MONO LAKE BACKGROUND

April 26, 2007 State Water Board Member Field Tour

Figure shows creeks, lakes, and conduits.
http://web.ladwp.com/~wsoweb/Aqueduct/realtime/monorealtime.htm

Mono Lake is located 2 hours south of Lake Tahoe on Highway 395, covering about 60 square miles. It is an ancient lake, over 700,000 years old -- one of the oldest lakes in North America. It has no outlet. Throughout its long existence, salts and minerals have washed into the lake from Eastern Sierran streams. Some the freshwater would evaporate from the lake each year leaving the salts and minerals behind. The lake is now approximately 2 + times as salty and 80 times as alkaline as the ocean.

MONO LAKE BACKGROUND

April 26, 2007 State Water Board Member Field Tour

MONO LAKE DATA (Source-Mono Lake Committee):

DEPTH OF MONO LAKE
Maximum = 160 feet. Average = 58 feet.

AGE OF MONO LAKE
At least 760,000 years old; among the oldest lakes in North America.

VOLUME OF MONO LAKE
4.3 million acre-feet at 6,417 feet above sea level (in 1941 before diversions)
3.0 million acre-feet at 6,392 feet above sea level (future stabilization level)
2.7 million acre-feet at 6,385 feet above sea level (1999 level, lake is currently at 6,384.4)
2.1 million acre-feet at 6,372 feet above sea level (1982, lowest recorded level)

LAKE LEVEL
The current lake level as of April 1, 2007 is approximately **6384.8 feet above sea level**, its volume is approximately 2.7 million acre feet, and its surface area is approximately 45,900 acres. It is expected to take about 15-20 years to reach the SWRCB-ordered stabilization level of 6,392 feet. Once it reaches 6,392, it should usually fluctuate about 6 feet in elevation and occasionally rise as high as 6,401 feet, and during extreme drought, drop as low as 6,382 feet. The yearly evaporation rate is approximately 45 inches per year. Without restrictions on stream diversions, the lake would have eventually stabilized at approximately 6,355 feet above sea level. During periods of extreme drought, the lake might have fallen as low as 6,336 - 6,337 feet above sea level.

PAST LAKE FLUCTUATIONS

{PRIVATE}20th Century Low, January 1982	6,372 feet above sea level
Beginning of Diversions, 1941	6,417 feet above sea level
20th Century High, 1919	6,428 feet above sea level
Overflow Level, perhaps 25,000 years ago	7,200 feet above sea level

{PRIVATE}**Elevation**	**Lake Area**	**Exposed Lakebed**	**Salinity**	**When**
6,417	55,180 acres (86.2 sq. mi.)	0 acres	51.3g/l	1941, prior to diversions
6,392	48,960 acres (76.5 sq. mi.)	6,000 acres	69.3g/l	stabilization level in 20 years
6,385	45,900 acres (71.7 sq. mi.)	9,300 acres	78.0g/l	1999
6,372	36,480 acres (57 sq. mi.)	18,000 acres	99.4g/l	1982, lowest recorded elevation

MONO LAKE BACKGROUND
April 26, 2007 State Water Board Member Field Tour

UNIQUE NATURAL RESOURCES:

Mono Lake and its surrounding watershed encompass a unique region in California. Sagebrush, Jeffrey pines, volcanoes, glacial moraines, tufa towers, freshwater streams, and alkaline waters comprise an unlikely world at the transition between the Sierra Nevada Mountains and the Great Basin. Trillions of brine shrimp and millions of alkali flies inhabit the briny waters of Mono Lake. Embracing 14 different ecological zones, over 1000 plant species, and roughly 400 recorded vertebrate species within its watershed, Mono Lake and its surrounding basin encompass one of California's richest natural areas.

TUFA TOWERS

The tufa towers are the most obvious geological feature at Mono Lake. These unusual spires and knobs are formed when calcium-bearing freshwater springs well up through alkaline lake water, which is rich in carbonates. The calcium and carbonate combine, precipitating out as limestone. Over many years, a tower forms around the mouth of the spring. This tufa-forming reaction happens only in the lake itself. As the lake level drops, exposing the springs and towers, they cease to grow.

The Mono Basin is also filled with resting volcanoes. Black Point erupted under the Ice Age Mono Lake about 13,000 years ago, and is now totally exposed on the north shore. To the south lie the Mono Craters, the youngest mountain chain in North America. Mono's islands are also volcanic in nature.

Evidence of the Mono Basin's connection with Ice Age glaciers can be seen in the moraines at the mouths of Bloody Canyon, Lee Vining Canyon, and Lundy Canyon.

A LIVING LAKE

Mono Lake has been called a "dead sea" but it actually abounds with life. It contains chlorides, carbonates, and sulfates - a chloride-carbonate-sulfate "triple water" lake. Few animals can tolerate Mono's salty, alkaline water (pH between 9 and 10), but these few species thrive in astronomical numbers.

