or move to BWMA to breed when conditions are favorable. Over our period of record, 2016 saw the highest summer number of waterfowl and coots at BWMA (potential breeders averaging 350 ducks and 300 coots over the two surveys in June, but only observed fewer than 20 waterfowl broods. Coots were seen nesting but broods were not estimated. Species that breed early in the season (for example Mallard), may actually find improved breeding conditions if productive open water areas persist to early May. Once hatched, upland nesting waterfowl species such as Mallard and their broods can be quite mobile and move their broods in response to changing conditions. Species that breed later (late May, June, and July) such as Gadwall and American Coot may not even settle and establish territories as drawdown will be complete by May 1. In short, even under conditions of continuous flooding in summer, while waterbird nesting has occurred, we do not have any evidence that BWMA has been highly productive for breeding waterfowl.*

*Additionally, the Interim BWMA Plan is placing an emphasis on not facilitating an expansion of saltcedar. Drying up a unit in July will result in salt cedar germination as the wetted area decreases. Flooding the unit into July will also create an expansion of cattails and bulrushes in the pond and may require additional maintenance.*

- CDFW recommends that the County and LADWP consider earlier draw-down dates as well as using multiple irrigation pulses to encourage the growth of appropriate wetland plants and maximize seed production. The plan should include an adaptive framework for making the decisions.

*LADWP agrees that the date selected for drawdown is tentative and will likely require adjustments after the first year of flooding and drawdown. We also welcome the technical assistance from CDFW in optimizing the timing of flooding and drawdown. However, a late season pulse flow will need to be weighed against the possibility that summer flooding will likely increase saltcedar expansion.*

- The County and LADWP should consider petitioning CDFW and the Fish and Game Commission to create a sanctuary unit within BWMA during waterfowl hunting season to provide refuge habitat for overwintering and migratory waterfowl.

*This recommendation is beyond the scope of the Interim Plan. However, we will take this comment under advisement if hunting pressure is determined to be problematic as a result of the plan. If CDFW pursues a sanctuary within the BWMA, a separate agreement would be required with CDFW's commitment for enforcement as LADWP and the County are not qualified to enforce CDFW regulations.*

Environmental compliance:

- The County and LADWP should identify if activities that impact the bed, bank, or channel (e.g., disking, replacement or installation of structures) of the BWMA units would be covered under an existing Lake and Streambed Alteration Agreement (1600-2008-0146-R6) or if the agreement needs to be amended to incorporate these activities.

*LADWP has recently renewed Agreement 1600-2008-0146-R6 for routine maintenance activities within the LORP. Disking of tules falls under provision 14C of the Agreement. This section reads:*

> *"The Applicant may breach tule stands to allow unencumbered flow during initial flow periods and generally to maintain stream flow in-stream, and into wetlands and into off-channel lakes and ponds. Tule stand breaching may be conducted using mechanical equipment."*

*Most other work necessary for implementing the Interim Plan will be maintenance, repair, or replacement of existing facilities that is covered under the existing agreement. If new structures are constructed, LADWP will apply for a new lake or streambed alteration agreement or consult with CDFW to determine if they can be incorporated into the existing agreement through amendment.*

- What has the County and LADWP considered for CEQA compliance, specifically necessary amendments, to the Lower Owens River Project (LORP) 2004 Environmental Impact Report?

*The LORP EIR/EIS (Section 2.5.4) recommended a review of BWMA flooding cycles 10 to 15 years following LORP implementation to determine if modifying the flooding regime could improve the project and bring it closer to achieving MOU goals. The BWMA was reviewed by LADWP and Inyo County in the LORP 2019 Evaluation Report; the Interim Plan was generated as a result of the findings in that report. The Interim Plan proposes to test the concepts of seasonal flooding and moist soil management in the BWMA for a period of five years before any permanent change to the project is made. The LORP EIR*

*does not need to be amended as it considers the need for potential adaptive management with the project.*

Per this existing framework established by the LORP documents, CDFW is available and looks forward to future coordination on this Project. In addition, CDFW would like to continue to be consulted regarding Blackrock Waterfowl Management Area (BWMA) annual operation plans and seasonal habitat flows as outlined in the 1997 MOU.

*Your comment is noted.*

Additional Questions:

- With the new plan framework (i.e., no permanently flooded units), what is the status of the resident breeding waterfowl habitat within the LORP? How much habitat is available for breeding waterfowl and what is the condition of the habitat (e.g., are bass present)? How much benefit is expected to be gained for migratory waterfowl vs. how much we are losing for breeding waterfowl (trade-offs).

*Few waterfowl likely remain year-round in Owens Valley, but migrate to, or move to BWMA to breed when conditions are favorable. The current conditions within BWMA of limited open water habitats from yearlong flooding regimes has not resulted in stable conditions for breeding waterfowl. Perhaps the first year of flooding creates open water habitat, but by the second year as cattails fill in, habitat is reduced. Breeding waterfowl exhibit site philopatry, and will return to areas where they bred successfully the year prior, or return to their natal ground to breed. Because the breeding habitat is not stable at BWMA, a stable breeding community has not developed. Creating a small breeding waterfowl pond as you have recommended would certainly provide local benefits by supporting a small number of broods perhaps, but would likely require extensive management to maintain its productivity. We question whether the investment is worth the return as even under the "best" conditions at BWMA, fewer than 20 waterfowl broods have been observed. The most breeding activity we have seen at BWMA was in the summer of 2016, when potential breeder waterfowl averaged 350 ducks over the two surveys in June. In that year we observed fewer than 20 waterfowl broods, which is the highest number we have seen in any one survey year at BWMA. In short, even under conditions of continuous flooding in summer, while waterfowl nesting has occurred, we do not have any evidence that BWMA has been highly productive for breeding waterfowl. From a waterfowl population standpoint, Owens Valley is not a significant contributor to waterfowl reproduction for any species. So 10-20 acres of hemi-marsh in Owens Valley would be insignificant to population trends. We believe the gains we could achieve for our migratory waterfowl populations by providing a stopover location that is more reliable and of higher quality far outweighs gains we could achieve by supporting a small breeding waterfowl population.*

- What will the status of the native fish be under the draft Plan's framework? Owens pupfish and Owens tui chub are listed under the 1997 MOU as indicator species for the BWMA.

*Seasonal flooding of wetlands is not conducive to supporting native fish populations. However, year-round flooding defined by the project has also not been conducive to supporting native fish as these ponds quickly become a bass fishery that would outcompete any native fish species. Further, BWMA*

*management was originally designed to rotate and periodically dry and rest the units which would also not support long term fish populations.*

- How will additional hunting pressure be managed? *See comment above.*

If you have any questions about the comments, please reach out to me through email or phone.

