Pebble EIS Draft Water and Sediment Quality Sections
EPA Comments
12/21/18

The EPA appreciates the opportunity, as a cooperating agency, to provide you with these comments on the preliminary draft Water and Sediment Quality Sections 3.18, K3.18, 4.18, and K4.18 (November 2018 review draft) of the Pebble EIS. Our comments are provided in table format below. Our public comments on the Draft EIS may include additional concerns or recommendations. These interagency comments or portions thereof may be protected by the deliberative process privilege.

Page	Section	Existing text (if applicable)	Recommendation
	3.18 and 4.18	General comment on baseline data, analysis area, and modeling.	The baseline studies are summarized in this section and in Appendix K3.18. We have the following overall recommendations related to section 3.18 and 4.18: (1) Clearly define the area of analysis for the baseline studies and impact analysis for this resource for all project components and alternatives; and (2) As recommended in our previous comments submitted to the Corps on 7/5/2018, please describe whether there are data gaps with the existing baseline studies for the proposed action and alternatives. If there are gaps, we recommend discussing whether there will be additional monitoring and when it will be included in the EIS. If no additional monitoring is planned, then describe the extent to which any data gaps affect characterization of the affected environment (section 3.18) and the impact analysis (section 4.18).
3.18-2	3.18.1.1	Samples for geochemical testing were selected from the numerous exploration cores drilled to outline the deposit. A summary of the geochemical testing program is provided in Table K3.18-2.	Per our previous comments submitted to the Corps on 7/5/2018, we continue to recommend that quantitative information be provided to show that the samples used for geochemical testing are representative of the composition of the waste rock and tailings materials. For example, information on the % of each ore type and then the % of samples that were used to characterize each ore type can be added to Table K3.18-2. In general, the number of samples used in the characterization should be similar to the % abundance of the particular ore-type.

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			There may be an exception for materials suspected to have more ARD/ML capacity, which may be assessed in a higher proportion than its abundance. Disclosure of this information is important to demonstrate the representativeness of the tested materials that are the basis for water quality predictions.
3.18-2	3.18.1.1	In addition, almost 60 tailings samples, comprised mostly of angular, pyritic, and gold plant tailings, from test processing of ore composites have also been characterized	Information should be provided on the % of the 60 samples from each of these types of materials. We also recommend this information be compared to the predicted abundance of these types of materials in the tailings.
3.18-3	3.18.1.1	[Acid-base accounting] testing has determined that the pre-Tertiary mineralized sedimentary and plutonic rocks at the proposed mine site are predominantly potentially acid generating.	We recommend including information on specifically how PAG is being defined and the basis for the PAG criteria. For example, samples are considered PAG when >X% pyrite, X% sulfur, and % NP.
3.18-3	3.18.1.1	The ABA and humidity cell data indicate that PAG and non-PAG rocks can be distinguished using an NP/AP ratio of 1.4 (SRK 2011a), and are applicable to pre-Tertiary, Tertiary, and overburden materials.	SRK 2011a provides a NP/AP ratio value of 1.6 on page 11-53. We recommend providing information in the DEIS to resolve this potential discrepancy and/or correcting anything that may be in error. In general, the distinction at other mine sites between PAG and non-PAG are often much more conservative, with non-PAG material having ratios of >3 or 4. We recommend that the DEIS include information acknowledging that NP/AP ratios for other sites are much higher than 1.4 and, per our previous comments submitted to the Corps on 7/5/2018, provide a description of how the 1.4 value was determined to be sufficient.
3.18-3	3.18.1.1	SRK 2011a	This SRK document provides the foundation for much of the geochemical characterization of the site. In this document, the data is presented for the East and West zones of the project. In the current proposal, the focus is on the West zone. We recommend ensuring, and explaining in the DEIS, that all of the analysis in section 3.18 only uses data from West zone dataset within the SRK 2011a document, which is currently not

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			clear from the EIS text.
3.18-3	3.18.1.1	To develop an understanding of weathering and leaching processes that might affect rocks exposed during mining (e.g., pit walls and stockpiled waste rock and tailings), additional laboratory and field geochemical tests were conducted. Laboratory tests included humidity cell, subaqueous (saturated) column, stored bag, and field barrel tests	Multiple lines of evidence/analysis were used to address the same question regarding predicted impacts to water quality from mine materials. We recommend that the DEIS address the following questions (here or in the appendix): (1) Did the multiple types of samples (e.g. HCTs, barrel tests, etc.) all provide similar and consistent results, or are there notable differences; and (2) Of these different types of tests conducted, which of the tests were used for the purposes of predictive water quality modeling?
3.18-4	3.18.1.1	Paste pH results for aged rock cores stored at the site suggest that acidification may be delayed up to 40 years.	We recommend providing additional data or a citation to support this statement.
3.18-4	3.18.1.1	Element release rates determined from kinetic tests were mainly a function of leachate pH rather than the element content of the samples.	We recommend providing a reference or a description of the statistical test that was used to identify which co-variate (i.e. pH, elemental composition) had a larger influence on the resulting release rates. In addition, please clarify whether the release rates are based on whole water or filtered concentrations of metals.
3.18-4	3.18.1.1	The ARD potential for the bulk tailings is lower than that of mineralized rock because most of the sulfur is removed to recover the economic minerals and separate out the pyritic tails while concentrating neutralizing minerals in the bulk tailings.	We recommend that the DEIS address the issue of grain size in this statement. While the sulfur content would be lower in the tailings, the grain size would also be much smaller and may result in an increase in ARD compared to a scenario where only sulfur content is considered.
3.18-4	3.18.1.1	Element leaching from the rougher tailings occurred at low rates, and unfiltered process supernatants were found to contain low levels of potential constituents relative to water quality standards.	For mercury (Hg), the applicable water quality criteria is 12 ng/L (see K3.18 Table 1); however much if not all of the analysis performed in SRK 2011a had detection limits for Hg between 50 and 100 ng/L. As such, there is no relevant information with regard to Hg concentrations as compared to water quality standards. We recommend that the DEIS discuss the mercury detection limits used in the SRK testing in comparison to the State of Alaska water quality standards. We recommend that it also discuss whether adequate information is available in order to determine the extent to which mercury

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			would leach from the tailings, given the reported high mercury detection limits. We note that later in the document, water quality predictions are shown to exceed WQS for Hg in several instances. Please clarify whether this is a function of using the reporting limit in the calculations in lieu of having actual concentration data. The EPA also recommends that an explanation of how these values were calculated be included in the DEIS.
3.18-4	3.18.1.1	However, for some elements (e.g., arsenic, molybdenum, and selenium), release can be environmentally significant under neutral pH conditions.	This statement provides very important information, particularly because later in the document it discusses sorting material differently depending on whether it is PAG or NAG. Per our previous comments submitted to the Corps, for the NAG materials, we continue to recommend that the DEIS provide a list of all the elements that can be released at significant concentrations under neutral pH conditions, instead of providing an example of three elements. Furthermore, we recommend providing additional information on which NAG materials have the potential to release these elements.
3.18-7	3.18.1.2	Higher concentrations of copper, molybdenum, nickel, zinc, and sulfate were present in SFK than in NFK, consistent with SFK's proximity to the Pebble deposit area	We recommend providing a description of the statistical test used to make this determination and the associated p-value for each constituent.
3.18-7	3.18.1.2	Total dissolved solids (TDS), pH, sodium, alkalinity, hardness, nitrogen (nitrate+nitrite), and nickel concentrations were greatest in the UTC drainage.	We recommend providing a description of the statistical test used to make this determination and the associated p-value for each constituent.
3.18-7	3.18.1.2	TSS, potassium, chloride, iron, and arsenic concentrations were highest in KC, while cadmium and lead concentrations were highest in the NFK drainage	We recommend providing a description of the statistical test used to make this determination and the associated p-value for each constituent.
3.18-7	3.18.1.2	Alkalinity was the parameter that was most frequently detected outside the range of the most stringent ADEC criterion. In all, 43 percent of all surface water samples were below this value.	We recommend that the text specify that the alkalinity criterion is a minimum.
3.18-11	3.18.1.3	mean concentrations of trace elements above the most stringent ADEC water quality maximum criteria for several constituents	We recommend that the DEIS specify whether these constituents were analyzed for whole water (total

