UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2020-00083

September 1, 2020

David O. Howell
Acting District Manager, Northwest Oregon
Bureau of Land Management
1717 Fabry Road SE
Salem, Oregon 97306

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Horning and Tyrrell Seed Orchards Integrated Pest Management Plan, Lower Clackamas River Watershed (1709001106), Lower Molalla River Watershed (1709000906); Upper Siuslaw River (1710020603)

Dear Mr. Howell:

Thank you for your letter of January 22, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Horning and Tyrrell Seed Orchards Integrated Pest Management Plan. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) Chinook salmon, LCR coho salmon (*O. kisutch*), Oregon Coast coho salmon, LCR steelhead (*O. mykiss*), UWR steelhead, or result in the destruction or adverse modification of their designated critical habitat.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the opinion for programs that do not require further Bureau of Land Management (BLM) decisions. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The incidental take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the Federal action agency must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

This document also includes the results of our analysis of the action's likely effects on EFH pursuant to section 305(b) of the MSA, and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. One of the conservation recommendation is a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the BLM must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please contact Mischa Connine of the Oregon/Washington Coastal Office at 503-230-5401, or Mischa.Connine@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Cory Sipher

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

Horning and Tyrrell Seed Orchards Integrated Pest Management Plan

NMFS Consultation Number: WCRO-2020-00083

Action Agency: USDI, Bureau of Land Management

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?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Upper Willamette River Chinook salmon	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Oregon Coast coho salmon	Threatened	Yes	No	Yes	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead	Threatened	Yes	No	Yes	No

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	Yes

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

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: September 1, 2020

TABLE OF CONTENTS

1. Introduction 1
 1.1 Background 1
 1.2 Consultation History 1
 1.3 Proposed Federal Action 1
  1.3.1 General Aquatic Conservation Measures 7
  1.3.2 Climate Change – Consider climate change information, such as predictive hydrographs for a given watershed or region, when designing projects covered by this opinion. 8
2. Endangered Species Act: Biological Opinion And Incidental Take Statement 18
 2.1 Analytical Approach 18
 2.2 Rangewide Status of the Species and Critical Habitat 19
  2.2.1 Status of the Species 21
  2.2.2 Status of the Critical Habitat 26
 2.3 Action Area 28
 2.3 Environmental Baseline 31
 2.4 Effects of the Action 32
 2.5 Cumulative Effects 47
 2.6 Integration and Synthesis 48
 2.7 Conclusion 50
 2.8 Incidental Take Statement 50
  2.8.1 Amount or Extent of Take 51
  2.8.2 Effect of the Take 52
  2.8.3 Reasonable and Prudent Measures 52
  2.8.4 Terms and Conditions 52
 2.9 Conservation Recommendations 55
 2.10 Reinitiation of Consultation 55
3. Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response 55
 3.1 Essential Fish Habitat Affected by the Project 56
 3.2 Adverse Effects on Essential Fish Habitat 56
 3.3 Essential Fish Habitat Conservation Recommendations 56
 3.4 Statutory Response Requirement 56
 3.5 Supplemental Consultation 57
4. Data Quality Act Documentation and Pre-Dissemination Review 57
5. References 59
6. Appendix 67

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

The 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 within 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 Oregon Washington Coastal Office.

1.2 Consultation History

On January 22, 2020, we received a request from the USDI Bureau of Land Management (BLM) for ESA section 7 consultation for Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) Chinook salmon, LCR coho salmon (*O. kisutch*), Oregon Coast coho salmon, LCR steelhead (*O. mykiss*), UWR steelhead, and designated critical habitat for these species. This consultation will replace the NMFS 2009a and letters of concurrence, and the NMFS 2010a, 2010b, and 2010c biological opinions. Consultation was initiated on January 22, 2020. This opinion is based on information provided during the above-mentioned meeting, the Seed Orchard Biological Assessment (BLM 2020), and other relevant information as described below.

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).

Under the MSA, "federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).]

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

The Integrated Pest Management Plan (IPM) for the Horning and Tyrrell Seed Orchards (referred to hereafter as the Seed Orchards) is an approach to managing pests that combines the following tools:

1. Chemical insecticides, herbicides, fungicides, and fertilizers
2. Cultural methods, including mechanical (tractor mowing) and manual (pruning) methods, mulch mats, and fences
3. Prescribed burning to remove vegetation
4. Biological controls, such as targeted grazing, bird or bat boxes to attract insect-eaters, or encouraging predators that can control animal pests

In past years from 2006 to 2018, chemical applications have occurred 654.4-711.6 acres at Horning, and 744.6-999.4 acres at Tyrrell. In past years from 2006 to 2018, chemical applications have occurred 654-712 acres at Horning, and 745-999 acres at Tyrrell. While most of the Seed Orchard IPM will remain the same analyzed in previous consultations, the BLM is proposing to modify its use of chemicals as follows (Table 1):

1. Consolidate and update the results of previous ESA consultations that all together authorized the Seed Orchards to use a total of 29 pesticides (NMFS 2009a, 2009b, 2010a, 2010b, and 2010c), and to expand the treatment windows for the use of those pesticides use consistent with pesticide labels that have been updated by the US Environmental Protection Agency (EPA) since 2005.
2. Add 14 pesticides to the authorized list that are already approved for use on other BLM lands adjacent to the Seed Orchards, including 10 pesticides that are covered under NMFS 2013a ("ARBO II," the "Aquatic Restoration Biological Opinion"), and three pesticides covered under NMFS 2019 ("IIPM," "Integrated Invasive Plant Management" biological opinion);
3. Expand the use of four pesticides that are approved for aquatic use under NMFS (2013a) so they may also be used over-water, above the waterline, on the exposed parts of emergent vegetation; and
4. Add four new pesticides to the authorized list that have not been previously analyzed for their effects on the ESA-listed species and critical habitats that are considered in this consultation.

Under the proposed IPM, invasive plants on the Seed Orchards would be treated according to the treatment key tables in Appendix C of the IIPM Environmental Assessment (EA) (BLM 2018), which is incorporated here by reference. This treatment key lays out treatment options and considerations by species groups.

Table 1. Pesticides and locations for the proposed operation of the Horning and Tyrrell Seed Orchards Integrated Pest Management Plan. All applications are proposed to occur year-round except as constrained by project design features and pesticide labels. All reference to tables and appendices in the Seed Orchard EA (BLM 2020)(Also see Appendix in this document).

	Pesticide	Covered in Previous ESA Consultations	Location	Limitations and Application Rates
Fungicides	Chlorothalonil	Yes-Tyrrell and Horning Seed Orchards	Orchards, greenhouses, native plant beds	Table C-11
	Hydrogen dioxide	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-10
	Mancozeb	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-11
	Propiconazole	Yes-Tyrrell and Horning Seed Orchards	Native plant beds	Table C-10
	Thiophanate-methyl	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-10
	Iprodione (Fungicide)	No	Greenhouses	Table C-11
Fumigant: Dazomet		Yes-Tyrrell and Horning Seed Orchards	Native plant beds	Table C-11
Herbicides	Dicamba	Yes-Tyrrell and Horning Seed Orchards	Orchards, native plant beds	Table C-4
	Glyphosate	Yes-Tyrrell and Horning Seed Orchards	Orchards, native plant beds, water	Table C-4
	Hexazinone	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-4
	Picloram	Yes-Tyrrell and Horning Seed Orchards	Orchards, native plant beds	Table C-4
	Triclopyr TEA	Yes-Tyrrell and Horning Seed Orchards	Orchards, native plant beds, water	Table C-4
	2,4-D amine	Yes-ARBO II	Orchards, native plant beds, water	Table C-4
	Aminopyralid	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Chlorsulfuron	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Clopyralid	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Difulfenzopry+dicamba	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Fluazifop-P-butyl	Yes-IIPM	Orchards, native plant beds	Table C-4
	Fluroxypyr	Yes-IIPM	Orchards, native plant beds	Table C-4
	Imazapic	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Imazapyr	Yes-ARBO II	Orchards, native plant beds, water	Table C-4
	Metsulfuron methyl	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Rimsulfuron	Yes-IIPM	Orchards, native plant beds	Table C-4
	Sethoxydim	Yes-ARBO II	Orchards, native plant beds	Table C-4
	Sulfometuron methyl	Yes-ARBO II	Orchards, native plant beds	Table C-4
Plant Hormone: Gibberellic acid		No	Orchards	Appendix G
Insecticides	Acephate	Yes-Tyrrell and Horning Seed Orchards	Orchards, greenhouses, native plant beds	Table C-7
	Bacillus thuringiensis (B.t.),	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-7
	Chlorpyrifos	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-8
	Diazinon	Yes-Tyrrell and Horning Seed Orchards	Orchards, native plant beds	Table C-7
	Dimethoate	Yes-Tyrrell and Horning Seed Orchards	Orchards	
	Esfenvalerate	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-8
	Horticultural oil	Yes-Tyrrell and Horning Seed Orchards	Orchards, greenhouses	Table C-8
	Imidacloprid	Yes-Tyrrell and Horning Seed Orchards	Orchards, greenhouses	Table C-8
	Permethrin	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-7
	Potassium salts of fatty acids	Yes-Tyrrell and Horning Seed Orchards	Orchards, greenhouses, native plant beds	Table C-7
	Propargite	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-7
	Emamectin benzoate	No	Orchards	Table C-8
	Spinosad	No	Orchards, greenhouses	Table C-8
Fertilizer	Ammonium Phosphate-Sulfate	Yes-Tyrrell and Horning Seed Orchards	Orchards	Seed Orchard EISs
	Calcium Nitrate	Yes-Tyrrell and Horning Seed Orchards	Orchards	Seed Orchard EISs

Chemical Treatment: Herbicides, Insecticides, and Fungicides

The BLM proposes to apply chemicals identified in Table 1 to terrestrial pests using the following methods: Airblast sprayer, high-pressure hydraulic sprayer, hydraulic sprayer with handheld wand, tractor-pulled spray rig with boom, backpack sprayer, capsule implantation, granular spreader, ground-pull fertilizer spreader, hand application, hand sprayer (greenhouse only), chemigation (greenhouse only), and total-release canister (greenhouse only). Additionally, helicopters may be used for aerial application of esfenvalerate and spinosad at both orchards, and for fertilizers and the biological insecticide *Bacillus thuringiensis* (B.t.), at the Tyrrell Seed Orchard. Additional information about the treatment methods and limitations related to each pesticide are described in the Seed Orchard EA, at Appendix C: Treatments and Treatment Plans (BLM 2020).

The BLM also proposes to treat aquatic plant infestations with herbicides. Aquatic infestations will be treated with the same four herbicides covered under ARBO II, which include 2,4-D amine, glyphosate, imazapyr, and triclopyr TEA (NMFS 2013a). However, unlike ARBO II, in the Seed Orchards IPM, the BLM also proposes to use these herbicides over-water, above the waterline. This includes vegetation that is within a waterbody, but only the exposed part of the plant above the surface of the water would be treated.

Cultural Control Methods

The cultural control of invasive plants includes the following methods:

- Vegetation: hand-pulling; non-powered and powered hand tools to cut and clear; tractors with various mowing attachments and gasoline-powered string trimmers for mowing grass and other vegetation; brush-cutting machine mounted on tractor for cutting brush and topping trees; chainsaw for cutting thinned, rogued, or dead/dying orchard trees and brush; pruner, power pruners, and similar equipment for cutting tree limbs and brush; chipping; tilling an unvegetated buffer around native plant beds; organic hot foam weed control; mulch mats to control vegetation around orchard trees; mulch or black plastic to cover, and control noxious weeds, and other vegetation
- Aquatic vegetation: hand-pulling, rakes, shovels, or bottom barriers/weed mats, and mechanical methods including dive-assisted suction harvest or tractors.[1] Treatments may be done via boat; for example, aquatic weeds may be manually pulled out by someone in a kayak.
- Insects: pruning, thinning, use of grafting wax or spray seal on tree wounds, sanitation of damaged branches and trees, cone sanitation (clean-picking cones from trees), hand-picking large and noticeable insect pupae
- Disease: pruning, thinning, cone sanitation, stump grinding, power saws to cut infected or dead trees, physical removal of stump by grinding or pulling; in greenhouse, knocking or blowing water off seedlings and control of air flow through the use of fans and convection tubes

[1] Mechanical methods would not include aquatic weed harvesters.

- Animal pests: trapping of gophers, porcupines, and other small mammals; walking (herding) stray deer and elk toward gate and out of orchard; pruning tree limbs up at the base of the trees; removing unwanted vegetation; mowing cover crop vegetation that provides cover for small mammals; live trapping; fencing to exclude deer and elk from orchard; Vexar tubes to protect seedlings; use of sticky traps in greenhouse; screening to exclude squirrels from seed extractor and cone shed

Prescribed Fire

- Vegetation: propane-fueled torch for vegetation removal in native plant beds prior to planting; pile burning of cut and cleared vegetation, and small patches of underburning in orchard units
- Insects: pile burning of insect-damaged branches and trees; burning insect-damaged cones and cones collected during sanitation operations or seed extraction
- Disease: pile burning of infected branches and trees; burning grass straw in bed rows in the native plant gardens

Biological Control

- Vegetation: domesticated grazing animals placed in the orchard units to control grass cover crop; planting fallow crops or certain cover crops in rows between orchard trees to limit growth of undesirable vegetation and noxious weeds
- Insects: bird boxes to attract insect-eating birds; bat boxes to attract insect-eating bats; naturally occurring bacteria such as B.t., a biological insecticide; predator mites and nematodes, ladybugs, and aphid lions.
- Animal pests: predators including coyote, fox, and cougar are present and frequent the seed orchard grounds to aid in the control of animal pests

Other Non-Pesticide Methods

- Insects: pheromone bait traps to attract and kill insects
- Fertilization to promote overall tree health, cone production, and disease resistance

Standard Operating Procedures and Project Design Features

There are numerous required standard operating procedures (SOPs), and project design features (PDFs) that have been developed to protect water resources, riparian and aquatic habitat, and aquatic organisms, and are listed in full in the Seed Orchard EA at in Appendix D (BLM 2020). Some of the SOPs or PDFS relevant to this proposed action include:

- For treatment of aquatic vegetation, (1) treat only that portion of the aquatic system necessary to meet vegetation management objectives, (2) use the appropriate application method to minimize potential for injury to desirable vegetation and aquatic organisms, and 3) follow water use restrictions on the herbicide label.
- Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide or combination of herbicides used, and use spot treatments rather than broadcast treatments.
- Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body.

- Do not rinse spray tanks in or near water bodies.
- Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams.
- When using targeted grazing by goats or sheep, their access to streams for crossing or for water will be limited to areas on bedrock or with stabilized banks and streambed to minimize trampling damage, sediments entering water, and other potential for damage to fish habitat. A full-time herder, or temporary stream exclosure fencing is required to keep the grazing focused on the target areas and species, and out of the stream.
- Cows and horses may be used for secondary grazing; however, they will be used only in the Seed Orchards, and excluded from riparian areas.
- When using prescribed fire, maintain vegetated buffers near fish-bearing streams to minimize soil erosion and soil runoff into streams.

The BLM proposes the following to further reduce effects on ESA-listed fish, and other aquatic organisms under the proposed action.

In waterbodies that contain federally threatened or endangered fish species or provide critical habitat, follow all Project Design Criteria developed in coordination with NMFS including setback distances in ARBO II (NMFS 2013a) (Table 2), except for the over-water use of 2,4-D amine, glyphosate, imazapyr, and triclopyr TEA), as described previously.

- Delay treating side channels and connected backwaters until they are disconnected from the mainstem river or during the period of lowest flow.
- When using aquatic 2,4-D amine, glyphosate, imazapyr, or triclopyr TEA in closed aquatic systems, implement a phased treatment (treating less than 50 percent of the surface area of the pond at a time) to reduce the likelihood of all of the aquatic plants dying at the same time, which would result in a rapid depletion of dissolved oxygen.

Table 2. Existing ARBO II (NMFS 2013a) criteria for application of aquatic and terrestrial herbicides. The following no-application buffers—which are measured in feet and are based on herbicide formula, stream type, and application method—will be observed during herbicide applications. Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are measured as map distance perpendicular to the bankfull for streams, the upland boundary for wetlands, or the upper bank for roadside ditches.