Thank you,

Alyssa Marquez

Environmental Scientist

California Department of Fish and Wildlife – Inland Deserts Region 6

787 North Main Street Suite 220

Bishop, CA 93514

Cell: (760) 567-0332

# 7.0 PUBLIC MEETING AND COMMENTS

## 7.1 LORP Annual Public Meeting

The LORP 2021 Draft Annual Report public meeting was held on December 7, 2021 at 3:00pm. Due to the COVID-19 pandemic, the meeting was hosted virtually on WebEx. Fifteen staff members from LADWP and Inyo County Water Department (ICWD) were in attendance as well as nine members of the public. An audio recording of the meeting can be made available upon request. Adaptive Management presentations given by LADWP and ICWD Staff are provided in LORP Public Meeting Appendix 1.

## 7.2 LORP 2021 Draft Annual Report Comments

The comment period for the LORP 2021 Draft Annual Report was from November 18, 2021 through December 22, 2021. One party (Owens Valley Committee) requested an extension for comments and was granted through December 31. 2021. No comment letters were received in the allotted comment period.

# Delta Habitat Area

## Interim Adaptive Management

Report on Year 1 Observations:

Runoff Year April 1, 2020-March 31, 2021

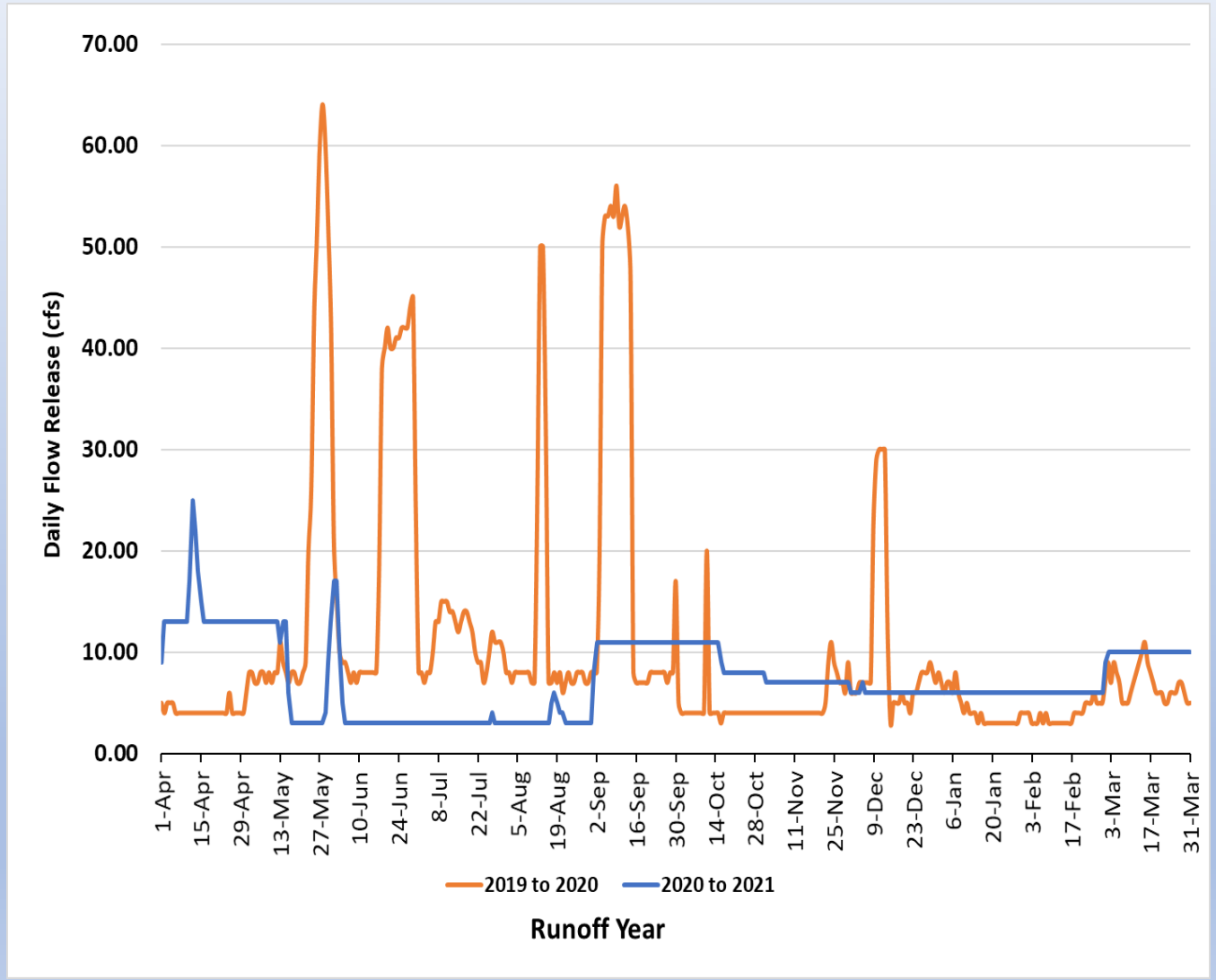
LORP Annual Report Public Meeting

December 7, 2021

# 2020-2021 Monitoring

- Flow Monitoring
- Adaptive Management Flow Effectiveness
- Avian Surveys
- Photopoints

# Interim vs. LORP EIR Releases



# Adaptive Management Flow Effectiveness

Criteria 1: Did the summer minimum baseflow result in drying and hydrologic stress of cattails in the DHA?

