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Rebuttal Report
NOVEMBER 6, 2023
Prepared for Protestant Nez Perce Tribe

BEFORE THE DEPARTMENT OF WATER RESOURCES OF THE STATE OF IDAHO

In the Matter of Application for Permit No. 77-14377, 77-14378, 77-14379;
Applications for Transfer 85396, 85397, 85398, 85399;
and Application for Exchange 85538
In the Name of Perpetua Resources Idaho, Inc.

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1. Introduction

Our previously submitted expert report dated September 11, 2023, summarized our concerns regarding the potential effect Perpetua Resources Idaho, Inc.'s ("PRII") water right applications, submitted to the Idaho Department of Water Resources for their proposed Stibnite Gold Project, could have on fish and other aquatic resources in the headwaters of the East Fork South Fork Salmon River ("EFSFSR"), including Meadow Creek. Our September 11 report also summarized our concerns regarding their proposed water right conditions.³ We concluded in our September 11 expert report that PRII's evaluations of their proposed water diversions lacked stream-specific data (i.e., EFSFSR upstream of Sugar Creek and Meadow Creek), detailed flow information, appropriate hydrology, and fish habitat information and analyses, which made it difficult for us to fully understand or predict impacts to fish and their habitat caused by PRII's proposed water withdrawals. We, therefore, presented possible approaches to accurately estimating habitat loss and recommended potential future studies to collect data and robustly model impacts to fish. With the information PRII had made available, we also presented our major concerns regarding the proposed water withdrawals effect on fish. These concerns were:

- PRII's proposed water rights would cause fish habitat loss below all points of diversions, including adult holding, spawning, incubation, and juvenile rearing habitat;
- PRII's proposed water rights would restrict fish passage below the EFSFSR point of surface water diversion;
- PRII's proposed point of quantification conceals the affect its proposed water rights will have on flow and fish habitat within the EFSFSR above its confluence with Sugar Creek;
- Immediate water withdrawals or shut-offs (i.e., ramping rates) by PRII could cause fish stranding and flushing;
- PRII's proposed water rights would reduce flows in the EFSFSR causing stream temperature increases during summer months and decreases during winter months;
- PRII's proposed water rights would reduce flows in the EFSFSR causing fish productivity losses;
- PRII's analyses have not considered climate change impacts and the resulting, predicted increases in future stream temperatures and flow regime shifts; and
- The cumulative effect of the potential impacts listed above on ESA-listed salmonids in the EFSFSR headwaters.

On September 11, 2023, PRII submitted a fisheries expert report ("PRII fisheries expert report") prepared by BioAnalysts, Inc. (dated September 10, 2023), which summarized PRII's proposed water withdrawal effects on fish using analyses presented in the U.S. Forest Service's Supplemental Draft Environmental Impact Statement ("SDEIS")⁴ for PRII's proposed Stibnite

³ Proposed conditions were detailed in a technical memorandum appended to an August 2, 2022, letter from the Idaho Governor's Office of Species Conservation and the Idaho Department of Fish and Game to James Cefalo, Regional Manager, Idaho Department of Water Resources.

⁴ <https://usfs-public.app.box.com/v/PinyonPublic/file/1052214209080>

Gold Project (USFS 2022). PRII's fisheries expert report considers "the most relevant comparisons and conclusions for water management"⁵ based on comparisons between the SDEIS's no action alternative and the preferred alternative, using evaluations of watershed condition indicators⁶ and results from spring/summer Chinook salmon and steelhead intrinsic potential ("IP") modeling⁷ (Cooney and Holzer 2006). Using these SDEIS evaluations, PRII's fisheries expert report concluded that watershed condition indicators started improving post mining operations (mine year 20) as compared to baseline conditions, and that, although IP habitat was initially reduced, it begins to recover at mine year 15 and shows a net positive gain by the end of mine life.

Although we did not have the time to conduct a comprehensive review of the SDEIS in preparation of this rebuttal report, we are familiar with the type of science used in it to evaluate impacts to fish. The application of watershed condition indicators and IP models to determine potential impacts to fish habitat in the EFSFSR and Meadow Creek as a result of PRII's proposed water withdrawals is inappropriate. Both approaches are intended to classify and prioritize stream reaches to determine which areas are most in need of habitat restoration or have the highest potential for quality habitat. Watershed condition indicators and IP models are not suited to accurately determine or quantify impacts to fish resulting from changes in streamflow management in highly degraded habitats for the following reasons:

