

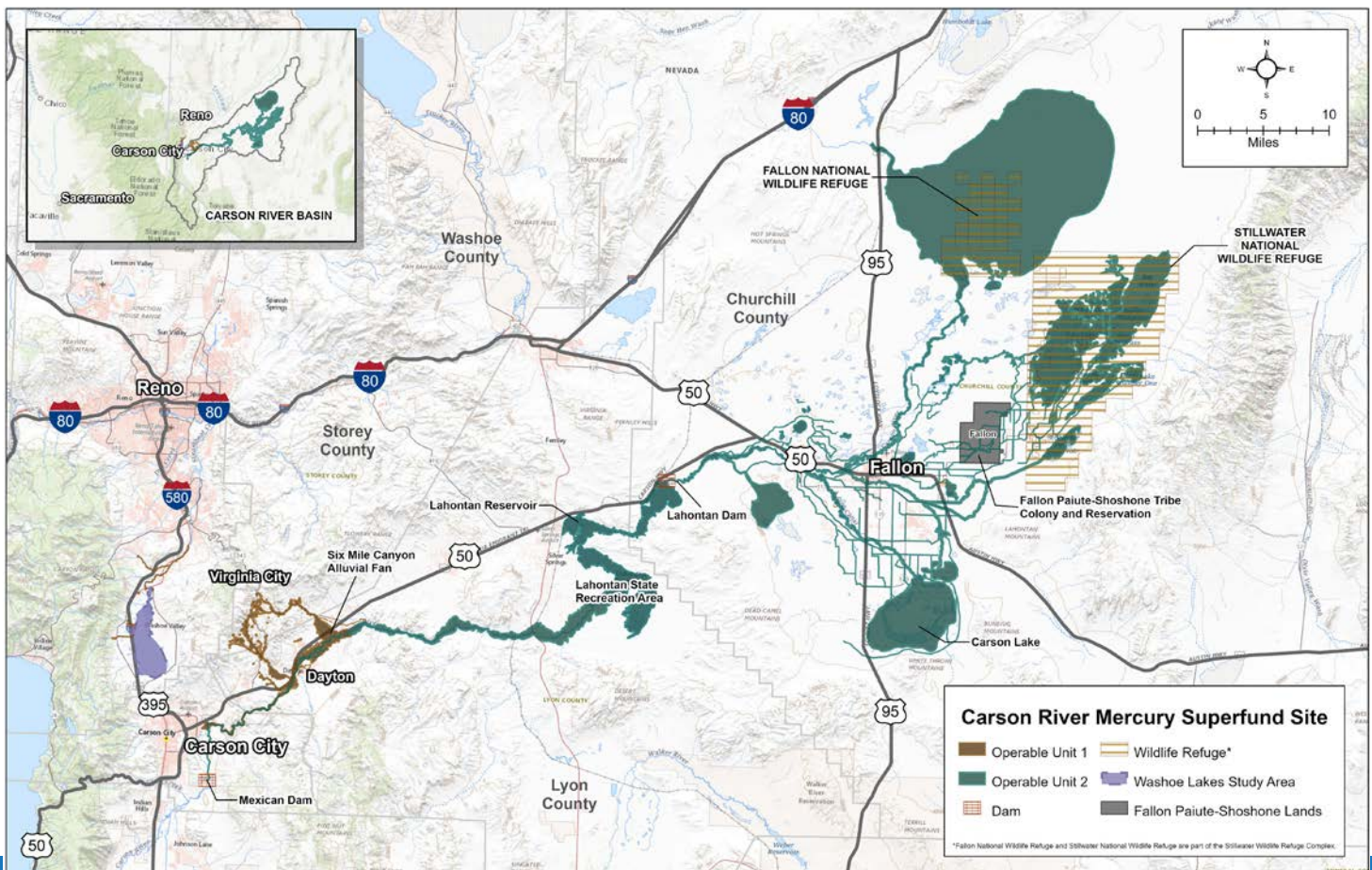


U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • September 2021

## Proposed Plan for the Carson River Mercury Superfund Site Operable Unit 2

Working with the Nevada Division of Environmental Protection (NDEP), the U.S. Environmental Protection Agency (EPA) proposes to protect human health and the environment through an interim remedy for the Carson River Mercury Superfund Site (CRMS) Operable Unit 2 (OU2). NDEP and EPA will use an interim remedy to protect human health. When new technology and/or more extensive evaluation of Lahontan Reservoir and Washoe Lake is available, a final remedy can be determined. EPA has administratively divided CRMS into two operable units (OUs): OU1 includes former mill sites near Carson City, Virginia City, and Dayton, Nevada.

OU2 includes soil and sediment in waterways from the mill sites extending more than 130 miles down the Carson River to the wetlands. As shown in Figure 1, this includes the Stillwater and Fallon Wildlife Refuges, Carson Sink and Carson Lake, among others. This Plan describes the remedial alternatives that we are considering and identifies our Preferred Alternative for implementation. We believe the Preferred Alternative will effectively address human exposure to mercury contamination. The public will have opportunities to learn about the Proposed Plan and send written comments about it during a minimum 30-day public comment period.









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## ■ Proposed Plan at a Glance

### Statement of the Problem

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EPA is concerned about mercury at this site. During the Comstock mining era beginning in 1859, miners used mercury to separate gold and silver ore. They released these mercury-contaminated tailings into the river, which then got into the sediments where it continues to bioaccumulate in the food chain. The river carried the tailings downstream to the floodplain and the wetlands. Tribal members who practice a traditional way of life by eating game fish, wild plants and waterfowl have potentially elevated human health risks. Mercury contamination also poses health risks to adults and children who eat Sacramento blackfish, commercially harvested from Lahontan Reservoir and game fish from certain areas of the river and lakes.

### Proposed Solution

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EPA's Preferred Alternative is an interim approach using a combination of Land Use Controls (LUCs), compliance and monitoring to help prevent mercury exposure and keep contamination from spreading. This alternative reduces human health risk in the floodplain by discouraging people from eating contaminated fish, wild plants and waterfowl through a comprehensive communication and public education program. Environmental Covenants (ECs, a voluntary title notice) would be placed on properties to help prevent exposure to mercury-contaminated soils. The interim action includes several prioritized actions that will reduce human health risks. They are intended to be consistent with and support a final cleanup action that will be selected in the future. Working with state partners, EPA will use English and Spanish signs, annual surveys, community outreach and educational programs to discourage

fish, wild plant and waterfowl consumption. The Preferred Alternative also recommends against the current practice of stocking the Carson River or Washoe Lake with game fish other than trout, while a fish advisory is still in place to reduce people's exposure to mercury contamination. In addition, EPA recommends that the state no longer issue permits for the commercial harvest of Sacramento blackfish for human consumption. This alternative also expands upon the current Long-term Sampling and Response Plan (LTSRP) used in the OU1 area since the 1995 Record of Decision for this particular area. The LTSRP addresses construction in residential and non-residential properties in the floodplain and/or active channels. EPA and NDEP would oversee soil sampling and possible remediation by commercial and residential developers in areas where mercury contamination may require action (i.e., removal or containment) to prevent it from further spreading. The Preferred Alternative would initially require annual monitoring of surface water, sediments, wild plants, waterfowl and fish tissue. This approach uses the latest science and technology to address mercury contamination.

As long as monitoring results indicate mercury levels that pose human health risks or until a final remedy is implemented, EPA and NDEP will continue to require compliance with the LUCs.



