Performance Measure 4.13: Barriers to Migratory Fish Passage

Performance Measure (PM) Component Attributes

Type: Output Performance Measure

Description

Remediate fish passage at priority barriers and select large rim dams in the Sacramento-San Joaquin River watershed, and screen priority diversions along native, anadromous fish migration corridors within the Delta.[1]

Expectations

Remediating priority fish migration barriers and large rim dams, and screening Delta diversions improves fish migration, reduces fish entrainment, enhances aquatic habitat connectivity, and contributes to anadromous species recovery.

Metric

Priority fish migration barriers and select large rim dams in the Sacramento-San Joaquin River watershed, and unscreened diversions along native, anadromous fish migration corridors in the Delta and Suisun Marsh. This metric will be evaluated annually.

Baseline

Number of fish passage barriers, large rim dams, and unscreened diversions listed in:

1. California Department of Fish and Wildlife (CDFW) 2018 Priority Barriers.

[1] *Remediate* in this context means to provide passage upstream and downstream to migratory fish by constructing, modifying, or removing a barrier.

- For rim dams, remediate means implementing a long-term fish passage program that may include capture, transport, and release of fish at different life stages.
- For unscreened diversions, remediate means to screen the diversion so that juvenile andand adult fish are physically protected from entrainment.

2. Central Valley Flood Protection Program (CVFPP) 2016 Conservation Strategy (Appendix K).
3. Large rim dams in the Sacramento–San Joaquin River watershed identified in the National Marine Fisheries Service's Central Valley Recovery Plan for Central Valley Salmon and Steelhead (2014) with recovery actions.
4. Unscreened diversions along Delta native, anadromous migration corridors listed in the Passage Assessment Database (PAD March 2018 version).

Target

1. By 2030, remediate all (100 percent) priority barriers identified in the 2018 CDFW priority barriers list. For subsequent updates, remediate 100 percent within 10 years of being included in the priority barrier list.
2. By 2030, remediate all (100 percent) of the priority fish migration barriers listed in CVFPP 2016 Conservation Strategy.
3. By 2050, remediate fish passage at all (100 percent) large rim dams in the Sacramento-San Joaquin River watershed.
4. By 2030, prioritize all (100 percent) unscreened diversions along native, anadromous fish migration corridors in the Delta, and by 2050 screen all (100 percent) priority diversions.

Basis for Selection

General Purpose

Several species of native, anadromous fish travel through the Delta and upstream as part of their lifecycle. Instream barriers or unscreened diversions of water from the streams can impede migratory movements. These obstacles can limit or cut off access to spawning and rearing grounds, and to areas that offer refuge from predation, exacerbating stressors that adversely affect overall species survival (CDFW et al. 2014, NMFS 2009 and 2011). Remediating fish passage barriers and screening diversions to prevent fish from being drawn into (entrained) water diversion pipes, is important for the survival of several listed species, including salmonids that migrate through the Delta (CDFW et al. 2014, Merenlender and Matella 2013).

Rim dams are large dams along the rim or edge of the Sacramento and San Joaquin watersheds and Sierra Nevada mountains (Herbold et al. 2018). It is necessary to

provide fish passage above rim dams so that fish can access high-elevation, cooler habitat (NMFS 2009).

Remediating all barriers to allow for volitional[2] fish passage will be challenging – especially large rim dams that provide water supply and flood control benefits. However, removing in-stream barriers and implementing fish passage programs at rim dams contributes to native fish population recovery, and increases species resilience and genetic diversity, among other benefits (CDFW et al. 2014, DWR 2014).

This performance measure tracks in-stream fish migration barriers and large rim dams that remediated fish passage to allow for migratory fish to travel upstream and downstream from the barrier. Screening of an unscreened diversion means juvenile or adult fish are physically protected from entrainment.

