UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

MEMORANDUM FOR: Enhancement of Survival Permits (23271, 23276, 23278, 23279, 23280, 23284, 23285, 23286, 23287, 23434, 23288, 23289, 23290, 23291) (ARN# 151422WCR2020AR00218)

FROM: Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

SUBJECT: Documenting Endangered Species Act section 7 consultation for issuing 14 section 10(a)(1)(A) Enhancement of Survival Permits and entering into the "Template Safe Harbor Agreement for Conservation of Coho Salmon in the Shasta River", affecting private lands and state lands in the Upper Shasta River, Big Springs Creek, Parks Creek, and their tributary streams in Siskiyou County, California

DATE: November 17, 2020

Pursuant to section 10(a)(1)(A) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536 *et seq*.), and agency policy, NOAA's National Marine Fisheries Service (NMFS) proposed to issue 14 Enhancement of Survival Permits (ESPs) as part of a Template Safe Harbor Agreement (Agreement). The parties to the Agreement (Parties) include: the California Department of Fish and Wildlife (CDFW), NMFS, and private landowners and irrigation districts who are collectively called the Shasta Watershed Conservation Group (SWCG). The SWCG is comprised of representatives from Hidden Valley Ranch (HVR), Seldom Seen Ranch, Hole in the Ground Ranch, Shasta Springs Ranch, Cardoza Ranch, North Annex Property, Rice Livestock Company, Grenada Novy Ranch, NB Ranches Inc., Parks Creek Ranch, Montague Water Conservation District (MWCD), the Edson Foulke Ditch Company, and the Grenada Irrigation District (GID). State lands covered by the Agreement include the Big Springs Wildlife Area managed by CDFW. Implementation of the Agreement will allow the recipients of the ESPs (Permittees) to incidentally take listed species via land and water management activities (referred to in the Agreement as Routine Agricultural Activities), including water diversion and delivery by two irrigation districts, wildlife, fisheries, and habitat management, and ranching operations that either divert water from the properties listed in the area covered by the Agreement (Covered Area) and/or are riparian to the Parks Creek, Shasta River, Big Springs Creek, other smaller streams, or related springs. In addition, the Agreement provides assurances to the Permittees that future alteration or modification of their covered lands (Enrolled Properties) back to Baseline Conditions or Elevated Baseline Conditions, as defined in individual Site Plan Agreements that tier from the Agreement, is authorized. Under the Joint U.S. Fish and Wildlife Service (USFWS) and NMFS Final Safe Harbor Policy (64 FR 32717 (June 17, 1999),

(Policy)), a Net Conservation Benefit finding is required to issue an ESA section l0(a)(l)(A) ESP. Upon finding a Net Conservation Benefit, NMFS will provide assurances that additional land, water, and/or natural resource use restrictions will not be imposed under the ESA to benefit the species to which the safe harbor agreement pertains as a result of the applicant's voluntary conservation actions to benefit the covered species. When an applicant fulfills their obligations under a safe harbor agreement, NMFS will authorize incidental taking of the associated covered species under NMFS' jurisdiction.

When granting ESPs, NMFS must carry out an intra-agency consultation under section 7 of the ESA to ensure that activities conducted under the ESPs do not appreciably reduce the likelihood of survival and recovery of ESA-listed species or destroy or adversely modify designated critical habitat. In compliance with section 7(a)(2) of the ESA, in this biological opinion, NMFS analyzed the effects of the issuance of ESPs (23271, 23276, 23278, 23279, 23280, 23284, 23285, 23286, 23287, 23434, 23288, 23289, 23290, 23291) authorizing incidental take of Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*).

cc: Admin File 151422WCR2020AR00218 (WCRO-2020-02923)

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Issuance of 14 Section 10(a)(1)(A) Enhancement of Survival Permits associated with the "Template Safe Harbor Agreement for Conservation Coho Salmon in the Shasta River" and individual Site Plan Agreements, affecting private lands and state lands in the Upper Shasta River, Big Springs Creek, Parks Creek and their tributary streams in Siskiyou County, California

NMFS Consultation Number: WCRO-2020-02923
Action Agency: National Marine Fisheries Service, West Coast Region

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Southern Oregon and Northern California Coast Coho Salmon (*0. kisutch*)	Threatened	Yes	No	Yes	No
Southern Resident DPS Killer Whale (*Orcinus orca*)	Endangered	No	No	N/A	N/A

Essential Fish Habitat and NMFS' Determinations:

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: November 17, 2020

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1 INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available after two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS' Northern California office in Arcata, California

1.2 Consultation History

On February 11, 2013, NMFS received letters from landowners and water districts of the Shasta Watershed Conservation Group (SWCG), stating their intent to work with NMFS and CDFW on a safe harbor agreement associated with Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*) (the Covered Species).[1]

On April 12, 2013, NMFS responded to SWCG parties with intention to providing resources to assist in developing a shared conservation program for SONCC coho.

From summer of 2013 through 2018 SWCG, NMFS, CDFW, and CalTrout met approximately bi-monthly to develop principles of the safe harbor agreement. Additional technical meetings occurred following the formation of the Technical Advisory Committee (TAC). TAC members included representation from the Yurok Tribe.

On February 19, 2019, NMFS received a proposed Template Safe Harbor Agreement (Agreement), proposed Site Plan Agreements for each of the 14 properties that would be covered by the Agreement (Enrolled Properties), and 14 ESA Section 10(a)1(A) permit applications.

[1] This opinion incorporates by reference the definitions contained in Section 2 of the Template Safe Harbor Agreement for Conservation of Coho Salmon in the Shasta River.

On October 15, 2019, we announced in the Federal Register a 30-day public comment period for the receipt of 14 applications for enhancement of survival permits (ESPs) (84 FR 55145 (October15, 2019)).

On November 4, 2019, we announced the extension of the comment period to December 31, 2019, to provide additional opportunity for public comment (84 FR 59358 (November 4, 2019)). On December 27, 2019, we announced we would continue to solicit review and comment from the public and interested parties on the applications and associated documents. The comment period was extended from December 31, 2019, to February 15, 2020 (84 FR 59358 (November 4, 2019)).

On July 28, 2020, NMFS initiated intra-agency consultation in order to assess the potential effects of entering into the Agreement and Site Plan Agreements and issuing the ESPs on SONCC coho salmon, SONCC coho salmon critical habitat, the Southern Resident Killer Whale Distinct Population Segment (DPS)(*Orcinus orca*) (Southern Residents), and EFH for coho salmon and Chinook salmon.

NMFS and the Applicant reached consensus on a final Template Safe Harbor Agreement for Conservation of Coho Salmon in the Shasta River on November 6, 2020.

1.3 Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

NMFS proposes to enter into a Template Safe Harbor Agreement for Conservation of Coho Salmon in the Shasta River" (Agreement)(SWCG, CDFW, and NMFS 2020) and 14 associated Site Plan Agreements, pursuant to which NMFS will issue 14 ESPs. The purpose of the Agreement is to establish the general requirements for NMFS to issue ESPs, under authority of section 10(a)(1)(A) of the ESA, to non-federal landowners in the Shasta River Basin to promote the conservation, enhancement of survival, and recovery of SONCC coho salmon. The parties to the Agreement (Parties) include: the California Department of Fish and Wildlife (CDFW), NMFS, and 11 private landowners and irrigation districts,[2] who are collectively called the Shasta Watershed Conservation Group (SWCG). CDFW is participating as both a regulatory agency and as a Permittee for an Enrolled Property. The 14 Enrolled Properties, associated permit numbers, and a brief description of the geographic location of each property are included in Table 1. These Enrolled Properties are where the proposed action would occur and collectively are referred to as the Covered Area. Approximate locations of each Enrolled Property are shown in Figure 1. The SWCG is comprised of representatives from Hidden Valley Ranch (HVR), Seldom Seen Ranch, Hole in the Ground Ranch, Shasta Springs Ranch, Parks Creek Ranch, Cardoza Ranch, North Annex Property, Rice Livestock Company, Grenada Novy Ranch, NB

[2] Landowners include: Outpost North Annex, CDFW, Cardoza Ranch, Edson Foulke Ditch Company, Grenada Irrigation District, 2019 Lowell L. Novy Revocable Trust, Hidden Valley Ranch, Emmerson Investments, Inc. Montague Water Conservation District, NB Ranches, Inc., Outpost Mole Richardson, Rice Livestock Company

Ranches, Inc., the Montague Water Conservation District (MWCD), the Edson Foulke Ditch Company, and the Grenada Irrigation District (GID). State lands within the Covered Area include the Big Springs Wildlife Area managed by CDFW. In addition to being a Party to the Agreement, each Permittee has an individual Site Plan Agreement for their Enrolled Property. The ESPs are based on both the Agreement (Section 1.3.1 below) and property-specific Site Plan Agreements (Section 1.3.3 below), which are both informed in part by a Flow Management Strategy (Section 1.3.2 below). The term of the proposed ESPs is 20 years from the time of signing.

Table 1. Permittee and Enrolled Properties affiliated with the Agreement

Permittee	Permit Number	Enrolled Property
Outpost North Annex	23271	Belcampo-North Annex Property 8030 Siskiyou Blvd, Grenada, CA 96038
California Department of Fish and Wildlife	23276	Big Springs Ranch Wildlife Area 41° 35' 44.76 N 122° 27' 31.52 W
Cardoza Ranch	23278	Cardoza Ranch 3710 East Louie Road, Montague, CA 96064
Edson Foulke Ditch Company	23279	Edson-Foulke Point of Diversion 41° 43' 52.6 N 122° 47' 46.8 W
Grenada Irrigation District	23280	Grenada Irrigation District Point of Diversion 41° 38’ 11.56’ N 122° 29’ 22.88 W
2019 Lowell L. Novy Revocable Trust	23284	Grenada-Novy Ranch Gazelle – 19931 Old Hwy 99 S, Gazelle, CA 96034 Grenada – 2426 County Hwy A-12, Grenada, CA 96034
Hidden Valley Ranch	23285	Hidden Valley Ranch 13521 Big Springs Road, Montague, CA 96064
Emmerson Investments, Inc.	23286	Hole-in-the-Ground Ranch 11825 Big Springs Road, Montague, CA 96064
Montague Water Conservation District	23287	Montague Water Conservation District N. 52°, 43’ E., approximately 2601 feet from SW corner of Section 25, T43N, R5W, MDB&M, being within the NE¼ of SW¼ of said Section 25
NB Ranches, Inc.	23434	Nicoletti Ranch 1824 DeSouza Lane, Montague, CA and 2238 DeSouza Lane, Montague, CA
Outpost Mole Richardson	23288	Parks Creek Ranch 25801 Old Hwy 99, Weed, CA 96094
Rice Livestock Company	23289	Rice Livestock Company 1730 County Highway A12, Montague, CA
Emmerson Investments, Inc.	23290	Seldom Seen Ranch 41° 54’ 63.2 N 122° 38’ 35.7 W
Emmerson Investments, Inc.	23291	Shasta Springs Ranch 21305 Slough Road, Weed, CA 96094

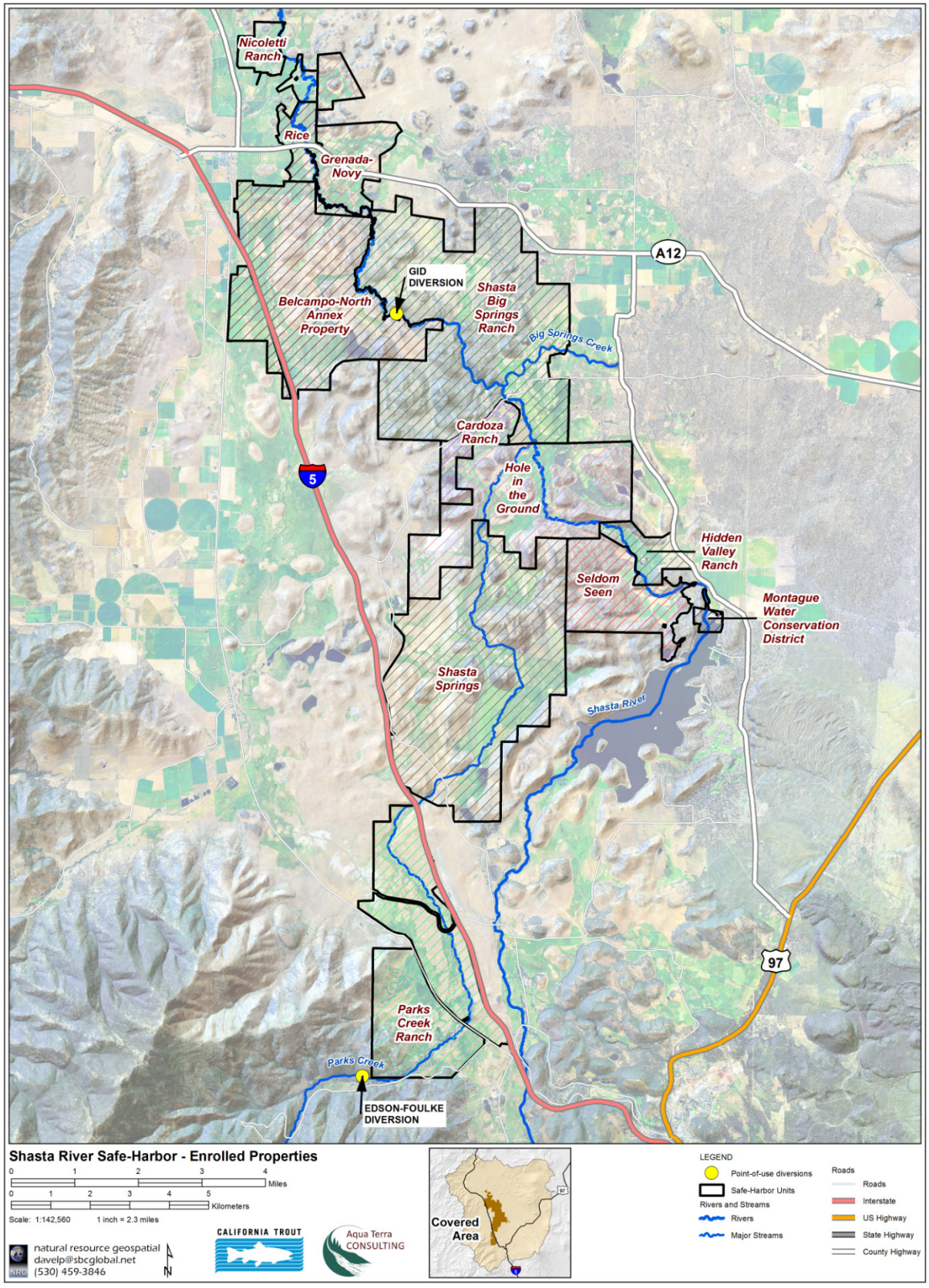

Figure 1. Location of Enrolled Properties for the Agreement.

1.3.1 Template Safe Harbor Agreement (Agreement)

Activities covered under the ESPs (Covered Activities) include Routine Agricultural Activities (Section 1.3.1.1) and Beneficial Management Activities (BMAs; Section 1.3.1.2), and associated monitoring activities (Section 1.3.1.4). Both Routine Agricultural Activities and BMAs incorporate Avoidance and Minimization Measures (AMMs) intended to decrease the impacts of those activities on the SONCC coho salmon ESU. The Routine Agricultural Activities, BMAs, AMMs, and associated monitoring and reporting requirements are described in the Agreement and individual Site Plan Agreements, as appropriate. In addition, Covered Activities include actions taken by Permittees to return their Enrolled Property to Baseline Conditions or Elevated Baseline Conditions, if applicable. Return to Baseline means the activities that a Permittee undertakes to return the Enrolled Property to Baseline Conditions. Elevated Baseline Conditions means Baseline Conditions improved as a result of certain Beneficial Management Activities, which are specified in individual Site Plan Agreements and discussed in Section 1.3.3 below. If Elevated Baseline Conditions are specified in their Site Plan Agreement, a Permittee may return conditions to Elevated Baseline Conditions only. For the purposes of this opinion, it is important to be clear that the term "Baseline Conditions" in the ESA Section 10 context (i.e., Baseline and Elevated Baseline Conditions as defined above) is different from the "environmental baseline" as defined in the ESA Section 7 context (i.e., the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action). This opinion includes both terms, but clarifies either Section 7 or Section 10 usage in each instance. The Covered Activities are described in detail in Appendix 2 of the Agreement: Covered Activities for the Template Safe Harbor Agreement for Conservation of Coho Salmon in the Shasta River, and in individual Site Plan Agreements. Appendix 2 of the Agreement is incorporated by reference into this section, but key information from that appendix is summarized in this section.

1.3.1.1 Routine Agricultural Activities

Routine Agricultural Activities are lawful practices for production of livestock, pasture and hay, and other crops, including, but not limited to, cultivation, growing, harvesting, and replanting of pasture and other crops; diversion of water, irrigation, irrigation run-off; preparation for market, vehicle operation, watering, and moving of livestock, and operation and maintenance of facilities associated with the production of livestock, pasture, and hay performed by a Permittee as described in the Permittee's Site Plan Agreement. Routine Agricultural Activities include riparian area cultivation and maintenance, monitoring infrastructure activities, erosion control, flood and emergency protection, invasive plant removal and control, and installation, repair, maintenance and operation of: diversions, fish screens, instream habitat structures, fences, roads, and stream crossings. These Routine Agricultural Activities are further described in the eight following subsections (Section 1.3.1.1.1 to Section 1.3.1.1.8) and in individual Site Plan Agreements, as appropriate. Each Routine Agricultural Activity includes associated AMMs that are measures to avoid or minimize adverse effects to the Covered Species. These AMMs are described in additional detail in Appendix 2 of the Agreement and summarized below.

1.3.1.1.1 Water Diversion and Diversion Facilities

This includes diversions of surface water through conduits or openings from streams, channels, or sloughs within the Covered Area by a Permittee in accordance with a valid water right. Specific activities include: ongoing management and/or maintenance of existing flashboard dams; ongoing maintenance, management, and repair of boulder weirs; installing, operating, maintaining, and removing push-up dams or weir or other temporary diversion structures; installing or placing pumps and sumps and maintaining existing pumps and sumps within or adjacent to the active channel of a stream; installing head gates and measuring; and operating head gates and measuring devices

The AMMs associated with water diversion and diversion facilities include:

A1. Install a locking head gate or valve sized appropriately for the authorized diversion that can regulate flow and install a functional measuring device or flow meter on any structure or facility connected to a stream used to divert water to facilitate better control and monitoring of water delivery within three years of the Effective Date of the Agreement, unless specified otherwise in the Site Plan Agreement, on or in all water diversion structures identified in this Agreement.

A2. Fish passage will be provided for all life stages when sufficient flows are available, per individual the Site Plan Agreements.

A3. Contact NMFS and CDFW at least five days before installing any dam or instream structure that could result in stranding of fish, or before changing the operation of any existing dam or instream structure that could result in stranding of fish. The types of activities that typically could result in stranding include rapid drawdown of flow or dewatering of the stream channel downstream of the diversion or within diversion ditches between the point of diversion, fish screen and bypass return flow channel.

A4. If no other option is available to provide head necessary to divert water at a diversion, the Permittee may construct, operate, maintain, and remove push-up and other temporary dams as described in the Agreement. Push-up dam or weir construction activities shall commence no earlier than May 1 and no later than November 1 unless otherwise approved by NMFS and CDFW. Permittees may commence push-up dam construction activities prior to May 1 if: (a) permittee notifies NMFS and CDFW at least seven (7) days in advance of any dam construction proposed to occur prior to May 1, (b) a survey is completed by NMFS, CDFW or a mutually agreed-upon qualified biologist sufficient to determine the presence and distribution of SONCC coho salmon, and (c) NMFS and CDFW determine that the activity may proceed. This variance would only be allowed if NMFS determines that the activity will not result in additional effects beyond what is considered in this opinion.

A5. Routine push-up dam construction and removal will be accomplished by the operation of a bucket attached to an excavator or backhoe that is situated outside of the wetted portion of the stream channel.

A6. Instream work shall occur only when Covered Species are least likely to be present or affected by the project, between June 15 and November 1, or as approved by NMFS and CDFW. Variances for instream work are not anticipated to be needed, and would only be allowed if

NMFS determines that the activity will not result in additional effects beyond what is considered in this opinion.

1.3.1.1.2 Irrigation Management and Maintenance

This includes management and maintenance of conveyance facilities on enrolled properties that are used for diverting surface waters including piping/buried mainline, buried mainline with risers, gated pipe, sprinkler systems, open ditches, sumps, storage ponds and tailwater capture ponds/sump. The activities associated with irrigation management and maintenance may include; head gate on/off operation, moving sprinklers, turning risers on and off, board or tarp removal/placement in ditches, pump, ditch and pond maintenance, pipe clearing/cleaning, maintenance of fish screens, operations of tailwater collection (pick-up ditches and ponds), storing water and irrigation runoff (tailwater production), general diversion of water, and operation and maintenance of all types of fish screens.

The AMMs associated with irrigation management and maintenance include:

B1. During regular maintenance work at diversions and fish screens, the permittee will minimize the discharge of sediments, debris, fine organic matter, and/or muddy, turbid, or silt-laden waters into natural waterways.

B2. The permittee will regularly inspect, clean, and repair all fish screens and bypass pipes or channels to ensure that they are effectively protecting salmonids and other fish species in accordance with CDFW and NMFS fish screening criteria. When necessary, the permittee will clean and repair all fish screens and bypass pipes or channels. If a fish screen is removed for cleaning or repair and in channel work is necessary, the permittee will ensure either that a replacement screen is installed immediately or water is not flowing through the area where the screen is removed by either implementing isolation or dewatering of the work site in coordination with the fish relocation effort described later in this document

B3. When a bypass pipe is present, the bypass entrance(s) shall be installed and operated such that all life stages of the Covered Species can easily locate and enter them. Sufficient flow (site specifically determined depending on the volume and type of bypass structure) will be supplied from the diversion into a fish bypass to safely and efficiently return fish back to the stream.

B4. When cleaning/maintaining irrigation or drainage ditches or ponds, the permittee will work when the ditch is as dry as possible to minimize or eliminate surface water turbidity and sediment transport.

B5. Permittee will regularly monitor and repair as necessary any earthworks or facilities designed to minimize tailwater entering natural waterways.

B6. Planned Instream work shall occur only when Covered Species are least likely to be present or affected by the project, between June 15 and November 1, or as approved by NMFS and CDFW. Variances for instream work are not anticipated to be needed, and would only be allowed if NMFS determines that the activity will not result in additional effects beyond what is considered in this opinion.

B7. In the case where the fish screen is down ditch (i.e., greater than 100 feet from the stream), the Permittee shall notify CDFW at least five days prior to closing a headgate or valve when fish stranding may occur in the diversion conduit, to allow fish rescue notification and coordination by NMFS and CDFW or otherwise mutually agreed upon qualified individuals.

B8. Water releases from off-channel impoundments, ponds, and tailwater basins will be conducted in a manner that minimizes turbidity, siltation, elevated temperatures, or pollution impacts to waterways supporting Covered Species. Water shall be released in the early morning (prior to 10:00 am) and/or during cool times of the year, and will be released as gradually as possible to minimize fine sediment discharges. If the release timing and rate is not feasible, landowner will contact NMFS and CDFW prior to release.

B9. When permittee is diverting water under the rotational provision under the Shasta River Decree, the river shall not be dewatered and an agreed upon bypass amount will always be provided, as stipulated under the reach wide flow management plans and/or the permittee's individual Site Plan Agreement.

1.3.1.1.3 Pasture Grazing and Riparian Grazing Management

Pasture grazing management includes the movement of cattle between pastures, as well as harrowing, mowing, and haying of pastures. Riparian grazing management includes cattle grazing within riparian areas according to a riparian grazing management plan that is part of a Site Plan Agreement.

The AMMs associated with pasture grazing and riparian grazing management include:

C1. Develop riparian grazing management plans for each Enrolled Property that includes this activity.

C2. Graze fenced riparian areas in accordance with grazing management plans.

C3. To avoid direct impacts to Covered Species spawning, incubation, and emergence, grazing in riparian pastures with streams that are accessible to the Covered Species will be allowed only from May 1 to November 1 or as approved by NMFS and CDFW. Again, variances for instream work are not anticipated to be needed, and would only be allowed if NMFS determines that the activity will not result in additional effects beyond what is considered in this opinion. Riparian areas adjacent to spawning habitat will be a last-choice option during the Covered Species spawning season.

1.3.1.1.4 Fence Maintenance

Fence maintenance includes installation, construction, maintenance, and removal of fencing material, including mesh field fence, panels, or other designed fence barriers, within riparian areas for riparian zone protection, stream crossings and stock-water access.

The AMMs associated with fence maintenance include:

D1. Inspecting and repairing riparian exclusion fencing during and after each season of grazing and after high flow events where over bank flows may inundate fences and prior to and after riparian grazing has occurred. If cattle are present, riparian fences shall be repaired before cattle get into the stream.

D2. If riparian fences are lost due to a catastrophic event, the permittee shall notify NMFS and CDFW of the loss in the annual report, and will repair up to the percentage of fencing they committed to replace in the Site Plan Agreement.

1.3.1.1.5 Road Use and Maintenance

Road use and maintenance includes both the use and the regular maintenance of all ranch roads on an Enrolled Property, which could include grading, rocking, laying base, and culvert replacement.

The AMMs associated with road use and maintenance include:

E1. Ensuring fish passage at road crossings of streams that are accessible to the Covered Species including at bridges, wet crossings, and culverts.

E2. Minimizing erosion and sedimentation from roads and roadwork.

E3. Planned Instream work shall occur only when Covered Species are least likely to be present or affected by the project, typically from June 15 through November 1.

E4. During wet or thaw periods, avoiding heavy traffic on native surface roads or on roads otherwise not designed and constructed for these conditions Inspecting roads annually to determine the need for structural maintenance.

1.3.1.1.6 Livestock and Vehicle Wet Crossings

Livestock and vehicle wet crossing routing activities includes moving livestock, vehicles, ATVs, and equipment across flowing streams or intermittent channels, stock water access, and/or the construction, maintenance, and use of stream crossings at designated locations where potential Covered Species spawning gravels, incubating eggs, and fry are not present, and use of wet crossings, which are also only allowed where the Covered Species is absent.

The AMMs associated with operating livestock and vehicle wet crossings include:

F1. Crossing livestock and vehicles only when completely necessary, and at stable, designated locations where potential spawning gravel, incubating eggs, and fry are not present.

F2. When operating vehicles in wetted portions of a stream channel, checking and maintaining vehicles on a daily basis to prevent leaks of materials that, if introduced to water, could be deleterious to aquatic life, wildlife, or riparian habitat.

F3. Maintaining fish passage at all crossing for all Covered Species life stages when sufficient flows are available.

1.3.1.1.7 Herbicide (Weed Management), Fertilizer and Pesticide Use

This includes weed management, in the form of livestock grazing, use of California legal weed spray products, manual removal, burning, and mowing.

The AMMs associated with herbicide, fertilizer, and pesticide use include:

G1. Ensuring that any pesticide or herbicide is handled and applied by a licensed applicator (when required) in accordance with all applicable, federal, state, local laws, regulations, procedures, and guidelines.

G2. Using care to minimize fertilizer use in applications that could result in nutrient loading to natural waterways.

G3. Reviewing label information and avoiding the use of any material known to be detrimental to fish where it could impact the Covered Species.

G4. Using and storing stationary petroleum-powered equipment in a manner to prevent the potential release of petroleum materials into natural waterways.

G5. Refueling machinery and storing hazardous materials no less than 150 feet away from the edge of any water body.

G6. When spraying herbicide along a riparian corridor, spraying from the direction of the creek towards the bank to reduce spray into the creek.

1.3.1.1.8 Flood or Emergency Events

Managing flood or emergency events include immediate work needed to prevent loss of or damage to property from emergencies, such as flood, fire, storm, earthquake or other unexpected natural events. Flood or emergency activities may include sediment and debris removal, emergency fish screen repairs, fencing repairs, streambank or crossing stabilization, and moving livestock or equipment across streams during emergencies.

The AMMs associated with managing flood or emergency events include:

H1: Prior to, during, or immediately after the event, contacting NMFS and CDFW to develop AMMs in coordination with the Permittee for the particular flood or emergency circumstances.

H2: Notify NMFS and CDFW within 14 days of beginning emergency work.

1.3.1.2 Beneficial Management Activities (BMAs)

The primary objective of the Agreement and Site Plan Agreements is to enhance, restore, or maintain habitat to benefit the Covered Species. The BMAs included in the Agreement are activities to benefit the Covered Species and are further specified in individual Site Plan Agreements. The suite of potential BMAs that could be implemented under the Agreement

include: 1) instream habitat structures and improvements, 2) beaver management, 3) barrier modification for fish passage improvement, 4) riparian habitat restoration, 5) removal of small dams, 6) off-channel and side-channel restoration, 7) fish screen installation or replacement, and 8) water conservation measures. As with Routine Agricultural Activities, the BMAs are described in additional detail in Appendix 2 of the Agreement and in Site Plan Agreements, as appropriate. The BMAs are summarized in the eight following subsections (Section 1.3.1.2.1 to Section 1.3.1.2.8). While the purpose of each BMA is to benefit the Covered Species, implementation of the BMAs has the potential to have short-term negative impacts. Therefore, the Agreement requires AMMs for all BMA projects to avoid or minimize adverse effects to the Covered Species and their critical habitat. The Agreement describes the AMMs that are intended to minimize these adverse effects. The AMMs for BMAs are described in additional detail in Appendix 2 of the Agreement and summarized in Section 1.3.1.2.9 below.

1.3.1.2.1 Instream Habitat Structures and Improvements

These BMAs include a variety of techniques. Plans for specific projects are included in individual Site Plan Agreements. Specific techniques may include placement of: large woody debris (LWD), boulder structures, and post-assisted wood structures (PAWS) or beaver dam analog structures (BDAS). BDAs will be implemented according to Pollock et al. (2018): The Beaver Restoration Guidebook.

1.3.1.2.2 Beaver Management

Beaver management is included as a BMA because beaver activity has the potential to provide habitat benefits for the Covered Species, but also to negatively impact Routine Agricultural Activities for Permittees. This BMA includes non-lethal measures that may be considered to mitigate for unwanted tree cutting in critical locations include the installation of wire mesh cages or the application of paint and sand mix at the base of trees in need of protection. Where the construction of beaver dams have raised the water level to cause unwanted flooding of ranch infrastructure landowners should consider installation of pond levelers or Clemson levelers as described by Pollock et al. (2018). Permittees agrees to create a management plan to, at a minimum, not deter dam building beaver activity except where it damages infrastructure, e.g., impairs irrigation control structures, inundates crossings, etc. However, where the construction of beaver dams has raised the water level to cause unwanted flooding of ranch infrastructure, landowners are permitted to modify the structure and discourage future beavers from utilizing the site once NMFS and CDFW have assessed the situation and agree on the extent of dam modification. When necessary, the Permittee will work in conjunction with NMFS and CDFW fisheries management personnel to physically breach dams.

1.3.1.2.3 Barrier Modification for Fish Passage Improvement

Barrier modification projects are intended to improve passage for the various life stages of the Covered Species, thereby providing access to upstream habitat, and increasing the duration of accessibility (both within and between years). These BMA projects may include passage improvements at beaver dams, existing culverts, diversions, dams, bridges, and paved and unpaved fords through replacement, removal, or retrofitting. In particular, these practices may

include the use of gradient control weirs upstream or downstream of barriers to control water velocity or water surface elevation or to provide sufficient pool habitat to facilitate jumps, or the use of interior baffles or weirs to mediate velocity and the increased water depth.

1.3.1.2.4 Bioengineering and Riparian Habitat Restoration

These projects are intended to improve Covered Species habitat through increased stream shading that is intended to lower stream temperatures, increase future recruitment of LWD to streams, and increase bank stability and invertebrate production. Riparian habitat restoration projects will aid in the restoration of riparian habitat by increasing the number of plants and plant groupings, and will include the following types of projects: natural regeneration, livestock exclusion fencing, bioengineering, and revegetation. The proposed activities will reduce stream sedimentation from bank erosion by stabilizing stream banks with appropriate site-specific techniques including: boulder-streambank stabilization structures, log-streambank stabilization structures, tree revetment, native plant material revetment, willow wall revetment, willow siltation baffles, brush mattresses, check dams, brush check dams, water bars, and exclusion fencing.

1.3.1.2.5 Removal of Small Dams (permanent and flashboard)

Types of small dams included under this BMA category are permanent, flash board, and seasonal dams. Removal of dams in part or in whole by the use of explosives is not included as a BMA. Dams included here must be less than 25 feet in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier to the maximum possible water storage elevation. In addition, this activity only includes dam removal that will result in the formation of a channel at natural grade and shape upstream of the dam, naturally or with excavation, in order to minimize negative effects on downstream habitat. Candidate dam removal projects will (1) have a relatively small volume of sediment available for release, that when released by storm flows, will have minimal effects on downstream habitat, or (2) be designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions.

Prior to small dam removal, data collection and analysis is required, along with further consultation with NMFS and CDFW, as described in the Agreement.

1.3.1.2.6 Creation of off-channel/Side Channel habitat

Types of side channel or off-channel restoration projects that are eligible as a BMA under the Agreement are: 1) connection of abandoned side channel or pond habitats to restore Covered Species access, 2) connection of adjacent ponds, 3) connection of oxbow lakes on floodplains that have been isolated from the meandering, 4) creation of side channel or off-channel habitat with self-sustaining channel, 5) creation of alcoves, and 6) improvement of hydrologic connection between floodplains and main channels. Projects that involve the installation of a flashboard dam, head gate, or other mechanical structure are not included under this BMA category. Off-channel ponds constructed under this BMA will not be used as a point of water diversion. The use of logs or boulders as stationary water level control structures will be allowed. Restoration projects in this category may include: removal or breaching of levees and dikes, channel and pond excavation, creating temporary access roads, constructing wood or rock tailwater control structures, and construction of LWD habitat features.

1.3.1.2.7 Fish screen installation or replacement

This BMA category includes the installation, operation, and maintenance of the types of fish screens described below, provided they meet the NMFS (NMFS 1996, 1997) fish screening criteria. Installing a fish screen usually includes site excavation, forming and pouring a concrete foundation and walls, excavation and installation of a fish bypass pipe or channel, and installation of the fish screen structure. Fish screen types include both: 1) self-cleaning screens, including flat plate self-cleaning screens, and other self-cleaning designs, including, but not limited to, rotary drum screens and cone screens, with a variety of cleaning mechanisms, and 2) non-self-cleaning screens, including tubular, box, and other screen designs consistent with NMFS screening criteria (NMFS 1996, 1997).

1.3.1.2.8 Water Conservation Measures

There are a suite of activities included in the Agreement that are water conservation measures, including: 1) developing alternative stockwater supply, 2) riparian restoration and revegetation, 3) installing/maintaining water storage and tailwater capture systems, 4) piping ditches, 5) headgates and water measuring devices, 6) optimizing cold water spring inputs, 7) combining or moving points of diversion, 8) water exchanges), and 9) State Water Board Water Code Section 1707 dedications. The diversion reductions that are made possible in part by these water conservation measures are discussed in a forbearance agreement that would be entered into by the 13 non-governmental Permittees and the Scott Valley and Shasta Valley Watermaster District (Forbearance Agreement, Section 1.3.2.1 below).

Developing alternative stockwater supply will be needed for projects that fence livestock out of some riparian areas. These are often ponds that have been excavated and are filled by rainwater, overland flow, surface diversions or groundwater. BMAs in this category also may include small wells with solar pumps, water lines, watering troughs, and piping used to provide ground or surface water to livestock. All pump intakes associated with surface diversions will be screened.

Riparian restoration and revegetation includes revegetation of riparian areas. Riparian vegetation is planted within or adjacent to the active channel, and often in or near the wetted channel. Plantings include native herbaceous perennials, emergent species, grasses, trees, and shrubs. Planting methods vary by species, site, and size of material planted, ranging from hand planting to using a backhoe or excavator. Maintenance activities include the occasional use of hand tools, portable pumps, pick-up trucks and/or water trucks in or near the bed, bank, or channel, for irrigation, debris removal, and replanting of restoration sites.

Installing/maintaining water storage and tail water capture systems projects addresses water storage that results from storage of water diverted from surface or groundwater sources and tailwater capture (off channel). A water storage facility enables a Permittee to use stored water at a later date or when desired. Water storage facilities can have many benefits that go beyond agricultural use including groundwater recharge and allowing diversion during winter and early spring when instream flow is ample. Water storage, when paired with reduction of water use later in the season, can benefit the Covered Species. Potential benefit to Covered Species will be considered when planning projects under this category. Tailwater is created in flood irrigation operations as unabsorbed, untranspired, and unevaporated irrigation water that may flow back

into the stream. Restoration projects to address tailwater input will include construction of tailwater capture systems (pond, berms or pick up ditches) to intercept tailwater before it enters streams as surface flow. Water held in capture systems, such as a pond, could be reused for future irrigation purposes, therefore, reducing the need for additional stream diversions. Tailwater ponds are used primarily during the irrigation season (dry summer months).

Piping ditch BMA projects consist of constructing a pipe to transport irrigation water as an alternative to conveying water in an open ditch, thereby reducing water loss including from evaporation and absorption. A water budget/balance or consumptive use analysis will be completed to determine actual amount of water saved by these projects. The amount determined to be saved will remain in the stream to benefit the Covered Species.

Headgates and water measuring devices can benefit Covered Species by increasing the likelihood that the amount of water intended to be left in stream is accurate. Measuring devices are typically installed with the head gate to allow water users to determine the volume of water diverted. These devices will help diverters ensure that they are diverting their legal water right. This BMA category also includes the installation and maintenance of stream gages in the active stream channel. For points of diversion with water rights less than or equal to 10 acre feet per year, diversion volumes will be recorded monthly.

Optimizing cold water spring inputs is an important BMA because cold water springs are a key habitat feature in the Covered Area and can provide both local and reach scale benefits to the Covered Species. Projects to optimize cold water spring inputs may include developing alcoves (described in the off channel section above), installing spring boxes or piping springs to the river to improve habitat conditions at a specific location. All spring optimization projects will be designed to maintain Covered Species passage, minimize erosion, and improve, or not impair, water quality conditions. All spring optimization projects must be reviewed and approved by NMFS or CDFW representative to ensure that these conditions will be met.

Combining or moving current points of diversion can be employed as a BMA in order to enhance flows in certain reaches, maintain cold water springs, or provide fish passage. Potential benefit to Covered Species will be considered when planning these projects.

Water exchanges may be done in certain reaches where additional stream flow can be diverted in lieu of a cold water source. The act of diverting additional water at a point of diversion must not impact flow requirements past that point of diversion or any downstream point. These exchanges must be monitored sufficiently to document that the exchanges are of equal amounts (stream diversion to spring water) to ensure dewatering of the channel is not occurring.

As a BMA, permittees may also dedicate a portion of their state water right to enhance conditions for the Covered Species via California Water Board Code Section 1707. California Water Board Water Code Section 1707 dedications allow permittees who divert water under any legal basis of right, including riparian, permitted, and licensed water rights, to petition the State Water Board pursuant a “change for purposes of preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation in, or on, the water.” The section 1707 petition may be coupled with an application for a water right or a petition to amend an existing permit or license

in order to modify an existing project so that diversion will occur in a manner that improves conditions for the Covered Species.

1.3.1.2.9 Avoidance and Minimization Measures for Beneficial Management Activities

Many of the BMAs described above include in-water or streamside construction work and the potential for impacts that are similar among activities, which, therefore, may be addressed by similar AMMs. Consequently, AMMs for BMAs include general protective measures that are part of the Covered Activities and are applicable to the BMAs. These include the following:

- Unless otherwise expressly allowed, the in-water construction season shall be from June 15 to November 1. Restoration, construction, fish relocation, and dewatering activities within any wetted or flowing stream channel shall only occur within this period. Revegetation outside of the active channel may continue beyond November 1, if necessary.
- Prior to construction of BMA structures, the Permittee or any contractor performing work shall be provided with the specific protective measures to be followed during implementation of the project. In addition, a qualified biologist shall provide the construction crew with information on the Covered Species and its habitat in the project area, the protection afforded the species by the ESA, and guidance on those specific protection measures that must be implemented as part of the project.
- All activities that are likely to result in negative aquatic effects, including temporary effects, shall proceed through the following sequencing of effect reduction: avoidance; reduction in magnitude of effect.
- Poured concrete shall be excluded from the wetted channel until the water surrounding the concrete structure has a PH between 6 and 8.5 to avoid water quality issues for Covered Species.
- If the thalweg (location of the deepest and fastest part) of the stream has been altered due to construction activities, it shall be reestablished it to its original configuration to the maximum extent practicable.
- Projects that require dewatering must follow the guidelines for dewatering described in Appendix 2 of the Agreement.
- Prior to dewatering a construction site, qualified individuals, as determined by NMFS and CDFW, will capture and relocate Covered Species to avoid direct mortality and minimize adverse effects. Projects that require Covered Species relocation must follow the Requirements for Covered Species Relocation and Dewatering Activities, as described in Appendix 2 of the Agreement.
- Projects that have the potential to degrade water quality must implement measures to reduce the potential for adverse effects to water quality during and post-construction as described in Appendix 2 of the Agreement, including: erosion control measures, and following guidelines for temporary stockpiling.
- Measures must be taken to minimize loss or disturbance of riparian vegetation as described in Appendix 2 of the Agreement.
- Lastly, measures must be taken to minimize the impacts of roads in the Covered Area as described in Appendix 2 of the Agreement.

1.3.1.3 Supplementation

Landowners with properties adjoining Parks Creek, Big Springs Creek, and Shasta River propose to provide access for coho supplementation activities. A coho supplementation program to augment the Shasta River coho population has been proposed by CDFW and NMFS, however, due to access limitations, the program efforts have stalled since 2013. Landowner access as proposed in the Site Plan Agreements will allow NMFS, CDFW, and other parties to consider supplementation as an opportunity to increase coho salmon population numbers.

1.3.1.4 Monitoring

As part of the Covered Activities, every Site Plan Agreement and each BMA project includes both implementation monitoring and effectiveness monitoring. Along with implementation and effectiveness monitoring, the Adaptive Management Program for the Agreement also includes validation monitoring. Implementation monitoring and effectiveness monitoring will be used to evaluate whether the objectives of the Agreement are being achieved over time. Implementation monitoring of BMAs will be used to inform the Parties and to confirm that each BMA has been constructed as intended, without any structural changes or omissions that would compromise the integrity of the project or reduce its intended benefits. Effectiveness monitoring will provide data to evaluate the effectiveness of the Agreement in achieving the habitat, instream flow, and water temperature objectives at the site and reach scale over the duration of the Agreement. The purpose of validation monitoring is to gather biological data to evaluate whether habitat improvements have affected the survival and spatial distribution of the Covered Species. Monitoring is described in some detail in the Agreement, and in individuals Site Plan Agreements, but is most fully described in Appendix 3 of the Agreement: Adaptive Management Program. That document is incorporated by reference into this document, and summarized in Section 1.3.1.4.2 below.