*Soil sampling in Six Mile Canyon with local, state and tribal partners (2017)*

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## Cleanup Framework

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The Proposed Plan fulfills the requirements of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA, also known as Superfund or Superfund Law) Section 117(a) and the National Contingency Plan (NCP) 40 CFR Section 300.430(f)(2). This plan highlights key information from the Remedial Investigation (RI) and Feasibility Study (FS) reports. The RI looks at where the mercury went, in what concentrations and the threats to human health and the environment if nothing is done to address it. This information then forms the basis of the cleanup alternatives found in the FS and evaluates the strengths and weaknesses of each. Interested readers can obtain copies of these documents, and other documents referenced and used by EPA in developing this plan, in the CRMS Administrative Record file, which is available online at [epa.gov/superfund/carsonrivermercury](https://epa.gov/superfund/carsonrivermercury) and in the information repository locations listed on the last page below.

## ■ Site Background and Characteristics

In 1859, miners discovered large natural deposits of gold and silver, also known as the Comstock Lode, in Virginia City, Nevada. Miners used an estimated 14 million pounds of mercury to process gold and silver ore. In Gold Creek and Six Mile Canyon (Dayton area), milling operations were intense. About 236 mills processed the ore (including 13 at Washoe Lake). Over several decades, this milling process released mercury into the environment. The mills required access to water and extended operations to New Empire in Carson City and with a flume to Virginia City, Gold Hill, and from Six Mile Canyon to Dayton. Contaminated tailings accumulated at the mine and mill sites. Over time, these tailings eroded and are washed into the Carson River.

The site spans five counties in Western Nevada that are part of the Carson River and Steamboat Creek watershed basins. The Carson River basin portion alone, covers 318 square miles, extending more than 130 miles end to end. Operable Unit 2 begins on the main stem of the Carson River at the Mexican Dam, eventually branching to the Stillwater and Fallon National Wildlife Refuges, including miles of agricultural canals and drains. The site occupies land owned or managed by the State of Nevada, the U.S. Bureau of Land Management, the U.S. Bureau of Reclamation, the U.S. Fish and Wildlife Service, residential areas and commercial businesses.

Historic mill sites in Carson City, Virginia City, Dayton, Washoe Valley and Pleasant Valley are contaminated with mercury. Streams and creeks carried mercury contamination from the mill sites and spread it the entire length of the Carson River and adjacent floodplains. EPA's site investigation found mercury in soil, sediments (earthen materials that settle to the bottom of a water body), fish and waterfowl.

Scientists have concluded most of the contaminated soil and sediment probably entered the river during the mining period around 1860 through 1890. Mercury trapped in miles of abandoned river channels is also an ongoing source of contamination, entering the river during riverbank erosion or construction activities. Once in the river, contaminated sediment flows downstream.

Located about 30 miles downstream from Six Mile Canyon, the Lahontan Reservoir normally traps sand and silt and associated contamination. Before the dam holding the Lahontan Reservoir was completed in 1915, flooding transported contaminated sediment throughout the valley. This sediment traveled more than 130 miles downstream from the mills to as far as the Lahontan Valley wetlands. The dam reduced downstream flooding. At times, major floods like the one in January 1997, forced contaminated sediment and water downstream. During normal river flow, mercury and methylmercury (the highly toxic form in fish) attached to fine particles that were transported downriver beyond the dam.





*Carson River below the Lahontan Dam spillway (2017)*

### **Regulatory Actions to Define Superfund Operable Units**

EPA divided the CRMS Project into two Operable Units. OU1 is the upland area along the river outside Carson City, stretching from New Empire, Virginia City and drainages to Dayton where the mills were located. These areas have surface soil with high mercury levels. After signing the Record of Decision in 1995, EPA began cleanup actions in OU1. OU2 includes mercury-contaminated areas in the Carson River system, including Lahontan Reservoir, Carson Lake, and Fallon and Stillwater National Wildlife Refuges.

EPA completed the Remedial Investigations (RIs) and Feasibility Studies (FS) for both OUs. The RI determines the nature and extent of mercury contamination and the risk to human health and the environment. The RI also informs the cleanup options EPA considers in the FS. OU2 is large and subject to changing environmental conditions along stretches of the Carson River. For the purpose of the RI and FS, OU2 was divided into subareas for investigation and evaluation. Because the actions for the subareas are similar in scope and design, EPA is treating OU2 as one area.

### **OU2 Site Characteristics**

Operable Unit 2 covers two primary watersheds—Middle Carson Basin and the Carson Desert. These watersheds are very different. The river slope decreases dramatically from the Middle to Lower Basin after the steep-walled canyons in Brunswick Canyon, becoming less steep below Dayton, where the riverbanks and alluvial fans are longer and broader with more floodplains and low areas. In the Carson Desert, the valley floor opens to form a broad valley of floodplains and playa (dry lake beds). Mercury releases from the former mills in CRMS OU1 directly affect these areas.

Before completion of the dam at Lahontan Reservoir in 1915, Carson River flowed directly from the canyon areas into the Carson Desert. Here, the river separates into smaller channels feeding the ancient dry lakes: Carson Lake, Sheckler Reservoir, Indian Lakes, Stillwater and Fallon marshes and Carson Sink.

The reservoir stores water for irrigation of agricultural areas around Fallon. Carson Desert extends from the Lahontan Dam to the Carson Sink. The Newlands Project, with water from both Lahontan Reservoir and the Truckee River, provides surface water from

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the river for irrigation water, and/or eventually makes its way to the Carson River wetlands.

Land use in OU2 consists primarily of tourism, residential, commercial, rural and agricultural uses, and includes recreational areas as well as wildlife habitat. The primary population centers are Carson City, Dayton, Silver Springs, Fallon, and Fallon Reservation. Residential tracts are being developed near several of the historic mill sites in the floodplain. Many of the former mill sites are located in the Virginia City National Historic Site and the Dayton area, scattered within the community. Some of the mill sites are in remote, upland areas surrounding the communities on BLM lands, and those mill sites are being addressed by the OU1 remedy.

Commercial and residential property development continues within the footprint of the CRMS. In addition, local, state, and other federal government agencies periodically perform activities that impact soils and sediments, such as construction and maintenance of bridges or utilities and mucking of waterways to remove accumulated sediments. Historically, some removed sediments have been placed along the banks of the waterway without soil testing.

### **Investigation Findings**

Various agencies have studied mercury in the Carson River Basin since 1973, including U.S. Geological Survey, Nevada Data Research Institute, NDEP and EPA. In 1990, EPA placed the CRMS on the Superfund National Priorities List. Studies continued through 2019, spanning more than 40 years. As part of the Remedial Investigation/Feasibility Study (RI/FS) process, EPA evaluated OU2 mercury contamination from the previous investigations, as well as federal and state monitoring programs. EPA conducted supplemental investigations across the Basin in 2015, 2017 and 2019. Arsenic and lead was also released during ore processing at the CRMS and can be an issue in OU1 soils. However, evaluations during the RI/FS established that mercury compounds are the only contaminant of concern in OU2. The RI report identified locations of contamination and the FS developed recommendations for actions to reduce or mitigate

potential health and environmental risks associated with the mercury.

Most of the soil and sediment contamination in the Carson River is trapped in the banks and deep channels between Sixmile Canyon and the Lahontan Reservoir Dam. EPA evaluated the soil and sediment for various forms of mercury, including mercuric chloride, which is more easily absorbed into plants, to better estimate the potential risks.