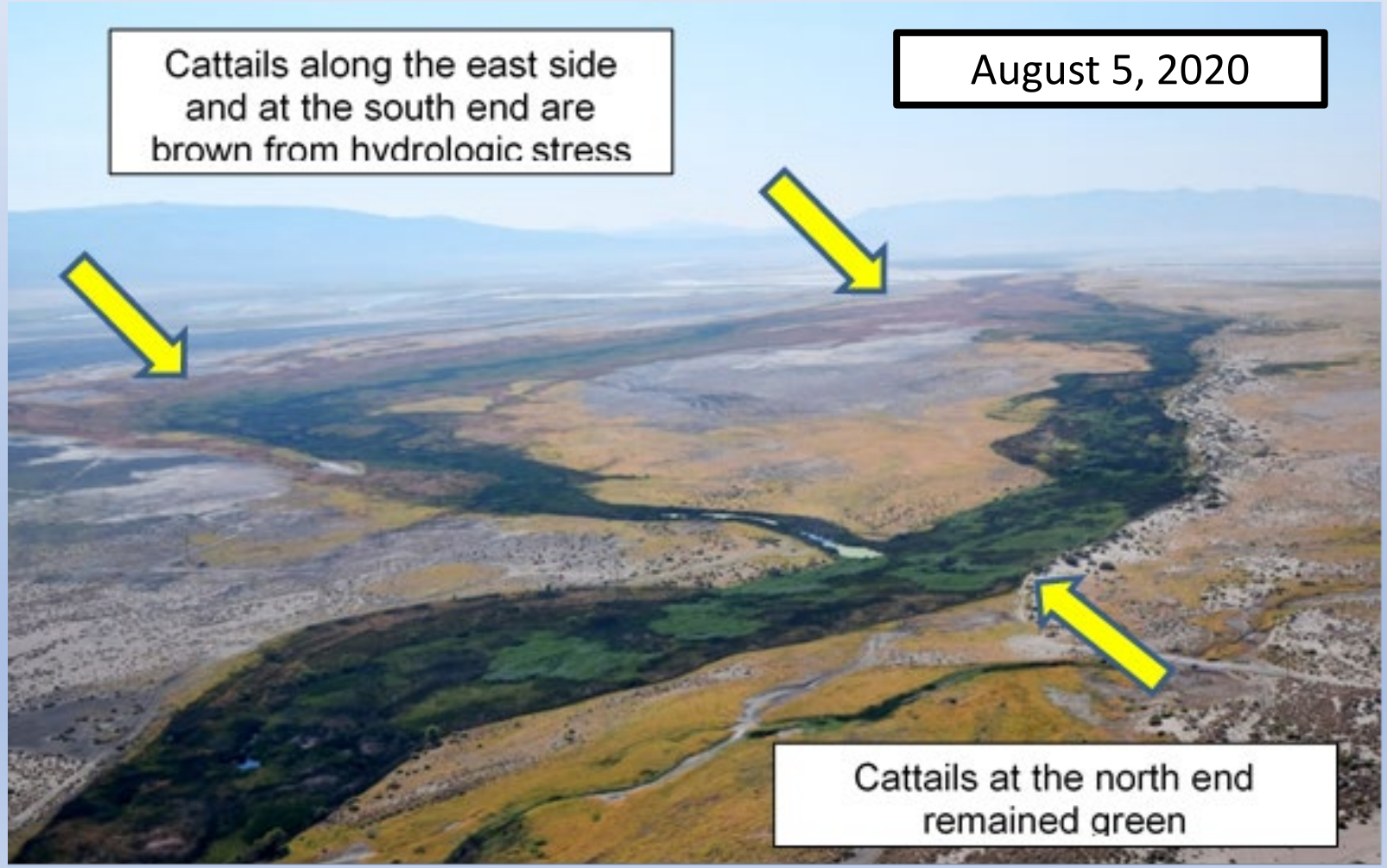
Criteria 2: Did the minimum summer base flow maintain water in permanent ponds serving as “control points”?

Criteria 3: Did the interim flows produce flooding of existing, seasonal ponds serving as “control points” from September through early May?

# Flow Effectiveness Monitoring

**Criteria 1**: Did the summer minimum baseflow result in drying and hydrologic stress of cattails AND

**Criteria 2***:* Did the minimum summer base flow maintain water in permanent ponds serving as “control points”?

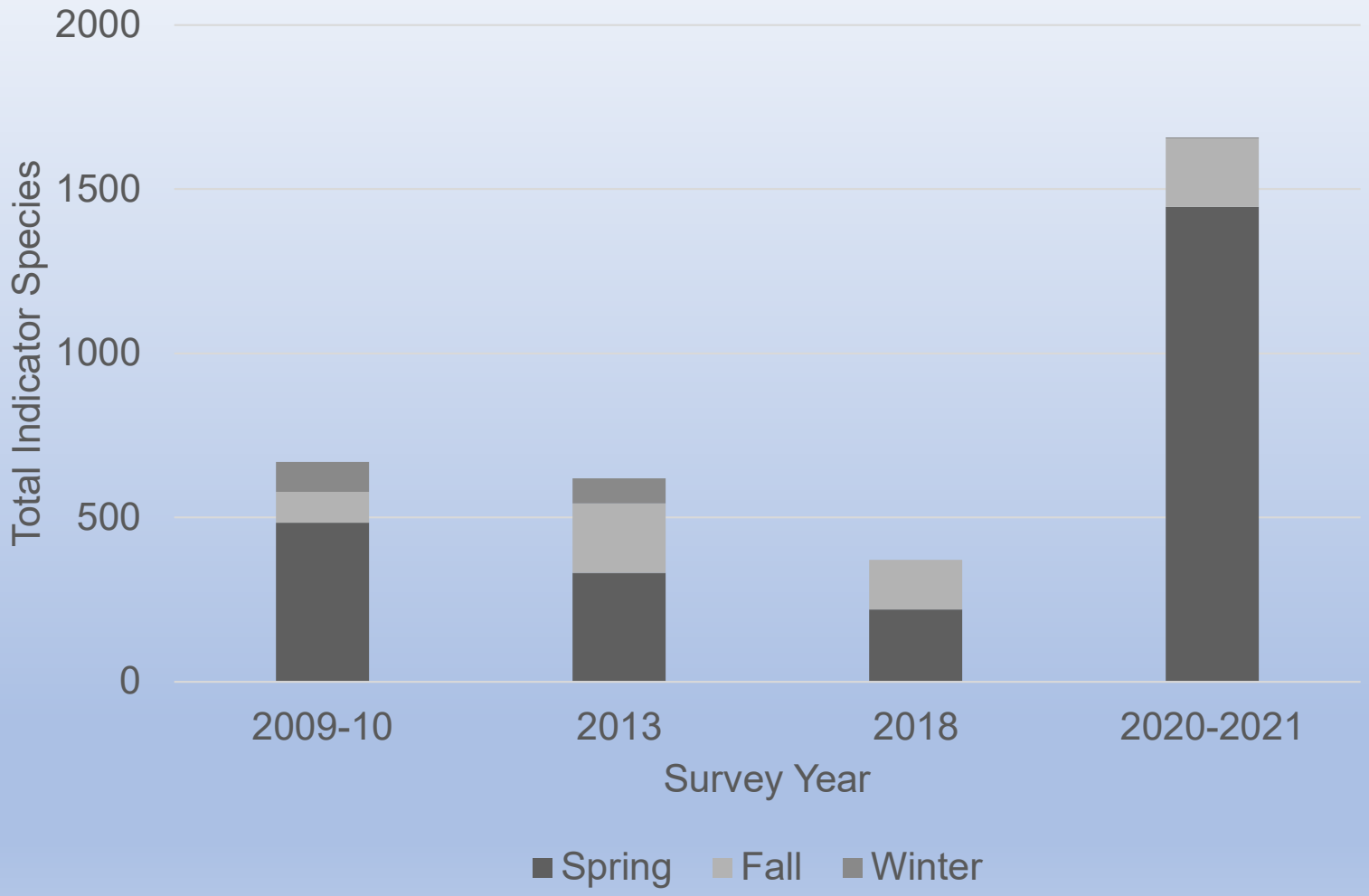


# Flow Effectiveness Monitoring

**Criteria 3**: Did the interim flows produce flooding of existing, seasonal ponds serving as “control points” from September through early May?



