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Technical Note on Updates to PLP's Proposed Project

Since submittal of Pebble Limited Partnership's (PLP) Department of the Army Permit Application on December 22nd, 2017 PLP has continued to refine the proposed project by advancing engineering design and looking for practicable opportunities to further avoid and minimize potential adverse impacts. Additionally, PLP paid close attention to the ongoing public process regarding the project, reviewing both informal public comments and those submitted through the ongoing US Army Corps of Engineers (USACE) scoping process.

As a result of this work PLP has made several updates to the proposed project that we believe further enhance environmental protections through operations and closure, further reduce project impacts, and further allow for regional stakeholders to benefit from the project. This memo outlines the updates to the proposed project.

Project Updates

The following updates are described in this section:

- 1) Mining and milling schedule
- 2) Tailings storage facility layout
- 3) Main water management pond size and location
- 4) Natural gas pipeline throughput alignment, and origin
- 5) Amakdedori port and concentrate loading

Mining and Milling Schedule

The original project had a peak mining rate of 90 million tons per year and a milling rate of 160,000 tons per day. Under this operating schedule the stockpiling of low grade ore (LGO) to feed the mill in later years was required, with the stockpile size peaking at 330 million tons. For the updated project the peak mining rate has been reduced to approximately 75 million tons per year and the milling rate has been increased to 180,000 tons per day, removing the requirement for the storage of large volumes of low grade ore during the first fourteen years of operation. These changes will not result in any substantive changes to the footprint associated with the mill and ancillary facilities.

Because of these changes, the following changes to the overall operating plan occur:

- 1) The project operating life remains unchanged at twenty years, but mining and milling operations will both continue for the full twenty-year operating life of the project.
- 2) Total tons mined will increase to approximately 1.5 billion tons, of which approximately 1.3 billion tons is ore and 200 million tons is waste. Waste rock is either utilized to construct the tailings dams, or stored through operations for placement back into the pit at closure.
- 3) Tailings tonnages increase to approximately 1,150 million tons of bulk tails and approximately 150 million tons of pyritic tails.
- 4) Pit dimensions will increase slightly and the pit outline will change. The location of the open pit water management pond will move to the south.
- 5) To accommodate the increased mill throughput the powerplant installed nameplate capacity will increase to 270 MW.
- 6) Annual concentrate production will increase to approximately 660,000 tons of copper-gold concentrate and approximately 16,500 tons of molybdenum concentrate. This will result in an approximately 10% increase in some associated road and marine traffic, specifically:
 - Up to 27 Handysize ships for concentrate transport
 - Up to 33 marine line haul barges of supplies
 - Up to 39 truck round trips per day
 - Average annual fuel requirements will decrease to 12-15 million gallons annually.
 - Lake ferry round trips will not increase and will remain at one per day on average.

These changes provide the following advantages:

- 1) The need for construction of a large lined pad for the long-term storage of low grade ore is removed. Removal of this facility allows the location to be used for other purposes.
- 2) Above ground storage of the PAG low grade ore resulted in the requirement to treat significant amounts of poor quality run-off water and seepage collected from the LGO stockpile. Removal of the LGO will facilitate water treatment during operations.
- 3) Annual mobile equipment and fuel requirements are reduced due to the reduction in the peak mining rate and the removal of ore re-handling for the low-grade material, with associated reductions in emissions from mobile equipment.

Tailings Storage Facility (TSF) Layout

The original TSF design consisted of a single facility with separate cells for the bulk and pyritic tails located in the North Fork Koktuli (NFK) West site. The updated design consists of an unlined bulk TSF located in the NFK West site, with a separate lined pyritic TSF located in the NFK East site, which will also be used to store potentially acid generating (PAG) waste sub aqueously during operations. The bulk TSF southern embankment is moved approximately 2000 feet to the south to take better advantage of the existing terrain for the embankment construction. The main (northern) embankment of the bulk TSF remains a flow-through design to facilitate water management within the bulk TSF.

These changes provide the following advantages:

- 1) Location of the pyritic tails and PAG waste in a separate facility located closer to the open pit will facilitate the placement of PAG waste and pyritic tails back into the pit at closure. Following

the cessation of operations, the pyritic tails and PAG waste will be relocated to the bottom of the open pit for permanent subaqueous storage below ground level, the pyritic TSF embankments will be breached, the liner will be removed, and the facility will be reclaimed. This provides three important long-term safeguards:

- a. The need for perpetual maintenance and water treatment of the pyritic facility is eliminated.
 - b. Storage of the pyritic tails below ground level eliminates all potential for downstream failure impacts associated with the pyritic tails storage after closure.
 - c. Storage of the pyritic tails and PAG waste rock below water at the bottom of the pit is the best means of providing for long term prevention of acid generation.
- 2) Location of the tails in two separate facilities significantly reduces overall embankment heights associated with the facilities and thereby reduces the amount of fill required to construct the facility.
 - 3) The reduced embankment sizes and the additional waste rock from the pit available for use in embankment construction results in a reduction in the amount of quarry rock needed for construction.

Main Water Management Pond Size and Location

The original layout had two collocated water management ponds (WMPs): the main WMP and the LGO WMP north of the LGO stockpile. These facilities have been replaced by a single, significantly larger, main WMP located in the NFK North site. This facility would be fully lined and constructed using rock fill embankments like the TSFs. Following the cessation of operations and once the facility is no longer needed for water storage prior to treatment, the embankments would be breached, the liner would be removed, and the facility would be reclaimed.