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		(aluminum, copper, iron, lead, and manganese).	recoverable metals) or dissolved metals.
3.18-16	3.18.2.1	However, only a few ions (copper, lead, aluminum, iron, manganese, and alkalinity) had concentrations outside benchmarks established by ADEC for freshwater.	We recommend that this text be revised to clarify that DEC establishes water quality standards rather than benchmarks.
3.18-16	3.18.2.1	Past water system violations in these communities reported by ADEC (between 1995 and 2018) are mostly monitoring violations that represent failure to collect a sample. Water quality constituent exceedances are rare and have included coliform, iron, manganese, arsenic, lead and copper (ADEC 2018).	We recommend that the DEIS clarify whether the exceedances were only of the drinking water standards, or whether there were also exceedances of surface water standards for each of these parameters.
3.18-20	3.18.2.3	Of 12 pond substrate samples analyzed by NURE within approximately 20 miles of the mine access road, none showed evidence of contamination (Grossman 1998).	We recommend including what parameters (e.g. metals, hydrocarbons) were analyzed by NURE.
3.18-21	3.18.3.1	More than 10 percent of the basin is covered by glaciers, and suspended sediment loading in glacier-fed rivers without lakes is significant, leading to generally high suspended sediment load in some portions of Cook Inlet.	We recommend that the DEIS clarify that the portions of Cook Inlet affected by glacier fed streams is in the upper Inlet and not in the vicinity of the project area.
3.18-22	3.18.3.1	Inorganics analyzed in both surface water and bottom water at a depth of about 50 ft in northern Kamishak Bay (Hart Crowser 2015: Table 34-8, Station MRC20) showed that none exceeded National Recommended Water Quality Criteria (USEPA 2009).	We recommend that the comparison of constituents in both surface and bottom water be made to the numeric criteria in the State of Alaska WQS, and that the EPA National Recommended Water Quality Criteria be used as a starting guideline if a constituent is absent from the Alaska WQS.
3.18-23	3.18.3.3	A combination of shallow water, high tidal fluctuations, and strong currents constantly mobilize seafloor sediments in the inlet, keeping sediments in suspension, resulting in highly turbid water, and inhibiting deposition of fine-grained sediments (Rember and Trefry 2005). Fine sediments introduced by major rivers feeding into upper Cook Inlet are carried in suspension and have been shown to be deposited as far as 150 miles south in lower Cook Inlet (ADL 2001).	We recommend review of *Distribution of Hydrocarbons and Microbial Populations Related to Sedimentation Processes in Lower Cook Inlet and Norton Sound, Alaska* (Atlas et.al, 1983), which indicates that Kamishak Bay is a depositional area with natural inputs of hydrocarbons that are not mentioned in this text. This is also discussed in the 2000 MMS Final Report entitled *Sediment Quality in Depositional Areas of Shelikof Strait and Outermost Cook Inlet*.
3.18-23	3.18.3.3	Sampling of offshore sediment has been conducted at two locations near the Amakdedori port site.	We recommend review of Cook Inlet sediment sampling documented in the *Final Report: Produced Water Discharge Fate and Transport in Cook Inlet, 2008-*

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			2009 (Kinnetic Laboratories 2010), which might provide additional information.
3.18-24	3.18.4.3	Water depths in the center of Cook Inlet range from about 50 to over 500 feet (NOAA nautical chart #16660). Numerous oil and natural gas pipelines currently span the bottom of Cook Inlet.	We recommend that the DEIS clarify that all of the current pipelines are in the upper Inlet and none are in the vicinity of the proposed project.
K3.18-2	Table K3.18-1		We recommend including the basis for the sediment standards here rather than waiting until later in the document.
K3.18-3	Table K3.18-1	Alkalinity | µg/L | > = 20,000	We recommend clarification regarding whether alkalinity is the same as Alkalinity as $CaCO_3$ that is listed further down in the table.
K3.18-3	Table K3.18-1	Hardness (as CaCO3) | mg/L | ~=100	We recommend clarifying that there is no criterion for hardness in the State of Alaska WQS.
K3.18-3	Table K3.18-1	Alkalinity as CaCO3 | mg/L | 20	If this is the same alkalinity as is referenced in the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances,* please clarify that this criterion is a minimum.
K3.18-3	Table K3.18-1	Total ammonia as N | mg/L | 0.18	We recommend including the pH and temperature values used in the equation to calculate this criterion.
K3.18-3	Table K3.18-1	Comment related to temperature criterion	We recommend including the appropriate criterion for temperature in this table.
K3.18-3	Table K3.18-1 footnote a	Water quality limits are based on the lowest 15th percentile hardness of the three proposed discharge locations.	We recommend clarifying the actual value (back calculating reveals at least three different values were used to determine the table values for the hardness-based criteria) and whether it is the 15^{th} percentile of all the hardness measures or the lowest of the 15^{th} percentile of each of the three data sets.
K3.18-4	K3.18.1.2	discharge of non-domestic wastewater to groundwater	We recommend also including the discharge of domestic wastewater to groundwater in this sentence.
K3.18-5	K3.18.2	These data were developed using representative overburden, rock cores, and metallurgical waste (tailings) samples from the Pebble east and west zones (PEZ and PWZ), and rock core samples from borings drilled in three proposed construction rock quarry areas	Per our comment on section 3.18.1.1, because the proposed action is for the West zone, we recommend that the analysis include data from the West zone only. We also recommend clearly describing how the data used are representative of the project.
K3.1	K3.18.2	Table K3.18-2	The grouping of materials into just two

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8-5			general categories (tertiary and pre-tertiary) is overly broad. Instead, we recommend that further distinctions be made, such as sedimentary and volcanic origins as well as other information on the rock type. Such information is necessary to provide an understanding of the representativeness of the types of ore at the site in relation to the geochemical characterization of the materials. In SRK 2011a, there is a much more complete partitioning of the data into different rock types. We recommend following a similar approach here in showing that the samples collected are representative of the abundance of the different rock types.
K3.1 8-5	K3.18.2	These data were developed using representative overburden, rock cores, and metallurgical waste (tailings) samples from the Pebble east and west zones (PEZ and PWZ), and rock core samples from borings drilled in three proposed construction rock quarry areas.	We recommend including a quantitative assessment showing that the samples are representative.
K3.1 8-6	K3.18.2 .1	As of 2018, the program had included analysis of over 1,000 rock samples from the Pebble deposit, and 26 samples of overburden materials. In addition, almost 60 tailings samples comprised mostly of rougher, cleaner scavenger, pyritic, and gold plant tails, from test processing of ore composites have also been characterized.	As noted above, we recommend specifying whether these numbers include data from the East and West zones or only from the West zone. Per our comment on section 3.18.1.1, because the proposed action is for the West zone, we recommend that the analysis includes data from the West zone only.
K3.1 8-6	K3.18.2 .1	This included ABA using the modified Sobek et al. (1978) method on more than 1,000 rock samples collected from drill holes blanketing the proposed mine area	As noted above, we recommend specifying whether these numbers include data from the East and West zones or only from the West zone. Per our comment on section 3.18.1.1, because the proposed action is for the west zone, we recommend that the analysis only use data from the west zone. See recommended edits above
K3.1 8-7	K3.18.2 .1	Humidity cell test data obtained for periods up to 8 years allow interpretation of long-term acid generation potential and neutralization rates as the rocks are oxidized and leached during wet and dry cycles	We recommend providing information in the DEIS on the minimum and average time periods under which the humidity cell tests were run, in addition to providing the maximum value of eight years, as it is likely that not all humidity cell tests were run for the entire time

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			period.
K3.18-7	K3.18.2.1	Element release rates determined from kinetic tests were mainly a function of leachate pH rather than the concentration of elements in the samples.	The impact of pH on release rates is clearly shown; however, it is not clear that variations in the pH from a given sample were more important in determining the final concentrations than variations in the metal concentrations in the ore/waste/tailings samples. We recommend providing information explaining this or a reference to where this analysis is provided.
K3.18-17	K3.18.2.2	A total of 59 tailings samples from concurrent metallurgical process test runs have been geochemically characterized	As noted above, we recommend specifying whether these numbers include data from the East and West zones or only from the West zone. Per our comment on section 3.18.1.1, because the proposed action is for the west zone, we recommend that the analysis include data from the West zone only. In addition, we recommend that the DEIS disclose whether the tailings were produced using the current proposed mineral processing approach.
K3.18-19	K3.18.2.2	Table K3.18-4	This table includes data from "Gold plant tails." We recommend that a footnote to this entry describe what is meant by this since the current project description does not have a gold plant tailings waste stream. As noted above, we recommend that the DEIS clearly describe whether the tailings used for testing are representative of the tailings to be created and managed as part of the proposed project.
K3.18-21	K3.18.3.1	Table K3.18-5. The results demonstrate that the quarry rock is dominated by unmineralized granodiorite, which would be geochemically suitable for use as construction fill due to its low metal leaching and ARD potential and is classified as non-PAG	Table K3.18-5 provides information on the concentrations of some elements in the samples. However, no information is provided to show that these materials have low leaching rates, and we recommend including this information in the DEIS.
K3.18-22	K3.18.3.1	This section contains baseline surface water data for parts of the project area that would be most affected by project activities.	Please provide a description of how the selected locations are considered representative or not representative of the surface water characteristics of this area. We also recommend including a discussion of whether samples were

