Los Angeles Department of Water and Power

MONO BASIN

Waterfowl Habitat Restoration Plan

Prepared for the
State Water Resources Control Board

In response to the
Mono Lake Basin Water Right Decision 1631

February 29, 1996

Mono Basin Waterfowl Restoration Plan

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PREPARED BY THE LOS ANGELES DEPARTMENT OF WATER AND POWER

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III: Letter: March 7, 1995, from Mr. Edward C. Anton (SWRCB) to Interested Parties regarding the Mono Basin Restoration Notes from the Meeting held in Sacramento on February 17, 1995.

IV: Letter: November 21, 1995, from Ms. Cindy Wise (SWQCB) to LADWP regarding SWQCB permitting process for proposed restoration projects.

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Mono Basin Waterfowl Habitat Restoration Plan

Executive Summary

The Mono Lake Basin Water Right Decision 1631 was adopted by the State Water Resources Control Board (SWRCB) on September 28, 1994. This Decision amended Water Right Licenses 10191 and 10192, held by the City of Los Angeles, to meet the public trust needs of the Mono Basin environment, and to comply with Fish and Game Code Sections 5937 and 5946. The Decision defined instream flow requirements in the four streams from which the Los Angeles Department of Water and Power (LADWP) diverts water, and established water diversion criteria to protect wildlife and other environmental resources (air quality, scenic value, water quality standards) in the Mono Basin.

Decision 1631 requires LADWP to prepare a Waterfowl Habitat Restoration Plan, to "...help mitigate the loss of waterfowl habitat due to the diversion of water...". This document is the plan required by the SWRCB.

The goal of the Mono Basin Waterfowl Habitat Restoration Plan is to assess opportunities in lake-fringing wetlands to restore or create waterfowl habitat and make recommendations as to which opportunities should be pursued. By developing a diversity of freshwater habitats within the Mono Lake ecosystem, it is expected that increased waterfowl numbers will be attracted to Mono Lake. In development of the waterfowl restoration plan, the waterfowl scientists identified measures to reach the project goal. The goal for waterfowl habitat restoration will be reached when the objectives for each of these measures are achieved. The plan identifies objectives for the measures.

Of the restoration actions proposed by the waterfowl scientists, highest priority has been given to increasing the level of Mono Lake to the targeted lake level of 6,392 feet. This action is expected to restore and provide the most diversity of waterfowl habitats. Other measures intended to complement rising lake levels include rewatering Mill Creek; rewatering important distributaries in the Rush Creek bottomlands; developing the DeChambeau Ponds/County Ponds/Black Point Project; and developing a prescribed burn plan for lake-fringing wetlands.

The level of Mono Lake will increase as a result of the streamflow requirements and export criteria established in Decision 1631. This assures that in addition to all other benefits that accrue with the rising lake level, most of the feasible restoration to the waterfowl habitat will also be accomplished. Further, the rewatering of Rush Creek distributaries has been identified as an important restoration measure for stream restoration, and is included in LADWP's Stream and Stream Channel Restoration Plan.

To accomplish the rewatering of Mill Creek, LADWP is proposing to dedicate its water right for this purpose. Further, LADWP is pursuing the dedication of other unappropriated water that may be available during the fall and winter months, when it would be needed most as waterfowl habitat.

Implementation of the suggested DeChambeau/County Ponds/Black Point Project will depend on the availability of water supplies and outside funding. The Waterfowl Habitat Restoration Plan proposes to phase this project. When outside funding is secured, LADWP will implement the DeChambeau component first. LADWP will proceed with the second phase provided that monitoring results of the first phase indicate no adverse impacts, and study of available water supply indicates that it is feasible. LADWP will seek funding from outside sources, both environmental organizations, as well as large agencies pursuing compensatory mitigation projects.

The prescribed burn program will be implemented in cooperation with the California Department of Forestry, under their Vegetation Management Program, which is a cost sharing agreement. Actual burn plans will have to be developed cooperatively with the appropriate agencies with land management responsibilities.

The focus of waterfowl habitat restoration is on creating habitat that is suitable for waterfowl use. Monitoring of long term trends will provide the data to decide on the success of restoration. The proposed monitoring program will focus on habitat parameters: hydrologic and limnologic conditions, vegetation; population counts and habitat use information will also be gathered.

The majority of the restoration work proposed by LADWP will be completed within 3 years from the approval of the plan by the SWRCB. Many parameters may influence the actual time to complete the work, such as time required for environmental documentation, permitting, licenses, outside funding availability, and, since some of the work is limited by weather, the actual start date. The monitoring program is scheduled to start as soon as a contract for the work can be secured.

The estimated cost of the LADWP proposal is $150,000. This includes the cost of the preparation of the necessary environmental documentation. Outside funding for an additional $753,000 for the DeChambeau/County Ponds/Black Point project will be pursued. Average annual expenses are estimated to be approximately $180,000. The largest component of this is the annual monitoring, estimated at $140,000.

The Waterfowl Habitat Restoration Plan includes provisions for reporting the planned activities for an upcoming year, as well as the results of previous years efforts, to the SWRCB. These provisions meet the requirements of Decision 1631.

LADWP has fully complied with the Decision in preparing its proposal for waterfowl habitat restoration. The proposal is consistent with statutes of the Mono Basin National Forest Scenic Area, and the Mono Lake Tufa State Reserve; proposed projects are identified, and their schedule, costs, method of financing, and water requirements are listed; existing conditions are described; a detailed monitoring plan is provided; and provisions are made for obtaining all necessary permits, and complying with State and Federal environmental documentation requirements. Finally, in preparing the Waterfowl Habitat Restoration Plan LADWP employed the TAG process, by which all parties named in Decision 1631, and other interested parties participated and had the opportunity to provide input.

Mono Basin Waterfowl Habitat Restoration Plan

I. Introduction

The Mono Lake Basin Water Right Decision 1631 was adopted by the State Water Resources Control Board (SWRCB) on September 28, 1994. The Decision amended Water Right Licenses 10191 and 10192, held by the City of Los Angeles, to meet the public trust needs of the Mono Basin environment and to comply with Fish and Game Code sections 5937 and 5946. As part of the amendment to the water right licenses, the Los Angeles Department of Water and Power (LADWP) is required to prepare and submit to the SWRCB for approval a stream and stream channel restoration plan and a waterfowl habitat restoration plan.

Decision 1631 states that the objective of the waterfowl habitat restoration plan is to help mitigate for the loss of waterfowl habitat due to the diversion of water from the Mono Basin. In 1941, LADWP was issued permits (and eventually licenses) to divert streams tributary to Mono Lake. Decision 1631 limits diversions so that Mono Lake can rise and then be maintained, at an average elevation of 6,392 feet. The SWRCB decision found that this elevation would not restore all of the waterfowl habitat that existed in the Mono Basin prior to 1941. The Decision requires LADWP to prepare a waterfowl habitat restoration plan to mitigate for the loss of habitat due to the lowered elevation of Mono Lake. This document is the plan that is required by the SWRCB.

Decision 1631 states that the plans are subject to technical and financial feasibility, reasonableness, and adequacy of measures proposed to achieve stated objectives. Restoration of all of the waterfowl habitat that previously existed may prove excessively costly or impractical. The Decision indicates that it is not the intention of the SWRCB to commit excessive resources nor initiate projects that may not prove effective. While this plan offers its definition of what is reasonable, it is the SWRCB that will make the final determination on feasibility and reasonableness issues.

Decision 1631 makes LADWP responsible for preparing a waterfowl habitat restoration plan, but it also requires LADWP to seek active input from several named parties in developing the plan. The parties listed in Decision 1631 are: California Department of Fish and Game (DFG), California State Lands Commission (SLC), California Department of Parks and Recreation (DPR), the United States Forest Service (USFS), the National Audubon Society (NAS), the Mono Lake Committee, and California Trout, Inc.

The schedule established in Decision 1631 required the final proposed restoration plans to be submitted to the SWRCB by November 30, 1995. In May 1995, however, the scientific experts assisting LADWP in preparing the restoration plans concluded that additional time was necessary to prepare their reports, from which LADWP would prepare its restoration plan. On May 16, 1995, LADWP petitioned the SWRCB for amendment of three conditions in Decision 1631. Included in the conditions was a 92-day extension in the schedule to develop the restoration plans. On July 19, 1995, the SWRCB adopted Order WR 95-10 which, among other things, granted the requested time extension. A copy of Order WR 95-10 is included as Appendix II.

II. Development of Waterfowl Habitat Restoration Plan

A. Draft Scope of Work

The first step in the preparation of the restoration plans was the development of the *Draft Scope of Work for the Development of the Mono Basin Stream and Waterfowl Habitat Restoration Plans*. On January 11, 1995, LADWP released a preliminary draft scope of work to the parties listed above so that they could comment on the document. Comments were to be sent to LADWP by January 24, 1995, to be considered and incorporated into the document. In addition to the parties listed above, LADWP also released the document to additional parties to give them an opportunity to provide input to the scope of work. Finally, an advertisement was placed in a local newspaper in Mono County to announce the availability of the document, thereby providing an opportunity for other interested parties and the general public to become involved in the restoration process. LADWP reviewed the comments received and on February 1, 1995, submitted a draft scope of work to the SWRCB. In addition, LADWP prepared a document entitled, *Comments and Response to Comments of the Draft Scope of Work for the Development of the Mono Basin Stream and Waterfowl Habitat Restoration Plans*, which included a copy of all the comments LADWP received on the draft scope of work. The document also showed how a comment was used or the reason why it was not incorporated.

After the draft scope of work was completed, the SWRCB hosted a workshop on February 17, 1995, to discuss the procedures for developing the restoration plans. Many parties and individuals were represented at the meeting, which was designed to answer some of the questions that interested parties, including LADWP, had about Decision 1631 and the restoration plan development process. Many consensus agreements were reached at that meeting. Mr. Edward Anton, Chief of the Division of Water Rights for the SWRCB, compiled notes from the meeting and distributed them to meeting attendees on March 7, 1995. A copy of Mr. Anton's letter and his meeting notes are included in Appendix III.

B. Scientific Experts Selected to Prepare Restoration Report

LADWP contacted several waterfowl experts and evaluated the credentials and availability of the candidates. The candidate pool was expanded to include individuals recommended for consideration by the named parties in Decision 1631. LADWP then interviewed all of the candidates, evaluated each candidate based on their qualifications, and presented their findings to the interested named parties. After a discussion of the needs for developing the restoration report, all parties agreed on the selection of three scientific experts.

The three waterfowl and wetland scientists selected were Dr. Roderick Drewien, Dr. Fritz Reid, and Mr. Tom Ratcliff. Dr. Reid had presented testimony before the SWRCB during the Mono Basin Water Right Hearings on behalf of the Mono Lake Committee and was somewhat familiar with the Mono Basin. Dr. Drewien was not as familiar with Mono Lake, but had much experience in working with restoration projects on Great Basin saline lakes. Mr. Ratcliff, an employee of the U. S. Forest Service, had worked on numerous wetland restoration projects in northern California. In addition to the three scientists selected to prepare the restoration report, Dr. Scott Stine prepared a report for the California State Lands Commission on the expected future wetland condition of Mono Lake, to assist the scientists in the preparation of their report.

C. Formation of Technical Advisory Groups

After the Mono Basin restoration workshop, LADWP formed Technical Advisory Groups (TAGs) for the two restoration plans. When forming the TAGs, at least one individual from each of the named parties was invited to participate. The main purpose of the TAGs was to provide input to the scientists and LADWP in preparing the report and restoration plans. The TAGs were important in selecting the experts to prepare the restoration report.

The waterfowl habitat restoration TAG met four times -- March 14, May 2-3, June 15, and July 28, 1995. The meetings were held in Sacramento (twice), and at Cain Ranch (twice). In addition, there was a field trip of the potential restoration sites held on June 14, 1995. The TAG was also given a brief aerial tour of the Mono Basin during the July TAG meeting.

The TAG process proved to be valuable in the development of the draft plans. New ideas and information were shared and each participant had the opportunity to express his or her concerns. One of the first accomplishment that the TAG completed was a list of goals for the development of the restoration plans. (A copy of the goals is included in the scientists' report.) LADWP provided requested information and data to TAG members. TAG members were given opportunities to provide written comments on draft outlines and sections of the waterfowl scientists report. When it became apparent that additional time was necessary for the waterfowl scientists to prepare their report, the parties agreed to allow for a time extension as requested.

D. Completion of Waterfowl Scientists' Restoration Report

On February 21, 1996, Dr. Drewien, Dr. Reid, and Mr. Ratcliff finalized their waterfowl habitat restoration report entitled, *Mono Lake Basin Waterfowl Habitat Restoration Plan.* A copy of their report is included as Appendix I. The document serves as the basis for LADWP's restoration plan.

As was described in the draft scope of work, LADWP reviewed the waterfowl scientists' restoration report to determine the technical and financial feasibility and reasonableness of restoration measures recommended in the report. Upon review, it was obvious that the waterfowl scientists had put much effort and analysis into their report. LADWP has presented the scientists' recommendations and its assessment of engineering, legal, and other limitations.

III. Scientists' Recommended Waterfowl Habitat Restoration Measures

The three waterfowl scientists' findings and specific restoration proposals are summarized in the conclusions of their report (Appendix I, p.111-114). They specifically recommend that the following projects be undertaken to restore waterfowl habitat in the Mono Basin:

- Increase the water surface elevation of Mono Lake to 6,392 feet;
- Rewater Mill Creek;
- Rewater important distributaries in Rush Creek below the narrows;
- Develop and implement the DeChambeau Ponds/County Ponds/Black Point restoration project;
- Develop and implement a prescribed burn program;
- Develop a cooperative program to control Salt Cedar, an exotic in lake-fringing wetlands.

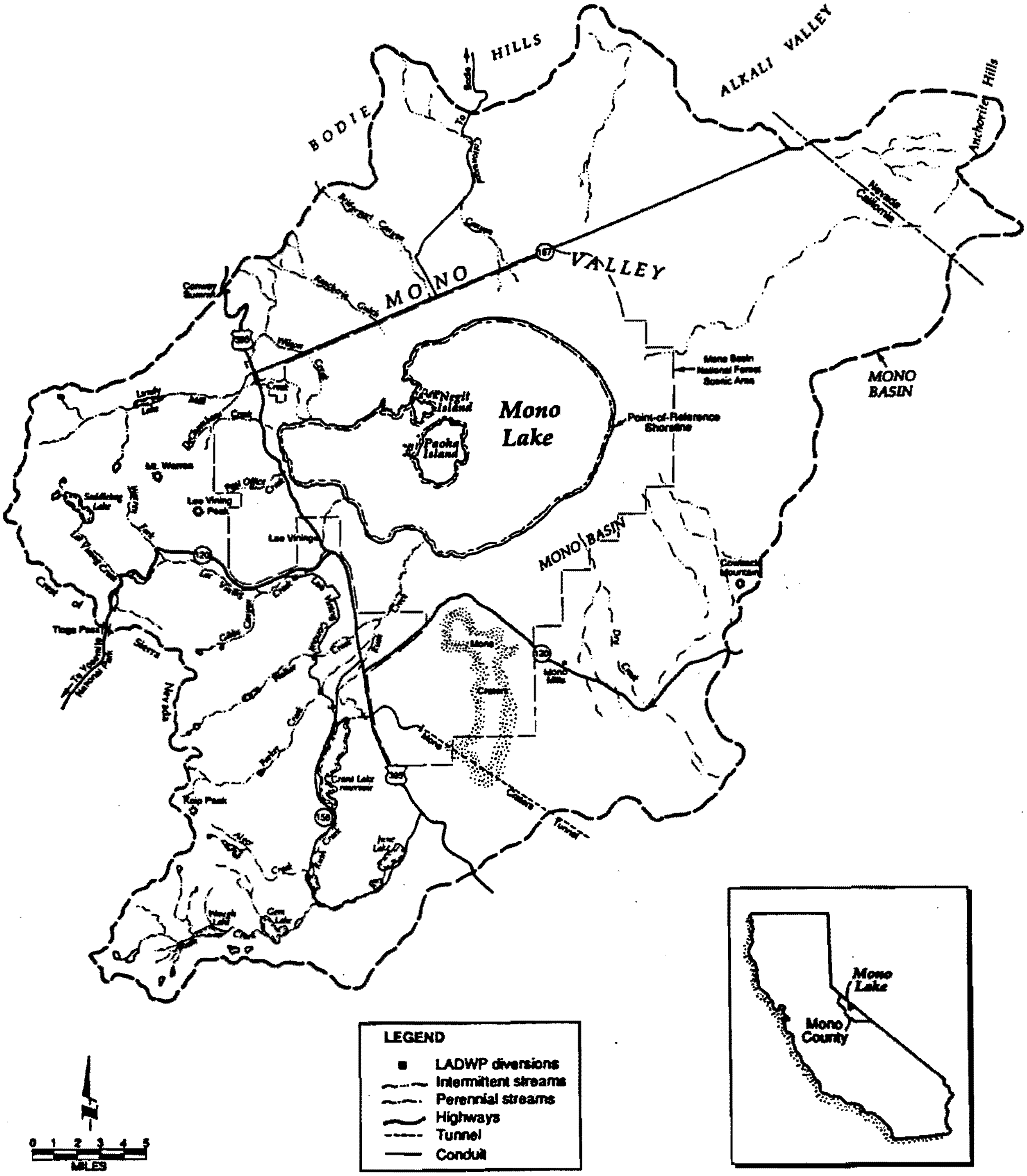
Figure 1 is a general map of the Mono Basin; the general locations of the specific project areas are shown in Figure 2.

A. Increase the Water Surface Elevation of Mono Lake to 6,392 feet

The three scientists have ranked this as the most important and highest priority restoration measure. Rising lake levels will naturally restore functioning ecosystems without the need for long term maintenance. This passive action is expected to restore and provide the most diverse waterfowl habitats in riparian areas, lake-fringing wetlands, and other freshwater habitats. By virtue of Decision 1631 this action is self sustaining and will result in long term restoration. This action is considered to contribute the most significant amount of restoration to waterfowl habitat of any of the other proposed measures.

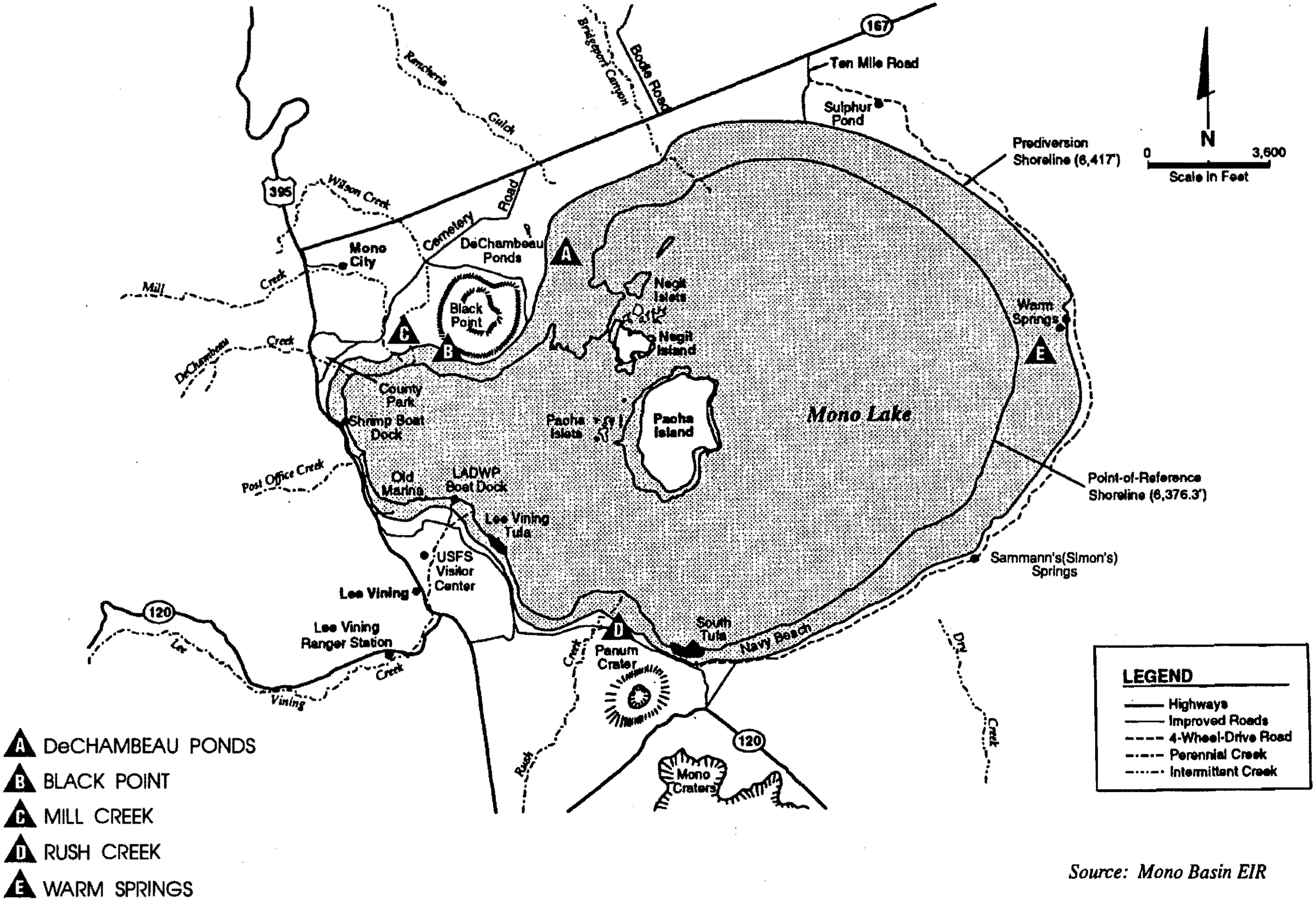
Because of the uncertainty of future conditions, it is difficult, if not impossible, to know exactly what effect the rising lake level will have on lake fringing waterfowl habitats. Stine[1], however, has made an attempt to quantify historical lake fringing habitats by area (acres) and predict future habitat by area (acres) at specific lake elevations as the Lake surface elevation rises. Table A, lists Stine's estimation of lake fringing habitat at various

[1] Stine, S. 1995. Historical and Future Waterfowl Habitat at Mono Lake, California



Source: Mono Basin EIR

Figure 1. Map of the Mono Basin



Source: Mono Basin EIR

Figure 2. Waterfowl Habitat Restoration Project Areas

Table 1. Shore-Fringing Waterfowl Habitats of the Mono Basin

Figures in acres. Except where noted, geographical division follows the EIR (Jones and Stokes, 1993).
(For assessment of coves and bights, see Table 2)

North, East, and South Shores

Simon's Springs	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	43	small	<0.2	0	minor
6376 feet (existing):	496	2	~1.5	0	minor
6383 feet:	385	26	~1.0	0	minor
6391 feet:	279	0	~1.0	0	minor

Warm Springs	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	34	small	1	0	minor
6376 feet (existing):	55	0	2.5	0	0
6383 feet:	85	0	2.5	0	0-minor
6391 feet:	59	0	~1	0	0-minor

South Tufa	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	7	0	0	0	2
6376 feet (existing):	3	0	0-minor	0	0
6383 feet:	5*	0	0-minor	0	0-minor
6391 feet:	5*	0	0-minor	0	0-minor

*Figure is estimated to be half way between the highest and lowest acreage that has existed since 1930.

Northwestern Shore near Black Point

Mill-Wilson Delta	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon	Hypopyc. ria (plus btmlnds)
Prediversion (6417 feet):	12	0	0	0	3	(NA)
6376 feet (existing):	43	0	0	0	<0.1	0
6383 feet:	19	0	var., on crk*	0	(transitional)	~8** (10)
6391 feet:	24	6	var., on crk*	0	to 40**	~14** (16)

* ponds of variable size will occur on the creek immediately above the lake margin when lake is rising stable.
** dependent on Mill Creek rewatering

Dechambeau Cr Delta (County Park)	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	7*	60*	0	0	0-minor
6376 feet (existing):	83	7 (dep. on irrig)	0	0	0-minor
6383 feet:	63	5 (dep. on irrig)	0	0	0-minor
6391 feet:	43	2 (dep. on irrig)	0	0	0-minor

* freshwater marsh plus seasonally wet meadow total =67 acres; division given here (7:60) is approximate.

Dechambeau Embay.	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	1	small	0	6	minor
6376 feet (existing):	68	0	0	0	minor
6383 feet:	75	0	0	0	minor
6391 feet:	53	0	0	0	minor

Rush and Lee Vining Creek Deltas

Rush Creek Delta	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon	Hypopyc. ria (plus btmlnds)
Prediversion (6417 feet):	13*	120*	0-minor	0	38	NA
6376 feet (existing):	2	0	0	0	0	0
6383 feet:	1	4	var., on crk**	0	(transitional)	~5 (12)
6391 feet:	4	4	var., on crk**	0	to 40	15-20 (4-8)

* freshwater marsh plus seasonally wet meadow = 133 acres; division given here (1:10) is approx.
**ponds of variable size will occur on the creek immediately above the lake margin when lake is rising stable.

Horse Creek Embay.	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	57*	6*	0	0	0-minor
6376 feet (existing):	27	0	0	0	0-minor
6383 feet:	12	0	0	0	0-minor
6391 feet:	12	0	0	0	0-minor

* pre-diversion freshwater marsh and meadow due to runoff into Horse Cr. from H-Ditch and Farmer's-Ditch argicultural lands. The 63 acres of marsh and meadow is estimated here to be at a ratio of 10:1.

Lee Vining Cr. Delta	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon	Hypopyc. ria (plus btmlnds)
Prediversion (6417 feet):	1	44*	minor	0	5	NA
6376 feet (existing):	6	0	minor	0	minor	0
6383 feet:	13	5	var., on crk**	0	(transitional)	~5 (6)
6391 feet:	4	4	var., on crk**	0	to 40	8-10 (10)

* pre-diversion wet meadow largely due to irrigation diversions from Lee Vining Creek.
** freshwater ponds of variable size will occur on the stream immediately above the lake margin during periods of rising and stable lake level.

Lee Vining Tufa	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	3	0	0	0	minor
6376 feet (existing):	43	1	0	0	minor
6383 feet:	15	0	0	0	minor
6391 feet:	7	0	0	0	minor

Other Perennial Lagoons of the Mono Shorelands

Bridgeport Cr.	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	0	0	0	29	0
6376 feet (existing):	20	14	0	0	0
6383 feet:	53	0	0	0	0
6391 feet:	33	0	0	0	0

North Beach*	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	1	0	0	175	0
6376 feet (existing):	1	0	0	0	0
6383 feet:	1	0	0	0	0
6391 feet:	1	0	0	0	0

* includes "dune lagoons" of the EIR

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Other Marshlands of the Mono Shorelands

Black Point	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	0	0	0	0	4*
6376 feet (existing):	1	0	0	0	0
6383 feet:	10	0	0	0	minor
6391 feet:	0	0	0	0	minor

* it is not certain that this short-lived lagoon on the flank of Black Point was brackish; indeed, the lack of evidence for freshwater influx at this point of the shorelands suggests that it may have been saline.

South Beach	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	7	0	0	0	0
6376 feet (existing):	6	0	0	0	0
6383 feet:	9	0	0	0	0
6391 feet:	6	0	0	0	0

Sierran Escarp.	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	60*	11*	0	0	<0.5
6376 feet (existing):	125	27	0	0	0-minor
6383 feet:	78	21	0	0	0-minor
6391 feet:	85	6	0	0	0-minor

*freshwater marsh plus seasonally wet meadow total =71 acres; division given here (60:11) is approximate.

East Beach	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	1	0	0	0	0
6376 feet (existing):	6	0	0	0	0
6383 feet:	1	0	0	0	0
6391 feet:	1	0	0	0	0

Paoha Island	Fshwtr marsh	Seasonally wet mdw	Fshwtr pond	Peren. brksh lagoon	Ephem. brksh lagoon
Prediversion (6417 feet):	1	0	0?*	3?*	0
6376 feet (existing):	3	0	0	0	0
6383 feet:	1	0	0	0	0
6391 feet:	1	0	0	0	0

* Ponds on Paoha were of two types: those that covered the bottoms of the cinder cones on the NE comer of the island were highly saline (such ponds are not listed here); those that filled landslide depressions on the western side of the island were likely brackish, and so are listed here under the "Perennial brackish-water lagoon" catagory. These landslide depressions have contained short-lived freshwater ponds during occasional wet periods in the recent past, and will continue to do so in the future.

location around the Lake at specific lake surface elevations, namely: 6,376 ft., 6,383 ft., 6,391 ft., and 6,417 ft. The general trend apparent in Table A is that the total acreage of lake fringing habitat diminishes as the Lake level rises, emphasizing the importance, historically, of lake or open water habitat to species such as the ruddy duck and northern shoveler.

B. Rewater Mill Creek

" In overall importance to waterfowl ", the waterfowl scientists consider the " restoration of riparian and deltaic wetland habitats on Mill Creek "[2] to be second only to raising the water surface elevation of Mono Lake. In their report (Appendix I), the waterfowl scientists conceptually present restoration of waterfowl habitat on Mill Creek as a process consisting of several key elements. The key elements they identify are:

- The establishment of a year-round instream flow in Mill Creek to develop habitat and benefit waterfowl during the annual peak waterfowl migration period;
- Instream flow releases to Mill Creek should mimic the natural (unimpaired) hydrology of Mill Creek to the extent possible considering Mill Creek's complex physical and legal constraints,
- Instream flows should be spread among lower Mill Creek distributaries to stimulate greater riparian growth and encourage backwater habitat.

In their opinion, the implementation of these elements would, most likely, restore potential waterfowl habitat on Mill Creek. To implement the key elements that they identify, they suggest that LADWP, and other interested parties, take the following actions (Appendix I p. 98-99):

- LADWP should dedicate their Mill Creek irrigation water, by right, to provide instream flow in Mill Creek (This action would provide flow during the irrigation season only);
- LADWP and other interested parties should explore methods of securing non-irrigation season[3] instream flow in Mill Creek, thus securing a year-round instream flow in Mill Creek that will provide freshwater habitat for staging waterfowl during peak migration;
- USFS should dedicate a portion or all of their Mill Creek water right to provide instream flow in Mill Creek;
- Channels (distributaries) B, C, and E on Mill Creek should be reopened;
- LADWP and others interest parties should explore the feasibility of increasing the capacity of SCE's Mill Creek Return Ditch (return ditch).

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[2] For an overview of Mill Creek's hydrology, physical facilities, and water rights, refer to *Mill Creek Report* (Appendix E) of the waterfowl scientists' report (Appendix I).

[3] Although the length of the non-irrigation season varies dependent on weather conditions, in the context of this plan the period is loosely interpreted to be October-April, inclusively.

C. Rewater Important Distributaries in Rush Creek below the Narrows

The waterfowl scientists recommend rewatering important distributaries in Rush Creek below the narrows, specifically:

- channel 4bii complex;
- channel 8 complex, unplugged lower section;
- channel 10 complex;
- channel 11, unplugged lower portion;
- channel 13 complex.

The 4bii complex, and channels 10 and 13 have also been recommended for rewatering as part of the stream restoration plan. The scientists recommend flows of 1 to 2 cfs into channels 8 and 11, and 10 cfs flow for the 4bii complex. Additionally, the scientists recommend that periodic evaluations be conducted to assess the recovery of secondary channels and depressional areas.

The proposed project will restore waterfowl and riparian habitat in the Rush Creek bottomlands. This action will provide both short and long term benefits depending on the ability of this treatment to sustain its functions naturally.

D. Develop and Implement the DeChambeau Ponds/County Ponds/Black Point Restoration Project

This project is an engineered, three-phase, project that will require on-going maintenance. The project consists of the following elements:

- Rewater a 10 acre riparian zone adjacent to the DeChambeau Ponds by extending an underground irrigation pipe from an existing well drilled for the Dechambeau Project in 1995;
- Artificially flood the County Ponds complex (approximately 20 acres), which is a natural basin and former lagoon that lies below the DeChambeau ponds and above relicted lands It is anticipated the project will require two additional wells, with water supplied to the County pond complex via an underground pipe. There is a possibility that local artesian flow may be able to accommodate project water requirements.
- Maintain up to 20-acres of shallow, seasonal wetland in the Black Point area utilizing an existing artesian well (~120 gpm). This project could be enhanced by two to five shallow scrapes increasing the wetland area by up to 10 additional acres.

Although the proposal is for a heavily engineered process requiring substantial maintenance, the scientists suggest that the project would provide critical waterfowl habitat to the basin, and would mitigate for loss of freshwater and lagoonal habitat not restored at the target lake level of 6,392 feet.

E. Develop and Implement a Prescribed Burn Program

The scientists recommend the implementation of a periodic or rotational prescribed burn program to enhance lake-fringing marsh and seasonal wet meadow habitats (~1,000 acres). This program would be implemented on lands adjoining Mono Lake that are managed by USFS, DPR, and LADWP. They also recommend the development and implementation of jackpot burning in the Rush Creek bottomlands during the winter.

The scientists recommend that an experimental prescribed burn program be implemented initially to collect site specific data so that the program can be later modified, if necessary. Implementation of this program will generate information that will lead to more specific methodology and time schedules for future prescribed burns to achieve optimum vegetation responses in wetland habitats. They also recommend that the burn program attempt to mimic natural fire ecology. The program requires continued periodic burning and it is anticipated that this action will restore waterfowl habitat by maintaining open water sites and increasing the vigor and health of surrounding wetland vegetation.

F. Develop a Cooperative Program to Control Salt Cedar in Lake-fringing Wetlands

Salt Cedar has the potential to negatively impact riparian and lake-fringing wetlands by competing with native species for water. It is an exotic species that spreads rapidly and is difficult to eradicate. The scientists recommend the development of a cooperative program to control its impact.

IV. Restoration Projects and Measures Proposed by LADWP

LADWP has reviewed the scientists' specific waterfowl habitat restoration recommendations and recommends that the SWRCB adopts their proposals with some minor modifications.

Following is a discussion of the feasibility of each of the specific measures. Additionally, the expected implementation schedule, cost estimate, method of financing, and water requirements are listed, in accordance with Decision 1631.

There are a variety of time related factors that will influence the implementation of the proposed projects. These factors include the following: 1) approval of this plan by the SWRCB; 2) obtaining the necessary permits (see section VII) from the appropriate agencies such as the Regional Water Quality Control Board, the Great Basin Unified Air Pollution Control District, the US Army Corps Of Engineers, and DFG; 3) compliance with the California Environmental Quality Act (CEQA) and the National Environmental

Protection Act (NEPA); and 4) the preparation of cooperative agreements with the involved entities.

A. Increase the Water Surface Elevation of Mono Lake to 6,392 feet

LADWP concurs with the waterfowl scientists that this is the most important and highest priority restoration measure. Raising the lake level will restore the largest acreage and the most diverse waterfowl habitats in riparian areas, lake-fringing wetlands, and other freshwater habitats. This action will happen as a result of Decision 1631 export criteria that will allow the lake level to rise to 6,392 feet.. Waterfowl habitat restoration is a side benefit.

1. Implementation Schedule

This process has already begun by virtue of the interim flows and wet winter of 1995 that have allowed the lake level to rise. At the present time, the water surface elevation of the Lake is 6378.9 ft. The stream flow requirements of Decision 1631 will enable the lake level to eventually rise to 6,392 feet. It is estimated that this will take between 12 to 33 years.

2. Cost Estimate

The cost associated with this activity has been extensively discussed in the Mono Basin EIR.

3. Financing

Financing necessary for this action is also discussed in the Mono Basin EIR.

4. Water Requirements

This waterfowl habitat restoration measure will be accomplished by complying with the flows requirements of Decision 1631.

B. Rewater Mill Creek

As discussed above, the waterfowl scientists conceptually present restoration of waterfowl habitat on Mill Creek as a process consisting of several key elements. They also identify specific actions that they suggest would provide these key restoration elements, when implemented.

To restore and sustain waterfowl habitat on Mill Creek, in accordance with the scientists' recommendations, LADWP will take the following actions:

- Dedicate all LADWP Mill Creek irrigation water, by right, currently used for the irrigation of LADWP owned pastureland to provide instream flow in Mill Creek.

- Actively pursue the securement of a non-irrigation season instream flow in Mill Creek, thus securing a year-round instream; this involves filing an application with the SWRCB to appropriate a seasonal right (a right to the unappropriated flow of the non-irrigation season) for the purpose of providing instream flow in Mill Creek;
- Monitor the response of wetland and riparian habitats to rewatering; any reopening of Mill Creek distributaries will be deferred until the need for this action is established through the monitoring process;
- Impose a grazing moratorium on all LADWP owned land in the Mill Creek floodplain.

A detailed discussion of these specific actions is included below along with a discussion of: FERC mandated instream flow releases by SCE, the USFS water right, the capacity of SCE's return ditch, and several unresolved Mill Creek issues.

1. LADWP's Proposed Mill Creek Instream Flows

Barring any legal or environmental constraints, LADWP will dedicate all LADWP Mill Creek irrigation water, by right, to provide instream flow in Mill Creek for the purpose of restoring and sustaining waterfowl habitat on Mill Creek. This encompasses all irrigation waters historically diverted by LADWP from both the Lundy Powerhouse tailrace and Mill Creek proper. Additionally, LADWP is pursuing the securement of a right to the non-irrigation season flow of Wilson Creek for release to Mill Creek. The range of expected instream flows that will become available as a result of these two actions are tabulated below. The expected average monthly instream flows for a median year are tabulated in Table B. The expected range of average monthly instream flows is tabulated in Table C. A discussion of these flows follows.

Table B

Expected Mill Creek Instream Flow in a Median Year (Including Return Ditch Flow) Monthly Flow (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Thompson Ranch	0	8	19	21	15	8	4	0	0	0	0	0
(2) Return Ditch[4]	16	12	6	6	9	1	10	9	8	9	9	11
(3) Expected Instream Flow	16	20	25	27	24	9	14	9	8	9	9	11

[4] This table assumes that LADWP can appropriate the non-irrigation flow. The October-April values are the flow through the Lundy Powerhouse in a median year. Values from Table F, row 3 (Net Difference).

Table C

Expected Range of Mill Creek Instream Flow (Including Return Ditch Flow) Monthly Flow (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Thompson Ranch	0-6	2-20	12-26	11-28	9-23	5-13	1-6	0-1	0	0	0	0
(2) Return Ditch Flow	8-16	9-16	9-16	3-16	0-16	0-16	5-16	6-16	6-16	6-16	5-16	5-16
(3) Expected Instream Flow	8-22	11-36	21-42	14-44	9-39	5-29	6-22	6-17	6-16	6-16	5-16	5-16

2. *LADWP's Mill Creek Water Right*

Most of the land currently irrigated by LADWP along Mill Creek is in the Thompson Ranch area, south of Mill Creek. This water, historically diverted through the two Thompson Ranch diversions, constitutes a significant portion of LADWP water available to provide instream flow in Mill Creek. Tabulated below in Table D are the median monthly irrigation flows historically diverted by LADWP at the Thompson Upper Ditch and Thompson Main Ditch diversion points.

Table D

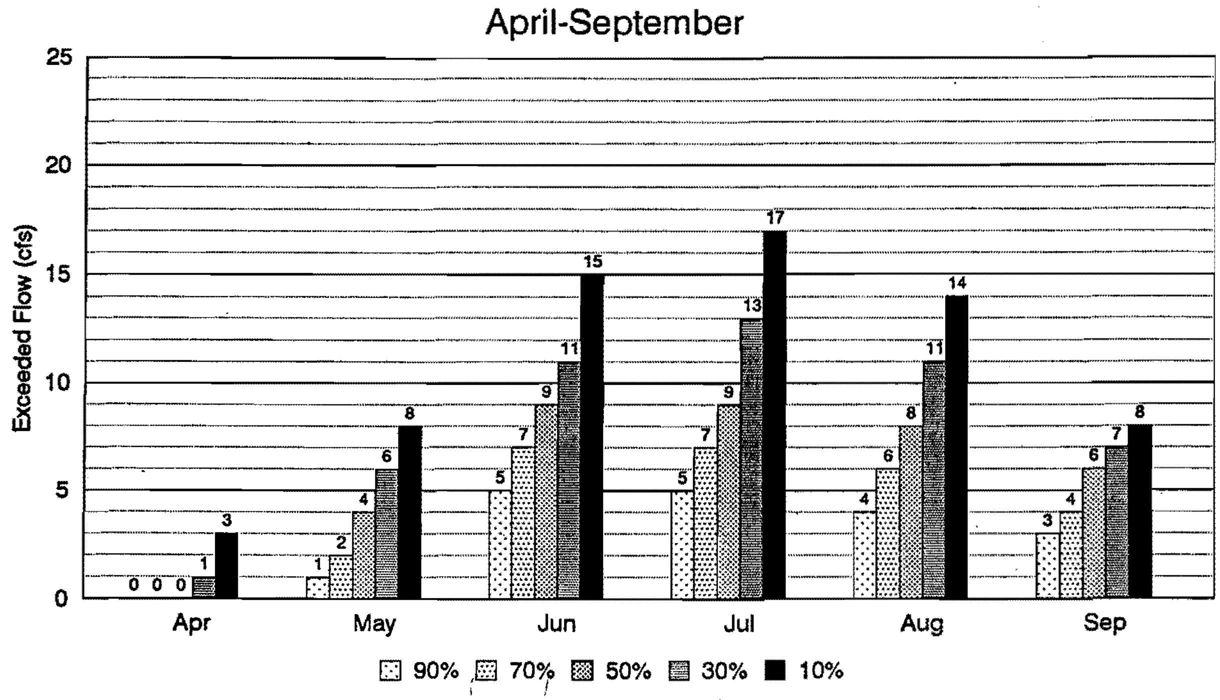
Historical Median Year LADWP Thompson Ranch Irrigation Diversions Monthly Flow (cfs)

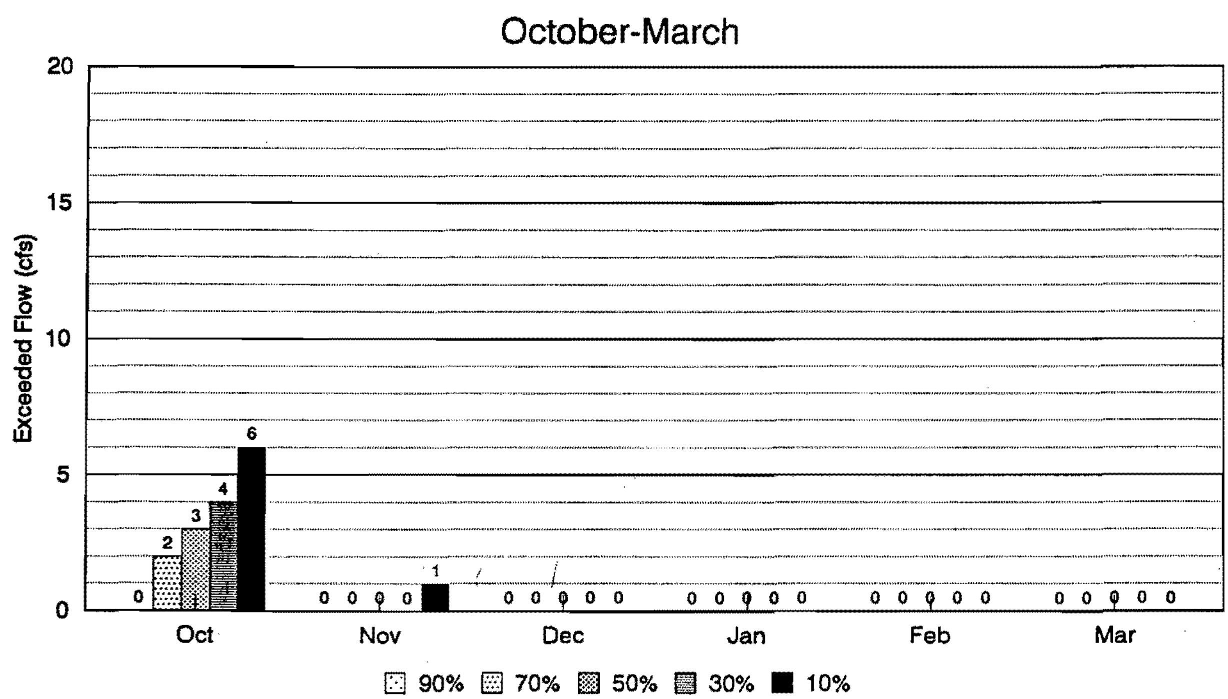
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Thompson Upper Ditch	0	4	9	9	8	6	3	0	0	0	0	0
(2) Thompson Main Ditch	0	4	10	10	7	3	0	0	0	0	0	0
(3) Total Thompson Ranch	0	8	19	21	15	8	4	0	0	0	0	0

Table D represents the median, or most probable, flows that would be made available for instream flow in Mill Creek if LADWP terminated their irrigation diversions through the Thompson Ranch ditch system. Although median flow data is very useful, diversions have historically varied year to year. A range of expected flows is, therefore, useful as well. Figures 3 and 4 graphically depict the range of flows historically diverted at both Thompson Ranch diversion points; Figure 3 represent flows diverted at the Thompson Upper Ditch while Figure 4 represents flows diverted at the Thompson Main Ditch. In

Thompson Upper Ditch Flow Frequencies

(Catergorized by percent of time flow is exceeded.)





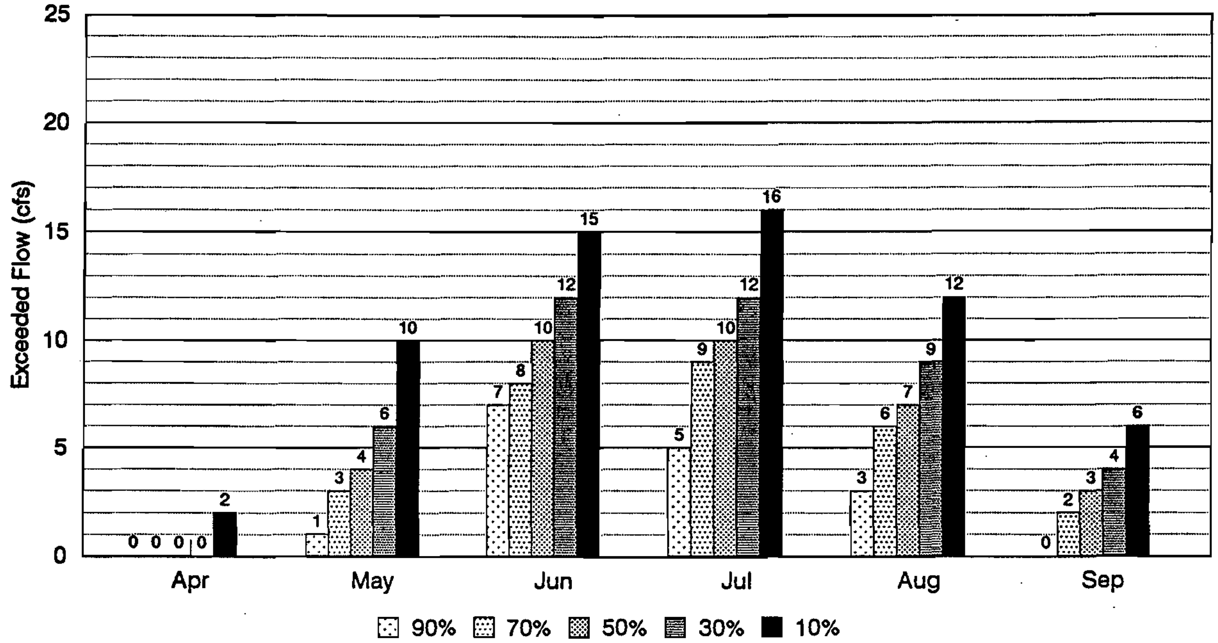
Note: Analysis uses the period of record 1941-1990.

Figure 3

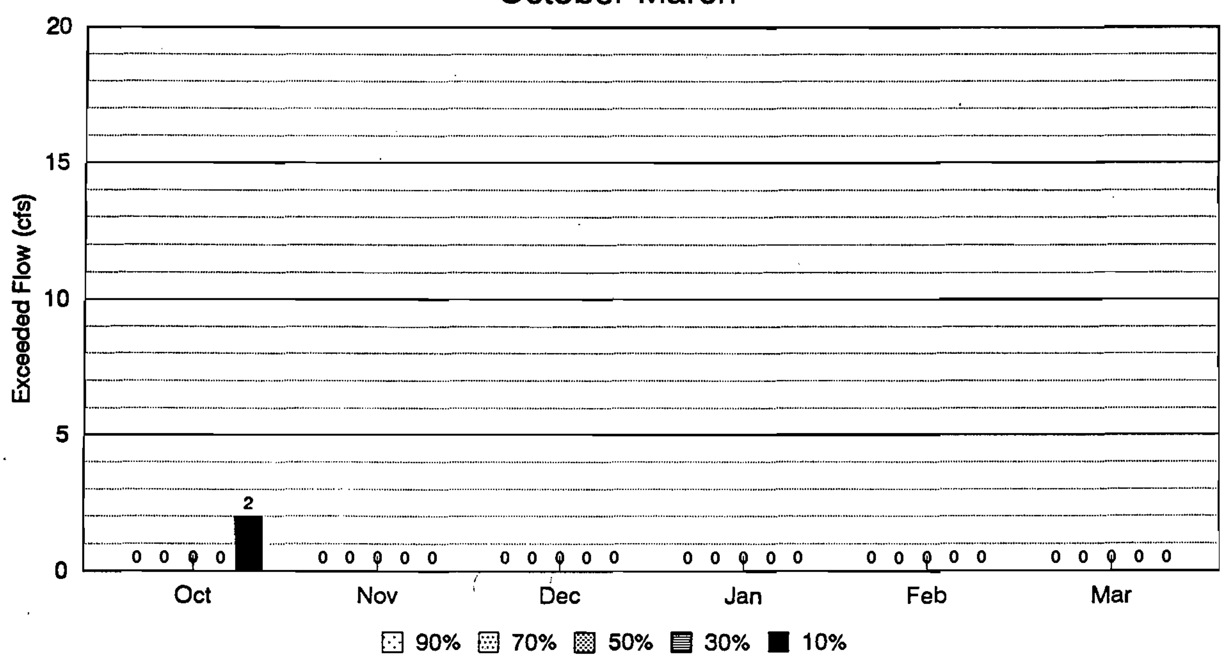
Thompson Main Ditch Flow Frequencies

(Catergorized by percent of time flow is exceeded.)

April-September



October-March



Note: Analysis uses the period of record 1941-1990.

Figure 4

each figure, the range of flows is divided into five categories.[5] Table E below summarizes the range of expected flows, graphically presented in Figures 3 and 4, that would be available for instream flow in Mill Creek once diversions to the Thompson Ranch are terminated.

Table E

Historical Range of LADWP Thompson Ranch Irrigation Diversions[6] Monthly Flow (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Thompson Upper Ditch	0-3	1-8	5-15	5-17	4-14	3-8	0-6	0	0	0	0	0
(2) Thompson Main Ditch	0-2	1-10	7-15	5-16	3-12	0-6	0-2	0	0	0	0	0
(3) Total Thompson Ranch	0-6	2-20	12-26	11-28	9-23	5-13	1-6	0-1	0	0	0	0

a. Additional Flow

Quite often, more water for instream flow is available than shown in Tables D and E. The median year monthly irrigation flows shown in Table D and the range of monthly irrigation flow shown in Table E quite often can be augmented by return flow conveyed through the return ditch. The reason for this additional flow is explained below.

Because the diversion point of the Upper Thompson Ditch is upstream of the return ditch, the source of this ditch is exclusively Mill Creek water -- a combination of controlled releases from Lundy reservoir, reservoir spill, and channel accretion (including the tributary Deer Creek) along the channel below Lundy Dam. In contrast, using available records, it is difficult to determine the source of all flow diverted at the Thompson Main Ditch since it heads at Mill Creek downstream of the return ditch. (Historical flow data for the return ditch is sparse.) In practice, the return ditch is used only when there is not enough water in Mill Creek to meet the irrigation demand at the Thompson Main Ditch. It follows then, that water in addition to that tabulated in Tables D and E may be available for instream flow via the return ditch. Table F lists the calculated monthly flow that would be available via the return ditch for instream flow in a median year.

[5] For a more detailed description of the flow analysis, refer to *Mill Creek Report*.

[6] The range represents 80 percent of the historical flow diverted to the Thompson Ranch. Ten percent of the time flows were lower and 10 percent of the time flows were higher.

Table F

Additional Instream Flow in a Median Year
Available Via the Return Ditch
Monthly Flow (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Flow via Return Ditch	16	16	16	16	16	4	10	9	8	9	9	11
(2) Thompson Main Ditch	(0)	(4)	(10)	(10)	(7)	(3)	(0)	(0)	(0)	(0)	(0)	(0)
(3) Net Difference	16	12	6	6	9	1	10	9	8	9	9	11

Row 1 is the monthly flow available, via the return ditch, in a median year. The values in row 1 assume that LADWP secures a non-irrigation season right and reflect both the limitations of LADWP water rights (the water available after all senior rights are met) and the physical limitations imposed by the Lundy Project -- the total flow diverted through the Lundy Powerhouse and the capacity of the Mill Creek return ditch (16 cfs). Row 2 is the historical monthly flow diverted at the Thompson Main Ditch in a median year. Row 3 represents the difference of Rows 1 and 2, the additional monthly flow available in a median year via the return ditch.

Combining the monthly values of Tables D (row 3) and F (row 3) yields Table B, median year monthly flows available for instream Mill Creek flow if LADWP abandoned irrigation in the Mill Creek area and obtained a non-irrigation season right.

The range of flows tabulated in Table E also increases when considering additional water via the return ditch. In wet years, when the Thompson Ranch irrigation demand would be totally satisfied by Mill Creek flow, additional flow would be available via the return ditch. This may be as much as 16 cfs, the capacity of the return ditch. Modifying Table E to include the additional water of a full return ditch (16 cfs) in wet years yields Table C, the expected range of flows available for instream flow as a result of LADWP termination of irrigation in the Thompson Ranch area (including return ditch water.)

3. Securing Non-irrigation Season Instream Flows in Mill Creek

The dedication of LADWP's irrigation water, by right, as described in the preceding section will provide instream flow to Mill Creek during the irrigation season. To ensure that instream flow is present in Mill Creek year-round, LADWP is actively pursuing the securement of a seasonal (non-irrigation season) instream flow as well. Currently, during most of the non-irrigation season, SCE releases 8-11 cfs (16 cfs in April) in a median year through the Lundy Powerhouse.[7] According to historical flow records, this seasonal flow

[7] Refer to Figure 4., *Mill Creek Report.*

through the powerhouse is ordinarily[8] not diverted and usually flows down Wilson Creek to Mono Lake.

Since the beneficial use of Mill Creek water by landowners is defined in the 1914 Mill Creek Decree to be the use of the water 'in a reasonable way and manner for the irrigation of said tracts of land and for the benefit and improvement of the soil thereof, and for watering cattle and stock, for domestic, culinary and other household proposes", it appears that non-irrigation season water may be available for appropriation. In that spirit, on February 29, 1996, LADWP filed an application with the SWRCB to appropriate this seasonal flow to provide instream flow in Mill Creek for waterfowl habitat. Pending the SWRCB review of this application, they may issue LADWP a permit to appropriate this seasonal flow. Upon receipt of a water right permit, LADWP will work with SCE to convey this appropriated water through their Mill Creek Return Ditch to provide a fall and winter instream flow in Mill Creek.

4. SCE's Mill Creek Instream Releases

In addition to the year-round instream flow LADWP plans to provide, SCE will also likely provide a year-round instream flow to Mill Creek. SCE is currently involved in the process of renewing their FERC license for the Lundy Project (Mill Creek). As part of the renewed license, they will be required to release a year-round flow immediately downstream of Lundy Dam. The quantity of water is still undetermined but should be a minimum of 3 cfs and could be as much as 7 cfs. This required release, whatever the amount, will complement the year-round flow released by LADWP.

5. Wet Year Releases

It is important to recognize that in addition to base flows that will be supplied by LADWP's water rights, acquired unappropriated water rights, and FERC mandated instream releases, Mill Creek will receive natural flushing or freshet flows in wet years as well. These periodic freshet flows will complement the base flows established through LADWP restoration efforts to develop habitat at the Mill Creek delta and within the existing floodplain.

Even with a reservoir on Mill creek, water is released directly into Mill Creek from the dam every year -- on average, 30 percent of the creek's annual flow. In wet years -- these occur, on average, every tenth year -- large flows are released. Due to the relatively small storage capacity of Lundy reservoir[9], in wet years, SCE is forced to either release water in anticipation of a spill or spill the reservoir. Table G summarizes both the flow magnitudes and durations of recent wet year controlled releases/spills.

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[8] Historical records show that Conway Ranch has occasionally diverted water in November, but it is their general practice to terminate irrigation in September or October and commence irrigation diversions again in May.

[9] Storage capacity on Mill Creek is only 18% of Mill Creek's average annual flow. In contrast, storage capacity on Rush Creek is 119% of Rush Creek's average annual flow.

Table G

Wet Year Flows Released Directly to Mill Creek from Lundy Reservoir (cfs)

	Number of Days		Peak Daily
Year	Flow greater than 70 cfs	Flow greater than 100 cfs	Flow (cfs)
1995	33	19	130
1983	43	18	167
1980	14	8	224

6. Rewatering Certain Mill Creek Distributaries

LADWP agrees with the scientists that the need for rewatering these distributaries can only be established after several "periodic assessments [are] conducted to determine the response of wetland and riparian habitats to rewatering"(Appendix I, p. 98).

There are several reasons for not rewatering Mill Creek distributaries at this time. First, due to several unresolved Mill Creek issues, (refer to *Unresolved Mill Creek Issues* below) there is still some degree of uncertainty regarding how much water will be available for instream flow in Mill Creek. Any discussion regarding distribution of an uncertain flow is, therefore, premature. Second, the rewatering process, by itself, may develop waterfowl habitats naturally. These habitats are preferred because of their sustainability and the biodiversity associated with the natural recovery process. The delta of Lee Vining Creek is a prime example of this natural process. Third, the Mill Creek delta and its lower reaches will be in very early recovery stages that lack adequate vegetation to maintain dynamic, yet structurally stable systems. Any rewatering efforts in these early stages of recovery will undoubtedly be rendered nonfunctional with the first significant freshet (flushing) flow. The system should be allowed to come into equilibrium with its new flow regime before any manipulation is even considered. After several years (5-10 years), rewatering of side channels may not be necessary. The need will depend on natural habitat developments that will occur within the floodplain of Mill Creek as water tables gradually rise.

7. LADWP's Mill Creek Grazing Moratorium

Similar to the grazing moratorium that LADWP has already imposed on other Mono Basin creeks, LADWP will also impose a moratorium on all grazing of LADWP owned land in the Mill Creek floodplain. This will promote the recovery of herbaceous and young woody plant species.

8. USFS's Mill Creek Water Right

After reviewing comments from interested parties regarding the Mill Creek Project, LADWP believes that the limitations of USFS's Mill Creek water right are not generally understood. USFS holds an 8th priority right of 12.6 cfs on Mill Creek. Mill Creek water rights senior to their right are: LADWP rights totaling 24.2 cfs, Conway Ranch rights totaling 17.0 cfs and the 4th priority Simis right of 1.8 cfs. The aggregate total of which amounts to 43.0 cfs.[10] The USFS right therefore, can be exercised at times when flow through the Lundy Powerhouse exceeds 43.0 cfs and can be fully exercised when the flow reaches 55.6 cfs.

During the process of preparing the Waterfowl Habitat Restoration plan, it was suggested that USFS may be willing to dedicate a portion or all of their water right to instream flows in Mill Creek for waterfowl habitat restoration purposes. Although the cooperative spirit exhibited by USFS to bring this project to fruition is welcome, due to the junior nature of the right, during most of the year there is seldom enough water passing through the Lundy Powerhouse to exercise their right. The junior nature of the right precludes its use as a base flow. Therefore, at best, it could be used to augment the annual peak flow of Mill Creek by 12.6 cfs and historic data suggests that 50 percent of the time (in below median years) there is insufficient flow released through the powerhouse for it to be exercised even for this purpose.

9. Increasing the Capacity of the SCE Mill Creek Return Ditch

LADWP considers the instream flows presented in this plan, namely flows provided by: (1) seasonal LADWP irrigation water, (2) year-round return ditch water (irrigation and non-irrigation season water), (3) year-round FERC mandated instream release by SCE, and (4) SCE wet year controlled releases/spills to be sufficient flow to create significant waterfowl habitat in the Mill Creek delta and floodplain. These flows, which are based on historical Mill Creek flow and irrigation records, have been conveyed using existing facilities and do not require additional conveyance capacity beyond the current capacity of the return ditch. LADWP, therefore, has not considered and will not pursue upgrading the return ditch.

10. Unresolved Mill Creek Issues

LADWP is committed to proceed with the above proposal to provide instream flow in Mill Creek in connection with the Waterfowl Habitat Restoration Plan, however several unresolved issues raise serious questions concerning the feasibility of LADWP's Mill Creek Project. In particular, two unresolved issues exist that may hinder LADWP's ability to secure some or all of the water from the Lundy Powerhouse tailrace as a source of a seasonal instream flow for Mill Creek. These two issues are: the future of the proposed Paoha Project and the status of Wilson Creek.

[10] Refer to Table 2, *Mill Creek Report* for a complete listing of Mill Creek water rights.

a. Paoha Project

In August, 1986, the SWRCB issued a permit to appropriate 70 cfs from Wilson Creek for the proposed Paoha Project, a proposed hydroelectric power generation facility. In July 1992, the Project was licensed by FERC. At the present time, it is unclear to LADWP how this proposed power project will affect LADWP's ability to secure water from the Lundy tailrace for our proposed Mill Creek Project. LADWP will request guidance from the SWRCB in resolving this apparent conflict.

b. Wilson Creek

Another significant issue that may affect LADWP's proposed Mill Creek Project is the status of Wilson Creek. For more than 80 years, 70 percent of Mill Creek water has been diverted through the Lundy Powerhouse and released to Wilson Creek. As a result, a self-sustaining fishery has developed in Wilson Creek. Flow in Wilson Creek also supports waterfowl habitat at the delta. Observations of waterfowl at the delta indicate that Wilson Creek supports the highest waterfowl numbers on the North Shore and one of the best waterfowl habitats in the Basin -- along with Warm Springs and Sammann's (Simon's) Springs.

In granting the Paoha Project a permit (see above) to appropriate water from Wilson Creek, it appears that the State may recognize Wilson Creek as a new natural water course. If this is the case and Wilson Creek has indeed, over time, become a new natural watercourse, it will be necessary to protect the fishery under State law. Moreover, if the Wilson Creek delta currently provides one of the better waterfowl habitats in the Basin, it seems unwise to dewater the Wilson Creek delta entirely as new habitat on Mill Creek will take several years to develop and mature. LADWP will request guidance from both the SWRCB and DFG regarding Wilson Creek issues. To that end, within the next six months, LADWP will facilitate a meeting with these two parties to discuss and resolve the Wilson Creek issues.

11. Implementation Schedule

Physically, LADWP could release its water right in the creek immediately. However, first the issue of securing flows in Mill creek during the non-irrigation season needs to be resolved. It is anticipated that the SWRCB's process for granting an appropriate right take some time, potentially 18 months. The Paoha and Wilson Creek issues need to resolved as well. It is anticipated that the SWRCB and DFG can address the Wilson Creek fishery and waterfowl habitat issues within six months (i.e., legal issues, impacts,). After the SWRCB approves the Waterfowl Habitat Plan, it is estimated meeting CEQA/NEPA requirements would require 6 months, and obtaining necessary permits and approvals would also require 6 months. The start of the process to the certification of all environmental documentation is therefore estimated to take at least 30 months.

12. Cost Estimate

The costs associated with this project consists of the loss of income to LADWP from current livestock lease holders, and the decrease in value of LADWP Mill Creek land.