# Avian Survey Results by Season




*No winter survey in 2018

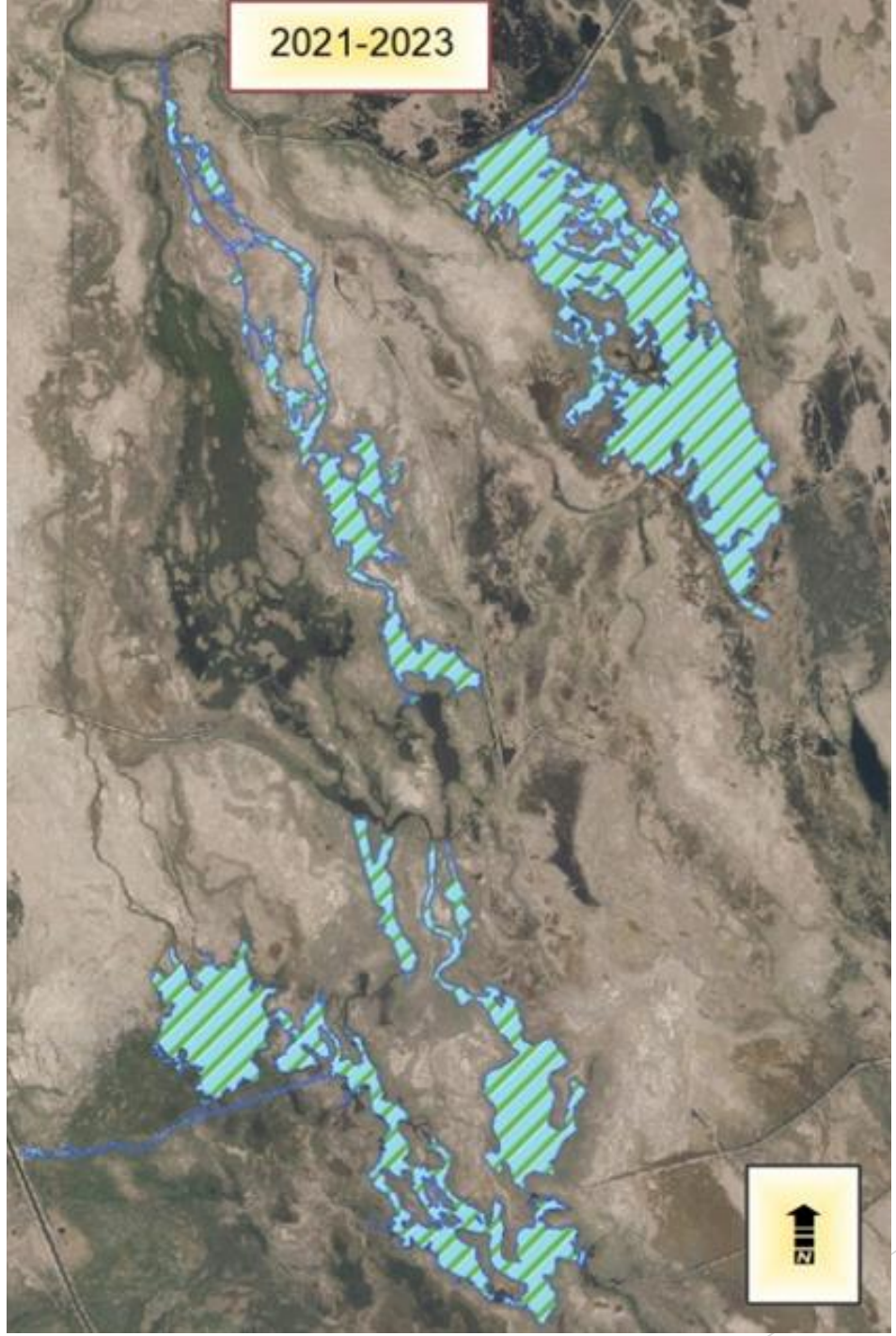
# Summary of Year 1 Adaptive Management Flows

- Interim flow regime was effective at meeting assessment criteria in Year 1
- Habitat Indicator Species similar to, or exceeded prior years
- Habitat conversion will be gradual without intervention

# Update on BWMA pilot project

John Hays, LADWP

East Winterton Unit




Waggoner Unit

Thibaut Unit

# Preparation for East Winterton and Waggoner Units

- Two weeks of spraying for pepperweed in July
- 3 days discing in  East Winterton (approx. 60 acres)
- 5 days discing in Waggoner (approx. 100 acres)