- The IP models are ill-suited for application in degraded or altered habitats, rendering their use unreliable in highly modified project area streams.
- Watershed condition indicators and IP model results depend heavily on inputs derived from modeled data (e.g., future streamflow or temperature conditions) or low-resolution, remotely sensed information, with limited validation against empirical data and no indication of modeled input uncertainty, thus compromising the confidence of their ability to accurately predict habitat impacts from changes in streamflow.
- The IP models were originally generated using datasets consisting of information collected across a large geographic area (e.g., interior Columbia Basin). Applying the model at small spatial scales (e.g., EFSFSR headwaters) may lead to inaccuracies and misrepresentation of the existing and proposed stream conditions making it difficult to accurately predict the habitat needs of local fish populations and impacts from changes in streamflow.
- IP models rely on hydrologic and geologic data at coarse scales and overlook ecological complexities (e.g., species interactions, food web dynamics, habitat diversity) and factors crucial to fish habitat quality and quantity (e.g., aquatic invertebrate production, cover), again making it difficult to accurately predict local habitat impacts from changes in streamflow.

⁵ PRII's fisheries expert report at 3.

⁶ A watershed condition indicator is a metric used within the watershed condition classification system to describe watersheds within three condition classes: functioning properly, functioning at risk, and impaired function (USFS 2011). PRII's watershed classification indicators are described in ESS (2019a).

⁷ Intrinsic potential models use geospatial data to rank stream reaches based on topographic metrics which influence habitat development and provide a method to estimate historical habitat potential in absence of human development (Sheer, et al. 2008).

Additionally, from the limited review we conducted of the SDEIS in order to understand PRII's fisheries expert report references, it appears that some model results in the SDEIS are missing, incongruent, or incomplete from results presented in PRII's fisheries expert report. Furthermore, the SDEIS evaluates the effects of the full proposed Stibnite Gold Project mine operations, thus making it impossible to evaluate and fully understand the potential impacts to fish habitat caused by the proposed water withdrawals as opposed to other mining actions.

We should also note that the SDEIS includes additional fish impact evaluations that PRII did not include in their report such as occupancy models, fish-flow productivity models, PHABSIM,⁸ and temperature evaluations. These evaluations and results are influenced by streamflow reductions and they indicate large negative fish impacts.

For the reasons articulated above, PRII's fisheries expert report does not remove our original concern that their proposed water rights, even with the water rights conditions they propose, will have a negative effect, currently of unknown scale, on fish habitat in the EFSFSR and Meadow Creek. We continue to believe that if the full proposed water right is withdrawn from the EFSFSR or Meadow Creek, fish impacts would be severe.

2. Critique of PRII's Fisheries Expert Report

2.1 PRII's Use of SDEIS Watershed Condition Indicators and IP Models to Assess Water Withdrawal Impacts on EFSFSR Headwaters Fish Habitat is Inappropriate

2.1.1 The SDEIS and the Mine Plan is Not Final

Given that the SDEIS is not a final decision, and the final mine and restoration plan is unknown, it is inappropriate to use the SDEIS to evaluate fish impacts from Perpetua's proposed water rights conditions. Rather, fish impacts from PRII's proposed water withdrawals and proposed water right conditions should be evaluated by comparing predicted habitat conditions under the water rights applications and proposed water right conditions against baseline habitat conditions.

2.1.2 Water Withdrawal Impacts on Fish Should be Understood in the Absence of Other Mining Actions

The SDEIS evaluations attempt to evaluate the impact of all proposed mine activities on fish habitat at the site. It is, therefore, not possible to determine from the SDEIS evaluations water withdrawal impacts on fish in absence of other project actions (e.g., future stream restoration).

2.1.3 Model Evaluations Lack Consideration of the Appropriate Spatial Scales

The IP model used in the SDEIS was originally developed to provide an indication of historical production potential of spring/summer Chinook salmon and steelhead across tributary habitats in the Interior Columbia Basin (Cooney and Holzer 2006). The purpose was to quickly, simply, and objectively describe the distribution of habitat across a large geographic area. The IP model was not intended to determine potential impacts to spring/summer Chinook salmon and steelhead habitat resulting from proposed water withdrawals in localized stream reaches like the EFSFSR headwaters. While the IP model can be adopted for smaller spatial scales, the original intent of the

⁸ Physical habitat simulation.

model was to broadly identify potential habitat using coarse geomorphic and stream channel conditions. There is widespread recognition in the ecological community that processes and parameters (e.g., fish feeding and survival, fluvial geomorphology) may differ among spatial scales (e.g., inches or feet versus meters or kilometers; Levin 1992); consequently, considering spatial resolution is an important element when developing or implementing an ecological model (Railsback 2016), including a fish habitat model capable of describing impacts from water withdrawals.

