ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET –PROPOSED FINAL

Individual Permit: AK0043354 – ConocoPhillips Alaska, Inc.
Kuparuk Seawater Treatment Plant

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Wastewater Discharge Authorization Program

555 Cordova Street

Anchorage, AK 99501

Alaska Online Public Notice System

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Proposed issuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to:

CONOCOPHILLIPS ALASKA, INC.

For wastewater discharges from:

Kuparuk Seawater Treatment Plant
Oliktok Point
Beaufort Sea, Alaska

The Alaska Department of Environmental Conservation (Department or DEC) proposes to reissue APDES individual Permit AK0043354 – ConocoPhillips Alaska, Inc., Kuparuk Seawater Treatment Plant (Permit). The Permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the Permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices to which the facility must adhere.

This fact sheet explains the nature of potential discharges from the Seawater Treatment Facility and the development of the Permit including:

- information on public comment, public hearing, and appeal procedures,
- a listing of proposed effluent limitations and other conditions,
- technical material supporting the conditions in the permit, and

Appeals Process

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 15 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation
555 Cordova Street, 3rd Floor
Anchorage AK, 99501

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal DEC review. See http://dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding informal reviews of DEC decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
410 Willoughby Street, Suite 303
Juneau AK, 99811-1800

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://.dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding appeals of DEC decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://dec.alaska.gov/water/wastewater/.

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501
(907) 269-6285

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
610 University Avenue
Fairbanks, AK 99709-3643
(907) 451-2183

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1.0 INTRODUCTION

On September 1, 2015, the Alaska Department of Environmental Conservation (DEC or Department) received an application from ConocoPhillips Alaska, Inc. (CPAI or permittee) for reissuance of Alaska Pollutant Discharge Elimination System Individual Permit AK0043354 – CPAI, Kuparuk Seawater Treatment Plant (Permit). Information contained in this fact sheet is based on information in the application and supplemental information provided by CPAI upon request by DEC. The Permit authorizes discharges to the Simpson Lagoon, Beaufort Sea from the Kuparuk Seawater Treatment Plant (STP or facility), located on the North Slope on Olitok Point, Beaufort Sea (See Appendix A – Figures).

1.1 Applicant

This fact sheet provides information on the APDES permit for the following entity:

Name of Facility:	Kuparuk Seawater Treatment Plant
APDES Permit Number:	AK0043354
Facility Location:	Oliktok Point, Simpson Lagoon, Beaufort Sea
Mailing Address:	ConocoPhillips Alaska, Inc. P.O. Box 100360 Anchorage, Alaska 99510
Facility Contact:	Ms. Jessika Gonzales

The Permit authorizes the following discharges:

Outfall	Description	Receiving Water	Latitude	Longitude
001	Strainer/Filter Backwash	Simpson Lagoon	70.514152	-149.876430
002	Marine Life Return System	Simpson Lagoon	70.512991	-149.872902

See Appendix A, Figure 2 for the location of the outfalls relative to the STP.

1.2 Authority

The APDES Program regulates the discharge of wastewater to waters of the United States (U.S.). Transfer of authority to administer the National Pollutant Discharge Elimination System (NPDES) Program to Alaska from the Environmental Protection Agency (EPA) occurred in four phases with oil and gas facilities transferring as part Phase IV on October 31, 2012. The state NPDES program is known as the APDES Program and is administered by DEC. Accordingly, DEC is now the permitting authority for regulating the discharges associated with the Permit and is reissuing the Permit for the first time post program transfer.

Section 301(a) of the Clean Water Act (CWA) and Alaska Administrative Code (AAC) 18 AAC 83.015 provide that the discharge of pollutants to water of the U.S. is unlawful except in accordance with an APDES permit. The Permit is being reissued per 18 AAC 83. A violation of a condition contained in the permit constitutes a violation of the CWA and subjects the permittee of the facility with the permitted discharge to the penalties specified in Alaska Statutes (AS) 46.03.760 and AS 46.03.761.

1.3 Permit History

CPAI is the permitted operator of the STP. The first NPDES permit for the facility was issued by EPA in September 1985 with an effective date of October 1985 and was subsequently reissued in November 1987, December 1994, April 2000, and March 2011 (existing Permit). CPAI submitted a timely completed application for permit reissuance to DEC on September 1, 2015 and the existing Permit was administratively extended prior to expiration on February 29, 2016.

2.0 BACKGROUND

2.1 Facility Information

The STP is located on the mainland shoreline at Oliktok Point at the western end of Simpson Lagoon and the eastern side of Harrison Bay in the Beaufort Sea. (See Appendix A – Figures, depicting various elements of the facility). The STP strains, filters, heats, bio-treats, and de-aerates seawater drawn from an intake bay located on the north side of the facility for waterflood and other industrial uses. Waterflood is injected into oil reservoirs to maintain formation pressures and enhance oil recovery from production wells. The STP currently discharges wastewater streams from two distinct outfalls: Outfall 001 - Strainer/Filter Backwash and Outfall 002 - Marine Life Return System (MLRS). The discharge line for Outfall 001 is a buried 12-inch diameter pipeline oriented in a northwest direction and terminates 869 feet offshore with a single port diffuser. Outfall 002 is a buried 14-inch diameter pipeline that runs parallel to Outfall 001 but terminates 607 feet closer to shore and expands to a 24-inch single-port diffuser at the terminus. Both outfalls are oriented perpendicular to prevailing currents at a depth of approximately 7 to 8 feet below sea surface (See Appendix A, Figure 2).

2.1.1 Outfall 001 – Strainer/Filter Backwash Description

The removal of suspended sediment in seawater must be performed prior to injection to prevent clogging of pore spaces in the formations. The straining and clarifying processes ultimately prevent the possibility of particulate matter blocking pore spaces in formations that could restrict the flow of oil of a producing well. Because seawater can have more suspended sediment during the open water season than in winter, there are two different modes of operation to account for seasonally different sediment loads. During the winter, strained seawater is typically treated to remove sediment using only sand filters and hypochlorite (to prevent biological growth on filters.) Coagulants and/or other clarifying agents are also included in the treatment during the open water season to enhance sediment removal. The use of coagulants and/or flocculants begins at breakup during late May or early June when turbidity and total suspended solids (TSS) concentrations rise, and use extends until freeze-up usually during October. When a coagulant and/or other clarifying agents are used, dosage is controlled via injection pump settings that are determined using a chemical-treating matrix developed by CPAI, which considers salinity, TSS concentration, and temperature. Heat is added to the seawater year round to decrease viscosity and enhance sediment removal. During filter backwashing, the bed volume containing hypochlorite becomes mixed with the backwash water and is stored in a collection/treatment tank along with strainer backwash. Sodium metabisulfite is used to dechlorinate the backwash prior to being discharged in Outfall 001 – Strainer/Filter Backwash. Accordingly, total residual chlorine (TRC) from injection of hypochlorite and temperature are primary parameters of concern (POCs) during normal operations.

After the sediment removal steps that result in a discharge to Outfall 001, clarified seawater is treated further to produce waterflood appropriate for injection by adding biocides and removing oxygen. Glutaraldehyde is injected ahead of the de-aerating tank to ensure destruction of sulfate-reducing bacteria that can produce hydrogen sulfide and clog pore spaces in the oil producing formations. The de-aerating tank uses fuel gas as a stripping medium to remove oxygen, which reduces pipeline corrosion in the waterflood and drill site distribution system. Although these chemicals are used in the waterflood treatment process, they cannot be discharged through Outfalls 001 or 002 unless treated waterflood in pipelines is drained back to the seawater intake system and reintroduced into the treatment process. (See Appendix A, Figure 4).

2.1.2 Outfall 002 - MLRS Description

Intake seawater passes through an initial intake screen followed by a primary and secondary diverter to remove debris and other materials and/or prevent marine animals from entering the seawater reservoir. Seawater that has had floating debris removed, and that may contain marine life, is then discharged through Outfall 002. Although seawater in the MLRS system is discharged prior to encountering any pumps, strainers, clarifiers, or filters the discharge picks up incidental heat while in the facility and from a heated recycle line that provides freeze protection at the intakes. Hence, the only POC in Outfall 002 - MLRS is temperature.

2.2 Discharge Descriptions and Effluent Characterization

2.2.1 Strainer/Filter Backwash (Outfall 001)

Review of effluent data from March 2011 through December 2015 included evaluation of flow, reported in million gallons per day (mgd), pH in standard units (SU), TRC in micrograms per liter (µg/L), chronic whole effluent toxicity (WET) measured in chronic toxicity units (TU_c), and temperature in degrees Celsius (°C). Note that the marine water quality criteria for temperature is based on a 1 °C increase over the ambient receiving water temperature. To provide a direct comparison with marine water quality criteria and limits from the existing Permit for temperature, DEC is using the difference in temperature (ΔT) to represent the POC, which is the effluent temperature minus the simultaneous receiving water ambient temperature. Only positive ΔT values were analyzed because negative values do not result in lowering of water quality of the receiving water based on the established marine temperature water quality criteria. Table 1 compares available data to existing permit limits and applicable state water quality criteria.

Table 1: Effluent Characterization (March 2001 - December 2015) Outfall 001

Parameter (Units)	Data Set	Existing Limits		Marine Criteria		Observed Range (Low – High, Ave) [1]
		(MDL)	(AML)	Acute	Chronic	
Flow (mgd)	48	2.2	---	---	---	0.0 – 1.9, 0.78
ΔT (°C) [2]	1,625	16/12 [3]	----	---	1° [4]	< 0.1 - **15.9,** 5.6
pH (SU)	96	6.0 ≤ pH ≤ 9.0		6.5 ≤ pH ≤ 8.5		**6.1 - 8.6**, 7.8 [5]
TRC (µg/L)	477	Report	Report	13	7.5	< 1.2 – **99.6**, 5.1
Chronic WET (TU_c)	18	Report		N/A	1.0	<1.0 - <1.7, <1.18 [6]

Notes:
1. Values that exceed water quality criteria or existing limits are presented in bold.
2. Δ T (°C) is effluent temperature minus ambient receiving water temperature. Only positive values were evaluated.
3. Open water limit/Under ice limit.
4. The marine water quality criteria is less than or equal to 1 °C above ambient temperature such that any ΔT greater than 1 °C, exceeds water quality criteria.
5. Median used in lieu of mean.
6. None of the reported chronic WET tests resulted in observation of target endpoints.

The comparison provided in Table 1 indicates temperature, ΔT, pH, and TRC are POCs for Outfall 001 that require further mixing zone and reasonable potential analysis (RPA). The existing Permit allowed for a reduction in chronic WET testing frequency if the first four samples tested did not demonstrate toxic effects. In 2015, DEC granted a reduction in monitoring frequency from quarterly to annual based on data available at that time. Given there were no observed chronic toxicity in any of the chronic WET tests during the full period of review, the applicability, or frequency of chronic WET monitoring should be reconsidered.

2.2.2 Marine Life Return System (Outfall 002)

Review of effluent data from March 2011 through December 2015 included flow and ΔT. Similar to Outfall 001, the marine water quality criteria for temperature is based on a 1 °C increase over the ambient receiving water temperature and DEC uses ΔT as the parameter of concern where only positive ΔT values were analyzed. Table 2 compares available data to existing permit limits and applicable state water quality criteria.

Table 2: Effluent Characterization (March 2001 - December 2015) Outfall 002

Parameter (Units)	Data Set	Existing Limits		Marine Criteria		Observed Range (Low – High, Ave) [1]
		(MDL)	(AML)	Acute	Chronic	
Flow (mgd)	51	---	---	---	---	0.0 – 1.4, 1.1
ΔT (°C) [2]	1,745	15/15 [3]		---	1° [4]	< 0.1 - 10.2, 1.1

Notes:
1. Values that exceed water quality criteria or existing limits are presented in bold.
2. Δ T (°C) is effluent temperature minus ambient receiving water temperature. Only positive values were evaluated.
3. Open water limit/Under ice limit.
4. The marine water quality criteria is less than or equal to 1 °C above ambient temperature such that any ΔT greater than 1 °C, exceeds water quality criteria.