The food chain begins with green algae. Two important animals feast on the algae: the brine shrimp and the alkali fly. The brine shrimp is a half inch long creature that, according to Mark Twain, looks "like a bit of thread frayed out at the edges". An estimated 4 trillion brine shrimp ply Mono's waters in the warm season, then over-winter as eggs. The alkali flies number in the millions and look similar to a house fly. The pupae stage of the alkali fly was used as a food source by the Kuzedika Paiute Indians.

MONO LAKE BACKGROUND
April 26, 2007 State Water Board Member Field Tour

Mono's shrimp and flies provide plentiful food for more than 80 species of migratory birds that visit the lake in the spring and summer. Particularly notable bird species include three migrants: the eared grebe, Wilson's phalarope, and the red-necked phalarope; and three nesting species -- the California gull, the snowy plover and the Caspian tern.

ALKALI FLIES

Alkali flies spend two of their three life stages entirely underwater. The larval and pupal life stages develop within the lake. When the adult fly is ready to emerge it floats to the surface where it then begins its adult life cycle. Eventually adult flies return underwater to lay eggs or feed on algae. Tiny hairs trap a thin layer of air which allows the fly to "scuba dive." On calm days in the summer you can watch small, silvery teardrop shapes amble along the bottom of the lake in shallow water.

At Mono Lake flies are food. Most birds prefer dining on the flies. Alkali flies provide more fat and protein than the brine shrimp. This is the principal food that Phalaropes use to grow new feathers and then migrate three thousand miles non-stop to South America. In the mid to late summer the {PRIVATE "TYPE=PICT;ALT=An old photo of a Kutzadika'a woman collecting alkali fly pupae at Mono Lake."} Wilson's Phalarope can be seen spinning in shallow water, creating a miniature vortex that brings alkali fly larvae and pupae to the surface. California Gulls run along the shoreline with beaks open catching adult flies.

The alkali fly was also important source of food for the Kutzadika people during the summer months. Linguistically related to the Northern Paiute peoples, the Kutzadika'a (pronounced Kootz-a'-di-ka-a') lived part of the year in the Mono Basin hunting and gathering. The pupal stage of the alkali fly was collected in shallow water along the lakeshore. Since the pupae are rich in fat and protein, they were an excellent source of food that were dried and used in stews. The Kutzadika'a even traded this delicacy with neighboring peoples. Kutzadika'a means "fly eater" in the Kutzadika'a native tongue.

BRINE SHRIMP

Within Mono Lake's briny waters are trillions of brine shrimp, *Artemia monica*, a species of brine shrimp found nowhere else in the world. An estimated 4-6 trillion brine shrimp inhabit the lake during the warmer summer months. Mono Lake shrimp are tiny, about the size of your thumbnail, and by July Mono Lake water looks very much like shrimp soup. Brine shrimp have no practical food value for humans, but birds regard them as a food item of choice.

In the winter and you will find the water empty of brine shrimp. The brine shrimp population dies off as the lake cools in the winter. Yet, by spring tiny brine shrimp mysteriously begin to reappear. In the late summer and fall, female brine shrimp produce tiny cysts, (dormant,

undeveloped embryos), that overwinter at the bottom of the lake. In the spring the cysts develop into tiny shrimp as the lake warms--beginning a new generation of shrimp.

Because of brine shrimp and alkali fly, the Mono Basin is an important migratory rest-stop refueling station in California with millions of birds arriving and departing between mid-summer and fall. A vital stop on the Pacific Flyway, migrating Eared Grebes, Wilson's Phalaropes, and Red-necked Phalaropes are among the most common of the nearly 100 species of birds that use Mono Lake, its stream deltas, near-shore wetland habitats and small embayments that retain fresh water for feeding and resting habitat.

CALIFORNIA GULLS

If you visit a beach in California and you see a California Gull, there's a better than 80% chance it was born at Mono Lake. By late spring anywhere from 44,000 to 65,000 California Gulls arrive to breed on Mono's lesser-known islands. Mono Lake is home to the second largest California Gull rookery in North America (Great Salt Lake is the largest). The majority of gulls used to nest on Negit Island, the black cinder cone island to the north of large white island named Paoha. In 1979 water diversions lowered the lake level to a point where a landbridge emerged connecting {PRIVATE "TYPE=PICT;ALT=Larus californicus, California Gulls, are one of the most common birds around the lake."} Negit Island with the mainland. Coyotes made easy prey of gull chicks, and the adults abandoned the island. Today the majority of California Gulls nest on the small islets neighboring Negit Island's north shore. A few gulls also nest on the Paoha islets, near Paoha's west shore. The gulls avoid Paoha Island entirely. As of 1998, no gulls had returned to nest on Negit, despite the fact that a rising lake has turned the landbridge into a shrinking island. Signs of coyotes persist on Negit. Someday the gulls may choose to return to Negit Island.

THE PHALAROPES

Of all the birds that come to Mono Lake, the Wilson's Phalarope stands out as the hardiest traveler. These small shorebirds, not much larger than a fist, arrive at Mono Lake in mid-summer after breeding in the northern U.S. and southern Canada. At Mono Lake they molt their feathers and double their weight after several weeks. By the middle of August they have mysteriously disappeared. Leaving in stages during the cover of darkness, they depart for a journey that takes them all the way to South America. The fact that these birds fly over 3,000 non-stop miles to South America is amazing enough, these little birds reach their destination in an unbelievable 3 days!