Mercury found in surface water samples is primarily in the form of suspended sediments-- particles of soil moving freely in the water. Mercury accumulates as methylmercury in game fish tissues. Methylmercury in fish tissue can be toxic to humans who consume the fish. Mercury methylation (transformation into a form more readily absorbed in fish tissue) is occurring in Lahontan Reservoir and the other lakes in the Carson River Basin. It is transferred from the bottom sediment into the water of the reservoir. Methylmercury production in Lahontan Reservoir is linked to low levels of a form of oxygen, called dissolved oxygen, located in deep parts of the lake (typically during July and August) as well as with mercury associated with fine particles in sediment.

Mercury contamination in riverbanks upstream of Lahontan Reservoir will continue to erode and wash into Carson River. The 1997 flood severely eroded riverbanks, exposing buried mercury rich sediment which increased the amount of mercury flowing into to Lahontan Reservoir and Carson River. USGS studies found that Lahontan Reservoir traps up to 92 percent of the mercury entering the reservoir. Mercury in surface water and soil contamination decreases significantly below Lahontan Reservoir.

### **Summary of Site Risks**

For EPA studies, “risk” is the probability humans and/or the environment will be harmed from exposure to contaminants. EPA evaluated the potential risk—both now and in the future—for humans in a Baseline Human Health Risk Assessment (HHRA) and for the environment in a Screening Level Ecological Risk Assessment (SLERA) as part of the RI/FS reports.

The results of the risk assessments are used to determine if site contamination poses an unacceptable risk to human health and the environment. This information is used to support an interim remedy (i.e., actions) to reduce exposure.

We evaluate the risks from exposure that can cause cancer, and risks that can cause other human health effects. Since there is no cancer risk due to mercury exposure, EPA calculated the non-cancer health effects using a hazard quotient (HQ) or hazard index (HI). If the HQ or HI is 1.0 or higher, it is possible that exposure to site contaminants could be a risk to human health. These effects include serious neurological damage, tremors and birth defects in babies.

As noted in Table 1, EPA found that mercury levels did not pose elevated health risks (i.e., HQs were

less than 1) for on-site adult and child residents, (*see footnote c in Table 1, below*) adult recreational users and agricultural workers exposed to mercury in all OU2 Subareas. The site risk assessments found that human health risks could exceed acceptable levels in sensitive populations. Based on the results, EPA developed remedial alternatives to reduce the risk. Under Superfund law, it is our responsibility to take actions to reduce non-cancer HQs to 1.0 or lower.

Based on a Screening Level Ecological Risk Assessment, EPA concluded that site contaminants posed insignificant risks to wildlife. Studies of impacts on birds that eat fish in Lahontan Reservoir were inconclusive. Because significant ecological risks were not identified, EPA will not address them in this plan.

## HUMAN HEALTH RISKS

The Human Health Risk Assessment, completed as part of the RI Report, evaluated risk for two types of receptor populations (those potentially exposed to the mercury from the site) — “current receptors” and “future receptors.” Receptors include:

- residents (child and adult)
- recreational users (hunters and sports fishermen, an adult and accompanying child)
- agricultural adult workers including commercial/industrial staff who work in the river floodplain areas); and
- people practicing a traditional tribal lifestyle (child and adult for both on reservation members and off reservation exposure).

These receptors are shown in the accompanying table.

TABLE 1: CRMS OU2 Human Health Risk<sup>a</sup> Identified for Each Subarea

Receptor	Subarea				Fallon Paiute Shoshone Tribe Reservation <sup>b</sup>
	OU2A	OU2B	OU2C	OU2D	
Traditional Tribal (adult and youth)	ingestion of wild plants and waterfowl	ingestion of wild plants, waterfowl, and game fish		ingestion of game fish	None (concentrations are below background)
Resident (adult and child) <sup>c</sup>	None	ingestion of Sacramento blackfish from Lahontan Reservoir (adult and child) sold on Asian market	None	ingestion of Sacramento blackfish from Indian Lakes and sold on Asian market	None (only Traditional Tribal Receptors assumed)
Recreational User (adult and child)	None	ingestion of game fish (child only)	None	None	None (only Traditional Tribal Receptors assumed)
Agricultural Worker	None				None (only Traditional Tribal Receptors assumed)

<sup>a</sup> Estimated mercury hazards above 1 for the listed exposure pathways.

<sup>b</sup> The Reservation is located within Subarea C (OU2C), but is listed separately herein because different exposure factors are used for on-reservation exposures compared with off-reservation exposures by Tribal members.

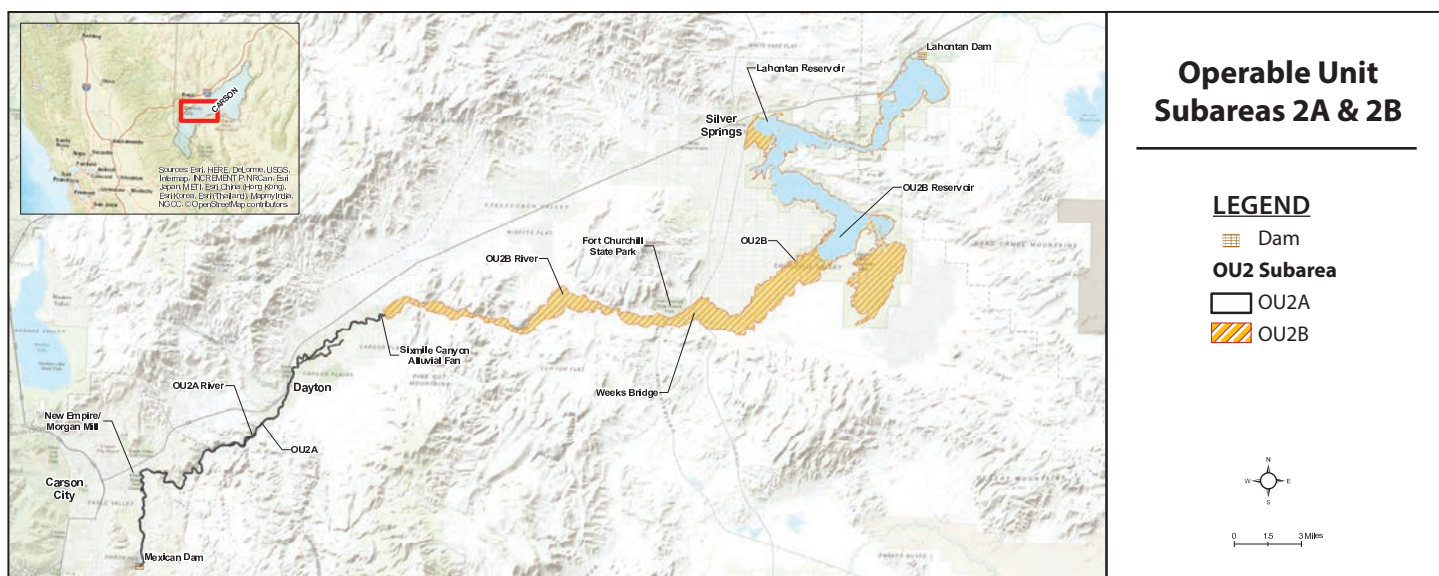
<sup>c</sup> Residents of existing homes in the floodplain may be at risk in areas that have not been sampled for mercury. Future development (residential and commercial) in the floodplain is a potential future risk in areas that have not been sampled.



