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-2020-00888

October 30, 2020

Mayor Joe Schey
City of Vader
PO Box 189
317 – 8th Street
Vader, Washington 98593

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the City of Vader Water Treatment Plant Upgrade, City of Vader, Lewis County, Washington. (Hydrologic Unit code 170800050701, Olequa Creek)

Dear Mayor Schey,

Thank you for your letter of May 19, 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 Vader Wastewater Treatment Plant Upgrade. 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 or result in adverse modification of designated critical habitat for the following species:

- Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha),*
- LCR coho salmon (*O. kisutch)*
- LCR steelhead (*O. mykiss)*

As required by section 7 of the Endangered Species Act, the National Marine Fisheries Service provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures the National Marine Fisheries Service considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions. Incidental take from actions that meet the term and condition will be exempt from the Endangered Species Act take prohibition.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast salmon and Pacific Coast Groundfish. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Scott E. Anderson (scott.anderson@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: Gary Cooper, City of Vader, Planning Director

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

City of Vader Water Treatment Plant Upgrade
City of Vader, Lewis County, Washington
(Hydrologic Unit code 170800050701, Olequa Creek)

NMFS Consultation Number: WCRO-2020-00888

Action Agency: Department of Housing and Urban Development

Affected Species and NMFS' Determinations:

ESA-Listed Species	ESA Status	Is Action Likely to Adversely Affect Species?	Is the Action likely to Jeopardize Species?	Is the action likely to adversely affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook salmon	T	Yes	No	Yes	No
Lower Columbia River coho salmon	T	Yes	No	Yes	No
Lower Columbia River steelhead	T	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: October 30, 2020

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1. INTRODUCTION

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

1.1 Background

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 U.S.C. 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 Oregon and Washington Coastal Office.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on October 28, 2019. We are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and, consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the opinion is fully consistent with the updated regulations.

1.2 Consultation History

This biological opinion is based on the information provided in the May 19, 2020, biological evaluation (BE) and supporting documents. A complete record of this consultation is on file at the Oregon Washington Coastal Office located in Lacey, Washington. HUD, through its Responsible Entity, (RE) concluded that the proposed action is likely to adversely affect:

- Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha),*
- Lower Columbia River (LCR) coho salmon (*O. kisutch)*
- LCR steelhead (*O. mykiss)*

NMFS concurs with the RE's determinations.

NMFS also reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect the EFH of Pacific Coast salmon.

1.3 Proposed Federal Action

"Action," under the ESA, 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).

The Department of Housing and Urban Development, through its RE, proposes to provide financial assistance to the City of Vader. The City of Vader intends to upgrade the Vader Wastewater Treatment Plant (WWTP). This project will upgrade plant infrastructure to address deficiencies (details below). There will be no operational changes to the outfall at Olequa Creek, which is the discharge site associated with WWTP, and which will continue to be used before and following the project. The upgrades include installing a new pipe to convey treated effluent from the treatment basins to the existing outfall in Olequa Creek.

The purpose of the proposed action is to reduce the amount of residual chlorine discharged, improve disinfection of wastewater prior to discharge into Olequa Creek, and reduce the temperature of the effluent. The plant is designed to accommodate an Average Day Flow Rate of 0.221 million gallons per day (MGD), with a Peak Instantaneous Flow Rate of 1.703 MGD. The project design is based on a 20-year planning period.

The following upland improvements have been proposed:

1. Replacing the existing headworks with a mechanically cleaned primary screen with a manual bypass to help improve solids removal.
2. Installation of a Parshall flume to measure influent flow rates.
3. Removing accumulated sludge from the existing lagoon basins and, assuming it complies with the standards for Beneficial Reuse, applying it to land.
4. Relining Basins 1 and 2 with a new dual liner system with leak detection.
5. Floating baffle curtains to effectively create 4 treatment cells within the 2 basins.
6. Installing new aerators/mixers in the 4 treatment cells (Cell 1 will be fully mixed and aerated while Cells 2, 3, and 4 will be partially mixed).
7. Constructing a pipe manifold between all 4 cells to allow the operator to fine-tune the treatment process as flow fluctuates seasonally.
8. Installing an on-site sodium hypochlorite generator to produce a sodium hypochlorite solution for disinfection.
9. Constructing a new chlorine contact chamber sized to meet contact time requirements.
10. Installing a dechlorination system to minimize the discharge of residual chlorine.
11. Installing a new pipe to convey treated effluent from the treatment basins to the existing outfall in Olequa Creek.
12. Installing a new municipal waterline to the property to supply a new on-site fire hydrant.

The project will not involve any in-water work. The new outfall conveyance pipe will daylight above the ordinary high-water mark (OHWM) of Olequa Creek where it will be connected to the existing outfall diffuser. The infrastructure currently within Olequa Creek will not be modified as part of this project. The existing footprint of the Vader WWTP will not change.

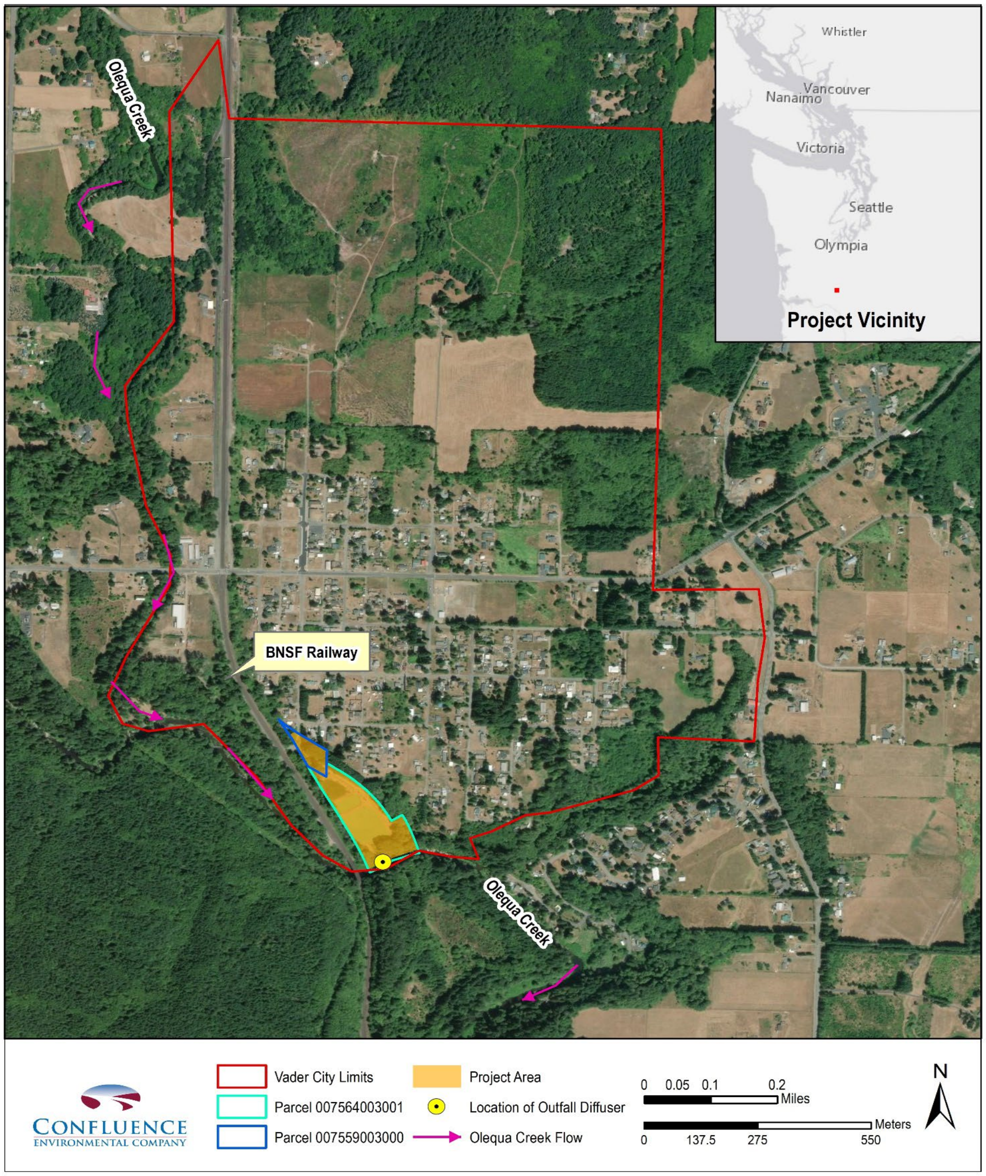

Figure 1. Aerial of Project Location and Boundaries.