The comparison provided in Table 2 indicates temperature, ΔT, is the only POC for Outfall 002 that requires a mixing zone analysis and RPA.

2.3 Compliance History

Discharge Monitoring Reports (DMRs) from March 2011 to December 2015 were reviewed to determine the facility's compliance with effluent limits. The permittee did not have any limit exceedances during the current permit cycle (all bold values in Table 2 reflect exceeding water quality criteria only). In addition, a review of EPA's Compliance Data revealed no violations under the existing Permit in the previous five years.

3.0 RECEIVING WATERBODY

3.1 Water Quality Standards

Section 301(b)(1)(C) of the CWA requires the development of limitations in permits necessary to meet water quality standards by July 1, 1997. Per 18 AAC 83.435, APDES permits must include conditions to meet 18 AAC 70 – Alaska Water Quality Standards (WQS). The WQS are composed of waterbody use classifications, numeric and/or narrative water quality criteria, and the state's Antidegradation Policy. The use classification system designates the beneficial uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the beneficial use classification of each waterbody. The Antidegradation Policy ensures that the beneficial uses and existing water quality are maintained.

Waterbodies in Alaska are designated for all uses unless the water has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). Some waterbodies in Alaska can also have site–specific water quality criterion per 18 AAC 70.235, such as those listed in 18 AAC 70.236(b). The Department has determined that there has been no reclassification nor has site-specific water quality criteria been established at the location of the discharge from the permitted facility into Simpson Lagoon. Accordingly, the Department has determined that all marine use classes must be protected. These marine use classes include: water supply; water recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life.

3.2 Water Quality Status of Receiving Water

Any part of a waterbody for which the water quality does not or is not expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the state's impaired waterbody list. For an impaired waterbody, Section 303(d) of the CWA requires states to develop a Total Maximum Daily Load (TMDL) management plan for the waterbody. The TMDL documents the amount of a pollutant a waterbody can assimilate without violating WQS and allocates that load to known point sources and nonpoint sources.

Beaufort Sea is classified as Category 2 waterbody on *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, July 15, 2010. The Beaufort Sea is not listed as an impaired waterbody nor is the subject waterbody listed as a CWA 303(d) waterbody requiring a Total Maximum Daily Load (TMDL). Accordingly, no TMDL has been developed for the subject waterbody.

3.3 Mixing Zone Analysis

Per 18 AAC 70.240 – 70.270, as amended through June 23, 2003, the Department may authorize a mixing zone in a permit. CPAI submitted a mixing zone application on September 1, 2015 requesting 100 meter (m) chronic mixing zones for Outfalls 001 and 002 using a similar approach to that used in the existing Permit. The mixing zone in the existing Permit was sized using the Visual Plumes (VP) software program and modeled effluent temperatures and TRC concentrations in representative summer and winter conditions in the receiving water. The previous modeling approach resulted in two seasonal chronic mixing zones with a single 100 m radii with seasonal differences in the authorized dilution factors. Instead of evaluating seasonal receiving water temperatures separately, DEC has evaluated paired data sets that account for seasonal differences in temperature (i.e., ΔT) for both Outfalls. Per request by DEC, a comparison between VP and the Cornell Mixing Zone Expert System model program (CORMIX) was provided by the applicant along with empirical mixing zone data obtained during a previous dye study for the facility. DEC prefers to use CORMIX over VP so long as there are consistent results. When comparing results from CORMIX with those from VP, and dye study where possible (a dye study was not performed for Outfall 002), DEC determined that within the key areas of interest CORMIX provided consistent information. Ultimately, DEC elected to use CORMIX and modify the analysis to result in mixing zones to ensure that the authorized mixing zones are as small as practicable.

Appendix D, Mixing Zone Analysis Checklist, outlines criteria per mixing zone regulations that must be considered when the Department reviews an application for mixing zones. These criteria include the size of the mixing zone, treatment technology, and existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, and endangered species. The following summarizes the Department's regulatory mixing zone analysis:

3.3.1 Size

Outfall 001 – The mixing zones for Outfall 001 were modeled using maximum effluent concentrations (MEC) for TRC (99.6 μg/L) for the acute mixing zone and the maximum expected ΔT (15.9° C) for the chronic mixing zone. Evaluating temperature as the difference between effluent temperature and ambient temperature as paired data sets eliminates the need for seasonal mixing zones when critical effluent and receiving water conditions are modeled concurrently. For the chronic mixing zone, the critical receiving water conditions are represented by under ice, initially un-stratified conditions and the 10th percentile current of 0.03 centimeters per second (cm/s). This modified approach resulted in authorization of a rectangular chronic mixing zone with an authorized dilution factor of 15.75 extending from the seafloor to the top of the unfrozen water column that is 19.5 m long by 16 m wide centered on the single-port discharge. The length is perpendicular to the discharge orientation and parallel with the prevailing currents.

For the acute mixing zone for Outfall 001, the MEC for TRC was used and the critical receiving water conditions were the same as with the chronic mixing zone except the 90th percentile current speed, 0.1 m/s, was used to determine the length of the mixing zone and the 10th percentile current for the width. Based on these modeled conditions, the Department is authorizing a rectangular acute mixing zone extending from the seafloor to the top of the unfrozen column that is 6.0 m long by 3.5 m wide centered on the discharge port similar to the chronic mixing zone. The authorized acute dilution factor is 7.5 for Outfall 001.

Outfall 002 – The chronic mixing zone for Outfall 002 was modeled using the maximum expected ΔT of 10.1° C. The critical receiving water conditions are represented by under ice, initially un-stratified conditions and the 10th percentile current of 0.03 cm/s. Based on CORMIX, the discharge plume is observed to rise and become trapped by the ice cover prior to receiving significant vertical mixing. These conditions result in authorization of a rectangular chronic mixing zone extending from the seafloor to the top of the unfrozen water column that is 185 m long (92.5 m in each current direction) by 95 m wide centered on the single-port discharge. The length is perpendicular to the discharge orientation and parallel with the prevailing currents. The authorized dilution factor is 10, which approximately matches the maximum ΔT from the paired temperature data set.

In accordance with 18 AAC 70.255, the Department determined that the size of the mixing zones for the wastewater discharge is appropriate and are as small as practicable. The size of the mixing zones are a small fraction of the area, or width of the Beaufort Sea. Using the 10th percentile current velocity of 0.03 m/s, a drifting organism can traverse the acute mixing zone associated with Outfall 001 in less than six minutes; well below the 15 minute duration used to evaluate lethality. Applicable water quality criteria representing the most stringent use classification are met at the boundary of the chronic mixing zone. Given the low concentrations of pollutants, rapid dispersion of the discharge plume and the absence of sensitive aquatic resources within the vicinity, the mixing zones are determined to be protective of aquatic life.

Discussion on Sizing – The comparative difference in chronic mixing zone sizes between Outfall 001 and Outfall 002 is due to the differences in exit velocities at the discharge ports and the resulting effects in the nearfield. The velocity exiting the 12-inch port for Outfall 001 is 2.4 times greater than that of the 24-inch port on Outfall 002. This difference translates to the discharge for Outfall 001 meeting chronic water quality criteria prior to the end of nearfield for both the low and high current conditions much sooner than it does for Outfall 002 where chronic water quality criteria is met in the farfield. This leads to assigning the width based on low current conditions representing spread of the plume beneath the ice layer and the length based on the high current because the spreading under ice is less pronounced. For Outfall 002, the controlling conditions for both the width and length is the low current condition due to less jet plume mixing in the nearfield associated with the low discharge velocity and dominance of impingement and spreading under the ice layer. As stated previously, the CORMIX results compared favorably with Plumes for both outfalls in the mixing zone boundary regions.

3.3.2 Technology

Per 18 AAC 70.240(a)(3), the Department is required to determine if "an effluent or substance will be treated to remove, reduce, and disperse pollutants, using methods found by the Department to be the most effective and technologically and economically feasible, consistent with the highest statutory regulatory treatment requirements" before authorizing a mixing zone. Applicable "highest statutory and regulatory requirements" are defined in 18 AAC 70.990(30) [2003]. Accordingly, there are three parts to the definition, which are:

- Any federal TBEL identified in 40 CFR 125.3 and 40 CFR 122.29, as amended through August 15, 1997, adopted by reference at 18 AAC 83.010;
- Minimum treatment standards in 18 AAC 72.040; and

- Any treatment requirement imposed under another state law that is more stringent than the requirement of this chapter.

The first part of the definition includes all applicable federal technology-based ELGs that may be adopted by reference at 18 AAC 83.010(g)(3) or TBELs developed using case-by-case Best Professional Judgment (BPJ). There are no ELGs that apply to the Permit. The Permit includes a TBEL for pH developed using case-by-case BPJ for both Outfalls 001 and 002. The Department determines that the first part of the definition has been met.

The second part of the definition from the WQS appears to be in error, as 18 AAC 72.040 considers discharge of sewage to sewers and not minimum treatment. The correct reference appears to be 18 AAC 72.050, minimum treatment for domestic wastewater. The application of 18 AAC 72.050 is not pertinent to the Permit as the discharge does not include domestic wastewater sources. Accordingly, the second part of the definition has been met.

The third part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 83, 18 AAC 72 and 18 AAC 15. The Permit is consistent with 18 AAC 83 and neither the regulations in 18 AAC 15, 18 AAC 72, nor another state legal requirement that the Department is aware of impose more stringent treatment requirements than 18 AAC 70. Therefore, the third and final part of the definition has also been met.

3.3.3 Existing Use

Per 18 AAC 70.245, the mixing zone has been appropriately sized to fully protect the existing uses of the Beaufort Sea. Water quality criteria are developed to ensure protection of existing uses. The chronic mixing zones have been appropriately sized to ensure water quality criteria will be met at, and beyond, the boundary of the mixing zone and that regulatory waterbody mixing zone size requirements have been met. Accordingly, the mixing zones result in the protection of the existing uses of the waterbody as a whole.

3.3.4 Human Consumption

Per 18 AAC 70.250(b)(2) and (b)(3), the pollutants discharged cannot produce objectionable color, taste, or odor in aquatic resources harvested for human consumption; nor can the discharge preclude or limit established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. The mixing zone is not at a location where aquatic resources are harvested or that could result in precluding or limiting established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. In addition, there is no indication that the pollutants discharged could produce objectionable color, taste, or odor in aquatic resources harvested for human consumption if such resources existing at the location of the mixing zone.

3.3.5 Spawning Areas

Per 18 AAC 70.225(h), a mixing zone is not authorized in an area of anadromous fish spawning or resident fish for spawning redds, Arctic grayling (*Thymallus arcticus*), northern pike (*Esox lucius*), inconnu/sheefish (*Stenodus leucichthys*) and all other whitefish in Alaska belonging to genera *Prosopium* and *Coregonus*, Arctic char (*Salvelinus alpinus*), Dolly Varden (*S. malma*), brook trout (*S. fontinalis*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O.clarkii*),

burbot *Lota*, landlocked coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), and sockeye salmon (*O. nerka*). The permit does not authorize the discharge of effluent to open waters of a freshwater lake, river, or other flowing freshwater. Therefore, there are no associated discharges to anadromous fish spawning areas or the resident freshwater fish listed in the regulation.

3.3.6 Human Health

Per 18 AAC 70.250 and 18 AAC 70.255, the mixing zone authorized in the permit shall be protective of human health. Per 18 AAC 70.250(d)(1), the Department has the authority to authorize mixing zones such that pollutants do not bioaccumulate, bioconcentrate, or persist above natural levels in sediments, water, or biota to significantly adverse levels. Given the characteristics of the effluent discharged through Outfalls 001 and 002, there are no indications that the discharges include pollutants that could bioaccumulate, bioconcentrate, or persist above natural levels in sediments, the receiving water, or biota. The Department determines that the discharges are protective of human health.