1.3.1.4.1 Monitoring and research in the Agreement

The agreement includes the potential for research and monitoring activities that have not yet been fully defined. Broadly, this may include studies and research that Permittees will allow to occur on the Enrolled Properties to further the understanding of the Shasta River, including SONCC coho salmon surveys, studies of riparian survival, habitat improvement studies, and food availability studies. In addition, Permittees may propose to conduct validation monitoring studies within the Covered Area. For monitoring activities not currently described in the Agreement, or for monitoring to be conducted by qualified individuals not employed by NMFS or CDFW, Permittees will provide NMFS and CDFW with the following information: Name of primary investigator and authorized individuals, monitoring purpose and overall objectives, timeframe, duration, and frequency of monitoring, summary of monitoring methods and survey/sampling locations (including a map), estimate of Covered Species take, avoidance and minimization measures proposed to reduce Covered Species injury and mortality, sample data sheets, and reporting plan. Capture/handling methods for SONCC coho salmon may include electrofishing, seining, dipnetting, tissue sampling, and tagging. If NMFS and CDFW agree that the proposed monitoring is consistent with the effects analyzed in this opinion (Section 2.5.8 below), NMFS and CDFW will provide written verification to proceed. All monitoring data and reports shall be provided to NMFS and CDFW.

1.3.1.4.2 Adaptive Management Program for the Agreement (Appendix 3 of the Agreement)

The BMAs identified in the Agreement and Site Plan Agreements are expected to enhance conditions and thus contribute, directly or indirectly, to the recovery of the Covered Species. Under the Adaptive Management Program, implementation monitoring, effectiveness monitoring, and validation monitoring will be used to evaluate whether the objectives of the Agreement are being achieved over time. The Adaptive Management Program defines the process for evaluating the results of all monitoring activities, and provides a process for recommending adjustments to BMAs within the framework of the Agreement. Adjustments to BMAs will require NMFS and CDFW approval, and will only occur if the changes are expected to improved conditions for the Covered Species. The Adaptive Management Program describes monitoring activities that are part of the Covered Activities.

1.3.1.4.2.1 Implementation Monitoring

As part of the Covered Activities described in the Agreement, implementation monitoring of Routine Agricultural Activities, BMAs, and AMMs as specified in Individual Site Plan Agreements will be accomplished by the Permittees or their consultants, with the assistance of the Parties, when appropriate, on a schedule specified in each Site Plan Agreement, and using specific protocols. Implementation monitoring includes those monitoring tasks associated with construction and implementation of BMAs (e.g., construction of habitat restoration projects), AMMs, and Permittees' diversion reductions. Implementation monitoring of BMAs serves to verify that habitat restoration projects are constructed as designed or intended. Each Site Plan Agreement contains a description of the BMAs and AMMs, and associated implementation monitoring protocols, that are required under the Agreement for the Enrolled Property. The results of implementation monitoring will inform the Adaptive Management Program as projects are constructed and monitored.

Implementation monitoring of Permittees' diversion reductions is a necessary component of the Flow Management Strategy (Section 1.3.2 below) and the associated Diversion Reduction Schedule (Sections 1.3.2.1.2 below), and is further discussed in those sections.

1.3.1.4.2.2 Effectiveness Monitoring

Effectiveness monitoring will provide data to evaluate the effectiveness of the Agreement in achieving the habitat, instream flow and water temperature objectives at the site and reach scale over the duration of the Agreement. The habitat parameters that are identified as being most tied to both limiting factors for the Covered Species in the Covered Area, and are also likely to be impacted by the Covered Activities include hydrology, water temperature, and secondary habitat elements (i.e., spawning gravel, large wood, riparian condition, and critical riffle height). Effectiveness monitoring focuses on these habitat parameters, and identifies performance indicators and success criteria for water temperature, hydrology, fish passage, riparian vegetation, instream habitat, and validation monitoring.

1.3.1.4.2.2.1 Hydrology

Effectiveness monitoring for hydrology and water temperature will consist of installation and operation of fixed monitoring stations located throughout the reaches within the Covered Area (Figure 2, Table 2). The monitoring stations will assist in determining whether any detectable

spatial and temporal changes in water quantity and temperature have occurred at the reach scale following implementation of BMAs. The monitoring stations will also be used to provide data to assist Permittees in implementing flows found in the Diversion Reduction Schedule (Section 1.3.2.1.2 below).

Instream flows will be monitored in real time at the locations identified in Table 2, which can be seen on Figure 2. These stream gages will provide continuous, real-time stage (water surface elevations, in feet) data. Stations that are indicated as priority sites for flow monitoring to ensure flow management BMAs are implemented will need to have regular stage-discharge curves created throughout the year. Gages will be operated and maintained monthly or more frequently and rating curve maintenance will require access to stations throughout the year.

Big Springs Ranch is currently owned and operated by CDFW. The CDFW, in conjunction with researchers from U.C. Davis's Watershed Sciences Center and The Nature Conservancy, have already conducted extensive investigations in Big Springs Creek and the Shasta River downstream that describe coho salmon habitat use and existing ESA Section 7 baseline conditions. These efforts have also been monitoring changes to environmental conditions that began following improvements to land management practices and instream flow that were initiated in 2010. As part of the Agreement, effectiveness monitoring in Big Springs Creek will continue and includes operation of the current instream flow and water temperature gages to allow for evaluation of proposed additional BMAs into the future.

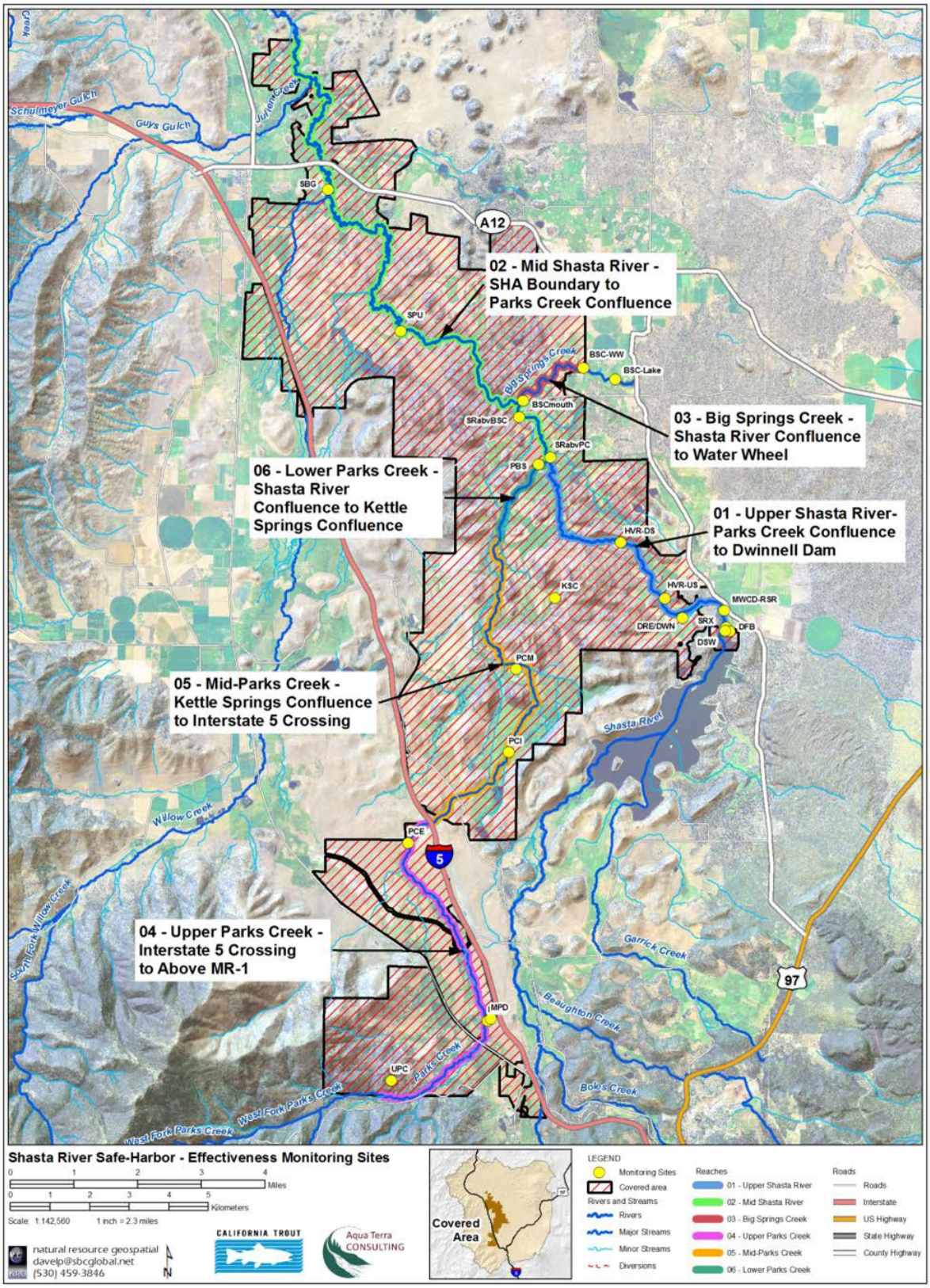

Figure 2. Covered Area reaches and approximate location of effectiveness monitoring sites.

Table 2. Water Quality Effectiveness Monitoring Locations

Reach and Station Locations	Designation	Monitoring Element	Maintenance Responsibility	Data Access	Status and Priority for Installation
Reach 1- Upper Shasta River - Parks Creek Confluence to Dwinnell Dam					
Montague Water Conservation District (MWCD) Dwinnell Dam	DRE/DWN	Real-Time (RT) Storage Volume/Elevation	MWCD	Public	Installed
MWCD Cross Canal/Prior Rights	SRX	RT Flow /Temp	MWCD	Public	Installed
MWCD Instream Flow Release	DFB	RT Flow /Temp	MWCD	Public	Installed
MWCD Dwinnell Dam Seepage	DSW	RT Flow /Temp	MWCD	Public	Installed
MWCD Upstream of Riverside Road	MWCD-RSR	RT Stage/Temp/Air	MWCD	Private	Installed
HVR Upstream Property Line	HVR-US	RT Stage/Temp/Air	SWCG	Private	Installed
HVR Downstream Property Line	HVR-DS	RT Stage/Temp/Air	SWCG	Private	Installed- Replaced with HIG project
Shasta River upstream of Confluence with Parks Creek	SRabvPC	RT Flow/Temp	SWCG	Private	Needed- **3rd Priority**

Reach 2 - Mid Shasta River – Highway A-12 to Parks Creek Confluence					
Upstream Big Springs Creek	SRabvBSC	RT Temp	CDFW	Public	Installed
Grenada Irrigation District	SPU	RT Flow/Temp	SWCG	Public	Installed
Shasta River Near A-12	SBG	RT Flow/Temp	SWCG	Private	Needed- **2nd Priority**
Reach 3 - Big Springs Creek – Shasta River Confluence to Water Wheel					
Big Springs Creek Lake	BSLake	Temp	CDFW	Public	Needed-**6th Priority**
Water Wheel	BSC-WW	RT Flow/Temp	CDFW	Public	Installed
Big Springs Creek Mouth	BSCMouth	RT Temp	CDFW	Public	Installed

Reach 4 - Upper Parks Creek – Interstate 5 Crossing to Above MR-1					
Upstream of Diversions on Parks	UPC	RT Flow/Temp	SWCG	Public	Installed
MWCD Parks Diversion	MPD	RT Flow	MWCD	Public	Installed
Below MWCD Diversion	PME	RT Flow/Temp	MWCD	Public	Installed
Upstream I-5	PCE	RT Flow/Temp	SWCG	Private	Needed- **1st Priority**
Reach 5 - Mid-Parks Creek – Kettle Springs Confluence to Interstate 5 Crossing					
Below Parks 4 diversion	PCI	Non Real-time Stage/Temp/Flow	SWCG	Private	Needed- **4th Priority**
Below Parks 5 diversion	PCM	Non Real-time-Flow/Stage/Temp	SWCG	Private	Needed- **5th Priority**
Reach 6- Lower Parks Creek – Shasta River Confluence to Kettle Springs Confluence					
Kettle Spring Creek	KSC	Non Real Time-Flow/Temp	SWCG	Private	Installed
Parks Creek at Mouth	PBS	RT Stage/Temp	SWCG	Public	Temp Installed-Replaced w/ Cardoza Project

1.3.1.4.2.2.2 Water Temperature

A near-continuous record of water temperature is essential to observe the daily maximum water temperature. Effectiveness monitoring for hydrology and water temperature will consist of installation and operation of fixed monitoring stations located throughout the reaches within the Covered Area (Figure 2, Table 2). Temperature data will be monitored in real time at the locations identified in Table 2, which can be seen on Figure 2. Both water temperature and riparian air temperature will be measured at each location. The collection interval will be short enough to record the maximum values for any one day. Half-hour readings are commonly recommended, but 1-hour intervals are acceptable and allowed by the Agreement. Sampling will be continuous (i.e., done year round and not seasonally or only for a few days each month) and will be monitored for the duration of the Agreement.

1.3.1.4.2.2.3 Secondary Habitat Elements

Secondary habitat elements include improvements to fish passage conditions, riparian function, spawning substrate quality, instream habitat complexity, and off channel habitat features. In addition to effectiveness monitoring, all of these types of habitat improvements will undergo implementation monitoring to evaluate if the features were constructed as designed with the intended benefits provided. Table 3 identifies potential monitoring elements that may be evaluated during the term of the Agreement to assess effectiveness of secondary habitat attributes at the site and reach-scale. Monitoring elements that are required on specific properties are further discussed in the effectiveness monitoring section of individual Site Plan Agreements. Permittees will also provide monitoring assistance needed for the reach-scale effectiveness monitoring (such as providing access or data) as listed in Table 3. Tracking riparian habitat extent may be accomplished by NMFS, CDFW, or a mutually approved contractor using aerial photo interpretation (e.g., Google Earth) along with spot checks/photo points in the field.

Table 3. Implementation and effectiveness monitoring of secondary habitat monitoring elements

Monitoring Element	Description	Time	Frequency	Permittee Commitment	Responsibility
Spawning Gravel	Photo point and mapping to monitor the distribution of spawning gravel over time	September – January	Once per year while spawning survey is conducted	Allow Access as specified in Site Plan Agreements	CDFW/NOAA mutually approved contractor
Large Wood Evaluation	Photo point				
Riparian					
Critical Riffle Analysis	Quantitative	All Year	Once per 5 years or after floods if justified to confirm passage for all life stages		

1.3.1.4.2.3 Performance Indicators and Success Criteria

The development of performance indicators is a critical step in the adaptive management process. Performance indicators need to be measurable, relate directly to the objective being evaluated, and accurately reflect those habitat parameters that are anticipated to be responsive to implementation of BMAs. Habitat responses are anticipated to include improved instream flow and water temperatures to improve conditions for freshwater life stages of the Covered Species. Because habitat characteristics and potential restoration opportunities differ between river reaches, the Adaptive Management Plan includes reach-specific performance indicators and success criteria. This strategy was used for those secondary physical habitat parameters, such as channel geometry and complexity, riparian community structure, and floodplain characteristics, which are created and maintained by reach level parameters that include instream flow, sediment transport, and channel slope. However, unlike these parameters, water temperature has a direct effect on fish metabolism and health. Water temperature is the overriding parameter that determines if other physical habitat characteristics provide conditions suitable for coho salmon growth and survival. In other words, even under ideal conditions where both cover and water velocities provide optimum conditions for rearing coho salmon, if water temperatures are above lethal levels the benefits of those other parameters can never be realized. Therefore, performance indicators and success criteria for water temperature are the same for all river reaches within the Covered Area and will be used to evaluate the benefits from BMAs.

Performance indicators for water temperature, hydrology (flow) and fish passage need to be quantitative and reflect the habitat suitability requirements of the Covered Species. Performance indicators for the secondary habitat parameters described above are qualitative and will rely on

photo monitoring and results of the implementation monitoring and validation monitoring efforts described in Section 1.3.1.4.2.4 below. Evaluation of habitat conditions by the various performance indicators and success criteria will be performed by NMFS and CDFW on an annual basis and again at a five-year check-in as described in the Adaptive Management Program. The following sections provide a description of performance indicators for water temperature, hydrology, fish passage, riparian, and other secondary habitat elements that will be used to evaluate the effectiveness of BMA implementation over the term of the Agreement.

1.3.1.4.2.3.1 Water Temperature

Performance indicators for water temperature are designed to evaluate water temperature conditions that trigger behavioral induced movement and provide improved water temperatures for a longer duration during the summer rearing season. Therefore, water temperature performance indicators employ two sets of criteria. A performance indicator of 18°C will be used to evaluate the onset of behavioral induced movement during the spring. The second set of water temperature criteria will focus on the physiological suitability of water temperatures and will use the criteria described by Stenhouse et al. (2012) for the Shasta River presented in Table 4. The evaluation will compare the number of days between May 1 and September 30 when water temperatures remain less than 18°C with baseline temperature data and will also compare the number of days in which water temperatures were determined to be optimal, suboptimal and detrimental as described in Table 4.

Table 4. Water temperature criteria for the Covered Species contemplated in the Adaptive Management Plan

Description	Water Temperature °C
Optimal	10 - 15.5
Suboptimal	15.6 - 20.3
Detrimental	> 20.3

The greatest benefits to water temperature will occur at the site scale where BMAs result in increased cold water contributions from springs or groundwater that enter directly into the stream. Improvements in water temperature at the reach scale may also occur as improvements in water conservation and management, channel structure, and riparian vegetation improve over time.

To evaluate the success of BMAs relative to water temperature within the Covered Area, the change in water temperature conditions due to implementation of BMAs will be analyzed. Starting water temperature conditions will be water temperature data collected at the water quality monitoring stations listed in Table 2. The evaluation will monitor the number of days between May 1 and September 30 when water temperatures remain less than 18°C and will also monitor the number of days in which water temperatures were determined to be optimal, suboptimal and detrimental (Table 4) at each water quality monitoring station.

1.3.1.4.2.3.2 Hydrology

Performance Indicators for instream flow for four key stream reaches are presented in Table 6. Performance Indicators are not identified for the Mid-Shasta Reach or Big Springs Creek. Instream flow volumes in these two reaches are generally sufficient to provide fish passage, spawning habitat, and rearing habitat for coho salmon, particularly downstream of the confluence with Big Springs Creek (NMFS and Aquaterra 2020).

Table 5. Instream flow performance indicators and corresponding water quality monitoring locations in Parks Creek and the Upper Shasta River upstream of Parks Creek.

Reach and Water Quality Monitoring Location	Adult Migration/Spawning - November 1 to December 31	Juvenile (1+) Rearing/Emigration - March 1 to May 15	Fry/Juvenile (0+) Summer rearing - May 15 to September 30
Upper Parks Creek (PCE)	11 cfs	20 cfs	3 cfs
Mid-Parks Creek (Below Parks 5)	11 cfs	20 cfs	3 cfs
Lower Parks Creek (PBS)	11 cfs	20 cfs	7 cfs
Upper Shasta River (SRabvPC)	11 cfs	20 cfs	6 cfs

Performance Indicators will be evaluated at each water quality monitoring location and for each coho salmon life stage period as BMAs and AMMs are implemented over time. To measure success, the change in the number of days that meet or exceed the Performance Indicators (flow targets; Table 5) for each life stage period will be evaluated through time. Along with existing data, baseline temperature data will be compiled during SHA implementation to be used as a comparison when determining success criteria. If, under future conditions, the number of days in which flow targets meet or exceed targets in Table 5 relative to the baseline or previous years, then conditions for this parameter will be considered to have improved. Since hydrologic conditions can be highly variable from year to year, determinations as to the success or failure of BMAs to improve flow conditions will not be based on a single year. Rather, success of the Agreement to improve flow conditions will be assessed annually, incorporating data from multiple previous years, so that results include multiple recent water year types and, therefore, provide a more robust set of information to better inform adaptive management.

1.3.1.4.2.3.3 Fish Passage

A critical riffle fish passage investigation was conducted over five sites in Parks Creek during 2016 and the results of the investigation are included in the Parks Creek Hydrologic and Water Temperature Assessment (AquaTerra Consulting 2017). The results of the investigation helped to inform development of the flow management strategy for Parks Creek that will be implemented through BMAs included in Site Plan Agreements located within Parks Creek. Changes in fish passage conditions could occur during the duration of the Agreement. These changes may be caused by channel forming flood events, through implementation of instream

habitat restoration actions, or may occur more gradually over time as the BMAs and AMMs help stimulate natural channel and floodplain recovery. To evaluate potential changes to fish passage conditions in Parks Creek that may occur over time, critical riffle analysis will be repeated every 5 years from the initiation of the Agreement, or after major flood events if reconnaissance surveys demonstrate a change in conditions that would result in impassable conditions for the Covered Species.

1.3.1.4.2.3.4 Riparian Vegetation

Many of the BMAs are designed to improve the conditions of the riparian corridor through installation of riparian fencing and improved grazing management of riparian pastures. The CDFW has developed a Google Earth map of the existing extent of riparian vegetation on the Enrolled Properties using three vegetation cover types: woody vegetation, herbaceous riparian vegetation, and open water/no riparian cover. This mapping effort will be used to evaluate changes to riparian vegetation by reach over the term of the Agreement. Therefore, this baseline map of riparian vegetation will serve as the basis for which changes to the riparian corridor will be evaluated. Riparian mapping is anticipated be conducted every ten years to allow adequate time for riparian communities to respond to BMAs and environmental conditions.

1.3.1.4.2.3.5 Instream habitat

To improve instream habitat quality and diversity some Site Plan Agreements include placement of spawning gravels, construction of large wood structures, construction of alcoves, and reconnection of off channel features such as oxbows and side channels. The effectiveness of these BMAs is dependent on the presence of suitable instream flow, water temperature, flooding, and geomorphic processes that these features experience over time. However, when flows and water temperatures are improved, instream habitat improvements are expected to provide additional rearing habitat with more abundant cover and diverse water velocity profiles where coho salmon feeding opportunities can be optimized. Success for these types of projects will rely primarily on the results of the implementation monitoring conducted specific to each project.

1.3.1.4.2.4 Validation monitoring

The purpose of validation monitoring is to gather biological data to evaluate whether habitat improvements have affected the survival and spatial distribution of the Covered Species. The BMAs and AMMs were designed to improve conditions with the overall objective of providing a net conservation benefit that will contribute to the recovery of the SONCC coho salmon ESU. The coho salmon life history phases that occur within the Covered Area include spawning, incubation, fry and juvenile rearing, and smolt emigration. The CDFW has been monitoring coho salmon populations within the Shasta River for several decades through the efforts of its Klamath River Project and Anadromous Fish Research and Monitoring Program. These efforts provide information describing the distribution and abundance of both adult and juvenile coho salmon produced within the Shasta River and also estimate survival rates from the adult to the smolt life stage based on the rotary trapping of emigrants. Continuation of these efforts will be crucial to the overall evaluation of the Agreement. Although the information gathered by CDFW monitoring of coho salmon populations in the Shasta River will be relevant to the Adaptive Management Program, those research programs will continue to be covered via the ESA Section 4(d) California State Research Program. However, additional validation monitoring related to the Agreement activities may be proposed as discussed in Section 1.3.1.4.1 above. A summary

of the validation monitoring elements that will be conducted to help evaluate biological responses to BMAs and AMMs is included in Table 6 below.

Table 6. Summary of validation monitoring elements to document the biological response of coho salmon to BMAs within the Covered Area.

Monitoring Element	Description	Time	Frequency	Permittee Commitment	Responsibility
Spawning Survey	Presence/ Absence	September - January	1 Survey per week during spawning	Allow reasonable access as specified in Site Plan	CDFW/NOAA/ mutually approved contractor
Juvenile Surveys and PIT tagging*	Presence/ absence surveys in habitat structures, cold water refugia, and off channel features. Includes collection for PIT tagging	All year	Variable depending on population status and time of year. Less frequent during the winter (monthly) and more frequent in the spring and summer (weekly)		
PIT tag Arrays (Capturing and Tagging Juveniles)	Monitor movement- between reaches	All Year	Maintenance 1 per month and download 2 per month		

*Capture and handling methods may include electrofishing, seining, dipnetting, tissue sampling, and tagging

1.3.1.4.3 Monitoring Agreement

Exhibit D of the Forbearance Agreement (See 1.3.2.1 below), the Monitoring Agreement, sets forth the details of the monitoring points at which the Permittees will monitor diversion reductions and/or instream flow releases and diversion volumes.

1.3.2 Flow Management Strategy

The Parties have developed a Flow Management Strategy (FMS; NMFS and Aquaterra 2020) that informs the Covered Activities under the Agreement in order to achieve desired flow objectives. One goal of the FMS, which is intended to help achieve the desired outcome of improved instream conditions for coho salmon, is to preserve and enhance aquatic and riparian habitat, specifically habitat conditions for each life stage of coho salmon. The FMS evaluates reach-specific water quality and quantity limitations and identifies actions that can benefit flow for coho salmon. The FMS is part of the proposed action in that it summarizes and describes seasonal diversion reductions by the Permittees, as further described in individual Site Plan Agreements. The FMS informs Exhibit C of the Forbearance Agreement, in which the participants agree to forbear or ensure the forbearance of their use of water rights as part of the safe harbor agreement process. Further, under the Agreement, Permittees state that agreed upon bypass amounts will always be provided. In addition, the diversion reductions agreed upon by the Permittees that are included in the flow schematics in the FMS are detailed in the Diversion Reduction Schedule (Section 1.3.2.1.2 below) and included in Appendix 3 of the Agreement: the Adaptive Management Program.

Additional details related to the strategic development of the FMS for the Agreement are included in the document FMS document, which is incorporated by reference into this section and summarized below.

The FMS objectives are based on the biological requirements of coho salmon at each freshwater life stage. For management purposes, these life stages were classified into four distinct time periods as follows:

1. Adult migration and spawning (October 1 to December 31)
2. Egg incubation and winter rearing juveniles (January 1 to February 28)
3. Spring rearing, redistribution and smolt emigration (March 1 to June 15)
4. Summer rearing (June 16 to September 30).

The FMS considered recommendations from studies conducted by McBain & Trush Inc. (2013) and McBain & Trush Inc. (2014). These researchers conducted an interim instream flow needs (IFNs) study in the Shasta River and provided flow recommendations for the upper Shasta River and Parks Creek. McBain & Trush Inc. (2013) developed IFNs estimates for salmonid species that use the upper Shasta River and the lower eight miles of Parks Creek, also referred to as the Big Springs Complex. The FMS also presents IFN recommendations by life stage for the lower Shasta River Canyon location, based on data presented in McBain & Trush Inc. (2014). Utilizing relevant scientific information including McBain & Trush Inc. (2013) and McBain & Trush Inc. (2014), the FMS formulated quantitative flow objectives for each coho salmon life stage in the Covered Area (Table 7). In some instances (e.g., Mid Shasta River Reach Adult Migration and Spawning), the current conditions are greater than the flow objective, indicating that the current conditions are meeting the flow requirements of the Covered Species as recommended by the FMS.

To attempt to achieve the flow objectives detailed in Table 7, the FMS examines current conditions, water rights, and the seasonal diversions in each reach in the Covered Area. The FMS includes schematics of flow inputs and diversions for each reach during each life stage period. An example flow schematic, that for the Upper Shasta River during the irrigation season (March 1 – November 1), is included here as Figure 3. The FMS includes similar schematics for each reach in the Covered Area and each life stage of the Covered Species.

Table 7. Copy of Table 3 from the FMS. Flow management strategy objectives and current instream flow conditions for each coho salmon life stage in the Agreement Covered Area.

Reach	Life Stage	Flow Objectives	Current conditions
Upper Shasta River	Adult Migration and Spawning	10 - 13 cfs	5 - 11 cfs
	Incubation and Winter Rearing	7 - 10 cfs	3.5 - 10 cfs
	Spring Rearing, Redistribution, Emigration	20 - 25 cfs peak with declining flows to mimic snow melt hydrograph	25 - 3 cfs
	Summer Rearing	6 cfs	3 cfs
Upper Parks Creek	Adult Migration and Spawning	10 - 11 cfs	0.05 - 7.5 cfs
	Incubation and Winter Rearing	6 - 10 cfs	7.5
	Spring Rearing, Redistribution, Emigration	March-April 20 cfs; 5/16 - 5/23 = 12 cfs; 5/24 - 5/31 = 8 cfs; 6/1 - 6/10 = 4 cfs	March = 7.4 cfs April = 12.2 cfs May = 12.2 cfs June = 7.2 cfs
	Summer Rearing	1 cfs	1.45 - 0 cfs
Mid Parks Creek	Adult Migration and Spawning	10 - 11 cfs	0 - 5.4 cfs
	Incubation and Winter Rearing	10 cfs	11 - 12 cfs
	Spring Rearing, Redistribution, Emigration	3/1 - 5/15 = 20 cfs; 5/16 - 5/23 = 12 cfs; 5/24 - 5/31 = 8 cfs; 6/1 - 6/10 = 4 cfs,	Mar-4.1 cfs Apr- 8.9 cfs May - 8.4 cfs June - 2.1 cfs
	Summer Rearing	1 cfs	June = 2.1 cfs July= 0 cfs August= 0 cfs Sept = 0 cfs
Lower Parks Creek	Adult Migration and Spawning	Oct 1 - 14 = 6.85 cfs; Oct 15 - 31 = 9.85 cfs; Nov = 17 cfs; Dec = 17 cfs	Oct - 1 cfs Nov - 11.4 cfs Dec - 18.1
	Incubation and Winter Rearing	13 cfs	Jan = 17.9 cfs Feb = 18.2 cfs
	Spring Rearing, Redistribution, Emigration	March =25.85 cfs; April = 25.85 cfs; May 1-15 = 25.85 cfs; May 16-23 = 17.85 cfs; May 24-31 cfs = 13.85 cfs; June 1 - 10 = 9.85 cfs; June 11 - 15 = 6.85 cfs	March = 5.1 cfs April = 9.9 cfs May = 9.4 cfs June = 3.1 cfs
	Summer Rearing	6.85 cfs	1 cfs

Table 7 Continued. Copy of Table 3 from the FMS. Flow management strategy objectives and current instream flow conditions for each coho salmon life stage in the Agreement Covered Area.

Reach	Life Stage	Flow Objectives	Current conditions
Mid Shasta River	Adult Migration and Spawning	70 cfs	140 -170 cfs[1]
	Incubation and Winter Rearing	76 cfs to 95 cfs	257 cfs[2]
	Spring Rearing, Redistribution, Emigration	112 cfs decreasing to 39 cfs by summer	12 to 89 cfs
	Summer Rearing	28 cfs to 39 cfs	25 to 36 cfs less GID Diversion Rates

1: Average monthly flow at USGS Yreka gage for water years 2000 to 2016 for October and November.
2: Average flow at the USGS Yreka gage for water years 2000 to 2016 for December and January, combined.

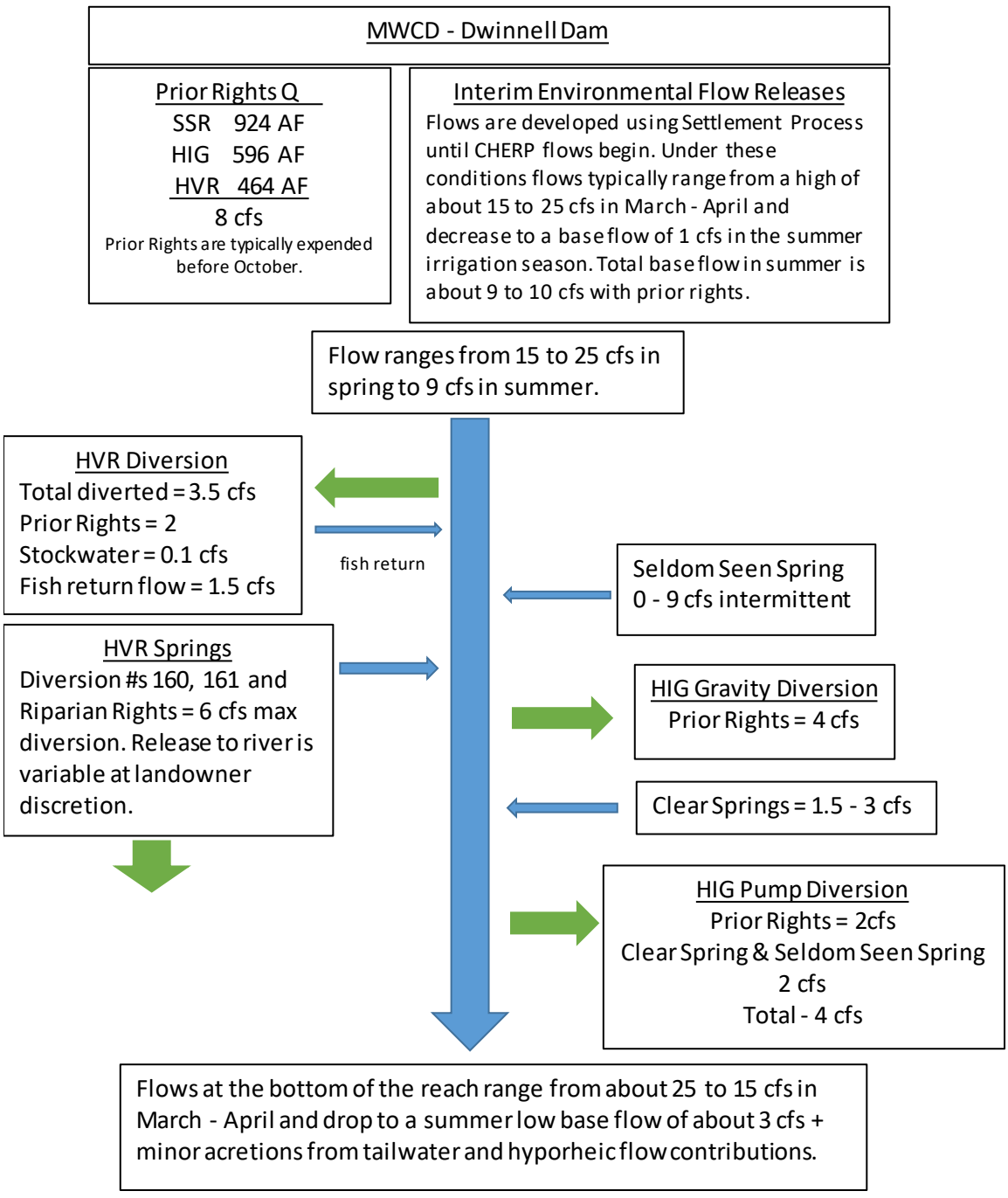

Figure 3. An example flow schematic from the FMS. Copy of Figure 7 from the FMS - Flow schematic of the existing conditions in the upper Shasta River between Dwinnell Dam and the confluence with Parks Creek during the summer season (March 1 to October 31).

The FMS then examined the diversion reductions that are agreed upon by the Permittees as outlined in the Diversion Reduction Schedule to see how the proposed reductions relate to seasonal flow objectives on the reach scale. The results of that comparison are discussed in the Effects of the Action Section (Section 2.5) below.

1.3.2.1 Forbearance Agreement

The Agreement for The Forbearance and Monitoring of Water for Fisheries Enhancement in the Shasta River System Siskiyou County, California (Forbearance Agreement) is a finalized but signature-pending agreement between the Scott Valley and Shasta Valley Watermaster District, the SWCG and the non-governmental Permittees to forbear diversion of certain amounts of water at certain times of year otherwise available under water rights and to leave said water instream for the purpose of improving habitat for the Covered Species within the Covered Area. The Forbearance Agreement contains the participants' commitment to forbear diverting the amounts of water described in the Flow Management Strategy component of the proposed action. The specific amounts of water to be bypassed are identified in the Site Plan Agreements and the master flow chart (Section 1.3.2.1.1 below), as discussed in the FMS.

1.3.2.1.1 Master Flow Chart

The Abbreviated Shasta Safe Harbor Master Flow chart, which details the diversion schedule bypass flow for each diverting entity by season or Covered Species life stage, is included as Exhibit C of the Forbearance Agreement. The bypass flows are informed by the flow investigations, water rights, and the FMS. The bypass flows are summarized in the Diversion Reduction Schedule (Section 1.3.2.1.2 below)

1.3.2.1.2 Diversion Reduction Schedule

The Diversion Reduction Schedule is a component of the Adaptive Management Program, which is Appendix 3 of the Agreement. The Diversion Reduction Schedule summarizes the proposed action in regards to bypass and forbearance commitments by each diverting Permittee. Permittee diversion reductions by reach are included in Table 8, which describes each Permittees' commitment to reducing diversions and the duration of those commitments.

Table 8. Shasta Safe Harbor Diversion Reduction Table

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Mid Shasta	Huseman/# 125	Rice Livestock	11.90 cfs	10.0 CFS	Yes	4/1 – 9/30 = 1.9 total – shared between Nicoletti and Rice	Throughout irrigation season	3-4 years
		Nicoletti Ranches						3-4 years
Mid Shasta	Novy-Rice-Zenkus Riparian	Rice Livestock and	10.00 CFS	5.00 CFS	Yes	5.00 cfs	Throughout irrigation season	
		Novy - Grenada Ranches			Yes	4/1-4/10 = 7.00 cfs 4/10-11/1 = 4.00 cfs 9/20-9/30 = 7.00 cfs	Throughout irrigation season	2-3 years
Mid Shasta	Novy Pump	Novy - Grenada Ranches	5.50 -6.00 CFS	5.50- 6.00 CFS	Yes	4/1 – 4/10 = 2.75 cfs 9/21 – 9/30 = 2.75 cfs 10/1 – 11/30 – 2 cfs for maximum of 10 days	Throughout irrigation season	3-5 years

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Mid Shasta	GID #149[3]	Grenada Irrigation District	40.00 CFS	4/1-4/9 =0 cfs 4/10-9/06=24.0 cfs 9/7-9/30=18.0 cfs[4]	No	4/1 -4/9 = 40.00 CFS 4/10 - 5/20= 16.00 CFS 5/21 – 9/6 - none 9/7 - 9/30 =6 CFS	Through irrigation season through life of permit	2-4 years

[3] **Grenada Irrigation District Diversion Volume Schedule -Normal and Drier years**

Date	Proposed Max CFS Diverted
4/01-4/9 (9 days)	0.0 CFS
4/10-5/20 (39 days)	24.0 CFS
5/21-8/15 (86 days)*	24.0 CFS
8/16-9/6 (22 days)*	24.0 CFS
9/7-9/30 (23 days)*	18.0 CFS

*Schedule does not consider limitations of diversion caused by decree, priority and water master service and, therefore, claims no instream benefits resulting during the identified period.

Grenada Irrigation District Diversion Volume Schedule -Wet Years

Date	Proposed Max CFS Diverted
4/01-4/9 (9 days)	0.0 CFS
4/10-5/20 (39 days)	24.0 CFS
5/21-8/15 (86 days)*	24.0 CFS
8/16-9/6 (22 days)*	24.0 CFS
9/7-9/30 (23 days)*	18.0 CFS

*Schedule does not consider limitations of diversion caused by decree, priority and water master service and, therefore, claims no instream benefits resulting during the identified period.

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Lower Parks	#234A/Kettle Springs	Shasta Springs Ranch - Lower Parks	1.2 cfs	1.2 cfs	Yes	3/1 - 6/15 = 2.85-6.35 CFS 6/16 - 9/30 = 2.85-6.35 CFS	Per previous column	Completed
Mid Parks	Emmerson -Parks #1-5; #221, 222, 224, 225, 233	Emmerson - Shasta Springs Ranch - Mid Parks	16 cfs	3/1-6/15 = 13.75 cfs from Parks #1	No	3/1-6/15 = 2.25 cfs from Parks #1 will be delivered downstream to Parks #4 POD	Per previous column	<=5 years
Mid Parks	Bridge Field Springs	Shasta Springs Ranch	3-5 cfs in summer; 1.5-2 in winter	1.8 cfs in summer	Yes	At least 1 cfs continuous release to stream	Yearly	>5 years
Lower Parks via Shasta River as conduit	#237/ Cardoza Diversion	Cardoza	4/1-10/1 = 2.98 CFS	4/1-10/1 = 2.98 CFS[5]	Yes	The project is beneficial due to leaving flow instream for several miles	Per previous column	1-2 years
Upper Parks	Div. #183	Edson Foulke	9.9 CFS 1/1-12/31 + 228 AF storage	6.9 cfs - Bypass 3.0 cfs prior to diverting	No	3.0 CFS by-pass prior to diverting and including additional reductions to ensure flow volumes in Parks Creek at PCE steam flow gage site described in footnote below.[6]		

[5] with moving POD 3 miles downstream to Shasta river- managed based on available flow in Parks Creek at PBS

[6] **Instream flow targets at PCE:**

Life Stage:	Time Period	Flow at PCE
Adult Migration and Spawning	11/1-12/31*	10.00 cfs @PCE prior to diverting
Over-wintering/Incubation	1/1-2/28*	6.00 cfs @PCE prior to diverting

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Upper Parks	Parks Creek Ranch Divs. (PCR 1), (PCR 2), (PCR-EF) # 182 188, 189, 190, 194	Parks Creek Ranch	3/1-10/31 = 11.3 CFS 11/1-2/28 = 5.15 CFS	8.5 CFS.	No	A reduction of 2.8 CFS, including a reduction of 1.2 cfs 1st priority and 1.6 cfs 23rd priority and including additional reductions to ensure flow volumes in Parks Creek at PCE steam flow gage site described in footnote below. [7]	Throughout calendar year and for life of the agreement	

[7] Juvenile outmigration/distribution

Stage 1:	3/1-5/16	8.45 cfs @PCE prior to diverting more than 12.9 cfs (PCR #1,2 and EF #3)
Stage 2:	3/1-5/16	20.00 cfs @PCE prior to diverting more than 6.95 cfs (PCR #3-6)
Juvenile outmigration/distribution	5/16-5/23	12.00 cfs @PCE prior to diverting**
Juvenile outmigration/distribution	5/24-5/31	8.00 cfs @PCE prior to diverting**
Juvenile outmigration/distribution	6/01-6/10	4.00 cfs @PCE prior to diverting**
Over-summering	6/11-10/14	1.00 cfs @PCE prior to diverting
Fall Ramp-up	10/15-11/14	4.00 cfs @PCE prior to diverting

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Upper Parks	Parks Creek Ranch Diversion Spring Creek System: 193, 195, 196, 197, 201, 202, 204, 205, 206, 208, 209, 210, 212	Parks Creek Ranch	2.0	2.0	No	This project is intended to benefit a stream reach upstream of Diversion #3 during the summer to provide over-summering habitat within the district reach. The flow will then be diverted at diversion #3, resulting in no net increase in stream flow.	Throughout calendar year and for life of the agreement	

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Upper Parks	Parks Creek Ranch Diversions 3-6 #211 (PCR 4); 213 (PCR 5); 219, 220 (PCR 6);	Parks Creek Ranch	3/1-10/31=5.35 CFS	3.9 CFS if including diversion #6	No	A reduction of 1.4 CFS if project includes diversion #6 and including additional reductions to ensure flow volumes in Parks Creek at PCE stream flow gage site	Throughout calendar year and for life of the agreement	
Upper Parks	PCE Stream Flow Gage, Combination of Parks Creek Divs 3,4,5 and potentially 6.	Parks Creek Ranch						
Upper Shasta	Div. #165 & #166	Hole in the Ground Ranch	6 cfs from Prior Rights 2.5 cfs from Clear Springs	6 cfs from Prior Rights 1.5 cfs from MWCD to keep Clear Spring instream		10/1 – 2/28 - 0.7-2.5 cfs from Clear Springs 3/1 – 6/15 – 0.7 – 1.2 cfs from Clear Springs for efficiency project 6/16 – 9/30 - 0.7 – 2.5 cfs from Clear Springs for efficiency project and substitution with MWCD		5 years

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Upper Shasta	MWCD-Shasta River (Dwinnell Reservoir) SWRCB #2452	MWCD	49,000 af	49,000 af with 8,152 af provided for instream benefit	No	See instream release schedules developed for the 5 corresponding water year types	Throughout Calendar year for life of the agreement	2 years
Upper Parks	MWCD-Parks Ck SWRCB #2453	MWCD	150 cfs	150 cfs with 40 cfs or greater by-pass value.	No	MWCD must provide the following by-pass flows (at gage site PCE) prior to diverting.[8]	Throughout Calendar year through Life of the Agreement	2-4 years

[8] **MWCD - Upper Parks Creek Flow Strategy - Instream flow targets at PCE:**

Upper Parks Creek Flow Strategy: MWCD will participate in a reach-wide flow strategy on upper Parks Creek. Upon completion of MWCD's infrastructure improvements at Parks Creek Diversion, MWCD will expand the bypass terms to include the following terms proposed in the Upper Parks Creek Flow Plan. These by-pass values assume Parks Creek Ranch and Edson-Foulke Ditch are participating in the flow strategy and their conservation projects are completed:

- **10/1-12/31:** Bypass 21.0 cfs at the Parks Creek at Edgewood (PCE) gage, located at the downstream extent of Upper Parks Creek reach, prior to diverting to aid adult migration and spawning from 10/1-12/31. 21 cfs includes conserved water made available when water conservation measures are implemented by Upper Parks Creek stream reach participants.