Herbicide	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry roadside Ditches		
	Broadcast Spraying	Spot Spraying	Hand selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
Aquatic Glyphosate	100	Waterline	Waterline	50	0	0
Aquatic Imazapyr	100	Waterline	Waterline	50	0	0
Aquatic triclopyr-TEA	Not Allowed	15	Waterline	Not Allowed	0	0
Aquatic 2,4-D (amine)	100	Waterline	Waterline	50	0	0
Low Risk to Aquatic Organisms						
Aminopyralid	100	Waterline	waterline	50	0	0
Dicamba	100	15	15	50	0	0
Dicamba + diflufenzopyr	100	15	15	50	0	0
Imazapic	100	15	Bankfull elevation	50	0	0
Clopyralid	100	15	Bankfull elevation	50	0	0
Metsulfuron-methyl	100	15	Bankfull elevation	50	0	0
Moderate Risk to Aquatic Organisms						
Imazapyr	100	15	Bankfull elevation	50	15	Bankfull elevation
Sulfometuron-methyl	100	15	5	50	15	Bankfull elevation
Chlorsulfuron	100	15	Bankfull elevation	50	15	Bankfull elevation
High Risk to Aquatic Organisms						
Triclopyr-BEE	Not Allowed	150	150	Not Allowed	150	150
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50
2,4-D (ester)	100	50	50	100	50	50

All other applicable PDCs for herbicide treatments (PDCs 10-20, and 33) listed in ARBO II (NMFS 2013a) would be used when implementing terrestrial treatments and are as follow, and as enumerated in ARBO II:

1.3.1 General Aquatic Conservation Measures

10. Technical Skill and Planning Requirements

a. Ensure that an experienced fisheries biologist or hydrologist is involved in the design of all projects covered by this opinion. The experience should be commensurate with technical requirements of a project.

b. Planning and design includes field evaluations and site-specific surveys, which may include reference-reach evaluations that describe the appropriate geomorphic context in which to implement the project. Planning and design involves appropriate expertise from staff or experienced technicians (*e.g.*, fisheries biologist, hydrologist, geomorphologist, wildlife biologist, botanist, engineer, silviculturist, fire/fuels specialists).

c. The project fisheries biologist/hydrologist will ensure that project design criteria are incorporated into implementation contracts. If a biologist or hydrologist is not the Contracting Officer Representative, then the biologist or hydrologist must regularly coordinate with the project Contracting Officer Representative to ensure the project design criteria and conservation measures are being followed.

1.3.2 Climate Change – Consider climate change information, such as predictive hydrographs for a given watershed or region, when designing projects covered by this opinion.

11. In-water Work Period – Follow the appropriate state (ODFW 2008) or most recent guidelines for timing of in-water work. If work occurs in occupied Oregon chub habitat, in-water work will not occur between June 1 and August 15. The BLM will request exceptions to in-water work windows through Level 1 NMFS or USFWS representatives as well as essential state agencies.

12. Fish Passage – Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction, stream isolation and dewatering is required during project implementation, or where the stream reach is naturally impassible at the time of construction. After construction, adult and juvenile passage that meets NMFS's fish passage criteria (NMFS 2011a) will be provided for the life of the structure.

13. Site Assessment for Contaminants – In developed or previously developed sites, such as areas with past dredge mines, or sites with known or suspected contamination, a site assessment for contaminants will be conducted on projects that involve excavation of >20 cubic yards of material. The action agencies will complete a site assessment to identify the type, quantity, and extent of any potential contamination. The level of detail and resources committed to such an assessment will be commensurate with the level and type of past or current development at the site. The assessment may include the following:

a. Review of readily available records, such as former site use, building plans, records of any prior contamination events.

b. Site visit to observe the areas used for various industrial processes and the condition of the property.

c. Interviews with knowledgeable people, such as site owners, operators, occupants, neighbors, local government officials, *etc.*

d. Report that includes an assessment of the likelihood that contaminants are present at the site.

14. Pollution and Erosion Control Measures – Implement the following pollution and erosion control measures:

a. Project Contact: Identify a project contact (name, phone number, an address) that will be responsible for implementing pollution and erosion control measures.

b. List and describe any hazardous material that would be used at the project site, including procedures for inventory, storage, handling, and monitoring;

notification procedures; specific clean-up and disposal instructions for different products available on the site; proposed methods for disposal of spilled material; and employee training for spill containment.

c. Temporarily store any waste liquids generated at the staging areas under cover on an impervious surface, such as tarpaulins, until such time they can be properly transported to and treated at an approved facility for treatment of hazardous materials.

d. Procedures based on best management practices to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum product, or other hazardous materials generated, used, or stored on-site.

e. Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities. Ensure that materials for emergency erosion and hazardous materials control are onsite (*e.g.*, silt fence, straw bales, oil-absorbing floating boom whenever surface water is present).

f. Best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action area.

g. No uncured concrete or form materials will be allowed to enter the active stream channel.

h. Steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

15. Site Preparation

a. **Flagging sensitive areas** – Prior to construction, clearly mark critical riparian vegetation areas, wetlands, and other sensitive sites to minimize ground disturbance.

b. **Staging area** – Establish staging areas for storage of vehicles, equipment, and fuels to minimize erosion into or contamination of streams and floodplains.

   i. No Topographical Restrictions – place staging area 150 feet or more from any natural water body or wetland in areas where topography does not restrict such a distance.

   ii. Topographical Restrictions –place staging area away from any natural water body or wetland to the greatest extent possible in areas with high topographical restriction, such as constricted valley types.

c. **Temporary erosion controls** – Place sediment barriers prior to construction around sites where significant levels of erosion may enter the stream directly or through road ditches. Temporary erosion controls will be in place before any significant alteration of the action site and will be removed once the site has been stabilized following construction activities.

d. **Stockpile materials** – Minimize clearing and grubbing activities when preparing staging, project, and or stockpile areas. Any LW, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. Materials used for implementation of aquatic restoration categories (*e.g.,* LW, boulders, fencing material) may be staged within the 100-year floodplain.

e. **Hazard trees** – Where appropriate, include hazard tree removal (amount and type) in project design. Fell hazard trees when they pose a safety risk. If possible, fell hazard trees within riparian areas towards a stream. Keep felled trees on site when needed to meet coarse LW objectives.

16. Heavy Equipment Use

a. **Choice of equipment** – Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (*e.g.*, minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).

b. **Fueling and cleaning and inspection for petroleum products and invasive weeds**

  i. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (*e.g.*, generators, canes), and gas-powered equipment with tanks larger than five gallons.

  ii. Store and fuel equipment in staging areas after daily use.

  iii. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.

  iv. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.

c. **Temporary access roads** – Existing roadways will be used whenever possible. Minimize the number of temporary access roads and travel paths to lessen soil disturbance and compaction and impacts to vegetation. Temporary access roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. When necessary, temporary access roads will be obliterated or revegetated. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period. Construction of new permanent roads is not permitted.

d. **Stream crossings** – Minimize number and length of stream crossings. Such crossings will be at right angles and avoid potential spawning areas to the greatest extent possible. Stream crossings shall not increase the risk of channel re-routing at low and high water conditions. After project completion, temporary stream crossings will be abandoned and the stream channel and banks restored.

e. **Work from top of bank** – To the extent feasible, heavy equipment will work from the top of the bank, unless work instream would result in less damage to the aquatic ecosystem.

f. **Timely completion** – Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.

17. Site Restoration

a. **Initiate rehabilitation** – Upon project completion, rehabilitate all disturbed areas in a manner that results in similar or better than pre-work conditions through removal of project related waste, spreading of stockpiled materials (soil, LW, trees, *etc.*) seeding, or planting with local native seed mixes or plants.

b. **Short-term stabilization** – Measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques. Short-term stabilization measures will be maintained until permanent erosion control measures are effective. Stabilization measures will be instigated within three days of construction completion.

c. **Revegetation** – Replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. Achieve re-establishment of vegetation in disturbed areas to at least 70% of pre-project levels within three years. Use an appropriate mix of species that will achieve establishment and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site. Barriers will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

d. **Planting manuals** – All riparian plantings shall follow Forest Service direction described in the Regional letter to Units, Use of Native and Nonnative Plants on National Forests and Grasslands May 2006 (Final Draft), and or BLM Instruction Memorandum No. OR-2001-014, Policy on the Use of Native Species Plant Material.

e. **Decompact soils** – Decompact soil by scarifying the soil surface of roads and paths, stream crossings, staging, and stockpile areas so that seeds and plantings can root.

18. Monitoring – Monitoring will be conducted by Action Agency staff, as appropriate for that project, during and after a project to track effects and compliance with this opinion.

a. **Implementation**

i. Visually monitor during project implementation to ensure effects are not greater (amount, extent) than anticipated and to contact Level 1 representatives if problems arise.

ii. Fix any problems that arise during project implementation.

iii. Regular biologist/hydrologist coordination if biologist/hydrologist is not always on site to ensure contractor is following all stipulations.

b. **401 Certification –** To minimize short-term degradation to water quality during project implementation, follow current 401 Certification provisions of the Federal Clean Water Act for maintenance or water quality standards described by the following: Oregon Department of Environmental Quality (Oregon BLM, Forest Service, and BIA).

c. **Post project** – A post-project review shall be conducted after winter and spring high flows.

i. For each project, conduct a walk through/visual observation to determine if there are post-project affects that were not considered during consultation. For fish passage and revegetation projects, monitor in the following manner:

ii. Fish Passage Projects – Note any problems with channel scour or bedload deposition, substrate, discontinuous flow, vegetation establishment, or invasive plant infestation.
iii. Revegetation – For all plant treatment projects, including site restoration, monitor for and remove invasive plants until native plants become established.
iv. In cases where remedial action is required, such actions are permitted without additional consultation if they use relevant PDC and aquatic conservation measures and the effects of the action categories are not exceeded.

19. **Work Area Isolation, Surface Water Withdrawals, and Fish Capture and Release** – Isolate the construction area and remove fish from a project site for projects that include concentrated and major excavation at a single location within the stream channel. This condition will typically apply to the following aquatic restoration categories: Fish Passage Restoration; Dam, Tidegate, and Legacy Structure Removal; Channel Reconstruction/Relocation.

a. **Isolate capture area** – Install block nets at up and downstream locations outside of the construction zone to exclude fish from entering the project area. Leave nets secured to the stream channel bed and banks until construction activities within the stream channel are complete. If block nets or traps remain in place more than one day, monitor the nets and or traps at least on a daily basis to ensure they are secured to the banks and free of organic accumulation and to minimize fish predation in the trap.

b. **Capture and release** – Fish trapped within the isolated work area will be captured and released as prudent to minimize the risk of injury, then released at a safe release site, preferably upstream of the isolated reach in a pool or other area that provides cover and flow refuge. Collect fish in the best manner to minimize potential stranding and stress by seine or dip nets as the area is slowly dewatered, baited minnow traps placed overnight, or electrofishing (if other options are ineffective). Fish must be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed fish shall be provided—large buckets (five-gallon minimum to prevent overcrowding) and minimal handling of fish. Place large fish in buckets separate from smaller prey-sized fish. Monitor water temperature in buckets and well-being of captured fish. If buckets are not being immediately transported, use aerators to maintain water quality. As rapidly as possible, but after fish have recovered, release fish. In cases where the stream is intermittent upstream, release fish in downstream areas and away from the influence of the construction. Capture and release will be supervised by a fishery biologist experienced with work area isolation and safe handling of all fish.

c. **Electrofishing** – Use electrofishing only where other means of fish capture may not be feasible or effective. If electrofishing will be used to capture fish for salvage, NMFS's electrofishing guidelines will be followed (NMFS 2000).[2]

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2 *Anadromous Salmonid Passage Facility Design* guidelines are available from the NMFS Northwest Region, Protected Resources Division in Portland, Oregon. (http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf).

i. Reasonable effort should be made to avoid handling fish in warm water temperatures, such as conducting fish evacuation first thing in the morning, when the water temperature would likely be coolest. No electrofishing should occur when water temperatures are above 18ºC or are expected to rise above this temperature prior to concluding the fish capture.
ii. If fish are observed spawning during the in-water work period, electrofishing shall not be conducted in the vicinity of spawning fish or active redds.
iii. Only Direct Current (DC) or Pulsed Direct Current shall be used.
iv. Conductivity <100, use voltage ranges from 900 to 1100. Conductivity from 100 to 300, use voltage ranges from 500 to 800. Conductivity greater than 300, use voltage to 400.
v. Begin electrofishing with minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized and captured. Turn off current once fish are immobilized.
vi. Do not allow fish to come into contact with anode. Do not electrofish an area for an extended period of time. Remove fish immediately from water and handle as described above (PDC 20b). Dark bands on the fish indicate injury, suggesting a reduction in voltage and pulse width and longer recovery time.
vii. If mortality is occurring during salvage, immediately discontinue salvage operations (unless this would result in additional fish mortality), reevaluate the current procedures, and adjust or postpone procedures to reduce mortality.

d. **Dewater construction site** –When dewatering is necessary to protect species or critical habitat, divert flow around the construction site with a coffer dam (built with non-erosive materials), taking care to not dewater downstream channels during dewatering. Pass flow and fish downstream with a by-pass culvert or a water-proof lined diversion ditch. Diversion sandbags can be filled with material mined from the floodplain as long as such material is replaced at end of project. Small amounts of instream material can be moved to help seal and secure diversion structures. If ESA listed-fish may be present and pumps are required to dewater, the intake must have a fish screen(s) and be operated in accordance with NMFS fish screen criteria described below (in part e.iv) of this section. Dissipate flow energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. Pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel.[3]

3 To the extent possible, incorporate measures to protect lamprey. For instructions on how to dewater areas occupied by lamprey, see Best Management Practices to Minimize Adverse Effects to Pacific Lamprey, *Entosphenus tridentatus* (2010).

e. **Surface water withdrawals**

i. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate. Where ESA-listed fish may be present, diversions may not exceed 10% of the available flow and fish screen(s) will be installed, operated, and maintained according to NMFS's fish screen criteria (NMFS 2011a).

ii. For the dewatering of a work site to remove or install culverts, bridge abutments *etc.*, if ESA-listed fish may be present, a fish screen that meets criteria specified by NMFS (2011e) must be used on the intake to avoid juvenile fish entrainment. If ESA-listed salmon, steelhead, eulachon, or green sturgeon may be present, the Action Agencies will ensure that the fish screen design is reviewed and approved by NMFS for consistency with NMFS (2011e) criteria if the diversion (gravity or pump) is at a rate greater than 3 cfs. NMFS approved fish screens have the following specifications: a) An automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and b) a round or square screen mesh that is no larger than 2.38 mm (0.094 inches) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069 inches) in the narrow dimension.

f. **Stream re-watering** – Upon project completion, slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden release of suspended sediment. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

33. **Non-native Invasive Plant Control** includes manual, mechanical, biological, and chemical methods to remove invasive non-native plants within Riparian Reserves, Riparian Habitat Conservation Areas, or equivalent and adjacent uplands. In monoculture areas (*e.g.*, areas dominated by black berry or knotweed) heavy machinery can be used to help remove invasive plants. This activity is intended to improve the composition, structure, and abundance of native riparian plant communities important for bank stability, stream shading, LW, and other organic inputs into streams, all of which are important elements to fish habitat and water quality. Manual and hand-held equipment will be used to remove plants and disperse chemical treatments. Heavy equipment, such as bulldozers, can be used to remove invasive plants, primarily in areas with low slope values. (Invasive plant treatments included in this opinion are to serve the Action Agencies' administrative units until such units complete a local or provincial consultation for this activity type.)

a. **Project extent** – Non-native invasive plant control projects will not exceed 10% of acres within a Riparian Reserve under the BLM Resource Management Plan (BLM 2016) within a 6^{th} HUC/year.

b. **Manual methods** – Manual treatments are those done with hand tools or hand held motorized equipment. These treatments typically involve a small group of people in a localized area. Vegetation disturbance varies from cutting or mowing to temporarily reduce the size and vigor of plants to removal of entire plants. Soil disturbance is minimized by managing group size and targeting individual plants.

c. **Mechanical methods** – Mechanical treatments involve the use of motorized equipment and vary in intensity and impact from mowing to total vegetation removal and soil turnover (plowing and seed bed preparation). Mechanical treatments reduce the number of people treating vegetation. Impacts could be lessened by minimizing the use of heavy equipment in riparian areas, avoiding treatments that create bare soil in large or extensive areas, reseeding and mulching following treatments, and avoiding work when soils are wet and subject to compaction.