The project is located within an area where EFH has been designated for Pacific Coast (Chinook and coho) salmon. 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 whether or not the proposed action would cause any other activities, and determined that it would cause the following activities: discharge of treated effluent into Olequa Creek. The project will not increase effluent volume, but will continue to discharge effluent into

Olequa Creek. The effluent discharged will be modified, and the effects of that discharge on ESA-listed species and Critical Habitat, as well as effects on EFH are discussed below.

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's "adverse modification" analysis 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 of critical habitat for Lower Columbia River salmonids uses the term primary constituent element (PCE). 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.

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. We then evaluate the influence of the individual level effects on the populations they comprise, if possible.
- 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 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 percent 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; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). 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 1.0-3.7ºC 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 Critical Habitat

Table 1. Critical habitat, designation date, federal register citation, and status of 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 2005). 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.
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 2005). 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.
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 2005). 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.

2.2.2 Status of the Species

Table 2, below provides a summary of listing and recovery plan information, status summaries and limiting factors for many of 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/). Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 2. Listing classifications and date, recovery plan reference, most recent status review, summary, and limiting factors for each species in this opinion.

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 2013	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 • Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	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	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				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	
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	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	• 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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				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.	

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). As mentioned above, effects include those of activities caused by the proposed action.

The action area includes the Olequa Creek regulatory mixing zone, which extends downstream about 301 ft and 100 ft upstream from the location of the outfall diffuser, and includes the three mile downstream portion of Olequa Creek, where it joins the Cowlitz River. The action area supports a primarily migratory corridor for three Columbia River salmonid evolutionarily significant units (ESU)/distinct population segments (DPS), (Table 4). All of these fish have designated critical habitat in the action area. Constituent elements in effluent will be present in Olequqa Creek, even though mixing distributes them at a level that makes measuring the load distinctly from the background level of contaminants impossible.

2.4 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).

The Vader WWTP is currently characterized as a conventional secondary treatment plant. The conventional secondary treatment system has physical phase separation to remove settleable solids and a biological process to remove dissolved and suspended organic compounds. The biological process is performed by indigenous, aquatic microorganisms in a managed aerobic habitat. Bacteria and protozoa consume biodegradable soluble organic contaminants (e.g., sugars, fats, and organic short-chain carbon molecules) while reproducing to form cells of biological solids..

Olequa Creek, from the above the point of discharge downstream to the Cowlitz River, is in a largely rural residential setting. The riparian buffer along the creek is mostly forested, but contains areas with steeply sloped and eroding banks (LCCD, 2016), and also includes invasive species such as Himalayan blackberry and Asian knotweed. The city's Shoreline Master Program generally prohibits intense development near the riparian zone to protect and preserve ecological functions. While data on Olequa Creek characteristics are limited, BHC Consultants (BHC) developed critical ambient water quality conditions based upon the G&O 2003 survey and limited Ecology data as part of the 2015 Wastewater Facilities Plan Amendment. The critical ambient water conditions were compiled in order to derive projected permit limits. These conditions include a pH of 7.9, a temperature of 19 degrees C in August, and hardness of 20 mg/L (BHC 2015).

Although no portions of the action area are on Ecology's Water Quality Assessment 303(d) list for impaired water or sediment quality, a stretch of Olequa Creek approximately 2,100 feet upstream of the action area (between the confluence with McMurphy Creek and the confluence with Stillwater Creek) has 2 Category 5 (polluted waters that require a water improvement project) listings for temperature and bacteria exceedances and 1 Category 2 (waters of concern) rating for Dissolved Oxygen levels (Ecology 2020). Olequa Creek was sampled by the Washington Department of Ecology in 1995 as part of a state-wide, pesticide-sampling program. Several small tributaries flow through or near Christmas-tree farms, which is the primary commercially grown crop in the area and the most likely source of pesticide contamination. Samples were collected at the bridge on Highway 506 in Vader, upstream of the Stillwater Creek confluence. Atrazine was detected in the April, June, and October samples. The June 0.30 parts per billion level was the highest concentration yet recorded for Atrazine by the Washington State Pesticide Monitoring Program. Six herbicides were detected at low levels in the October samples. Four of these are commonly used for forest management, but Atrazine is the only one registered for use on Christmas trees in Washington. Atrazine was the only pesticide detected more than once.

In 2015, 66,000 to 100,000 fish were killed in Olequa Creek after a fire razed a warehouse nearby, releasing potentially more than a thousand gallons of vegetable oil into the creek, impacting 3.7 miles of the creek. Limited large woody debris in Olequa Creek is noted by the Lewis County Shoreline Restoration Plan (2016), along with low stream flows after extended dry spells. Olequa is considered among highest priority for protection and restoration, such as riparian vegetation planting, improving water quality, and enhancing adjacent wetlands.

The Vader WWTP presently discharges treated effluent near river mile 3 of mainstem Olequa Creek under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA0023639, issued by Washington Department of Ecology. The City's wastewater collection system was originally constructed in 1918. In 1958, the City upgraded their system by constructing a single-cell wastewater lagoon to treat and disinfect wastewater prior to discharge into Olequa Creek. The single-cell lagoon system was converted to a 3-cell lagoon system with limited aerators and chlorine disinfection in 1980 to improve the performance of the WWTP (CWES 2018). The plant underwent additional sewer and man-hole repairs in 2004-2005 and 2014-2015. The NPDES permit classifies the existing facility as a "three cell aerated facultative lagoon" (CWES 2018). While the plant has discharged to Olequa Creek since 1918, the current outfall diffuser was installed during the 1980 upgrades to the WWTP (BHC 2015).

A WDFW managed weir is located at RM of Olequa Creek. This weir is used to enumerate returning adult salmonids migrating up Olequa Creek and other tributaries, including Stillwater Creek. Nearly all spawning in the Olequa Creek watershed takes place above the WWTP outfall (Figures 2 and 3). According to WDFW, an estimated 157 natural origin (NOR) steelhead and a total of 456 NOR coho spawners returned to the Olequa Creek watershed in 2018 (Serl et al, 2019). In comparison, WDFW estimated a total abundance of coho salmon was estimated to be 3,868 coho spawners (2,820 – 7,295, 95% credible interval) in the lower Cowlitz River tributaries for spawn year 2018, and another 3,161 NOR coho returned to the mainstem Cowlitz River (Serl et al. 2019). As such, approximately four percent of Lower Cowlitz NOR coho salmon used the Olequa Creek watershed in 2018. WDFW estimated a total of 161 coho redds above the weir for 2018 in the Olequa Creek watershed.

Abundance of winter steelhead was estimated to be 541 steelhead spawners (373 – 817, 95% credible interval) combined, in all lower Cowlitz River tributaries for spawn year 2018. WDFW also estimated a total of 358 NOR steelhead spawners returned to the mainstem Cowlitz River in 2018. In comparison, Olequa Creek watershed NOR steelhead represented approximately 17 percent of all lower Cowlitz NOR steelhead. A total of 75 steelhead redds were estimated in the Olequa Creek watershed in 2018 (Figure 2).