- **1/1-2/28:** Bypass 6.0 cfs at PCE from 1/1-2/28 prior to diverting. MWCD will work with agencies and other participants in the Upper Parks Creek stream reach to evaluate if redds are sufficiently protected with 6.0 cfs of bypass by the close of the 5th year of the agreement. If redds are not sufficiently protected, up to 10.0 cfs may need to be bypassed at PCE to meet the biological objective. MWCD will assure 10.0 cfs is at PCE after MWCD diverts more than 20 cfs from 1/1-2/28, bypass 21.0 cfs at PCE prior to diverting from 3/1-6/15. The 21 cfs bypass includes water conserved through conservation projects conducted by Parks Creek Ranch and Edson-Foulke Ditch when proposed upstream water conservation projects are completed. Bypass of conserved water by other participants is contingent on operating gages at PCE and participating diversions.

- **3/1-6/15:** By-pass values from 3/1-6/15 prior to diverting. In order to provide flow variability in Parks Creek, MWCD will provide the following bypass values as diversion volumes increase a presented below:

MWCD's Parks Creek Diversion By-pass requirement at gage PCE from 3/1-6/15: In order to provide increased flow variation below MWCD Parks Creek diversion, MWCD agrees to increase by-pass values proportionality with diverted volume, verified downstream by CDEC stream flow gage PCE (PCE stream flow gage is the downstream extent of Upper Parks Creek reach). Proportionate by-pass to diversion values include:

1.) Stream flow in Parks Creek at PCE gage must equal 21.0 cfs or more before MWCD can begin diversion and can divert up to 20 cfs.

2.) Stream flow in Parks Creek at PCE gage must equal 30 cfs or more before MWCD can divert more than 20 cfs but less than 90 cfs.

3.) Stream flow in Parks Creek at PCE gage must equal 40 cfs or more before MWCD can divert more than 90 cfs but less than 150 cfs.

Upper Shasta	Divs. # 158, 160, 161	Hidden Valley Ranch	11/1-3/1 =0.25 CFS stock water 3/1-11/1 = 1.47-2 cfs CFS Prior Right 2.8 cfs from S024837 (Upper Spring) Additional 2.0 CFS from #160 & 161	Prior right= 2.0 cfs Substitution water from MWCD = 1.5 cfs in exchange for upper spring water delivered instream S024837 Upper Spring Riparian= 0.5 cfs 160/161+ riparian right= 1 cfs	Yes, except spring	10/1-6/15 = 0.5 cfs delivered instream if spring > 0.25cfs 6/16-9/30 = 0.5-3 cfs spring water delivered instream if spring > 0.75 - **0.5 cfs to be released from spring continuously for efficiency improvements on prior rights conveyance** - **Up to 1.5 cfs to be released from spring for exchange water from MWCD** - **All excess spring water will be released if spring produces more than 3 cfs** *For additional conditions relevant to this diversion reduction refer to Ex. E to the Forbearance Agreement.*	Throughout Calendar year for life of the agreement	2 years

Reach	Diversion Name/ Decree #	Permittee Name	Max Diversion Volume/CFS	Max diversion under SHA	Full right available through season?	Diversion Reduction Amount (Instream Commitment Value)	Duration of Commitment	Anticipated Time Period to Realization of Diversion Reduction
Big Springs Creek	167-172 Hole in the Ground Creek;	CDFW Big Springs Ranch	4/1- 10/1 0 cfs	1.5 cfs[9]	Yes	Throughout irrigation season	Decreed Rights	
	241 Big Springs Creek;		6.71 cfs	6.71 cfs[10]	No			
	243, 244, 245, 246 Little Springs Creek;		7.6 cfs	5 cfs[11]	Yes			
	247-248 Nelson Shasta River		2.3 cfs	2.3 cfs	Yes			

[9] Water is diverted to minimize tailwater impacts to creek temperature at the alcove springs, and is not used for irrigation.
[10] This diversion is limited by instream temperature objective of 18 C at mouth of Big Springs Creek.
[11] This diversion is limited by instream temperature objective of 16 C at mouth of Little Springs Creek.

1.3.3 Site Plan Agreements

Individual Site Plan Agreements detail each Permittee's commitment to reducing diversions, as summarized in Section 1.3.2.1.2 above, in addition to each BMA planned for their Enrolled Property, as discussed in Section 1.3.1.2 above. Additional details related to the proposed action are included in each Site Plan Agreement, which are incorporated by reference into this document. Key aspects of the Site Plan Agreements are summarized in Appendix 1 to this opinion and summarized in Table 9 below. Table 9 identifies project types included in each Site Plan Agreement, including estimated completion timeline, if available. Each Site Plan Agreement includes sections to describe each action stage (i.e., ESA Section 10 Baseline Conditions, ESA Section 10 Elevated Baseline Conditions, or Beneficial Management Activity) and each habitat parameter/action type (i.e., hydrology/water quality, passage/migration/ screening, instream habitat complexity, riparian condition/function, substrate quality, pasture management, assessment/studies, and supplementation).

Table 9. Project type and estimated timeline for completion** for each Enrolled Property as described in the Site Plan Agreements.

Reach*	MS					BSC	LPC & MS	MPC & LPC	UPC		US & LPC	US		
Enrolled Property / Covered Activity	Nicoletti	Rice Livestock	Novy Ranches	Bel Campo	GID	Big Springs Ramch	Cardoza Ranch	Shasta Springs Ranch	Parks Creek Ranch	Edson Foulke	Hole in the Ground	Hidden Valley Ranch	Seldom Seen Ranch	MWCD
Move diversion point	open						yr 3 -5		eval	yr 2 -7				
Diversion structure improvements	BL	BL/ 2022	2022				yr 3 -5	BL/ yr 5	yr 4		BL/yr 5	Yr 1	yr 5	BL/yr 2/yr10
Diversion screening	BL	BL/ 2022	2022				yr 3 -5	BL/ eval	BL/ eval	yr 2 -6	BL	BL		BL/ yr 5
Improve fish passage		BL	2022		BL	BL/yr 1	yr 3 -5	eval		yr 2 -6	BL		yr 5	BL/ eval
Water exchange											Open	BL/ yr 2		BL/ yr 2
Tailwater capture, re-use, reduction	BL/ 2023	BL	BL	BL		BL	open	BL/yr 2/yr 5	BL/yr 2/yr 4		BL/yr 5	BL		
Piping ditches	eval	yr 3		2021	open			BL	BL		BL/ eval	BL		

* Reaches: MS=Mid Shasta, BSC=Big Springs Creek, LPC=Lower Parks Creek, MPC=Mid Parks Creek, UPC=Upper Parks Creek, US=Upper Shasta

** Timeline for completion: BL=baseline or elevated baseline, 2022 = by end of 2022, 2023 by end of 2023, yr x = by end of x^{th} year after start of Agreement, open=activity indicated without distinct timeline for completion, eval=timeline pending completion of an evaluation. Some Site Plan Agreements include multiple projects for each activity that have different timelines. Blank cells indicate that no associated commitments are included in the Site Plan Agreements.

Table 9 (continued). Project type and estimated timeline for completion** for each Enrolled Property as described in the Site Plan Agreements.

Reach*	MS					BSC	LPC & MS	MPC & LPC	UPC		US & LPC	US		
Enrolled Property / Covered Activity	Nicoletti	Rice Livestock	Novy Ranches	Bel Campo	GID	Big Springs Ranch	Cardoza Ranch	Shasta Springs Ranch	Parks Creek Ranch	Edson Foulke	Hole in the Ground	Hidden Valley Ranch	Seldom Seen Ranch	MWCD
Line canals														2023
Crossing improvement/ maintenance	BL	BL						BL/ yr 5			BL	BL	BL	
soil moisture sensors	eval	BL	yr 1	yr 3			yr 1	eval	yr 5		yr 10		yr 15	
Spawning gravel augmentation		eval	eval	eval	eval	yr 5		eval			yr 10	eval	yr 10	BL/ yr 5
Install large woody debris	yr 5	yr 3	yr 3 -6	2023	yr 4	yr 5		eval	yr 4		yr 10	BL	yr 5	BL/ yr 5
Beaver management	open	open		yr 1	open	open		yr 5	open		open	open	open/ yr 5	
Create off-channel/alcove habitat	yr 5	yr 3	eval	2023		yr 5		eval	yr 5			BL	yr 10	
Riparian restoration and revegetation	BL/yr 5	eval	eval	yr 4	BL	yr 10	open	BL/ eval	BL/yr 4		yr 15	BL	yr 15	BL/yr 3

* Reaches: MS=Mid Shasta, BSC=Big Springs Creek, LPC=Lower Parks Creek, MPC=Mid Parks Creek, UPC=Upper Parks Creek, US=Upper Shasta

** Timeline for completion: BL=baseline or elevated baseline (activity already completed but will be maintained) , 2022 = by end of 2022, 2023 by end of 2023, yr x = by end of x^{th} year after start of Agreement, open=activity indicated without distinct timeline for completion, eval=timeline pending completion of an evaluation. Blank cells indicate that no associated commitments are included in the Site Plan Agreements.

Table 9 (continued). Project type and estimated timeline for completion** for each Enrolled Property as described in the Site Plan Agreements.

Reach*	MS					BSC	LPC & MS	MPC & LPC	UPC		US & LPC	US		
Enrolled Property / Covered Activity	Nicoletti	Rice Livestock	Novy Ranches	Bel Campo	GID	Big Springs Ramch	Cardoza Ranch	Shasta Springs Ranch	Parks Creek Ranch	Edson Foulke	Hole in the Ground	Hidden Valley Ranch	Seldom Seen Ranch	MWCD
Livestock exclusion fencing/off-channel stock watering	BL/ yr 1	BL	eval			BL	open	BL	BL/ yr 4		BL/ yr 5	BL	BL	yr 3
1707 Dedication/ forbearance agreement for instream beneficial use	Open	yr 3	2022		BL/ eval	BL/ eval	yr 2	BL/ eval	BL/ eval	BL/ eval	BL/ eval	BL/ eval	BL/ eval	BL/ eval
Pasture Management/UCCE grazing plan	yr 1		BL	yr 1		BL		yr 2	yr 2		BL/ yr 5	BL		
evaluate Dwinnell Dam passage														yr 10

* Reaches: MS=Mid Shasta, BSC=Big Springs Creek, LPC=Lower Parks Creek, MPC=Mid Parks Creek, UPC=Upper Parks Creek, US=Upper Shasta

** Timeline for completion: BL=baseline or elevated baseline (activity already completed but will be maintained) , 2022 = by end of 2022, 2023 by end of 2023, yr x = by end of x^{th} year after start of Agreement, open=activity indicated without distinct timeline for completion, eval=timeline pending completion of an evaluation. Blank cells indicate that no associated commitments are included in the Site Plan Agreements.

2 ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

We have determined the proposed action is not likely to adversely affect Southern Residents. Our determination is documented in the "*Not Likely to Adversely Affect" Determinations* section (Section 2.12).

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the ESA Section 7 environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the ESA Section 7 environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

This opinion analyzes the effects of the action on the following listed salmonids and their designated critical habitat:

Threatened SONCC coho salmon ESU
Listing determination (70 FR 37160 (June 28, 2005))
Critical habitat designation (64 FR 24049 (May 5, 1999)).

2.2.1 Species Description and General Life History

SONCC coho salmon is an anadromous fish species that generally exhibits a relatively simple three-year life cycle. Adults typically return from the ocean beginning their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. Spawning occurs mainly in November to December in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers. Depending on river temperatures, eggs incubate in ‘‘redds’’ (gravel nests excavated by spawning females) for 1.5 to four months before hatching as ‘‘alevins’’ (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles or ‘‘fry’’ and begin actively feeding. Juvenile rearing usually occurs in tributary streams with a gradient of three percent or less, although they may move up to streams of four percent or five percent gradient. Juveniles have been found in streams as small as 3.3 to 6.6 feet wide. They may spend one to two years rearing in freshwater, or emigrate to an estuary shortly after emerging from spawning gravels. Coho salmon juveniles are also known to “redistribute” into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear, and often disperse in response to high water temperatures as is strongly evident in the Klamath River. Juveniles rear in fresh water for up to 15 months, and then undergo “smoltification” to migrate to the ocean as “smolts” in the spring. Coho salmon typically spend about another 15 months in the ocean before returning to their natal stream to spawn as 3-year-olds. Because of this life history in which multiple life stages utilize the freshwater environment, SONCC coho salmon require complex freshwater habitats with sufficient quantities of water of suitable quality (e.g., suitable life stage specific temperatures). In addition to adequate water quality and quantity, coho salmon require complex pool habitats, sufficient suitable spawning substrate, unimpeded passage, access to low velocity habitat (e.g., side channels, floodplains) during high flow events, and adequate quantities of food.

2.2.2 Status of Species and Critical Habitat

In this opinion, NMFS assesses four population viability parameters to help us understand the status of each species and their ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity (McElhany et al. 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Recovery Plan for SONCC Coho Salmon (NMFS 2014) and the most recent status review for SONCC coho salmon (Williams et al. 2016a) to determine the general condition of each population and factors responsible for the current status of the ESU. We use these population viability parameters as surrogates for reproduction, numbers, and distribution; the criteria found within the regulatory definition of “jeopardize the continued existence of” (50 CFR 402.02). This opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

2.2.2.1 Status of SONCC Coho Salmon

2.2.2.2 SONCC Coho Salmon Abundance and Productivity

Although long-term data on coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the previous status review (Williams et al. 2011) for populations in this ESU (Williams et al. 2016a). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population. The productivity of a population (i.e., production over the entire life cycle) can reflect conditions (e.g., environmental conditions) that influence the dynamics of a population and determine abundance. In general, declining productivity equates to declining population abundance. Available data show that the 95 percent confidence intervals for the slope of the regression line include zero for many populations in the SONCC coho ESU, indicating that whether the productivity is decreasing, increasing, or stable cannot be determined (McElhany et al. 2000, NMFS 2014).

2.2.2.2.1 SONCC Coho Salmon Spatial Structure and Diversity

The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which SONCC coho salmon are now absent (NMFS 2001, Good et al. 2005, Williams et al. 2011, Williams et al. 2016a). Extant populations can still be found in all major river basins within the ESU (70 FR 37160 (June 28, 2005)). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the SONCC coho salmon's spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

2.2.2.3 Status of Critical Habitat

In designating critical habitat for the SONCC coho salmon ESU, NMFS identified the following five essential habitat types (PBFs): (1) juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas. Within these areas, essential features of coho salmon critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049 (May 5, 1999)). The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that currently depressed population conditions are, in part, the result of the following human induced factors affecting critical habitat: overfishing, artificial propagation, logging, agriculture, mining, urbanization, stream channelization, dams, wetland loss, and water withdrawals

(including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995, 70 FR 37160 (June 28, 2005), 64 FR 24049 (May 5, 1999)). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.2.4 Factors Related to the Decline of Species and Degradation of Critical Habitat

The factors, many of which are noted above under *Status of Critical Habitat*, that caused declines include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good et al. 2005, Williams et al. 2016b). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance of SONCC coho salmon (Good et al. 2005). From 2014 through 2016, the drought in California reduced stream flows and increased temperatures, further exacerbating stress and disease. Ocean conditions have been unfavorable in recent years (2014 to present) due to both the El Nino in 2015 and 2016, and the existence of a northeast Pacific marine warming phenomenon, in 2013 through 2015, referred to as "the blob" (Cavole et al. 2016). Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

Scientific data gathered from around the earth indicates that the earth's climate is warming, and that this change could significantly impact ocean and freshwater habitat conditions (Intergovernmental Panel on Climate Change 2014), which affects survival of coho salmon. Of all the Pacific salmon species, coho salmon are likely one of the most sensitive to climate change due to their extended freshwater rearing. Additionally, the SONCC coho salmon ESU is near the southern end of the species' distribution and many populations reside in degraded streams that have water temperatures near the upper limits of thermal tolerance for coho salmon.

Since 1895, annual average air temperatures have increased throughout California, with temperatures rising at a faster rate beginning in the 1980s, and recent years being increasingly some of the warmest during that period of record. Temperatures at night have increased more than during the day: minimum temperatures (which generally occur at night) increased at a rate of 2.3 °F per century, compared to 1.3°F per century for maximum temperatures (Milanes et al. 2018). According to the Independent Scientific Advisory Board's recurring reports (https://www.nwcouncil.org/fw/isab/), these effects may have the following physical impacts within approximately the next 40 years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.

- With a shift to more rain and less snow, snowpack will diminish in those areas that typically accumulate and store water until the spring/summer melt season.

- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.

- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.

For Northern California and southern Oregon, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (DWR 2013). Annual precipitation could increase by up to 20 percent over northern California. A greater proportion of precipitation events occurring during the mid-winter months is likely to occur as intense rain and rain-on-snow events that are likely to lead to higher numbers of landslides and greater and more severe floods (Luers et al. 2006, Doppelt et al. 2008). Overall, there will be earlier and lower low-flows and earlier and higher high-flows. Increased flooding is likely to scour salmon eggs from their redds and displace overwintering juveniles, while lower low flows are likely to increase summer water temperatures and decrease available salmon habitat.

Water temperature is likely to increase overall, with higher maximum temperatures along with higher minimum temperatures in streams. Increases in winter and spring temperature regimes are likely to include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, increased bio-energetic and disease stresses on fish, and increased competition among species. In addition, the increase in summer water temperatures are likely to be especially dramatic since flows in many streams are expected to continue decreasing as a result of decreasing snowpack (Luers et al. 2006, Crozier et al. 2008, Doppelt et al. 2008, Crozier 2016). This loss of snowpack will continue to create lower spring and summertime flows while additional warming will cause earlier onset of runoff in streams.

Marine ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Feely 2004, Osgood 2008, Turley 2008, Abdul-Aziz et al. 2011, Doney et al. 2012). These changes are likely to have deleterious impacts on coho salmon growth and survival while at sea. Ocean acidification also has the potential to affect the phytoplankton community due to the likely loss of most calcareous shell-forming species such as pteropods (Crozier 2016). Related direct effects to coho salmon likely include decreased growth rates due to ocean acidification and increased metabolic costs due to the rise in sea surface temperature (Portner and Knust 2007).

The threat to coho salmon from global climate change will increase in the future. In general, conditions in the climate and within the ecosystems on which coho salmon rely will change

dramatically over the next several decades. Climate change is having, and will continue to have, an impact on salmonids throughout the Pacific Northwest and California (Crozier 2016). Overall, climate change represents a growing threat for the SONCC coho salmon ESU, and will challenge the resilience of coho salmon (NMFS 2014).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The size and intended use of the fourteen Enrolled Properties covered by the Agreement are summarized in Table 10. These are the properties in which the Covered Activities would occur and comprise the Covered Area. The Enrolled Properties are adjacent to the Shasta River, Parks Creek, or Big Springs Creek, and primarily managed for agricultural production and rural residences. The effects of the proposed action on the SONCC coho salmon and their critical habitat, e.g., sediment impacts, improvements to water quality, etc., are expected by NMFS to be insignificant downstream of the most downstream Enrolled Property. Therefore, for the purposes of this opinion, the Covered Area is the action area and is shown in Figure 1 above.

Table 10. Size and intended use of properties included in the Agreement

Property Title	Property Size (acres)	Property Use
Belcampo-North Annex Property (North Annex)	4,167	Pasture
Big Springs Ranch Wildlife Area	6,000	Wildlife Management, Fisheries Management, Pasture
Cardoza Ranch	497	Pasture
Edson Foulke Yreka Ditch Company	Diversion irrigates 488.1 acres	Ditch association operation of diversion point for pasture production, crop production, stock water, and delivery to storage.
GID	GID provides water to over 60 users who irrigate up to 1,477 acres.	A special district that owns and operates four parcels including the point of diversion, a lift station, and a parcel along the main ditch.
Hidden Valley Ranch	431	Pasture
Novy Ranches	659	Pasture
Hole in the Ground Ranch	3,100	Pasture
MWCD	228	Pasture
NB Ranches, Inc. (Nicoletti)	357.2	Pasture
Parks Creek Ranch	5,100	Pasture
Rice Livestock Company, Inc. (Rice Livestock)	2,100	Pasture
Seldom Seen Ranch	1,421	Pasture
Shasta Springs Ranch	5,900	Pasture

2.4 Environmental Baseline

The ESA Section 7 "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The ESA Section 7 environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the ESA Section 7 environmental baseline (50 CFR 402.02).

Coho salmon in the action area belong to the Interior Klamath diversity stratum, one of seven diversity strata for the ESU, which extends from Elk River in Oregon to the Mattole River in California. The Shasta River population is one of five populations in the Interior Klamath Diversity Stratum, along with the Mid Klamath, Salmon River, Scott River, and Upper Klamath populations (Williams et al. 2016a). Coho salmon were once numerous and widespread within the Klamath River basin (Snyder 1931). Today, due to migration barriers, habitat degradation, and other factors, the small populations that remain occupy a fraction of their historical area, in limited habitat within the tributary watersheds (i.e., Shasta River, Scott River, and Salmon River) and the mainstem Klamath River just below IGD (NRC 2004).

2.4.1 Status of Critical Habitat in the Action Area

The diversity and complexity of physical and environmental conditions found within the Shasta River basin created unique life history strategies and diverse coho salmon habitat. Historical instream river conditions, fostered by unique cold spring complexes, created abundant summer rearing and off channel overwintering habitat that were favorable for production of coho salmon in the Shasta River basin. The Shasta River coho salmon population evolved in areas of large spring complexes, which provided sustained sources of cold, clean, high quality water, and abundant areas for rearing during hot, dry summer months (NMFS 2014). According to NMFS (2014), the most vital habitat in the Shasta River basin are its cold springs, which create cold water refugia for juvenile coho salmon, decrease overall water temperatures throughout the basin, and allow for successful summer rearing of individuals in natal and non-natal creeks and mainstem areas. Impaired water quality, altered hydrologic function, impaired mainstem function, increased disease/predation/ competition, lack of floodplain and channel structure, degraded riparian forest conditions, altered sediment supply, migration barriers, and adverse hatchery-related effects are also recognized as factors limiting the Shasta River coho salmon population (NMFS 2014). The high priority recovery actions identified for the action area include: increasing instream flows by securing unused water rights and establishing a water trust to benefit salmon, increasing cold water in the Upper Shasta basin, reducing water temperatures and increasing dissolved oxygen, increasing instream flows by improving the GID ditch diversion to decrease impacts to SONCC coho salmon, and reducing warm tailwater inputs into the stream (NMFS 2014).

In 2014, NMFS (2014) categorized the threat of climate change to each life stage of SONCC coho salmon in the Shasta River as either low or medium. This threat categorization can be compared to other SONCC coho populations in the Interior Klamath Diversity Stratum, where the threat of climate change is categorized as medium to very high (NMFS 2014). NMFS (2014) recognized that the Shasta River population maintains a diversity of habitat features, including predominantly spring flow dominated hydrology, that contribute to the adaptability and resiliency of the Shasta River population to combat future climate effects and catastrophic events. However, although the Shasta River's spring flow dominated hydrology is expected to confer some resiliency to climate change, Parks Creek, a major contributor to the Shasta River hydrology, is principally a rain and snow melt driven tributary (McBain & Trush Inc. 2013). Van Kirk and Naman (2008) found statistically significant declines in April 1 snow water equivalent since the 1950s at several snow measurement stations throughout the Klamath Basin, particularly those at lower elevations (<6000 ft.). Regonda et al. (2005) analyzed western states data from, including data from the Cascade Mountains of southern Oregon, and found a decline in snow water equivalent of greater than 6 inches during March, April, and May in the southern Oregon Cascades for the recent 50-year period evaluated. A decline of 6 inches equals an approximate 20 percent reduction in snow water equivalent. Declines in snowpack are expected to continue in the Klamath Basin, including in the Shasta River basin. In summary, while the action area is expected to be somewhat resilient to the effects of climate change, at least relative to SONCC coho habitat in nearby Klamath River tributaries, flow is expected to decrease and water temperature is expected to increase in the future.

SONCC coho salmon habitat conditions in the action area are described in detail in Appendix 1 of the Agreement: Covered Species, Biological Requirements and Habitat Conditions. Appendix 1 of the Agreement is incorporated by reference into this action area section (2.4.1). Key information from Appendix 1 to the Agreement is summarized below. Key habitat parameters stream flow and stream temperature are discussed on the scale of the entire action area in Sections 2.4.1.1.1 and 2.4.1.1.2, respectively. The discussion of critical habitat is broken down into six reaches as discussed in Section 2.4.1.2 to Section 2.4.1.7, in which stream flow and stream temperature, along with other habitat parameters, are further described. The reaches include the Upper Shasta River from Dwinnell Dam downstream to the confluence of Parks Creek (RM 40.6 to 35), the Mid-Shasta River from the confluence of Parks Creek downstream to the northern boundary of the action area (RM 35 to 20), Big Springs Creek from the confluence with the Shasta River upstream to the water wheel crossing (RM 1.6 to 0), Upper Parks Creek (RM 14.5 to 8), Mid-Parks Creek (RM 8 to 2), and Lower Parks Creek (RM 2 to 0) as shown in Figure 2.

2.4.1.1 Action area wide habitat parameters

As mentioned above, key habitat parameters – stream flow and stream temperature – are discussed on the scale of the entire action area in Sections 2.4.1.1.1 and 2.4.1.1.2, respectively.

2.4.1.1.1 Stream Flow

At its source, streamflow for the Shasta River is driven by releases from Dwinnell Dam and by rain and snowmelt for Parks Creek. Downstream flows are further modified by a series of

diversions and spring inputs (NMFS and Aquaterra 2020). Flows are typically adequate to support adult migration in most reaches, but limiting throughout much of the Covered Area for summer rearing habitat. McBain & Trush Inc. (2013) developed Tier No. 1[12] Instream Flow Needs (IFNs) estimates for salmonid species that use the upper Shasta River and the lower eight miles of Parks Creek, also referred to as the Big Springs Complex. The study included estimates of minimum flow rates that would provide suitable conditions for several life stages of Chinook and coho salmon including summer rearing, adult spawning, winter rearing, juvenile spring rearing and outmigration (Table 11). In their study, they developed flow recommendations for the Shasta River downstream of Parks Creek (Mid-Shasta Reach), Parks Creek downstream of I-5 crossing (Mid and Lower Parks Creek Reaches), and for the Upper Shasta River just upstream of the Parks Creek confluence (Upper Shasta Reach). Their evaluation did not include IFN estimates for Big Springs Creek.

Table 11. Recommended interim minimum instream flow needs for priority reaches in the Big Springs Complex (McBain & Trush Inc. 2013)

Salmonid Life Stage	**Mid Shasta below Parks Creek** **QMIN (cfs)**	**Mid Parks below Slough Road** **QMIN (cfs)**	**Lower Parks above confluence** **QMIN (cfs)**	**Upper Shasta above Parks Ck** **QMIN (cfs)**
September 7 to September 30: Early Adult Chinook Salmon Migration	20	11 to 15	11 to 15	10
October 1 to December 31: Chinook and coho Salmon Spawning Habitat and Adult Chinook Migration	20 to 22	11 to 15	11 to 15	10 to 13
January 1 to March 31: Winter Juvenile Salmonid Rearing Habitat	20	10	12	7 to 10
April 1 to June 15: Spring Pulse and Smolt Outmigration	40	20 to 25	20 to 25	20 to 25
June 16 to September 6: Summer Juvenile Salmonid Rearing Habitat	13	2	7	6

[12] Moyle et al. (1998) developed metrics for fish condition by distinguishing three tiers of fish health: individual (Tier No. 1), population (Tier No. 2), and community (Tier No. 3). Under Tier No. 1, individual fish should (1) have a healthy body conformation; (2) be relatively free of diseases, parasites, and lesions; (3) have reasonable growth rates for the region; and (4) respond in an appropriate manner to stimuli (e.g., predator avoidance).

In July of 2015, Aqua Terra Consulting, MWCD, and several cooperating landowners conducted an experimental flow and water temperature study in the upper Shasta River downstream of Dwinnell Dam to the confluence of Parks Creek (AquaTerra Consulting 2015). The water management strategies evaluated included variation in release volumes from Dwinnell Reservoir, use of cold groundwater pumping to supplement reservoir releases, and use of water exchanges to increase cold spring water releases to the river. The results of the experiment provide valuable insight for implementation of water management strategies that improve water temperatures within the reach. Findings indicated that releases of about 11 cfs from Dwinnell Dam that were comprised of 5 cfs from the reservoir, 5.5 cfs of cold groundwater from the Flying L Pumps, and 0.5 cfs of cold seep water from the base of the dam provided the greatest over all benefit to water temperatures. In addition, the experiment also provided additional insight to describe the current Section 7 environmental baseline and helped to verify the predictions of the water temperature model outputs provided by Water Course Engineering with funding from the SWCG. These release volumes exceed the recommended minimum IFNs (6 cfs) proposed by (McBain & Trush Inc. 2013) for summer rearing habitat.

2.4.1.1.2 Stream Temperature

Warm water temperatures during the summer rearing period is one of the key factors limiting the survival and recovery of SONCC coho salmon in the Shasta River, Big Springs Creek and Parks Creek. In a review of the effects of water temperature on coho salmon, Stenhouse et al. (2012) found that water temperatures exceeding 20.3 °C have detrimental effects to rearing coho salmon (Table 4). In the Shasta River, Chesney (2009) found that juvenile coho salmon avoid habitats when water temperatures begin to approach 20 °C and will migrate to cold water refugia habitats often associated with cold water spring sources. Currently, water temperatures can begin to exceed 20°C in May and warm water conditions typically remain a concern until late September.

2.4.1.2 Reach 1 - Upper Shasta River

2.4.1.2.1 Streamflow

Streamflow in the Upper Shasta River is primarily controlled through releases from Dwinnell Reservoir, which is owned and operated by the MWCD. Dwinnell Reservoir was constructed on the Upper Shasta River in 1928, and MWCD holds appropriative water right permits to divert and store a total of 49,000 acre-feet of water from the upper Shasta River (35,000 acre-feet) and Parks Creek (14,000 acre-feet) annually. The season of diversion under both of these permits begins on October 1 and ends on June 15, annually.

In 2016, MWCD completed the permitting process with the U.S. Army Corps of Engineers to implement a Conservation and Habitat Restoration and Enhancement Project (CHERP). The CHERP includes development of a long term water conservation and flow enhancement program to improve conditions for coho salmon downstream of Dwinnell Dam. Under the CHERP, MWCD proposes to increase instream environmental releases by an average of 4,400 acre-feet below Dwinnell Dam as a conservation measure to improve conditions for coho salmon using water conserved through lining of up to 8.4 miles of its main irrigation canal.

2.4.1.2.2 Stream Temperature

Water temperatures commonly exceed 20 °C throughout the majority of this reach during the late spring and summer. Over-summering habitat within this reach is currently limited to areas of cold water created and maintained by spring flow or areas where hyporheic flow enters the channel. Diversion of cold water sources for irrigation purposes reduces the amount of cold water instream that would otherwise be available to improve habitat conditions for juvenile coho salmon.

2.4.1.2.3 Adult Migration and Spawning Habitat

The upstream portion of Reach 1 lacks suitable substrate for spawning (i.e., gravel and cobble). Substrate quality is poor proximal to Dwinnell Dam, and improves in the lower extent of the reach. Adult coho salmon spawning has been documented in the lower mile of this reach downstream of existing beaver dams at about RM 36 (CDFW 2018). Beavers are known to colonize and persist in the lower and mid portions of the reach. While beaver dams are known to create high quality summer rearing habitat, the dams may impede adult upstream migrations at lower streamflows.

2.4.1.2.4 Juvenile Rearing and Migration Habitat

Habitat conditions in Reach 1 are generally suitable for coho salmon rearing through spring of each year. With improved water quality and water quantity conditions, fitness of juvenile coho salmon could potentially be high in this reach due to the large abundance of invertebrate food sources available to fish (Lusardi pers. Comm. 2015). However, once water temperatures begin to approach 20 °C juvenile coho salmon exhibit avoidance behavior triggering movement towards cold water habitats. Channel characteristics where suitable conditions are typically found include complex pools, backwaters, alcoves, and sloughs, associated with cold water springs or hyporheic flow contributions along the channel. Reach 1 contains a number of discrete cold water sources in the form of springs, especially between RMs 56 and 61, as well as diffuse cold water sources from in-channel groundwater accretions. During late spring and summer, low flows may reduce the fitness and survival of juvenile coho salmon by reducing the size of refugial areas and impeding the connectivity between refugial areas.

Preferred coho salmon over-wintering habitat features such as backwaters, alcoves, side-channels, oxbows, and other secondary channel features providing refuge from displacement by high-flow events and are absent from segments of Reach 1. Moreover, channel roughness provided by riparian vegetation and associated LWD exists in only portions of the reach. While lack of such features is typically thought to present a limiting factor for juvenile winter survival, the key over-wintering habitat attribute of such features is the velocity refuge they provide from high winter flows. Within the Upper Shasta River reach, however, the regulated hydrology associated with operation of Dwinnell Dam, as well as the presence of beaver dams, appears to provide the low velocity conditions that are generally associated with high winter survival. Moreover, spring discharges in the Upper Shasta River are known for their relatively constant water temperatures of 12-14°C. While spring discharges help to reduce Shasta River temperatures in the summer, they also help to raise water temperatures during the winter to levels more suitable for coho salmon. Adams (2013) attributed the higher winter survival of juvenile coho salmon within this reach to stable base flows and favorable thermal conditions.

2.4.1.3 Reach 2 – Mid Shasta River

2.4.1.3.1 Streamflow

This reach includes the confluence of Big Springs Creek about 1.3 miles downstream from the confluence of Parks Creek. There is a small unnamed spring that contributes about 3.0 cfs of cold water to the channel along the right bank a short distance downstream of the Parks Creek confluence near where Hole in the Ground Creek enters the river. In 2008, Mount et al. (2009) measured stream flows in Hole in the Ground Creek and found the average flow to be 4.83 cfs during the irrigation season (April 1 to September 30) and 6.22 cfs in the non-irrigation season. Downstream of the Big Springs Creek confluence channel widths and depths increase substantially due to the large flow contributions entering from Big Springs Creek. Groundwater derived streamflow from Big Springs Creek provides voluminous and stable baseflows to the valley portion of the Shasta River while Parks Creek regularly provides larger winter and spring runoff flows (Nichols et al. 2010). There are about five points of diversion within this reach with adjudicated and riparian water rights totaling just over 69 cfs during the irrigation season.

2.4.1.3.2 Stream Temperature

The entire length of Hole in the Ground Creek flows through agricultural pastures that lack mature riparian vegetation and, therefore, water temperatures in the channel tend to exceed levels suitable for coho salmon. During the summer, water temperatures commonly exceed 20°C and increase in a downstream direction. Even though much of this reach is highly productive and may be capable of supporting rearing coho salmon during much of the summer, coho salmon typically avoid these habitats once water temperatures approach 20°C. Coho salmon likely spawn in the upper sections of the reach and juvenile coho salmon are known to use available habitats in this reach during the spring, fall and winter when water temperatures are suitable (Chesney et al. 2010, Adams 2013).

2.4.1.3.3 Adult Migration and Spawning Habitat

Upstream of the confluence of Big Springs Creek, the Shasta River channel has an alluvial gravel/cobble bar morphology with typical riffle- run-pool habitat types dispersed throughout the reach. Instream flows in this reach when adult coho salmon are migrating and spawning (mid-October through early January) are generally adequate after the end of the irrigation (diversion) season (October 1) (McBain & Trush Inc. 2013). As described by Nichols et al. (2010), channel gradients of the Shasta River downstream of Big Springs Creek are less than 1% as the river meanders through the central portions of the Shasta River Valley. While adult coho salmon are known to spawn within the upper portion of this reach (from RM 33 to RM 35) where suitable substrates are present (i.e., vicinity of Parks Creek and Big Springs Creek confluences) (e.g., Chesney and Knechtle 2014), the lower portion of this reach (RM 27 to RM 32) generally lacks

the substrates size classes (gravel, small cobble) and habitat types (e.g., riffles, pool tail-outs, point bars) that typically constitute suitable spawning habitat.

2.4.1.3.4 Juvenile Migration and Rearing Habitat

This reach provides suitable rearing habitat for juvenile coho salmon (CDFW 2018). However, while juvenile coho salmon have been observed within the upper portion of the reach (RM 32.9) during the spring and early summer, elevated summer water temperatures following the onset of the irrigation season appear to result in juveniles leaving the reach in search of cold water refugia within the upper watershed or downstream in the Klamath River. Adams (2013) noted that the timing and severity of the initial increase in stream temperatures above a tolerable level for juvenile coho salmon likely varies from year to year, and hypothesized that the consequence of this displacement may, therefore, be more detrimental in some years than others. This reach is used by rearing coho salmon during the winter months, and the low gradient, low width-to-depth ratios, and sinuous meander patterns common throughout much of this reach appear to provide suitable winter rearing habitat.

2.4.1.4 Reach 3 – Big Springs Creek

2.4.1.4.1 Streamflow

Big Springs Creek is a spring-fed tributary to the Upper Shasta River and is the dominant source of flow to the Upper Shasta River during the summer and spring. This reach includes approximately 1.6 miles of Big Springs Creek from its confluence with the Shasta River upstream to the edge of the property boundary, and the entire length of Little Springs Creek which is about 1 mile (Nichols et al. 2014). In 2008, Mount et al. (2009) and Nichols et al. (2010) estimated that flows in Big Springs Creek averaged about 83 cfs during the non-irrigation season (October 1 to March 31) and decreased to a minimum flow of about 40 cfs during the irrigation season (April 1 to October 1).

2.4.1.4.2 Stream Temperature

Big Springs Creek provides the largest source of cold water, typically about 12 °C, within the entire Shasta River watershed (Nichols et al. 2014). This constant supply of cold water makes the Big Springs Creek a critically important stream for coho salmon recovery and production of anadromous salmonids within the Upper Shasta River. Further, the growth of aquatic vegetation in this reach each summer provides several instream benefits for rearing salmonids. Once established, the aquatic vegetation greatly increases shading of the water column and reduces solar radiation that helps keep instream water temperatures cool. However, the benefits provided by aquatic vegetation are only realized seasonally and cease once the aquatic vegetation dies back in the late fall or winter after air temperatures begin to drop below freezing. The channel lacks cover for rearing and over- wintering coho salmon after the aquatic vegetation dies back. In addition, the temperature benefits provided by the increased shading and narrowing of the channel thalweg are absent during the spring prior to the establishment of new aquatic vegetation

growth. It is during the spring season that maximum water temperatures commonly exceed 20 °C (Nichols et al. 2014).

Little Springs Creek is the sole tributary to Big Springs Creek whose confluence with Big Springs Creek is at about RM 0.47. Like Big Springs Creek, Little Springs Creek is entirely spring fed and is another important source of cold water (14.5 °C) for rearing coho salmon during summer months (Deas et al. 2015).

2.4.1.4.3 Adult Migration and Spawning Habitat

Big Springs Creek is recognized as one of the primary coho salmon spawning grounds in the Shasta River watershed, as it contains extensive areas of suitable spawning gravel (CDFW 2018). Streamflows are adequate to support adult migration and spawning within Big Springs Creek. Little Springs Creek, the major tributary to Big Springs Creek, does not provide spawning habitat as it lacks suitable substrates (Deas et al. 2015).

2.4.1.4.4 Juvenile Migration and Rearing Habitat

High quality habitat found in Big Springs Creek likely support coho salmon rearing under existing conditions. The narrowing and deepening of the Big Springs Creek channel appears to provide adequate depths for juvenile spring redistribution and smolt outmigration. However, instream cover and habitat diversity is seasonally limited until the growth of emergent vegetation begins in the spring. As water temperatures approach 20 °C juvenile coho salmon begin to exhibit avoidance behavior and begin to seek out cold water habitats generally associated with spring inflows. Little Springs Creek also provides non-natal juvenile coho salmon rearing habitat with documented favorable summer water temperatures and abundant food resources (Deas et al. 2015).

Adams (2013) documented substantial fall redistribution of juvenile coho salmon within the upper Shasta River and Parks Creek, suggesting that while some areas of the watershed may become unfavorable in winter, other areas within the watershed are meeting the over-winter rearing needs of coho salmon. Adams (2013) observed substantial movements of juvenile coho salmon out of Big Springs Creek in the fall and hypothesized that winter may be associated with seasonal change in physical habitat in the Big Springs Reach.

2.4.1.5 Reach 4 – Upper Parks Creek

2.4.1.5.1 Streamflow

Unlike the Shasta River downstream of Dwinnell Dam, the hydrology of upper Parks Creek is dominated by rainfall and snowmelt. The annual hydrograph is typical of snowmelt dominated systems characterized by high flows in the winter and spring, followed by gradually decreasing flows through the summer, with the lowest flows typically occurring in late summer and fall. Various estimates of monthly unimpaired instream flows for Parks Creek and the Shasta River

are summarized in Table 6 of the "Shasta River Big Springs Complex Interim Instream Flow Needs Assessment" (McBain & Trush Inc. 2013).

2.4.1.5.2 Stream Temperature

Water temperatures are generally suitable for rearing coho salmon throughout most of the year, however, detrimental temperatures for rearing coho salmon have been measured during July in recent years (McBain & Trush Inc. 2013, AquaTerra Consulting 2017). Spot data describing summer daytime water temperatures in this reach suggest that existing conditions may exceed the temperature suitability range for juvenile coho salmon.

2.4.1.5.3 Adult Migration and Spawning Habitat

Under current conditions, flows estimated to be sufficient for migration and spawning are met at times when rainfall events elevate base flows (McBain & Trush Inc. 2013), however, due to the rapid decline in the hydrograph, the flow requirements of adult coho salmon are generally of short duration. However, the winter hydrology of Upper Parks Creek is dependent on precipitation and can vary greatly in response to precipitation and run-off events. There have not been any investigations to determine actual flow levels that would provide adequate migration and spawning conditions for coho salmon in this reach. The extent to which winter water right diversions may affect the natural frequency and duration of suitable coho salmon spawning conditions is currently unknown.

2.4.1.5.4 Juvenile Migration and Rearing Habitat

Juvenile coho salmon are currently not known to utilize the Upper Parks Creek Reach for spring redistribution, smolt emigration, or summer rearing (CDFW 2018). Upper Parks Creek can be divided into three geomorphologically distinct sub-reaches. In some sections, subsurface accretions appear to support relatively high quality physical habitat conditions for summer rearing, including some springs inflows, mature woody riparian corridor, and instream habitat complexity for juvenile coho salmon rearing. Further downstream, however, sub-optimal summer rearing habitat conditions exist that are due to channel incision (including several head-cut nick points that may impede juvenile upstream passage), lack of riparian habitat, and limited instream cover. Similar to summer rearing habitat over-wintering habitat in Upper Parks Creek also varies by sub-reach, with the channel upstream of Old Highway 99 likely experiencing excessive velocities during high discharge events, the channel between Old Highway 99 and the railroad bridge offering valuable instream habitat complexity and refuge, and the reach below the railroad lacking velocity refuge.