Barriers, Diversions, and Nonstructural Impediments

The term *barrier* can refer to several different types of impediments including dams, weirs, and low-flow road crossings such as culverts. Barriers can be partial or complete. Some barriers can change with instream flow, and are therefore affected by water year type, weather, sediment loads, and other factors. The term *unscreened diversions* refer to structures that divert water such as water diversion pipes that are not screened and may entrain fish. Water diversion pipes pose a risk to fish, especially salmon and steelhead (Vogel 2011), but also other native species such as Delta smelt, longfin smelt, sturgeon, and Pacific lamprey. Installing fish screens at these diversions is an effective means of preventing fish entrainment (Poletto et al. 2015, Goodman et al. 2017).

Barriers to migration and unscreened diversions are two of many factors affecting fish survival. Other factors include predation, food availability, suitable habitat and refuge, and water temperature (DWR 2014). The size of a fish population and its use of different migration routes are also important (Perry and Skalski 2008). The importance of different migration routes depends on factors such as flow, water operations, and infrastructure. For example, when the Delta Cross Channel is closed, a lower proportion of migrating fish pass through the interior Delta (Perry and Skalski 2008), reducing the negative impact on fish migration of unscreened diversions or barriers in the interior Delta.

In addition to the Delta's importance to fish migration, the Delta provides important nonnatal rearing habitat. In a study of Endangered winter-run Chinook salmon on the Sacramento River by Phillis et al. (2018), early winter-run Chinook appear to exit their

[2] *Volitional* in this context means fish have the opportunity to travel upstream and downstream of the remediated barrier without any human intervention.

natal Sacramento River to rear for extended times at nonnatal habitats (other tributaries) and/or further downstream in the Delta prior to entering the ocean.

Within the Delta, reduced survival during migration may result from a combination of lack of suitable refugia and food sources, challenging environmental conditions (e.g., water temperature), and the cumulative effect of unscreened diversions. There are over 1,458 unscreened diversions on the Delta primary fish migration corridors (SFEI-ASC 2018) with thousands more throughout Delta channels and sloughs (CalFish Passage Assessment Database 2019). While the number of unscreened diversions and the volume of water being diverted can possibly impact fish populations, fish screening can be useful conservation tools to minimize loss of fish (Moyle 2002). Due to limited resources and the large number of these unscreened diversions in the Delta, priority should be given to gathering additional field data about each site (see New ER Recommendation "H") to allow prioritization and ranking of unscreened diversions for screening.

Rim Dams

Complete barriers are a major obstacle in the Sacramento and San Joaquin River watersheds. Large rim dams in particular have dramatically altered fish passage and access to upstream, cold water spawning habitat (Herbold et al. 2018). Rim dams are estimated to have cut off access for salmonids to approximately 80 percent of their pre-dam accessible habitat (Lindley et al. 2006). This habitat is especially valuable because it is at higher elevation, influenced by snowmelt, and could provide an important climate refuge as water temperatures rise over the remainder of the 21st century. Without access to this habitat, native runs of salmon may become extinct over the coming century. The National Marine Fisheries Service's (NMFS) Recovery Plan for Central Valley Salmon and Steelhead establishes recovery actions to conduct Central Valley-wide assessment of anadromous salmonid passage opportunities at large rim dams, including assessing quality and quantity of upstream habitat, passage feasibility and logistics, and passage-related costs (NMFS 2014).

The 2009 Biological Opinion on Long-Term Operations of the Central Valley Project and State Water Project (BiOp) notes there are likely to be large impacts on salmonid populations due to inadequate cold water available downstream of large rim dams, especially in dry and critically dry years (NMFS 2009, pp. 659-660). Because of the importance of habitat above large rim dams, it is important to continue to study and find creative solutions to facilitate fish passage past large rim dams.

