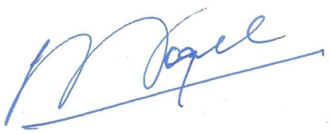
Northern Territory
Environment Protection Authority

DIRECTION TO PROVIDE INFORMATION FOR THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Direction given under clause 14(2)(a) of the Environmental Assessment Administrative Procedures 1984

Proposal	Fountain Head Gold Project
Proponent	PNX Metals Limited
Proposed action	Resumption of mining the Fountain Head pit, located near Hayes Creek, Northern Territory, with an expansion of the current and on-site processing of ore to extract gold. Tailings would be co-disposed with benign waste rock in an above ground facility. The proposal life is approximately three years.
Direction	The proponent is directed to provide information considered necessary to facilitate the examination of the Environmental Impact Statement, as detailed in Attachment A.
Submission period	The additional information must be submitted to the NT EPA within twelve (12) months of the date of this Direction.
Person authorised to give direction	
Name and position	Dr Paul Vogel AM – Chairperson, Northern Territory Environment Protection Authority Delegate of the NT EPA under section 36 of the *Northern Territory Environment Protection Authority Act 2012*
Signature	
Date of direction	6 January 2022

Attachment A – Additional information requested relating to the Environmental Impact Statement

PNX Metals Limited - Fountain Head Gold Project (proposal)

Section of Supplement	Comment	Additional information required
WATER: Hydrological processes, inland water environmental quality, and aquatic ecosystems		
3.3 Groundwater Appendix 4 and Appendix 5	<u>Evaporation pond, seepage and groundwater mounding</u> The draft EIS indicated the potential for impacts to groundwater due to seepage from the evaporation pond stating that the impact would be negligible. However, there was considerable uncertainty in the modelling, and values of the receiving environment that could be impacted, such as the presence of groundwater dependent ecosystems (GDEs) close to the proposal site, were not identified. The NT EPA's Direction to prepare the Supplement required the proponent to demonstrate that the evaporation pond would be constructed and operated with a high degree of certainty that contaminated water would not enter groundwater and the downstream environment. Modelling undertaken for the Supplement confirmed that seepage through the evaporation pond floor would result in groundwater mounding that has the potential to impact beyond the footprint of the site. The seepage is predicted to be contaminated, with dissolved arsenic concentrations in the evaporation pond predicted to increase from current levels to over 40,000 µg/L from mid-2023, and then to around 80,000 µg/L by 2024.	Additional information is required to demonstrate, with certainty, that the operation and subsequent decommissioning of the proposed evaporation dam would not have an unacceptable impact on sensitive receptors and values in the downstream environment, particularly the recorded sacred site and relevant GDEs identified in Figure 1. Detailed measures must be proposed that are likely to avoid and/or mitigate: 1. Potential impacts to the downstream environment from pit dewatering activities. 2. Passive or uncontrolled discharge of contaminants and impacts from the sources of contamination (evaporation pond and Fountain Head Pit). Information must be provided to clearly define the extent, magnitude and duration of impacts and demonstrate that impacts to the environment, including from mitigation measures such as discharge, do not have significant residual impacts. Demonstrate/explain how the mitigation measures proposed are achievable and will result in the best environmental outcome.