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			collected during high flow or baseflow conditions and how that is expected to influence the results.
K3.1 8-22	Table K3.18-6	Water Temperature (^{o}C) | 347 | -0.30 - 19	Above, the EPA recommended the inclusion of the temperature criterion in Table 3.18-1 so that exceedances of the criterion could be documented in this Table. We note that the most stringent temperature criterion listed in 18 AAC 70.021(b)(10) is 13 ^{o}C.
K3.1 8-22	Table K3.18-6	Total Suspended Solids	We recommend that the document explain that there are no state WQS for TSS, as well as clarify the basis for any comparison to the observed values (exceedances are shown in Tables K.18-8).
K3.1 8-23	Table K3.18-6	Alkalinity, Total	Please clarify whether Total Alkalinity is the same parameter as Alkalinity or Alkalinity as $CaCO_3$ listed with criteria in Table K3.18-1. If not, please make sure that the DEIS clarifies the differences among the Alkalinity parameters.
K3.1 8-23	Table K3.18-6	Nitrate-Nitrite | 229 | 0.031 - 3.94	We recommend that the DEIS explain why Table K3.18-1 lists separate criteria for these two parameters, yet in K3.18-6 the criteria are lumped together. We also recommend clarifying why a value of 1.21 in Table K3.18-7 is highlighted as an exceedance but a value of 3.94 in Table K3.18-6 is not.
K3.1 8-24-25	Table K3.18-7		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.1 8-25	Table K3.18-8		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.1 8-28	Table K3.18-9		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.1 8-30	Table K3.18-9	Cadmium | 11 | 0 - 0 | 0.000018 Cyanide, Total | 11 | 0 - 0 | 0.00075	We recommend rechecking the calculations for cadmium and cyanide since the mean is greater than the maximum.
K3.1 8-31	Table K3.18-10		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.1 8-31	Table K3.18-10		We recommend clarifying whether the values shown as zeros or NA in this Table would actually be different if more

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			decimal places were used, as the other values for the same parameter would indicate. If that is the case, we recommend going out to additional decimal places as needed in order to disclose the values.
K3.18-33	Table K3.18-11		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.18-34	Table K3.18-11	Copper | 45 | 0.000198 | - | 0.001480 | **0.002680**	We recommend rechecking the calculations for copper since the mean is greater than the maximum.
K3.18-36	Table K3.18-12		We recommend that all tables use the same units of measure (this one uses µg/L while all others use mg/L) and further recommend that the units used be the same as which the WQS are expressed at 18 AAC 70.
K3.18-36	Table K3.18-12		See water temperature, alkalinity, nitrate-nitrite, and TSS comments above for Table K3.18-6.
K3.18-40	Table K3.18-12		The row for DOC in this Table is all blanks. We recommend that the DEIS clarify whether DOC was supposed to be measured but was not, or correct if this is an error.
K3.18-45	K3.18.4	The following baseline groundwater data tables are provided in this appendix	We recommend providing a map of the sample locations or a reference to where the map can be found, and a description of how the selected locations are considered representative or not representative of the groundwater characteristics of this area.
K3.18-54	K3.18.5	The following baseline groundwater data tables are provided in this appendix	Based on our review, it appears that the text here should say sediment rather than groundwater. In addition, we recommend that the DEIS provide a description of how the selected locations are considered representative or not representative of the waterbodies of this area.
4.18-1	4.18	Effects due to reagents	Xanthate and other processing reagents listed in Chapter 2 are not captured in the water quality modeling and are not discussed in Section 4.18. We recommend that this section of the DEIS describe whether and to what extent the mine processing reagents could impact surface water or groundwater quality and the

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			procedures that would be in place to monitor (e.g., toxicity testing of effluents) and mitigate impacts.
4.18-1	4.18	Effects on drinking water sources.	Section 3.18 describes the water quality of existing drinking water sources in the project area. However, Section 4.18 does not directly discuss whether the proposed project could impact drinking water quality in these existing sources, with the exception of a brief reference in Table 4.18-1. The discussion on impacts to drinking water sources appears to be limited to discussion of new drinking water wells that would be developed to support the project. We recommend the DEIS include analysis and discussion of the potential for impacts to existing public and private drinking water sources.
4.18-2	4.18.2.1	Figure showing outfall locations	Outfall locations are provided in Figure 4.16-1. Due to the scale of the figure, it is difficult to discern the outfall locations in relation to the surface water monitoring stations. We recommend that an additional figure be provided in the DEIS that shows a close-up of each outfall location in relation to the nearby surface water monitoring locations and tributaries.
4.18-2	4.18.2.1	All runoff water contacting the facilities at the mine site and water pumped from the open pit would be captured to protect overall downstream water quality.	Following this sentence, we recommend including a summary sentence on contact water that infiltrates to groundwater. Also, we recommend that the DEIS include a sentence (with reference to where more information can be found) that indicates what proportion of contact water is expected to manifest as surface runoff versus infiltrate to the groundwater. Such a statement is important to provide context for the sentence on 4.18-2 indicating that all of the runoff water will be captured. Finally, we also recommend adding the same sentence to Chapter 5, along with the details for how this water would be "captured" and what would be done with it (e.g., directed to a holding pond;

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			treated and released; reference to a map indicating the location of discharge – Figure 4.16-1 shows diversion channels and collection ditches, but not effluent locations).
4.18-2	4.18.2.1	Non-acid-generating quarry or waste rock would be selected and used in construction of mine site roads and embankments, utilizing techniques commonly used for grade control in open pit mines (PLP 2018-RFI 021c), such as testing for acid rock drainage (ARD) and metals at specified intervals or block sizes.	Section 3.18.1.1 mentions that some metals are mobile under neutral conditions. Therefore, we recommend that the DEIS explain how the selection and testing of construction materials will ensure that metals will not leach from these materials under neutral pH conditions.
4.18-2	4.18.2.1	• Water diversion, collection, and treatment systems would be installed to address the effects of ground disturbance and erosion on water quality during construction. • Best management practices (BMPs) for water management and sediment control structures, including temporary settling basins, and silt fences, would be installed to accommodate initial construction at the mine site."	We recommend that the DEIS include details and figures that show where these would be constructed, direction of flows, etc. for the construction period. We also recommend adding the details from these 2 bullets to Chapter 5, Table 5-2.
4.18-3	4.18.2.1	Paragraph: "Effects of dewatering water discharge in construction" Statement "Following module WTP processing, water would be discharged to the South Fork Koktuli River (SFK) catchment"	We recommend including the details for mitigating effects that are included in this paragraph (e.g., temporary sedimentation pond, tank or sand separator; chemical addition; modular treatment) to Chapter 5, Table 5.2. We recommend adding reference to the figures (4.16-1 and additional figure requested in our comments above on this section) showing locations of discharge points for treated water. It would also be helpful to show anticipated flows to be discharged on the maps, or, at a minimum, refer a reader to where this information is located.
4.18-3	4.18.2.1	Paragraph titled: "Effects of waste rock/tailings storage and water management ponds"	We recommend including the details for mitigating these effects (e.g., containment, recycling/reuse) in Chapter 5, Table 5.2.
4.18-3	4.18.2.1	…pyritic tailings would remain fully submerged in the lined pyritic TSF to minimize ARD and ML. The water over the pyritic tailings would be maintained sufficiently deep to minimize aeration of the water column, resuspension of	We recommend that the DEIS provide a reference or discussion to disclose how the oxygen content of the water was predicted. From the description in the text, it sounds like the oxygen content