Climate change introduces new stressors to migratory salmon in the Sacramento and San Joaquin watersheds, including higher water temperatures and more frequent extreme weather events such as droughts. Central Valley rim dams block access to historical, cold-water spawning habitat. A spatially explicit model of salmon population

dynamics for Butte Creek indicates that due to flow limits and high temperatures, salmon in the system are vulnerable to extinction without access to upstream areas (Thompson et al. 2012). Historically, the climate has been variable in the Central Valley of California, and salmon have had access to heterogeneous habitats, and genetic and phenotypic diversity among populations was high, resulting in population resilience (Herbold et al. 2018). Current salmon fisheries management seeks to improve salmon adaptive capacity in response to climate change by reconnecting and restoring habitats to facilitate ecosystem processes, providing refuge from temperature stress and predation risk as well as increasing food availability (Crozier et al. 2019).

Prioritization of Barriers

Due to a large number of fish passage barriers located within the Sacramento-San Joaquin watershed, resource agencies prioritize the most important barriers to remediate. CDFW and DWR have different methods of barrier / diversion prioritization but have the same goal of providing fish passage to anadromous fish.

1. CDFW 2018 Priority Barriers, Including Priority Barriers in North Central and Central Regions (Sacramento and San Joaquin River Watersheds)

CDFW Priority Barriers lists prioritize barriers across both coastal and Central Valley watercourses based on these criteria:

1. high likelihood to improve migration for anadromous species
2. availability of recent data of fish and habitat
3. willing partners and land access
4. known political support at a local, state, or national level
5. the site is a barrier to a federal recovery plan "core" population
6. the watercourse is an eco-regional significant watershed
7. CDFW is committed to monitoring before, during and after any barrier improvement project is undertaken
8. the site is considered to be a *keystone barrier*, meaning the barrier was the lower-most in that river or creek

The CDFW priority barrier list is updated on an annual basis with remediated barriers being removed from the list and new barriers being added to the list. Barriers that remain on the annually updated list are not yet remediated (due to factors such as funding, access, or other issues) and continue to be a priority. Remediated barriers are verified by CDFW PAD staff before they are removed from the priority lists (PAD data standards 2014; T. Schroyer, personal communication 2020).

2. Central Valley Flood Protection Plan (CVFPP) Conservation Strategy, Appendix K (DWR 2016), Including the Central Valley Flood System Fish Migration Improvement Opportunities (FMIO) study (DWR 2014)

DWR's CVFPP contains prioritized fish passage barriers in the Central Valley Flood System Fish Migration Improvement Opportunities (FMIO) study and Appendix K of the CVFPP Conservation Strategy. The fish barriers are prioritized using dual metrics in each of the following three categories:

1. Barrier frequency:
    a. Waterway hydrology – frequency of migratory corridor containing water.
    b. Barrier status – total barrier, partial barrier, or temporal barrier.
2. Barrier intensity:
    a. Barrier location in the target area – barriers are given a score to reflect their spatial distribution in the target area. Highest scores for anadromous species are given to barriers farthest downstream.
    b. Species diversity/presence – number of anadromous species that can reach the barrier from upstream or downstream.
3. Upstream habitat:
    a. Upstream miles of waterway – when comparing two or more barriers, the barrier with the most upstream miles of habitat (to the next barrier) gets the highest score.
    b. Type of upstream habitat – spawning, rearing, and holding habitats.

DWR's priority barriers list does not consider diversions, and there are no plans to regularly update DWR prioritization lists. The lists from these studies are included because they represent the most in-depth analysis of barriers, and opportunities for improvements, currently available.

Large Rim Dams in the National Marine Fisheries Service's Recovery Plan

The National Marine Fisheries Service's (NFMS) Recovery Plan for Central Valley Salmon and Steelhead establishes a strategic approach to recovery which identifies critical recovery actions for the Central Valley as well as watershed and site-specific recovery actions (NOAA 2014, p 102). Each major tributary to the Central Valley watershed contains specific recommended recovery actions including evaluating fish passage at large rim dams.

Unscreened Water Diversions

CDFW has prioritization criteria specific to unscreened diversions and develops a priority list of regional annual water diversions for screening based on the following ranking criteria: presence of listed and at-risk species, number of other diversions in the watershed, location of the diversion, intake orientation, duration of pumping, and ongoing efforts in cooperation with the diverter to screen the facility.