d. **Biological methods** – Release of traditional host specific biological control agents (insects and pathogens) consists of one or two people depositing agents on target vegetation. This results in minimal impact to soils and vegetation from the actual release. Over time, successful biological control agents will reduce the size and vigor of host noxious weeds with minimal or no impact to other plant species.

e. **Chemical methods –** Invasive plants, including state-listed noxious weeds, are particularly aggressive and difficult to control and may require the use of herbicides for successful control and restoration of riparian and upland areas. Herbicide treatments vary in impact to vegetation from complete removal to reduced vigor of specific plants. Minimal impacts to soil from compaction and erosion are expected.

    i. **General Guidance**

        1. Use herbicides only in an integrated weed or vegetation management context where all treatments are considered and various methods are used individually or in concert to maximize the benefits while reducing undesirable effects.
        2. Carefully consider herbicide impacts to fish, wildlife, non-target native plants, and other resources when making herbicide choices.
        3. Treat only the minimum area necessary for effective control. Herbicides may be applied by selective, hand-held, backpack, or broadcast equipment in accordance with state and federal law and only by certified and licensed applicators to specifically target invasive plant species.
        4. Herbicide application rates will follow label direction, unless site-specific analysis determines a lower maximum rate is needed to reduce non-target impacts.
        5. An herbicide safety/spill response plan is required for all projects to reduce the likelihood of spills, misapplication, reduce potential for unsafe practices, and to take remedial actions in the event of spills. Spill plan contents will follow agency direction.
        6. Pesticide applicator reports must be completed within 24 hours of application.
        7. **Herbicide active ingredients** – Active ingredients are restricted to the following (some common trade names are shown in

parentheses; use of trade names does not imply endorsement by the US government):4

8. aminopyralid (e.g., terrestrial: Milestone VM)
9. chlorsulfuron (e.g., terrestrial: Telar, Glean, Corsair)
10. clopyralid (e.g., terrestrial: Transline)
11. dicamba (e.g., terrestrial: Vanquish, Banvel)
12. diflufenzopyr + dicamba (e.g., terrestrial: Overdrive)
13. glyphosate (e.g., aquatic: Aquamaster, AquaPro, Rodeo, Accord)
14. imazapic (e.g., terrestrial: Plateau)
15. imazapyr (e.g., aquatic: Habitat; terrestrial: Arsenal, Chopper)
16. metsulfuron methyl (e.g., terrestrial: Escort)
17. picloram (e.g., terrestrial: Tordon, Outpost 22K)
18. sethoxydim (e.g., terrestrial: Poast, Vantage)
19. sulfometuron methyl (e.g., terrestrial: Oust, Oust XP)
20. triclopyr (e.g., aquatic: Garlon 3A, Tahoe 3A, Renovate 3, Element 3A; terrestrial: Garlon 4A, Tahoe 4E, Pathfinder II)
21. 2,4-D (e.g., aquatic: 2,4-D Amine, Clean Amine; terrestrial: Weedone, Hi-Dep)

ii. **Herbicide adjuvants –** When recommended by the label, an approved aquatic surfactant would be used to improve uptake. When aquatic herbicides are required, the only surfactants and adjuvants permitted are those allowed for use on aquatic sites, as listed by the Washington State Department of Ecology: http://www.ecy.wa.gov/programs/wq/pesticides/regpesticides.html. (Oregon Department of Agriculture also often recommends this list for aquatic site applications). The surfactants R-11, Polyethoxylated tallow amine (POEA), and herbicides that contain POEA (*e.g.*, Roundup) will not be used.

iii. **Herbicide carriers –** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

iv. **Herbicide mixing –** Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge. Impervious material will be placed beneath mixing areas in such a manner as to contain any spills associated with mixing/refilling. Spray tanks shall be washed further than 300 feet away from surface water. All hauling and application equipment shall be free from leaks and operating as intended.

v. **Herbicide application methods** – Liquid forms of herbicides will be applied as follows:

1. Broadcast spraying using booms mounted on ground-based vehicles (this consultation does not include aerial applications).
2. Spot spraying with hand held nozzles attached to back pack tanks or vehicles and hand-pumped sprayers to apply herbicide directly onto small patches or individual plants.

4 The use of trade, firm, or corporation names in this opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

3. Hand/selective through wicking and wiping, basal bark, frill ("hack and squirt"), stem injection, or cut-stump.
4. Dyes or colorants, (*e.g.*, Hi-Light, Dynamark) will be used to assist in treatment assurance and minimize over-spraying within 100 feet of live water.

vi. **Minimization of herbicide drift and leaching –** Herbicide drift and leaching will be minimized as follows:

1. Do not spray when wind speeds exceed 10 miles per hour to reduce the likelihood of spray/dust drift. Winds of 2 mph or less are indicative of air inversions. The applicator must confirm the absence of an inversion before proceeding with the application whenever the wind speed is 2 mph or less.
2. Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
3. Keep boom or spray as low as possible to reduce wind effects.
4. Avoid or minimize drift by utilizing appropriate equipment and settings (*e.g.*, nozzle selection, adjusting pressure, drift reduction agents). Select proper application equipment (*e.g.*, spray equipment that produces 200-800 micron diameter droplets [Spray droplets of 100 microns or less are most prone to drift]).
5. Follow herbicide label directions for maximum daytime temperature permitted (some types of herbicides volatilize in hot temperatures).
6. Do not spray during periods of adverse weather conditions (snow or rain imminent, fog, *etc.*). Wind and other weather data will be monitored and reported for all pesticide applicator reports.
7. Herbicides shall not be applied when the soil is saturated or when a precipitation event likely to produce direct runoff to fish-bearing waters from a treated site is forecasted by NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides can be applied as long as label is followed. Do not conduct any applications during periods of heavy rainfall.

vii. **Herbicide buffer distances –** The following no-application buffers—which are measured in feet and are based on herbicide formula, stream type, and application method—will be observed during herbicide applications (Table 5). Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are measured as map distance perpendicular to the bankfull for streams, the upland boundary for wetlands, or the upper bank for roadside ditches.

Summary

Currently, the BLM's Tyrrell and Horning seed orchard management program is covered by the NMFS 2009a, and NMFS 2009b LOCs; NMFS 2010a, and NMFS 2010c opinions. The BLM will also add chemicals currently used in ARBO II (NMFS 2013a), and the BLM IIPM (NMFS 2019). Because the BLM will continue to use the conservation measures proposed or required by those consultation documents, we are incorporating the effects analyses from those documents by reference. The BLM will also proposed to use four new chemicals that are not currently covered under ESA consultations. Therefore, the analysis in this opinion will focus on the new proposed chemicals.

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.

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 CFR402.02). 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 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 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 essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote et al 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2013). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7°C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the Species

Table 3, below, provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/).

Table 3. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and VSP (Viable Salmonid Population).

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013b	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	Reduced access to spawning and rearing habitat Hatchery-related effects Harvest-related effects on fall Chinook salmon An altered flow regime and Columbia River plume Reduced access to off-channel rearing habitat Reduced productivity resulting from sediment and nutrient-related changes in the estuary Contaminant

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011b	NWFSC 2015	This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.	Degraded freshwater habitat Degraded water quality Increased disease incidence Altered stream flows Reduced access to spawning and rearing habitats Altered food web due to reduced inputs of microdetritus Predation by native and non-native species, including hatchery fish Competition related to introduced salmon and steelhead Altered population traits due to fisheries and bycatch

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013b	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners .Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	Degraded estuarine and near-shore marine habitat Fish passage barriers Degraded freshwater habitat: Hatchery-related effects Harvest-related effects An altered flow regime and Columbia River plume Reduced access to off-channel rearing habitat in the lower Columbia River Reduced productivity resulting from sediment and nutrient-related changes in the estuary Juvenile fish wake strandings Contaminants
Oregon Coast coho salmon	Threatened 6/20/11; reaffirmed 4/14/14	NMFS 2016a	NWFSC 2015	This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review indicated a moderate risk of extinction. Significant improvements in hatchery and harvest practices have been made for this ESU. Most recently, spatial structure conditions have improved in terms of spawner and juvenile distribution in watersheds; none of the geographic area or strata within the ESU appear to have considerably lower abundance or productivity. The ability of the ESU to survive another prolonged period of poor marine survival remains in question.	Reduced amount and complexity of habitat including connected floodplain habitat Degraded water quality Blocked/impaired fish passage Inadequate long-term habitat protection Changes in ocean conditions

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013b	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	Degraded estuarine and nearshore marine habitat Degraded freshwater habitat Reduced access to spawning and rearing habitat Avian and marine mammal predation Hatchery-related effects An altered flow regime and Columbia River plume Reduced access to off-channel rearing habitat in the lower Columbia River Reduced productivity resulting from sediment and nutrient-related changes in the estuary Juvenile fish wake strandings Contaminants
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011b	NWFSC 2015	This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.	Degraded freshwater habitat Degraded water quality Increased disease incidence Altered stream flows Reduced access to spawning and rearing habitats due to impaired passage at dams Altered food web due to changes in inputs of microdetritus Predation by native and non-native species, including hatchery fish and pinnipeds Competition related to introduced salmon and steelhead Altered population traits due to interbreeding with hatchery origin fish

2.2.2 Status of the Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005d). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 4, below.

Table 4. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005d). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005d). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005d). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Oregon Coast coho salmon	2/11/08 73 FR 7816	Critical habitat encompasses 13 subbasins in Oregon. The long-term decline in Oregon Coast coho salmon productivity reflects deteriorating conditions in freshwater habitat as well as extensive loss of access to habitats in estuaries and tidal freshwater. Many of the habitat changes resulting from land use practices over the last 150 years that contributed to the ESA-listing of Oregon Coast coho salmon continue to hinder recovery of the populations; changes in the watersheds due to land use practices have weakened natural watershed processes and functions, including loss of connectivity to historical floodplains, wetlands and side channels; reduced riparian area functions (stream temperature regulation, wood recruitment, sediment and nutrient retention); and altered flow and sediment regimes (NMFS 2016a). Several historical and ongoing land uses have reduced stream capacity and complexity in Oregon coastal streams and lakes through disturbance, road building, splash damming, stream cleaning, and other activities. Beaver removal, combined with loss of large wood in streams, has also led to degraded stream habitat conditions for coho salmon (Stout et al. 2012).
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005d). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005d). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005d). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.

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).

For the purposes of this analysis, the action area includes the boundary of the Horning (Figure 1) and Tyrrell Seed Orchards (Figure 2), where pest management would occur. Specifically for the Horning seed orchard, the action area includes unnamed streams in the Section 13 portion of the orchard, Swagger Creek, Clear Creek, and the lower Clackamas River to its confluence with the Willamette River. In addition, the action area includes unnamed streams in the Section 23 portion of the orchard and Milk Creek to its confluence with the Molalla River.

For the Tyrrell seed orchard, the action area begins within the drainages (ephemeral and perennial) within, and downstream from, the orchard, including OC coho-bearing Douglas Creek, Stream 8, and Stream 1 as they drain into the Siuslaw River. The downstream portion of the action area extends into the Siuslaw River estuary.

The overall action area is also designated by the Pacific Fishery Management Council (PFMC) as EFH for Pacific Coast salmon (PFMC 2014), or is in an area where environmental effects of the proposed action is likely to adversely affect designated EFH for those species.