3.3.7 Aquatic Life and Wildlife

Per 18 AAC 70.250 and 18 AAC 70.255, the mixing zone authorized in the permit shall be protective of aquatic life and wildlife and will not result in concentrations outside of the mixing zone that are undesirable, present a nuisance to aquatic life, permanent or irreparable displacement of indigenous organisms, or a reduction in fish or shellfish population levels. Based on the characteristics of the effluent in Outfalls 001 and 002 and size of the acute mixing zone for TRC in Outfall 001, there is no anticipation of lethality to drifting organisms. Nor do the effluent characteristics indicate there will be undesirable nuisance aquatic life effects or displacement, or reduction, of existing aquatic life outside the mixing zones. The Department therefore concludes aquatic life and wildlife will be maintained and protected.

3.3.8 Endangered Species

Per 18 AAC 70.250(a)(2)(D), the authorized mixing zone will not cause an adverse effect on threatened or endangered species. Species that have some potential to be in the vicinity of the STP's Outfall 001, and are listed under the Endangered Species Act (ESA) are discussed in Section 8.1.

4.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

4.1 Basis for Permit Effluent Limits

Per 18 AAC 83.015, the Department prohibits the discharge of pollutants to waters of the U.S. unless the permittee has first obtained a permit issued by the APDES Program that meet the purposes of AS 46.03 and is in accordance with the CWA Section 402. Per these statutory and regulatory provisions, the Permit includes effluent limits that require the discharger to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 –WQS, and (3) comply with other state requirements that may be more stringent. The CWA requires that the limits for a particular pollutant be the more stringent of either TBELs or WQBELs.

The Permit includes numeric WQBELs and Best Management Practices (BMPs) for temperature for both Outfalls 001 and 002, as well as a WQBEL for TRC for Outfall 001. In addition, TBELs for pH developed using case-by-case BPJ are included for Outfall 001 (See Appendix B for additional details).

4.2 Technology Based Effluent Limits

As discussed in Appendix B, TBELs are either established using case-by-case BPJ or set via EPA rule makings in the form of ELGs, adopted by reference in 18 AAC 83, that correspond to the level of treatment achievable in selected industries using available treatment technology. There are no established ELGs applicable to the discharges authorized by the Permit. The existing permit, however, did establish a TBEL through BPJ for pH. DEC has evaluated effluent characteristics and available treatment technologies and has concluded that the TBEL limitation of 6.0 – 9.0 SU at all times is still appropriate and is retaining the limitation.

4.3 Water Quality Based Effluent Limits

4.3.1 Strainer/Filter Backwash (Outfall 001)

The Department has determined, based on available evidence, there is reasonable potential for the discharge of strainer backwash to exceed numeric water quality criteria for temperature, pH, and TRC at the point of discharge. However, as discussed in Section 2.1.1 only temperature and TRC are evaluated in the RPA for limit derivation purposes as the driving parameters for the chronic and/or acute mixing zones, respectively.

4.3.1.1 Reasonable Potential Analysis (Outfall 001)

As the driving parameters for the acute and chronic mixing zones, the Department determined there is reasonable potential for TRC and ΔT to exceed, or contribute to an exceedance, of water quality criteria at the respective mixing zone boundaries. In Appendix B, the Department developed the following WQBELs for ΔT and TRC.

4.3.1.2 WQBEL Derivation (Outfall 001)

TRC: The WQBEL derivation resulted in an MDL of 98 µg/L and an AML of 29 µg/L. However, both of these limits are below what is quantifiable using EPA-approved methods in 40 CFR 136. DEC establishes the minimum level (ML) for TRC of 100 µg/L as the compliance limit for these WQBELs. Because the facility uses continuous TRC monitoring equipment calibrated to 12 µg/L, rules for reporting and averaging are necessary (See Section 4.4.1.3).

Temperature Differential (ΔT): The WQBEL derivation resulted in an MDL of 23°C for ΔT. The permittee shall continue to monitoring the receiving water at the intake bay simultaneously with the effluent to demonstrate compliance with the temperature limit. Temperature monitoring is only applicable when there is a discharge occurring. Hence, the permittee is not required to monitor and report temperature differential if there is no discharge occurring.

4.3.2 Marine Life Return System (Outfall 002)

The Department has determined, based on available evidence, there is reasonable potential for the discharge of the MLRS discharge to exceed numeric water quality criteria for temperature at the point of discharge. The permittee has applied for a mixing zone for Outfall 002 and as

discussed in Section 2.2.2, temperature is the sole parameter evaluated in the RPA for the chronic mixing zone.

4.3.2.1 Reasonable Potential Analysis (Outfall 002)

Temperature is the driving parameter for the chronic for Outfall 002. In Appendix C, the Department determined there is reasonable potential for ΔT to exceed, or contribute to an exceedance, of water quality criteria. In Appendix B, the Department developed the following WQBEL for ΔT.

4.3.2.2 WQBEL Derivation (Outfall 002)

Temperature Differential (ΔT): The WQBEL derivation resulted in an MDL of 19° C for ΔT. The permittee shall continue to monitoring the receiving water at the intake bay simultaneously with the effluent to demonstrate compliance with the temperature limit. Temperature monitoring is only applicable when there is a discharge occurring. Hence, the permittee is not required to monitor and report temperature differential if there is no discharge occurring.

4.4 Effluent Limits and Monitoring Requirements

Per AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. The following sections provide the effluent limits and monitoring requirements for each outfall.

4.4.1 Outfall 001 Strainer Backwash

The Permit requires the limitation and monitoring requirements as per Table 3.

Table 3: Outfall 001 Strainer Backwash Limits and Monitoring Requirements

Parameter	Effluent Limits			Monitoring Requirements	
	Units	MDL	AML	Frequency	Type
Flow	mgd	2.2	Report	Continuous	Meter
pH [4.4.1.1]	SU	6.0 to 9.0		1/Week	Meter or Grab
Temperature Differential (ΔT) [4.4.1.2]	° C	22	N/A	Daily	Meter or Grab
TRC [4.4.1.3]	µg/L	98	29	Daily	Meter or Grab
Chronic WET [4.4.2]	TU_c	Report		Annual [4.4.1.4]	Grab

4.4.1.1 pH Conditions

The pH must not be less than 6.0 or greater than 9.0. The permittee must report the monthly maximum and monthly minimum on the DMR.

4.4.1.2 ΔT Conditions

Temperature differential is the effluent temperature minus the receiving water temperature. Receiving water temperature shall be monitored at the seawater intake. The permittee must record the weekly maximum ΔT and submit the daily data with the next application for reissuance.

4.4.1.3 TRC Conditions

The compliance level for TRC is 100 µg/L. Because the facility currently uses continuous TRC monitoring equipment calibrated to detect down to 12 µg/L the following rules for reporting

and averaging apply. If equipment modifications result in different calibrations, the new detectable value may be used instead of 12 μg/L as long as the compliance level of 100 μg/L is achieved.

For reporting on DMRs, if the monitoring equipment reports values that are less than 12 μg/L, then the permittee reports < 12 μg/L on the DMR. If the equipment reports between 12 μg/L and 100 μg/L, the permittee reports < 100 μg/L on the DMR. If the equipment records 100 μg/L or greater, the permittee reports the actual value on the DMR.

For averaging purposes, if the equipment records a value that is less than 12 μg/L, the permittee uses zero for averaging. If the equipment records a value between 12 μg/L and 100 μg/L, the permittee uses 12 μg/L for averaging. Lastly, if the equipment reports 100 μg/L or greater, the permittee uses the actual value for averaging.

4.4.1.4 Chemical Inventory

Although the permittee currently uses only NALCO 7768 and CHEMLINK 4835 as approved in the existing Permit, substitution or addition of other clarifying agents may be used under the Permit upon written approval from DEC. Use of different clarifying agents also triggers chronic WET monitoring per Section 4.4.2 to provide characterization data based on a new chemical treatment process. In addition, the permittee must development and implement a chemical-dosing matrix to optimize the use of coagulants and other clarifying agents as a BMP specific to discharge 001 (See Section 7.3.1).The permittee must maintain an annual inventory of chemical additives used seasonally in the clarifier system. The annual inventory must include the following three components:

1) type of each chemical (product name) injected into the clarifiers,
2) estimated concentrations listed in item 1) that are injected into the clarifier system, and
3) estimated volume of chemically treated clarifier discharges.

An applicable month for conducting a chemical inventory is a month where chemicals have been injected into the clarifiers. Hence, this requirement does not pertain to months where no clarifying chemicals have been used. The permittee must submit a report to DEC by January 31 of each year of operation even if no chemicals have been used in the prior year. In this situation, the report submitted must declare that no chemicals were injected into the clarifier system. Outfall 002 Marine Life Return System

The Permit requires the limitation and monitoring requirements as per Table 4.

Table 4: Outfall 002 Marine Life Return System Limits and Monitoring Requirements

Parameter	Effluent Limits			Monitoring Requirements	
	Units	MDL	AML	Frequency	Type
Flow	mgd	Report	Report	Continuous	Meter
Temperature Differential (ΔT) [4.4.1.2]	° C	19	N/A	Daily	Meter or Grab

4.4.2 Chronic WET Monitoring

If clarifying agents other than NALCO 7768 and CHEMLINK 4835 are used in the clarifiers, the permittee must notify DEC per Section 4.4.1.4 and conduct chronic WET testing for the following vertebrate and invertebrate species:

- Vertebrate (survival and growth): *Atherinops affinis* (topsmelt minnow). In the event the topsmelt is not available, *Menidia beryllina* (Inland Silverside) may be used as a substitute. Each WET report shall document the species used in testing.
- Invertebrate: For larval development tests, the permittee must use bivalve species *Crassostrea gigas* (pacific oyster) or *Mytilus spp*. (mussel). The initial screening of invertebrate testing shall also include the mysid shrimp, *Americamysis bahia* (formally *Mysidopsis bahia*) for survival and growth. Due to seasonal variability, testing may be performed during reliable spawning periods (e.g. December through February for mussels and June through August).

A series of at least five dilutions and a control must be tested. The recommended initial dilution series is 6.25, 12.5, 25, 50, and 75% and a control dilution water control (0% effluent). DEC may require subsequent tests to use modified dilution series that increases the likelihood of observing the EC_{25} endpoint and provides a more accurate estimate of chronic toxicity. Similarly, the permittee may request written approval form DEC to modify the dilution series based on previous test results.

For the bivalve and primary marine fish species, the presence of chronic toxicity must be estimated as specified *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to West Coast Marine and Estuarine Organisms* (EPA/600/R-95/136). For the shrimp and alternate marine fish species *Menidia beryllina*, USEPA *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*, Third Edition (EPA-821-R-02-014) must be used.

Both the no observed effect concentration (NOEC) and 25 % inhibition concentration (IC_{25}), must be provided in the full WET report. The chronic toxicity results reported on the DMR must use $TU_c = 100/IC_{25}$, $100/EC_{25}$ or 100/NOEC. If the endpoint is estimated to be above the highest dilution, the permittee must indicate this on the DMR by reporting a less than value for TU_c based on the highest dilution. The Department may compare the reported TU_c based on the IC_{25} or EC_{25} with one based on the NOEC during evaluation of data during the next Permit reissuance. Although acute WET monitoring is not required, the permittee must estimate an NOEC for acute toxicity based on observations of total mortality recorded for chronic tests and include this information in the WET report.

The Permit specifies annual Chronic WET testing of both vertebrate and invertebrate species in order to identify the most sensitive test species for toxicity testing. Upon identification of the most sensitive test species, the permittee may submit a written request to eliminate the less sensitive species in subsequent WET analysis for DEC approval. The permittee shall not make any changes to the selection of test species or dilution series without prior written DEC approval.

The logistics of shipping WET samples to the lower 48 can be challenging as poor weather delays or missed connections during shipping can result in violation of the standard 36-hour hold time. If extenuating circumstances occur, WET samples hold times can exceed 36 hours but must not exceed 72 hours. The permittee must document the conditions that resulted in the need for

the holding time to exceed 36 hours and any potential effect the extended hold time could have on the test results.