However due to limited surveys and access within the Delta, water diversions within the Delta lack sufficient details to be able to apply the ranking criteria to them (T. Schroyer, personal communication 2020). Therefore, a first step in prioritizing unscreened diversions within Delta is to gather the additional field data (see New ER Recommendation "H").

Linkages to Delta Reform Act and the Coequal Goals

Delta Reform Act

Habitat fragmentation and limited access to spawning and rearing grounds are major stressors to conservation and recovery of salmon species. Entrainment of fish into unscreened water diversions increases mortality of native resident and migratory fish species. Achieving the target in this performance measure would support the following characteristics of a healthy Delta, as identified in the Delta Reform Act:

- **"Viable populations of native resident and migratory species." (Water Code section 85302(c)(1)).** Remediating instream barriers and screening Delta diversions is important for the survival of several listed species by improving fish migration, reducing fish entrainment, enhancing aquatic habitat connectivity, and contributing to anadromous species recovery.
- **"Functional corridors for migratory species." (Water Code section 85302(c)(2)).** Instream barriers and unscreened water diversions impede migratory movements, and they limit or cut off access to spawning and rearing grounds and areas that offer refuge from predation (CDFW et al. 2014, NMFS 2009 and 2011). Remediating instream barriers and screening Delta diversions restores corridors for migratory species, enhances aquatic habitat connectivity, and opens access to salmon spawning and rearing grounds.
- **"Reduced threats and stresses on the Delta ecosystem." (Water Code section 85302(c)(4)).** Instream barriers and unscreened water diversions exacerbate stressors that adversely affect migratory fish species (CDFW et al. 2014, NMFS 2009 and 2011). Allowing migratory salmon to access historical, cold-water spawning habitat blocked by rim dams will improve salmon adaptive

capacity by providing refuge from temperature stress and predation risk (Crozier et al. 2019).

- **"Conditions conducive to meeting or exceeding the goals in existing species recovery plans, and state and federal goals with respect to doubling salmon populations."** (Water Code section 85302(c)(5)). Meeting the target of this measure will contribute to the recovery of salmon populations by improving fish migration and opening access to additional spawning and rearing grounds.

Achieving the target in this performance measure supports the following subgoal and strategy for restoring a healthy ecosystem: **"Establish migratory corridors for fish, birds, and other animals along selected Delta river channels." (Water Code section 85302(e)(2)).**

This performance measure tracks priority fish migration barriers. Remediating fish passage at priority barriers restores corridors for migratory species, enhances aquatic habitat connectivity, and opens access to salmon spawning and rearing grounds, contributing to the Doubling Goal for Central Valley Chinook Salmon Natural Production (PM 4.6).

Delta Plan Core Strategy

4.4 Protect Native Species and Reduce the Impact of Nonnative Invasive Species.

Methods

Baseline Methods

The baseline is all of the priority barriers identified by CDFW and DWR—99 Large rim dams in the Sacramento-San Joaquin Delta watershed, and 1,458 unscreened diversions along migratory routes in the Sacramento-San Joaquin Delta and Suisun Marsh.

The **priority barriers** listed in Tables 1 and 2 below are based on the CDFW 2018 Regional Fish Passage Priority List and DWR's CVFPP Conservation Strategy (Appendix K, 2016). The methods used by CDFW and DWR to select these barriers are described in the "Basis for Selection" section (p. 6-7) of this document. DWR stated that there will be no regular updates to their list, thus the list will remain as a static baseline (consisting of the current barriers in Tables 1 and 2 under column two). While CDFW updates their priority barrier lists annually, the performance measure target is based on the CDFW 2018 Regional Fish Passage Priority List.

The **large rim dams** identified (Table 3 in Methods) were selected because of their targeted recovery actions specified in the National Marine Fisheries Service's (NMFS) 2014 Recovery Plan. Each river identified contains several listed recovery actions. The Recovery Plan identifies an action for most rivers in the Central Valley involving large rim dams and smaller downstream dams, which calls for planning for development and/or implementation of a program to reintroduce salmon species and steelhead to historic upstream habitats. NMFS recommends that programs should include feasibility studies, habitat evaluations, fish passage design studies, and a pilot project. Each recovery action also identifies potential collaborators, duration, and estimated costs (NMFS 2014). Current examples of fish passage programs are shown in the "Interim Performance Assessment" section of this document.