This decrease in value will result from the transfer of the water rights associated with each parcel and will be substantial -- the equivalent cost of replacing the water, most likely by drilling a well or wells.

13. Financing

No financing is required for this project.

C. Rewater Important Distributaries in Rush Creek below the Narrows

LADWP will rewater Rush Creek distributaries as part of both LADWP's Stream and Stream Channel Restoration Plan and Waterfowl Habitat Restoration Plan. The specific distributaries to be rewatered in addition to those that are part of the stream plan are:

- the channel 8 complex, unplugged lower section;
- the channel 11, unplugged lower portion.

The scientists expect this project to restore waterfowl and riparian habitat in the Rush Creek bottomlands and to provide both short and long term benefits depending on the ability of this treatment to sustain its functions naturally.

LADWP considers this project to be technically and financially feasible. LADWP will implement this project concurrent with the implementation of LADWP's Stream and Stream Channel Restoration Plan.

1. Implementation Schedule

LADWP proposes to begin the construction activities during the first full field season after the plan has been approved by the SWRCB. The work will be done in conjunction with the rewatering of the Rush Creek distributaries as part of the Stream and Stream Channel Restoration Plan. There are nine channels proposed for rewatering on Rush Creek, including those in the Stream Restoration Plan. The goal is to complete as much work as possible during the first year of construction. Because there are uncertainties about level of effort required to open many of the channels, it may be difficult for LADWP to open all nine channels in the first year. The channels may have to be opened during the course of two or more years

2. Cost Estimate

The estimated cost associated with this project is $68,000.

3. Financing

This project will be funded by LADWP.

4. Water Requirements

No additional water will need to be committed to this project.

D. Develop and Implement DeChambeau Ponds-County Ponds Restoration Projects

The DeChambeau/County Ponds/Black Point Project is a three-phase project that consists of the following elements listed in sequential order:

- Rewater a 10 acre riparian zone adjacent to the DeChambeau Ponds by extending an underground irrigation pipe from an existing well drilled for the Dechambeau Project in 1995; this action is expected to improve the vigor of the riparian vegetation and reflood small, depressional wetlands (estimated cost: $90,000);
- Artificial flooding of the County Ponds complex (~20 acres), which is a natural basin and former lagoon that lies below the DeChambeau ponds and above relicted lands. It is anticipated the project will require two additional wells, with water supplied to the County pond complex via an underground pipe. There is a possibility that local artesian flow may be able to accommodate project water requirements (estimated cost: $640,000);
- Increase the wetland area in the Black Point area by up to up to 10 additional acres by making two to five shallow scrapes. These would be maintained by an existing artesian well (~120 gpm).

LADWP believes that this project is not financially feasible without significant funding contributions from other sources. The projects are of minimal benefit to the overall restoration, especially when considering the benefit of raising the lake level to 6,392 feet. The projects are heavily engineered, and very expensive (in addition to start-up costs, annual expenditures for operation and maintenance are estimated to be $30,000). LADWP will pursue funding for these projects. Provided funding is obtained, implementation of the project will be in a phased manner, with the DeChambeau pipe extension as first priority; and the County ponds and the Black Point scrapes completed thereafter.

Many questions regarding alternate water supplies other than Mill/Wilson Creek water and their potential impacts to existing aquifers and surrounding vegetation need to be addressed in each phase. LADWP plans to investigate all alternative water supplies with the intent of minimizing any environmental impacts and reducing maintenance efforts. Questions persist regarding potential availability of water because of private ownership of existing wells and potential detrimental impacts to delicate wetlands.

The feasibility of this project may hinge on the water required to sustain the project above and beyond the anticipated amount the waterfowl scientists originally concluded. If larger wells are required, the cost of installation, maintenance, and materials may rise significantly. It is LADWP's understanding that the existing water supply for the recently constructed Dechambeau project may not be adequate as anticipated. Concern arises as substantial increases in groundwater extraction may lead to impacts elsewhere.

LADWP will make every effort to implement the original recommendation of the waterfowl scientists, however, due to reasons stated above, LADWP may need to reevaluate the status of the project if water requirements are substantially more than initially anticipated. Further, there has to be agreement among the landowners that each will be responsible for maintenance and monitoring the portions of the project that are on their land.

LADWP intends to clearly identify all these issues and determine if there are ways to avoid any adverse impacts and go forth with implementation of the proposed projects as described above.

1. Implementation Schedule

LADWP will present a proposal to various potential sources of funding within 3 months of the approval of this plan by the SWRCB. It is expected that funding will be secured within one year from the time the proposals are submitted. All physical work will be performed during the first field season after funding is secured. During the time that LADWP is attempting to secure funding, existing data will be analyzed to determine artesian flow conditions and well ownership, to provide answers to questions in these areas. This project can only be considered technically feasible if permission from the appropriate landowners is granted to LADWP and the other involved entities to proceed with the necessary work.

After three years of operation of the DeChambeau project, if monitoring and water supply data analysis indicate that it is feasible, LADWP will present proposals for funding for the County Ponds and Black Point scrapes projects. The County Ponds project will be implemented during the first field season after funding has been secured, provided there is adequate water supply. The Black Point scrapes will also be implemented at the same time, once again, provided there is adequate water supply.

It is estimated that approximately 12 months will be required to develop plans for the work, from the time the SWRCB approves the plan. After the plans are developed, it is estimated that meeting CEQA/NEPA requirements would require 6 months, and obtaining necessary permits and approvals would require 6 months after. The start of the process to the certification of all environmental documentation is therefore estimated to take at least 24 months.

2. Cost Estimate

The cost of this three phase project is expected to consist of \$753,000 in capital expenditures and \$30,000 in annual operation and maintenance costs. If additional water is needed, the costs, however, could be significantly higher.

3. Financing

LADWP proposes to seek funding from the California Department of Transportation (Caltrans) highway mitigation funding and the Eastern Sierra Intermountain West Joint Venture Group which obtains federal funding resulting from the North American Waterfowl Management Plan. Both groups have been active is seeking mitigation projects and may show an interest in this project. The USFS and LADWP may also participate in funding this project.[11] LADWP considers this project as financially feasible, provided that the entities named above are willing to participate.

A suggestion was made that LADWP pay for the continued operation and maintenance of the existing DeChambeau Project, undertaken as an Interagency project and completed in September 1995, exclusive of LADWP. LADWP believes that it has no obligation to take over operation and maintenance costs of previously existing agency projects, and does not propose to pay for these. When the involved parties initiated this project in 1994, they recognized the potential maintenance costs and accepted them as part of the project.

4. Water Requirements

Groundwater will be extracted to meet the demands of this project. Alternately, existing artesian flow may be utilized.

E. Develop and Implement a Prescribed Burn Program

The goal of the prescribed burn program is to improve the vigor of lake fringing wetland vegetation and maintain open water habitat. It is anticipated waterfowl use will increase at these sites as a result of burning treatments. LADWP plans to implement rotational burns, which includes approximately 1,000 to 1,200± acres of marsh and seasonal wet meadow habitats (see Table 1, Page 36, Appendix I). About 400 acres will initially be burned on an experimental basis to gain knowledge for future fire management prescriptions. Monitoring of these sites will guide future burns that will not be inundated by the targeted lake level.

In addition to the prescribed burn program, LADWP plans to conduct Jackpot burning. Jackpot burns are defined as "spot burning" of large accumulations of old woody debris within abandoned creek channels. The debris is piled to concentrate the material to be burned at a later date when conditions minimize the risk of fire spreading (winter or spring). These dense piles are thought to retard regeneration of desirable riparian vegetation and reduce areas of open water and ponds.

Jackpot burning will be conducted in the Rush Creek bottomlands with the assistance of CDF and working with the cooperation of appropriate landowners. LADWP has very strong concerns about fire escaping the project area to other areas where the restoration process has already begun. LADWP, therefore, will strictly adhere to all the precautions

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[11] LADWP's position on joint financing is given in the *Comments and Response to Comments*, General Response 13.

required by CDF. If, however, in spite of all precautions taken, other areas outside the target area are burned, LADWP will consider this as a natural and unavoidable event, and will not attempt to restore these areas.

Jackpot burns will be phased in over several years and will contribute to habitat complexity in the streams. It will also alleviate any potential threats of fire escaping the intended sites and damaging habitats elsewhere. This is a concern because access to these areas is limited, making fire fighting difficult. This is a concern because stream restoration TAG members have expressed concern for other bottomland habitats.

Currently, LADWP staff is working on a vegetation management plan (VMP) through the use of prescribed burns elsewhere in the eastern Sierra Nevada. LADWP intends to include Mono Basin prescribed burns in its VMP and will encourage other agencies to develop their own VMP program for the lands they manage. LADWP will obtain California Department of Forestry (CDF) assistance through their Vegetation Management Program to conduct the burns. LADWP is currently working out agreement/contract details at this time with CDF.

1. Implementation Schedule

LADWP plans to implement burns as quickly as possible, following finalization of cooperative agreements with appropriate landowners and agencies. It is estimated that approximately 3 months, from the time the SWRCB approves the plan, will be required to develop a cooperative agreement for burns on non-LADWP lands. Concurrently, LADWP would prepare plans for prescribed burns on its lands. Permitting is expected to take 3 to 4 months. The start of the process to the certification of all environmental documentation is therefore estimated to quick, approximately 3 to 4 months.

2. Cost Estimate

The unit cost of prescribed burning is estimated by the scientists to be approximately $30 per acre, this estimate, however, has been debated. The cost of the initial experimental burn on approximately 400 acres of relicted land is estimated to be $12,000. After the experimental burn, burning will be implemented about every 5 years or as needed. The time between burns will vary, dependent on prevailing weather conditions and other factors. The cost per burn is estimated to be $36,000 or $7,200 annually if conducted every fifth year.

3. Financing

The respective landowners will be responsible for financing prescribed burns on their lands. LADWP will finance monitoring costs above what is required of appropriate land management agencies and their current directives to implement existing land management plans. LADWP will encourage cooperative agreements among all the involved land management agencies. This project is considered technically and financially feasible.

4. Water Requirements

No additional water will need to be committed to this project.

F. Develop a Cooperative Program to Control Salt Cedar in Lake-fringing Wetlands

LADWP believes that all agencies with land and resource management responsibilities in the Mono Basin, have an obligation to control Salt Cedar as well as other exotic species. It is therefore appropriate that all involved take an interagency approach to address this issue. LADWP will assist and participate in such a joint approach.

V. Monitoring Plan

The focus of monitoring will be based on habitats rather than a projected number of waterfowl. The condition of breeding, wintering, and staging habitats outside of the Mono Basin are beyond LADWP's control. Conditions at these areas may significantly affect number of waterfowl observed at Mono Lake. Therefore, by developing a variety of freshwater habitats at Mono Lake it is hopeful that the maximum potential waterfowl numbers will be attracted. This, however, is highly dependent on general conditions elsewhere. Additionally, this number is unknown and can not be accurately assessed. Upon review of the proposed monitoring projects described in the plan prepared by the waterfowl scientists, LADWP recommends that the SWRCB adopts these as activities appropriate for monitoring the status of waterfowl habitat restoration in the Mono Basin. The projects are outlined below:

A. Hydrology

The monitoring includes Mono Lake elevation, stream flows, and periodic spring surveys. The work is currently performed by LADWP and will continue to be in the future. As a result, no additional costs will incur. Hydrologic data will be collected at these sites according the following schedule:

- Lake elevation: collected weekly by LADWP personnel;
- Stream flows: collected daily by LADWP equipment;
- Spring surveys: performed every five years during the month of August by LADWP personnel; will start the first year after the SWRCB approves LADWP's waterfowl habitat restoration plan.

Hydrologic data will continue to be collected through one complete wet/dry cycle after the lake level has stabilized.

B. Lake Limnology and Secondary Producers

The monitoring includes meteorological data, data on the physical and chemical environment of the lake, phytoplankton, and brine shrimp population levels. This will be performed by contract (currently being performed by UCSB). Monitoring will continue annually at the current frequency, until the lake reaches a relatively stable level. LADWP will evaluate monitoring at that time and make a recommendation to the SWRCB whether or not to continue.

LADWP considers the monitoring at current levels to be reasonable and adequate to provide the necessary information. It is estimated that this monitoring cost will $80,000 annually and will be funded by LADWP.

C. Vegetation Status in Riparian and Lake-Fringing Wetland Habitats

Monitoring will include the establishment of vegetation transects in lake-fringing wetlands green lines, woody species, and the establishment of photo points on permanent vegetation transects. Monitoring will be implemented to coincide with stream vegetation monitoring efforts to maintaining cost efficiency. LADWP will invite the California Department of Fish and Game to assist in selecting appropriate sites.

Monitoring will start during the first year after the SWRCB approves the restoration plans. Monitoring will be performed in five year intervals, or after extremely wet year events, whichever comes first. Monitoring after an extremely wet year will reset the five year 'clock'. In addition, prescribed burns will be photographed before and after to record changes, and associated transects will be read before and after. Monitoring will continue until 2014, at which time LADWP will evaluate the necessity to continue with this program, and present its findings to the SWRCB. Monitoring will be performed by LADWP personnel where possible, or contracts administered by LADWP.

1. Aerial photographs

Photographs (1:6,000 scale) will be taken every five years. Photographed areas will include the lake fringing wetlands and Mono Lake tributaries. The aerial photography program will start during the first year after the SWRCB approves the restoration plans, and will continue until Mono Lake reaches the target elevation 6,391 feet. This will be performed by contract, administered by LADWP.

D. Waterfowl Population Surveys and Studies

The components of the monitoring program consists of several tasks: fall aerial counts, aerial photography of waterfowl habitats, ground counts, and a waterfowl time activity budget study. All waterfowl population survey work will start during the first year after the SWRCB approves the plans submitted by LADWP, and will continue through one complete wet/dry cycle after the targeted lake level is reached. LADWP plans to monitor annually until the year 2014. Work will be performed by LADWP staff, complemented with contracts administered by LADWP. Population surveys and studies will be conducted according to the following schedules:

- Fall Aerial Counts: two counts conducted every other year, conducted during the October 15 to November 15 window; the October survey is to be complemented with a boat survey;
- Aerial Photography: conducted during, or following, one fall aerial count;
- Ground counts: a total of eight counts each year, six in the fall and two in the summer;
- Waterfowl time activity budget study: study will be conducted during each of the first two fall migration periods after the SWRCB approves LADWP's restoration plans, and then again when the lake level is at or near the 6,392 feet target elevation.

Total costs of these activities is estimated to be $60,000. LADWP considers this to be a financially feasible proposal.

VI. Management of Restoration Measures

Entities with resource management responsibilities on land that a restoration measure is to be implemented should be responsible for managing the restoration measures. This is significant, particularly to DeChambeau Ponds-County Ponds Restoration Complex and the areas designated for prescribed burns, where LADWP is not the owner of the land. The appropriate agency, USFS or SLC, must agree to manage projects on their lands. LADWP may assist these agencies with the maintenance of these projects, if necessary.

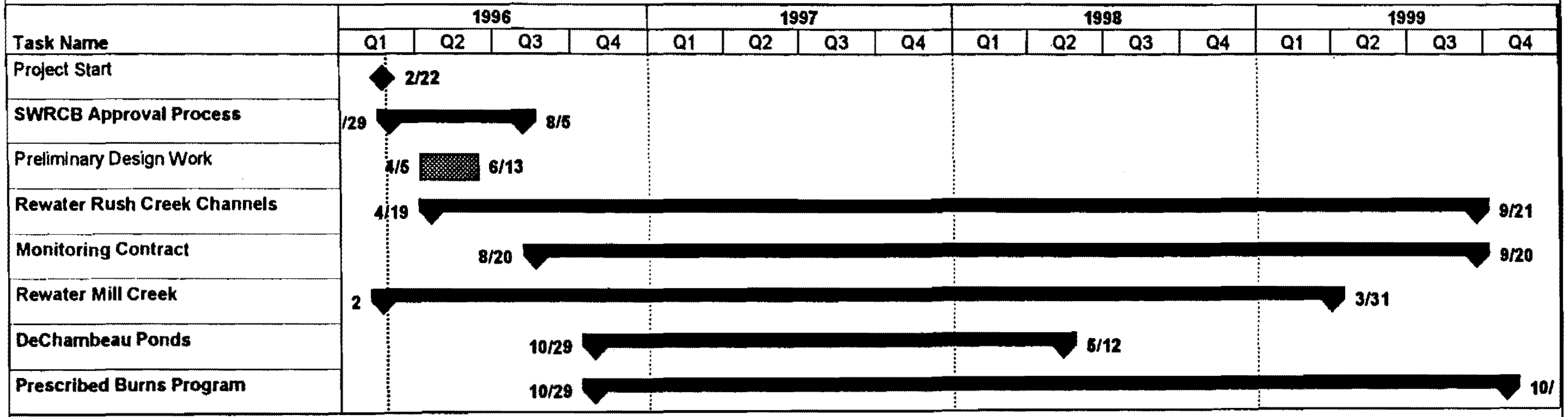
LADWP is recommending to enter into a cooperative agreement with the involved agencies, whereby all the physical and financial arrangements are described. LADWP again recommends the landowners pursue development of individual VMP programs with CDF to facilitate implementation of burning programs.

VII. Restoration Plan Implementation Schedule

Implementation of this restoration plan includes several different components. These are: 1) implementation of the specific restoration projects (i.e., rewatering Mill Creek, prescribed burn program), 2) monitoring activities and 3) administrative processes (i.e., preparing environmental documentation, contract administration) Figure 6 provides a timeline summary for implementation of the waterfowl habitat restoration work. Implementation of the specific restoration projects is contingent on LADWP's compliance with applicable state and federal environmental regulations. Due to the uncertainty associated with the time it will take to complete the environmental documentation process, actual dates may differ from those indicated on the schedules -- they may occur earlier of later.

Each project schedule identifies specific tasks that combined constitute the project. Several tasks can be completed simultaneously, other tasks can not be started until other tasks are completed. Figures 5 through 11 are the implementation schedules for the

MONO BASIN WATERFOWL RESTORATION PROJECTS
Summary Schedule of Major Projects



Tentative Schedule, Subject to Revision

Date: 2/29/96

Figure 5

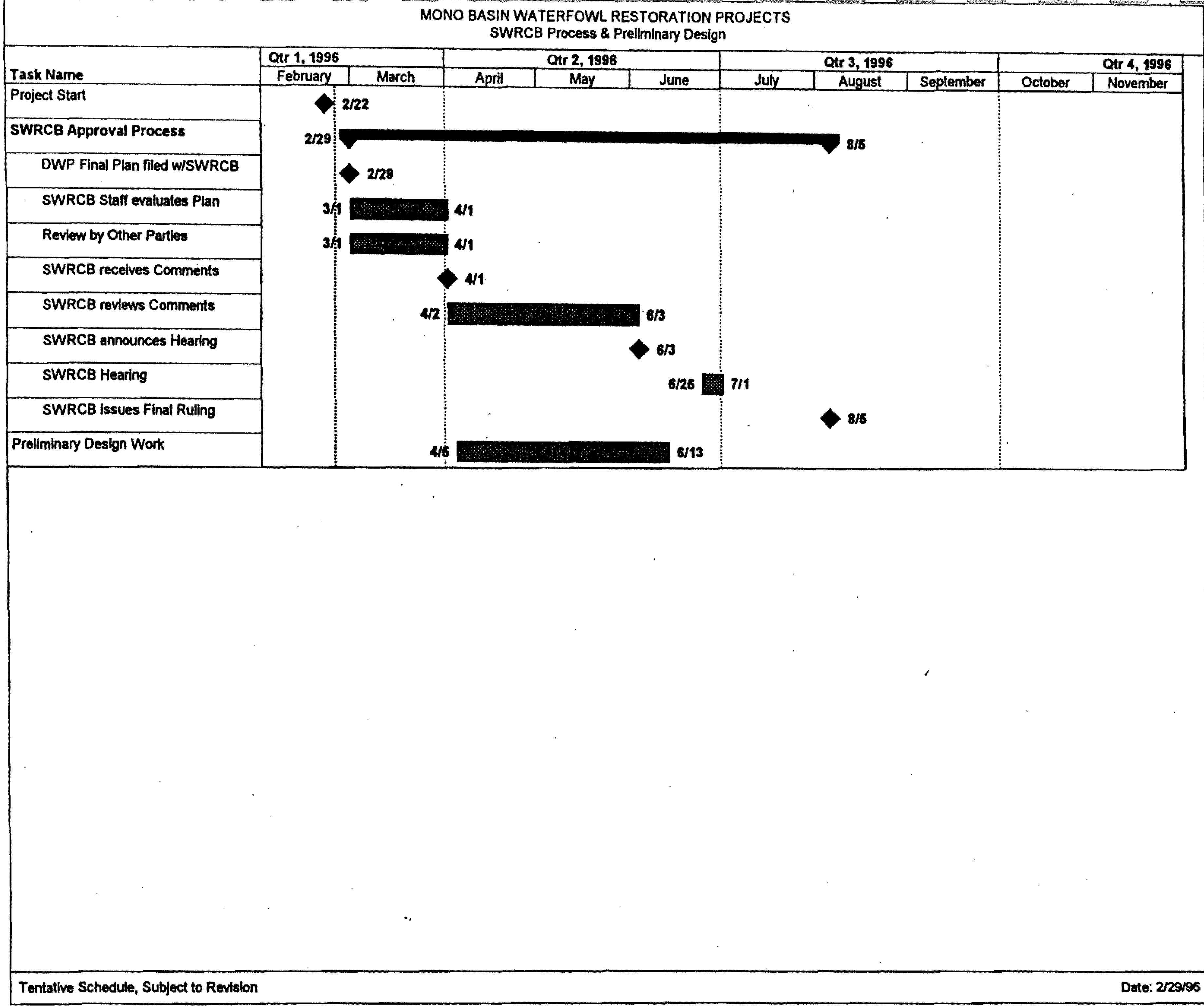
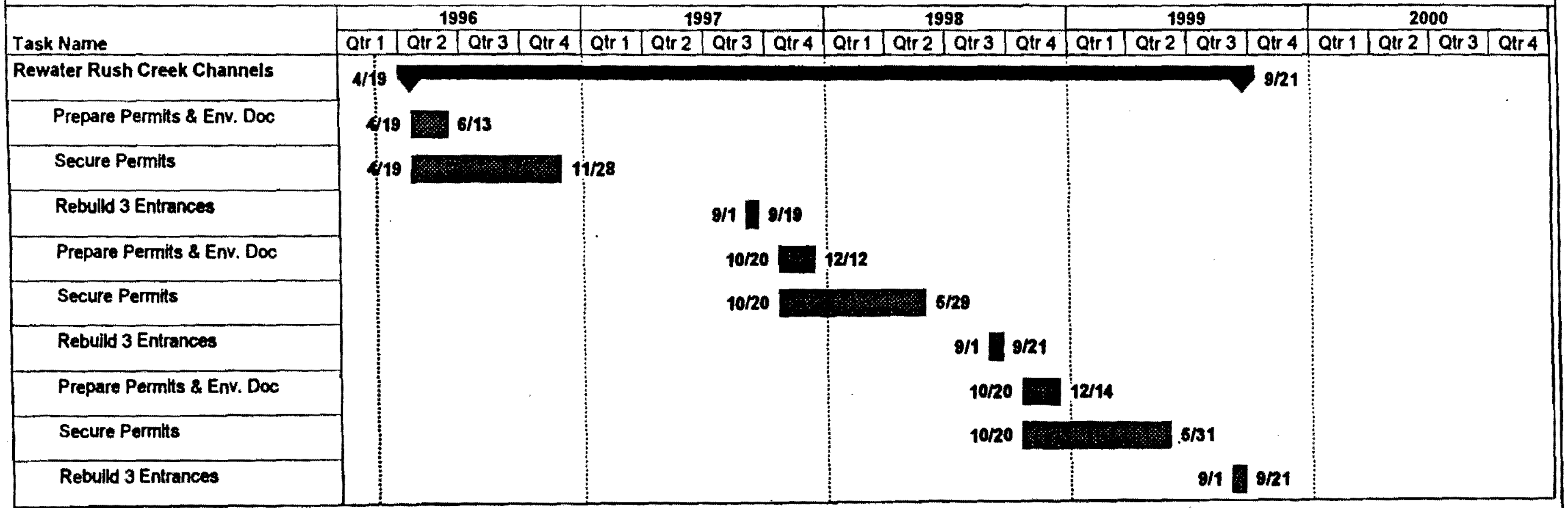

MONO BASIN WATERFOWL RESTORATION PROJECTS
SWRCB Process & Preliminary Design
Task Name
Qtr 1, 1996
Qtr 2, 1996
Qtr 3, 1996
Qtr 4, 1996
February
March
April
May
June
July
August
September
October
November
Project Start
2/22
SWRCB Approval Process
2/29
8/5
DWP Final Plan filed w/SWRCB
2/29
SWRCB Staff evaluates Plan
3/1
4/1
Review by Other Parties
3/1
4/1
SWRCB receives Comments
4/1
SWRCB reviews Comments
4/2
6/3
SWRCB announces Hearing
6/3
SWRCB Hearing
6/25
7/1
SWRCB Issues Final Ruling
8/5
Preliminary Design Work
4/5
6/13
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 6

Figure 7

MONO BASIN WATERFOWL RESTORATION PROJECTS

Rush Creek Channel Rewatering



Tentative Schedule, Subject to Revision

Date: 2/29/96

MONO BASIN WATERFOWL RESTORATION PROJECTS
Secure Environmental Consultant Contract & Commence Monitoring
Monitoring will be performed as described in Plan

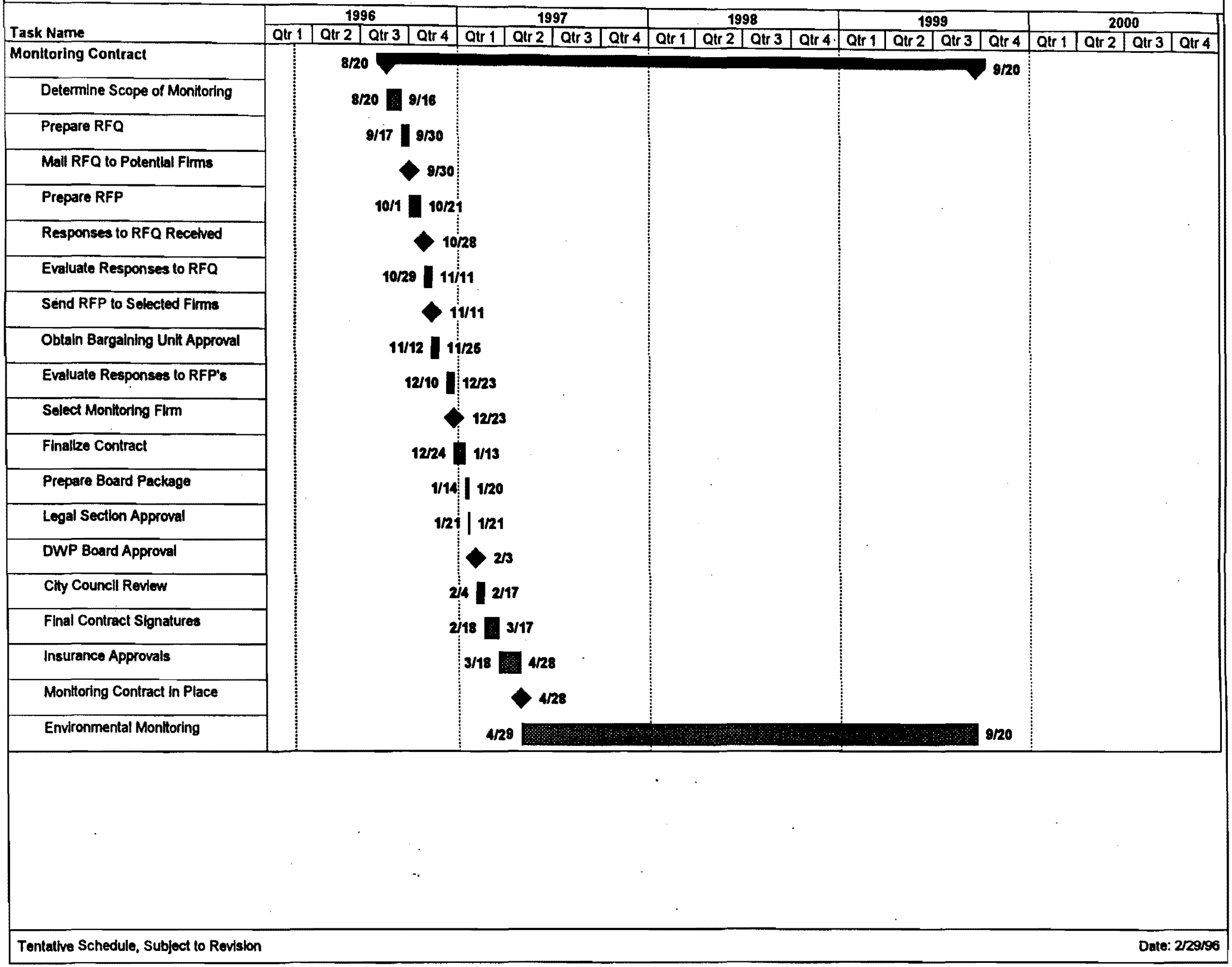


Figure 8

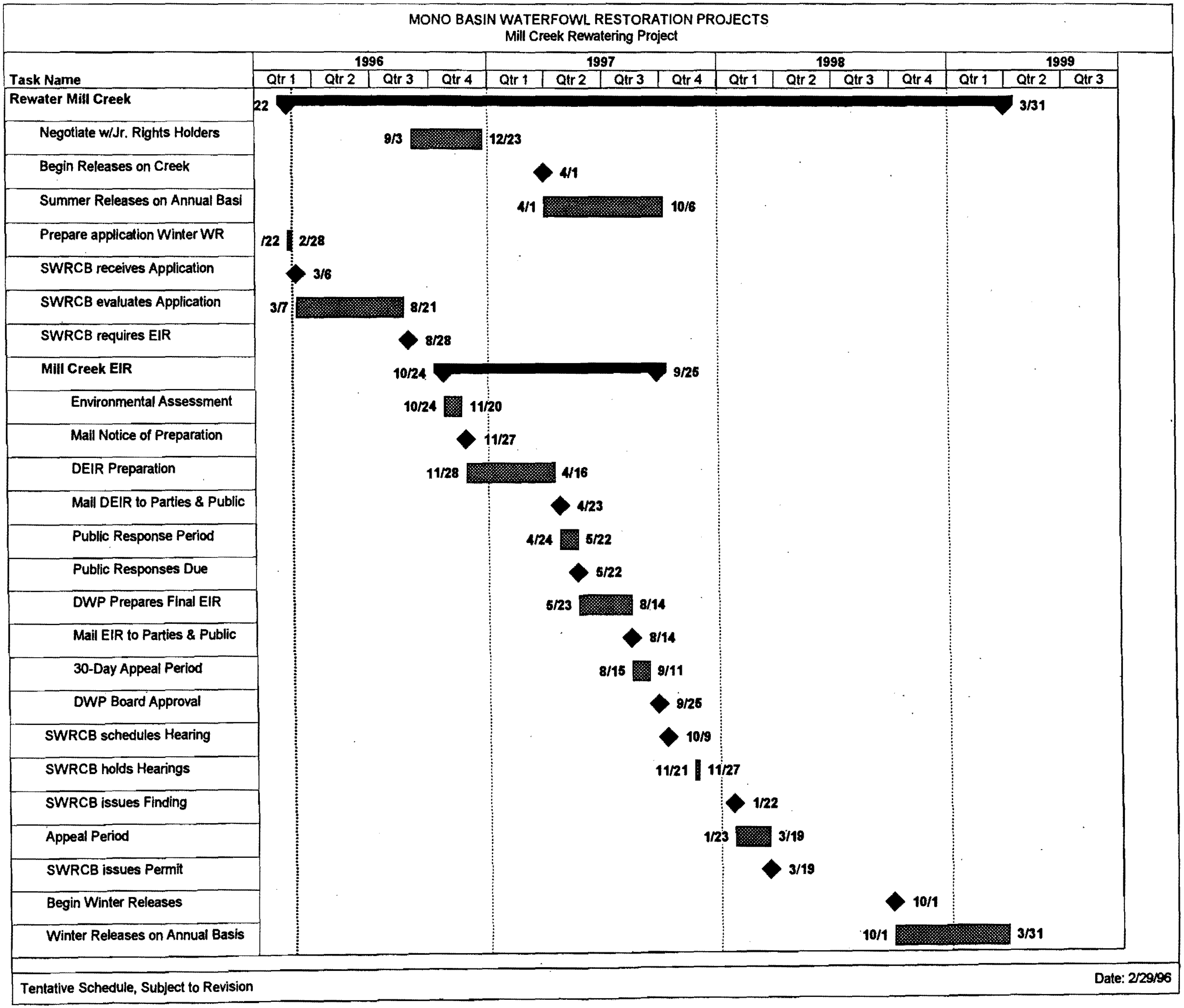

MONO BASIN WATERFOWL RESTORATION PROJECTS
Mill Creek Rewatering Project
Task Name
1996
1997
1998
1999
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Rewater Mill Creek
22
3/31
Negotiate w/Jr. Rights Holders
9/3
12/23
Begin Releases on Creek
4/1
Summer Releases on Annual Basi
4/1
10/6
Prepare application Winter WR
/22
2/28
SWRCB receives Application
3/6
SWRCB evaluates Application
3/7
8/21
SWRCB requires EIR
8/28
Mill Creek EIR
10/24
9/25
Environmental Assessment
10/24
11/20
Mail Notice of Preparation
11/27
DEIR Preparation
11/28
4/16
Mail DEIR to Parties & Public
4/23
Public Response Period
4/24
5/22
Public Responses Due
5/22
DWP Prepares Final EIR
5/23
8/14
Mail EIR to Parties & Public
8/14
30-Day Appeal Period
8/15
9/11
DWP Board Approval
9/25
SWRCB schedules Hearing
10/9
SWRCB holds Hearings
11/21
11/27
SWRCB issues Finding
1/22
Appeal Period
1/23
3/19
SWRCB issues Permit
3/19
Begin Winter Releases
10/1
Winter Releases on Annual Basis
10/1
3/31
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 9

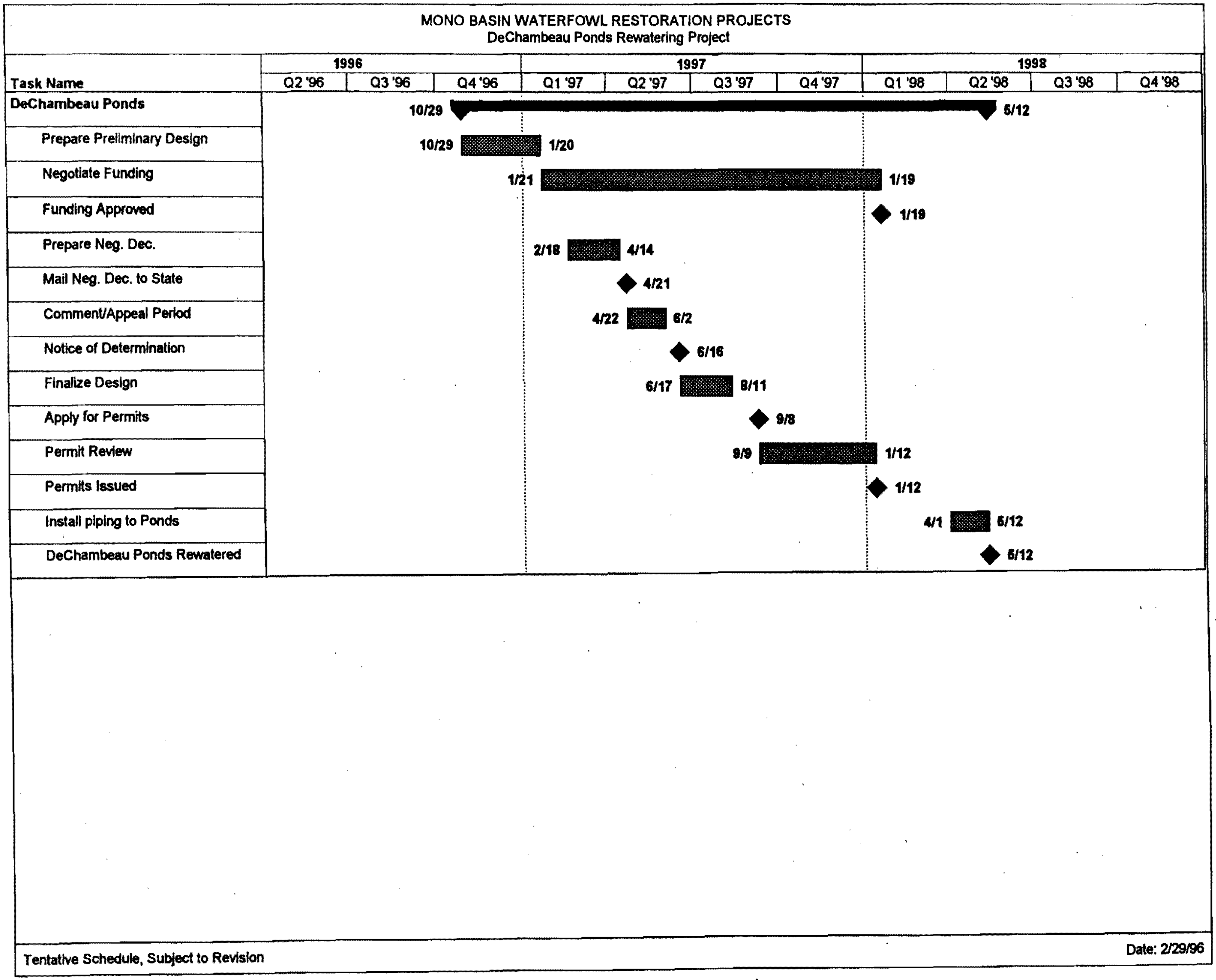

MONO BASIN WATERFOWL RESTORATION PROJECTS
DeChambeau Ponds Rewatering Project
1996
1997
1998
Task Name
Q2 '96
Q3 '96
Q4 '96
Q1 '97
Q2 '97
Q3 '97
Q4 '97
Q1 '98
Q2 '98
Q3 '98
Q4 '98
DeChambeau Ponds
10/29
5/12
Prepare Preliminary Design
10/29
1/20
Negotiate Funding
1/21
1/19
Funding Approved
1/19
Prepare Neg. Dec.
2/18
4/14
Mail Neg. Dec. to State
4/21
Comment/Appeal Period
4/22
6/2
Notice of Determination
6/16
Finalize Design
6/17
8/11
Apply for Permits
9/8
Permit Review
9/9
1/12
Permits Issued
1/12
Install piping to Ponds
4/1
5/12
DeChambeau Ponds Rewatered
5/12
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 10

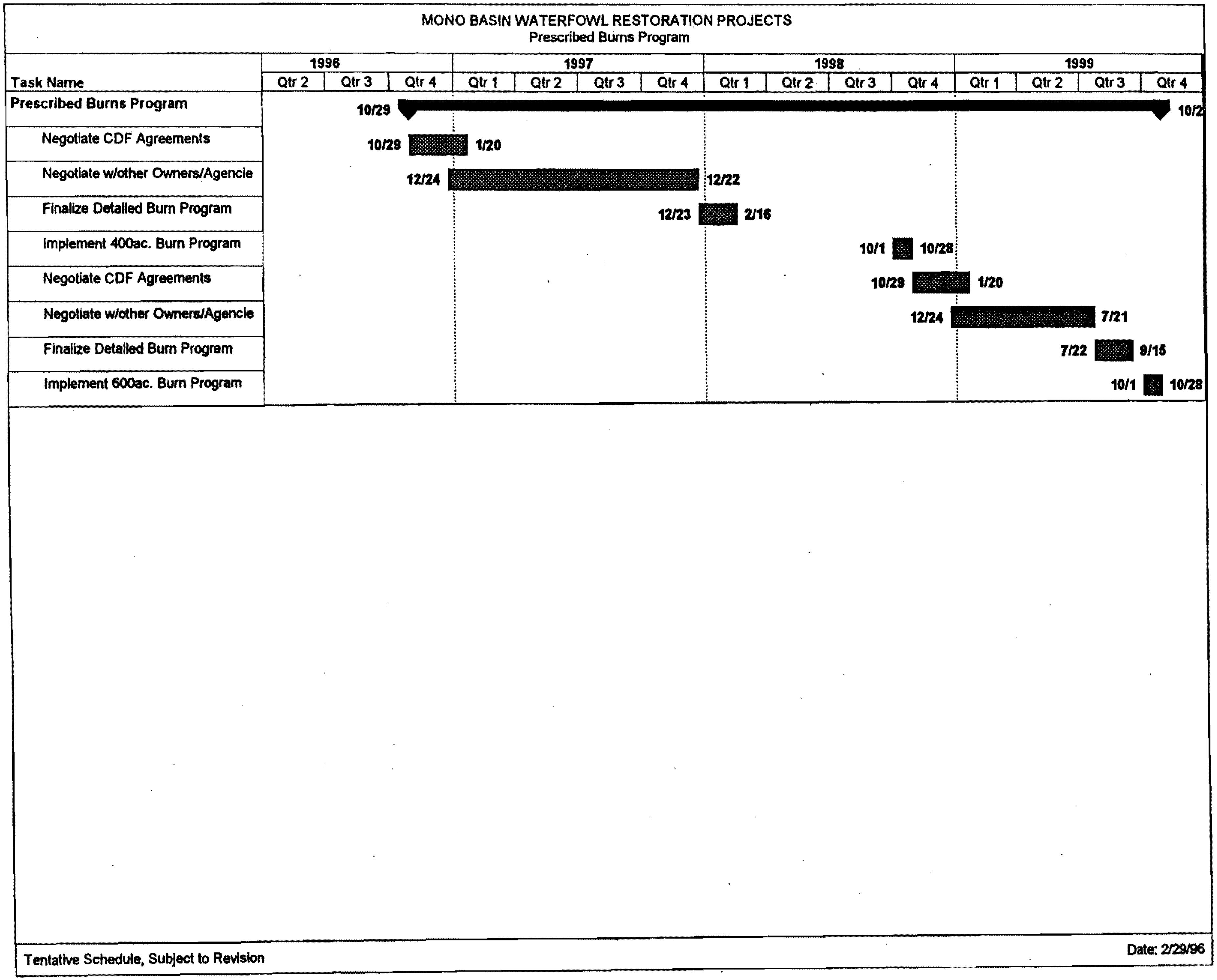

MONO BASIN WATERFOWL RESTORATION PROJECTS
Prescribed Burns Program
Task Name
1996
1997
1998
1999
Qtr 2
Qtr 3
Qtr 4
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Qtr 1
Qtr 2
Qtr 3
Qtr 4
Prescribed Burns Program
10/29
Negotiate CDF Agreements
10/29
1/20
Negotiate w/other Owners/Agencie
12/24
12/22
Finalize Detailed Burn Program
12/23
2/16
Implement 400ac. Burn Program
10/1
10/28
Negotiate CDF Agreements
10/29
1/20
Negotiate w/other Owners/Agencie
12/24
7/21
Finalize Detailed Burn Program
7/22
9/15
Implement 600ac. Burn Program
10/1
10/28
Tentative Schedule, Subject to Revision
Date: 2/29/96

Figure 11

SWRCB Process and Preliminary Design, the specific projects, and the waterfowl monitoring program.

VIII. Restoration Plan Implementation Cost Estimate

The initial cost estimate for the Waterfowl Restoration Plan is $901,000 in capital expenditures with annual operation and maintenance costs of $180,000. LADWP will seek funding from other agencies and outside parties for a portion of this cost. LADWP has identified certain projects, the DeChambeau Ponds/County Ponds/Black Point Project in particular, which in its view are not financially feasible without funding from other sources/agencies. This view is based in part on the benefit derived from these projects compared to their cost.

LADWP, therefore will seek funding from the California Department of Transportation (Caltrans) highway mitigation funding and the Eastern Sierra Intermountain West Joint Venture Group which obtains federal funding resulting from the North American Waterfowl Management Plan. Both groups have been active is seeking mitigation projects and may show an interest in the DeChambeau Ponds-County Ponds Restoration Projects. The USFS and LADWP may also participate in funding this project. In addition, the respective landowners will be responsible for financing a portion of the Prescribed Burn Program by managing prescribed burns on their lands. LADWP will also request funding assistance from other groups that have fund raising capabilities and would be in an ideal position to assist with the financing of these projects. Table H summarizes the cost estimates for each of the waterfowl habitat restoration projects.

IX. Environmental Documentation and Regulatory Compliance

The waterfowl habitat restoration measures proposed in this plan will likely require some environmental documentation for compliance with the California Environmental Quality Act (CEQA) and/or the National Environmental Policy Act (NEPA). In addition, permits and approvals will have to be obtained from one or more governmental agency before any physical work can proceed. Until more specific information is developed, there will be some uncertainty as to what is needed for environmental compliance and the type of permits and approval that will have to be obtained.

Table H

ESTIMATED COST OF PROPOSED WATERFOWL HABITAT RESTORATION MEASURES

	Item Costs	TOTALS
I. REWATER ADDITIONAL CHANNELS RUSH CREEK	$68	$68
II. DeCHAMBEAU/COUNTY PONDS PROJECT [1]		
1. DeChambeau ponds	$90	
2. County Ponds	Capital $638 O & M $30	
3. Black Point scrapes	$25	
	SUBTOTAL II	Capital $753 O & M $30
III. BURNS [2]	$30 when needed, approx every 3 to 5 years	Equivalent annual expense is approximately $10
IV. ENVIRONMENTAL DOCUMENTATION	$81	$81
V. MONITORING [3]		
Limnology	$80	
Population Surveys	$60	
	SUBTOTAL V	Annual $140
	TOTAL	**CAPITAL $901** **Annual and O & M expenses $180**

1 LADWP's proposal is to obtain outside funding for this project. Absent outside funding, LADWP considers this project too costly in light of the expected benefit.

2 LADWP's proposal is to participate with appropriate land owners in implementing this proposal.

3 LADWP's proposal assumes that other agencies with resource management responsibilities will perform monitoring on their lands.

A. Regulatory and Permitting Requirements

1. Scenic Area and Tufa Reserve Plans

In 1984, congress designated federal lands within the Mono Basin as a National Forest Scenic Area. The Scenic Area Comprehensive Management Plan (Management Plan) was developed to protect its geologic, ecological, cultural, scenic, and other natural resources, while allowing recreation, scientific, and other activities consistent with this goal. The Management Plan, allows wildlife management activities for maintaining stable wildlife habitat in most areas of the scenic area. The waterfowl habitat restoration work LADWP is proposing is consistent with the direction and policies in the Management Plan.

Members of the Forest Service have participated in the Waterfowl Habitat Restoration Technical Advisory Group (TAG) meetings. The TAG was established by LADWP for soliciting input for consideration in the development of the Waterfowl Habitat Restoration Plan. LADWP will continue to consult with the Forest Service when implementing the final Plan.

2. Mono Lake Tufa State Reserve

In 1982 the State of California designated the state-owned lands surrounding the lake below elevation 6,417 feet as the Mono Lake Tufa State Reserve. The reserve was established to preserve the tufa and other natural and cultural features at Mono Lake. Parks and Recreation manage the reserve under guidelines and statutes favoring a natural and undisturbed environment. Some of the projects LADWP are proposing to undertake are located in the floodplain of the creek and are outside the boundaries of the tufa state reserve. The remainder of the projects being proposed are within the boundary of the Tufa State Reserve; however, the activities proposed will not disturb the tufa formations or sand structures. A major component in the restoration rely on the lake elevation increasing to 6,392 feet; however, as Decision 1631 points out, raising the lake to 6,392 feet will result in covering and toppling tufa and destroying existing sand structures.

B. Other Environmental Statutes and Approvals

1. California State Water Quality Control Board, Lahontan Region

Conditional waiver of waste discharge requirements and Clean Water Act Section 401 Water Quality Certification: Several factors must be considered when trying to determine the time involved in obtaining permit(s). First, it must be determined whether the project is defined as all of the measures proposed in the plan or if each of the measures proposed in the plan can be defined as separate projects. Second, there must be detailed descriptions of the projects with assumptions on the amount of disturbance that will likely occur. Finally, there must be an implementation schedule. All of this information is required before the Water Quality Control Board can determine the type of approval and the time frame in which to process the approval. Until the design and engineering have been completed for the projects proposed, there is no way of reasonably estimating the time frame with any certainty. In a letter dated November 21, 1995, the Water Quality Control Board indicated that without more information they would only be able to provide an estimates which ranges from 60 to 120 days. A copy of the Water Quality Control Board's letter is included in Appendix IV. LADWP will continue to consult with the Water Quality Control Board's staff, especially during the development of the projects and submittal of the requests, to ensure that requests are promptly processed.

2. Army Corps of Engineers

Nationwide Permits under Section 404 of the Clean Water Act: As is the case with the RWQCB, the time involved in processing a request will depend primarily on LADWP providing detailed descriptions for the waterfowl habitat restoration projects proposed in the restoration plan. Another consideration will be the size of the project. The Corps may consider the Plan as one project or it may consider each of the proposed restoration measures as individual and separate projects. In a letter dated November 16, 1995, the Corps indicated that without more detailed descriptions of the projects activities they would be unable to provide LADWP with specific permit requirements or give any estimate of time other than 30 to 120 days. A copy of the Corps letter is included in Appendix V.

The projects that will most likely require approval are those on Mill and Rush creeks. The projects on Rush Creek are covered in the draft Stream Restoration Plan. LADWP will continue to consult with the Corps. As more information becomes available for the Plan and more details developed on the proposed measures the Corps will be better able to provide information on approvals and time frames.

3. California Department of Fish and Game

Complying with California Fish and Game Code Section 1601. Some of the waterfowl habitat restoration measures proposed will require compliance with Section 1601. The distributary channel rewatering projects on Rush Creek will require compliance with Section 1601. No instream work has been proposed for Mill Creek.

Section 1601 requires LADWP to submit plans to the Department of Fish and Game sufficient to indicate the nature of the project for construction. There are statutory time requirements for the Department of Fish and Game and LADWP to respond to plans submitted and for modifications proposed to the plans; however the time may be extended if that is mutually agreed upon. The time involved in reaching an agreement also depends on the amount of negotiations required and whether or not the process involves arbitration.

C. Time Frame for Permitting and Approval Process

State Water Quality Control Board	60 to 120 days
Army Corps of Engineers	30 to 120 days
Department of Fish and Game	30 days to Indefinite

Requests can be submitted to the agencies concurrently. However, a permit or waiver is required first from the State Water Quality Control Board before the Army Corps of Engineers can approved an application. Submitting request concurrently can significantly reduce the time required to obtain approvals.

D. Environmental Documentation

1. California Environmental Quality Act (CEQA)

Several options may be available for LADWP to consider for complying with CEQA when implementing the final Waterfowl Habitat Restoration Plan. The options range from a Categorical Exemption to preparing an Environmental Impact Report. The option LADWP selects will significantly affect the time involved for complying with CEQA. It is our opinion that many of the waterfowl habitat restoration measures that are proposed qualify for a Categorical Exemption. The remainder of the projects, where a Categorical Exemption is not appropriate, may only require a Mitigated Negative Declaration.

In developing the schedule for implementing LADWP' proposal, some assumptions were made regarding the environmental documentation required for the specific projects. However, until the restoration plan is final and more details are available on the measures proposed, no final determination on the minimum CEQA requirements can be made.

2. National Environmental Protection Act (NEPA)

NEPA applies to projects which are carried out, financed, or approved in whole or in part by federal agencies. Since some of the waterfowl habitat restoration measures proposed are located on federal lands, it would appear that compliance with NEPA is required.

The NEPA process is similar to CEQA. The level of effort is based on the particular action and by the degree in which the action may adversely affect the environment. Until more information is developed for the proposed projects, there is no way of determining NEPA requirements nor the time required to meet them.

3. Time Frame for Environmental Compliance

The time involved to comply with CEQA and/or NEPA could range from approximately 30 days to more than one year.

Mono Basin Waterfowl Restoration Plan

Appendices

February 29, 1996

PREPARED BY THE LOS ANGELES DEPARTMENT OF WATER AND POWER

Appendix I

MONO LAKE BASIN WATERFOWL HABITAT RESTORATION PLAN

PREPARED BY:
R. C. DREWIEN,
F. A. REID, AND
T. D. RATCLIFF

MONO LAKE BASIN WATERFOWL HABITAT RESTORATION PLAN

PREPARED BY:

RODERICK C. DREWIEN[1], FREDERIC A. REID[2] AND THOMAS D. RATCLIFF[3]

PREPARED FOR:

LOS ANGELES DEPARTMENT OF WATER AND POWER

FEBRUARY 1996

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EXECUTIVE SUMMARY

The State of California Water Resources Control Board adopted Decision 1631 on 28 September 1994, amending the water right license of the City of Los Angeles, Department of Water and Power (LADWP) to divert water from the Mono Basin. The decision included an order to prepare a work plan for restoring waterfowl habitat lost due to trans-basin stream diversions initiated in 1941. The goal of this work plan is to provide technical guidance to restore waterfowl habitat at Mono Lake and associated lake-fringing wetlands, and it is submitted as part of an overall restoration program required by the decision.

Decision 1631 requires increasing the median level of Mono Lake to 6,392 feet and recognizes that this would allow restoration of some lost waterfowl habitat, but that additional habitat could be restored through other measures. Maximum restoration of waterfowl habitat would require maintaining a lake level at or above 6,405 feet. The decision also requires the plan to 1) be consistent with management regulations of the Mono Basin National Forest Scenic Area and the Mono Lake Tufa State Reserve, and 2) seek active input from specified parties. These parties formed a Waterfowl Habitat Technical Advisory Group and developed 10 guidelines for restoration efforts which emphasized 1) restoring pre-1941 waterfowl habitat conditions where feasible, 2) focusing restoration in lake-fringing habitats, 3) a preference for restoration through natural processes and projects that were self-sustaining, and 4) the need to monitor restoration treatments.

Information provided by long-term Mono Basin residents, waterfowl experts, and available literature provided insight into waterfowl populations and the habitats they utilized in the

Mono Basin during the prediversion (<1941), early diversion (up to mid-1960s), and current periods. For all periods, minimal quantitative waterfowl count data were available. However, sufficient information existed to indicate that hundreds of thousands to a million fall migratory waterfowl used Mono Basin during the prediversion and early diversion period. After the mid-1960s, waterfowl numbers crashed and current estimates suggest that some 10,000-15,000 ducks use the area annually. Available evidence suggests that waterfowl numbers declined by greater than 95 percent.

Major adverse ecological changes in waterfowl habitats occurred in lake-fringing wetlands and on the lake itself as a result of trans-basin stream diversions. By 1947, the lake began to recede and within 20 years had dropped 30 feet. The lake reached its historic low stand of 6,372 feet in 1982, a 45-foot drop from the prediversion period. Most lake-fringing wetlands and freshwater inflows that overlaid dense saline lake water (hypopycnal environments) were eliminated or severely degraded. These habitats were the preferred waterfowl use areas and their losses were the primary cause for the large precipitant decline in waterfowl use. The combined losses in quantity and quality of fresh and brackish water areas reduced the diversity of wetland habitats required by various waterfowl species, and left mainly a hypersaline and hyperalkaline lake primarily attractive to small numbers of salt-tolerant species such as ruddy ducks and northern shovelers.

To increase numbers of migratory waterfowl using Mono Lake requires restoring and recreating a diverse mosaic of fresh and brackish water lake-fringing wetlands and hypopycnal environments. We recommend a number of restoration treatments to approach this goal.

The most important and highest priority restoration effort is to increase Mono Lake to a median level of 6,392 feet as ordered in Decision 1631. This action will restore the largest acreage and provide the most diversity of waterfowl habitats. Our second priority is rewatering Mill Creek to restore riparian wetland and hypopycnal habitats. Restoration efforts in Mill Creek were not directed in Decision 1631 because degraded habitat conditions were not a result of trans-basin diversions by LADWP. However, incision occurred in the Mill Creek delta because of the lowering of Mono Lake as a result of LADWP's water diversions. Restoration of all potential waterfowl habitat on Mill Creek does not appear feasible under current conditions due to complicated issues involving water rights and the need for structural improvements to convey increased flows. However, a major and significant first step in achieving needed flows would be for LADWP to dedicate its water right to flow down Mill Creek as described in its draft proposal. To improve waterfowl habitats, it is necessary to provide high flows throughout spring and summer, and base flows throughout fall and winter. To accomplish needed flows, we recommend investigating the feasibility of upgrading the Mill Creek Return Ditch. Additional suggestions for rewatering Mill Creek are provided and should be initiated as soon as possible. Any restoration efforts in Mill Creek are considered as mitigation for waterfowl habitat lost elsewhere at Mono Lake. We further recommend the following projects be implemented to restore, enhance, or mitigate for lost waterfowl habitats: 1) Rewater important distributaries in Rush Creek below the Narrows, 2) Develop a water system to rewater the County ponds, 3) Extend the existing below-ground water system to maintain riparian habitat at DeChambeau Ponds, 4) Investigate the feasibility of creating one or several shallow ponds near Black Point using an existing 120 gpm artesian flow, 5) Investigate the feasibility of enhancing existing artificial ponds near Simons Springs and the creation of one or several shallow ponds (scrapes) in similar lake-fringing marsh and wet meadow habitats, 6) Develop and implement a prescribed burning plan to enhance lake-fringing marsh and wet meadow habitats in cooperation with the U.S. Forest Service and the California Department of Parks and Recreation, and 7) Control Salt Cedar (Tamarisk), an exotic, in lake-fringing wetlands and riparian areas.

The recommended monitoring projects on hydrology, limnology, vegetation, and waterfowl populations are minimal but essential to adequately document measurable changes in the availability of wetland habitats and responses of waterfowl populations to these changes. All restoration treatments and monitoring projects can and should be initiated in 1996 because none are dependent on achieving target lake levels. If these projects are delayed, recovery of waterfowl populations and their habitats will also be delayed and evaluation of restoration treatments will be incomplete due to lack of comparative baseline data. We do not expect restoration treatments will completely compensate for waterfowl habitat losses that have accrued over the past 50 years due to trans-basin diversions. This would at minimum, require a lake level of 6,405 feet or higher.

MONO LAKE BASIN WATERFOWL HABITAT RESTORATION PLAN

INTRODUCTION

The goal of this plan is to provide technical guidance to restore waterfowl habitat in the Mono Lake Basin. In its Mono Lake Basin Water Right Decision 1631 (D-1631) of 28 September 1994, the State of California Water Resources Control Board (SWRCB) concluded that "Mono Lake and nearby areas provided important habitat and a major concentration area for migratory waterfowl prior to out-of-basin diversions by LADWP [Los Angeles Department of Water and Power] and up to the early 1960s. The loss of open water habitats and fresh-water sites around the lake due to water diversions by LADWP coincided with the decline in migratory waterfowl populations at Mono Lake" (D-1631:117).

D-1631 requires increasing the water level to an average of 6,392 feet and recognizes that this will allow restoration of some of the lost waterfowl habitat, but that additional habitat could be restored through other measures. Maximum restoration of waterfowl habitat would require maintaining a water level at or above 6,405 feet. The decision emphasizes restoration efforts in lake-fringing wetlands, and directs that the restoration plan is subject to technical and financial feasibility, reasonableness, and adequacy of the measures proposed to achieve stated objectives. LADWP is also directed to consider various waterfowl habitat restoration measures identified in the Draft EIR (Environmental Impact Report) and the hearing record.

D-1631 requires the Waterfowl Habitat Restoration Plan [Plan] to make recommendations on waterfowl habitat restoration measures and to describe how any restored waterfowl areas will be managed on an on-going basis. Specifically, D-1631 (SWRCB:206-207) requires the Plan to:

1. Be consistent with the management regulations and statutes governing the Mono Basin National Forest Scenic Area and the Mono Lake Tufa State Reserve.

2. Identify specific projects to be undertaken, implementation schedule, estimated costs, method of financing, and estimated water requirements.

3. Include a method for monitoring the results and progress of proposed restoration projects. The monitoring proposal shall identify how results of restoration activities will be distinguished from naturally occurring changes and shall propose criteria for determining when monitoring may be terminated.

In addition, D-1631 (SWRCB 1994:207) states that the "Licensee [LADWP] shall be responsible for compliance with all applicable state and federal statutes governing environmental review of projects proposed in the restoration plan. In developing the restoration plans, LADWP shall emphasize measures that have minimal potential for adverse environmental effects. The time schedule specified in the restoration plan shall include procedures for compliance with the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) and for obtaining all necessary permits or governmental agency approvals."

D-1631 requires that LADWP shall seek active input from the following parties (SWRCB 1994b:207): California Department of Fish and Game, California State Lands Commission, California Department of Parks and Recreation, United States Forest Service, National Audubon Society, Mono Lake Committee, and California Trout, Inc. The following parties convened on 14 March 1995, and formed a Waterfowl Habitat Technical Advisory Group (TAG): LADWP, California Department of Fish and Game, California State Lands Commission, California Department of Parks and Recreation, United States Forest Service, National Audubon Society and Mono Lake Committee. They have developed the following 10 guidelines for waterfowl habitat restoration efforts:

1. Restore pre-1941 waterfowl habitat conditions and ecological processes where feasible.

2. Focus on lake-fringing habitats, but due to Decision 1631 lake management target of 6,392 feet and variation around that target (below pre-1941 conditions), some restoration of pre-1941 lake-fringing waterfowl habitat may not be possible. Therefore, mitigation options on the tributary streams and elsewhere in the Mono Basin should be examined, and may be required.

3. Restoration preference is for natural processes and conditions as opposed to heavily engineered habitats.

4. Preference shall be on recreating or restoring naturally occurring ecosystems or functions, as opposed to "creating" new habitat.

5. Single species management shall be avoided. Emphasis shall be on the ecosystem approach.

6. Restoration preference shall be on self-sustaining habitats without the need for long-term maintenance activities.

7. Keep options and opportunities open as to lands where restoration treatments take place.

8. The focus of lake-fringing habitats shall be on long-term restoration associated with the 6,392 feet target level, rather than short-term restoration.

9. There shall be monitoring of the restoration treatments which should consider:

   a. Duration for restoration to occur.

   b. Goals and objectives of the particular project.

   c. Level of effort necessary to collect data for adequate monitoring program.

   d. A baseline assessment of pre-1941 and existing conditions.

   e. Waterfowl use.

   f. Aquatic invertebrates.

   g. Vegetative succession.

   h. Water chemistry.

10. Elements of the waterfowl habitat restoration plan unrelated to lake level shall be implemented as soon as practicable. The timing of the implementation of elements of the

waterfowl habitat restoration plan related to lake level shall be addressed on a case-by-case basis.

WATERFOWL IN THE MONO BASIN

Pre-1955 waterfowl population data are rare for any locality in North America (Banks and Springer 1994), but California Division of Fish and Game Biennial Reports reveal a state harvest estimate of 1.9-2.0 million ducks in the early 1940s. Duck harvest estimates for 1940 in the Mono Basin indicated a harvest of 5,000 ducks, but it may have been considerably higher. Much of the actual Mono Basin waterfowl harvest may have been erroneously attributed to the Los Angeles area, since many of the hunters in the Mono Basin were recorded by their county of domicile. Even the 5,000 harvest estimate suggests a fall population level of more than 100,000 ducks at Mono Lake in 1940, based on standard waterfowl harvest levels.