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		tailings by wind-induced waves, and oxidation of the tailings. Excess water from the pyritic TSF would be pumped to the main WMP.	would be low because the water will be deep. We recommend providing information on how deep the water will need to be in order to create thermal stratification and oxygen depleted conditions in the water overlying the tailings. Anecdotally, we note that it does not seem likely that the water depth in a storage facility would be sufficient to allow for a low oxygen content above the tailings to develop; therefore, we recommend that additional information be provided to make this case, or consider reanalyzing (or collecting) the necessary data in the event that a different conclusion may be reached. We also recommend providing an estimate of the depth of the water that will cover the tailings to understand what is meant by "sufficiently deep." We assume that pumping excess water is necessary to mitigate the potential for overtopping during operations and recommend that this be clarified in the document. We recommend that details for mitigation measures within these sentences be captured in Chapter 5, Table 5-2. Currently, only the pit is discussed in Chapter 5 with overtopping in closure and the bulk TSF for spill risk in operations/closure. We recommend adding discussion of mitigation measures for reducing the impact of overtopping risk for the pyritic TSF to Chapter 5, Table 5-2.
4.18-4	4.18.2.1	Based on the geochemical analysis of source rock, the chemistry of runoff from rockfill in embankment dams is expected to be comparable to that of natural surface water and groundwater, with two possible exceptions (SRK 2018d):	SRK 2018d is not included in the references section, therefore, these predictions cannot be evaluated. We recommend including SRK 2018d in the reference list.
4.18-4	4.18.2.1	The main embankment at the bulk TSF would operate as an unlined flow-through facility. Water collecting in the bulk TSF would flow through the embankment to the main embankment's seepage collection pond (SCP).	We recommend clarifying whether the last reference to the bulk TSF should be pyritic TSF since the previous text already discusses the bulk TSF.

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		From there, water would be directed either to the main WMP for use in the mill, or to the main WTP (WTP#2) for treatment and discharge. Excess surface water in the bulk TSF would be similarly managed	
4.18-4	4.18.2.1	"The size of the ponds and the design criteria intended to prevent overtopping of pond water are described in Section 4.16, Surface Water Hydrology. Upset conditions that could lead to unexpected release of pond water to the environment are addressed in Section 4.27, Spill Risk."	No measures are discussed in Table 5-2 to mitigate for the risks of spills from any of the ponds and Chapter 4.27 is not available to determine what measures are discussed there. We recommend adding the details of mitigation measures to reduce the impacts of overtopping ponds to Chapter 5, Table 5-2.
4.18-4	4.18.2.1	"Effects from Embankment Rockfill Runoff…This rock would be managed separately based on PAG classification and would be used only in limited locations on the northern embankment of the pyritic TSF where runoff would be directed to the main WMP."	We recommend that the DEIS include the details in the discussion of what would be done to mitigate the effects from this rock in closure/post closure.
4.18-4	4.18.2.1	*Rock containing explosive residues*. Explosives used during mining would consist of ammonium nitrate/fuel oil (ANFO) mixtures manufactured on site (PLP 2018d). This rock would be monitored until explosive residues have been leached	It isn't clear from the text how rock containing explosive residues would be managed and monitored. We recommend that the DEIS provide details for where these rocks would be placed, how leachate would be collected, how the leachate would be managed (e.g., treatment), and the specific monitoring and criteria that would be used to determine that the explosive residues have leached so that the rock is safe for placement. These details are necessary to understand the effectiveness of this mitigation measure and determine water quality impacts due to explosive residues. We recommend that these rocks be placed where any leachate will be directed toward a storage pond for treatment so that ammonia, nitrate, and fuel oil are not released to the groundwater, surface water, or soils in the area. We recommend that this section discuss the extent to which explosive residuals were estimated and disclosed in predicting changes to water quality. We recommend that details regarding management of rock containing explosive

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			residues and treatment and disposal of leachate be added to Chapter 5, Table 5-2. We note that water treatment of selenium by a fluidized bed reactor (FBR) is inhibited by the presence of nitrate – nitrate must be used up by the bacteria before selenate will be reduced. We recommend that the DEIS consider this factor given the water treatment proposed. http://www.envirogen.com/files/files/ETI_Selenium_GrayPaper_V_FINAL.pdf
4.18-4	4.18.2.1	Should a small spill occur, effects on the surrounding environment would be minimized by implementing controls, including automatic shutoff devices, and in-place spill response equipment and procedures (PLP 2018d). Section 4.27, Spill Risk, describes the potential for and effects of a large hydrocarbon spill.	We recommend that a preventative maintenance program also be included as an “implementing control” since smaller spills can be prevented if hoses, especially on large equipment, are replaced before they have a chance to burst. We also recommend adding discussion of shutoff devices to Chapter 5, Table 5-2.
4.18-4	4.18.2.1	“Potential effects of contact and runoff water during construction on downstream water quality would be minimized through treatment prior to discharge.	Please provide details for mitigation of impacts from contact and runoff water during construction to Chapter 5, Table 5-2.
4.18-5 K4.18.[illegible] K4.18.[illegible]	4.18.2.1	Water treatment – “There is some concern, however, that salt and selenium could build up over time in the pyritic TSF, which has the potential to lead to increased TDS concentrations that would require treatment in the main WTP”. “This may require further investigation as design progresses and/or long-term adaptive management strategies (Chapter 5)”	Our assessment is that this concern is likely to occur, since the concentrated residual waste solids from both treatment plants will be added to the pyritic TSF. This also may be a concern with the oxidized and reduced sludges produced during other steps in water treatment also being added to the pyritic TSF. Whether metals, metalloids, and non-metals will be released from those waste streams will depend on whether they are held under the same conditions as when they were formed. Oxic precipitates (e.g., ferric oxyhydroxides – along with any sorbed metals/metalloids) can be expected to be reductively dissolved if in reducing conditions; reduced precipitates (e.g., amorphous elemental selenium, metal sulfides) can be expected to re-dissolve if in oxidizing conditions. Increased ionic strength (higher TDS) will cause release of ions sorbed to

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			precipitates if they are not chemically bonded. Ions released will become re-sequestered as either oxidized or reduced solids (or re-sorbed to another solid) depending on their final environment, but this may take some time. We recommend considering alternatives for management of concentrated treatment wastes, such as disposal off-site under conditions suited to minimize potential for remobilization (and hence, retreatment), if this is possible. While adaptive management is defined in Chapter 5, there is no discussion of this approach with respect to TDS or selenium (Se). We recommend that this discussion be added to Chapter 5.
4.18-5	4.18.2.1	The open pit WTP would also include biological selenium removal	We recommend that the document explain whether this WTP technique has been utilized at other mine sites, in particular for the proposed treatment rates. If it has been utilized elsewhere, please explain how the differences in temperature at the Pebble site would affect the biological activity associated with Se removal, as well as describe whether the effect of temperature on the efficiency of Se removal using this technique has been evaluated.
4.18-5	4.18.2.1	discharge water from both WTPs is currently expected to meet ADEC criteria	We recommend that the DEIS provide a comparison with expected APDES permit effluent limitations in addition to ADEC criteria.
4.18-5	4.18.2.1	Treated water from the WTPs would be used to supply process needs, and the remainder would be discharged to the environment downstream of the mine site. All WTP#1 treated water and most WTP#2 treated water would be discharged, and a small portion of the WTP#2 treated water would be used for process and power plant needs.	These two sentences seem to contradict each other. We recommend that the DEIS clarify whether the first (which seems to indicate that process needs would be a large use of water) or the second (which states that only a small portion of the water would be used in the process) is reflective of the expected conditions on site.
4.18-5	4.18.2.1	Water from both treatment plants would be strategically discharged in a manner that would optimize downstream aquatic habitat, based on modeling and monitoring during	As noted in our comments on section 4.16, we recommend that additional details be provided in the DEIS to understand how this water discharge would be implemented during