2.4.1.6 Reach 5 – Mid Parks Creek

2.4.1.6.1 Streamflow

Creek morphology in this reach can be described as a low gradient single thread alluvial channel that flows in a southwest to northeast direction. Bridge Field and Black Meadow springs surface along the southeast side of the valley. Bridge Field Spring flow fluctuates throughout the year from a low of 1.5 cfs in the winter to a high of 5.7 cfs in the summer. Black Meadow Spring also fluctuates from 0.5 cfs during the winter to 1.3 cfs during mid-summer (AquaTerra

Consulting 2017). About 2.6 cfs of Bridge Field spring is used for irrigation purposes. There are approximately five other active points of diversion from Parks Creek within this reach that are identified under the Shasta River Decree. These five diversions have adjudicated rights to divert a total of about 16 cfs during the irrigation season between March 1 and October 1.

2.4.1.6.2 Stream Temperature

Bridge Field and Black Meadow springs surface provide a consistent source of cold water. However, water temperatures in much of the reach typically exceed those preferred by rearing coho salmon and commonly exceed lethal temperature thresholds in the upstream segments of this reach (AquaTerra Consulting 2017). Rearing habitat is limited to small areas of thermal refugia associated with either spring flow contributions or direct connections with groundwater.

2.4.1.6.3 Adult Migration and Spawning Habitat

Adult coho salmon have been observed spawning throughout most of the upper four miles of this reach (CDFW 2018). Based upon habitat mapping of riffles composed of spawning sized gravels and riffle crest thalweg depths, McBain & Trush Inc. (2013) recommended a minimum flow of approximately 10 cfs to provide adequate conditions for spawning anadromous salmonids and 8 cfs for migration of adult coho salmon. Higher streamflows would provide more spawning habitat, but the rate of increase in spawning habitat area would decline as flows increase.

2.4.1.6.4 Juvenile Migration and Rearing Habitat

Spring flows in Mid-Parks Creek vary widely dependent on hydrologic conditions in the rainfall and snowmelt-dominated watershed. However, summer rearing habitat in the Mid Parks Creek Reach is currently limited by poor water quality and flow. While conducting snorkel surveys during the summer of 2011, Carson Jeffres of U.C. Davis documented juvenile coho salmon over summering in pool habitats in the alluvial reach from North Slough upstream to about RM 7. Cold water contributions from interconnected groundwater provided cold water sources that were able to support juvenile coho salmon throughout the summer. Although juvenile coho salmon have not been documented rearing in Black Meadow or Bridge Field springs during the summer, both of these locations provide a source of cold water that may be capable of supporting coho salmon over the summer. Rearing habitat is limited to small areas of thermal refugia associated with either spring flow contributions or direct connections with groundwater.

2.4.1.7 Reach 6 – Lower Parks Creek

2.4.1.7.1 Streamflow

There are no tributary streams that originate from higher elevations entering this reach. Therefore, channel and flow characteristics predominantly reflect contributions from Mid-Parks Creek and Kettle Springs and water right diversions necessary to irrigate agricultural lands and provide stock water for cattle. Kettle Springs contributes 6-7 cfs of cold water at the head of a tributary creek that flows in a northwesterly direction through a meandering channel for about 1.5 miles where it joins Parks Creek just upstream of an existing flashboard dam (AquaTerra Consulting 2017). The rate of flow is not constant but varies annually and seasonally.

2.4.1.7.2 Stream Temperature

High water temperatures and low flow conditions limit the suitability of this reach to support rearing salmonids during the late spring and summer and may also create thermal barriers to migration during the spring when air temperatures rise (AquaTerra Consulting 2017). However, Kettle Springs provides an important source of cold water refugia habitat for fry and juvenile coho salmon during the late spring and summer (Chesney et al. 2010). A flashboard diversion dam is located on Lower Parks Creek just downstream of the confluence of Kettle Springs Creek. During the irrigation season, flashboards are placed over the culverts creating an impoundment inundating approximately 25 acres. The impoundment creates a heat sink causing water temperatures to rise, and increases stream temperatures downstream.

2.4.1.7.3 Adult Migration and Spawning Habitat

Adult coho salmon spawning is generally limited to the downstream sections of this reach (CDFW 2018). McBain & Trush Inc. (2013) found that minimum flows of at least 8 to 10 cfs are needed to provide adequate conditions for migration of coho salmon. Based on McBain & Trush Inc. (2013), most of the potential spawning habitat present in the main channel may become suitable for spawning once flows reach 9.9 cfs, and the amount of suitable spawning habitat would continue to increase if flows increase further. Operation of an existing flashboard dam within this reach may impede adult coho salmon passage at certain flows.

2.4.1.7.4 Juvenile Migration and Rearing Habitat

McBain & Trush Inc. (2013) recommended a flow of 20-25 cfs to improve smolt rearing habitat and to increase stream productivity during the snowmelt runoff period, and estimated that flows of 22 cfs would keep water temperatures from exceeding 19ºC through mid-June. These recommendations are based on qualitative observations of three different streamflow levels at two locations that were aimed at estimating flows necessary to initiate channel bench inundations. During the summer, McBain & Trush Inc. (2013) recommend a rearing flow of 7 cfs in this reach to optimize cold water contributions from spring sources upstream and to allow thermal connectivity through the reach such that rearing salmonids could access thermal refugia habitats upstream.

The lower Parks Creek Reach generally flows through open, low-gradient pasture lands that likely were historically comprised of open marsh lands with multiple channels. During large flood events, juvenile coho salmon may occupy adjacent pasture lands and seek refuge in irrigation ditches, ponds, or other topographic features that provide shelter from higher water velocities. As floods recede fish in these locations may be vulnerable to stranding, should they seek refuge in locations that do not connect back to the active stream channel. Spring fed channels, such as Kettle Springs Creek, which does connect to Parks Creek, would not be impacted by high-flow events and may provide over wintering habitat.

2.4.1.8 Summary of Critical Habitat Elements in Reaches in the action area.

Conditions of designated critical habitat and associated limiting factors for the SONCC coho salmon are variable by reach. However, there are some commonalities among reaches. Water temperature is a concern during the summer rearing period, at least on occasion, in all of the reaches. Even Upper Parks Creek (Reach 4), which exhibits suitable water temperatures for rearing coho salmon throughout most of the year, has exceeded suitable temperatures during July in recent years. Therefore, cold water springs inputs are important coldwater refugia throughout the action area. Some key cold water springs include Big Springs Creek and Little Springs Creek (Reach 3), and Bridge Field Springs and Black Meadow Springs (Reach 5). Streamflows are typically sufficient for adult migration throughout the action area, although Upper Shasta (Reach 1) flow releases may not provide sufficient depth and velocity in the upper extent of the reach to allow adult coho salmon migration. However, some suitable spawning locations in the action area are lacking substrate (e.g., Upper Shasta (Reach 1) and Mid Shasta (Reach 2) reaches), or may be limited by flow in some years, (e.g., Lower Parks Creek (Reach 6)). Flow and temperatures throughout the action area are typically suitable for juvenile overwintering, but habitat features and complexity that can protect juvenile coho salmon from occasional excessive stream velocities are lacking in most reaches.

2.4.2 Status of SONCC Coho Salmon in the Action Area

The Shasta River coho salmon population is a core, functionally independent population within the interior Klamath River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams et al. 2006). NMFS has estimated that, in order to contribute to stratum and ESU viability, the Shasta River core population should have at least 4,700 spawners (NMFS 2014). Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, as a core population, the Shasta River coho salmon population may serve as a source of spawner strays for nearby populations. At present, the capacity of the Shasta River coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from the nearby Scott River and Upper Klamath River may enhance recovery of the Shasta River.

CDFW has conducted adult spawning surveys and fish counts at weirs since 1934. Weir counts indicate that the minimum number of adult spawning coho salmon in the Shasta River have varied between 0 to 400 for most years, with a high of approximately 900 returning adults in 1978 (CDFW unpublished data). These data may not account for the entire adult coho salmon brood year numbers, as weirs were sometimes removed due to high flows before all coho salmon spawners had entered the Shasta River. CDFW spawning surveys are similarly limited in that species determinations of redds are not always possible. In recent years, confirmed coho redds observed during CDFW spawning surveys, and their location, are described in Table 12. Again, these observations are not intended to be population estimates or total redd count estimates because of the limited sampling period of the counting weir, and because of the limited ability to

assign redds to species. However, since 2012, all of the locations in which CDFW spawning surveys identified confirmed coho redds are located in the action area.

Table 12. Number of adult coho salmon observed to have passed above the Shasta River counting weir, the number of confirmed coho salmon redds, and the location of confirmed coho salmon redds.

Year	Adult Coho salmon above the Shasta River counting weir	Confirmed coho salmon redds	Location of confirmed coho salmon redds*	Citation
2012	115	1	mainstem Shasta River between Parks Creek and Hidden Valley Ranch	(Chesney and Knechtle 2013)
2013	134	47	The majority of redds identified as coho redds occurred on upper Parks Creek and on the main stem Shasta River between Parks Creek and Big Springs.	(Chesney and Knechtle 2014)
2014	46	1	Parks Creek	(Chesney and Knechtle 2015)
2015	45	11	Mainstem Shasta River between Parks Creek and Hole in the Ground Ranch	(chesney and Knechtle 2016)
2016	48	1	Parks Creek	(Chesney and Knechtle 2017)
2017	41	0	-	(Giudice and Knechtle 2018)
2018	39	0	-	(Giudice and Knechtle 2019)

* All of the locations in which CDFW spawning surveys identified confirmed coho redds are located in the action area

The historical distribution of coho salmon spawners is concentrated in the mainstem Shasta River from river mile 32 to about river mile 36 (i.e., the upper portion of the Mid-Shasta River Reach and the lower portion of the Upper Shasta River Reach, which divide at the Parks Creek confluence at river mile 35), Big Springs Creek, lower Parks Creek, and in the Shasta River Canyon (river mile 0 to 7) (CDFW 2018). Of those locations, only the Shasta River Canyon, which is downstream, is outside of the action area. Juvenile rearing is also occurring in these same areas, and occasionally in lower Yreka Creek (Garwood 2012) and the upper Little Shasta River (Whelan 2006). Outmigrant trapping has occurred in the Shasta River Basin annually (e.g., as summarized by Stenhouse et al. (2016)). However, the location of the rotary screw trap at the confluence of the Klamath River (downstream from, and outside of, the action area) does not allow for inference about juvenile coho salmon abundance in the action area. Nevertheless, several studies have documented juvenile coho salmon utilizing the action area and making

seasonal movements within the action area in response to changing habitat conditions (Chesney et al. 2009, Adams 2013, Adams and Bean 2016, CDFW 2018). Coho salmon have also been observed utilizing aquatic macrophyte habitat in the Big Springs Creek area that is both complex and productive. The current distribution is both a small fragment of the current Shasta River stream network and of the modeled Intrinsic Potential in the basin (Williams et al. 2006, Williams et al. 2008).

2.4.3 Previous Section 7 Consultations and Section 10 Permits in the Action Area

One important ESA section 7 Consultation has occurred in the action area, between NMFS and the U.S. Army Corps of Engineers, on the MWCD CHERP (NMFS 2017). The CHERP actions were determined to be likely to adversely affect, but not likely to jeopardize, the continued existence of SONCC coho salmon. MWCD's work proposed under CHERP is a long-term commitment that is currently being implemented concurrent with and complementary to the MWCD Site Plan Agreement. Therefore, the CHERP commitments are part of the current ESA Section 7 environmental baseline. While CHERP actions are included in the Agreement and individual Site Plan Agreement, they are considered ESA Section 10 Baseline Conditions (i.e., not Elevated Baseline Conditions). The MWCD activities required under CHERP that relate to relevant habitat parameters within the action area are described in the MWCD Site Plan Agreement (Section A1.9.1.1 of Appendix 1).

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Some components of the proposed action (i.e., Routine Agricultural Activities, BMAs, and their associated AMMs), and the diversion reductions described in the FMS, principally impact the SONCC coho salmon via effects to habitat parameters (i.e., hydrology/water quality, passage/migration/screening, instream habitat complexity, riparian condition/function, substrate quality). Therefore, the effects of those actions on SONCC coho salmon and their critical habitat are described in habitat parameter sections below. Effects of SONCC coho salmon relocation (Section 2.5.7), and of research and monitoring (Section 2.5.8) are principally direct to individuals, rather than to habitat, so they are considered separately below.

2.5.1 Hydrology/Water Quality

2.5.1.1 Flow Management Strategy and the Diversion Reduction Schedule

The objective of the Diversion Reduction Schedule is to optimize cold water habitats and provide stream connectivity to allow coho salmon to migrate to cold water spring input areas for summer refugia. These expected improved conditions would also support food production from riffle habitats and allow coho salmon more opportunities to move between habitats when water temperatures outside of refugia areas allows. The FMS, as described in Section 1.3.2 above, compares biologically based flow targets against the instream flow conditions base upon agreed upon diversion reductions, to estimate the effect of those diversion reductions on reach and season specific instream habitat conditions. The results of those reach and life stage specific comparisons are shown the far right column of Table 13.

Table 13. Comparison between current instream flow conditions and instream flow conditions anticipated under the FMS (Derived from Tables 10, 11, and 12 of the FMS).

Reach	Life Stage	Flow Objectives	Current conditions	SHA Flow Strategy Conditions	Comparison Result
Upper Shasta River	Adult Migration and Spawning	10 - 13 cfs	5 - 11 cfs	8 - 14 cfs	+ 3 cfs, Objective met more often and exceeded at times
	Incubation and Winter Rearing	7 - 10 cfs	3.5 - 10 cfs	5.5 - 12 cfs	+2 cfs, Objective met more often
	Spring Rearing, Redistribution, Emigration	20 - 25 cfs peak with declining flows to mimic snow melt hydrograph	3 - 25 cfs	6.5 - 33 cfs	+ 3 cfs to 8 cfs throughout the season
	Summer Rearing	6 cfs	3 cfs	5 - 13 cfs	+2 cfs to 10 cfs, Objectives met more frequently and exceeded at times
Upper Parks Creek	Adult Migration and Spawning	10 – 11 cfs	0.05 cfs	1 - 12 cfs	+4.5 cfs, the objective is met earlier in the season
	Incubation and Winter Rearing	6 – 10 cfs	7.5 cfs	6 cfs	Small decrease
	Spring Rearing, Redistribution, Emigration	March 20 cfs 5/16 – 5/23 = 12 cfs 5/24 – 5/31 = 8 cfs 6/1 – 6/10 = 4 cfs	March = 7.4 cfs April = 12.2 cfs May = 12.2 cfs June = 7.2 cfs	March = 14.6 cfs April = 21.6 cfs May = 24 cfs June = 12.6 cfs	Flow volumes are nearly doubled and better mimic natural flow patterns
	Summer Rearing	1 cfs	1.45 - 0 cfs	1 cfs	Connectivity and fish passage improved

Table 13 Continued. Comparison between current instream flow conditions and instream flow conditions anticipated under the FMS (Derived from Tables 10, 11, and 12 of the FMS).

Reach	Life Stage	Flow Objectives	Current conditions	SHA Flow Strategy Conditions	Comparison Result
Mid Parks Creek	Adult Migration and Spawning	10-11 cfs	0 - 5.4 cfs	10/1-10/14 = 8.7 cfs 10/15-10/31 = 11.7 cfs Nov = 19.4 cfs Dec= 21.6 cfs	Objectives met sooner and exceeded after October 15th
	Incubation and Winter Rearing	10 cfs	11 - 12 cfs	15 - 17 cfs	+5 cfs objective met
	Spring Rearing, Redistribution, Emigration	3/1-5/15 = 20 cfs 5/16-5/23 = 12 cfs 5/24-5/31 = 8 cfs 6/1-6/10 = 4 cfs	March = 4.1 cfs April = 8.9 cfs May = 8.4 cfs June = 2.1 cfs	March = 16.2 cfs April = 23.5 cfs May = 25.1 cfs June = 12.1 cfs	Flow volumes are much higher and better mimic natural flow patterns
	Summer Rearing	1 cfs	June = 2.1 cfs July = 0 cfs August = 0 cfs September = 0 cfs	June = 9.9 cfs July = 9.9 cfs August = 9.6 cfs September = 8.8 cfs	Base flows and cold water habitat is increased
Lower Parks Creek	Adult Migration and Spawning	Oct 1-14 = 6.85 cfs Oct 15-31 = 9.85 cfs Nov = 17 cfs Dec = 17 cfs	October = 1 cfs November = 11.4 cfs December = 18.1 cfs	Oct 1-14 = 9.69 cfs Oct 15-31 = 12.69 cfs Nov = 19.2 cfs Dec = 21.41 cfs	Flows are improved earlier and objectives are met
	Incubation and Winter Rearing	13 cfs	January = 17.9 cfs February = 18.2 cfs	January = 16.4 cfs February =17.7 cfs	Small decrease, objectives exceeded
	Spring Rearing, Redistribution, Emigration	March = 25.85 cfs April = 25.85 cfs May 1-15 = 25.85 cfs May 16-23 = 17.85 cfs May 24-31 = 9.85 cfs June 1-10 = 9.85 cfs June 11-15 = 6.85 cfs	March = 5.1 cfs April = 9.9 cfs May = 9.4 cfs June =3.1 cfs	March = 17.2cfs April = 24.5 cfs May = 26.1 cfs June =13.1 cfs	Spring flows are substantially increased and objectives are exceeded
	Summer Rearing	6.85 cfs	1 cfs	9.8 - 10.6 cfs	Base flows are increased substantially and cold water refugia is increased.

Table 13 Continued. Comparison between current instream flow conditions and instream flow conditions anticipated under the FMS (Derived from Tables 10, 11, and 12 of the FMS)

Reach	Life Stage	Flow Objectives	Current conditions	SHA Flow Strategy Conditions	Comparison Result
Mid Shasta River	Adult Migration and Spawning	70 cfs	140 - 170 cfs	Oct = 65 - 78 cfs Nov = 79 - 89 cfs Dec = 86 - 96 cfs	Objectives generally met or exceeded
	Incubation and Winter Rearing	76 – 95 cfs	257 cfs	70 - 91 cfs	Objectives generally met or exceeded
	Spring Rearing, Redistribution, Emigration	112 cfs decreasing to 39 cfs by summer	89 to 12 cfs	4/1-4/10 = 99 - 89 cfs 4/10-4/30 = 62 - 52 cfs May = 58 - 40 cfs 6/1-6/15 = 38 - 28 cfs	Flows are improved and better mimic snow melt hydrology
	Summer Rearing	28 – 39 cfs	25-36 cfs less GID diversion Rates	23 - 62 cfs	Flows are similar, however, flows during the spring and fall transitions are improved to help juvenile emigration and adult immigration

Table 13 does not include an analysis of the Big Springs Creek Reach of the action area because the FMS did not directly compare current instream flow conditions against instream flow conditions anticipated under the FMS for this reach. However, the FMS does discuss effects of the proposed action to the Big Springs Creek Reach. The only Enrolled Property that is Party to the Agreement with property adjacent to Big Springs Creek is the Big Springs Ranch, which is owned and operated by CDFW. The majority of the water rights associated with Big Springs Ranch are highly valuable cold water springs. The flow management actions proposed by CDFW (e.g., managing the tailwater capture pond installed within the Big Springs unit to prevent tailwater coming from upslope pastures from entering Big Springs Creek (ESA Section 10 Baseline) and improving irrigation infrastructure (ESA Section 10 Elevated Baseline Conditions), are expected to improve conditions for coho salmon during the spring and summer irrigation seasons. CDFW may potentially restore Hole in the Ground Creek (Additional BMAs) (see Section A1.8.3 in Appendix 1), which would provide additional water quality benefits; however, we do not rely on these benefits in our analysis as it is not certain that this project will occur. CDFW will continue to implement these management actions for juvenile spring redistribution and smolt emigration during the summer rearing season. Coho salmon currently use Big Springs Creek to spawn each year and the stable flow regime provides good conditions for incubating eggs and embryos. McBain & Trush Inc. (2013) did not develop IFNs for the Big

Springs Creek Reach, in part because stream flows are currently adequate to support adult salmon migration and spawning within Big Springs Creek.

In summary, as shown in Table 13 of this opinion, given the diversion reductions described in the FMS, which are part of the proposed action, flow objectives will be achieved more often, and often exceeded. In addition, flow patterns are expected to better mimic natural patterns. Further, under the FMS, NMFS anticipates reach scale improvements to water temperature from additional cold water inputs, changes in water management strategies, and from improvements to stream channel morphology and riparian vegetation that result through implementation of BMAs and AMMs over time. NMFS expects the greatest improvements to occur during the spring and summer seasons when fry and juvenile coho salmon are present. Many of the BMAs, particularly the diversion reductions, are designed to improve water temperatures in the Shasta River and Parks Creek with the objective of keeping water temperatures below 18 °C to optimize available rearing habitats and delay triggering behavioral induced movement of juvenile coho salmon in the spring and early summer. Water temperature improvement will likely occur because spring flows will better mimic natural snow melt hydrology and peak flows will generally meet or exceed minimum instream Tier 1 objectives recommended by McBain & Trush Inc. (2013) for upper Shasta River and Parks Creek. In addition, summer base flows will slightly improve in Upper Parks Creek Reach, with greater improvements accumulating downstream. Spring flow contributions will increase throughout the action area, increasing the availability of cold water refugia habitats in several locations with the greatest improvements expected to occur in Upper Shasta River and Mid-Parks Creek reaches.

NMFS expects spawning and overwintering conditions to improve as well. Fall flows may increase earlier in the year and may provide suitable spawning conditions by November. Over wintering flows generally would remain similar to current conditions with some localized improvements that NMFS expects should benefit over wintering juvenile coho salmon and incubating eggs.

As described above, NMFS expects substantial benefits to hydrology and water quality for all life stages of SONCC coho salmon in the action area to result from the flow benefits included in the proposed action. Again, the greatest improvements are expected to occur during the spring and summer rearing and migration seasons. However, benefits to coho salmon via the FMS are expected to be fully realized in a phased approach as water conservation projects described in the individual Site Plan Agreements are completed. The vast majority of projects that are expected to affect hydrology and water quality are anticipated to be completed within five years of initiation of the Agreement (see Table 9). Based on our experience with similar types of restoration efforts and projects, we anticipate that approximately 80% of the projects that are scheduled to be completed within the first five years will be completed in that time frame. In addition, we anticipate the benefits from projects on instream flows may vary somewhat from those described in Site Plan Agreements and the FMS. This is because there is limited understanding of the mechanisms that influence spring flow volumes, hyporheic flows, and tailwater return pathways to the river. Hydrological uncertainties underscore the importance of implementing effectiveness monitoring program described in the Adaptive Management Program, including comparing seasonal flow to the performance indicators indicated in Table 5 above to validate the flow requirements of the Agreement.

2.5.1.2 Routine Agricultural Activities

Even with the FMS, and the various BMAs and associated AMMs, the primary adverse effects to SONCC coho salmon and their critical habitat described in this opinion are caused by direct diversions, and secondarily impacts to the riparian corridor that effect water quality. Again, key stressors for SONCC coho salmon in the Shasta River, and their critical habitat, include impaired water quality and altered hydrologic function (NMFS 2014). Temperature is a concern throughout most of the Covered Area, and summer rearing habitat limited to small areas of thermal refugia associated with either spring flow contributions or direct connections with groundwater (e.g., portions of Big Spring Creek, Mid Parks Creek near Bridge Field Springs and Black Meadow Springs). Even in Upper Parks Creek and Big Spring Creek, where water temperatures are generally suitable for rearing coho salmon throughout most of the year, detrimental temperatures for rearing coho salmon have been measured during the summer in recent years. The diversion reductions and BMAs included in the FMS section above (Section 2.5.1.1) are expected to provide the benefits discussed in that section over time; meanwhile there is still harm to SONCC coho salmon resulting from habitat impacts of Routine Agricultural Activities that are described below in this opinion. The harm to SONCC coho salmon resulting from adverse effects to their critical habitat that results from Routine Agricultural Activities is expected to be minimized by implementation of AMMS, the flow improvements in the FMS, and the various BMA projects, as they are completed.

2.5.1.2.1 Water Diversion and Diversion Facilities

All of the Enrolled Properties manage water in some capacity, and many maintain diversion facilities in the action area. Water diversion facilities can impact SONCC coho salmon through several mechanisms. Decreased flow from diversions is a direct concern for fish passage downstream, and diversions can impinge individual fish if they are not suitably screened. These effects are addressed in Section 2.5.2. Extreme diversion can lead to dewatering and impact various life stages by stranding, which is not expected under the proposed action, because the diversion reductions described in the FMS include adequate bypass flows. However, one main impact of diverting water from a stream is the impact to hydrologic function and water quality. Decreased water volume instream results in decreased heat capacity in stream, which increases the impact of ambient temperatures on stream temperatures. Stream temperatures are a concern throughout most of the action area during the spring, summer, and fall when juveniles are rearing or migrating. With the exception of temperature refugia at various locations noted in the environmental baseline section above (Section 2.4), stream temperatures often exceed 20°C, resulting in avoidance behavior by juvenile coho salmon. Another component of diversion facilities that can have an adverse effect on SONCC coho salmon is the seasonal construction and removal of push-up dams or temporary diversion structures that create depth at points of diversion to allow diversion infrastructure to operate as intended. As with other construction projects, construction and removal of temporary diversion structures may result in some temporary, short-term adverse effects related to sedimentation, and may also require dewatering and SONCC coho salmon relocation, as discussed in Section 2.5.7 below. However, construction of temporary diversion structures would not result in impacts to SONCC coho

salmon due to passage concerns (i.e., Section 2.5.2 below) because fish passage must be maintained for all life stages when implementing the proposed action. For example, push up dams cannot stretch across the entire flowing channel.

Although difficult to quantify due to the diffuse nature of the diversion in each reach and throughout the action area, and to the correlation with ambient air temperature, the adverse effects of water diversions by the Permittees in the action area can have a significant adverse impact on juvenile coho salmon in the action area as noted above. However, this harm to SONCC coho salmon from adverse effects to their critical habitat that results from Routine Agricultural Activities is expected to be minimized by the flow improvements in the FMS and the various BMA projects as they are completed, as summarized below.

As seen in Table 9, and described in the Site Plan Agreements, several of the Permittees have proposed diversion structure improvements, or moving the point of diversion, to facilitate better control and monitoring of water delivery for water conservation, to conserve water, and to generate irrigation efficiencies that can be provided to fish and wildlife as a beneficial use. These include: Nicoletti, Rice Livestock, and Novy Ranches, Cardoza Ranch, Shasta Spring Ranch, Parks Creek Ranch, Edson Foulke, Hole in the Ground Ranch, Seldom Seen Ranch, and MWCD. The vast majority of the 16 proposed projects are expected to be completed within five years of initiation of the Agreement. These projects are expected to improve water temperature and stream flow, especially during the summer months when juvenile coho salmon are in the rearing life stage. Based on our experience with similar types of restoration efforts and projects, we anticipate that approximately 80% of the projects that are scheduled to be completed within the first five years will be completed in that time frame. NMFS expects these improvements, along with others described below, to assist in achieving the flow recommendations in McBain/Trush and, therefore, will minimize harm to SONCC Coho Salmon from adverse effects to hydrology and water quality from these diversions. There are also likely to be adverse effects from the construction of these improvement projects, especially if dewatering is required, and water quality impacts such as sedimentation, but the AMMs for these activities that are part of the proposed action will limit those impacts.

2.5.1.2.2 Irrigation Management and Maintenance

2.5.1.2.2.1 Tailwater recapture, reuse, and reduction

Tailwater is created in flood irrigation operations as unabsorbed, untranspired, and unevaporated irrigation water that may flow back into the stream. When unmanaged, tailwater returning to the stream can impact SONCC coho salmon and their critical habitat by increasing water temperature and increasing turbidity. Restoration projects to address tailwater input will include construction of tailwater capture systems (pond, berms or pick up ditches) to intercept tailwater before it enters streams as surface flow. Water held in capture systems, such as a pond, can be reused for future irrigation purposes, therefore, reducing the need for additional stream diversions. Tailwater ponds are used primarily during the irrigation season (dry summer months). Tailwater projects can also minimize tailwater, which generally has decreased water quality including increase temperature, from entering the stream, thereby improving instream water quality.

Tailwater management projects are included for 10 of the 14 enrolled properties, with at least one project being included in each of the six Agreement reaches. The four properties that are not proposing to address tailwater issues do not have substantial tailwater impacts because they: 1) are entities that divert water but don't manage land in a manner that produces any tailwater (i.e., MWCD and Edson Foulke), 2) only maintain parcels that have minimal grazing and, therefore, produce minimal tailwater (i.e., GID), or 3) are entirely sprinkler irrigated and, therefore, produce minimal tailwater (i.e., Seldom Seen Ranch). Many of the projects are included in the ESA Section 10 Baseline Conditions and would be required to be maintained in the proposed ESPs, meaning that once completed the Permittee will maintain these projects after the termination of the Agreement. Many of the tailwater management projects included in the Agreement have already been completed, and we anticipate that about 80% of the remaining projects that are scheduled to be completed within the first five years will be completed in that time frame (Table 9). NMFS expects the projects to be completed during the term of the Agreement will help improve water temperature and stream flow, especially during the summer months when juvenile coho salmon are in the rearing life stage. This is because less water will need to be diverted from streams due to tailwater capture for future irrigation use. Adverse effects on SONCC coho salmon and their critical habitat from these projects are not anticipated.

2.5.1.2.2.2 Ditch improvements

Ditch piping projects can improve water quality conditions by reducing water loss from evaporation and absorption. As with other water conservation projects, conserved water can be maintained instream to improve habitat conditions. Many of the Permittees who propose to implement or maintain tailwater management projects also propose ditch piping projects, with 10 of the 14 Enrolled Properties including ditch piping projects in their Site Plan Agreements. Again, several of the projects are included as ESA Section 10 Baseline Conditions, meaning that once completed the Permittee will maintain them after the Agreement is terminated. Most of the benefits contemplated here are expected within five years of initiation of the Agreement. Adverse effects on SONCC coho salmon and their critical habitat from these projects are not anticipated. These projects are constructed outside of stream beds and are unlikely to contribute sediment to streams during or after construction based on the minimal amount of sediments disturbed.

2.5.1.2.2.3 Soil moisture sensors

Implementation of soil moisture sensors is another water conservation project undertaken under the Agreement. Soil moisture sensors optimize irrigation application rate efficiency and ensure adequate irrigation without over application of water. As with other water conservation projects, conserved water can be maintained instream to improve habitat conditions by increasing flow and decreasing temperature. Again, the majority of the enrolled properties, nine of the fourteen, have include soil moisture sensor projects in their Site Plan Agreements, with most projects to be completed within 5 years of initiation of the Agreement. These projects are expected to improve water temperature and stream flow in the action area by helping to reduce the amount of water taken from streams for irrigation. These benefits will be most evident during the summer months when juvenile coho salmon are in the rearing life stage. Adverse effects related to hydrology or water quality from these projects on SONCC coho salmon or their critical habitat are not

anticipated because installation of soil moisture sensors (relatively small devices) creates negligible physical and biological disturbance in the action area.

2.5.1.2.2.4 Canal improvements

Canal lining is a water conservation action similar in effect to piping diversions. Only one Enrolled Property, MWCD, is proposing canal ditches. In this case, lining of the MWCD main canal, is a CHERP action that is included as part of the environmental baseline and has been previously analyzed, as described in Section 2.4.3 above. The MWCD Site Plan Agreement indicates that the project may be completed by 2023, and the Agreement states that lining of MWCD main canal may take up to five years to complete, and CHERP flows will not occur until this water conservation project is complete. Prior to completion of the canal lining, MWCD will implement an interim flow schedule with conservation measures to improve water quality and habitat conditions for aquatic resources. With regards to this project, returning to ESA Section 10 Baseline Conditions would include maintaining a lined main canal that provides permanent water saving efficiencies. Therefore, NMFS does not anticipate any adverse effects on SONCC coho salmon and their critical habitat because saving water will result in less water being diverted from streams in the action area for agricultural purposes

2.5.1.2.3 Pasture Grazing and Riparian Grazing Management

2.5.1.2.3.1 Riparian Grazing Management

Most of the Permittees have proposed some level of grazing management intended to benefit SONCC coho salmon. Many of the Enrolled Properties have already completed Riparian Grazing Management Plans with UCCE Range Specialists. These Grazing Management Plans provide property-specific guidance on cattle grazing operations, given riparian and hydrologic conditions. The Grazing Management Plans include stream enhancement objectives that include positive impacts to water quality conditions by improving riparian habitat. In many Agreement reaches, improved riparian habitat can decrease stream temperature by providing shade along the stream corridor. These proposed management plans either are completed or will be completed within five years of initiation of the Agreement. The adverse effect of grazing on SONCC coho salmon critical habitat will be limited to small, localized, short-term turbidity increases when cattle cross water within action area streams, or when water from recently grazed areas adjacent to streams (e.g., tailwater) flows into the stream. Further, the proposed grazing strategies, monitoring, and AMMs will contribute to limiting the potential effects of the action on critical habitat to low levels. As grazing management actions are implemented under the Agreement, critical habitat is expected to continue to improve since grazing is being monitored followed with adaptive management decisions that will continue allowing riparian vegetation and stream channels to recover to appropriate conditions.

2.5.1.2.3.2 Fence Maintenance/off-channel stock watering

Livestock exclusion fencing and off-channel stock watering projects is expected to provide benefits to SONCC coho salmon via improvements to water quality through reduced sediment impacts that occur when cattle enter the riparian corridor to feed or water. Fencing riparian areas will also improve water quality by allowing riparian vegetation to grow, thus providing shade

that can decrease stream temperature in the summer. Many of the Enrolled Properties already maintain some fencing included in the ESA Section 10 Baseline Conditions, but several are also proposing additional projects. We anticipate that about 80% of the projects that are scheduled to be completed within the first five years will be completed in that time frame. There are no adverse effects to water quality anticipated from stream fencing or maintenance of off-channel stock watering facilities, because the construction of these projects would occur outside of the streambed. The small amount of soils that may be disturbed are not anticipated to reach streams due to the location of these projects away from stream banks. Thus, NMFS does not anticipate adverse effects to SONCC coho salmon or their critical habitat from these projects.

2.5.1.2.4 Road Use and Maintenance/Livestock and Vehicle Wet Crossings

Road use and crossing maintenance projects, and adhering to AMMs at wet crossings, can have important impacts on water quality. Cattle and heavy equipment, which is often necessary for ranch management, can have significant water quality impacts, principally related to sedimentation and turbidity. AMMs for these Routine Agricultural Activities include minimizing erosion and sedimentation, planning instream work when SONCC coho salmon are least likely to be present, and crossing livestock and vehicles only at stable, designated locations where potential spawning gravel, incubating eggs, and fry are not present. Six of the fourteen Enrolled Properties address this Routine Agricultural Activity in their Site Plan Agreements, and five of those include continuing the AMMs as part of ESA Section 10 Baseline Conditions, meaning the benefits would continue after termination of the Agreement. However, following the AMMs associated with these activities should benefit water quality conditions on those properties. In summary, there will be a minor, temporary decrease in water quality associated with increased turbidity associated with road use maintenance, and at livestock and vehicle wet crossings, during and soon after vehicles and cattle are crossing streams. However, by implementing the AMMs, the amount of sediment and turbidity entering streams from these projects will be minimized. These measures, coupled with improving riparian conditions over time (see discussions above and below), will likely eliminate adverse effects from agricultural operations including road use and maintenance, and vehicle and cattle crossing of streams.

2.5.1.2.5 Instream Habitat Structures and Improvements

Instream habitat structures can improve water quality conditions by providing flow variability and depth that encourages temperature stratification, which provides important cold water refugial resources for rearing juvenile coho salmon.

2.5.1.2.5.1 Large Woody Debris (LWD)

LWD installation and maintenance provides rearing habitat for juveniles and improves hydrologic connection between floodplains and main channels. Scour from LWD interacting with flow can create temperature stratification, and provide flow refugia. Most of the Enrolled Properties, 11 of 14, have included LWD installations in their Site Plan Agreements. These structures will be designed and installed per CDFW Restoration Manual (CDFW 2010) specifications, and wood pieces will be placed into the flowing stream by machinery operating from the streambank (i.e., outside the wetted channel). Not all of the Site Plan Agreements state

the number of LWD installations they proposed to install, but the ones that do total 134 separate installations in the action area, which would provide substantial habitat improvements. Based on available funding and our experience with similar types of restoration efforts and projects, we anticipate that about 80% of the projects that are scheduled to be completed within the first five years will be completed in that time frame. Some short term negative impacts to water quality are expected to result from construction of these LWD structures, principally due to sedimentation, but will be minimized by following the AMMs that are part of the proposed action. Therefore, these restoration activities are not expected to adversely affect SONCC coho salmon or their critical habitat.

2.5.1.2.5.2 Creation of off-channel/side-channel habitat

Similar to LWD installation, off-channel/side-channel habitat projects affect hydrology and water quality by increasing variability of flow, depth, and temperature. Eight of the fourteen Enrolled Properties have included creation of off-channel/side-channel habitat projects in their Site Plan Agreements, and the majority of those projects are expected to be completed within 5 years of initiation of the Agreement. Based on our experience with similar types of restoration efforts and projects, we anticipate that about 80% of the projects that are scheduled to be completed within the first five years will be completed in that time frame. Some short term negative impacts to water quality are expected to result from construction of these habitat features, principally due to sedimentation, but will be minimized by following the AMMs that are part of the proposed action. For example, restoration and construction, within any wetted or flowing stream channel shall only occur within the in-water construction season when SONCC coho salmon are least likely to be present, and will follow the guidelines for dewatering and relocation as discussed in Section 2.5.7 below. Therefore, these restoration activities are not expected to adversely affect SONCC coho salmon or their critical habitat.

2.5.1.2.5.3 Beaver Management

Beaver management is included as a BMA because beaver activity has the potential to provide habitat benefits for SONCC coho salmon, but also to negatively impact Routine Agricultural Activities for Permittees. Beaver dams create favorable habitat conditions for rearing coho salmon by providing slow water habitats with abundant woody cover. This slow water habitat is useful for both summer and winter rearing juvenile coho salmon. Many of the Permittees have agreed to develop beaver management plans that adhere to beaver management best practices, including allowing beaver activity to continue if it is not negatively affecting ranching activities. In addition to providing cover, similar to LWD and creation of off-channel/side-channel habitat, beaver activity can positively affect water quality conditions for SONCC coho salmon. There is no timeline for completion for most of these projects, with the exception of Site Plan Agreements that identify timelines for completing beaver management plans, because the activity is contingent on natural colonization or activity by beavers. Because Permittees are agreeing to beaver management plans and techniques described by Pollock et al. (2018) that limit the frequency and extent of beaver dam removal, we expect the benefits of beaver dams to coho salmon critical habitat to be realized more frequently under the proposed action than under ESA Section 7 environmental baseline conditions. In instances where beaver dams need to be removed, those removals would likely have adverse effects to coho salmon habitat, but those impacts would occur less frequently, and would also be limited in that NMFS and CDFW would help inform the extent of any dam removals. .

2.5.1.2.6 Riparian Restoration and Revegetation, Bank Stabilization

Riparian restoration and revegetation projects are intended to improve habitat for SONCC coho salmon through increased stream shading that is intended to lower stream temperatures, increase future recruitment of LWD to streams (see Section 2.5.1.2.5.1 above for LWD impacts to water quality), and improve hydrologic function. Nearly all (13 of 14) of the Enrolled Properties address this BMA in their Site Plan Agreements. The one property that does not, Edson Foulke, is an association that does not own property and only manages a point of diversion in the action area. The majority of the proposed projects are expected to be completed within five years of initiation of the Agreement, although some have longer timelines, including pending further evaluation or have an unspecified timeline. Again, based on available funding and our experience with similar types of restoration efforts and projects (NMFS 2019), we anticipate that about 80% of the project that are scheduled to be completed within the first five years will be completed in that time frame. These projects are expected to improve water temperature and stream flow, especially during the summer months when juvenile coho salmon are in the rearing life stage.

Bank stabilization projects involve appropriate site-specific techniques, including: boulder-streambank stabilization structures, log-streambank stabilization structures, tree revetment, native plant material revetment, willow wall revetment, willow siltation baffles, brush mattresses, check dams, brush check dams, water bars, and exclusion fencing. Using these methods, restored riparian areas can provide ecosystem services that benefit SONCC coho salmon critical habitat by improving water quality, including providing shade, controlling bank erosion and sedimentation, filtering stormwater runoff, and providing low velocity areas that allow deposition of fine sediments during overbank flows (NMFS 2019). Conventional bank stabilization project (e.g., riprapping) can have negative impacts to salmonid habitat by preventing important habitat improving process (e.g., LWD recruitment), but the proposed action avoids those adverse effects by utilizing bio-technical techniques that integrate riparian restoration for riverbank stabilization instead of conventional riprap. All bank stabilization projects in low gradient reaches where rivers and streams naturally would meander can disrupt habitat forming processes. Given the relatively small size of the bank stabilization projects, the bio-engineering approaches to be used, and adherence to the associated AMMs (e.g., prior to construction, determining locations and equipment access points that minimize riparian disturbance), NMFS anticipates adverse effects to SONCC coho salmon and their critical habitat from these revegetation and restoration projects, including bank stabilization, to be minimal.

2.5.2 Passage/Migration/Screening

2.5.2.1 Flow Management Strategy and the Diversion Reduction Schedule

The summarized details of the Diversion Reduction Schedule and the associated FMS are included for the hydrology/water quality Section above (Section 2.5.1.1) and in Table 13. However, in addition the benefits to hydrology and water quality, adherence to the FMS is expected to have positive benefits on adult and juvenile SONCC coho salmon migration in some

years. Most reaches maintain suitable flow for adult migration at all times, but some reaches (i.e., Upper Shasta, Mid Parks Creek, and Lower Parks Creek) do exhibit some flow related inhibition of adult migration in some years. In addition, temperature barriers can impact juvenile migration and redistribution among thermal refuge areas in most reaches. The available data do not allow NMFS to determine how much of any adult or juvenile migration inhibition or impacts might be caused by agricultural operations in the action area vs. natural variability. However, the benefits and increased flow demonstrated through the FMS are expected to help alleviate these conditions (whether natural or human caused) in many cases by providing increase depth at critical riffle locations, and by providing suitable thermal connectivity during a greater range of ambient conditions. Adult coho salmon will have access to all stream reaches due to improved fish passage conditions. In addition, suitable migration conditions relative to fish passage are expected to occur earlier in the year providing additional benefits for fall Chinook salmon.

2.5.2.2 Barrier Modification for Fish Passage Improvement

Passage improvement projects that are part of the proposed action include culvert removal or improvement, and operation and maintenance of fish passage facilities at weirs and points of diversion. The goal of these projects is to improve fish passage for both juvenile and adult coho salmon to provide access to upstream habitat, downstream habitat, and increase the duration of accessibility (both within and between years). In total, 10 projects have been included, with most of them expected to be completed within five years. Projects are included for at least one property in each of the six reaches. Some short term impacts of construction activities associated with these restoration actions are possible, either through sedimentation or entrainment into the construction area (see Section 2.5.7 below), but the AMMs associated with this BMA are expected to minimize any adverse effects on SONCC coho salmon.