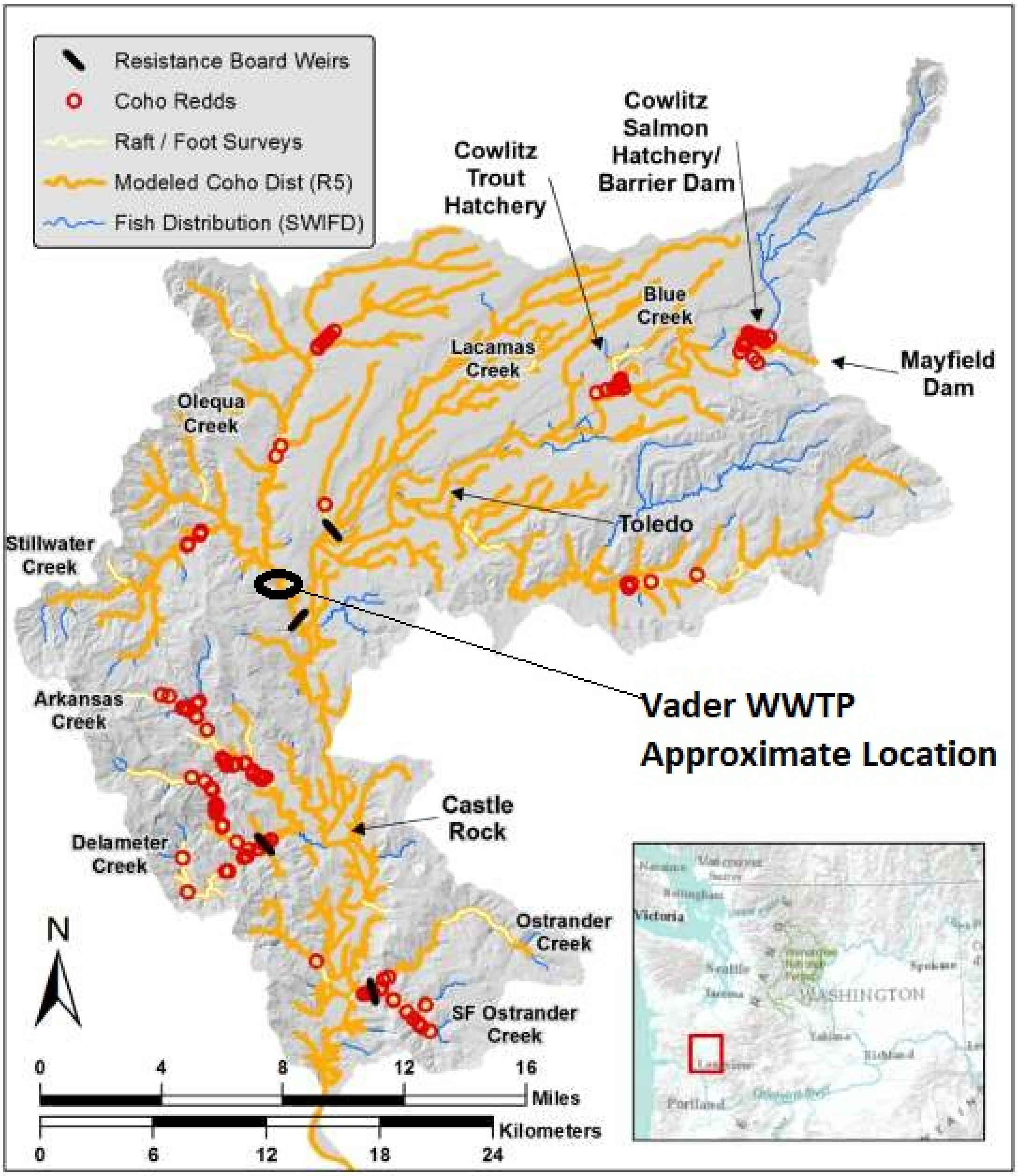

Figure 2. Coho salmon spawner survey reaches and observed redds in 2018. Modeled distribution is based on GIS-derived watershed characteristics as per the Cowlitz Monitoring and Evaluation Plan (FHMP Appendix J) published in 2011.

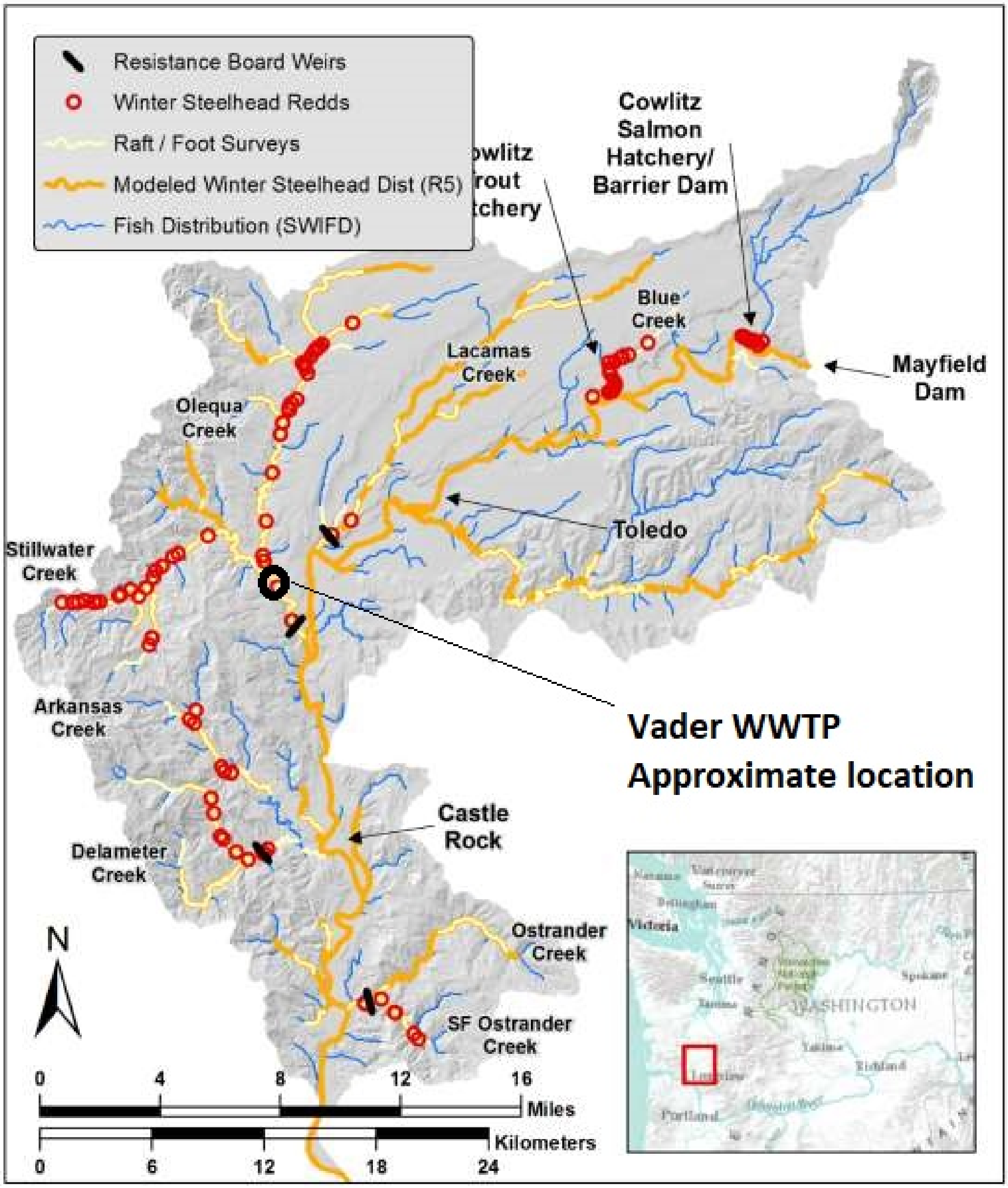

Figure 3. Winter-run steelhead spawner survey reaches and observed redds in 2018. Modeled distribution is based on GIS-derived watershed characteristics as per the Cowlitz Monitoring and Evaluation Plan (FHMP Appendix J) published in 2011.

Chinook salmon do not typically pass the weir at Olequa Creek. However, a few Chinook are known to enter the lower end of the creek to presumably spawn each year.