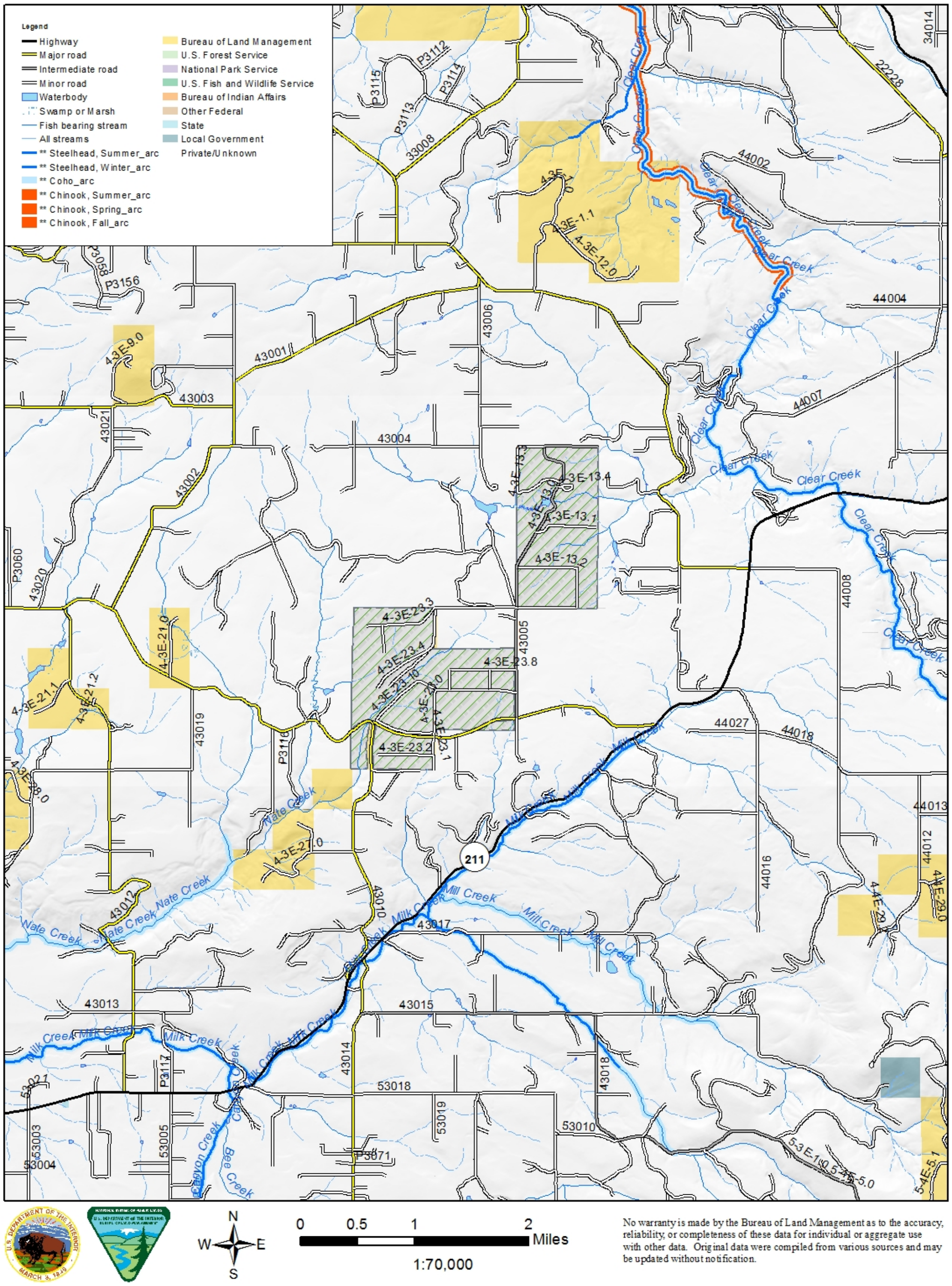

Figure 1. Horning seed orchard action area

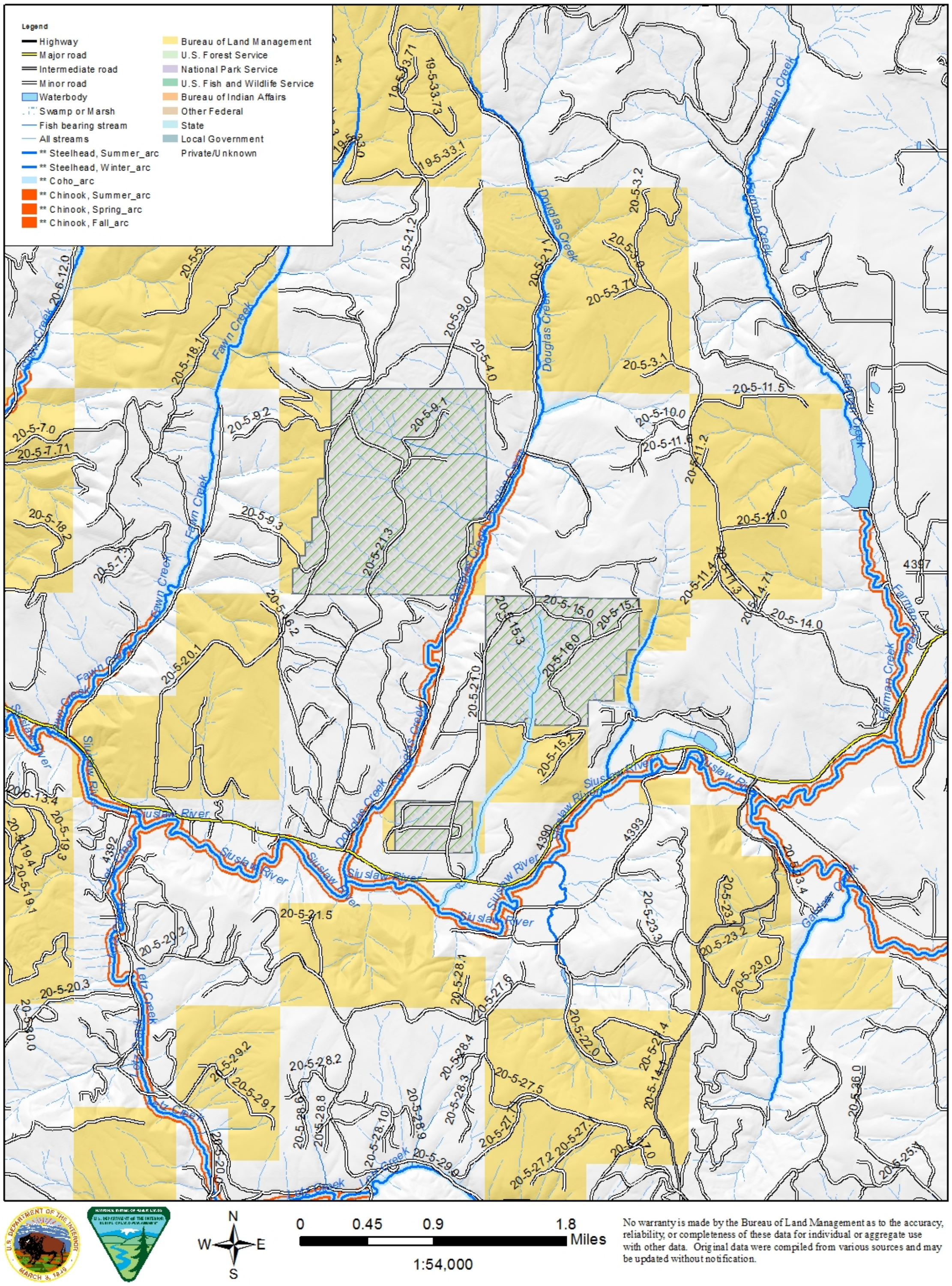

Figure 2. Tyrrell seed orchard action area

2.3 Environmental Baseline

The “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 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 environmental baseline (50 CFR 402.02).

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of anadromous species considered in this opinion vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the action area, many stream and riparian areas have been degraded by the effects of land and water use, including urbanization, road construction, forest management, agriculture, mining, transportation, and water development. Restoration actions within the action area, provide some beneficial effects.

Land uses neighboring the Seed Orchards include small farms, timber operations, Christmas tree farms, livestock grazing, rural residences, and an organic farm. These type of land uses near the seed orchard may use many of the same chemicals as BLM proposes to use, however, the BLM could not determine which chemicals may be used, or the extent to which chemicals may be used in the Clear Creek and Milk Creek subwatersheds. Christmas tree farmers adjacent to the orchard, aerially apply pesticides to their fields to reduce unwanted competitive vegetation. However, the products used are not known. There is a reasonable deduction that these type of land uses may incorporate pesticides into their land management, though the timing, quantities, and frequency of applications of pesticides are unknown at this time.

The Horning and Tyrrell Seed Orchards were established on lands that were previously managed for timber production and harvested as such. The riparian areas were harvested according to accepted practices of the time and have been reestablished through both artificial and natural means to their current state. Many of the riparian stands are densely stocked with a combination of conifer and hardwood species. Streams have been slowly depleted of sources of large wood over several decades and habitat for aquatic species has been simplified with few large, complex pools.

The previous pest management plans for the Horning and Tyrrell Seed Orchards were covered under the following letter of concurrences and biological opinions:

Horning Seed Orchard

- On December 21, 2004, NMFS issued its first opinion for the Horning Seed Orchard (NMFS 2004).
- On August 15, 2005, NMFS issued an amendment to the December 21, 2004 opinion (NMFS 2005a).

- Formal consultation on that action was reinitiated and a second opinion was issued on October 30, 2006 (NMFS 2006).
- On December 1, 2009, NMFS issued a letter of concurrence (NMFS 2009a) to the BLM for the aerial application of esfenvalerate.
- In 2010, NMFS issued an opinion on the reinitiation of the integrated pest management program at the Horning Orchard (NMFS 2010a).

Tyrrell Seed Orchard

- In 2005, NMFS issued a Conference Opinion on the effects of the proposed implementation of a five-year Integrated Pest Management Program (IPM) at the Travis Tyrrell Seed Orchard.
- On February 9, 2005, NMFS issued an amendment (NMFS 2005b) to the January 13, 2005, conference opinion (NMFS 2005c).
- On September 15, 2008, NMFS adopted the NMFS 2005b conference opinion (NMFS 2008). The Opinion expired on February 9, 2010.
- On December 1, 2009, NMFS issued a letter of concurrence for the aerial application of esfenvalerate (NMFS 2009b).
- On August 9, 2010, NMFS issued an opinion to the BLM for the Tyrrell Seed Orchard (NMFS 2010b).
- That opinion was amended in Oct 2010 to include the ground application of esfenvalerate (NMFS 2010c).

Forest practices covered by those consultations had temporary negative effects on local baseline conditions, but no significant long-term adverse effects that outside of the fact that they contribute to a diffuse pattern of minor, intermittent water quality impairment due to pesticide drift and runoff, and increased sedimentation and turbidity due to cultivation, drainage, road construction and similar operations. These effects have been analyzed extensively in previous biological opinions (e.g., NMFS 2013a, 2019) and in general result in some reduced fitness and survival in a small number of individuals.

2.4 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).

As stated previously, the BLM currently manages the Tyrrell and Horning seed orchard programs covered by the NMFS 2009a and 2009b LOCs; NMFS 2010a, 2010b, and 2010c opinions. The BLM will also add chemicals currently approved in ARBO II (NMFS 2013a), and the BLM IIPM (NMFS 2019) (Table 5).

NMFS completed consultation with the U.S. Environmental Protection Agency (EPA) on registration of several chemicals. For this consultation, the chemicals include dimethoate (NMFS 2010d); chlorothalonil, and 2,4-D (NMFS 2011c); propargite (NMFS 2015); and chlorpyrifos, and diazinon (NMFS 2017). Dimethoate, chlorpyrifos, and diazinon, belong to the organophosphate class of insecticides and are highly toxic to mammals, fish, and aquatic invertebrates (NMFS 2010d, NMFS 2017). Although dimethoate is an organophosphate, NMFS' analysis did not result in jeopardy to the species considered in this opinion. However, the opinion for chlorpyrifos, among other things, concluded that current application rates and application methods are likely to result in jeopardy to all six species considered in this opinion, and destruction or adverse modification of their designated critical habitats. Diazinon would have similar results, but would not jeopardize LCR or OC coho salmon, or result in destruction or adverse modification of designated critical habitats for LCR Chinook salmon, LCR coho salmon, OC coho salmon, or LCR steelhead. NMFS determined chlorothalonil would not jeopardize any of the species considered in this opinion; however, adverse modification of critical habitat was found for UWR Chinook salmon, and UWR steelhead. Prey species residing in shallow aquatic habitats proximal to pesticide use sites are expected to be the most at risk. NMFS concluded that 2,4-D would result in jeopardy to all six species considered in this opinion, or adverse modification of critical habitats. Finally, NMFS concluded that propargite would result in jeopardy to five species (all except for OC coho salmon) considered in this opinion, or adverse modification of critical habitats.

To avoid jeopardy and adverse modification to the species affected, NMFS identified reasonable and prudent alternatives (RPAs) for each of the six chemicals listed above. Although the RPAs have different elements for each chemical, there are some elements that are common to all the chemicals listed above. These include the following:

- Limit the frequency of application to once per year for persistent pesticides (this applies to all chemicals listed above, except for dimethoate, and 2,4-D).

- Include the following risk reduction measures for the pesticides to reduce pesticide drift, and runoff (this applies to all chemicals listed above except for dimethoate, and 2,4-D):
    - Maintain a functional riparian system alongside water ways > 10 meters wide

- Do not apply chemicals when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 1- mph will carry drift away from perennial streams.

- Do not apply when a precipitation event, likely to produce direct runoff to perennial streams from the treated area, is forecasted by NOAA/NWS or other similar forecasting service within 48 hours following application.

The BLM will implement these elements of the RPAs. The BLM states that the riparian reserves were established through a combination of natural, and artificial stocking. Natural disturbance or artificial management (e.g. thinning) in the riparian reserves has been limited. This resulted in densely stocked, second-growth stands with a combination of conifers and hardwoods, with a brushy understory. In some instances, the BLM will be more restrictive than what is identified in the RPAs. For example, in addition to maintaining a functional riparian area adjacent to streams, the BLM will further restrict pesticide treatments for ground-based applications between 50 and 200 feet from streams, and beyond 200 feet for aerial applications. In addition, the distance from orchard unit boundaries to the nearest perennial stream ranges 150-450 feet. The BLM will also be more restrictive for application based on forecasted, and current weather conditions. Specifically, the BLM will prohibit spraying within 72 hours of predicted precipitation that would result in runoff and measurable increase in stream flow.

Because the BLM will continue to use all conservation measures proposed or required by these previous letters of concurrence, the reasonable and prudent measures and terms and conditions in the previous biological opinions, and the RPAs for the chlorothalonil, and 2,4-D (NMFS 2011c); propargite (NMFS 2015); and chlorpyrifos, and diazinon (NMFS 2017) opinions, we are incorporating the effects analyses from those documents by reference.

The BLM also proposes to use four new chemicals that are not currently covered under any of those ESA consultations. Therefore, the analysis in this opinion will focus on the new proposed chemicals.

Table 5. Pesticides and locations for the proposed operation of the Horning and Tyrrell Seed Orchards Integrated Pest Management Plan. For all pesticide groups the application range is year-round except as constrained by project design features (appendix D) and pesticide label. Stream setback distances for pesticides not covered in ARBO II (NMFS 2013a) are from Table 2.3.1 (2005 Tyrrell IPM EIS, Chapter 2-17), except as modified by project design features adopted by the Seed Orchard EA (BLM 2020). Where two distances are listed, the first is for aerial/broadcast spray and the second is for targeted, ground-based spray. (†) means pesticides or uses not considered in ARBO II, see Appendix for tables with limits, rates, and setback distances.

Chemical	Covered in Previous ESA Consultations	Location(s)	Limitations and Application Rates	Setback Distances for Chemicals not covered in ARBO II	Setback distances for herbicides in feet (ARBO II)					
					Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry roadside Ditches		
					Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use										
Aquatic Glyphosate (Herbicide)	Yes-Tyrrell and Horning Seed Orchards and ARBO II	Orchards, native plant beds, water	†	†	100	waterline	waterline	50	0	0*
Aquatic Imazapyr (Herbicide)	Yes-ARBO II	Orchards, native plant beds, water	†	†	100	waterline	waterline	50	0	0
Aquatic Triclopyr TEA (Herbicide)	Yes-Tyrrell and Horning Seed Orchards and ARBO II	Orchards, native plant beds, water	†	†	Not Allowed	15	waterline	Not Allowed	0	0
Aquatic 2,4-D amine	Yes-ARBO II	Orchards, native plant beds, water	†	†	100	waterline	waterline	50	0	0
Risk Category-NO RISK (Chemicals restricted to greenhouses will not produce runoff to streams)										
Hydrogen dioxide (Fungicide)	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-10	†	†	†	†	†	†	†

* Under the proposed action, the BLM can hand paint glyphosate, imazapyr, triclopyr, and 2,4-D on the foliage of plants over water, but above the waterline. This will not occur in ESA-listed fish habitat, and will only occur in closed systems.

Chemical	Covered in Previous ESA Consultations	Location(s)	Limitations and Application Rates	Setback Distances for Chemicals not covered in ARBO II	Setback distances for herbicides in feet (ARBO II)					
					Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry roadside Ditches		
					Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Mancozeb (Fungicide)	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-11	†	†	†	†	†	†	†
Thiophanate-methyl (Fungicide)	Yes-Tyrrell and Horning Seed Orchards	Greenhouses	Table C-10	†	†	†	†	†	†	†
Iprodione (Fungicide)	No	Greenhouses	Table C-11	†	†	†	†	†	†	†
Emamectin benzoate (Insecticide)	No	Orchard units	Table C-8	50	†	†	†	†	†	†
Risk Category-LOW RISK										
Aminopyralid (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	waterline	waterline	50	0	0
Dicamba (Herbicide)	Yes-Tyrrell and Horning Seed Orchards and ARBO II	Orchards, native plant beds	†	†	100	15	15	50	0	0
Dicamba + diflufenzopyr (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	15	50	0	0
Imazapic (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	bankfull elevation	50	0	0
Clopyralid (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	bankfull elevation	50	0	0
Metsulfuron-methyl (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	bankfull elevation	50	0	0
Hexazinone (Herbicide)	Yes-Tyrrell and Horning Seed Orchards	Orchards	Table C-4	50	†	†	†	†	†	†
Rimsulfuron (Herbicide)	No	Orchards, native plant beds	Table C-4	50	†	†	†	†	†	†
Fluroxypyr (Herbicide)	No	Orchards, native plant beds	Table C-4	50	†	†	†	†	†	†
Bacillus thuringiensis (B.t.) (Insecticide)	Yes-Tyrrell and Horning Seed	Orchard units	Table C-7	200/50	†	†	†	†	†	†

Chemical	Covered in Previous ESA Consultations	Location(s)	Limitations and Application Rates	Setback Distances for Chemicals not covered in ARBO II	Setback distances for herbicides in feet (ARBO II)					
					Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry roadside Ditches		
					Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
	Orchards									
Spinosad (Insecticide)	No	Orchard units, greenhouses	Table C-8	50	†	†	†	†	†	†
Calcium Nitrate (Fertilizer)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-7	50	†	†	†	†	†	†
Dazomet (Fumigant)	Yes-Tyrrell and Horning Seed Orchards	Native plant beds	Table C-10	50	†	†	†	†	†	†
Gibberellic acid (Growth regulator)	No	Orchard units	Table G-4	†	†	†	†	†	†	†
Risk Category-MODERATE RISK										
Chlorsulfuron (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	bankfull elevation	50	15	bankfull elevation
Sulfometuron methyl (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	15	5	50	15	bankfull elevation
Acephate (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units greenhouses, native plant beds	Table C-7	200/50	†	†	†	†	†	†
Imidacloprid (capsules)(Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units, greenhouses	Table C-8	50	†	†	†	†	†	†
Potassium salts of fatty acids (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units, greenhouses, native plant beds	Table C-7	200/50	†	†	†	†	†	†
Risk Category-HIGH RISK										
Chlorothalonil (Fungicide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units, greenhouses, native plant beds	Table C-11	200	†	†	†	†	†	†
Picloram (Herbicide)	Yes-Tyrrell and Horning Seed Orchards and ARBO II	Orchards, native plant beds	†	†	100	50	50	100	50	50
Fluazifop-P-butyl (Herbicide)	No	Orchards, native plant beds	Table C-4	300	†	†	†	†	†	†

Chemical	Covered in Previous ESA Consultations	Location(s)	Limitations and Application Rates	Setback Distances for Chemicals not covered in ARBO II	Setback distances for herbicides in feet (ARBO II)					
					Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry roadside Ditches		
					Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Sethoxydim (Herbicide)	Yes-ARBO II	Orchards, native plant beds	†	†	100	50	50	100	50	50
Dimethoate (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-7	200	†	†	†	†	†	†
Horticultural oil (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units, greenhouses	Table C-8	200	†	†	†	†	†	†
Propargite (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-7	200	†	†	†	†	†	†
Risk Category-VERY HIGH RISK										
Propiconazole (Fungicide)		Native plant beds	Table C-10	50	†	†	†	†	†	†
Esfenvalerate (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-8	200/50	†	†	†	†	†	†
Permethrin (Insecticide)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-7	200	†	†	†	†	†	†
Ammonium Phosphate Sulfate (Fertilizer)	Yes-Tyrrell and Horning Seed Orchards	Orchard units	Table C-8	50	†	†	†	†	†	†
Chlorpyrifos (Insecticide)	Yes-Tyrrell and Horning Seed Orchards, NMFS 2017	Orchard units	Table C-8	200	†	†	†	†	†	†
Diazinon (Insecticide)	Yes-Tyrrell and Horning Seed Orchards, NMFS 2017	Orchard units, native plant beds	Table C-7	200	†	†	†	†	†	†

The BLM proposes to treat non-native, and invasive vegetation in accordance with the PDCs in ARBO II (NMFS 2013a), although on a smaller scale. The effects analysis in the ARBO II opinion is directly relevant to the effects from the proposed action and thus we are incorporating by reference the effects of ARBO II into this opinion. Since the ARBO II, we are not aware of any new information about the effects of these chemicals on ESA-listed species and their habitat. The PDCs outlined in ARBO II are still considered the best ways to minimize the amount and likelihood that these chemicals would enter the stream where ESA-listed fish are present. In the ARBO II analyses, we concluded there would be a temporary reduction in water quality from increased chemical contamination and suspended sediment, decreased dissolved oxygen, as well as harassment/displacement of fish. In summary, this is because the PDCs included in that proposed action, including limitations on the herbicides, adjuvants, carriers, handling procedures, application methods, drift minimization measures, and riparian buffers, greatly reduce the likelihood that significant amounts of herbicide will be transported to aquatic habitats, although some herbicides are still likely to enter streams through aerial drift, in association with eroded sediment in runoff, and dissolved in runoff, including runoff from intermittent streams and ditches.