4.4.3 Electronic Discharge Monitoring Reports

4.4.3.1 E-Reporting Rule, Phase I

The permittee must submit DMRs electronically through NetDMR per Phase I of the E-Reporting Rule (40 CFR 127) upon the effective date of the Permit. For access to the NetDMR Portal, go to https://cdxnodengn.epa.gov/oeca-netdmr-web/action/login. DMRs submitted in compliance with the E-Reporting Rule are not required to be submitted as described in Permit Appendix A – Standard Conditions unless requested or approved by the Department. DEC has established an e-Reporting Information website at http://dec.alaska.gov/water/Compliance/EReportingRule.htm which contains general information about this new reporting format. Training modules and webinars for NetDMR can be found at https://netdmr.zendesk.com/home.

4.4.3.2 E-Reporting Rule, Phase II

Phase II of the E-Reporting Rule Permittees will integrate electronic reporting for all other reports required by the Permit (e.g., Annual Reports and Certifications) and implementation is expected to begin during the permit cycle. Permittees should monitor DEC's E-Reporting website (http://dec.alaska.gov/water/Compliance/EReportingRule.htm) for updates on Phase II of the E-Reporting Rule and will be notified when they must begin submitting all other reports electronically. Until such time, other reports required by the Permit may be submitted in accordance with Permit Appendix A – Standard Conditions.

4.4.4 Additional Effluent Monitoring

The permittee has the option of taking more frequent samples than required under the Permit, or DEC may request this additional information. These additional samples can be used for averaging if they are conducted using the Department approved test methods (generally found in 18 AAC 70 and 40 CFR 136 [adopted by reference in 18 AAC 83.010], and if the method detection limits are less than the effluent limitations and are sufficiently sensitive. All data collected during the Permit term must be provided to the Department with the next application for reissuance. This information is necessary to adequately characterize the effluent and conduct an RPA. When data is being collected to characterize effluent or receiving water, a sufficiently sensitive method must be used that allows comparison of results with applicable water quality criteria. A method approved under 40 CFR 136 is sufficiently sensitive when:

1) The method minimum level (ML) is at or below the level of the applicable water quality criterion for the measured parameter, or
2) The method ML is above the applicable water quality criterion, but the amount of the pollutant or pollutant parameter in the discharge is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter in the discharge (e.g., not applicable to effluent or receiving water monitored for characterization), or
3) The method has the lowest ML of the analytical methods approved under 40 CFR 136 for the measured pollutant or pollutant parameter (e.g., the receiving water concentration or the criteria for a given pollutant or pollutant parameter is at or near the method with the lowest ML).

5.0 ANTIBACKSLIDING

Per 18 AAC 83.480, "effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit." Per 18 AAC 83.480(c), a permit may not be reissued "to contain an effluent limitation that is less stringent than required by effluent guidelines in effect at the time the permit is renewed or reissued."

Effluent limitations may be relaxed as allowed under 18 AAC 83.480, CWA §402(o) and CWA §303(d)(4). 18 AAC 83.480(b) allows relaxed limitations in renewed, reissued, or modified permits when there have been material and substantial alterations or additions to the permitted facility that justify the relaxation, or, if the Department determines that technical mistakes were made.

CWA §303(d)(4)(A) states that, for waterbodies where the water quality does not meet applicable WQS, effluent limitations may be revised under two conditions, the revised effluent limitation must ensure the attainment of the WQS (based on the waterbody TMDL or the waste load allocation) or the designated use which is not being attained is removed in accordance with the WQS regulations.

CWA §303(d)(4)(B) states that, for waterbodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the state's Antidegradation Policy. Even if the requirements of CWA §303(d)(4) or 18 AAC 83.480(b) are satisfied, 18 AAC 83.480(c) prohibits relaxed limits that would result in violations of WQS or ELGs.

State regulation 18 AAC 83.480(b) only applies to effluent limitations established on the basis of CWA Section 402(a)(1)(B), and modification of such limitations based on effluent guidelines that were issued under CWA Section 304(b). Accordingly, 18 AAC 83.480(b) applies to the relaxation previously established case-by-case TBELs developed using BPJ. To determine if backsliding is allowable under 18 AAC 83.480(b), the regulation provides five regulatory criteria (18 AAC 83.480[b][1-5]) that must be evaluated and satisfied.

Data from Outfall 001 collected during the previous permit term was evaluated by the Department using the *Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)*, which resulted in a WQBEL for temperature that is less stringent than limits for temperature in the existing Permit. The *RPA/WQBEL Guidance* uses different methods for calculating the MDL for temperature than was used by EPA during development of the existing Permit (note, these methods still find their basis in EPA's *Technical Support Document for Water Quality – based Toxics Control* [1991], which is the document EPA used to calculate limitations in the previous permit). In addition, the less stringent limits in the Permit are based on new data and mixing zone authorization. DEC has also modified chronic WET conditions to include readily available species and removing accelerated testing requirements based on the observed data; none of the chronic WET monitoring conducted during the previous term resulted in observation of chronic endpoints. These less stringent limits and conditions comply with WQS including the Antidegration Policy (See Section 6.0) as the permit still requires compliance with WQS in the waterbody such that impairments should not occur if permit conditions are adhered.

6.0 ANTIDEGRADATION

Section 303(d)(4) of the CWA states that, for waterbodies where the water quality meets or exceeds the level necessary to support the designated uses of the waterbody, WQBELs may be revised as long as the revision is consistent with the state Antidegradation Policy.

The Antidegradation Policy per 18 AAC 70.015 states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected. This section of the fact sheet analyzes and provides rationale for the Department decision to reissue the Permit with respect to the Antidegradation Policy.

The Department's approach in implementing the Antidegradation Policy, found in 18 AAC 70.015, is based on the requirements in 18 AAC 70 and the *Policy and Procedure Guidance for Interim Antidegradation Implementation Methods, July 14, 2010* (*Interim Methods*). Using these requirements and policies, the Department determines whether a waterbody, or portion of a waterbody, is classified as Tier 1, Tier 2, or Tier 3 where a higher numbered tier indicates a greater level of water quality protection. The receiving water for discharges from the facility is Simpson Lagoon, which is a Tier 2 water.

Wastewater discharged under this Permit is subject to a Tier 2 antidegradation analysis, as detailed in the *Interim Methods*. The state Antidegradation Policy in 18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water (Tier 2), that quality must be maintained and protected unless the Department finds that the five specific requirements of the Antidegradation Policy at 18 AAC 70.015(a)(2)(A)-(E) are satisfied. These five findings are:

1. **18 AAC 70.015 (a)(2)(A).** *Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.*

   Based on the evaluation required per 18 AAC 70.015(a)(2)(D) below, the Department has determined that the most reasonable and effective pollution prevention, control, and treatment methods are being used and that the localized lowering of water quality is necessary.

   The Alaska Oil and Gas Association (AOGA) 2017 Final Report - AOGA Economic Impact Study (2017 AOGA Final Report) indicates that the petroleum industry is easily the top employer in the North Slope Borough (NSB) generating a total of 1845 direct, support, or indirect jobs with wages paid totaling $105 million in 2016. In addition, the oil and gas industry paid $347.5 million in property taxes to the NSB in 2016 contributing 96.7% of total NSB tax revenues. The 2017 Active Oil and Gas Lease Inventory by the Alaska Department of Natural Resources, Oil and Gas Division states that oil and gas leases sales involving North Slope and Beaufort Sea acreage made by the state totaled approximately 3.5 million acres as of July 6, 2017. The 2014 Annual Report by the Alaska Department of Natural Resources, Oil and Gas Division states that since 1964, oil and gas leases sales involving North Slope and Beaufort Sea acreage, representing a total of 5.5 million acres have been made by the state.

   The 2017 AOGA Final Report also indicates that CPAI is the largest oil producer in the state with a net production rate of 179,000 barrels per day of oil equivalent and is a 29% owner of the Trans-Alaska Pipeline System. The waterflood operation is of critical importance to CPAI and the state for providing the injection of treated seawater into aging oil reservoirs to enhance oil recovery from production wells.

The Department finds that the requirements of this part of the Antidegradation analysis have been met.

2. **18 AAC 70.015 (a)(2)(B).** *Except as allowed under this subsection, reducing water quality will not violate the applicable criteria of 18 AAC 70.020 or 18 AAC 70.235 or the whole effluent toxicity limit in 18 AAC 70.030.*

   The Department evaluated the applicable criteria in 18 AAC 70.020 while establishing permit limits and conditions. An acute mixing zone has been authorized for TRC at Outfall 001, and in addition, a chronic mixing zone has been authorized for TRC, pH, and temperature. A chronic mixing zone has also be authorized for temperature at Outfall 002. The size of the authorized mixing zones were developed to ensure water criteria will be met at, and beyond, their boundaries and that the waterbody has a whole would be protected. There are no site-specific criteria addressed by the Permit so 18 AAC 70.235 does not warrant further consideration. In addition, WET testing in the Permit for Outfall 001 consists of monitoring only so WET limits associated with 18 AAC 70.030 also do not warrant further consideration. Therefore, DEC concludes that the finding is met.

3. **18 AAC 70.015(a)(2)(C).** *The resulting water quality will be adequate to fully protect existing uses of the water.*

   Water quality criteria are established such that, if the criteria are met, the uses of the waterbody will be protected. DEC developed and incorporated narrative and numeric permit limitations at the point of discharge based on meeting the most stringent water quality criteria applicable to all uses of the waterbody at the boundaries of the mixing zones. Because criteria are being met at the boundaries of the mixing zones and these criteria protect the uses of the waterbody, DEC concludes that the resulting water quality will fully protect the existing uses of the waterbody as a whole and the finding is met.

4. **18 AAC 70.015(a)(2)(D).** *The methods of pollution prevention, control, and treatment found by the Department to be most effective and reasonable will be applied to all wastes and other substances to be discharged.*

   For Outfall 001, water used to backwash filters is dosed with hypochlorite to prevent biofouling of the filter media. The chlorinated backwash water is mixed with reject water from the pre-filter strainers and dechlorinated using sodium metabisulfite prior to discharge. Effluent characterization data indicates that the dechlorination system effectively removes chlorine to detection levels. During summer, additional clarifying agents (flocculants and/or coagulants) may be used to pretreat seawater in a clarifier system prior to filtration. Through the BMP Plan, the clarifying agents are selected based on their low toxicity and this is verified via chronic WET monitoring during periods when additional clarifying agents are used. No toxic endpoints have been observed during the previous permit term indicating adequate controls are in place and supports removal of accelerated testing as discussed in Section 5.0. Heat added to the treatment process to enhance removal of particulates in the filtration process is controlled using heat exchanges.

   For Outfall 002, the recirculating seawater picks up incidental heat as well as heat added to maintain open water conditions during the winter. The amount of heat added is controlled via heat exchangers and BMPs. Similar with Outfall 001, a BMP Plan is developed and implemented to achieve the following two primary objectives:

1. The number and quantity of pollutants and the toxicity of effluent generated, discharged, or potentially discharged at the facility shall be minimized by the permittee to the extent feasible by managing each potential influent waste stream in the most appropriate manner.
2. Under the BMP Plan, any Standard Operating Procedures (SOPs) must be included in the Plan to ensure proper operation and maintenance of the STP.

DEC has determined the most reasonable and effective pollution prevention, control, and treatment is being used.

18 AAC 70.015(a)(2)(E). *All wastes and other substances discharged will be treated and controlled to achieve (i) for new and existing point sources, the highest statutory and regulatory requirements; and (ii) for nonpoint sources, all cost-effective and reasonable best management practices.*

Applicable "highest statutory and regulatory requirements" are defined in 18 AAC 70.990(30), as amended through June 26, 2003, and *Interim Methods*. Accordingly, there are three parts to the definition, which are:

- Any federal TBEL identified in 40 CFR 125.3 and 40 CFR 122.29. as amended through August 15, 1997, adopted by reference at 18 AAC 83.010;
- Minimum treatment standards in 18 AAC 72.040; and
- Any treatment requirement imposed under another state law that is more stringent than the requirement of this chapter.