Table 3. National Discharge Elimination System (NPDES) Effluent Limits Pre and Post Construction

Parameter	Effluent Limits, Year-round Existing Effluent Flow	Effluent Limits, Year-round 2035 Effluent Flow
BOD_5 Average Monthly Average Weekly	 30 mg/L, 85% removal 45 mg/L	 30 mg/L, 85% removal 45 mg/L
TSS Average Monthly Average Weekly	 30 mg/L, 85% removal 45 mg/L	 30 mg/L, 85% removal 45 mg/L
Chlorine Average Monthly Daily Maximum	 11 µg/L 31 µg/L	 10 µg/L 26 µg/L
Fecal Coliform Geometric Mean, Monthly Geometric Mean, Weekly	 200 colony forming unit (CFU)/L 400 CFU/L	 200 CFU/L 400 CFU/L
Parameter	**Effluent Limits, June-Sept. Existing Effluent Flow**	**Effluent Limits, June-Sept. 2035 Effluent Flow**
Ammonia Average Monthly Daily Maximum	 12 mg/L 24 mg/L	 8 mg/L 17 mg/L
Copper Average Monthly Daily Maximum	 3 µg/L 5 µg/L	 3 µg/L 4 µg/L
Temperature	20 °C (68°F)	19 °C (66°F)

Source: City of Vader City of Vader Wastewater Treatment Plant Upgrades Biological Assessment. Confluence, 2020.

2.5 Effects of the Action

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

Effects of the action will occur in Olequa Creek. Short term effects are associated with the construction of the WWTP upgrades. The long term effects are the discharge of modified effluent into Olequa Creek, and its consequences.

2.5.1 Effects on Critical Habitat

Critical habitat includes Physical and Biological Features (PBFs) necessary to support various lifestages of listed fish and include good water quality, appropriate substrate, good riparian conditions, and sufficient prey. Water quality and forage are the PBFs of critical habitat that will be affected by this project. Water quality effects of the proposed action include temporary effects that will occur during the construction phase of the WWTP upgrade, and long term effects associated with the post-upgrade effluent.

<u>Temporary Habitat Exposure to Reduced Water Quality, Phase 1 Construction.</u>

The most acute effects on water quality are expected during phase 1 of construction because raw influent will enter the creek through the existing headworks (coarse screening only). This effluent will not receive dechlorination treatment, and will undergo a shorter residence time in Basin 1. We expect water quality effects to include an increase in total suspended solids (TSS), biochemical oxygen demand (BOD), PPCPs, chlorine, metals such as copper, mercury, and zinc, and additional pollutants during phase 1 of construction. Effects to water quality could be significant for up to 5 months during the construction period. Additionally, during a portion of that time the outfall will not be entirely submerged (during summer low flows), meaning the effluent may not be properly diffused or diluted during extreme low flows (BHC 2015).

The presence of elevated chlorine can also effect forage for salmonids. Palmer et al. (2003) compared benthic macroinvertebrate community structure between sites exposed to chlorinated and unchlorinated sewage in two rivers. In both rivers invertebrate abundance and number of taxa were substantially reduced (sometimes to zero) immediately downstream of the chlorinated effluent discharge. However, unchlorinated effluent caused very little change in community structure. For example, the mayfly Baetis harrisoni was completely absent at sites downstream of chlorinated sewage outflows, yet was present and appeared relatively unaffected by unchlorinated effluent exposure. This suggests that chlorine, rather than the effluent was responsible for its absence. In 2010, Washington State Department of Ecology (2010) sampled invertebrates Olequa Creek near the confluence of Cowlitz River. The creek received a rating of “good” for invertebrate diversity, taxa, and quantity of invertebrates, suggesting chronic effluent discharge from the WWTP has had little effect on forage. Nevertheless, we expect elevated chlorine and other contaminants to result in some loss of forage, particularly in the mixing zone, during Phase 1 of construction.

Effects to water quality are fewer during phases 2 and 3, when dechlorination, improved treatment lagoon cells, aerators/mixers, and other improvements are brought on line. Dissolved copper is another constituent commonly found in WWTP discharge. Hecht (2007) described dissolved copper ranges 0.18–2.1 µg/L, corresponded to reductions in predator avoidance behavior of approximately 8–57%. These benchmark examples represent the dCu concentration (above background) expected to affect the ability of juvenile salmonids to avoid predators in freshwater. These concentration thresholds for juvenile salmonid sensory and behavioral responses fall within the range of other sublethal endpoints affected by dCu such as behavior, growth, and primary production, which is 0.75–2.5 µg/L. Current NPDES effluent limits for the Vader WWTP are 5 ug/L, with future reduction to 4 ug/L required as part of the NPDES permit. These concentrations will become dilute once they enter the mixing zone, but will remain within the range of effects described above while in the mixing zone.

The project includes erosion and sediment control measures surrounding the construction sites to minimize runoff carrying sediment to Olequa Creek. As such, we do not expect elevated suspended sediments to have significant adverse effects on water quality. The exception would be if there is a particularly if large rain event that creates an unexpected amount of runoff from the construction area. In this case there is a possibility of elevated suspended sediment in Olequa Creek during upland construction, but this is likely to be impossible to distinguish from other runoff and poor water quality condition in the stream that typically occurs during large storm events.

<u>Long-Term Habitat Exposure to Reduced Water Quality</u>

The Vader WWTP presently discharges treated effluent near river mile 3 of Olequa Creek under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA0023639, issued by Washington Department of Ecology. The permit verifies that discharges comply with the provisions of the State of Washington Water Pollution Control Law Chapter 90.48 Revised Code of Washington and the Federal Water Pollution Control Act (Clean Water Act) Title 33 United States Code, Section 1251 et seq. NPDES permits are used to manage effluent discharges and set authorized mixing zones, where water quality may exceed state criteria within the mixing zone prior to dilution to background levels of the receiving waterbody. The permit's influent flow limit (treatment capacity) is 14.95 million gallons per day (MGD) monthly average flow (maximum month). The effluent limits of the permit address BOD (5 day), TSS, Fecal Coliform Bacteria, pH, Acute Whole Effluent Toxicity (WET), and Total Ammonia (as NH3-N). The NPDES Permit does not have limits for Pharmaceuticals and Personal Care Products (PPCPs) in the effluent. For According to the NPDES for this WWTP, the state authorized mixing zone will extend 301 feet downstream of the outfall diffuser, and 100 feet upstream of the diffuser. The acute mixing zone will extend approximately 22 feet downstream from the diffuser. Load associated with the effluent will travel 3 miles downstream to the confluence with the Cowlitz River, where we expect that dilution in the larger water body will reduce level of impact on water quality and prey to levels that cannot be distinguished.

Water quality treatment at the Vader WWTP includes detaining water in settlement ponds prior to discharge. The existing detention ponds allow water temperatures to increase due to solar radiation prior to discharge. The improvements at the WWTP will reduce the amount of residual chlorine, in the effluent, while improving disinfection of wastewater. The temperature of effluent prior to discharge into Olequa Creek will also be reduced by modifying the shape of these detention basins which will reduce the temperature increases during treatment.

Based on water quality monitoring reported in the NPDES permit, ambient temperatures in Olequa Creek currently exceed 19 degrees C in August and discharges exceed 20 degrees C at the outfall during the late summer, indicating that the baseline effluent has a warming effect on the lower 3 miles of the receiving water body, and the receiving water body itself exceeds values suitable for salmonids. The proposed action is expected to decrease effluent temperature to values that do not exceed that of Olequa Creek. If achieved, this will benefit water temperatures within the creek, and could be most beneficial during summer low flows, when receiving water temperatures are highest. However, we cannot predict the extent of beneficial effects on stream temperatures because the actual decrease in effluent temperature will not be known until the project is complete.

The use of chlorine to disinfect effluent is a common practice in WWTPs. Chlorine in freshwater can be toxic to aquatic organisms, including fish and invertebrates. Ward & DeGraeve (1978) found that *Daphnia magna* was the most sensitive to residual chlorine toxicity out of a wide range of aquatic organisms tested. Total residual chlorine (TRC) concentrations as small as 0.070 mg/L (70 ug/L, 70 parts per billion) were lethal to three-day-old *D. magna* after exposure for 10.5 hours. In a 48-hour acute test with *D. magna* less than one day old, the LC50 (concentration that produces 50% mortality in the population) was 0.017 mg/L (17 ug/L) total residual chlorine.

Despite intended reductions in several aspects of the effluent, the discharge of municipal wastewater effluent will continue to adversely affect water quality in the receiving water body. In addition to ammonia, which is a regulated constituent of the effluent, municipal effluent typically contains many unregulated chemical contaminants derived from products that are disposed of via municipal sewer systems. Municipal effluents have been identified as sources of endocrine disrupting chemicals (EDCs), pharmaceuticals, and personal care products (PPCPs), persistent, bioaccumulative and toxic chemicals (PBTs), metals, including dissolved copper, and other compounds of anthropogenic origin in surface waters of the United States, and Europe (Valder et al, 2014); Gerbersdorf et al, 2015); (Lazorchak et al, 2014); (Luo et al, 2014).