East Winterton

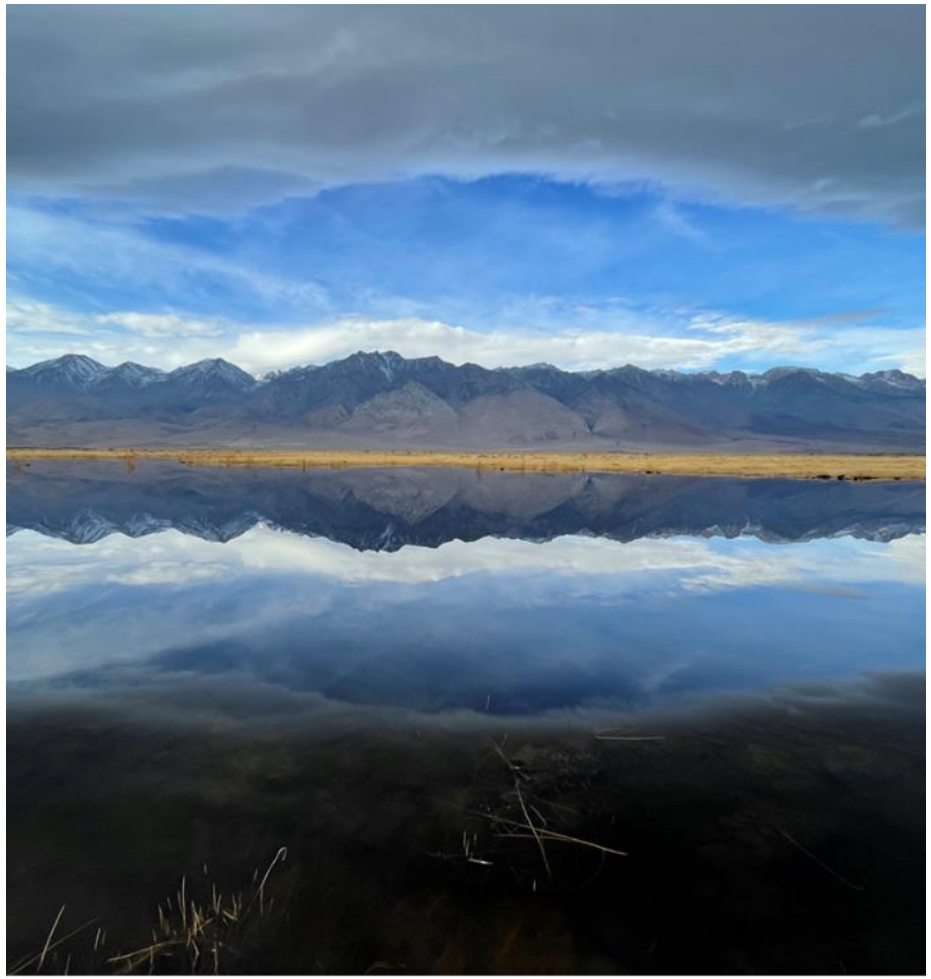
Waggoner

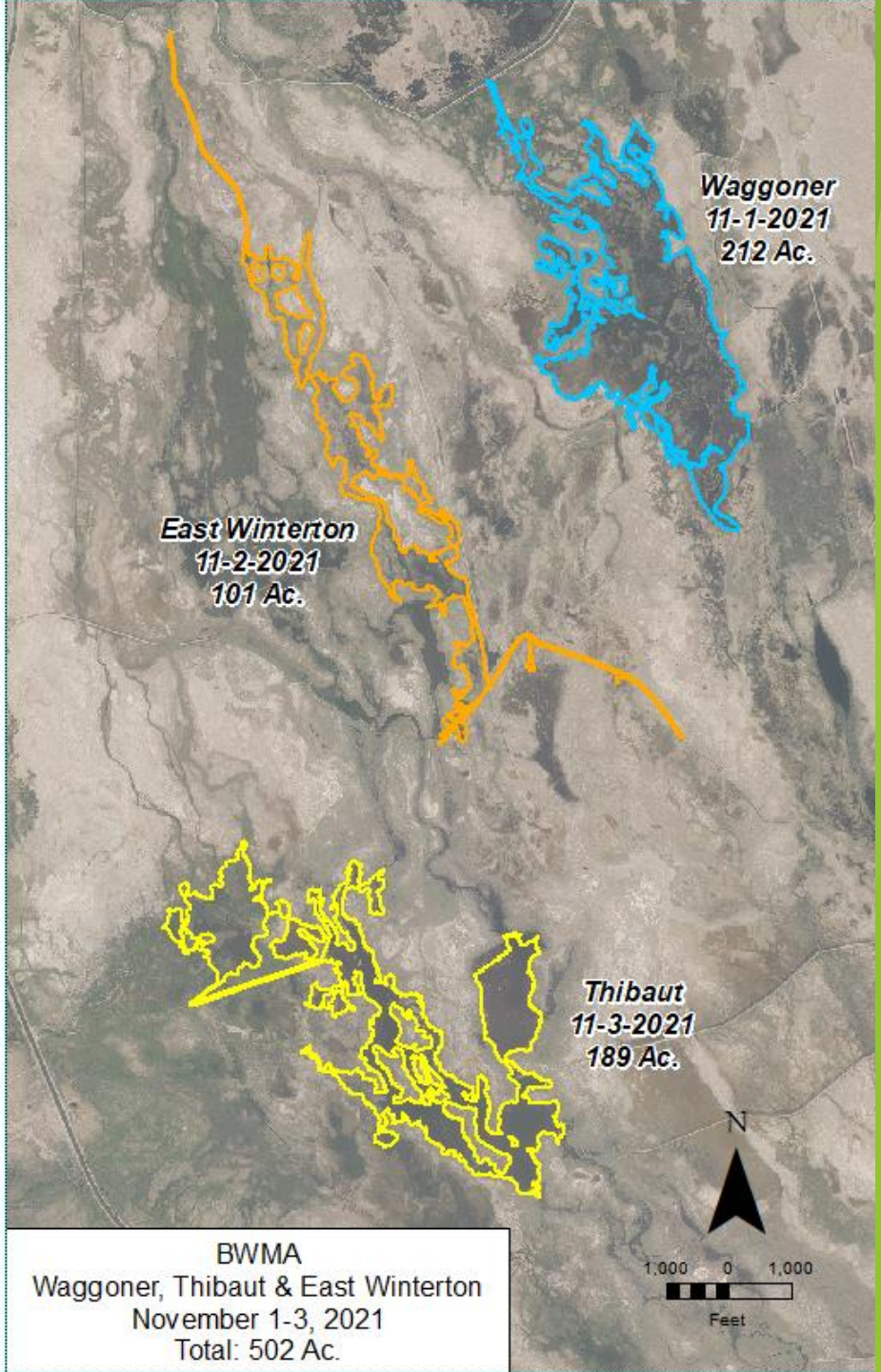
# Infrastructure Improvements

- Installation of weir plates & ditch cleaning at Diversion #8 and Diversion #3
- Four headgates, multiple culverts

# Flooding began September 15th

# First week of November = 502 acres





# Avian surveys

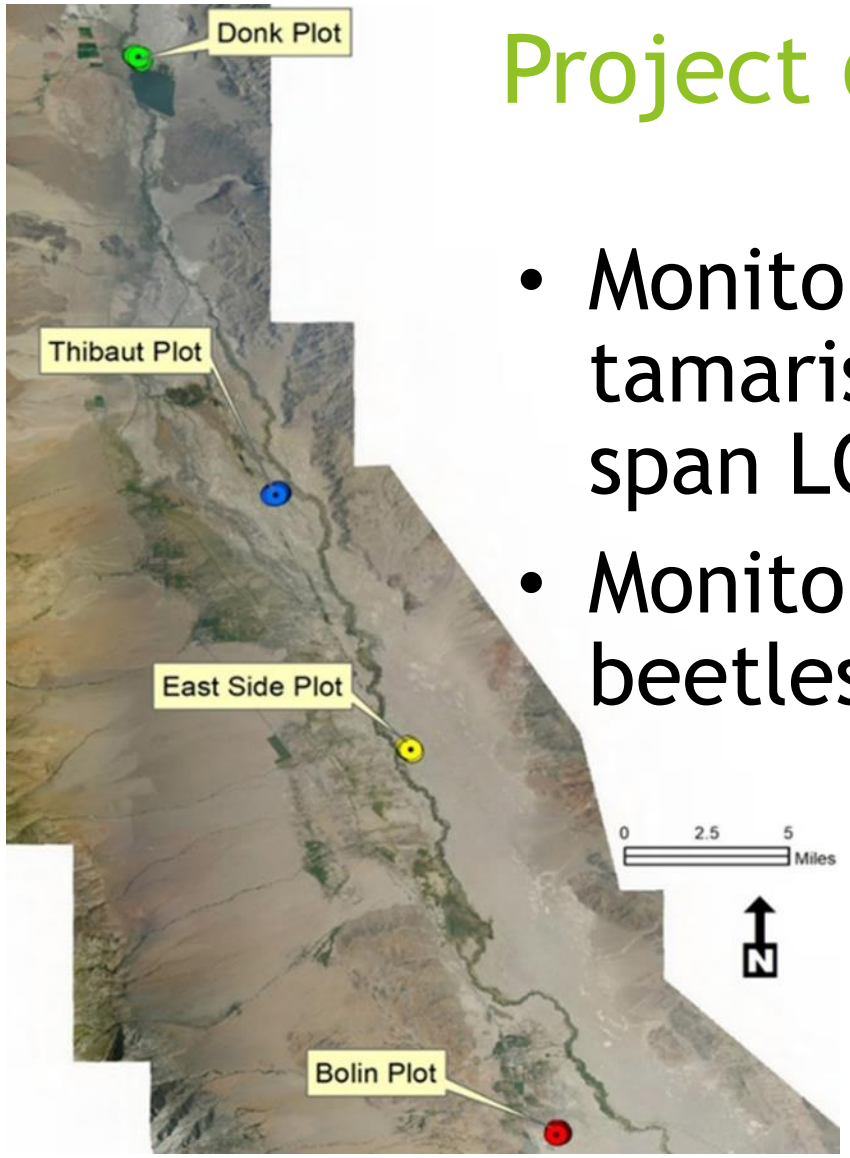
✓ 3 Fall surveys
2 Winter surveys
4 Spring surveys


Thank you, the end.