2.1.4 Inappropriate Application of Intrinsic Potential Models to Altered EFSFSR Habitats

The IP models used in the SDEIS rely on three input variables; stream width (wetted or bankfull), stream gradient, and valley confinement. These variables are intended to capture broad geomorphic and hydrologic conditions that influence fish habitat quality under historical conditions (Sheer, et al. 2009). Additionally, the variables do not directly capture changes in stream flow and they do not capture shifts in habitat quality due to anthropogenic impacts. PRII's fisheries expert report references the SDEIS IP models and incorrectly uses them to evaluate habitat uplift or loss resulting from predicted changes to streamflow as a result of PRII's water right applications. The intrinsic historical potential of a stream reach is no longer a useful baseline in the EFSFSR headwaters to evaluate the effect of new changes to the landscape, such as PRII's proposed water withdrawals.

IP models are intended to be applied to unaltered habitats to represent historical habitat potential in the absence of human disturbance (Sheer, et al. 2009). IP models are based on natural (i.e., intrinsic) topographic and climatic conditions and are intended to reflect pristine conditions prior to anthropogenic changes to the landscape (e.g., forestry, mining, road construction, etc.). The habitat in the EFSFSR headwaters has been heavily modified by previous mining activities over the last 100 plus years. Thus, application of the IP model to altered conditions in the EFSFSR headwaters and based on stream width (wetted and bankfull), gradient, and valley confinement is an ill-suited application of the model which could lead to erroneous results and conclusions of water withdrawal impacts on fish.

2.1.5 Lack of Consideration for Fish Ecology

Many models in the SDEIS, including the IP model that are used to evaluate impacts to fish overlook ecological complexities that determine the quantity and quality of fish habitat because they are highly reliant on coarse geographic- and hydrologic-centric data. Metrics that better predict fish habitat selection and quantity likely differ among species and regions and should be carefully considered when determining models to assess changes in stream flows. Instead of using coarse-scale regional models (i.e., IP model), models could have been selected or developed that consider local fish observation and habitat data (including a suite of habitat variables) to determine, from the field data, which variables best describe local fish-habitat relationships to describe fish abundance and habitat selection. Such models should also consider dynamic flow and temperature regimes, not just extremes (Railsback 2021), as well as other factors important to fish ecology (e.g., food, cover, competition, etc.).

2.1.6 PRII's Reliance on Modeled and Unvalidated Data Inputs

Many of the models used in the SDEIS to evaluate mining impacts to fish and fish habitat, including the IP model were highly reliant on modeled inputs or inputs derived from low-resolution remote geographic information systems data (e.g., using ESRI ArcGIS, StreamStats). Further, when empirical or field data were available, they were sparsely used to validate modeled input data. Less than five percent of the IP input data for wetted bankfull widths were from empirical, field collected data. As an example, the IP model is based on geomorphic stream characteristics, including wetted width, bankfull width, gradient, valley bottom width, and valley width ratio (ESS 2019b). Using data derived at such coarse scales and largely not validated in the field is likely to lead to inaccurate or imprecise predictions of fish habitat potential.

There was also no validation of the input data modeled in the SDEIS, calling into question the validity of the IP model to determine fish habitat loss and gain from changes in stream flows resulting from the proposed water rights applications. For instance, there is a gaping discrepancy between the distributions of modeled and field data for bankfull and wetted widths used in the model, most notably the minimum, mean, and median values (Tables 4 and 5 in ESS 2019b). And, the median modeled bankfull width was 1.9 meters, a stark disparity from the median bankfull value of 6.0 meters observed in field data. For this single input, the IP model, as applied, seems flawed, as 95 percent of the inputs are derived from models and/or remotely sensed data that does not match empirical data collected at the site. The other input data (gradient, valley bottom width, valley width ratio) are entirely modeled and the SDEIS includes no indication of the accuracy or precision of the modeled data or comparisons to empirical measurements.

2.2 PRII's Rebuttal Report Analysis Lacks Analytical Rigor

2.2.1 Unclear Comparisons

PRII's fisheries expert report predicts minimal impacts to fish habitat from PRII's proposed water rights conditions, citing analyses conducted for the SDEIS and a fish passage analysis completed by Rio ASE (Rio ASE 2023). The report states PRII's preferred alternative (ModPRO2) decreases "the project's footprint and potential environmental impacts,"⁹ which will reduce the mine's water needs and lower stream temperatures. However, PRII's fisheries expert report is not clear as to what it is comparing with the preferred alternative. Is it comparing the preferred alternative to another mining plan or to baseline conditions? Additionally, it is unclear how PRII has evaluated the proposed water rights for impacts on fish without considering the other Stibnite Gold Project activities and proposed future stream restoration considered in the SDEIS.