Additionally, municipal effluents commonly contain fragrances or musks which are ubiquitous ingredients in perfumes, lotions and cosmetics. There are no current regulatory requirements for testing these emerging chemicals, nor are water quality standards or other recognized benchmarks available, although research has shown them to be frequently detected in rivers, lakes and streams, as discussed below. Further, while these emerging chemicals are not currently under the auspices of regulatory authority requirements, various effects concentrations have been identified in the scientific literature.

While we do not have monitoring data on effluent from the Vader WWTP, the review of similar treatment methods found in Lubliner et al (2010) for municipal waste water indicate the removal of metals, PBTs, PPCPs, EDCs and other contaminants discussed above is significant at this facility. Data used for this characterization included NPDES effluent data from the Puyallup WWTP from April 2003 to October 2008. Although the Puyallup WWTP services a significantly much larger population and discharges a maximum 13.98 million gallons per day (mgd) compared to discharges a maximum of 1.73 mgd for the Vader WWTP, treatment is proportional to the population, thus we expect constituents in the effluent to be similar from both plants. The study evaluated efficacy of biological nutrient removal in reducing the loading and concentration of PPCPs conducted in 2010 that included the Puyallup WWTP (Lubliner et al. 2010), and surrogate data from similar size WWTPs in the Puget Sound region. The EPA used the latter study to predict PPCP concentrations discharged from the facility, as these chemicals are not monitored. These predicted concentrations, along with predicted concentrations of other compounds expected to be found in effluent from the Puyallup WWTP, can be found in Table 3. Lubliner et al, (2010**)** also noted that the Puyallup WWTP removed a significant amount of the total suspended solids and nutrients (roughly 99 percent each). Because treatment methods for the Vader WWTP and the Puyallup WWTP are very similar, we assume similar removal efficacy.

Pharmaceuticals and Personal Care Products. Pharmaceuticals and personal care products are an emerging environmental and human health issue and have been identified as constituents discharged into receiving waterbodies in a recent survey of effluent from five municipal wastewater treatment plants (Lubliner et al. 2010). Any product used by individuals for personal, health, or cosmetic reasons are considered PPCPs. They are present at low concentrations in surface water, groundwater, soils, sediments, marine waters, and drinking water often in the part per trillion range. Researchers monitoring the environment find PPCPs virtually everywhere domestic wastewater is discharged. PPCPs enter the environment as they pass-through the human body or when unwanted PPCPs are disposed of down the drain. Other significant sources include livestock, aquaculture, pets, and agriculture. PPCPs have not been monitored in the Vader WWTP effluent.

The NPDES associated with this facility identifies an acute and a chronic mixing zone – areas where it is identified that water quality will exceed state standards, but are permitted based on the understanding that the load will become dilute, and the most significant adverse effects are constrained to a small section of the receiving water body. The acute toxicity mixing zone is an area for rapidly mixing a discharge plume with the receiving water to prevent acute toxicity to fish and aquatic life. The existing acute mixing zone boundary under the NPDES permit is 22 feet downstream and upstream from the diffuser's discharge ports, with an acute mixing zone ratio (dilution factor) of 18:1 (river flow : effluent flow).

The chronic toxicity mixing zone is a 301-foot area in the receiving water in which the discharge of an effluent is mixed with the receiving water to assure dilution of any toxicant in the effluent to concentrations such that no chronic impacts to fish and aquatic organisms will occur outside of the mixing zone. Discharges to flowing streams have the mixing zone calculated as a dilution ratio based on the stream and effluent design flows. While the NPDES required mixing zone is a measurable way to ensure effluent contaminants are diluted, chronic, low-levels of contaminants in Olequa Creek will persist in Olequa Creek for 3 miles downstream where they are further diluted in the Cowlitz River.

Although mixing zones predict an area in Olequa Creek that contaminants will be at a specific concentration, salmonids and their habitats experience the entire plume of the effluent and likely experience adverse effects within and outside of the mixing zone.

Effects on Physical and Biological Features
As described above, the proposed action has short term detriments (5 months) during construction when the treatment is 'offline', and has long term benefits for two water quality parameters including reduced temperature and contaminant load, and long term negative effects on water quality in the mixing zone and in the action area. Chronic contribution of chemical load into Olequa Creek can cause secondary negative effects on other features of critical habitat such as safe passage, sediment quality, and forage. For safe passage, we expect little effect because salmonids will be primarily moving passively through the effluent plume and the lower three miles of the creek until they reach the Cowlitz River. Sediment quality may also be minimally affected, reducing primary and secondary production of invertebrates in the sediment. Forage may be reduced below the outfall, where contaminant levels keep forage (invertebrates) at lower

levels then would be expected above the outfall. These adverse effects on PBF's will not diminish the conservation value of critical habitat for salmonids in Olequa Creek.

Effects on Listed Species

Effects on species are a function of exposure and response coupled with the sensitivity of the exposed individual. Exposure among individuals can occur at different life stages (egg, alevin, juvenile, adult), have varying degrees of intensity, and be brief or longer term. The individual's response will vary based on these factors and the individual's sensitivity and overall health. Salmonids in the action area will be exposed to elevated contaminants while they move through the lower three miles of Olequa Creek as juveniles and adults. Because the temporary nature of exposure and because adult fish are not as sensitive as juveniles and will move through the area in a matter of minutes to hours, effects on adult salmonids are negligible.

Discharge During Construction

Phase 1 Construction

Throughout construction, wastewater will continue to receive treatment prior to discharge. The most consequential effects are expected during phase 1 of construction because raw influent will enter through the existing headworks (coarse screening only), will not receive dechlorination treatment, and will undergo a shorter retention time due to the absence of residence time in Basin 1. Thus, there is the potential for an increase in TSS, BOD, chlorine, and additional contaminant levels during phase 1 of construction. Because this phase of construction will last approximately 5 months, effects to water quality could be significant. Phase 1 is expected to begin in the winter months, and be completed mid-summer. High winter flows are expected to assist in dilution of contaminants. However, juvenile salmonids typically emerge from gravel from February through June. As such, elevated contaminant levels would co-occur with newly-emerged juvenile salmonids from each of the three populations of ESA-listed fish. This co-occurrence is expected to be most significant towards the end of the five month period when in-stream flows decline. The outfall is not entirely submerged during summer low flows, meaning the effluent may not be properly diffused during extreme low flows (BHC 2015). Any juvenile salmonids moving through or rearing in the effluent plume would suffer from reductions in forage, disorientation, delayed migration, general reduced fitness, and increased predation. These effects would likely result in sublethal effects, with the exception of those fish that are preyed upon.

Suspended sediment

There is also a possibility of elevated suspended sediment in Olequa Creek during upland construction, particularly if large rain events create runoff from the construction area. The project will implement erosion and sediment control measures surrounding the construction sites. As such, we do not expect elevated suspended sediments to have significant adverse effects on ESA-listed fish. Suspended sediment levels and subsequent effects on listed fish will be decreased during phases 2 and 3 of construction due to the completion and operation of key treatment processes.

Long Term Discharge

Contaminants
Once Phase 1 construction is complete, the WWTP will discharge effluent treated at a higher level than before construction. Nevertheless, all fish in Olequa Creek will be exposed to the constituents of the effluent discharged into the creek at points downstream from the outfall. The degree of their exposure will likely range from short term (minutes to hours) but some fish could also be exposed longer term (days to weeks). Short-term exposure is expected to be very brief because of the size of the mixing zone, but longer-term exposure at very low levels is expected for the duration of time these fish stay in Olequa Creek. That duration can vary by species. Data indicate juvenile Chinook salmon, steelhead, coho, and other salmonids may reside in their natal stream for extended periods i.e. weeks to months. However, because salmonids seek out cold water and move around within the stream while rearing, and the mixing zone includes a small portion compared to overall habitat availability in Olequa Creek, NMFS does not expect these juveniles to spend more than a few minutes to an hour within the predicted acute or chronic mixing zone. Further, effluent discharge will only affect the lower three miles of Olequa Creek. The majority of spawning takes place in tributaries well above the discharge location (Figures 2 and 3). These fish are likely to rear in their natal stream prior to moving passively downstream (Groot and Margolis, 1991), at which time they will have grown and become less vulnerable than newly-emerged fish. The majority of these fish would likely move through the area and into the Cowlitz River, although some may hold up to feed or rest below the discharge in Olequa Creek. That said, the contaminant plume extends beyond the mixing zone and any juveniles that spend longer durations rearing in the three-mile downstream area will likely experience adverse effects. We anticipate a small percentage of the salmonid, juvenile cohort to occupy the plume for extended periods (days to weeks).