These changes provide the following advantages:

- 1) The ability to store significant additional process contact water separate from the TSF facilities. This change has further improved the project's ability to deal with multi-year climatic precipitation variability.
- 2) Maintaining a conservative maximum normal operating level for the main WMP provides significant capacity for additional water storage in the event of water treatment facility problems or extreme precipitation events.
- 3) Maintaining adequate minimum storage levels within the main WMP will provide additional certainty for the supply of process water during dry conditions.
- 4) The large storage volume available will allow for flexibility in water treatment and release and improve the ability to optimize discharges and minimize downstream impacts.

Natural Gas Pipeline Throughput, Alignment, and Origin

Ongoing work on the natural gas pipeline alignment and engineering design have led to the conclusion that a 10-inch diameter pipeline is not optimal. This is driven by several considerations:

- 1) The increase in mill throughput that requires more power.
- 2) The potential for use of LNG (produced at site from natural gas) as a future truck fuel.

- 3) Accommodation for potential regional energy requirements given that this this will be an open access pipeline (most likely a contract carrier).
- 4) The associated compression requirements and line operating pressures are not optimal with a 10-inch line.

The current design utilized a 12-inch pipeline for the marine and lake portions of the alignment for buoyancy reasons. The updated design incorporates a 12-inch diameter line for the marine, lake, and land portions of alignment. This results in a reduction in compression requirements and associated air and noise emissions, without any increase in the ROW footprint.

The proposed method for the installation of the deep-water (at least 12 feet or deeper) portions of the natural gas pipeline has been modified to use heavy-wall and/or concrete coated pipe and placement over the existing bottom surface, rather than placement of the pipe in a trench such that the top of the pipe is below the natural bottom. The use of heavy wall pipe to address pipe protection:

- 1) Meets code requirements for the Pipeline and Hazardous Materials Safety Agency (PHMSA).
- 2) Better addresses pipeline protection in consideration of Cook Inlet's tide and current conditions.
- 3) Is consistent with techniques used on other Cook Inlet pipelines.
- 4) Minimizes impacts associated with trenching the sea and lake bottom during construction.

Several changes have also been made, or are being considered, to the proposed pipeline alignment. These changes will be further refined and confirmed by fieldwork proposed for this summer.

- 1) The pipeline origin point is now at the compressor station location north of Anchor Point. Further discussion with gas pipeline operators on the Kenai confirmed that the existing pipeline network currently extends far enough south along the Sterling Highway and has sufficient excess capacity to supply gas directly to the proposed compressor station location north of Anchor Point, removing the requirement for the first nine miles of pipeline construction along the Sterling Highway and reducing the overall pipeline length and associated footprint.
- 2) In addition to the proposed pipeline route that starts with an HDD from the compressor location directly into Cook Inlet, PLP is evaluating an alternative route that utilizes an alignment that runs down the Sterling Highway from the compressor station to the Anchor River Recreation Area and then out into Cook Inlet utilizing a trench located adjacent to the road through the recreation area, removing the need for an HDD off the bluff. A final decision on the preferred alignment will be made following additional fieldwork this summer.
- 3) The alignment has been routed further to the south of Augustine Island to address potential pipeline geohazard concerns related to Augustine Volcano. Additional adjustments to the offshore alignment are anticipated as the ongoing geophysical data collection advances.

[Amakdedori Port and Concentrate Loading](#)

Ongoing engineering and logistical studies now support a conclusion that the shipment of concentrate from the Amakdedori port site can be accomplished using barges to lighten the concentrate containers to deeper water. The bulk carrier would anchor at established mooring points and the containers would be unloaded directly into the hold of the bulk carrier using a crane mounted on the barge. Two locations for lightering have been identified:

- 1) Approximately 12 miles offshore due west of the proposed Amakdedori port. This would be the primary lightering location.
- 2) Approximately 18 miles west-northwest of the proposed Amakdedori port between Augustine Island and the mainland. Wave heights in this area are reduced by Augustine Island and it would be used when required by sea conditions.

Both locations are located outside of the designated Beluga Whale and Cook Inlet Sea Otter critical habitat.

Two or three lightering vessels (depending on the location) would be required to move concentrate between the port and ship. About ten trips by the lightering vessels would be required to load the bulk carrier, which would be anchored for four to five days at the lightering location. The containers would be picked up using a crane mounted on the lightering vessel, dumped into the hold of the bulk carrier, and then returned to the deck of the lightering vessel. Loading would be interrupted when sea and weather conditions preclude operations. All consumables and fuel for the operation would be barged directly into the Amakdedori Port using marine line haul barges. No lightering of fuel or supplies would be required.

These changes provide the following advantages:

- 1) The requirement for dredging and subsequent maintenance dredging of a deep-water access channel is eliminated.
- 2) The requirement to store up to 20 million cubic yards of dredged material at the Amakdedori port site is eliminated.
- 3) Bulk carrier navigation and handling requirements are simplified as they no longer have to transit the access channel and maneuver in the turning basin.

PLP will continue to investigate options for a restricted access (high tide only) port facility to reduce dredging requirements to address the questions raised in RFI-033.

Conclusion

PLP believes that the outlined updates to the proposed project will further enhance environmental protections through operations and closure, further reduce project impacts, and preserve potential for regional stakeholders to benefit from the project. Please feel free to contact me if there are any questions regarding these changes or any additional information that is required.