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		discharge (PLP 2018d).	construction, operations, and closure. Also, our review finds that PLP 2018d is not currently provided in the list of references.
4.18-5-6	4.18.2.1	ADEC regulates wastewater discharges from hard-rock mining facilities through various permits:…	We recommend clarifying that an APDES permit would be issued unless the discharge is not to WOTUS, necessitating a domestic wastewater discharge permit.
4.18-6	4.18.2.1	"Additionally, installing engineered discharge chambers at discharge points would reduce effects on certain water conditions such as turbidity and dissolved oxygen by baffling the discharge and allowing for more equilibrium of water condition at the discharge point."	Discussion of discharge chambers is also included in Table 4.18-1 (with respect to groundwater) and on Page 4.18-13 (with respect to erosion). We recommend adding this mitigation measure to Chapter 5, Table 5-2, and note that discharge chambers are also a mitigation measure for water/sediment quality and for fish.
4.18-6	4.18.2.1	Some waterbodies may also have site-specific water quality criterion.	We recommend that the DEIS either clarify that no waterbodies in the project area have site specific criterion or delete this sentence as it is not applicable to the project. We note that if a request for site specific water quality criteria is to be made, there is an established process to follow with the state and the EPA.
4.18-7	4.18.2.1	Appendix K4.18 provides the methodology used to calculate the incremental increase in surface water and Table K4.18-12 shows the results.	From reading the description in the Appendix, it does not appear that loading to surface water from soil runoff is included in the calculations; however, this may be a relatively large flux since the settled dust to the terrestrial landscape will be more mobile than native soil particles. We therefore recommend that it be considered in the analysis.
4.18-7	4.18.2.1	The results indicate a small expected increase in the concentration of metals in surface water as a result of dust deposition, ranging from 0.1 to 0.7 percent, which would not result in exceedances of the most stringent water quality criteria	While fugitive dust alone would not be sufficient to exceed a WQS, it is not clear if the additive effect of fugitive dust and WTP outflow were evaluated cumulatively. We recommend providing a Table showing the cumulative concentrations and loadings from these sources as compared to current conditions and the criteria.
4.18-7	4.18.2.1	Effects from deposition of fugitive dust and Effects from dust suppression water	These sections discuss impacts of dust on water and sediment quality, but dust is only presented in Table 5-2 with respect to air quality. We recommend adding details for mitigation of impacts from dust (and suppression water) to Chapter 5,

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			Table 5-2.
4.18-7	4.18.2.1	"…water level in the open pit would be maintained to allow controlled placement and management of the PAG waste rock in dry areas of the pit, while keeping a water cover over the submerged pyritic tailings."	We recommend adding this mitigation measure to prevent oxidation of the pyritic tailing in the pit during placement to Chapter 5, Table 5-2, along with detail for the water level in the pit during this stage of filling the pit with mining wastes.
4.18-7	4.18.2.1	"…maximum management level…"	We recommend providing a numerical estimate of the water level referred to here.
4.18-7	4.18.2.1	"Free water on the surface of the bulk TSF would be pumped to the main WMP through approximately year 15 post closure, then to the open pit through approximately year 50 post-closure. The bulk TSF would be graded and revegetated to direct surface runoff toward the closure spillway at approximately year 10 post-closure."	Chapter 2 states that the bulk TSF would have a dry closure. The second sentence here indicates that the TSF would be graded and revegetated (at ~ 10 years post-closure) such that water would not remain on the top of TSF but run off toward a spillway. However, the first sentence indicates there would be "free water on the surface" and that it would be pumped to the open pit from years 15-50 "post-closure." Please clarify why there would be free water on the surface of the TSF <u>after</u> it had been graded and revegetated or revise where necessary. In addition, we recommend providing details on the spillway and where the water will be directed.
4.18-7 and 8	4.18.2.1	Water management and treatment during closure and post-closure is expected to minimize effects on water quality during both the physical closure of the site and associated reclamation activities, as well as during long-term post-closure and associated maintenance and monitoring activities. Water quality would be monitored and the treatment process would be adjusted as needed. Table K4.18-5 provides an estimate of treated discharge water quality from the pit lake. WTP processes are expected to be effective in treating water to meet discharge criteria, although concerns regarding potential long-term increased TDS levels may require further investigation as design progresses and/or adaptive management strategies are implemented during operations (Chapter 5)	We recommend that the reference to Table K4.18-10 which shows treated discharge quality at closure be corrected. Table K4.18-10 shows that discharge water quality is predicted to exceed water quality criteria for mercury and selenium. Because of these exceedances, the conclusion that the WTP processes are expected to be effective is not accurate. Given that predicted exceedances are discussed, we recommend that this conclusion be revised. We recommend that the DEIS specifically disclose predicted exceedances of water quality criteria at closure, including the magnitude, duration, and geographic extent of these exceedances downstream of the discharge points. In addition, we recommend that an alternative or variant WTP process be developed, analyzed, and

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			included in the DEIS so that there is an alternative to the proposed action that would result in all water quality standards being met at closure.
4.18-8	4.18.2.1	Groundwater modeling estimates that the bulk TSF would contribute about 0.2 cfs of seepage to the underlying groundwater system during and at the end of mining	It is not clear whether the 0.2 cfs value is a mean, maximum, etc. We recommend that the DEIS clarify this value and describe any uncertainties associated with the estimate.
4.18-9	4.18.2.1	Hydraulic containment of seepage flow from the bulk TSF would be achieved and maintained using a series of control measures (Appendix K4.15, Table K4.15-1) Groundwater modeling suggests that a sump or pumping wells with an operating elevation of 1,250 ft at the main SCP and a grout curtain with an effective hydraulic conductivity of $1x10^{-5}$ cm/s would be effective in capturing seepage (Piteau 2018)	Table K4.15-1 does not provide the details regarding the location of these seepage capturing features or the details that would support the conclusions that all the groundwater from the bulk TSF would be contained. Therefore, insufficient information is currently provided to evaluate the impacts to groundwater quality from the bulk TSF. Per our comments submitted to the Corps on 8/15/18, we continue to recommend providing additional information related to hydraulic containment. We recommend that this information include, at a minimum: (1) figures that show the location of the underdrains; (2) figures that show the locations and cross-sections of the seepage pumpback wells in relation to the plume of contaminated groundwater; and (3) a discussion of these designs in relation to the groundwater modeling that reflects the Corps' independent analysis, specific conclusions on the effectiveness of these measures, and any uncertainties.
4.18-8 4.18-9 4.18-9	4.18.2.1	"…be captured by the main embankment SCP" "The main embankment of the bulk TSF would be designed to promote seepage to the SCP, thereby minimizing the volume of water contained within the tailings impoundment and promoting embankment stability" "North-flowing underdrains…Seepage pump-back wells downgradient of the three SCPs." For the pyritic TSF: "Potential leakage through the liner would be diluted by unimpacted groundwater flowing northward down the NFK	We recommend adding details on mitigation of seepage to Chapter 5, Table 5-2. Also, we recommend that the Corps consider whether the well field downstream from the WMP, that would intercept any leakage from the pyritic TSF going to the WMP, is sufficient to protect groundwater quality, or whether a double liner would be advised (under either or both the pyritic TSF and WMP) as an additional mitigation measure. We further recommend that this analysis be

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4.18-9		east drainage, and would be intercepted by the main WMP and its downgradient seepage pumpback wells."	discussed in the DEIS.
4.18-9	4.18.2.1	Groundwater modeling suggests that a sump or pumping wells with an operating elevation of 1,250 ft at the main SCP and a grout curtain with an effective hydraulic conductivity of $1x10^{-5}$ cm/s would be effective in capturing seepage (Piteau 2018).	Piteau 2018 is not included in the references and therefore the groundwater quality modeling cannot be adequately evaluated. We recommend that this document be added to the reference list. Also, we recommend that the model approach, evaluation, and sensitivities and uncertainties be disclosed, as described in our comments on the other models used. In addition, we recommend that the DEIS clearly describe what is meant by "modeling suggests" so that the level of confidence in this information is disclosed to agency decision makers and the public.
4.18-9	4.18.2.1	The predicted concentration of constituents in groundwater beneath the bulk TSF and between the TSF and the main SCP would be similar to those listed in Table K4.18-2 and Table K4.18-3 for the main SCP. Several metals, TDS, and sulfate in the main SCP are predicted to exceed baseline concentrations and regulatory criteria at the end of mining and the end of closure Phase 3, and thus would require continued treatment at WTP#3 in post-closure (Knight Piésold 2018d).	Table K4.18-2 does not have a column titled SCP or seepage collection pond, therefore it not possible to know what predicted concentrations of constituents in groundwater are being referred to. We recommend clearly adding the necessary information to the tables referenced. Assuming the SCP may be listed as the "Pyritic Tailings Sand Wedge" column in the table, the predicted water quality would exceed WQS for numerous metals. However, given the differences in metal composition between the pyritic and bulk TSF, it seems unlikely that predicted concentrations in groundwater would be similar to those for surface water. We recommend that additional information be provided on the predicted groundwater concentrations below the bulk TSF. We recommend that the DEIS clearly disclose in this section which metals are predicted to exceed baseline and regulatory criteria in groundwater and the length of time over which post-closure groundwater management and collection and water treatment (associated with

