



ENVIRONMENTAL, SOCIAL AND GOVERNANCE REPORT

APRIL 2021

PREAMBLE

This Environmental, Social and Governance (“ESG”) report describes the basic ESG principles and practices adopted and applied by Northern Dynasty Minerals (“Northern Dynasty”, “NDM” or the “Company”) in concert with its 100%-owned U.S.-based subsidiary Pebble Limited Partnership (“Pebble Partnership” or “PLP”). It characterizes these commitments as they have been applied to the geological exploration, project design, engineering/scientific studies, permitting and social/government outreach phases of the Pebble Project for the period 2002 to 2020. Subsequent phases of project development, including construction, operation, mitigation and closure, will be subject to similar and increasingly detailed ESG principles and practices as each future phase develops.

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1 INTRODUCTION

Northern Dynasty Minerals Ltd. acquired its interest in the Pebble deposit and surrounding mineral lands in southwest Alaska in 2001. Since then, the Company has funded geological, environmental, engineering and other technical studies, as well as government, stakeholder and public outreach, in order to responsibly advance the project toward permitting and development.

Dealing with nomenclature at the outset will, we hope, be helpful to the reader. Northern Dynasty's goal during the two decades it has been involved with the Pebble Project has been to responsibly develop the mineral resources located within its state-granted mineral claims in southwest Alaska. References to the 'Pebble Project' or to 'Pebble' in this report will have that broad meaning – a reference to Northern Dynasty and its partners' efforts to responsibly develop the mineral resources contained within the Pebble mineral claims.

When we refer to the specific project description with which the Pebble Partnership recently initiated federal permitting (2017), we will refer to it as 'the proposed Pebble mine,' the 'proposed project' or as individually 'proposed' project features – such as 'proposed tailings storage facilities,' 'proposed transportation infrastructure' or similar. As defined in the permit application submitted to the U.S. Army Corps of Engineers ("USACE") in December 2017, the proposed Pebble mine has a 20-year operating life. It represents the only specific project design for which NDM or PLP has ever sought government approval.

Should Northern Dynasty, the Pebble Partnership or any other entity desire to develop the mineral resources at Pebble beyond this initial 20-year plan, such development would require the proponent to again go through a rigorous, multi-year project evaluation and permitting process – involving federal, state and local regulatory authorities, as well as extensive opportunities for tribal and public participation. Neither NDM nor PLP currently has *any* approved plan to permit subsequent phases of development at Pebble beyond the initial 20 years of mining proposed in 2017.

While Pebble's trajectory has been influenced by the involvement of several significant funding partners over the years (including major mining companies), Northern Dynasty's leadership has always provided a cardinal direction. In particular, NDM's *Responsible Mining Principles* (RM Principles)¹ have provided both a vision and a roadmap for management of environmental, social and governance considerations at Pebble.

In 2007, the Pebble Limited Partnership was established as a U.S.-registered limited partnership, based in Anchorage, Alaska, to serve as the principal proponent of the Pebble Project, holder of Pebble's state-issued mineral claims and a partnership vehicle for Northern Dynasty and current and/or future owners. PLP also brought Alaskan and American leadership to the project – including through CEO John Shively and other prominent Alaskans with established records for supporting environmentally sound and socially responsible resource development in the state.

¹ See <https://northerndynastyminerals.com/responsible-mining/our-principles/>

The perspective that PLP brings to the Pebble Project has been an important adjunct to NDM's RM Principles. Pebble's U.S. management and leadership team have invested the project with a uniquely Alaskan view about how mineral resources can be developed safely and profitably for the benefit of rural villages and all Alaskans, while protecting key environmental values.

Despite the positive intentions, values and actions of NDM and PLP, the Pebble Project has been contentious since at least 2005. In the Company's view, there are a number of key external factors that help explain why the project has attracted so much public attention and rancor:

- *the size of the resource* – the Pebble deposit is one of the most significant accumulations of metal ever discovered. It represents, for instance, ~1.3% of all the copper ever produced or discovered in the world and ~1.8% of all the gold. It is the most significant rhenium resource in the world and hosts significant stores of silver, molybdenum, palladium and other valuable metals;
- *its proximity to globally significant fisheries* – eight large watersheds drain into southwest Alaska's Bristol Bay, and collectively support the world's largest commercial fishery for sockeye salmon, as well as important subsistence and recreational fisheries. The Pebble deposit has a footprint in two of these large watershed areas;
- *its location in a largely undeveloped area* – the Bristol Bay region of southwest Alaska is ~40,000 sq. miles, about the same size as Ohio or Iceland. It is home to ~7,000 people living mostly in ~30 small, isolated villages;
- *the culture and demographics of local communities* – the vast majority of Bristol Bay residents are of Alaska Native descent, and rely on the region's fish, game and other natural resources for subsistence harvests, culture and tradition, as well as jobs and economic activity;
- *early and sustained ENGO (environmental non-governmental organizations) activism* – for at least 15 years, millions of dollars have been expended annually by activist groups to oppose Pebble, and to fan the fears and concerns of local people – particularly with respect to the project's potential effect on fish and aquatic habitat.