The first part of the definition includes all applicable federal technology-based ELGs adopted by reference at 18 AAC 83.010(g)(3) and TBELs developed using case-by-case BPJ. There are no applicable federal ELGs for seawater treatment facilities. However, a pH TBEL has been established using case-by-case BPJ for Outfall 001 in conjunction with BMPs.

The second part of the definition is in error and inapplicable to STP discharges as discussed previously in Section 3.3.2.

The third part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 83 and 18 AAC 15. The Permit is consistent with 18 AAC and neither the regulations in 18 AAC 15, or other state legal requirement(s) the Department is aware of, impose more stringent treatment requirements than 18 AAC 70.

In the absence of ELGs, DEC has concluded that this criterion has been met through the implementation of TBELs using case-by-case BPJ and implementation of BMPs to control sources of pollution to ensure discharges are treated to the highest statutory and regulatory requirements.

7.0 OTHER PERMIT CONDITIONS

7.1 Standard Conditions

Appendix A of the Permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

7.2 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The permittee is required to update the Quality Assurance Project Plan (QAPP) within 120 days of the effective date of the final Permit. Additionally, the permittee must submit a letter to the Department within 120 days of the effective date of the Permit stating that the plan has been implemented within the required time frame. The QAPP shall consist of standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples; laboratory analysis; and data reporting. The plan shall be retained on site and made available to the Department upon request.

7.3 Best Management Practices Plan

A BMP Plan is a collection of pollution control methods and housekeeping measures which are intended to minimize or prevent the generation and the potential release of pollutants from a facility to the waters of the U.S. through normal operations and ancillary activities. Per CWA Section 402(a)(1), development and implementation of BMPs may be included as a condition in APDES permits. CWA 402(a)(1) authorizes DEC to include miscellaneous requirements that are deemed necessary to carry out the provision of the CWA in permits on a case-by-case basis. The BMP Plan must be developed to control, or abate, the discharge of pollutants in accordance with 18 AAC 83.475. A BMP Plan must include certain generic BMPs as well as specific BMPs for controlling pollutants (See Section 7.3.1).

Within 120 days of the effective date of the Permit, the permittee must revise and implement their existing BMP Plan. Upon revising the BMP Plan, the permittee must submit written certification that the BMP Plan has been revised and implemented within 120 days of the effective date of the Permit. In subsequent years of the Permit, the permittee must establish a review committee to review and revise the BMP Plan annually to include any modifications deemed to be necessary or appropriate since the previous revision to meet the objectives and specific requirements in the Permit. By January 31st of each year thereafter, the permittee must submit written certification that the BMP Plan review committee has reviewed and modified the BMP Plan, as appropriate.

7.3.1 Specific BMPs

In addition to the generic BMPs listed in Permit Section 3.2.4, DEC requires that the BMP Plan include a specific BMP (e.g., a chemical-dosing matrix) to optimize the use of coagulants and other clarifying agents. See also Section 4.4.1.4– Chemical Inventory.

8.0 OTHER LEGAL REQUIREMENTS

8.1 Endangered Species Act

The Endangered Species Act (ESA) requires federal agencies to consult with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) if their actions could beneficially or adversely affect any threatened or endangered species. As a state agency, DEC is not required to consult with these federal agencies regarding permitting actions. However, the Department voluntarily requested this information from these services on November 10, 2015 to inform permit development. The Department reviewed the Marine Mammal Protection Map (MMPA) - interactive map for habitat ranges and found the following may occur in the Beaufort Sea at the vicinity of one of the discharges: Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), Polar Bear (*Ursus maritimus*), Bowhead Whale (*Balaena mysticus*), Humpback Whale (*Megaptera novaeangliae*), Bearded Seal (*Erginathuse barbatus nauticus*), and Ringed Seal (*Phoca hispida hispida*)..

8.2 Essential Fish Habitat

Essential fish habitat (EFH) includes the waters and substrate (sediments, etc.) necessary for fish from commercially-fished species to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NOAA when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH. Although DEC, as a state agency, is not required to consult with these federal agencies regarding permitting activities, the Department voluntarily requested this information November 10, 2015, from these services to inform permit development. The Department also inspected the NMFS interactive map of EFH and found the area in the vicinity of the discharges is EFH for Arctic Cod (*Arctogadus glacialis*).

No other North Pacific marine fish species were listed on the NMFS interactive website as having EFH in the general area of the discharges.

8.3 Ocean Discharge Criteria Evaluation

CWA Section 403(a), Ocean Discharge Criteria, prohibits the issuance of a permit under CWA Section 402 for a discharge into the territorial sea, the water of the contiguous zone, or the oceans except in compliance with Section 403. Permits for discharges seaward of the baseline on the territorial seas must comply with the requirements of Section 403, which include development of an Ocean Discharge Criteria Evaluation (ODCE).

The Permit requires compliance with Alaska WQS. Consistent with 40 CFR 125.122(b), adopted by reference at 18 AAC 83.010(C)(8), discharges in compliance with Alaska WQS shall be presumed not to cause unreasonable degradation of the marine environment. EPA made the connection between the similar protections provided by ODCE requirements and WQS when promulgating ocean discharge criteria rules in 1980, as stated, "the similarity between the objectives and requirements of [state WQS] and those of CWA Section 403 warrants a presumption that discharges in compliance with these [standards] also satisfy CWA Section 403." (Ocean Discharge Criteria, 45 Federal Register 65943.). As such, given the Permit requires compliance with Alaska WQS, unreasonable degradation to the marine environment is not expected and further analysis under 40 CFR 125.122 is not warranted for this permitting action.

8.4 Permit Expiration

The permit will expire five years from the effective date of the permit.

9.0 References

1. Alaska Department of Environmental Conservation, 2003. *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances*, as amended through December 12, 2008.
2. Alaska Department of Environmental Conservation, 2010. *Alaska's Final 2010 Integrated Water Quality Monitoring and Assessment Report*, July 15, 2010.
3. Alaska Department of Environmental Conservation, 2003, 2009, and 2012. Alaska Water Quality Standards.
4. Alaska Department of Environmental Conservation. Interim Antidegradation Implementation Methods. Division of Water. Policy and Procedure No. 05.03.103. July 14, 2010.
5. Alaska Department of Natural Resources – Division of Oil and Gas, *Annual Report*, 2014.
6. Alaska Department of Natural Resources – Division of Oil and Gas, North Slope Borough and Beaufort Sea Oil and Gas Lease Inventory, July 16, 2017.
7. Alaska Oil and Gas Association. *Economic Impact Report – The Role of the Oil and Gas Industry in Alaska's Economy*, May 2017.
8. Alaska Pollution Discharge Elimination System Discharge and Monitoring Report, 2011 – 2015.
9. National Oceanic and Atmospheric Administration, 2017 *EFH Mapper. N.p.,n.d.* Web August 23, 2017.
10. National Oceanic and Atmospheric Administration, 2017 *MMPA Mapper. N.p.,n.d.* Web August 23, 2017.

APPENDIX A. FIGURES

Figure 1: Vicinity Map Location of Kuparuk Seawater Treatment Plant

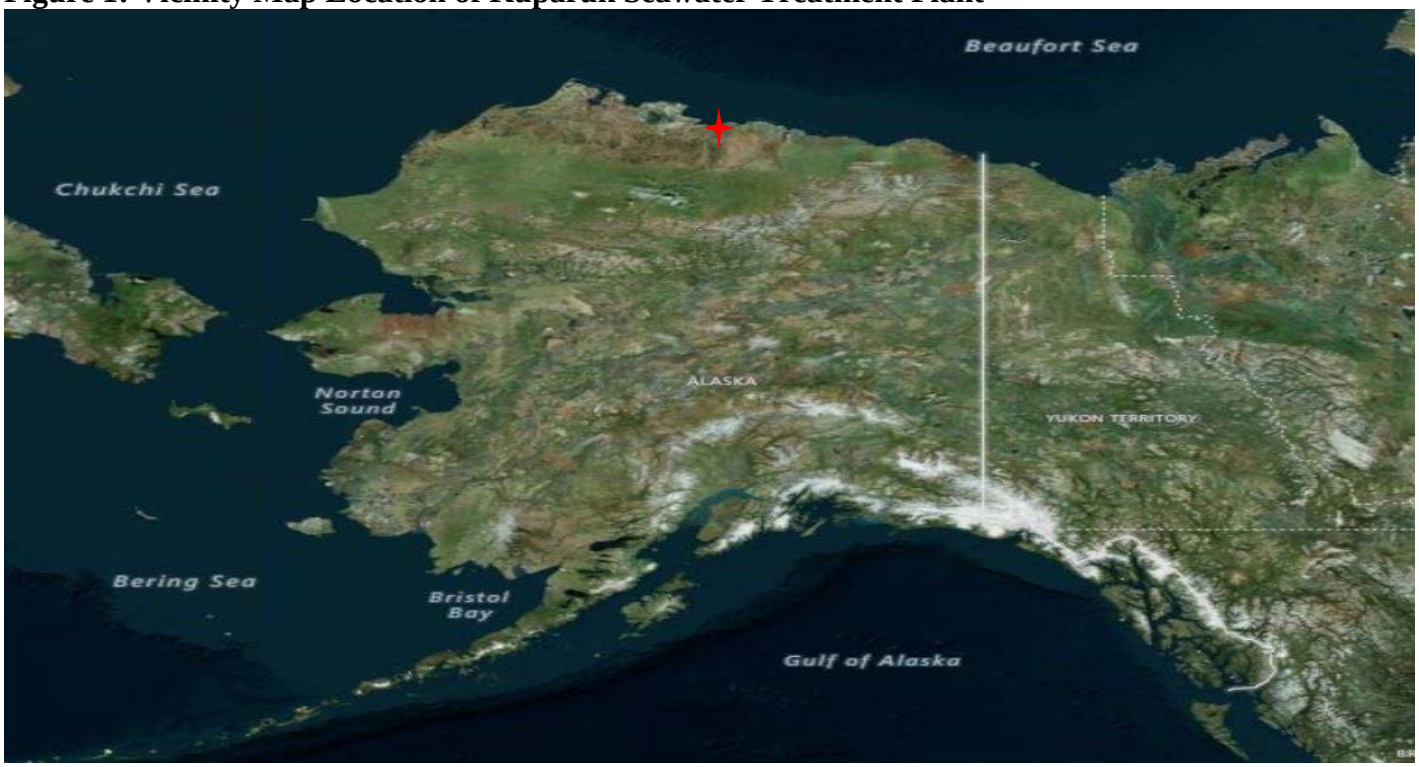
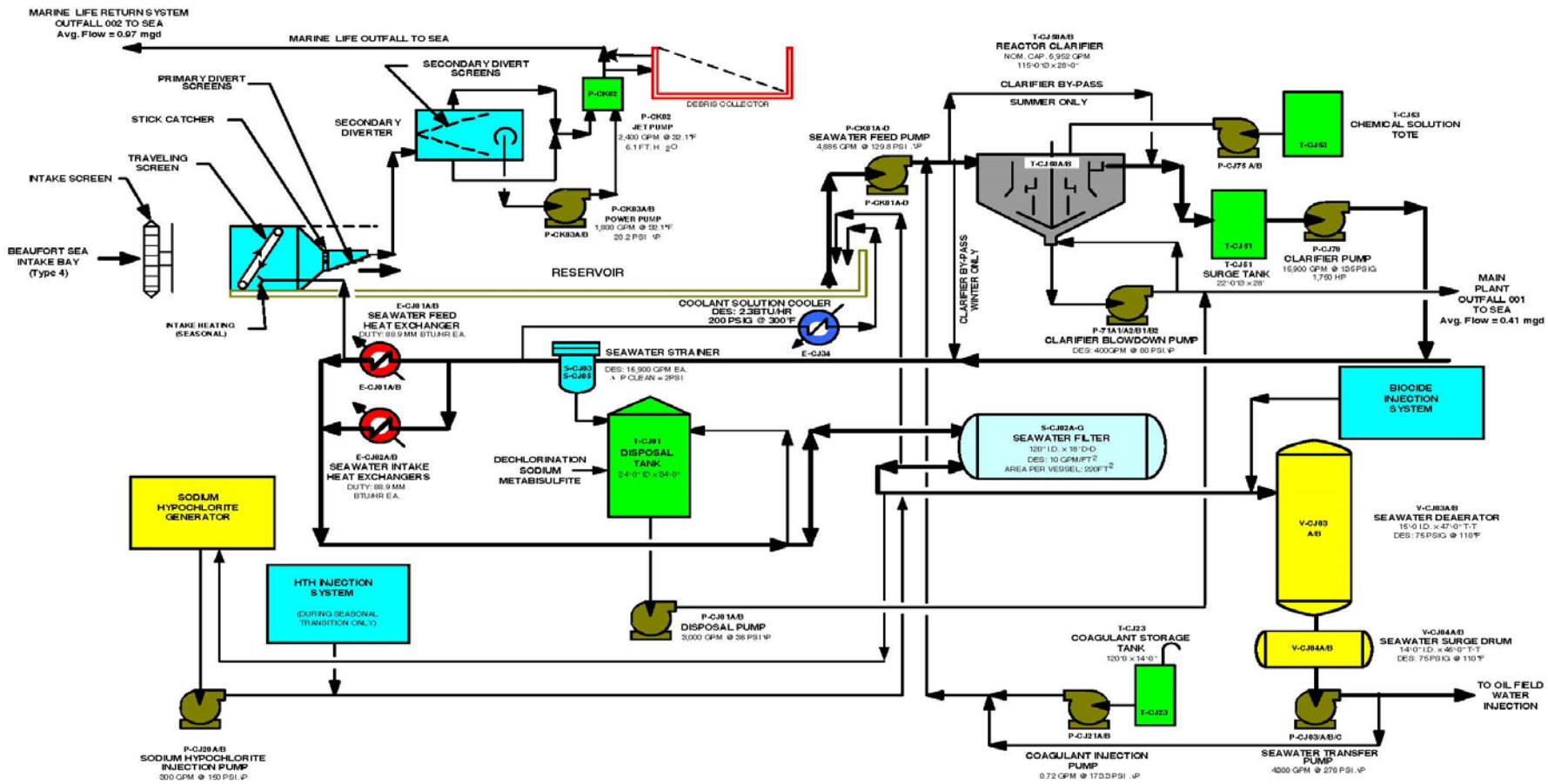