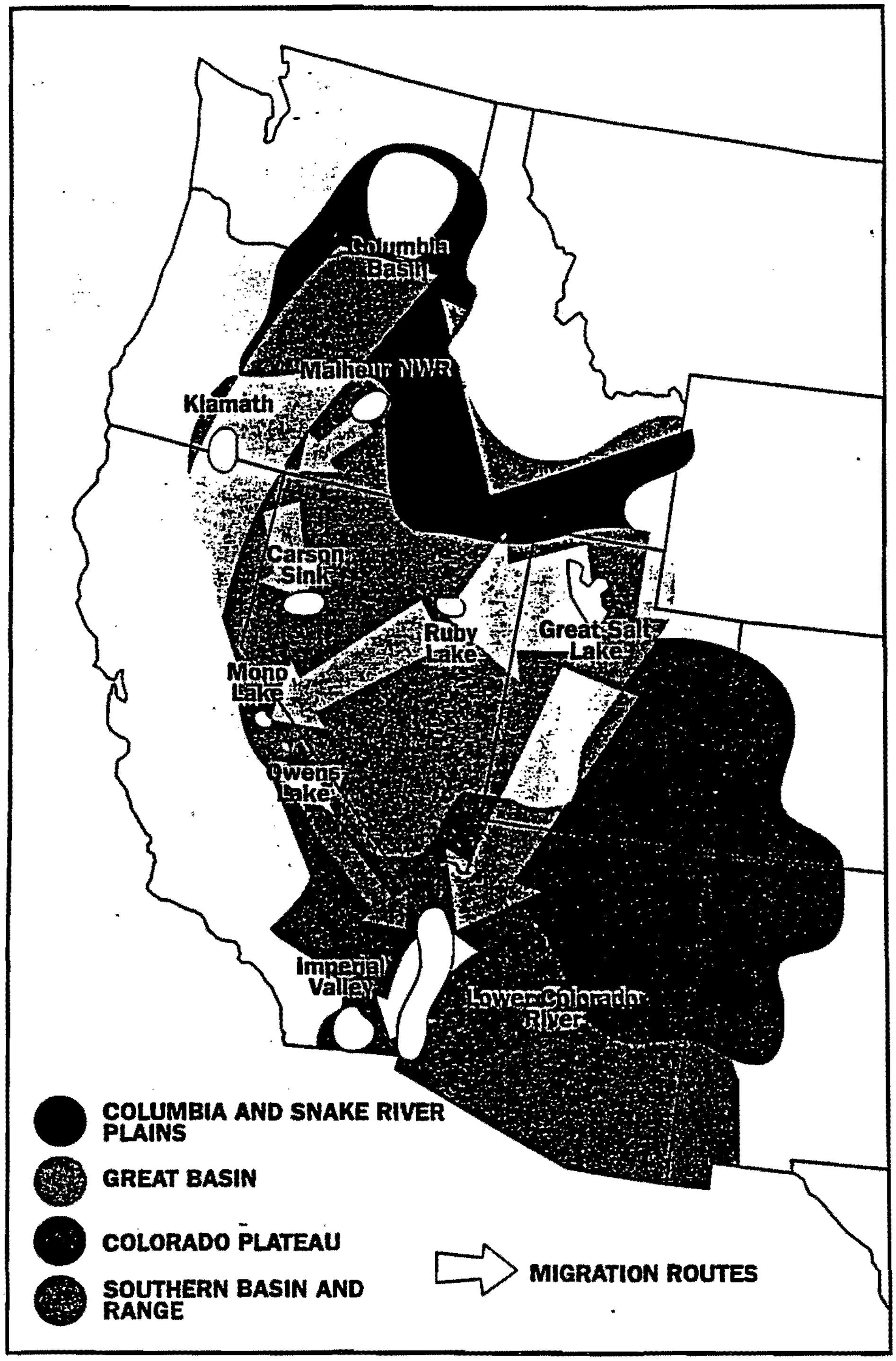
Statements by long-term residents of the Mono Basin (SWRCB 1993), including D. Banta, K. DeChambeau, W. McPherson, and J. Preston, described fall populations that numbered in the hundreds of thousands to a million waterfowl at a single time. Accounts of waterfowl in the nearby Owens River Valley, prediversions, also described over a million ducks during fall migration (Kahrl *in* Jehl 1994:267). The statements about Mono Lake duck populations were from waterfowl hunters who spent many days in the field, over many years, observing the ducks and geese they hunted. Their statements indicated that population levels stayed relatively high until the early to mid-1960s, when duck populations crashed (SWRCB 1993). A California Fish and Game aerial survey in September 1993 counted less than 900 ducks on Mono Lake and associated tributaries (R. Thomas, Calif. Fish and Game, pers. comm.). Recent estimates during the 1980s-90s indicate that ±10,000-15,000 total ducks use the Mono Basin annually (SWRCB 1993(2):3F 39-41).

Two California Fish and Game employees (E. Vestal and W. Dombrowski) were in agreement with local hunters regarding much higher waterfowl population levels at Mono Lake prior to and during the early period of trans-basin water diversions (SWRCB 1993(2): 3F-38). Dombrowski's waterfowl population estimates in fall 1948 (Appendix A) indicated numbers in the hundreds of thousands to a million. Drombrowski stated that the ruddy duck (*Oxyura jamaicensis*) and northern shoveler (*Anas clypeata*) comprised 80 percent of the population, but that 70 percent of the harvest was northern shoveler; few ruddy ducks were harvested. Vestal stated that he had observed hundreds of thousands of waterfowl on Mono Lake on numerous occasions between 1939-50, and that the ruddy duck and northern shoveler were the predominant species. Vestal also noted that he had observed waterfowl in other important concentration areas in California, including some sites along the coast and in the Central Valley, yet he never observed as many waterfowl at those locations as he observed at Mono Lake during the late 1930s and 1940s. Based on current waterfowl migration corridors (Fig. 1), population levels of migratory waterfowl in the Great Basin and Pacific Flyway (Banks and Springer 1994, Bartonek 1995), and aerial photos depicting former lagoon and marsh habitats along the Mono Lake shores and deltas, prediversion lake wetland habitats supported several orders of magnitude more waterfowl than exist there today.

When duck populations plunged during the 1960s, long-term local residents (Banta, DeChambeau, McPherson) indicated that the ruddy duck may have become relatively more common during that decade (SWRCB 1993(2):3F-39). Estimates of waterfowl species composition at Mono Lake in the 1980s and early 1990s by T. Taylor and J. Jehl (SWRCB 1993(2):3F-41) indicated that ruddy ducks and northern shovelers still predominated,

FIGURE 1

MAJOR WATERFOWL MIGRATION CORRIDORS IN THE INTERMOUNTAIN WEST OF THE PACIFIC FLYWAY


Columbia Basin
Malheur NWR
Klamath
Carson Sink
Ruby Lake
Great Salt Lake
Mono Lake
Owens Lake
Imperial Valley
Lower Colorado River
COLUMBIA AND SNAKE RIVER PLAINS
GREAT BASIN
COLORADO PLATEAU
SOUTHERN BASIN AND RANGE
MIGRATION ROUTES

comprising approximately 54-67 percent of the fall population followed by 17-18 percent green-winged teal (*A. crecca*). Ruddy ducks have a higher salinity tolerance than most other ducks (Jehl *in* SWRCB 1993(2):3F-41, Jehl 1994) and apparently were least affected by losses of freshwater habitats and the increasing salinities that resulted from declining lake levels.

The possibility has been suggested that waterfowl use at Mono Lake declined because duck populations that formally stopped there no longer existed or had shifted their fall migration to other Great Basin lakes or the Central Valley of California. Indices of the number of ducks wintering in the Pacific Flyway showed declines from the late 1950s through the late 1960s, followed by increases during the 1970s with major declines starting again during the early 1980s (Banks and Springer 1994). In the 1990s, Pacific Flyway duck populations started increasing (Bartonek 1995). It has been stated (Banks and Springer 1994) that the most important factor influencing the overall decline of most species of waterfowl in western North American and the Pacific Flyway during the past century has been the modification or loss of suitable habitat. In addition to the loss of habitat in the Mono Basin, Pacific Flyway waterfowl habitats in such areas as Owens Lake, Rio Grande/Hardy Delta, and other locations along the west coast of Mexico, Central Valley of California and elsewhere have also been degraded or totally obliterated. Winter waterfowl populations in the Central Valley have declined from 10-12 million birds in the mid-1960s-early 1970s to a current population of 3-6 million, representing a reduction of about 40-60 percent in these years (Heitmeyer et al. 1989).

Systematic duck census data are not available from Mono Lake, but local residents reported that major declines in the lake's duck populations began during the 1960s (D. Banta, K.

DeChambeau, A. Hess, K. Kellogg, W. McPherson, T. Murphy, SWRCB 1993(2):3F 37-39). Assuming that the lake's duck population also declined by about half between the late 1940s and early 1960s (i.e., to about 500,000 peak), and assuming about 10,000-15,000 ducks visit Mono Lake currently (SWRCB 1993(2):3F-40), the lake's duck populations have declined by about 97-98 percent since the mid-1960s. In contrast, Pacific Flyway midwinter and breeding population count data (Bartonek 1995) of the two dominant duck species, found at Mono Lake during fall migrations (northern shoveler and ruddy duck), do not provide evidence of a population decline of this magnitude on a flyway scale (Fig. 2-5). Compared to the magnitude of the decline in waterfowl in the Central Valley (Heitmeyer et al. 1989) and the Pacific Flyway (Bartonek 1995), the much greater reduction in numbers of ducks in the Mono Basin since the 1960s indicates that fundamental changes in the quantity and quality of waterfowl habitat occurred during the diversion period (SWRCB 1993).

Reports during the 1940s-50s indicated that Canada geese (*Branta canadensis*), greater white-fronted geese (*Anser albifrons*), snow geese (*Chen caerulescens*), and tundra swans (*Cygnus columbianus*) also occurred as fall migrants at Mono Lake, but declined after the mid-1960s, although not to the same extent as ducks (SWRCB 1993(2):3F-43). Pacific Flyway population levels of these species, except for white-fronted geese, have generally been stable or increasing in recent years, especially since the 1980s (Banks and Springer 1994, Bartonek 1995). Thus, recent declines in geese and swans as fall migrants in the Mono Basin resulted from losses of suitable habitat rather than from declining flyway population levels of these species.

FIGURE 2

PACIFIC FLYWAY WINTER INDEX OF RUDDY DUCK POPULATION, 1955-94

Ruddy Duck

Pacific Flyway Midwinter Index

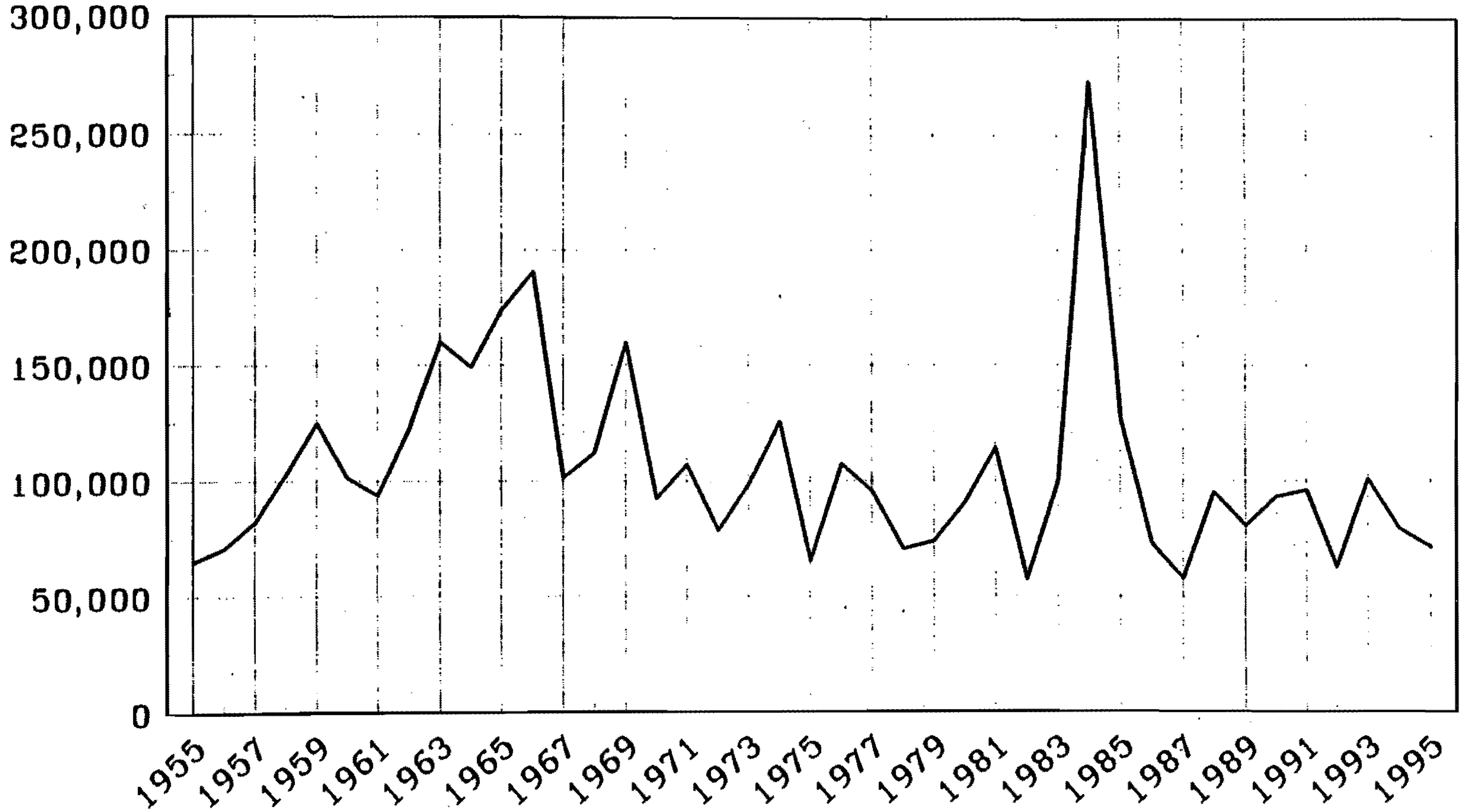


FIGURE 3

RUDDY DUCK BREEDING POPULATION INDICES, 1955-94

Ruddy Duck

Breeding Population Indices in Surveyed Areas

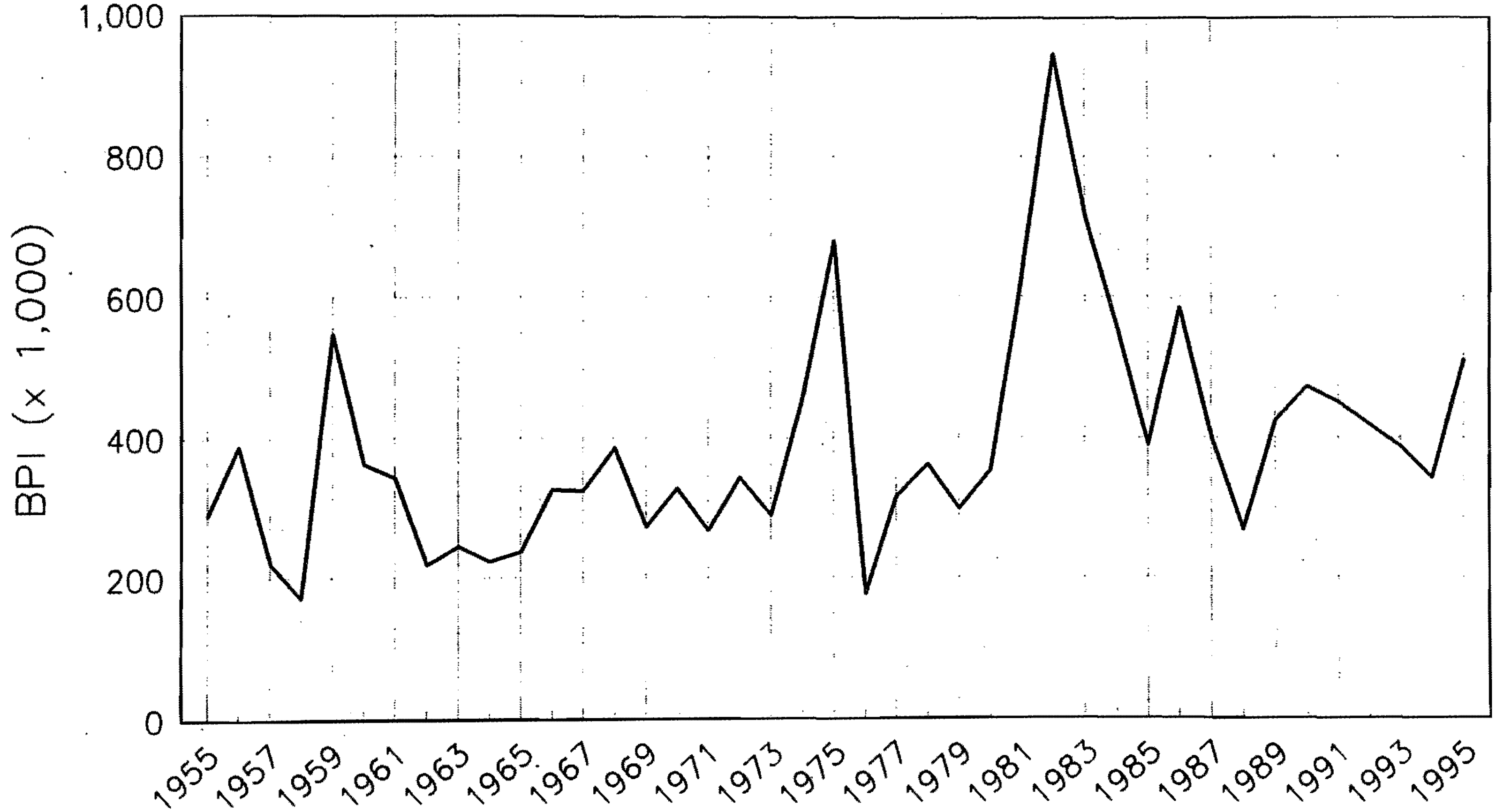


FIGURE 4

PACIFIC FLYWAY WINTER INDEX OF NORTHERN SHOVELER POPULATION, 1955-94

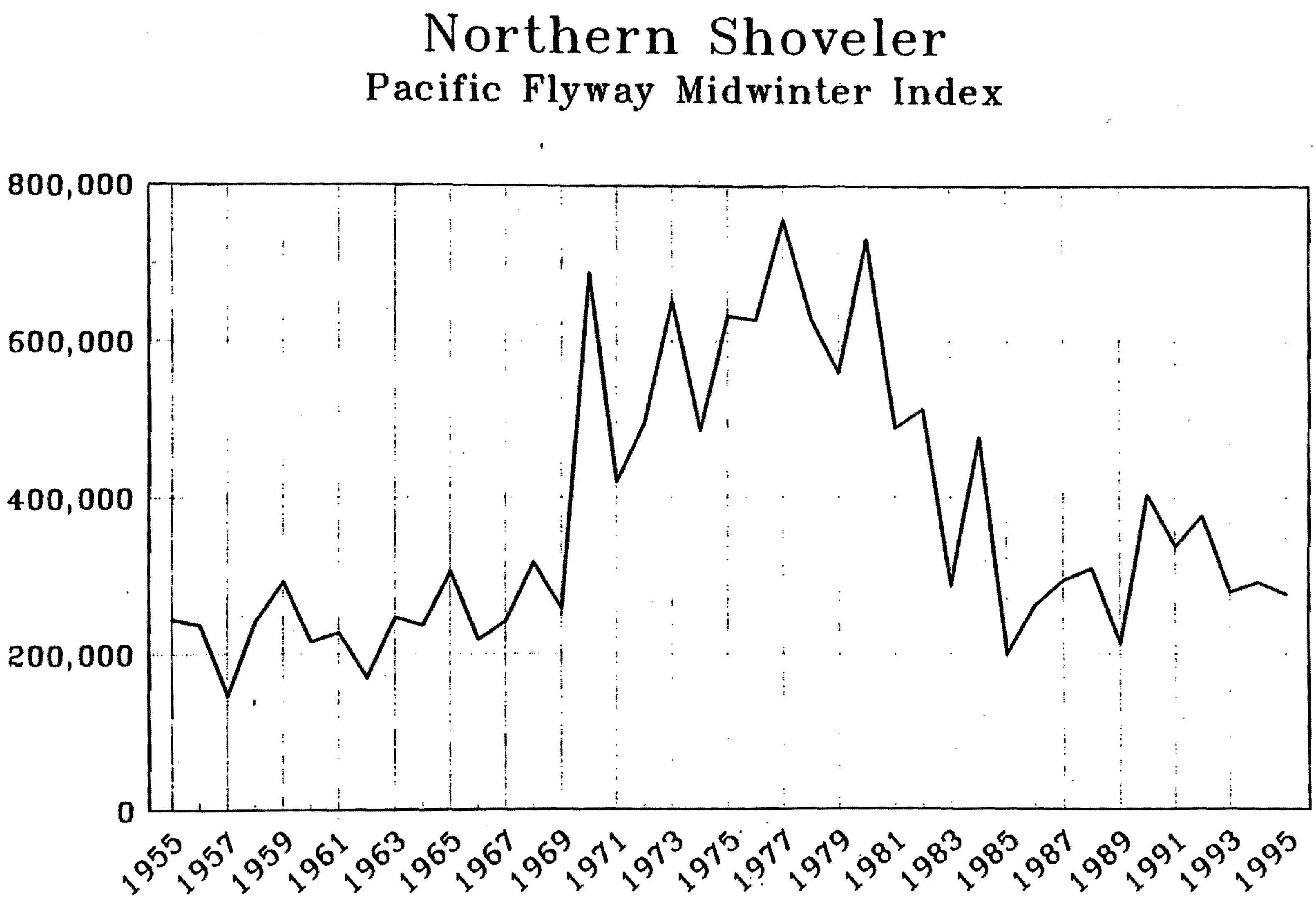
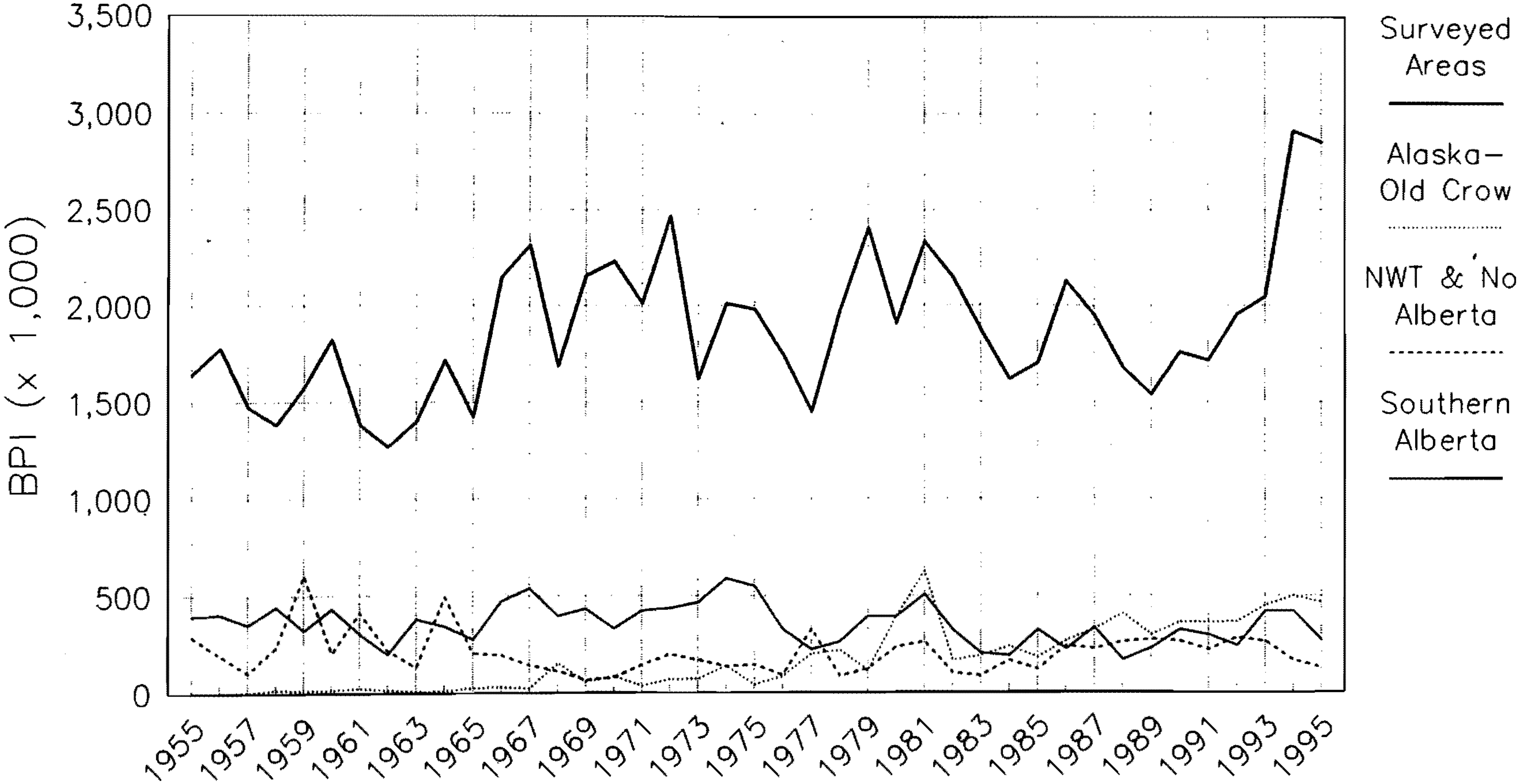

Northern Shoveler
Pacific Flyway Midwinter Index
800,000
600,000
400,000
200,000
0
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995

FIGURE 5

NORTHERN SHOVELER BREEDING POPULATION INDICES, 1955-94

Shoveler

Breeding Population Indices in Surveyed Areas



WATERFOWL HABITATS

Great Basin

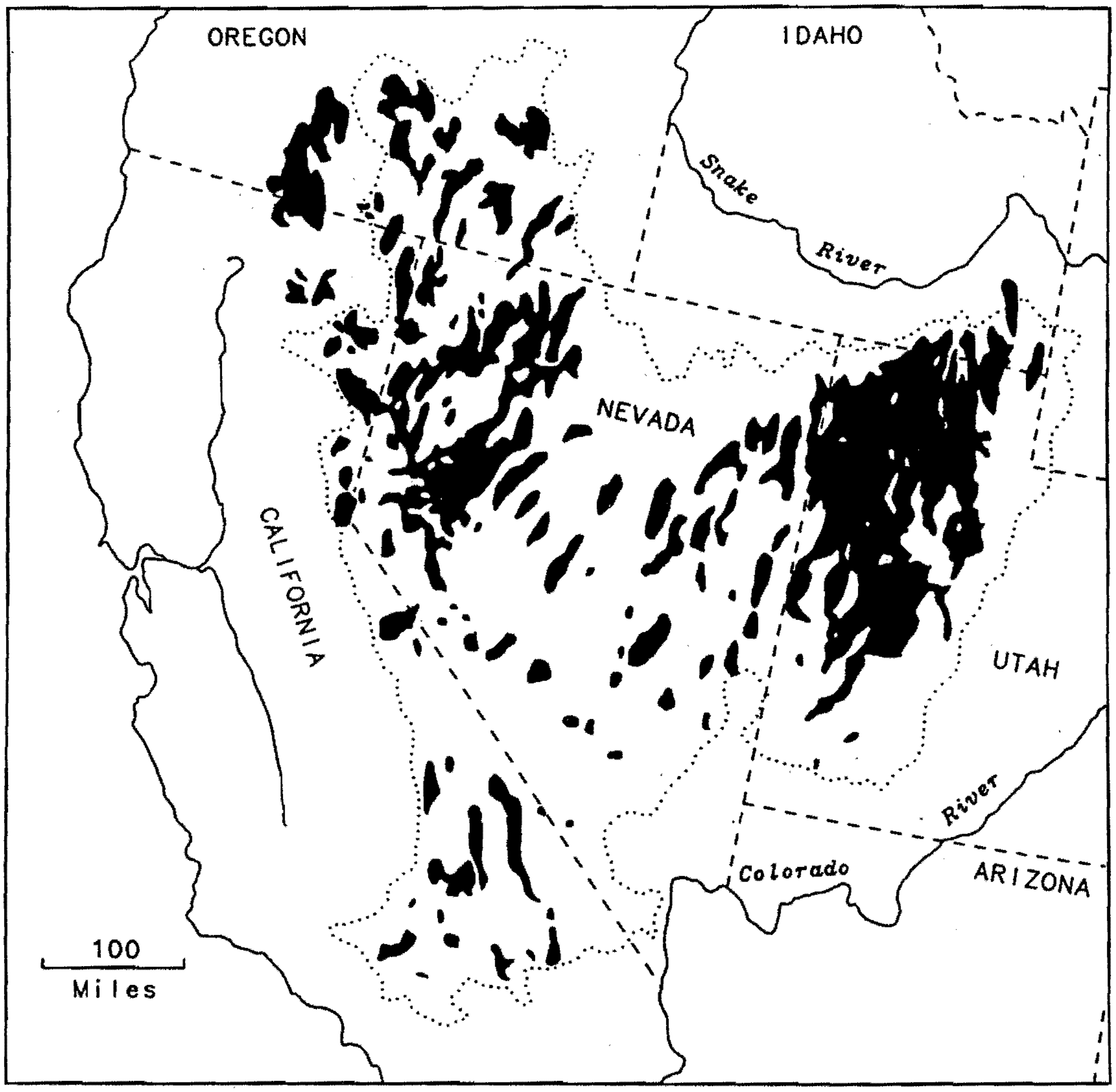
The hydrographic Great Basin covers some 165,000 square miles and extends between the Sierra Nevada and southern Cascades in the west, to the Wasatch Mountains in the east, and south from the Columbia Plain to the Colorado Basin (Grayson 1993). It includes most of Nevada, western Utah, and southeastern Oregon, with smaller sections in eastern California and western Wyoming. The Great Basin is among the most geologically diverse areas in the United States (Jensen and Platts 1990). Topographically, it contains many small to moderate size north-south mountain ranges separated by broad, level valleys (Minshall et al. 1989, Jensen and Platts 1990). All drainages are internal with no outlets to the sea. Most streams start in the mountains, with the primary water supply from snowmelt, and they flow into closed basins such as Mono Lake.

Pleistocene lakes whose levels were higher than exist today because of altered ratios of precipitation and evaporation were termed "pluvial lakes." During the late Pleistocene, the Great Basin held at least 27.8 million acres of lakes, a figure that is likely to be conservative because small, ancient pluvial lakes are difficult to detect long after the fact (Grayson 1993). At least 11 times more of the Great Basin's surface was covered by water during parts of the Pleistocene (Fig. 6) than is covered today.

Grayson (1993) reported 45 permanent valley bottom lakes in the Great Basin today, covering some 2.5 million acres, of which almost half is in the Great Salt Lake. The actual acreages of these lakes, however, are highly variable due to changes in precipitation and diversions of

FIGURE 6

MAP OF GREAT BASIN PLEISTOCENE LAKES


OREGON
IDAHO
Snake
River
NEVADA
CALIFORNIA
UTAH
River
Colorado
ARIZONA
100
Miles

water for other purposes. Most of these lakes are in the northern, eastern, and western fringes of the Great Basin, with few in the south or central portions of the region.

A substantial portion of Pacific Flyway waterfowl passes through the northern and central Great Basin during migration (Fig. 1) between breeding grounds and wintering areas in California and western Mexico (Chattin 1964, Bellrose 1980). Wetlands favored by waterfowl for migratory stopovers and breeding are usually associated with rivers, lakes, or springs. Examples of major waterfowl habitats include the Great Salt Lake marsh complex, Utah (associated with freshwater deltas of Bear, Jordan, and Weber Rivers, Fig. 7); Ruby Lake marshes (spring fed) and Carson Sink (closed basin), Nevada; and the Malheur-Harney Lakes Basin (stream-fed) in Oregon. Many Great Basin wetlands have been impacted by man's activities, especially by drainage for agriculture and diversion of water for other uses (Kadlec and Smith 1989, Minshall et al. 1989, Ratti and Kadlec 1992, Grayson 1993, Jehl 1994).

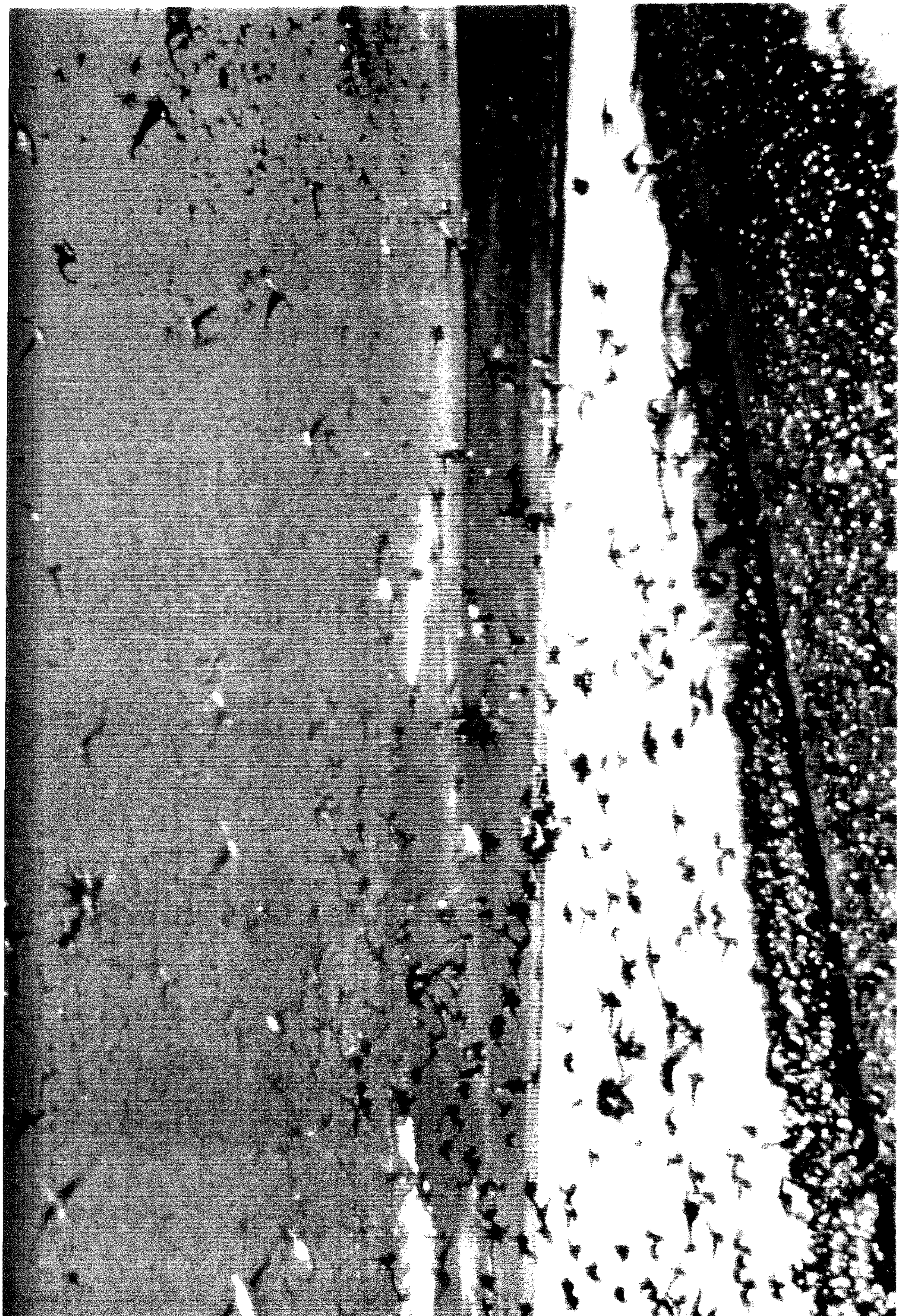
Due to the arid climate and limited amounts of water, there is a perception that the region has limited value to waterfowl and other waterbirds. Kadlec and Smith (1989:451) state: "In contrast to the perception that the Great Basin is a 'desert' of little value to waterfowl, the reality is that the marshes and wetlands are of higher value to waterfowl than are many areas in wetter regions. In fact, the very rarity of marshes in a dry region adds to their value." Because of limited numbers of wetland stopovers in the Great Basin, large and spectacular concentrations of migrating waterfowl often are found on suitable areas (Chattin 1964, Fig. 8). Occasional concentrations of over one million waterfowl have been reported during autumn at the marsh complex of the Great Salt Lake (Nelson 1966) and at Mono Lake (Dombrowski

Figure 7

Deltaic Waterfowl Habitat at the Great Salt Lake, Utah

FIGURE 8

MIGRATORY WATERFOWL IN THE KLAMATH BASIN, OREGON



1948). In recent years, the Intermountain West region, which includes the Great Basin, has wintered 26 percent of the Pacific Flyway waterfowl population (Ratti and Kadlec 1992).

Waterfowl habitat management in the Great Basin has mainly focused on meeting food and water requirements (Kadlec and Smith 1989). Marshes are usually managed on the basis of whether the underlying sediments are fresh or saline. In the Great Salt Lake area, the basic design in managed marshes is spreading freshwater from rivers over salt flats, causing a freshening of the substrate and the establishment of aquatic macrophytes. In closed drainages, water loss is largely or entirely by evaporation and salts concentrate in basins, leading to ionic concentrations equal to or greater than sea water. As wetland water levels change, their salinities change, resulting in further alterations of evaporation rates (Grayson 1993) and the presence and abundance of biota.

Saline and alkaline Great Basin lakes are not only important to a major segment of the Pacific Flyway waterfowl population, but also are used by large numbers of the continent's population of the California gull (*Larus californicus*), Wilson's phalarope (*Phalaropus tricolor*), red-necked phalarope (*P. lobatus*), and eared grebe (*Podiceps nigricollis*). These four species are mainly dependent upon abundant invertebrate prey found in these lakes, primarily brine shrimp (*Artemia* spp.) and alkali flys (*Ephydra* spp.). Mono Lake is the continent's largest molting and staging area for eared grebes, holds the second largest breeding concentration of California gulls, and is a major staging area for both species of phalaropes; in some years it holds the second largest concentration of Wilson's phalarope (Jehl 1994).

Mono Lake

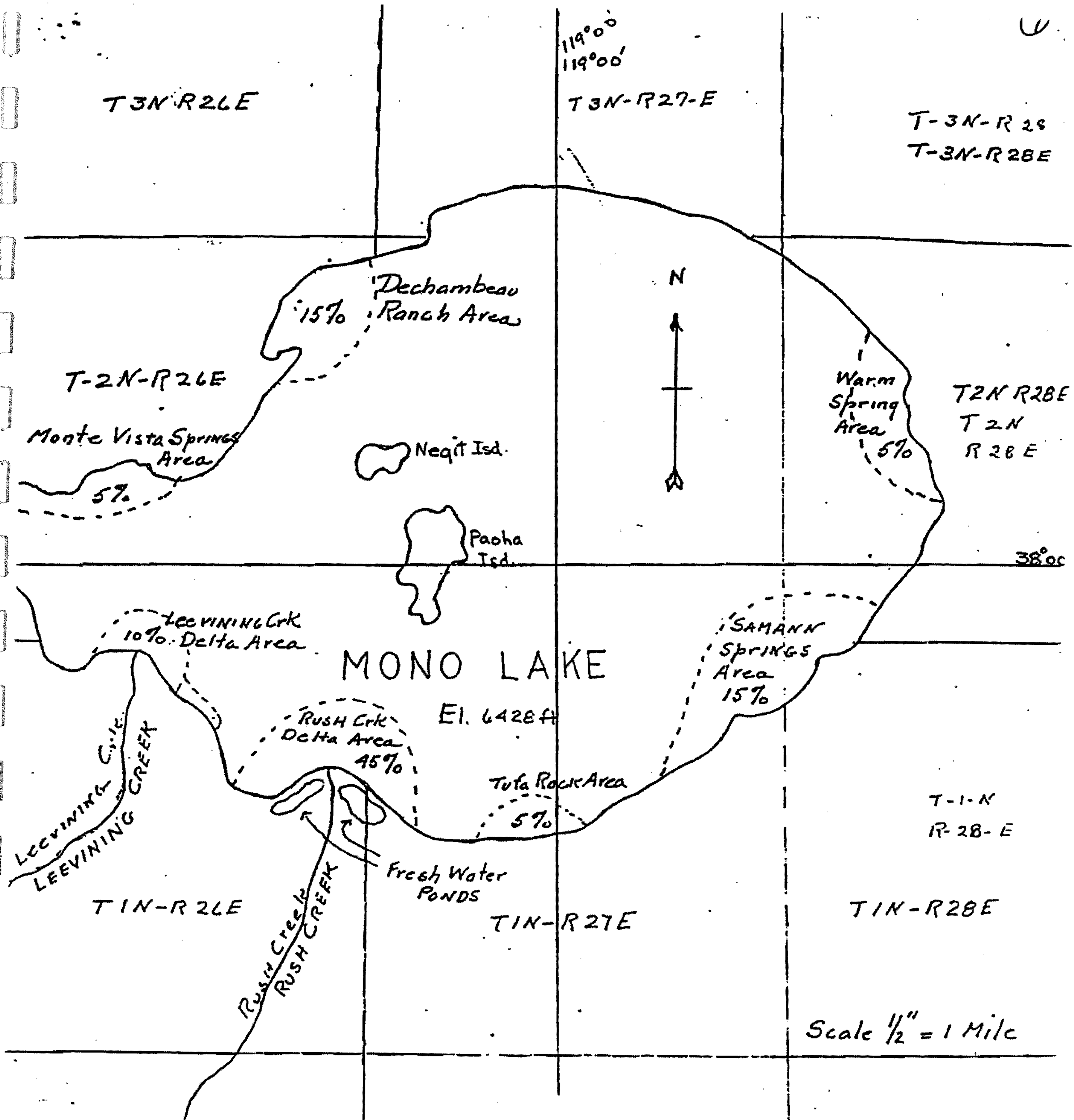
Mono Lake, at elevation 6,377 feet (1989), covers some 44,500 acres, and is a hydrographically closed, hypersaline, alkaline lake (salinity ±88 gl., ph 9.8-10.0), losing water only by evaporation (Stine 1991a). It is the fourth largest saline lake in North America (Patton 1987). Like other closed lakes in the Great Basin, water levels fluctuate because of changes in inflow and evaporation. During the past 3,800 years, Mono Lake has fluctuated over a vertical range of about 131 feet (Stine 1990). In 1857 the lake level was 6,407 feet; it reached a historic high of 6,428 feet in 1919, and declined to 6,417 feet by 1940, prior to water diversions by LADWP (Stine 1991a:67). The 6,417 feet level in 1940 was slightly below the level at which Mono Lake would be today if water diversions by LADWP had not occurred (Stine 1995a:15). However, by 1982 the lake had dropped an additional 45 feet to its historic low of 6,372 feet, due to trans-basin diversions in April 1995, the lake level was 6,376 feet.

Detailed information concerning Mono Lake Basin wetland and waterfowl habitats was provided in the SWRCB (1993) Draft Environmental Impact Report (EIR), the Final EIR (SWRCB 1994a), D-1631 (SWRCB 1994b), Stine (1991b, 1993, 1995a,b) and records filed with the Mono Lake Committee. Our discussions and conclusions concerning prediversion, current, and future waterfowl habitats in the Mono Lake Basin rely heavily upon data provided in these reports, observations of historic waterfowl use reported by long-term residents of the Basin, our own limited surveys in 1995, and brief surveys during summer 1995 conducted by two waterfowl habitat consultants (Smith 1995-Appendix B, Zahm 1995-Appendix C). These reports contain much data that will not be repeated here except in a summarized form which relates to our discussions and conclusions. We refer readers to these aforementioned reports for more detailed information.

Numerous descriptions provided by long-term Mono Basin residents and others confirm that large populations of ducks concentrated in the lake and associated fresh and brackish water wetlands prior to the mid-1960s. Rush Creek, including the delta area and the bottomlands below the Narrows, was recognized as a major waterfowl concentration area by long-term Mono Basin residents (J. Andrews, D. Banta, E. Blaver, K. Clover, J. Durant, A. Hess, K. Kellogg, W. McPherson, J. Preston, and others) during both prediversion and early diversion periods (SWRCB 1993, Mono Lake Committee, unpub. records). According to Dombrowski's map (Fig. 9, Dombrowski 1948), the lake-fringing habitats in the vicinity of the Rush Creek delta supported 45 percent of Mono Basin's ducks, far more than any other single area. The wetland complex on Rush Creek, including riparian, deltaic, and hypopycnal areas, provided habitat requirements for loafing, foraging, courting, and preening. Preston reported that "there were so many ducks along the shore sometimes...that when they'd move out all together (it appeared) like the shore itself was moving out." He further stated that before diversions there were lots of duck blinds on the ponds and marshes at the mouth of Rush Creek. He postulated that ducks needed this freshwater for bathing, feeding and vegetative cover. Clover stated that "the sky used to go black with huge flocks of ducks...they fed in the lake near the mouth of Rush Creek and would rinse off their feathers in the fresh creek water. The ducks would settle in big flocks on the sandbar at the mouth of Rush Creek." Durant, raised near the mouth of Rush Creek, stated that her grandfather would bring home a gunnysack full of ducks at times. McPherson described fall duck populations

FIGURE 9

W. DOMBROWSKI'S MAP SHOWING THE AUTUMN DUCK POPULATION DISTRIBUTION (%) AT MONO LAKE IN ≈ 1948



MAP of MONO LAKE
showing

relative approximate percentages of waterfowl distribution around shore of the lake. This distribution is naturally affected by shooting during the open season.

that were so abundant that they appeared as a dark, moving, 10 foot-wide ring around the lakeshore from the mouth of Lee Vining Creek to beyond the mouth of Rush Creek. Hess stated that Rush Creek provided the best duck hunting and described jump-shooting mallards (*A. platyrhynchos*) and other species in deepwater ponds created from the overflow of the creek. Kellogg likewise described jump-shooting ducks along Rush Creek, mainly mallards, and stated that hunting was especially good in still-water areas full of watercress (*Rorippa nasturtium-aquaticum*).

Likewise, Simons (Samann) Springs, Warm Springs, DeChambeau Ponds and other locations along the north and northwest shores and Paoha Island were described as important waterfowl concentration and hunting areas since the early 1900s by long-term residents and others (Dombrowski 1948, LaBraque 1984:59, SWRCB 1993). The major waterfowl concentration areas were associated with fresh and brackish water habitats including stratified hypopycnal environments (areas of freshwater inflows that overlay dense, saline lake water, Fig. 10).

Reports by these long-term residents indicated that the quantity and quality of fresh and brackish, open water ponds and other wetlands were far greater than exist today, especially in Rush Creek (SWRCB 1993). Waterfowl habitat described by Stine (1995a) showed 248 acres of marsh, 241+ acres of seasonal wet meadows, but only some 1.2 acres of freshwater ponds during the prediversion period (Table 1). We suspect that much of the acreage classified as marsh and wet meadow by Stine (1995a) and SWCB (1993: Table 2) provided more open water habitat, especially during the autumn following extensive summer and early fall livestock grazing. Patton (1987) reported that livestock have grazed in the Mono Basin since the 1850s. Russell (1889) noted as early as 1881 that wet meadows on the western edges of

FIGURE 10

HYPOPYCNAL ENVIRONMENT AT RUSH CREEK DELTA, MONO LAKE

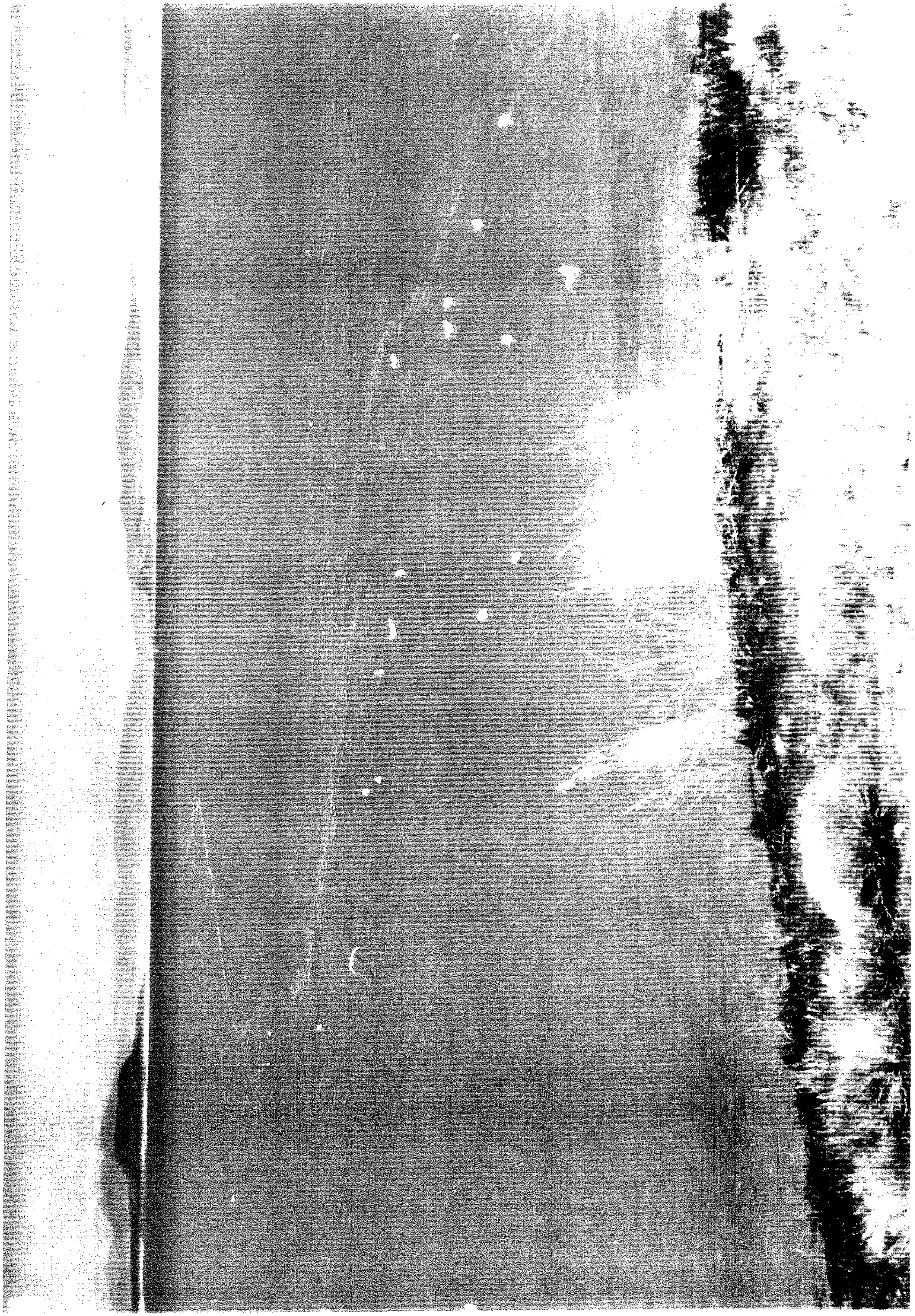


TABLE 1

Locations and Approximate Acreage of Various Wetland Habitats During Pre-diversion (6,417' - ≤ 1941), Existing (6,376' - 1995), and Predicted (6,390') Lake Elevations, Mono Lake, California. Data From Stine (1995a).

Location and Lake Elevation (ft)	Wetland Habitat Type[a]					
	Fshwt. Marsh	Seasonal Wet Meadow	Fshwt. Pond	Peren. Brksh. Lagoon	Emphem. Brksh. Lagoon	Hypopyc.ria (plus btmlands)
<u>North, East and South Shores</u>						
Simon's Springs						
6,417	43	small	<0.2	0	minor	
6,376	496	2	~1.5	0	minor	
6,391	279	0	~1.0	0	minor	
Warm Springs						
6,417	34	small	1	0	minor	
6,376	55	0	2.5	0	0	
6,391	59	0	-1	0	0-minor	
South Tufa						
6,417	7	0	0	0	2	
6,376	3	0	0-minor	0	0	
6,391	5[b]	0	0-minor	0	0-minor	
<u>Northwestern Shore near Black Point</u>						
Mill-Wilson Delta						
6,417	12	0	0	0	3	(N/A)
6,376	43	0	0	0	<0.1	0
6,391	24	6	var., on crk[c]	0	to 40[d]	~14[d] (16)
DeChambeau Cr Delta (County Park)						
6,417	7	60	0	0	0-minor	
6,376	83	7 (dep. on irrig)	0	0	0-minor	
6,391	43	2 (dep. on irrig)	0	0	0-minor	
DeChambeau Embayment						
6,417	1	small	0	6	minor	
6,376	68	0	0	0	minor	
6,391	53	0	0	0	minor	

Location and Lake Elevation (ft)	Wetland Habitat Type[e]					
	Fshwt. Marsh	Seasonal Wet Meadow	Fshwt. Pond	Peren. Brksh. Lagoon	Emphem. Brksh. Lagoon	Hypopycnia (plus btmlands)
<u>Rush and Lee Vining Creek Deltas</u>						
Rush Creek Delta						
6,417	13[f]	120[f]	0-minor	0	38	N/A
6,376	2	0	0	0	0	0
6,391	4	4	var., on crk[g]	0	to 40	15-20 (4-8)
Horse Creek Embayment						
6,417	57[h]	6[h]	0	0	0-minor	
6,376	27	0	0	0	0-minor	
6,391	12	0	0	0	0-minor	
Lee Vining Cr. Delta						
6,417	1	44[i]	minor	0	5	N/A
6,376	6	0	minor	0	minor	0
6,391	4	4	var., on crk[j]	0	to 40	8-10 (10)
Lee Vining Tufa						
6,417	3	0	0	0	minor	
6,376	43	1	0	0	minor	
6,391	7	0	0	0	minor	
<u>Other Perennial Lagoons of the Mono Shorelands</u>						
Bridgeport Cr.						
6,417	0	0	0	29	0	
6,376	20	14	0	0	0	
6,391	33	0	0	0	0	
North Beach[k]						
6,417	1	0	0	175	0	
6,376	1	0	0	0	0	
6,391	1	0	0	0	0	

Location and Lake Elevation (ft)	Wetland Habitat Type[a]					
	Fshwt. Marsh	Seasonal Wet Meadow	Fshwt. Pond	Peren. Brksh. Lagoon	Emphem. Brksh. Lagoon	Hypopyc.ria (plus btmlands)
<u>Other Shore Marshlands</u>						
Black Point						
6,417	0	0	0	0	4[l]	
6,376	1	0	0	0	0	
6,391	0	0	0	0	minor	
South Beach						
6,417	7	0	0	0	0	
6,376	6	0	0	0	0	
6,391	6	0	0	0	0	
Sierran Escarpment						
6,417	60[m]	11[m]	0	0	<0.5	
6,376	125	27	0	0	0-minor	
6,391	85	6	0	0	0-minor	
East Beach						
6,417	1	0	0	0	0	
6,376	6	0	0	0	0	
6,391	1	0	0	0	0	
Paoha Island						
6,417	1	0	0?[n]	3?[n]	0	
6,376	3	0	0	0	0	
6,391	1	0	0	0	0	
Total						
6,417	248	241+	1.2+	213	52.5+	
6,376	988	51	4.0+	0	minor	
6,391	617	22	2.0+	0	to 120+	37-44 (30-38)

[a] Fshwter marsh = Freshwater marsh, Fshwter pond = Freshwater pond, Peren. brksh lagoon = Perennial brackish lagoon, Ephem. brksh. lagoon = ephemerial brackish lagoon, Hypopyc. ria = hypopycnal ria (where a stream in a delta meets the lake inside a trench, spreading freshwater over the heavier saltwater), btmlands = bottomlands.

[b] Figure is estimated to be half way between the highest and lowest acreage that has existed since 1930.

[c] Ponds of variable size will occur on the creek immediately above the lake margin when lake is rising or stable.

[d] Dependent on Mill Creek rewatering.

[e] Freshwater marsh plus seasonally wet meadow total = 67 acres; division given here (7:60) is approximate.

[f] Freshwater marsh plus seasonally wet meadow = 133 acres; division given here (1:10) is approximate.

[g] Ponds of variable size will occur on the creek immediately above the lake margin when lake is rising stable.

[h] Pre-diversion freshwater marsh and meadow due to runoff into Horse Cr. from H-Ditch and Farmer's-Ditch agricultural lands. The 63 acres of marsh and meadow is estimated here to be at a ratio of 10:1.

[i] Pre-diversion wet meadow largely due to irrigation diversions from Lee Vining Creek.

[j] Freshwater ponds of variable size will occur on the stream immediately above the lake margin during periods of rising and stable lake level.

[k] Includes "dune lagoons" of the EIR.

[l] It is not certain that this short-lived lagoon on the flank of Black Point was brackish; indeed, the lack of evidence for freshwater influx at this point of the shorelands suggests that it may have been saline.

[m] Freshwater marsh plus seasonally wet meadow total = 71 acres; division given here (60:11) is approximate.

[n] Ponds on Paoha were of two types: those that covered the bottoms of the cinder cones on the NE corner of the island were highly saline (such ponds are not listed here); those that filled landslide depressions on the western side of the island were likely brackish, and so are listed here under the "Perennial brackish-water lagoon" category. These landslide depressions have contained short-lived freshwater ponds during occasional wet periods in the recent past, and will continue to do so in the future.

the lake had been "nearly ruined" by domestic sheep and that perennial herbaceous growth near areas of freshwater was cropped so closely that nesting and escape cover were severely reduced. Although such open habitat conditions are not conducive to nesting waterfowl, they provide the high visibility sought by fall migrants for security from predators, and are attractive to those species that are grazers such as Canada geese, snow geese, and American wigeon (*A. americana*).

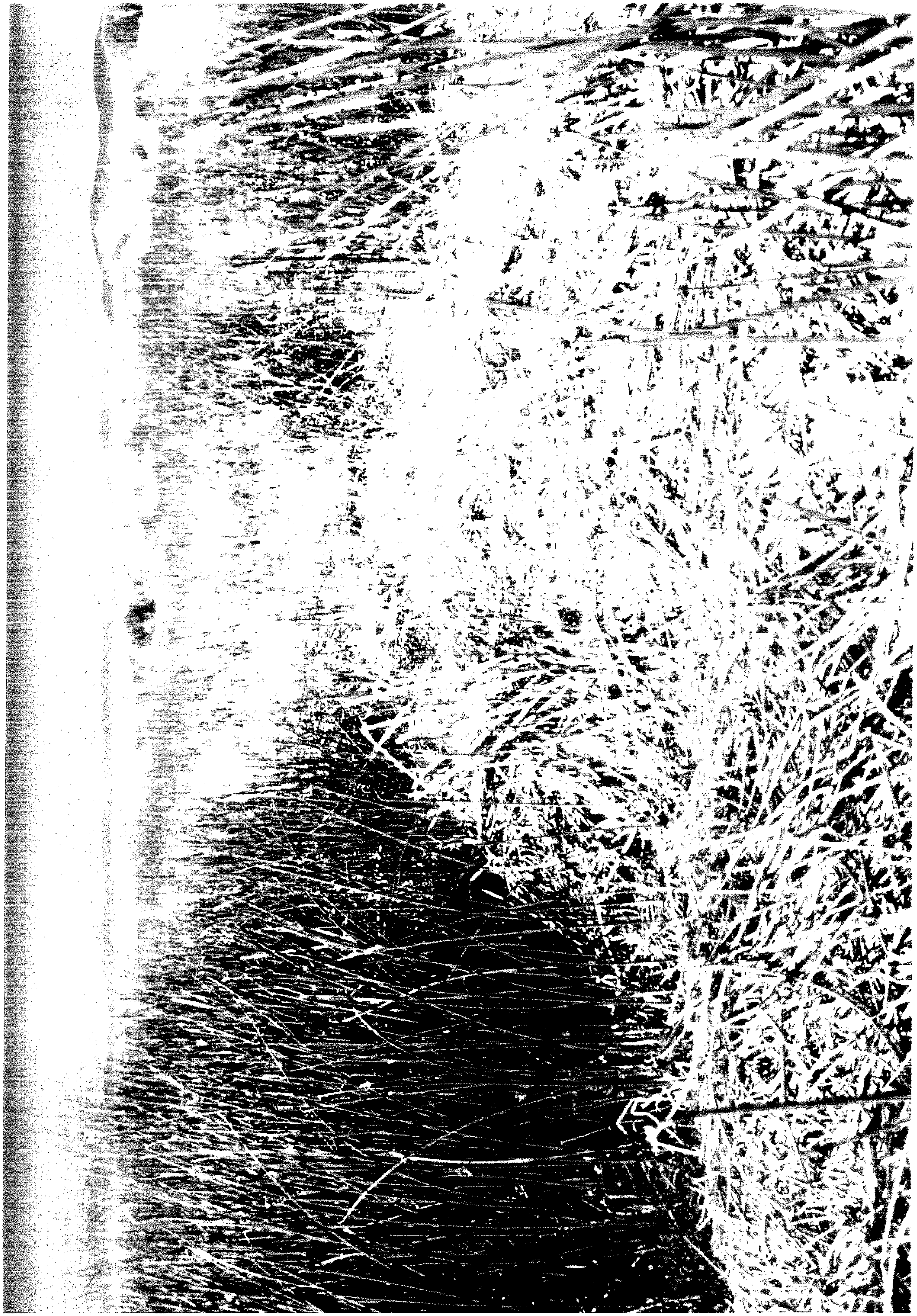
Several early observers (Andrews, Blavers, Hess, Kellogg, McPherson) also reported that ducks gathered where abundant beds of watercress occurred, especially in the Rush Creek bottomlands, and at Simons Springs and Warm Springs. Palatable to waterfowl, watercress is a herb that forms both submergent and emergent carpets, is frequently associated with streams and springs, but can tolerate a wide range of flows from negligible to rapid. It grows best in shallow (8-12 inches) waters with little fluctuation in depth, ample sunlight, and high alkalinity (>250ppm) (Haslam 1978). The ecological requirements of watercress also indicate that more open and continuously wet environments with numerous open channels, rills, and ponds prevailed in areas where it was abundant. Few beds of watercress are found in these locations today, indicating significant changes have occurred in water regimes.