# Tamarisk Beetle study

## Overview of the project from May 2020-August 2021

Presented by John Hays, LADWP



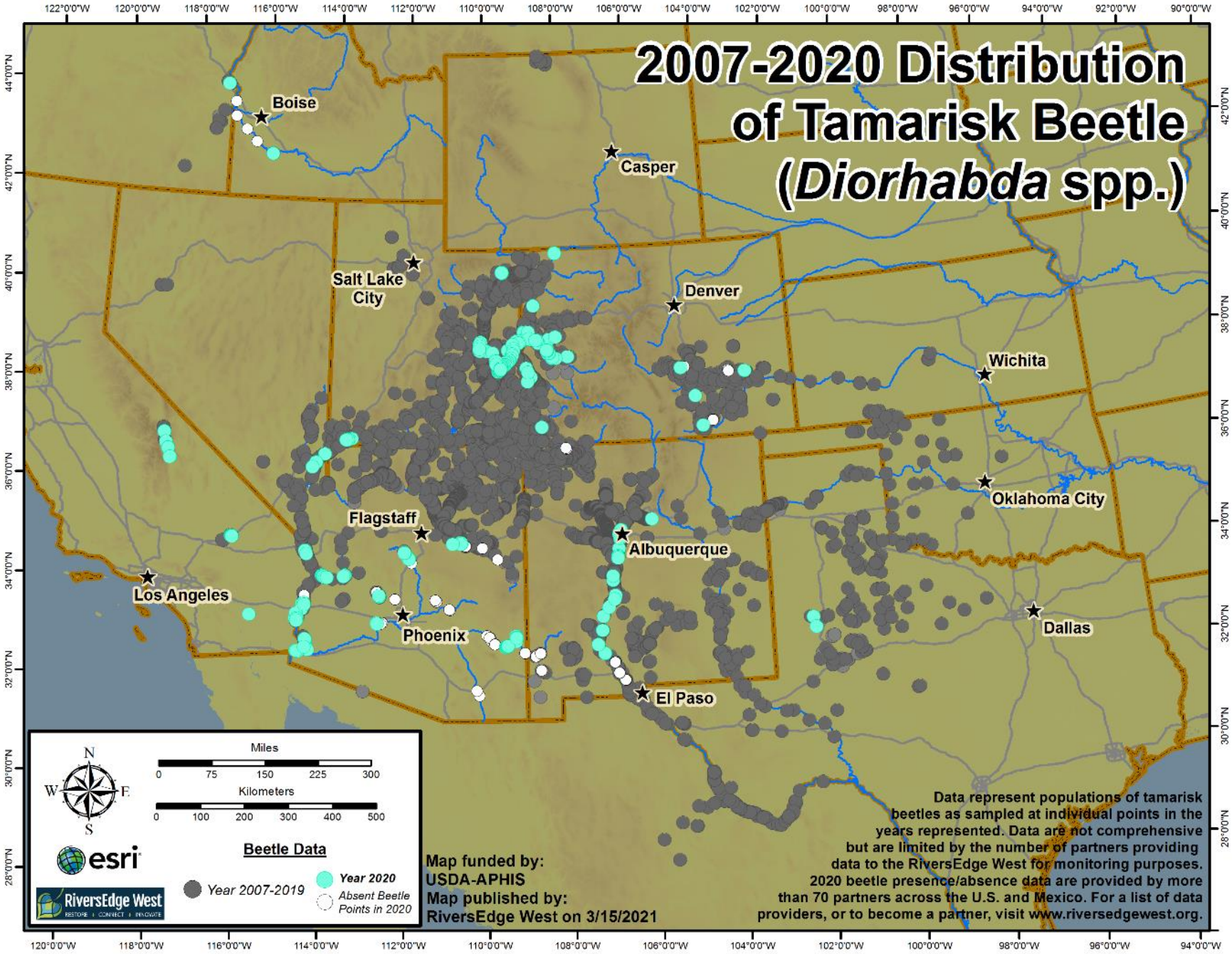

# Project objectives

- Monitor presence/absence of tamarisk beetle in four locations that span LORP project area
- Monitor impacts on tamarisk where beetles are present

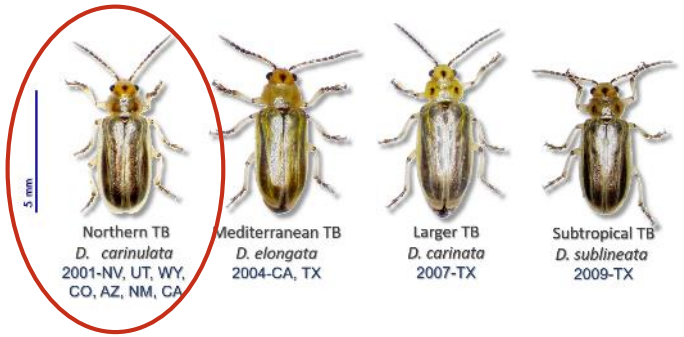
# Life cycle of the Tamarisk Beetle

- After overwintering (diapause) adult beetles emerge, mate, lay eggs.
- Eggs hatch a week later
- Three larval stages “instars” (5-7 days for each instar)
- Drop to prepupal then pupal case and remerge as adults (7-10 days)
- Number of cycles determined by day length in particular region*