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			groundwater) would be required.
4.18-9	4.18.2.1	Pond water leaking through the pond liners would be ~~intersected~~ intercepted by underdrain systems included in the design of those facilities, and subsequently pumped back to the respective WMP (PLP 2018-RFI 019a); however, some water could bypass the underdrain system and seep into underlying shallow groundwater	It is not clear based on the information presented how it was determined with certainty that 100% of the TSF seepage will be collected, while for the smaller, lined WMP, it is anticipated that seepage could bypass the system and impact groundwater. We recommend including additional information in the DEIS to support the 100% seepage collection conclusion or alternatively, revising that conclusion as appropriate.
4.18-9	4.18.2.1	The potential for liner damage (e.g., from ice or placement of waste rock) leading to leakage of tailings porewater was evaluated in the EIS-Phase Failure Modes Effects Analysis (FMEA), and the likelihood of occurrence was considered to be low to moderate (AECOM 2018l).	AECOM 2018l is not included in the references and therefore information on the potential for leakage through the liner cannot be evaluated. Of specific interest are the predictions of number of defects/ holes per area of the liner. There are several different values for this available in the literature that could result in significant differences in terms of groundwater concentrations/impacts. Therefore, having access to this information is critical for the evaluation of the EIS and we recommend that the AECOM 2018I document be provided in the text or appendix of the DEIS for review and comment.
4.18-9	4.18.2.1	"If monitoring were to find that groundwater quality is not improving during the post-closure period, additional remedies would be implemented to capture and/or treat impacted groundwater."	We recommend that the DEIS describe the groundwater monitoring that would occur during closure/post-closure (monitoring locations, frequency, and parameters), the criteria that would be used to determine if additional remedies are needed, and details of the additional remedies that would be implemented.
4.18-9 and 10	4.18.2.1	"Pond water leaking through pond liners would be intersected by underdrain systems included in the design of those facilities…"	We recommend adding these details to Chapter 5, Table 5-2.
4.18-10	4.18.2.1	In a discussion of the estimated maximum leakage rate through the liner of the main WMP: "…daily leakage rate of nearly 23,000 gallons." "Based on the current mine plan, it is possible that gaps exist along the main WMP embankment that would allow potentially	This seems like a lot of water to leak daily. The response to RFI 019c stated that 1 l/s equates to about 30 gallons/acre/day for each facility, which is < 480 gal/acre/day stated as being regulated for "metal laden seepage water" (https://geosynthetic-institute.org/papers/paper15.pdf). This is a lot of water to have to store in the

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		affected groundwater to flow through areas where wells are limited (e.g., along the southwest side of the embankment, Figure 4.16-1). As discussed in the EIS-Phase Failure Modes Effects Analysis (FMEA), the final location and spacing of pump-back wells would be determined based on additional hydrogeologic investigation as design progresses to minimize the likelihood of this occurrence.”	pond, treat, and potentially not capture. We were unable to find the actual acreage for any of the mine facilities in the PLP plan (Chapter 2) and were unable to find any information about the type of liner and its hydraulic conductivity. In addition, the FMEA was not provided in the current document. It is unclear whether this value considers both seepage (inherent loss expected due to the hydraulic conductivity of the material) and leakage (assumed from deformities or damage to the liner), or from only leakage. We recommend that these details be discussed in the DEIS. We recommend that it may be less costly to have a better liner system (double liner to protect against defects and damage to one) than to have to pump this much water back to a pond and then have to pump it out and treat it later, not to mention needing to consider this in sizing of the pond (which results in an increased footprint). Additionally, the discussion includes that there is potential for gaps in the well network (also can see on Fig 4.16-1), which would lead to potential impacts on groundwater. We note that the best mitigation measure for groundwater impacts caused by the potential inability to capture seepage is to minimize the potential for seepage to occur. For all of these reasons, we recommend that the Corps consider an alternative, variant, or additional mitigation measures to minimize leakage from these liners (facilities), such as a double-liner system. In addition, we recommend that the DEIS include details from the additional hydrogeologic investigation regarding well placement and consider revised or additional well placement as needed to improve the ability to capture leakage and seepage.
4.18-10	4.18.2.1	Discussion of seepage from overburden stockpile: “…limited by segregating mineralized	We recommend including these measures in Chapter 5.

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		overburden from non-mineralized overburden, and stockpiling mineralized materials that exhibit a high potential for leaching in the pyritic TSF.”	
4.18-11	4.18.2.1	After lake level rise, groundwater gradients toward the pit would be maintained by managing the pit lake level through pumping and treating the lake water in perpetuity. With the pit water level maintained at the maximum management level of 890 ft msl, groundwater flow is expected to be directed radially toward the pit from all directions.	We recommend providing information on the volume/discharge that would be required to pass through the water treatment plant in order to maintain a pit lake level of 890 ft during periods of spring snowmelt. In order to provide context for the post-closure discharge rate, we recommend that the DEIS discuss how this discharge rate compares with the volumes of water treated during the operating phase of the mine.
4.18-11 and 12	4.18.2.1	If monitoring shows that groundwater quality is not improving during the post-closure period, additional remedies would be implemented to capture and/or treat the impacted groundwater as needed.	As noted above, we recommend providing additional information that describes the groundwater monitoring that would occur at closure/post-closure and the additional remedies that would be implemented.
4.18-11	4.18.2.1	“Groundwater monitoring would be conducted at selected wells surrounding the pit lake to confirm that groundwater flow is toward the pit and that impacted groundwater is not migrating outside of the pit. Should monitoring find that groundwater does not flow toward the pit or that groundwater quality outside the pit is degraded during the post-closure period, the maximum management level (890 ft msl) currently proposed would be reconsidered, and the pit lake level would be lowered to maintain hydraulic containment.”	Please provide information in the DEIS on the current groundwater level and flow direction in the area of the pit. We recommend that this information be provided on a figure, along with the cone of depression of the water table expected during mining operations due to de-watering. In addition, we recommend providing information on anticipated changes in pit water conditions (e.g., stratification, depths of oxygen infiltration, water turn over) and any anticipated (if there are any) influences on the covered PAG and pyritic tailings if the pit water level needs to be decreased.
4.18-11	4.18.2.1	“Placeholder: Additional information on pit lake modeling, lake stratification, and its effects on water quality was received November 1, 2018” “This information will be reviewed and incorporated in the DEIS.”	Figure K4.18-01 shows the top of the PAG waste rock at 650 ft and the maximum water level at 890 ft. We recommend that the DEIS discuss the anticipated water environment for the submerged tailings and PAG and whether the 240 feet of pit water is expected to stratify and/or turn over. In addition, we recommend that the DEIS provide the depth at which water

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			will be obtained for treating (if there is stratification, water quality could be expected to differ at differing depths).
4.18-12	4.18.2.1	Discussion of the effect of dewatering on wetlands in the vicinity of the mine site.	We note that previously reduced soils will become oxidized and there is the potential for the oxidized metals to be mobilized or form oxyhydroxides or be sorbed to the soils (dependent on pH and specific ions present). We recommend that the DEIS discuss the mitigation measures necessary to reduce these potential impacts to soils and groundwater. We recommend that the DEIS clarify if these areas are within the region covered by capture of runoff during operations and closure and whether these areas are within the region that would be captured by flow into the pit post-closure. (NOTE: If runoff from these areas is not captured, re-saturation of the soils may result in release of oxidized metals until new reducing conditions are attained to resequester the oxidized metals as sulfides. Mitigation during that time may be required and should be discussed in the DEIS.)
4.18-13	4.18.2.1	"However, the potential exists for erosion during periods of high precipitation and runoff to overwhelm the BMPs, resulting in an influx of fine sediment and increased turbidity into gravel-dominated streambeds."	We recommend that the DEIS discuss the impacts that the erosion would have, both temporary and longer-term and describe the mitigation measures necessary to reduce those impacts. We recommend that redundant BMPs be used and/or that settling basins/ponds/ditches be sized to consider extreme events. We recommend that it is more protective to oversize these components than to undersize them based on averages.
4.18-14	4.18.2.1	"Thus, low-intensity sediment contamination in between the removed facilities could persist at the mine site for decades in post-closure[,] potentially contributing to water quality impacts over time. To address this potential impact, Chapter 5, Mitigation, provides a recommendation for additional testing of sediment quality between facility footprints at closure."	We recommend including this recommendation in Chapter 5.