The **Delta unscreened diversions** baseline was identified by using the PAD March 2018 GIS layer. The data was filtered for "SITETYPE" = "diversions" and "BarStatus" = "unscreened" and clipped to only count diversions within the Delta. Next, it was further clipped to only count unscreened diversions that are on anadromous fish migration corridors. The total count of unscreened diversions is 1,458.

Table 1. Comparative List of Priority Fish Migration Barriers Identified in the Sacramento River Watershed

Sacramento River Fish Migration Barriers	Priority Barrier in CVFPP 2016 Conservation Strategy	Priority Barrier in CDFW 2018
Lisbon Weir	Yes	No
Yolo Bypass Road Crossings	Yes	No
Cache Creek Settling Basin	Yes	No
Fremont Weir[1]	Yes	Yes
Oroville-Thermalito Complex	Yes	No
Knights Landing Outfall Gates (KLOG)[2]	Yes	No
Tule Canal Crossings	Yes	No
Sacramento Weir	Yes	No
Sunset Pumps Diversion Dam	Yes	Yes
Sutter Bypass Weir No. 1	Yes	Yes
Sutter Bypass (multiple structures)	Yes	No
Tisdale Weir	Yes	Yes
Moulton Weir	Yes	No
One-Mile Dam	Yes	Yes
Big Chico Creek Gates (Five-Mile Dam)	Yes	Yes
Lindo Channel Gates	Yes	No
Sewer Pipe Crossing, Dry Creek	No	Yes
Battle Creek Restoration Project Dams (8 total barriers)	No	Yes
Antelope Creek Edwards Diversion	No	Yes
Deer Creek Stanford Vina Dam Fish Ladders		Yes
Mill Creek Fish Passage Project - Upper Dam		Yes

Sources: DWR 2016 and CDFW 2018

Key:
CDFW = California Department of Fish and Wildlife
CVFPP = Central Valley Flood Protection Plan

Notes:
[1] Upstream migration over the Fremont Weir was partially addressed in 2018. However, it remains a barrier to downstream migration until overtopping under high flow conditions.
[2] The KLOG had operational gates added in 2015 as part of the EcoRestore project. It is operated as an intentional barrier to keep migrating salmonids in the mainstem of the Sacramento River, under certain conditions.

Table 2. Comparative List of Priority Fish Migration Barriers Identified in the San Joaquin River Watershed

San Joaquin River Fish Migration Barriers	Priority Barrier in CVFPP 2016 Conservation Strategy	Priority Barrier in CDFW 2018
San Joaquin River Headgates	Yes	No
Sack Dam	Yes	Yes
Mendota Dam	Yes	Yes
San Joaquin River Control Structure	Yes	No
Donny Bridge	Yes	No
Lost Lake Rock Weir #1 (Lower)	Yes	No
Mariposa Bypass Control Structure	Yes	No
Mariposa Bypass Drop Structure	Yes	No
Eastside Bypass Rock Weir	Yes	No
Eastside Bypass Control Structure	Yes	No
Dan McNamara Road Crossing	Yes	No
Merced Refuge Weir #1 (Lower)	Yes	No
Merced Refuge Weir #2 (Upper)	Yes	No
Avenue 21 County Bridge	Yes	No
Ave 18½ County Bridge	Yes	No
Pipeline Crossing	Yes	No
Eastside Bypass Drop 2 (Upper)	Yes	No
Bellota Weir	No	Yes
Merced River Cowell Agreement Diverters (CAD) Wingdams (7 total barriers)	No	Yes
Eastside Bypass Drop 1 (Lower)	Yes	No
Chowchilla Bypass Control Structure	Yes	No
Hosie Low Flow Road Crossing	No	Yes
Central California Traction Railroad Bridge	No	Yes