Table 1 summarizes the risks posed due to mercury contamination in the CRMS OU2. Based on fish consumption modeled on mercury uptake from surface water, EPA found unacceptable health risks for tribal members practicing a traditional tribal lifestyle outside the reservation area (HQs ranged from 8.5 to 15). However, mercury levels in reservation surface water were below background (i.e., naturally occurring). We found unacceptable risks for tribal members practicing a traditional tribal lifestyle who visit the other OU2 Subareas (hazard quotients ranged up to 12 for game fish consumption). In addition, EPA found unacceptable risks for children and adults who eat Sacramento Blackfish from the Lahontan Reservoir and Indian Lakes. These fish are primarily sold at markets in Asian-American neighborhoods as far away as San Francisco (HQs ranged from 2 to 4). We also found unacceptable risks for children (recreational user) eating any fish in and above Lahontan Reservoir (i.e., Subarea 2B; with an HQ of 3). Tribal members who practice a traditional tribal lifestyle would face elevated risk from consuming wild plants and waterfowl (based on soil and sediment mercury uptake) in Subareas OU2A, B and C (HQs ranged from 3 to 5), but risk on the reservation was not a concern. Mercury levels in reservation soil and sediment were below background and were not a concern in Subarea OU2D (HQs were less than 1).

EPA based the risk assessment on the assumption that tribal residents live on the reservation and practice a subsistence way of life in which they would eat fish, wild plants, small game and waterfowl. The Fallon Paiute Shoshone tribal staff informed EPA that, generally, their members no longer ate cattails and fish from the river basin, because they were aware of and concerned about the associated health risks. They indicated, however, that they eat a significant amount of locally hunted waterfowl. We were informed that other tribes visiting the river basin likely practice traditional tribal lifestyles.

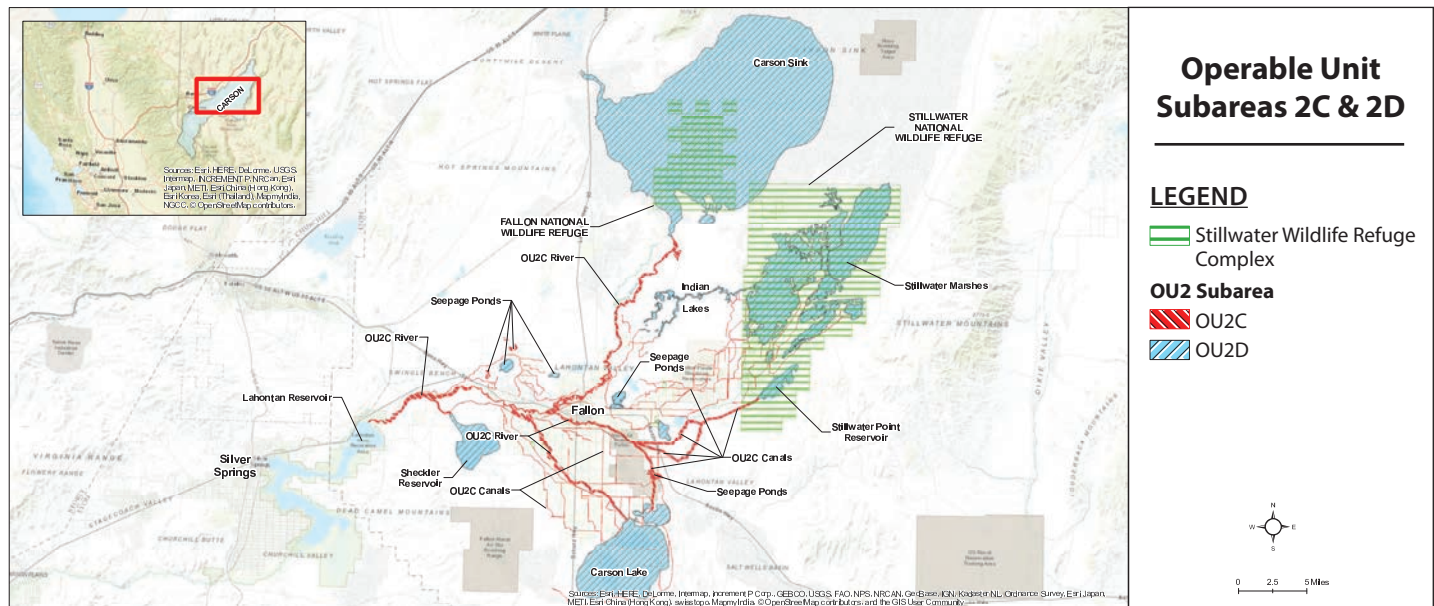
EPA also found no elevated health risks (HQs were below 1) for Lahontan Reservoir surface water used for irrigation around the city of Fallon and Churchill County, Nevada. Therefore, bioaccumulation (uptake) of mercury in agricultural plants, including fruits and vegetables, or as forage for cows (dairy) and steers/heifers (beef) does not appear to present an unacceptable risk.



Based on these Human Health Risk Assessment findings, EPA established the Remedial Action Objectives (RAOs), including Remedial Action Objectives for mercury. Remedial Action Objectives guide the design and selection of the alternatives evaluated in the FS.



# Remedial Action Objectives



The interim remedy RAOs focus on reducing human exposure to mercury-contaminated waterfowl, wild plants and game fish that present a potential human health risk, as well as preventing human exposure to mercury-contaminated soil or sediments as a result of releases during construction activities. Final RAOs to protect human health and wildlife will be determined in a Final ROD, at a later time. The interim remedy RAOs are:

## RAO 1

Reduce the risk to adults and children practicing the traditional tribal lifestyle from consuming mercury-contaminated waterfowl and wild plants. Under this RAO, EPA's goal is to reduce the consumption of waterfowl and wild plants containing concentrations of mercuric chloride above 3.3 mg/kg and 0.067 mg/kg, respectively.

## RAO 2

Reduce human health risks from consumption of mercury-contaminated game fish. Under this RAO, EPA's goal is to reduce game fish consumption levels to the EPA and FDA advisory of 0.46 mg/kg for total mercury by the following exposure pathways:

- the consumption of fish by tribal adults and children (off-reservation);
- the consumption of Sacramento blackfish (adults and children), commercially harvested from Lahontan Reservoir and Indian Lakes, sold at markets in Asian-American communities in California; and
- the consumption of fish locally by a child recreational user.

## RAO 3

Reduce future exposure to mercury contaminated soil in existing and future residential developments to a level of 80 milligrams per kilogram (mg/kg) for total mercury for soil and sediment.

This value is consistent with the level used in the CRMS OU1.

## RAO 4

Reduce the potential of future exposure as a result of sediment and soil disturbance from residential, commercial development and local/state/federal activities within the CRMS footprint to concentrations below 80 milligrams per kilogram (mg/kg) for total mercury for sediment and soil.