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4.18-14	4.18.2.2	Based on a field review of geology at material sites, PAG material has not been identified at any site along the transportation corridor, and the rock types present are not typical of PAG rock.	As noted earlier in the EIS, there are numerous metals that are mobile under neutral pH conditions (e.g. arsenic, molybdenum, and selenium). Therefore, evaluating material on the basis of its acid generation potential and not also due to the concentration of other metals/metalloids would potentially overlook water quality impacts along the transportation corridor. We recommend providing additional information to support this statement and provide a discussion of how NPAG metal leaching rock will be managed in the DEIS.
4.18-14	4.18.5	**Surface Water**: Metals concentrations in surface water predicted to increase by 0.1% to 0.7% as a result of fugitive dust deposition, although no exceedances of water quality standards are expected	It is not clear from the text whether these predictions include watershed loading via surface water runoff. If runoff is not included in the predictions, these percentages may be underestimates of the impacts of fugitive dust on water quality. We recommend clarifying and including additional information in the DEIS.
4.18-15	4.18.2.2	"In addition, stormwater treatment systems would be in place at both ferry terminal locations to capture potential contaminants."	We recommend that this read "capture and treat." Page 4.18-16 discusses details for mitigation of surface runoff at the Amakdedori Port, including treatment that we recommend also be included in Chapter 5.
4.18-16	4.18.2.3	"The solids removed would be thickened and disposed of appropriately."	We recommend that the DEIS describe how they will be disposed.
4.18-16	4.18.2.3	Section on Surface Water Quality	We recommend that mitigation details in this section also be included in Chapter 5, Table 5-2.
4.18-16	4.18.2.3	Section on Dust Impacts on Marine Water Quality	We recommend that discussion of mitigation of dust when loading the concentrate also be included in Table 5-2.
4.18-16	4.18.2.3	A container barrier wall built around the fuel tanks and a perimeter containment curb constructed around the terminal would prevent surface water runoff from these facilities and activities from reaching off-site surface water.	We recommend clarifying whether these barriers are in addition to any required secondary containment.
4.18-16	4.18.2.3	The clarified water would then be treated with sodium hydrogen sulfide, sodium hydroxide, and ferrous sulfate to further co-precipitate the remaining metals under reducing conditions	We recommend clarifying whether the treatment described would be adequate to treat any discharges of hydrocarbons that could occur in the surface runoff.

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4.18-18	4.18.2.3	Marine vessel activity in Upper Cook Inlet does not appear to have contributed to measurable sediment contamination (USACE 2013).	We recommend explaining how the information on Upper Cook Inlet, which is a <u>non-depositional</u> area, is applicable to Kamishak Bay, which is a <u>net depositional</u> area in the DEIS.
4.18-18	4.18.2.4	Surface water quality at pipeline stream crossings is expected to be within water quality standards for turbidity during construction. Natural turbidity measurements at stream crossings along the transportation corridor were mostly below the instrument's minimum detection level of 7–11 nephelometric turbidity units (NTU) during 2018 field studies (Section 3.18, Water and Sediment Quality) (PLP 2018-RFI 036). ADEC water quality standards specify that turbidity levels may not exceed 5 NTU above these conditions (when the natural turbidity level is 50 NTU or less). Isolated occurrences of impacts above this standard could occur (e.g., during high-precipitation periods along summer construction segments)	We recommend clarifying the discrepancy between the first and last sentences where one says turbidity will be within WQS and the other says there will be impacts above the WQS.
4.18-18	4.18.2.4	The extent of potential impacts from hydrostatic testing for pipeline pressure testing would be limited because the water volumes required would be small compared to the volumes of potential sources from rivers and small lakes along the route.	We recommend clarifying that this discharge would need a state authorized permit under 18 AAC 72 if it is discharged to land.
4.18-19	4.18.2.4	"Section 4.16, Surface Water Hydrology, addresses the potential for sediment suspension, plume transport, and redeposition to occur during construction in the marine environment."	We note that no mitigation for these impacts is provided in either Table 5-2 or in Chapter 4.16. We recommend that mitigation measures be provided for these impacts and discussed in the DEIS.
4.18-19	4.18.3.1	Due to similar seepage design and downstream capture under Alternatives 1 and 2, the downstream dam alternative for the bulk TSF main embankment would likely have the same impacts on surface water and groundwater quality as centerline construction	We recommend that the DEIS provide figures that show the seepage design systems for Alternatives 1 and 2 in order to support the conclusion that impacts would likely be the same.
4.18-21	4.18.3.4	In discussion of the natural gas pipeline corridor in Alternative 2: "Impacts would be the same as described for the transportation corridor under Alternative 3 for the portion from Diamond Point to the mine site."	We note that the pipeline corridor is not discussed in Alternative 3's section on the transportation corridor and we recommend that this discussion be added to the text.
4.18-21	4.18.4	"Under alternative 3, impacts on the pipeline corridor would be the same as those described for Alternative 2."	Section 4.18.3.4 is the "Natural Gas Pipeline Corridor." As noted in the previous comment, impacts are not described in Alternative 2 for the

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			complete pipeline corridor. We recommend that the text be revised as necessary.
4.18-22	4.18.4.3	The water removed from the concentrate would be treated in a WTP to meet marine water quality standards and discharged through an outfall pipeline and diffuser to the marine environment.	We recommend clarifying the circumstances which would allow for a discharge of process wastewater to waters of the U.S. under the Clean Water Act and NPDES regulations (40 CFR 122.2 defines *Process wastewater* as any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product) considering the prohibition on this type of discharge found in 40 CFR 440 Subpart J.
4.18-23	Table 4.18-1	**Surface Water**: Ground disturbance and fill placement could result in increased turbidity in local waterbodies and streams, to be mitigated through BMPs. **Groundwater**: Metals concentrations in shallow groundwater may increase as a result of the disruption of wetlands and fill placement	In order to understand the significance of these impacts, we recommend that these sentences be expanded to list the metals that would be exceeded in groundwater and the areal extent and depth of exceedances. For surface water, we recommend describing the magnitude of the turbidity exceedances and geographic extent (which waterbodies and how far downstream).
4.18-24	Table 4.18-1	**Groundwater**: Local impacts on shallow groundwater quality in the NFK west, east, and north drainages are likely from vertical seepage through the bulk TSF, or leakage through the pyritic TSF or WMP liners. This would result in localized exceedances of water quality standards within the mine site footprint,	As noted above, we recommend that the DEIS lists the parameters that would be exceeded in groundwater and the areal and vertical extent as well as the duration (years).
4.18-25	Table 4.18-1	Fugitive dust effects	We recommend summarizing the areal extent of fugitive dust impacts on groundwater for all of the alternatives.
4.18-24	Table 4.18-1	Pit lake water quality would exceed water quality standards but would be pumped to maintain operational levels and treated prior to being discharged to the environment.	As we have commented previously, we recommend that this be revised to disclose that mercury and selenium discharges would exceed water quality standards at closure. As noted above, we recommend that the magnitude of these exceedances be disclosed, including the geographical extent downstream, and the duration of the impact.
4.18-	Table	Localized increase in turbidity at approximately	We recommend that the DEIS describe

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26	4.18-1	100 stream crossings.	what is meant by “localized” or provide the estimated extent of impacts and define the magnitude of the increases so that the significance can be understood by agency decision makers and the public. In addition, we recommend that the table summarize whether impacts during operations would be different than construction.
4.18-26 to 27	Table 4.18-1	Construction vs operations impacts	We recommend that impacts from construction and operations for the road, ferry, and port site components be summarized separately since it is otherwise unclear which activities are resulting in the impacts and the duration of impacts.
4.18-29	4.18.6	“Pebble Project buildout – development of 55 percent of resource over a 78-year period” The buildout would correspond to an increase in the magnitude and local extent of ground disturbance impacts and fill placement on substrate, with a duration increase of up to 98 years. The potential for impacts on surface water, groundwater, and substrate would increase, and would be greater than the combined impacts of Alternatives 1 and 2. Additional design features to capture and treat impacted water and waste streams would be necessary to manage mine site impacts. Overall, the magnitude of cumulative impacts on surface water, groundwater, and substrate quality from RFFAs in general would be expected to be minimal, with the exception of activities from the Pebble project buildout RFFA. Cumulative effects would increase within the mine site footprint when expanded to include buildout development and increased fill placement.	No analysis has been provided in the cumulative effects section to support these conclusions. We recommend that additional information and analysis be provided in the DEIS that includes estimates of the extent, duration, and magnitude of the cumulative impacts of developing 55% of the resource over a 78-year period. For example, predicted groundwater and surface water quality concentrations would likely be different due to the presence of larger TSFs, new large waste rock facilities, and additional water management ponds and features. Some of these features would be placed in the UTC watershed. Clearly the water balance will be different. These and other factors could contribute to significant changes in groundwater and surface water quality, and we recommend that the EIS provide a detailed analysis of these cumulative impacts in order for the reader to understand the significance of the impacts.
4.18-29	4.18.6	“The estimated area of disturbance would be greater than under Alternatives 1 and 2 combined,…”	We recommend adding values for estimated numbers of acres, wetlands, streams, etc. affected in a table for easier visualization of cumulative impacts by a reader.
4.18-29	4.18.6	“Also, adding a diesel fuel line would increase the likelihood of hydrocarbon spills…”	To improve the analysis of potential cumulative effects, we recommend providing a detailed description of the