Figure 2: CPAI Kuparuk Seawater Treatment Plant – Beaufort Sea – Outfalls 001 and 002

Figure 3: Kuparuk Seawater Treatment Plant

Figure 4: Seawater Treatment Plant Simplified Process Flow Diagram



APPENDIX B. EFFLUENT LIMITATIONS

The Alaska Department of Environmental Conservation (Department or DEC) prohibits the discharge of pollutants to waters of the United States (U.S.) per Alaska Administrative Code (AAC) 18 AAC 83.015 unless first obtaining a permit issued by the Alaska Pollutant Discharge Elimination System (APDES) Program that meets the purposes of Alaska Statutes (AS) 46.03 and is in accordance with Clean Water Act (CWA) Section 402. Per these statutory and regulatory requirements, individual permit AK0043354 – ConocoPhillips Alaska, Inc. Kuparuk Seawater Treatment Plant (Permit) includes effluent limitations that require the discharger to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 – Alaska Water Quality Standards (WQS), (3) and comply with other state requirements that may be more stringent. The CWA requires that the limits for a particular parameter be the more stringent of either technology-based effluent limits (TBEL) or water quality-based effluent limits (WQBEL). TBELs are set via rule makings by the Environmental Protection Agency (EPA) in the form of Effluent Limitation Guidelines (ELGs) that correspond to the level of treatment that is achievable using available technology. In situations where ELGs have not been developed or have not considered specific discharges or pollutants, a regulatory agency can develop TBELs using best professional judgment (BPJ) on a case-by-case basis. A WQBEL is designed to ensure that WQS codified in 18 AAC 70 are maintained and the waterbody as a whole is protected. WQBELs may be more stringent than TBELs. In cases where both TBELs and WQBELs have been generated, the more stringent of the two limits will be selected as the final permit limit.

B.1 TECHNOLOGY BASED EFFLUENT LIMITS

EPA has not established national ELGs for seawater treatment facilities for waterflood production. However, the Department is adopting a TBEL developed using case-by-case BPJ for pH. The Permit requires pH to be no less than 6.0 standard units (SU) and no greater than 9.0 SU. This TBEL was also included in the existing Permit and is being retained in the proposed Permit.

B.2 WATER QUALITY BASED EFFLUENT LIMITS

B.2.1 Statutory and Regulatory Basis

Per 18 AAC 83.435(a), an APDES permit must include conditions (e.g., WQBELs) in addition to, or more stringent than established TBELs as necessary to protect WQS. When evaluating if WQBELs are needed in addition to TBELs, the permitting authority conducts a reasonable potential analysis (RPA) based on pertinent pollutants of concern (POCs). Pertinent POCs are those that the Department considers as having the potential to exceed water quality criteria at the point of discharge or at the boundary of a mixing zone, if authorized. If a mixing zone is authorized, the Department may consider the dilution available in the receiving water in the analysis. Per 18 AAC 83.435(c), DEC must also use procedures that account for effluent variability (e.g., maximum expected effluent concentrations [MEC] and coefficient of variation), existing controls on point sources (e.g., treatment systems), and nonpoint sources of pollution (e.g., ambient receiving water concentrations). The Department developed and implemented a *Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)* and associated spreadsheet tool that were used in development of the WQBELs in the Permit.

B.2.2 Reasonable Potential Analysis

The RPA procedures use statistical methods to estimate MECs or, in the case of temperature in this permit, maximum expected temperature difference between effluent and the ambient receiving water (MEΔT). Using a mass balance approach, the RPA projects the concentration, or temperature, at the boundary of a mixing zone if authorized. Because DEC has authorized acute and chronic mixing zones, the mass balance procedure evaluates if the effluent exceeds, or contributes to an exceedance, of water quality criteria at the boundary of either the acute or the chronic mixing zone. Based on the RPA summarized in Appendix C, the Department has determined temperature has a reasonable potential to exceed chronic marine criteria the boundary of the chronic

mixing zone and TRC at the boundary of the acute mixing zone for Outfall 001, and temperature at the boundary of the chronic mixing zone for Outfall 002. Accordingly, WQBELs for temperature (ΔT) and total residual chlorine (TRC) are established per 18 AAC 83.435 to be consistent with the calculated available wasteload allocation (WLA) and are stringent enough to ensure compliance with WQS. No other parameters were determined to have reasonable potential.

B.2.3 Wasteload Allocations

In the context of this section, a wasteload allocation (WLA) is the concentration of a pollutant that can be discharged to the receiving water and comply with the acute (a) or chronic (c) water quality criteria ($WQC_{a,c}$), accounting for ambient concentrations and authorized acute or chronic dilution factors ($DF_{a,c}$) in the mixing zones, if applicable. For TRC, no ambient concentrations of TRC are assumed due to the natural chlorine demand in marine waters. The WLA for TRC is calculated by rearranging Equation C-3a in Appendix C and substituting WQC for receiving water concentration and WLA for the maximum expected concentration. The resulting mass balance equation is:

$$WLA_{TRC} = DF_{a,c} \times WQC_{a,c}$$

Per the derivation of Equation C-3b in Appendix C, ΔT is the limited parameter and internally accounts for ambient temperatures of the receiving water. This requires the chronic WQC for temperature to be 1 °C and the WLA equation for temperature simplifies to:

$$WLA_{\Delta T} = DF_c \times 1$$

B.2.4 WQBELs for Outfall 001

Per Section B.2.2, the effluent characteristics for Outfall 001 demonstrated reasonable potential for ΔT at the boundary of the chronic mixing zone and TRC at the boundary of the acute mixing zone. Therefore, Outfall 001 requires limits for ΔT and TRC as described in Sections B.2.4.1 and B.2.4.2, respectively.

B.2.4.1 *Temperature Difference (ΔT)*

The maximum daily limit (MDL) and average monthly limit (AML), if applicable, for ΔT are based on MEΔT equaling 15.9 degrees Celsius (°C), a calculated coefficient of variation (CV) of 0.3145, and an assumed four samples per month. The WLA is used to determine whether the acute long-term average (LTA_a) or the chronic long-term average (LTA_c) is the most stringent for developing the WQBELs. For ΔT, LTA_c is the most limiting and is used in the derivation because the LTA_a is not applicable given there is no acute criteria for temperature in the WQS. Consistent with the existing Permit, DEC is establishing an MDL but not an AML. The resulting MDL is 22.0 °C. The following steps were conducted for calculation of the MDL per Part 5.4 (Permit Limit Derivation) of the EPA Technical Support Document and the DEC *RPA/WQBEL Guidance.*

- **Determine $\boldsymbol{LTA_s}$**: the LTAs are calculated as follows:

$$LTA_{chronic} = WLA * [\exp(0.5\hat{\sigma}_4^2 - Z_{99}\hat{\sigma}_4)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA = 15.75\ °C, CV = 0.3145, Z_{99} = 2.326, \sigma_4 = 0.1563\ and\ \sigma_4^2 = 0.0244$$

$$\boldsymbol{LTA_{chronic}} = 11.08\ °C$$

- **Calculate the $\boldsymbol{MDL}$**:

$$MDL = LTA_c\ [\exp(Z_{99}\sigma - 0.5\sigma^2)], where\ \sigma^2 = \ln(CV^2 + 1)$$

$$CV = 0.3145, Z_{99} = 2.326, \sigma = 0.3071, and\ \sigma^2 = 0.0943$$

$$\boldsymbol{MDL = 21.6\ °C}$$

$$\boldsymbol{Round\ up\ to\ 22.0\ °C}$$

B.2.4.2 *Total Residual Chlorine*

The RPA revealed that only TRC has reasonable potential to exceed water quality criteria at the boundary of the acute mixing zone requiring development of WQBELs. The TRC MDL and AML are based on maximum expected effluent concentration equaling 99.6 micrograms per liter (µg/L), a calculated CV of 3.739, and an assumed four samples per month. The resulting MDL is 98 µg/L and AML is 29 µg/L. The following steps were conducted for calculation of the MDL and AML per Section 5.4 (Permit Limit Derivation) of the EPA Technical Support Document and DEC's *RPA/WQBEL Guidance.*

- **Determine $\boldsymbol{LTA_s}$**: the LTAs are calculated as follows:

$$LTA_a = WLA * [\exp(0.5\sigma^2 - Z_{99}\sigma)], where\ \sigma^2 = \ln(CV^2 + 1)$$

$$WLA = 97.5\frac{\mu g}{L}, CV = 3.739, Z_{99} = 2.326, \sigma = 1.645\ and\ \sigma^2 = 2.707$$

$$\boldsymbol{LTA_a} = 8.22\ \mu g/L$$

$$LTA_c = WLA * [\exp(0.5\sigma_4^2 - Z_{99}\sigma_4)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA = 118.1\ \ \mu g/L, CV = 3.739, Z_{99} = 2.326, \sigma_4 = 1.226, and\ \sigma_4^2 = 1.503$$

$$\boldsymbol{LTA_c} = 14.46\ \ \mu g/L$$

- $\boldsymbol{Determine\ the\ most\ limiting\ (lowest) LTA}$

$$\boldsymbol{LTA_a}\ is\ the\ most\ limiting = 8.22\ \ \mu g/L$$

- **Calculate the MDL and AML**

$$\boldsymbol{MDL = LTA_a}[exp(Z_{99}\sigma - 0.5\sigma^2)], where\ \sigma^2 = ln(CV^2 + 1)$$

$$CV = 3.739, Z_{99} = 2.326, \sigma = 1.645\ and\ \sigma^2 = 2.707$$

$$\boldsymbol{MDL = 97.5\ \mu g/L}$$

$$\boldsymbol{Round\ up\ to\ 98.0\ \mu g/L}$$

$$AML = LTA_a\ [\exp(Z_{95}\sigma_4 - 0.5\sigma_4^2)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)]$$

$$CV = 3.739, Z_{95} = 1.645, \sigma_4 = 1.226, and\ \sigma_4^2 = 1.503$$

$$\boldsymbol{AML = 29.13\ \mu g/L}$$

$$\boldsymbol{Round\ down\ to\ 29.0\ \mu g/L}$$

B.2.4.3 *Temperature Difference (ΔT) Outfall 002*

The RPA revealed that temperature (ΔT) at Outfall 002 has reasonable potential to exceed water quality criteria at the boundary of the chronic mixing zone requiring development of WQBELs. Similar to Outfall 001, only an MDL will be developed based on the LTAc. In addition, an MEC of 10.2 degrees Celsius (°C), a calculated CV of 1.133 and an assumed four samples per month are used in the WQBEL derivation. The following steps were conducted per Section 5.4 (Permit Limit Derivation) of the EPA *Technical Support Document* and the DEC *RPA/WQBEL Guidance* resulting in an MDL of 19.0 °C.