- ❑ 6 week life cycle
- ❑ 2-3 lifespans/year

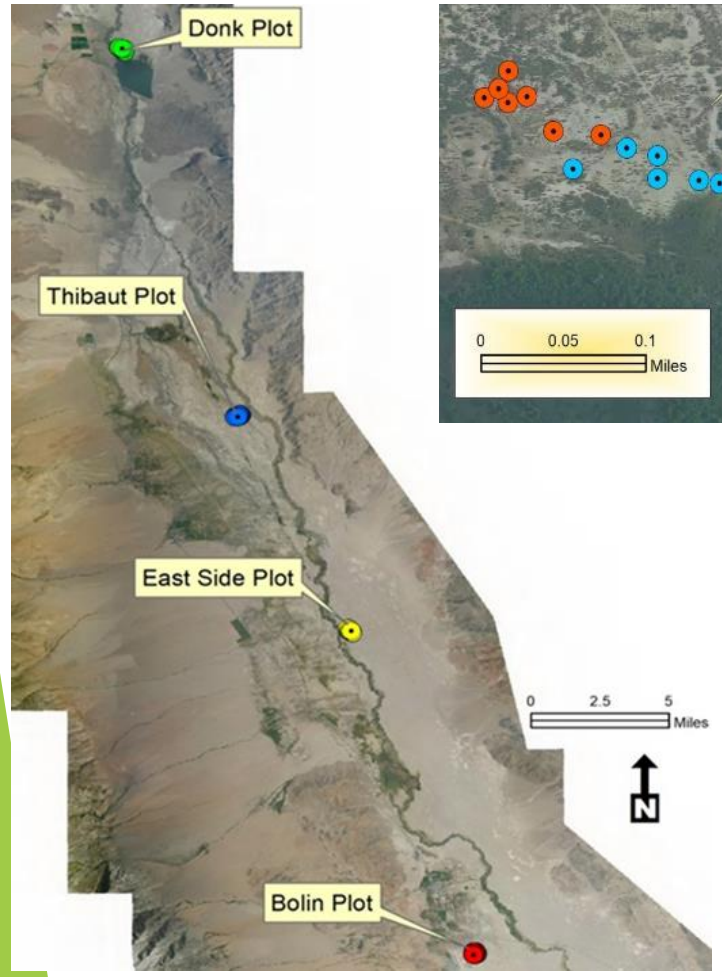


2007-2020 Distribution of Tamarisk Beetle (Diorhabda spp.)
Boise
Casper
Salt Lake City
Denver
Wichita
Oklahoma City
Flagstaff
Albuquerque
Los Angeles
Phoenix
Dallas
El Paso
Miles
0 75 150 225 300
Kilometers
0 100 200 300 400 500
N
W
E
S
esri
Beetle Data
Year 2007-2019
Year 2020
Absent Beetle Points in 2020
RiversEdge West
Map funded by:
USDA-APHIS
Map published by:
RiversEdge West on 3/15/2021
Data represent populations of tamarisk beetles as sampled at individual points in the years represented. Data are not comprehensive but are limited by the number of partners providing data to the RiversEdge West for monitoring purposes. 2020 beetle presence/absence data are provided by more than 70 partners across the U.S. and Mexico. For a list of data providers, or to become a partner, visit www.riversedgewest.org.

# Tamarisk Beetle in the Owens Valley



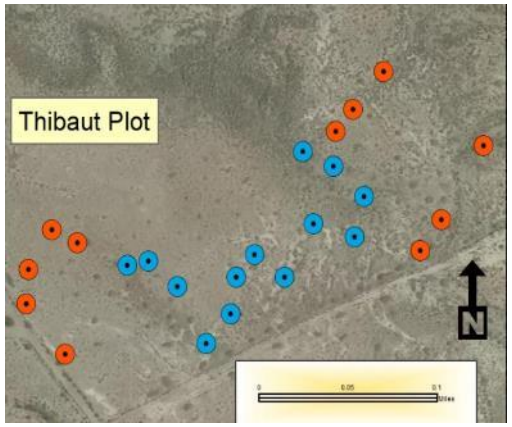

- Introduced in a research plot at Tinnemeha in 1999.
- Beetle spread to a 2km buffer from research site
- Initial assumption limited to 37$^{th}$ parallel because of shorter summertime day lengths
- Evidence that the beetle is evolving (Bean 2012)
- Confirmed observations of tamarisk beetle in 2017
- Dispersed south of the Intake to Owens Lake

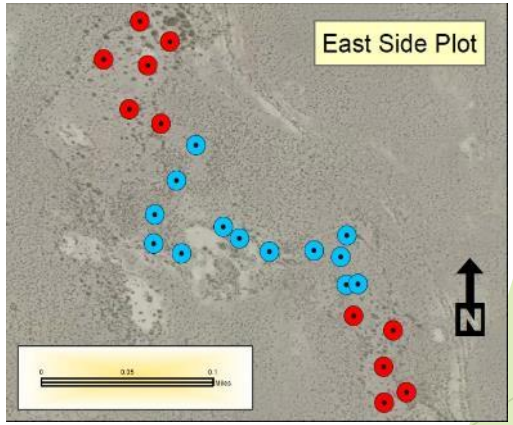
# Study area

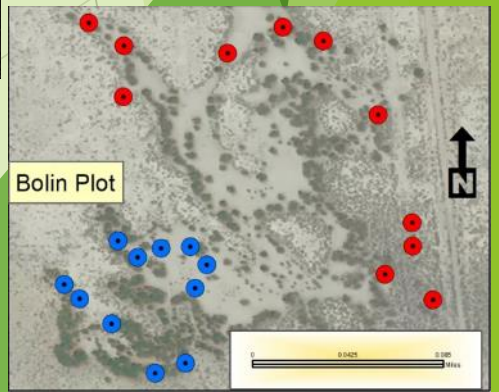









https://riversedgewest.org/services/tamariskbeetle

# Trees are evaluated in late spring and late summer

6/2/20

9/2/20

6/10/21

8/9/21

- ✓Estimate % brown
- ✓Estimate # beetles
- ✓Estimate # larvae and class
- ✓Estimate % dead branches

# Results from 2020-2021

- Widespread herbivory on Bolin plot for both years (83% of trees in 2021)
- Some use across Thibaut plot (58% of trees in 2021)
- No recent activity on the Donk plot, evidence from 1999 event (dead wood).
- No significant use on the East Side plot
- **No mortality** observed on any plots
- Herbivory will vary both locally and across landscapes
- Mortality will only occur after several years of herbivory, if at all.