As explained in more detail in ARBO II (NMFS 2013a), each type of proposed treatment is likely to affect fish and aquatic macrophytes through a combination of pathways, including disturbance, chemical toxicity, dissolve oxygen and nutrients, water temperature, sediment, instream habitat structure, forage, and riparian and emergent vegetation (Table 6).

Table 6. Potential pathways of effects of invasive and non-native plant control (from ARBO II, NMFS 2013a).

	Pathways of Effects							
Treatment Methods	**Disturbance***	**Chemical Toxicity**	**Dissolved Oxygen and Nutrients**	**Water Temperature**	**Fine Sediment and Turbidity**	**Instream Habitat Structure**	**Forage**	**Riparian and Emergent Vegetation**
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*Stepping on redds, displacing fish, interrupting fish feeding, or disturbing banks.

Aquatic Herbicide Treatments

As currently used in the IIPM (NMFS 2019), the BLM proposes to use the same four herbicides (2,4-D Amine, Glyphosate, Imazapyr, and Triclopyr-TEA) in aquatic habitats. These herbicides will be applied in limited areas that are in close proximity to the Seed Orchards.

Two factors determine the risk to aquatic organisms (early life stages i.e., egg-to-fry) from use of herbicides: the toxicity of the chemical to individual organisms, and the likelihood organisms would be exposed to the chemical. Because some aquatic herbicides would be applied to vegetation where plants are in the water column, Risk Assessments (RAs) focusing on the toxicity to organisms from direct exposure, including an accidental spill, are the appropriate scenarios for evaluating risk to aquatic flora and fauna from use of aquatic herbicides. The BLM used the U.S. Forest RAs for effects to aquatic organisms (SERA 2009, SERA 2011a, SERA 2011b, SERA 2011c, and 2014a).

Our assessment of risk of effects on fish and other aquatic organisms from herbicides is based on the RA information (summarized below in Table 7). Fish species analyzed in the RA include Chinook salmon, coho salmon, chum salmon, sockeye salmon, pink salmon, rainbow trout, fathead minnows, and bluegills.

2, 4-D amine. The RA for aquatic formulations of 2,4-D amine shows a hazard quotient (HQ) of less than 0.5 (essentially no risk) under all scenarios analyzed with direct spray to fish and other aquatic fauna. Therefore, there is no potential that use of this herbicide would impart direct or indirect effects to these aquatic species.

Glyphosate. The RA for aquatic glyphosate shows a HQ of less than one for typical non-accidental applications for susceptible fish and aquatic macroinvertebrates. However, under the accidental acute exposure scenario (e.g., a spill), the risk is elevated to 73 (moderate) at typical application rates, and 257 (high) at maximum application rates to fish and is within the moderate range for aquatic macroinvertebrates. However, the proposed application rates are less than 1.5 percent of the maximum rate and only 5 percent of the typical rate analyzed by the RA (BLM 2018). At these low concentrations, there would be no risk to aquatic fauna from glyphosate, unless a spill of concentrated chemical occurred directly in water, which would result in localized impacts to aquatic organisms. SOPs such as mixing and loading in areas where spill would not contaminate waterbodies would eliminate or reduce to a very low level the risk of such a spill. Given the small area to be treated in any given year, and lack of direct risk to fish and other aquatic organisms, and the very low risk of a spill, any potential future use of glyphosate as proposed is not expected to affect fish or aquatic insects.

Triclopyr TEA. The RA for the aquatic formulation of triclopyr TEA shows no risk to any aquatic organisms under all scenarios, except for the accidental acute exposure scenario calculated for maximum rates of application at 10 lbs. / acre (IIPM EA 2018, at Table B-2)(BLM 2018). SOPs such as mixing and loading in areas where spill would not contaminate waterbodies would eliminate or reduce to a very low level the risk of such a spill such that we do not expect effects from triclopyr spills. Proposed application rates of triclopyr in aquatic systems range from 0.6 to 2 lbs. / acre; therefore, there would be no risk to any aquatic fauna from use of this herbicide as proposed (IIPM EA 2018, at Appendix C)(BLM 2018).

Table 7. Forest Service-Evaluated Herbicide Risk Categories for Aquatic Organisms (Aquatic Formulations)(SERA 2008, SERA 2011a, SERA 2011b, SERA 2011c)

Receptor		2,4-D Amine		Fluridone		Glyphosate		Imazapyr		Triclopyr TEA	
		Typ[1]	Max[1]	Typ	Max	Typ	Max	Typ	Max	Typ	Max
Flora											
Accidental Acute Exposures											
Macrophyte	Susceptible	H	H	H	H	H	H	H	H	H	H
Macrophyte	Tolerant	0	L	H	H	0	0	M	H	L	M
Algae	Susceptible	L	L	H	H	H	H	L	L	M	H
Algae	Tolerant	0	0	H	H	0	L	0	0	L	M
Non-Accidental Acute Exposures											
Macrophyte	Susceptible	M	M	M	M	L	M	M	M	H	H
Macrophyte	Tolerant	0	0	0	L	0	0	0	L	0	0
Algae	Susceptible	0	0	0	L	L	L	0	0	0	L
Algae	Tolerant	0	0	0	0	0	0	0	0	0	0
Chronic / Longer term Exposures											
Macrophyte	Susceptible	M	M	L	M	L	L	M	M	M	H
Macrophyte	Tolerant	0	0	0	L	0	0	0	L	0	0
Algae	Susceptible	0	0	0	L	0	L	0	0	0	0
Algae	Tolerant	0	0	0	0	0	0	0	0	0	0
Fauna											
Accidental Acute Exposures											
Fish	Susceptible	0	0	H	H	M	H	0	L	0	L
Fish	Tolerant	0	0	M	M	L	L	NE	NE	0	0
Amphibian	Susceptible	0	0	NE	NE	0	0	NE	NE	0	L
Amphibian	Tolerant	0	0	NE	NE	0	0	NE	NE	0	L
Invertebrate	Susceptible	0	0	H	H	M	M	NE	NE	0	L
Invertebrate	Tolerant	0	0	M	M	0	0	0	0	0	0
Non-Accidental Acute Exposures											
Fish	Susceptible	0	0	0	0	0	L	0	0	0	0
Fish	Tolerant	0	0	0	0	0	0	NE	NE	0	0
Amphibian	Susceptible	0	0	NE	NE	0	0	NE	NE	0	0
Amphibian	Tolerant	0	0	NE	NE	0	0	NE	NE	0	0
Invertebrate	Susceptible	0	0	0	0	0	0	NE	NE	0	0
Invertebrate	Tolerant	0	0	0	0	0	0	0	0	0	0
Chronic / Longer Term Exposures											
Fish	Susceptible	0	0	0	L	0	L	0	0	0	0
Fish	Tolerant	0	0	0	0	0	0	0	0	0	0
Amphibian	Susceptible	NE	NE	NE	NE	0	0	NE	NE	NE	NE
Amphibian	Tolerant	NE	NE	NE	NE	0	0	NE	NE	NE	NE
Invertebrate	Susceptible	0	0	0	0	0	0	NE	NE	0	0
Invertebrate	Tolerant	0	0	0	0	0	0	0	0	0	0

1. Typ = Typical application rate; and Max = Maximum application rate (see Table B-2, *Herbicide Information*, for typical and max applications rates. Application rates by species group can be found in the *Treatment Key* in Appendix C)

Risk categories: 0 = No risk (majority of Hazard Quotients < 1); L = Low risk (majority of Hazard Quotients >1 but < 10); M = Moderate risk (majority of Hazard Quotients > 10 but < 100); H = High risk (majority of Hazard Quotients > 100); and NE = Not evaluated. Risk categories are based on upper Hazard Quotient estimates. To determine risk for lower or central Hazard Quotient estimates, see the individual herbicide Risk Assessments. Risk categories are based on comparison to the Hazard Quotient of 1 for typical and maximum application rates.

Fluridone. The RA for fluridone showed no risk to macroinvertebrates, a low risk to susceptible fish under chronic long-term exposure, and a high risk at typical rates of application from acute accidental exposure to both fish and insects (BLM 2018). SOPs such as conducting mixing and loading operations in areas where an accidental spill would not contaminate an aquatic body, would further reduce risk of exposure such that we do not expect effects from fluridone spills. Application rates proposed for fluridone use under the proposed action are very low (5 to 30 parts per billion in water) and fluridone would only be used in closed aquatic habitats that are disconnected and do not flow into streams and only on an extremely limited basis (less than 1 percent of all anticipated future treatments). Because treatments using fluridone would be limited, if ever used at all, concentrations would be so low, and would not be applied to any habitat occupied by ESA-listed fish, there is a very low potential that use of it would result in any effects to ESA-listed fish.

Suspended Sediment and Harassment/Displacement. The BLM proposes to hand paint herbicides on some vegetation that is in the water column. This will likely cause a short-term increase of suspended sediment from disturbing the substrate while walking in the water. This disturbance would also cause harassment and displacement of any fish in the area of treatment. These effects will be minor and short-term (hours), and spatially and temporally separated.

Summary of Aquatic Herbicide Effects. Under the proposed action, aquatic formulations of 2,4-D, glyphosate, imazapyr, triclopyr TEA, and fluridone would be available to treat submerged and floating aquatic invasive plants and emergent aquatic invasive plant infestations. These herbicides will be applied in limited areas that are in close proximity to the Seed Orchards.

In the short term, there would be minimal effects from herbicide treatments on ESA-listed fish. This is because the herbicides that can be used in salmon-bearing waters pose a low toxicity risk to fish and macroinvertebrates, and the herbicides that have high toxicity would be restricted by PDFs that minimize the likelihood of herbicides reaching streams that contain ESA-listed fish. However, there would be a minor effect from suspended sediment, and harassment/displacement of fish from the treatment of vegetation in the water column.

Over the long term, there would be a benefit to streams and ESA-listed fish populations by application of herbicide treatments to control invasive plant populations and restore native vegetation assemblages. This is because invasive plants typically provide low value to riparian and aquatic ecosystem. Invasive plants tend to form monocultures, reduce diversity of native, plants, and generally disrupt aquatic habitat forming processes.

Orchard Units and Greenhouse Management

The Horning and Tyrrell Seed Orchard LOCs, and Biological Opinions (NMFS 2009a, and NMFS 2009b LOCs; NMFS 2010a, and NMFS 2010c) analyzed the effects of the application of pesticides to the orchard units, and that analysis is incorporated here by reference. In this analysis, we concluded the following: Chlorpyrifos and diazinon can contaminate designated critical habitat and other aquatic habitats utilized by listed salmonids through runoff, leaching, drift, and deposition from precipitation. All life stages of salmonids may be exposed to these pesticides through direct contact with contaminated surface water or pore water. Additionally, dietary consumption of the active ingredients is a likely route of exposure in salmonids and their prey. The dietary route of exposure may be most significant for chlorpyrifos given its greater tendency to accumulate in the tissues of aquatic organisms (EPA 2003). However, exposure from consumption of dead or dying aquatic and terrestrial insects also represents a potential route of exposure for both pesticides. Chlorpyrifos and diazinon are typically applied to control terrestrial insects which often make up a substantial portion of salmonids' diets (Baxter et al. 2007).

Updated RA for Dazomet. Although Dazomet was analyzed in previous opinions (NMFS 2005a, NMFS 2005b), we used more recent literature to analyze the effects of Dazomet on ESA-listed fish covered in this opinion.

As discussed in the most recent EPA risk assessment on dazomet (EPA/OPP/EFED 2008), dazomet is rapidly converted to methyl isothiocyanate primarily by hydrolysis-i.e., hydrolysis half-lives of 3 to 9 hours in water and a soil hydrolysis half-time of 17.2 hours. As discussed further in Section 3.2.11, soil incorporation of dazomet must be followed by irrigation to facilitate the hydrolysis of dazomet to methyl isothiocyanate. Methyl isothiocyanate forms a vapor which serves as the active soil fumigant. Methyl isothiocyanate is much more persistent than dazomet-e.g., the dissipation half-lives are about 1.5 to 2 days for dazomet and about 10 days for methyl isothiocyanate. In addition, as discussed further in Section 3, methyl isothiocyanate is more toxic than dazomet. Consequently, methyl isothiocyanate is the agent of concern for most exposure scenarios following applications of dazomet.

The hazards quotient (HQ) for fish are below the level of concern (HQ=0.09), except for the accidental spill exposure scenarios (SERA 2014b). The HQs for the accidental spill scenarios are 100 for tolerant species, and 15,000 for tolerant species. Based on expected concentrations of methyl isothiocyanate in water, however, all HQs are substantially below the level of concern. The highest acute HQ is 0.09 (the upper bound HQ for sensitive species of fish) and the highest longer-term HQ is 0.001 (the upper bound HQ for aquatic invertebrates). PDFs, and SOPs such as conducting mixing and loading operations in areas where an accidental spill would not contaminate an aquatic body, would further reduce risk of exposure such that we do not expect effects from Dazomet spills.

Calcium Nitrate and Ammonium Phosphate-Sulfate 2. The Horning Seed Orchard Biological Opinion (NMFS 2006) analyzed the effects of the application of calcium nitrate, and ammonium phosphate-sulfate 2 to the orchard units, and that analysis is incorporated here by reference. In this analysis, we concluded the following:

> Most of these fertilizers are very soluble in water and can contribute ammonia and nitrates in runoff to surface waters. Ammonia is of much concern due to its relatively toxic nature and its ubiquity in water bodies.
>
> Concentrations of ammonia acutely toxic to fishes may cause loss of equilibrium, hyperexcitability, increased breathing, cardiac output and oxygen uptake (USEPA 1986). In extreme cases, damage to the central nervous system from acute levels can lead to convulsions, coma, and death (Randall and Tsui 2002). Other mechanisms of ammonia toxicity were outlined by (Ruffier et al. 1981) include gill damage leading to suffocation,

> osmoregulation dysfunction (bloating) causing kidney failure, and inhibition of ammonia excretion leading to neurological and cytological failure.
>
> At lower concentrations, ammonia has many adverse effects on fishes, including a reduction in hatching success, increased respiratory distress, hormonal dysfunction, and reduction in growth rate and morphological development (Rice and Bailey 1980; Soderberg et al. 1983; EPA1999; EPA 1986). Chronic exposure to low levels of ammonia can disrupt the structure and function of select tissues and organs such as gills, livers, and kidneys and their increased susceptibility to disease. Behavioral responses to chronic ammonia are reduced swimming stamina and performance, which would disrupt predator avoidance and foraging behaviors.