NDM and PLP recognized these factors early on and determined that their approach to development at Pebble must emphasize key 'environmental' and 'social' issues. For example:

- in order to design, permit, build and operate a modern mine at Pebble that would demonstrably protect important fish, water and aquatic habitat resources, and co-exist with globally important fisheries, NDM and PLP have made since 2004 what we believe to be the single largest investment in environmental science in support of a development project in the history of U.S. mining;
- in order to ensure that local people could both influence the project in a meaningful way, and benefit from its development over time, NDM and PLP pioneered entirely new public engagement and participation programs – including offering local people an opportunity to share in the profits of Pebble's development.

Many of the progressive ESG programs, commitments and approaches Pebble’s proponents have employed over the past two decades to address the unique conditions of the Bristol Bay region are explored in the pages of this report.

Notwithstanding these efforts, however, political activism at Pebble has never waned. Rather, the contentious and politicized nature of the project eventually led to some unprecedented government actions.

For instance, in 2014, the U.S. Environmental Protection Agency (“EPA”) initiated a Proposed Determination under the *Clean Water Act* (“CWA”) in an unprecedented effort to ‘veto’ the Pebble Project before its proponents had even applied for permits. Litigation filed by PLP led to a preliminary injunction against the EPA later that year, and eventually to a settlement that would allow Pebble to initiate federal permitting under the CWA in 2017.

In July 2020, the proposed Pebble mine achieved a major milestone when the USACE published a Final Environmental Impact Statement (“Final EIS”). The Final EIS is the most relevant, objective, science-based assessment of the proposed project ever conducted, incorporating analysis and conclusions from expert regulators and third-party consultants led by the USACE, 12 federal, state and local cooperating agencies, and federally recognized tribes.

Importantly, the Final EIS found the proposed Pebble mine would not have a measurable impact on local fish populations, and would co-exist with important commercial, subsistence and recreational fisheries in Bristol Bay.

The Final EIS also found that development of the proposed Pebble mine would make a profound and positive socioeconomic contribution to the Bristol Bay region and the State of Alaska. It is also abundantly clear that the proposed project would help address a growing national crisis in the United States related to the domestic production of critical metals – such as copper and rhenium, for which the country is heavily reliant on foreign producers.

Notwithstanding the positive findings of the Final EIS, the USACE inexplicably issued a negative Record of Decision (“ROD”) in November 2020, denying the proposed project a key federal permit under the CWA. PLP is now appealing that decision – a verdict we believe to be fundamentally unsupported by the administrative record (including the Final EIS published by the USACE).

At the time this ESG Report is being prepared for publication, the USACE has accepted the Pebble Partnership’s appeal of the ROD. The State of Alaska also appealed the federal agency’s decision on the proposed Pebble mine, noting the precedent it establishes threatens future resource development in the state. The USACE has denied the State the opportunity to appeal.

Depending on the outcome of the administrative appeal process, NDM and PLP may seek other remedies, including through the courts. The Company continues to believe in the Pebble Project and its potential to benefit the people and communities of Bristol Bay, Alaska and the nation.

We believe the proposed Pebble mine can fundamentally co-exist with the important fisheries resources of Bristol Bay, and even strengthen the economic contribution they make to the

region and the state. Furthermore, we believe America needs long-term domestic sources of copper and other critical minerals present at Pebble – especially if it is to meet its own ambitious climate change goals, and at a time when other countries and regions are pursuing their own similar goals.

As debate about the proposed Pebble mine continues to evolve through administrative and legal process, and political and public discourse, what is too often missed is a fair and objective look at the actual project design the men and women behind PLP have proposed.

How have the project’s proponents advanced the proposed mine on the ground? How have NDM and PLP planned and conducted their activities in the project’s exploration, development and permitting phases? How has project design and engineering for proposed mine construction and operations addressed the priorities and concerns of local people and all Alaskans?

Unfortunately, these questions too often go unasked and unanswered – overwhelmed by the rhetoric of opposition groups, and their cataclysmic claims about project risks.

This ESG report is an effort to explain simply and directly, without embellishment, what NDM and PLP have done in the years 2001 to 2020 to advance the Pebble Project in an environmentally sound and socially/corporately responsible way.

We do not expect to convince readers based on this document alone that the Pebble deposit can or should be developed. Rather, the intent is to contribute to a more informed and balanced dialogue about the proposed Pebble mine and the future of the Pebble Project by facilitating greater understanding of its past.

2 NDM'S GENERAL COMMITMENT TO ESG PRINCIPLES

NDM and PLP are committed to the successful application of RM Principles at the Pebble Project². These principles were designed with a specific focus on complying with rigorous local, national and international regulations and contributing to the sustainable development of local resources and communities. PLP deploys a comprehensive program of project-focused initiatives, reflecting its commitment to sustainability by protecting important fisheries and other environmental resources and thereby ensuring conservation of commercial, sport, and subsistence activities. This was complemented by actions that optimize local education, employment, business development and training opportunities.