EPA developed preliminary remediation goals based on site-specific risks identified in the remedial investigation and feasibility study. EPA also considered activities performed by tribal members and other populations active at the site. We also considered OU1 cleanup levels. The FS and this Proposed Plan use an action level of 80 milligrams per kilogram (mg/kg) for total mercury for soil and sediment. The FS also estimated a risk-based level of 7.8 mg/kg total mercury using conservative estimates of bioaccumulation (build-up of mercury as it moves through the food chain). However, in this Proposed Plan, EPA proposes to use the higher concentration of 80 mg/kg, because the Fallon Paiute Shoshone Tribal staff stated that they are not aware of members who consume fish and wild plants harvested beyond the reservation. The relationship between preliminary remediation goals and action levels for the RAOs are:



*Fish advisory signs at Lahontan Reservoir, Washoe Lakes and river access points (2013)*

#### Reduce risk from consuming waterfowl and wild plants

Under the Superfund law, EPA is managing mercury levels at 80 mg/kg for soils and sediments to protect human health. Although this level of mercury-contaminated soil and sediments does not pose significant human health risks through direct human contact, it is likely to accumulate in wild plants and waterfowl, which are documented traditional foods of local tribes. Consequently, this level of mercury-contaminated soil could pose human health risks for tribal members as it accumulates through the food chain.

#### Reduce risk from consuming fish

In addition, research strongly suggests mercury in fish results from the transfer of mercury-contaminated sediment to the water column and then to the fish. This is especially relevant to the Carson River, which is on the List of Impaired Waters (Clean Water Act 303[d]). For sediment and soil, EPA recommended an action level of 80 mg/kg total mercury, based on uncertainties of the different forms of mercury, such as the conversion process to methylmercury, how it spreads and how people are exposed to it. For game fish, our goal is to reduce consumption where the mercury levels in fish exceed EPA and FDA advisory levels.

#### Reduce residential exposure

This 80 mg/kg action level applies to soil or sediment that may be addressed by active soil management (i.e., sampling and mitigation) or impacted by activities performed by others within the CRMS river and floodplain. This approach is consistent with soil cleanup actions in Operable Unit 1 (OU1).

#### Reduce exposure as a result of soil/sediment disturbance

Active remediation or cleanup actions are included as two of the remedial alternatives considered in the FS. However, EPA's preferred alternative consists of LUCs, compliance and monitoring. Under the preferred alternative, EPA or NDEP do not perform active remediation (cleanup) of soils or sediments. Instead, the agencies would perform oversight for any construction activities that impact soils and sediment with concentrations of mercury at or above the action level of 80 mg/kg, which could result in potential releases of and exposure through the food chain.



## Description of Remedial Alternatives

EPA is proposing a preferred alternative from one of the four remedial alternatives or options evaluated in the FS. See description below:

<b>Alternative 1</b>	No Further Action
<b>Alternative 2</b>	Land Use Controls (LUCs) and Monitoring
<b>Alternative 3</b>	Limited Areas of Riverbank Stabilization with Sediment Excavation and Disposal, LUCs and Monitoring
<b>Alternative 4</b>	Limited Areas of Riverbank and Riverbed Removal and Disposal, Riverbank Stabilization LUCs and Monitoring

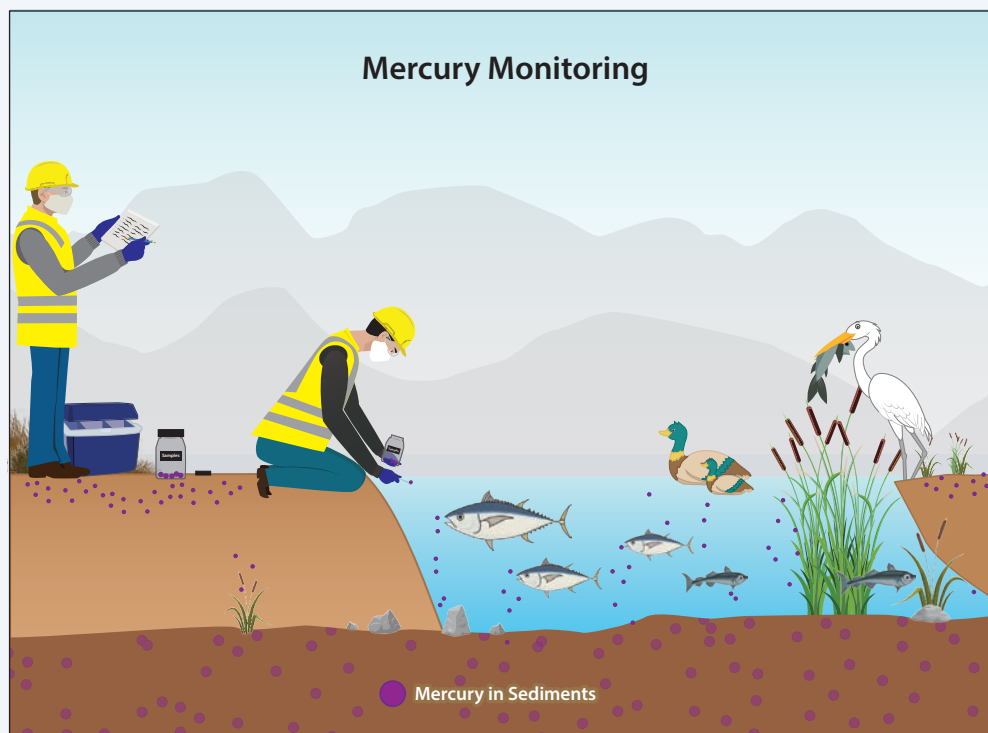
### Net Present Value (NPV):

Net Present Value (NPV) is the cost in today's dollars of a project's total costs, including post-construction operations and maintenance activities, taking into account the time value of money.

### Alternative 1: No Action

Alternative 1, No Action, assumes that no remedial actions, including LUCs or monitoring are implemented. It is included for reference as a baseline alternative for comparing other alternatives as required under CERCLA. This is not considered an acceptable alternative, as the site currently presents unacceptable human health risks. There are no costs associated with this alternative.

### Alternative 2: LUCs, Compliance and Monitoring



Alternative 2 combines LUCs and monitoring to address any concerns that are identified. LUCs help to minimize the potential for exposure to contamination. They are designed to limit land and/or resource use by providing information that helps modify or guide people's behavior at a site. EPA would design and the State of Nevada would expand upon the existing framework of resources to educate the public about the risks associated with eating fish, wild plants and waterfowl. This alternative

## Alternative 2: LUCs, Compliance and Monitoring (Continue)

builds upon current LUCs by expanding the network of fish consumption advisories, including bilingual signage and postings along waterways and in public buildings. It also informs the public about health risks of mercury and gets their input through annual surveys, enhanced outreach and education. This alternative recommends that the State of Nevada discontinue permitting the commercial harvest of Sacramento blackfish for human consumption or modify the existing permit to restrict human consumption. It also recommends that the state either discontinue stocking game fish in the river and in the Lahontan Reservoir, or stock with alternative fish that do not uptake or absorb mercury in high levels. Additionally, this alternative would require NDEP to monitor annually the surface water, sediments, fish tissue, wild plants, and waterfowl to determine if these resources continue to be impacted. This research would help EPA provide additional information for development and the selection of a final remedy.

As commercial and residential development continues along the Carson River, this alternative provides agency oversight for any development on both residential and non-residential properties. EPA and NDEP would provide guidance for soil and/or sediment sampling and management for future construction activities in the floodplain or active channels (residential and non-residential) performed by landowners, or other government agencies. The purpose of this oversight is to ensure active management of contaminated soils and sediments with concentrations at or above

80 mg/kg to reduce exposure to risks. Currently, this approach is successfully used for construction activities at existing residential properties at OU1. It can be implemented together with the construction permitting process and Environmental Covenants on construction where there are risks of mercury exposure. A Geographic Information System (GIS) database and web mapping tools would be used to share real time information with the public, government agencies and commercial interests for identification and Institutional Controls (ICs) tracking purposes.