2.2.2 Contradictory Results

PRII's fisheries expert report acknowledges streamflow as a primary contributor to the amount of IP habitat in Meadow Creek. The report also acknowledges that predicted flow changes in Meadow Creek resulting from proposed mining activities during the low flow period will reduce the amount of IP habitat available for spring/summer Chinook salmon and steelhead in Meadow Creek. However, the amount of predicted flow change in Meadow Creek during the life of the mine and its impact on the available habitat under the proposed water rights is unclear. PRII's fisheries expert report indicates a 36.4% decrease in Meadow Creek during the low flow period (mine year

⁹ PRII's fisheries expert report at 1.

seven in Table 4.12-5; USFS 2022) from mine activities, while the SDEIS reports up to a 40% reduction (SDEIS at 4-166). To further add to the confusion, the SDEIS's own appendix (ESS 2019c) provided summaries showing even different percent changes in flow for three alternatives for select mine years, and each indicate a greater than 36.4% reduction. It is unclear which Meadow Creek result is correct, which one should be used to evaluate impacts to fish, and whether the results include the full proposed water right application.

PRII's fisheries expert report claims improvements to habitat conditions (e.g., large woody debris, pool frequency) and habitat access under interim and restored phases of the project, relative to baseline (existing) conditions, citing results from SDEIS (USFS 2022) analyses. However, when reviewing the SDEIS sections PRII cited in its fisheries expert report, we often could not locate the results for information to which PRII was citing. We also could not determine which proposed mining alternative or which mine years PRII's fisheries expert report is referring to when citing positive habitat results as well as the amount of streamflow reductions being evaluated for the proposed alternative to achieve those purportedly positive results. It is further difficult to determine whether PRII is evaluating the proposed water rights application when citing positive fish habitat results and/or the spatial and temporal scale of the water withdrawals that PRII is referring to.

PRII's fisheries expert report states, "the SDEIS did not compare WCI [watershed condition indicators] metrics before and after restoration/enhancement . . ." ¹⁰ yet, the expert report includes a table presenting WCIs for baseline conditions and those predicted to occur under the preferred alternative. The report also claims, "these indicator metrics shows [sic] improvement in habitat conditions . . ." ¹¹ What is the source of this information if it was not included in the SDEIS? SDEIS Table 3.12-17 (SDEIS at 3-316) shows baseline WCI ratings for 23 habitat metrics, and Table 4.12-6 summarizes changes to WCIs during and after mining operations for five metrics. PRII's fisheries expert report, on the other hand, only shows predicted WCIs for four metrics. Do the WCIs excluded from PRII's Table 1 only maintain or worsen?

For a better evaluation of changes in fish habitat using WCIs, we suggest a more thorough comparison of fish habitat conditions, spatially and temporally, that accounts for additional metrics that contribute to a functioning stream ecosystem. Additionally, it appears the ratings in Table 1 of PRII's fisheries expert report do not completely match those reported in the SDEIS. For example, the SDEIS states that Meadow Creek's large woody debris is functioning appropriately (Table 3.12-17) under baseline conditions whereas PRII's fisheries expert report shows that large woody debris is functioning at unacceptable risk under baseline conditions.

In our September 11 fisheries expert report, we showed that in most (10 of 12) months, median flows in Meadow Creek were below 10 cfs (Table 1). If the full proposed water right (9.6 cfs; 77-14378) was exercised, nearly 100 percent of Meadow Creek flows could be diverted from the EFSFSR during those months. Now, while we understand that PRII may not divert their full water rights at all times, the possibility exists under their current water rights application and conditions that they could. If PRII were to divert their full water right from Meadow Creek it would have severe impacts for fish in Meadow Creek. These discrepancies in the proposed change to Meadow Creek flows inhibit a full understanding and evaluation of the water withdrawal impacts on fish.

¹⁰ *Id.* at 3.

¹¹ *Id.*

PRII's fisheries expert report noted predicted changes in stream flows affect the amount of spring/summer Chinook salmon and steelhead IP habitat in Meadow Creek based on their own science. PRII's fisheries expert report concludes, referencing the SDEIS, that some habitat loss in Meadow Creek was recovered by mine year 15, and that IP habitat was not affected by streamflow management activities in any other stream reach. This conclusion obscures the result (SDEIS Table 4.12-9) that total IP habitat for spring/summer Chinook salmon in Meadow Creek is 81% lower than baseline condition in mine years six and 11 and remains 34% lower than baseline in mine year 15. A 34% reduction in IP habitat from baseline is not "recovered" habitat. Moreover, the 0.66 km of "High" IP rating habitat in Meadow Creek is expected to be lost early in mine operations and is never expected to recover. Further, according to the SDEIS, Meadow Creek's high quality IP habitat for steelhead decreases similarly during mine operations and does not recover and improve until mine year 18; however, the total IP habitat available in Meadow Creek in mine year 18 is still 27% lower than baseline conditions (SDEIS Table 4.12-12 at 4-370).