There is considerable evidence that fishes inhabiting waters that receive effluent from municipal WWTPs are exposed to chemicals that affect reproductive endocrine function. Male fish downstream of some WWTP outfalls produce vitellogenin (egg yolk precursor protein) mRNA (messenger ribonucleic acid, which carries information from DNA in the nucleus to the ribosome sites of protein synthesis in the cell), and protein associated with oocyte (an immature ovum or egg cell) maturation in females, and early-stage eggs in their testes (Jobling et al. 1998).

This feminization has been linked to the presence of estrogenic substances such as natural estrogen, 17 beta-estradiol (E2) and synthetic estrogen, 17 alpha-ethenylestradiol (EE2). These substances are usually found in the aquatic environment at low parts per trillion concentrations, typically less than 5 nanograms (ng)/L (Zhou et al. 2007). Synthetic estrogen is used in birth control pills (EE2) and is one of the more potent estrogens and has been linked to the feminization of male fishes in rivers receiving municipal wastewater (Thorpe et al. 2003). Laboratory studies have shown decreased reproductive success of fish exposed to less than 1-5 ng/L of EE2 (Parrott & Blunt 2005).

Kidd et al., (2007) showed that chronic exposure of fathead minnows to low concentration (5-6 ng/L) of EE2 led to feminization of males through the production of vitellogenin mRNA and protein, impacts on gonadal development as evidenced by intersex in males and altered oogenesis (egg cell production) in females. This exposure ultimately caused a near extinction of this fish species from the lake where they were being studied. This outcome demonstrated that the concentrations of estrogens and their mimics observed in freshwaters can impact the sustainability of wild fish populations.

In studies conducted by Kidd et al., 2007 and Parrott and Blunt (2005), fish were exposed to either greater concentrations of EE2 or longer exposure periods than what NMFS would expect a juvenile salmonid residing in the action area to be exposed to. Parrot and Blunt (2005) observed an increase in the ovipositor index (a female secondary sex characteristic) as the most sensitive early response 60 dph (days post hatch) when fish were exposed to EE2 concentrations greater than or equal to 3.5 ng/L in a laboratory setting. However, no significant changes were seen in fish exposed for up to day 30. Kidd et al., 2007 observed elevated vitellogenin seven weeks after the first estrogen additions to the experimental lake began in 2001.

Review of the data collected by Lubliner et al., (2010) revealed that the hormones and phthalates were removed to nearly undetectable levels from the Puyallup WWTP effluent. Reproductive hormones including 17 alpha-estradiol, ethinyl estradiol, and estradiol were all removed at 85 to 95 percent of their influent concentrations, resulting in concentrations of less than 2 parts per trillion (2 ng/L). The removal efficiency of these hormones is significant as these compounds are highly biologically active at low concentrations, as discussed above, and often responsible for much of the endocrine activity in fish exposed to municipal effluents.

Cleuvers (2004) demonstrated that some pharmaceuticals, including NSAIDs diclofenac, ibuprofen, naproxen and acetylsalicylic acid, follow the concept of "concentration addition", meaning that these substances applied at less than their individual "no observable effect levels" (NOECs), can nevertheless contribute to a toxic mixture, as can be seen in Table 4 below. Of the NSAIDs investigated by Cleuvers (2004), naproxen and ibuprofen were detected in WWTP effluent, and their combined predicted surface water concentration was 9.2 ng/L. This concentration is well below levels shown to cause effect even when combined with other NSAIDs.

Table 4. Concentrations (mg/L-1) of the tested drugs at their effective concentrations (EC) applied in the mixture in the acute Daphnia survival test in comparison to the individual NOECs of the single compounds*

Substance	$EC_5/4$ (mgL^{-1})	$EC_{10}/4$	$EC_{20}/4$	$EC_{50}/4$	$EC_{80}/4$	NOEC
Diclofenac	2.5	3.8	6.4	17.0	45.3	45
Ibuprofen	14.6	16.5	19.1	25.3	33.5	75
Naproxen	6.6	9.9	16.2	41.6	106.7	32
ASA(Salicylate, aspirin)	9.5	11.5	14.4	22.0	33.8	75

*For assessing mixture toxicity, a quarter of the calculated effect concentrations (EC5/4, EC10/4, EC20/4, EC50/4, and EC80/4) of each substane was used. (Source: Cleuvers 2004)

While juvenile salmonids will be temporarily exposed to PPCP's in the Vader WWTP effluent, the PPCP concentrations are expected to be below those known to cause severe endocrine related effects and other effects from PPCPs discussed above. Nevertheless, the chronic exposure to these contaminants will result in reduced reproductive fitness, and will likely contribute to overall reduced fitness when combined with other effects resulting from elevated temperature (discussed below) and presence of chlorine and other contaminants.

Temperature

As discussed above in section 2.4, the most recent NPDES permit identifies winter effluent temperatures as averaging 8.9 Celsius (C) with a maximum winter discharge temperature of 9.45 C. Summer temperatures in Olequa Creek from the WWTP have an average discharge temperature of 17.2 C, and a maximum of 22.3 C (Ecology 2012a). For salmonids, the optimal range for feeding and other early life stage functions is 12 C to 20 C (McCullough et al 2001). While data on Olequa Creek characteristics are limited, BHC Consultants (BHC) developed critical ambient water quality conditions based upon the G&O 2003 survey and limited Ecology data as part of the 2015 Wastewater Facilities Plan Amendment. The critical ambient water conditions were compiled in order to derive projected permit limits. Olequa Creek was monitored for temperature in August 19 degrees C in August of 2015 (BHC 2015). Dilution modeling suggests mixing in Olequa Creek is expected to constrain increased temperatures to the mixing zone (Ecology 2012a).

Warm water temperatures can decrease dissolved oxygen in the water and can act as a barrier to migration. Increased water temperatures can decrease the availability of dissolved oxygen to the eggs, decrease egg hatchability, and decrease the survival of fry once they emerge from the eggs (Mcullogh et al. 2001). Warm temperatures can decrease, inhibit, or reverse the physiological function of smoltification, as well as, decrease available oxygen to the smolt. McCullough (1999) found increased mortality of salmonids in holding ponds at 17 degrees C. Richter and Kolmes (2005) found increased susceptibility to disease at 15.6-16 degrees C. As such, with monitored temperature of 19 degrees C in August, summer temperatures within Olequa Creek are outside of the optimal range for salmonids. Similar to adult migrants, warm water temperatures can act as a barrier to migrating smolts moving downstream, decrease physiological function and growth, and decrease dissolved oxygen availability to the fish (Mcullogh et al. 2001). Temperartures in Olequa Creek typically range from about 5-10 C in winter and spring and 11-19 C in summer and early fall (Ecology, 2020). Temperatures during the early and late spring in Olequa Creek are within the optimal range for feeding, smoltification, migration, and growth. Modifications to the WWTP's existing treatment ponds are expected to result in decreased temperatures of discharged effluent. However, without an estimate of how much temperature will be decreased, we assume it will continue to discharge effluent at slightly elevated temperature levels as discussed above.