Declining lake water levels have resulted in large increases in lake fringing wetlands classified as marsh, wet meadow, and wet riparian scrub (Tables 1 and 2). However, although acreages have increased, these habitats in their current condition have negligible value to waterfowl (Smith 1995, Zahm 1995), especially during migration. Our surveys revealed that the marshes are mainly choked with dense, and often decadent stands of emergent aquatic vegetation (Fig. 11). Wet meadow habitats also suffer from an abundance of dense, decadent

TABLE 2 SUMMARY OF AVAILABLE LAKE-FRINGING WETLAND HABITATS AT SPECIFIC LAKE ELEVATIONS, MONO LAKE, CALIFORNIA. DATA FROM SWRCB (1993(1):TABLES 3C-15 & 16)		
Lake Elevation (ft)	Marsh, Wet & Alkali Meadow, Wet Riparian Scrub (acres)	Ponds & Lagoons (acres)
6,372	2,859	1
6,383.5	2,325	6
6,390	2,071	16
6,410	754	261
6,417 (pre-diversion)	356	260

FIGURE 11

DENSE AND DECADENT MARSH VEGETATION AT SIMONS SPRINGS

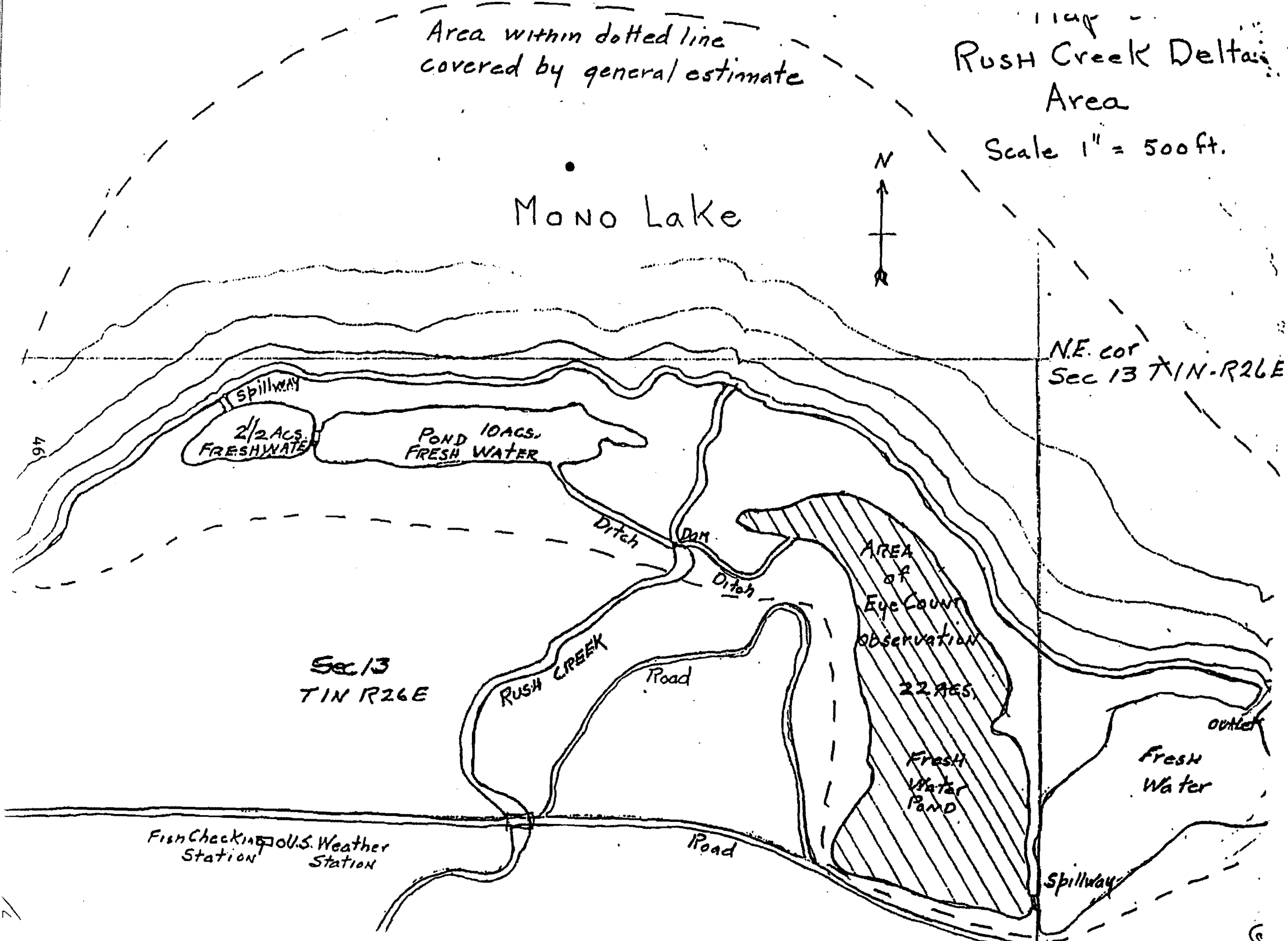


stands of vegetation; in some locations areas of dense, dead mats have virtually no new growth. These overgrown and decadent conditions have little value and are largely unattractive to waterfowl. Further, the almost complete lack of open water ponds within marsh and wet meadow habitats (Fig. 11) severely limits current use by waterfowl and other aquatic birds. Indeed, Dombrowski himself altered the delta hydrology of Rush Creek by creating freshwater ponds to concentrate waterfowl (Fig. 12). He obviously recognized that shallow, open freshwater habitats would attract waterfowl. In summary, the vast increases in acreages of marsh and wet meadow habitats resulting from declining lake levels (Tables 1 and 2) are misleading because the current condition of these habitats is mainly unsuitable for waterfowl.

Out-of-basin water diversions started in 1941 and by 1947 the lake began to recede. Within 20 years water levels had fallen 30 feet, and in 1982 reached a historic low stand of 6,372 feet, a 45-foot drop from the prediversion period. Reductions in stream flows and the resultant decline in lake water levels adversely impacted a variety of waterfowl habitats associated with lake-fringing wetlands, stream deltas and bottomlands, protected coves and bights, and hypopycnal environments in areas where freshwater inflows were reduced or eliminated. By the mid-1950s, some 200 acres of perennial brackish water lagoons had been lost along the north shore. Waterfowl habitat losses accelerated during the late 1950s and 1960s as the lake level continued to recede, specifically: 1) autumn flows in Lee Vining and Rush Creeks were minimal ($\pm$2cfs-Rush Cr.) to nonexistent and creek deltas started incising, 2) lagoons, open water marshes, and freshwater ponds on delta plains disappeared due to incision, 3) wetlands in riparian habitats were greatly reduced or eliminated, 4) still-water coves and embayments along the lakeshore were stranded and then drained, 5) hypopycnal

FIGURE 12

W. DOMBROWSKI'S MAP OF ARTIFICIAL POND LOCATIONS ON RUSH CREEK DELTA, MONO LAKE, 1944


Map - Rush Creek Delta Area
Scale 1" = 500 ft.
Area within dotted line covered by general estimate
Mono Lake
N
N.E. cor Sec 13 T1N-R26E
Spillway
2 1/2 Acs. Freshwater
Pond 10 Acs. Fresh Water
Ditch
Dam
Ditch
Area of Eye Count observation
22 Acs.
Fresh Water Pond
Outlet
Fresh Water
Spillway
Rush Creek
Road
Sec 13 T1N R26E
Fish Checking Station
U.S. Weather Station
Road

lenses were largely eliminated or disappeared, and 6) a decline occurred in the formation of ephemeral brackish lagoons along the lakeshore.

Many ecological changes have resulted from declining lake levels. For waterfowl, the losses in quantity and quality of most open, fresh and brackish open water habitats were especially detrimental. These habitats and the open lake were previously used by up to a million waterfowl during fall migration prior to the 1960s. Available evidence and our own habitat surveys indicate that the losses of these habitats were the primary cause for the large and precipitant decline of fall waterfowl populations after the mid-1960s (SWRCB 1993, 1994a-b, Stine 1995a, Smith 1995, Zahm 1995). The combined losses of fresh and brackish open water areas greatly reduced the diversity of habitats available to the various waterfowl species, and left mainly a hypersaline and hyperalkaline lake habitat that was primarily attractive to salt-tolerant waterfowl species such as the ruddy duck and northern shoveler.

Historic (1930s-60s) reports and observations, and testimony by current waterfowl experts (Dombrowski 1948, SWRCB 1993(2):3F 7-10, 39-44, SWRCB 1994b:112-119) indicated that migratory waterfowl stopping at Mono Lake primarily used fresh and brackish water wetland habitats and locations where freshwater inflows entered Mono Lake. Dombrowski (1948) mapped major waterfowl use areas (percent population distribution) at Mono Lake during fall 1947 or 1948 (Figs. 9 and 12) and showed the most important areas were 1) Rush Creek delta (45%), 2) Simons Springs (Samann Springs) (15%), 3) DeChambeau Ranch (15%), 4) Lee Vining Creek delta (10%), 5) South Tufa (Tufa Rock Area) (5%), 6) Warm Springs (5%), and the 7) Mill-Wilson/DeChambeau Creek deltas (Monte Vista Springs Area) (5%). Testimony by several waterfowl experts (T. Beedy, Jones and Stokes Assoc., R. Thomas, Calif. Fish and Game, F. Reid, Ducks Unlimited and others, SWRCB 1994a) pointed out that it was the open fresh and brackish water areas within marshes, rather than the vegetated marshes themselves, that were the preferred duck habitats. Our assessment of Mono Lake wetland habitats concurs with their testimony in that current waterfowl use is severely restricted by the minimal acreage of fresh and brackish open water wetlands, and the decline in the quantity and quality of the hypopycnal environment.

Studies of how various waterfowl species utilize different wetland habitats have not been conducted at Mono Lake. Further, virtually no information is available about hypopycnal environments and how they contribute to habitat requirements of waterfowl at Mono Lake or elsewhere in the Great Basin. However, the testimony of long-term residents and information available about waterfowl habitat use in other Great Basin wetland complexes clearly support the concept that no single form of wetland habitat supplies the daily or seasonal needs of waterfowl (Fredrickson and Reid 1988, Kadlec and Smith 1989). The lakeshore, open lake, and upwelling areas of the hypopycnal environment are all important sites for foraging on brine shrimp and alkali flys. Creek deltas and freshwater ponds are critical for bathing, drinking, courtship display, foraging, preening, and escape from inclement weather. Freshwater wetlands also provide specific habitat needs for such species as mallards, green-winged teal, and Canada geese. Stream corridors and associated marshes, sloughs, and wet meadows provide important thermal cover from high winds and cold temperatures, as do sheltered lakeshore coves and embayments. The differential uses of habitat types by various species indicate that no single wetland type within the Basin will supply all waterfowl needs. Rather, all of the types should be in close proximity and must be restored in quantity and quality to a functional complex in order to sustain larger waterfowl populations. Directly related to the water diversion, the most reduced habitat for waterfowl at Mono Lake is the suitable open, fresh and brackish-water wetlands.

Stine (1995a) provided information on predicted changes in important waterfowl habitats based upon increasing the median lake level to 6,391 feet. According to estimates provided by LADWP, after reaching its target level (6,392 ft.), the lake will fluctuate between 6,390-6,397 feet approximately 80 percent of the time (Table 3) due to annual changes in climate and management decisions. Stine estimated that salinity will be approximately 72 g/l or about halfway between the current salinity and that of 1940. Comparisons of approximate acreages of important waterfowl habitats available at lake levels during prediversion (6,417 ft.), current (6,376 ft.), and future (6,391 ft.) periods are provided in Tables 1 and 2. A summary of predicted changes in primary waterfowl habitats expected to result from reaching target lake levels (Stine 1995a,b) includes:

Freshwater Marshes and Seasonal Wet Meadows

Approximately 490 acres of these habitat types existed during the prediversion period, ≈1,040 acres are currently available, and about 640 acres will occur at the target lake level. This change will result from an increase in marsh acreage from 248 (predivision) to 617 (+249%), while seasonal wet meadow will decline from 241+ (prediversion acres) to 22 (-90.9%). However, the current condition of these habitats is unattractive to waterfowl regardless of the increases or decreases in available acreage, but could be corrected by initiating appropriate management strategies.

TABLE 3. EXCEEDENCE RANGES FOR PROJECTED MONO LAKE LEVELS AFTER TRANSITION TO THE 6,391 FEET ELEVATION UNDER D1631 OPERATING RULES. THE TABLE WAS BASED UPON 1941-90 HYDROLOGY. SOURCE: LADWP (B. HAZENCAMP, PERS. COMM.). (ELEVATION IN FEET.)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Minimum	6,389.5	6,389.5	6,389.5	6,389.7	6,389.4	6,389.1	6,388.8	6,388.7	6,388.6	6,388.7	6,388.8	6,389.3
10%	6,390.4	6,390.4	6,390.4	6,390.5	6,390.6	6,390.2	6,389.9	6,389.7	6,389.7	6,390.1	6,390.3	6,390.3
20%	6,390.9	6,391.0	6,391.0	6,391.0	6,390.9	6,390.7	6,390.6	6,390.5	6,390.6	6,390.6	6,390.8	6,390.8
30%	6,391.5	6,391.6	6,391.5	6,391.3	6,391.5	6,391.3	6,391.1	6,390.9	6,390.9	6,391.0	6,391.2	6,391.4
40%	6,391.9	6,391.9	6,391.9	6,391.9	6,391.8	6,391.5	6,391.2	6,391.2	6,391.2	6,391.3	6,391.5	6,391.8
50%	6,392.1	6,392.2	6,392.2	6,392.2	6,392.1	6,391.8	6,391.6	6,391.5	6,391.4	6,391.6	6,391.8	6,392.0
60%	6,392.3	6,392.4	6,392.5	6,392.4	6,392.3	6,392.1	6,391.8	6,391.7	6,391.7	6,391.8	6,392.1	6,392.3
70%	6,392.8	6,392.8	6,392.8	6,393.0	6,393.0	6,392.9	6,392.6	6,392.4	6,392.3	6,392.5	6,392.6	6,392.7
80%	6,393.7	6,393.7	6,393.7	6,393.7	6,393.5	6,393.2	6,393.2	6,393.1	6,393.1	6,393.2	6,393.5	6,393.7
90%	6,396.6	6,396.7	6,396.7	6,396.6	6,396.4	6,396.7	6,396.7	6,396.5	6,396.4	6,396.4	6,396.5	6,396.5
Maximum	6,399.0	6,399.0	6,399.2	6,399.5	6,399.3	6,399.1	6,398.9	6,398.7	6,398.6	6,398.7	6,398.8	6,399.0

Freshwater Ponds

Data in Table 1 show that only 1.2+ acres of freshwater ponds existed during the prediversion period, and 4.0 acres currently; about 2.0 acres are expected at the target lake level. However, we expect that substantially larger acreages of freshwater ponds will exist after completion of restoration projects. Testimonies by early Mono Basin residents (SWRCB 1993) suggested that considerably more acreage of open fresh water habitat occurred during fall than depicted in Table 1.

Perennial Brackish Water Lagoons

Depressions of the former northshore lagoons or those on Paoha Island will not be rewatered at 6,392 feet. Approximately 213 acres of this habitat will be lost for waterfowl and other aquatic birds.

Ephemeral Brackish Water Lagoons

These temporary lagoons (Fig. 13) develop during periods of relative lake stability and were well developed in 1940. Stine (1995a) indicated that with lake stability at 6,392 feet, up to 80 acres may be restored, and an additional 40 acres could be restored if Mill Creek is rewatered (Table 1). During future periods of relative lake stability, ephemeral brackish-water lagoons at Mono Lake will likely form as often, and be as large and widespread as they were during pre-diversion time (Stine 1995a:57).

Hypopcynal Environment

The hypopcynal environment will increase from current conditions as the lake level reaches the target level. Increased stream flows will restore freshwater lenses at the mouths of creeks

FIGURE 13

ESTABLISHMENT OF EPHEMERAL BRACKISH WATER

LAGOONAL HABITAT WITH RISING LAKE LEVELS, SUMMER 1995

(Fig. 10), and the increasing lake level will inundate some coves and bights that historically had hypopycnal conditions. The hypopycnal environment will also increase in incised delta trenches that previously did not exist, and along shoreline areas with springs such as at Simons Springs and Warm Springs. The average area of the hypopycnal environment will be somewhat larger near the mouth of Lee Vining Creek, but overall the total area will remain substantially less than during the prediversion period.

Rush Creek Bottomlands

The Rush Creek bottomlands below the Narrows were characterized by a high water table, ponded water, and multiple channels that supported dense riparian woodlands, marsh, and seasonal wet meadows. Marsh and meadow vegetation covered over 130 acres during the prediversion period and nearly 40 acres currently remains (SWRCB (1):3C-7), although much of it is degraded and not attractive to waterfowl. The target lake level will restore approximately 15 acres of bottomland habitat in the delta trench while the rewatering of abandoned channels below the Narrows could restore many additional acres. However, Stine (1995a,b) noted that approximately 58 acres of former waterfowl habitat in the downstream portion of the bottomlands were lost to stream incision and probably cannot be restored and should be considered lost habitat. Potentially 15 acres of new bottomland environment will form naturally at the target lake level. Additional bottomland waterfowl habitat could be restored by rewatering the lower reaches of Mill Creek.

Increasing the median lake level to 6,392 feet will restore a significant portion of waterfowl habitats lost from stream diversions. However, at a minimum, some 213 acres of brackish-water lagoons, 43 acres of bottomland waterfowl habitat in Rush Creek, and an unknown amount of hypopycnal environment will be irretrievably lost. D-1631 (SWRCB 1994b:118) recognized that the target lake level would not restore all lost prediversion waterfowl habitat but ordered additional restoration measures as mitigation for these losses.

RECOMMENDATIONS FOR WATERFOWL HABITAT ENHANCEMENT AND RESTORATION PROJECTS

Restoring waterfowl habitats can be difficult because wetlands are generally complex hydrological systems with diverse chemical, physical, and biological properties. It is commonly assumed that wetland losses can be mitigated by restoring or creating wetlands of equal value. However, most wetland scientists recognize that duplication of natural wetlands is impossible and simulation is improbable because information usually is lacking about what functions were lost and how to replace them (Zedler and Weller 1990, Cairns 1992). According to Lavine and Willard (1990), some functions of lake-fringing wetlands are 1) providing important wildlife habitat, 2) stabilizing lake shorelines, and 3) affecting water quality through their influence on nutrient cycling (acting as a sink for nutrients), sedimentation (filtering suspended solids), and heavy metal movement (absorbing heavy metals).

Goals of land management agencies for habitats at Mono Lake include maintaining the scenic integrity of the area and restoring natural ecological processes (U.S. Forest Service 1989, Barry and Harrison 1995-Appendix D). Therefore, the most acceptable waterfowl habitat enhancement and restoration projects are those that attempt to emulate natural processes. The management of pristine environments should be passive, and emphasis should be placed on investigations or monitoring that result in understanding the dynamic processes of natural production, wetland function, and wildlife use (Fredrickson and Reid 1990). However, the target lake level does not restore near pristine/prediversion (6,417 feet) levels or a water level of 6,405 feet or higher considered necessary for maximum restoration of waterfowl habitat

(SWRCB 1994b:117). Our recommendations for enhancement and restoration projects at Mono Lake are directed at improving the quality and quantity of fresh and brackish open water habitats and hypopycnal environments in lake-fringing areas that have been degraded due to altered water levels from trans-basin stream diversions. Major proposed projects at Mono Lake involve restoration by natural processes, whereas a smaller subset of proposed projects requires low impact engineering techniques. Some guidelines for utilizing low impact construction techniques are provided by Cairns (1992) and Zahm (1995). We are not recommending any offsite mitigation measures because adequate opportunities exist onsite. Evaluation of restoration opportunities at more distant wetland sites in the Mono Basin and eastern Sierra should be addressed in on-going planning efforts involving the Intermountain West Joint Venture.

Legal Mandates and Policies Governing Habitat Manipulations on Public Lands at Mono Lake

The U.S. Forest Service and the California Department of Parks and Recreation jointly manage the shorelines surrounding Mono Lake. In 1982, the State of California established the Mono Lake Tufa State Reserve which consisted of those state-owned lake bed lands at or below the elevation of 6,417 feet. The Reserve was established to preserve the unique tufa and associated sand formations and other natural and cultural features at Mono Lake. In 1984, Congress established the Mono Basin National Forest Scenic Area under Section 304 of the California Wilderness Act (PL 98-425). The National Forest Scenic Area encompasses approximately 117,000 acres which include Mono Lake (U.S. Forest Service 1989). Both agencies' management programs favor preservation of natural ecosystems and allow human intervention only to the extent necessary to protect or restore native species habitat.

Federal and state legislative mandates and policies limit management and development activities of these lands, with laws governing the management of state reserves being more stringent. The Mono Basin National Forest Scenic Area Comprehensive Management Plan (U.S. Forest Service 1989:53-54) allows wildlife management activities for maintaining or enhancing wildlife habitat in three of the four designated zones): 1) Developed Recreation Zone, 2) General Use Zone, 3) Limited Development Zone (if it does not significantly detract from other emphasized resources), and will consider wildlife management activities and structural improvements in the 4) No Development Zone (most of the shoreline) only when needed to protect or restore native species habitat. In general, large scale, visually obtrusive engineering projects to develop habitat are not consistent with either agency's management policies. On some of these lands, especially those within the Tufa State Reserve, prescribed burns may be the only important and acceptable management tool that can be used to manipulate vegetation density and composition in order to increase open freshwater waterfowl habitat. Management goals in state reserves focus on restoration of natural ecosystems and ecological cycles, such as fire (Barry and Harrison 1995). Due to management objectives of both agencies and the recommendations of the Waterfowl Habitat Technical Advisory Group (pgs. 3-4), we have attempted to develop and recommend habitat enhancement and restoration projects that conform with the spirit and intent of these mandates and policies.

Increasing the Level of Mono Lake

The most important waterfowl habitat restoration priority is increasing the level of Mono Lake to a median level of 6,392 feet as ordered in D-1631 (SWRCB 1994b). This passive action, increasing flows in Basin streams and raising the lake level, will restore the largest acreage and provide the most diversity of waterfowl habitats in riparian areas, lake-fringing wetlands, and hypopycnal environments. However, increasing the median lake level to 6,392 feet will not restore waterfowl habitat to prediversion levels, nor provide the habitat that could be achieved at 6,405 feet (SWRCB 1994b:117). The proposed waterfowl habitat restoration projects that follow are intended to help offset irretrievable habitat losses at the target lake level of 6,392 feet. We do not expect restoration efforts will entirely compensate for waterfowl habitat losses resulting from trans-basin diversions.

Use of Prescribed Fire for Waterfowl Habitat Enhancement

Fire History in the Mono Basin

According to Patton (1987:129-132): "fires have burned repeatedly throughout at least the past century in the Mono Basin....Fires are known to have swept over all vegetative types in the basin, including marshes, brushlands, woodlands, and forests....Within the scenic area there are known scars of over 40 fires that burned in years ranging from before 1875 to 1986, but no fire larger than 100 acres is evident. Most fires burn fewer than 10 acres before natural factors or direct intervention by fire-control teams limits their spread." Native Americans also used fire in the Mono Basin and surrounding region to manipulate vegetation (Barry and Harrison 1995).

While fire history in Mono Basin is limited, especially for areas near lake-fringing wetlands, we can assume that these wetlands and associated meadows burned periodically due to lightning ignitions and fires started by Native Americans. Most fires likely burned in late summer/early fall during periods of low humidity and precipitation, and high temperatures. Patton (1987:130-131) did not consider fire to be a serious threat to vegetation near the lake because the water table was near the surface and a number of species of shrubs and herbs associated with these habitats respond positively to fire.

Need for Prescribed Burning Programs to Improve Wetland Habitats at Mono Lake

Smith and Kadlec (1986) stated that any marsh maintained in the same condition over many years will show a decline in productivity and that periodic disturbance is needed and essential for long-term productivity. They suggested that some type of disturbance every five years would probably be beneficial for Great Basin marshes. Man-induced disturbances, such as fire, flooding or drawdown, cutting (haying), and grazing are commonly used to improve marsh plant communities to favor waterfowl in Great Salt Lake marshes and elsewhere (Smith et al. 1984, Smith and Kadlec 1985a,b,c,d, 1986, Kadlec and Smith 1989), especially where hydrologic alterations have occurred to the watershed (Fredrickson and Reid 1990). Because man has altered many natural perturbations in Great Basin wetlands, especially hydrologic cycles and wild fires, management programs are often needed to simulate natural disturbances in order to promote vegetation productivity and diversity.

Fire is an integral component of many natural wetland communities, but man has intentionally intervened and suppressed many wildland fires in recent years (Fredrickson and Reid 1990). Prescribed burns can be used to create vegetation stands more conducive to waterfowl use. Fire sets back plant succession, influences species composition, releases nutrients to enhance new plant growth, opens dense and decadent vegetation stands, and changes vegetation structure to make conditions more attractive to waterfowl and other wildlife. Vegetation structure is an important cue for waterbird use of wetlands (Weller and Fredrickson 1974, Reid 1993). Waterbird species richness was highest in marshes where an approximate ratio of

50:50 open water/vegetation mix occurred (Weller and Fredrickson 1974). Fire can also be used as a tool to manage wetland habitats at remote locations or where extensive physical developments are impractical or too expensive (Fredrickson and Reid 1990).

We recommend recreating natural fire regimes at Mono Lake by use of prescribed burns. Prescribed burns will make habitat conditions in lake-fringing wetlands, riparian areas, and meadows more attractive to waterfowl and other wildlife. Currently, at a number of lake-fringing locations (e.g., Warm Springs, Simons Springs, South Tufa), dense stands of emergent marsh and wet and dry meadow vegetation occur (Fig. 11). The wettest sites (marshes) are dominated by common cattail (*Typha latifolia*), hardstem/tule bulrush (*Scirpus acutus*), three-square bulrush (*S. pugens*), Cooper's rush (*Juncus cooperi*), Nevada rush (*J. nevadensis*), and several sedges (*Carex* spp.). Important species in seasonal wet meadows include various species of sedges, tufted hairgrass (*Deschamsia cespitosa*), Baltic rush (*J. balticus*) and desert saltgrass (*Distichlis spicata*). Our surveys and those by Smith (1995) and Zahm (1995) revealed that many of these sites are dominated by dense stands of living vegetation interspersed with mats of dead and decaying vegetation, and they show a monotypic effect due to multiple years of uninterrupted growth and stagnation. Fire would also expose more acreage of fresh, spring-fed sloughs and ponds in marsh and wet meadow habitats, and greatly enhance their attractiveness to waterfowl and other avian species.

The greatest potential values of marsh and seasonal wet meadow vegetation to waterfowl are for foraging areas and escape cover during inclement weather for spring and fall migrants; only limited value exists for small numbers of nesting pairs. Since dense thatch layers from dead and decaying vegetation cover many of these habitats, use by waterfowl and other avian species has been greatly reduced and spring green-up is delayed several weeks or longer compared to stands with more vigorous growth. Lake-fringing marsh and wet meadow habitats visited by the authors and Smith (1995) and Zahm (1995) during summer 1995 showed this delay in new growth due to excess build-up of decadent vegetation; minimal use by avian species was noted in these areas.

Examples of Prescribed Burns of Wetlands in the Western United States

Based on experiences in other wetland habitats in the western United States, we expect a positive response by waterfowl and other avian species to prescribed burning. For example, burns at Boles Meadow, a 3,000 acre wetland on the Modoc National Forest, California, resulted in 10,000+ ducks and geese staging during spring and fall migrations each year following fall burning. The positive response lasted about four years after the burn. Dramatic increase in use of this area by sage grouse (*Centrocercus urophasianus*), white-faced ibis (*Plegadis chihi*), and shorebirds was also noted (J. Stutler and G. Studinski, Modoc Natl. For., pers. comm.).

Prescribed spring burns were used every three to five years to maintain vegetation quality and habitat characteristics desirable to waterfowl at Alamosa and Monte Vista National Wildlife Refuges in south-central Colorado (M. Nail., U.S. Fish and Wildl. Serv., Alamosa, CO, pers. comm.). These high elevation ($\pm$ 7,600 ft.), alkaline wetland habitats are similar to those at Mono Lake with seasonal wet meadows dominated by Baltic rush and salt grass, and marshes dominated by hardstem bulrush and cattail. At Grays Lake National Wildlife Refuge, Idaho, fall burning of dense stands of hardstem bulrush produced a positive response by waterfowl for three years before regrowth closed most open water areas (R. Drewien, unpub. data).

The Malheur National Wildlife Refuge, Oregon, has a longstanding prescribed fire program to manage wetland and adjacent upland vegetation. Wetland habitats are similar to those found at Mono Lake. Both wetland and upland vegetation are treated with fire; in wetter sites, hardstem bulrush and cattail are common species for treatment. The normal treatment uses hot, fall (September or October) burns to open dense stands; cooler spring or winter burns are used to stimulate vegetative resprouting to create more palatable, nutritious forage for waterfowl and other wetland dependent species. Upland sites, consisting of sagebrush (*Artemsia sp.*), greasewood (*Sarcobatus vermiculatus*) and understory grasses such as Idaho fescue (*Festuca idahoensis*), are burned to reduce shrub density and promote denser stands of grasses and forbs required by nesting birds.

Response to burning at Malheur Refuge includes dramatically increased use of freshly burned areas in fall by migrant geese when burns were conducted early and regrowth followed irrigation. Increased use by geese and shorebirds in spring following burning was also documented; up to a tenfold increase in use by geese was recorded. White-faced ibis, sandhill cranes (*Grus canadensis*) and other species also utilize these burned areas. Although low nesting densities occurred in burned areas, nests experienced high hatching success. Up to 5,600 acres are burned annually, but prescribed fire is applied to units as small as 100 acres. Costs vary with size of unit being burned and complexity of fuels, but average about $35 per acre (G. Ivey, U.S. Fish and Wildl. Serv., Burns, OR, pers. comm.)

Modoc National Wildlife Refuge, near Alturas, California, uses prescribed burns to enhance wetlands and increase wildlife use. According to D. Johnson, Refuge Manager (pers. comm.), about 600 acres have been burned during the past three years. They found that hot, late summer or early fall burns (September and October) produced openings in dense, thatch covered vegetation stands such as those found at Mono Lake. Winter or spring burns produced a less dramatic effect, usually only removing dead material but preparing burned sites for earlier spring green-up. Prescription for fall burns is primarily to open dense, decadent stands of emergent wetland plants such as cattail and bulrush. Winter or spring burns are used to encourage early green-up and to treat older stands of upland grasses and shrubs to improve forage palatability by resprouting the existing stand.

Habitats Recommended for Prescribed Burns at Mono Lake

- Lake-fringing Wetlands

  Our surveys of lake-fringing wetlands that exhibit degraded habitat due to the accumulation of decadent vegetation indicate that approximately 1,000 acres of marsh and seasonal wet meadow habitats currently exist (Table 1) that could potentially be enhanced by fire treatment. These areas are managed by the U.S. Forest Service, the California Department of Parks and Recreation, Mono Lake Tufa State Reserve, and LADWP. All agencies recognize the value of restoring fire to its natural role to manipulate vegetation within the Mono Basin (U.S. Forest Service 1989, Barry and Harrison 1995, B. Tillemans, LADWP, pers. comm.). The California Department of Parks and Recreation prepared a draft prescribed burn plan for an experimental fire during fall 1995 at Simons Springs (Appendix D) where historically about 15 percent of the waterfowl at the lake concentrated (Fig. 9). An experimental burn was conducted in November 1995. Implementing additional burns should produce fires sufficient to open stands that have closed in from thatch accumulation, provide more open freshwater habitat, and improve foraging opportunities for waterfowl (Smith 1995, Zahm 1995).

Fall and winter burning will have little impact on nesting or brood rearing activities of avian species and other wildlife, and could provide an immediate positive response by waterfowl. Early spring burns (mid-January to mid-March) may also produce beneficial results in some years if sufficient acreages can be burned before the nesting season.

- Rush Creek

Within abandoned channels of Rush Creek, there are several small sites with large accumulations of dead woody materials (i.e., willow and cottonwood stems). These dense piles obstruct potential stream flow, retard regeneration of desirable riparian vegetation, and reduce potential areas of open water ponds and sloughs. "Jackpot burning" (one-time spot burning of piles) of these debris accumulations would remove channel obstructions, promote regeneration of hardwoods and other riparian vegetation, and enhance the development of depressional wetlands favored by various species of puddle ducks such as mallard, green-winged teal and gadwall (*A. strepera*). Jackpot burns should be undertaken in a highly selective and controlled manner and only during winter or spring so adjacent riparian habitat is not burned. Debris accumulations that contribute to channel or bank stability or provide instream habitat needs for fish should not be burned.

- DeChambeau Ranch Meadow

We recommend the use of prescribed burns to maintain a seasonal wet meadow complex in a more desirable condition at the DeChambeau Ranch. The meadow, covering approximately 20 acres, could be subdivided into two or three units with individual units being treated during different years. A rotation burn treatment schedule would promote differences in vegetation structure, age classes, and palatability, which would be more attractive to and provide for various habitat requirements of waterfowl and other wildlife.

The cooperative wetland restoration project (U.S. Forest Service, Ducks Unlimited, Mono Lake Committee, California Transportation Commission) completed in 1995 at the ranch includes an underground irrigation system supplied with well water within the meadow. The irrigation system could be used to flood units in the meadow where fire treatment is not desired during a specific burn. The irrigation system also provides opportunities to flood newly burned areas in fall to encourage vegetation regrowth that would make the meadow highly attractive to fall migrants such as Canada geese, various puddle duck species, and shorebirds (Zahm 1995).

Prescribed Burn Methods and Schedules

Specific methodology and time schedules for prescribed burns to achieve optimum vegetation responses in wetland habitats at Mono Lake are unknown. Experimental burns are needed to obtain the information necessary to develop plans for future prescribed burns (Smith 1995). We recommend that experimental burns be initiated in 1996 or as soon as feasible in lake-fringing marsh and seasonal wet meadow habitats below 6,392 feet elevation, and spot burns in the Rush Creek bottomlands. Because about 400 acres will be inundated by increasing lake elevations, these lake-fringing areas offer excellent opportunities for experimentation to gather appropriate information to develop future fire management prescriptions (Table 1, Fig. 14).

Experience from prescribed burns in other areas indicates that cooler burns generally produce vegetative responses similar to existing vegetation (i.e., regrowth of existing species) and

FIGURE 14

INUNDATION OF LAKE-FRINGING WETLAND VEGETATION NEAR SIMONS SPRINGS, RESULTING FROM RISING LAKE LEVELS DURING SUMMER 1995

results are usually short-lived (one to three years). Hotter burns tend to stimulate growth of a greater variety of plant species and have a longer lasting effect (three to ten years) (Smith 1995). Hot burns are best achieved during late summer-early fall when temperatures are higher (75-90°F), humidities are low (<30%), and winds are generally moderate (≤15 mph). Such burning conditions will consume green vegetation when abundant accumulations of dead vegetation are present (Smith and Kadlec 1985a, Smith 1995). Cooler burns can be expected during fall through spring periods when vegetation is dormant and temperatures are lower. The keys to insuring good results are low fuel moisture in vegetation and firing pattern.

Lacking site specific data on vegetation responses to prescription burns at Mono Lake, we recommend experiments with prescribed burns at about five year intervals that could be modified after collecting appropriate data. Appropriate monitoring programs are needed to assess results of experimental burns and burning conditions, and to follow vegetative changes and waterfowl/wildlife population responses in order to develop guidelines for future prescribed burning programs. Some published information on use of fire in wetlands is found in papers by Schlictmeier (1967), Smith et al. (1984), Smith and Kadlec (1985a,b,c,d, 1986), Kantrud (1986), Higgins et al. (1989), and Kadlec and Smith (1989).

Agency personnel should test various burning techniques under different weather conditions to obtain a variety of treatment effects (hot and cool burns). Favorable results will be achieved if fires produce a mosaic of burned and unburned areas to provide an interspersion of different vegetation stands. Subtle differences in burn effects can produce dramatic differences in vegetative responses. For example, a 10 percent difference in fuel moisture

content of vegetation up to one inch in diameter can have a pronounced effect on fuel consumption (Smith 1995, J. Hurley, Plumas Natl. For., Blairsden, CA, pers. comm.).

Costs: A range in costs is associated with prescribed burning programs in wetland vegetation. Factors influencing costs include:

- Size of burn; generally the larger the burn, the cheaper the cost per acre. Higgins et al. (1989) reported costs and hours of effort were inversely related to burn area size, and cost ratios were highest for fires of less than 10 acres.

- Development of site fire plan and layout of site; need for fire lines; identification of adjacent vegetation stands or structures that require protection.

- Site topography; slopes are easier to treat than flat lands; burns on flat lands usually require some wind for proper firing, but winds may increase the need for protection of adjacent vegetation or structures.

- Meeting air quality standards of the respective state, county or local jurisdiction.

- Experience base of the burn team; highly experienced teams can usually burn for less dollars per acre, require less escape contingency, handle a mixture of vegetative sites more easily and implement subtle prescription requirements more effectively.

- Agency-to-agency differences in requirements and mandates in burn team qualifications, stand-by requirements and other unique needs will vary. For example, some burns have been done for less than $3.00 per acre where a three-man team burned 150 acres in less than three hours, with no mop-up and where existing gravel access roads were used for control lines.

- Pre- and post-burn monitoring; monitoring costs are properly associated with a burn. Monitoring is essential and levels of sophistication and monitoring intensity vary from simple photo-points to pre- and post-burn plant species, density and nutrient content analysis. Associated costs, therefore, vary from a few cents per acre to some instances where monitoring costs exceed burn implementation costs.

Prescribed burns in wetland vegetation in the western United States are possible for an average cost of approximately $30 per acre including burn plan development, burn implementation and pre- and post-burn monitoring, but will vary depending upon factors described above. LADWP should consult with the U.S. Forest Service and California Department of Parks and Recreation to jointly develop and implement a prescribed burning management plan for lake-fringing wetlands at Mono Lake.

Efficiency and flexibility can be maximized by developing and implementing a cooperative burn plan that takes advantage of adjoining, similar waterfowl habitat in lake-fringing wetlands managed by the three agencies. Cooperative agency efforts to develop and implement a prescribed burn plan will maximize waterfowl habitat enhancement and minimize overall costs.

Control of Salt Cedar

Salt Cedar (*Tamerix pentandra*) has the potential to negatively impact riparian and lake-fringing wetlands in the basin. Continued and expanded eradication of this introduced exotic species, using appropriate control techniques, is highly recommended.

Enhancing Open Water Habitats in Lake-Fringing Wetlands

Lake-fringing marsh and wet meadow habitats could be made far more attractive to waterfowl by increasing the amount and distribution of perennial open water areas. At Simons Springs, several artificially created (blasted) ponds exist, but they are not attractive to waterfowl in their current condition. Existing ponds have steep-sided walls, deep water, lack adequate loafing sites, and are engulfed by tall, dense emergent vegetation (Fig. 15). These ponds can be enhanced by sloping and scalloping the edges and elongating the ponds with low impact construction techniques that minimize visual and soil disturbance. Such minor modifications would provide habitat requirements sought by waterfowl by providing loafing areas, high visibility to detect predators, and improve foraging conditions by improving the substrate for submerged aquatic vegetation. These areas have previously been modified by humans and such low impact enhancement would greatly improve their attractiveness to waterbirds. After enhancement, evaluation of waterfowl use will reveal the importance of open, freshwater habitat.

If burning remains excluded from lake-fringing wetlands, we also recommend investigating the feasibility of constructing additional small channels in marsh and wet meadow habitats, mimicking shallow swales with low-impact engineering. Shallow, freshwater ponds (scrapes)

FIGURE 15

AN ARTIFICIAL POND AT SIMONS SPRINGS CREATED BY BLASTING

averaging one acre (0.5-2.0 acres) can be created in similar habitats in lake-fringing wetlands at a cost of approximately $6,500 each (assumption: borrowing 1,600 yards at three to five dollars per yard plus mobilization costs). Compared to the costs associated with restoration of this habitat type elsewhere in the Basin, this alternative is very cost effective.

We estimate that at least 100 acres of shallow, freshwater scrapes could be developed in complexes within the lake-fringing wetlands. These shallow sloughs would provide far more freshwater habitat then exists in the basin today. However, we do not recommend developing scrapes at this time, as we believe that concentrating low impact engineering project improvements at the DeChambeau/County Ponds/Black Point Complex is a preferred option to mitigate losses of open freshwater habitats. These areas have already undergone changes in hydrography by humans and serve as a better landscape for mitigation. We further recommend that development of these scrapes be reconsidered if monitoring indicates other habitat development does not produce desired results.

Perennial Brackish Water Lagoons

Over 200 acres of perennial brackish water lagoons (Table 1) existed along the north shore in 1940 but were lost when the lake receded below the floor of the lagoons. The target lake level will not inundate the lagoons (Stine 1995a). We explored options for reflooding the lagoons with artificial sources of water, including:

- Provide a secure water source to flood the lagoons by developing wells. The estimated water requirements indicated that five wells, pumping 1,000 gpm, plus other associated work were required to flood the depressions to create acceptable waterfowl habitat. The

estimated development cost to complete the project, not including annual maintenance, was nearly $2.5 million; project details are summarized in Table 4.

- Provide a secure water source by diverting 10 cfs from the U.S. Forest Service diversion on Wilson Creek. The water would be transported eight miles through an underground, 18-inch, PVC pipeline that would require a diesel or propane pumping station to move the water over the eight miles. About 32 turnouts for water distribution would be also required. The estimated cost of this project was over $2.8 million; project details are summarized in Table 5.

These potential projects were prepared with the assistance of Robert Charney (M.S., P.E.), regional engineer for Ducks Unlimited, who has extensive expertise with wetland restoration in the western United States, and specifically in the Great Basin. Given the high estimated costs for both restoration options, the visual impacts due to engineering requirements and the high potential costs of operation and maintenance, we do not recommend restoration of the perennial brackish water lagoons. We believe that alternative habitat restoration projects at other lake-fringing and tributary locations could partially mitigate for this lost habitat.

DeChambeau Ponds--County Ponds Complex

At the onset of trans-basin diversions, artificial freshwater ponds were created at the DeChambeau Ranch. These ponds were flooded from a deep well and water diverted out of the Mill Creek system into Wilson Creek and down into the ponds. Other diverted water irrigated nearby meadow, alfalfa and riparian areas. As many as seven small ponds existed

TABLE 4

RESTORATION ELEMENTS AND ESTIMATED COSTS TO FLOOD (WELL WATER) APPROXIMATELY 200 ACRES OF BRACKISH WATER LAGOONS ALONG THE NORTH SHORE OF MONO LAKE

Statement of Probable Cost for Wells @ Sulpher Creek	Quantity	Units	Unit Cost	EXT Cost
1,000 GPM Water Well & Appurtanences	5	EA	$150,000	$ 750,000
600KW Diesel Propane Generator Set	1	EA	100,000	100,000
Block Building/Sitework	1	LS	100,000	100,000
10" PVC Pipeline	15,840	LF	25	396,000
Valves/Turnouts	32	EA	1,000	32,000
Pump Control System	1	LS	30,000	30,000
Misc. Ground Contouring	20,000	CY	3	60,000
Direct Burial Power Cable	26,400	LF	15	396,000
Erosion Protection	64	CY	100	6,400
CONSTRUCTION SUBTOTAL				**1,870,400**
Construction Contingency (15%)				**280,560**
TOTAL CONSTRUCTION COST				**2,150,960**
Engineering (15%)				**322,644**
GRAND TOTAL				**$2,473,604**

Restoration Elements:

- **Provide a secure water source to the Sulpher Springs area by construction of approximately five water wells.**
- **Provide a diesel propane electrical generation system for power.**
- **Provide 32 turnouts for water distribution along the North portion of the Lake through 10" pipelines.**
- **Provide very limited contouring of turnout points to allow sheet flow of water.**

and were extensively used by waterfowl (Banta, DeChambeau), principally northern shoveler, mallard, green-winged teal, northern pintail (*A. acuta*), gadwall and Canada geese.

By 1992, only two of these ponds held water due to degradation of levees from lack of maintenance. The well and water delivery system were also in a deteriorated state indicating that the entire area would be dry within a few years. The U.S. Forest Service joined with Caltrans, the Mono Lake Committee and Ducks Unlimited to restore the degraded ponds and adjacent meadow (Figs. 16 and 17). The biological and engineering plan, topographic map, site specification and design, construction and inspection were undertaken by Ducks Unlimited and the other partners during 1994-95. The project consisted of drilling a new well, installing a propane generator and submersible pump, developing an underground water delivery system, and redeveloping levees and stop-log water structures for five semipermanent or seasonal impoundments. The project was completed in September 1995 and includes 15 acres of ponds and 20 acres of seasonal wet meadow. In addition, portions of an adjacent willow riparian area can be periodically sub-irrigated. Initial flood-up will require substantial water to swell dry clay layers to create an impermeable layer that will trap surface water. After initial flood-up, it is estimated that under average evaporation and rainfall on site, approximately 140 acre feet of water are necessary annually to maintain the complex. These water inputs would require pumping chiefly during the months of April, May, September, and October, for a total of less than 59 days pumping annually (Table 6).

The DeChambeau Ponds project cost $430,000 to complete and is managed by the U.S. Forest Service with annual operations and maintenance estimated at $30,000 (including partial salary

TABLE 5

RESTORATION ELEMENTS AND ESTIMATED COSTS TO FLOOD APPROXIMATELY 200 ACRES OF BRACKISH WATER LAGOONS ALONG THE NORTH SHORE OF MONO LAKE BY DIVERTING WATER THROUGH A BELOW GROUND PIPELINE FROM WILSON CREEK

Statement of Probable Cost for Wilson Creek Diversion to the East	Quantity	Units	Unit Cost	EXT Cost
10 CFS Diesel Propane Pumping Plant	1	EA	200,000	200,000
Block Building/Sitework	1	LS	100,000	100,000
18" PVC Pipeline	42,240	LF	40	1,689,600
Valves/Turnouts	32	EA	1,200	38,400
Manhole/Air Release Valves	16	EA	2,500	40,000
Misc. Ground Contouring	20,000	CY	3	60,000
Erosion Protection	64	CY	100	6,400
CONSTRUCTION SUBTOTAL				**2,134,400**
Construction contingency (15%)				**320,160**
TOTAL CONSTRUCTION COST				**2,454,560**
Engineering (15%)				**368,184**
GRAND TOTAL				**2,822,744**

Restoration Elements:

- **Provide a secure water source to the Sulpher Springs area by diversion of 10 cfs from the Forest Service diversion on Wilson Creek through a new 18" PVC pipeline.**
- **Provide a diesel/propane pumping plant and pipe appurtenances for eight miles of pipeline.**
- **Provide 32 turnouts for water distribution along the North portion of the Lake through 10" pipelines.**
- **Provide very limited contouring of turnout points to allow sheet flow of water.**

FIGURE 16

CONSTRUCTION OF DECHAMBEAU PONDS COMPLEX, SUMMER 1995

FIGURE 17

RESTORATION OF DECHAMBEAU PONDS COMPLEX WAS COMPLETED IN 1995

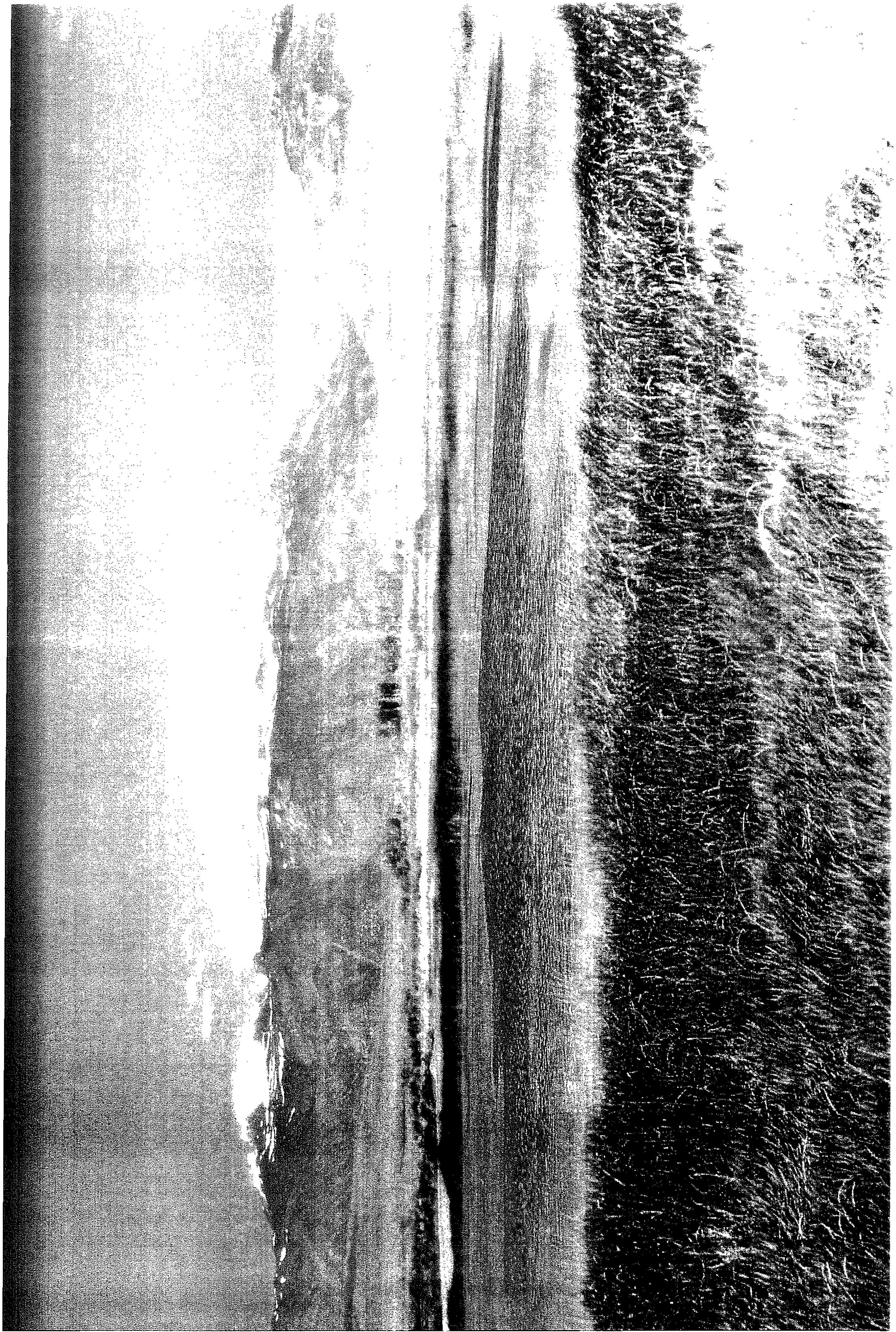


Table 6. Water Balance for Dechambeau Ponds/Meadowlands

Pond	Type	Area	Dpth	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
		(ac)	(ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
Evaporation (ac-ft)																
Avg Monthly Evap (In)				0.79	1.10	2.32	3.78	5.13	6.50	7.57	7.08	4.96	2.81	1.42	0.73	44.2
Pnd 1	Perm	7.5		0.50	0.69	1.45	2.36	3.20				3.10	1.75	0.89	0.46	14.4
Pnd 2	Perm	2.3		0.15	0.21	0.44	0.72	0.98				0.95	0.54	0.27	0.14	4.4
Pnd 3	Seas	1.2		0.08	0.11	0.23	0.38	0.51				0.50	0.28	0.14	0.07	2.3
Pnd 4	Seas	5		0.33	0.46	0.97	1.57	2.14					1.17	0.59	0.31	7.5
Pnd 5	Seas	2		0.13	0.18	0.39	0.63	0.85					0.47	0.24	0.12	3.0
Meadow		20					6.30	8.54								14.8
Riparian		14						5.98	7.58		8.26	5.79				27.6
Total Evap. (ac-ft)				1.2	1.7	3.5	12.0	22.2	7.6	0.0	8.3	10.3	4.2	2.1	1.1	74.1
Rainfall (ac-ft)																
Avg Monthly Rain (in)				1.3	1.17	0.94	0.53	0.4	0.3	0.31	0.28	0.38	0.48	1.14	1.27	8.5
Pnd 1	Perm	7.5		0.81	0.73	0.59	0.33	0.25				0.24	0.30	0.71	0.79	4.8
Pnd 2	Perm	2.3		0.25	0.22	0.18	0.10	0.08				0.07	0.09	0.22	0.24	1.5
Pnd 3	Seas	1.2		0.13	0.12	0.09	0.05	0.04				0.04	0.05	0.11	0.13	0.8
Pnd 4	Seas	5		0.54	0.49	0.39	0.22	0.17					0.20	0.48	0.53	3.0
Pnd 5	Seas	2		0.22	0.20	0.16	0.09	0.07					0.08	0.19	0.21	1.2
Meadow		20					0.88	0.67								1.6
Riparian		14						0.47	0.35		0.33	0.44				
Total Rainfall (ac-ft)				2.0	1.8	1.4	1.7	1.7	0.4	0.0	0.3	0.8	0.7	1.7	1.9	12.7
Net Rain (Evap) (ac-ft)				0.8	0.1	(2.1)	(10.3)	(20.5)	(7.2)	0.0	(7.9)	(9.5)	(3.5)	(0.4)	0.8	(59.8)
Average Pumping Requirement																
Evaporation makeup						2.07	10.29	20.48				9.54	3.49	0.42		46.3
Flood-up lost to soil																
Pnd 1	Perm	7.5	0.5									3.75				3.8
Pnd 2	Perm	2.3	0.5									1.15				1.2
Pnd 3	Seas	1.2	2.0									2.4				2.4
Pnd 4	Seas	5	2.0										10			10.0
Pnd 5	Seas	2	2.0										4			4.0
Meadow		20	1.0				20									20.0
Riparian		14	1.0					14			14					28.0
Flood to average depth																
Pnd 1	Perm	7.5	1.0									7.5				7.5
Pnd 2	Perm	2.3	1.0									2.3				2.3
Pnd 3	Seas	1.2	2.0									2.4				2.4
Pnd 4	Seas	5	2.0										10			10.0
Pnd 5	Seas	2	1.0										2			2.0
Meadow		20	0.0									0				0.0
Riparian		14	0.0									0				0.0
Total Pumping (ac-ft)					0.0	2.1	30.3	34.5	0.0	0.0	14.0	29.0	29.5	0.4		139.8
Required Pumping Days					0.0	0.9	12.6	14.4	0.0	0.0	5.8	12.1	12.3	0.2		58.2

for Forest Service biologist). These O/M costs could be born by LADWP for partial mitigations of other lost habitats. This project demonstrated that viable artificial freshwater habitats could be developed within the Basin. While natural hydrologic flows within the Basin are more favorable for Great Basin waterfowl habitat than artificial impoundments, this project will provide critical open, freshwater habitat required by waterfowl and other waterbirds in the Basin.

In addition to flooding the DeChambeau Ponds, it is possible to extend the underground irrigation pipe to rewater the adjacent 10 acre riparian zone. Riparian vegetation stands, dominated by willows (*Salix* spp.) and buffalo berry (*Shepherdia argentea*), are deteriorating due to an inadequate water sources. Extension of an underground line from the existing system could improve the vigor of riparian vegetation and reflood small, depressional wetlands.

Immediately below the Dechambeau Ponds is the County Pond system. This natural basin had been a lagoon, but as the lake level dropped below 6,405 feet (in the 1950s), it has remained dry (Fig. 18). It has been temporarily reflooded on occasion with water diverted from Wilson Creek. When this occurred, as in 1993, late summer and early fall use by gadwall numbered in the several hundreds, and other aquatic birds made extensive use of the ponds. Diversion of Wilson Creek water, however, has incised the natural drainage corridor from the lip of the County Ponds basins to a small meadow area. The U.S. Forest Service discontinued diversion of surface flows to avoid further problems with incision. Restoring Wilson Creek to an intermittent stream and allowing more water to flow in Mill Creek is

Figure 18

Site of Historic County Ponds That Have High Potential for Waterfowl Habitat Restoration

desirable for waterfowl habitat restoration. Such a scenario could make surface flows from Wilson Creek unavailable for the DeChambeau Ponds-County Ponds area.

It would be possible to artificially flood the County Ponds complex (20 acres) using below ground water delivery, similar to DeChambeau Ponds. This project would require two additional wells drilled above the relicted lands and water piped underground to the County Ponds (Table 7). An additional pump and pumphouse would not be necessary if available power from the current DeChambeau pumphouse can be used. It is also possible that artesian flow will occur and no artificial pumping will be necessary. If a small levee separated the two natural basins, independent water control could provide seasonal or semipermanent water in those basins. Because a natural berm exists now, it is possible to release the cost estimates in Table 7. Repair of the incised lip should occur as part of the project. The long-term management would be conducted by the U.S. Forest Service at a cost less than the DeChambeau Pond project, because maintenance is limited to the water delivery system. Costs could be born by LADWP as mitigation for other lost habitats.

An existing well with artesian flow (~120 gpm) and under private control, is located at the Black Point cinder quarry. Currently this flows into a small (~1 acre) pond and then flows below ground. The current flow could maintain up to a 20 acre shallow, seasonal wetland if clay soils were present. As that area has been previously disturbed by human activity, it would provide an excellent site to explore the feasibility of 2-5 shallow scrapes (total of up to 10 acres). These scrapes would consist of linear channels, mimicking open water channels used by waterfowl in the Simons and Warm Springs area.

TABLE 7

RESTORATION ELEMENTS AND ESTIMATED COSTS TO PROVIDE A WATER SOURCE FOR COUNTY PONDS

Statement of Probable Cost for County Ponds Restoration	Quantity	Units	Unit Cost	EXT Cost
1,000 GPM Supply Well	2	EA	$150,000	$300,000
10" PVC Pipeline	3,500	LF	25	87,500
Direct Burial Power Cable	4,100	LF	15	61,500
10" Alfalfa Valves	5	EA	750	3,750
10" In-line Valves	2	EA	1,500	3,000
Control System Upgrade	1	LS	10,000	10,000
Earthwork	5,000	CY	3	15,000
Erosion Protection	20	CY	100	2,000
CONSTRUCTION SUBTOTAL				**482,750**
Construction Contingency (15%)				**72,413**
TOTAL CONSTRUCTION COST				**555,163**
Engineering (15%)				**83,274**
GRAND TOTAL				**$638,437**

Restoration Elements

- Provide a secure water source to the County Ponds from a new 1,000 gpm well powered by the existing propane generator sytem.
- Repair existing head cut and divide the pond into two independent cells.
- Provide a supplemental water source (1,000 gpm well) to allow complete flooding of willow/riparian areas west of the DeChambeau Ponds.
- Upgrade the generator/pump control system to operate three wells and provide direct burial cable to the two new wells.

If completed, the entire DeChambeau Pond-County Pond Complex would provide 45 acres of semipermanent or seasonal freshwater wetlands, 22 acres of wet seasonal meadow, and 10 acres of riparian habitat for waterfowl and other wildlife. Although requiring active management, this habitat complex would provide critical waterfowl habitat to the Basin and mitigate for loss of freshwater and lagoonal habitat not restored at the target lake level of 6,392 feet. These projects would produce one of the best waterfowl complexes in the Basin, and were highly recommended by Smith (1995), Zahm (1995), and Vestal (1996). A great diversity of waterfowl and shorebird species would use this complex.

Cost: Estimated costs for individual projects are for construction only and do not include annual o/m costs. Maintenance for projects A & B are limited to the water delivery system. No maintenance would be required for projects.

A) Extension of irrigation pipe to riparian area at DeChambeau Ponds - $90,200

B) County Ponds (Table 7) - $638,437

C) Black Point Scrapes - $25,000

Rewatering/Reopening Creek Channels

Rush Creek. The Rush Creek bottomlands, from below the Narrows to the county road, was characterized as a wide, multiple channel floodplain supporting riparian and wetland habitats highly attractive to waterfowl during the prediversion and early diversion periods (SWRCB 1993, 1994a,b, Stine 1995a). Approximately 18,700 feet of primary stream channel and some 15,200 feet of secondary channels existed during this time (Stine et al. 1994). This system spread water over the bottomlands and supported a high water table with associated riparian, marsh, and wet meadow waterfowl habitats. With trans-basin stream diversions, most of these habitats were degraded or disappeared, leaving abandoned, desiccated channels and depressions, minimal acreage of marshes and wet meadows, and a reduced hypopycnal zone in the delta.

The recent perennial rewatering of Rush Creek, starting in 1984, has provided variable flows mainly to the primary stream channel and to some unplugged secondary channels. Extremely high stream flows experienced in 1995 raised the floodplain water table and rewatered additional segments of secondary channels, flooded overflow channels and some depressional sites. In addition, the Channel 10 Complex (Reach 4B) was reopened mechanically in early October 1995, resulting in increases in the floodplain groundwater level and the rewatering of secondary channels and depressional wetlands (S. English, R. Ridenhour, S. Stine, and B. Tillemans, pers. comm.). Subbing has occurred in lower portions of Channel 9 with the 1995 flows (S. Stine, pers. comm.).

We recommend that additional secondary channels be reopened in the Rush Creek bottomlands to provide small flows ($\pm$1.0-2.0 cfs) for backwater depressions to restore waterfowl and other aquatic bird habitats. Rewatering selected channels will increase groundwater across the floodplain, reduce water velocities, increase silt deposition, and enhance the development of depressional wetlands, riparian and aquatic vegetation (submergent and emergent macrophytes), marshes and seasonal wet meadows. When reopening channels, consideration should be given to sites that will be self-maintaining and not require extensive maintenance. Mechanical disturbance to surface areas by equipment should be minimized. Specific secondary channels that have high potential to restore waterfowl habitat include:

- Channel 4bii complex

- Channel 8 complex-unplugged lower portion
- Channel 10 (completed in October 1995)
- Channel 11-unplugged lower portion
- Channel 13

We envision that many depressional sites in the bottomlands will be rewatered by increasing the water table in the floodplain through natural processes. However, periodic (three year intervals) assessments should be conducted and those secondary channels and depressional areas that have not recovered naturally should be evaluated for mechanical reopening to restore additional waterfowl habitat.

Lee Vining Creek. With increasing lake levels, Lee Vining Creek's major contribution to waterfowl habitat in the delta will be an increase in the hypopycnal environment (~8-10 acres), the formation of brackish water lagoons (~20 to 40 acres), and 10 acres of riparian bottomlands. Restoration efforts in the creek have been considerable due to court orders and recommendations of the Restoration Technical Committee; these efforts have been summarized by Inter-fluve (1995). We recommend no additional restoration projects for waterfowl habitat other than rewatering the creek.

Mill Creek. Much of the information about Mill Creek in this Plan was obtained from draft reports prepared by LADWP (1995-Appendix E) and Stine (1995c-Appendix F). S. Stine prepared his report as a consultant to the Waterfowl Habitat Restoration Team. The LADWP report provides an overview concerning the possibilities and constraints of returning their water right to Mill Creek to restore waterfowl and other wildlife habitat in the floodplain and delta. It also contains information on Mill Creek, including 1) the historical use of water, 2) hydrology, 3) water diversion facilities and structures, 4) water rights, and 5) current operations. The LADWP report also proposes flows for returning water to Mill Creek for habitat restoration and summarizes the limitations on returning flows because of other water rights, facility capacities, and operational constraints. The report by Stine summarizes information about 1) geology, geomorphology, and hydrology, 2) history of diversion-induced impacts, 3) measures necessary to restore waterfowl habitats in riparian areas and the hypopycnal environment in the incised delta, and 4) reviews the various potential legal considerations (water rights) and engineering needs (structural modifications) that would be required to ultimately restore all or most flows, thereby maximizing the amount of waterfowl habitat that could be restored at Mill Creek under present day conditions.

In overall importance to waterfowl, we consider the restoration of riparian and deltaic wetland habitats on Mill Creek to be second only to raising the level of Mono Lake to 6,392 feet. Mill Creek is the third largest tributary stream to Mono Lake with an average annual flow of 22,200 acre-feet and a length of approximately 13 miles. Approximately 80 percent of the annual runoff occurs during April-September and 20 percent during October-March. Until late last century, Mill Creek flowed perennially, supporting a broad, multi-channeled bottomland of riparian wetlands along its lower ~2 miles. Mill Creek played a critical role for waterfowl habitat in freshwater inputs to the lake, creating a hypopycnal environment beyond its mouth, providing backwater meadow and riparian habitats in the channels and by increasing spring flows that occurred from groundwater subbing.

Diversion of water from the stream, first for agricultural purposes and later for hydropower generation, resulted in the loss of these habitats. Currently, about 70 percent of the annual flow is diverted through the Lundy powerhouse for power generation and the remainder of the water flows down Mill Creek. Today, the multiple channels of the Mill Creek bottomlands are abandoned, but mainly intact. The dry delta has been incised along two trenches because of the drop in Mono Lake resulting from trans-basin export of water. Perennial stream flows are limited to the upper reaches, whereas the lower reach receives water only during the snowmelt season of very wet years. Few if any wetlands exist in the bottomlands of the delta during the months of greatest waterfowl abundance.

To restore waterfowl and other wildlife habitat, it is essential that Mill Creek be rewatered with year round flows. High flows throughout the spring and summer are essential for maintaining channel integrity, re-establishing riparian vegetation and replenishing ground water that can then persist in the fall and winter. While spills from Lundy Dam, and releases from the dam in anticipation of spills, occur relatively often, they are neither frequent enough, high enough, nor prolonged enough to maintain multi-channel bottomlands (Stine 1995c). Peak flows should replicate the timing and velocity of natural flows. These flows should be maximized during the spring and summer period, with increasing and decreasing flows on either end of the period to avoid unnatural lateral erosion in the stream corridor. To maintain the perennial nature of the stream and provide water to the bottomlands during the peak waterfowl use period, a flow emulating natural conditions ($x = 11.4$ cfs) is critical during the fall-winter period (September-March).