These principles³ cover the following specific areas:

- health and safety;
- stakeholder engagement;
- community development;
- environment and society;
- resources use;
- human rights; and
- labor conditions.

In addition, NDM and PLP's actions have been guided by a number of internationally accepted ESG principles, voluntary codes and standards – including the Equator Principles⁴, the International Finance Corporation (IFC) Performance Standards on Social & Environmental Sustainability⁵, and the World Bank Group Environment, Health & Safety Guidelines⁶, including their accompanying Environment and Social Standards.⁷

In addition, the responsible mining principles prepared by the International Council on Mining and Metals (ICMM) have been considered in the design and development of the Pebble Project. The ICMM principles were recently updated with a greater focus placed on operational transparency, recognition of local communities, ethical social practice, biodiversity and pollution/waste.

“These principles define good practice environmental, social and governance requirements for the mining and metals industry through a comprehensive set of performance expectations.”⁸

Finally, work on the Pebble Project has been guided and informed, where appropriate, by the United Nations Sustainable Development Goals. These 17 Sustainable Development Goals:

² <https://www.northerndynastyminerals.com/responsible-mining/our-principles/>

³ Further discussion on these principles is included in Section 6. (Governance)

⁴ <https://equator-principles.com/>

⁵ https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/

⁶ <http://documents1.worldbank.org/curated/en/157871484635724258/pdf/112110-WP-Final-General-EHS-Guidelines.pdf>

⁷ <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-standards>

⁸ <https://www.icmm.com/>

“...are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice.”⁹

NDM and PLP acknowledge that these and other similar ESG principles, voluntary codes and standards have become critical and necessary guideposts for mineral development and mining companies advancing major development projects. The companies also acknowledge that financial markets, civil society interests and other project stakeholders broadly expect operators of major mines to both commit to measuring their on-the-ground performance against widely accepted ESG codes and standards, and to undertake regular, audited reporting.

Given the pre-permit, pre-construction and pre-operational status of the Pebble Project, many of the goals, reporting standards and metrics prescribed by various extra-governmental ESG systems do not currently apply. It is also the case that NDM fully expects a major mining company (or consortium of companies) to hold an interest in the proposed Pebble mine when it advances into the construction and operations phases.

Rather than committing the Pebble Project to any specific set of ESG principles, codes, standards or reporting systems at this time, NDM intends to defer any such commitments until the operator or operating consortium of the future Pebble mine is in place. In all likelihood, the ownership entity advancing the proposed Pebble mine into its operational phase will be an ICMM member, and the ICMM's *Mining Principles* and associated reporting methodologies will apply.

Until then, the Pebble Project is being advanced with the ESG principles, codes and standards discussed above firmly in sight. NDM and PLP are proud of the environmentally sound and socially/corporately responsible manner in which the Pebble Project has been advanced to date, and confident the foundation it has provided to the project in its pre-construction phase will support robust ESG compliance and reporting in future.

⁹<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

3 NDM's LONGSTANDING COMMITMENT TO ESG IS REFLECTED IN ITS APPROACH TO EXPLORING AND DEVELOPING THE PEBBLE PROJECT

From the onset of early geological exploration work in 2002, NDM staff, consultants and contractors were sensitive to environmental and social considerations. Environmental protection was a priority – for example, NDM adopted a “**No Exploration Road**” policy that avoided impacts associated with construction of a road into the project area. Although significantly more expensive, helicopter support was used for transporting all workers and equipment to the deposit area. In addition, tundra protection was accomplished by using pallets for drill rig pads. The pallets were removed when work was completed and drill sites were carefully remediated after drilling, with tundra contouring and revegetation to complete remediation.

This approach to site access goes ‘*above and beyond*’ what is required by regulation or is common practice in Alaska. It was among the first policy decisions NDM took, and it was done in order to send a signal to the region and the state that we intended to take an extraordinarily careful and environmentally protective approach to our work in recognition of the important fisheries resources in the region. We have stuck by this commitment for nearly two decades.

PLP maintains a database documenting the current condition of all 1,385 drill sites associated with the Pebble Project, including the 656 sites retained for active monitoring. Approximately 20 percent of all sites are inspected each year to verify previous reclamation efforts and conduct maintenance as needed. Each year, Alaska Department of Natural Resources (“DNR”) conducts random inspections at a number of sites. DNR has consistently found PLP’s site operations to be in full compliance with all permit requirements.

In addition, NDM and PLP implemented a policy of “**No Hunting -- No Fishing -- No Guiding**” to minimize and avoid Pebble employee and contractor impacts on sport fishing/guiding and traditional subsistence activities and harvest. Employees and consultants brought into the region are not allowed to hunt or fish, or even to gather berries. Local people employed by Pebble are free to continue their own traditional subsistence activities. NDM and PLP have conducted proactive community consultations not only to introduce the Company, the project and its potential, but also to actively engage in a “**Good Neighbor**” policy that includes active listening and responsiveness to local concerns. Northern Dynasty and the Pebble Partnership also undertook extensive local hiring and job training. These policies and activities were complemented by extensive and ongoing dialogue with local villagers, elders and other stakeholders.