Additionally, it is unclear how the IP habitat was summed in SDEIS Tables 4.12-9 and 4.12-12, which may lead to even larger expected losses of habitat. Figure 2 in Appendix J-3 within the original Stibnite Gold Project Draft Environmental Impact Statement ("DEIS," USFS 2020) indicates a barrier to all upstream fish passage at the tailings storage facility ("TSF") buttress in Meadow Creek. Yet, Appendix J-4 Figures 8 and 9 show IP habitat being available upstream of the TSF buttress. After reviewing PRII's fisheries expert report and sections of the SDEIS and DEIS, we are still unsure which stream sections are included in IP habitat summaries. If reaches upstream of proposed fish barriers are incorrectly included, then the SDEIS and PRII's fisheries expert report are underreporting fish habitat losses.

2.3 PRII Failed to Consider Other Species of Concern

Our primary concern is with fish habitat loss upstream of PRII's proposed surface water intake (in the forebay just south of PRII's proposed diversion tunnel south portal) in the EFSFSR and Meadow Creek and with fish passage through the EFSFSR reach downstream of the proposed surface water intake and upstream of the EFSFSR confluence with Sugar Creek. The species we are concerned about include the salmonid species listed in PRII's fisheries expert report (i.e., spring/summer Chinook salmon, steelhead, bull trout, and westslope cutthroat trout); however, the South Fork Salmon River watershed is home to additional aquatic species with ecological and cultural significance to the Nez Perce Tribe.

Pacific Lamprey (*Entosphenus tridentatus*), which require different habitat and passage conditions than salmonids, should be considered when evaluating proposed water right impacts. Pacific Lamprey are very important to the Nez Perce Tribe and have distinctive habitat requirements for their various life stages from larval ammocoetes and macrophthalmia to returning anadromous adults (e.g., larval ammocoetes typically live in silty or sandy substrates to burrow and filter feed (Moser, et al. 2021; Clemens, et al. 2010)). In addition, lamprey have different passage requirements than salmonids; they can be hindered by high-velocity, turbulent areas and squared or sharp corners in salmon passage facilities (Goodman and Reid 2017; Pacific Lamprey Technical Workgroup 2017). In order to thoroughly evaluate proposed water rights and their impacts on fish, all aquatic species, including lamprey, currently present in the EFSFSR watershed should be considered.

2.4 PRII Failed to Report Negative SDEIS Evaluations

In reviewing the referenced SDEIS to confirm and further understand statements made in PRII's fisheries expert report, we identified other completed fish evaluations that were not included in PRII's fisheries expert report including temperature, fish-productivity, PHABSIM, and occupancy model evaluations. We summarize these additional results from the SDEIS below because they are useful to evaluate impacts to fish resulting from streamflow reductions (i.e., partially related to PRII's proposed water withdrawals), and they provide a more complete record of potential negative impacts to fish and their habitat highlighted in the SDEIS.

2.4.1 Temperature

The SDEIS provides modeled predictions of stream temperatures during various mine year periods, summarizes temperature changes from baseline conditions, and estimates stream habitat loss due to water temperatures that are out of compliance with thermal requirements for salmonids. For most stream reach and mine year combinations, the SDEIS predicts that stream temperatures will be below 18°C¹² (SDEIS Table 4.12-2)—a critical threshold for salmonids (Carter 2005). Interestingly, stream temperatures in Meadow Creek decrease from baseline conditions during mining operations due to PRII's plan to pipe¹³ the stream and avoiding solar radiation (SDEIS at 4-336). Once low-flow pipes are removed from the TSF in mine year 23, Meadow Creek temperatures are predicted to rise above 18°C during the summer months. The percent of total available habitat loss during mine year six for spring/summer Chinook salmon is 37% (SDEIS Table 4.12-7), 26% for steelhead (SDEIS Table 4.12-10), and approximately 25–32% for bull trout and westslope cutthroat trout (SDEIS Table 4.12-13,-16).

2.4.2 Flow-Productivity Evaluation

Similar to our September 11 fisheries expert report, the SDEIS provided an evaluation of reduced stream flows associated with Perpetua's proposed mine (based on mine operation needs for three mining alternatives) on spring/summer Chinook salmon and steelhead productivity (ESS 2019d). Chinook salmon productivity was shown in SDEIS Table 4.12-8 to decrease in the EFSFSR upstream from Sugar Creek by an average of 11% (range: -2% to 21%) and 9% (range: -4 to 29%) in Meadow Creek. Steelhead productivity estimates indicate similar average reductions of 11% (range: 0 to 21%) in the EFSFSR above Sugar Creek and 14% (range: 0 to 30%) in Meadow Creek (Table 4.12-11). Estimated productivity reductions are a direct result of altered stream flows caused by proposed water withdrawals to support mine operations.