Restoring Mill Creek waterfowl habitat will also require the rewatering of abandoned channels in the bottomlands, the rewatering of both delta trenches, and the reestablishment of perennial flows along the lower reach of the stream. Stine (1995c) identified five plugged channels

(channels A, B, C, D, E) that could be reopened in the bottomlands and thus provide over 5,300 feet of additional watercourses replete with ponds, backwaters, and channel-side marshes; three channels are relatively easy to reopen. Providing water to both delta trenches will maximize the area of hypopycnal ria and riparian wetlands. This would require splitting the flow of Mill Creek, rather than containing all the flow in the eastern trench, as occurs today. The rewatering of Channel E in combination with a conduit at the county road, would provide the simplest means of watering the western trench (Stine 1995c). The rewatering of both trenches will stimulate greater riparian growth and encourage backwater habitat where subbing occurs.

To provide water year round to Mill Creek bottomlands, we investigated the feasibility of constructing an underground pipeline from the County road crossing on Wilson Creek to the lower reach of Mill Creek. Water returned to the bottomlands by an underground pipeline could provide perennial flows in the lower portions of Mill Creek, have negligible impact on upstream fisheries in Wilson Creek, and would not infringe on other water rights except for those of the U.S. Forest Service during the summer period. The U.S. Forest Service has expressed an interest in exploring the possibility of rewatering Mill Creek (R. Porter, pers. comm.). The estimated engineering cost is high (Table 8), and habitat and scenic impacts are uncertain. Although this scenario would provide a method for returning perennial water to the lower reach of Mill Creek bottomlands, we believe that returning water to the higher reaches near Mill Creek Return Ditch would be more beneficial ecologically and probably have less environmental impacts. The obvious facility to return additional water is via the Wilson Creek to Mill Creek Return Ditch, owned and operated by Southern California Edison.

TABLE 8 POTENTIAL REWATERING OF LOWER PORTIONS OF MILL CREEK FROM WILSON CREEK AT COUNTY ROAD				
Statement of Probable Cost for Diversion of Wilson Creek to Mill Creek	**Quantity**	**Units**	**Unit Cost**	**EXT Cost**
20 CFS Diesel/Propane Pumping Plant	1	EA	$300,000	$ 300,000
Discharge Structure	1	LS	5,000	5,000
Block Building/Sitework	1	LS	100,000	100,000
24" PVC Pipeline	7,392	LF	60	443,520
Cleanout/Air Release Valves	4	EA	2,500	10,000
Erosion Protection	20	CY	100	2,000
CONSTRUCTION SUBTOTAL				860,520
Construction Contingency (15%)				**129,078**
TOTAL CONSTRUCTION COST				989,598
Engineering (15%)				**148,440**
GRAND TOTAL				$1,138,038

Restoration Elements

- **Pump up to 20 cfs of water from Wilson Creek at the Forest Service diversion up to Mill Creek.**
- **Provide a diesel propoane pumping plant.**

However, the capacity of the Return Ditch is limited to 16 cfs. Changes needed to upgrade existing facilities to accommodate increased flows should be explored due to the desirability of higher flows down Mill Creek during the summer and early fall periods. Stine (1995c) provides a discussion on the requirements necessary to upgrade facilities to accommodate higher flows. To reinforce our earlier statement, we strongly endorse rewatering Mill Creek from the Return Ditch to the mouth.

As stated previously, Mill Creek has been highly altered by diversion for hydropower generation and agricultural irrigation. The bottomland habitat was lost during the late 1800s and early 1900s; the riparian habitat was clearly degraded by 1929 (Stine 1995c). Consequently, Mill Creek wetlands did not contribute habitat for the abundant waterfowl populations reported at Mono Lake during the 1930s - early 1960s period. Therefore, rewatering Mill Creek offers an excellent opportunity for mitigating other irretrievably lost waterfowl habitats such as 43 acres in the Rush Creek bottomlands. Rewatering the Mill Creek bottomlands, including abandoned channels, will create some of the best waterfowl habitat restoration benefits we have located in the Basin. Simulating the natural hydrology of periodic peakflows during the late spring-early summer period and providing base flows during the remainder of the year would recreate viable waterfowl habitat. The amount of restored habitat would be dependent upon how close the natural Mill Creek hydrology could be emulated. Stine (1995c) estimated that approximately 14 acres of hypopycnal environment at the stream mouth, 16 acres of riparian wetlands in the stream bottomlands, and 25 acres of riparian vegetation on the exterior delta could be restored, off-setting some of the similar habitat losses at Rush Creek.

Restoring the maximum amount of waterfowl habitat in Mill Creek would require reinstating most, if not all, of the current annual flows. Restoration of all potential waterfowl habitat on Mill Creek does not appear feasible under current conditions due to complicated issues involving water rights and the need for structural improvements to convey increased flows.

Reinstating sufficient base flows in Mill Creek is the first step toward restoring riparian and deltaic waterfowl habitat. The proposal in the draft report by LADWP to dedicate its water, by right, to flow down the Mill Creek corridor is a major and significant first step toward achieving this habitat restoration goal. We recommend and endorse this proposed action by LADWP. If this action is initiated, periodic assessments should be conducted to determine the response of wetland and riparian habitats to rewatering. An important second step would be for the U.S. Forest Service to dedicate a portion or all of its water right for rewatering Mill Creek. However, because it is a junior right and sometimes not fulfilled, the method of conveyance would have to be more thoroughly explored, because it could not be currently accommodated during the summer period in the Wilson Creek to Mill Creek Return Ditch due to the limited capacity of the ditch. We also recommend that channels B, C, and E, covering over 4,500 feet, be reopened and that the feasibility of reopening channels A and D be assessed. In addition, LADWP and other interested parties should begin negotiations with Conway Ranch and other entities to explore methods to obtain water during the September-March period that currently flows down Wilson Creek, contributing minimal benefits to waterfowl habitat. During November-March period the flows are normally not used. Most or all of this water could be returned to Mill Creek for waterfowl habitat restoration. Such fall-winter flows are not guaranteed even if LADWP and the U.S. Forest Service dedicate their water rights to Mill Creek. We recommend that LADWP and others explore the feasibility of upgrading the Mill Creek Return Ditch to accomplish increased flows in Mill Creek.

Wilson Creek. Wilson Creek's channel is currently so incised, narrow and steep that minimal waterfowl habitat exists. Historically an ephemeral channel, flowing only at peak runoff, this channel currently has limited value to waterfowl and little potential for restoration. The best ecological use of current Wilson Creek water is to return most of it to Mill Creek as close to the headwaters as possible. Waterfowl habitat consultants also made similar recommendations (Smith 1995, Zahm 1995).

MONITORING PROGRAMS

Baseline inventory data are a prerequisite to evaluate progress and success of habitat restoration and enhancement projects. However, baseline data on current waterfowl populations using Mono Lake are minimal and inadequate to accomplish this task. High monitoring priorities are to 1) establish the current status of waterfowl populations by species, and to 2) determine how these populations use various Mono Lake wetland habitats during summer and autumn. This information will provide a basis for comparisons with future population levels and evaluation of population responses to habitat restoration and enhancement efforts.

Various baseline data sets exist on lake hydrology and limnology, vegetation, certain species of birds and other topics (SWRCB 1993, LADWP, B. Hazencamp, pers. comm.). These data can assist in evaluating waterfowl habitat restoration efforts. To maximize the utility of this information, minimize duplication of effort, and facilitate information exchange, we recommend that LADWP, in cooperation with the U.S. Forest Service, California Department of Parks and Recreation, Mono Lake Committee and other interested groups (such as Point Reyes Bird Observatory), institutions, and individuals assemble, house, and make available various data sets in an accessible location in the Mono Basin. An accessible data bank would help managers in evaluating waterfowl and stream restoration programs and be useful for future monitoring programs, research studies, and land management activities.

Success in achieving the goal of restoring habitats for migrating waterfowl at Mono Lake may be difficult to assess directly. Increases in acreages of restored wetlands can be more readily determined, whereas measuring the quality of these wetlands may be more difficult.

Assessing restoration success by increases in densities of waterfowl populations will also be difficult. Natural annual and long-term variability in flyway population numbers, productivity, availability and condition of other migratory habitats, weather conditions during migration and other factors will also influence numbers stopping in the Mono Basin. Likewise, long-term changes in migration routes, precipitation cycles and availability of habitats along migration routes and at winter destinations will influence numbers using the Mono Basin. All of these factors can make it difficult to distinguish changes resulting from habitat restoration efforts, however, we expect to see measurable increases in waterfowl use. Realistically, success cannot be determined in a short time frame. Success of restoration efforts must be considered over many years.

The proposed monitoring projects, when considered collectively, should provide appropriate information to follow changes in 1) acreages of various wetland habitats, 2) limnological (including secondary production) and hydrological conditions of the lake, 3) vegetation responses to restoration, 4) population levels of waterfowl and other waterbirds by species, and 5) how waterfowl utilize various wetland habitats.

Progress toward restoration goals should be reported annually by LADWP. Information from monitoring programs should be analyzed and summarized in reports. We suggest that LADWP, members of the Waterfowl Technical Advisory Group, and other interested parties meet annually to review information, evaluate progress of restoration efforts, and consider corrections in restoration treatments if necessary.

We consider that the following monitoring programs are needed to provide minimum long-term data to follow changes in waterfowl populations and their environment, and to evaluate success of habitat enhancement and restoration efforts. Monitoring data should be analyzed and reported annually by LADWP. We also encourage additional surveys and research studies on specific areas of work as the need arises.

1. Hydrology

Lake water levels should be measured on a weekly basis. Flow data should be recorded for Mill, Lee Vining, Walker, Parker and Rush Creeks. Spring flows should be measured from Simons Springs and Warm Springs.

Lake: The LADWP will continue to monitor the surface elevation of Mono Lake. LADWP's weekly records extend back to June 1912. LADWP personnel will continue to measure and record the staff gauge elevations weekly on Mono Lake. As the lake level changes, LADWP will install new staff gages and verify for accuracy.

Streams: LADWP has measuring stations on Lee Vining, Walker, Parker and Rush Creeks. Several of these stations have been active for more than 50 years. LADWP measures stream flows above and below diversion facilities with continuous recording devices connected to a telemetry system for real-time data. Information from these measuring stations is placed into the long-term data base. Occasionally, winter streamflows are temporarily estimated when streams freeze and gauges become inoperable. On Mill Creek, LADWP obtains data provided by Southern California Edison and enters it into LADWP's mainframe computer.

Springs: Springs adjoining Mono Lake have been surveyed by LADWP at various occasions since the 1930s; early records contain only flow data. Between 1981-92, data collection expanded and individual springs were photographed. Information on water quality, flow, temperature, mineral analyses and other chemical properties were collected.

As required by Decision 1631, LADWP will continue to measure lake levels and streamflows both above and below its diversion facilities in the Mono Basin. In addition, we recommend that springs be monitored and photographed periodically (three year intervals) as lake levels increase. Photographs and data similar to those obtained during the 1981-92 period should be collected, summarized and made available to interested parties.

Cost: Annual monitoring costs are currently being incurred by LADWP.

2. <u>Lake Limnology and Secondary Producers</u>

Significant ecological changes will occur in Mono Lake as the lake level increases to 6,392 feet. One of the most important changes will be a reduction in salinity which will affect abiotic and biotic processes of the ecosystem. Reduced salinity of lake waters may affect survival and population levels of primary (algae) and secondary producers (brine shrimp and alkali fly). Brine shrimp and alkali flies probably are important food for some waterfowl species, especially northern shovelers and ruddy ducks. Consequently, there is a need to annually monitor changes in basic lake limnological parameters and their impacts on brine shrimp, alkali fly and other aquatic invertebrate populations. Fortunately, limnological research at Mono Lake extends back over 30 years and includes a number of published manuscripts and annual reports submitted to LADWP (SWRCB 1994, Jellison et al. 1995).

Since 1982, LADWP has contracted with the University of California, Santa Barbara for an intensive monitoring program to follow changes in the physical, chemical and biological environments at Mono Lake (Jellison et al. 1995). Information collected for the monitoring program include:

A. Meteorological data (wind speed and direction, incident radiation, air temperature, rainfall and humidity);
B. Data on the physical and chemical environment of the lake (temperature depth profiles, transparency, underwater light depth profiles, oxygen depth profiles, conductivity depth profiles and ammonium and phosphate depth profiles);
C. Phytoplankton (chlorophyll production);
D. Brine shrimp population levels.

Meteorological data are collected continuously and other data are collected monthly during January, February, September through November and bi-weekly during June through August.

We believe the current annual monitoring program is adequate to assess limnological and biological factors, other than alkali fly populations, that may influence waterfowl use of lake habitat. We recommend that the same monitoring program be continued during the period of rising lake levels to 6,392 feet elevation and at a minimum for 20 years after relatively stable lake levels are reached. The 20-year cycle will pass through at least one large drought and wet cycle in the major breeding and wintering grounds of North America waterfowl. We also recommend that annual changes in alkali fly populations be included in the monitoring program.

Costs: Expenses for the annual monitoring program are already incurred by LADWP, except for monitoring alkali fly populations.

Alkali flies were found to be an important component of the diet of northern shovelers during fall migration at Lake Abert, Oregon (Boula and Jarvis, 1984). Alkali flies are also eaten by several species of ducks in the Great Salt Lake, Utah, although no quantitative data are available to identify their importance (T. Aldrich, Utah Div. Wildl. Res., Salt Lake City, Pers. commun.). We suspect that alkali flies could provide an important food resource for waterfowl at Mono Lake. We recommend that at a minimum, a sampling scheme be developed and implemented to 1) provide an annual index of abundance and, 2) availability during the migratory period. Data on annual alkali fly populations at Mono Lake were collected during 1991-95 (D. Herbst, pers. commun.) and could provide baseline data.

3. Vegetation Status in Riparian and Lake-fringing Wetland Habitats

Restoration of streamflows will result in significant changes in the riparian habitats. Increasing lake levels and use of prescribed burns in lake-fringing wetlands will alter species composition and biomass in marsh, seasonal wet and dry meadow, and associated shrub committees. Monitoring and reporting on these vegetation communities are essential to assess seasonal and long-term changes in vegetation and to interpret waterfowl responses to these vegetation changes. It is beyond the scope of this plan to specify detailed and site specific monitoring protocols or costs. We recommend that LADWP establish and monitor transects and photo points in riparian habitats and jointly work with the U.S. Forest Service and California Department of Parks and Recreation in lake-fringing wetland habitats. General guidelines for minimal vegetation monitoring needs include:

A. Establish permanent (marked) vegetation transects in lake-fringing wetlands (e.g., Simons and Warm Springs, South Tufa) and in riparian areas along lower Rush, Lee Vining and Mill Creeks. We encourage the use of any previously established transects and photo points if they are available and suitable.

   One commonly used technique to assess marsh and meadow habitats is a point-intercept method outlined in the National Park Service Western Regional Fire Monitoring Handbook (Sydoriak 1991). Alternative methods are described by Higgins et al. (1994). Riparian vegetation could be monitored by use of Green Line Vegetation Composition Transects (USFS 1992) or equivalent method. This widely used linear sampling method classifies vegetation by seral community based on percent cover and is measured immediately along the wetted edge of the stream.

B. Establish photo points on permanent vegetation transects and rephotograph at one-year intervals to document vegetative change. Photo points located in riparian areas should show upstream, downstream and cross-channel views to document riparian vegetative development. Maximum value of riparian photo points will be realized when located where stream channel cross-section transects are established.

C. Develop a Geographic Information System (GIS) for Mono Basin. Based on Landsat or SPOT satellite imagery, historic aerial photos, and known vegetation communities (SWRCB 1993), a GIS needs to be developed. Such GIS programs have been conducted for other areas such as the Copper River Delta in Alaska and the ricelands in the Central Valley of California to evaluate changes in waterfowl habitat over time (Kempka et al. 1994, Spell et al. 1995). This digital product can then be used to display changes in habitat since water diversions began and further predict general habitat community types at the lake sites (SWRCB 1993). This product will be useful in tracking changes in existing and potential waterfowl habitats and for the management of such lands by U.S. Forest Service and California Department of Parks and Recreation. A team with experience in remote sensing and aerial interpretation, waterfowl habitats, Mono Basin hydrology and geomorphology, and wetland vegetation could produce this product.

Cost: $50,000: This project could be funded by a partnership of several agencies and organizations, including LADWP.

5. Waterfowl Population Surveys and Studies

A. Fall Aerial Counts

Monitoring waterfowl use is a high priority for evaluating habitat restoration effectiveness. We recommend a minimum of two fall aerial counts conducted every two years between October 15-November 15 at Mono Lake and at Bridgeport Reservoir and Crowley Lake. The importance of this population data may justify the need for such counts on an annual basis. During counts at Mono Lake, waterfowl numbers and species should be recorded by location in order to assess distribution of birds in various habitats and restoration treatment areas. During the October survey, a ground/boat count should be made to validate aerial counts and species composition. Data collected at Bridgeport Reservoir and Crowley Lake would be used to assess fall waterfowl population trends in the eastern Sierra and provide insight into interpreting rate of population changes at Mono Lake in response to restoration efforts.

B. Aerial Photography of Waterfowl Habitats

Immediately following or during one fall count, aerial photographs of habitats of principal waterfowl concentration areas should be obtained. Habitats photographed should include but not be limited to:

- Rush Creek delta and bottomlands
- Lee Vining Creek delta and bottomlands
- Mill-Wilson Creek delta and Mill Creek bottomlands
- DeChambeau Creek delta, Restoration Ponds and Meadow
- County Ponds
- Simon Springs
- Warm Springs
- South Tufa

Surveys should be conducted by two experienced waterfowl biologists. Use of aircraft with Loran/GPS navigation equipment will allow for accurately relocating sites to take photographs in successive years. **Cost (for A&B):** Estimated annual costs of aerial flights (at four hours of flight time per count), salaries, photographic needs, and report writing are $5,000.

C. Ground Counts at Specific Waterfowl Habitats

- Fall counts--record numbers and species composition every two weeks between 15 September-1 December (six counts) at principal waterfowl habitats listed above.
- Spring/Summer counts--conduct once monthly in mid-June and mid-July and record numbers and species composition.
- Record numbers and species of other waterbirds present at specific habitats when spring/summer and fall waterfowl ground surveys are conducted (see locations in 4B).

Cost: We estimate the cost of fall ground counts at $6,000 for salaries, travel, data summary and report writing by two biologists. Each count would be one to two days to complete. Estimated costs of two spring counts are $2,500, including salaries, travel, data summary and report writing. All counts and photography surveys should be continued until the lake stabilizes at 6,392 feet elevation and at a minimum for 20 years after relatively stable lake levels are reached.

D. Waterfowl Time Activity Budget Study

Activity budgets will identify various activities of waterfowl flocks and how they use different wetland habitats at Mono Lake. A comparison can be analyzed by testing activities in open, saline lake habitat, hypopycnal environments, and freshwater areas of streams, deltas and pond sites. Time budget data will also help identify responses of waterfowl to restoration efforts. At a minimum, the study should include two fall migration periods (1996-97), and then be repeated at or near target lake levels to measure response to restored habitat conditions. Consideration should also be given to collecting periodic time budget data (three to five year intervals) to further assess waterfowl responses to changes in habitat availability as lake levels increase.

Data collected will identify how much time waterfowl spend in various activities and behaviors in different habitats and identify the importance of those habitats. We expect that differences in habitat use by various species will be found.

Activities of waterfowl should be sampled during all daylight hours with some nocturnal samples obtained to identify roost areas. Observations should be made from blinds and vehicles with the aid of binoculars and spotting scopes. Choice of flocks sampled should be made as randomly as possible.

Scan sampling (Altman 1974) should be used to collect time-activity data from waterfowl flocks on land and water. Data should be recorded on a cassette tape. Major activity categories recorded should include: feeding, drinking, resting, comfort movements (body and plumage maintenance), vigilant/alert behavior, agonistic, vocalization and locomotion (swimming, flying, walking). Location, habitat type, time, date and weather parameters should be recorded.

Cost: Estimated costs for 1996-97 are $40,000, and include two biologists for 2.0-2.5 months (October - early December) for two fall periods, per diem, travel, data analysis and report writing.

CONCLUSIONS

Available evidence shows that loss of diverse fresh and brackish water wetland habitats due to trans-basin water diversions has contributed to a major reduction in waterfowl numbers in the Mono Lake Basin. The implementation of the waterfowl habitat restoration projects proposed in this Plan should measurably improve the quantity and quality of freshwater and brackish-water wetlands and hypopycnal environments. We do not expect restoration efforts will completely compensate for waterfowl habitat losses that have accrued over the past 50 years due to trans-basin stream diversions. This would, at a minimum, require a lake level of 6,405 feet or higher.

The most important restoration effort, and our highest priority, is to increase the level of Mono Lake to 6,392 feet as ordered in D-1631. This action will restore the largest acreage and the most diversity of waterfowl habitats, and should be achieved as soon as feasible through natural flows of Basin tributaries.

Our second priority is rewatering Mill Creek, including important distributaries, and raising the water table in the floodplain to restore riparian, marsh, spring, wet meadow, and open water ponds and sloughs, and to recreate a hypopycnal environment off the mouth of the stream.

We further recommend that the following projects be implemented to restore, enhance, or mitigate for lost waterfowl habitat:

1. Rewater important distributaries in Rush Creek below the Narrows.

2. DeChambeau Ponds/County Ponds/Black Point Restoration Complex Projects:

   a. Develop water system and rewater the County Ponds.

   b. Extend existing below-ground water system, rewater and maintain the riparian area in the Ranch meadow.

   c. Investigate the feasibility of creating one or several shallow ponds (scrapes) near Black Point using the existing, privately controlled ~120 gpm artesian flow.

3. Develop a prescribed burn plan, including monitoring and implementing annual, rotation burns to enhance lake-fringing marsh and seasonal wet meadow habitats (±1,000 acres) on lands adjoining Mono Lake that are managed by the U.S. Forest Service, California Department of Parks and Recreation, and LADWP. Develop a burn plan and implement one-time jackpot burning of debris piles in the Rush Creek Bottoms during the winter period.

4. Develop a cooperative program to control Salt Cedar (Tamarisk), an exotic, in lake-fringing wetland habitats.

5. Investigate the feasibility of enhancing existing artificial ponds near Simms Springs and the creation of one or several shallow ponds (scrapes) in other lake-fringing habitats.

We are not recommending any off-site mitigation measures because adequate opportunities exist within the Mono Lake Basin.

We consider the monitoring projects (hydrology, limnology, vegetation, waterfowl populations/activities/habitat, GIS) recommended in this Plan to be minimal but essential in order to adequately document and assess changes in the availability of wetland habitats and the responses of waterfowl populations to restoration efforts and to ecological changes that will occur as the lake level increases. All restoration and monitoring projects should be initiated in 1996 because none of these projects are dependent on achieving the target lake level. If these projects are delayed, recovery of waterfowl populations in the Mono Basin will also be delayed, and evaluation of restoration efforts will be incomplete due to lack of comparative baseline data.

LADWP should annually summarize and report information collected from monitoring programs. We recommend that LADWP and members of the Waterfowl Habitat Technical Advisory Group (TAG) meet annually to review this information and evaluate restoration efforts. Adjustments in waterfowl habitat restoration and management programs should be considered if information justifies such action.

From the waterfowl breeding habitat of the prairies of Alberta to the wintering grounds of California and western Mexico, efforts to restore critical, degraded and lost waterfowl habitat in the Pacific Flyway have been initiated. For any migrating bird, a loss of key habitat along the migratory corridor will produce a "break in the chain" of that traditional pathway. Today, Mono Basin is such a "break in the chain" for waterfowl, especially northern shoveler and ruddy ducks. If corridors of quality waterbird habitats are to exist in western North America, hydrologic integrity must be restored to these wetlands and enhancement of historic pathways that are currently degraded must be a priority.

A review of the biological, limnological, and historical changes (primarily man-induced) in eight of the most important saline and alkaline Great Basin lakes describes how these changes may have affected the lakes' ability to support breeding and migratory birds during the past 150 years (Jehl 1994). Based upon this review, Jehl concluded that only Mono Lake, Pyramid Lake in Nevada and perhaps the Great Salt Lake in Utah will likely remain largely unchanged in their ability to support current population levels of migratory birds well into the next century. This prognosis of the future availability of suitable saline and alkaline Great Basin lake habitats highlights the significance of restoring and maintaining Mono Lake's ecologically diverse wetland habitats for future use by waterfowl and the other avifauna that depend upon these unique and increasingly threatened wetlands.

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APPENDIX A: PACIFIC FLYWAY WATERFOWL INVESTIGATIONS, MONO LAKE, 1948

W. Dombrowski

PACIFIC FLYWAY WATERFOWL INVESTIGATIONS

POPULATION DATA

1. Date September 20, 1948 Time 4:30 PM

2. Locality (be specific) Rush Creek Delta, Mono Lake, Mono County, Calif

3. Estimated total number of waterfowl by species.

Whistling Swan	0	Redhead	0
Honker	0	Ring-necked duck	0
Lesser Canada	0	Canvasback	0
Cackling Goose	0	Greater Scaup	0
Black Brant	0	Lesser Scaup	0
White Fronted Goose	0	American Golden-eye	0
Tule Goose	0	Barrows Golden-eye	0
Lesser Snow Goose	0	Buffle-head	0
Ross Goose	0	Old Squaw	0
		Harlequin duck	0
Mallard	21#	White-winged Scoter	0
Gadwall	7 #	Surf Scoter	0
Baldpate	13 #	American Scoter	0
Pintail	142#		
Green-winged Teal	47#	Ruddy duck	0
Blue-winged Teal	6#	Fulvous tree duck	0
Cinnamon Teal	0	Wood duck	0
Shoveller	3250#	Coot	460#

4. Remarks # Eye count. Made on fresh water pond East of Rush Creek (shaded area shown on map) Total number of ducks observed in general area estimated at 175,000 to 200,000.

Weather clear and moderately warm. Light SW wind less than 5 MPH.

Walt. Toulkowski

PACIFIC FLYWAY WATERFOWL INVESTIGATIONS

POPULATION DATA

1. Date September 27th 1948

2. Locality (be specific) Rush Creek Delta, Mono Co, California
South shore of Mono Lake

3. Estimated total number of waterfowl by species.

Whistling Swan	0	Redhead	6
Honker	0	Ring-necked duck	0
Lesser Canada	0	Canvasback	0
Cackling Goose	0	Greater Scaup	0
Black Brant	0	Lesser Scaup	0
White Fronted Goose	0	American Golden-eye	0
Tule Goose	0	Barrows Golden-eye	0
Lesser Snow Goose	0	Buffle-head	0
Ross Goose	0	Old Squaw	0
		Harlequin duck	0
Mallard	16	White-winged Scoter	0
Gadwall	0	Surf Scoter	0
Baldpate	10	American Scoter	0
Pintail	42		
Green-winged Teal	19	Ruddy duck	0
Blue-winged Teal	4	Fulvous tree duck	0
Cinnamon Teal	0	Wood duck	0
Shoveller	395	Coot	66

4. Remarks The eyecount is low this time on account of last weeks storm taking out the dyke on the East side and we lost most of the water in it. This has been repaired and next weeks count will be much larger. The estimate of all ducks in this vicinity remains at 175,000 to 200,000.

Submitted by Walter Dombrowski

PACIFIC FLYWAY WATERFOWL INVESTIGATIONS

POPULATION DATA

1. Date ~~October 4th~~ (1948)

2. Locality (be specific) ~~Rush Creek Delta, Mono Co. Calif (South shore of Mono Lake)~~

3. Estimated total number of waterfowl by species.

Whistling Swan	0	Redhead	0
Honker	0	Ring-necked duck	0
Lesser Canada	0	Canvasback	0
Cackling Goose	0	Greater Scaup	0
Black Brant	0	Lesser Scaup	0
White Fronted Goose	0	American Golden-eye	0
Tule Goose	0	Barrows Golden-eye	0
Lesser Snow Goose	0	Buffle-head	0
Ross Goose	0	Old Squaw	0
		Harlequin duck	0
Mallard	45 #	White-winged Scoter	0
Gadwall	12 #	Surf Scoter	0
Baldpate	65 #	American Scoter	0
Pintail	225 #		
Green-winged Teal	36 #	Ruddy duck	7 #
Blue-winged Teal	0	Fulvous tree duck	0
Cinnamon Teal	0	Wood duck	0
Shoveller	3200	Coot	87 #

4. Remarks ~~Estimated number of ducks in vicinity 175,000 Time 9.00AM Weather cool and part cloudy, Temp 60° Lowest last night 29° Calm. Ducks were not moving very much.~~

Submitted by

PACIFIC FLYWAY WATERFOWL INVESTIGATIONS

POPULATION DATA

1. Date October 11, 1948 — Weather: Cloudy, Southeast wind 25 Mi per hour Temp 62 Minimum last night 30.4°

2. Locality (be specific) Rush Creek Delta, Mono County, Calif

South shore of Mono Lake.

3. Estimated total number of waterfowl by species.

Whistling Swan	0	Redhead	#12
Honker	0	Ring-necked duck	0
Lesser Canada	0	Canvasback	0
Cackling Goose	0	Greater Scaup	0
Black Brant	0	Lesser Scaup	0
White Fronted Goose	0	American Golden-eye	0
Tule Goose	0	Barrows Golden-eye	0
Lesser Snow Goose	0	Buffle-head	0
Ross Goose	0	Old Squaw	0
		Harlequin duck	0
Mallard	#75	White-winged Scoter	0
Gadwall	#15	Surf Scoter	0
Baldpate	#40	American Scoter	0
Pintail	#850		
Green-winged Teal	#225	Ruddy duck	18
Blue-winged Teal	0	Fulvous tree duck	0
Cinnamon Teal	0	Wood duck	0
Shoveller	#5200	Coot	350

4. Remarks Estimated ducks in vicinity 300,000 - 400,000 On account of storm conditions it was impossible to obtain eyecount of birds on pond. Upon first observation it was estimated that there were about 60,000 in pond. Birds were frightened off the pond and a half hour count of ducks returning produced the above count. The coots and ruddies did not leave pond.

Submitted by Walter [signature]

In counting the returning birds only flocks were counted as follows:

Species	No of Flights	Ave No of Birds per flight
Shoveller	160	30 - 35
Pintail	72	10 - 15
Mallard	9	8 - 10
Green wing teal	14	15 - 20
Gadwall	3	5 - 6
Baldpate	7	5 - 6
Redhead	1	12

Singles and pairs were ignored

PACIFIC FLYWAY WATERFOWL INVESTIGATIONS

POPULATION DATA

1. Date of Census ~~November 1, 1948~~ Time of Day ~~8.00 AM~~

2. Locality (be specific) ~~Rush Creek Delta Mono County (S. shore Mono~~

3. Weather for Censusing ~~Strong SE wind Cloudy~~ Visibility ~~Good~~ (Good, Fair, Poor)

4. Temperature ~~46°~~ Condition of tide if applicable

5. Estimated total number of waterfowl by species:

Whistling Swan	~~0~~	Cinnamon Teal	~~0~~
Canada Goose (Honker)	~~0~~	Shoveller	~~27~~
Lesser Canada	~~0~~	Redhead	~~3~~
Cackling Goose	~~0~~	Ring-necked Duck	~~0~~
Black Sea Brant	~~0~~	Canvasback	~~0~~
White-fronted Goose	~~0~~	Scaup	~~0~~
Tule Goose	~~0~~	Golden-eye	~~0~~
Lesser Snow Goose	~~0~~	Buffle-head	~~4~~
Ross Goose	~~0~~	Old Squaw	~~0~~
		Harlequin	~~0~~
Unidentified Geese	~~0~~	Scoter	~~0~~
Mallard	~~2~~	Ruddy	~~9~~
Gadwall	~~7~~	Fulvous tree duck	~~0~~
Baldpate	~~3~~	Wood Duck	~~0~~
Pintail	~~10~~		
Green-winged Teal	~~4~~	Unidentified Ducks	~~6~~
Blue-winged Teal	~~0~~	Coot	~~92~~
		Mergansers	~~0~~

6. Remarks: ~~On account of the open season and concentration of hunters in this area it was impossible to take a census on the 18th and 25th of September. The ducks at present are rafted up near the center of the lake where it is difficult to make an estimate of the number. However including ruddies there are now well over a million ducks on the lake 80% of which are ruddies and shovelers.~~

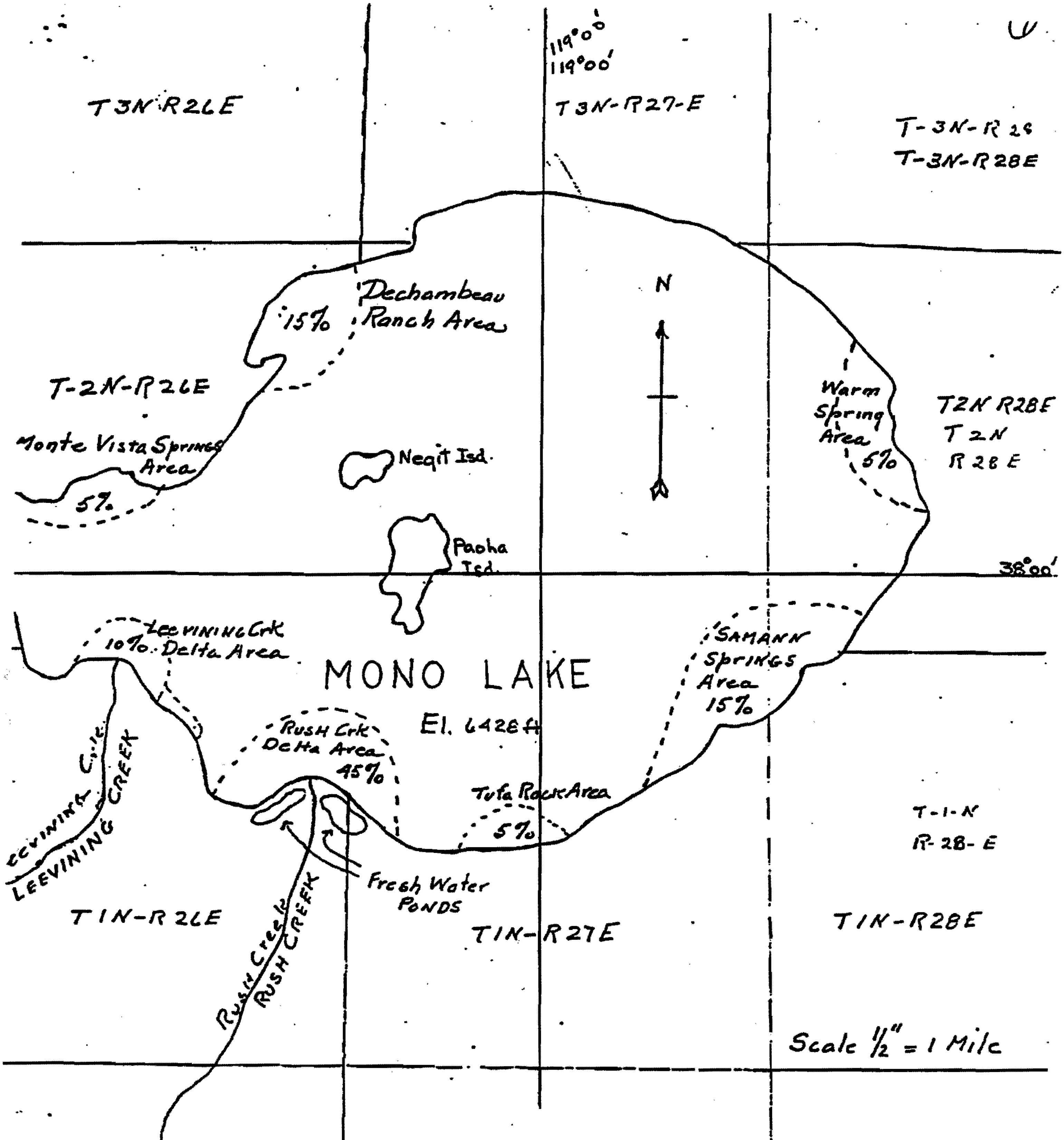
Submitted by

Considering the number of ducks in the area, the season was poor from a shooting viewpoint. With a rough estimate of about 4500 man shooting days less than three thousand birds were killed around Mono Lake. Full moon, fair weather and no wind were responsible. The birds can feed and obtain water from the fresh wter springs in the lake so the birds remained far from shore during the open season.

Of the birds killed ABOUT 70% wre shovellers, 15% gadwall, the other 15% pintail, greenwing teal, baldpate and mallards in about equal percentages. Few ruddies were killed. Early part of the season the kill consisted mostly of females but towards the end there were more males.

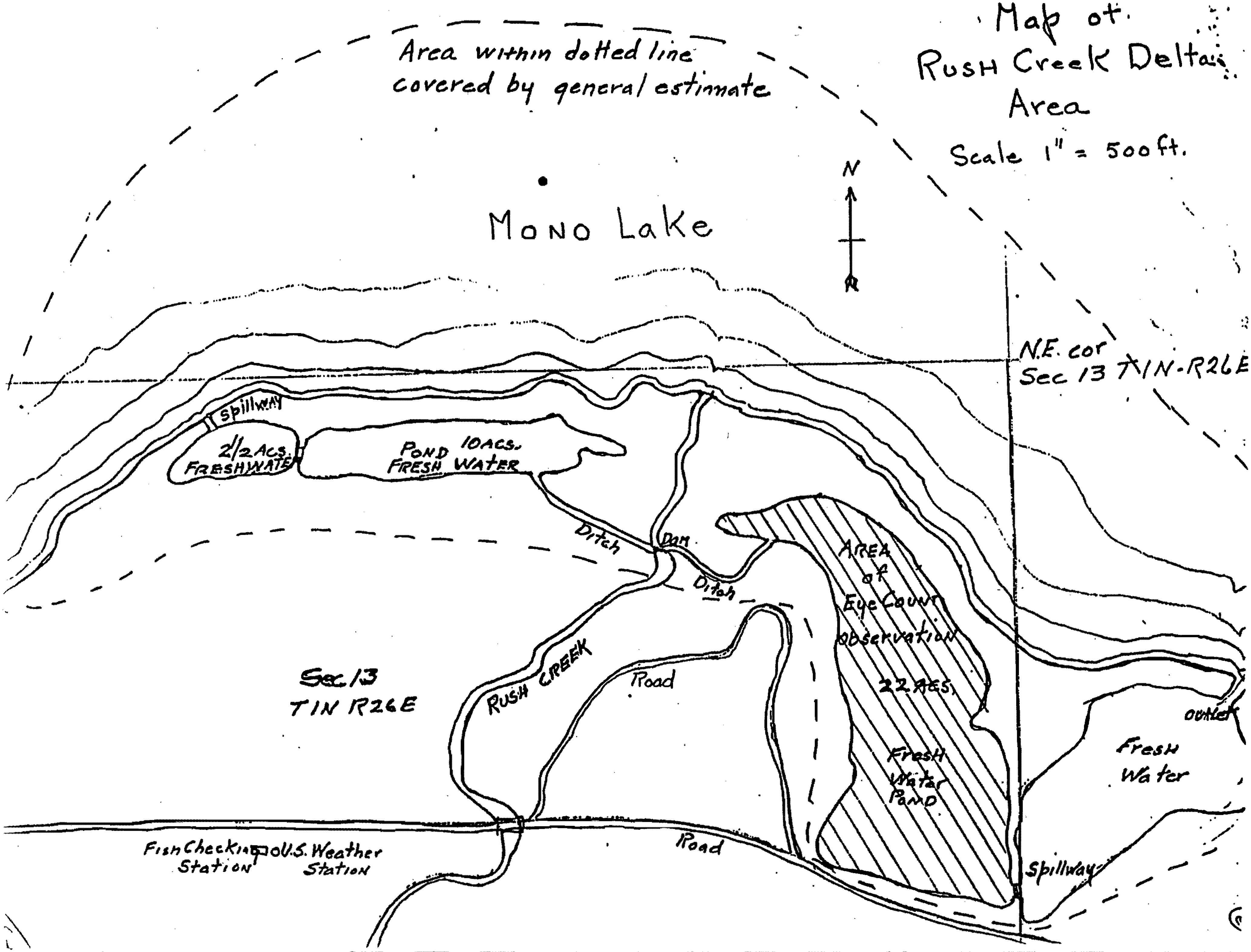
Since the birds feed on the lake early mornings the morning flight in this area is negligible and the shooting closes to early in the day to take advantage of any evening flight.

WD



MAP of MONO LAKE
showing

relative approximate percentages of waterfowl distribution around shore of the lake. This distribution is naturally affected by shooting during the open season.



Map of
Rush Creek Delta
Area
Scale 1" = 500 ft.
Area within dotted line
covered by general estimate
Mono Lake
N
N.E. cor
Sec 13 T1N-R26E
Spillway
2 1/2 Acs.
Freshwater
Pond 10 Acs.
Fresh Water
Ditch
Dam
Ditch
Area
of
Eye Count
observation
22 Acs.
Fresh
Water
Pond
Fresh
Water
outlet
Spillway
Rush Creek
Road
Road
Sec 13
T1N R26E
Fish Checking Station
U.S. Weather Station

APPENDIX B: RECOMMENDATIONS FOR RESTORATION OF MONO BASIN WATERFOWL HABITAT

Loren M. Smith, Department of Range and Wildlife Management, Texas Tech. University, Lubbock, TX 79409

OVERVIEW AND ASSUMPTIONS

This report is based on a four-day trip (July 28-31, 1995) to the Mono Basin and concurrent discussions with personnel (R.C. Drewien, F.A. Reid, T. Ratcliff, S. Stine, and D. Carle) familiar with the ecosystem. Since 1941, and earlier, water was diverted from Mono Lake for municipal and agricultural uses. The lake level subsequently dropped substantially reducing the amount and quality of waterfowl habitat. Because of a September 1994 decision by the California State Water Resources Control Board, the water level of the lake will be restored to 6,392 elevation and waterfowl habitat should be restored to pre-1941 conditions (see below).

As with most alkali, saltwater bodies in the Great Basin (e.g., Great Salt Lake; Smith and Kadlec 1986), the majority of waterfowl habitat (i.e., marshes, deltas, riparian zones) is associated with freshwater inflows (i.e., creeks and springs) into Mono Lake. Freshwater is very important for meeting the consumption and body maintenance requirements of waterfowl using saline systems (Anderson 1994). Because the 6,392 elevation will not meet pre-1941 levels, however, complete natural restoration of these waterfowl habitats is not possible. To mitigate some of the differences in habitat between pre-1941 levels and the targeted 6,392 elevation some additional measures (county ponds, DeChambeau Ranch) should be considered to restore waterfowl habitat. It is assumed that the primary value of the lake and associated wetlands for waterfowl was as fall migration habitat although it will also serve other seasonal habitat needs.

Creeks and Deltas

Three major creeks with substantial delta habitat enter the lake, (in order of flow least to greatest: Mill, Lee Vining, and Rush). However, currently water that could restore fall waterfowl habitat in Mill Creek is entering a lesser, narrower creek, Wilson. Because Wilson has a narrow drainage and delta this increased flow is creating substantial (and unnatural) erosion, harming natural wildlife habitat there. The majority of this water should be directed to Mill Creek to restore natural riparian conditions there. The water should enter the creek as high as possible in the drainage to create maximum habitat benefits. Also all channels within Mill Creek should be opened to allow development of riparian plants and create slower moving water. This will also prevent unnatural erosion and allow more expansive delta formation. As the habitat recovers there, beaver will likely move in, further improving fall waterfowl habitat. Not only will the freshwater riparian habitat be important in meeting waterfowl cover and feeding requirements, it will also be important for waterfowl (e.g., northern shovelers) needing freshwater for consumption and body maintenance after feeding in open saltwater in the lake. This will be true for all of the creeks and deltas.

Grazing should be eliminated from the drainages, as well as where feasible in the watershed, to allow recovery of woody and herbaceous cover. Grazing should also be eliminated in the other two creeks riparian areas and associated deltas. The improved vegetative conditions will benefit annual and perennial waterfowl food plants, enhance invertebrate production (also important foods), and increase the cover value of these habitats to waterfowl during inclement weather. Also aggressive control of woody exotic riparian species such as salt cedar should be maintained in all wetlands within the Mono Basin. Not only does salt cedar occupy space of native species but it also uses high amounts of water that would be available to enter the lake or aid in native vegetation recovery (Dirar 1982).

Much of the flow has been restored to Lee Vining Creek. The fall habitat for waterfowl is recovering there as evidenced by numerous native woody seedlings, such as willow, becoming established on the gravel bars. Apparently much of the recovery is due to the elimination of sheep grazing as well as restored creek flows. As many channels as possible, should remain open here, to restore fall waterfowl habitat (reasons detailed above). Natural creek flows should be maintained.

Rush Creek, the largest freshwater inflow into Mono Lake, is in poor ecological condition. High water flows in one main channel in the drainage have created substantial erosion problems and high turbidity. All channels in the drainage should be opened immediately to slow water flows and create habitat by allowing establishment of riparian plants. This will also improve water clarity, macrophyte production, and thus invertebrate production. Deep incisions along the main channel will require years to recover. Indeed many cubic meters of bank soil was lost while we surveyed the site. However, with the numerous channels and oxbows present, the potential benefits to waterfowl will be immediate if they are opened to freshwater inputs.

Fringing Wetlands

Because water levels will not be completely restored to pre-1941 levels, natural restoration of waterfowl habitat in many fringing wetlands is not possible. Therefore, artificial means should be considered where practical, as is the case for county ponds, and where artificial ponds existed previously as is the case at DeChambeau Ranch. These areas can mitigate some of the habitat loss that cannot be recovered because of the 6,392 foot water levels. The six ponds being rehabilitated and/or constructed at DeChambeau Ranch should be managed at different permanency states (e.g., seasonal and semi-permanent wetlands) to meet the different requirements of waterfowl. To maintain these stages water fluctuations will obviously be needed. These six wetlands will provide freshwater (benefits listed above) and emergent, submergent, and invertebrate foods for waterfowl.

Two basins, county ponds, that were naturally formed could also be relatively easily managed as seasonal semi-permanent wetlands. The ponds will need a freshwater source to manipulate water levels, but they have the natural contours (Reid et al. 1989) for a diversity of vegetation and invertebrates, to become established. The vegetation and invertebrates will help meet the different requirements of waterfowl (see above benefits).

Simon Springs, Warm Springs, and South Tufa Grove have extensive areas of annual and perennial wetland plants that are a result of springs and seeps. However, because of a lack of natural disturbance (e.g., fire, water fluctuation), the marsh areas have developed dense mats of dead material and lack open water areas for waterfowl and other birds to use. As lake levels rise and fluctuate in the future, some of this problem will be eliminated. In areas where this will not occur, a natural disturbance such as fire can improve the habitat for waterfowl feeding and freshwater habitat use (benefits listed above; Smith and Kadlec 1985a). Historically, these fires probably occurred in summer and early fall **(I did not receive info. on fire history, so I hypothesized from other areas in the Great Basin)**. Prescribed burning, mimicking these fires, will likely provide the most benefit in opening up habitat and allowing waterfowl food plants to colonize. Hot fires (high temperatures 75-90F, low humidities <30%, and moderate winds ≤15 mph) can be used in late summer to consume green vegetation with the current dead vegetative mat serving as fuel (Smith and Kadlec 1985b). This would probably be more successful in opening up and changing the composition of the habitat than cooler burns that occur later in the season after vegetation is dormant (Saenz and Smith 1995). Shallow scrapes in the dense emergent vegetation surrounding some springs, could also be constructed to mitigate loss of >6,392 wetland habitat.

Waterfowl Habitat Evaluation

The changes in the waterfowl habitat that occur as the lake water level rises and as a result of active management, should be documented (Smith 1990). At a minimum, annual aerial photos should document these changes by measuring vegetation distribution in fringing wetlands, riparian zones and deltas. Waterfowl population surveys should be conducted in the fall to document species response. It would be desirable, at the beginning of the restoration of water levels and habitat, to have some behavioral time budgets (nocturnal and diurnal) of the major waterfowl species present to document use of the different habitats (e.g., fresh vs. saltwater [hypopycnal]) for their different requirements (e.g, feeding vs. cover). Most waterfowl require freshwater (as noted earlier), if they have been using saltwater habitats and these data would aid in future habitat management recommendations. Also some measure of secondary productivity of the lake's invertebrates should be taken because of their importance in waterfowl diets. Finally, if prescribed burning is used to enhance habitats, species composition (step-points) and biomass (clip plots) should be estimated prior to and several times after the fires so that the technique can be adjusted in the future to provide the maximum benefit to waterfowl in the Mono Basin.

Conclusions

Because of the extreme importance of all wetland habitat in the arid Great Basin and the degradation of wetlands to the north and south of Mono Lake in the Pacific Flyway, the importance of the fall waterfowl habitat in the Mono Basin is key to the welfare of waterfowl populations in the region (Heitmeyer et al. 1989, Kadlec and Smith 1989). In addition, the restoration of freshwater habitat in a high salinity environment is essential to maximize the health, abundance, and diversity of waterfowl using Mono Basin. Finally, not only will the proposed enhancement of riparian, delta, and fringing wetlands improve waterfowl populations, but it will greatly increase the biodiversity in the region.

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EXPERIENCE

1984-present	Professor (including Associate Chairman since 1991), Department of Range and Wildlife Management, Texas Tech University, Lubbock, TX.
1993-95	Editor-in-Chief, The Journal of Wildlife Management. Volumes 58 and 59. The Wildlife Society. Bethesda, MD.
1983	Postdoctoral Research Associate, The University of Georgia's Institute of Ecology, Savannah River Ecology Laboratory, Aiken, SC.
1980-1983	Research/Teaching Assistant, Department of Fisheries and Wildlife, Utah State University, Logan, UT.
1978-1980	Research/Teaching Assistant, Department of Wildlife and Fisheries Science, South Dakota State University, Brookings, SD.
1978	Wildlife Research Assistant, Iowa Conservation Commission, Red Haw Research Station, Chariton, IA.

Experience in North America, South America and Europe; member of seven professional societies; numerous commissions and boards; currently has seven graduate students in avian and wetland ecology.

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Published more than 70 technical articles on avian and wetland ecology. Edited three journals and one book.

AWARDS

- Wildlife Publication Award - Edited Book, "Habitat Management for Migrating and Wintering Waterfowl in Norther America" (1991, The Wildlife Society)
- Outstanding Researcher, College of Agricultural Sciences - Texas Tech. University - 1991
- Outstanding Technical Publication Award - "The Response of Prairie Wetland Vegetation to Seasonality of Drawdown" (1991, Texas Chapter of The Wildlife Society)

APPENDIX C: RECOMMENDATIONS FOR WATERFOWL HABITAT RESTORATION WITHIN THE MONO LAKE BASIN

Gary R. Zahm

Based upon on-site observations made during July 28-31, 1995, the following is provided as supplemental information to the Mono Basin Waterfowl Habitat Restoration Plan (Drewien, Reid, Ratcliff).

Waterfowl Habitat Restoration and Enhancement

- **DeChambeau Ranch Unit.** The existing wetland restoration is a prime example of the utilization of low impact restoration techniques. Natural basins were selected; clay soils from adjacent sumps were used to create wide, low-profile levees; pipelines were buried and covered with top soil to encourage rapid vegetation; equipment access routes were limited to future wetland basins, thus minimizing effects to upland vegetation; and the well house was constructed of natural material, which when subjected to annual weathering processes, will blend with existing, historical features.

On those basins which have been restored, both gadwall and cinnamon teal broods were observed, while hundreds of California gulls and Wilson's phalaropes (the first arrivals of the 1995 summer migration) were observed coming into the wetlands to drink and bather in the fresh (deep well) water. This current use is just an indication of future use by waterfowl and other migratory birds on the DeChambeau Ranch unit and other wetlands which could be restored.

The periodic use of prescribed fire on the associated short grass/forb meadow habitat will be an important management tool and produce potential feeding and loafing habitat for Canada geese, common snipe, killdeer, horned larks, etc. The deep well and associated pipeline development will produce optimum, yet low impact, management flexibility.

- **County Ponds.** These natural basins are prime candidates for restoration and when complete, will produce outstanding waterfowl and wetland-dependent wildlife habitat. Because the restoration will be employed in natural basins and existing contours, the final product will be indistinguishable from other Great Basin wetlands.

The water source will come from the possible rehabilitation of an existing well or the development of a new facility. The pipeline, which should be buried and routed along the natural contours, will allow restoration of existing, upslope head cuts and incisions.

Again, low impact construction methods should be utilized to minimize soil disturbance, reduce aesthetic impacts, and to speed vegetative regeneration. Upslope clay soils should be used if any levee work is required. It appeared that the potential exists for the restoration of seasonal and semi-permanent wetland habitat within the natural basins. If engineering surveys show this potentiality, construction should be geared to that goal. The diversity of moist soil plants associated with the wetland edge and submergent growth within the semi-permanent basin will attract the greatest diversity of migratory birds.

The pipeline should be routed and modified to allow the application of periodic irrigation flows onto the upslope wet meadow habitat. The restoration of this valuable meadow habitat and the associated willow scrub community will add to the diversity of the area. The application of spring and early summer water (irrigations) will allow the production of seeds and emergent cover that will be utilized by the migrating waterfowl flocks, plus allow usage of the habitat by migrant and resident passerine species.

Following restoration, the wetland/wet meadow habitat management of the county ponds and the DeChambeau Ranch wetlands should be accomplished in a similar fashion. Such a management scheme will allow the two areas to become one diverse complex. It is expected that a more frequent provision of water will create sub-irrigated areas that will support the growth of additional willow scrub habitat. To speed up the natural regeneration, supplemental plantings (from adjacent riparian stock) could be made. This riparian development will produce excellent natural corridors between the wetland units.

- **Simons Springs.** This is a very interesting area, high in potential, and subject to major ecological changes as the lake level begins to rise. It appears that upslope seeps move subterraneously and surface in the bench-like meadow habitat between the current lake edge and the upland shrub zone. Because of this, rank meadow vegetation has proliferated and reached a Baltic rush climax. Very little diversity exists except for the two artificial wetlands that were previously created via blasting with ammonium nitrate and fuel oil. These wetlands, which have evolved into a very natural-appearing aspect, continue to produce valuable waterfowl and wetland-dependent species habitat. Cattail stands, which hosted yellow-headed blackbirds, song and savannah sparrows, ringed the edges, while submergent stands of *Ruppia* and *Rannunculus* were present. At least one Cinnamon teal flushed from the wetlands and despite their small size, the ponds most certainly support waterfowl broods and provide a source of fresh water to migrating waterfowl.

Unless additional depressions are constructed (via low visibility scrapes or blasting), the only other non-"heavily engineered" technique that could be employed to enhance waterfowl use would be prescribed burning. Under inspection, it is clearly evident that a major mulch buildup has occurred in both the wet meadow habitat and in the narrow bands of cattail. Prescribed burning will reduce this mulch, thus stimulating the new growth and species diversity. It is expected that the new growth, if the prescribed burning is done prior to the arrival of the fall migrants, will produce grazing opportunities for Canada geese and American wigeon, plus produce short-grass loafing sites for other waterfowl species and wading birds. The burns may also expose additional open water channels which will benefit waterfowl. As the vegetation regrows in the spring and summer, nesting habitat will be enhanced. Surveys should be established to determine the optimum frequency for future burns.

<u>Stream Channel/Riparian Restoration</u>

- **Wilson, Mill, Lee Vining and Rush Creeks.** The rewatering of Mono Lake's feeder creeks will present some outstanding opportunities for waterfowl habitat enhancement. As a more stable in-flow regime develops, the delta areas will begin to support emergent vegetation along the shoreline and streamsides. Waterfowl will be attracted to the shallow delta for seeds, invertebrates, fresh water (for drinking and bathing), and depending upon exposure, thermal cover during windy and stormy periods.

In order to maximize the use of these creek bottoms for migratory waterfowl, the instream flows should be distributed throughout the existing network of natural channels, the majority of which are currently dry because of silt and rock blockages. The redistribution of the water will enhance adjacent wet meadows (especially in the upper stretches of Rush and Mill Creek), inundate deeper pockets of the side channels, and increase the vigor and diversity of existing riparian vegetation. As the peak flows subside, emergent moist soil food plants (Baltic rush, sedges, etc.) will invade the mud flats and produce waterfowl food that will ultimately wash into the delta area. Beaver will be expected to move into the creeks and begin their dam-building activity and the associated creation of ideal waterfowl nesting habitat. Mallards, green-winged teal and gadwall will readily use these beaver ponds.

A diversity of neotropical migratory bird species, many of which have exhibited major declines, will readily accept the various stages of riparian vegetation which is expected to proliferate following the rewatering of the creek beds. Raptors will also be attracted to these creek bottoms for both nesting and the increase in prey species associated with the new vegetation.

To obtain maximum waterfowl and riparian habitat benefits in Mill Creek and its associated delta, this stream should be restored via the provision of a permanent, instream flow. The artificial diversions into Wilson Creek should be redistributed into Mill Creek, thus returning Wilson Creek into an intermittent watercourse. Prior to the diversion, side channel blockages in Mill Creek should be removed to facilitate optimum spreading of water. Removal of the blockages prior to the rewatering will allow (if required) the use of bulldozers as habitat damage will be limited, and what damage might occur will soon be obliterated as the water and new vegetation cover the restoration efforts.

<u>Summary</u>

As a result of the Mono Lake Basin Water Rights Decision 1631, there will be gradual restoration and enhancement of waterfowl habitat. This restoration, however, could certainly be expanded and accelerated via aforementioned recommendations by this author and others. Many "hands-on" habitat restoration procedures exist which will not only enhance the Mono Lake environment, but respect U.S. Forest Service and California Department of Parks and Recreation management prescriptions and guidelines that pertain to the preservation of natural ecosystems.

Some guidelines that would facilitate those agency concerns are:

- Wetland restoration and stream channel openings should utilize low impact construction techniques.
- Natural depressions should be incorporated into wetland restoration projects.
- Compacted clay soils should be used in the construction of dikes and levees.

- Low-maintenance water control structures (concrete headers and polypropylene pipes if alkaline soils are present) should be installed.
- Critical vegetation should be identified and avoided during restoration.
- Equipment movement across uplands should be avoided or minimized.
- Buried pipelines are preferable over open ditches.
- Well houses should be constructed of natural material and sited (if possible) in locations which minimize visual obstructions. Vegetative screening could also be employed.
- Future wetland management plans should duplicate natural flooding regimes that have attracted waterfowl and wetland-dependent species.

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EXPERIENCE

1963-present Refuge Manager, National Wildlife Refuge System, Department of the Interior, U.S. Fish and Wildlife Service

Past locations of employment at refuges with major emphasis on the restoration, enhancement, and management of habitat for migratory waterfowl, raptors and major passerine species:

- Monte Vista NWR/Monte Vista, CO
- Bear River Migratory Bird Refuge/Brigham City, UT
- Tishomingo NWR/Tishomingo, OK
- Bosque del Apache NWR/Socorro, NM
- Lake Andes NWR-Wetland Management District/Lake Andes, SD

PRESENT POSITION/LOCATION

Project Leader, San Luis NWR Complex (Los Banos, CA) since 1980. Oversees operations and management of five national wildlife refuges (35,000 acres) plus two wildlife management areas (55,000 acres of perpetual conservation easements on privately-owned wetlands and grassland/riparian habitat) within the 160,000 acre Grasslands Ecological Area, Merced County, CA. The Grasslands Ecological Area represents over one-third of wetlands left in the Central Valley and is the largest block of contiguous wetland habitat within the Central Valley.

Major emphasis on the restoration and enhancement of wetland and riparian habitat, with over 1,000 acres of seasonal and permanent wetland habitat restored since 1991 and an additional 1,000 acres scheduled for completion in 1996. Ongoing riparian restoration, including native tree and shrub planting, plus natural channel enhancement, on 78 miles of riverine channels.

San Luis NWR Complex restoration and management operations are recognized as state-of-the-art within the National Wildlife Refuge System. Complex selected as flagship of newly-founded California Riparian Habitat Joint Venture. National Audubon Society has recognized the Complex as a primary example of ecosystem management within the National Wildlife Refuge System.

OTHER

Professional photojournalist with emphasis on portrayal of wildlife behavior in the natural environment. Over 1,400 photos and 50 articles published since 1973. Active member of the Outdoor Writers Association of American (9174) and North American Photography Association (1995).

SELECTED PUBLICATIONS

Zahm, G.R., E.S. Jemison and R.E. Kirby. 1987. Behavior and Capture of Wood Ducks in Pecan Grove. J. Field Ornithology. 58(4):474-479.

Zahm, G.R. 1985. Kesterson Reservoir and Kesterson National Wildlife Refuge: History, Current Problems and Management Alternatives. Trans. 51st N.A. Wildl. & Nat. Res. Conf.

AWARDS

- Washburn Award. New Mexico Audubon Society, 1980.
- J. Martin Winton Award. Grasslands Resource Conservation District/Grasslands Water District. 1994.

APPENDIX D: MONO LAKE TUFA STATE RESERVE EXPERIMENTAL PRESCRIBED FIRE PLAN

W. James Barry & Wayne R. Harrison

STATE OF CALIFORNIA
THE RESOURCES AGENCY
CALIFORNIA DEPARTMENT OF PARKS AND RECREATION

MONO LAKE TUFA STATE RESERVE

EXPERIMENTAL PRESCRIBED FIRE PLAN

(Review Draft, Oct. 13, 1995)

W. James Barry & Wayne R. Harrison

Approved By: ______________________________

Gary E. Walter
Sierra District Resource Ecologist

Approved By: ______________________________

Robert G. Macomber
Sierra District Superintendent

Approved By: ______________________________

Richard G. Rayburn
Resource Management Division Chief

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INTRODUCTION

On September 28, 1994 - ten years to the day that the Mono Lake National Scenic Area was established - the California State Water Resources Control Board (SWRCB) ruled in favor of the Public Trust Doctrine and against further extraction of water from the Mono Basin. Until such time that the lake level reaches 6392 average elevation, no water can be exported from the basin by Los Angeles Department of Water and Power (LADWP). This landmark decision was based upon a 16 year battle by environmental groups and a lengthy environmental review process which included 43 days of hearings by the Board. The State Water Resources Control Board's "Mono Lake Basin Water Right Decision 1631" orders the Los Angeles Department of Water and Power to submit a "waterfowl habitat restoration plan" that shall make recommendations on waterfowl habitat restoration measures and shall describe how any restored waterfowl areas will be managed on an ongoing basis. The plan shall focus on restoration measures in lake-fringing wetland areas. Additional plans for stream/riparian restoration and Grant Lake management were ordered.

LADWP is required to present plans to the Board by the end of August, 1995; an extension has was requested for the Waterfowl Habitat Restoration Plan; an extension to November 1, 1995 has been approved by SWRCB. To accomplish the planning and implementation phases of ecosystem restoration LADWP has established three technical advisory groups (TAGs). These groups participate in the choosing of consultants to write the plans, provide technical support and direction to the consultants, review the plan and help implement actions called for in the plans. The TAGs are made up of representatives of Federal, State, and local agencies as well as The Mono Lake Committee and Audubon Society.

The "Mono Basin Waterfowl Habitat Restoration TAG" has had several meetings. The group feels that restoring the natural role of fire in the wetlands will enhance their value for seasonal waterfowl use. The use of prescribed burns in lake fringing wetlands is likely to be the best way to enhance these systems for waterfowl use. Much of the otherwise open fresh water is clogged with debris from dead herbaceous vegetation. The proposed experimental burns are near Simons Spring where historically 15 percent of the waterfowl in the Mono Basin occurred (**Figure 1**, and **Figure 2**). At "point of reference", the area consisted of 496 acres of marsh, 2 acres of wet meadow, 200 acres of alkali meadow, 3 acres of wetland scrub, 164 acres of dry meadow edaphotypes. The proposed site includes small examples of most vegetation formation types associated with lake fringing wetlands. The 80 acre site is within the relicted lands of Mono Lake Tufa State Reserve.