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	While the Supplement indicated that predicted mounding would not express to surface except within the evaporation pond itself, there is the potential for long term (post closure) groundwater quality impacts from seepage down-gradient of the site including adverse impacts to nearby GDEs (Figure 1). The significance of this potential impact cannot be predicted from the information provided. The proponent should note that unauthorised discharge (active or passive) of polluted water (diluted or non-diluted) to a waterway is considered an offence under the *Water Act 1992* and the *Waste Management and Pollution Control Act 1998*.	
Section 2.4 Appendix 5, Appendix 6, Appendix 8, and Appendix 10	<u>In-pit storage of potentially acid-forming (PAF) material</u> The predicted volume of PAF material is 280,000 m^3 and the Supplement indicates approximately 957,700 loose cubic metres (LCM) (equivalent to 2 million tonnes) of PAF waste may be stored within Fountain Head pit, and encapsulated in three separate pods. This storage capacity is three times the estimated volume of PAF material to be stored. Pod 1 has capacity to contain the highest amount of PAF material at 470,300 LCM and would be located above the pit lake water table. • There are concerns that Pod 1 will not be sufficiently submerged at closure to prevent oxidisation. • All three pods will be exposed (in-pit) until the pit is flooded at closure and likely to be generating acid and metalliferous drainage in the intervening period before a pit lake is formed.	1. As the storage capacity is three times the estimated volume of PAF material to be stored, clarify this discrepancy, and provide additional information and details on the design, location, and operation of pods 1, 2 and 3. 2. Clarify that the predicted volume of PAF material is 280,000 m^3. 3. Provide a detailed description of the movement, placement and management of the PAF material. 4. Provide a detailed description of the methods to differentiate, and classify, the various water types likely to be encountered in the pit, and the proposed management options for each type. 5. Clarify the probable volume of acid and metalliferous drainage (seepage and runoff from pods) likely to be generated during the mining phase (Phase 2) of the project (following initial dewatering operations, and prior to flooding of the pit) that requires management. 6. Review and improve the models and site water balance (refer to comments from Water Resources, DEPWS), and focus on the collection, storage and disposal of this incidental water type.

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	The pods and wall rock will be exposed to ongoing oxidation and generating acid mine drainage for some time before full submergence. It is stated that the runoff from these pods will be managed within the pit perimeter and as part of the ongoing dewatering of the pit during mining as described in Section 3.3 of the Draft EIS - through the pit dewatering process i.e. reporting to the evaporation pond.	
3.4 Evaporation Pond and Pit Water Quality Appendix 5, Appendix 6, and Appendix 8	<u>The Fountain Head pit and post mining pit lake</u> Noting model limitations, and extrapolation from only 4 data points (Appendix 8), the modelling suggests that the water quality of the pit lake during the mining and post mining phases of the Project is likely to deteriorate where the primary dissolved constituent of concern is arsenic. High concentrations of arsenic will be generated from the likely sources of PAF material placed into the pit, wall rock interaction, evaporation, and seepage into groundwater from the evaporation pond. Contaminants will likely be transported to the downstream environment along the regional groundwater flow direction. A pit water quality assessment was undertaken to assess the storage of PAF material within the pit, and to understand the long term water quality. Elevated concentrations of dissolved metals (Al, As, Co, Cu, Fe and Mn) in surface water (run-off) and groundwater (throughflow) means that groundwater and possibly surface water, is generally not suitable for drinking (for humans or livestock). Post mining, the dissolved arsenic concentration is predicted to remain above the current average pit water concentration of 600 µg/L. This is higher than the livestock	1. Additional information is required to demonstrate that the disposal of up to two million tonnes of PAF material in the pit reflects best practice at closure, and will not result in an unacceptable impact on sensitive receptors and values in the downstream environment, particularly the relevant GDEs identified in Figure 1. 2. Demonstrate that the option to submerge PAF waste rock beneath a water cover in the Fountain Head pit (scenario 1 as the base case) will result in achieving best practice closure (and an environmental improvement over the pre-existing conditions at the Proposal site). 3. Due to the expected presence of groundwater through-flow (in a northerly direction) forming a pathway for contaminant transport, demonstrate that contaminants are prevented from migrating from the sources, and an unacceptable impact on the environment would be avoided. 4. Provide estimations of the potential arsenic concentrations and other contaminant loads from the identified sources (evaporation pond and Fountain Head pit) along flow-paths in surface and groundwater both within, and outside the mine site. 5. Describe the processes and mechanisms that lead to a predicted rapid decline in arsenic concentrations in those areas likely to be contaminated both within, and beyond the boundary of the proposal site, post-closure.