By 2004, NDM had delineated the Pebble deposit sufficiently to begin rigorous engineering and scientific studies and project design work. At that time, a number of new ESG policies were created, with a firm priority on protecting fish habitat, fish populations and their harvests. A “**No Net Loss/Fisheries Conservation**” policy was developed with the objective of ensuring no loss of important fish populations, thus protecting the commercial, recreational, and subsistence harvests. NDM and PLP undertook this commitment in recognition that the Bristol Bay fisheries have tremendous economic, cultural and social importance for communities and people throughout the region.

These policies drove a robust commitment towards scientific excellence and the collection of extensive environmental baseline data over many years, focusing on the physical, chemical, biological, and social characteristics of the air, land and water environments. This work was undertaken by independent third-party scientists who had significant experience in the State of Alaska. Their work characterized all relevant aspects of the environment with particular emphasis in the areas where development may take place. As much as \$248 million was spent on these studies, representing perhaps the most comprehensive environmental baseline study program ever undertaken for a mine project. The resulting empirical database was used to:

- characterize existing environmental conditions;
- drive an optimized engineering design to avoid and minimize impacts;
- assess residual effects of the proposed project and inform mitigation planning;
- establish a comprehensive, multi-disciplinary, neutral database for long-term monitoring;
- facilitate local, state and federal permitting; and
- provide dependable scientific information to support stakeholder outreach.

In short, the unprecedented scope and rigor of this work provided reliable science to ensure a safe mine design, and that construction, operation and closure could be achieved, all while protecting the environment.

This work culminated in the Environmental Baseline Document (“EBD”), which spanned the period 2004 to 2008. It was published and released to regulatory agencies, stakeholders and the public in January 2012. Detailed environmental studies continued as engineering design modifications developed leading to the production of the Supplementary Environmental Baseline Document (“SEBD”), which covered the 2009 to 2012 period. This material was released early in PLP’s effort to secure a ‘dredge-and-fill’ permit from the USACE pursuant to Section 404 of the CWA. It was posted on the USACE website for review by other agencies, stakeholders and the public.

The success of these sustainability efforts is reflected most accurately in the multi-year work of the USACE on the Final EIS required for the proposed Pebble mine under Section 404 of the federal CWA. That comprehensive study has determined that, because of the hard work and planning that NDM and PLP have done, the proposed Pebble mine will not result in damage to the world-class fishery in Bristol Bay. As just one example, the Final EIS stated:

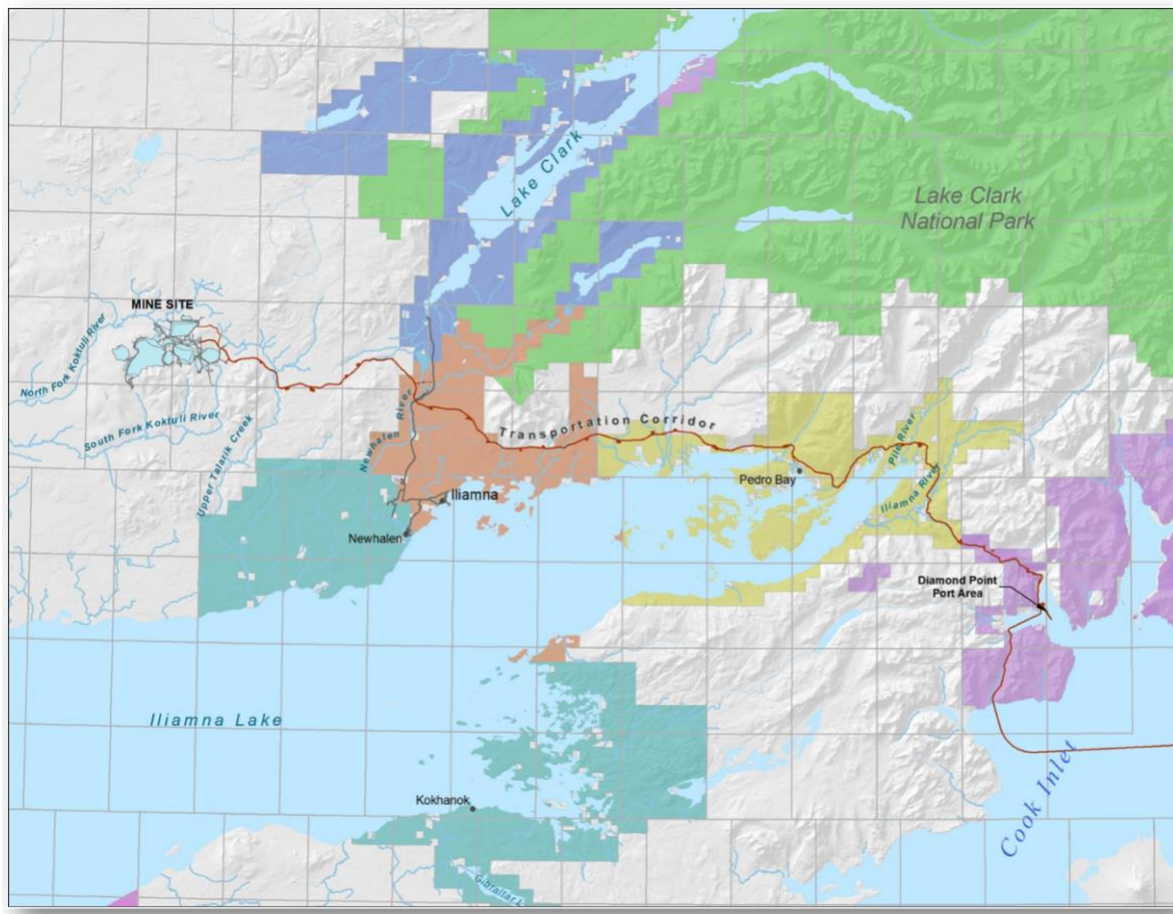
“Under normal operations, the [mine plan] alternatives would not be expected to have a measurable effect on fish numbers or result in long-term changes to the health of the commercial fisheries in Bristol Bay.”¹⁰