Sources: DWR 2016 and CDFW 2018

Key:
CDFW = California Department of Fish and Wildlife
CVFPP = Central Valley Flood Protection Plan

Table 3. Large Rim Dams Identified in Recent Recovery Plan Biological Opinion for Central Valley Chinook Salmon and Steelhead Passage

Rim Dam Name	Associated Downstream Dams	Tributary Name	Watershed
Shasta Dam	Keswick Dam	Sacramento River	Sacramento River
Folsom Dam	Nimbus Dam	American River	Sacramento River
Oroville Dam	Thermalito Diversion Dam	Feather River	Sacramento River
New Bullards Bar Dam	Englebright Dam and Daguerre Point Dam	Yuba River	Sacramento River
Friant Dam	N/A	San Joaquin River	San Joaquin River
New Melones	Goodwin and Tulloch Dam	Stanislaus River	San Joaquin River
New Don Pedro	La Grange Dam	Tuolumne River	San Joaquin River
New Exchequer Dam	Crocker-Huffman Dam Merced Falls Dam McSwain Dam	Merced River	San Joaquin River
Pardee Dam	Camanche Dam	Mokelumne River	San Joaquin River

Source: NMFS 2014 and 2009

Target Methods

The **DWR's CVFPP priority barriers** will have a target of 100% remediation of the listed barriers by 2030. A 100% remediation target by 2030 was selected due to several current timelines and estimates of fish passage barrier remediation projects. Some fish passage barrier projects are already being implemented such as the Fremont Weir in the Yolo Bypass and Mendota Dam on the San Joaquin River. Other barriers such as Lisbon Weir, Yolo Bypass Agricultural Crossings, and East Side Bypass on the San Joaquin River will begin project implementation in 2020 or planned for in the following years. Additional assessment needs for barriers are identified in Appendix K of the CVFPP.

CDFW's priority barrier list is updated annually and has a target of 100% remediation of the listed barriers within 10 years of the barrier being listed in the priority list. Each new barrier listed in subsequent lists will be tagged with the year it was added to the priority list. A 100% remediation target within 10 years was selected because it provides enough time for the responsible agencies to carry out the remediation. In addition, a 10-year time frame is considered to be a realistic goal (T. Schroyer, personal communication 2020).

- E.g. 2018 Priority Barriers (last updated October 2019) will have a target of 100% remediation by 2030. Barriers added in 2022, will have a 100% remediation target by 2032 and so on.

Large rim dams are to be 100% remediated by 2050. This metric will depend on future or current feasibility studies being completed and fish passage programs being

implemented. Further discussion about feasibility studies are located in the "interim performance assessment" section.

Unscreened diversions will have a target of 100% remediation by 2050. This metric will depend on future prioritization schemes because it is currently limited within the Delta compared to other regions. Identifying priority water diversions for screening using ranking criteria specific to unscreened diversion is set as a near-term target (100% prioritized by 2030). Screening of all priority diversions is expected by 2050.

Data Sources

Primary Data Sources

This primary data source will be used for tracking this performance measure annually:

1. California Fish Passage Assessment Database (PAD). The PAD is an "inventory of known and potential barriers to anadromous fish in California," and includes all instream dams, including the rim dams, in the Sacramento-San Joaquin River watershed. The PAD database reports the fish passage status of the barriers, dams, and unscreened diversions.
    a. Content: Updated fish passage status of remediated barriers.
    b. Update frequency: Three times per year.

Alternative Data Sources

Alternative data sources will be used if the primary data sources become unavailable or insufficient. These data sources were used in compiling the passage priorities, and updates to fish passage barrier priorities can be used concurrently with the primary data sources as a reference, or as supplemental information.