- **Determine $\boldsymbol{LTA_c}$**: the LTA_c was calculated as follows:

$$LTA_c = WLA * [\exp(0.5\hat{\sigma}_4^2) - Z_{99}\hat{\sigma}_4)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA = 10.0\ °C, CV = 1.133, Z_{99} = 2.326, \sigma_4 = 0.5276\ and\ \sigma_4^2 = 0.2783$$

$$\boldsymbol{LTA_c} = 3.37\ °C$$

- **Calculate the $\boldsymbol{MDL}$**:

$$MDL = LTA_c\ [\exp(Z_{99}\sigma - 0.5\sigma^2)], where\ \sigma^2 = \ln(CV^2 + 1)]$$

$$CV = 1.133, Z_{99} = 2.326, \sigma = 0.9087, and\ \sigma^2 = 0.8258$$

$$\boldsymbol{MDL = 18.5\ °C}$$

$$\boldsymbol{Round\ up\ to\ 19.0\ °C}$$

APPENDIX C. REASONABLE POTENTIAL DETERMINATION

The Alaska Department of Environmental Conservation (Department or DEC) determined if the permitted discharge has reasonable potential (RP) to cause or contribute to a violation of Alaska Water Quality Standards (WQS) in accordance with the Environmental Protection Agency (EPA) *Technical Support Document for Water Quality-Based Toxics Control, 1991 (Technical Support Document)* and the *DEC Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)*

The Department determines RP by comparing the maximum projected receiving water concentration at the boundary of the acute or chronic mixing zone boundary to the water quality criteria for each pollutant of concern (POC). RP to exceed exists if the projected receiving waterbody concentration at the boundary of the respective mixing zone exceeds the applicable criteria for the POC and a water quality-based effluent limit (WQBEL) must be included in the permit per 18 AAC 83.435. By procedure, DEC does not authorize more dilution than that required to meet water quality criteria for the POC(s) requiring the most dilution in the mixing zone (driving parameters). Hence, the driving parameters for mixing zones will have RP and, subsequently, a WQBEL.

This Appendix discusses how the maximum projected receiving waterbody concentrations were determined for these discharges to marine waters and summarizes the calculations. To illustrate the procedures, calculations for TRC and temperature for Outfall 001, and temperature for Outfall 002 follow.

C.1 MASS BALANCE

Normally, for a discharge of a parameter at the MEC into a marine receiving environment with a known ambient water concentration (AWC), the projected RWC is determined using a steady state model represented by the following mass balance equation:

$$(V_{MEC} + V_{AWC})RWC = V_{MEC} * MEC + V_{AWC} * AWC \qquad \text{(Equation C-1)}$$

where,

RWC = Receiving waterbody concentration downstream of the effluent discharge.

MEC = Maximum projected effluent concentration (or MET)

AWC = Ambient waterbody concentration, taken as the 85th percentile of data or 15 percent of the chronic criteria if no ambient data is available.

V_{MEC} = Volume of the maximum expected effluent discharged into the control volume.

V_{AWC} = Volume of the ambient receiving water in the control volume.

Definition:

$$\text{Dilution Factor (DF)}, DF = \frac{V_{MEC}+V_{AWC}}{V_M} \qquad \text{(Equation C-2)}$$

Upon separating variables in Equation C-1 and substituting Equation C-2 yields:

$$DF = \frac{(MEC - AWC)}{(RWC - AWC)} \qquad \text{(Equation C-3a)}$$

The preceding equation provides the dilution factor achieved at the boundary of the mixing zone if based on the MEC. To determine the dilution factor required to meet water quality criteria at the boundary, the water quality criteria (WQC) is substituted for RWC in Equation C-3a. However, for temperature Equation C-3a is not directly applicable in the same manner because the marine water quality criteria for temperature is in reference to the instantaneous ambient receiving water temperature; the increase above ambient cannot be more than 1 °C (i.e., WQC = AWC +1). By making substitutions and using the descriptor "ΔT" for temperature instead of "C" for concentration, Equation C-3a can be rewritten to:

$$DF = \frac{(ME\Delta T - AWT)}{[(AWT + 1) - AWT]}$$

Simplifying…

$$DF = ME\Delta T \qquad \text{(Equation C-3b)}$$

Where:

$$ME\Delta T = \text{Maximum Effluent Temperature} - \text{Ambient Receiving Water Temperature}$$

Rearranging Equation C-3a to solve for RWC yields:

$$RWC = \frac{(MEC - AWC)}{DF} + AWC \qquad \text{(Equation C-4a)}$$

In the case of temperature, Equation C-4 simplifies to the following equation:

$$RWC = \frac{ME\Delta T}{DF} + 1 \qquad \text{(Equation C-4b)}$$

C.2 MAXIMUM PROJECTED EFFLUENT CONCENTRATION

To calculate the MEC (or MEΔT) per the *RPA/WQBEL Guidance*, the Department uses modified procedures from the *Technical Support Document* Section 3.3. Specifically, DEC uses a 95th confidence interval with a 99th percentile to determine a reasonable potential multiplier (RPM). In addition, DEC evaluates the distribution of the data set using EPA's *ProUCL Statistical Software Program, Version 4.1 (ProUCL)* rather than assuming a lognormal distribution as described in portions of the *Technical Support Document* for calculating and applying the coefficient of variation (CV) in derivation equations. The possible statistical distributions include lognormal, normal, gamma, or non-parametric. In addition, *ProUCL* has the ability to impute data below detection levels to improve statistical analysis of the underlying distribution and statistical parameters used in the *RPA/WQBEL Guidance*.

The RPM is calculated differently depending on the type of distribution, CV of the data, and the number of data points. When fewer than 10 data points are available, the *RPA/WQBEL Guidance* assumes the CV = 0.6, a conservative estimate that assumes a relatively high variability. The CV is defined as the ratio of the sample standard deviation of the data set to the sample mean.

$$CV = coefficient\ of\ variation = \frac{standard\ deviation}{mean}$$

For data sets with a normal or gamma distributions or analyzed by a non-parametric method (Kaplan-Meier):

$$CV = \frac{\hat{\sigma}_y}{\hat{\mu}_y} \qquad \text{(Equation C-5)}$$

Where: $\hat{\mu}_y = estimated\ mean = \frac{\Sigma[x_i]}{k}, 1 \leq i \leq k$

$\hat{\sigma}_y^2 = estimated\ variance = \Sigma\frac{[(x_i - \mu)^2]}{k-1}, 1 \leq i \leq k$

$\hat{\sigma}_y = estimated\ standard\ deviation = (\sigma^2)^{0.5}$

$k = number\ of\ samples$

For data sets with a lognormal or log-ROS distribution:

$CV = [\exp(\hat{\sigma}_y^2) - 1]^{0.5}\ or\ \hat{\sigma}_y^2 = \ln(CV^2 + 1)$

Where: $y_i = \ln(x_i)\ for\ i = 1,2, \ldots, k$

$\hat{\mu}_y = mean = \Sigma(y_i)/k$

$\hat{\sigma}_y^2 = variance = \Sigma[(y_i - \hat{\mu}_y)^2]/(k-1)$

$k = number\ of\ samples$

The RPM is the ratio of the upper bound of the distribution at the 99th percentile to the percentile represented by the maximum observed concentration (MOC), at the 95% confidence level. The general equation C-7 is expanded using equations C-8 and C-9 or C-10 and C-11 for data with a lognormal distribution or normal distribution as follows:

$$RPM = \frac{C_{99}}{C_{pn}} \qquad \text{(Equation C-7)}$$

$$C_{99} = \exp[(Z_{99} * \hat{\sigma}_y) - (0.5 * \hat{\sigma}_y^2)] \qquad \text{(Equation C-8)}$$

$$C_{pn} = \exp[(Z_{p_n} * \hat{\sigma}_y) - (0.5 * \hat{\sigma}_y^2)] \qquad \text{(Equation C-9)}$$

In the case of data displaying normal or no discernable distribution, equations for C_{99} and C_{Pn} become:

$$C_{99} = \hat{\mu}_n + Z_{99} * \hat{\sigma} \qquad \text{(Equation C-10)}$$

$$C_{p_n} = \hat{\mu}_n + Z_{pn} * \hat{\sigma} \qquad \text{(Equation C-11)}$$

In all Equations C-9 and C-11, the percentile represented by the MOC is:

$$p_n = (1 - confidence)^{1/n} \qquad \text{(Equation C-12)}$$

Where:

$p_n = the\ percentile\ represented\ by\ the\ MOC\ (or\ MO\Delta T)$

$n = the\ number\ of\ samples$

$$Confidence\ Level = 0.95\ for\ this\ analysis$$

Once the p_n is determined, ZP_n can be looked up in standard statistical tables or calculated using a spreadsheet equation (ZP_n = normsinv(P_n) and used in calculating the RPM. In the event that an RPM that is calculated equals less than one (1), the value calculated defaults to a value of one (1) per *RPA/WQBEL Guidance*. The MEC is determined by multiplying the MOC by the RPM to derive the MEC:

$$MEC = (RPM) * (MOC) \qquad \text{(Equation C-13a)}$$

Or for Temperature Differential: $$ME\Delta T = (RPM) * (MO\Delta T) \qquad \text{(Equation C-13b)}$$

If the RWC (acute or chronic) calculated by Equation C-4a or C-4b is found to exceed the respective criteria for the pollutant of concern, then reasonable potential exists for the parameter and a WQBEL must be developed for that parameter.

C.3 RPA CALCULATIONS FOR TOTAL RESIDUAL CHLORINE – OUTFALL 001

The mixing zone analysis identified TRC as the driving parameter for the acute mixing zone. The Department authorizes an acute mixing zone with a DF of 7.5 and a chronic mixing zone with a DF of 15.75. The following calculations demonstrates TRC has reasonable potential to exceed, or contribute to an exceedance, at the boundary of the acute mixing zone.