Calcium nitrate is applied by hand or with on-the-ground equipment to terrestrial settings. This allows little to no possibility for the fertilizer to enter the stream network, especially considering calcium nitrate's low propensity to leach (Pionke and Lowrance 1991). Similarly applied ammonium phosphate-sulfate is strongly adsorbed by soils (Pionke and Lowrance 1991), and therefore is unlikely to run off into the stream network. Aerially applied ammonium phosphate-sulfate would be more likely to enter the stream network through drift or accidental application over a waterbody; however, project design features ensure that drift is minimized, all streams and wetlands receive a 50-foot buffer, and that mixing, loading, transport, and application occurs even farther from waterbodies.

Previous Monitoring Reports. Annual monitoring reports from Horning and Tyrrell Seed Orchards have not documented aerially applied pesticides in nearby stream corridors. Runoff of applied chemicals is unlikely given the directed application method, protection measures, binding capacity, and environmental fate.

Monitoring of drift cards showed some ambiguous results in the first years of drift card monitoring, due to tree drip, placement pattern, and type of card material used. After the initial four years, monitoring was refined and has since shown consistent absence of drift outside treated areas. The following two excerpts from a BLM Salem District report summarize monitoring at Horning Seed Orchard from 2005 to 2008:

> "In the past, results of drift card monitoring have been difficult to characterize, often due to conditions that are too moist (2007), cards too close or too far from application areas (2006) and card material that wasn't sensitive enough (2001–2004). …when cards were placed in the correct proximity and were protected from contamination, we have had no indication of drift offsite from the application areas" (BLM 2008).

Similarly, surface water and runoff monitoring from 2005 to 2008 detected no pesticides and was discontinued due to redundancy in 2009.

The secondary monitoring, using semi-permeable membrane cards (SPMDs) placed in streams for approximately a month, also showed no contamination, as described in this excerpt from the 2005–2008 monitoring summary:

"Most of the analysis results from the SPMD samples showed no detectible concentrations accumulated during the period of deployment (at a detection limit of 0.02 ppb.). In the two instances where detection was recorded (0.026 ppb.), it occurred at the Nate Creek 'above site' which measures incoming stream flow to the orchard lands. This represents esfenvalerate contribution from private land actions (Christmas tree farms)" (BLM 2008).

In general, the monitoring summary concluded in 2008 that the modeled outcomes (predictions far below lab detectible concentrations) in the 2005 Seed Orchard IPM EISs risk assessment were accurate and that the established project design features were effective in preventing drift. In subsequent years, up to 2019, very limited drift has been detected on drift cards, and SPMD monitoring results are consistent with the 2008 summary.

The Seed Orchard EA (BLM 2020) analyzed how the proposed chemicals move through soil resources after application and that analysis is incorporated herein, by reference. The pesticides proposed for application have a low mobility in soil due to a higher rate of adsorption. These pesticides would remain near the surface of the soil and degrade over time (BLM 2005). Although under some conditions, pesticides may have a higher propensity for leaching, or runoff (BLM 2005), and their application season would be extended under the proposed action, label restrictions and PDFs would limit their use in the proposed action to locations and times when leaching and runoff would be unlikely.

Proposed New Chemicals. The BLM proposes to use three new insecticides that have not been previously analyzed for use in the Seed Orchards: Spinosad, Emamectin benzoate, and iprodione.

Spinosad

The BLM conducted an RA for Spinosad for the maximum application rate, using the HQ analysis. The HQ categories are as follows:

0	No Risk	HQ < LOC for the species
L	Low Risk	HQ = 1 to 10 times the LOC[5] for the species
M	Moderate Risk	HQ = 10 to 100 times the LOC for the species
H	High Risk	HQ > 100 times the LOC for the species

Table 8 shows the risk assessment for spinosad for aquatic species, including machrophytes; invertebrates; and tolerant, and susceptible fish.

The RA shows that spinosad would be 0 risk to fish from the non-accidental acute exposure scenario, and the chronic/longer term exposure scenario. The only scenario that shows a risk to fish is a low risk for the accidental exposure scenario to susceptible fish species. SOPs and PDFs such as conducting mixing and loading operations in areas where an accidental spill would not contaminate an aquatic body, would further reduce risk of exposure such that we do not expect

[5] As noted in the previous discussion, LOCs are generally set at 1/10th of the LOAEL. In some cases, no adverse reaction happens at any dose (or at any reasonable dose), and the LOC is the NOAEL.

effects from spinosad spills. In addition, SOPs and PDFs governing spinosad at the Seed Orchards would prohibit application immediately preceding, during, or following a precipitation event until soils dry and no overland flow is observed. Aerial application of spinosad would be buffered from any stream or drain system, thereby protecting surface water quality. Based on the information, it is unlikely there would be an adverse effect on ESA-listed fish or critical habitat from the use of spinosad.

Emamectin Benzoate

Emamectin benzoate will only be injected into trees, and is taken up and dispersed into the cones where insect infestations are located. The injection application methods will prevent the chemical from reaching the soil. Because of this, it is highly unlikely that emamectin benzoate would reach streams. Therefore, there would not be an adverse effect to ESA-listed fish, or critical habitat.

Iprodione

Iprodione would be applied only in greenhouses. The BLM stated that greenhouse drainage is captured, and contained, preventing any leaching into the groundwater, and preventing any runoff into streams (BLM 2020). Because of this, there would not be an adverse effect to ESA-listed fish, or critical habitat.

Gibberellic Acid

The BLM will use gibberellic acid as a plant growth regulator. Gibberellic acid will be applied by injection, and foliar application with a backpack sprayer.

The available aquatic data show that gibberellic acid is practically non-toxic to fish [(rainbow trout LC_{50} > 150 parts per million (ppm) and aquatic invertebrates (*Daphnia magna* LC_{50} > 143 ppm)] (EPA 2012).

Gibberellins are highly biodegradable and have low to no persistence in the environment once applied (EPA 2019). Gibberellic acid is very water soluble (4,280 mg/L), has a very low potential for bioaccumulation (log P = 0.72), is non-persistent (DT_{50}[6] = 3.4 days soil; DT_{50} = 27 days hydrolysis), and photo degrades rapidly (DT_{50} = 0.2 days) (EPA 2012).

It is unlikely there would be an adverse effect to ESA-listed fish, or critical habitat from the use of gibberellic acid. This is because the gibberellic acid is practically non-toxic to fish. In addition, the BLM will use injection, and backpack spray methods. The BMPs proposed by the BLM, including not spraying when wind speeds exceed 10 miles per hour, and only when wind direction is downwind of streams would minimize the chance of chemical drift to streams.

6 Days for 50 percent breakdown at 20°C and a pH of 7.

Table 8. Spinosad risk assessment for aquatic species.

Risk Assessment Scenario	Risk Categories at Maximum Application Rates
Accidental Acute Exposures Fish Susceptible	L
Accidental Acute Exposures Fish Tolerant	0
Accidental Acute Exposures Invertebrate Susceptible	H
Accidental Acute Exposures Invertebrate Tolerant	H
Accidental Acute Exposures Macrophyte Susceptible	ND
Accidental Acute Exposures Macrophyte Tolerant	L
Non-Accidental Acute Exposures Fish Susceptible	0
Non-Accidental Acute Exposures Fish Tolerant	0
Non-Accidental Acute Exposures Invertebrate Susceptible	H
Non-Accidental Acute Exposures Invertebrate Tolerant	L
Non-Accidental Acute Exposures Macrophyte Susceptible	NA
Non-Accidental Acute Exposures Macrophyte Tolerant	0
Chronic/Longer Term Exposures Fish Susceptible	0
Chronic/Longer Term Exposures Fish Tolerant	0
Chronic/Longer Term Exposures Invertebrate Susceptible	M
Chronic/Longer Term Exposures Invertebrate Tolerant	0
Chronic/Longer Term Exposures Macrophyte Susceptible	NA
Chronic/Longer Term Exposures Macrophyte Tolerant	0

1. Risk categories: 0 = No risk (HQ < LOC); L = Low risk (HQ = 1 to 10 x LOC); M = Moderate Risk (HQ = 10 to 100 x LOC); and H = High risk (HQ > 100 LOC). Risk categories are based on upper estimates of hazard quotients and the LOC of 1.0.

2.5 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.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the action area was described in the Status of the Species and Environmental Baseline sections, and are expected to continue into the future. Some adjacent lands are in private timber production. Private forest management can produce adverse effects to listed fish, including increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Chemical fertilizers or pesticides likely are used on these lands, but no specific information is available regarding their use. On some streams that are on non-Federal lands, forestry operations conducted in compliance with the Oregon Forest Practices Act are likely to reduce stream shade, slow the recruitment of large woody debris, and add fine sediments. Since cumulative watershed effects are not limited by the Act, road density on private forest lands, which is high throughout the range of ESA-listed species considered in this opinion, is likely to increase or stay the same (71 FR 834).

Historically, resource-based industries caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. The economic and environmental significance of Oregon's natural resource-based economy is declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the action area for the indefinite future. The activity level of some industries, such as forest products, may increase in intensity as the nation's economy improves and export opportunities increase, raising the value of extracted materials.

While natural resource extraction within Oregon may be declining, general resource demands (*e.g.*, demands due to urban and suburban development, recreational activities, road construction and maintenance, shipping, and water withdrawals) are increasing with growth in the size and standard of living of the local and regional human populations. As of 2010, Oregon has a population of approximately 3.8 million residents. During the most recent 50-year period (1960-2010), decadal growth averaged 16.9%, with a range of 7.9% (1980s) to 25.9% (1970s). During the latest census period (2000-2010), the population of Oregon grew 12% (Mackun et al. 2011, PSU 2012).

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 environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.6 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.

The six species considered in this consultation are listed as threatened. Their current status results from low abundance, low productivity, reduced spatial structure, and reduced genetic diversity. These viability characteristics are driven in part by systemic habitat loss or degradation, where physical and biological features of critical habitat are insufficient to support abundance characteristic of a viable population.

The environmental baseline in the action area is such that individual ESA-listed salmonids in the action area are exposed to simplified in-stream channel morphology; reduced instream roughness and cover; loss and degradation of off-channel areas, refugia, estuarine rearing habitats, riparian areas, spawning areas, and wetlands; degradation of water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants); and blocked fish passage. Individuals of ESA-listed salmon, and steelhead, use the action area for rearing, migration, and spawning. The viability of the various populations that comprise the six salmon and steelhead species considered in this opinion ranges from extirpated or nearly so to populations that are a low risk for extinction.

Habitat improvement projects are being actively implemented through salmon recovery efforts, the restoration projects and other conservation measures built into other actions, and a combination of Federal, tribal, state and local actions. At the same time, population growth and development pressures on aquatic systems are increasing, particularly in the Willamette Valley.

Limiting factors for populations affected by the proposed actions included degraded floodplain connectivity and function, degraded channel structure and complexity, degraded riparian areas and large wood recruitment, degraded stream substrate, degraded water quality from altered water temperature, and degraded stream flows. Although ESA-listed salmonids are affected by these limiting factors, Federal lands managed under the NWFP have shown an overall improvement in aquatic ecosystems over the past 20 years (Reeves et al. 2016). These improvements include a diversity and complexity of watershed features; spatial and temporal connectivity within and between watersheds; physical integrity; water quality; sediment input storage, and transport; instream flows (e.g., both peak and low flows); floodplain inundation; riparian plant species composition and structural diversity; and habitat to support well-distributed populations of native plant, invertebrate, and vertebrate aquatic-and riparian-dependent species (Reeves et al. 2016).

Effects from the proposed action will affect salmon species considered in this opinion by causing physical, chemical, and biological changes to the environment. These effects include a temporary reduction in water quality from the use of fertilizers, herbicides, and pesticides (increased suspended sediment, increase in chemical contamination, and decrease in dissolved oxygen); and increased suspended sediment, and harassment/displacement from removal of vegetation below OHW.

The proposed action is likely to cause a slight decrease in the rate of egg and fry survival, and injury in juveniles and adults as a result of increased suspended sediment, increased chemical contamination, and decreased dissolved oxygen. However, these effects are not expected to cause a biologically meaningful effect at the population scale. This is due to narrow limits on amount of annual invasive species removal at and in close proximity to the Seed Orchards, and the relatively short duration of the minor, anticipated effects. The BLM owns 714,395 acres in the Northwest Oregon District. Annually, the BLM proposes to use mechanical control methods on 1,450 acres, chemical applications on 180 acres, and 50 acres of other treatment methods. This is approximately 0.2 percent, and 0.02 percent, 0.007 percent respectively of all BLM lands in western Oregon. In addition, the effects will be minor and short-term, and at, and in close proximity to the Seed Orchards. Because of this, there will likely be only a very small number of fish affected at any one time, (a very small reduction in abundance) and thus there will be little or no effect on the other viability parameters (productivity, spatial structure, diversity) of LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, OC coho salmon, LCR steelhead, and UWR steelhead. Based on this program's protective suite of PDFs, PDCs, and SOPs, and past monitoring results, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of ESA-listed salmonids, even when combined with a degraded environmental baseline, cumulative effects, and climate change.

Streams in the action area are designated as critical habitat for ESA-listed salmon and steelhead. CHART teams determined that most designated critical habitat for ESA-listed salmon and steelhead has a high conservation value, based largely on its restoration potential. Baseline conditions for these PCEs vary widely, from poor to excellent. The value of critical habitat in some areas is limited by altered hydrology, blocked fish passage, and a lack of complex habitat to provide forage, cover, and spawning habitat.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action will be minor to moderate intensity due to the small to moderate magnitude of suspended and depositional sediment, and decrease in water quality likely to occur. As stated above, the effects will be minor and short-term, and limited at, and in close proximity to the Seed Orchards. Because of this, the effects of the proposed action will not preclude or significantly delay development of the critical habitat features and its ability to conserve ESA-listed fish covered in this opinion.

2.7 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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UWR Chinook salmon, LCR coho salmon, Oregon Coast coho salmon, LCR steelhead, UWR steelhead, or destroy or adversely modify its designated critical habitat.

2.8 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.

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

- Harm to juveniles and adults of all ESA-listed salmon and steelhead considered in this opinion due to fertilizer, herbicide, and pesticide application that causes reduced water quality, including but not limited to decreased dissolved oxygen.
- Harm to eggs, fry, juveniles and adults of all ESA-listed salmon and steelhead considered in this opinion due to a temporary increase in suspended sediment during manual and mechanical invasive plant removal (reduced water quality).

The distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. In such circumstances, NMFS cannot provide an amount of take that would be caused by the proposed action. In such circumstances, NMFS uses an "extent of take" that can be monitored, and that is causally related to the take.

The best available indicators for the extent of take are:

1. For harm associated with fertilizer, herbicide, and pesticide application, the best available indicator is the number of acres treated per year. This feature best integrates the likely take pathway associated with this action, is proportional to the anticipated amount of take, and is the most practical and feasible indicator to measure. There is a causal link between the surrogate and the take pathway because the number of acres of herbicides that are used each year are proportional to the amount of herbicides that may enter streams, and thus cause incidental take of fish. Therefore, the extent of take indicator that will be used as a reinitiation trigger for this consultation is fertilizer, herbicide, and pesticide application on a maximum of 180 acres per year.

2. For harm associated with an increase in suspended sediments, the best available indicator is the number of acres manually, and mechanically treated per year. This feature best integrates the likely take pathway associated with this action, is proportional to the anticipated amount of take, and is the most practical and feasible indicator to measure. There is a causal link between the surrogate and the take pathway because the number of acres that are treated manually each year are proportional to the amount of disturbance, and the amount of sediment that may enter streams, and thus cause incidental take of fish. Therefore, the extent of take indicator that will be used as a reinitiation trigger for this consultation is manual and mechanical invasive plant treatment on a maximum of 1,450 acres per year.

These take indicators act as effective reinitiation triggers because these features best integrate the likely take pathways associated with this action, are proportional to the anticipated amount of take, and are the most practical and feasible indicators to measure. In particular, the number minutes the impact and vibratory hammers are in operation is directly correlated to the potential for harm due to hydroacoustic impacts, and thus the number of individuals harmed due to pile replacement. In addition, the extent of suspended sediment plumes rationally reflects the amount of take from suspended sediment caused by pile replacement because larger sediment plumes are correlated with harm to a larger number of individual fish.

Exceeding any of the indicators for extent of take will trigger the reinitiation provisions of this opinion.