Bolin A-19, 6/21

Bolin A-19, 8/21

# The End

# LORP Adaptive Management: Riparian Tree recruitment

**Meredith Jabis**
**Inyo County Water Department**

# Questions:
# Tree recruitment

1. Describe conditions that allowed tree establishment: *pre-project*

2. Assess conditions permitting recruitment: *post project initiation*

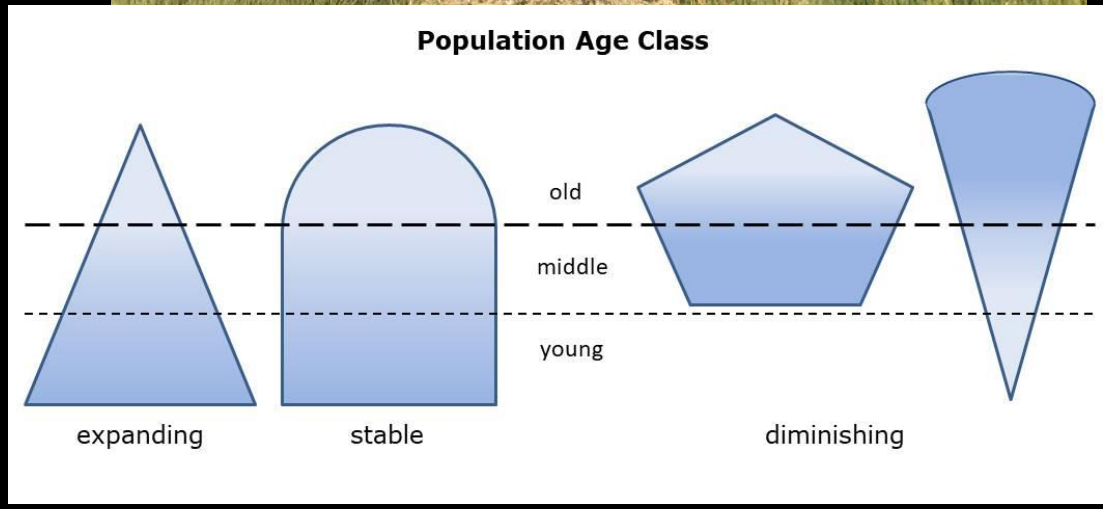
3. ~~identifying current biological processes that could limit tree germination or establishment.~~


work to-date (as of October 2021) on the LORP project area.

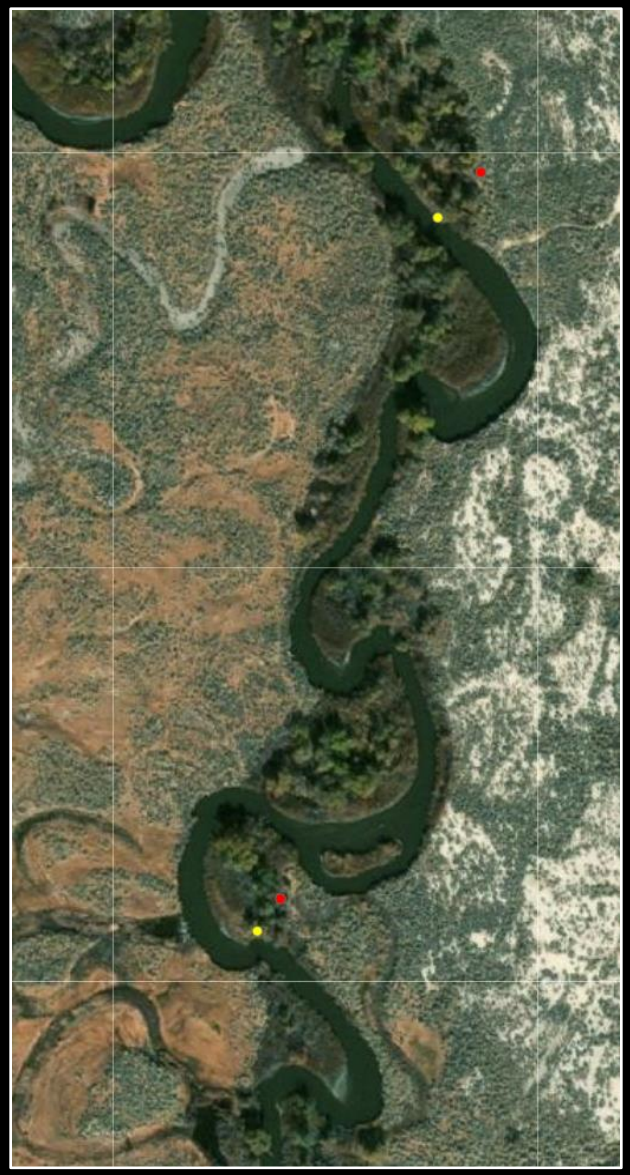
# Tree establishment Pre project: TypeD

1. What historic conditions fostered tree establishment along the Owens River, floodplain, and old meanders?

2. What is the current age- and size- structure of Owens River riparian forests; is the population *expanding, stable or diminishing*?



# Establishment Pre-Project: Type D Riparian Transects

Run from channel edge to span the width of floodplain; span extent of tree canopy

# Establishment Pre-Project: TypeD Data Collected

- Tree height, diameter, health, canopy cover, stand density, co-occurring species
- Soil samples collected: salinity and texture
- Trees cored for precise age estimation
- Tree topographic elevation relative to water stage

# Establishment Pre-Project Type D Riparian: Status

- 28 transects completed on the LORP
- 4-8 transects per reach
- Results will be presented in a future annual report

# Tree Recruitment:
# Post-project implementation

Re-visit recruitment sites

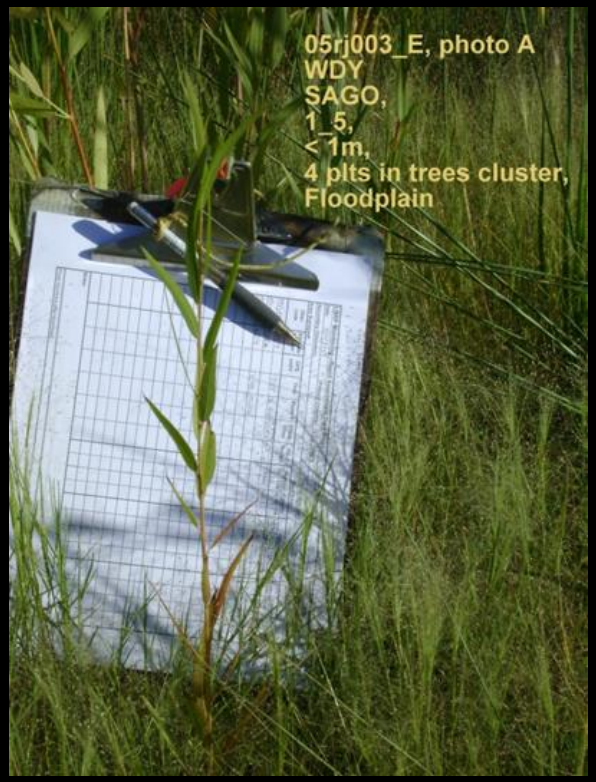
- identified during the LORP Rapid Assessment Survey (RAS)

# Recruitment Post-project: data collected

- Tree count, basal diameter, height
- Co-occurring species recorded
- Tree topographic elevation relative to water stage
- Patch distance from channel
- Soils: salinity and texture
- Collected saplings (dead trees) for age estimates

# Recruitment Post-project: status

- Visited 30 sites across all LORP reaches
- Results will be presented in a future annual report




Species: black & red willow (*Salix goodingii, Salix laevigata*) and Fremont cottonwood (*Populus fremontii*)

# Questions?

# LORP Weed Surveillance and Treatment

- Lepidium (LELA2) is a growing concern
- Transported to LORP from up-river sources
- LELA2 has established in the LORP with community spread
- ICDW, LADWP, I/M Ag monitor and map
- Coordinated aggressive control efforts are underway
- 16.8 net acres treated by Inyo/Mono Ag Office (20-21)
- 692 gross acres treated by LADWP in the BWMA
- Dry years offer best opportunity to treat