Number of effluent data (n) = 476
MOC = 99.6 µg/L

The data was found to have a LogROS distribution with the following imputed statistical parameters:

$\hat{\mu}_n = 0.00345, and,$

$\hat{\sigma} = 0.0129$

Therefore, $CV = 3.379, \hat{\sigma}_y^2 = 2.707,\ and\ \hat{\sigma}_y = 1.645$

For a data set containing 476 TRC samples:

$p_n = (1 - 0.95)^{1/476}$

$p_n = 0.994$

Therefore, $Z_{99.4} = 2.4964\ for\ the\ 99.4\ percentile\ (Calculated\ with\ Excel\ Spreadsheet), and$

$$Z_{99} = 2.326\ for\ the\ 99\ percentile\ (Calculated\ with\ Excel\ Spreadsheet)$$

Because the data was found have a LogROS distribution, the following equation applies to the RPM calculation per the *RPA/WQBEL Guidance.*

$$RPM = \frac{\exp[(Z_{99} * \hat{\sigma}_y) - (0.5 * \hat{\sigma}_y^2)]}{\exp[(Z_{p_n} * \hat{\sigma}_y) - (0.5 * \hat{\sigma}_y^2)]}$$

$Substituting\ the\ values\ becomes$::

$$RPM = \frac{\exp[(2.326 * 1.645) - (0.5 * 2.707)]}{\exp[(2.496 * 1.645) - (0.5 * 2.707)]}$$

$\boldsymbol{RPM = 0.756}$: $Therefore\ use\ the\ minimum\ RPM\ value = 1.0\ per\ the\ RPA/WQBELGuide.$

Using Equation C-13a for acute and chronic TRC,

$MEC = \left(1.0 * 99.6\frac{\mu g}{L}\right) = 1.2\ \mu g/L\ (maximum\ projected\ effluent\ concentration).$

$AWC = 0$

$For\ DF_{acute} = 7.5$

$$RWC_{acute} = \frac{99.6\ \mu g/L - 0\ \mu g/L}{7.5} + 0\ \mu g/L = 13.28\ \mu g/L$$

$For\ DF_{chronic} = 15.75$

$$RWC_{chronic} = \frac{99.6\ \mu g/L - 0\ \mu g/L}{15.75} + 0\frac{\mu g}{L} = 6.324\ \mu g/L$$

The RWC at the boundary of the chronic mixing zone is less than the water quality criteria 7.5 µg/L so there is no chronic RP. However, the RWC for TRC at the boundary of the acute mixing zone is above the acute water quality criteria of 13 µg/L. Therefore, TRC must have a WQBEL in the Permit.

C.4 RPA CALCULATIONS FOR TEMPERATURE DIFFERENTIAL (ΔT) OUTFALL 001

The mixing zone analysis identified ΔT as the driving parameter for the chronic mixing zone resulting in the Department authorizing a chronic mixing zone with DF of 15.75. The following calculations demonstrate that ΔT has reasonable potential to exceed, or contribute to an exceedance, of temperature criteria at the boundary of the chronic mixing. Note that there is no acute temperature criteria and because the temperature differential is being evaluated, the applicable chronic criteria at the boundary of the chronic mixing zone is 1 degree Celsius (°C).

Number of effluent data (n) = 1625
MOΔT = 15.9 °C

The data was found to have a non-discernable distribution but was deemed to be closest to lognormal with

$\hat{\mu}_n = 5.056, and$
$\hat{\sigma} = 1.59$

Therefore, $CV = 0.3145, \hat{\sigma}_y^2 = 0.094,\ and\ \hat{\sigma}_y\ = 0.307$

For a data set containing 1625 ΔT samples:

$p_n = (1 - 0.95)^{1/1625}$
$p_n = 0.9982$

Therefore, $Z_{99.82} = 2.904\ for\ the\ 99.82\ percentile\ (Calculated\ with\ Excel\ Spreadsheet), and$

$Z_{99} = 2.326\ for\ the\ 99\ percentile\ (Calculated\ with\ Excel\ Spreadsheet)$

Because the data was deemed to have a lognormal distribution, the following equation applies to the RPM calculation per the *RPA/WQBEL Guidance*.

$$RPM = \frac{\exp(Z_{99}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}{\exp(Z_{p_n}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}$$

$Substituting\ values\ the\ equation\ becomes$:

$$RPM = \frac{\exp[(2.326 * 0.307) - (0.5 * 0.0904)]}{\exp[(2.904 * 0.307) - (0.5 * 0.0904)]}$$

$\boldsymbol{RPM = 0.837}$: $Therefore\ use\ the\ minimum\ RPM\ value = 1.0\ per\ the\ RPA/WQBELGuide.$

Using Equation C-13b for MEΔT,

$ME\Delta T = (1.0)(15.9\ °C) = 15.9\ °C\ (maximum\ projected\ effluent\ concentration),$

$For\ DF_{chronic} = 15.75$

$$RWC_{chronic} = \frac{15.9\ °C}{15.75} = 1.010\ °C$$

Because the RWC for ΔT at the boundary of the chronic mixing zone is above 1°C, the Permit must have a WQBEL for ΔT for Outfall 001.

C.5 RPA CALCULATIONS FOR TEMPERATURE DIFFERENTIAL (ΔT) OUTFALL 002)

The mixing zone analysis identified ΔT as the driving parameter for the chronic mixing zone resulting in the Department authorizing a chronic mixing zone with DF of 10.0. The following calculations demonstrate that ΔT has reasonable potential to exceed, or contribute to an exceedance, of temperature criteria at the boundary of the chronic mixing. Note that there is no acute temperature criteria and because the temperature differential is being evaluated, the applicable chronic criteria at the boundary of the chronic mixing zone is 1 °C.

Number of effluent data (n) = 1745
MOΔT = 10.2 °C

The data was found to have a non-discernable distribution but was closest to lognormal with statistical parameters:

$\hat{\mu}_n = 1.063, and$
$\hat{\sigma} = 1.204$

Therefore, $CV = 1.133, \hat{\sigma}_y^2 = 0.8254,\ and\ \hat{\sigma}_y\ = 0.909$

For a data set containing 1745 ΔT samples:

$p_n = (1 - 0.95)^{1/1745}$
$p_n = 0.9983$

Therefore, $Z_{99.82} = 2.926\ for\ the\ 99.83\ percentile\ (Calculated\ with\ Excel\ Spreadsheet), and$

$Z_{99} = 2.326\ for\ the\ 99\ percentile\ (Calculated\ with\ Excel\ Spreadsheet)$

Because the data was deemed to have a lognormal distribution, the following equation applies to the RPM calculation per the *RPA/WQBEL Guidance*.

$$RPM = \frac{\exp(Z_{99}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}{\exp(Z_{p_n}\hat{\sigma}_y - 0.5\hat{\sigma}_y^2)}$$

$Substituting\ values\ the\ equation\ becomes$:

$$RPM = \frac{\exp[(2.326 * 0.909) - (0.5 * 0.8254)]}{\exp[(2.926 * 0.909) - (0.5 * 0.8254)]}$$

$\boldsymbol{RPM = 0.58}$: $Therefore\ use\ the\ minimum\ RPM\ value = 1.0\ per\ the\ RPA/WQBELGuide.$

Using Equation C-13b for MEΔT,

$ME\Delta T = (1.0)(10.2\ °C) = 10.2\ °C\ (maximum\ projected\ effluent\ concentration),$

$For\ DF_{chronic} = 10.0$:

$$RWC_{chronic} = \frac{10.2\ °C}{10.0} = 1.020\ °C$$

Because the RWC for ΔT at the boundary of the chronic mixing zone is above 1°C, the Permit must have a WQBEL for ΔT for Outfall 002.

MIXING ZONE ANALYSIS CHECKLIST

Mixing Zone Authorization Checklist

based on Alaska Water Quality Standards (2003)

The purpose of the Mixing Zone Checklist is to guide the permit writer through the mixing zone regulatory requirements to determine if all the mixing zone criteria presented in the Alaska Administrative Code (AAC) at 18 AAC 70.240 through 18 AAC 70.270 are satisfied, as well as provide justification to authorize a mixing zone in an Alaska Pollution Discharge Elimination System permit. In order to authorize a mixing zone, all criteria must be met. The permit writer must document all conclusions in the permit Fact Sheet. However, if the permit writer determines that one criterion cannot be met, then a mixing zone is prohibited, and the permit writer need not include in the Fact Sheet the conclusions for when other criteria were met.

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Size	Is the mixing zone as small as practicable? - Applicant collects and submits water quality ambient data for the discharge and receiving waterbody (e.g. flow and flushing rates)	Yes •Technical Support Document for Water Quality Based Toxics Control •Water Quality Standards Handbook • DEC's RPA Guidance • EPA Permit Writers' Manual Fact Sheet Section 3.3	18 AAC 70.240 (a)(2) 18 AAC 70.245 (b)(1) - (b)(7) 18 AAC 70.255(e) (3) 18 AAC 70.255 (d)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Technology	Were the most effective technological and economical methods used to disperse, treat, remove, and reduce pollutants? **If yes**, describe methods used in Fact Sheet at Section 3.3. Mixing Zone Analysis. Attach additional documents if necessary.	Yes Fact Sheet Section 3.3.2	18 AAC 70.240 (a)(3)	Y
Low Flow Design	**For river, streams, and other flowing fresh waters.** - Determine low flow calculations or documentation for the applicable parameters. Justify in Fact Sheet	N/A – Marine Discharge	18 AAC 70.255(f)	
Existing use	Does the mixing zone…			
	(1) partially or completely eliminate an existing use of the waterbody outside the mixing zone? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.3	18 AAC 70.245(a)(1)	Y
	(2) impair overall biological integrity of the waterbody? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.3	18 AAC 70.245(a)(2)	Y
	(3) provide for adequate flushing of the waterbody to ensure full protection of uses of the waterbody outside the proposed mixing zone? **If no, then mixing zone prohibited.**	Yes Fact Sheet Section 3.3.3	18 AAC 70.250(a)(3)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
	(4) cause an environmental effect or damage to the ecosystem that the Department considers to be so adverse that a mixing zone is not appropriate? **If yes, then mixing zone prohibited.**	No Fact Sheet Section 3.3.3	18 AAC 70.250(a)(4)	Y
Human consumption	Does the mixing zone…			
	(1) produce objectionable color, taste, or odor in aquatic resources harvested for human consumption? **If yes, mixing zone may be reduced in size or prohibited.**	No Fact Sheet Section 3.3.4	18 AAC 70.250(b)(2)	Y
	(2) preclude or limit established processing activities of commercial, sport, personal use, or subsistence shellfish harvesting? **If yes, mixing zone may be reduced in size or prohibited.**	No Fact Sheet Section 3.3.4	18 AAC 70.250(b)(3)	Y
Spawning Areas	Does the mixing zone…			
	(1) discharge in a spawning area for anadromous fish or Arctic grayling, northern pike, rainbow trout, lake trout, brook trout, cutthroat trout, whitefish, sheefish, Arctic char (Dolly Varden), burbot, and landlocked coho, king, and sockeye salmon? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.5	18 AAC 70.255 (h)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Human Health	Does the mixing zone…			
	(1) contain bioaccumulating, bioconcentrating, or persistent chemical above natural or significantly adverse levels? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6	18 AAC 70.250 (a)(1)	Y
	(2) contain chemicals expected to cause carcinogenic, mutagenic, tetragenic, or otherwise harmful effects to human health? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6		Y
	(3) Create a public health hazard through encroachment on water supply or through contact recreation? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6	18 AAC 70.250(a)(1)(C)	Y
	(4) meet human health and aquatic life quality criteria at the boundary of the mixing zone? **If no, mixing zone prohibited.**	Yes Fact Sheet Section 3.3.6	18 AAC 70.255 (b),(c)	Y
	(5) occur in a location where the Department determines that a public health hazard reasonably could be expected? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6	18 AAC 70.255(e)(3)(B)	Y
Aquatic Life	Does the mixing zone…			

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
	(1) create a significant adverse effect to anadromous, resident, or shellfish spawning or rearing? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.250(a)(2)(A-C)	Y
	(2) form a barrier to migratory species? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7		Y
	(3) fail to provide a zone of passage? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7		Y
	(4) result in undesirable or nuisance aquatic life? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.250(b)(1)	Y
	(5) result in permanent or irreparable displacement of indigenous organisms? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.255(g)(1)	Y
	(6) result in a reduction in fish or shellfish population levels? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.255(g)(2)	Y
	(7) prevent lethality to passing organisms by reducing the size of the acute zone? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.255(b)(1)	Y
	(8) cause a toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.7	18 AAC 70.255(b)(2)	Y

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Endangered Species	Are there threatened or endangered (T/E species) at the location of the mixing zone?If yes, are there likely to be adverse effects to T/E species based on comments received from United States Fish & Wildlife Service or National Oceanic & Atmospheric Administration. If yes, will conservation measures be included in the permit to avoid adverse effects? **If yes, explain conservation measures in Fact Sheet. If no, mixing zone prohibited.**	Fact Sheet Section 3.3.8 and Section 8.0	Program Description, 6.4.1 #5, 18 AAC 70.250(a)(2)(D)	Y