¹⁰ Pebble Project EIS: Final Environmental Impact Statement, United States Army Corps of Engineers, July 2020, p. 4.6-3

4 ENVIRONMENT

4.1 A Fundamental Change – Pebble’s Work to Reduce Risk

Figure 1: The proposed Pebble mine site



The proposed Pebble site is located in southwest Alaska, approximately 65 miles from tidewater on Cook Inlet, 19 miles northwest of the Alaska Native villages of Iliamna and Newhalen on Iliamna Lake, and 125 miles from Bristol Bay.

A significant planning and design priority for the Pebble Project was to minimize risks to the natural environment and local communities. This priority was accomplished through careful compliance with internationally accepted sustainability guidelines, and specifically through the following measures:

- 1) Comprehensive study and characterization of existing environmental and social conditions in the project area;
- 2) Intensive analyses of mine site and infrastructure alternatives;
- 3) Fundamental changes to project design to reduce footprints and minimize related impacts (including consideration of thousands of responses from federal and state regulatory agencies, Indigenous peoples and related stakeholders); and
- 4) A significant and responsive stakeholder engagement/consultation process.

A description of each of these measures follows. In addition, they are discussed in the more detailed sections on tailings, water management and seismicity.

4.1.1 Characterization of Existing Environmental and Social Conditions

Significant salmon production in the broad region of the Bristol Bay drainages and the importance of that resource to support subsistence, sport and commercial fishing provided clear priorities to NDM and PLP's multi-disciplinary team during its work. These priorities were adopted even though the vast majority of Bristol Bay salmon production and fishing activity occurs outside the deposit and mine facilities area. The primary environmental-design drivers were:

- water resources (surface and groundwater hydrology);
- waste management (tailings, waste rock, contaminants);
- stream and wetland resources;
- aquatic habitat; and
- fish resources.

4.1.2 Analyses of Mine and Related Infrastructure Alternatives

A key tenet of sustainable mine development is the careful consideration of a wide array of alternatives, for the purpose of avoiding or minimizing potential environmental and community impacts. The NDM and PLP team adopted this approach from the very start, and undertook detailed engineering and environmental analyses of various alternatives for:

- mining method;
- mine size;
- mill location and throughput;
- tailings storage methods and locations;
- water management methods and infrastructure;
- water treatment plant technology and location;
- water treatment release scenarios;
- site infrastructure location;
- transport mode;
- transportation corridor alignment;
- road and pipeline alignments;
- concentrate conveyance technology;
- seawater port location;
- seawater port concentrate loading facility;
- power station size and location and energy source;
- gas pipeline marine location;
- gas pipeline source;
- stream and wetlands mitigation;
- mine and facilities reclamation and closure;
- community involvement in operations – employment and business development;
- community partnering; and
- community ownership in project.

Upon completing a comprehensive evaluation of these engineering, environmental, social and financial alternatives, the Pebble Partnership selected a mine concept to advance into federal permitting that was considerably smaller than many of the concepts previously considered. The proposed Pebble mine is also substantially smaller than two of the three hypothetical mine scenarios the EPA evaluated in the Bristol Bay Watershed Assessment (“BBWA”), upon which the federal agency attempted to preemptively veto the Pebble Project. However, the project concept PLP proposed to initiate federal permitting was not selected for its reduced footprint size alone.

The Pebble Partnership had listened to the concerns of Alaskans about the potential size and scope of the proposed mine. But PLP also wanted to ensure that, whatever the size of the mine put forth in its permit application, all possible steps to minimize environmental impacts and risks had been considered and, where viable, incorporated into the design. The project’s proponents had to ensure the proposed mine had the potential to be economically feasible, and could secure necessary federal, state and local permits and authorizations. Ultimately, a substantially smaller project with several new environmental safeguards was selected and submitted to the USACE in December 2017 to initiate the federal permitting process¹¹.