2.5.2.3 Fish screen installation or replacement

Adequate diversion screening and maintenance reduces the potential for entrainment into a diversion or impingement diversion infrastructure. Again, many of the Enrolled properties propose either to maintain adequate screens on their diversion facilities or to complete some improvement to their diversion screens. The majority of these projects are anticipated to occur within five years of initiation of the Agreement. The proposed screens are designed to continuously clean the screen surface. Periodic maintenance may be needed to remove siltation, debris, sedimentation and anything else that could inhibit normal operation, which would require lifting the screen and using heavy equipment to remove sedimentation/debris. Screens also require regular greasing of bearing and other mechanical parts. Therefore, some short term impacts to water quality, or fish passage during maintenance, is possible, but the associated AMMs are expected to minimize any adverse effects. AMMs for this activity include regular maintenance, monitoring, and coordinating fish rescue in instance when fish screens are inoperable and stranding in diversion conduits may occur.

2.5.2.4 Move diversion point

The effect of moving or consolidating diversion points on fish passage is to eliminate fish passage issues at existing diversion facilities. For example, The Cardoza Ranch has a fish passage barrier on Parks Creek, which can be addressed by moving the point of diversion to the

Shasta River on the CDFW's property upstream of the Louie Road Bridge. This option would eliminate the need for the diversion structure on Parks Creek and fish passage would no longer be an issue. There are six projects proposed that include moving or combining points of diversion to address passage concerns. As with fish screen installation, diversion construction projects can involve in water work with some adverse effects to SONCC coho salmon and their critical habitat, but these effects will be minimized by following the associated AMMs.

2.5.3 Improvements to Instream habitat complexity

Lack of summer and winter rearing habitat has been identified as a stressor in many of the reaches in the action area including the Upper Shasta, Mid Shasta, Big Springs Creek, and Mid Parks Creek reaches.

2.5.3.1 Flow Management Strategy and the Diversion Reduction Schedule

The summarized details of the FMS and associated Diversion Reduction are included in Section 2.5.1.1 above. In addition to the benefits to hydrology/water quality, and passage/migration that are expected to be seen via the FMS, the increased flow associated with diversion reductions is expected to provide increased habitat especially during the summer rearing period for rearing juvenile coho salmon, including at key cold water refugial areas.

2.5.3.2 Instream Habitat Structures and Improvements

The summarized details of the proposed instream habitat structures and improvement are included in Section 2.5.1.2.5 above. Categories of projects that are intended to increase instream habitat complexity include LWD installations and management, creation of off-channel/side-channel habitat, and beaver management. In addition to improvements to hydrologic function and water temperature, instream habitat complexity provides important cover from predation and for feeding, provides resting cover (including during flood conditions), can impact sorting of sediment to provide increase spawning habitat, improve pool to riffle ratios, and add habitat complexity and diversity. Some of these proposed projects also serve to reconnect previous floodplain and channel features, providing additional flow complexity during critical periods for juvenile and adult migration, and juvenile rearing. Again, the majority of these benefits are anticipated to occur within five years of initiation of the Agreement.

2.5.4 Improvements to Riparian condition/function

Degraded riparian habitat is noted as a current condition and stressor in many of the action area reaches. A well-functioning riparian habitat is important for salmonids in stream because it provides filtration for agricultural run-off, decreases sedimentation events during storms, impacts hyporheic exchange that can provide important temperature refugia, and provides shade that can decrease stream temperature decrease stream temperatures during the day. The realized benefits of these effects are principally improved hydrology and water quality (discussed in Section 2.5.1). The projects that are likely to impact riparian condition/function are also described above, including primarily riparian restoration and revegetation (Section 2.5.1.2.6), but also the Flow Management Strategy and the Diversion Reduction Schedule (Section 2.5.1.1), irrigation

management and maintenance (Section 2.5.1.2.2), pasture grazing and riparian grazing management (Section 2.5.1.2.3), and road use and maintenance/livestock and vehicle wet crossings (Section 2.5.1.2.5).

2.5.5 Improvements to Substrate quality

Proposed projects that can affect substrate quality include primarily placing spawning gravel (Section 2.5.5.1 below). Various other types of projects can also improve substrate by improving hydrologic processes that distribute and sort sediments have already been described above, including: the Flow Management Strategy and the Diversion Reduction Schedule (Section 2.5.1.1), instream habitat structures and improvements (Section 2.5.3.2), irrigation management and maintenance (Section 2.5.1.2.2), pasture grazing and riparian grazing management (Section 2.5.1.2.3), and road use and maintenance/livestock and vehicle wet crossings (Section 2.5.1.2.5).

2.5.5.1 Spawning gravel augmentation

Lack of sufficient spawning gravel in reaches that would otherwise be suitable for spawning is noted particularly for the Mid Shasta and Upper Shasta reaches. The majority of the Enrolled Properties in the Mid Shasta and Upper Shasta reaches (Table 9) include spawning gravel augmentation in their Site Plan Agreements. Many of those proposals are pending an evaluation of the utility of spawning gravel placements on individual properties, or are committed to being completed within either 5 or 10 years of initiation of the Agreement. The purpose of these projects is to improved spawning habitat quantity or quality. As with construction projects, spawning gravel augmentation may result in some temporary, short-term adverse effects related to sedimentation, and may also require dewatering and SONCC coho salmon relocation, as discussed in Section 2.5.7 below. Any related adverse effects would be minimized or avoided by following the associated AMMs for BMA construction projects.

2.5.6 Summary of effects to habitat and resulting effects to SONCC coho salmon individuals

NMFS expects minor, and generally short-term, adverse effects to SONCC coho salmon designated critical habitat associated with the Routine Agricultural Activities and construction associated with BMAs, mostly related to impacts on hydrology and water quality. However, the proposed action is expected to provide long-term improvements to SONCC coho salmon critical habitat in the action area. Specifically, implementation of the FMS is expected to improve hydrologic function, improve stream temperatures during the summer months, and provide increased temperature connectivity among temperature refugial areas. Construction of secondary habitat elements is also expected to provide reach level benefits by creating more favorable conditions that allow coho salmon to expand their distribution and improve adult to smolt survival rates. Placement of large wood is expected to improve cover complexity, increase velocity diversity, increase channel depth, and provide important cover from predators and provide sheltered areas that provide some protection from seasonal high flow events. Introduction of spawning gravels is also expected to provide immediate benefits to spawning adults and may improve diversity and production of invertebrate food items important to fry and juvenile salmon. Considered overall, the proposed action is expected to result in improved value

of critical habitat for conservation in the action area and increases in the abundance, productivity, and distribution of SONCC coho salmon in the action area over time as various BMAs are completed.

2.5.7 Dewatering and SONCC coho salmon relocation

Any of the construction projects that include in-water work, whether associated with Routine Agricultural Activities or BMA projects, could potentially require dewatering and associated SONCC coho salmon relocation. Examples of these types of project in the proposed action include installing or removing diversion structures, installing or removing push-up dams, fish screen installation or maintenance, or LWD construction. All project sites that require dewatering will include SONCC coho salmon relocation. A qualified biologist, as identified by NMFS and CDFW, will capture and relocate coho salmon away from the project work site to minimize adverse effects of dewatering. Coho salmon in the immediate project vicinity will be captured by seine, dip net and/or by electrofishing, and will then be transported and released to a suitable instream location.

2.5.7.1 Exposure

Although the in-water work window overlaps with the beginning of the adult coho salmon migration season, due to their large size, conspicuousness, and avoidance behavior, these protective measures are expected to be sufficient to prevent any harm to adult SONCC coho salmon via dewatering. However, juvenile coho salmon are less likely to avoid detention in project work areas and would be captured and relocated during dewatering activities.

2.5.7.2 Response

Fish relocation activities may injure or kill rearing juvenile coho salmon. Any fish collecting gear, whether passive or active (Hayes 1983), has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip-netting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Habera et al. 1996, Nielsen 1998, Habera et al. 1999, Nordwall 1999).

Most of the stress and death from handling result from differences in water temperature between the stream and the temporary holding containers, dissolved oxygen levels, the amount of time that fish are held out of the water, and physical injury. Handling-related stress increases rapidly if water temperature exceeds 18 °C or dissolved oxygen is below saturation. A qualified fisheries biologist will relocate fish, following both CDFW and NMFS electrofishing guidelines. Because of these measures, direct effects to, and mortality of, juvenile coho salmon during capture will be greatly minimized.

Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-

term stress from crowding at the relocation sites. Relocated fish may also have to compete with other salmonids, which can increase competition for available resources such as food and habitat. Some of the fish at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and lower fish densities. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

Fish relocation activities are expected to minimize individual project impacts to juvenile coho salmon by removing them from restoration project sites where they would have experienced high rates of injury and mortality. Fish relocation activities are anticipated to only affect a small number of rearing juvenile coho salmon within a small stream reach at and near the project site and relocation release site(s). Rearing juvenile coho salmon present in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the effects associated with fish relocation are anticipated to be non-lethal. However, a very low number of rearing juvenile coho salmon captured may be injured or killed. In addition, the number of fish affected by increased competition is not expected to be significant at most fish relocation sites, based upon the suspected low number of relocated fish inhabiting the small project areas. Effects associated with the fish relocation activities will be significantly minimized by following the measures included in the Requirements for Covered Species Relocation and Dewatering Activities Section of the Agreement.

2.5.7.3 Risk

NMFS considered several pieces of information when estimating number of coho salmon that may be captured, injured, and killed each year from the dewatering and relocation activities. The NOAA RC monitoring reports from the Arcata Office Programmatic Biological Opinion show that the program dewaters approximately 36 percent (14 out of 39 projects) of the projects that occur under the programmatic biological opinion (NMFS 2012). When estimating the maximum number of coho salmon that may be captured each year, NMFS used the NOAA RC monitoring reports to assess the actual number of coho salmon captured, injured, and killed in the SONCC coho salmon ESU. NMFS used the highest percentage (1 percent) recorded under the NOAA RC program to estimate the percent of SONCC coho salmon that would be injured or killed each year. Based on the various proposed projects and estimated timelines for completion (Table 9), NMFS expects that as many as 14 projects could be completed in a single year during the first five years. After the first five years, some projects are expected to still occur each year, but many of the proposed projects are expected to have been completed. The data from NOAA RC varies greatly. However, it shows on average that 40 coho salmon are captured and relocated per project, although as many as 300 were captured during a single project. Because the action area includes some of the densest juvenile rearing populations in the Klamath Basin, NMFS expects the number of juveniles relocated per project will be higher than average (40) but less than the maximum (300). NMFS estimates an average of 100 juvenile coho salmon will be relocated per project and that up to 14 projects per year will be implemented. Therefore, 1,400 juvenile SONCC coho salmon could potentially be captured annually during projects that require dewatering, of which up to 14 may be injured or killed annually.

2.5.8 Research and Monitoring

Various monitoring elements are proposed as part of the Agreement as described in Section 1.3.1.4 above. These include implementation and effectiveness monitoring at specific BMA project sites (Table 3), and effectiveness monitoring related to the FMS including flow and water temperature (Table 2). Validation monitoring may include spawning surveys, juvenile snorkel surveys and tagging, and operation of PIT tag arrays. None of the activities are expected to appreciably impact instream or riparian habitat, and only capture and tagging studies, which are discussed in Section 2.5.8.1 below, are expected to appreciably impact individual coho salmon. Juvenile coho salmon may be captured and handled, but adult coho salmon may only be observed via visual survey. This monitoring is aimed at further assessing habitat conditions and fish distribution and response to improvements in the action area. As an added benefit, the proposed habitat monitoring will allow the Permittees, NMFS, and CDFW to react to changing conditions and new data so that impacts are minimized and a net benefit to the species remains.

Again, the proposed research activities would have no measurable effects on SONCC coho salmon habitat.

2.5.8.1 Effects of capturing, handling, and tagging for research and monitoring

Most of the monitoring and research that is included as part of the proposed action will not directly impact coho salmon, but under validation and effectiveness monitoring some take may occur via capturing and tagging individual coho salmon. While the exact details and extent of that take is not currently understood, NMFS authorizes substantial research and monitoring take of ESA listed species via our section 10(a)(1)(A) and Section 4(d) research programs, and we have substantial knowledge of the harm associated with the capture and tagging methods that could be proposed. While the proposed activity would provide a net benefit by providing valuable monitoring and research data, capturing, handling, and releasing fish generally leads to stress and other sub-lethal effects, but the fish do sometimes die from such processes. The following subsections describe the types of activities being proposed.

2.5.8.1.1 Observing

Validation monitoring could involve direct observation during snorkel surveys (juvenile and adult coho salmon) or spawning surveys (adult coho salmon). Direct observation is the least disruptive method for determining a species' presence/absence and estimating their relative numbers. Its effects are also generally the shortest-lived and least impactful of the research activities discussed in this section because a cautious observer can effectively obtain data while only slightly disrupting the fishes' behavior. NMFS expects only minimal behavioral disruption and no injuries or deaths are expected to occur. Because these effects are so small, there is little a researcher can do to mitigate them except to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves. However, because the effects are so small, no harassment, injury, or mortality is expected to be associated with observation activities. Therefore, no adverse effects to adult or juvenile coho salmon are expected as a result of the proposed research and monitoring involving fish observation.

2.5.8.1.2 Capturing/handling

Any physical handling can be stressful to fish (Sharpe et al. 1998). The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures between the river and wherever the fish are held, unsuitable dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18º Celsius or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process and fish can experience stress and injury from overcrowding in traps if the traps are not emptied regularly. The ESP terms and conditions would stipulate measures to mitigate or avoid factors that commonly lead to stress and trauma from handling, and thus minimize the harmful effects of capturing and handling fish.

2.5.8.1.3 Seines and Block Nets

A seine is a net that traps fish by encircling them with a long wall of webbing. Typically, the top edge of a seine has floats, the bottom edge is weighted, and the seine has a brail (wooden pole) on each end. As the net is closed the fish become concentrated in the net. Seines are usually large enough that they are fished by two or more people though can be small enough to be fished by one person. Generally, seines are set in an arc around the targeted fish and then dragged to shore. Seines are effective for sampling littoral areas of lentic habitats. In lotic habitats, seines are most easily used in areas of low velocity, but can be used in high velocity areas if the brails are held in place while someone approaches the net from upstream, herding fish into the net. To be most effective, a seine needs to be deployed quickly enough that the target species cannot escape the encircling net. Accordingly, habitat structure and complexity negatively influence seine efficiency by reducing the speed at which one deploys a seine and by offering escape cover. Small fish can be gilled in the mesh of a seine. Scales and dermal mucus can be abraded by contacting the net. Fish can be suffocated if they are not quickly removed from the net after the net is removed from the water to process the fish. In addition, the fish can be crushed by the handler when removing the net from the water.

While capturing fish with seine or block nets, fish may be injured or killed. Small fish may be gilled in the mesh of a seine and potentially injured. Fish can be suffocated if they are not quickly removed from the net after the net is removed from the water to process the fish. Scales and dermal mucus can be abraded if fish contact the net. Also, the fish can be crushed by the handler when removing the net from the water. To reduce the risk of injury to fishes, researchers will utilize seines with knotless nylon mesh to minimize scale and mucus abrasion. Seine tows will be of short duration and distance to prevent suffocation and to ensure that no debris (rocks, logs, etc.) are trapped in the seine that may suffocate or crush fish. Researchers will also select the smallest mesh-size seine that is appropriate to achieve sampling objectives to reduce the probability that smaller fish will become gilled in the net.

2.5.8.1.4 Electrofishing

Electrofishing can cause a suite of effects ranging from simply disturbing the fish to actually killing them if the voltage is not appropriate for the water conditions or fish size. The amount of unintentional mortality attributable to electrofishing varies widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have

severe effects on adult salmonids when conducted improperly. Adult salmonids can suffer from spinal injuries caused by the forced muscle contraction following electrical shocks that are too strong. For example, Sharber and Carothers (1988) reported that improperly conducted electrofishing killed 50 percent of the adult rainbow trout in their study.

Permit conditions will require that all Permittees and their contractors follow NMFS's electrofishing guidelines (NMFS 2000). The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. All areas will be visually searched for fish before electrofishing may begin. Electrofishing will not be conducted in the vicinity of known redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators will work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units are used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate are kept at minimal levels and water conductivity is tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care. In all cases, electrofishing will only be is used only when other capture methods are not feasible.

2.5.8.1.5 Dip Nets

Dip nets are bag-shaped nets affixed to a frame attached to a handle. The net is placed under the fish and then lifted from the water in a scooping motion. Dip nets are useful when collecting fish that have been trapped by other methods, such as electrofishing or trap nets. Scales and mucus can be abraded by the net, and fish can be crushed by the frame when the handler is attempting to catch them.

2.5.8.1.6 Tissue Sampling

Tissue sampling techniques such as fin-clipping are common to many scientific research efforts using listed species. All sampling, handling, and clipping procedures have an inherent potential to stress, injure, or even kill the fish. Tissue sampling is a common practice in fisheries science characterizing the genetic "uniqueness" and quantifying the level of genetic diversity within a population. Tissue samples should be a small (< 1.0 cm2) fin-clip collected from soft pelvic or caudle fin tissues using a pair of sharp scissors. Tissue samples should be preserved in individually labeled vials containing 95 percent ethanol. The adverse effects of fin-clipping ESA-listed salmonids may include stress and injury from handling and damaged fins resulting in infection and delayed mortality. However, in general, most wounds caused by partial fin-clips heal quickly and do not alter fish growth.

Researchers will follow several precautionary measures to reduce the risk of stress and injury to ESA-listed salmonids from fin-clipping, including: (1) only a very small amount of fin tissue (not more than 1.0 cm^2) will be collected from any fin, but primarily the upper lobe of the caudal fin; (2) fin-clips will be collected only from ESA-listed salmonids which appear to be in good

condition and are not exhibiting injuries or abnormal behavior; and (3) all ESA-listed salmonids will be closely observed and allowed to recover fully before being released.

2.5.8.1.7 Tagging/Marking

Techniques such as PIT tagging, coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays passive signals to a radio receiver and allows individuals carrying the tags to be identified whenever they pass a location containing such a receiver without researchers having to recapture and handle the fish again to record its presence in the area. A PIT tag is usually inserted into the body cavity of the fish just in front of the pelvic girdle.

When implanted by experienced technicians using establishes methods, PIT tags have been shown to have very little effect on growth, mortality, or behavior. Some reported studies of PIT tags have shown no effect on growth or survival (Prentice et al. 1987, Prentice et al. 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 kilometers), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 were similar to growth rates for salmon that were not tagged (Rondorf and Miller 1994). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids. However, other studies have shown that PIT tags can have negative impacts on fish survival (e.g., Knudsen et al. 2009). Therefore, established protocols must be followed when implementing PIT tagging studies.

2.5.8.2 Exposure

Because the exact validation monitoring projects are yet to be proposed, the number of juvenile coho salmon that could be captured is yet to be determined. However, NMFS and CDFW must approve any proposed validation monitoring projects and would ensure that projects capture the minimum number of fish necessary to achieve beneficial study objectives, and that all researchers work together so as not to duplicate sampling effort when sampling would result in adverse effects to SONCC coho salmon. Therefore, given the general level of anticipated sampling, and expected capture efficiency of approved sampling methods, we anticipate that the majority of juvenile coho salmon present in the covered area during monitoring would not be effected by research and monitoring activities.

2.5.8.3 Response

NMFS has substantial experience related to monitoring and research of ESA listed salmonid species via our ESA section 10(a)(1)(A) and section 4(d) research programs. Because the majority of the fish that would be captured and tagged are expected to recover with no ill effects,

the true effects of the proposed action are best seen in the context of the fish that the action is likely to kill. For the capture methods included, permitted unintentional mortality associated with research and monitoring for NMFS research permits is typically two percent of total captured individuals. This estimate is conservatively protective for listed species because actual reported mortality is generally substantially less than that. NMFS and CDFW will review research and monitoring proposals and reporting to ensure that two percent reported mortality of juvenile SONCC coho salmon is not exceeded in the action area.

2.5.8.4 Risk

The research and monitoring could kill, at most, two percent of the juvenile population of SONCC coho salmon in the action area. This is a small effect, and it is certainly an overestimate, because sampling efforts will not occur over the entire Covered Area, sampling is unlikely to occur in all years, and collection methods do not have perfect capture efficiency. Therefore, the impact on the species' abundance in the action area would almost certainly be below 2 percent. An effect of the research that cannot be quantified is the conservation benefit to the species resulting from the research; the data collected would be used to inform future management actions in the action area.

2.5.9 Supplementation

Due to low abundance of SONCC coho salmon in the Shasta River, NMFS, CDFW, Humboldt State University, and other interested parties developed a coho supplementation program proposal. The proposed program was developed to utilize key cold water refugia, and other high quality habitats as locations to out plant adult coho salmon. Agreement landowner properties comprise the entirety of these habitats. As a result of landowners agreeing to provide access for out planting and monitoring activities, coho supplementation efforts, which have stalled since 2013, can be re-considered as a viable means to improving abundance of the Shasta coho salmon population. Supplementation has been identified as a next step for increasing population numbers, with a long-term goal of increasing the abundance of natural-origin SONCC coho salmon. The potential for supplementation that is provided by the proposed action could benefit SONCC coho salmon by increasing abundance in the future, but because there are no clear plans (e.g., responsible party, timeline for implementation, etc.) to implement a supplementation project at this time, future additional permitting and ESA consultation analyzing the effects of that action would be required before this benefit could be realized.

2.5.10 Flood or Emergency Events

The Agreement notes that managing flood or emergency events may require immediate work needed to prevent loss of or damage to property from emergencies, including flood, fire, storm, earthquake or other unexpected natural events. These activities may include sediment and debris removal and stream bank or crossing stabilization (Section 2.5.1.2.6), emergency fish screen repairs (Section 2.5.2.3), fencing repairs (Section 2.5.1.2.3), and moving livestock or equipment across streams during emergencies (Section 2.5.1.2.4). Although similar activities are included and analyzed in this opinion, the extent of responses to floods or other emergencies cannot be predicted in advance. In order for the activities to be covered under this opinion, they must be completed in a manner that is similar to the actions described in this opinion (e.g., debris

removal must protect, and not destroy riparian habitat). If NMFS determines that the emergency response activities result in effects larger than are considered in this opinion then those actions will require additional consultation.

2.5.11 Future return to ESA Section 10 Baseline Conditions

The ESPs do not authorize actions that would cause habitat conditions for the Covered Species to go below the agreed upon ESA section 10 Baseline Conditions or ESA section 10 Elevated Baseline Conditions, as applicable, as described in each Site Plan Agreement. The ESA Section 10 Baseline Conditions and Elevated Baseline Conditions described in the Site Plan Agreements (e.g., maintaining compliant fish screen, maintaining roughened channels that are suitable for fish passage, maintaining improved pasture and grazing management practices, maintaining fish screen and diversion structures, etc.) are conditions that provide suitable habitat and would not cause harm to SONCC coho salmon individuals or their critical habitat. This is especially true for the ESA Section 10 Elevated Baseline Conditions, which represent long-term improved conditions for SONCC coho salmon. Therefore, NMFS does not anticipate take of SONCC coho salmon associated with returning to ESA Section 10 Baseline or Elevated Baseline Conditions.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the ESA Section 7 environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the ESA Section 7 environmental baseline (Section 2.4).

NMFS coordinates closely with the private and public (CDFW) landowners in the action area. Due to the action area comprising the contiguous properties of the agreement, NMFS does not anticipate cumulative effects that are otherwise not described as part of the proposed action or the environmental baseline in this opinion. Therefore, beyond the actions contemplated in this opinion, no future state or private activities with likely impacts to instream or riparian habitat are anticipated at this time.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section,

we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

SONCC coho salmon have experienced a serious decline in abundance, and long-term population trends suggest a negative growth rate. Human-induced factors have reduced historical populations and degraded habitat, which in turn has reduced the ESU's resilience to natural stochastic events, such as droughts, floods, and variable ocean conditions. Prominent threats to SONCC coho salmon recovery that affect the Shasta River and tributaries, one of five populations in the Interior Klamath Diversity stratum, include agriculture and dams/diversions. Most areas in need of habitat restoration are located on private land, and landowners have been historically apprehensive about cooperatively working with state and federal agencies to recover threatened and endangered species on their property. Up to 53% of the SONCC coho salmon critical habitat is within private land holdings across the ESU's geographic area in Oregon and California. Thus, management of private lands are important to the survival and recovery of the SONCC coho salmon. Demonstrating that agency/landowner cooperation can benefit both parties is paramount to achieving recovery in the Shasta River basin, and elsewhere in the Klamath Basin, and the Agreement represents an important step toward forging further relationships that can foster further safe harbor agreement development in the future.

Aquatic species cannot only benefit from improved instream habitat, but also by activities on lands adjacent to streams and within the watershed that subsequently affect water quality and habitat. A major step in the recovery and conservation of the SONCC coho salmon ESU is to encourage their presence and appropriate management of their habitat on private lands. The Agreement sets a goal of protecting and enhancing aquatic and terrestrial (riparian) habitat through implementation of Beneficial Management Activities including barrier removals, instream flow improvement strategies, and physical habitat enhancements within the action area. Again, much of the proposed action will be integral in supporting the recovery strategy outlined in NMFS's recovery plans for the SONCC coho salmon ESU. High priority recovery actions identified for the action area include increasing instream flows by securing unused water rights and establishing a water trust to benefit salmon, increasing cold water in the Upper Shasta basin, reducing water temperatures and increasing dissolved oxygen, increasing instream flows by improving the GID ditch diversion to decrease impacts to SONCC coho salmon, addressing passage concerns in Parks Creek, and reducing warm tailwater inputs into the stream (NMFS 2014). These recovery actions are directly addressed by the proposed action. By including the Enrolled Properties in this Agreement, the SONCC ESU of coho salmon is likely to see increased productivity, survival, and spatial structure in the covered reaches.

Another critical component of the Agreement is the proposed riparian restoration and protection projects. Similar to the above argument, the Permittee's plans, soil moisture sensors, tailwater maintenance, livestock exclusion fencing, wet crossing maintenance AMMs, and riparian vegetation restoration will not only minimize impacts in the action area resulting from their

grazing operations, but also demonstrate these techniques to other landowners in the basin who may choose to implement similar actions in the future. The development of the Flow Management Strategy and the associated Diversion Reduction Schedule and Forbearance Agreement, entered into by the Permittees, represents an important example for how science based decision making can provide critical habitat benefits to listed species while still allowing private land owners to functionally utilize their properties. The implementation of the associated Adaptive Management Program will increase the likelihood that the Agreement is successful, and provide additional insights to inform future projects in the Klamath Basin.

Global climate change presents another real threat to the long-term persistence of the three species, especially when combined with the current depressed population status and human caused impacts. Regional (i.e., North America) climate projections for the mid to late 21st century expect more variable and extreme inter-annual weather patterns, with a gradual warming pattern in general across California and the Pacific Northwest. However, extrapolating these general forecasts to our smaller action area is difficult, given local nuances in geography and other weather-influencing factors. Assuming these regional climate change forecasts apply to the Shasta River watershed, coho salmon in the action area may experience greater stress from warmer water temperatures during the duration of the Agreement (20 years). However, cold spring-fed systems, such as much of the action area, can function as cold-water refugia for the SONCC coho salmon ESU should ambient water temperature rise in the future due to climate change.

In conclusion, the Agreement will improve instream flow, water temperature, hydrologic function, riparian function, and adult and juvenile passage conditions within the action area for SONCC coho salmon. Even with these improvements, the Permittees' continued diversion operations and other agricultural activities will likely still limit the rate and spatial extent of habitat recovery, adversely affecting coho salmon critical habitat to some extent and resulting in small amounts of harm to coho SONCC coho salmon. There will also be some injury and mortality of juvenile SONCC coho salmon due to both research and monitoring, and from relocation due to dewatering for construction projects. Despite the fact that the Shasta River basin is somewhat resilient to the effects of climate change, impacts of continued Routine Agricultural Activities, including water diversions, will likely be exacerbated by climate change related impacts to snow pack and ambient air temperature. Therefore, the extent to which the benefits of the proposed BMAs and AMMs will be realized will be related in part to the timeline for completion for the various proposed projects, including attaining the proposed diversion reductions.

NMFS expects the net effects of the proposed action on the Shasta River population of SONCC coho salmon to be an overall improvement to population viability. The adverse effects, which include harm, injury, and death to small numbers of juvenile coho salmon, will be offset in the near term through recent and near term improvements to habitat in the Covered Area. Several of the projects to improve habitat conditions under the Agreement have already been implemented and are currently affording suitable conditions to meet the habitat needs of the Shasta coho salmon population in the action area. Even with current operations, the action area maintains some coldwater springs refugial areas that provide functional habitat for rearing juvenile SONCC coho salmon and make the population of SONCC coho salmon in the action area somewhat

resilient to the adverse effects of the agricultural activity. The action area also currently maintains some functional adult spawning habitat. Within five years, the proposed action is expected to progressively expand and improve these key habitat features.

Once the majority of the BMAs and AMMs are implemented and being maintained, NMFS anticipates further improvements to SONCC coho salmon habitat, and an additional positive effect on SONCC coho salmon abundance, productivity, and spatial distribution in the action area.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the SONCC coho salmon ESU, or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows: 1) NMFS anticipates the proposed action will result in incidental take in the form of harm to SONCC coho salmon ESU critical habitat through Routine Agricultural Activities that, even with the use of AMMs, decrease flow and elevate water temperatures, 2) NMFS anticipates direct take of juvenile SONCC coho salmon individuals due to dewatering and relocation (Section 2.9.1.2), and 3) NMFS anticipates direct take of juvenile SONCC coho salmon due to research and monitoring (Section 2.9.1.3). Quantifying and measuring the amount of incidental take from fish relocation and monitoring is achievable through the described monitoring and reporting, but quantifying the amount or extent of incidental take of SONCC coho salmon from Routine Agricultural Activities is difficult since this incidental take occurs as a result of hydrologic changes and water quality impacts. NMFS cannot quantify the amount or extent of

incidental take from these hydrologic changes and resulting habitat-based effects in terms of numbers of individuals of coho salmon since finding dead or impaired specimens resulting from habitat-based effects is unlikely because of the dynamic nature of riverine systems, including variations in hydrologic conditions, variations in the population size of coho salmon, annual variations in the timing of spawning and migration, and variations in habitat use within the action area. When NMFS cannot quantify the amount or extent level of incidental take in terms of the numbers of individuals, NMFS uses surrogates to estimate the amount or extent of incidental take. In this opinion, NMFS uses the following surrogate to estimate the amount of take from routine agricultural activities: completion of critical restoration actions (Section 2.9.1.1). This surrogate is quantifiable and may be monitored, serving the intended role as a clear reinitiation trigger.

2.9.1.1 Completion of Critical Restoration Actions

Benefits to coho salmon are expected to be fully realized in a phased approach as water conservation projects described in individual Site Plan Agreements are completed (Table 9). The Effects of the Action Section above considers the potential effects of the proposed action assuming that the various beneficial components will be completed under the indicated timelines for completion. However, if actions that are expected to have beneficial impacts on habitat in the action area are not substantially completed as scheduled, then the incidental take from the proposed action will be greater than the amount of take anticipated in this opinion.

Most of the BMA proposed projects that have the most beneficial impacts on SONCC coho salmon (e.g., diversion structure improvements or movement of diversion points, diversion screening, installation of LWD, creation of off-channel/side-channel habitat, and riparian restoration and revegetation) are anticipated to be completed within five years of issuance of the ESPs. The Adaptive Management Program (Appendix 3 of the Agreement) includes required annual reporting, which NMFS and CDFW will be administering. The Adaptive Management Program also includes a five-year check-in, at which point NMFS and CDFW will assess the cumulative effectiveness of the Agreement relative to making a contribution towards recovery of the Covered Species. If at that point, at least 80% of the proposed projects that provide the greatest contributions to improved conditions for SONCC coho salmon (diversion structure improvements or movement of diversion points, diversion screening, installation of LWD, creation of off-channel/side-channel habitat, and riparian restoration and revegetation) have not been completed then take will be considered exceeded. This surrogate is quantifiable and may be monitored, and is proportional to the take of the species from routine agricultural activities because we assumed the realized benefits of these proposed actions, and the likelihood of their completion on schedule in the effects analysis of this opinion.

2.9.1.2 Dewatering and Relocation

Juvenile coho salmon will be captured, wounded, or killed from the dewatering and fish relocating activities at project sites. Based on monitoring data of similar activities described in this opinion, we concluded 100 coho salmon may be captured and relocated per project, and up to 1 percent of those captured may be injured or killed. NMFS identified that, on average, 14

projects may be completed annually. Juvenile coho salmon that avoid capture in the project work area will die during dewatering activities. NMFS expects that the number of coho salmon that will be killed as a result of barrier placement and stranding during site dewatering activities is very low, likely far less than one percent of the total number of salmonids in the project area. Based on information that 100 coho fry and juveniles are estimated to be captured and relocated per project, and of those captured and relocated, up to 1 percent are estimated to be injured or killed, and the parties are expected to complete up to 14 projects annually, NMFS expects no more than 1,400 juvenile and fry SONCC coho salmon are expected to be captured and relocated annually and up to 14 may be injured or killed annually, either during capture and relocation or by dewatering. These thresholds are quantifiable, will be monitored, and will be reported at specific times during the proposed action, as described in more detail in the terms and conditions below, serving as clear, effective reinitiation triggers throughout the term of the proposed action.

2.9.1.3 Research and Monitoring

The proposed action does not include a specific amount of take for research and monitoring associated capture, handling, and tagging, but does include the possibility for Permittees or implementing agencies to include take for these activities via supplemental request, as described in the Agreement. Research and monitoring may include mortality during the capture and tagging of up to two percent of juvenile SONCC coho salmon in the action area annually. Again, this mortality rate for the allowed research and monitoring techniques will certainly be an overestimate for morality rate for the juvenile SONCC coho salmon population in the Covered Area because sampling efforts will not occur over the entire Covered Area, and collection methods do not have perfect capture efficiency. Mortality during capture and tagging activity can be monitored, so this threshold is quantifiable, will be monitored, and will be reported, and is thereby an effective reinitiation trigger throughout the term of the proposed action.

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes the following reasonable and prudent measure is necessary and appropriate to minimize take of SONCC coho salmon:

1.) When completing Routine Agricultural Activities and BMAs, all Permittees shall follow the AMMs and monitoring and reporting requirements as described in their ESPs.

2.9.4 Terms and Conditions

1.) The Terms and Conditions of each ESP are incorporated by reference here. This term and conditions implements reasonable and prudent measure 1 above.

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information. NMFS coordinated closely with the Permittees and CDFW during the development of the Agreement, and we have no further conservation recommendations for the Permittees at this time. However, given the importance of non-Federal lands in the Klamath Basin and across the SONCC coho salmon ESU, NMFS intends to pursue additional Safe Harbor Agreements with other non-Federal partners in the SONCC coho salmon ESU to provide further benefits to SONCC coho salmon critical habitat and to advance the priority restoration actions in the SONCC coho salmon Recovery Plan (NMFS 2014).

2.11 Reinitiation of Consultation

This concludes formal consultation for on the proposed action. As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect"' Determinations

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

2.12.1 Southern DPS Killer Whales

We determined that the proposed action may affect, but is not likely to adversely affect, the Southern Resident Killer Whale DPS (again, Southern Residents). The action area is not within areas designated as critical habitat for Southern Residents. There is a potential impact of the proposed action to affect southern DPS Killer Whale via impacts to their prey resources, namely Chinook salmon. However, for the reasons described below, we found that effect of the proposed actions on Chinook salmon in the action area will either be completely beneficial or insignificant.

The Southern Resident Killer Whale DPS, composed of J, K and L pods, was listed as endangered under the ESA in 2005 (70 FR 69903 (November 18, 2005)). A 5-year review under the ESA completed in 2016 concluded that Southern Residents should remain listed as endangered and includes recent information on the population, threats, and new research results and publications (NMFS 2016). Again, the action area does not include the area designated as critical habitat for Southern Residents. Therefore, this section does not examine the condition of critical habitat for Southern Residents or further address such critical habitat.

Southern Residents consume a variety of fish species (22 species) and one species of squid (Ford et al. 1998, Ford et al. 2000, Ford and Ellis 2006, Hanson et al. 2010, Ford et al. 2016), but salmon are identified as their primary prey. Southern Residents are the subject of ongoing research, including direct observation, scale and tissue sampling of prey remains, and fecal sampling. The diet data indicate that the whales are consuming mostly larger (i.e., older) Chinook salmon. Chinook salmon is their primary prey despite the much lower abundance in some areas and during certain time periods in comparison to other salmonids, for reasons that remain unknown, but factors of potential importance include the Chinook salmon species' large size, high fat and energy content, and year-round occurrence in the whales' geographic range.

Although Southern Residents consume Chinook salmon, including potentially the Chinook salmon that originate in the action area. The Chinook salmon in the Shasta River, including the action area, are part of the Upper Klamath Trinity River (UKTR) ESU, which is not listed under the ESA. Juvenile Chinook salmon can display either a "stream type" or "ocean type" life history strategy where the "stream type" rears for a greater length of time in freshwater than the "ocean type." However, Williams et al. (2013) determined that juvenile Chinook salmon in the UKTR ESU typically do not display the "stream type" strategy. Therefore, juveniles in the Klamath and Trinity rivers will usually outmigrate shortly after emergence between March and June. The majority of the negative impacts of the proposed action are to hydrologic and water quality conditions during the summer months, when juvenile Chinook salmon are no longer in the system. The vast majority of in water construction work will be completed when Chinook salmon are not present. In addition, many of the habitat improvements that are intended to provide habitat benefits for coho salmon (e.g., spawning gravel augmentation, barrier modifications to improve passage, etc.) will be beneficial for Chinook salmon as well. Therefore, the effects of the proposed action on Southern Residents are considered insignificant. Based on this analysis, NMFS finds that the proposed action is not likely to adversely affect Southern Residents.

3 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

EFH managed under the Pacific Coast Salmon Fishery Management Plan may be adversely affected by the project. Habitat Areas of Particular Concern (HAPCs) for pacific salmon are: complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation (see descriptions of salmon HAPCs in Appendix A to the Pacific Coast Salmon Fisheries Management Plan (FMP).

3.2 Adverse Effects on Essential Fish Habitat

The adverse effects of the project on EFH have been described in the preceding biological opinion in section 2.5 (Effects of the Action). To summarize, the project may impact salmonid habitat via routine agricultural activities including water diversions and grazing. The principal impacts of these activities are to hydrology and water quality. The diversions are constrained by a diversion reduction schedule that was informed by a flow management strategy that considered the instream flow needs of salmonids. The project is proposed with design, monitoring, AMMs and adaptive management strategies meant to avoid or minimize adverse effects to EFH of the project, and with elements to promote habitat recovery. As such, NMFS anticipates the proposed project may result in temporary and minimal adverse effects to EFH, and is likely to result in a net improvement in EFH conditions. Thus, no EFH conservation recommendations are currently provided.

3.3 Supplemental Consultation

NMFS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are NMFS and the Permittees. Individual copies of this opinion were provided to the Permittees. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. It adheres to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH response contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses included or incorporated by reference are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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6 APPENDICES

Appendix 1 – Site Plan Agreements

Proposed actions from each Site Plan Agreement are summarized in this appendix. Each Site Plan Agreement includes sections to describe each action stage (i.e., Present Baseline, Elevated Baseline, or Beneficial Management Activity), and each habitat parameter/action type (i.e., hydrology/water quality, passage/migration/screening, instream habitat complexity, riparian condition/function, substrate quality, pasture management, assessment/studies, and supplementation). If projects may affect multiple habitat parameters (e.g., tailwater reduction is related to both hydrology/water quality and pasture management), then the project is only described for the section in which it is first described in the associated Site Plan Agreement, but the effects of the project on all habitat parameters are still considered in this document. If Permittees are not planning to implement any actions for a given habitat parameter/action type then those sections are omitted from the following summaries.

A1.1 Belcampo-North Annex Property (Permit 23271)

The Belcampo-North Annex Property is a privately owned property, owned and operated by Outpost M-R LLC. The Belcampo-North Annex property is located on the Mid Shasta Reach. Under the Site Plan Agreement for this Enrolled Property, Outpost M-R LLC proposes the actions summarized in this section. Outpost M-R LLC agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in the individual Site Plan Agreement.

A1.1.1 Actions required to maintain baseline conditions

A1.1.1.1 Hydrology/Water Quality

- For increased delivery and irrigation efficiencies, Outpost M-R LLC will continue to maintain existing pipeline infrastructure that has been added to replace open unlined ditches over the past years in several pastures for better irrigation efficiency, reduce water usage and maintain efficiency of open ditches.

- Tailwater and reuse systems have been developed in the pastures where flood irrigation occurs. Tailwater will continue to be collected in open ditches, pipelines and developed sump ponds with return systems. Collection and reuse systems will be maintained and operated.

- Existing livestock watering systems, other than the Shasta River will continue to be developed, used and maintained including: ponds, ditches, and/or water troughs to reduce impacts to the riparian area.

A1.1.1.2 Riparian Condition

- Outpost M-R LLC agrees to a continued intensively managed grazing schedule for pastures riparian to and adjacent to the Shasta River. The riparian areas grazed by livestock and are observed daily and moved prior to impacts to riparian species using electric cross fencing to reduce impacts to riparian area. Grazing practices will continue to ensure protection of existing riparian and promote riparian expansion along Shasta River

A1.1.1.3 Pasture Management

- Outpost M-R LLC will continue to implement Intensive and Holistic Pasture management to avoid overgrazing. Over grazing has been associated with increased tailwater production and heating, sedimentation, increased water use, etc. Pastures are divided into 30 to 50 distinct areas through which the livestock are rotated based upon the size of the herd and the size of the pasture. Herd movements are done based upon the height of the grass (amount of available feed) for the size of the herd. Livestock will remain in a designated pasture until another pasture has enough height (volume) of grass to support the herd or when the grass in the current holding pasture is at a general stubble height of 4” or more. Livestock are provided hay (grown off site) during winter/early spring periods as well as times when pasture grass is unavailable due to weather conditions (drought conditions, etc.).

A1.1.2 Actions required to achieve elevated baseline conditions

Outpost M-R LLC is not proposing to implement any activities to achieve elevated baseline conditions.

A1.1.3 Additional Beneficial Management Activities

A1.1.3.1 Hydrology/Water Quality

- Outpost M-R LLC agrees to work with UC Extension Service to install soil moisture sensors throughout the ranch under advisement with UC-Extension to monitor irrigation application and ensure adequate irrigation without over application of water. Outpost M-R LLC commits to having up to three soil moisture sensors installed by the close of the 3rd year of the agreement.

- Outpost M-R LLC agrees to support and allow GID access to improve delivery efficiency through installation of a pipeline from its POD on Shasta River through Permittee property to Grenada Irrigation District boundary. Permittee will work with and grant necessary easements to implement and maintain proposed pipeline project so as long as the impacts to Belcampo are minimized. This project is in the design and planning phase and will end with a completed design by early 2019. Implementation is intended to occur by 2021.

A1.1.3.2 Passage/Migration/Diversion Screening

- Outpost M-R LLC encourages the development of beaver dams on the reach to further expand the presence of pools and cover. Such dams are found on other reaches and expected to occur along this reach in the future. The Permittee will adhere to the Beaver BMPs from the 1st year through the end of the agreement.