2.8.2 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.

2.8.3 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).

The BLM shall:

1. Minimize incidental take associated with the use of 42 pesticides previously authorized terrestrial or aquatic use, four new pesticides authorized for terrestrial use in this opinion, and new aquatic applications of 2,4-D amine, glyphosate, imazapyr, and triclopyr TEA.

2. Minimize incidental take associated with the use of chemicals listed in ARBO II (NMFS 2013a).

3. Minimize incidental take associated with the use of persistent pesticides identified in the RPAs for chlorothalonil, and 2,4-D (NMFS 2011c); propargite (NMFS 2015); and chlorpyrifos, and diazinon (NMFS 2017).

4. Complete notification, monitoring, and reporting for seed orchard activities, and to confirm that the take exemption for the proposed action is not exceeded.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the BLM must comply with them in order to implement the RPMs (50 CFR 402.14). The BLM has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1 as described in SOPs and PDFs in the IPM for Seed Orchards EA, from Appendix D (BLM 2020):
   a) Fluridone will only occur in closed aquatic habitats that do not flow into streams during the treatment window. These are typically ponds and lakes, or sloughs and pools of standing water on floodplains connected to rivers only during high water events.
   b) Aquatic invasive plants in streams and rivers would only be treated with 2,4-D amine , glyphosate, imazapyr, and triclopyr TEA in areas where a portion of the plant is sticking out of the water or when water levels are at their lowest and the invasive plants that were previously submerged or floating are no longer in water.
   c) For treatment of aquatic vegetation:
      i) Treat only that portion of the aquatic system necessary to meet vegetation management objectives.
      ii) Use the appropriate application method to minimize potential for injury to desirable vegetation and aquatic organisms.
      iii) Follow water use restrictions on the herbicide label.
   d) Minimize treatments near fish-bearing water bodies during periods when fish are in life stages most sensitive to the herbicide(s) used and use spot treatments rather than broadcast treatments.
   e) Conduct mixing and loading operations in an area where an accidental spill would not contaminate an aquatic body.
   f) Do not rinse spray tanks in or near water bodies.
   g) Consider the proximity of application areas to salmonid habitat and the possible effects of herbicides on riparian and aquatic vegetation. Maintain appropriate buffer zones around salmonid-bearing streams.
   h) When using targeted grazing, limit access of domestic animals to streams and other water bodies to minimize sediments entering water and potential for damage to fish habitat.
   i) When using prescribed fire, maintain vegetated buffers near fish-bearing streams to minimize soil erosion and soil runoff into streams.

2. The following terms and conditions implement reasonable and prudent measure 2 as described in ARBO II (NMFS 2013a:
   a. Administer every action funded or carried out under this opinion in a manner consistent with PDC 1 through 4.
   b. For each action with a general construction element, apply PDC 10 through 20.
   c. For non-native invasive plant control, apply PDC 33. If aquatic restoration activities have complementary actions, follow the associated PDC and conservation measures for each complementary action.

3. The following terms and conditions implement reasonable and prudent measure 2 as described in chlorothalonil, and 2,4-D (NMFS 2011c); propargite (NMFS 2015); and chlorpyrifos, and diazinon (NMFS 2017).
    a. Limit the frequency of application to once per year for persistent pesticides (this applies to all chemicals listed above, except for dimethoate, and 2,4-D).
    b. Include the following risk reduction measures for the pesticides to reduce pesticide drift, and runoff (this applies to all chemicals listed above except for dimethoate, and 2,4-D):
        i. Maintain a functional riparian system alongside water ways > 10 meters wide
        ii. Do not apply chemicals when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 1- mph will carry drift away from perennial streams.
        iii. Do not apply when a precipitation event, likely to produce direct runoff to perennial streams from the treated area, is forecasted by NOAA/NWS or other similar forecasting service within 48 hours following application.

4. The following terms and conditions implement reasonable and prudent measure 3 (monitoring and reporting):
    a. The BLM will complete and submit a monitoring report to NMFS by February 15 each year that includes the following information:
        i. A description and list of pesticide applications conducted over the reporting period, including the number of acres treated by formula.
        ii. The number of acres of manual and mechanical invasive plant control by method.
        iii. A description of any incidents of mortality and adverse effects to non-target species that occur within the vicinity of the treatment area, including areas downstream and downwind, including any incidents where listed species appear injured or killed as a result of pesticide applications.
        iv. The results of the previous year monitoring program. If an accidental discharge occurred during the previous year, explain the what factors contributed to the accident, and any steps taken to prevent such accidentsl in the future.
    b. Submit annual monitoring report to:

        National Marine Fisheries Service
        Oregon Washington Coastal Office
        Attn: WCRO-2020-00083
        1201 NE Lloyd Boulevard, Suite 1100
        Portland, OR 97232-2778

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

NMFS offers the following conservation recommendation: Minimize the use of insecticides, and herbicides for pest control, and non-native and invasive vegetation control by emphasizing cultural, and biological control methods.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Horning and Tyrrell Seed Orchards Integrated Pest Management Plan.

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 biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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. The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” 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) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the BLM and 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

The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook and coho salmon as identified in the Fishery Management Plan for Pacific coast salmon (Pacific Fishery Management Council 2014).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have adverse effects on EFH designated for Chinook and coho salmon. These effects include a temporary reduction in water quality from increased suspended sediment, and increase in contaminants from insecticide, fungicide, herbicide, and fertilizer use.

3.3 Essential Fish Habitat Conservation Recommendations

1. Follow terms and conditions 1-4 not including monitoring and reporting for fish capture and handling) as presented in the ESA portion of this document to minimize adverse effects to water quality and monitor program effects.
2. Implement the conservation recommendations presented as part of the ESA portion of this document.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 160 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the BLM must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The BLM 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 of the opinion 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 user of this opinion is the BLM. 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. They adhere 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 consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses 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. APPENDIX

From Appendix A in the Seed Orchard BA (BLM 2020). Application rate and methods from the Environmental Assessment for Integrated Pest Management on Horning and Tyrrell Seed Orchards.

Table C-4. Updated Herbicide Application Rates and Methods (Undesirable Vegetation and Invasive Plants)

Herbicide	Treatment Use		Location	Maximum Application Rate	Application Methods
	Invasive Plants	Undesirable Vegetation			
2,4-D	✓	✓	Orchards, native plant beds, water	2 lbs a.e./acre	Backpack (selective foliar), hack-and-squirt, and roadside hydraulic spray applications, and direct application to emergent aquatic vegetation
Aminopyralid	✓	✓	Orchards, native plant beds	0.11 lbs a.e./acre	Backpack (selective foliar), hydraulic spray
Chlorsulfuron	✓		Orchards, native plant beds	0.141 lbs a.i./acre	Directed ground, broadcast ground
Clopyralid	✓	✓	Orchards, native plant beds	0.5 lbs a.e./acre	Directed ground, broadcast ground
Dicamba	✓		Orchards, native plant beds	2 lbs a.e./acre.[2]	Directed ground, broadcast ground
Diflufenzopyr+ dicamba	✓		Orchards, native plant beds	0.35 lbs a.e./acre	Directed ground, broadcast ground
Fluazifop-P-butyl	✓		Orchards, native plant beds	Single application: 0.375; maximum annual application: 1.125. Research and Demonstration herbicide[1]	Ground broadcast applications or directed foliar application (i.e., spot treatments)
Fluroxypyr	✓	✓	Orchards, native plant beds	0.5 lbs a.e./acre	Ground broadcast applications or directed foliar application (i.e., spot treatments)
Glyphosate	✓	✓	Orchard, native plant beds, water	7 lbs a.e./acre	Backpack applied directed foliar spray, broadcast foliar ground applications, cut stem applications, and direct application to emergent aquatic weeds
Hexazinone	✓	✓	Orchard, native plant beds	4 lbs a.i./acre	Directed ground spray, broadcast ground spray
Imazapic	✓		Orchard, native plant beds	0.1875 lbs a.e./acre	Directed ground, broadcast ground
Imazapyr	✓	✓	Orchard, native plant beds, water	1.5 lbs a.e./acre[3]	Ground broadcast, directed foliar (including spot treatments), various cut surface treatments, and direct application to emergent aquatic vegetation
Metsulfuron methyl	✓	✓	Orchard, native plant beds	0.15 lbs a.i./acre[4]	Directed ground, broadcast ground
Picloram	✓		Orchard, native plant beds	1 lbs a.e./acre	Ground application: backpack and boom spray
Rimsulfuron	✓		Orchard, native plant beds	0.0625 lbs a.i./acre	Directed ground, broadcast ground

Herbicide	Treatment Use		Location	Maximum Application Rate	Application Methods
	Invasive Plants	Undesirable Vegetation			
Sethoxydim	✓		Orchard, native plant beds	0.375 lbs a.i./acre. Research and demonstration herbicide[1]	Directed foliar, broadcast foliar
Sulfometuron methyl	✓	✓	Orchard, native plant beds	0.38 lbs a.i./acre	Directed ground, broadcast ground
Triclopyr	✓	✓	Orchard, native plant beds, water	2.6 or 7.2 lbs a.e./acre (BEE or TEA)	Backpack (selective) foliar applications, ground broadcast foliar application, basal bark, cut stump, and streamline basal bark, and direct application to emergent aquatic vegetation

Table C-7. Insecticide Application Adopted by the Records of Decision for the 2005 Seed Orchard IPM EISs and the Decision Record on the Horning IPM ROD Clarification EA

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
Acephate: Acecap® 97 (97% a.i. in an implant capsule)	Root weevil, gypsy moth, tussock moth, Douglas-fir needle midge	Implants	**Horning**: Individual trees in any seed production or breeding & preservation orchard **Tyrrell**: Individual trees: pines in multi-species orchards; or Douglas-fir orchards	1 capsule per 4 inches of tree circumference **Horning**: 1 application to 600 trees **Tyrrell**: 1 application to 100 trees (To protect ecological resources, project design features, applicable at Tyrrell, limit applications in certain scenarios. See Appendix D.)		**Horning**: Apr. to May **Tyrrell**: Apr	**Horning**: Every 1 to 3 years **Tyrrell**: Once every 3 years
Acephate: Orthene® Turf, Tree & Ornamental WSP (75% a.i. in a water-soluble bag)	Gypsy moth, Douglas-fir needle midge **Horning**: Root weevil, tussock moth, **Tyrrell**: Douglas-fir tussock moth	High-pressure hydraulic sprayer -or- (at **Horning**) hydraulic sprayer with handheld wand	**Horning**: Individual trees in any seed production or breeding & preservation orchard	0.01 lbs a.i./tree, in water at 2 gal/tree **Horning:** 1 application to 600 trees **Tyrrell**: 1 application to 1,500 trees on 30 acres		Apr. to Sept.	**Horning**: Every 1 to 3 years **Tyrrell**: Once every 3 years

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
	larvae, ponderosa pine needle miner		**Tyrrell**: Pines and minor species orchards				
	Root weevil, gypsy moth, tussock moth, Douglas-fir needle midge	Hand sprayer	Greenhouses 1 and 2 and center-span	0.0075 lbs a.i./gal, in water at 1 gal/100 sq ft 1 application to 3 tables (96 sq ft)	0.0075 lbs a.i./gal, in water at 1 gal/100 sq ft 2 applications to 3 tables (96 sq ft)	June to Sept.	Every 1 to 3 years
Acephate: 1300 Orthene® TR (12% a.i. in 4- or 12-oz. total release canisters)	Root weevil	Total-release canisters	Greenhouses	Two (4 oz.) cans per greenhouse 1 application to both greenhouses	Two (4 oz.) cans per greenhouse and one (4 oz.) can in center-span 2 applications to both greenhouses and center-span	June to Sept.	Every 1 to 3 years
B.t.: Deliver® (18% a.i. as a wettable granular bioinsecticide)	Gypsy moth, Douglas-fir tussock moth, spruce budworm, tent caterpillar	High-pressure hydraulic sprayer -or- hydraulic sprayer with handheld wand -or- (at **Tyrrell**) aerial	All orchard areas	0.27 lbs a.i./acre, in water at 100 gal/acre (0.30 lbs a.i./acre for aerial) **Horning:** 1 application to trees on 75 acres **Tyrrell**: 1 application to trees on 20 acres (for both ground and aerial application methods)	0.27 lbs a.i./acre, in water at 100 gal/acre (0.30 lbs a.i./acre for aerial) **Horning:** 1 application to trees on 150 acres **Tyrrell:** 1 application to trees on 80 acres for ground-based methods, 3 applications up to 200 acres for aerial application	Apr. to Sept.	**Horning:** Every year of a harvestable cone crop **Tyrrell**: Once every 3 years
Chlorpyrifos: Dursban 50W (50% a.i. as a wettable powder in water-soluble packets)	**Horning:** Adelgids, Cooley spruce gall aphids, gypsy moth, Douglas-fir tussock moth,	**Horning**: Airblast sprayer **Tyrrell**: High-pressure hydraulic sprayer	All orchard areas	1 lbs a.i./acre, in water at 100 gal/acre (0.02 lbs a.i./tree)	2 lbs a.i./acre, in water at 100 gal/acre (0.04 lbs a.i./tree)	Apr. to Sept.	**Horning**: Seldom: 1 to 2 times in a 10-year period **Tyrrell**: Once every 3 years

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
	spruce budworm, Lygus spp., maple leaf cutters, oak skeletonizers, pitch pine moths, weevils, bark beetles **Tyrrell**: Douglas-fir coneworm			**Horning**: 1 application to 75 acres **Tyrrell**: 1 application to 20 acres	**Horning**: 1 application to 150 acres **Tyrrell**: 1 application to 40 acres		
				(Project design features limit applications in certain scenarios. See Appendix D.)			
Diazinon: Diazinon 50W (50% a.i. as a wettable powder)	**Horning**: Two-spotted mites, aphids, budmoths, root weevils, tent caterpillars, obscure root weevil **Tyrrell**: Douglas-fir coneworm	High-pressure hydraulic sprayer	Individual trees in all orchard areas **Horning**: Native plant beds	0.015 lbs a.i./tree, in water at 3 gal/tree **Horning**: 1 application to 1,500 trees **Tyrrell**: 1 application to 500 trees on 10 acres	0.075 lbs a.i./tree, in water at 5 gal/tree **Horning**: 2 applications to 1,500 trees **Tyrrell**: 2 applications to 1,000 trees on 20 acres	Apr. to Sept.	**Horning**: Seldom: 1 to 2 times in a 5-year period **Tyrrell**: Once every 3 years
				(Project design features limit applications in certain scenarios. See Appendix D.)			
Dimethoate: Digon 400 (43.5% a.i. as a liquid concentrate)	Douglas-fir cone moth, Douglas-fir cone gall midge, Douglas-fir seed chalcid, coneworm	High-pressure hydraulic sprayer	**Horning**: Individual trees in any seed production orchard **Tyrrell**: All orchard areas	0.13 lbs a.i./tree, in water at 2 gal/tree **Horning**: 1 application to 1,000 trees **Tyrrell**: 1 application to 80 acres	0.34 lbs a.i./tree, in water at 4 gal/tree **Horning**: 2 application to 1,000 trees **Tyrrell**: 2 applications to 135 acres	Apr. to June	**Horning**: Only if esfenvalerate was unavailable **Tyrrell**: Every 3 years
				(Project design features limit applications in certain scenarios. See Appendix D.)			
Esfenvalerate: Asana® XL (8.4% a.i. as an	Douglas-fir cone moth, coneworm	Aerial (helicopter)	Seed production orchards	0.19 lbs a.i./acre, in water at 10 gal/acre	0.19 lbs a.i./acre, in water at 10 gal/acre	**Horning**: Apr. to July	Annually, rotating among units