During the federal permitting process for the proposed Pebble mine, the USACE and its third-party technical consultants AECOM identified and studied four project alternatives with five different variants. This assessment included a consideration of more than 100 alternatives, all of which were documented in the Final EIS (Chapter 2 and Appendix B).

In summary, planning and design of the proposed Pebble mine considered a significant number of different alternatives encompassing all aspects of construction, operation and closure phases. The resulting project design submitted to the federal CWA permitting process has been optimized to achieve important environmental, social and overall sustainability goals.

4.1.3 Fundamental Changes to Mine Design

NDM and PLP’s fundamental commitment is to design, permit and build a mine that would do no harm to the Bristol Bay fishery. PLP’s world-class environmental baseline

¹¹ Note: In describing the proposed mine design concept taken into permitting to stakeholders in Alaska, the Pebble Partnership was clear that subsequent phases of development may be proposed in future. Further, PLP was explicit that any future development plan would have to undergo an intensive, multi-year permitting process to include federal, state and local regulatory agencies, as well as tribal and public participation.

This approach to mine development reflects Northern Dynasty and the Pebble Partnership’s response to heightened stakeholder and public concern about the Pebble Project. The proponents sought to advance a project into permitting that minimized environmental impacts and risks, while also achieving economic and permitting viability. In doing so, the Pebble Partnership sought an opportunity to demonstrate the responsible development and operation of a mine at Pebble that successfully co-exists with fisheries and other important land uses in the region, and provides meaningful socioeconomic benefits to local communities and the State as a whole. Only after demonstrating this capability, and securing public confidence and political support for its operations, would the proponents seek to permit subsequent phases of development.

study program reflects that commitment. Further, the EPA published its BBWA in 2014, a scientifically flawed document that it used to defend its proposed preemptive veto of the Pebble Project that same year. In the BBWA, EPA assessed the environmental consequences of three differently sized hypothetical mine scenarios. Throughout these periods, PLP undertook extensive outreach to stakeholders across Alaska, listening to their concerns about the project.

Each of these undertakings helped inform the Pebble Partnership's approach to the mine plan it would put forward in its permit application. PLP made many significant changes in the proposed mine plan, as compared to some of the mine scenarios that had been considered previously. Those changes were part of the risk reduction and impact mitigation measures that would help create a more sustainable project. Importantly however, those changes also reflected PLP's responses to the concerns raised by stakeholders across Alaska. Pebble proposed its revised mine plan in a permit application submitted in December 2017, after EPA's preemptive veto attempt was halted by a federal court, clearing the way for PLP to initiate permitting.

4.1.3.1 Smaller Mine Size

The first major design change was a significant reduction in the mine size and overall footprint, as compared to some alternatives previously considered. The proposed pit size was reduced to 6,800 feet in length, 5,600 feet in width and 1,950 feet in depth, and the proposed mill throughput was set at 180,000 tons per day. The mine site footprint of PLP's proposed project design is only 8,390 acres (or 13.1 square miles). This proposed footprint is only slightly larger than the smallest hypothetical mine developed by the EPA in its BBWA, and which the EPA stated it would have allowed to go into the CWA permit process.

4.1.3.2 Tailings Storage Facility Re-Design

The Pebble Partnership's improvements to its proposed tailings storage facility (TSF) design are among the most important and exceptional changes made in the proposed mine plan, and have achieved significant risk reduction. The Pebble approach to tailings management may well set a new industry standard for safety and stability.

The new design creates a flow through Bulk TSF, which allows for seepage and collection of water. This results in the proposed Bulk TSF in essence being a tailings sands storage facility, as it avoids storage of large water volumes. The proposed tailings facility's embankment slope has been flattened with a series of buttresses. The resulting overall slope of 2.64 to 1 has a static factor of safety greater than the industry standard and minimizes potential failures.

In the Final EIS, the USACE reviewed estimates of the probability of tailings dam failures, which range from one failure for every 714 dam-years to 250,000 dam-years.¹² The Final

¹² USACE, Pebble Project – Final Environmental Impact Statement, July 2020, Section 4.27-102.

EIS found that PLP’s proposed Bulk TSF design significantly reduces the risk of these types of failures:

“The Applicant’s bulk TSF design is different than that of most other historic and current TSFs. The proposed design is especially distinct when compared to most historic mines that have experienced large failures.”¹³

As discussed in the Final EIS, the tailings storage facilities that have been shown to be the most robust and resistant to failure are those that have annual technical review by qualified engineers throughout their lifetime, including after closure. The Alaska Dam Safety Program would require this annual technical review throughout the life of the proposed Pebble mine.¹⁴ Thus, the already low risk of dam failure would be further reduced by the safety measures that will be in place for the proposed Pebble Project.