The total 30-year NPV cost of Alternative 2 is \$23,629,000. This total cost includes \$376,000 for capital expenses spent in the first year. The remaining \$23,253,000 is expended over a 30-year period for annual operation and maintenance costs, including monitoring. Costs for addressing residential and non-residential property development are not included. Typical costs for these activities are provided in *Technical Memorandum- Supplement to the Final Feasibility Study Carson River Mercury Site Operable Unit 2 Carson City, Nevada (APTIM, June 2020)*.



*Monitoring soils and Land Use Controls activities*



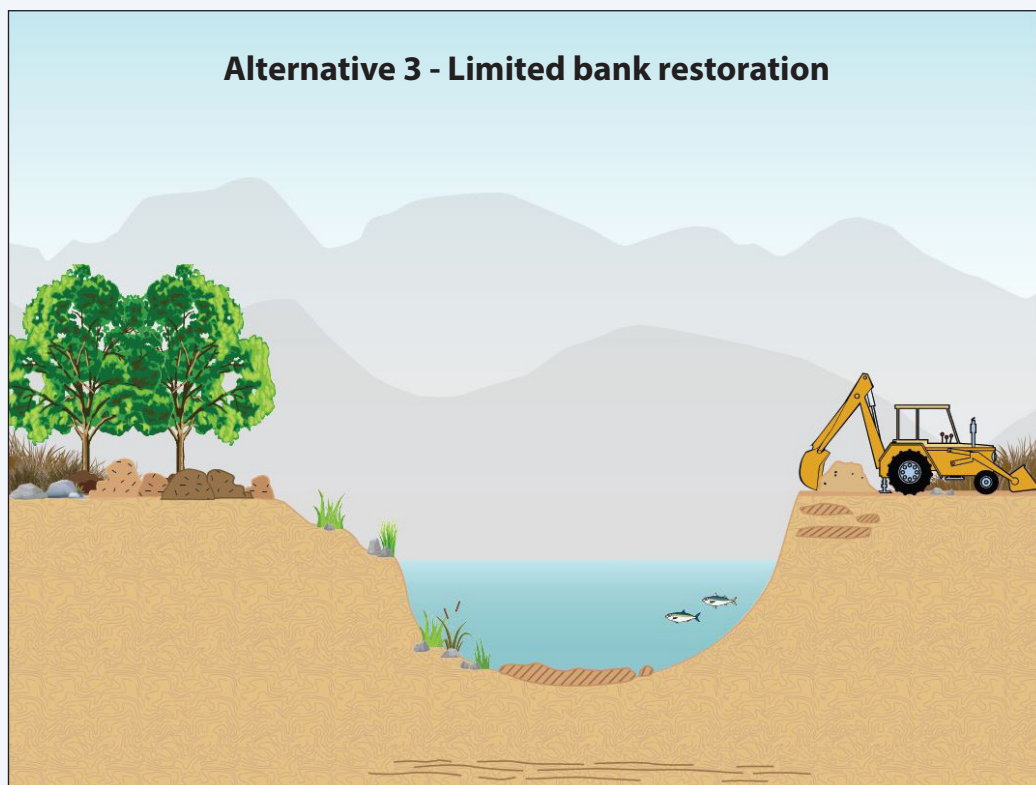
### **Alternative 3: Limited Areas of Riverbank Stabilization with Sediment Excavation and Disposal, LUCs and Monitoring (Riverbank stabilization does not apply to the terminal wetlands-OU2D)**

Alternative 3 includes the LUCs and monitoring described in Alternative 2. In addition, Alternative 3 also addresses riverbank sediments/soil that may be a source of downstream sediment and surface water contamination over time. Although it is known that sediments and soil in the riverbanks provide an ongoing source of contamination, these areas have not been completely delineated. EPA would use Adaptive Management (iterative modification of the remedial action as new data is evaluated), to help prioritize and implement this remedial alternative, because it is not possible for physical, biological, and chemical conditions to be fully defined for this large and complex river system.

Under Alternative 3, annual inspections are used to identify new erosion areas from major flood events or high flow conditions. The riverbank would be sampled to determine if concentrations exceed the Remedial Action Objectives, and if so, stabilized. EPA would stabilize areas of erosion along the riverbank by excavating or removing sediment to contour the surface and then placing erosion resistant stone or planting vegetation to cover it. EPA would limit excavation to

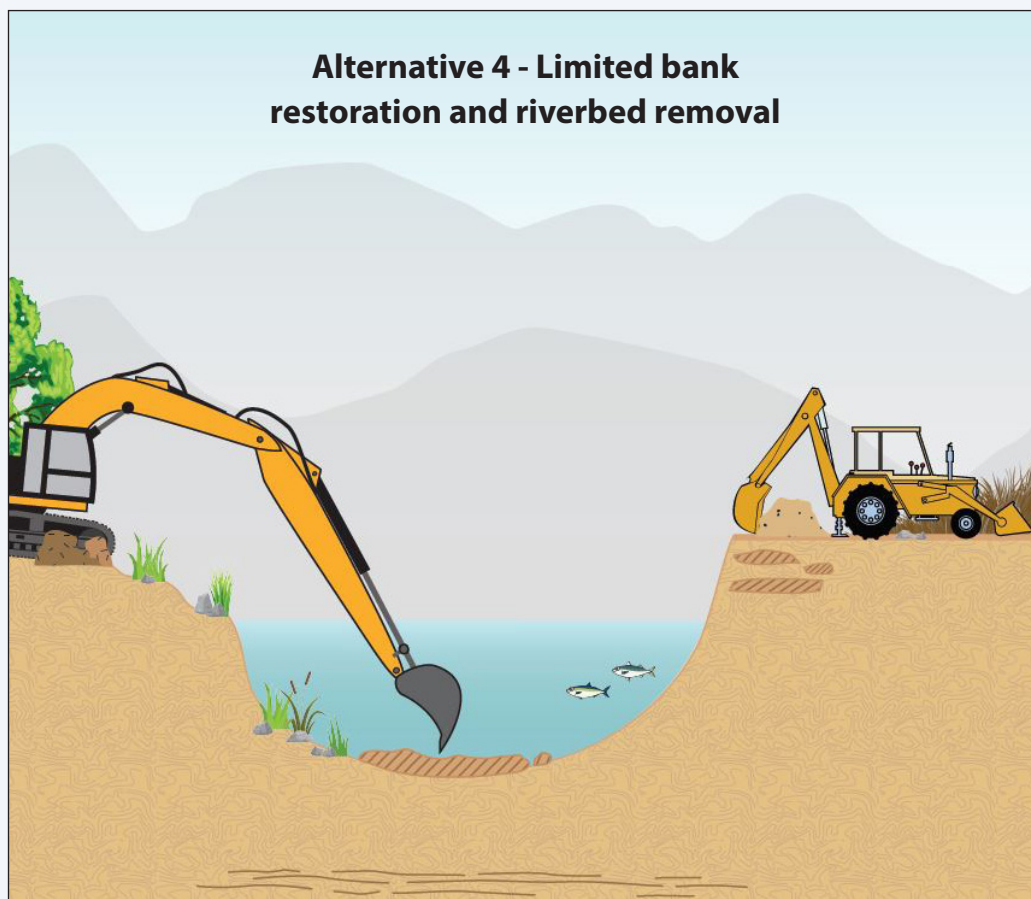
areas where placement of erosion resistant stones are necessary and promote vegetative growth. After excavation, the sediments would be dewatered, then trucked to an off site permitted landfill for disposal or, if appropriate, retained as beneficial reuse fill at locations near the site. The total 30-year NPV cost of Alternative 3 is \$162,774,000. This total cost includes \$376,000 for capital expenses spent in the first year. Periodic construction costs for Alternative 3 included limited stabilization of portions of the riverbank. For estimating this alternative, it was assumed these activities would occur over a 30-year period at approximately 5-year intervals and are included under the operation and maintenance cost.