When added to the contaminants and temperature effects from other sources, these effects will manifest with the co-occurrence of elevated temperatures and low levels of contaminants including dissolved copper, PPCPs, and other constituents in the mixing zone. Effects from effluent discharge will have higher consequences (discussed above) during late summer low-flow periods, when the smallest and most vulnerable life stages of salmonids have migrated out of Olequa Creek. Higher flows and subsequent smaller discharge mixing zones are expected during the late winter and spring when the most vulnerable juvenile salmonids are rearing. As such, the sublethal effects discussed above may be more consequential for larger juvenile salmonids from all three species that could be rearing in the late summer. Nevertheless, we expect sublethal affects to occur on all three species. These sublethal effects are expected to include disruption of metabolism, increase vulnerability to disease, reduced food supply, and elevated vulnerability to predators. These sublethal effects could eventually lead to death for some juvenile salmonids that co-occur with the chronic or acute mixing zone, particularly during the summer low-flow period when temperatures are elevated.

Response to Water Quality Effects During Construction

For the five month period of reduced treatment, the most significant impact of even a brief encounter with a thermal plume is expected to be an increased vulnerability to predation due to a period of elevated stress levels which diminish avoidance abilities. Other probable effects include increased susceptibility to disease, disorientation and subsequent delayed migration. These effects would be most consequential to newly-emerged and other very young juvenile salmonids. However, there is likely a wide range of responses from individual fish, both behaviorally and physiologically, depending on the physical circumstances at the time of encounter and on differences between individual fish (Cramer et al 2010).These effects will be primarily sublethal, but some juvenile salmonids would likely die from predation related to the effects discussed above. Others may die later in time resultant from disease, and reduction of general fitness related to elevated contaminants.

Response to Long-Term Water Quality Effects

After phase one upgrade is complete, discharge from the Vader WWTP is expected to contain reduced temperatures and reduced concentrations of contaminants.

Water temperature is a key factor influencing fish and salmon survival. High temperatures can decrease dissolved oxygen, disrupt metabolism, increase susceptibility to contaminants, increase vulnerability to disease, reduce food supply, and affect ability to avoid predators (Irle 2000). Small increases in temperature above biologically optimal ranges can reduce salmonid fitness (Poole et al. 2001).

The intended effects of the proposed action are beneficial. The most recent permit identifies winter effluent temperatures as averaging 8.9 Celsius (C) with a maximum winter discharge of 9.45 C. Summer temperatures have an average discharge temperature of 17.2 C, and a maximum of 22.3 C (Ecology 2012a). Temperatures of effluent are expected to be lower than authorized by this permit, post upgrade. High temperatures can decrease dissolved oxygen, disrupt metabolism, increase susceptibility to contaminants, increase vulnerability to disease, reduce food supply, and affect ability to avoid predators (Irle 2000). Small increases in temperature above biologically optimal ranges can reduce salmonid fitness (Poole et al. 2001). As discussed above, dilution modeling suggests mixing is expected to constrain increased temperatures to the mixing zone (Ecology 2012a).

Chlorine in effluent discharge from the Vader WWTP allows a maximum concentration of 31 ug/L (0.031 mg/L)(Table 2). Studies indicated 31 ug/L is well below thresholds for fish health.

Zillich (1972) found sublethal effects on caged fathead minnow from residual chlorine concentrations 0.04 and 0.05 mg/L (40 and 50 ug/L) which are both above 31ug/L. Osborne et al. (1981) found that even where high TRC concentrations occurred (200 ug/L to 1000 ug/L), juvenile rainbow trout would move into the chlorinated plume but move out before they were adversely affected. Further, effluent will immediately dilute when discharged to the creek, quickly reducing chlorine concentrations to below 31 ug/L.

Hecht (2007) described dissolved copper ranges 0.18–2.1 µg/L, corresponded to reductions in predator avoidance behavior of approximately 8–57%. These benchmark examples represent the dCu concentration (above background) expected to affect the ability of juvenile salmonids to avoid predators in freshwater. Dissolved copper concentration thresholds for juvenile salmonid sensory and behavioral responses fall within the range of other sublethal endpoints affected by dCu such as behavior, growth, and primary production, which is 0.75–2.5 µg/L. Current NPDES effluent limits for the Vader WWTP are 5 ug/L, with future reduction to 4 ug/L required as part of the NPDES permit. These concentrations will become dilute once they enter the mixing zone, but will remain within the range of effects described above while in the mixing zone. These concentrations will become dilute once they enter the mixing zone, but will remain within the range of effects described above while in the mixing zone.

Based upon the brief exposure duration anticipated in the mixing zone, and the low levels of environmental estrogens and other PPCPs, current data do not indicate that significant elevations in vitellogenin or other effects related to endocrine activity discussed above would occur in salmonids that enter the mixing zone from this facility.

Nevertheless, any juvenile salmonids rearing in Olequa Creek below the outfall downstream to the Cowlitz River will be exposed to the chronic but low-level load of these contaminants, and a portion of these fish will incur effects discussed above. These effects could be pronounced during summer low flow when dilution is decreased. Regardless of the time of year, we expect these effects to result in sublethal effects to exposed salmonids. Using redd surveys and estimates from WDFW (2019), we estimate (below) approximately 7245 coho smolts and 22,383 steelhead smolts will pass through the effluent plume and the lower three miles of Olequa Creek. The majority of these fish are expected to move passively through the action area during high flows in spring through early summer, with limited temporal exposure to the effluent.

Coho

- 161 coho redds (WDFW, 2018)
- Fecundity: 3,000 eggs/redd * 161 = 483,000 eggs
- Egg to Fry Survival = 19 percent, therefore (483,000 eggs * 0.19) = 91,770 coho fry (2019 year class).
- Egg to Smolt Survival Rate = 1.5 percent (483,000 coho eggs * 0.015) = 7245 smolts (Groot and Margolis 1991).

Steelhead

- 75 redds (WDFW, 2018)

- Fecundity: 3,316 eggs/redd* 75 redds = 248,700 steelhead eggs deposited in 2018.
- Egg to Smolt Survival = 0.08564 percent (Groot and Margolis 1991).
- Number of smolts produced 2019= 22,383 smolts

Summary of Effects to Listed Species
We anticipate individual juvenile salmonids will suffer increased susceptibility to disease, disorientation, delayed migration, reduced fitness, and predation resulting from exposure to contaminants in the effluent discharge. These effects will be most consequential during the first five months of construction (phase 1) where chlorine, elevated temperature, and other contaminants are minimally treated prior to discharge. Upon completion of phase 1, concentrations of chlorine and all other contaminants, as well as temperature, are expected to be reduced. Nevertheless, the long-term discharge of effluent will have sublethal effects on a portion of juvenile salmonid populations in Olequa Creek. However, we cannot predict the number of individual juveniles that would be exposed or predict the intensity to which they are exposed. Nor can we predict the number of salmonids that would be predated upon while suffering effects from such exposure. However, we can conclude that affected fish will represent a fraction of the overall populations of each of the three salmonids, as discussed in the Environmental Baseline section. We do not anticipate these effects and the numbers of individuals exposed would reduce any of the populations' VSP parameters.

2.6 Cumulative Effects

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

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the 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).

The Vader WWTP is located in Vader, Washington. Vader is a small, rural town in Lewis County with a population of approximately 600 people and an expected annual growth rate of 2% (BHC 2015). The BNSF railway is located west of the WWTP and A street is the access road to the plant. No major roadways are adjacent to the plant. The land east and north of the WWTP are zoned as Single Family Residential, while the land to the west is zoned as Industrial (City of Vader 2020). Much of the forested land to the west and south is owned and operated by large timber companies (Lewis County 2020).

The riparian areas along Olequa Creek are mostly forested and protected by the City's floodplain and Critical Areas Ordinances (G&O 2014). The creek and associated riparian areas are zoned as Urban Conservancy under the City's Shoreline Master Program (SMP), meaning intense development is generally prohibited in order to protect and preserve the ecological functions of these areas (Lewis County 2020).

For these reasons, we expect that land use in areas contributing stormwater pollutants as nonpoint runoff are unlikely to change, and that any activities that more directly affect the river, such as recreational structures, other outfalls or withdrawals, will fall within an ESA section 7 review due to federal permitting authority and therefore are excluded from the cumulative effects. The remaining non-federal effect that is likely to influence the action area over the lifetime of this proposed action (roughly 20 years) is climate change, which may include a highly variable range of effects including warming air and water temperatures, longer period of low flow, more dynamic hydraulic conditions as rainfall events become more intense, and increasing risk of large stochastic events such as flood or wildfire.