After evaluating the design of each proposed embankment and assessing the likelihood of a wide range of potential failure modes, the probability of a full breach of the proposed bulk or pyritic (potentially acid generating or “PAG”) TSF tailings embankments at Pebble was assessed to be extremely low, and therefore was not reasonably foreseeable. The Final EIS found:

“...the probability of a full dam breach to be very low for the bulk TSF (i.e., would require a lengthy causal chain of unlikely events).”¹⁵

4.1.3.3 *Elimination of Waste Rock*

Another fundamental design change in the proposed Pebble mine was the elimination of separate waste rock storage. The environmental benefit of not having separate waste rock storage at surface includes no associated long-term risk of acid rock drainage or metal leaching. The proposed mine plan was purposefully designed to reduce the amount of waste rock to an extremely low 0.12 tons of waste per ton of mineralized material. Some of that waste material, if suitable, will be used for construction. Overburden soils will be stockpiled to use for reclamation. The remaining rock will be co-disposed with pyritic tailings to eliminate the possibility of acid generation. This rock and the pyritic tailings will be relocated to the open pit at closure, eliminating long-term risk.

4.1.3.4 *Water Treatment Plant Re-design*

The two Water Treatment Plants (“WTP”) at the proposed Pebble mine were re-designed to accommodate the reduced mill throughput and water treatment volumes. Updated models were used to optimize effective treatment of all constituents to ensure achievement of state and federal water quality guidelines, utilizing proven technology at a proven scale of operation. This allows for the effective management of all contact water, impacted surface and groundwater.

¹³ USACE, Pebble Project – Final Environmental Impact Statement, July 2020, Appendix K, Section 4.27.2.

¹⁴ USACE, Pebble Project – Final Environmental Impact Statement, July 2020, Section 4.27-103.

¹⁵ USACE, Pebble Project – Final Environmental Impact Statement, July 2020, Executive Summary Section 3.5.

As well, there is a redundancy in the two proposed WTP designs that mitigates for potential failures. The average design capacity is 90% greater than average treatment requirements, which is equivalent to three years of surplus water. This benefit is enhanced by the capture and diversion of natural inflows from rain and snowmelt, thus reducing WTP capacity requirements. In addition, the proposed WTP's release scenarios have been designed to release optimally treated water at specific locations and in specific volumes. These measures result in substantial benefits to downstream fish habitat and production. All water use and discharge plans are subject to state agency approvals, including permits from the Alaska Department of Environmental Conservation ("DEC"), Alaska Department of Fish & Game ("DF&G") and Alaska DNR.

4.1.3.5 No Cyanide

PLP eliminated the use of cyanide in its proposed new mill design in response to concerns raised by stakeholders. While secondary recovery of gold using cyanide could be done in an environmentally safe manner by using a closed loop system and a cyanide destruction circuit, thereby avoiding releases to the environment, the perceived risks of cyanide contamination remained among many stakeholders. The Pebble Partnership listened to those concerns and took a step that results in reduced mineral recovery, but that honors our commitment to listen to and respond to community concerns.

4.1.3.6 Long Term Care of Potentially Acid Generating (PAG) Tailings

The re-design of the proposed PAG tailings storage at Pebble resulted in a significant reduction in risks of downstream contamination. First, the PAG materials would not be co-disposed in the proposed bulk tailings storage facility, but in a much smaller, separate tailings storage facility in a manner that contains all contact water and prevents potentially reactive, pyritic rock from access to oxygen. This occurs by using subaqueous storage in a lined tailings storage facility, which will prevent acid rock drainage.

At closure, potentially reactive tailings will be returned to the pit and stored under water, which will prevent acid rock drainage and any releases to the environment. This allows for safe, stable and permanent storage of potentially reactive material. Because the proposed open pit will be maintained as a hydrological sink (the water level will be lower than surrounding groundwater), any risk for catastrophic failure or release would be virtually eliminated.

A preliminary 'Closure Water Management Plan' and a 'Reclamation and Closure Plan' were submitted as part of the federal permitting process.

4.2 Tailings, Water Management and Seismicity

All the actions described above were crucially important in ensuring that the permit application submitted to the USACE contained a socially and environmentally sustainable mine plan. Without doubt, however, the principal concerns regarding many mines are questions around tailings and water management and how risks of seismicity are addressed. That is particularly

true in an area that has as much precipitation and is as seismically active as the State of Alaska. NDM and PLP wanted to ensure that this document presented a substantial discussion of those issues, which we set forth in the pages below.

The proposed Pebble mine has adopted a state-of-the-practice approach to waste and water management. Key features include:

- extensive geotechnical site investigation with additional work planned during feasibility and design;
- long term meteorological data collection calibrated to a 76-year record at the Iliamna Airport;
- integrated tailings and water management plan;
- separate facilities for bulk and pyritic tailings and for water storage;
- flattened embankment slopes which improve the load the embankments can withstand divided by the expected load to a value approaching 1.9 versus the industry standard of 1.5;
- embankments founded on bedrock;
- a flow-through main embankment for the bulk TSF to facilitate water management, tailings consolidation and closure;
- industry standard lined pyritic TSF to control acid generation;
- PAG waste rock co-disposed in pyritic TSF; and
- pyritic tailings and PAG waste rock moved to pit at closure and pyritic TSF reclaimed.