The remaining \$162,398,000 is expended over a 30-year period for annual operation and maintenance costs, including monitoring.



#### **Alternative 4: Limited Areas of Riverbank and Riverbed Removal and Disposal, Riverbank Stabilization LUCs and Monitoring (Riverbank and Riverbed Removal and Disposal, Riverbank Stabilization does not apply to the terminal wetlands-OU2D)**

Alternative 4 includes the LUCs and monitoring, as described in Alternative 2 and stabilization of riverbanks as described in Alternative 3. In addition, Adaptive Management is used to address limited areas of riverbed sediments. Although it is known that sediments and soil in the riverbanks and riverbeds are an ongoing source of contamination, they have not been fully defined in the Carson River drainage, associated wetlands, and canals in OU2. As in Alternative 3, Adaptive Management would help prioritize and implement this remedial alternative.



Areas for removal would be based on identification of depositional areas (where sediment builds up such as sand bars) during routine inspections. Sediments would be sampled to determine if concentrations exceed the RAOs, and if so, removed. After removal of the riverbed sediments, the material would be dewatered and trucked to an off site permitted landfill for disposal or considered for beneficial reuse. The total 30-year NPV cost of Alternative 4 is \$212,566,000. This total cost includes \$376,000 for capital expenses spent in the first year. Periodic construction costs for Alternative 4 included limited stabilization of portions of the riverbank and limited riverbed sediment removal. For estimating this alternative, it was assumed these activities would occur over a 30-year period at approximately 5-year intervals and are included under the operation and maintenance cost.

The remaining \$212,190,000 is expended over a 30-year period for annual operation and maintenance costs, including monitoring.

The 50-year NPV cost of Alternative 4 is approximately \$86.4 million (after discounting). The estimated costs are broken down into \$47.5 million for capital expenses, \$11.7 million in periodic expenses (monitoring well installation and five-year reviews), and \$2.0 million per year for average annual Operations & Maintenance (O&M) expenses.



## Evaluation Criteria

EPA uses nine CERCLA Evaluation Criteria, referred to as threshold criteria, primary balancing criteria, and modifying criteria, to determine the best alternatives to address risks from mercury at the site. A summary of the evaluation of alternatives according to the nine CERCLA criteria is provided below and in Table 2.

### Nine criteria analysis

**Alternative Evaluation Table for Carson River OU2**

NINE CRITERIA ANALYSIS	Alternative 1	Alternative 2	Alternative 3	Alternative 4
THRESHOLD CRITERIA				
Overall Protectiveness	○	◐	◐	◐
Compliance with State & Federal Requirements (ARARs)	○	●	●	●
BALANCING CRITERIA				
Long-term Effectiveness	○	◐	◐	◐
Implementability	○	◐	◐	◐
Short-term Effectiveness	○	●	◐	◐
Reduction of Mobility, Toxicity or Volume by Treatment	○	○	○	○
Estimated Project Cost	\$0	\$23,629,000	\$162,774,000	\$212,566,000
MODIFYING CRITERIA				
Tribal & State Acceptance	We value the input of our tribal and state partners.			
Community Acceptance	EPA may change its Proposed Plan based on public feedback.			

● = Fully meets criterion   ◐ = Mostly meets criterion   ◐ = Partially meets criterion   ○ = Does not meet criterion

Alternative 1, the No Action alternative, would not provide overall protection of human health and the environment and would not achieve the Interim Remedy RAOs. Therefore, it does not meet the first threshold criterion. This alternative does not prevent further migration or movement of contaminated media (material, i.e., soil or water), or reduce contaminant mobility, volume, or toxicity through treatment. Therefore, it is not considered a feasible remedial alternative.

## Evaluating Alternatives

### Overall Protection of Human Health and the Environment

Alternative 2, 3 and 4 will meet the Interim Remedy RAOs through the use of LUCs, compliance and monitoring. They will be consistent with the final remedy which will provide overall protection of human health and the environment. Alternative 3 also includes limited riverbank stabilization, while Alternative 4 adds limited riverbed sediment removal to provide additional risk reduction. Overall protection of human health and the environment would be challenging to achieve with existing technology. This is further complicated by the large area impacted, the random occurrence of elevated mercury concentration and the reliance on compliance with LUCs. However, the implementation of each alternative as an interim action will reduce exposure until a final remedy is determined.

### ARARs

Alternatives 2, 3, and 4 can be designed and implemented to meet Applicable or Relevant and Appropriate Requirements (ARARs, i.e., local, state and federal ordinances, regulations and/or laws).

### Long-term Effectiveness

The land use control program provided in Alternatives 2, 3, and 4 will reduce the long-term risk through comprehensive risk communication and a public education program, compliance, and monitoring. Advisories are implemented through warning signs and social and educational programs. Advisories are only effective if they are clearly communicated and followed. The Carson River continues to be stocked with game fish. Discontinuing the practice of stocking the Carson River with fish or stocking it with alternative species may reduce the exposure to people because fewer game fish would be caught. Fish tissue samples will continue to be monitored to confirm that stocking with alternative species has reduced the concentration of mercury in fish tissue. Discontinuing the permitting of the commercial harvest of Sacramento blackfish for sale in markets from Lahontan Reservoir will also reduce this exposure pathway. Each of these actions contribute to long-term effectiveness.

Alternatives 2, 3 and 4 also include EPA and/or NDEP oversight for any commercial or residential development and other construction activities such as utility installation and maintenance, bridge construction and maintenance; and mucking (dredging) of canals performed by local, state or other government agencies. Under agency oversight, any necessary soil and/or sediment characterization and management will be performed in accordance with the Long-term Sampling Response Plan by the property owners and/or land managers. Monitoring mercury levels in soil, sediments and water will help protect the environment and human health by limiting exposure to contamination to acceptable risk-based levels.

Under Alternatives 3 and 4, annual inspections are performed as part of the long-term monitoring program, including identification of areas of new erosion from major flood events or high flow conditions. Using information from annual surveys, these alternatives apply the data to perform riverbank stabilization in limited areas (both Alternative 3 and Alternative 4) and removal of contaminated riverbed sediments in limited areas (only Alternative 4). Although these actions contribute to the long-term effectiveness, neither of these alternatives prevent ongoing transport of mercury already in the system.

### Implementability

The technical feasibility of implementing Alternative 2 is high, as there is a similar existing land-use control and monitoring program at OU1, which can be utilized in OU2. Local, state, and federal agencies can perform the short and long term monitoring requirements using standard practices, technologies, and monitoring activities. Alternatives 3 and 4 are more difficult to implement than Alternative 2 because removal of contaminated sediments in the river and wetlands can be challenging and costly.



### Short-term Effectiveness

Alternative 2 would pose little short term risk to the community and a slight risk to workers due to the usual physical hazards from working on steep slopes and on a boat during sampling and monitoring. No short term environmental impacts are expected from the implementation of Alternative 2. There are some short-term impacts to the river in the form of bank disturbance for Alternatives 3 and 4 and riverbed disturbance under Alternative 4. There is also a short-term risk to workers and the public related to potential air pollution and transportation. These risks can be managed using routine industry standard practices. Off-site landfill capacity may be an issue over time.