2.7 Integration and Synthesis

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

Species
The listed species are all considered threatened species, which have low abundance relative to historical levels, reduced spatial structure, and diminished diversity. Productivity is limited by a variety of modified habitat conditions that constrain either reproduction, or survival of juveniles.

The environmental baseline condition varies throughout the several miles of the stream, but is largely rural to suburban in character, with some water quality concerns. The specific populations are each part of Lower Cowlitz populations and include LCR Chinook salmon, LCR coho salmon, and LCR steelhead. The lower Cowlitz population of LCR coho salmon are considered a "primary" population with a very low viability status but important to the overall ESU. Chinook and steelhead are both considered "contributing" populations, with very low viability status and moderate importance to their respective ESU's overall health (Tacoma Power, 2011).

With this understanding, we consider the short term, long term, beneficial, and detrimental effects of the action. The action has short term and long term low level effects to individuals that comprise the species in Table 1. When added to the contaminants and temperature effects from other sources, these effects will manifest with the co-occurrence of elevated temperatures and low levels of contaminants including copper, PPCPs, chlorine, ammonia and others. These effects will largely be sublethal and will only affect the Olequa components of the three Cowlitz populations (Chinook, coho, steelhead), and so will only affect a small portion of juvenile salmonids. Because the effects are expected to be sublethal, we do not expect response of fish to alter current abundances and productivities of the affected populations and therefore due not rise to the level of affecting the species as a whole.

The proposed action authorizes the current discharge to occur for another 20 years, thus adding to baseline conditions. Therefore, even assuming that the proposed action would impact population viability parameters, at most this would consist of a small contribution to maintaining those population parameters in their current state. Because the abundance and productivities of these populations are below recovery targets, maintaining the existing parameters presumably delays reaching recovery targets. The contribution of the proposed action's retention of PPC as constituent elements of effluent does not improve conditions, but neither does it add to them, and some effects of the proposed action are expected to be incrementally beneficial (temperature and reduced discharge of chlorine) so we expect relative stasis in fish response at the population scale, and therefore no appreciable change in abundance, productivity, spatial structure, or diversity. If any change occurs we expect it to be extremely small for the reasons described above – the primarily sublethal nature of the effects and small percentage of the affected populations likely to be exposed to the contaminants and temperature effects of the proposed action. Because the effects of the proposed action are not expected to measurably affect population trends among salmonids, exposed to the action that contribute to the viability of the of these species, the overall effects of the action will not jeopardize the existence of the any species in Table 1, or appreciably reduce the likelihood of both the survival and recovery of ESUs or DPSs in the wild.

Critical Habitat

The entire action area is located in critical habitat for the species found in Table 1. The effluent discharged from the Vader WWTP and other effluent and non-point sources considered in the cumulative effects analysis adversely affect the water quality PBF in the action area. Additionally, habitat for rearing and migrating fish has been impacted by degraded water quality, bank armoring, channelization, and loss of riparian cover. Under the proposed action, effects from the Vader WWTP discharge will be most severe during the five month period where chlorine, suspended solids, and other constituents are subject to limited treatment. Upon completion of the first stage of construction effluent with upgraded treatment will continue to discharge in perpetuity. Considering future population growth and climate change, there will continue to be private and state actions that will produce cumulative effects associated with development (e.g., associated impervious surfaces). The effects of population growth will place additional pressures on PBFs of critical habitat, but the precise effect of these pressures cannot be predicted presently. Notwithstanding, the effects of the proposed action will not change the conservation value of critical habitat in Olequa Creek because the habitat in the action will be minimally altered. Also, while the proposed action has negative effects on water quality in the mixing zone and in the action area, the discharge of multiple contaminants are not a substantial change from the baseline condition, and components of the effluent including chlorine and temperature should improve.

Thus, the function of two aspects of the water quality PBFs are expected to slightly improve, but not at a scale that is appreciable beyond Olequa Creek. Since these effects are not noticeable beyond the site scale, they will not appreciably alter the conservation role of the watershed in which the site is located for any of the designated critical habitats.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, 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 species in table 1 or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as harm from exposure to degraded water quality. Harm is typically impossible to quantify as a number of individuals because number of fish exposed varies over time and space, the response can range among exposed individuals, and injury or death can be unnoticed when affected fish sink, are consumed by other species, or mortality is delayed and occurs outside of the action area.

In such circumstances we describe an extent of take, which identifies the area and/or time frame in which harm will occur, because it is a discernible measure that can be monitored. In this case, harm (sublethal effects) resultant from contaminants present in effluent discharged in Olequa Creek among 100 percent of fish rearing in and near the effluent mixing zone to be harmed during a five-month timeframe during construction when treatment processes are reduced, as discussed above in Section 2.5.1.

After phase 1 is completed and full treatment of effluent is resumed, we expect sublethal effects to occur to a small portion of each species in Table 1 that may be rearing in or near the chronic (301 foot) and acute (22 foot) mixing zones, and also to a lesser extent, in the three miles downstream in Olequa Creek prior to dilution with the Cowlitz River.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The NPDES permit requires regular sampling of wastewater influent and effluent to monitor the performance of the WWTP. Samples are taken from two composite, 24-hour samplers maintained by the City. The NPDES permit requires regular sampling of wastewater influent and effluent to monitor the performance of the WWTP. Samples are taken from two composite, 24-hour samplers maintained by the City. Frequent testing (more than once per week) is performed in the laboratory on-site by the operator, who is tasked with maintaining plant operations along with the collection and reporting of required testing (CWES 2018). Frequent testing (more than once per week) is performed in the laboratory on-site by the operator, who is tasked with maintaining plant operations along with the collection and reporting of required testing (CWES 2018).

Because non-regulated contaminants such as pharmaceuticals and personal care products are not regularly monitored and are currently outside the monitoring requirements for the NPDES permit, we use monitored contaminants (Dissolved Oxygen, BOD, temperature, etc.) as a surrogate for effects within the chronic and acute mixing zones.

The reasonable and prudent measure for this action is to ensure by routine monitoring that conventional effluent constituents are within permit limits within the acute and chronic mixing zones.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the HUD or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The HUD or any applicant 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:

   a) Provide monitoring results associated with NPDES. Monitor constituents every two weeks during the summer low-flow season (July-September) at the end of the chronic and acute mixing zone. This report should describe results of monitoring for temperature, dissolved copper, chlorine, and dissolved oxygen concentrations in the effluent.
   b) Provide NMFS with annual monitoring reports of regulated discharge constituent concentrations at the outfall and rapidly inform NMFS of any exceedences of permit limits regardless of when they happen.

2.10 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).

- Support the investigation of the re-use of treated municipal wastewater for appropriate municipal and agricultural needs such as irrigation. Such actions would not only alleviate effects to listed fish within Olequa Creek by decreasing discharge volume, but would also decrease the demand for clean freshwater in the municipality.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Vader WWTP.

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 HUD and descriptions of EFH for Pacific Coast salmon (PFMC 2014); 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 are described in the BA. The project encompasses 3 miles of habitat that has been designated as EFH for various life-history stages for Chinook salmon and coho salmon (*O. kisutch*).

3.2 Adverse Effects on Essential Fish Habitat

Effects from elevated temperature and contaminants occur in Olequa Creek, affecting water column EFH for the life of the WWTP. Decreased water quality would be found in the mixing zone, covering an area approximately 3 miles in length throughout the water column, affecting rearing, foraging, and spawning success of Chinook, and coho salmon.

3.3 Essential Fish Habitat Conservation Recommendations

1. Continue to investigate (and implement where possible) new technologies to further remove contaminants and to attenuate elevated effluent temperatures prior to discharging into Olequa Creek. Investigate methods to reduce the volume of discharged wastewater. These methods could include re-use for municipal and/or agricultural purposes and/or infiltration.

2. Develop criteria/threshold values for PPCPs and PBDEs (at a congener-level) that are protective of salmonids.

NMFS expects that full implementation of these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2 above, 3 miles of designated EFH for Pacific coast salmon species.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 3 miles of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, HUD 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 HUD 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 users of this opinion are HUD Other interested users could include the City of Vader. Individual copies of this opinion were provided to the HUD. 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, if applicable*] 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, if applicable*], and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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