Simon Spring is on the southeastern shoreline of Mono Lake located immediately west of the Simon's Springs Fault at a point just south of the north boundary of Section 7, T1N R28E. The project site is along the fault rift from the current lake level to around 6390 feet (all below the 1940 natural lake level of 6417).

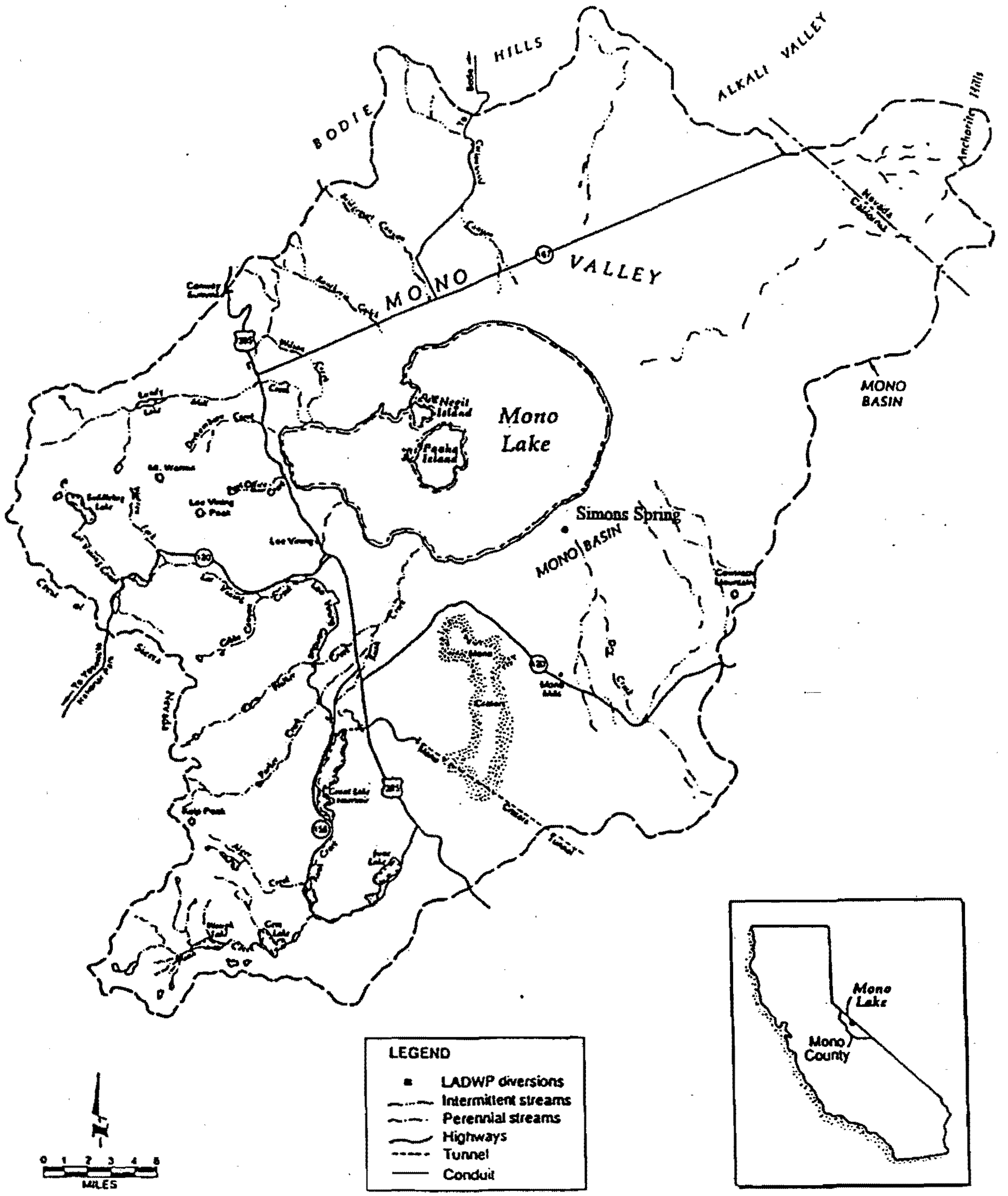

Figure 1. The Mono Basin (from Jones & Stokes Associates, 1993) with the project site is near Simons Spring.

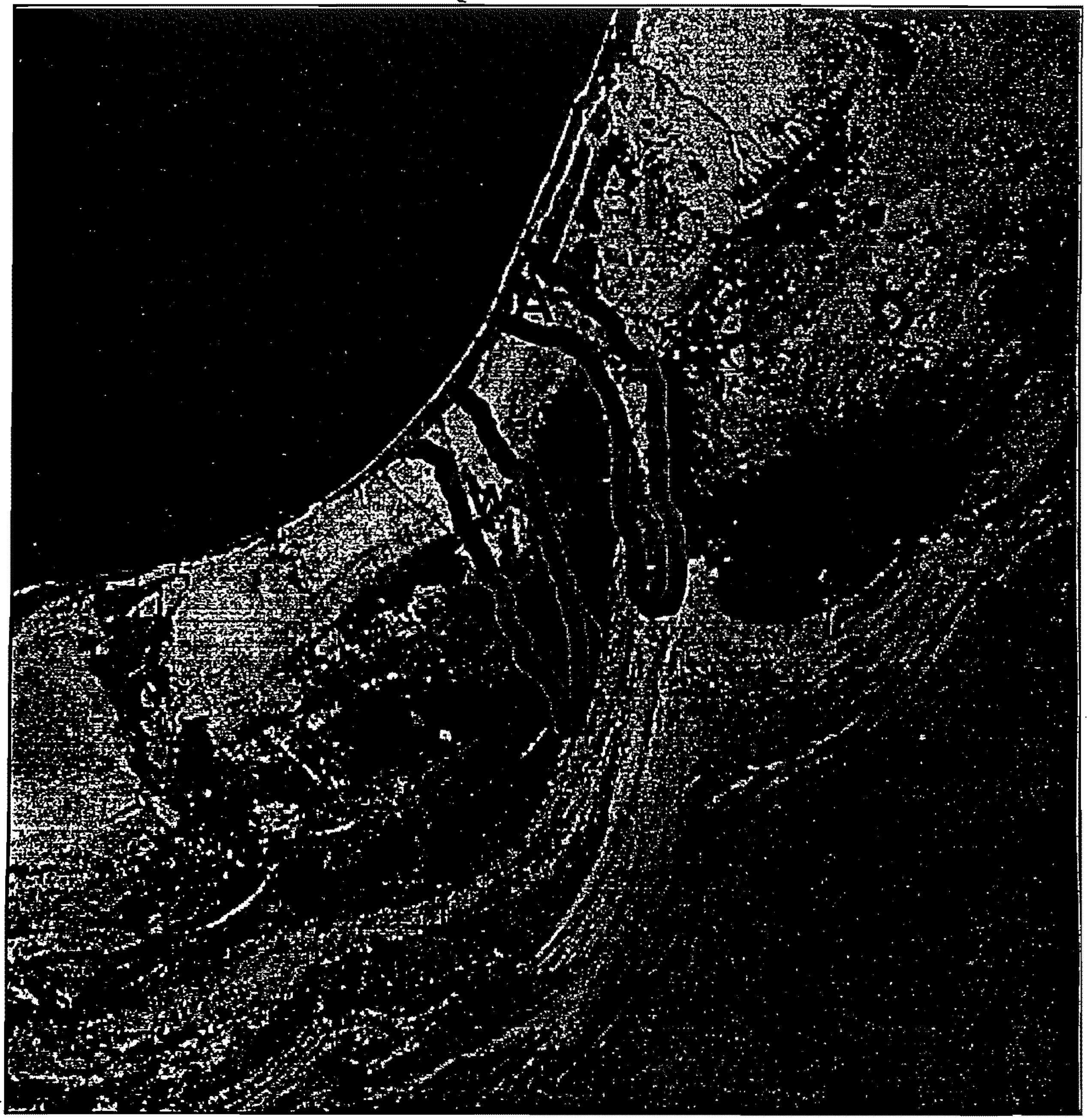

Figure 2. Simons Springs wetlands; "A" denotes area of autumn burn and "W" denotes area of winter burn.

ATMOSPHERIC FEATURES

The atmosphere serves as an important transport medium for cycling compounds through the ecosystem. The liquid, solid, and gaseous components of the atmosphere directly and indirectly affect the structure and function of an ecosystem. The liquid components, and to some extent, the solid and gaseous components of the atmosphere are considered in meteorology, the study of climate. The solid or particulate matter and gaseous components are considered under air quality.

Air Basins

California has been divided into 13 air basins. Within these basins the California Air Resources Board has established standards. These standards are defined for pollution control districts established within each air basin. Both legal air standards and actual measured standards should be listed when data is available. The Mono Air Basin is within Great Basin Valleys (No. 10) designation.

Mono Air Basin is among the cleanest air in California 89% of the time (20 micrograms total suspended particulate (TSP)). In a small area on the east shore, exceeds the California Standards for TSP (100 microns/cubic meter) for a 24 hr period 11% of the time during southwest winds (Cahill and Gill, 1988). Dust storms are visible in areas of extensive alkali playas; only 114 acres of alkali playas occur in the Simon Spring area.

Climate

A hierarchical classification of climate, is difficult to produce, especially since the quality of available data on California climates is "poor" according to Major (1977:12). Radiation is a fundamental feature of climate and net radiation (R_n) is the residual that runs earthly ecosystems. In California potential evapotranspiration approaches R_n as a limit. California has only eight stations recording total or global radiation. Annual values in California from 139 kcal/cm /yr at La Jolla on the south coast to 207 at Inyo Kern in Indian Wells Valley.

The elements of climate can best be approached through energy and waterbalance in the ecosystem. The best graphic representations of climates available are climatic diagrams which are pictures of monthly heat and water balance assuming 10° C = 2Omm precipitation (Major, 1977:18).

The world great climatic groups of Papadakis (1961:143-165) are used for the highest level of classification. He records three of his 10 great climatic groups for California. These are Desertic (3), Mediterranean (6), and Marine (7).

The world climatic classification of Walter and Lieth (1960-67) will be used here for the 2nd level of hierarchical classification. There are 9 climatic regions of Walter and Lieth found in California. Mono Lake occurs in the Arid (with cold season) VII 6 (IV) Climatic Region.

These 9 regions can be somewhat subdivided into 19 climatic types following the modified Köeppen classification revised for California climates by James (1966). Climatic types are based on the relationship of rainfall to potential evaporation, on temperature, and on the seasonal variation of drought.

The next lower classification is climatic zones as described and mapped in the "Sunset Western

Garden Book" (Dunmire, 1979:8-29). However in some cases, James is more detailed, especially in colder climates. Climatic zones are based on plant climates which are areas in which a common set of temperature ranges, humidity patterns, and other geographic and seasonal characteristics combine to allow certain plants to succeed and cause others to fail. The six most important factors are latitude, elevation, maritime influence, continental air mass influence, mountains and hills, and local terrain.

The Mono Basin climate is classified into the following hierarchy:

BA3 Desertic Climatic Group
BA32 Cold Arid Climatic Region (Region VII 6 (IV) of Walter and Lieth, 1960-67)
BA321 Cold Desert Climatic Type (Semiarid and Steppe Climates of James, 1966 with mean temperature of the coldest month at 32° F).
BA322 Cold Steppe Climatic Type (BSh of James, 1966, part of Zone 2 of Dunmire, 1979:9).

The Cold Steppe Cliamtic Type typically has snow in winter. In the northerly latitudes and interior areas where the continental air mass dominates the weather patterns. This type occurs around Salt Lake City, along parts of the Snake River of Idaho, the Grande Ronde and Burnt Rivers of Oregon, along the Columbia River and Spokane River in eastern Washington, and in the lakes region of the Idaho panhandle. In Colorado, the cold steppe is comprised of the river valleys of the western portion of the state and the low-elevation plains of the southeast corner of the state. This type makes up most of the high territory of New Mexico. The Cold Steppe that exists in California and Arizona is in higher elevations.

During a 20-year period, annual low temperatures ranged from -3° to - 34° F. The growing season averages about 150 days. Some places may have almost 200 frost-free days in a row.

The average annual precipitation in the Mono Basin varies from 5.7 in. at the east side of the lake to about 50 in. at higher elevations in the Sierra Nevada. Simon Spring area would be slightly higher than the east side station. Cain Ranch is 11.44 and would represent the closest station to the west; interpellation would put the precipitation at Simon Spring to be around 8 in. Approximately 75 percent of the annual precipitation occurs between October and March. October 12 is the average date of 20 degree F freeze; June 15 is the average last spring date of 32 degree minimum. The highest temperature is 90 degrees on August 6 and the lowest recorded temperature is 10 degrees on February 1.

Autumn winds average 4 miles per hour (mph) between 9:00 and 10:00 AM and increase to a daily maximum of 7.8 mph between 3:00 and 5:00 pm. Maximum hourly average wind speed is 28.9 to 31.8 respectively. Windless days however do occur during the Autumn. Wind direction is 175 degrees between 9:00 and 10:00 AM and swings to 238 degrees between 4:00 and 5:00 pm.

ARCHEOLOGICAL SENSITIVITY

According to Schumacher (1969), the oldest evidence of human occupation of the Mono Basin - Owens Valley area, is between 10,000 and 20,000 years ago. A human migration occurred from the east and northeast during this time frame. During ancient mesic times 4,000 to 5,000 years ago, the Pinto people occupied the region. It is believed that these people left the region when the climate became arid.

For the last 3,000 years the Paiute have occupied the region. The Mono Lake Paiute occupied the Mono Basin area, and the Owens River Paiute lived primarily in the Lower Owens River area. To the west of the basin lived the central and southern Sierra Miwok. The Mono Lake Paiute practiced what has been termed a "desert culture strategy", which depended upon flexibility of movement for most of the year, with groups congregating only during winter. The family was the primary settlement unit. During the spring and early summer, they lived along streams draining from the Sierra Nevada. There, they gathered seeds, berries, bulbs, and grasses, and hunted for game. When summer came, insects were collected. Alkali fly larvae dislodged by wind driven waves frequently formed extensive windrows of larva around portions of the Mono Lake shoreline. The protein rich insect resources were so important to the Mono Lake Paiute that thy called themselves Kuzedika, or "fly larvae eaters". Another major food source was Pandora moth larvae, which were collected from stands of Jeffrey pine. In the autumn, pine nuts were collected, mainly from pinyon pine (*Pinus monopylla*). Prong-horn and jackrabbits were driven into extensive drive fences.

Although little of the area around Mono Lake has been systematically surveyed, investigations to date have not identified any sites near the present lake margin. All recorded sites are located at elevations above 6,440 feet, which is well above the historical highstand and pre-diversion lake levels. One exception, marked by a few projectile points found in "dry pond beds", is located at 6,430 feet, which is also above these levels. Recorders speculate that the site was used for hunting waterfowl when the previous lake level supported fresh or brackish water in lake-fringing wetlands (Mono Basin EIR, May 1993). Pre-diversion Simons Spring was located approximately 1 mile south of the proposed burn area (see attached map). This a likely spot for encampment; and an archeological site does exist there. The proposed burn site is all below the natural lake level; therefore no archeological sites are likely to occur in the proposed burn area.

THE NATURAL ROLE OF FIRE IN THE MONO BASIN

The lightning era started at least 11,000 years ago (Langenheim and Greenlee, 1983). Lightning ignitions tend to be more prevalent at higher elevations on the west side of Mono Basin. Lightning set fires are more common in the summer; they usually creep down from the higher elevations of the

Sierra Nevada. Under natural conditions lightning fires are generally confined to areas between major streams. One lightning fire occurred in the early 1980's about a mile south west of Simons Spring; it burned around 1,000 acres.

In addition to lightning set fires, Native Americans utilized fire in a multitude of plant communities. Fire was one to the earliest human tools. The post-glacial California vegetation has evolved under a frequent fire regime. Aboriginal use of fire is considered to be natural by the DPR and is included in the restoration of natural fire cycles. These cycles are usually determined by studying fire scars and analyzing ash layers in soil profiles and sediment layers. Historical accounts are also researched.

Freshwater marshes provided many plant taxa utilized by the Kuzedika (Mono Piaute). One of the most valuable genera was tules (*Scirpus*) used for mat, boat, basketry, rug, blanket, duck decoys, and skirt construction and as a food. Common cattail (*Typha latifolia*) was used for fastening tules together in boat construction and domed-shaped houses covered with cattail mats; cattail tubers were eaten. Tule areas were burned to remove the old growth, and stimulate the production of long straight, new tules. Burning cleared out reed-choked marshes reducing the density and creating an edge effect. Burning allowed for space for waterfowl movement, for nesting sites, and for increased species diversity. Willows (*Salix*), and sedges (*Carex)* were utilized for basketry one year after burning. Periodic autumn burning was wide spread for indigenous peoples of the region; in October and November fires were set, on an annual basis (Anderson, 1993). These fires did not necessarily burn all areas, rather would creep through areas where fuel accumulation allowed and missing areas where fuel was not sufficient. Thus a mosaic of pyric successional communities occurred, some burning every year, others burning perhaps every five years on the average.

The authors do not know of any record of wetland burning by the Kuzedika however documentation of such burning by Kumeyaay to the south is provided by Shepeck (1993). " In marshy areas, cattails and reeds were regularly burned to improve their qualities as sources of both food and materials for technical purposes (e.g., they supplied house thatching, boat reeds, and a cane stalk which was used for arrow shafts). They, along with basket grasses, were spot burned every three years; in addition, the root areas were dug around and heavy root clumps were divided--often for the purposes of establishing the plant elsewhere." Irrigation and planting occurred in Owens Valley, the Walker River drainage, and probably Pahrump Valley and Ash Meadows in southwestern Nevada. This irrigation created wetlands for the production of wild-hyacinth or blue dicks (*Dichelostemma pulchella*) and yellow nut-grass *(Cypresus esclentus*). The tubers of these plants were utilized as food; Cultivated seed plants included lovegrass (*Eragrostis mexicana* ssp. *virescens*?), wheat grass (*Elymus trachycaulus ssp. trachycaullus*) Great Basin wildrye (*Leymus cinereus* or *Leymus triticoides*). sunflower (*Helianthus nuttallii?*) and white pigweed or pitseed goosefoot (*Chenopodium berlandieri*). western yellow cress (*Rorippa curvisililiqua*) (Lawton, et al 1993). Although not mentioned in historical accounts, fire was undoubtedly part of this wild plant cropping system.

The Kuzedika nearest neighbors to the west were the Yosemite Miwok who were trading partners. Juaquin Miller visited Yosemite Valley and in 1887 noted his observations: "In the Spring...the old squaws began to look for the little dry spots of headland or sunny valley, and as fast as dry spots appeared they would be burned. In this way fire was always the servant, never the master...By this means, the Indians always kept their forests open, pure and fruitful, and conflagrations were unknown." (as quoted in Biswell, 1968:48) The Kuzedika obviously new of the management activities of their neighbors an would have adapted those necessary to manage their resources.

PRESCRIPTION - Autumn and Winter Burns

Desired Fire Characteristics

A hot, head fire is desired to reduce the mulch layer and dead standing plant material. The fire must spread across marsh edaphotopes and produce open water; therefore a head fire is likely to be more successful than a backing fire. Winter burn is expected to be more patchy with some areas not burned.

Ignition pattern: from southeast corner along east line; beginning with a backing fire. If intensity is not great enough to burn all dead material, begin a head fire from the southwest corner of burn plots (**Figure 3**,and **Figure 4**).

Weather (based on 14:00 hr. observation):

Min High: 60; Min RH: 25% (Autumn); Min High: 50: Min RH 20% (Winter)
Max High: 85; Max RH: 80% (Autumn); Max High: 85: Max RH 75% (Winter)

Winds: 0-10 MPH from northwest or west (Autumn); Winds: 5-15 MPH (Winter)

Date: Mid October - Mid November, 1995 - after first killing frost and marsh vegetation turns brown (Autumn). Mid February - March, 1996 - after dry period of a week or more (Winter)

Smoke Management

There are no residences that will be impacted by smoke. Burning will occur only on designated burn days.

Personnel and Equipment

Pre-burn: (Autumn) 1 CCC/Americorps day ; 1 DPR ranger day; 4 Resource Ecologist Days
Burn: A qualified Level III burner will serve as burn boss (Gary Walter or his designed) 6-8 DPR staff, 1 DPR engine, 1 USFS engine with their crews, 5 - 10 gal fuel.
(Winter) 2 CCC/Americorps day ; 1 DPR ranger day; 2 Resource Ecologist Days
Burn: A qualified Level III burner will serve as burn boss (Gary Walter or his designed) 6-8 DPR staff, 1 DPR engine, 5 - 10 gal fuel.

Post-burn: No mop-up is anticipated for a marsh - meadow burn. The control lines will be patrolled until the embers along these lines are completely cold.

Preburn Tasks

Fireline Construction: Most of the Autumn burn plot is surrounded by tufa and no lines need to be constructed in that area. Where tufa is broken by marsh vegetation, lines to standing water will be constructed using a weed-whips. The cut material will be deposited in the burn area for consumption. The winter burn plot will require fire lines to be cut through marsh and mesic grassland areas

Weather Monitoring Activities: Local Rangers to monitor the weather for one or more weeks prior to burns

Agency Notification: US Forest Service, Air Resources Board

Public Information: Mono Lake Visitor Center, Mono Lake Committee, Ducks Unlimited

Safety: A standard first aid kit will be included in the equipment necessary for the burn. Medical personnel and equipment are available in LeVining less than an hour from the site.

Budget

Ttl: 17 person days + one crew day (Autumn); 15 person days + 2 crew days (Winter)

Estimated Cost: $6000 (Autumn); $7000 (Winter) (Not including ecosystem monitoring) Note: USFS Engine and Crew not included in this estimate. The DPR State Wide Burn Team has the expertise and equipment necessary to conduct these burns.

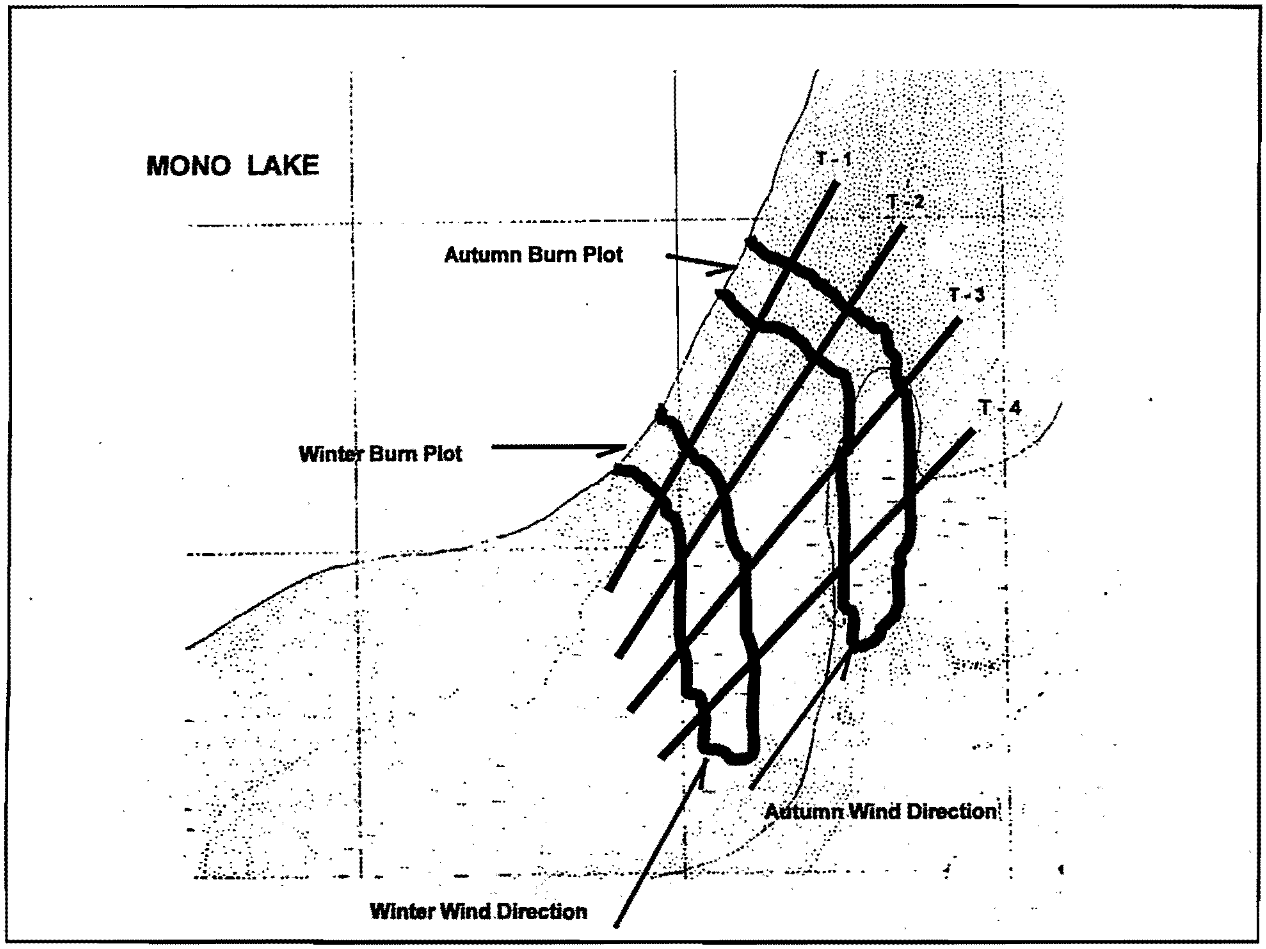

Figure 3. Outline of prescribed burn areas near Simons Spring, Mono Lake. Baseline - monitoring transects are noted as T-1 through T-4. Autumn wind direction varies from 187 degrees at 9:00 to 238 at 17:00 hrs; Winter wind direction varies from 187 degrees at 10:00 to 212 at 16:00 hrs. Autumn average wind speeds for these hours varies from 5 mph at 10:00 to 7.8 between 15:00 and 17:00 hrs; maximum wind speed varies between 29.1 at 10:00 and 31.8 at 15:00 to 17:00 hrs. Winter average wind speeds for these hours varies from 4.2 mph at 10:00 to 5 between 15:00 and 16:00 hrs; maximum wind speed varies between 26 at 12:00 and 32 at 10:00 hrs.

SITE SPECIFIC VEGETATION

The site is dominated by herbaceous vegetation with scattered shrubs (*Chrysothamnus nauseosus*) occurring only on the tufa ridges that surround the site. The cover photo and **Figure 4** illustrate the character of the vegetation on the Autumn burn plot. Semiterrestrial or wetland vegetation consist of a mosaic of graminoid types. Stands of common cattail (*Typha latifolia*) of Nevada rush (*Juncus nevadensis*) and to a lesser extent, stands of two sedges (*Carex rostrata*?, *Carex praegracilsi*?, *Carex douglasi*?, *Carex diandra* ?, *Carex nebrascensis*? or *Carex lasicarpa*?). Associated with the wetland ecotopes are various meadow or grassland environments. Wet meadow ecotopes include stands of tufted hairgrass (*Deschampsia cespitosa* ssp. *cespitosa*). Baltic rush (*Juncus balticus*) often dominates mesic meadow ecotopes, and desert saltgrass (*Distichlis spicata* var. *stricta*) is found on xeric meadow edaphotopes. The wetland and meadow ecotopes support a scattering of uncommon taxa among the dominates; these include *Cryptantha circumscissa, Puccinellia lemmonii, Descurainaia pinnata* ssp. *halictorum*, *Erigeron pumilus* ssp. *intermedius, Epilobium adenocaulon* var. *parishii, Solidago spectabilis, Eriogonum ampullaceum*, and *Castilleja exilis*. See Appendix A for hierarchial classification of plant communities found at Simons Spring.

Figure 4. View of the upper portion of the Autumn burn plot showing terrestrial vegetation along the tufa ridges and semiterrestrial (wetland) vegetation between tufa ridges.

ECOSYSTEM MONITORING

It is important to establish the vegetation\wildlife transects as soon as possible. Many plant taxa are only identifiable when in bloom. The changes in biomass and species composition of plants needs to be documented in order to measure the success of this management decision. Waterfowl numbers and species need to accessed just before the prescribed burn and periodically after the burn. Seasonal monitoring is necessary for several years. Appendix B contains specific protocol for each type of monitoring outlined below.

Vegetation

Mapping: Prior to experimental burns a vegetation map of the Simons Springs Fault wetlands should be completed prior to the experimental burns. This should be drawn from areal photographs at a scale of 1:500. Photos should provide full stereoscopic coverage of the wetlands. False color infra-red transparencies or prints of 9-9 in format should be used for interpretation of vegetation. The map should be delineated to the plant community or plant association level of detail. The wetlands should be re-mapped in the spring and fall of 1996. Locations of sensitive taxa should be pinpointed on the map. Utah monkeyflower (*Mimulus glavratus* ssp. *utahensis*) may occur in the wetlands along the shoreline. Mono Lake lupine (*Lupinus duranii*) and Mono Lake milk-vetch (*Astragalus monoensis* var. *monoensis*) may occur on the tufa ridges.

Transects: The vegetation monitoring protocol will utilize the point-intercept method (100-m, 100 point transects) following procedures outlined in the National Park Service Western Regional Fire Monitoring Handbook (with the exception of transect length). This method records taxa and their height occurring at regular, predetermined intervals along the transect. Ecological attributes that can be quantified from this method include species composition, frequency of occurrence, height, and cover. At least 6 transect lines will be placed across the burn site to cover all vegetation formation types on the site. Ends of transects will be marked by fence posts and will be photographed from each end prior to the prescribed burn. Each transect line will extend beyond the perimeter of the burn for at least 150 meters. Each end will contain a control transect; each transect line will have at least 2 transects in the burn site. These will be picked to represent various vegetation formation types within the burn site.

Standing Crop: Biomass can be estimated for the above ground portions of herb communities or understory associations. Subplots are clipped to 2.5 cm. (1 in.) in 10 x 10 cm subplots. Fresh weight portions can be separated into forbs and graminoids. Grasses may be further separated into annual and perennial or native and alien. These categories may also be estimated. Dry weight is obtained after oven drying of 60°C (140°F) for 24 hours.

Effects of fire on organic layers and the soil surface: Preburn baseline data should include measurements of the organic layers present. These layers may include slash, litter, and/or duff layers. Duff reduction pins should be placed in permanent plots on a 10 cm, 1 m, or 10 m grid (dependent on size of plot 1 m2, 10 x 10 m, 100 x 100 m etc.). The pins are inserted to the top of the duff layer in tree or shrub formation classes and to the top of the litter layer in the herb formation class. These are then measured post-burn for duff and/or litter reduction on the plot.

traps, sweep samples and vacuum samples. Sampling should be done when winds are less than 10 mph and under clear, warm conditions. Sampling frequency along transects should be determined by the entomologist conducting the sampling.

Budget

Ttl: 20 person days for baseline establishment prior to Autumn burn; 35 person days for post burn monitoring

Estimated Cost: $10,000 (Autumn); 17,000 (Spring, Summer and Autumn 1996). Local expertise is desired, especially biologists who have worked in the basin. DPR has expertise in all monitoring activities except invertibrates. Rangers, Resource Ecologists and Environmental Service Interns with various specialties can be drawn upon. However, back-filling of current workload would be required.

APPENDIX A

HIERARCHIAL CLASSIFICATION OF VEGETATION FOUND AT SIMONS SPRINGS FAULT AREA

(Extracted from Barry, 1995)

G741 TERRESTRIAL ENVIRON CLASS

G7411 **True Terrestrial Environ Subclass**

G74113 **Herb Formation Class**

The herb formation class includes all vascular plant communities dominated by non-woody vascular plants. This formation subclass is world wide in distribution, but is more important in polar and temperate regions.

G741133 **Graminoid Formation Subclass**

The graminoid formation subclass contains groups of communities dominated by grasses or grass-like herbs (sedges, rushes, etc.). The term grasslands is commonly used for this important formation subclass. Graminoid communities are best developed in temperate regions but also occur in tropical and polar regions. Communities of the graminoid formation subclass have generally developed in regions of the world where fire is frequent, either man caused (aboriginal burning, escaped fires, and more recently prescribed burning) or natural (lightening and occasionally volcanic activity).

G7411331 Perennial Graminoid Formation Group

The perennial graminoid formation group contains communities dominated by perennial grasses or grass-like herbs

G7411331 B Perennial Tussock Graminoid Formation Subgroup

The perennial tussock graminoid formation subgroup contains communities dominated by perennial graminoids which are densely tufted with leaves mostly at the base and erect or somewhat spreading clump of stems.

G7411331 BDECA00 *Deschampsia caespitosa* "Tufted Hairgrass" Graminoid Formation Type

Ecological realm. - Nearctic

G7411331 BDECA005 *Deschampsia caespitosa* "Tufted Hairgrass" Short Graminoid Formation

G7411331 BDECA005 B *Deschampsia caespitosa* "Tufted Hairgrass" Prairie Subformation

G7411331 BDECA005 B1 *Deschampsia caespitosa* "Tufted Hairgrass" Short Prairie Community

Description. - The tufted hairgrass (*Deschampsia caespitosa*) short prairie community is a primary successional community on the lake shores of Mono Lake. Shoreline that has emerged since water diversion began in 1941 support this community on wet to mesic sites. Permanent plots established at Simon Springs by Barry and S. Harrison in the summer of 1983.
Ecological province. - Sierra Nevada - Cascade, Great Basin - Columbia-Snake Plateau
Locations, ownerships, and natural area #. - This community is protected at Mono Lake Tufa State Reserve and Tuolumne Meadows within Yosemite National Park.

G7411331 C Perennial Sod Graminoid Formation Subgroup

The perennial sod graminoid formation subgroup contains communities dominated by graminoids with erect flowering stems and creeping stems above (stolons) or below (rhizomes) ground.

G7411331 CDISPS0 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Graminoid Formation Type

Definition and composition. - The desert saltgrass formation type is often of low diversity. Plots at Simon Spring, Mono Lake Tufa State Reserve contained only tree other taxa with Scirpus nevadensis the most common. Occasionally *Muhlenbergia richardsonis* and *Gilia micromeria* were recorded in the plots.
Ecological realm. - Nearctic
Variants and associated vegetation. - The desert saltgrass graminoid formation type is closely related to the desert saltgrass semiterrestrial graminoid formation type (see pg. 23) and the desert saltgrass semiterrestrial herb formation type (see pg. 24).

G7411331 CDISPS05 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Short Graminoid Formation

G7411331 CDISPS05 B *Distichlis spicata* var. *stricta* "Desert Saltgrass" Short Prairie Subformation

G7411331 CDISPS05 B1 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Short Prairie Community

Description. - The desert saltgrass (*Distichlis spicata* var. *stricta*) short prairie community forms solid stands around alkali seeps and alkali flats.
Ecological province. - Californian, North American Desert
Locations, Ownerships, and Natural Area #. - This community is protected at Anza-Borrego Desert State Park, San Luis Island National Refuge, Grasslands State Park project, Death Valley National Monument, and Mono Lake Tufa State Reserve. It has been noted at Salt Creek Drainage, Martin Ranch within the Interior Coast Range of western Fresno County.

G7412 **Semiterrestrial (Wetland) Environ Subclass**

G74123 **Semiterrestrial Herb Formation Class**

The semiterrestrial herb formation class includes all wetland vascular plant communities dominated by non-woody vascular plants. This formation subclass is world wide in distribution, but is more important in polar and temperate regions.

G7412331 Semiterrestrial Perennial Graminoid Formation Group

The semiterrestrial perennial graminoid formation group contains communities dominated by perennial grasses or grass-like herbs

G7412331 C Semiterrestrial Sod Perennial Graminoid Formation Subgroup

The semiterrestrial perennial sod herb formation subgroup contains communities dominated by wetland herbs with erect flowering stems and creeping stems above (stolons) or below (rhizomes) ground.

G7412331 CDIST00 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Semiterrestrial Graminoid Formation Type

Definition and composition. - The desert or interior saltgrass (*Distichlis spicata* var. *stricta*) semiterrestrial graminoid formation type often forms near monotypical stands. It is nearly equivalent to the "alkali grassland" of Bittman, 1985) This formation type is often characterized by occasional shrubs of seepweed (*Suaeda moquinii*), pickleweed (*Salicornia subterminalis*), and alkali heath (*Frankenia grandifolia* var. *campestris*), and suffrutescent annuals such as spikeweed (*Hemizona pungens*) and low seepweed (*Suaeda depressa* var. *erecta*), interspersed with stands of annual and perennial grasses. Native grass species include desert salt grass, Nuttall's alkali grass (*Puccinellia nuttalliana*), California alkali grass (*Puccinellia simplex*), hair grass (*Deschampsia danthonoides*), and alkali sacaton (*Sporobolus airoides*). Alien grasses such as foxtail (*Hordeum* spp.), red brome (*Bromus rubens*), and rye grass (*Lolium multiflorum*) are also common. The desert saltgrass formation type occurs in Colusa and Yolo Counties at the two northern populations of *Cordylanthus palmatus* (Showers, 1988:16-18).

Ecological realm. - Nearctic

Geographic distribution. - This type is found in the San Juaquin Valley, Great Basin, Colorado River Valley Desert, and eastward to Texas (Munz, 1974:963).

Ecological relationships. - This type occurs in seeps and marshes on alkali soils to elevations of 7000 feet (Munz, 1974:963). It occurs on poorly-drained alkaline soils subject to overland winter flooding. It appears that this formation occurs on slightly higher ground within sinks where the duration of inundation is shorter than with alkali scrub ecosystems (Bittman 1985). This type occurs in interior cold temperate marshlands within the "Great Basin desertscrub" of Minckley and Brown (1982:245-247).

Variants and associated vegetation. - The desert saltgrass semiterrestrial graminoid formation type is closely related to the desert saltgrass semiterrestrial herb formation type (see pg. 24) and the desert saltgrass graminoid formation type (see pg. 22). It shares dominance with goldfield (*Lasthenia platycarpha*) at San Luis Island National Wildlife Refuge, San Juaquin Valley, California (Barry, 1972:55).

G7412331 CDIST005 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Short Semiterrestrial Graminoid Formation

Definition and composition. - The desert or interior saltgrass type often forms monotypical, mat-like stands.

Ecological realm. - Nearctic

Geographic distribution. - Communities of the desert saltgrass type may be found in the San Joaquin Valley, the Great Basin, and the Colorado Desert to Texas. The type ranges to elevations of 2130 meters (7000 feet) (Munz, 1974:963).

Ecological relationships. - Alkali seep and marsh edaphotopes support desert saltgrass communities (Munz, 1974:963). Desert saltgrass communities also occur in the "interior cold temperate marshlands within the Great Basin desert scrub" of Minckley and Brown (1982:245-247). This type dominates dryer alkali marsh edaphotopes along Salt Creek, Death Valley National Monument, San Bernardino County, California, where desert saltgrass communities occur from below sea level to more than 2,150 m elevation.

Variants and associated vegetation. - It shares dominance with *Lasthenia platycarpha* at San Luis Island National Wildlife Refuge, San Joaquin Valley, California (Barry, 1972:55). In the desert regions of California characteristic species include a waternymth (*Najas marina*), western miterwort (*Nitrophila occidentalis*), broadleaf pondweed (*Potomogeton latifolius*), sago pondweed (*P. pectinatus*), widgeongrass (*Ruppia maritima*), and horned-pondweed (*Zannichellia palustris*) (Holland, 1986:43).

G7412331 CDIST005 B *Distichlis spicata* var. *stricta* "Desert Saltgrass" Semiterrestrial Closed Graminoid Subformation

G7412331 CDIST005 B1 *Distichlis spicata* var. *stricta* "Desert Saltgrass" Semiterrestrial Short Closed Graminoid Community

Description. - The desert saltgrass (*Distichlis spicata* var. *stricta*) semiterrestrial short closed graminoid community forms a turf on alkali seeps and flats. Alkali barley (***Hordeum depressum***) and alkali sacaton (*Sporobolus airoides*) are frequently present.

Ecological Province. - Californian, Sonoran, Great Basin - Columbia-Snake Plateau

Locations, ownerships, and natural area #. - This community is found adjacent to Col. Allensworth State Historical Park, Salt Creek Drainage on the Martin Ranch within the Interior California Coast Ranges in Fresno County. According to Minckley and Brown (182:247,260) it occurs in Obed Meadows south of Saint Johns, Apache County, Arizona at 2000 m elevation; this meadow is made up almost exclusively of desert salt grass short prairie. This community is protected in Anza-Borrego Desert State Park and the Grasslands project, Death Valley National Monument where it occurs from below sea level, and it is protected at Mono Lake Tufa State Reserve.

G7412331 CSCAM20 *Scirpus americanus* "American Tule" Semiterrestrial Graminoid Formation Type

Definition and composition. - The American bulrush (*Scirpus americanus*) semiterrestrial graminoid formation type is part of the "Montane, Plains and Great Basin Marshlands" of Minckley and Brown (1982:245). Common associates include Lyngbye sedge (*Carex lyngbyei*), Pacific sedge (*Carex obnupta*), coastal saltgrass (*Distichlis spicata* var. *spicata*), Baltic rush (*Juncus balticus*), soft rush (*Juncus effusus*), silverweeds (*Potentilla* spp.), and Pacific alkali bulrush (*Scirpus robustus*) (MacDonald, 1977:275).

Ecological realm. - Nearctic

Geographic distribution. - The American bulrush type occurs along the California coast from Del Norte County to Ventura County, in the Great Central Valley of California, in Inyo, Mono, Lassen, and Modoc Counties; occasionally in San Bernardino and Imperial Counties, California (Mason, 1969:315) and in the Great Basin (Minckley and Brown, 1982:245).

Ecological relationships. - Brackish marshes in Humboldt Bay are dominated by this type which is replaced with tule bulrush (*Scirpus acutus*), then with broadleaf cattail (*Typha latifolia*) in progressively less saline ecotopes (MacDonald, 1977:275). This type occurs in alkaline stream side marshes in the interior California Coast Ranges (Barry, 1985). Medium wet alkaline to fresh water marshes around Mono Lake are dominated by American Bulrush and Pacific alkali bulrush (*Scirpus robustus*) (Burch, et al., 1977:115).

Variants and associated vegetation. - The montane, plains and Great Basin marshlands of Minckley and Brown (1982:245) may contain broadleaf cattail (*Typha latifolia*), tule bulrush (*Scirpus acutus*), rushes (*Juncus* spp.), sedges (*Carex* spp.) and desert saltgrass (*Distichlis spicata* var. *stricta*).

Bolsa Bay upper salt marsh ecotopes are dominated by American bulrush communities which contain near pure stands of coastal saltgrass (*Distichlis spicata* var. *spicata*) and Hottentot-fig (*Carpobrotus edulis**). Common tule (*Scirpus acutus*) is locally abundant; saltbush (*Atriplex coulteri?*) is common and fleshy jaumea (*Jaumea carnosa*) and deer-weed (*Lotus scoparius*) occur occasionally.

At Benicia State Recreation Area, Southampton Bay mudflats, brackish water marsh edapotopes are dominated by an American bulrush community which includes fleshy jaumea (*Jaumea carnosa*), common pickleweed (*Salicornia virginica*), common reed (*Phragmites australis (communis)*) and tule bulrush (Showers, 1987:11).

G7412331 CSCAM205 *Scirpus americanus* "American Tule" Short Semiterrestrial Graminoid Formation

G7412331 CSCAM205 B *Scirpus americanus* "American Tule" Semiterrestrial Closed Graminoid Subformation

G7412331 CSCAM205 B1 *Scirpus americanus* "American Tule" Semiterrestrial Short Closed Graminoid Community

Ecological Province. - Californian
Locations, ownerships, and natural area #. - This community forms a narrow ribbon along the banks of Cantua Creek, Martin Ranch in the Interior California Coast Ranges of western Fresno County.

G7412331 CSCNE00 *Scirpus nevadensis* "Nevada Bulrush" Semiterrestrial Graminoid Formation Type

Definition and composition. - The Nevada bulrush (*Scirpus nevadensis*) semiterrestrial graminoid formation type contains alkali muhly (*Muhlenbergia asperifolia*), foxtail barley (*Hordeum jubatum**), *Polypogon* spp. and desert saltgrass (*Distichlis stricta* var. *spicata*) (Burch, et.al., 1977:115).
Ecological realm. - Nearctic
Geographic distribution. - This type is known from Gull Bath, Warm Springs, Simons's Springs and Paoha Island on the west shores of Mono Lake, Mono County, California.
Ecological relationships. - This type occurs in dryer marsh edaphotopes around springs.

G7412331 CTYLA00 *Typha latifolia* "Broadleaf Cattail" Semiterrestrial Graminoid Formation Type

Definition and composition. - The broadleaf cattail (*Typha latifolia*) semiterrestrial graminoid formation type consists of communities which are often made up of pure stands of broadleaf cattail. However these stands may be mixed with narrowleaf cattail (*Typha angustifolia*) and southern cattail (*Typha domingensis*). Communities of the broadleaf cattail type have a wide variety of associated taxa.
Geographic distribution. - The broadleaf cattail type is widely distributed in the Northern Hemisphere (Mason, 1969:41), and Eurasia. The type occurs to 1,500 meters (5,000 feet) elevation (Munz, 1974:1012).
Ecological relationships. - This type occurs in sub-alkaline and freshwater marsh (Munz, 1974:1012) edaphotopes on coastal stream/river beds, channel margins and banks in floodplain basins which are semi-permanently flooded and permanently saturated (Ferren, 1988:39). Seasonally to permanently flooded margins of channels, springs and ponds in fresh to mixosaline edaphotopes of Bailey's (1980:54-62) Colorado Plateau and American Desert provinces (Ferren, 1988:45-47). At Sinkyone Wilderness State Park, Mendocino County, broadleaf cattail communities form concentric zones around sag pond edaphotopes on Kneeland soils with Franciscan sandstone parent material. These sag ponds occur on sea terraces at 30 meters (100 feet) elevation. In deeper water broadleaf cattail is displaced by the aquatic coontail (*Ceratophyllum demersum*) while

concentric zones of common spikerush (*Eleocharis palustris*), Pacific bog rush (*Juncus effusus* var. *pacificus*), and field horsetail (*Equisetum arvense*) occur as water becomes shallower (Bowcutt, 1987:117). The later two taxa may be either wetland or riparian.

Variants and associated vegetation. - Representative taxa in the Colorado Plateau and American Desert ecological provinces of Bailey (1980:54-62) include *Berula erecta*, *Carex lanuginosa*, Douglas waterhemlock (*Cicuta douglasii*), spikerushes (*Eleocharis* spp.), Nuttall sunflower (*Helianthus nuttallii*), Torrey rush (*Juncus torreyi*), common monkeyflower (*Mimulus guttatus*), giant reed (*Phragmites australis*) and bulrushes (*Scirpus* spp.) (Ferren, 1988:47). On the shores of Mono Lake, in the Great Basin physiographic region, Burch, et al. (1979:115) found this type associated with small-Indian paintbrush (*Castelleja exilis*), *Epilobium adenocaulon*, common monkeyflower (*Mimulus guttatus*), and alkali buttercup (*Ranunculus cymbalaria*).

In the California Chaparral ecological province of Bailey (1980:41-43), associated species include *Arenaria paludicola*, *Berula erecta*, Gambell bittercress (*Cardamine gambellii*), *Chenopodium macrospermum*, Bolander waterhemlock (*Cicuta bolanderi*), *Oenanthe sarmentosa*, yellow waterlily (*Nuphar polysepalum*), *Juncus xiphioides*, marsh purslane (*Ludwigia peploides*), *Lythrum californicum*, *Polygonum amphibium*, pale smartweed (*Polygonum lapathifolium*), water smartweed (*Polygonum punctatum*), watercress (*Rorippa nasturtium-aquaticum*), *Rorippa palustruis* ssp. *occidentalis*, docks (*Rumex* spp.), tule bulrush (*Scirpus acutus*), American bulrush (*Scirpus americanus*), California bulrush (*Scirpus californicus*), panicled bulrush (*Scirpus microcarpus*), *Scirpus pungens*, broadfruit burreed (*Sparganium euycarpum*), *Stachys chamissonis*, and water speedwell (*Veronica anagallis-aquatica*) (Ferren, 1988:39-40). At Benicia State Recreation Area, adjacent to Southampton Bay, Showers (1987) reports a broadleaf cattail - Pacific alkali bulrush (*Scirpus robustus*) community with a coastal saltgrass (*Distichlis spicata* var. *spicata*) and common pickleweed (*Salicornia virginica*) understory. In San Mateo County, a broadleaf cattail - California bulrush community occurs at Pescadero Marsh Natural Preserve within Pescadero State Beach. Pacific alkali bulrush is present but of less importance than at Southampton Bay. Common pickleweed (*Salicornia virginica*) and a sneezeweed (*Helenium* sp.) make up the understory of this type at Pescadero Marsh (Barry, 1985).

G7412331 CTYLA003 *Typha latifolia* "Broadleaf Cattail" Semiterrestrial Tall Graminoid Formation

G7412331 CTYLA003 B *Typha latifolia* "Broadleaf Cattail" Semiterrestrial Closed Graminoid Subformation

G7412331 CTYLA003 B1 *Typha latifolia* "Broadleaf Cattail" Semiterrestrial Tall Closed Graminoid Community

Description. - The broadleaf cattail (*Typha latifolia*) semiterrestrial tall closed graminoid community is a highly diverse community of sub-alkali and freshwater marsh edaphotopes.

Ecological Province. - Californian

Locations, ownerships, and natural area #. - This community is found at Southhampton Bay. It is protected at Mono Lake Tufa State Reserve, Pescadero Marsh Natural Preserve within Pecadero State Beach, and Benicia State Recreation Area.

APPENDIX B

TAXA LISTS FOR SIMONS SPRINGS FAULT AREA

(IN PROGRESS)

CALIFORNIA

WILDLIFE HABITAT RELATIONSHIPS SYSTEM

10/15/95

Supported by the
CALIFORNIA INTERAGENCY WILDLIFE TASK GROUP
and maintained by the
CALIFORNIA DEPARMENT OF FISH AND GAME
Database Version: 5.0
This copy of the database is owned by: Calif. Dept. of Parks & Recreation

NOTICE

The lists of animals generated by the California Wildlife Habitat Relationships (WHR) Database provide predictions for all of the regularly occurring species of terrestrial vertebrates potentially found in the habitat(s), geographic location(s) and season(s) specified. In most cases, the number of species predicted by the database exceeds the number detected in field studies. However, the probability of detecting all predicted species increases when larger land areas and longer time periods are considered.

Differences between predicted and observed lists is due, in part, to the underlying assumptions of the WHR system (see Airola 1988). The assumptions most influencing the species list are:

> (1) habitats are available in the proper mix for species requiring a juxtaposition of two or more habitats; (2) all special habitat elements are present in adequate amounts for species requiring the elements; and (3) adequate amounts of habitat are available.

herefore, the user should compare the species lists produced by the compter database with the species accounts in the appropriate volume of California's Wildlife (Zeiner et al. 1988, Zeiner et al. 1990). The accounts allow WHR users to refine the redicted species list by eliminating species unlikely to occur in the study area because, for example, a special habitat element is absent, or the area is outside the species' known geographic range.

Finally, it must be acknowledged that wildlife populations are inherently dynamic in space and time, and competition, barriers, and historic overharvesting also influence wildlife populations. Therefore, differences between predicted and observed species lists will occur. The predicted species lists are intended to be used by qualified Wildlife Biologists in conjunction with the supporting WHR publications (Airola 1988, Mayer and Laudenslayer 1988, Zeiner et al. 1988, Zeiner et al. 1990). At a minimum, field observations of the study area are needed to identify WHR habitat types and stages and special habitat elements.

SPECIES DETAIL LIST SELECTION CRITERIA:

Locations:
MONO OWENS LAKES HYDROLOGIC REGION

Habitats:

1 FRESH EMERGENT WETLAND	SHORT HERB	DENSE	60-100%	(1D)
2 FRESH EMERGENT WETLAND	TALL HERB	DENSE	60-100%	(2D)

Elements Included:

ALGAE
AMPHIBIANS
AQUATICS, EMERGENT
AQUATICS, SUBMERGED
BARREN
BIRDS, LARGE
BIRDS, MEDIUM
BIRDS, SMALL
DUFF
EGGS
FLOWERS
FORBS
FUNGI
GRAMINOIDS
GRASS/WATER
INSECTS, FLYING
INSECTS, TERRESTRIAL
INVERTEBRATES
INVERTEBRATES, AQUATIC
LAKES
LAYER, HERBACEOUS
LICHENS
LITHIC
LITTER
MAMMALS, LARGE
MAMMALS, MEDIUM
MAMMALS, SMALL
MOSS
MUD FLATS
PONDS
REPTILES
SALT PONDS
SEEDS
SOIL, SALINE
SOIL, SANDY
SPRINGS
SPRINGS, MINERAL
WATER
WATER, SLOW

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY
A029	GREAT BASIN SPADEFOOT	*Scaphiopus intermontanus*	PELOBATIDAE
A031	BLACK TOAD	*Bufo exsul*	BUFONIDAE
A032	WESTERN TOAD	*Bufo boreas*	BUFONIDAE
A039	PACIFIC TREEFROG	*Hlya regilla*	HYLIDAE
A045	NORTHERN LEOPARD FROG	*Rana pipiens*	RANIDAE
A046	BULLFROG	*Rana catesbeiana*	RANIDAE
B006	PIED-BILLED GREBE	*Podilymbus podiceps*	PODICIPEDIDAE
B009	EARED GREBE	*Podiceps nigricollis*	PODICIPEDIDAE
B010	WESTERN GREBE / CLARK'S GREBE	*Aechmophorus occidentalis / Clarkii*	PODICIPEDIDAE
B049	AMERICAN BITTERN	*Botaurus lentiginosus*	ARDEIDAE
B050	LEAST BITTERN	*Ixobrychus exilis*	ARDEIDAE
B051	GREAT BLUE HERON	*Ardea herodias*	ARDEIDAE
B053	SNOWY EGRET	*Egretta thula*	ARDEIDAE
B057	CATTLE EGRET	*Bubulcus ibis*	ARDEIDAE
B058	GREEN-BACKED HERON	*Butorides striatus*	ARDEIDAE
B059	BLACK-CROWNED NIGHT HERON	*Nycticorax nycticorax*	ARDEIDAE
B067	TUNDRA SWAN	*Cygnus columbianus*	ANATIDAE
B075	CANADA GOOSE	*Branta canadensis*	ANATIDAE
B077	GREEN-WINGED TEAL	*Anas crecca*	ANATIDAE
B079	MALLARD	*Anas platyrhynchos*	ANATIDAE
B080	NORTHERN PINTAIL	*Anas acuta*	ANATIDAE
B083	CINNAMON TEAL	*Anas cyanoptera*	ANATIDAE
B084	NORTHERN SHOVELER	*Anas clypeata*	ANATIDAE
B085	GADWALL	*Anas strepera*	ANATIDAE
B087	AMERICAN WIGEON	*Anas americana*	ANATIDAE
B089	CANVASBACK	*Aythya valisineria*	ANATIDAE
B090	REDHEAD	*Aythya americana*	ANATIDAE
B091	RING-NECKED DUCK	*Aythya collaris*	ANATIDAE
B094	LESSER SCAUP	*Aythya affinis*	ANATIDAE
B105	COMMON MERGANSER	*Mergus merganser*	ANATIDAE
B107	RUDDY DUCK	*Oxyura jamaicensis*	ANATIDAE
B110	OSPREY	*Pandion haliaetus*	ACCIPITRIDAE
B113	BALD EAGLE	*Haliaeetus leucocephalus*	ACCIPITRIDAE
B114	NORTHERN HARRIER	*Circus cyaneus*	ACCIPITRIDAE
B123	RED-TAILED HAWK	*Buteo jamaicensis*	ACCIPITRIDAE
B124	FERRUGINOUS HAWK	*Buteo regalis*	ACCIPITRIDAE
B125	ROUGH-LEGGED HAWK	*Buteo lagopus*	ACCIPITRIDAE
B126	GOLDEN EAGLE	*Aquila chrysaetos*	ACCIPITRIDAE
B127	AMERICAN KESTREL	*Falco sparverius*	FALCONIDAE
B128	MERLIN	*Falco columbarius*	FALCONIDAE

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY
B129	PEREGRINE FALCON	*Falco peregrinus*	FALCONIDAE
B131	PRAIRIE FALCON	*Falco mexicanus*	FALCONIDAE
B145	VIRGINIA RAIL	*Rallus limicola*	RALLIDAE
B146	SORA	*Porzana carolina*	RALLIDAE
B149	AMERICAN COOT	*Fulica americana*	RALLIDAE
B158	KILLDEER	*Charadrius vociferus*	CHARADRIIDAE
B164	AMERICAN AVOCET	*Recurvirostra americana*	RECURVIROSTRIDAE
B168	WILLET	*Catoptrophorus semipalmatus*	SCOLOPACIDAE
B173	LONG-BILLED CURLEW	*Numenius americanus*	SCOLOPACIDAE
B199	COMMON SNIPE	*Gallinago gallinago*	SCOLOPACIDAE
B200	WILSON'S PHALAROPE	*Phalaropus tricolor*	PHALAROPODIDAE
B214	RING-BILLED GULL	*Larus delawarensis*	LARIDAE
B215	CALIFORNIA GULL	*Larus californicus*	LARIDAE
B233	FORSTER'S TERN	*Sterna forsteri*	LARIDAE
B262	COMMON BARN OWL	*Tyto alba*	TYTONIDAE
B265	GREAT HORNED OWL	*Bubo virginianus*	STRIGIDAE
B273	SHORT-EARED OWL	*Asio flammeus*	STRIGIDAE
B275	LESSER NIGHTHAWK	*Chordeiles acutipennis*	CAPRIMULGIDAE
B276	COMMON NIGHTHAWK	*Chordeiles minor*	CAPRIMULGIDAE
B281	VAUX'S SWIFT	*Chaetura vauxi*	APODIDAE
B282	WHITE-THROATED SWIFT	*Aeronautes saxatalis*	APODIDAE
B293	BELTED KINGFISHER	*Ceryle alcyon*	ALCEDINIDAE
B321	BLACK PHOEBE	*Sayornis nigricans*	TYRANNIDAE
B333	WESTERN KINGBIRD	*Tyrannus verticalis*	TYRANNIDAE
B339	TREE SWALLOW	*Tachycineta bicolor*	HIRUNDINIDAE
B340	VIOLET-GREEN SWALLOW	*Tachycineta thalassina*	HIRUNDINIDAE
B341	NORTHERN ROUGH-WINGED SWALLOW	*Stelgidopteryx serripennis*	HIRUNDINIDAE
B343	CLIFF SWALLOW	*Hirundo pyrrhonota*	HIRUNDINIDAE
B344	BARN SWALLOW	*Hirundo rustica*	HIRUNDINIDAE
B354	COMMON RAVEN	*Corvus corax*	CORVIDAE
B372	MARSH WREN	*Cistothorus palustris*	TROGLODYTIDAE
B411	EUROPEAN STARLING	*Sturnus vulgaris*	STURNIDAE
B435	YELLOW-RUMPED WARBLER	*Dendroica coronata*	EMBERIZIDAE
B461	COMMON YELLOWTHROAT	*Geothlypis trichas*	EMBERIZIDAE
B505	SONG SPARROW	*Melospiza melodia*	EMBERIZIDAE
B506	LINCOLN'S SPARROW	*Melospiza lincolnii*	EMBERIZIDAE
B519	RED-WINGED BLACKBIRD	*Agelaius phoeniceus*	EMBERIZIDAE
B522	YELLOW-HEADED BLACKBIRD	*Xanthocephalus xanthocephalus*	EMBERIZIDAE
B524	BREWER'S BLACKBIRD	*Euphagus cyanocephalus*	EMBERIZIDAE
B528	BROWN-HEADED COWBIRD	*Molothrus ater*	EMBERIZIDAE
M003	VAGRANT SHREW	*Sorex vagrans*	SORICIDAE
M004	DUSKY SHREW	*Sorex monticolus*	SORICIDAE
M006	ORNATE SHREW	*Sorex ornatus*	SORICIDAE

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY
M021	LITTLE BROWN MYOTIS	*Myotis lucifugus*	VESPERTILIONIDAE
M023	YUMA MYOTIS	*Myotis yumanensis*	VESPERTILIONIDAE
M025	LONG-EARED MYOTIS	*Myotis evotis*	VESPERTILIONIDAE
M028	CALIFORNIA MYOTIS	*Myotis californicus*	VESPERTILIONIDAE
M029	SMALL-FOOTED MYOTIS	*Myotis leibii*	VESPERTILIONIDAE
M032	BIG BROWN BAT	*Eptesicus fuscus*	VESPERTILIONIDAE
M034	HOARY BAT	*Lasiurus cinereus*	VESPERTILIONIDAE
M039	BRAZILIAN FREE-TAILED BAT	*Tadarida brasiliensis*	MOLOSSIDAE
M112	BEAVER	*Castor canadensis*	CASTORIDAE
M117	DEER MOUSE	*Peromyscus maniculatus*	CRICETIDAE
M133	MONTANE VOLE	*Microtus montanus*	CRICETIDAE
M134	CALIFORNIA VOLE	*Microtus californicus*	CRICETIDAE
M136	LONG-TAILED VOLE	*Microtus longicaudus*	CRICETIDAE
M139	MUSKRAT	*Ondatra zibethicus*	CRICETIDAE
M142	HOUSE MOUSE	*Mus musculus*	MURIDAE
M145	PORCUPINE	*Erethizon dorsatum*	ERETHIZONTIDAE
M146	COYOTE	*Canis latrans*	CANIDAE
M149	GRAY FOX	*Urocyon cinereoargenteus*	CANIDAE
M153	RACCOON	*Procyon lotor*	PROCYONIDAE
M158	MINK	*Mustela vison*	MUSTELIDAE
M162	STRIPED SKUNK	*Mephitis mephitis*	MUSTELIDAE
M166	BOBCAT	*Felis rufus*	FELIDAE
M181	MULE DEER	*Odocoileus hemionus*	CERVIDAE
R051	RACER	*Coluber constrictor*	COLUBRIDAE
R058	COMMON KINGSNAKE	*Lampropeltis getulus*	COLUBRIDAE
R062	WESTERN TERRESTRIAL GARTER SNAKE	*Thamnophis elegans*	COLUBRIDAE
R063	WESTERN AQUATIC GARTER SNAKE	*Thamnophis couchi*	COLUBRIDAE
R076	WESTERN RATTLESNAKE	*Crotalus viridis*	VIPERIDAE

TOTAL SPECIES: 112

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APPENDIX E: MILL CREEK REPORT

J. R. Perrault,
Los Angeles Department of Water and Power

DRAFT

Mill Creek Report

Prepared by:

James R. Perrault

Los Angeles Department of Water and Power

Background

Historical Use of Mill Creek Water:

Historically, water from Mill Creek has been used for two purposes: (1) the irrigation of pastureland for livestock grazing, and (2) the generation of hydroelectric power. In 1911, the Southern Sierra Power Company, predecessor to SCE, completed construction of the Lundy Project, a hydroelectric powerplant on Mill Creek. The Lundy Project diverts Mill Creek water through the Lundy powerhouse and releases the water to the Lundy tailrace. From the tailrace, water can either be immediately diverted for irrigation using the Conway ditch system or returned to Mill Creek via the Wilson Creek to Mill Creek return ditch (return ditch) for irrigation using the Thompson ditch system. The remainder of the tailrace water is either diverted downstream by the U.S. Forest Service or flows down Wilson Creek to Mono Lake. Operation of the Lundy Project has significantly reduced flows in the Mill Creek channel below Lundy reservoir. Flows during the months of October-April are most significantly affected. During these months of low flows almost all of the Mill Creek flow is diverted to the powerhouse and little, if any flow, remains in the channel immediately downstream of the dam.