1. CDFW Watershed Restoration Grants Branch. CDFW provides a list of fish passage priorities in grant proposal solicitation notices. Proposition 68 awards grants to projects that improve a community's ability to adapt to the unavoidable impacts of climate change; or ones that improve and protect coastal and rural economies, agricultural viability, wildlife corridors, or habitat. Proposition 1 awards grants to projects that meet objectives of reliable water supplies, restoration of important species and habitat, and more resilient, sustainably managed water resources system.
    a. Content: Updated prioritization of fish passage barriers to be available for Prop 1 and Prop 68 proponents.

b. Update frequency: Annually.

2. Updates to Central Valley Flood Protection Plan (CVFPP) Conservation Strategy. DWR updates the Conservation Strategy as a system-wide conservation plan to support integrated flood system planning and integration of environmental stewardship into the CVFPP.

   a. Content: Updated prioritization of fish passage barriers within the Central Valley Flood Protection Plan.

   b. Update frequency: Every five years.

Process

Data Collection and Analysis

Every year, Council staff will update the status of this performance measure by:

1. For all of the identified priority barriers in the PAD priority list (Table 1 and 2), identify those that were remediated each year by downloading their new priority lists at calfish.org.

   a. Add additional barriers to the overall measure list (tagged with the year of their addition) that were added to the PAD priority list.

      i. Count the total number of barriers that were remediated with verification from CDFW staff.

      ii. Update the number of total remediated barriers for CDFW, with context for each barrier if possible.

2. For the identified barriers in DWR's CVFPP priority barriers (Tables 1 and 2), contact DWR staff to receive information about priority barrier status.

   a. If any of the listed barriers are remediated, update the number of total remediated barriers for the CVFPP list with context for each barrier if possible.

3. For large rim dams, contact the responsible agencies (U.S. Department of the Interior, Bureau of Reclamation (Reclamation); U.S. Army Corps of Engineers; etc.) regarding the statuses of feasibility studies, pilot programs, and other fish passage related efforts. Any relevant efforts at these dams will be actively tracked and noted.

4. For unscreened diversions:

a. Review results of CDFW water diversions screening prioritization and inquire about the status of the prioritization scheme for unscreened diversion within the Delta.

b. To view status of unscreened diversions remediation, download the most recent PAD GIS dataset (annually updated) and check the total number of unscreened diversions. Verify with CalFish staff if the number if accurate and for context.

Interim Performance Assessment

Along with the annual evaluation and tracking of this performance measure, performance assessment in relation to interim milestones will be conducted every five years, coinciding with the Delta Plan five-year review process. The interim milestones are set to allow for assessment of short-term progress toward the performance targets.

Interim Milestones – Priority Barriers

1. Interim progress will be tracked against the baseline 2018 priority list with a milestone of 50% remediated barriers by 2025.
2. CDFW conducts a statewide fish passage barrier prioritization process annually. Annual changes to prioritized barriers (additional barriers) will be tracked and compared to the 2018 baseline barriers.
    a. Council staff will coordinate with CDFW fish passage coordinator to obtain contextual information for newly added and removed priority barriers, and inquire about priorities, timelines, and feasibility.
3. Updates or changes to the CVFPP priority barrier list are not expected. Interim milestone is remediation of 50% of priority barriers by 2025.

Interim Milestones - Rim Dams

4. Fish passage feasibility studies initiated, ongoing, or completed for the listed large rim dams.
    a. If fish passage is found feasible at the dam site, this PM will track and report the progress of the study and recovery plan.
    b. If fish passage is found infeasible at the dam site, what additional efforts are being conducted to remediate Rim Dams?
    c. Are there current feasibility studies being conducted? Progress on existing efforts will be tracked including:
        i. Reclamation's Shasta Dam Fish Passage Evaluation, https://www.usbr.gov/mp/bdo/shasta-dam-fish-pass.html. This is part of

Reclamation's Fish Passage program that involves evaluation of the reintroduction of winter-run and spring-run Chinook salmon and steelhead above Shasta Dam. The goal is to increase the geographic distribution, abundance, productivity, and spatial distribution, and to improve the life history, health, and genetic diversity of the target species. Folsom and New Melones Dams are also included in Reclamation's Fish passage program and will be addressed in independent planning studies (Reclamation 2015).