EARED GREBES

The Eared Grebe, a diving, duck-like bird that spends its entire life on water, arrives at Mono Lake in greater numbers than any other species. Aerial surveys have revealed 1.5-1.8 million

birds on the lake in the fall—comprising a large portion of North America's population! Mono Lake provides a staging area for these water-bound birds as they feed on brine shrimp. The grebes double, and in some cases nearly ***triple*** their weight after gorging themselves on shrimp. Many grebes end up getting too fat to fly, and must lose weight before departing for winter destinations.

AN IMPORTANT REST-STOP

Mono Lake is a small, but vital part of the big migration picture. Because large numbers of phalaropes, gulls and grebes depend on the lake, along with approximately 100 species of other birds, Mono Lake was designated as a part of the Western Hemisphere Shorebird Reserve Network (WHSRN). WHSRN is a collection of critical migratory bird habitats in North and South America. Birds like the Wilson's Phalarope depend on Mono Lake as well as Great Salt Lake, and a host of other lakes in South America for their survival.

WATERFOWL

There is evidence to suggest that Mono Lake once hosted hundred of thousands of ducks as recently as 1948. Nearly 40 years later in 1986, only 14,000 could be counted.

Water diversions lowering Mono Lake reduced the lake's surface (the major waterfowl habitat), increased its salinity, and disconnected or changed the character of shoreline wetland habitats used by waterfowl in the Mono Basin. Combined with the loss of habitat throughout North America and specifically the Pacific Flyway, waterfowl populations have declined significantly over the decades.

A wide variety of waterfowl can be observed at Mono Lake, mostly in the fall. Canadian Geese, Mallards, Northern Shovelers, Northern Pintails, Gadwalls, Ruddy Ducks, Cinnamon Teals, and Green-winged Teals are locally common around the lake with occasional observations of Bufflehead, Lesser Scaup, Snow Geese, or even migrating Tundra Swans in the late fall.

THE WATER ISSUE:

In 1940, the City of Los Angeles and the City of Los Angeles Department of Water and Power received permits to divert water from four streams that are tributary to Mono Lake. The permits authorized diversion of water for municipal use and hydroelectric power production. At the time it issued the permits, the Department of Public Works, Division of Water Resources (a predecessor to the present State Water Resources Control Board) concluded that the California Water Code required issuance of the permits despite anticipated damage to Mono Lake and other natural resources. Los Angeles developed the proposed project and received Licenses 10191 and 10192 confirming its water rights in 1974.

MONO LAKE BACKGROUND

April 26, 2007 State Water Board Member Field Tour

Four of the streams that feed Mono Lake were diverted starting in1941 to supply water to Los Angeles. As a result, the lake fell 45 feet by 1982 and doubled in salinity. In 1978 citizens groups began the effort to protect Mono Lake based on concerns about the lake's ecosystem and about the effects of wind-blown alkali dust on Mono Basin air quality, as well as the esthetics of a shrinking lake. Also, gull nesting islands were becoming connected to shore, no longer safe from predators like coyotes.

This led citizen groups (the Mono Lake Committee and National Audubon Society) to begin the legal effort to protect Mono Lake. The Mono Lake Committee and National Audubon Society took Los Angeles to court.

Sixteen years after the efforts began and following a long series of court decisions that mandated protection for the lake, the SWRCB amended the City's water diversion licenses. Various governmental agencies, including the Mono Basin National Forest Scenic Area and the Mono Lake Tufa State Reserve, joined with research scientists and the citizen groups in the hearings. Los Angeles announced that it would not appeal, but would move forward, cooperatively, to implement the requirements in the decision.

HIGHLIGHTS OF ORDER 1631

On September 28, 1994, after 40+ days of hearings, thousands of pages of testimony, the SWRCB issued an order (D-1631) to protect Mono Lake and its tributary streams. The order required a management lake level 17 feet higher that the then existing level (6,392 feet above sea level), which would likely take a minimum of 20 years. Stream and waterfowl habitat restoration efforts are underway as required in the order. In D-1631, Mono Lake was designated an Outstanding National Resource Water pursuant to the Clean Water Act. The decision set a lake level which will reduce lake salinity which will help protect the lake's algae, shrimp, flies and birds. The islands will be surrounded by plenty of protective water, and the dust storms should be reduced to acceptable levels. The streams which had been diverted have also received attention during this process. They are not only being rewatered, but the fisheries values of those streams are being restored and actively monitored. Minimum flows were spelled out based on natural flow cycles. A waterfowl habitat restoration plan is also required, to help mitigate lost shoreline qualities that once attracted close to a million ducks and geese.

The decision recognizes that some of Mono Lake's pre-diversion qualities will not be restored at the 6392 level but that it is a reasonable balance between competing uses of water.

MONO LAKE BACKGROUND

April 26, 2007 State Water Board Member Field Tour