Overview of Mill Creek Facilities:

Figure 1 shows the location of major facilities within the Mill Creek watershed. These facilities include: the Lundy reservoir, the Lundy powerhouse, the Lundy powerhouse penstock, and the return ditch, all part of SCE's Lundy Project, and a network of irrigation ditches, head gates, and gaging stations operated, by LADWP and Conway Ranch. The capacities of major facilities are listed below.

Table 1

Physical Capacities:

Lundy Reservoir Storage Capacity:	3,820 af
Reservoir Storage to Annual Flow Ratio[1]:	0.18
Lundy Powerhouse Penstock:	70.6 cfs
Farmer's Gate:	150 cfs
Wilson Creek to Mill Creek Return Ditch:	16 cfs

Water is released from Lundy reservoir either through a controlled release or by overtopping the dam/spillway. Controlled releases from Lundy reservoir can be made in two ways: (1) through the penstock intake for power generation, or (2) through the Farmer's gate (a release gate on the dam) into the Mill Creek channel. The ability to release water to Mill Creek through the Farmer's gate is limited by the water surface elevation of the reservoir. The Farmer's gate inlet is located on the dam at an elevation of 7,779 ft., approximately the midpoint elevation between the penstock outlet and the top of the reservoir spillway. Notwithstanding this limitation, due to the small size of the reservoir relative to the watershed (refer to Table 1), releases through the Farmer's gate are generally made every year during the summer months when peak flows occur. Controlled releases through the Farmer's gate are also made at other times when determined necessary for operational reasons.

Pasturelands in the Mill Creek area are irrigated using a network of irrigation. (See map, Figure 1.) The major ditches are listed below.

Mill Creek Irrigation Ditches

Upper Conway Ditch
Lower Conway Ditch
Thompson Upper Ditch
Thompson Main Ditch

[1] This ratio expresses the total storage capacity on the stream relative to the average annual runoff of the stream. It is the ratio of Lundy reservoir storage (3,820 af) to the average annual flow of Mill Creek (21,200 af).

The two Conway ditches divert water below the Lundy powerhouse tailrace as does the return ditch. The two Thompson ditches divert water from Mill Creek. The Thompson Upper Ditch diverts water above the return ditch while the Thompson Main Ditch diverts water below it. As a result, return ditch water can only be used to supplement diversions at the Thompson Main Ditch. These ditches are used for irrigation purposes during the months of April-October. Average monthly flows (cfs) of the Thompson irrigation ditches are given in Figure 2.

Overview of Mill Creek Hydrology:

Surface water runoff in the Mill Creek watershed is primarily snowmelt driven. Annual Mill Creek unimpaired[2] runoff for the 1941-1990 period averaged 21,200 acre-feet (29 cfs), approximately half the flow of the next largest Mono Lake tributary, which is Lee Vining Creek. Eighty-one percent of the runoff (17,100 af) is attributed to snowmelt runoff during the April-September period. The remaining 19 percent of runoff is attributed to base flows during the October-March period. The average monthly unimpaired flow distribution of Mill Creek is shown in Figure 3.

On average, 70 percent of the annual flow of Mill Creek is diverted through the Lundy powerhouse for power generation. The remainder of the water flows down Mill Creek. A frequency analysis of the flows diverted through the Lundy powerhouse during the period of 1968-1994 is graphically presented in Figure 4. The results are grouped into two seasonal flow scenarios: (1) spring and summer (April-September) when flows are highest and water rights have traditionally been exercised, and (2) fall and winter (October-March) when flows are reduced and water rights traditionally have not been exercised except in October. (Refer to Figure 2.) For the analysis, five flow exceedence levels were chosen that incorporate 80 percent of the observed flows during the period of record. The five levels range from low flows that were exceeded 90 percent of the time to high flows that were exceeded 10 percent of the time during the 27 year period.

[2] Unimpaired Mill Creek runoff is a calculated value--the sum of flow through the Lundy powerhouse (SCE gages 365 and 366), flow in Mill Creek below Lundy reservoir (SCE gage 355), and storage change in Lundy reservoir.

Location of Flow Measuring Devices:

Flow in the Mill Creek watershed is measured by both SCE and LADWP. SCE measures the storage in Lundy reservoir, the flow in Mill Creek ¼ mile below the dam (gage 355), the flow passing through the powerhouse (sum of SCE gages 365 and 366). LADWP measures the flow entering the return ditch and flow at the LADWP irrigation diversion points. Below is a list of SCE's and LADWP's flow measuring devices within the area.

Mill Creek Flow Measuring Devices

SCE

Mill Creek Below Lundy Lake (Gage 355)
Lundy Plant Tailrace (Gage 365)
Upper Conway Ditch (Gage 366)
Lundy Reservoir Storage

LADWP

Wilson Creek to Mill Creek Return Ditch
Conway Lower Ditch
Conway Upper Ditch[3]
Thompson Upper Ditch at Intake
Thompson Main Ditch at Intake

In addition, point measurements of Mill Creek flow have been made periodically by other parties. In their Final Environmental Assessment of the Lundy Project, the Federal Energy Regulatory Commission (FERC) cites three such flow samplings conducted in October 1986, December 1986, and March 1987. In each case, the cumulative natural accretion in Mill Creek was measured at four sites along the Mill Creek channel between the toe of Lundy dam and the Mill Creek diversion point of the Upper Conway Ditch (abandoned). Their findings showed total accumulated accretion at the diversion point (including ungaged Deer Creek flow) ranging from a low of 6.6 cfs in March 1987 to a high of 10.5 cfs in October 1986. It is important to note that these studies were conducted during the low flow/non-irrigation season.

[3] A diversion from the Conway Upper Ditch measured downstream of the SCE station.

Mill Creek Water Rights:

Mill Creek was adjudicated in a judgment and decree by the Mono County Court on November 30, 1914. The adjudication distributed water rights to landowners based on a quantity and right priority. Since that time many of the parcels of land, with the accompanying water right, have changed ownership. Currently LADWP and the owners of the Conway Ranch hold the majority of the rights to Mill Creek water. The U.S. Forest Service and the Simis family also holds rights of lesser priority. Table 2 lists the Mill Creek water rights by right holder in order of priority.

Current Operations in Mill Creek

SCE Operations:

SCE's operation of the Lundy Project plays a dominant role in the Mill Creek watershed. Operation of the project has significantly altered the flow in both Mill and Wilson creeks. As noted above, 70 percent of the annual Mill Creek flow is currently diverted to the Wilson Creek drainage via the Lundy tailrace. Current irrigation diversions in the watershed also have an affect on Mill Creek flows, but to a lesser extent. LADWP, Conway Ranch, the U.S. Forest, and the Simis family all irrigate with Mill Creek water.

LADWP Operations:

LADWP owns several parcels of land and the associated water rights in the Mill Creek area. Originally these parcels were purchased with the intent of exporting Mill Creek water to Los Angeles. These plans, however, were never realized and LADWP has continued to use this water to irrigate pastureland.

LADWP operations in the Mill Creek area have not changed much over the years. Within the Mill Creek watershed, LADWP operations are limited to the maintenance of irrigation ditches, the operation of headworks, and the measurement of flow. These ditches are used to irrigate LADWP owned pasturelands that are leased to local ranchers.

Rewatering Mill Creek

Suggested Rewatering Guidelines:

Ideally, the flows released into Mill Creek should be timed to coincide with natural hydrologic events. This should develop the best potential waterfowl habitat. However, due to the limitations of certain legal constraints (i.e., water rights) and facility constraints (i.e., Lundy Project) this may not always be possible. Therefore, a priority of time releases is suggested below.

***Scenario 1*:**
Provide a year round flow with a minimum winter base flow and highest flows occurring during the growing season (April-October). This would promote wetland and riparian vegetation recruitment, especially when coupled with periodic spills of Lundy reservoir during wet years.

***Scenario 2*:**
As much as possible, provide flows during the growing season (April-October) to promote habitat development and allow for freshwater input at the Mill Creek delta for the waterfowl fall migratory period, which is September- November annually.

***Scenario 3*:**
To the extent possible, provide flows during the growing season and hope the additional rewatering efforts will build flood plain water tables to the point a consistent freshwater source flows at the delta site.

LADWP Operational Changes
Barring any legal constraints, LADWP could potentially commit all LADWP Mill Creek water, by right, to waterfowl habitat restoration by terminating all LADWP controlled irrigation in the Mill Creek area. This would encompass all waters currently diverted by LADWP from both the Lundy tailrace and Mill Creek.

Most of the land currently irrigated using LADWP water is in the Thompson Ranch area, south of Mill Creek. Therefore, the water historically diverted at the two Thompson diversions would be a significant portion of the LADWP water available for rewatering. Tabulated below in Table 3 are the median monthly flows historically[4] diverted for irrigation at the Thompson Upper and Thompson Main ditches.

Table 3

Thompson Ranch Water Diversion
Median Monthly (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Thompson Upper Ditch	0	4	9	9	8	6	3	0	0	0	0	0
Thompson Main Ditch	0	4	10	10	7	3	0	0	0	0	0	0
Total Water Returned	0	8	19	19	15	9	3	0	0	0	0	0

Table 3 represents the most probable flows that would be available for rewatering Mill Creek if diversion through the Thompson ditch system were terminated. Because diversions have varied year to year it might be helpful to also look at a range of available rewatering flows. Similar to the flow analysis previously described of flows diverted through the Lundy powerhouse, Figures 5 and 6 graphically depict a frequency analysis of the range of flows historically diverted at the two Thompson diversion points. This analysis represents the range of expected flows under differing hydrologic conditions. The analysis divides the range of flows into five flow exceedence levels that incorporate 80 percent of the observed flows during the period of record. The five levels range from low flows that were exceeded 90 percent of the time to high flows that were exceeded 10 percent of the time during the 50 year period, 1941-1990.

Additional Flow

The flows presented in Table 3 only represent the flow diverted from Mill Creek through the Thompson ditch system. In most years, LADWP water, by right, exceeds this amount. Therefore, additional flow via the return ditch is also potentially available for rewatering Mill Creek. How much flow, is limited by three conditions: (1) the legally available

[4] Diverted during the period of record 1941-1990.

LADWP flow by right, (2) the capacity of the return ditch (16 cfs), and (3) to what extent the return ditch has been used to meet the irrigation demands at the Thompson Main Ditch.

Using available records, it is difficult to determine the source of all flow diverted at the Thompson Main Ditch since it heads at Mill Creek below the return ditch. However, in practice, the only time the return ditch has been used was to meet the irrigation demand at the Thompson Main Ditch. Table 4 below, gives a range of available flows for rewatering via the return ditch. Row 1 is the monthly flow available, via the return ditch, in a median year after meeting conditions 1 and 2 above (all rights senior to LADWP rights are met and flow is limited by the 16 cfs capacity of the ditch). Row 2 is the historical median monthly flow diverted at the Thompson Main Ditch. Row 3 is the difference of Rows 1 and 2, or the available flow if conditions 1 and 2 above are met and the return ditch is the sole source of flow in the Thompson Main Ditch. Therefore, the monthly values is Row 1 theoretically represent the maximum additional monthly flow available in a median year while the values in row 3 theoretically represent the minimum.

Table 4

Range of Additional Flow Via the Return Ditch
Median Monthly (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(1) Water via Return Ditch	4	16	16	16	16	4	1	1	1	1	1	1
(2) Thompson Main Ditch	(0)	(4)	(10)	(10)	(7)	(3)	(0)	(0)	(0)	(0)	(0)	(0)
(3) Difference	4	12	6	6	11	1	1	1	1	1	1	1

Combining the monthly values of Tables 3 and 4 yields Table 5, the range of median year flows available for rewatering Mill Creek if LADWP abandoned irrigation in the Mill Creek area. (Total of the Thompson Ranch irrigation water and return water.) In wet years, more flow would be available as a result of larger and longer controlled releases and/or spills from Lundy reservoir.

Table 5

Range of Mill Creek Rewatering Flows
Mean Monthly (cfs)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Maximum Available	4	24	35	35	31	13	4	1	1	1	1	1
Minimum Available	4	20	25	25	26	10	4	1	1	1	1	1

Limitations on Flows:

As mentioned previously there are several factors that limit the amount of water available to rewater Mill Creek. These limitations include water rights, facility capacities, and operational constraints.

Water Rights Senior to LADWP Rights:

Although LADWP holds the first priority right to Mill Creek water, the right is only 1.0 cfs. Conway Ranch holds the second and more substantial priority right of 12 cfs. This factor significantly limits the amount of return ditch water legally available for rewatering each year, especially during the November-March period. Except for wet years, the flow through the Lundy powerhouse during the November-March period is insufficient to completely satisfy the 12 cfs, first priority Conway Ranch right. (See Figure 4.) Therefore, the water that can legally be returned to Mill Creek through the return ditch during the November-March period is limited to the LADWP first priority right of 1.0 cfs.

In contrast, during the April-October period, there is sufficient water to fully satisfy the Conway Ranch right. In June, July, and August there is sufficient enough water to meet the Conway Ranch right and still fill the return ditch to capacity. A lesser amount is available during April and September; after meeting the Conway Ranch right, 4.0 cfs is available to be passed through the return ditch.

Simis Water Right:

Although a relatively minor right, this fourth priority, 1.8 cfs right must be satisfied any time the flow in Mill Creek equals or exceeds 19 cfs. (Refer to Table 2).

Wilson to Mill Creek Return Ditch:

The return ditch, operated by SCE, was built to return Mill Creek water, diverted for power generation, back to Mill Creek proper. Historically, it has been operated to satisfy water rights when releases from Lundy reservoir and accretion below the reservoir were insufficient to meet water rights. The ability to return water to Mill Creek is limited by the capacity of the ditch, which is 16 cfs.

Lundy Reservoir Releases:

Historically SCE has released water down Mill Creek, below Lundy reservoir, by means of controlled releases through the Farmer's gate (capacity 150 cfs) or by allowing the reservoir to spill. Both release methods are limited by the water surface elevation of the reservoir. Controlled releases through the Farmer's gate can be made once the reservoir reaches an minimum elevation of 7,779 ft

Even though controlled releases are limited by water surface elevation, controlled releases are made during the peak runoff months in most years because of the relatively small size of the reservoir--the storage to annual inflow to the reservoir ratio is :0.18. (See Table 2.)

Maintenance:

Under a rewatering scenario, there would not be a need to maintain the currently used LADWP irrigation ditches, and maintenance of these facilities would most likely cease. Maintenance of the return ditch, however, would still be required. Maintenance of the return ditch has been SCE's responsibility. They have maintained this ditch in the past because of their responsibility to return the water diverted to Wilson Creek back to Mill Creek to meet water rights demands downstream of the Lundy dam. Under a rewatering scenario, water rights would not change, only the use of the water. Therefore, SCE would retain the responsibility to maintain the return ditch to a level suitable to meet their responsibility.

Legal Considerations of Rewatering Mill Creek:

LADWP legal staff has reviewed several legal issues related to the rewatering of Mill Creek. The legal staff has concluded that it should be feasible to change the place of use and place of diversion of all LADWP Mill Creek water rights so long as the rights of others are not affected and/or there is no injury to others as a result of a change. However, CEQA requirements may be triggered by a proposal to alter a long held operating criteria and to transfer certain amounts of water away from Wilson Creek to Mill Creek. One of the inquiries that would have to be made is whether a change in operating criteria would have a "significant effect on the environment". The depth and extent of CEQA's involvement is dependent upon the determination of that inquiry.

Monitoring:

Minimal monitoring, if any, of Mill Creek is required under Decision 1631 since this tributary was not a component of the decision. Therefore, periodic aerial photos coupled with other monitoring efforts, or ground photo points to be taken every several years should suffice to document Mill Creeks status. A baseline inventory of delta vegetation conditions should be conducted and monitored at three year intervals to document changes in waterfowl habitat at this site.

Forest Service Water Right:

The U.S. Forest Service holds a Mill Creek 8th priority right of 12.6 cfs. The diversion point for this right is on Wilson Creek, downstream of the return ditch. This right can be exercised any time that the flow in Mill Creek equals or exceeds 43 cfs. (See Table 2.) Rights senior to this right are: LADWP rights totaling 24.2 cfs, Conway Ranch rights totaling 17.0 cfs and the fourth priority Simis right of 1.8 cfs.

U.S. Forest Service personnel have indicated that a portion or all of this right possibly could be made available for rewatering Mill Creek. If so, due to the junior nature of this right, the need for the water and the method of conveying the water to Mill Creek would need to be studied more carefully. Historical flow data indicates that the median flow through the Lundy powerhouse only exceeds the 43 cfs threshold, the flow required to exercise this right, during June and July--the same two months that the flow in Mill Creek below Lundy reservoir peaks due to a combination of natural accretion and controlled releases by SCE. Moreover, the return ditch, which is the most likely conveyance channel for this water, would already be filled to capacity by LADWP rights senior to the U.S. Forest Service right.

Effect of Proposed Rewatering Project

Restoration of Waterfowl Habitat:

Rewatering of Mill Creek should provide for an increase in floodplain water tables. The degree of water table rise will depend on many factors including: the quantity of annual releases, the frequency of flushing flows released through the Farmer's gate of over the Lundy reservoir spillway, and precipitation. As this occurs it is anticipated that floodplain vegetation will respond correspondingly. Recovery of riparian species, formation of depressional wetlands in the floodplain, and most importantly delta wetlands, should provide freshwater habitats benefiting not only waterfowl, but many other species of wildlife as well. Mill Creek wetlands, combined with other wetland habitats within the Mono Basin ecosystem, may then attract more waterfowl to the area.

Loss of Lease Revenue:

Under a rewatering scenario LADWP would lose the annual revenue currently generated by leasing pasturelands to local ranchers. This loss of revenue, however, would be relatively small.

Impact to Lessees:

The livestock operators, currently leasing LADWP lands require enough base property to maintain livestock numbers when off federal allotments. Without adequate base properties -- resulting from the loss of LADWP grazing leases -- they may be required to cut their livestock numbers and therefore take a cut in profit margins.

Impact to SCE Operations:

The rewatering plan as outlined above would have a minimal impact on SCE operations. SCE would still be legally bound to meet downstream water rights although use of the water would change. However, since the return ditch would most likely be used more frequently, additional maintenance of the ditch may be required.

Impact to Wilson Creek Flows/Fish:

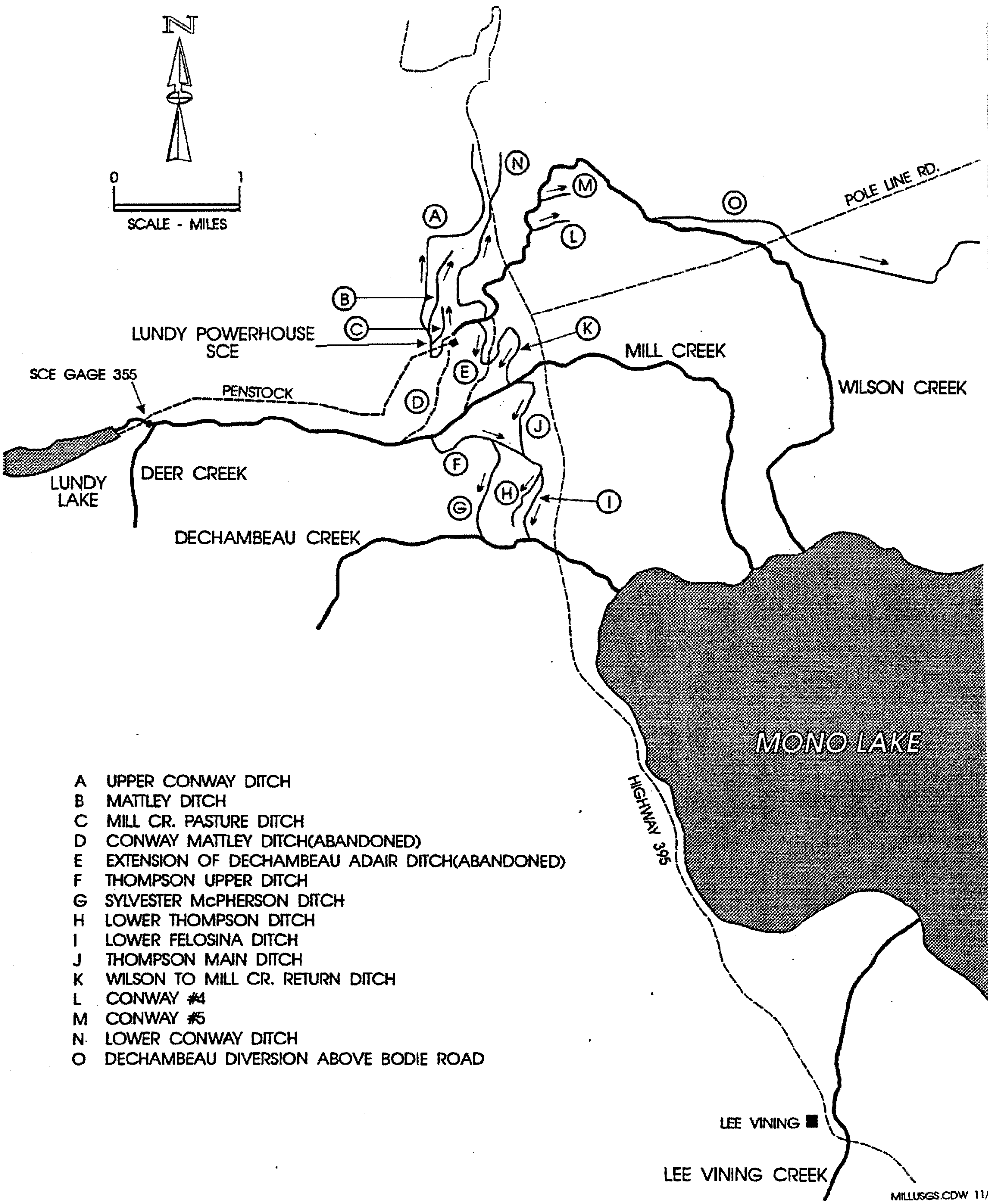
By returning water to Mill Creek, the brown trout fishery currently existing in Wilson Creek may be affected due to decreased flows in that system. This is an issue that the Department of Fish and Game would have to address.

Impact to Irrigated Lands and Migratory Livestock:

Acreage of irrigated pastures on the currently leased Thompson Ranch will be reduced due to the lack of available water from Mill Creek. Additionally, sage grouse, deer, and other wildlife species may be impacted due to decreased forage in the upland and pasture sites. However, the anticipated habitat development along Mill Creek and its delta should compensate for any losses.

Figure 1.

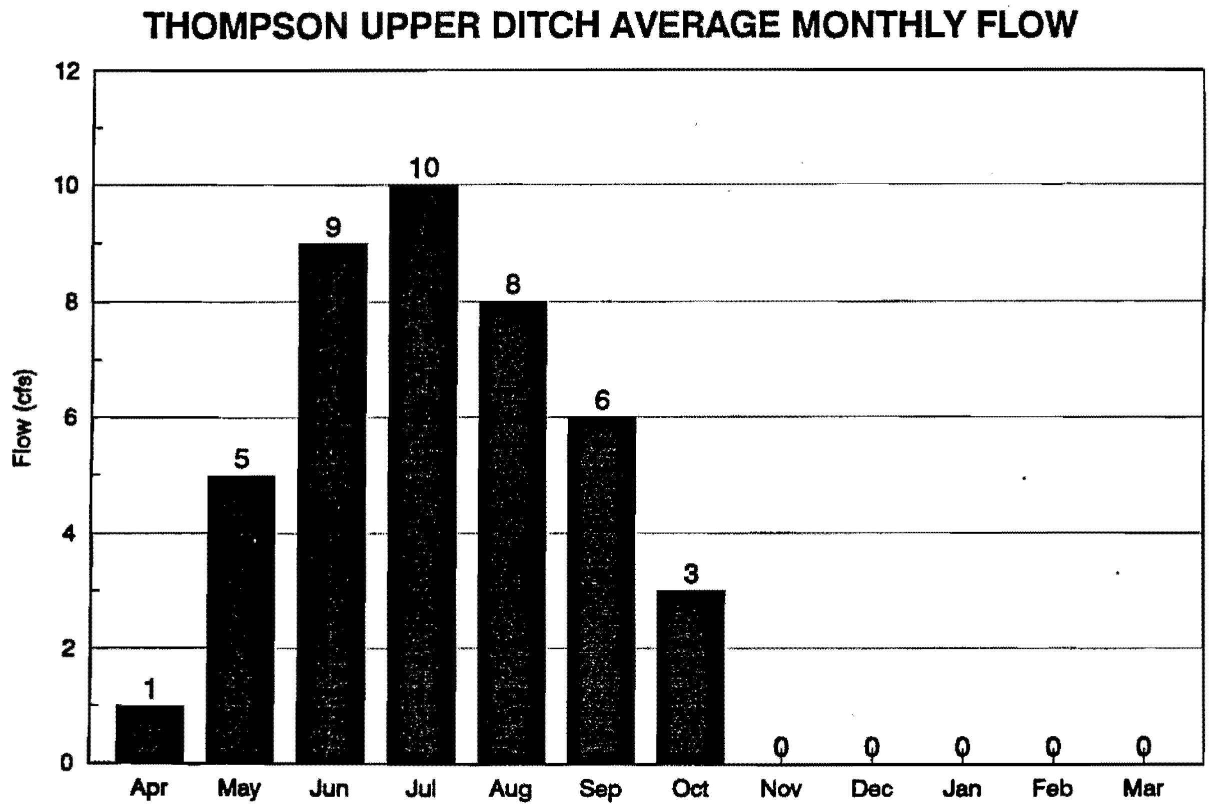
MILL CREEK FACILITIES AND IRRIGATION DIVERSIONS

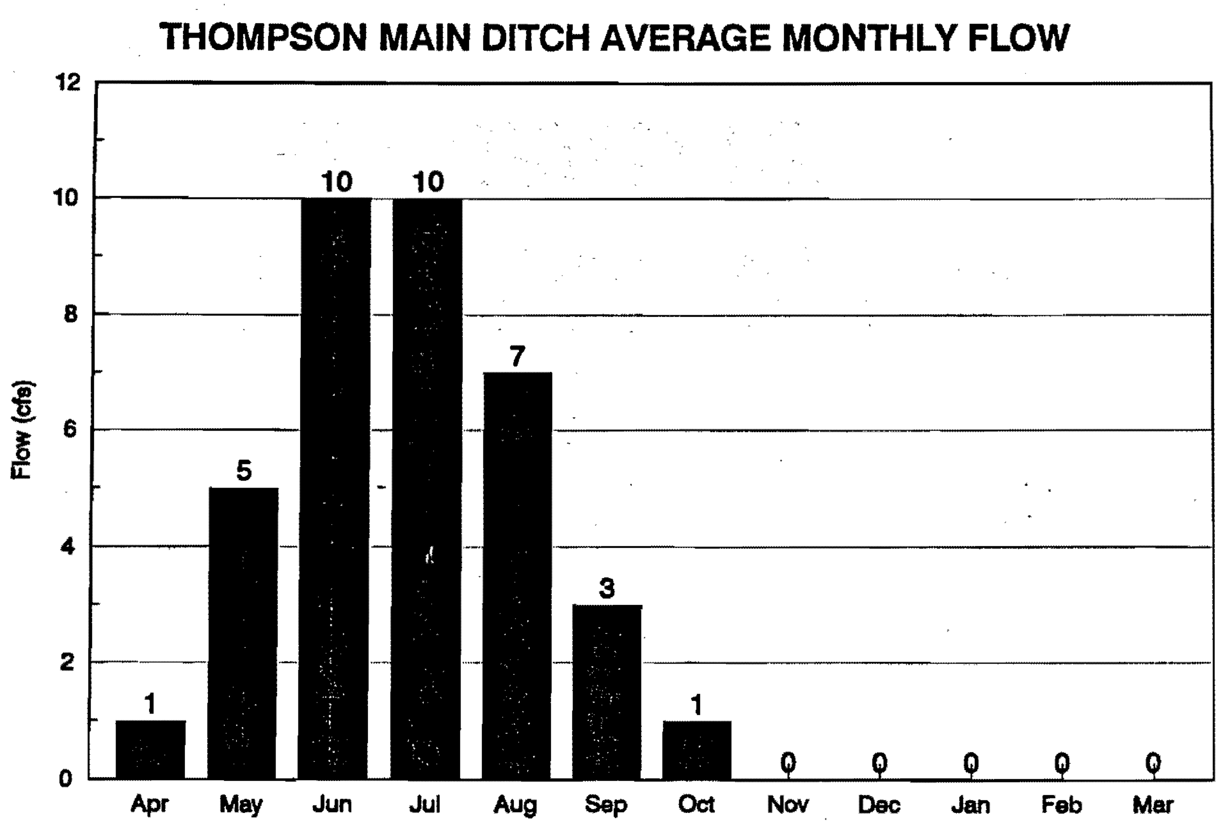


A UPPER CONWAY DITCH
B MATTLEY DITCH
C MILL CR. PASTURE DITCH
D CONWAY MATTLEY DITCH(ABANDONED)
E EXTENSION OF DECHAMBEAU ADAIR DITCH(ABANDONED)
F THOMPSON UPPER DITCH
G SYLVESTER McPHERSON DITCH
H LOWER THOMPSON DITCH
I LOWER FELOSINA DITCH
J THOMPSON MAIN DITCH
K WILSON TO MILL CR. RETURN DITCH
L CONWAY #4
M CONWAY #5
N LOWER CONWAY DITCH
O DECHAMBEAU DIVERSION ABOVE BODIE ROAD

MILLUSGS.CDW 11/

Figure 2. Perrault, Draft 11/16/95



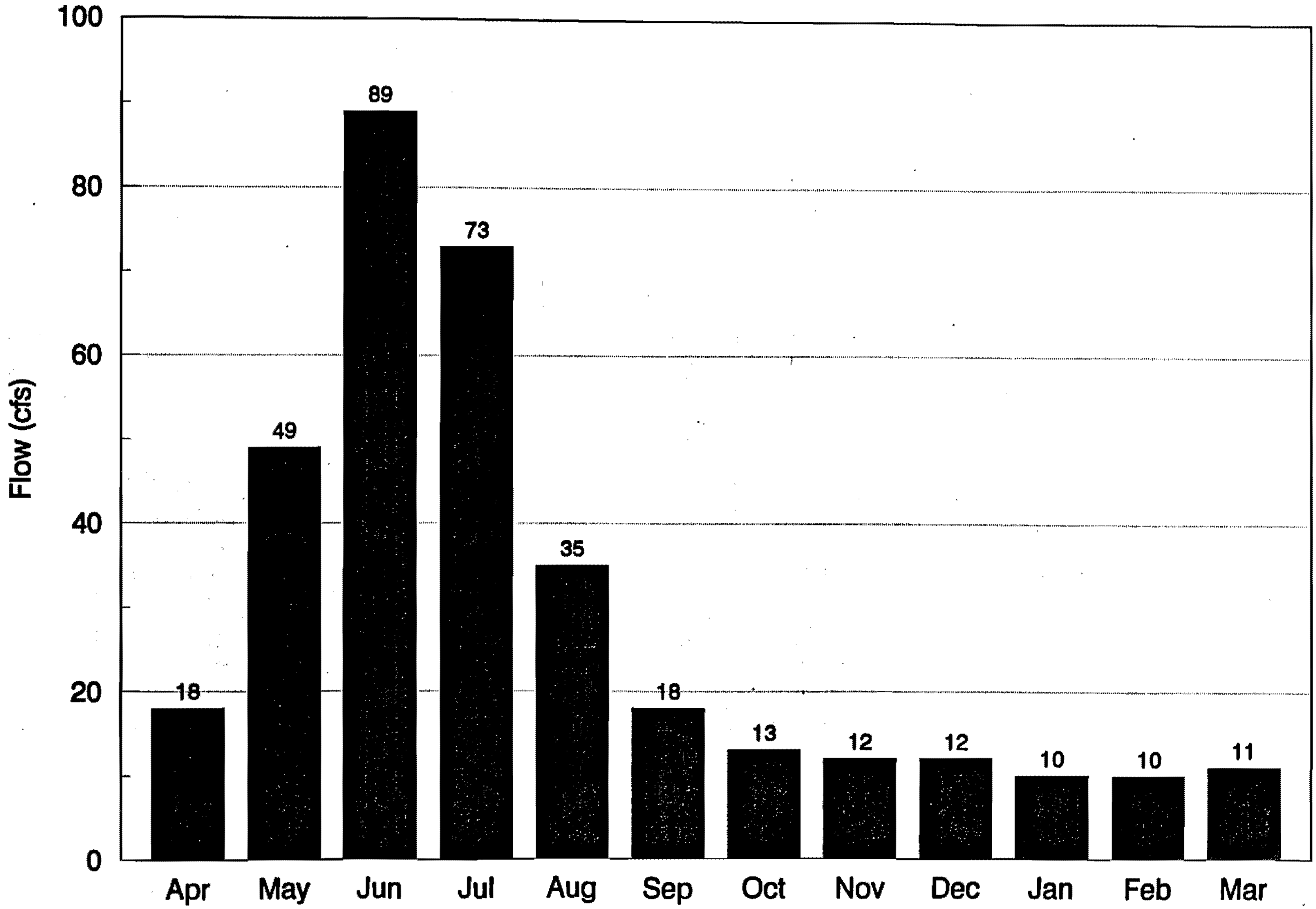


Note: Average based on the 50 year period 1941-1990.

Figure 3.

Perrault, Draft 11/16/95

MILL CREEK UNIMPAIRED AVERAGE MONTHLY FLOW



Note: Average based on the 50 year period 1941-1990.

Figure 4.

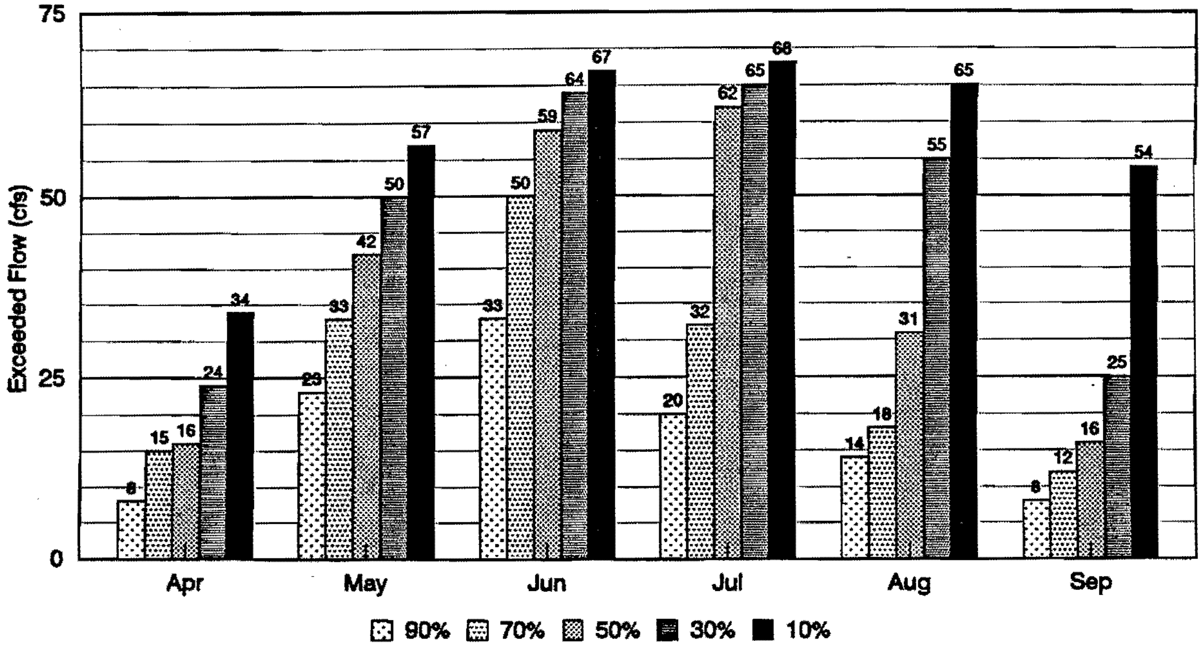
Perrault, Draft 11/16/95

Mill Creek Flow Frequencies

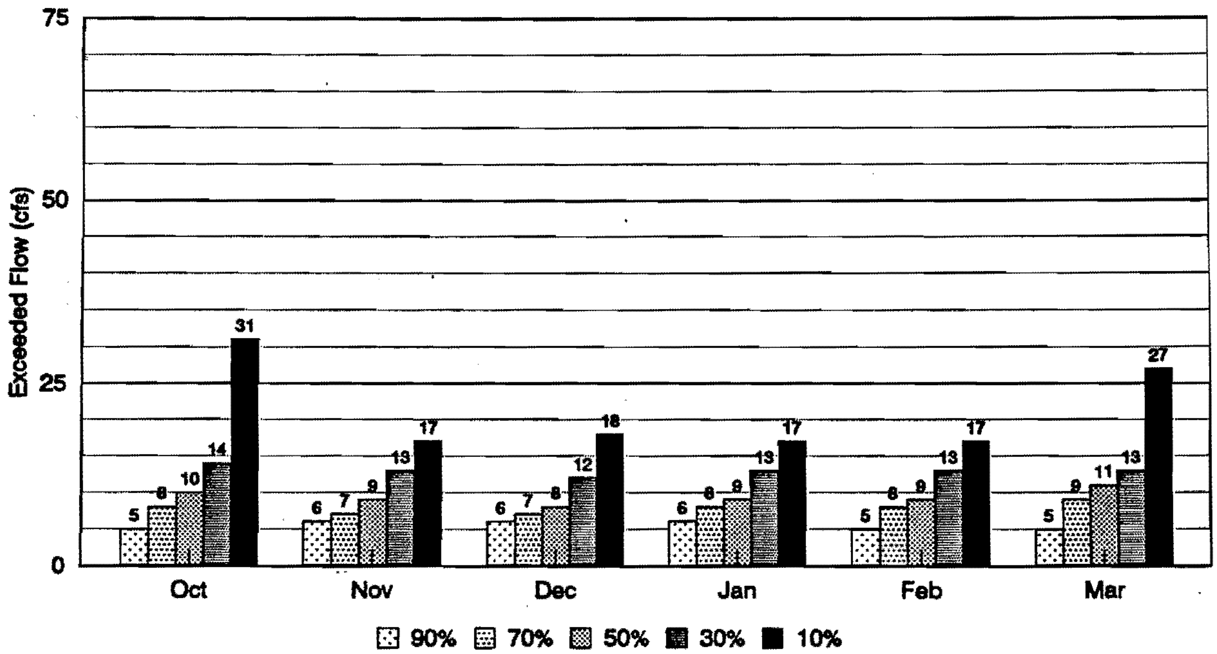
Flow Diverted Through the Lundy Powerhouse*

(Catergorized by percent of time flow is exceeded)

April-September



October-March

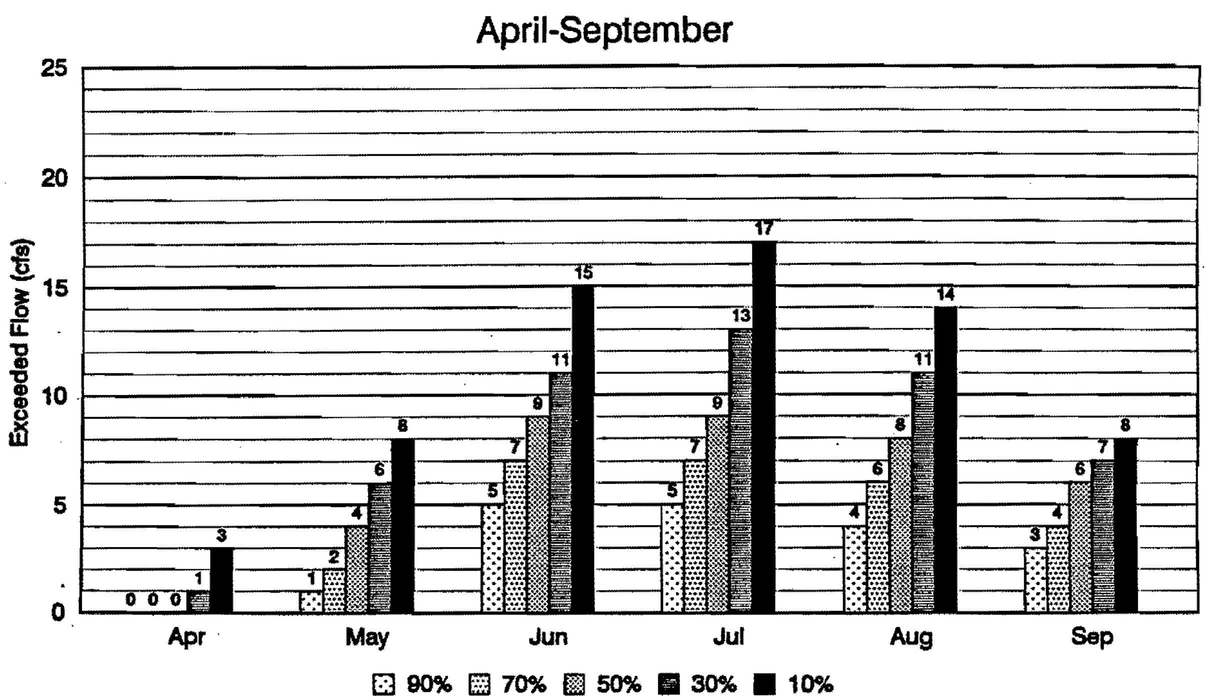


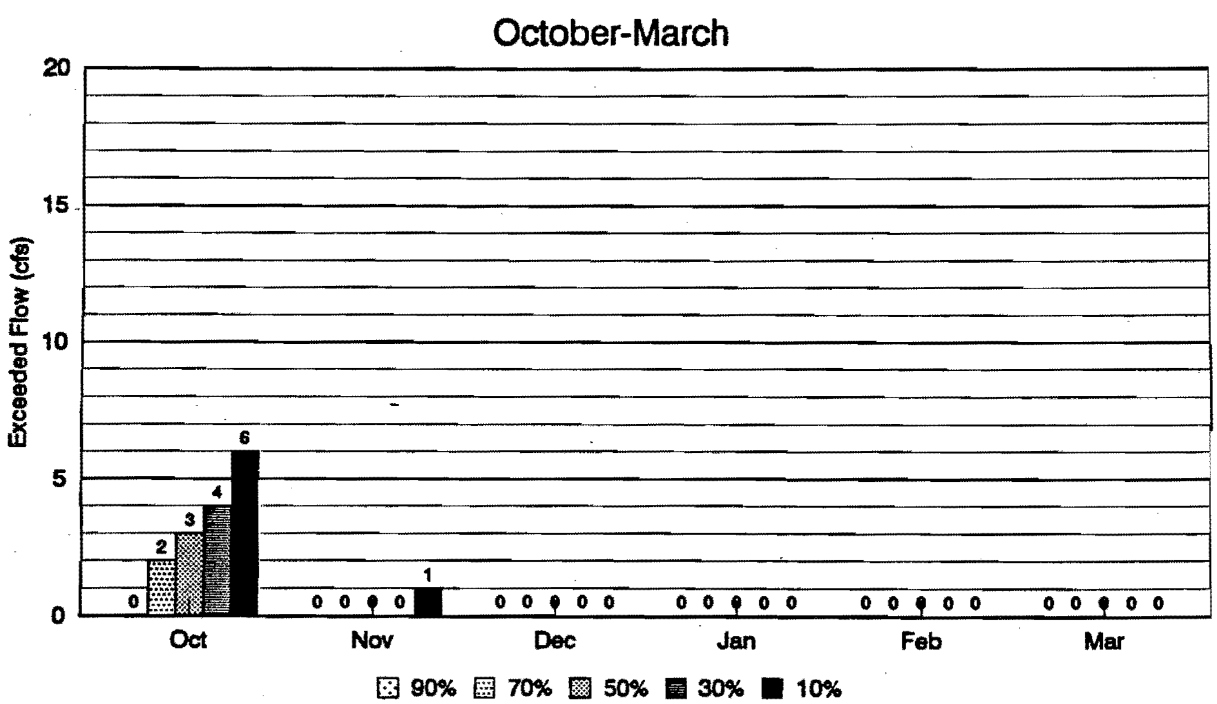
*Lundy Plant Tailrace + Upper Conway Ditch Diversion
Note: Analysis uses the period of record 1968-1994.

Figure 5. Perrault, Draft 11/16/95

Thompson Upper Ditch Flow Frequencies

(Catergorized by percent of time flow is exceeded.)



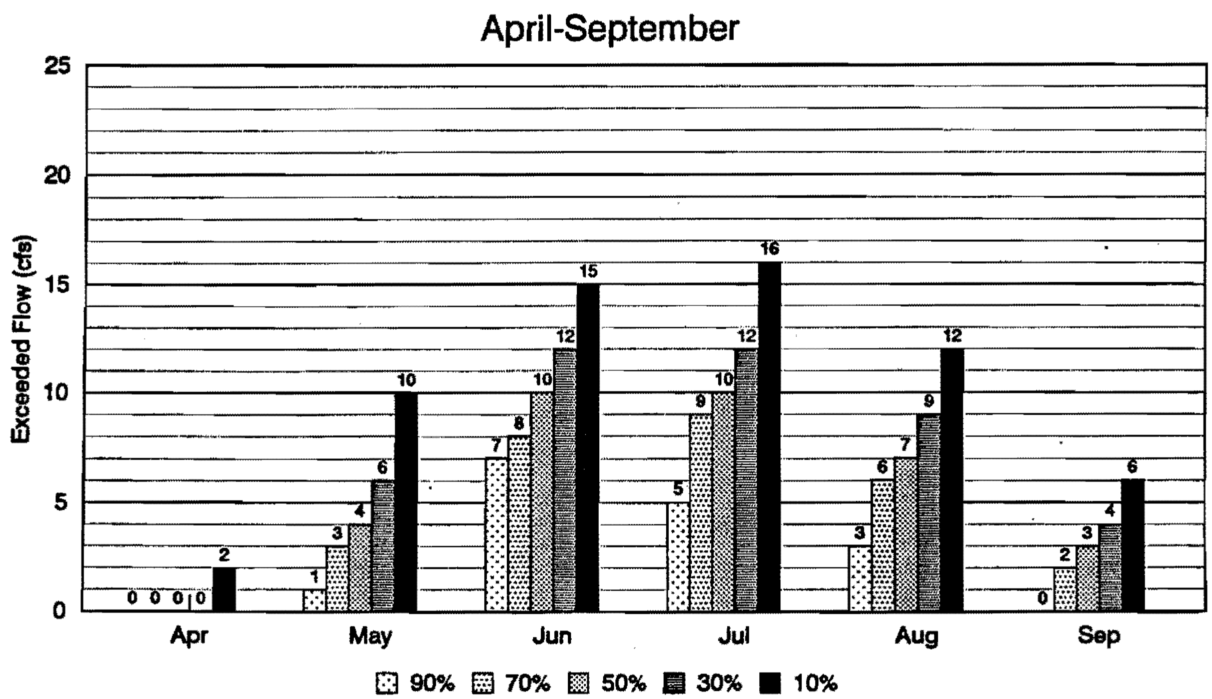


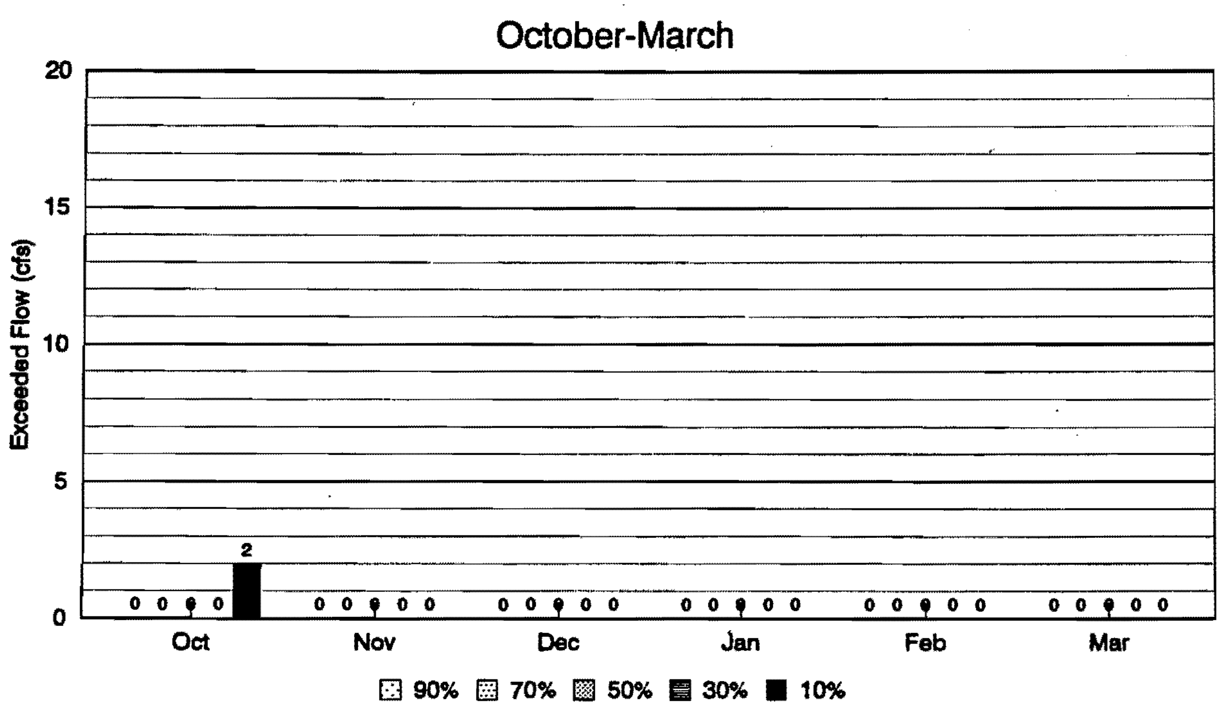
Note: Analysis uses the period of record 1941-1990.

Figure 6. Perrault, Draft 11/16/95

Thompson Main Ditch Flow Frequencies

(Catergorized by percent of time flow is exceeded.)





Note: Analysis uses the period of record 1941-1990.

Table 2.

Mill Creek Water Rights

(1914 Mill Creek Court Adjudication and Subsequent Conveyences)

Right Priority	Right Holder	Quantity (cfs)	Cumulative DWP (cfs)	Cumulative Conway (cfs)	Cumulative Total (cfs)
1st	LADWP	1.0	1.0	0.0	1.0
2nd	Conway Ranch	12.0	1.0	12.0	13.0
3rd	LADWP	6.0	7.0	12.0	19.0
4th	LADWP	3.2	10.2	12.0	22.2
4th	Simis	1.8	10.2	12.0	24.0
5th	LADWP	14.0	24.2	12.0	38.0
6th	Conway Ranch	3.0	24.2	15.0	41.0
7th	Conway Ranch	2.0	24.2	17.0	43.0
8th	U.S.F.S.	12.6	24.2	17.0	55.6
9th	LADWP	3.0	27.2	17.0	58.6
10th	LADWP	3.0	30.2	17.0	61.6
11th	LADWP	2.0	32.2	17.0	63.6
12th	LADWP	2.0	34.2	17.0	65.6
13th	LADWP	2.0	36.2	17.0	67.6
14th	LADWP	6.0	42.2	17.0	73.6
15th	Conway Ranch	1.0	42.2	18.0	74.6

APPENDIX F: **RESTORATION OF DEGRADED RIPARIAN, WETLAND, AND DELTAIC ENVIRONMENTS ON MILL CREEK, MONO COUNTY, CALIFORNIA**

S. Stine, Ph.D.

Restoration of Degraded Riparian, Wetland, and Deltaic Environments on Mill Creek, Mono County, California

Report to

Dr. Fritz Reid, Ducks Unlimited
Dr. Rod Drewien, Hornocker Wildlife Research
Mr. Tom Ratcliff, United States Forest Service
and the
Los Angeles Department of Water and Power

by

Scott Stine, Ph.D.
Berkeley, California 94702

November, 1995

Restoration of Degraded Riparian, Wetland, and Deltaic Environments on Mill Creek, Mono County, California

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Restoration of Degraded Riparian, Wetland, and Deltaic Environments on Mill Creek, Mono County, California

Introduction

With a length of ~13 miles and an average annual flow of approximately 22,000 acre feet, Mill Creek is the third largest stream in the Mono Basin. It heads at the Sierran crest, and flows eastward over the bedrock of Lundy Canyon, then over glacial and deltaic sediments to Mono Lake.

Since before the early 1880s water has been diverted from Mill Creek, initially for irrigation, and later (beginning in 1905) for hydropower generation. These diversions have had a substantial impact on the lower ~11,000 feet of the stream, destroying much of the vegetation, and transforming the multi-channeled "Mill Creek bottomlands" into a single-channeled system.

The lowermost 5000 feet of the stream has been further impacted since the 1940s, when Mono Lake began to fall in response to the trans-basin diversion of Rush and Lee Vining creeks by the Department of Water and Power (DWP). This drop in base level, totaling 45 vertical feet by 1982, forced Mill Creek to incise its exterior delta, creating two elongate trenches up to 10 feet deep.

This report documents the history of diversion-induced impact to Mill Creek; it examines the measures that could be taken to restore the riparian and wetland environments of the Mill Creek bottomlands; and it proposes measures to maximize hypopycnal-ria-type waterfowl habitat on the incised exterior delta of Mill Creek.

Environmental Setting

Hydrologically, geologically, and geomorphologically Mill Creek is divisible into three reaches: a bedrock canyon of approximately 9.25 miles (~49,000 feet), composed of crystalline rocks of the Sierra Nevada; a "Pleistocene delta" reach of approximately 3.45 miles (18,200 feet), the bed of which is underlain alternately by permeable gravels and relatively impermeable lacustrine silts; and a "Holocene delta" reach of approximately 2.15 miles (~11,200 feet), underlain by permeable cobbles and gravels. This latter reach is further divisible into an "interior delta" (length ≃ 7800 feet), and an "exterior delta" (length ~ 5000 feet).

The bedrock reach (Lundy Canyon). Mill Creek heads in a cirque at the crest of the Sierra Nevada. It flows eastward over the glacially scoured bedrock of Lundy Canyon for approximately 49,000 feet, exiting the canyon mouth at elevation ~7200 feet (approximately 3.25 miles downstream from Lundy Dam). Hydrologically, this bedrock reach is the most productive portion of the catchment, receiving roughly 85% of the watershed's precipitation. Lundy Canyon thus generates the great bulk of the water for the lower two reaches. It is the stream's sole gaining reach, and the only reach characterized by tributaries (including the perennial Deer Creek, and numerous unnamed intermittent water courses). A primary feature of this reach is Lundy Lake, a natural water body dammed by recessional moraines of the Tioga glacial advance.

Glaciation during Late Pleistocene time eroded most of the soil and sediment mantle from Lundy Canyon, leaving only a small potential for storing groundwater. This small storage potential, coupled with the marked seasonality of precipitation and runoff, contributes to a strong season-to-season variation in the natural flow regime of Mill Creek. Unimpaired flows measured immediately downstream from Lundy Lake typically reach an annual maximum between late May and early July (average monthly flow for June = 89 cfs), and then decline to a base flow (averaging 14 ± 4 cfs) between September and late April[1] (FW Env. Corp, 1995; Perrault, 1995).

The Pleistocene Delta Reach. Mill Creek debouches from its bedrock canyon at an elevation of ~7200 feet. For the next 3.45 miles it flows eastwardly through a narrowly incised late Pleistocene delta over a bed of alternating coarse-alluvial and fine-lacustrine sediments. Aerial photos and field observations indicate that this Pleistocene Delta Reach of Mill Creek was characterized over most of its length by a single channel lined with a narrow band of riparian vegetation (mainly willows, cottonwoods, aspens, and Jeffrey pines). Only locally did the stream braid into

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[1] A gain ("accretion") of 3 to 10 cfs occurs downstream of this gauge in the lower portions of the bedrock reach (EBASCO, 1995). Thus, both the base flow and the average monthly maximum flow at the foot of the bedrock reach are slightly higher than the figures given above.

multiple channels. Observations made since 1980 leave no doubt that water seeps to the ground along this portion of the stream, with an estimated loss of perhaps 2-4 cfs over the length of the reach.

The Holocene Delta Reach--Mill Creek's interior and exterior delta. At elevation ~6630 feet the narrow, eastward-trending gorge of Mill Creek begins a sweeping bend to the south, and becomes progressively wider along its bottom. For purposes of this report, this change in valley orientation and width at elevation ~6630 feet marks the boundary between Mill Creek's Pleistocene Delta Reach and its Holocene Delta Reach. The Holocene Delta Reach stretches 2.45 miles to Mono Lake.

The downstreamward widening of the canyon bottom beginning at ~6630 feet is the result of Holocene deltaic sedimentation on Mill Creek. Simply put, progradation (lengthening) of Mill Creek resulting from the construction of its "exterior delta" (stretching from the county road to Mono Lake, a distance of ~5000 feet) has instigated agradation or backfilling into the Mill Creek canyon, creating the stream's "interior delta" (stretching from the county road upstream to the aforementioned bend, a distance of ~7800 feet). Under natural conditions, this interior delta, like all active interior deltas, was characterized by multiple channels, or "distributaries". These narrow channels distributed the stream flow widely across the valley bottom, creating a "bottomlands environment" characterized by wooded wetlands. Riparian woodland was common along these narrow distributaries, and on the interfluves that separated them, as evidenced by the dead snags that remain abundant on the ground today.

History of Diversions

By the late 19th century irrigation interests were diverting water from the upper two reaches of Mill Creek by way of ditches. The highest of these irrigation diversions--the Upper Conway Ditch--tapped the left bank of Mill Creek at an elevation of ~7520 feet. It irrigated lands near the present-day site of the Lundy Power Plant, and near the base of the Bodie Hills. Approximately 1.5 miles farther downstream, near the boundary between the Bedrock Reach and the Pleistocene Delta Reach (elevation of 7185 feet), the Upper Thompson Ditch bifurcated from the right bank of Mill Creek, transporting water east- and southward to the Thompson Ranch (now DWP lands) near Dechambeau Creek. At slightly lower elevation (~7080 feet) the Lower Conway Ditch diverted water from the left bank of Mill Creek toward the Conway and Dechambeau ranchlands to the north and east. The right bank was again tapped at elevation 6920 feet by the Thompson Main Ditch. The lowest of the Mill Creek ditches, the "McGahn Ditch", departed from the stream's left bank at an elevation of 6650 feet, approximately 1 mile downstream from the Highway 395 stream crossing. It watered an ~80-acre parcel of land (now owned by DWP) lying between Mill and (present-day) Wilson creeks.

In 1905 the predecessors to Southern California Edison constructed a power generating facility (the "Jordan Power House") at a site north of Mill Creek (and indeed beyond the boundary of the Mill Creek watershed). Shortly after its construction, this facility was obliterated by an avalanche. It was replaced in 1911 by the Lundy Power House (Vorster, pers. com., 1995).

As part of this hydroelectric project, a dam was built on Lundy Lake that raised the outlet by ~37 vertical feet (from elevation 7766 feet to 7803 feet). This dam was constructed near the mouth of Deer Creek, and was intended to capture the flow of that main tributary.[1] The stored water is diverted from near the Lundy Dam into an aqueduct and penstock that feeds the powerhouse. This facility has the capacity to accommodate a diversion of up to 70.6 cfs (Perrault, 1995).

Following completion of the Lundy Dam, Southern California Edison and its predecessors in all but the wettest years diverted the bulk of water from the Mill Creek watershed into the power plant. Once through the plant and into the tailrace, the flow was split: a high percentage was directed into the Conway-Dechambeau ditch system (this rendered unnecessary the direct off-stream diversions at the Upper Conway Ditch and the Conway-Dechambeau Ditch); the relatively small (and occasional) remainder entered a newly constructed return ditch that carried the water back to Mill Creek, ensuring a supply to downstream diverters.

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[1] Sometime between 1956 and 1968 Deer Creek shifted eastward on its alluvial fan, so that today it enters Mill Creek immediately below the dam. This flow is typically taken up by downstream irrigation interests.

Throughout Mill Creek's upper two reaches, dewatering due to irrigation and hydropower diversions was rare. Accretion below Lundy Dam, together with minor seepage from the dam and small obligatory releases to downstream diversion interests, kept this portion of the stream perennially watered. As a result, riparian vegetation has remained largely intact, protecting the streambanks from wholesale erosion.

Degradation of the Mill Creek Bottomlands

In contrast to Mill Creek's upper two reaches, which were seldom devoid of flow, the lower reach of the stream was frequently dewatered. Death of the riparian vegetation appears to have come early (possibly even before the turn of the century), so that by 1929, when the first aerial photos of the Mono Basin were produced, most of the riparian stand had already been lost. Today, long-dead remnants of trees and shrubs testify to the once-widespread woodland.

The 1929 photos also show the geomorphological consequences of this vegetation degradation: Much of the system of multiple channels has been abandoned, and the single existing channel is in the process of being widened over some segments. Further channel degradation, including overwidening along lengthy new segments, is evident on the 1940 photos (presumably this more recent degradation occurred during the high-runoff year of 1938). Later photos show that by 1955 nearly the entire reach has been transformed into a straight, wide wash with little to no channel definition.

Beginning in the early 1960s a series of natural and artificial events conspired to force the frequent watering of Mill Creek's lowest reach. In September of 1961 the Lundy Powerhouse was damaged, apparently by a landslide. The facility remained inoperative over the ensuing 7 years, during which time a diminished amount of water was diverted to the Conway-Dechambeau lands. As a consequence, Mill Creek carried flow during most of the months of that period. Following the powerhouse repair, the stream received flow during the peak snowmelt times of numerous normal to wet years: 1969, '73, '74, '78, '80, '82, '83, '84, '86, '93, and '95. As a consequence of these releases, riparian vegetation, though largely confined to the active wash, is more abundant today than it has been at any time during the past 65 years. The stream channel, however, remains wide and ill-defined along most of its length. While braiding across the wash is evident in numerous places, there is no indication of a return to a system of narrow distributary channels.

Restoring the Mill Creek Bottomlands

Introduction. Many of the narrow distributary channels that characterized the Mill Creek bottomlands under natural conditions are still in existence. Their heads are typically plugged by sediment generated during the periods of erosion-induced widening of the existing channel.

Rewatering these channels would accomplish the following:

- distribute streamflow widely across the valley bottom
- raise the water table across the valley bottom
- promote ponding in the numerous natural depressions
- promote growth of riparian vegetation across the valley bottom by dispersing seeds, raising the water table, and providing natural irrigation

The abandoned channels: Delineation. The abandoned channels of the Mill Creek bottomlands were mapped during the late summer and early fall of 1995. That map is included here as Figure 1. Descriptions of the channels are provided in Table 1. A discussion of the channels follows.

The abandoned channels: Discussion. The multiple channels of the Mill Creek bottomlands were abandoned when the loss of vegetation destabilized the channel banks. This loss of bank stability not only caused the stream to cut a new, straighter path at weakened meander points, but it also mobilized sediment which then clogged the entrance of the distributaries. Thus, in most cases, rewatering the abandoned distributaries would entail removal of these plugs of sediment. (Note that these plugs are typically far smaller than the deposits of quarry waste that today clog the abandoned channels of the Rush Creek bottomlands.) Along most of their length, the abandoned channels of Mill Creek retain their former width and sinuosity, though at a few highly localized sites rewatering would require improving the channel definition.