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
emulsifiable concentrate)	**Horning:** Western conifer seed bug, seed chalcid, pine conelet bug, pine needle midge, spruce budworm, balsam woolly adelgid **Tyrrell**: Douglas-fir cone gall midge, Douglas-fir seed chalcid			**Horning**: 1 application to 75 acres **Tyrrell:** 1 or 2 applications to 80 acres	**Horning**: 2 applications to 150 acres **Tyrrell:** 2 applications to 80 acres	**Tyrrell**: Mar. to Aug.	
		Airblast sprayer		0.05 lbs a.i./acre, in water at 100 gal/acre **Horning**: 1 application to 75 acres **Tyrrell:** 1 or 2 applications to 80 acres	0.088 lbs a.i./acre, in water at 175 gal/acre **Horning**: 2 applications to 150 acres **Tyrrell:** 3 applications to 135 acres	**Horning**: Apr. to June **Tyrrell**: Mar. to Aug.	
		High-pressure hydraulic sprayer -or- hydraulic sprayer with handheld wand -or- (at **Horning**) backpack sprayer	Individual trees in all orchard areas	0.001 lbs a.i./tree, in water at 2 gal/tree **Horning**: 1 application to 1,000 trees **Tyrrell:** 1 or 2 applications to 2,000 trees on 40 acres	Cumulative maximum = 1.6 lbs a.i./acre per year 0.002 lbs a.i./tree, in water at 4 gal/tree **Horning**: 2 applications to 1,000 trees **Tyrrell:** 3 applications to 5,000 trees on 100 acres		
Horticultural oil: Dormant Oil 435 (98.8% paraffinic hydrocarbon oil)	Spider mites, scales	High-pressure hydraulic sprayer	Individual trees in all orchard areas, as an additive to other pesticides; or	0.03 gal oil/tree, in water at 3 gal/tree **Horning**: 1 application to individual trees on 10 acres		Mar. to Sept. (as an additive) **Horning**: Sept. to May (as a dormant oil)	**Horning**: Every 1 to 2 years as an alternate or supplement to non-chemical treatments

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
			alone as a dormant spray	**Tyrrell**: 1 application to individual trees on 20 acres		**Tyrrell:** Sept. to July (as a dormant oil)	**Tyrrell**: Once every 3 years
Imidacloprid: Imicide® (10% a.i. in an implant capsule)	Douglas-fir gall midge, coneworm	Implants	**Horning**: Individual trees in any seed production or breeding & preservation orchard **Tyrrell**: Individual trees in multi-species and Douglas-fir orchards	1 3-ml capsule/4 inches tree circumference at breast height **Horning**: 1 application to 500 trees on 10 acres **Tyrrell:** 1 application to 750 trees on 15 acres	1 3-ml capsule/4 inches circumference at breast height **Horning**: 1 application to 6,000 trees on 120 acres **Tyrrell:** 1 application to 6,750 trees on 135 acres	Jan. to Mar.	Annually, rotating among orchard units
Permethrin: Pounce® 3.2 EC (38.4% a.i. as an emulsifiable concentrate)	Douglas-fir coneworm, Western conifer seed bug	**Horning**: Airblast sprayer	**Horning**: Pine orchards	**Horning**: 1.05 lbs a.i./acre, in water at 100 gal/acre **Horning**: 1 application to 9 acres	**Horning**: 1.05 lbs a.i./acre, in water at 100 gal/acre **Horning**: 2 applications to 9 acres	**Horning**: May to Aug.	**Horning**: Only if esfenvalerate was unavailable
		High-pressure hydraulic sprayer	**Horning**: Individual trees in pine orchards **Tyrrell**: Pines in multi-species orchard	0.01 lbs a.i./tree, in water at 5 gal/tree **Horning**: 1 application to 900 trees **Tyrrell**: 1 application to 500 trees	0.02 lbs a.i./tree, in water at 10 gal/tree **Horning**: 2 applications to 900 trees **Tyrrell**: 2 applications to 500 trees	May to Aug.	**Horning**: Only if esfenvalerate was unavailable **Tyrrell**: Every 1 to 2 years
	Western cedar gall midge	**Horning**: Airblast sprayer	**Horning**: Western red cedar orchards	**Horning**: 0.2 lb a.i./acre, in water at 100 gal/acre 1 application to 4 acres	**Horning**: 0.2 lb a.i./acre, in water at 100 gal/acre 2 applications to 4 acres	**Horning**: February - March	**Horning**: Annually, rotating between orchard units

Insecticide	Target Pest	Application Method	Location	Typical Application Rate and Area	Max. Label Application Rate and Max. Area	Application Date Range[1]	Anticipated Frequency
		Horning: High-pressure hydraulic sprayer	**Horning**: Individual trees in western red cedar orchards	**Horning**: 0.01 lb a.i./tree, in water at 5 gal/tree 1 application to 400 trees	**Horning**: 0.02 lb a.i./tree, in water at 10 gal/tree 2 applications to 400 trees		
Potassium salts of fatty acids: Safer® Soap (49.0% a.i. as a ready-to-use liquid)	Aphids **Tyrrell**: Mites, earwigs, and tent caterpillars	**Horning**: Hand sprayer	**Horning**: Greenhouse, individual trees or tree branches in all orchard areas	**Horning**: As needed	**Horning**: As needed	Apr. to Sept.	Every 1 to 2 years as an alternate or supplement to non-chemical treatments
		Tyrrell: High-pressure hydraulic sprayer with handheld wand -or- backpack sprayer	**Tyrrell**: Individual trees or tree branches in all orchard areas	**Tyrrell**: 2.50 fl. oz. concentrate/tree, in water at 1 gal/tree 1 application to individual trees on 5 acres	**Tyrrell**: 2.50 fl. oz. concentrate/tree, in water at 1 gal/tree 2 applications to individual trees on 5 acres		
Propargite: Omite® CR (32% a.i. as a wettable powder in water-soluble bags)	Spider mites	High-pressure hydraulic sprayer	Individual trees in all orchard areas	1.4 lbs a.i./acre, in water at 100 gal/acre **Horning**: 1 application to 20 acres **Tyrrell**: 1 application to 500 trees on 10 acres	2.4 lbs a.i./acre, in water at 100 gal/acre **Horning**: 2 applications to 20 acres **Tyrrell**: 2 applications to 1,000 trees on 20 acres	Apr. to Oct.	**Horning**: 1 to 2 times in a 10-year period **Tyrrell**: Once every 3 years
				(To protect worker health at Tyrell, project design features limit applications in certain scenarios. See Appendix D.)			

Table C-8. Updated Insecticide Application Rates and Methods

	Pesticide	Location	Maximum Application Rate	Application Methods
Insecticides	Chlorpyrifos	Orchards	1 lbs a.i./acre (Project design features limit applications in certain scenarios. See Appendix D.)	Backpack (directed foliar) or tractor-mounted spray boom.
	Emamectin benzoate	Orchards	630 to 46,000 mg a.i./tree	Tree injection
	Esfenvalerate	Orchards	2.4 to 4.8 oz a.i./acre or 0.0125 to 0.0247 lbs a.i./acre with a typical total use of 1 lb per year	Tractor-mounted boom broadcast or backpack directed foliar
	Horticultural oil	Orchards, greenhouses	0.03 gal oil/tree, in water at 3 gal/tree	Chemigation, high-pressure hydraulic sprayer
	Imidacloprid	Orchards, greenhouses	Maximum annual application rate is 0.5 lbs a.i. /acre Maximum rate for a single application is 0.4 lbs/acre	Tree injection or implants. Foliar applications in greenhouse
	Spinosad	Orchards, greenhouses	Single application: 0.225 lbs a.i./acre with maximum of two applications annually (at least 6 days apart)	Directed foliar (hand spray or backpack), ground broadcast foliar, or aerial foliar applications, hand sprayer in greenhouse

Table C-10. Fungicide and Fumigant Application Adopted by the Records of Decision for the 2005 Seed Orchard IPM EISs

Fungicide / Fumigant	Target Pest	Application Method	Location	Typical Application Rate and Area	Max Label Application Rate and Max Area	Application Date Range	Anticipated Frequency
Chlorothalonil: Bravo® 500 (40.4% a.i. as a liquid concentrate)	*Swiss needlecast,* ***Horning****: Rhabdocline needlecast, Botrytis seedling blight, Phoma twig blight, Sirococcus tip blight*	High-pressure hydraulic sprayer	Individual trees in all orchard areas	2.1 lbs a.i./acre, in water at 100 gal/acre **Horning**: 1 application to 250 trees **Tyrrell**: 1 application to 500 trees on 10 acres	4.2 lbs a.i./acre, in water at 100 gal/acre **Horning**: 2 applications to 500 trees **Tyrrell**: 2 applications to 1,000 trees on 20 acres	Feb. to June	**Horning**: 1 to 2 times in a 10-year period **Tyrrell**: Once every 3 years
Chlorothalonil: Daconil Ultrex® (82.5% a.i. as water-dispersible granules)	*Alternaria, Anthracnose, Botrytis, Cercospora, and Fusarium leaf spots; and Scirrhia brown spot*	Chemigation -or- hand sprayer	Greenhouses 1 and 2 and center-span (Horning)	1.65 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse)	4.12 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse)	May to Dec.	Every 2 weeks

Fungicide / Fumigant	Target Pest	Application Method	Location	Typical Application Rate and Area	Max Label Application Rate and Max Area	Application Date Range	Anticipated Frequency
				17 applications to 1 greenhouse	17 applications to 1 greenhouse		
Dazomet: Basamid® Granular (99% as a granular material)	Nematodes, weeds, fungi **Tyrrell**: Insects	Ground-pull fertilizer-type spreader	Native plant beds	**Horning**: 173 lbs a.i./acre **Tyrrell**: 248 lbs a.i./acre 1 application to 2 acres	**Horning**: 300 lbs a.i./acre **Tyrrell**: 347 lbs a.i./acre **Horning**: 1 application to 3 acres **Tyrrell**: 1 application to 2 acres	**Horning**: Apr. to July **Tyrrell**: June	**Horning**: Annually or less, depending on the plant species **Tyrrell**: Every 2 to 3 years
Hydrogen dioxide: ZeroTol® (27% a.i. as a liquid concentrate)	*Algae, Botrytis, Fusarium, Pseudomonas, Pythium, Phytophthora, Rhizoctinia*	Chemigation	Greenhouses 1 and 2 and center-span (Horning)	100 fl. oz. product/quadrant, in water at 100 gal/quadrant (= 400 gal/greenhouse) 47 applications to both greenhouses and center-span	250 fl. oz. product/quadrant, in water at 100 gal/quadrant (= 400 gal/greenhouse) 47 applications to both greenhouses and center-span	Mar. 15 and July to Jan. 15	Every week
Mancozeb: Dithane T/O (75% a.i. as a microgranular product)	*Anthracnose, Cylindrosporium, Cercospora and Phomopsis blight, Lophodermium needlecast, pine gall rust, Scirrhia brown spot, cedar-apple rust, Alternaria, and Phyllosticta leaf spots*	Chemigation -or- hand sprayer	Greenhouses 1 and 2 and center-span (Horning)	1.12 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse) 14 applications to 1 greenhouse (To protect worker health, project design features limit applications in certain scenarios. See Appendix D.)	1.12 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse) 14 applications to 1 greenhouse	May to Nov.	Every 1 to 2 years as an alternate or supplement to non-chemical treatments
Propiconazole: Banner® MAXX (14.3%	Rust **Horning**: Mildew **Tyrrell**: Grass fungus	Tractor-pulled spray rig with	Native plant beds	0.12 lbs a.i./acre, in water at 100 gal/acre	0.20 lbs a.i./acre, in water at 100 gal/acre	Mar to Nov.	**Horning**: 1 to 2 times per year

Fungicide / Fumigant	Target Pest	Application Method	Location	Typical Application Rate and Area	Max Label Application Rate and Max Area	Application Date Range	Anticipated Frequency
a.i. as a liquid concentrate)		boom -or- hydraulic sprayer with handheld wand		**Horning**: 4 applications to 3 acres **Tyrrell**: 2 applications to 2 acres	**Horning**: 4 applications to 15 acres **Tyrrell**: 3 applications to 2 acres		**Tyrrell**: Once every 2 years
Thiophanate-methyl: Cleary's 3336® WP (50% a.i. as a wettable powder in 8-oz. water-soluble bags)	*Botrytis and Fusarium stem rots*	Chemigation -or- Hand sprayer	Greenhouses 1 and 2 and center-span	0.38 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse) 17 applications to 1 greenhouse	0.75 lbs a.i./quadrant, in water at 100 gal/quadrant (= 400 gal/ greenhouse) 17 applications to 1 greenhouse	June 15 to Jan. 15	Every 2 to 3 weeks

Table C-11. Updated Fungicide and Fumigant Application Rates and Methods

Pesticide		Location	Maximum Application Rate	Application Methods
Fungicide / Fumigant	Chlorothalonil	Orchards, greenhouses, native plant beds	2.1 lbs a.i./acre with an application volume of 30 gallons/acre. Five acres may be treated in a single application lasting 1 hour. Up to 30 acres may be treated annually.	Broadcast spray through tractor mounted spray booms or directed foliar backpack spray
	Dazomet	Native plant beds	350 lbs a.i./acre on up to 40 acres annually	Soil incorporation
	Iprodione	Greenhouses	1.0 to 2.0 quarts per 100 gallons of water (0.25 lbs to 0.5 lbs a.i. per 100 gallons).	Foliar spray or soil drench
	Mancozeb	Greenhouses	Maximum single application rate is 17.4 lbs a.i./acre; maximum amount handled by a single worker is 7.875 lbs a.i. Up to four applications may be made per year with a minimum application interval of 10 days.	Chemigation or hand sprayer
	Thiophanate-methyl	Greenhouses	0.375 lbs a.i./acre with a maximum total use of 12 lbs	Chemigation or hand sprayer

Table G-4. Dosage of ProCone for Douglas-fir and Western Hemlock

Tree DBH		Cross Sectional Area	Amount of a.i. to Use (mg)			lbs a.i. / Acre 218 Trees / Acre		lbs a.i. / Acre 109 Trees / Acre	
Inches	cm	cm^2	Lowest Rate	Typical Rate	Maximum Rate	Typical Rate	Maximum Rate	Typical Rate	Maximum Rate
2.0	5.08	20.27	15.20	22.80	30.40	0.011	0.015	0.005	0.007
2.5	6.35	31.67	23.75	35.63	47.50	0.017	0.023	0.009	0.011
3.0	7.62	45.60	34.20	51.30	68.41	0.025	0.033	0.012	0.016
3.5	8.89	62.07	46.55	69.83	93.11	0.034	0.045	0.017	0.022
4.0	10.16	81.07	60.80	91.21	121.61	0.044	0.058	0.022	0.029
4.5	11.43	102.61	76.96	115.43	153.91	0.055	0.074	0.028	0.037
5.0	12.70	126.68	95.01	142.51	190.02	0.068	0.091	0.034	0.046
5.5	13.97	153.28	114.96	172.44	229.92	0.083	0.111	0.041	0.055
6.0	**15.24**	**182.41**	**136.81**	**205.22**	**273.62**	**0.099**	**0.132**	**0.049**	**0.066**
6.5	16.51	214.08	160.56	240.84	321.13	0.116	0.154	0.058	0.077
7.0	17.78	248.29	186.21	279.32	372.43	0.134	0.179	0.067	0.089
8.0	20.32	324.29	243.22	364.83	486.44	0.175	0.234	0.088	0.117
9.0	22.86	410.43	307.82	461.74	615.65	0.222	0.296	0.111	0.148
10.0	**25.40**	**506.71**	**380.03**	**570.05**	**760.06**	**0.274**	**0.365**	**0.137**	**0.183**
11.0	27.94	613.12	459.84	689.76	919.67	0.332	0.442	0.166	0.221
12.0	30.48	729.66	547.24	820.87	1,094.49	0.395	0.526	0.197	0.263
13.0	33.02	856.34	642.25	963.38	1,284.50	NA	NA	0.232	0.309
14.0	35.56	993.15	744.86	1,117.29	1,489.72	NA	NA	0.268	0.358
15.0	38.10	1,140.09	855.07	1,282.60	1,710.14	NA	NA	0.308	0.411
16.0	40.64	1,297.17	972.88	1,459.32	1,945.76	NA	NA	0.351	0.468
17.0	43.18	1,464.38	1,098.29	1,647.43	2,196.58	NA	NA	0.396	0.528
18.0	45.72	1,641.73	1,231.30	1,846.95	NA	NA	NA	0.444	NA

For western redcedar, the BLM applies ProCone® to trees 10 to 12 ft in height (on average; trees would not exceed 15 feet). Applications of 137-274 mg a.i. (rates similar to a 6 in. DBH Douglas-fir/western hemlock) may occur three times per year; 380-760 mg a.i. applications may occur once per year (rates similar to a 10 in. DBH Douglas-fir/western hemlock).

BLM would not apply more than 0.529 lbs (239,950 mg) a.i. per acre annually.