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			Pebble Project buildout in Section 4.18.6, or a reference to where the description is provided. We also recommend that this section describe specifics of that scenario that are relevant to surface water and groundwater quality. For example, it is not clear how waste rock would be managed/segregated and how the waste rock facilities would be designed. It is not clear whether TSF seepage management would change, whether there would be different types of water treatment processes and outfalls and how these could change at closure. We recommend that this information be provided in the DEIS. The brief description in Chapter 4.1 does not mention the fuel line. We recommend that the DEIS explain why a mine developed based on the proposed action description would shift to utilizing a concentrate pipeline and diesel line under the expanded development scenario.
K4.1 8		Nitrates and ammonia from blasting residues	The discussions of water quality estimates do not explain whether the predictions include contributions from explosives residuals, such as nitrates and ammonia, that may leach to groundwater or surface water or be contained in the water management ponds and require treatment. We recommend that this appendix clearly describe whether this information was factored into the estimates and describe the procedures used. If it was not included, then we recommend that these predictions be developed and provided in the DEIS.
K4.1 8-1	K4.18.1 .1	Climate variability is incorporated in the model using a 76-year synthetic time series of monthly temperature and precipitation values to simulate the cyclical nature of the climate record.	We recommend providing information on the rationale for using a period of 76 years in the model, and why monthly values were used.
K4.1 8-1	K4.18.1 .1	Three of these model runs were selected to represent dry, average, and wet climate conditions and illustrate the range of potential flows for the mine site under these varying conditions.	We recommend explaining how the dry and wet conditions are being defined and determined.

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K4.18-1	K4.18.1.1	Details regarding the water balance model inputs and assumptions are provided in Knight Piésold (2018a).	The reference section (Chapter 9) does not include a Knight Piésold (2018a) document. As recommended in our previously submitted comments, models used for environmental predictions should include discussion of model inputs and assumptions, a sensitivity analysis, and discussion of uncertainties. Otherwise, the validity of the outputs cannot be determined. As such, there is insufficient information provided in this section to evaluate the impacts from this project on water quality and we recommend that additional information be included in the DEIS regarding the model inputs and assumptions.
K4.18-1	K4.18.1.1	The water quality model is used to predict the influent water quality to the water treatment plants and the water quality in the water management ponds (WMPs), under varying climate conditions	We recommend providing information regarding how the groundwater quality was modeled, particularly the bulk/main TSF.
K4.18-1	K4.18.1.1	Geochemical source term inputs for the water quality model were developed by SRK Consulting (Canada) Inc. (SRK) (2018a).	The references (in Ch 9) do not include an SRK 2018a document. Without reviewing how the source terms were calculated, the validity of these input parameters cannot be determined. As such, there is insufficient information provided in the EIS to evaluate the impacts from this project on water quality and we recommend that additional information on the modeling inputs be included in the DEIS. Specific information that we recommend be included in the DEIS includes but is not limited to: (1) Specifying the geochemical characterization data that were used to develop the source terms. (For example, whether only the HCT results were used or whether barrel test results were also incorporated.) We recommend providing a rationale for these decisions; (2) Describing whether release rates from multiple tests were averaged or otherwise combined, or whether only selected test results were used; (3) Describing whether the source terms were developed from data over the entire duration of the tests or if they were from a differently defined

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			time period; and (4) Describing any temperature corrections used when translating lab-based predictions to model predictions of field conditions.
K4.18-2	K4.18.1.1	Table K4.18-1	It is not clear what "realization #" is referring to. We recommend that the DEIS define this.
K4.18-3	K4.18.1.1	Table K4.18-2	In general, in this document, mercury (Hg) pollution originating from the mine site has not been highlighted in any of the text. However, based on this table the predicted water quality concentrations are very elevated: 2,170 ng/L, 500 ng/L, and 6,200 ng/L for the waste rock, rock fill, and non-acidic stockpiles. These values are somewhat surprising given the relatively low Hg concentrations in the ore-body. However, given that the water quality standard is 12 ng/L, the exceedance of this value by several orders of magnitude is of concern, and we recommend that this be discussed in detail in the text of section 4.18. What is of additional concern is that these materials associated with these high Hg values are all from non-acidic sources and may not be subjected to a similar level of treatment/capture as materials destined for the PAG TSF. The potential for Hg releases in conjunction with sulfate releases (even if the WTP meets WQS for sulfate—250 mg/L) are also of concern because the WQS for sulfate are based on direct impacts from sulfate and not on its impact on promoting Hg methylation through stimulation of sulfate reducing bacteria. We recommend expanding the analysis and discussion of Hg impacts in Section 4.18.
K4.18-4	K4.18.1.1	Table K4.18-2	We recommend that the text or a footnote to the table describe what is meant by "Tailings Pond Adjustment."
K4.18-6	K4.18.1.1	Values in the table represent the maximum monthly predicted concentrations for the 50th percentile flow values and the 95th percentile	We recommend providing additional information on the "50th percentile flow values" and why this was selected instead

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		source term concentrations for flows going to the WTPs from each facility for the final year of operations.	of the 95th percentile as was done with the source terms concentrations. Ideally, instead of a singular value presented in this table, a range of values should be included and/or a mean value with a measure of dispersion around the mean to represent the expected variability in the predictions. We recommend that the table and accompanying text be revised accordingly.
K4.18-6	K4.18.1.1	Table K4.18-2	The table presents data on the concentrations but not on the mass loads of the parameters to surface waters. In identifying potential impacts to the environment, it would be very helpful to provide mass loading data alongside the concentration data. For example, based only on the information provided in this table, it is not possible to identify the relative importance of the different mine site geochemical sources. As such, providing loading data alongside the concentration data is important for assessing the potential impacts of the project on the environment and we recommend that this information be added to the table or provided in additional tables.
K4.18-17 to 22	K4.18.1.1	Tables K4.18-5, 6, 7, and 8	We recommend that the DEIS describe why the 50th percentile of the max monthly values is used to represent predicted water quality values. As noted above, we recommend that a range of values be reported and/or a measure of dispersion around the mean value be included in the DEIS.
K4.18-24	K4.18.1.3	Surface runoff into the pit lake could cause metals to leach from the pit walls. In addition, contaminated groundwater would flow into the pit.	We recommend that the text describe the sources of contaminated groundwater that would flow into the pit at closure.
K4.18-27	K4.18.2.4	The predicted quality of discharge water from both WTPs in operations is provided in Table K4.18-9, and from the WTP in closure in Table K4.18-10.	It is not clear whether the predicted values in these tables represent average or maximum values. We recommend that both the 50th percentile and 90th percentile values be provided.

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K4.18-29	K4.18.2.4	Table K4.18-10	The Cd outflow value of 0.049 mg/L is in bold, indicating that it does not meet WQS; however, in Table K3.18-1, the standard is shown to be 0.08 mg/L. We recommend that the DEIS address this potential discrepancy.
K4.18-30	K4.18.2.4	Table K4.18-10	The Hg concentration from the WTP outflow post-closure is predicted to be 61 ng/L, which is significantly elevated above the WQS of 12 ng/L. This, in conjunction with the sulfate levels of 151 mg/L (same table), have the potential to create a problem with methylmercury production and the potential bioaccumulation of methylmercury in downstream fish tissue. We recommend that this be described in the DEIS in section 4.18 and 4.24 (fish values). Because the PDEIS predicts that the closure WTP discharges would exceed water quality standards for mercury and selenium, we recommend that an additional alternative or variant be added that includes an improved closure WTP that will treat selenium and mercury to levels below the water quality standards. We recommend that this alternative be included in the DEIS.