A1.1.3.3 Instream Habitat Complexity

- As riparian planting is completed and riparian woody species mature, they will become a natural source of LWD recruitment. Where appropriate, LWD will be left in the stream bed to support cover for various life stages of the Covered Species. In addition, Outpost M-R LLC commits to allow access, assist in seeking funding and implementation of habitat improvement projects as specified on the Habitat Improvement maps. Specifically, Outpost M-R LLC will allow the installation of up to 40 pieces of LWD along up to seven outside meander bends to reduce bank erosion and provide instream cover. Outpost M-R LLC commits to provide available materials (trees with root wads, rock) participate in permit development, seeking funds and implementation with funding and permitting made available through public restoration programs by 2023.

A1.1.3.4 Off Channel Habitat

- Outpost M-R LLC commits to reconnect up to three disconnected oxbows to enhance off channel habitat, which will be constructed as specified on the habitat improvement map. Each oxbow will also include the installation LWD at a rate of up to 7-10 structures per oxbow. Outpost M-R LLC will allow access, donate trees for the project and assist with materials development, and use of heavy equipment if needed. Outpost M-R LLC commits to provide materials, participate in permit development, seeking funds and implementation with funding and permitting made available through public restoration programs by 2023.

A1.1.3.5 Riparian Function

- Outpost M-R LLC agrees to allow additional riparian plantings within the riparian areas on the ranch, in addition to areas identified for LWD or off channel project. Permittee agrees to seek funding, allow access, assist in planting, maintenance and protection of up to 3.0 acres of riparian cuttings in 3-5 distinct sites where riparian establishment is consider probable by the close of the 4th year of the agreement.

- Outpost M-R LLC agrees to have a grazing plan developed by UC Extension Service for the riparian area that is protective of riparian establishment. Outpost M-R LLC commits to have the riparian grazing plan complete by the end of the first year of the SHA agreement.

A1.1.3.6 Substrate Quality

- Outpost M-R LLC will allow NMFS and CDFW access to determine the feasibility of the introduction of spawning gravel and will allow implementation of spawning gravel enhancement projects. Up to three sites will be evaluated and potentially implemented.

A1.1.3.7 Pasture Management

- Outpost M-R LLC allow abide by riparian pasture management plan developed by UC Extension Service. Outpost M-R LLC will ensure grazing practices do not impact woody plant and riparian specie development. Because Outpost M-R LLC produces many livestock species and management is more intensive than cattle production, the riparian grazing plan will require additional consideration an input from UC Extension Service. Outpost M-R LLC agrees to work with UC Extension Service to develop a riparian grazing plan by the end of the first year of the agreement.

A1.1.3.8 Assessments/Studies

- Outpost M-R LLC will work with research entities such as UC Davis, Shasta Valley Resource Conservation District (SVRCD), CDFW, USFWS, and NMFS to conduct studies to describe salmonid habitat conditions, life history requirements, habitat utilization and productivity to help inform efforts to improve survival and productivity of coho salmon in the future.

- Outpost M-R LLC will allow for test plots to evaluate the effectiveness of the intensively managed grazing that is employed on the ranch.

A1.1.3.9 Supplementation

- Outpost M-R LLC will allow access for salmonid supplementation and all associated monitoring activities.

A1.2 Big Springs Ranch Wildlife Area (Permit 23276)

The Big Springs Ranch Wildlife Area property (Big Springs Ranch) is owned by the CDFW. The Big Springs Ranch is located on the Mid Shasta Reach and the Big Spring Creek Reach. Under the Site Plan Agreement for this Enrolled Property, the CDFW proposes the actions summarized in this section. CDFW agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.2.1 Actions Required to Maintain Baseline Conditions

A1.2.1.1 Hydrology/Water Quality

- The TNC filed California Water Code Section 1707 petitions with the SWRCB in July 2012 with the expressed intent to recognize fish and wildlife preservation and enhancement as a beneficial use of Big Springs Ranch water rights, while retaining the beneficial uses of irrigation and stock water. TNC hired Davids Engineering to calculate the consumptive use of the water rights. The consumptive use is the portion of the water right that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. To successfully add fish and wildlife as a beneficial use to the property's water rights, TNC showed that such an action would not harm other water right holders. As a result, SWRCB added instream flow as a beneficial use fish and wildlife preservation and enhancement to the water rights on the property (18.11 cfs) but only the consumptively used portion of these water rights can be bypassed downstream of the Montague USGS measuring weir (USGS 11517000) as specified in the Order approved by the SWRCB on May 8, 2014. Annually, CDFW will notify the Shasta Valley Watermaster District of its intent to leave the water rights instream per the Compliance Plan associated with the 1707 petition.

- Most of the source water associated with the Big Springs Ranch water rights are cold water springs that are highly valuable to Coho Salmon in particular and to the Shasta River Watershed in general. CDFW will maintain irrigation management as described in the Site Plan Agreement.

- If irrigation occurs within the Big Springs Unit, and if tailwater measurably affects stream temperature (i.e., changes stream temperature by more than 0.1 degrees Celsius from upstream to downstream), CDFW will continue to manage the tailwater capture pond installed within the Big Springs unit to prevent tailwater coming from upslope pastures from entering Big Springs Creek. The pond is equipped with temperature monitoring stations that inform CDFW when the temperature of the water is suitable to return into Big Springs Creek. Tailwater that is warmer than the creek is held in the pond until its temperature is the same or lower than Big Springs Creek water.

- When not irrigating, CDFW will close the head gate after the spur ditch heading to Bass Lake to mitigate for any tailwater that may travel on to the property from adjacent properties.

- CDFW commits to maintain the existing off-channel stock water system if livestock are present.

A1.2.1.2 Passage/Migration/ Diversion Screening

- CDFW commits to continuing to monitor and to unplug culverts on Little Springs Creek on an as needed basis until the culverts are removed. CDFW plans to remove the two upper culverts and provide unimpeded passage at the third to reduce thermal loading and provide fish passage.

- CDFW will evaluate the Nelson Unit diversion fish screen and make sure it meets NMFS fish screen criteria. If it does not meet criteria, CDFW shall install a new fish screen within one year from the signing the Agreement. If it does meet criteria, CDFW will maintain the Nelson Unit fish screen when the diversion is in use.

- CDFW will screen all active diversions.

A1.2.1.3 Instream Habitat Complexity

- Natural woody debris from existing trees along the banks throughout the property will be left in place for refugia.

A1.2.1.4 Riparian Condition

- Riparian exclusion fencing has been completed for the entire ranch, excluding cattle from entering the riparian areas. This action has resulted in restored aquatic vegetation and improved bank stabilization. CDFW commits to maintain all riparian fencing into the future if livestock is present.

- CDFW commits to eliminate the five water lanes to reduce negative impacts to the watercourse and replaced with alternative stock water systems. No additional crossings will be developed during the term of the Template Safe Harbor Agreement.

A1.2.1.5 Substrate Quality

- Riparian exclusion fencing has been completed for the entire ranch, which benefits substrate quality due to more stable banks. CDFW commits to maintain all riparian fencing into the future if livestock is present.

A1.2.1.6 Pasture Management

- CDFW may utilize existing pasture units for cattle grazing as an adaptive management tool for enhancing wildlife habitat.

A1.2.2 Actions Required to Achieve Elevated Baseline Conditions

A1.2.2.1 Hydrology/Water Quality

- If long-term irrigation is planned, CDFW will develop a comprehensive, long- term plan for improving irrigation infrastructure and management practices that will continue to diminish any adverse effects on the conservation values that arise from the water diversion, water conveyance, and the means used to apply water.

A1.2.2.2 Passage/Migration/ Diversion Screening

- The culvert on Little Spring Creek at Louie Road is a partial passage barrier to fish. Siskiyou County has funding to replace this culvert with a larger one to reduce impoundment upstream on Little Springs Creek. This project will enhance fish passage to over one mile of habitat on Little Springs Creek. CDFW will provide access as needed to implement the project and tracking general project schedule.

- CDFW plans to remove the two culverts, provide unimpeded fish passage at the third upstream of the County road on Little Springs Creek for fish passage, and water quality benefits within 3 years of signing the Agreement.

A1.2.2.3 Riparian Function

- The CDFW will continue existing management that protects riparian function. CDFW will eliminate the watering lanes and replace with alternative stockwater systems within three years.

A1.2.2.4 Assessments/Studies

- The CDFW will allow access for studies related to the covered species and will provide data from existing studies but does not propose additional actions at this time.

A1.2.3 Additional Beneficial Management Activities

A1.2.3.1 Hydrology/Water Quality

- CDFW commits to maintaining the real-time system and archive real-time data on water temperature and flow at locations described in the Site Plan Agreement.

- The shared management of the water right on Big Spring Lake causes some fluctuation in stream flow that could impact fisheries in Big Springs Creek. CDFW and the neighboring landowner have agreed to a detailed Stipulated Judgment to share the diversion over the irrigation season based on certain criteria described in their Site Plan Agreement.

- The Cardoza Ranch (an adjacent property owner and Agreement Permittee) has a fish passage barrier on Parks Creek that will be alleviated by moving the point of diversion to the

Shasta River on the CDFW's property upstream of the Louie Road Bridge. CDFW will provide an easement for the proposed Cardoza pump station and all associated infrastructure upstream of the Louie Road Bridge. The implementation schedule for this action is currently estimated to occur within 2 years of the signing of this Site Plan Agreement. This action will ensure passage to more than 12 miles of Parks Creek habitat. The funding for this activity has been secured.

• Water entering Big Spring Ranch from Hole in the Ground (HIG) Ranch via HIG Creek can possess elevated water temperatures (consistently over 20 °C) and significant discharge (up to 6.5 cfs) during the irrigation season due to off ranch activities outside the control of CDFW. This water often has a negative impact to the Mid Shasta Reach and as conditions improve in the Mid Shasta Reach, this impact could be more significant. There are also cool, diffuse springs, and known habitat for Coho Salmon, near the mouth of HIG, which could also be impacted by upstream discharges. CDFW will prepare a feasibility analysis to identify enhancement and restoration opportunities in coordination with the adjacent landowner on HIG Creek. These opportunities may include enhancement of channel form and riparian vegetation, channel relocation, riparian fencing, reducing water temperatures, eliminating fish passage barriers, and comprehensive restoration of the entire reach of HIG Creek. This analysis will occur within 5 years of the signing of this Site Plan Agreement.

Depending on the results of the evaluation on HIG Creek identified above and contingent on an approved agreement with Hole in the Ground Ranch, CDFW will implement one of the following actions to ensure thermal impacts from this water source are minimized:

a) If deemed feasible and beneficial to the Covered Species, the CDFW commits to designing, permitting and implementing restoration of HIG Creek on Big Springs Ranch. Upon completion of restoration activities (on both Big Springs Ranch and HIG Ranch) and if said activities address the water quality issues associated with this water, then the CDFW agrees to change the existing permissive CWC §1707 dedication of water rights associated with HIG Creek to a permanent dedication for the purposes of instream beneficial use. This would include the submission of necessary notifications to the Scott and Shasta Valley Watermaster District that describes the intent to dedicate these water rights instream permanently. If implemented, the project could restore two miles of habitat on HIG Creek; or

b) If the above enhancement proposal is deemed infeasible and/or if HIG Creek water is still deemed an impact to the Upper Shasta Reach or the spring near the HIG mouth, alternatives shall be explored to keep the HIG water from entering the Upper Shasta Reach. If a feasible project can be developed, CDFW will pursue the project.

The completed implementation schedule of this action is currently estimated to occur within five years of the signing of this Site Plan Agreement, contingent on funding and permitting.

A1.2.3.2 Passage/Migration/ Diversion Screening

- Beaver dams have been documented on CDFW‘s property and will not be discouraged if the beaver activity does not inhibit use of head gates or crossings. If infrastructure may be impacted by beaver activity, actions may be taken to dissuade dam building at that location.

A1.2.3.3 Instream Habitat Complexity

- CDFW commits to the enhancement of up to four existing spring alcoves along the Shasta River adding up to five Large Woody Debris (LWD) structures for cover. CDFW will install LWD from upland sources of juniper. The implementation schedule of this project is estimated to occur within five years of the signing of this Site Plan Agreement. These activities will be combined with other habitat improvement projects on Big Springs Creek and Mid-Shasta reaches.

- CDFW commits to implementing a pilot LWD project on Big Springs Creek, which could include the construction of post-assisted complex wood structures within a 1,000-foot reach of channel as designated on the Habitat Improvement map. After the evaluation of the effectiveness, additional stretches of BSC may be treated with up to 40 structures installed. The total number of structures installed will be based on adaptive management and lessons learned as structures are installed. CDFW will design, permit and implement the project, and provide LWD from upland sources of juniper. The implementation schedule of this project is currently estimated to occur within 5 years of the signing of this Site Plan Agreement.

- CDFW commits to the placement of LWD bank stabilization along the Mid Shasta Reach in cooperation with adjacent property owners as designated on the Habitat Improvement map. The project would entail the placement of LWD structures on outside bends of meanders to provide cover and stabilize eroding banks. CDFW commits to design, permit and implement the project, and provide LWD from upland sources of juniper. The implementation schedule of this project is currently estimated to occur within five years of the signing of this Site Plan Agreement.

- CDFW commits to connecting to three disconnected oxbows within the Mid Shasta reach as designated on the Habitat Improvement map, if deemed appropriate. This would entail excavation to reconnect the oxbow, installing LWD in channel to provide sweeping velocities to keep oxbow connected and installing one LWD structure for every 50-feet of bank within the newly constructed off channel habitat for cover. CDFW commits to design, permit and implement the project, and provide LWD from upland sources of juniper. The implementation schedule of this project is currently estimated to occur within five years of the signing of the Site Plan Agreement.

A1.2.3.4 Riparian Function

- CDFW agrees to replace 100% of riparian fencing if needed due to flood damage if grazing will occur.

- Within the fenced areas (exclusion zones), efforts to establish riparian trees have been taken throughout the riparian zone. The plantings will be monitored, weeded and planting cages removed as necessary.

- CDFW may plant riparian species in areas where suitable environmental conditions occur, if deemed appropriate. The implementation schedule of this project is estimated to occur within 10 years of the signing of this Site Plan Agreement if the riparian exclusion zone is grazed, the CDFW agrees to adhere to the Riparian Grazing Management Plan included in the Site Plan Agreement

A1.2.3.5 Substrate Quality

- The CDFW commits to the placement of a gravel stockpile on the Shasta River as designated on the Habitat Improvement map, if a gravel distribution analysis determines that it is appropriate. CDFW agrees to evaluate gravel placement as a potential habitat enhancement tool in the Shasta River. The implementation schedule of this project is currently estimated to occur within five years of the signing of this Site Plan Agreement.

A1.2.3.6 Assessments/Studies

- CDFW commits to continue to allow research entities such as UC Davis, SVRCD, USFWS, NMFS and others to conduct studies to describe salmonid habitat conditions, life history requirements, and productivity to help inform efforts to improve survival and productivity of Coho Salmon in the future, as long as they have the appropriate permits and follow the existing protocols for obtaining approval to conduct studies on State property.

- CDFW will allow access to perform riparian grazing management evaluation plots on Big Springs Ranch if riparian grazing occurs.

A1.2.3.7 Public Education/Outreach

- CDFW may develop up to eight gravel surfaced parking areas for public access, education and outreach opportunities. Educational kiosks will be installed at some locations for public access and viewing. Parking areas will be located a minimum of 100 feet from watercourses and will be designed so drainage will not discharge to watercourses.

A1.3 Cardoza Ranch (Permit 23278)

The Cardoza Ranch is a privately owned property. Cardoza Ranch operation influences both the Lower Parks and Mid Shasta reaches as designated within the Agreement; however, the river corridor is not directly adjacent to the property. The Parks Creek overflow, a small tributary to the Shasta River, runs through the ranch. Under the Cardoza Ranch Site Plan Agreement, Cardoza Ranch proposes the actions summarized in this section. Cardoza Ranch agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.3.1 Actions Required to Maintain Baseline Conditions

Cardoza Ranch does not propose any actions to maintain present baseline conditions.

A1.3.2 Actions required to Achieve Elevated Baseline Conditions

A1.3.2.1 Hydrology/Water Quality

- Cardoza Ranch agrees to construct, operate, and maintain a pipeline infrastructure throughout the ranch for better irrigation efficiency and reduce tailwater in accordance with the pipeline's Operations and Maintenance Manual for the term of the agreement.

A1.3.2.2 Passage/Migration/ Diversion Screening

- To eliminate passage issues at the existing diversion structure, Cardoza Ranch is committing to relocate the point of diversion from Parks Creek approximately 2.5-miles downstream to the Shasta River, near the Louie Road bridge, and pump the water into a series of proposed pipelines on the ranch. This alternative requires plumbing the ranch backward from its current configuration. Irrigation water would be lifted via a river pump to a high point on the ranch with ample head to deliver the water to all locations on the ranch via a gravity pipeline. This option would eliminate the need for the diversion structure on Parks Creek and fish passage would no longer be an issue. A new self-cleaning cone screen will be designed at the new point of diversion. This project has funding for the design, environmental review, and permits. Implementation money will be pursued once designs are at 65%, with the goal to have it fully constructed in 2019-2021 or 3 to 5 years from the signing of this agreement. Cardoza Ranch agrees to operate and maintain the new fish screen for the duration of the agreement.

- A new crossing will be constructed at the current point of diversion to meet neighboring ranch owner's property access and cattle crossing needs, but impounding of Parks Creek will no longer occur. The new crossing structure is currently in the design phase to provide fish passage for all life stages of salmonids while maintaining a cattle crossing across Parks Creek. Implementation money will be pursued once designs are at 65%, with the goal to have it fully constructed in 2019-2021 or 3 to 5 years from the signing of this agreement.

A1.3.3 Additional Beneficial Management Activities

A1.3.3.1 Hydrology/Water Quality

- Cardoza Ranch agrees to maintain pickup ditch and will collect tailwater wherever possible and put to beneficial use in such a way that re-use of tailwater will not increase consumptive use.

- Multiple field moisture sensor stations will be installed, maintained and used in the main pasture to inform the irrigator when to irrigate to optimize irrigation application rate efficiency. Cardoza Ranch agrees to the development of irrigation management plans developed in collaboration with experts from academia (University of California, California State Universities, or other experts approved by the Agencies) to better manage efficient application of water throughout the irrigation season. Irrigation efficiencies based on soil moisture monitoring will be reported in the annual report.

- To reduce adverse water quality impacts to Covered Species at the end of each irrigation cycle, Cardoza Ranch will drain the existing impoundment in a manner that minimizes turbidity, siltation, and elevated water temperatures to Parks Creek downstream. Whenever feasible, initiation of drawdown through removal of dam boards or other obstacles should be released in the early morning (prior to 10:00 am) and/or during cool times of year, and will be released as gradually as possible to minimize fine sediment discharges.

A1.3.3.2 Passage/Migration/Diversion Screening

- Until the point of diversion is moved to the Shasta River, Cardoza Ranch will operate the existing Point of Diversion as follows: During the interim period, prior to the removal of the diversion on Parks Creek, Cardoza Ranch will remove dam boards at the existing point of diversion when water temperatures first reach 19°C in the spring months at the PBS (Parks Big Springs) real-time monitoring location (located near the mouth of Parks Creek). The impoundment will be fully drained, then left open for at least seven consecutive days to allow for redistribution of fish. After the 7 days, Cardoza Ranch can resume normal diversion operations throughout the rest of the irrigation season.

A1.3.3.3 Instream Habitat Complexity

- Cardoza Ranch agrees to an assessment of Parks Creek overflow channel. If it is determined through an assessment, after the point of diversion is moved to the Shasta River, that Parks Creek overflow channel warrant additional habitat complexity, Cardoza Ranch has committed to participate in the implementation of needed habitat improvements.

A1.3.3.4 Riparian Function

- Cardoza Ranch agrees to adhere to the Riparian Grazing Management Plan (Appendix C of the Cardoza Ranch Site Plan Agreement).

- Cardoza Ranch agrees to installation of a stock water system in conjunction with the proposed efficiency piping project.

- Cardoza Ranch commits to allowing riparian planting along Parks Creek overflow channel.

A1.3.3.5 Pasture Management

- Cardoza Ranch will add cross fencing to manage pasture grazing to keep grass between 4 to 6- inches.

A1.3.3.6 Assessments/Studies

- Parks Creek overflow channel could provide off-channel habitat in the winter. A habitat assessment will be completed to determine if additional channel complexity is needed.

- All relevant studies associated with the covered species, as specified in Agreement and the Adaptive Management Program (Appendix 3 of the Agreement) that are relevant to the covered property will be allowed under this agreement of 5 years.

A1.3.3.7 Supplementation

- Cardoza Ranch will allow access for salmonid supplementation and all associated monitoring activities.

A1.4 Edson-Foulke Point of Diversion (Permit 23279)

The Edson Foulke Yreka Ditch Company Site Plan Agreement describes activities related to the Agreement for the Edson Foulke Yreka Ditch Company (Edson Foulke), an association consisting of six individual members that divert water through a single delivery system commonly known as the Edson-Foulke or China Ditch. The water diverted through Edson-Foulke ditch is a combination of multiple shared water rights. Edson Foulke owns no real property and operates a diversion through an easement on Parks Creek Ranch, which is located on the Upper Parks Creek reach within the Agreement. Under the Edson Foulke Site Plan Agreement, Edson Foulke proposes the actions summarized in this section. Edson Foulke agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

Edson Foulke is an association that does not own property. Edson Foulke manages a point of diversion at Parks Creek and a ditch that passes through, with easements, multiple non-association properties. Therefore, projects for instream benefit are limited. Edson Foulke's focus is to improve ditch conveyance efficiencies where conserved water would be used to provide by-pass flows in Parks Creek.

A1.4.1 Actions Required to Maintain Baseline Conditions

A1.4.1.1 Hydrology/Water Quality

- Edson Foulke will continue to operate and maintain the diversion facility including operation of an adjustable head gate. A seasonal cobble coffer berm is constructed to divert flows as flow volumes reduce typically after the beginning of June. Some minor instream work is necessary to maintain the seasonal diversion structure for passage. Work conducted to clear diversion of debris from high flow events and construct annual diversion berm will not exceed 10 cubic yards per year. Routine operations include constructing temporary gravel berm and/or remove bed load material from intake structure to divert water as flows reduce and maintaining a fish passage route through the diversion berm. Edson Foulke will monitor, maintain and repair the Edson Foulke Ditch to ensure best delivery efficiency.

A1.4.1.2 Passage/Migration/Diversion Screening

- An in-canal fish screen was installed in 2007 with a 30' long by-pass pipe returning flow and fish to Parks Creek. A fish screen will be evaluated to ensure it meets criteria. Edson Foulke will install downstream of fish screen a CA Department of Water Resources (DWR) stage recorder measuring device to ensure diversion volumes are not exceeded.

A1.4.2 Actions required to Achieve Elevated Baseline Conditions

A1.4.2.1 Passage/Migration/Diversion Screening

- Edson Foulke will evaluate the current fish screen and fish passage at point of diversion (POD) using current criteria, and perform one of following four scenario actions:

Scenario 1. If current fish screen and fish passage is acceptable, leave in place as is. If new POD facility/structure will be built, fish screen and fish passage will be reevaluated.

Scenario 2. If alternative fish screen and fish passage is needed, this project would occur simultaneously with the assessment and design process of a new diversion, automated gate and gaging/monitoring facility/structure at Edson Foulke's POD.

Scenario 3. If alternative fish screen and fish passage is necessary, but funding for a new diversion, automated gate and gaging/monitoring facility/structure is not achieved, a separate project would be initiated for fish screen and/or fish passage alternatives

Scenario 4. If current fish screen and fish passage is acceptable, but instream improvements are necessary to improve instream fish passage, Edson Foulke agrees to assist agencies to design and seek funding for instream improvements. If a new POD facility/structure will be built, instream fish passage will be reevaluated.

For the above scenarios, evaluation and analysis of current fish screen and fish passage and development of possible design alternatives, if necessary, would be completed by close of the 3rd year of permit, and improvement/replacement, if necessary, would be completed by close of 6th year of project

A1.4.2.2 Assessment/Studies:

- Edson Foulke will work with upper Parks Creek participants and agencies to develop and implement an interim program to collect data that will inform and evaluate habitat parameters including flow volume, diversion volume, water quality leading to improved projects and justified expectations.

A1.4.3 Additional Beneficial Management Activities

A1.4.3.1 Hydrology/Water Quality

- Edson Foulke agrees to participate in Upper Parks Creek Flow Plan as described in their Site Plan Agreement, in which Edson Foulke agrees to coordinate diversion volume and by-pass volumes with the other Permittees within the Upper Parks Creek reach to optimize reach-scale flow objectives. The Upper Parks Creek Flow Plan focuses on meeting biological objectives through water conservation and, at times, by-passing water or reducing (or ceasing) diversion below legal right to meet the biological flow targets presented below. Edson Foulke will

coordinate with Parks Creek Ranch and MWCD to assure the instream flow targets identified below are met, based on the Upper Shasta Flow Plan and priority identified in the Shasta River Decree.

- The Upper Parks Creek Reach downstream boundary is located below the I5 crossing of Parks Creek, identified as PCE on California Data Exchange (CDEC). PCE is a current measuring site. The Upper Parks Creek Flow Plan identifies target flows at gage site PCE. The Upper Parks Creek Flow Plan also requires accurate measuring of flows at the involved diversion facilities. The Biological Flow Objectives and instream flow targets included as part of the Upper Parks Creek Flow Strategy are described in the Edson Foulke Site Plan Agreement and the FMS.

- For Edson Foulke to abide by the Proposed Upper Parks Creek Flow Plan and ensure water conserved through the proposed water conservation project is provided to instream benefit, a new diversion facility (i.e., POD) is required. Proposed Facility/Structure shall include: programmable, automated head gate and flow gage/monitoring for diverted water with real time capability. Real time stream flow gage/monitoring located upstream or downstream of the diversion (dependent on design) is necessary to affirm by-pass provided by either meeting the flow objective or verifying conserved water provided by the water conservation project.

- Enhanced Parks Creek POD Phases:

Phase 1. Assessment and selection of preferred POD alternative:
Edson Foulke commits to seek funds and participate jointly with agencies and Parks Creek Ranch to assess appropriate POD location and preliminary design criteria. Phase 1 to be completed by close of 2nd year of permit.

Phase 2. POD design and permitting for installation:
Edson Foulke commits to seek funding and participate jointly with agencies and Parks Creek Ranch to select a design engineering firm to conduct and complete POD enhanced design based on preferred POD location and preliminary design criteria and related permitting for installation. Phase 2 to be completed by close of 4th year of permit.

Phase 3. POD installation:
Edson Foulke commits to seek funding jointly with agencies and Parks Creek Ranch and participate with installation of POD enhancement by close of 6th year of permit.

- Edson Foulke focus is to improve ditch conveyance efficiencies where conserved water would be used to provide by-pass flows in Parks Creek. To that end, Edson Foulke proposes projects as follows:

Phase 1: Assessment and design alternatives analysis of water conservation project:

- Edson Foulke commits to jointly seek funding with agencies to hire a 3rd party to help Edson Foulke continue to assess where water can be conserved and identify what project

alternatives would best conserve this water. Complete final analysis and issue report. Review report with agencies and mutually select preferred alternative/project.

- Edson Foulke is committed to conserve at least 3.0 cfs when the ditch is operating at 60% capacity.
- Phase 1 to be completed by close of 2nd year of permit.

Phase 2: Engineering and permitting of shovel ready design:

- Edson Foulke commits to jointly seek funding with agencies to hire an engineering firm to conduct final assessment and analysis of preferred design and to complete final designs and required permits.

- Phase 2 to be completed by close of 4th year of permit.

Phase 3: Project Installation:

- Edson Foulke commits to jointly seek funding with agencies to complete construction of project.

- Upon completion of project, Edson Foulke will deliver 3.0 cfs of its 9.9 cfs rights for instream benefit. The 3.0 cfs will be provided for instream benefit prior to diverting for irrigation. Edson Foulke agrees to incorporate other fish and wildlife as a secondary beneficial use of conserved water.

- Phase 3 to be completed by close of 7th year of permit.

If at any Phase, funding cannot be found or approved or other aspects of the project would result in a delay, Edson Foulke and agencies will meet to discuss project scope and other alternatives that will allow project to move forward or be terminated.

- Edson Foulke agrees to enter into a Forbearance Agreement with SWCG members for improving habitat for covered species in the Shasta River.

A1.5 Grenada Irrigation District (Permit 23280)

Grenada Irrigation District (GID) owns four parcels including a small reach of the Shasta River, as well as provides irrigation water to the GID comprising of approximately 1477 irrigated acres. Only two parcels located on or near the Shasta River that include intake and pumping infrastructure are included within the Agreement. Approximately 300-feet of the Shasta River is within GID ownership, designated to be in the Mid Shasta Reach in the Agreement. Under the GID Site Plan Agreement, GID proposes the actions summarized in this section. GID agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.5.1 Actions Required to Maintain Baseline Conditions

A1.5.1.1 Hydrology/Water Quality

- GID will continue to operate and maintain the recently upgraded diversion facility that eliminated a large diversion dam that impounded water and prevented fish passage. The new diversion is on the active channel of the Shasta River and does not require impoundment. The impounding of water also impacted water quality by increasing resident time and heating. The new intake facility and pumping station allow for remote operation of diversion facility including limiting diversion volume per schedule.

A1.5.1.2 Passage/Migration/ Diversion Screening

- GID will continue to operate and maintain the recently upgraded diversion facility (operable in 2014) that eliminated a large diversion dam that impounded water and prevented fish passage.

- GID will maintain the intake structure and the roughened channel that was completed in 2014 which provides continuous fish passage to all life stages.

- GID will maintain the compliant fish screen that was completed in 2014 when the diversion point was re-constructed.

A1.5.1.3 Instream Habitat Complexity

- GID will maintain stream barb structures that were installed in 2012 as part of the diversion upgrade including stream barbs opposite of the Fish screen.

A1.5.1.4 Riparian Condition/Function

- GID will continue to maintain boundary fence with Belcampo Farms to protect riparian area and riparian plantings from unmanaged grazing. Riparian fencing has been constructed and will be maintained by GID as part of this Site Plan Agreement. Riparian planting occurred in

2014 and 2015 with limited survival. Plantings should have higher success with several years of maintenance.

A1.5.1.5 Substrate Quality

- Spawning gravel was placed at head of constructed riffle and has been utilized by salmonid for spawning in 2013, 2015 and 2016.

A1.5.1.6 Assessments/Studies

- GID has flow gage (stage only) and temp gage on southern boundary that is connected to CDEC that is expected to be continued through SWCG compliance monitoring

A1.5.2 Actions required to Achieve Elevated Baseline Conditions

A1.5.2.1 Hydrology/Water Quality

- GID will submit a Change Petition to add Fish and Wildlife as secondary beneficial use and increase delivery efficiency through installation of a pipeline from GID Pump Station to identified district boundary. GID proposes to install a pipeline which can be used in lieu of the existing Main Canal. The pipeline would be aligned to deliver water directly to the District (approx.3.3 miles of pipeline proposed) rather than following the existing contouring ditch alignment (5.3 miles). The pipeline design and permitting phase has received funding, allowing design work to commence. Remote pump control capabilities will allow for pump volume to be adjusted or turned off at any time without being present, including setting the pumping volume on a pre-programmed schedule. GID is actively working with SWRCB, CDFW, NOAA and stake holders to develop and submit a Change Petition to the SWRCB.

A1.5.3 Additional Beneficial Management Activities

A1.5.3.1 Hydrology/Water Quality

- GID will participate in the Reach-wide Flow Management Strategy. GID agrees to coordinate diversions with the other landowners along the reach to optimize reach-scale flow objectives in the Mid Shasta Reach. The flow objectives in the Mid-Shasta Reach are to participate in more gradual ramping into irrigation, reducing diversion to enhance conditions during important life stages for coho salmon and more quickly ramp out of irrigation season in September. Additional specifics of GID's commitment to the Mid-Shasta Reach are included in the GID Site Plan Agreement, and are described in context of the broader Agreement FMS in Section 1.3.2 above. In summary, GID proposes, more gradual ramp into irrigation season, reduced diversion during out-migration and 0+ distribution, and reduced diversion at end of irrigation season. Implementation funding will be applied for within 2 years after receipt of the SHA permit. If implementation funding is not secured within 6 years after issuance of the permit, GID will meet with CDFW and NOAA to develop alternative proposals.

- GID will install a pipeline to connect GID pump station to GID district boundary to improve delivery efficiency. GID has considered numerous strategies to reduce the volume of water diverted based on enhancing flow conditions during life stage needs for Coho Salmon while still meeting the irrigation demands of its district users. Investigations show delivery inefficiency in GID's main canal is significant when diverting. During wet years, GID is typically not curtailed during the latter part of the summer and would continue to be allowed to divert. During normal and drier years, curtailment and even cessation of diversion can occur during late summer period. Therefore, GID would propose two diversion schedules representing: 1.) Normal or drier years and 2.)Wet years. Water year type would be determined using MWCD's water year determination process modified for GID using two water year types: Normal and drier and Wet, as described in GID's Site Plan Agreement.

- In addition, GID will work with involved parties to consider using the stream flow gauge at GID for more accurate and responsive capabilities to adaptively manage diversion volume and instream flow objectives compared to the current Montague gage. Currently, Water master service curtail GID using the flow gage near Montague, which is approximately 12 river miles downstream, which is noticed 15- 18 hours after the flow change passes of GID point of diversion, resulting in erratic flow variability throughout the Shasta River during periods of curtailment.

A1.5.3.2 Instream Habitat Complexity

- GID will seek funding and participate in implementation of habitat enhancement projects including instream structures and winter rearing habitat development including enhancing backwater near old pump station and installing a LWD structures below roughened channel, if deemed feasible. Instream enhancement projects are expected to be investigated for feasibility and design within 3 years of executing the Agreement with implementation funds sought within 4 years of executing the Agreement.

- GID agrees to encourage the development of beaver dams on the reach to further expand complexity. Such dams are found on other reaches and expected to occur along this reach in the future. GID will adhere to the beaver management AMMs (see Section 1.3.1.2.2 above).

A1.5.3.3 Riparian Condition/Function

- GID will continue to allow riparian investigations, promote and assist with riparian planting and will agree to maintain and protect the riparian areas from GID operations. Limited riparian planting is expected to occur within 3 years of executing the Agreement.

A1.5.3.4 Substrate Quality

- GID will install additional spawning substrate at the constructed riffle if deemed beneficial. Maintenance of site will include maintaining spawning size material grade that may also be used to hold riffle elevation and maintain consistent flow curve for potential gage

monitoring site (CDEC SPU). Maintenance of substrate will occur once every ten years or as developed with Flow Monitoring Plan for SWCG.

A1.5.3.5 Assessments/Studies

- GID will allow for and assist with assessments and studies and monitoring, including existing gauging and temperature monitoring if that is part of the long term monitoring and verification plan.

A1.5.3.6 Supplementation

- GID will allow access for salmonid supplementation and all associated monitoring activities.

A1.6 Grenada-Novy Ranch (Permit 23284)

The Grenada Novy Ranches is owned by Lowell L. Novy (Novy Ranches). Grenada Novy Ranches is located within the lower part of the Mid-Shasta Reach and is adjacent to the Rice Livestock Company, Inc. Ranch. Under the Grenada Novy Ranches Site Plan Agreement, Novy Ranches proposes the actions summarized in this section. Novy Ranches agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.6.1 Actions Required to Maintain Baseline Conditions

A1.6.1.1 Hydrology/Water Quality

- To increase water delivery as a result of irrigation efficiencies Diversion relocation/combination, Novy Pump replaced usage of the Huseman Ditch in 2007, thus moving it downstream. This improvement left at least 5.5 cfs in the river for an additional 3.5 miles. Novy Ranches agrees to continue to maintain pump to standards.

- To reduce tailwater, Novy Ranches installed six tail water berms throughout Grenada Novy Ranches from 2009 to 2013 to reduce tail water temperature impact upon the Shasta River. Novy Ranches agrees to continue to monitor and repair tailwater berms as needed. In addition, irrigation practices will be monitored to ensure that there are no new tailwater impacts.

- Hand-held soil moisture sensors have been used by irrigators to identify when to begin and stop irrigating. Novy Ranches currently use the Soil Moisture Meter product by LIC. This product rates soil moisture on a scale of 1-10, where 1 is dry and 10 is wet. Throughout the ranch, Soil Moisture Tool Boxes have been placed for easy usage by the irrigator. Novy Ranches tries to keep its field moisture levels within the 4-6 (average wet) range.

A1.6.1.2 Passage/Migration/Diversion Screening

- Novy Ranches installed Novy Pump with a compliant in-channel cone fish screen in 2007. The Novy Pump has a current, updated Streambed Alteration Agreement for operation of the compliant self-cleaning fish-screen and diversion intake. Grenada Novy Ranches agrees to maintain the diversion facility and fish screen.

- Novy Ranches agrees to manage and adjust flashboards and by-pass volume at Novy, Zenkus Rice diversion structure based on fish passage objectives.

A1.6.1.3 Riparian Function

- Approximately 12,400 linear feet of riparian exclusion fencing within Grenada Novy Ranches will continue to be maintained. However, the Novy Ranches will not accept the responsibility of repairing loss from major floods or other events where 20% of the fence or greater needs replacement. If riparian fencing loss greater than 20 percent occurs, Grenada Novy Ranches will work with partners to obtain funding to repair or replace the fencing.

- To reduce riparian grazing intensity/frequency, pastures adjacent to the river have been fenced, to restrict free access by the cattle.

- Novy Ranches operates a grazing management in accordance with the grazing plan developed by UC Extension Service.

- To evaluate riparian management, four test plots along the Shasta River were planted at different elevations and locations in April, 2015 to better understand survival ability, to further provide future river shading and riparian habitat enhancement. Each plot contained plantings of apple, hazelnut, peach, black walnut, ash, plum, choke cherry, and elderberry. Primarily due to small rodents, flooding and cattle destruction, survival of these trees has had low success. The time involved with watering, upkeep, building of solid fencing as well as implementing rodent barriers has been greater than expected. Grenada Novy Ranches agrees to further monitor these four plots.

A1.6.1.4 Substrate Quality

- Substrate for spawning has not been observed on the Grenada Novy Ranches; however, a site visit will be conducted with agency staff to address this question.

A1.6.1.5 Pasture Management:

- Novy Ranches will continue beneficial rotational grazing practices.

A1.6.1.6 Assessments/Studies

- Grenada Novy Ranches has been and is actively involved with the assessment and investigation being conducted on the Novy-Rice, Zenkus Riparian Diversion by the Shasta RCD. The investigation evaluates methods to improve delivery efficiency and irrigation methods to reduce the volume of water Grenada Novy Ranches applies to the 194 acres under irrigation by the Novy -Rice -Zenkus Riparian Ditch and under the management Grenada Novy Ranches, as well as livestock watering. This assessment also investigated fish passage at the diversion point.

- Grenada Novy Ranches will continue to allow access to monitor water quality parameters including temperature and flow and will consider allowance and participation in future assessments and inventories that enhance agricultural viability and/or instream enhancement.

A1.6.2 Actions required to Achieve Elevated Baseline Conditions

A1.6.2.1 Passage/Migration/Diversion Screening

- At the Novy, Rice, Zenkus Pre-1914 Riparian Diversion, the existing fish screen is located in the diversion ditch approximately 1,700’ below the POD and the by-pass does not meet current screening criteria. Grant-funded studies are ongoing on the Grenada Novy Ranches

to determine the best design options that will insure year- round compliance with fish passage criteria.

- Novy Ranches agrees to work with the agencies to seek funding, and assist with installation, of a compliant fish passage facility with a functional diversion facility. Once the screen is installed, Grenada Novy Ranches commits to operate and maintain an effective diversion facility that provides year-round fish passage per fish passage criteria. Implementation is expected to be completed by 2022, but will be based on funding availability.

A1.6.3 Additional Beneficial Management Activities

A1.6.3.1 Hydrology/Water Quality

- To increase delivery and irrigation efficiency at the Novy, Rice, Zenkus Pre-1914 Riparian Diversion, Novy Ranches will commit to the efficiency improvements recommended in the Shasta RCD assessment and work to develop and implement conservation solutions. Scope includes reducing diversion from 10.00-cfs to 5.00-cfs through converting main ditch and lateral to piping, lift pump and flood valves.

- Grenada Novy Ranches, in coordination with NRCS and secondary funding, will commit to the efficiency improvements recommended in the Shasta RCD assessment and work to develop and implement conservation solutions. Scope includes creating irrigation efficiencies via piping of the Novy Pump diversion and open ditch. If feasible, with funding in place, this action will be implemented. Water conserved as a result of delivery efficiency will result in cessation of diversion per rotation based upon noticed efficiencies. Implemented pipeline may result in cessation of diversion for several days a month during March, April, May June and October. Novy Pump Diversion water conservation implementation funding will be applied for through FRGP, Prop 1, NRCS and other funding sources. Implementation is expected to be completed by 2022, but will be based on funding availability.

- Novy Ranches will enroll the assistance of UC-Cooperative Extension to discuss implementation and usage of other soil moisture sensors (while still using current hand-held soil moisture sensors), including the use of randomly selected soil sampling sites throughout ranch to further adjust irrigation practices accordingly. This element will be completed within one year of signing the Template Safe Harbor Agreement.

- Novy Ranches will additionally cooperate in the Mid-Shasta Flow strategy, as described in the Grenada Novy Ranches Site Plan Agreement and summarized in the FMS.

- Novy Ranches will work with SWCG to add instream beneficial use as a secondary benefit for the water conserved by proposed projects for Novy-Rice- Zenkus diversion. The estimated timeframe for seeking funding is 2019 and 2020. The timeframe for implementation is 2022.

A1.6.3.2 Passage/Migration/Screening

- Novy Ranches will seek funding, aid in implementation, operate and maintain fish screen and fish passage facility components of Novy, Rice, Zenkus Diversion. The estimated timeframe for seeking funding is 2019 and 2020. The timeframe for implementation is 2022.

A1.6.3.3 Instream Habitat Complexity

- Novy Ranches will allow investigations and will participate in design and placement of instream structures including LWD structures, off-channel habitat and developing existing oxbows. Novy Ranches is willing to allow development of back-water rearing areas, if feasible, in this stretch of the Shasta River as long as liabilities and impacts to ranching are not elevated. If actual projects are developed, Novy Ranches will provide trees and on-site rock.

- Novy Ranches is willing to re-work one specific bank erosion site that is just upstream of the Novy, Rice, Zenkus Diversion. At this site, a log jam would be incorporated in addition to adding LWD, as funding is available. This action will stabilize the bank and reduce sedimentation while increasing habitat complexity. Novy Ranches will provide trees and on-site rock. It is anticipated that a grant application for these LWD projects will be submitted within the first year after signing the Template Safe Harbor Agreement. The estimated timeframe for implementation of LWD features is between 3-6 years after signing the Agreement.

A1.6.3.4 Riparian Function

- Off-channel stock water facilities were completed in 2013. With the potential piping of the Novy, Rice, Zenkus Diversion and Novy Pump, Novy Ranches will allow additional off-channel stock watering options once they are identified.

- Grenada Novy Ranches will allow for and participate in further native and non- native riparian plantings, in coordination with the agencies, as time and funding (for supplies and labor) become available.

A1.6.3.5 Substrate Quality

- This reach of the Shasta River does not currently have spawning substrate. Novy Ranches is open to allowing spawning gravel to be placed at the proposed re- constructed riffle during the Novy, Rice, Zenkus Riparian diversion retrofit.

A1.6.3.6 Assessment Studies

- Novy Ranches is agreeable to water temperature and DO monitoring on their Enrolled Property.