2.4.3 PHABSIM

The SDEIS provides an evaluation of potential changes to bull trout and westslope cutthroat trout habitat based on predicted changes in streamflow due to mining activities, using the PHABSIM model and estimates of weighted usable area (WUA). These results demonstrate that any streamflow reduction will result in a loss of fish habitat. But, these known reductions were not

¹² EPA (2003) recommends that the seven-day average of the daily maximum temperatures should not exceed 18°C in waters where both adult salmonid migration and “non-core” rearing occur during the period of summer maximum temperatures (Carter 2005). Temperatures above this point can reduce growth, increase stress, affect reproduction, or create disease problems in salmonids.

¹³ Piping the stream and decreasing temperatures pose new habitat threats to fish beyond the scope of our evaluations and the subject of this rebuttal.

included in PRII's fisheries expert report. The PHABSIM results reported in the SDEIS to present possible changes in Meadow Creek habitat originate from a study completed in Summit Creek (Secesh River headwaters) in 1986. PHABSIM results from a similar study during the same time in Sugar Creek were used to indicate potential habitat loss or gain in the EFSFSR above Sugar Creek. The Summit Creek (used as an analogue to Meadow Creek) study showed that an 87% reduction in flow led to an approximately 90% reduction in adult and juvenile bull trout habitat, while a flow reduction of 44% yielded a 41% loss of bull trout habitat (SDEIS at 4-375). The percent habitat loss for westslope cutthroat trout was higher at 99% and 56% for similar stream flow reductions, respectively (SDEIS at 4-381). While it is unclear how the predicted reductions in streamflow under SDEIS alternatives relate to PRII's proposed water right applications and conditions, as proposed they allow a water withdrawal of more than 9.6 cfs. This is at time greater than 40% of the flow in the EFSFSR above Sugar Creek and greater than 90% in Meadow Creek. Given these types of flow reductions, the PHABSIM results indicate fish habitat in the EFSFSR above Sugar Creek will decrease by approximately 40% and Meadow Creek will decrease by almost 90%. The SDEIS concluded "impacts on physical habitat would be major, long term, and localized." (SDEIS at 4-376.)

It is unclear why the SDEIS did not apply the PHABSIM model to spring/summer Chinook salmon and steelhead to evaluate for potential loss of habitat resulting from predicted reductions in streamflows related to mining activities. Univariate preference curves, similar to those used for bull trout and westslope cutthroat trout in the SDEIS, are also available for Chinook salmon and steelhead (Maret, et al. 2006; Rubin, et al. 1991; Raleigh, et al. 1986; Raleigh, et al. 1984). Further, if the PHABSIM model was applied to Chinook salmon and steelhead, presumably it could be updated to reflect the predicted changes in habitat due to the reduced streamflows predicted in the SDEIS (Table 4.12-5 at 4-354) or from the water right application (77-14378). Although we recognize various limitations of PHABSIM and hydraulic suitability models (Railsback 2016), these types of models are more appropriate for evaluating habitat effects from water withdrawals than the coarser-scale models (i.e., the IP, watershed condition indicators) used within PRII's fisheries expert report to support their conclusion that their proposed water rights will have a minimal impact on fish habitat.

2.4.4 Occupancy Models

IP models are not currently available for bull trout and westslope cutthroat trout. In their absence the SDEIS used occupancy probability models (Isaak, et al. 2017) to estimate changes to these fishes' habitat. Although the occupancy probability models contain similar problems to those we have highlighted with IP models, the SDEIS occupancy model results are more helpful to understanding water withdrawal effects on fish habitat because a key input variable in the SDEIS occupancy models was streamflow.

Occupancy model results within the SDEIS showed an immediate 46% reduction in bull trout habitat in mine year six, which roughly continues until mine year 18 (SDEIS Table 4.12-15). Bull trout habitat in Meadow Creek is expected to improve above baseline conditions after mine year 27 from major stream restoration projects. The EFSFSR between Sugar Creek and the Yellow Pine Pit, or proposed tunnel, however, is expected to remain in poor condition for bull trout with an expected habitat loss of 42–58% for mine years six to 112. Table 4.12-18 shows similar results for westslope cutthroat trout.

3. Summary

We dispute PRII's fisheries expert report's assertion that PRII's proposed water withdrawals will have minimal impact on fish. PRII supports this assertion by citing SDEIS evaluations and accompanying documents, which were intended to evaluate impacts caused by Stibnite Gold Project's full mining operation, including stream restoration actions. As a result, the SDEIS does not provide an adequate evaluation of impacts solely attributed to proposed water withdrawals. Furthermore, our scrutiny of their SDEIS cites has exposed multiple inconsistencies in their reported results. Finally, our review of the SDEIS revealed that the document identifies substantial impacts to fish from PRII's proposed mine operations, which PRII omitted from its expert fisheries report.