### Reduction of toxicity, mobility, or volume through treatment

The alternatives do not reduce the toxicity, mobility, or volume of contamination through treatment. The science for treatment of mercury compounds, specifically methylmercury, is still evolving and has not reached a point to prevent mercury uptake in the food chain. Any form of treatment would be difficult to implement in a large, complex system such as the Carson River and its associated water bodies, due to both the scale needed and the changing flow and chemical conditions observed. Treatment may be incorporated in a future final remedy if a promising technique is identified.

### Cost

The estimated cost of Alternative 3 is about seven times the cost of Alternative 2, and Alternative 4 is about nine times the cost of Alternative 2. Alternatives 2, 3 and 4 would require the State of Nevada to take full financial responsibility for O&M, as is required by CERCLA law and the NCP in the case of this fund-lead site.



*Applying rapid-sampling research techniques at several mill sites in Six Mile Canyon with our NDEP partners (2019)*

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## ■ Discussion of the Evaluation of Alternatives

### Common factors

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Alternatives 2, 3, and 4 all include LUCs (comprehensive risk communication and a public education program, compliance, and monitoring) and modifications to the Nevada Department of Wildlife (NDOW) program that currently stocks gamefish and permits the commercial harvest of Sacramento blackfish. These alternatives also include EPA and NDEP oversight of any commercial or residential development and other construction activities, such as utility installation and maintenance, bridge construction and maintenance, and mucking of canals performed by local, state or other government agencies, so that impacted media impacted is properly handled. Similar ICs programs have been successfully implemented at OU1. Implementation will focus on the strengths and weaknesses of the existing fishing advisories and the addition of wild plant and waterfowl advisories, when conducting annual stakeholder surveys to be responsive to changes in risk behaviors. Monitoring programs in each alternative will also be used to document remedy performance.

### Differences

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Alternatives 3 and 4 provide for riverbank stabilization (Alternative 3) and riverbank stabilization/riverbed removal (Alternative 4); however, the scope of this active remediation is limited, and costs are significantly higher to implement. Neither will eliminate the ongoing release of mercury downstream, as these approaches will only address contamination hotspots.

### Other Factors

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Given the size of the area, the technical limitations to address mercury, and the random occurrence of elevated mercury concentrations in OU2, it would be challenging to completely protect human health and achieve long-term effectiveness. The primary exposure pathway is the consumption of fish. Multiple communities are present along 130 miles of the Carson River and associated waterbodies. Based on discussions with community leaders, the river is

used primarily for recreational fishing; there is no evidence of current subsistence fishing. A second exposure pathway is the consumption of wild plants and waterfowl by those living a subsistence way of life. Communications with tribal representatives indicate that these resources are only partially utilized within the Fallon Paiute Shoshone Reservation, where mercury concentrations are below background levels (naturally occurring). Annual surveys and performance monitoring will be used to determine the success of land use control programs and will continue until a final remedy is in place.

## ■ EPA Prefers Alternative 2

EPA believes that the existing threats to human health are significant and do not represent an acceptable condition or are likely to change appreciably in the near term. Based on the evaluation presented in this plan, Alternative 2, which consists of LUCs, compliance, and monitoring is the Preferred Alternative to address human health risks.

This is the Preferred Alternative because it provides the most reasonable approach, meeting threshold criteria and balancing factors of cost and benefits. Alternative 2 will meet the Interim Remedy RAOs by building on the success of the current approach at OU1. OU1 combines LUCs with oversight of construction activities to address impacted non-residential and residential development. For successful implementation, local, state, or federal agencies performing new construction or maintenance activities will need to continue to coordinate efforts with EPA or NDEP. This alternative is the least disruptive, provides the lowest cost, and protects the community.

Based on information currently available, EPA believes the Preferred Alternative best meets the threshold criteria and provides the most reasonable tradeoffs among the other alternatives with respect to the balancing criteria. EPA expects the Preferred Alternative to satisfy the following statutory



requirements of CERCLA §121(b): 1) will meet the Interim Remedy RAOs through the use of LUCs, compliance and monitoring; and are anticipated to be consistent with the final remedy that will provide overall protection of human health and the environment; 2) comply with ARARs; and 3) be cost-effective. However, this remedy does not utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; or satisfy the preference for treatment as a principal element. These statutory requirements will be addressed in the final remedy.

The Preferred Alternative will be implemented as an interim remedy. Any final remedial action implemented for OU2 will require substantial time to implement. The LUCs and monitoring will be needed to:

- control consumption of impacted fish, waterfowl and wild plants
- monitor the performance of the remedy; and
- document when RAOs are achieved.

This interim remedy can be incorporated into the final remedy, and is flexible, so that the LUCs and monitoring can be modified as needed.



*Collecting sediment to assess contamination in the Lahontan Reservoir during drought (2015)*

## Information Repositories

### U.S. Environmental Protection Agency

Region 9 Superfund Regional Records Center (third floor)  
75 Hawthorne Street  
San Francisco, CA 94105  
[r9records@epa.gov](mailto:r9records@epa.gov) | (415) 947-8717  
Monday – Friday: 8 a.m. – 5 p.m.

### Nevada State Library and Archives

100 N. Stewart Street  
Carson City, NV 89701

### Churchill County Library

553 S. Maine Street  
Fallon, NV 89406

### Dayton Valley Library

321 Old Dayton Valley Road  
Dayton, NV 89403

### Silver-Stage Library

P.O. Box 310  
3905 Hwy 50 W  
Silver Springs, NV 89429





# Carson River Mercury Superfund Site

## Public Participation and Solicitation of Comments

The EPA will accept public comments for 30 days — October 15 through November 15, 2021. This public comment period is an opportunity to comment on the Preferred Alternative and other alternatives EPA considered. EPA relied on the Administrative Record to produce the Proposed Plan.

The Preferred Alternative can change in response to public comment or new information.

Comments will be accepted by mail or email. Due to Covid-19, EPA staff are unable to travel to the CRMS communities for an in-person public meeting and will use a recorded presentation on this website instead to summarize the Proposed Plan (see [epa.gov/superfund/carsonrivermercury](https://epa.gov/superfund/carsonrivermercury)). Please reference the “Carson River Mercury Superfund Site, Operable Unit 2, Proposed Plan” in your submitted comments. Send written comments by email to: [bain.andrew@epa.gov](mailto:bain.andrew@epa.gov) or mail, **postmarked no later than November 15, 2021**, to the address below, or comment orally by leaving a voicemail at the toll-free number below:

### Andrew Bain

Carson River Mercury Site, Remedial Project Manager  
U.S. Environmental Protection Agency, Region 9 (SFD 8-2)  
75 Hawthorne Street, San Francisco, CA 94105 – 3901  
(800) 231 – 3075 | [bain.andrew@epa.gov](mailto:bain.andrew@epa.gov)

Para ver la presentación resumida del plan propuesto con subtítulos en español, visite nuestra página web: [epa.gov/superfund/carsonrivermercury](https://epa.gov/superfund/carsonrivermercury)

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United States Environmental Protection Agency, Region 9  
75 Hawthorne Street (SFD-6-3)  
San Francisco, CA 94105  
Attn: Andrew Bain (Carson River 9/2021)

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