ii. Yuba Salmon Partnership Initiative. (YSPI) http://www.dfg.ca.gov/fish/Resources/Chinook/YSPI/. The YSPI is a collaboration between CDFW, NOAA, Yuba County Water Agency, and several other entities to return spring-run Chinook salmon and possibly steelhead to more than 30 miles of the north Yuba River (New Bullards Bar dam). The program would truck juvenile salmon in the winter downstream and recover them in spring to be trucked up New Bullards Bar dam (YSPI 2015).

iii. The Turlock Irrigation District and Modesto Irrigation District included a fish passage assessment for reintroduction of anadromous fish above Don Pedro Dam in their Environmental Impact Statement for Hydropower Licenses, https://www.ferc.gov/industries/hydropower/enviro/eis/2019/02-11-19-DEIS/P-2299-082-DEIS.pdf. Additional information of their efforts regarding fish passage can be found in the document at pages 3-162 to 3-170.

iv. The Upper Mokelumne Salmonid Restoration Team (SRT) is a collaboration of state, federal, local, and NGO agencies that aims to reestablish a successfully reproducing population of fall-run Chinook salmon and/or Central Valley steelhead in the upper Mokelumne River (Cramer Fish Sciences 2018). In 2018, they completed an assessment of the potential for Chinook salmon reintroduction above Pardee Dam, http://www.foothillconservancy.org/dl.cgi/1552580969_22399.f_doc_pdf.pdf/UM_2018_final.pdf.

5. Progress and findings from the Central Valley-wide assessment of anadromous salmonid passage opportunities at large rim dams including the quality and quantity of upstream habitat, passage feasibility and logistics, and passage-related costs (NOAA 2014).

Interim Milestones - Unscreened Diversions

6. Field data is collected at unscreened diversions, in addition to diversion size and site location, to provide additional information allowing prioritization of

unscreened diversions. The large majority of Delta agricultural diversions is below 100 cfs, but large unscreened diversions located on important migratory routes may remain.

7. Conduct prioritization of unscreened diversions for screening priorities following CDFW statewide prioritization protocol. The prioritization process includes contribution of the diversion to the cumulative loss of fishes to the system and the impact of this contribution on fish populations, especially those of declining species. Such an evaluation could help determine priorities for spending limited funds available for fish conservation (Moyle 2002 Memo).
8. Based on prioritization results, screen high priority barriers.

Process Risks and Uncertainties

As previously discussed in the basis for selection, it is unlikely that all in-stream barriers will be remediated but remediating the prioritized barriers will benefit native fish survival and resilience.

Large rim dams provide water supply and flood control benefits, and the technological solutions to upstream and downstream fish passage are complex. Interim steps include conducting Central Valley-wide assessment of anadromous salmonid passage opportunities. This also includes preparing site-specific feasibility studies to evaluate upstream habitat quality and quantity, passage feasibility and logistics, passage-related costs, and reintroduction of the species.

Similarly, to screen over 1,400 unscreened diversions within the Delta priority migration corridor is unlikely. Ranking the diversions for screening priorities is an important initial step to focus limited funds available for fish conservation for screening projects with highest impact of populations.

Process risks and uncertainties related to this measure are:

1. Environmental variability such climate, ocean, hydrology, freshwater flow, and native fish populations
2. Gaining land access and willing partners from landowners
3. Support from local, state, or federal agencies due to differing agency priorities and funding
4. Acquiring and implementing suitable fish passage technologies

Reporting

Every year, Council staff will report the status of this performance measure by:

1. Posting updates on the Performance Measures Dashboard.
2. Providing results in the Council's annual report (published in January).
3. Communicating management-relevant results at Council and Delta Plan Interagency Implementation Committee (DPIIC) public meetings.

Every five years, Council staff will assess and report the status of this performance measure by:

1. Communicating findings in the five-year review of the Delta Plan.
2. Informing the Council's adaptive management process and other decision-making.

References

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