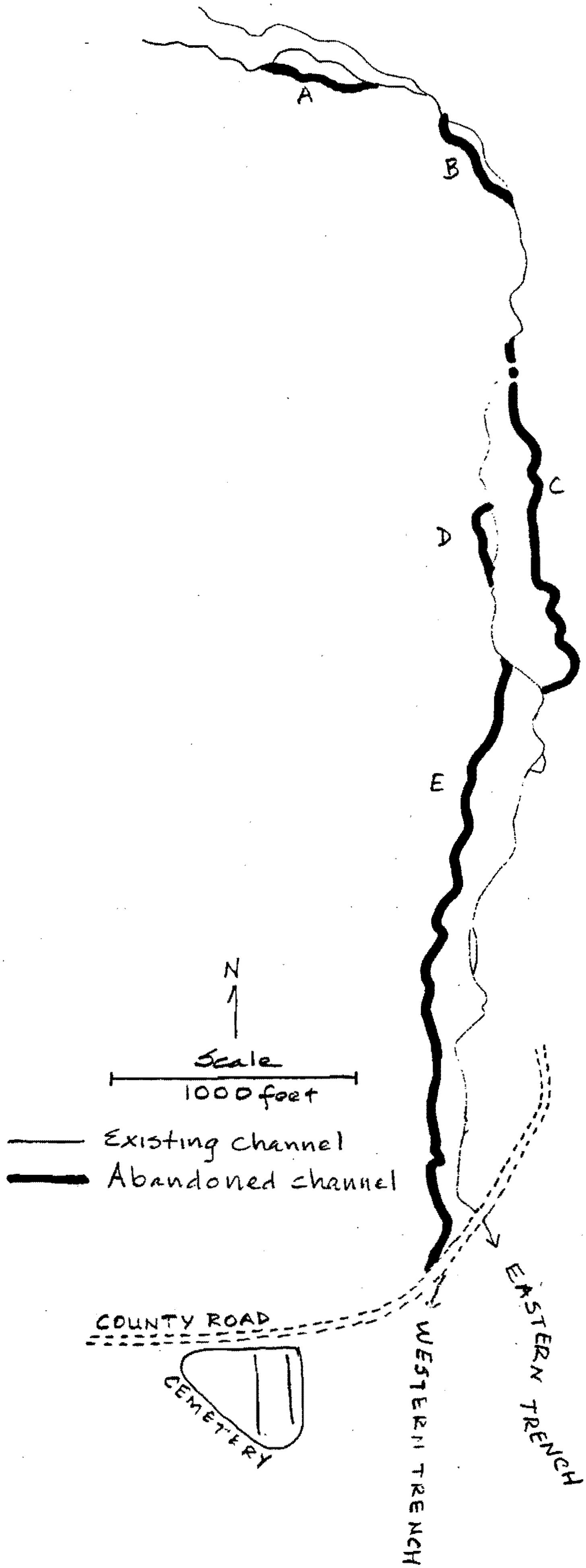

Figure 1
Abandoned Channels of the Mill Creek Bottomlands (see Table 1 for descriptions)

Sources: USDA Forest Service aerial photo 8-22-93;
field observations of 9/93 and 10/93

TABLE 1

ABANDONED CHANNELS OF THE MILL CREEK BOTTOMLANDS
(see Figure 1 for channel locations)

The table that follows outlines the characteristics of the abandoned channels of the Mill Creek bottomlands. Each of the channels has been designated by capital letter (A through E). This designation is by elevational sequence, with Channel A being the upstream-most of the abandoned channels, and Channel E being the downstream-most. The channel lengths given here are based on analysis of aerial photos, and so should be considered approximate.

In addition to the objective information provided in the table, each of the channels is assigned a restoration priority (either 1 or 2). While admittedly subjective, the assigned priorities are based on objective criteria, including length of channel, ease of rewatering, degree to which a rewatered channel would spread flow across the bottomlands, and other factors explained in the "Priority" subsections.

Channel A. This abandoned channel lies west of the main channel, immediately above the very big westward bend (upstream) of the stream. It is reasonably well-defined at its upper and lower ends.
Approximate Length: 450 feet
Elevation at upper end: ~6620 feet
Grade at upper end: 4-5 feet above existing active channel
Grade at lower end: 4-5 feet above existing active channel
Sinuosity: Variable, though greater than the modern channel complex.
Priority: 2. The stretch of stream along which Channel A runs is already characterized by 2 well-formed channels, offsetting the need to spread the water laterally. Furthermore, Channel A is stranded 4 to 5 feet above the existing active channel, and so presents a problem in entrance and exit design.

Channel B. This abandoned distributary lies west of the modern channel complex. It has carried water this year, and will continue to do so during times of high flows.
Approximate Length: 450 feet
Elevation at upper end: ~6600 feet
Grade at upper end: In grade with existing active channel
Grade at lower end: In grade with existing active channel
Sinuosity: moderate-- greater than most of the modern channel complex
Other characteristics: Channel B is part of the modern channel complex. It might be encouraged to take more water, since the lower portions of the channel constitute a fine wetland.
Priority: 1. Channel B is presently watered at high flows; it should be examined to determine suitability for augmenting flow, with an eye to retaining wetland habitat during fall and winter seasons.

TABLE 1 (cont.)

Channel C. This abandoned channel lies east of, and runs parallel to, the modern channel complex. It is reasonably well-defined, though blocked by a fallen cottonwood trunk, at its upper end. Because of this blockage, and a cobble that extends down channel for a short distance, the channel entrance lies approximately 2-3 feet above the modern channel complex. Rewatering might entail getting semi-permanent flow into a portion of the modern complex that, presently, carries water only during moderate to high flows. The channel is well-defined near its head, locally clogged in some of the middle sections, and exceptionally well defined in its lower reaches. In these lower reaches it runs along the canyon wall *a la* Rush Creek's channel 10. It enters the existing channel at grade, and through an aspen-lined lowland with a small (1- acre) depression which, when watered, would constitute a pool.

Approximate Length: ~1510 feet
Elevation at upper end: ~6570 feet
Grade at upper end: ~3 feet above modern channel complex, due to fallen cottonwood and sediment clog.
Grade at lower end: In grade with modern channel complex
Sinuosity: Variable, though greater than the modern channel complex.
Priority: 1. Channel C is considered a high-priority channel, since it would a) spread water far to the east, and indeed graze the east canyon wall along its lower reaches; b) encourage the growth of riparian woodland over a long (~1500-foot) stretch which today is largely lacking in arboreal growth; and c) encourage ponding of water at several points, most notably at the downstream end of the channel. Channel definition would be required at several sites through the middle reaches of Channel C.

Channel D. This channel lies west of the main stream complex. It is a small meander that was cut off sometime between 1930 and 1940 (likely in 1938).

Approximate Length: 300 feet
Elevation at upper end: ~6540 feet
Grade at upper end: 2-3 feet above modern channel complex
Grade at lower end: near grade
Sinuosity: high
Priority: 2. Channel D represents only a small departure from the modern channel complex. While it is might provide both direct and indirect benefits to waterfowl, it is relatively short. Assuming that Channel C were rewatered, the rewatering of Channel D would then create three active channels abreast, perhaps leading to a problem of water sharing in years of only moderately high flows.

TABLE 1 (cont.)

Channel E. This abandoned channel lies west of, and runs parallel to, the modern channel complex. It follows a course marked in places by large amounts of dead and downed willow. It heads near a dead (but standing) cottonwood tree. With a length of ~2600 feet, this is by far the longest of the abandoned channels. It is characterized by numerous small depressions, and one extensive depression (the "Big Hole", approximately 800 feet upstream of the County Road) that would become ponds when rewatered.

Approximate Length: ~2610 feet

Approximate Width: Variable, typically 3-4 feet bottom width and 6-9 feet top width

Elevation at upper end: ~6520 feet

Grade at upper end: ~3 feet above modern channel complex

Grade at lower end: In grade

Sinuosity: Variable, though greater than the modern channel complex.

Priority: 1. Channel E is considered a highest-priority channel, since it would a) spread water far to the west of the bottomlands; b) encourage the growth of riparian woodland over a long (~2600-foot) stretch which today is largely lacking in arboreal growth; c) encourage ponding of water at several points, most notably at the "Big Hole" (approximately 800 feet upstream of the County Road); and d) provide a means of getting water down the westernmost of the two trenches that trisect the Mill Creek delta trench. Channel definition would be required along 5% to 10% of its length, most notably through the middle sections of the abandoned channel.

Based on such considerations as channel length, ease of rewatering, degree to which a rewatered channel would distribute flow widely across the bottomlands, and other factors, each of the abandoned channels was assigned a priority of 1 (highest) or 2. Three of the 6 channels (B, C, and E) are deemed Priority 1. Channel B is already watered at high flows, but might be modified slightly to insure that it carries flow during the fall and winter seasons. Channels C and E share the following traits: They are long (with a total length of 4100 feet); they spread water to the edges of the bottomlands (to the east side in the case of Channel C, and to the west side in the case of Channel E); and they are characterized by depressions that would become ponds when rewatered. Channel E has an additional advantage in that it terminates at the county road immediately upstream of the westernmost of the two trenches that trisect the exterior delta of Mill Creek, and would thus provide a means of rewatering that trench. A discussion of the two trenches follows:

Mill Creek's Entrenched Exterior Delta: The Potential for Creating Hypopycnal Rias and Wooded Wetlands

Creation of the trenches. The artificially-induced drop in the level of Mono Lake since 1940 has caused the lake's main feeder streams to incise their deltas. While Rush and Lee Vining creeks have each cut a single trench, Mill Creek has cut two--an eastern one, which has carried most of the flow of the stream, and a western one, which was cut in 1969 when high flows plugged the culvert under the county road and caused the stream to avulse westward. Similar short-lived freshets, leading to further deepening of the western trench, occurred in 1980 and 1986.

Creation of hypopycnal rias and wooded wetlands. As Mono Lake rises toward 6391 feet, as ordered by the California State Water Resources Control Board, it will engulf the lower reaches of these two trenches, creating two elongate embayments, or "rias". Deposition of bay-mouth bars at the foot of the trenches will create highly sheltered, slack-water conditions within the rias. At times when fresh water is flowing down the Mill Creek trenches, it will override the heavy salt water of the embayment, creating "hypopycnal" conditions (density-induced stratification of waters). Such sheltered, hypopycnal conditions were favored by waterfowl at Mono Lake during the early and middle decades of this century.

To the extent that water is flowing down Mill Creek's delta trenches, the presence of rias will induce agradation, avulsion, and bifurcation of the stream. This, in turn, will create, within each of the trenches, wooded wetlands characterized by a high water table, dense riparian vegetation, multiple channels, and ponds. Such an environment can be expected to stretch roughly 1000 feet upstream from the saltwater embayments. All told, with fresh water flowing down both of the two trenches and Mono Lake standing at an elevation of 6391 feet, approximately 14 acres of slack-water hypopycnal ria, roughly 16 acres of wooded wetlands, and roughly 25 acres of stream-side riparian vegetation, will exist on Mill Creek's exterior delta.

Desirability of groundwater flow to the Mill Creek trenches. Streamflow through much of Mill Creek's Pleistocene Delta Reach, and through most of its Holocene Delta Reach, results in loss of water to the ground. This "lost" water runs through the permeable alluvium of the two reaches, then reappears as springs and seeps near the lower ends of the delta trenches. This subsurface flow contributes water to the woodlands, wetlands, and hypopycnal layer in the trenches throughout the year, most importantly during periods when surface flow in the stream is low. Equally as importantly, the seeps and springs will keep these habitats wetted into the early winter, after the stream itself has frozen up. For these reasons, groundwater replenishment should be considered an essential component of Mill Creek restoration.

Modification of the county road. Neither rewatering the two delta trenches, nor creating the hypopycnal rias and wooded wetlands, will require in-channel manipulations on the exterior delta. (Indeed, the hypopycnal rias and the wooded wetlands will be highly dynamic and self-perpetuating.) Getting water into the western trench, however, will require modification of the county road. Presently the road blocks that trench, directing all flow down the eastern watercourse.

The amount of road modification required to rewater the two trenches would be minimized if the flow of Mill Creek above the county road were split between the presently existing channel system (which would continue to feed the eastern trench) and the now-abandoned Channel E (which would deliver water to the western trench). Presently the downstream end of Channel E lies close to the upstream end of the western trench; only the road prevents the two from being a continuous channel. Insertion of a culvert or bridge on the county road would eliminate this blockage.

Since the eastern trench is both wider and deeper than its western counterpart, it would seem reasonable that the eastern trench should receive a greater portion of the stream flow. With this in mind I suggest a 2/3 - 1/3 split, with the division occurring where Channel E (which would receive the 1/3 flow) bifurcates from the existing channel system (which would receive 2/3 of the flow).

Required Flow Regime

Introduction. Successful restoration of woodlands, wetlands, and hypopycnal rias along Mill Creek's Holocene Delta Reach (i.e. the Mill Creek bottomlands and the exterior delta) would require release of water throughout the year. Ideally, these releases would mimic (though would not necessarily need to duplicate) the natural flow regime of the stream. Presently, use of water for irrigation, and regulation of flows for hydropower generation, preclude duplication of the natural flow regime.

The flow regime necessary for restoration of the bottomlands and exterior delta of Mill Creek can be generalized into three components:

1) Base flows, September through April. Under natural conditions, flows on Mill Creek are low during the period September through April, fluctuating between monthly averages of roughly 10 to 20 cfs. This includes the period September through December, during which the largest numbers of migrating waterfowl inhabit the Mono Basin. Thus, by feeding marshes, ponds, and rills, and by maximizing hypopycnal conditions within the delta trenches, the flows during these months are of direct use to the birds. It is therefore highly desirable, and perhaps essential, that the small amount of water that is naturally available in the Mill Creek watershed in fall and winter all be in the stream during these months.

2) Channel- and riparian-maintenance flows, late spring and early summer. Under natural conditions, peak flows on Mill Creek coincide with the period of peak snowmelt (typically May in dry years, June in normal years, and early July in wet years). For the period 1941-1990, the average unimpaired flow is 89 cfs for June and 73 cfs for July. In the wettest June (1983) of this period, flow averaged roughly 167 cfs, while in the wettest July (1967) it averaged approximately 166 cfs. In each of these cases, peak daily and weekly flows were higher.

Because of the small capacity of Lundy Reservoir, water in many years spills from the dam (in such years it is also released from the dam in anticipation of spillage). As a result, lower Mill Creek occasionally receives flow for a short time in late spring or early summer. Such existing flows, if augmented and prolonged with additional water from water-rights holders, and with unappropriated water from the powerplant tailrace (see below), would contribute greatly to the restoration of Mill Creek's bottomland and deltaic environments, which in turn constitute waterfowl habitat. Such flows are required to maintain channel form, build floodplains, disperse seeds of riparian vegetation, and irrigate that vegetation. (Note that these channel- and riparian-maintenance flows would need to be ramped up and down to avoid damaging the channels. A discussion of such ramping is beyond the scope of this paper.)

3) Groundwater replenishment, late spring, summer, and early fall. For reasons described above (maximization of fresh water at the mouths of the trenches during the low-flow months, and emission of relatively warm groundwater during months of freezing temperatures) it is beneficial to replenish the groundwater reservoir by maintaining water in Mill Creek whenever possible. It is thus desirable to maintain flows in Mill Creek not only in the summer (when riparian and channel maintenance dictate that flows be high) and in the winter (when flows are of direct use to waterfowl), but in the spring and fall as well.

Rewatering Mill Creek: Formulating a Plan

Introduction. Any plan for rewatering Mill Creek must take into consideration the needs of the stream (see above), as well as the limitations imposed by nature, by water rights, and by facilities (i.e. ditches, dam gates, etc.). These limitations, and potential future changes in these limitations, are taken into account in the following consideration of a plan for rewatering Mill Creek.

Potential sources of water--the appurtenant rights. The rights to Mill Creek water are summarized by priority on Table 2, and by land ownership on Table 3. These tables are based on data generated during the Aitken Case proceedings of 1934. They differ in several respects from the water rights table compiled by Mr. J.R. Perrault of the LADWP in his revised document of August 18, 1995. The differences generally involve small amounts of water and low-priority rights, and so bear little on the broad issues being discussed here. Note that all discussions of quantity and priority of water rights hereafter are based on Tables 2 and 3, and that they are subject to adjustment as the differences in the water-rights lists are resolved.

It is clear from Tables 2 and 3 that Conway Ranch and the Department of Water and Power hold highest priority rights to the largest quantity of water. In both priority and water quantity, the United States Forest Service ranks third in importance. (The only other existing right is that of Simis. While of relatively high (No. 4 of 12) priority, it consists of only 1.6 cfs, and is exercised only during the irrigation season. The Simis

Table 2
Summary of Mill Creek Water Rights (by Priority and Current Land Owner)

Priority	Current Owner	1914 Claimant	Lands	Ditch	Volume (cfs)
1.	DWP	NCP Co.	Cemetery	Mill Cr pasture	1.0
2.	Conway Ranch	Conway	Conway	Conway-Mattly	12.0
3, 4.	DWP	Miller, Felosina	Miller, Felosina, Allen	Upper Thompson	9.4
4.	Simis	Sylvester Estate	Sylvester	Upper Thompson	1.6
5.	DWP	Cain Irr.	Thompson Ranch	Thompson Main	14.0
6, 7.	Conway	Mattly, Conway	Conway-Mattly	Conway	5.0
7.	US Forest Service	LW Dechambeau	Dechambeau Ranch	Wilson	12.6
8, 9.	DWP	D. Currie M. Felosina	Currie and Felosina	Main & Upper Thompson	6.0
10.	Conway	H. Mattly	Mattly Ranch	Conway-Mattly	1.0
11.	DWP	Cain Irr.	McGahn	"McGahn",	2.0
12.	DWP	Cain Irr.	Lundy Lk	storage	6.0

Source: FW Env. Cons., 1995, with ditch data by Vorster, pers. com., 1995.

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11.	DWP	Cain Irr.	McGahn	"McGahn",	2.0
12.	DWP	Cain Irr.	Lundy Lk	storage	6.0

Source: FW Env. Cons., 1995, with ditch data by Vorster, pers. com., 1995.

Table 3

Summary of Mill Creek Water Rights (by Current Land Owner and Location of Lands)

Current Owner	Priority	Lands (location)	Volume (cfs)
DWP	1, 3, 4, 5, 8, 9, 11, 12.	97% s. of Mill Creek	32.4 (+6 storage in Lundy Lk)
Conway	2, 6, 7, 10.	NE of Mill Creek	18.0
US Forest Service	7.	NE of Mill Creek	12.6
Simis	4.	S. of Mill Creek	1.6

right is thus considered to be insignificant to discussions of rewatering Mill Creek.)

Historical peculiarities in the distribution of tailrace water. A portion of the DWP right has historically been satisfied by water released from, and accreted below, Lundy Lake. But the remainder of the DWP right, like all of the Conway right and all of the Forest Service right, has been supplied by water that has first passed through the Lundy Powerhouse, and thence out the tailrace.

Historically, allocation of the tailrace water from the powerhouse by Southern California Edison has been peculiar in several respects. While the lands northeast of Mill Creek have water rights totaling just 31.6 cfs (Conway = 18 cfs; Forest Service = 12.6 cfs; DWP = 1 cfs), far more water than this has typically been diverted toward those lands during much of the irrigation season. The excess has ended up in lower Wilson Creek, rather than being returned to Mill Creek. Equally as curious is the historical allocation of Mill Creek water during the non-irrigation season. By late in October, the application of water onto the grazing lands east of Mill Creek has ceased. But even after cessation of irrigation, virtually all of the Mill Creek water that has passed through the powerhouse tailrace has been diverted northeastward toward Wilson Creek, rather than being returned to Mill Creek through Southern California Edison's Return Ditch.

Rewatering Mill Creek: A Plan for Discussion and Debate

Plan elements. The plan for restoring the woodland, wetland, and deltaic habitats on Mill Creek consists of 4 elements, each of which is discussed below. Included in this discussion is 1) a list of the changes in the facilities, facilities management, and exercise of water rights that would be required for the implementation of each element, and 2) an appraisal of the extent to which each element would satisfy the "Required Flow Regime" outlined above.

I stress that the plan presented here is intended to be a point of departure for discussion and debate rather than an exhaustive dissertation of all possible actions. Additionally, note the following:

a) The plan assumes that hydroelectric generation will continue to be a factor in the future operation of the Mill Creek system, with most of the water from the drainage basin passing through the powerhouse and out the tailrace before being further distributed. (This is not to say that flow to the powerhouse could not be curtailed in the future, with more water being released from Lundy Lake into Mill Creek.)
b) The 4 elements are not mutually exclusive, but rather are complementary and cumulative.
c) For the sake of simplicity, the discussions of channel- and riparian-maintenance flows focus on the effect of the plan in years of normal and high runoff. In years of low runoff, neither the plan, nor nature, can be expected to provide ideal, or even adequate, channel- and riparian-maintenance flows.
d) The plan is intended to address broad issues, rather than the intricacies that come with such complications as change-in-use permits, future Federal Energy Regulatory Commission requirement on Southern California Edison[1], precise ramping, dam-release, and power generation schedules[2], etc.

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[1] FERC is in the process of relicensing SCE's Lundy operation. At issue is how much water should be released immediately below Lundy Dam. This release, whatever its amount, will obviously impact Mill Creek flow in a way that affects the plan described below.

[2] It may be possible for SCE, without loosing revenue, to regulate hydropower releases such that October flows are kept at higher than historical levels, thus making more water available available for potential releases down Mill Creek.

<u>Element 1</u>: *The Los Angeles Department of Water and Power dedicates its Mill Creek water right to instream use on Mill Creek.*

Description:

As part of its overall program to restore waterfowl habitat to the Mono Basin, the Los Angeles Department of Water and Power will exercise its non-storage rights to Mill Creek water by returning that water to (via the tailrace and Southern California Edison's Return Ditch), or not diverting it from, Mill Creek. This will contribute, during the peak runoff period of most years, a total of 32.4 cfs to the flow of Mill Creek. Owing to the higher-priority right of Conway Ranch, and to rights held by the Forest Service, this contribution will necessarily decrease through the summer , and will likely be near zero during the late fall and winter .

Required changes in existing facilities:

Of DWP's total non-storage Mill Creek water right of 32.4 cfs, a portion (9.4 cfs) is appurtenant to lands fed by the Upper Thompson Ditch. This ditch lies above Southern California Edison's Return Ditch (which heads at the powerplant tailrace), and so must be fed by water released from the Lundy Dam (at "Farmer's Gate"), and/or by water that accretes below the dam. The remainder of DWP's Mill Creek water right (= 23 cfs minus whatever water in excess of 9.4 cfs is in the Mill Creek channel immediately below the Upper Thompson Ditch) will have to be returned to Mill Creek by way of Southern California Edison's Return Ditch. T o the extent that only 9.4 cfs is in the Mill Creek channel at the Upper Thompson Ditch, and that there is sufficient water in the Mill Creek system to furnish the DWP with their entire water right, the capacity of the Return Ditch, presently rated at 16 cfs, will have to be upgraded to 23 cfs. (Less upgrading will be required if, at such times, more than 9.4 cfs is present in Mill Creek at the Upper Thompson Ditch.)

Components of the "Required Flow Regime" satisfied by Element 1:

During the late spring and early summer of moderately wet to very wet years, when water is spilling from Lundy Reservoir (or is being released from the dam by Southern California Edison in anticipation of a spill), the return of DWP's water (at such times, 32.4 cfs) to Mill Creek will contribute in an important way to riparian- and channel-maintenance flows. In years when little or no water passes through or over the Lundy Dam, streamflows high enough to benefit riparian- and channel-maintenance will likely not occur . Even in these years, however , DWP's summertime contribution will provide important environmental benefits, by replenishing groundwater supplies, and by providing riparian irrigation during the growing season.

The return of DWP's rightful water to Mill Creek will contribute only a very small amount of water to the stream during the months of September through April. This is because, for all intents and purposes, the bulk of DWP's total right is junior to the bulk of the Conway right. Thus, in an average month of, say , November , with only ~10-12 cfs present in the Mill Creek system, Conway will have the right to nearly all the available flow , and DWP's potential contribution will drop to near zero. While DWP's contribution of its water right is an important, indeed essential, first step in the restoration of Mill Creek, it will do little to insure that the Mill Creek bottomlands are wetted, or that hypopycnal conditions in the delta trenches are available, during the months of peak waterfowl abundance.

Element 2: ***All Mill Creek water not used for irrigation is returned to (via Southern California Edison's Return Ditch), or retained in, Mill Creek, to satisfy instream uses.***

Description:

All tailrace flow in excess of the water rights associated with the Conway and Forest Service lands will be returned to Mill Creek by way of Southern California Edison's Return Ditch. As a result, the maximum flow of tailrace water that will be diverted toward the Conway and Forest Service lands will be 30.6 cfs (Conway total = 18 cfs; Forest Service total = 12.6 cfs).

Any tailrace water that is not used for irrigation by Conway Ranch and/or the Forest Service, even if that unused water is within the flow specified in the Conway and Forest Service water rights, will be returned to Mill Creek by way of the Return Ditch. Thus, in the late summer , fall, and winter , at times when the tailrace flow exceeds the amount of water spread onto the Conway and Forest Service lands for irrigation, the excess water will be returned to Mill Creek.

Required changes in existing facilities:

The capacity of Southern California Edison's Return Ditch, presently rated at 16 cfs, will have to be upgraded to at least 40 cfs (this figure is derived by subtracting the Conway and Forest Service rights--total 30.6 cfs--from the powerhouse capacity of 70.6 cfs).

The water in the Return Ditch (up to 40 cfs) will need to pass under the Lundy Canyon Road. As part of increasing the capacity of Return Ditch, it will likely be necessary to increase the capacity of the culvert that passes under the road, or to replace that culvert with a more suitable structure.

Components of the "Required Flow Regime" satisfied by Element 2:

Because it will increase irrigation-season flows in Mill Creek by up to 16 cfs above that outlined in Element 1, Element 2 will contribute substantially to channel- and riparian-maintenance flows, and to summertime groundwater replenishment.

Element 2 will result in all, or nearly all, tailrace flows being returned to Mill Creek in the non-irrigation season. As a result, in the months October through April, Mill Creek on average will receive an additional 10 to 16 cfs beyond that provided in Element 1. Flow through the bottomlands and across the exterior delta of Mill Creek will be close to that which would occur under natural conditions. By watering ponds, rills, and marshes, and by insuring hypopycnal conditions within the delta trenches, this additional water will directly benefit waterfowl during the months when they are in greatest abundance.

<u>Element 3</u>: *The United States Forest Service dedicates its water right to instream use on Mill Creek.*

Description:

The United States Forest Service, in the interest of restoring the Mill Creek environment, will exercise its right to Mill Creek water by returning that water to (via the tailrace and Southern California Edison's Return Ditch), or not diverting it from, Mill Creek. This middle-priority right (7th out of 12), comprising up to 12.6 cfs, can begin to be exercised only at times when divertable flow exceeds 43 cfs. Such flows are typically exceeded only during June and July . The Forest Service contribution would thus occur in the weeks prior to, during, and following, the period of peak runoff.

Required changes in existing facilities:

Under this element, the maximum amount of flow that will be diverted northeastward from the powerhouse tailrace will be 18 cfs (the Conway right). The remainder of the tailrace flow (up to 52.6 cfs) will be returned to Mill Creek by way of Southern California Edison's Return Ditch. The capacity of the Return Ditch, presently rated at 16 cfs, will thus have to be upgraded to at least 52.6 cfs.

The water in the Return Ditch (up to 52.6 cfs) will need to pass under the Lundy Canyon Road. As part of increasing the capacity of Return Ditch, it will likely be necessary to increase the capacity of the culvert that passes under the road, or to replace that culvert with a more suitable structure.

Under this element, Mill Creek below the Return Ditch will receive all of the flow from the drainage basin except 18 cfs. Thus, all other things being equal, during years of high runoff Mill Creek below the Return Ditch will experience flows up to 52.6 cfs higher than have occurred historically . It may therefore be necessary to modify the Highway 395 crossing of Mill Creek, to insure that it can accommodate flows up to 52.6 cfs higher than have occurred since the highway was constructed.

Because of the increase in flow noted immediately above, it may be necessary to modify the county road crossing of Mill Creek. Any need to accommodate higher flows at the county road would be minimized if both of Mill Creek's delta trenches were rewatered, since this would necessitate 2 county road crossings.

Components of the "Required Flow Regime" satisfied by Element 3:

Because the Forest Service water right can typically be exercised only during May through August, the dedication of that right to instream use will necessarily occur when flows on Mill Creek are naturally near their annual maximum. It will thus constitute an important (to 12.6 cfs) contribution to channel- and riparian-maintenance flows, as well as to summertime groundwater replenishment, on Mill Creek.

By contributing to groundwater replenishment during the summertime (and thus to springflow during the fall and winter), the return of the Forest Service's rightful water to Mill Creek will directly benefit waterfowl during the months when they are in greatest abundance.

<u>Element 4</u>: *The Conway Ranch dedicates its Mill Creek water right to instream use on Mill Creek.*

Description:

The present or future owners of the Conway Ranch, in the interest of restoring the Mill Creek environment, will exercise their right to Mill Creek water by returning that water to (via the tailrace and Southern California Edison's Return Ditch), or not diverting it from, Mill Creek. T wo-thirds (= 12 cfs) of the Conway right (= 18 cfs), holds high priority (No. 2 of 12). It, or at least a large portion of it, is thus theoretically available throughout the year .

Required changes in existing facilities:

Under the full extent of this element, no water will be diverted northeastward out of the Mill Creek drainage. Thus, the entire tailrace flow (up to 70.6 cfs) will be returned to Mill Creek by way of Southern California Edison's Return Ditch. The capacity of the Mill Creek Return Ditch, presently rated at 16 cfs, will thus have to be upgraded to 70.6 cfs.

The water in the Return Ditch (up to 70.6 cfs) will need to pass under the Lundy Canyon Road. As part of increasing the capacity of Return Ditch, it will likely be necessary to increase the capacity of the culvert that passes under the road, or to replace it with a more suitable structure.

Under this element, Mill Creek below the Return Ditch will receive all of the flow from the drainage basin. Thus, all other things being equal, during years of high runoff Mill Creek below the Return Ditch will experience flows up to 70 cfs higher than have occurred historically . It may therefore be necessary to modify the Highway 395 crossing of Mill Creek, to insure that it can accommodate flows up to 70 cfs higher than have occurred since the highway was constructed.

Components of the "Required Flow Regime" satisfied by Element 4:

Element 4 will return Mill Creek to a condition in which it functions very much as it did under natural conditions. (The continued operation of Lundy Dam for hydroelectric generation will prevent precise duplication of the natural regime, by delaying, and attenuating, peak runoff in most years.) It will thus provide the greatest and most thorough environmental benefits to Mill Creek.

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MONO BASIN WATERFOWL HABITAT RESTORATION PLAN: REFLECTIONS ON THE HISTORICAL "FIT" OF THE PROPOSED PROGRAM

Report to:
Dr. Fritz Reid, Ducks Unlimited
Dr. Rod Drewien, Hornocker Wildlife Research
Mr. Tom Ratcliff, United States Forest Service
and the
Los Angeles Department of Water and Power

Submitted by:
Elden H. Vestal
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January 31, 1996

APPENDIX G: MONO BASIN WATERFOWL HABITAT RESTORATION PLAN: REFLECTIONS ON THE HISTORICAL "FIT" OF THE PROPOSED PROGRAM

By: Elden Vestal

FORWARD

The writer was invited to review the Mono Basin Waterfowl Habitat Restoration Plan prepared in response to Mono Lake Basin Water Rights Decision No. 1631 of the State Water Resources Control Board, September 28, 1993. Particular attention was to be given in comments to the appropriateness of the Plan to historical (i.e., prediversion 1941) habitat conditions of Mono Lake and the function of the complex ecosystem as an integral part of the Pacific Flyway for waterfowl. I strongly feel that the scientific team has captured the historical conditions of waterfowl habitat and use at Mono Lake, especially given the extreme constraints in available data.

The Waterfowl Habitat Restoration Plan was prepared by a team of waterfowl experts consisting of Dr. Fritz Reid of Ducks Unlimited, Dr. Rod Drewien of Hornocker Wildlife Research and Mr. Tom Ratcliff of the U.S. Forest Service.

The writer was a District Fisheries Biologist for the California Department of Fish and Game and lived and worked in the Mono Basin from 1938 to 1950. Observations and experience with Mono Lake and tributaries and waterfowl developed through many hours afield and through contacts with CDFG wardens, long-term residents of Lee Vining, other Basin old-timers, DWP hydrographer Claude James, and a long-term association with Walter Dombrowski, a former County Supervisor. Mr. Dombrowski became a seasonal CDFG

STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

ORDER

	8042		5555		10191
Applications	8043	Permits	5556	Licenses	10192

ORDER WR 95-10 AMENDING
WATER RIGHT DECISION 1631

WHEREAS:

1. Licenses 10191 and 10192 were issued to City of Los Angeles (Los Angeles) on January 25, 1974, pursuant to Applications 8042 and 8043 respectively.

2. Licenses 10191 and 10192 authorize diversion and use of water from Rush Creek, Lee Vining Creek, Walker Creek and Parker Creek for municipal use and power generation.

3. On September 28, 1994 the State Water Resources Control Board (SWRCB), entered Decision 1631 which amended the terms and conditions of Licenses 10191 and 10192.

4. On May 16, 1995, Los Angeles filed a petition requesting changes in the conditions governing water diversions under Licenses 10191 and 10192 as follows:

   a. Extend to November 1, 1995, the date by which Los Angeles must submit a draft stream and stream channel restoration plan and a draft waterfowl habitat restoration plan;

   b. Eliminate the required flushing flow of 300 cubic feet per second (cfs) for Rush Creek for 1995; and

   c. Allow the export of up to 4,500 acre-feet from the Mono Lake Basin in 1995.

5. The SWRCB provided written notice of the petition to interested parties on May 26, 1995.

6. The SWRCB received written comments on the proposed changes from the National Audubon Society and Mono Lake Committee ("Audubon"), the Department of Fish and Game (DFG) and California Trout (Cal Trout).

7. Counsel for Audubon advised the SWRCB that Audubon "does not object" to the proposed changes, but that it believes other deadlines in Decision 1631 regarding the restoration plans should also be extended by three months. Audubon requests that any export of water from the Mono Basin during 1995 "be carried out in a manner which does the most good for (or least harm to) the Owens River fishery."

8. Counsel for DFG advised the SWRCB that DFG "does not oppose the petition" by Los Angeles. Counsel for DFG advised the SWRCB that DFG supports the changes requested by Los Angeles with the qualifications that other deadlines regarding the restoration plans be extended by three months; that at least 160 cfs be released at Mono Gate One Return Ditch during the high runoff period and flows be increased if inspection of the ditch indicates that it can sustain higher flows; and that water exports from the Mono Basin to the upper Owens River be subject to monitoring and be done in a way that will not harm the upper Owens River. A supplemental letter from DFG staff requested that Los Angeles be required to prepare a proposed schedule of Mono Basin exports for review and concurrence by DFG.

9. Cal Trout stated that it "does not oppose the petition" by Los Angeles. Cal Trout further stated that it would be appropriate to extend the date for submittal of the restoration plans provided that "as an incident to submittal of" the draft restoration plan, Los Angeles notify the SWRCB and interested parties of interim stream restoration work undertaken pursuant to a March 1995 agreement and that all subsequent dates for review and comment on the restoration plans shall also be extended by three months. Cal Trout agreed to elimination of the 300 cfs flushing flow requirement for Rush Creek in 1995. Cal Trout does not oppose the export of up to 4,500 acre-feet of water in 1995 provided that it is done in a way that does not harm the upper Owens River and provided that, prior to the export, Los Angeles submit a schedule to the SWRCB showing the rate and timing of water exports.

10. The SWRCB received no protests or requests for a hearing on Los Angeles' petition.

11. Extension of the date for submittal of the draft restoration plans will allow for continuation of a cooperative effort in the restoration planning process and may reduce future disagreement over proposed restoration measures. In order to allow adequate time for review and comment on the draft restoration plans by interested parties and the SWRCB, it is appropriate to extend the other dates in the restoration planning process as specified below.

12. Providing a 300 cfs flushing flow in Rush Creek may not be feasible for 1995 due to the condition of the Mono Gate One Return Ditch.

13. The unusually high precipitation and expected runoff in the Mono Basin make it reasonable to allow export of 4,500 acre-feet of water provided that the water elevation of Mono Lake is at or above 6377 feet at all times that water is exported and that the water is exported in a manner consistent with protection of the fishery in the upper Owens River.

14. The petitioned changes would not constitute the initiation of a new right nor operate to the injury of any other legal user of the water involved.

15. It is in the public interest to grant the changes requested in the petition.

NOW, THEREFORE, IT IS ORDERED THAT:

1. The date by which the Licensee must submit a draft stream and stream channel restoration plan and a draft waterfowl habitat restoration plan is hereby extended to November 1, 1995. The draft restoration plans shall include a status report on any interim restoration work undertaken to date and shall identify any interim restoration work expected to be undertaken prior to implementation of the long-term restoration measures proposed in the restoration plans. Interested parties shall have 60 days from November 1, 1995 to review and comment upon the draft restoration plans. Following any revisions to the draft plans made in response to comments, Licensee shall prepare and submit final proposed restoration plans to the SWRCB by February 28, 1996. Interested parties may submit comments on the proposed plans to the SWRCB by March 31, 1996.

2. Licensee shall not be required to provide a channel maintenance and flushing flow of 300 cfs in Rush Creek during 1995, provided that Licensee maintain a minimum flow of 160 cfs during the period that the 300 cfs flow would otherwise be required under the conditions established in Decision 1631.

3. Licensee may export up to 4,500 acre-feet of water from the Mono Basin in 1995 provided that the following conditions are met:

   a. The water level of Mono Lake shall be at or above 6377 feet any time that diversion of water for export occurs.

   b. Licensee shall schedule exports of water from the Mono Basin in a manner intended to benefit the fishery in the upper Owens River. Prior to undertaking any export of water from the Mono Basin in

1995, Licensee shall consult with and obtain the concurrence of the California Department of Fish and Game regarding the timing and rate of Mono Basin water exports.

c. Prior to undertaking any export of water from the Mono Basin in 1995, Licensee shall provide written notification to the Chief of the Division of Water Rights of the proposed timing and rate of water exports.

Dated: 7/19/95

Edward C. Anton, Chief
Division of Water Rights

feasibility as well as reasonableness of reaching the restoration goals.

- The restoration plans should identify the specific projects to be undertaken, the implementation schedule, the estimated costs, the method of financing, and the estimated water requirements. (D-1631, page 206 d(2)).

- Restoration actions identified in the plan shall include a justification rationale that considers:

    1. Why it is necessary to take a particular restoration action.

    2. The time it will take to complete the task.

    3. The time it will take to achieve the objective.

    4. The cost and method of financing (to be provided by LADWP staff).

- Measurable criteria should be used to monitor the results of the treatments implemented to achieve the restoration objectives.

WATERFOWL HABITAT RESTORATION

- Decision 1631 does not establish specific goals in this area but does state that the restoration plans for lake-fringing waterfowl habitat shall include measures that are functionally linked to the lake level specified in the order.

- The restoration focus is wetlands and habitat functionally linked to 6,392 lake level and the hydrologic variation around that target management level.

- The plans should consider opportunities in adjacent areas of the Mono Basin.

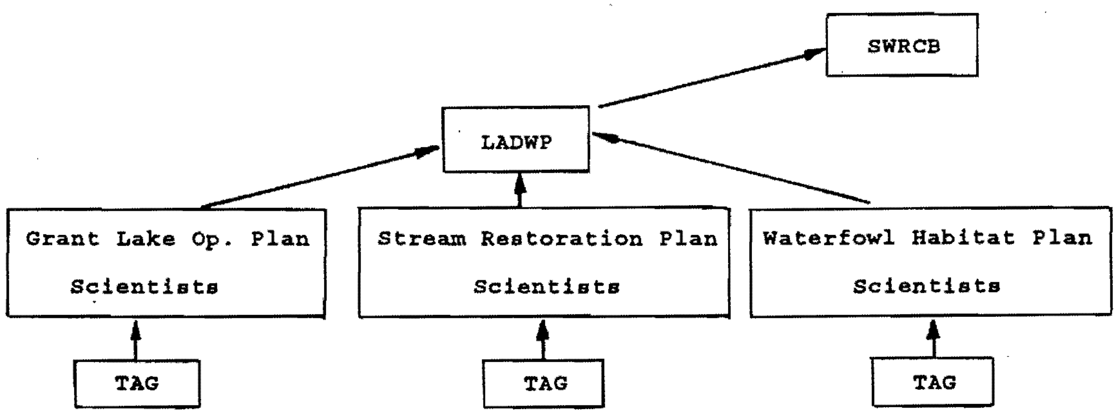
- The restoration efforts should aim to get the most "bang for the buck".

- The time-line for the submittal of these plans to the SWRCB may be more flexible than the stream restoration and Grant Lake Management Plans because of the time it will take to achieve the target lake levels set forth in D-1631.

- LADWP agreed to allow parties to submit names of additional candidates for consideration for the scientist

recommendations in the written report on the cultural resources investigations.

- o The following is a flow chart of the planning program:



SCIENTISTS PARTICIPATION

- o Scientists (Drs. Ridenhour, Trush and Mr. Hunter) agreed to take the lead on the preparation of the stream restoration plan.
- o LADWP must initiate contracts ASAP with scientists.
- o Scientists requested additional resources beyond their own compensation.
- o The scientists should have discretionary authority to expend reasonable costs for plan task development for:

  a. Expert consultation
  b. Expert travel expenses
  c. Expert report preparation

- o The scientists need to quantify these costs.
- o The details of subcontracting and discretionary resources are to be worked out between LADWP and the scientists. However, both the scientists and LADWP will be flexible and creative in solving this issue.
- o SWRCB wants to be sure that contracting delays do not become a cause for delaying the preparation of the various plans. LADWP will be creative on expediting the processing of the contracts so work can start as soon as possible.

PERMIT ASSISTANCE

- Permit Assistance Team concept is a good idea to assist in the permitting of the restoration plans.

- LADWP is the state lead agency and will discuss with SWRCB staff and others about the necessary permits when appropriate.

INTERIM RESTORATION

- Interim work should not hold up progress on the long-term planning effort.

- Specific work should be identified.

- LADWP and the Mono Lake Committee/National Audubon have nearly reached agreement on interim restoration work to be done. Attorneys will look at how to address interim work procedurally.

- 1995 Revegetation Plan will be prepared under the direction of Mr. Trihey (provided contracts are completed and Mr. Trihey accepts contract). Work will be initiated this spring. Revegetation Plans will be sent to the parties.

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Appendix IV

NOVEMBER 21, 1995 LETTER FROM MS. CINDY WISE

November 21, 1995

To: Steve McBain, Los Angeles Department of Water and Power
faxed to 213-367-1128...paper copy to follow by mail (17 pages)
phone 213-367-0963

Cindy Wise (916) 542-5408

From: Cindy Wise, Lahontan Regional Water Quality Control Board

Enclosed is permitting information for your planned restoration work in the Mono Basin. Please note that this is general information based upon our best estimates to date of the types of projects you are planning for the Mono Basin. We may need to update the information once we receive more specific project details from you.

We are looking forward to a very productive and worthwhile meeting with you in December to further discuss your planned restoration work. You might consider having the US Army Corps and/or the CA Dept. of Fish and Game participate by telephone in our meeting.

Happy Thanksgiving!

cc:(w/o enclosures)

Chris Adair/ Lahontan Regional Board
Jim Canaday/Water Rights/SWRCB
Tiffany Welch/US Army Corps of Engineers
CA Fish and Game

11/21/95

NOTES ON PERMITTING ISSUES FOR LADWP'S WORKPLAN FOR MONO BASIN STREAM AND WETLAND RESTORATION PROJECTS AS REQUIRED COMPONENT OF MONO LAKE WATER RIGHTS DECISION

Any discharge must comply with:

(Note: page numbers refer to the ***1994 Water Quality Control Plan for the Lahontan Region or Basin Plan***. Basin Plan ordering information is enclosed. If you wish to purchase copies of the specific sections referred to below, please call me.)

General Objectives with General Direction regarding Compliance
Nondegradation Objective (page 3-2)
State and Federal antidegradation regulations; also ONRW for Mono Lake

Water quality objectives for surface waters (pages 3-3 to 3-7 in Basin Plan) (ammonia and oxygen tables)

Water quality objectives for ground water (pages 3-12 to 3-13)

Specific objectives
Water quality objectives for Mono Hydrologic Unit
(pages 3-44 and 3-45)

Waste Discharge Prohibitions
Regionwide waste discharge prohibitions (page 4.1-1

Exceptions for Restoration Projects (page 4.1-1)

Specific prohibitions for Mono-Owens Hydrologic Units (page 4.1-8)

Other Basin Plan Implementation:

Stormwater (pages 4.3-1 to 4.3-12)

Erosion Control (pages 4.8-1 to 4.8-2)

Water Quality/Quantity Issues; Water Export and Storage (pages 4.9-3 to 4.9-8)

Watershed Restoration (pages 4.9-28 to 4.9-34)

Other (review of final project details and plans may require compliance with other Basin Plan section.

Appendix V

NOVEMBER 16, 1995 LETTER FROM DAVID J. CASTANON

alternatives to the project in light of the overall project purpose, a public interest determination and an environmental impact analysis pursuant to the National Environmental Policy Act. The goal of the Corps is to render a decision on the vast majority of individual permits in less than 120 days.

(2) Nationwide Permits (33 CFR Part 330) - Nationwide permits are a type of general permit issued by the Chief of Engineers and are designed to regulate with little, if any, delay or paperwork certain activities having minimal impacts. The attached Public Notice describes the key provisions of the Corps' current Nationwide Permit Program (NWP). For NWPs requiring Notification to the Corps, the timeframe for rendering a decision is 30 days and NWPs not requiring Notification the goal is generally less than 60 days.

Without having a more detailed description of project activities it is difficult to determine which nationwide permits or combination of permits might be applicable. I encourage you to become familiar with the nationwide permit regulations to better understand the type(s) of authorizations available. A copy of the regulations are included for your convenience.

Please note, however, that the Corps has suspended use of nationwide permit #26 until further notice. Attached is a Public Notice that describes the decision in more detail. Also, all nationwide permits are scheduled to expire on January 21, 1997. A public notice describing the new program once implemented will be disseminated. This new program will likely modify the terms and conditions of several NWPs.

I hope the information we have provided assists you in meeting the requirements of Decision 1631. Should you need further assistance, please contact Ms. Tiffany Welch of my staff at (805) 641-2935.

Sincerely,

FOR David J. Castanon
Chief, North Coast Section

Enclosure(s)

employee and worked with the writer during the major part of the CDFG Rush Creek Creel Census project conducted by the writer from 1947 to 1951. In addition, Mr. Dombrowski was an avid waterfowl observer and hunter. He participated in the Pacific Flyway investigations and, in 1948, gave me copies of his waterfowl shore distribution maps and population estimates.

It was a pleasure to hunt waterfowl with Mr. Dombrowski in the Rush Creek delta and partly through him greatly add to personal experience and observations of waterfowl on Mono Lake. Between 1939 and 1950 hundreds of thousands of waterfowl were observed by the writer on Mono Lake on numerous occasions with the northern shoveler and ruddy duck the predominant species. Other duck species included pintail, mallards, widgeon, green-winged teal, redhead, gadwall and cinnamon teal, the latter being observed particularly in the swampy, cress-filled meadows area of lower Rush Creek bottom lands.

Mr. Dombrowski's maps showed "relative approximate percentages of waterfowl distribution around shore of the lake--." He did not attempt routinely to enumerate the vast numbers of waterfowl, which together we observed at times on the open water of Mono Lake and, at times, congregating about the west end of the lake. Nevertheless, in his Pacific Flyway investigations population data report of November 1, 1948 he stated, "--The ducks at present, are rafted up near the center of the lake where it is difficult to make an estimate of the number. However, there are well over a million ducks on the lake, 80% of which are ruddies and shovelers."

Other long-term residents of the Mono Basin, including Don Banta, Kent DeChambeau, Wallis McPherson and Jack Preston, described fall waterfowl populations that numbered in the hundreds of thousands to a million at a single time.

Thus, documentation of the magnitude of waterfowl numbers of the Pacific Flyway seasonally utilizing pre: 1941 Mono Lake habitats was entered in the record of the SWRCB draft and final EIR and subsequent hearings and remained unequivocal. Indeed, the evidentiary chronicle amounted to a vast Public Trust resource within the complex of California and North American Wildlife resources.

PREDIVERSION WATERFOWL HABITATS ON MONO LAKE (1941)

In the period from 1938 to 1950 Mono Lake elevation remained relatively high at 6,417 feet (1941). Lake surface area was approximately 54,924 acres and lake volume 4,342,000 acre feet with a salinity of 48.3 g/l. It was the fourth largest saline lake in North America (Patton, 1987). The record confirms that historically large numbers of waterfowl utilized the lake and associated fresh and brackish water wetlands.

Lower Rush Creek, its delta and the swampy bottom lands with spring-fed watercress beds below The Narrows was a major waterfowl concentration area. Dombrowski (1948) estimated 45% of Mono Lake ducks in his shoreline distribution map utilized the delta area, which included shallow ponds he created. Stine (1995) estimated 133 acres of habitats made up by freshwater marsh and seasonal wetlands. Additionally, a hypopycnal zone of freshwater overlaying the heavier saline water fanned out broadly beyond the mouth and this area of undetermined extent was richly occupied seasonally by great numbers of waterfowl. The sounds and sight of great flocks of ducks about the Rush Creek delta area at times was, indeed, awesome!

The Horse Creek Embayment was adjacent and west of the Rush Creek delta area. Here Stine (op. cit.) estimated some 63 acres of freshwater marsh and seasonal wet meadow habitat available to and utilized by waterfowl. Again, a hypopycnal zone of undetermined extent augmented the shoreward habitat.

The Lee Vining Creek delta was estimated by Dombrowski (1948) to accommodate 10% of waterfowl distribution around Mono Lake shore and comprised 45 acres of freshwater marsh and seasonal wet meadow. A broad hypopycnal zone of undetermined extent added to the available delta area. Stine (op. cit.) also observed 3 acres of freshwater marsh about Lee Vining tufa.

Between Lee Vining Creek, Cunningham Point and beyond McPherson's landing in calm weather hypopycnal "slicks" from upwelling freshwater springs were often observable from the lakeward margin of U.S. Highway 395. Around the "slicks" milled countless thousands of shorebirds and, at times, waterfowl (ruddies and shovelers). Although, of the undetermined area, the aggregate surface acreage of the upwellings from hundreds of subsurface tufa "sprouts" and towers must have been very considerable.

Orientation as to the Tufa Rock Area, Simon Springs, Warm Springs and the DeChambeau Ranch was aided by two circumlake trips with Claude James, DWP hydrographer, who periodically measured wells around the lake. Mr. James was a keen waterfowl observer and hunter and pointed out the important waterfowl habitats. Dombrowski (1948) estimated percentages of waterfowl distribution for these habitats at 5%, 15%, 5% and 15%, respectively--all described by Mr. James and by long-term Mono Basin residents as important waterfowl concentration and hunting areas. According to Stine (op. cit.) the aggregate freshwater marsh and seasonal wet meadow areas were estimated at 151 acres. Likewise important were the hypopycnal augmentations of undetermined area lakeward from these areas and the cast shoreline due to freshwater inflows overlaying the dense, saline water. At Simon Springs and DeChambeau Ranch area, in particular, such habitat augmentations must have been considerable.

Dombrowski (1948) estimated the percentage of waterfowl distribution in the Monte Vista Springs area at 5%. This shore habitat area, as I recall, encompassed Fisher Springs and the Danburg Ranch, plus an undetermined area of freshwater spread over the dense saline water. Stine (op. cit.) estimated the freshwater marsh and seasonal wet meadow areas of waterfowl habitat at 12 acres.

Thus, in the aggregate pre: 1941 waterfowl habitat amounted to an estimated 248 acres of marsh and about 241 acres of seasonal wet meadows, while perennial and brackish lagoon habitat amounted to an estimated 213 and 52.5 acres, respectively (Stine, op. cit.). In addition, were undetermined acreages of hypopycnal stratification which must have amounted to a very considerable seasonal habitat for waterfowl. Naturally, these lake surface hypopycnal habitats were an integral part of the Mono Lake surface area of approximately 54,924 acres in 1941. In entirety, then, the combination of waterfowl habitats comprised a vast, vital mosaic seasonally utilized by the known abundant Pacific Flyway resource.

SUMMARY AND IMPACT OF TRANS-BASIN STREAM DIVERSIONS INITIATED IN 1941

Stream diversions from the four main tributaries to Mono Lake were begun by the City of Los Angeles Department of Water and Power in Spring 1941. By 1947, the lake had begun to recede, dropping 30 feet in 20 years following, to a total of 45 feet to lake elevation 6,372 feet by 1982. As early as 1948, major inflow from the tributaries had virtually ceased. By 1982 vital fringing wetlands, stream delta areas and hypopycnal environments were degraded to a shocking extreme! Following the mid-1960s, the once vast waterfowl plummeted by more than 95%! The remainder consisted of those species like ruddies and shovelers prone to utilize lake habitats of higher salinities and alkalinity.

PLAN FOR RESTORATION OF LOST WATERFOWL HABITAT

Provisions and conditions incorporated in the Mono Lake and tributaries Water Rights Decision No. 1631 of the SWRCB in September 1993 included requirements of the Licensee LADWP for the development of a plan for restoration of some of the mosaic of waterfowl habitats severely degraded by the decline of Mono Lake. Early on, it was recognized that by restoring the level of the lake to an average of 6,392 feet such lake elevation would foreclose on much vital pre: 1941 waterfowl habitat. Scientists agreed more complete restoration would require return of the lake to elevation 6,405 feet or higher (SWRCB, December 13, 1993). Consequently, restoration efforts in lake-fringing wetlands were stressed.

The Mono Basin Waterfowl Habitat Restoration Plan required of the Licensee LADWP in the SWRCB Decision 1631, in turn necessitated the assistance of the triad of waterfowl scientists described in the Foreward of this report. The expert team published an interim draft of their restoration plan November 20, 1995. Specific restoration measures for Mono Basin waterfowl habitat include the following five principal measures:

1. Increase the water surface elevation of Mono Lake to 6,392 feet;
2. Rewater Mill Creek;
3. Rewater important distributaries in Rush Creek below The Narrows;
4. Develop and implement DeChambeau Ponds-County Ponds restoration projects; and
5. Develop and implement a prescribed burn program.

The first four measures are essentially water manipulation, development and control. The fifth is the periodic application of control burning, widely tested in the Pacific Flyway, to revitalize marsh and bottom lands for waterfowl.

Top priority has been given by the Waterfowl Team of experts to restore the level of Mono Lake to the management stabilization level of 6,392 feet. This single, passive measure will "--restore the largest acreage and provide the most diversity of waterfowl habitats in riparian areas, lake-fringing wetlands and hypopycnal environments--" (Plan, Appendix I, p. 56). Despite this, there will be irretrievable losses of habitat for waterfowl in the Mono Lake ecosystem and some for which mitigation and/or restitution will not be possible.

It would appear that the prospects for rewatering of Mill Creek offer considerable mitigation and restoration possibilities toward riparian and delta waterfowl habitat. New hypopycnal environment in the delta would add to this important restoration measure. The measure will be contingent, however, upon resolving historical water rights and diversions and the required engineering for modified control and manipulation of water supply.

By rewatering several old channels in Lower Rush Creek below The Narrows and tactical periodic burning of congestive debris, remaining bottom lands could be improved for seasonal use by mallards, cinnamon teal, green-winged teal and gadwall. Such work could also provide riparian and instream enhancement for trout habitat. Stine (op. cit.) has described important delta potentials including ria information and hypopycnal extensions from sustained stream flows beyond the mouth. At the same time, he indicated irretrievable losses of once valuable habitat in the old bottom lands area and delta plain due to catastrophic incision.

The DeChambeau Ponds/County Ponds restorations have begun and some elements in the plan here implemented in 1994-95. Critical open freshwater waterfowl and shorebird habitat will be provided. The diversion of Wilson Creek as augmentation to lower Mill Creek would contribute greatly to waterfowl habitat restoration in the DeChambeau Ranch/County Ponds complex.

The proposed spot-burning of channel-blocking debris in lower Rush Creek is recommended by the team of waterfowl scientists as part of a larger program of about 1,000 acres for periodic control burns to revitalize marsh and wetland area habitats. Simon Springs, DeChambeau Ranch meadows complex, and areas managed by the U.S. Forest Service, Department of Parks and Recreation, Mono Lake Tufa Reserve, and LADWP were also considered in this important segment of the habitat restoration plan.

COMMENTS ON HISTORICAL "FIT" OF HABITAT RESTORATION PLAN WITH RESPECT TO PRE: 1941 MONO LAKE

From rapid review of the Waterfowl Habitat Restoration Plan prepared by the expert team of waterfowl scientists and available ancillary reports and documents, the writer has inferred the following changes and deficiencies from the proposed target level of Mono Lake versus pre: 1941 conditions:

1. The most obvious deficiency is the great loss in the stabilization lake surface area amounting to 6,031 acres. The commensurate volume loss is 1,034,750 acre feet with a salinity increase of 20.7 g/l. These basic changes in lake bathymetry would translate into multiple fundamental habitat impacts adversely affecting waterfowl staging on Mono Lake in the Pacific Flyway, mainly in terms of decreased food supply and open lake sanctuary.

2. Lake-fringing habitat losses cited in the Plan include 213 acres of brackish lagoons and 22 acres (91%) of wet meadows. Some 58 acres of once high-value bottom lands on Rush Creek would be lost forever. Further, on Rush Creek, would be lost permanently delta plain wetlands and lagoons which were converted by Dombrowski to shallow ponds heavily used by waterfowl.

3. Hypopycnal areas aggregating considerable lake acreage associated with lake-fringing wetlands would be lost. The full extent of these areas is uncertain.

4. Some habitat gains would accrue from rias and associated hypopycnal areas about the mouths of streams; and the full extent of such areas is uncertain.

5. Some habitat losses would be offset by valuable habitat for waterfowl (and shorebirds) resulting from the DeChambeau Ranch-County Pond developments.

6. Favorable prospects for habitat improvement estimated at 1,000 acres would result from the periodic spot-burning to revitalize marsh and wetland habitats.

I strongly feel that the scientific team has captured the historical conditions of waterfowl habitat and use at Mono Lake, especially given the extreme constraints in available data.

THE BOTTOMLINE

In the opinion of the writer, the foregoing Plan for Waterfowl Habitat Restoration in the Mono Basin represents the mighty efforts of the team of highly qualified waterfowl experts and allied scientists--in effect, to attempt to mend a seriously traumatized Mono Lake environment. Such pre: 1941 environment consisted of a complex mosaic of habitats which were badly degraded or permanently destroyed by half a century of desiccation. By the terms and conditions imposed upon the Licensee in Decision 1631, the SWRCB has presented the team an enormous challenge, seemingly unprecedented in the history of wildlife resources in California. There can be no "quick fixes" here. Only a great "tincture of Time" and the best favors of Nature with the natural vicissitudes of climate and, especially, <u>water</u> can heal the Mono Lake environmental complex in the calculated (if not fervent) hopes of many that it

Supplementary: Linduska, J.P. and Nelson, Arnold, L. Waterfowl Tomorrow. The United States Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Services, 1964, pp. 770.

Appendix II

ORDER WR 95-10 AMENDING WATER RIGHT DECISION 1631

STATE WATER RESOURCES CONTROL BOARD
PAUL R. BONDERSON BUILDING
901 P STREET
SACRAMENTO, CALIFORNIA 95814
(916) 657-1359
FAX: 657-1485

Mailing Address
DIVISION OF WATER RIGHTS
P.O BOX 2000, Sacramento, CA 95812-2000

In Reply Refer
to:342:BHP:8042 & 8043

JULY 19 1995

Thomas W. Birmingham
Kronick, Moskovitz, Tiedemann & Girard
400 Capitol Mall, 27th Floor
Sacramento, CA 95814-4417

Dear Mr. Birmingham:

ORDER APPROVING CHANGES IN CONDITIONS GOVERNING DIVERSION OF WATER UNDER WATER RIGHT LICENSES 10191 AND 10192 OF THE CITY OF LOS ANGELES (APPLICATIONS 8042 AND 8043)

On May 16, 1995, you submitted a petition on behalf of the City of Los Angeles Department of Water and Power (Los Angeles) which requested amendment of three conditions governing diversions of water in the Mono Basin under Water Right Licenses 10191 and 10192. The petition requested that the license conditions established in State Water Resources Control Board (SWRCB) Decision 1631 be amended as follows:

1. Extend to November 1, 1995, the date by which Los Angeles must submit a draft stream and stream channel restoration plan and a draft waterfowl habitat restoration plan;

2. Eliminate the required flushing flow of 300 cubic feet per second for Rush Creek for 1995; and

3. Allow the export of up to 4,500 acre-feet of water from the Mono Basin in 1995.

Written notice of the petition was mailed to interested parties on May 26, 1995. Interested parties were given until June 9, 1995 to file a protest to the requested changes. Although no protests to the requested changes were received, the SWRCB received written comments from the National Audubon Society and Mono Lake Committee (Audubon), the Department of Fish and Game (DFG) and California Trout (Cal Trout). The comment letters requested that various conditions be included in any SWRCB order approving the requested changes.

Based on information provided by Los Angeles and interested parties, and acting pursuant to delegation of authority from the SWRCB, I entered an order approving the changes requested by Los Angeles, subject to the conditions stated in the enclosed copy of the order.

On a related note, Bill Soule of my staff was advised that the work of the consultant preparing the cultural resources report required by Decision 1631 will be delayed due to permitting requirements of the United States Forest Service for further fieldwork on National Forest property. A copy of a June 5, 1995 letter from Los Angeles' cultural resources consultant to Steve McBain of Los Angeles indicates that the Cultural Resources Inventory Report required by Decision 1631 cannot be prepared prior to September 15, 1995. However, the consultant currently sees no need to alter the November 30, 1995 submittal date for the Cultural Resources Treatment Plan required in Decision 1631.

In view of the extension for completion of the restoration plans discussed above, it does not appear that the delay in completing the initial cultural resources report will delay the restoration planning efforts. I want to emphasize, however, that the SWRCB is committed to timely completion and implementation of restoration planning measures required under Decision 1631. Los Angeles should make every effort to ensure that there are no delays in completing the Cultural Resources Treatment Plan. Therefore, within 15 days of the date of this letter, I request that Los Angeles staff provide a written schedule for further work to be done to complete the cultural resources report and the Cultural Resources Treatment Plan required under Decision 1631.

The one-time waiver of the required flushing flow for Rush Creek in 1995 is granted due to the condition of the Mono Gate One Return Ditch. However, Los Angeles shall provide the SWRCB not later than September 1, 1995, with a schedule for completing the necessary physical modifications and/or repair of the Mono Gate One Return Ditch to allow the release of the appropriate stream channel maintenance flows in Rush Creek for 1996. The schedule should identify all state and federal approvals necessary to carry out the required work, necessary environmental clearances (CEQA/NEPA) and the time frames for their preparation and finalization including any required public comment periods. Therefore, by September 1, 1995, Los Angeles shall provide the SWRCB the schedule for completing the modifications to the Mono Gate One Return Ditch in order to comply with the stream maintenance flows for Rush Creek as identified in Decision 1631.

In closing, please be advised that the SWRCB appreciates the cooperative efforts of Mr. Hasencamp and other members of the Los Angeles staff in developing the stream and waterfowl restoration plans. If you or the Los Angeles staff have any questions regarding the requirements described in the enclosed order, please call me at (916) 657-1359.

Sincerely,

ORIGINAL SIGNED BY:

Edward C. Anton, Chief
Division of Water Rights

cc: See attached mailing list