Even if PRII's use of the SDEIS evaluations they cite in their fisheries rebuttal report was appropriate and helpful to understanding the effect their proposed water withdrawals will have on fish, the underlying science and PRII's application of the results in this context is flawed. These flaws include:

- The unsuitability of the SDEIS IP model for application in degraded or altered habitats. IP models are unreliable in the highly modified streams such as the EFSFSR headwaters.
- The SDEIS's watershed conditions indicator and IP models rely heavily on inputs derived from other modeled data or low-resolution remotely-sensed information, with limited validation against empirical data, and no description of model error and uncertainty.
- PRII applied the SDEIS's IP models at inappropriate spatial scales to evaluate their proposed water withdrawals, leading to inaccuracies and misrepresentation of the actual stream conditions during their proposed mining.
- IP models overlook ecological complexities and variables critical to fish habitat quality and quantity (e.g., temperature, cover, stream complexity, interspecific interactions) due to their overreliance on hydrologic and geologic data.

The SDEIS reflects our concerns about the various models cited in PRII's fisheries expert report to support their conclusion that their proposed water withdrawals will have minimal impact on fish. The SDEIS states that limited reach-specific fish data exists, or is not available, for all the streams potentially affected by the action alternatives, including PRII's proposed water withdrawals (SDEIS at 4-329). The SDEIS also acknowledges incomplete information and cautions:

Some habitat conditions could not be quantitatively evaluated due to a lack of available data or a suitable site-specific model (e.g., impacts of stream flow reductions on overwintering fish, and a site-specific stream flow/productivity model). Other examples include lack of modeling of existing habitat for many fish at multiple life stages.

SDEIS at 4-329.

After a thorough examination of PRII's fisheries expert report and the fish-related science their report cites to in the SDEIS, we have concluded that major negative impacts from proposed water withdrawals on ESA-listed Chinook salmon, steelhead and bull trout, and westslope cutthroat trout, as well as other non-listed fish species and their aquatic habitats are highly likely, but an exact estimation of the impacts is unknown. This ambiguity arises from the inadequacy of PRII's existing evaluations, which rely on broad-scale remotely sensed data, lack site-specific empirical fish and fish habitat data, and primarily focus on hydrologic and geologic characteristics to assess localized fish impacts resulting from water withdrawals.

3.1 Recommendations

As we stated in our September 11 report, water rights conditions should include or establish minimum stream flows for all stream reaches affected by water withdrawals, account for altered stream temperatures caused by water withdrawals, and include “up-ramping” or “down-ramping” rates to minimize risks to juvenile fish and aquatic biota stranding and flushing. Water withdrawals will result in increases in stream temperatures during warm months and decrease stream temperatures during winter months, more frequently pushing temperatures out of optimum ranges. Proposed conditions should limit or cease water withdrawals if any stream reach drops below minimum levels or stream temperatures approach maximum thresholds (Table 4). Additionally, proposed conditions should include ramping rates to avoid any negative effects to aquatic species.

Alternatively, we recommend a delay in approval of the proposed water right application until more appropriate, site-specific data is collected and analyzed, or until the Final Environmental Impact Statement and Record of Decision are available which describe the mine's specific water needs. Potential reductions in streamflow resulting from existing and proposed water withdrawals need to be summarized and conveyed more clearly throughout the project area, both spatially and temporally. Relatedly, a hydraulic model needs to be produced for the entirety of the project area which describes hydraulic conditions (i.e., depth and depth averaged velocities, among others) seasonally and across a range of flows, for both existing and proposed conditions. The hydraulic model should be validated and supported by appropriate fish habitat surveys throughout the project and reference areas, which collect a suite of habitat metrics important to fish habitat quantity and quality. Finally, appropriate models should be selected and applied which consider a dynamic hydrograph as well as other variables that consider the ecological complexities of fish and fish habitat (e.g., temperature, cover, invertebrate drift, interspecific interactions, substrate, pool frequency, large wood, etc.). A more thorough evaluation of potential impacts to fish should use approaches that rely more on local, site-specific data and place additional emphasis on fish and fish ecology. It may also be productive to allocate resources toward developing a comprehensive monitoring, evaluation, and action plan with appropriate triggers (e.g., implement trap-and-haul, cease water withdrawals, fish salvage, etc.) in place if negative impacts (e.g., prespawn mortality, redd dewatering, fish stress or mortality, etc.) are detected. This proactive approach would ensure that if any adverse impacts to fish are observed as a result of PRII's water withdrawals, timely and effective measures can be implemented to mitigate the effects and protect fisheries resources and aquatic ecosystems.