- Novy Ranches is agreeable to providing access for and having PIT tag antennas on site after hearing proposal and understanding/negotiating level of access.

- Novy Ranches will allow access for juvenile presence/absence surveys and juvenile tagging on the property if given SWCG standard notice prior to survey efforts.

A1.6.3.7 Supplementation

- Novy Ranches is open to salmonid supplementation when proper protections against Take liability are in place (e.g., the Agreement).

A1.7 Hidden Valley Ranch (Permit 23285)

The Hidden Valley Ranch (HVR) is a privately owned property, operated by HVR LLC. HVR is located Upper Shasta Reach within the Agreement). Under the HVR Site Plan Agreement, HVR LLC proposes the actions summarized in this section. HVR LLC agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.7.1 Actions Required to Maintain Baseline Conditions

A1.7.1.1 Hydrology/Water Quality

- HVR LLC will operate and maintain the 8,378 feet of pipeline infrastructure that has replaced open unlined ditches in several pastures for better irrigation efficiency, to reduce water use and reduce tailwater impacts to the Shasta River.

- HVR LLC will continue to operate and maintain pipelines and flood irrigate pastures, monitoring tailwater for each set performed in the course of irrigating pastures. In addition to the pipelines, a tailwater berm project has been implemented and managed to collect tailwater in the bunk house pasture, as described in the HVR Site Plan Agreement. Tailwater has been reduced in the bunkhouse pasture where pipelines were installed in 2011.

- HVR LLC will continue to bypass all spring production to the river from November 1 to March 1, with exception of the ranch's non- irrigation (stockwater) season water right of 0.6 cfs. HVR LLC is committed to spring water released during this time period to assist Adult Migration and Spawning.

A1.7.1.2 Passage/Migration/ Diversion Screening

- The delivery of prior right water via diversion 158 consists of a boulder weir impoundment control by a waterman valve. The boulder weir was rebuilt in 2000 after winter storm damage. A streambed alteration agreement was obtained from CDFW for construction, operation, and maintenance of the boulder weir and diversion. It has been deemed passable to fish by NOAA and DFW staff even at low flow conditions (3 cfs). HVR LLC agrees to regular inspection of the boulder weir by NOAA and/or CDFW staff to ensure passage and will maintain this boulder weir for the term of this agreement to allow for fish passage and function of the diversion.

A1.7.1.3 Instream Habitat Complexity

- HVR LLC agrees to leave natural LWD from existing trees in place along the banks throughout the property for refugia.

A1.7.1.4 Riparian Condition

- Within the riparian fenced areas, efforts to establish riparian trees have been taken along approximately 300 feet of river bank at the south end of the property up to a distance of approximately 20-feet from the bank. HVR LLC will maintain this baseline condition.

- Riparian exclusion fencing has been completed for the entire ranch. HVR LLC will continue to perform the yearly maintenance (replace posts, functioning gates, etc.) of the riparian fence over the duration of the Agreement. Riparian fencing widths range from 10 feet to over 100 feet along the river and as much as 500 feet (estimate of the SW hill corner of the ranch). All riparian zones will continue to be managed under riparian grazing plan, where cattle are only allowed to access area under HVR management, they do not have free access.

- There are two cattle "wet" crossings and one watering access point, both of which are reinforced with angular rock to reduce impacts riparian area. A light load bridge acts as a cattle crossing to the west 40 pasture, however, it cannot support heavy equipment. Therefore, the rocked low water crossing is used when heavy equipment is needed in the west pasture, which happens infrequently. HVR LLC will maintain the crossings to ensure they are useable for cattle while minimizing impacts to the stream for the term of the Agreement.

- Cattle have access to water via water access lanes, ponds, ditches, and/or water troughs which restrict access and reduce adverse impacts to the riparian area, which will be maintained by HVR LLC for the term of the agreement and no other instream sources are deemed necessary.

A1.7.1.5 Substrate Quality

- Riparian fencing has been completed for the entire ranch, with the exclusion zones widths ranging from 10 feet to over 100 feet along the river and as much as 500 feet (SW hill corner of the ranch), which benefits substrate quality due to more stable banks. HVR LLC commits to maintain all riparian fencing into the future if livestock are present.

A1.7.1.6 Pasture Management

- Pasture management has been implemented on HVR to avoid overgrazing, which has been associated with increased tailwater production and heating, sedimentation, increased water use, etc. HVR LLC will continue existing pasture management and does not propose additional actions at this time.

A1.7.1.7 Assessments/Studies

- HVR LLC will continue to allow access to CDFW to maintain a passive integrated transponder (PIT) tag antenna array to monitor fish movement onto the ranch. The array is located at the downstream end of the ranch. HVR LLC will also continue to work with research entities such as UC Davis, Shasta Valley (RCD), CDFW, USFWS, and NMFS to conduct studies to describe salmonid habitat conditions, life history requirements, and productivity to help inform efforts to improve survival and productivity of coho salmon in the future.

A1.7.2 Actions required to Achieve Elevated Baseline Conditions

A1.7.2.1 Hydrology/Water Quality

- To increase delivery and irrigation efficiency, HVR LLC commits to pipe the entire prior rights conveyance ditch, from the newly constructed fish screen to the existing prior rights pipeline at the place of use. The current prior rights conveyance has approximately 2,500-feet of open ditch, resulting in ditch loss and an increased non-consumptive diversion amount. This project has been completed. In exchange for the increased efficiency, HVR LLC agrees to release 0.5 cfs of spring water to the Shasta River continuously, as long as the springs are producing at or above this amount, for the duration of the agreement.

- Tailwater is a large concern in this reach, and the ranch topography includes sloped pastures with gullies. HVR LLC commits to the construction and maintenance of approximately 1000-feet of tailwater infiltration berms at known tailwater return points within the Bunkhouse Pasture. The berm was designed to collect water from the pasture over time, allow it to percolate into the ground, and/or be released in the morning hours if cool enough via a waterman valve and culvert. This project was constructed in 2017 with funds from the Shasta Valley RCD. HVR utilized this feature in 2017 with overall success and will maintain and manage the berm for the term of the agreement.

- A water exchange of 1.5 cfs with MWCD has being negotiated to facilitate improvement to water quality by releasing additional spring water to the channel. Once the terms with MWCD are settled and a 1707 has been completed, the exchange would be exercised for the term of the agreement. In order to exercise the exchange, the installation of an additional pipeline (approximately 4000-feet) to deliver up to 1.5 cfs of MWCD water (in addition to current prior rights deliveries) in exchange for bypassing available cold spring water directly to the Shasta River from June 1 through September 15th is needed. This project has been completed. The water exchange will be managed using real-time flow meters, measuring spring released to the river and exchange water used for irrigation.

- HVR LLC commits to bypass an additional 1 cfs of spring water to the Shasta River from June 1st through September 15th, when total spring water sources are producing over 2.25 cfs. The 2.25 cfs is the amount that is needed to fulfill the 0.25 cfs adjudicated right on the springs for irrigation purposes, the 1st priority bypass of 0.5 cfs spring bypass due to irrigation efficiency improvements and the 2nd priority bypass of 1.5 cfs spring water in exchange for MWCD water as described in the Site Plan Agreement. The additional spring water contribution will be monitored via a real-time flow meter.

A1.7.2.2 Passage/Migration/Diversion Screening

- The present fish screen/diversion weir utilized at diversion 158 has been determined to pose a threat to fish by stranding when the current ditch is dewatered at the end of the irrigation season, and is presumed to result in elevated water temperatures in the Shasta River at the point of fish bypass flow discharge. To benefit the Covered Species, HVR LLC has committed to

moving, upgrading, and operating the new fish screen as designed. The new self-cleaning cone screen will be relocated to the channel at the current point of diversion, thereby eliminating the potential for stranding and bypass flow heating in the ditch. Funding for this project has been secured by California Trout and the environmental compliance and permits are completed.

A1.7.3 Additional Beneficial Management Activities

A1.7.3.1 Hydrology/Water Quality

- HVR LLC will collect tailwater in open ditches and reused whenever possible.

- HVR LLC will participate in Reach-wide Flow Management Strategy, as described in their Site Plan Agreement, and in the FMS.

- HVR LLC will install, utilize and maintain soil moisture sensors throughout the ranch under advisement with UC-Extension in order to inform irrigation water application and to assist HVR LLC with making informed decisions around the crop water needs of the pastures.

- HVR LLC will voluntarily bypass excess spring water over the 3 cfs of spring water committed to under Elevated Baseline. These riparian rights will be protected via a permissive 1707 dedication or some other arrangement such as a forbearance agreement acceptable to the parties The agreement will be applied for within 3 years after the execution of the Agreement.

A1.7.3.2 Passage/Migration/ Diversion Screening

- HVR LLC encourages the development of beaver dams on the reach to further expand the presence of pools and cover. Such dams are found on other reaches and expected to occur along this reach in the future. HVR LLC will adhere to the beaver management AMMs (see Section 1.3.1.2.2 above).

A1.7.3.3 Instream Habitat Complexity

- Where appropriate, LWD will be left in the streambed to support cover for various life stages of the Covered Species.

- HVR LLC will participate in the implementation of habitat improvement projects (LWD, grade control structures, etc). Up to 24 sites (some shared with adjacent property owner) have been identified on the ranch for LWD placement, which would entail placement of root wads/pieces to improve existing habitat while minimizing impacts to adjacent land. Participate is defined as allowing access, tracking design and funding progress done by others, reviewing plans and providing junipers from upland areas on the ranch.

- HVR LLC agrees to allow an existing alcove to be enhanced where the spring water will re- enter the channel to provide a refugia. The enhancement will entail enlarging the existing alcove and provide cover and backwatering using up to five LWD structures. This project is estimated to be designed and implemented 3 years after SHA signature. HVR will work with the

Agencies and engineers to design improvements to the alcove that remain within the riparian zone (existing fence configuration) and address concerns of the landowner relating to erosion and any other factors created by the activity prior to any construction. The landowner will not be responsible for repairs, loss of use, or other conditions if the site is lost due to flood or other natural disaster.

A1.7.3.4 Riparian Function

- HVR LLC agrees to maintain up to 50-percent of the riparian fencing in the event of flood damage to the fencing.

- HVR LLC agrees to participate in additional riparian plantings within between 3-5 other riparian areas on the ranch to fill in the gaps between existing old growth riparian. The total planting area could be as much as 0.5 acres. The riparian assessment is estimated to be designed and implemented 5 years after SHA signature.

- HVR LLC agrees to adhere to the Riparian Grazing Management Plan (Appendix D of their Site Plan Agreement).

A1.7.3.5 Substrate Quality

- HVR LLC will allow the introduction of spawning gravel at up to five sites throughout the reach on the ranch. This effort is also in conjunction with a proposed potential "supplementation effort".

A1.7.3.6 Pasture Management

- HVR LLC will cross fence 3 large pastures to better manage stubble height and pasture health. This effort will be accomplished within 3 years of implementation of this agreement.

A1.7.3.7 Assessments/Studies

- HVR LLC is supportive of surveys to determine food types and quantities sufficient to support life stages of coho salmon and the relationships such food supply may have toward variations in water temperatures.

- All relevant studies associated with the covered species, as specified in the Agreement and the Adaptive Management Program (Appendix 3 of the Agreement) that are relevant to the covered property will be allowed under this agreement of 5 years, after which the Agencies may request an additional period of access for a like specified period of time.

- Two monitoring stations will be installed on HVR as part of the effectiveness monitoring program. These will be real time flow, water temp, and air temperature sensors at the upstream and downstream HVR property lines.

A1.7.3.8 Supplementation

- HVR LLC will allow access for salmonid supplementation and all associated monitoring activities.

A1.8 Hole-in-the-Ground Ranch (Permit 23286)

The Hole in the Ground Ranch is a privately owned property, managed by Emmerson Investments, Inc. (Emmerson Investments). The Hole in the Ground Ranch is located north of Lake Shastina, and west of Big Springs Road. Streams flowing through the Ranch include the Shasta River, Parks Creek, and Hole in the Ground Creek. The confluences of the creeks with the Shasta River are off the property. For the purposes of this Safe Harbor Agreement, activities on the Ranch have the potential to influence the Upper Shasta River and Lower Parks Creek sub-reaches. Under the Hole in the Ground Ranch Site Plan Agreement, Emmerson Investments proposes the actions summarized in this section. Emmerson Investments agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.8.1 Actions Required to Maintain Baseline Conditions

A1.8.1.1 Hydrology/Water Quality

• To increase delivery and irrigation efficiencies, Emmerson Investments has undertaken the following actions:

- With funding provided by the Pacific States Marine Fisheries Commission under a grant from NMFS, in cooperation with CDFW, undertook an irrigation efficiency study.

- Cooperated in more than seven years of CDFW studies of juvenile salmonid distribution and habitat use with direct observations, PIT tag technology, water temperature monitoring, flow monitoring, etc.

- Replaced 500 feet of open ditch with pipe on the Gravity Ditch.

- Repaired concrete lining on 1500 feet of main Pump Diversion, Main Ditch in 2013.

- Upgraded irrigation turnouts on 300-400 feet of Pump Diversion, Alyssa Field Ditch, in 2013.

• Emmerson Investments agrees to the diversion of Appropriative Water Right for "Clear Spring" to protect water quality for instream habitat. Spring flow may fluctuate annually, seasonally and diurnally, so full right of 2.5 cfs is generally not diverted to accommodate the variability, thereby improving stream temperatures below the Pump Station POD and increasing volume of the summer rearing habitat for juvenile salmonids, especially 0+ coho and steelhead.

• Emmerson Investments agrees to maintain concrete lining on main delivery ditch of Pump Diversion.

• Emmerson Investments is cooperating with the University of California Cooperative Extension (UCCE) to experiment with the use of soil moisture sensors and related technology to

optimize applied water, which may result in a reduction of diversion and, ideally, improved instream water quality.

- Since 2009, Emmerson Investments modified practices on Gravity Ditch to irrigate short and/or steep pastures, which require more frequent changes, during the day. The more distant, flatter, and longer pastures are irrigated at night.

- Emmerson Investments repaired and/or established tailwater berms at the low side of irrigated pastures.

- Emmerson Investments agrees to continue and refine irrigation practices that minimize applied water accumulating at the low side of fields.

- Emmerson Investments agrees to maintain tailwater berms and continue irrigation practices that reduce to insignificant or eliminate tailwater returning as warm surface flow to perennial streams

- Emmerson Investments agrees to participate in a reach-wide Diversion Management Plan as described in their Site Plan Agreement and the FMS.

- Emmerson Investments has cooperated in studies to redesign neighbor's diversion located on the property (the Cardoza Diversion) with access through the property and despite anticipated pasture management changes to accommodate a potential loss of sub-irrigated acreage.

- Emmerson Investments has cooperated in studies to evaluate Hole in the Ground Creek for alternative water supply for neighbor's property

- In 2008, due to the research in which the Emmerson Investments cooperated, allowing CDFW personnel to study distribution and habitat use by coho juveniles in the Shasta River through the Ranch, it was determined that coho were rearing downstream of Clear Spring. In that year, CDFW expressed concerns for late summer habitat water quality, specifically the water temperature. Emmerson Investments agreed to exchange diversion of water from Clear Spring for deliveries of MWCD stored water. The stored water was diverted at the Gravity Diversion, which is upstream of the Clear Springs diversion. In addition, the Pump Diversion, which is the POD for water from Clear Springs, was not used for the balance of the irrigation season. By refraining from diverting at the Pump Station, cold water signature from the spring source was maintained further downstream increasing the amount of summer-rearing habitat available for coho and steelhead.

A1.8.1.2 Passage/Migration/Diversion Screening

- Emmerson Investments conducted for one year and continues to participate in spawner surveys for all reaches with suitable spawning habitat.

- Emmerson Investments cooperated in more than seven years of CDFW studies of juvenile salmonid population estimates, distribution, and habitat use with direct observations, PIT tag technology, water temperature monitoring, flow monitoring, etc.

- Emmerson Investments modified Gravity Ditch Diversion from flashboard dam to roughened channel, eliminating potential juvenile coho barrier and improved the fish screen in 2007.

- Emmerson Investments modified Pump Diversion from flashboard dam to roughened channel, eliminating a large impoundment which contributed to degraded water quality downstream and created a barrier to juvenile coho and improved fish screen in 2007.

- Emmerson Investments agrees to maintain fish passage through roughened channel reaches

A1.8.1.3 Riparian Function/ Channel Structure

- Emmerson Investments, with matching funding from USFWS Partners in Conservation Program, has fenced 100% of Shasta River to exclude cattle grazing.

- Emmerson Investments with matching funding from USFWS Partners in Conservation Program has fenced 60% of Parks Creek to exclude cattle grazing.

- Emmerson Investments agrees to maintain riparian fencing, and to replace, out-of-pocket, at least 20% of riparian fencing if needed due to high flow damage. Partners for additional funding to replace fencing to 100% will be sought, if necessary.

- Emmerson Investments has limited cattle and vehicle access to the Shasta River to three vehicle crossings and six stock crossings (inclusive; i.e., vehicle crossings also serve as stock crossings when necessary)

- In the exclusion fenced portion, Emmerson Investments has limited cattle and vehicle access to Parks Creek and tributaries to two crossings -- one rocked ford, and one culvert crossing. Emmerson Investments agrees to maintain crossings and cap the number of livestock and vehicle access points to current number

- Emmerson Investments created two off-channel tanks/ponds for stock water to support riparian exclusion.

- Emmerson Investments provided access and/or labor on several occasions to monitor and breach beaver dams.

A1.8.1.4 Spawning Substrate

- Emmerson Investments cooperated in McBain and Trush study (McBain & Trush Inc. et al. 2010) by allowing access for evaluation of gravel composition and quality.

A1.8.1.5 Pasture Management

- Fall calving producing calves big enough to fully utilize upland, seasonal range, comprising more than half of the Ranch. Emmerson Investments agrees that rotation and stocking rates in irrigated and non-irrigated pasture will be managed to maintain optimum forage cover and heights based on water year type.

A1.8.2 Actions required to Achieve Elevated Baseline Conditions

A1.8.2.1 Hydrology/Water Quality

- With acquisition of sufficient matching funds, Emmerson Investments agrees to complete, operate, and maintain a Diversion Combining Project, which includes replacing up to 4000 feet of open, mostly earth-lined Gravity Ditch with pipe. Upon completion, seepage loss savings (estimated at 0.7 cfs) will be exchanged for an equal volume of Clear Spring water retained in-stream and not diverted. This project is underway and completion is estimated within 5 years of permit issuance. In the interim, before completion of the Diversion Combining Project, Emmerson Investments agrees to collect further data to quantify ditch loss to be translated into efficiency savings with implementation of the completed Project.

- Emmerson Investments will seek matching funds to and establish fences to create riparian pastures or exclusion fencing on Hole in the Ground Creek within 5 years of permit issuance.

- With regards to tailwater reduction, Emmerson Investments agrees to work cooperatively with neighboring landowners to solve issue of warm surface water, from source not on Hole in the Ground Ranch, entering Hole in the Ground Creek near north property line within 5 years of permit issuance.

- Emmerson Investments agrees to continue participating in studies to redesign neighbor's diversion (Cardoza Diversion) and eliminate associated water quality issues. Participation includes providing access for personnel and equipment during design and construction, implementation monitoring, and effectiveness monitoring, and adjusting livestock management to accommodate project design, construction, monitoring, and post-construction changes in vegetation. Completion of this project estimated within 5 years of permit issuance

A1.8.2.2 Passage/Migration/ Diversion Screening

- Emmerson Investments agrees to continue cooperating in project to move Cardoza Diversion, eliminate associated fish passage issues, and maintain fish passage at the new crossing. Completion of this project estimated within 5 years of permit issuance

A1.8.2.3 Riparian Function/ Channel Structure

- Emmerson Investments to establish fences to create riparian pastures or exclusion fencing on remaining 40% of Parks Creek. Permanent fencing materials and alignment will be determined after ~5 year riparian grazing trials using temporary electric fence following recommendations from UC Davis Cooperative Extension. Temporary fencing will be used for up to the first five years after permit issuance. Permanent fencing will be established by the sixth year after permit issuance.

- Emmerson Investments agrees that a riparian grazing plan, developed by UCCE Range Specialists for riparian pastures along Parks Creek at the Cardoza and Rattlesnake fields, will be implemented. A riparian grazing plan will be developed in consultation with UCCE Range Specialists for riparian pastures along Hole in the Ground Creek and will be implemented within 5 years of permit issuance.

- Emmerson Investments agrees to cap number of crossings to current without consulting NMFS and CDFW.

- Emmerson Investments agrees to continue participating in project to restore stream function at crossing on site of Cardoza Diversion that is slated to be moved, within 5 years of diversion being moved.

- Five years, or more if agreed upon, after the alteration of Cardoza Diversion, Emmerson Investments will take part in evaluation of riparian conditions and planting projects where existing riparian habitat is less than site-potential along Parks Creek.

- Post-alteration of Cardoza Diversion, Emmerson Investments agrees to cooperate in evaluation and placement of instream LWD placement, as appropriate, in Parks Creek, within 5 years of completion of diversion alteration project.

A1.8.2.4 Spawning Substrate

- Post-alteration of Cardoza Diversion, Emmerson Investments agrees to evaluate and take part in gravel augmentation projects, as appropriate, in Lower Parks Creek, within 5 years of completion of diversion alteration project.

A1.8.3 Additional Beneficial Management Activities

A1.8.3.1 Hydrology/Water Quality

- With acquisition of sufficient matching funds, Emmerson Investments agrees to complete Diversion Combining Project, which includes replacing up to 4000 feet of open, mostly earth-lined Gravity Ditch with pipe. Upon completion, seepage loss savings (estimated at 0.7 cfs) will be exchanged for an equal volume of Clear Spring water retained in-stream and not diverted. Completion of this project estimated within 5 years of permit issuance

- Emmerson Investments agrees to include Ranch pastures in Project Area for testing effectiveness of soil moisture sensor technology to increase irrigation efficiency, and to implement routine use of soil moisture sensors where appropriate, and adjust water management accordingly.

- Emmerson Investments agrees to continue participating in the Upper Shasta River Flow Management Strategy, as described in their Site Plan Agreement and the FMS.

- Emmerson Investments agrees to continue participating in studies to redesign the Cardoza Diversion and eliminate associated water quality issues. Participation includes providing access for personnel and equipment during design and construction, implementation monitoring, and effectiveness monitoring, and adjusting livestock management to accommodate project design, construction, monitoring, and post-construction changes in vegetation. Completion of this project estimated within 5 years of permit issuance.

- Emmerson Investments agrees to an exchange with MWCD for Clear Spring water, per the Upper Shasta River Flow Management Strategy, as described in their Site Plan Agreement. Emmerson Investments will utilize a different temperature threshold for initiating and concluding the use of "Exchange" water if it is agreed with Agencies that a different standard better achieves the criteria of being biologically significant for the Covered Species in the Shasta River, measurable for management purposes, unambiguous, and accurate through time.

- Emmerson Investments agrees to enter into a Forbearance Agreement with SWCG members for the purpose of improving habitat for the Covered Species in the Shasta River.

- Emmerson Investments agrees to create a management plan to, at a minimum, not deter dam building beaver activity except where it damages infrastructure, e.g. impairs irrigation control structures, inundates crossings, etc. When necessary, Emmerson Investments will work in conjunction with fisheries management personnel to physically breach dams during smolt outmigration, juvenile redistribution, and/or adult spawning periods, generally April to mid-June and November to January or provide alternate passage opportunities through or around the beaver dams.

- With additional funding, Emmerson Investments agrees to take part in riparian planting projects where existing riparian habitat is less than site-potential along the Shasta River. Completion of this project estimated within 15 years of permit issuance

- Emmerson Investments agrees to maintain fences and utilize adaptive management approach to monitor, assess, and, where necessary, modify riparian management practices, whether exclusion or prescriptive grazing strategies

- Emmerson Investments will take part in projects to add up to15 LWD structures in reach between Pump Diversion and north fenceline. Existing pools with documented use by juvenile salmonids will be considered priority sites. Completion of this project estimated within 10 years of permit issuance

A1.8.3.2 Spawning Substrate

- Emmerson Investments agrees to take part in project(s) to add gravel in Shasta River at up to 4 sites between Pump Diversion and north fenceline. Existing riffles will be considered as priority sites. Completion of this project estimated within 10 years of permit issuance

A1.9 Montague Water Conservation District (Permit 23287)

The Montague Water Conservation District (MWCD) is a public irrigation district that owns and operates Dwinnell Reservoir located in the southern portion of Shasta Valley and provides irrigation water to users within the district boundary, located in the northern portion of Shasta Valley. MWCD owns Dwinnell Reservoir, the property under the high water mark of Dwinnell Reservoir and the property along the Shasta River immediately below Dwinnell Reservoir where much of the water operations for the irrigation district occurs. The MWCD Enrolled Property is located at the upstream terminus of the Upper Shasta River Reach, within the Agreement. Under the MWCD Site Plan Agreement, MWCD proposes the actions summarized in this section. MWCD agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.9.1 Actions Required to Maintain Baseline Conditions

A1.9.1.1 CHERP

MWCD is in the process of obtaining approvals and implementing numerous habitat and operational improvement projects identified as MWCD's Conservation Habitat Enhancement and Restoration Project (CHERP). CHERP is an independently required consultation separate from but complementary to the Agreement. MWCD is considering work proposed under CHERP as a long term commitment that is currently being implemented concurrent and complementary to the MWCD Site Plan Agreement. Therefore, the CHERP commitments are part of the current baseline. It has been mutually concluded that while CHERP actions are included, they are baseline conditions (i.e., not Elevated Baseline Conditions). The MWCD activities required under CHERP that relate to relevant baseline condition habitat parameters are described in this section. Additional MWCD actions beyond CHERP that relate to baseline condition habitat parameters are included in sections 1.3.3.9.1.2 to 1.3.3.9.1.6 below.

The following suite of projects are proposed below within the infrastructure at Dwinnell Dam infrastructure through MWCD's CHERP.

a.) Finish Flying L Pipeline and service redundancy project to provide cold water during over-summering conditions to cold water habitat and the upper Shasta River.

b.) Construct side channel cold water habitat near confluence of Cross Canal and Shasta River fed by either Dwinnell Releases, seeps and/or Flying L pumps, depending on temperature of sources to ensure over- summering refugia similar to Clear Springs Kettle Springs.

c.) Expand Cross Canal capacity from a maximum 45 cfs of 110 cfs to increase volume of water released to Shasta River from Dwinnell Reservoir via Cross Canal to aid in habitat enhancement resulting from increased flow volumes and pulse flows.

d.) Continue gauging, operations infrastructure and data presentation for monitoring/verification.

e.) Seek funding and construct Parks Creek Fish Passage and Fish Screening Facility including continued gauging of flow below POD and of diverted volume at Parks Creek POD.

A1.9.1.1.1 Hydrology/Water Quality actions under CHERP

- In exchange for water conservation and water quality projects proposed under MWCD's CHERP, MWCD will proportionally increase releases for instream benefit or projects that aid water quality based on Coho Salmon life stage needs and water quality enhancements. The primary project that will increase instream is lining reaches of MWCD's Main Canal.

- MWCD will complete installation of Flying L pipeline that will connect the Flying L pumps to the Cross Canal and Cold Water Habitat to provide up to 5.5 cfs of cold water to the Shasta River. MWCD will operate "Flying L" pipeline to provide cold water contributions to prior rights, and/or instream flow releases when water temperatures in Shasta River on MWCD property exceeds 18.0 C. MWCD has secured funding and committed in-kind contribution of operating the Flying L pumps. MWCD commits to have this project completed two years after issuance of permit.

- MWCD will construct a lateral cold water habitat near the base of Dwinnell Reservoir at the confluence of MWCDs Cross Canal and the Shasta River to ensure cold water refugia. Flow from the Seeps, Flying L pumps, and/or releases from Dwinnell Reservoir can be delivered to the off Channel habitat, dependent on temperature. MWCD has secured funding and committed to in-kind contribution for this project. MWCD will have the project completed two years after issuance of permit.

- MWCD will expand Cross Canal capacity to increase volume of water released to Shasta River from Dwinnell Reservoir via Cross Canal. Increased capacity will aid in increased flow volumes that can be released to Shasta River improving conditions in the Shasta River. Funding and participant cost share has been secured to conduct this work and MWCD commits to have work completed 2 years after issuance of permit.

- MWCD will continue to work with SWRCB to obtain approval of submitted Change Petition to add Fish and Wildlife and Municipal uses as additional beneficial uses of water and protect water released for fish and wildlife purposes through Water Code 1707.

A1.9.1.1.2 Passage/Migration/Diversion Screening actions under CHERP

- MWCD will seek funding, implement and maintain fish passage and fish screening facility at Parks Creek diversion. The project is designed and under the progress of obtaining permitting. MWCD will actively seek funding through the first three years of the permit. If not funded by 5 years after issuance of permit, MWCD will meet with CDFW and NOAA to re-evaluate project.

- From October 1 to February 28, annually, MWCD will assure 6.0 cfs is by-passed at MWCD's Park Creek diversion prior to diverting to aid adult migration and Spawning, and will provide increased by-pass volumes to enhance flows and better mimic the natural hydrograph.

• From March 1 to September 30, annually, MWCD will by-pass 16.00 CFS at its diversion prior to diverting to ensure spring out-migration and redistribution, and will provide increased by-pass volumes to enhance flows and better mimic the natural hydrograph.

A1.9.1.1.3 Riparian Condition/Function actions under CHERP

• MWCD will plant, maintain and protect riparian species within the Cross Canal, the cold water habitat and along the Shasta River within its ownership. Partial funding and in-kind match is secured and MWCD will seek additional funds. MWCD intends to have riparian planting completed by fall of 2021 or three years after issuance of the Agreement.

A1.9.1.1.4 Hydrology/Water Quality

• MWCD will maintain existing instream by-pass conditions below the Parks Creek diversion point per as described in their Site Plan Agreement and the FMS.

• MWCD will continue release of flows for environmental purposes from Dwinnell Dam as identified in the Site Plan Agreement, largely based on storage volumes in Dwinnell Reservoir as an interim step until the Main Canal lining is completed.

• MWCD will continue to operate, maintain and keep the following gage locations:

Gage Name:	Purpose:
CDEC MPD	MWCD Parks Creek Diversion- CFS/AF
CDEC PME	MWCD Parks Creek- Stage
CDEC DRE	MWCD Dwinnell Reservoir Storage -AF
CDEC DSW	MWCD Seeps- CFS
CDEC DFB	MWCD Environmental Water to Shasta River- CFS
CDEC SRX	MWCD Shasta River Prior rights - CFS

• MWCD will provide access and continue to work with partners to ensure funding and completion of legacy diversion structure to provide fish passage on Shasta River located on MWCD property.

• MWCD will maintain and Operate existing Flying L pipeline and pumps as designed to provide cold water to Shasta River when water released from Dwinnell Reservoir exceeds 18C.

• MWCD will maintain alternative City of Montague Point of diversion located near the City of Montague. Releases will only be from sources to Shasta River when release temperatures are less than 18C, meaning only water that is less than 18C will be used to provide these deliveries.

A1.9.1.1.5 Passage/Migration/ Diversion Screening

- MWCD will continue to use existing infrastructure to provide fish passage on Parks Creek using the existing concrete and flashboard infrastructure.

- MWCD will continue to seek permitting and seek funding for Parks Creek Screening and Passage Project Implementation.

- Provide access and continue to work with partners to ensure permitting, funding and implementation of Seldom Seen legacy diversion structure to provide fish passage on Shasta River to MWCDs proposed cold water refugia.

A1.9.1.1.6 Instream Habitat Complexity

- MWCD will continue to work with partners to design, permit, fund, and install LWD projects on MWCD property on the Shasta River below Dwinnell Reservoir in the upper Shasta Stream reach.

A1.9.1.1.7 Substrate Quality

- MWCD will continue to work with partners to design, permit, fund, and install spawning gravel projects on MWCD property on the Shasta River below Dwinnell Reservoir in the upper Shasta Stream reach.

A1.9.1.1.8 Assessments/Studies

- MWCD will allow CDFW and NOAA staff involved with the Agreement access for monitoring and assessment as long as the scope and duration link to Agreement objectives is provided to the MWCD Board for review and consideration.

- MWCD will continue to participate in flow experiments similar to the experiments conducted in 2015 (Upper Shasta River) and 2016 (Parks Creek).

- MWCD will continue temperature monitoring of MWCD cross canal.

A1.9.2 Actions required to Achieve Elevated Baseline Conditions

The MWCD Site Plan Agreement does not identify any actions intended to achieve elevated baseline conditions.

A1.9.3 Additional Beneficial Management Activities

A1.9.3.1 Hydrology/Water Quality

- MWCD will use Interim Settlement models with CDFW and NOAA to determine the volume of water provided between issuance of permit and full implementation of the main Canal Lining Project as described in their Site Plan Agreement. Upon completion of the Main Canal Project lining project (estimated to be completed in spring of 2023), MWCD will use CHERP flow schedule to release conserved water. In addition to continuing CHERP flows provided by water conserved through the Main Canal Lining Project, MWCD will expand its instream bypass commitment at Park Creek and on the Shasta River. All instream commitments will be measured by an approved flow gage and flow data will be recorded on at least an hourly frequency:

- MWCD will participate and play leading role in implementing a reach-wide flow strategy on upper Parks Creek including seeking funding for water conservation projects as described in their Site Plan Agreement and the FMS, and serving on advisory panel to confirm implementation plans and monitoring.

- MWCD will assess and if feasible, add new point of re-diversion in lower Shasta River to allow flow to be released from Dwinnell Reservoir to seasonally deliver water for irrigation via the Shasta River rather than delivering via MWCD's main canal. This measure would increase streamflow for approximately 23 miles of the Shasta River miles when water quality released from MWCD is suitable (18 C or less) to be released. MWCD proposes up to 9.4 cfs of flow to be released for re-diversion and delivery for irrigation purposes within MWCD district. This measure would aid instream flow particularly in normal and drier years. MWCD has submitted a Change Petition to SWRCB including this measure, adding municipal and Fish and Wildlife as secondary benefits. If approved by SWRCB, MWCD will commit to determine feasibility and secure approved access by the fifth year of the Agreement, with full implementation scheduled by the 10th year of MWCD's SHA agreement.

- MWCD will assess and if feasible, add new POD or point of re-diversion in lower Shasta River to deliver water for irrigation purposes via Parks Creek and the Shasta River when water quality is suitable (18 C or less). This water would available for diversion and by-passed from Parks Creek POD in addition to values established in the Upper Parks Creek Flow Strategy. Proposed point of re-diversion would be close City of Montague, adding increased streamflow for approximately 25 miles of Parks Creek and Shasta River during the spring. MWCD will commit to determine feasibility and secure SWRCB approval and approved POD and delivery access by close of the fifth year of the issuance of the permit. If approved by SWRCB and MWCD would seek funding with the intention to implement the project by the 10th year of the agreement.

- MWCD will investigate and if feasible, implement a retrofit of trash racks and gate adjustment on Dwinnell Reservoir spill gates of emergency tower to prevent debris from becoming lodged in adjustable gates when opened, preventing full closure. Depending on design and agency approval requirements, including Division of Dam Safety, MWCD commits to having investigation completed prior to close of the sixth year of the issuance of the permit.

Release values will be coordinated including consideration of protection of downstream infrastructure and restoration projects.

- MWCD will work with partners and to gain SWRCB approvals to implement water exchanges with downstream Permittees who have water rights to either Clear Springs and or Hidden Valley Springs, sources of cold water inputs during the period of the year when water temperatures exceed 18C. If implementable, MWCD requires the exchange site be gauged and tele-metered and will provide up to 1.50 cfs for Clear Springs and 1.50 cfs for Hidden Valley Springs, or match any volume that is provided for instream benefit. MWCD commits to further development of an Operations Plan per exchange site within one year of approval by SWRCB. MWCD will work with SHA involved SHA participants to seek funding for infrastructure to allow these project to occur.

- MWCD agrees to enter into a Forbearance Agreement with SWCG members for the purpose of improving habitat for covered species in the Shasta River.

A1.9.3.2 Passage/Migration/Diversion Screening

- MWCD will continue to evaluate need, alternatives and constraints for future fish passage above Dwinnell Reservoir. MWCD commits to develop an assessment by the closing of the 10th year of the issuance of the permit.

- MWCD will coordinate permitting and installation with Seldom Seen POD fish passage project on MWCD property. MWCD commits to provide access, coordinate with permitting and assist with implementation of the project to provide fish passage. MWCD commits to allow Seldom Seen participant access throughout the term of the agreement for construction and maintenance of the fish passage project, including cooperating on the maintenance of the proposed streamflow gage and water temperature monitoring site.

A1.9.3.3 Instream Habitat Complexity

- MWCD will provide access and participate in implementation of LWD and gravel instream enhancement project on MWCD property below the Cross Canal on the Shasta River. MWCD commits to continue to work with participants and permitting entities for implementation within three years of the issuance of the permit. MWCD will provide up to 100 cu/yds of approved diameter bed load within 5 years of the issuance of the permit.

- MWCD will cooperate in a hydrologic/geomorphic assessment of sediment transport, channel maintenance flow needs, and implement channel periodic maintenance flows as coordinated with NMFS, SHA, CDFW for Wet and Very Wet flow release schedules. MWCD commits to have the assessment completed by the close of the 7th year of the permit.

A1.9.3.4 Riparian Condition/Function

- MWCD commits to develop riparian stand and seed source for over story riparian species on MWCD property surrounding Cold water habitat and cross canal. Maintain and enhance

riparian habitat along Cross Canal, Cold water habitat and Shasta River within MWCD ownership. MWCD will commit to seek funds and will provide in-kind protection and maintenance during first two years of establishment. Tree will be planted by the end of the third year of the permit.

- MWCD will fence the property line East of the Shasta River on MWCD property below Dwinnell Reservoir (approximately 1,100') by the end of the 3rd year of the permit. MWCD will maintain riparian fence for term of Agreement, if installed.

A1.9.3.5 Substrate Quality

- Based on results of an Upper Shasta River hydrologic/geomorphic assessment of sediment transport and channel maintenance flow needs MWCD will implement channel periodic maintenance flows as described in their Site Plan Agreement.

A1.9.3.6 Assessments/Studies

- MWCD will provide access for studies including the Upper Shasta River hydrologic/geomorphic assessment of sediment transport and channel maintenance flow needs.

A1.9.3.7 Supplementation

- MWCD is open to Supplementation and associated monitoring when CHERP components are complete and the SHA agreement is active.

A1.10 Nicoletti Ranch (Permit 23434)

The Nicoletti Ranch is a privately owned property, operated by NB Ranches, Inc. (Nicoletti). Nicoletti Ranch is located on the Mid Shasta Reach within the Agreement. Under the Nicoletti Site Plan Agreement, Nicoletti proposes the actions summarized in this section. Nicoletti agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.10.1 Actions Required to Maintain Baseline Conditions

A1.10.1.1 Hydrology/Water Quality

- Nicoletti will maintain second Huseman point of diversion that was added 5.9 river miles downstream in 2012 of the original diversion point. The diversion was modified from a flashboard dam and gravity diversion to an on river pump diversion where sufficient flow and fish passage is provided at all times (minimum estimated by-pass at Huseman diversion is 30-40 cfs).

- Nicoletti will continue to reduce and manage tailwater re-entering the Shasta River using existing collection and reuse systems that captures Shasta Water Users Tailwater.

A1.10.1.2 Passage/Migration/ Diversion Screening

- Huseman has a compliant on-channel self-cleaning cone screen and no diversion structure that impedes fish passage. The diversion has a Streambed Alteration Agreement for operation of the screen and diversion intake. Nicoletti agrees to maintain the diversion facility and fish screen with the Huseman Ditch Association users.

A1.10.1.3 Riparian Condition/Function

- Nicoletti agrees that riparian area grazing will occur during limited time periods during the spring and summer within the riparian area. Stubble height of 4-6” and impacts to woody vegetation will be identified as triggers when removing livestock from riparian area. Livestock will not have access to the riparian area after September 15th – April 15th to protect redds and habitat.

- Riparian exclusion fencing has been installed throughout the Ranch except for the northern most section where approximately 1,600' is needed on the west side of the River. An additional 1,200’ immediately south needs to be improved or replaced as well (also on west bank). Nicoletti will repair or replace up to 25% of the existing riparian fencing if it is damaged or lost due to floods or other events.

- Nicoletti will maintain the existing bridge used for livestock and vehicles over the Shasta River west locate near the center of the ranch.

- Nicoletti will maintain existing wet livestock crossing located at north end of property

- Nicoletti will maintain two existing water lanes used for livestock watering.

A1.10.1.4 Pasture Management

- Rotation pasture management is utilized on pasture fields. Majority of the cattle are moved off –site during winter to allow for pasture recovery and limit impacts of annual grazing.

A1.10.2 Actions required to Achieve Elevated Baseline Conditions

A1.10.2.1 Hydrology/Water Quality

- Moderate amounts of tailwater occur on the property due to a swale through the Hay Field. Nicoletti proposes to install a lateral pipeline with risers along the east side of the fence to control volume and coverage. The estimated 3,200' pipeline would reduce/eliminate up to 0.7 cfs of intermittent tail-water entering the Shasta River. The estimated schedule for this work is as follows: project design completed by 2020, apply for implementation grant funding 2021, implement piping project by 2023.

A1.10.3 Additional Beneficial Management Activities

A1.10.3.1 Hydrology/Water Quality

- Nicoletti will install, utilize and maintain soil moisture sensors throughout the ranch under advisement with UC-Extension in order to inform irrigation water application and to assist Nicoletti with making informed decisions around the crop water needs of the pastures. The purpose will be monitoring water application versus need for water in the soil profile. After consultation between Nicoletti and UC Extension, soil moisture sensors will be installed in different pastures, with sensors at different soil depths to monitor when irrigation is needed for particular pastures.

- Nicoletti commits to reevaluate existing conceptual design for a pipeline for Huseman Ditch, if conservation benefit is determined beneficial by CDFW and NOAA using cost benefit analysis and water budget, Nicoletti will seek funds to implement a pipeline from the northern Rice Livestock property line to the end of the Huseman Ditch.

- In exchange for piping the from current POD to end of existing ditch, Huseman Ditch, including Nicoletti will permanently reduce the maximum diversion volume from 11.9 cfs to 10.0 cfs for irrigation purposes.

- Nicoletti will permanently cease diversion of two cold-water springs (Rivers Edge Spring and Driveway Spring) and provide the spring water for instream benefit as a commitment for the pipeline. The combined spring water volume is estimated to be 0.3 cfs resulting in an additional

109 acre feet provided for instream benefit as a condition of providing a pipeline for houseman ditch.

- Nicoletti will work with SWCG to add instream beneficial use as secondary benefit for water conserved by the proposed projects for Huseman Ditch through a Section 1707 or equivalent process.

- Nicoletti, through Huseman Ditch, will cooperate in the Mid- Shasta Flow Strategy, as described in their Site Plan Agreement, and the FMS.

A1.10.3.2 Passage/Migration/Diversion Screening

- Nicoletti will maintain Huseman Ditch Self-Cleaning Fish Screen located at the current POD. A diversion structure is not needed at this site.

A1.10.3.3 Instream complexity

- Nicoletti will participate in planning and development of instream structures including LWD structures, off-channel habitat and developing access to an existing oxbow. Nicoletti will provide rock and trees to participate. Nicoletti will participate in seeking design funds within the first three years of the Agreement and implementation funds within the first five years.

- In exchange for piping Huseman Ditch through Nicoletti property to current terminal pond, Nicoletti will allow cold water spring sources to be delivered to develop cold water over-summering habitat as well as overwintering habitat, including alcove development. Nicoletti will commit spring water through a 1707 petition or equivalent once the Huseman Ditch piping is implemented, estimated at 2023. Design and SWRCB approval, if necessary will occur within the first three years of the Agreement.