Section of Supplement	Comment	Additional information required
	drinking water guideline (500 µg/L), and the aquatic ecosystem 80% protection level trigger value (140 µg/L).	6. Specify measures to mitigate the risk of contaminants entering the downstream environment, including development and implementation of trigger action response plans for water quality.
	Post mining pit lake scenarios – water management options Two scenarios are described for management of the pit post mining, both of which have potential risks. Scenario 2 is presented as the preferred option (assumes diversion of 80% of the Fountain Head upper catchment water through the Fountain Head pit at the end of mining). However, diversion of run-off from the upstream catchment through the Fountain Head pit (in scenario 2) may be problematic due to the design, location and construction of the Integrated Waste Landform becoming a barrier.	1. Clarify that scenario 2 as the preferred option (where catchment inflows are diverted to flood the pit), can be effectively implemented without compromising the long term stability of the constructed IWL. 2. Provide details of the design that demonstrate how the scenario can be implemented without reconfiguring the IWL. 3. Provide details on how any flow-on effects of the design changes, including the potential impacts from diverting flood flows to the pit, will be managed in accordance with the environmental decision-making hierarchy stipulated in the EP Act.
	Surface and groundwater quality The Proponent advised that potential residual impacts to aquatic biodiversity were assessed in the Draft EIS and Supplement as negligible to low with impacts predicted to be either short term, localised, or undetectable with respect to natural variation. However, the concentrations of arsenic, for example, in the proposed discharges via groundwater and surface waters, the water quality is several orders of magnitude above the national default guideline value (DGV). DGVs are established by modelling the results of standard laboratory ecotoxicology tests to determine the threshold concentrations above which there may be a risk of causing harm to aquatic biota. It is also several orders of magnitude above the human health and livestock drinking guidelines	1. Conduct an environmental risk assessment of the proposed discharges via groundwater and surface water in accordance with ANZG (2018) Water Quality Guidelines - Applying the framework. 2. Describe the toxicity of arsenic and other contaminants of concern noting that suspended sediment, nutrients, ionic composition and ionic strength, hydrology are all potential stressors to be considered, and where: • Seepage effects (mounding), the loss of containment of waste products, and transport of contaminants and waste into the downstream environment, are likely at the evaporation pond. • Levels of dissolved arsenic concentrations are predicted in the modelling to increase in the evaporation pond from current levels to over 40,000 µg/L from mid-2023, and then to around 80,000 µg/L by 2024, and

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	An evaluation of post closure pit water quality was requested in the Direction to prepare the Supplement, and this has been provided as Appendix 8 of the Supplement. The modelling is showing concerning amounts of arsenic and metals will be generated.	• Concentrations are predicted to decline to levels below the respective stock water guideline (500 µg/L) by the end of 2027 and the guideline for aquatic ecosystems (80% protection) shortly after in early 2028. 3. Demonstrate that the inland water environmental quality (surface and groundwater) is maintained or improved at the end of mining i.e. where the water quality objective meets the ANZG (2018) 95% species protection default guideline values.
5.2.13 Aquatic Ecosystems – Aquatic Ecology	<u>Aquatic ecosystems</u> The TOR states: *Describe values of all ecosystems and include:* • *Abundance, distribution of aquatic ecosystems within this area and comparable control areas extent of baseline data of aquatic ecosystems downstream of the Proposal that is sufficiently statistically robust to enable detection of any impacts to these ecosystems in the event of an unplanned pollution event*. In response, the aquatic study commissioned for the Hayes Creek Zinc, Gold and Silver Project, which included the proposal area was presented as Appendix 9 of the Draft EIS. Seven locations were investigated during the survey. The sites s1, s2, s3 and s5 lie in the Margaret River catchment (site of Iron Blow and Mount Bonnie), and are not directly relevant to this project. The sites s7 and s6, is upstream and in an adjacent sub-catchment to the proposal site, and s8 which is approximately 10 km downstream of the proposal site are more relevant to Fountain Head. Site s8 is (on the Margaret River approximately 10 km downstream of the proposal area) is proximal to	Undertake a study of the downstream aquatic ecosystem and include the following: 1. Identify and characterise the current condition of significant and sensitive habitats, fauna species, and GDEs directly downstream of the proposal noting that the baseline stream habitats and GDEs may be in areas potentially exposed to disturbance and impacts from previous mining activity. 2. Provide the rationale for site selection for the baseline characterisation, and justification that data are adequate to meet stated objectives for both fish and macroinvertebrates. 3. Implement the biological monitoring program (based on the Department of Environment, Parks and Water Security's submission on the Draft EIS and Supplement), and 4. In addition to collecting baseline data, develop and apply methods for carrying out the environmental risk assessment of the aquatic systems as relevant to the proposed action and the receiving environment using multiple lines of evidence such as direct toxicity assessment (DTA). Methods should conform with recommendations provided by ANZG (2018) e.g. Water Quality Guidelines - Accounting for local conditions. 5. Identify options for managing/responding to exceedances of arsenic (and other contaminants) in groundwater down-gradient of the proposal site, and downstream aquatic ecosystems post-mining in the event of an unplanned pollution event.