4. Literature Cited

- Carter, K. 2005. The Effects of Temperature on Steelhead Trout, Coho Salmon, and Chinook Salmon Biology and Function by Life Stage 27.
- Clemens, B.J., T.R. Binder, M.F. Docker, M.L. Moser, and S.A. Sower. 2010. Similarities, Differences, and Unknowns in Biology and Management of Three Parasitic Lampreys of North America. *Fisheries*. 35(12):580-594. DOI: 10.1577/1548-8446-35.12.580
- Cooney, T. and D. Holzer. 2006. Appendix C: Interior Columbia Basin Stream Type Chinook Salmon and Steelhead Populations: Habitat Intrinsic Potential Analysis. National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center. March 16, 2006.
- Ecosystem Sciences (ESS). 2019a. Appendix J-1: Fish and Aquatic Resources - Supplemental Information. Stibnite Gold Project Draft Environmental Impact Statement.
- Ecosystem Sciences (ESS). 2019b. Appendix J-4: Intrinsic Potential Model Chinook Salmon and Steelhead. Technical Memorandum. Prepared for AECOM. Prepared by Ecosystem Sciences, LLC. November 22, 2019.
- Ecosystem Sciences (ESS). 2019c. Appendix J-8: PHABSIM Technical Memorandum. Prepared for AECOM. Prepared by Ecosystem Sciences, LLC. December 2019.
- Ecosystem Sciences (ESS). 2019d. Appendix J-5: Chinook Salmon Flow-Productivity Analysis. Technical Memorandum. Prepared for AECOM. Prepared by Ecosystem Sciences, LLC. December 2019.
- Goodman, D.H. and S.B. Reid. 2017. Climbing above the competition: Innovative approaches and recommendations for improving Pacific Lamprey passage at fishways. *Ecological Engineering*. 107:224-232. <https://doi.org/10.1016/j.ecoleng.2017.07.041>
- Isaak, D.J., S.J. Wenger, and M.K. Young. 2017. Big biology meets microclimatology: defining thermal niches of ectotherms at landscape scales for conservation planning. *Ecological Applications*. 27(3):977-990.
- Levin, S.A. 1992. The problem of pattern and scale in ecology. *Ecology*. 73:1943-1967.
- Maret, T.R., J.E. Hortness, and D.S. Ott. 2006. Instream flow characterization of upper Salmon River Basin streams, central Idaho, 2005: U.S. Geological Survey Scientific Investigations Report 2006-5230, 110 p.
- Moser, M.L., P.R. Almeida, J.J. King, and E. Pereira. 2021. Passage and freshwater habitat requirements of anadromous lampreys: Considerations for conservation and control. Review. *Journal of Great Lakes Research*. 47(2021):S147-S158.
- Pacific Lamprey Technical Workgroup. 2017. Practical guidelines for incorporating adult Pacific lamprey passage at fishways. June 2017. White Paper. 47 pp + Appendix. Available online: <https://www.fws.gov/pacificlamprey/mainpage.cfm>.

- Railsback, S.F., D. Ayllon, and B.C. Harvey. 2021. InSTREAM 7: Instream flow assessment and management model for stream trout. *River Research Applications*. 37:1294-1302. DOI: 10.1002/rra.3845
- Railsback, S.F. 2016. Why it is time to put PHABSIM out to pasture. *Fisheries* 41(12):720-725.
- Raleigh, R.F., W.J. Miller, and P.C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Chinook salmon. U.S. Fish and Wildlife Service. Biol. Rep. 82(10.122). 64 pp.
- Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: Rainbow trout. U.S. Fish and Wildlife Service. FWS/OBS-82/10.60. 64 pp.
- Rio ASE. 2023. Technical memorandum: Stibnite Gold Project Fish Passage Evaluation. Prepared for Perpetua Resources, Idaho, Inc. Prepared by Rio ASE, Boise, ID. Project: 023-090-001-16. Date: 3/21/2023.
- Rubin, S.P., T.C. Bjornn, and B. Dennis. 1991. Habitat suitability curves for juvenile Chinook salmon and steelhead development using a habitat-oriented sampling approach. *Rivers* 2(1):12-29.
- Sheer, M.B., D.S. Busch, E. Gilbert, J.M. Bayer, S. Lanigan, J.L. Schei, K.M. Burnett, and D. Miller. 2009. Development and management of fish intrinsic potential data and methodologies: State of the IP 2008 summary report: Pacific Northwest Aquatic Monitoring Partnership Series 2009-004, 56 p.
- United States Forest Service (USFS). 2022. Stibnite Gold Project Supplemental Draft Environmental Impact Statement. Forest Service, Region 4, Payette and Boise National Forests, Valley County, Idaho.
- United States Forest Service (USFS). 2020. Stibnite Gold Project Draft Environmental Impact Statement. Forest Service, Region 4, Payette and Boise National Forests, Valley County, Idaho.
- United States Forest Service (USFS). 2011. Watershed Condition Classification Technical Guide. FS-978.