- Beaver dams have existed in the past and future occurrences will not be discouraged. Nicoletti will adhere to the beaver management AMMs (see Section 1.3.1.2.2 above).

A1.10.3.4 Riparian Condition/Function

- Nicoletti will allow and participate in riparian investigations and riparian planting programs but will not be held accountable for survival percentages or vigor. Nicoletti will abide by interim grazing standards during riparian planting establishment as per the Grazing Management Plan developed for the Nicoletti Ranch. Nicoletti will seek funds and assist with implementation within the first five years of the Agreement.

- Nicoletti will work with UC Extension to develop and implement a Riparian Grazing Management Plan for riparian pastures. Nicoletti agrees to abide by the grazing plan upon development and mutual agreement. The estimated timeframe for Riparian Grazing Management Plan development is within one year of signing the Agreement.

- Nicoletti will seek funds and participate in design for installation of additional watering lanes or install alternative stock watering systems to limit riparian access for livestock watering purposes. Nicoletti will work with NRCS to conduct an analysis to compare watering access sites compared to alternative stock watering sites located outside of the riparian area. NB Ranches will provide analysis to CDFW and NOAA within one year after signing of agreement and mutually conclude direction and timing of livestock watering approach.

A1.10.3.5 Substrate Quality

- Nicoletti will not disturb existing spawning habitat and will provide access for enhancement projects if determined feasible by the Parties.

A1.10.3.6 Pasture Management

- Nicoletti will continue rotation pasture management in that a majority of the cattle are moved off –site during winter.

A1.10.3.7 Assessment Studies

- Nicoletti will review studies and survey proposals and will agree to provide access or otherwise participate on a case by case basis once proposals are reviewed.

- Nicoletti is agreeable to providing access for water temperature and DO monitoring, PIT tag antennas, and will allow juvenile presence/absence surveys and juvenile tagging on the property if given 7 days' notice prior to survey efforts.

A1.10.3.8 Supplementation

- Nicoletti commits to salmonid supplementation when proper protections against Incidental Take are in place through the Agreement and associated Permit.

A1.11 Parks Creek Ranch (Permit 23288)

Parks Creek Ranch is privately owned by Outpost M R, LLC and operated by Belcampo Farms (Parks Creek). Parks Creek Ranch is located along the Upper Parks Creek Reach within the Agreement. Under the Parks Creek Ranch Site Plan Agreement, Parks Creek proposes the actions summarized in this section. Parks Creek Ranch agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.11.1 Actions Required to Maintain Baseline Conditions

A1.11.1.1 Hydrology/Water Quality

- Parks Creek will maintain the following constructed tail-water/ water quality project, Northern Bottom tail-water collection facility. The adjustable water control structure allows collection of tailwater to be re-used and incorporated in a collection ditch below diversion ditch #3.

- Parks Creek will maintain the "Lower corrals" tailwater collection and piping allowing for re-use. The lower corrals system allows tailwater to be collected prior to entering Parks Creek and used rather than increasing the volume of water diverted by diversion #3.

A1.11.1.2 Passage/Migration/ Diversion Screening

- Parks Creek diverts water from seven active points of diversion on Parks Creek, including sharing the Edson-Foulke Ditch. Edson-Foulke is another participating Permittee and is, therefore, addressed in a separate site plan. Parks Creek agrees to continue efforts to maintain passage at all of the diversion points, as described in their Site Plan Agreement.

- All sites on Parks Creek have fish screens although the existing fish screens on diversions #4, #5 and #6 have been damaged by high flows, are difficult to maintain and don't function in this applied setting. Parks Creek currently operates and maintains all fish screens and commits to continue to do so.

A1.11.1.3 Riparian Condition

- Riparian fencing has been completed on a 1.0 mile reach of Parks Creek downstream of the lower corrals and for approximately 1.7 miles above Old Hwy 99. 2.9 river miles remain unfenced below Old Hwy 99. Parks Creek will continue to perform the yearly maintenance (replace posts, functioning gates, etc.) of the existing riparian fence over the duration of the Agreement and will not intentionally damage riparian existing plantings within the current fenced area.

- Within the existing fenced area downstream of Old Hwy 99 (exclusion zones), Parks Creek Ranch has planted approximately 0.75 acres. Cuttings were taken from existing trees along Park Creek. Parks Creek agrees to maintain and protect riparian cuttings.

A1.11.1.4 Substrate Quality

- Parks Creek Ranch has potential spawning habitat available. Parks Creek Ranch will manage to protect and maintain spawning sites.

A1.11.1.5 Pasture Management

- Parks Creek will continue to manage livestock using current grazing rotation.

A1.11.2 Actions required to Achieve Elevated Baseline Conditions

A1.11.2.1 Hydrology/Water Quality

- Parks Creek will implement Tailwater Project #1: Lower Reach of Parks Creek: Parks Creek will collect and re- route tail-water prior to entering Parks Creek. Collected tail water will be delivered for irrigation purposes downstream to replace or reduce the volume of water diverted at PCR diversion #6 rather than entering Parks Creek. Parks Creek Ranch will assist in development of the design, seek funding, and assist with implementation if funds are secured. Design and permitting will begin within two years after issuance of permit with intended implementation by the close of the fourth year of the issuance of the permit.

A1.11.2.2 Passage/Migration/ Diversion Screening

- Parks Creek will conduct a fish screen evaluation if suitable diversion combination projects are determined infeasible. Parks Creek is proposing diversion combination projects reducing the number of diversion sites from 7 to 2 or 3 diversion points. Irrigation efficiency projects focusing on piping to improve delivery efficiency projects will accompany the diversion combination proposals as described in the Parks Creek Site Plan Agreement. In the event evaluation and compliance work is necessary, Parks Creek will assist evaluators and seek assistance is refurbishing or replacing the existing fish screens within 4 years of the issuance of the permit. Parks Creek will operate and maintain any new compliant fish screens installed in the future.

A1.11.2.3 Riparian Function

- Parks Creek will seek funding and assist with installation of riparian fencing along the approximately 2.5 river miles of Parks Creek that does not have riparian fencing. Fencing placement will be in accordance with Parks Creek Ranch management objectives and a Riparian Grazing Plan produced with UC Extension Service. Parks Creek Ranch will pursue development of fencing layout, seek funding to implement riparian fencing and assist in implementation of riparian fencing beginning in the first year of the issuance of the permit and intending to have riparian fencing completed by the close of the 4th year of the issuance of the permit.

A1.11.3 Additional Beneficial Management Activities

A1.11.3.1 Hydrology/Water Quality

- Parks Creek will participate in a comprehensive reach-wide Flow Management Strategy as described in their Site Plan Agreement and in the FMS. The Upper Parks Creek Flow Strategy was developed in conjunction with NOAA and CDFW to achieve sufficient bypass flow as required during different life stages.

- Parks Creek Ranch diverts water from seven active points of diversion on Parks Creek. The numerous points of diversion and varied priorities of rights makes assimilating and abiding by a reach wide flow strategy difficult. Further, the multiple points of diversion play into increased delivery loss. Parks Creek proposes to assess, design and if mutually agreeable, seek funds to implement, operate, and maintain a combined point of diversion (POD) for PCR diversion points #1, #2 and rights in Edson-Foulke ditch. This proposal would include a diversion facility, including a fish screen, method to accurately measure volume of water by-passing the facility and volume of water diverted to the facility.

- Parks Creek Ranch diverts water from seven active points of diversion on Parks Creek. The numerous points of diversion and varied priorities of rights makes assimilating and abiding by a reach wide flow strategy difficult. Further, the multiple points of diversion play into increased delivery loss. Parks Creek proposes to assess, design and if mutually agreeable, seek funds to implement, operate, and maintain a combined point of diversion (POD) for PCR diversion points #3, #4, #5 and potentially #6. This proposal would include a diversion facility, likely near the existing point of diversion for diversion #3 including a fish screen, method to accurately measure volume of water by-passing the facility and volume of water diverted to the facility. The project also proposes to design, install, operate, and maintain a pipeline to deliver water to the areas serviced for irrigation under those PODs to improve delivery efficiency. Further, the proposed pipelines will use irrigation flood risers to increase irrigation efficiency, where determined effective. In exchange for the combined point of diversion, increased delivery efficiency and irrigation efficiencies, Parks Creek agrees to by-pass 0.6 -1.45 cfs (volume depends on design, inclusion of diversion #6) of the 5.35 cfs of water available for diversion for instream benefit for the life of the project or term of the permit, whichever is longest. In addition, when water conserved through conservation projects does not meet instream flow objectives, Parks Creek will by-pass additional water as needed to meet instream flow objectives. Design will begin by the end of the first year the permit is issued. If a project is mutually agreed upon funding will be sought by close of the third year the permit is issued.

- Parks Creek will assess, design and seek mutual agreement of delivering cold water either from Spring Creek system or from Diversion #1 (under combined diversion concept or otherwise) to the identified over-summering reach downstream of MWCD diversion to aid in developing and enhancing cold water habitat for over-summering juvenile Coho salmon. A period of monitoring and measurement of available flows is necessary to determine the volume of cold water available. During base flows, the expected potential increase in flows will be 0.2 to 0.6 cfs of water under 18.5 C that will be provided to ensure flows exceed flow (2.0 cfs) and

address temperature objectives within the over summering reach during the over-summering period.

- In addition to the provided water, Parks Creek will allow and participate in construction of an alcove habitat at the existing spring discharge (or where mutually agreed upon) that enters the over-summering. This project is expected to provide both summer rearing and winter off-channel habitat. Parks Creek will seek design and implementation funds by the close of the 5th year of the issuance of the permit.

- Parks Creek will assess, design and implement an efficient alternative livestock watering system to aid adult migration and spawning. In exchange for design and installation of efficient livestock water facilities, Parks Creek will to limit livestock diversion volume to 1.2 cfs rather than the 5.6 cfs stock water right. In pastures where livestock have access to Parks Creek, watering lanes may be used, depending on design. Parks Creek will provide map identifying need for watering sites by the close of the 2nd year of the agreement. Parks Creek will seek design and implementation funds with the intention to have the system constructed by the close of the fourth year of the issuance of the permit.

- As a part of assessing and designing a water conservation project, Parks Creek will also assess how to provide early releases of water at critical times of the year, prior to securing funding for a water conservation project. The volume, location, and the timing of such early releases will be determined by the parties within two years of permit issuance.

- Parks Creek agrees to enter into a Forbearance Agreement with SWCG members for the purpose of improving habitat for covered species in the Shasta River.

A1.11.3.2 Passage/Migration/ Diversion Screening

- Existing fish screens and diversion facilities will be evaluated under current fish screen and fish passage criteria if combined point of diversion projects proposed above are mutually not agreed upon and deemed infeasible. If diversion combination projects are determined infeasible, existing fish screens will be assessed for refurbishment or replacement. Parks Creek will operate and maintain any new compliant fish screens installed at diversions.

- Parks Creek is agreeable in allowing MWCD to implement, operate, and maintain a compliant fish screening, fish passage and diversion facility so as long as there are no impacts to Parks Creek Ranch operations and Parks Creek Ranch is allowed to review and comment on design (and impacts are addressed during construction). The process will allow for negotiations including mutual agreement of the project design and terms of the easement, if revision of the easement is necessary.

- Parks Creek is agreeable in allowing Edson-Foulke Ditch Company to make improvements necessary to construct, operate, and maintain a compliant fish screening, fish passage and diversion facility so as long as there are no impacts to Parks Creek Ranch operations and Parks Creek Ranch is allowed to review and comment on design (and impacts are addressed during construction). The process will allow for reasonable negotiations including mutual

agreement of the project design and terms of the easement, if revision of the easement is necessary

- Parks Creek will allow access to conduct assessment of floodplain restoration project at stream reach below the railroad crossing, and assess, design and if mutually agreeable, implement a channel and floodplain restoration project near the railroad crossing.

A1.11.3.3 Instream Habitat Complexity

- Parks Creek agrees to construct an alcove at the existing spring outlet within the over-summering reach. The alcove will be designed to naturally scour and LWD will be placed to provide cover. The habitat will provide cold-water over-summering habitat as well as overwintering habitat. This project is anticipated to be designed within 3 years after execution of the Agreement and implemented within 5 years of execution of the Agreement.

- Parks Creek agrees to assist in development, provide available materials, assist in seeking funding and assist in implementation of habitat improvement projects. Up to 15 LWD structures with 3-5 pieces each are proposed. Sites where active erosion is occurring within the over-summering reach are a priority for structures by Parks Creek Ranch. This project is anticipated to be designed within two years after execution of the Agreement and implemented within 4 years of execution of the Agreement.

- Parks Creek agrees to encourage and allow the development of beaver dams on Parks Creek so as long as beaver activity does not affect operations. Parks Creek will adhere to the beaver management AMMs (see Section 1.3.1.2.2 above).

A1.11.3.4 Riparian Function

- Parks Creek will work with UC Extension Service to define ranch objectives and develop a riparian grazing plan. Parks Creek will work with UC Extension Service to complete riparian grazing plan by the close of the second year of the issuance the Agreement.

- Parks Creek Ranch will participate and provide cuttings materials for riparian planting, and specifically in areas downstream of Old Hwy 99 to I-5. Parks Creek will seek funding and intends to plant four acres of riparian plantings within the first four years of the issuance of the Agreement.

A1.11.3.5 Substrate Quality

- Parks Creek ranch operation will protect spawning substrate and ensure riparian grazing plan is protective of potential redds.

A1.11.3.6 Pasture Management

- Parks Creek will follow UC Extension Service advice and seek funding to install and operate soil moisture sensors per UC Extension Service guidance to improve water efficiency resulting in reduced diversion, instream benefit and improved pasture production. Parks Creek will coordinate this measure with delivery and irrigation efficiency projects with intension to have moisture sensors operating by year five of the agreement.

A1.11.3.7 Assessments/Studies

- Parks Creek will review and allow access for reasonable studies that support Agreement objectives.

- Parks Creek will allow access and support stream channel and floodplain restoration feasibility study for the railroad crossing reach. If feasible and mutually agreed upon, Parks Creek will allow the project to be implemented to improve passage and channel function.

A1.11.3.8 Supplementation

- The ranch is open to salmonid supplementation when Incidental Take is authorized and in place through the Agreement and associated permit.

A1.12 Rice Livestock Company (Permit 23289)

The Rice Livestock Company, Inc. (Rice Livestock) is a privately owned property. Rice Livestock is located along the Mid Shasta Reach within the Agreement. Under the Rice Livestock Site Plan Agreement, Rice Livestock proposes the actions summarized in this section. Rice Livestock agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.12.1 Actions Required to Maintain Baseline Conditions

A1.12.1.1 Hydrology/Water Quality

- As a user of Huseman Ditch, the Rice Livestock will operate and maintain the Huseman Ditch diversion which was constructed 5.9 river miles downstream of the original diversion structure in 2011. Prior to 2011, the flashboard dam diversion for Huseman Ditch (shared with GID) was eliminated and replaced by the Huseman Ditch pump diversion where sufficient by-pass flow and fish passage is provided at all times (minimum estimated by-pass at Huseman diversion is 30-40 cfs). The diversion facility includes pumps, a self-cleaning cone screen and shade structure to protect the infrastructure. Rice Livestock will continue remote control of Huseman diversion which allows users to shut off pump remotely, reducing diversion volume and tail water.

- Rice Livestock will also operate and maintain the existing pipeline and irrigation infrastructure constructed as part of 2011 project which added a second point of diversion. Rice Livestock will operate and maintain the water efficiency project constructed in 2011 including the conversion from an open ditch flooding to buried pipeline, the flood riser in portions of Field #4, and the Boot field combined with developed irrigation management, which has significantly reduced tail-water and reduced volume of water diverted compared to conditions prior to 2011.

- Rice Livestock will continue soil moisture monitoring as a management tool to reduce tailwater: A real-time soil moisture sensor was installed at the bottom of Field 4. The real- time soil moisture sensor also has a tail-water sensor that alerts the irrigator when tailwater reaches it and the irrigator can shut off the pump remotely to reduce the amount of tail-water that reaches the river and to conserve water.

A1.12.1.2 Passage/Migration/ Diversion Screening

- The Huseman Ditch diversion has an on-channel self-cleaning cone screen and the diversion provides volitional fish passage at all times. The diversion has a streambed agreement for screen operation, maintenance, and diversion intake. Rice Livestock agrees to operate and maintain the diversion facility and fish screen in coordination with other active users.

- The Novy, Zenkus, Rice Riparian Diversion (NZR) Diversion is managed with a steel frame and flashboard diversion structure where vertical flashboards extend across the river. NZR never completely blocks flow (does not install the flashboards from bank to bank). Depending on flow, a 4’ to 35’ foot opening is always maintained within the wetted channel

during the irrigation season. Flashboards are removed during the non-irrigation season. Rice Livestock will manage existing flashboards as described above to allow for fish passage at current facility.

- Rice Livestock will continue to participate in an ongoing assessment that is expected to lead to an approved redesign of the NZR Diversion to allow for agency compliant fish screening and passage facilities.

A1.12.1.3 Riparian Function

- Riparian exclusion fencing was completed for the entire Rice Livestock Property in 2003. Rice Livestock intends to continue livestock exclusion of the riparian area. Rice Livestock will continue to maintain riparian fencing and will repair up to 25% of flood-damaged riparian fencing. If riparian fencing loss due to flood is greater than 25 percent, Rice Livestock will, install temporary electrical fencing and work with CDFW, NOAA and funding partners to repair or replace the fencing.

- Rice Livestock will maintain the wet crossing and limit crossing to about 10 times a years from May 1 through November 1. Livestock watering access sites also exist at the Boot Field, Field #3 and Gravel Pit Field. The access sites are rocked with angular rock, are approximately 20 feet wide and panels exist to limit access into the river. The livestock watering sites but are not currently used and will only be used if the existing alternative livestock watering system is not functioning.

- Rice Livestock will maintain existing off-channel alternative stock water systems.

A1.12.1.4 Pasture Management

- Rice Livestock will maintain soil moisture probe in Field #4 and continue beneficial rational grazing pastures. Because livestock exclusion of the riparian area will be continued, a riparian grazing plan is not proposed.

A1.12.1.5 Assessments/Studies

- Rice Livestock allows access for monitoring temperature and DO as described in their Site Plan Agreement.

A1.12.2 Actions required to Achieve Elevated Baseline Conditions

A1.12.2.1 Hydrology/Water Quality

- Rice Livestock has several tail-water re-entry sites that will be reduced or addressed including the following:

- Huseman Fields 1 and 2: Improve berm and develop catch ditch to deliver and re-distribute excess tail-water water to under irrigated property. This site will be addressed within the 2nd year of signing the Agreement.

- Huseman Field 3: Improve catch and redistribution ditches. Use remote pump operation for Huseman Ditch so pump can be remotely turned off to reduce run- off. This site will be addressed within the 2nd year of signing the Agreement

- Huseman Boot Field and Field 4: Use remote activated pump operation so pump can be remotely turned off when soil moisture probe notifies Rice Livestock. This change in operation will begin within 2nd year of signing the Agreement.

- Novy-Zenkus- Rice Riparian -Gravel Pit Field. Improve berm at Shasta River. This site will be addressed within 2nd year of signing the Agreement

• Rice Livestock also agrees to conduct work to maintain infrastructure and operations so significant tail-water contributions are minimized and infrequent.

A1.12.2.2 Passage/Migration/ Diversion Screening

• A recently completed design is under review for NRZ diversion. Based on agency feedback, the Rice Livestock will continue to participate in refinement of design and seek funding opportunities for project implementation. Rice Livestock agrees to long-term maintenance and operation.

• Rice Livestock agrees to work with the agencies and diversion users to seek funding and assist with installation of a compliant fish passage facility with a functional diversion facility at the NRZ diversion. Rice Livestock commits to operate and maintain the new diversion facility in order to provide year-round fish passage per agency fish passage criteria. Rice Livestock will continue to refine the design (completed in 2018) and seek implementation funding (also applied for in 2018). Implementation is expected to be complete by 2022. If funding is not secured by 2024, the Rice Livestock will meet with agencies to re-evaluate the project.

• The existing fish screen at the NRZ diversion is located in the diversion ditch approximately 1,700’ down ditch from the POD and the by-pass does not meet current screening criteria. Grant-funded studies are ongoing to determine the best design options that will ensure year round compliance with fish screening criteria. Rice Livestock agrees to seek funding, assist with installation, and maintain an effective diversion facility that includes a fish screen that meets fish screening criteria. One hundred percent design is anticipated to be completed by mid-2018. Implementation funding will be applied for during 2018 and implementation is expected to be complete by 2022. If funding is not secured by 2024, Rice Livestock will meet with agencies to re-evaluate the project.

A1.12.3 Additional Beneficial Management Activities

A1.12.3.1 Hydrology/Water Quality

- In exchange for the water conservation improvements identified in the project design on the NRZ Riparian Ditch, Rice Livestock agrees to the efficiency improvements identified in the design that is under development, and the Rice Livestock will work to develop and implement conservation solutions. The scope of this work includes reducing diversion from 10.0 cfs to 5.0 cfs through converting main ditch and lateral ditches to piping and flood valves. Rice Livestock will work with SWCG to add instream beneficial use as an additional benefit for water conserved by proposed projects for Huseman and Novy-Rice-Zenkus Riparian Diversion including using water code 1707 or equivalent. Implementation is estimated to occur within 3 years of signing the Agreement. If funding is not secured by 2024, Rice Livestock will meet with agencies to re-evaluate the project.

- Through the Rice Livestock and NB Ranches Site Plan Agreements, a comprehensive piping proposal is proposed for the entire Huseman Ditch. The comprehensive Huseman Ditch piping proposal is to dedicate 1.9 cfs for instream benefit in exchange for a pipeline approximately 13,800' in length with two proposed laterals (one to allow release of a spring to the Shasta River for instream benefit, the other to reduce tailwater). This proposal includes NB Ranches dedicating two cold water springs (approximately 0.3 cfs) to instream benefit in addition to the 1.9 cfs reduction (Rice Livestock and NB Ranches) in maximum diversion. The Huseman Ditch Association will include instream beneficial uses as an additional beneficial use and dedicate the 1.9 cfs to instream benefit through California Water Code section 1707 or equivalent.

- As a result of water delivery and irrigation efficiency provided by the proposed continued pipeline for Huseman Ditch through the Rice Livestock property, maximum diversion use will reduce from 11.9 cfs to 10.0 cfs while Rice Livestock is irrigating with Huseman Ditch water (on average 6 days of irrigation out of every 15 days). The pipeline length through the Rice Livestock Property would be approximately 6,500'. Reduced diversion volume and increased efficiency would result in approx. 299 afy of conserved water for Rice Livestock. Rice Livestock will participate in re-design, seek funding and assist with implementation with a projected implementation target of three years after signing the Agreement. If funding is not secured by 2024, Rice Livestock will meet with agencies to re-evaluate the project.

- Huseman Ditch, through NB Ranches, Inc. and Rice Livestock Company, Inc. will work with SWCG to add instream beneficial use as secondary benefit for water conserved by proposed projects for Huseman. The project has been designed by NRCS but would require some revision to truncate the piping reach, determine pipe diameter and conduct necessary permitting. Rice Livestock and NB Ranches are initiating re-design with NRCS currently. Rice Livestock and NB Ranches are willing to enter process to protect conserved water through Water Code 1707 or equivalent with the "batched approach" moving forward with TNC in 2018. Rice Livestock and NB Ranches commit to seeking funds for design, permitting and installation of the pipeline. Rice Livestock and NB Ranches intend to have pipeline installed by the close of the 5th year of the agreement and will meet with permitting agencies if funding is not obtained by that point.

- Rice Livestock will cooperate in the Mid-Shasta Flow Strategy as describe in their Site Plan Agreement and the FMS. These measures are in addition to the water conservation projects described for the Novy-Rice- Zenkus Riparian water conservation project and the Huseman Ditch water conservation project, as described above.

- Rice Livestock agrees to enter into a Forbearance Agreement with SWCG members for the purpose of improving habitat for covered species in the Shasta River.

A1.12.3.2 Instream Habitat Complexity

- Rice Livestock will allow and participate with the design, funding and installation of instream structures including four LWD structures, and enhancement of two existing off-channel habitats/oxbows located in the gravel field. Rice Livestock is willing to participate in developing back-water rearing, if feasible, in this stretch of the Shasta River. Rice Livestock will participate in design, seek funding and assist with implementation with a hopeful implementation target of three year after signing of agreement. If funding is not secured within 5 years of permit issuance, Rice Livestock will meet with agencies to re-evaluate project.

- Rice Livestock will participate in a beaver management plan developed for the Mid-Shasta Reach.

A1.12.3.3 Riparian Function

- Rice Livestock will allow and participate in riparian investigations and assessments that will lead to an established riparian area, if feasible. If riparian plantings are proposed, Rice Livestock is supportive and will aid to protect plantings but will not be held accountable for meeting any performance/success standards based on previous planting results.

- Rice Livestock, intends to continue riparian area exclusion unless significant damage to existing riparian fencing results in reconstruction and realignment of riparian fencing.

- Riparian exclusion fencing was completed for the entire Rice Livestock Property in 2003. Rice Livestock intends to continue livestock exclusion of the riparian area. Rice Livestock will continue to maintain riparian fencing and will repair up to 25% of flood-damaged riparian fencing. If riparian fencing loss due to flood is greater than 25 percent, Rice Livestock will, install temporary electrical fencing and work with CDFW, NOAA and funding partners to repair or replace the fencing.

- Rice Livestock maintain the wet crossing and limit crossing to about 10 times a years from May 1 through November 1. Livestock watering access sites also exist at the Boot Field, Field #3 and Gravel Pit Field. The access sites are rocked with angular rock, are approximately 20 feet wide and panels exist to limit access into the river. The livestock watering sites but are not currently used and will only be used if the existing alternative livestock watering system is not functioning.

A1.12.3.4 Substrate Quality

- Rice Livestock will conduct a site visit with agency representatives to determine if the stream reach has spawning substrate.

A1.12.3.5 Assessments/Studies

- Rice Livestock will continue to allow access for studies and assessments including existing temperature and DO monitoring at Hwy A-12.

- Rice Livestock will review other existing studies and assessments. Participation with other surveys will be considered on a case by case basis.

A1.12.3.6 Supplementation

- Rice Livestock will allow reasonable access for salmonid supplementation and all associated monitoring activities.

A1.13 Seldom Seen Ranch (Permit 23290)

The Seldom Seen Ranch is a privately owned property, operated by Emmerson Investments, Inc. (Emmerson Investments). Seldom Seen Ranch is located along the Upper Shasta Reach within the Agreement. Under the Seldom Seen Ranch Site Plan Agreement, Emmerson Investments proposes the actions summarized in this section. Emmerson Investments agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.13.1 Actions Required to Maintain Baseline Conditions

A1.13.1.1 Hydrology/Water Quality

- With funding provided by the Pacific States Marine Fisheries Commission under a grant from NMFS, in cooperation with CDFW, Emmerson Investments undertook an irrigation efficiency study and cooperated in more than seven years of CDFW studies of juvenile salmonid distribution and habitat use with direct observations, PIT tag technology, water temperature monitoring, flow monitoring, etc.

- Seldom Seen Ranch is sprinkler irrigated and Emmerson Investments agrees to continue using groundwater and precipitation, only, for irrigation.

A1.13.1.2 Passage/Migration/ Diversion Screening

- Emmerson Investments conducted for one year and continues to participate in spawner surveys for all reaches with suitable spawning habitat.

- Emmerson Investments cooperated in more than seven years of CDFW studies of juvenile salmonid population estimates, distribution, and habitat use with direct observations, PIT tag technology, water temperature monitoring, flow monitoring, etc.

- Emmerson Investments has cooperated with NMFS and CDFW in redesign and implementation of upgrade to Diversion 156 within 5 years of permit issuance.

A1.13.1.3 Riparian Function/ Channel Structure

- The Shasta River through the Seldom Seen Ranch is 100% narrow-corridor fenced for exclusion of cattle from the riparian area. Emmerson Investments agrees to maintain riparian fencing, and to replace, out-of-pocket, at least 20% of riparian fencing if needed due to high flow damage. Partners for additional funding to replace fencing to 100% will be sought, if necessary.

- Emmerson Investments has limited cattle and vehicle access to the Shasta River to two crossings Emmerson Investments agrees to maintain crossings and cap the number of livestock and vehicle access points to current number.

A1.13.1.4 Spawning Substrate

- Emmerson Investments cooperated in McBain and Trush study (McBain & Trush Inc. et al. 2010) by allowing access for evaluation of gravel composition and quality.

A1.13.1.5 Pasture Management

- Emmerson Investments maintains that fall calving to produce calves big enough to fully utilize upland, seasonal range, comprising more than half of the Seldom Seen Ranch, and rotation and stocking rates in irrigated (and non-irrigated) pastures are managed to maintain optimum forage cover and heights based on water year type.

A1.13.2 Actions required to Achieve Elevated Baseline Conditions

A1.13.2.1 Hydrology/Water Quality

- Emmerson Investments agrees to continue cooperation in project to upgrade the neighboring Mallet Hidden Valley Ranch (MHVR) diversion (POD) as described in their Site Plan Agreement within five years of permit issuance.

- Emmerson Investments agrees to change plumbing at Wheel Line Fields to eliminate wheel line drain- water proximate to river, within 2 years of permit issuance.

A1.13.2.2 Passage/Migration/ Diversion Screening

- Emmerson Investments agrees to continue working collaboratively with NMFS and CDFW in redesign and implementation of upgrade to Diversion 156 (upstream of ranch fenceline on MWCD property). Completion estimated within 5 years of permit issuance

A1.13.3 Additional Beneficial Management Activities

A1.13.3.1 Hydrology/Water Quality

- Emmerson Investments agrees to include Seldom Seen Ranch pastures in Project Area for testing effectiveness of soil moisture sensor technology, and other appropriate technologies, to increase irrigation efficiency, to implement routine use where appropriate, and to adjust water management accordingly, within 15 years of permit issuance

- Emmerson Investments agrees to enter into a Forbearance Agreement with SWCG members for improving habitat for the Covered Species.

- Emmerson Investments agrees to continue cooperating in studies to redesign and reconstruct MHVR diversion located on Seldom Seen Ranch. Completion of this project estimated within 5 years from permit issuance.

A1.13.3.2 Riparian Function/Channel Structure

- Emmerson Investments agrees to create a management plan to, at a minimum, not deter dam building beaver activity except where it damages infrastructure, e.g. impairs irrigation control structures, inundates crossings, etc. When necessary, Emmerson Investments will work in conjunction with fisheries management personnel to physically breach dams during smolt outmigration, juvenile redistribution, and/or adult spawning periods, generally March to mid-June and November to January or provide alternate passage opportunities through or around the beaver dams. Estimated completion within 5 years of permit issuance

- Emmerson Investments agrees to work collaboratively with NMFS and CDFW to seek funding and implement riparian planting projects where existing riparian habitat is less than site-potential, at various locations in sub-reach from Riverside Road to property line, within 15 years of permit issuance.

- Emmerson Investments agrees to maintain fences and utilize adaptive management approach to monitor, assess, and, where necessary, modify riparian management practices, whether exclusion or prescriptive grazing strategies.

- Emmerson Investments agrees to work collaboratively with NMFS and CDFW to seek funding and implement projects to place up to a total of nine LWD structures in reach between Riverside Road and MHVR fenceline. Completion estimated within 5 years of permit issuance.

- Emmerson Investments agrees to work collaboratively with NMFS and CDFW to seek funding and implement projects to place up to a total of 14 LWD sites in coordination with MHVR in sub-reach of the river that is the common property boundary of the two ranches. Completion estimated within 5 years of permit issuance.

- Emmerson Investments agrees to work collaboratively with NMFS & CDFW to seek funding, design, and implement a project to increase in-stream habitat complexity, generally and specifically at the confluence of the Seldom Seen Spring channel and the river. Completion estimated within 10 years of permit issuance

A1.13.3.3 Spawning Substrate

- Emmerson Investments agrees to work collaboratively with NMFS and CDFW to seek funding and implement projects to augment spawning gravels at up to seven sites between Riverside Road and MHVR fenceline. Existing riffles will be considered as priority sites. Completion estimated within 10 years of permit issuance

- Emmerson Investments agrees to work collaboratively with NMFS and CDFW to seek funding and implement projects to augment spawning gravels up to four riffles in reach common with MHVR. Completion estimated within 10 years of permit issuance.

A1.14 Shasta Springs Ranch (Permit 23291)

The Shasta Springs Ranch is a privately owned property, operated by Emmerson Investments. Shasta Springs Ranch is located in the Covered Area east of Interstate 5. Named streams flowing through the Enrolled Property are Parks Creek and Kettle Springs Creek. Significant springs, two of which are sometimes referred to as Black Meadow and Bridge Field, emerge at the west margin of the ridge between Lake Shastina and the Enrolled Property. For the purposes of the Agreement, activities on Shasta Springs Ranch have the potential to influence the Mid Parks Creek Reach and Lower Parks Creek Reach. Under the Shasta Springs Ranch Site Plan Agreement, Emmerson Investments proposes the actions summarized in this section. Emmerson Investments agrees to follow all relevant AMMs, monitoring, and reporting requirements, as described in the Agreement and its appendices, and in their Site Plan Agreement.

A1.14.1 Actions Required to Maintain Baseline Conditions

A1.14.1.1 Hydrology/Water Quality

- With funding provided by the Pacific States Marine Fisheries Commission under a grant from NOAA in cooperation with CDFW, Emmerson Investments undertook and irrigation efficiency study and cooperated in more than seven years of CDFW studies of juvenile salmonid distribution and habitat use with direct observations, PIT tag technology, water temperature and flow monitoring, etc.

- Emmerson Investments has completed project to design and construct a spring source management structure at the head of Kettle Springs Creek, including replacing 2300 feet of open ditch with pipe and alfalfa valves. Emmerson Investments agrees to operate and maintain the Kettle Springs Irrigation Management Structure that by design leaves flow in excess of water right instream.

- Emmerson Investments is cooperating with UCCE to experiment with the use of soil moisture sensors and related technology to optimize applied water, which may result in a reduction of diversion and, ideally, improved instream water quality. Emmerson Investments agrees to implement modified irrigation practices if so informed by the findings of the research.

- Emmerson Investments repaired and will continue maintaining tailwater berms at the low side of irrigated pastures.

- Emmerson Investments agrees to continue to refine irrigation practices that minimize applied water accumulating at the low side of fields.

- Emmerson Investments in a 2016 flow/diversion experiments in Parks Creek to evaluate alternative diversion coordination scenarios

- Emmerson Investments cooperated in McBain and Trush, Big Springs Complex Interim Instream Flow Needs study with access and data Upgrade/repair/maintain diversion facilities.

- Emmerson Investments ceased using Kettle Springs impoundment and outlet as a drain for the slough to the south.

- Emmerson Investments has completed redesign and upgrade of diversion structure at the head of Kettle Springs Creek to: 1) provide uninterrupted flow of water from Kettle Springs, 2) preclude fish from swimming into ditches while still being able to irrigate, and 3) increase efficiency, allowing more water to be kept instream for summer rearing habitat. Emmerson Investments agrees to operate and maintain the structure and pipelines.

A1.14.1.2 Passage/Migration/ Diversion Screening

- Emmerson Investments conducted for one year and participated in, for several years, spawner surveys for all reaches with suitable spawning habitat.

- Emmerson Investments cooperated in more than seven years of CDFW studies of juvenile salmonid population estimates, distribution, and habitat use with direct observations, PIT tag technology, water temperature monitoring, flow monitoring, etc.

- With grant from USFWS Partners in Fish and Wildlife Program, and a match from the NRCS, Emmerson Investments modified Parks #5 Diversion from a flashboard dam to a roughened channel, eliminating a potential barrier to juvenile Covered Species springtime distribution

- Emmerson Investments cooperated in studies to reconstruct fish migration barrier located upstream of the Enrolled Property (under the I-5 bridge) with closest access through the property and agrees to continue cooperating to completion and for monitoring.

A1.14.1.3 Riparian Function/ Channel Structure

- Emmerson Investments with matching funding from USFWS Partners in Conservation Program and NFWF, has fenced 60% of Parks Creek, 100% of Kettle Springs Creek, and 80% of Bridge Field Springs Creek to exclude cattle grazing. Emmerson Investments agrees to maintain riparian fencing, and to replace, out-of-pocket, at least 20% of riparian fencing if needed due to high flow damage. Partners for additional funding to replace fencing to 100% will be sought, if necessary.

- Emmerson Investments has limited cattle and vehicle fording across Parks Creek and tributaries to four vehicle/stock crossings and three stock only crossings. Emmerson Investments agrees to maintain crossings and cap the number of livestock and vehicle access points to current number

- Emmerson Investments realigned fencing to water cattle off-channel in pastures west of Parks Creek.

- No beaver-created fish passage barriers have been detected, but beaver-exclusion cages were added to riparian plantings at Parks #5 Fish Passage Improvement Project.

- Emmerson Investments included woody riparian planting with Parks #5 Fish Passage Improvement Project, including re-alignment of exclusion fence at Emmerson Investments' expense. Emmerson Investments agrees to monitor survival of plantings at Parks #5 and replace any damaged tree protection until cuttings are established

- Emmerson Investments included woody riparian planting with Kettle Springs Improvement Project.

A1.14.1.4 Pasture Management

- Fall calving producing calves big enough to fully utilize upland, seasonal range, comprising more than half of the Shasta Spring Ranch. Emmerson Investments agrees that rotation and stocking rates in irrigated and non-irrigated pasture will be managed to maintain optimum forage cover and heights based on water year type.

A1.14.2 Actions required to Achieve Elevated Baseline Conditions

A1.14.2.1 Hydrology/Water Quality

- Emmerson Investments agrees to construct and maintain enhanced tailwater berms to eliminate tailwater returning as warm surface flow to Kettle Springs Creek, if applicable, within 2 years of permit issuance

- Emmerson Investments agrees to conduct an evaluation of water quality conditions in and in the vicinity of the road crossing over Kettle Springs Creek to identify and eliminate any man-made variables contributing to elevated temperatures observed in this stream segment in past studies. The study will be completed within 2 years of permit issuance. Solutions for management-induced variables will be sought concurrently with findings and implemented within five years of permit issuance.

A1.14.2.2 Passage/Migration/ Diversion Screening

- With acquisition of funding, Emmerson Investments agrees to upgrade remaining POD to current fish passage and screening standards, post-evaluation that will be part of Mid-Parks', East Side Pastures and Spring Channels Renovation Project, proposed.

A1.14.2.3 Riparian Function/ Channel Structure

- Emmerson Investments agrees to implement the riparian grazing plan developed in conjunction with UCCE Range Specialists for riparian pastures along Parks Creek in and upstream of the Wheatgrass Field, as described in their Site Plan Agreement, within 2 years of permit issuance.

• Emmerson Investments agrees to implement the riparian grazing plan developed in conjunction with UCCE Range Specialists for riparian zone inside the corridor fencing along Parks Creek between the Lake Field and the North Slough as described in their Site Plan Agreement, within 2 years of permit issuance.

A1.14.3 Additional Beneficial Management Activities

Many of the Beneficial Management Activities discussed in this subsection, are components of a larger project called the "Mid-Parks Creek, East Side Pastures and Spring Channels Renovation Evaluation Project" (Mid-Parks Creek Project), which is described in detail in their Site Plan Agreement, and summarized for each habitat parameter below.

The Mid-Parks Creek Project goals include:

- Increase the volume of self-sustaining, complex instream habitat for salmonids in Mid-Parks Creek reach and/or unnamed spring channels, including but not limited to safe passage at irrigation diversions in spring channels. The latter would be considered as part of "elevated baseline";

- Increase the reliability and quality of spring water inflow into Parks Creek from springs east of Parks Creek in the Mid-Parks Creek reach;

- Increase the productivity of the pastures east of Parks Creek on the Shasta Springs Ranch through improved reliability of water and efficiency of irrigation;

- Increase channel and floodplain function, minimize landowner emergency actions to protect property, and reduce overall maintenance during flood flows and the aftermath.

Emmerson Investments agrees to the following Mid-Parks Creek Project actions:

- to collaborate with NMFS and CDFW on a feasibility study, to be completed in five years from permit issuance.

- to bypass at least 1 cfs of Bridge Field Springs for the interim period of five years from permit issuance, for the feasibility study. Emmerson Investments will also assess and, to the extent feasible, provide quantifiable additional (above irrigation demand) spring flows in this period.

- to work collaboratively with the NMFS and CDFW to commit to implementation of the study recommendations, if the above goals can be satisfactorily accomplished, per the findings of the feasibility study.

Failing to find satisfactory achievement of the above goals at conclusion of feasibility study, Emmerson Investments agrees to meet and confer with NMFS and CDFW to seek alternative solutions to provide net conservation benefits for the Covered Species.

A1.14.3.1 Hydrology/Water Quality

• Assuming acquisition of additional funding for evaluation, design, permits, and construction, Emmerson Investments will reconstruct, operate, and maintain Parks #4 Diversion to supply irrigation to fields on both sides of Parks Creek. Between ditch loss savings (of an undetermined quantity) and flow bypassed between Parks #1 and #4, stream habitat quality could benefit significantly, especially during the critical spring time-frame for smolt migration and juvenile Covered Species redistribution. Estimated completion within 5 years of permit issuance.

• Emmerson Investments agrees to take part in the Mid-Parks Creek Project, as described above, within 5 years of permit issuance for feasibility study.

• Emmerson Investments agrees to include additional Shasta Springs Ranch pastures in Project Area for testing effectiveness of soil moisture sensor technology to increase irrigation efficiency, implement routine use where appropriate, and adjust irrigation management accordingly

• Emmerson Investments agrees to continue taking part in Parks Creek Diversion Management Strategy with forbearance agreement as described in their Site Plan Agreement and the FMS.

A1.14.3.2 Passage/Migration/ Diversion Screening

• Emmerson Investments agrees to conduct water quality investigation of Bridge Field Springs Creek and the North Slough to evaluate limitations to improving summer rearing conditions for juvenile salmonids, within 2 years of permit issuance

• Emmerson Investments agrees to evaluate alternatives for screen placement at Parks #3 diversion. Existing screen and fish bypass are functioning but further down-ditch than current guidelines recommend. Assuming an improved design can be developed and funded, Emmerson Investments agrees to implement upgrade. Funding for design and implementation will be sought within 5 years of permit issuance.

• Emmerson Investments agrees to continue cooperating in project to remediate fish migration barrier located upstream of the Shasta Springs Ranch (under the I-5 Bridge).

A1.14.3.3 Riparian Function/ Channel Structure

• Emmerson Investments agrees to create a management plan to, at a minimum, not deter dam building beaver activity except where it damages infrastructure, e.g. impairs irrigation control structures, inundates crossings, etc. When necessary, Emmerson Investments will work in conjunction with fisheries management personnel to physically breach dams during smolt outmigration, juvenile redistribution, and/or adult spawning periods, generally April to mid-June and November to January or provide alternate passage opportunities through or around the beaver dams. Estimated completion within 5 years of permit issuance.

• Emmerson Investments agrees to take part in riparian planting projects where existing riparian habitat is less than site-potential along Parks Creek. No sites are currently planned; however, it is expected that sites will be identified as an outcome of Mid-Parks Creek Project.

• Post-alteration of Cardoza's POD, Emmerson Investments agrees to work collaboratively with NMFS and CDFW on riparian enhancement projects in lower Mid- Parks Creek, within 5 years, post-completion of Cardoza's POD change.