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	Woolwonga mine. Site S8 would likely be influenced by Woolwonga, Iron Blow, and Mount Bonnie, as well as the proposal area. To date: • There are no sites within the sub-catchment upstream of the proposal site and none directly downstream of the proposal site upstream of site 8 • The field survey was limited to a rapid assessment and provides only a snapshot • Diversity and abundance of riparian vegetation was not recorded This information was requested in the Direction to prepare the Supplement.	The biological monitoring program will require a hypothesis-testing framework that is structured to detect mine-related impacts on, or declines in, aquatic ecosystem health.
5.2.7 Hydrological Processes – Groundwater, 5.2.17 Culture and Heritage – Impacts to Sacred Sites, Appendix 4 and Appendix 5	<u>Groundwater Dependent Ecosystems</u> Margaret River and, of particular relevance, the perennial billabong and waterhole located 550 m downstream to the northeast of the proposal area (**Figure 1**), have a high potential of being aquatic GDEs i.e. high likelihood of being reliant on surface expressions of groundwater. The riparian vegetation along the unnamed tributary creek to the north of the proposal area, as well as the Margaret River, are classified as having a moderate potential of being terrestrial GDEs, i.e., moderate likelihood of being reliant on groundwater. An evaluation of GDEs was requested in the Direction to prepare the Supplement.	1. Revise the assessment of the risk to GDEs based on the presence of the vegetation within the area affected by groundwater drawdown or mounding effects. 2. Refine the hydrogeological conceptual model to include alluvial and fractured rock aquifers and their interaction with the GDEs. 3. Refine the numerical model to a class 2 model as a minimum to improve confidence in the assessment and prediction of groundwater drawdown and recovery, and potential impacts on GDEs, and provide the improved assessment and model.
Appendix 4, and Appendix 5	<u>Groundwater modelling</u>	1. Demonstrate that the model is a Class 2 model based on the criteria in the Australian Groundwater Modelling Guidelines (*Barnett et al. 2012*) noting the existing groundwater monitoring is

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	The groundwater model has not been refined as requested in the Direction to prepare the Supplement, to the extent it can be fit for purpose. The model has characteristics of a Class 1 model based on the criteria in the Australian Groundwater Modelling Guidelines (*Barnett et al. 2012*). The Guidelines recommend at least a Class 2 model for adequate impact and water balance modelling for dewatering projects.	inadequate for the calibration of the numerical model to a Class 2 standard. 2. As a priority improve the groundwater model's performance for predicting potential impacts to the surrounding environment, dewatering requirements and for adequate water balance predictions. 3. Refine the conceptual model to include alluvial and fractured rock aquifers and their interaction with the GDEs. 4. Revise, expand and improve the local monitoring (groundwater and surface water) network for better modelling outcomes (predictions) and to reduce model uncertainty/assumptions. 5. Monitor and collect an appropriate baseline dataset to evaluate the surface water and groundwater interactions with a focus on developing post closure monitoring of the groundwater system. 6. Review and refine the model input data with site specific aquifer tests to determine hydraulic conductivity (kH and kV) and storage parameters. 7. Collect time-series groundwater levels at most (if not all) existing monitoring bores over at least one wet season and dry season cycle (to better constrain recharge estimates). 8. Model and describe how the proposal has been designed to consider, or allow for, impacts of a changing climate e.g. capacity and efficiency of water facilities to allow for potential increase in evaporation and/or large rainfall events, and changes in the frequency or intensity of extreme weather events. 9. Refer to comments from Water Resources, DEPWS for more detail.

Figure 1: Aquatic (*blue) and terrestrial (green) groundwater dependent ecosystems mapping. From Bureau of Meteorology, 2012. National Groundwater Dependent Ecosystems (GDE) Atlas. Bioregional Assessment Source Dataset.