The proposed Pebble mine has five major tailings and water management facilities:

- the bulk tailings storage facility with a capacity of approximately 1.1 billion tons, to store benign tailings produced by the first processing step;
- the pyritic tailings storage facility, which will hold the pyritic tailings (155 million tons) from the final processing step as well as PAG waste rock;
- the main water management pond (WMP), with a capacity of 22 billion gallons, providing surge water storage for processing and treatment for discharge;
- the seepage collection pond (SCP), with a capacity of 980 million gallons, which collects seepage from the Bulk TSF main embankment; and
- the mine water pond (MWP), with a capacity of 280 million gallons, providing surge water storage for mine dewatering and treatment for discharge.

Figure 2: Proposed Pebble mine site Layout



Figure 2 illustrates how proposed mine-site facilities have been grouped closely together, reducing the overall footprint of the mine and providing other environmental benefits, such as reduced energy use in water pumping.

4.2.1 Site assessment

Northern Dynasty, and subsequently the Pebble Partnership, commenced its assessment of potential tailings disposal sites in 2004 and this work continued through 2018. In all, NDM and PLP evaluated more than 30 different locations (Figure 3) and storage configurations using the following considerations:

- *minimize potential impact to environmental resources* — the selected sites for proposed tailings storage and water management/treatment facilities are within valleys supporting mixed uplands and wetland shrub/herbaceous shrub. The valleys include tributaries to the North Fork Kooktuli that have experienced intermittent flows. Index counts indicate lower fish presence than at other locations. Potential impacts to waterfowl are likewise reduced by avoiding areas with high-value habitats for nesting, breeding, molting or migration.
- *provide adequate storage capacity* — the proposed sites will accommodate tailings for the 20-year life of the proposed Pebble mine.
- *reasonable proximity* — the proposed sites minimize the distance to the process plant, which reduces power consumption and the overall project footprint, while also reducing the proposed project's carbon footprint.
- *facilitate closure* — segregating the pyritic tailings and PAG waste allows for placement of both in the open pit at the end of the proposed mine life, thus eliminating the PAG TSF from the long-term closure plan.

Figure 3: Tailings cases

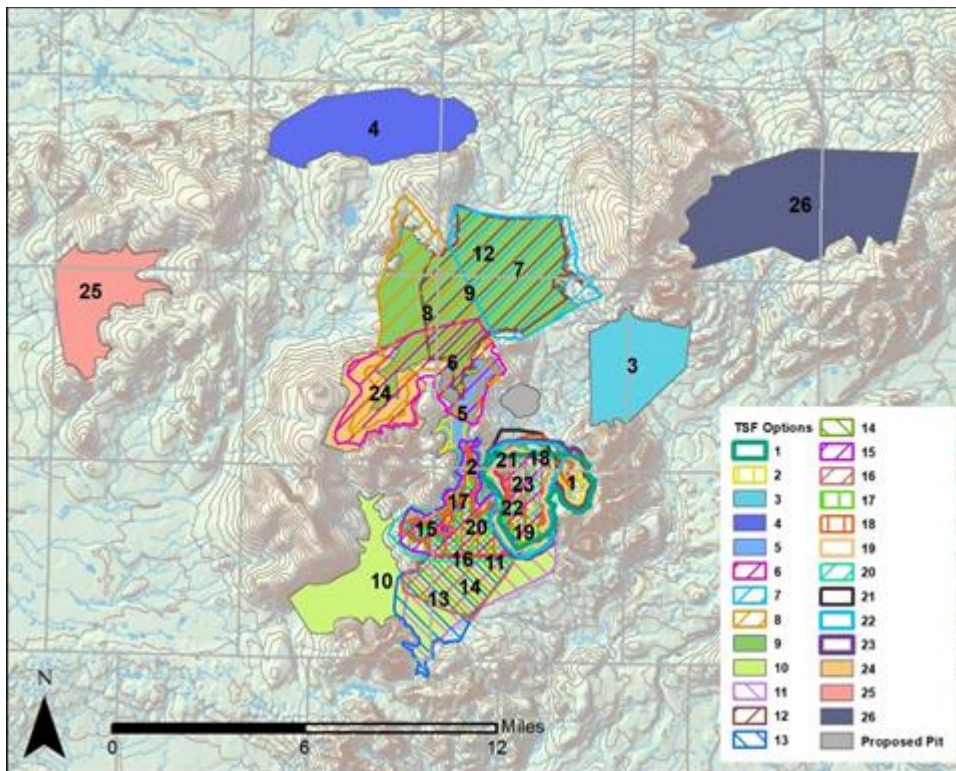


Figure 3 shows the number of potential tailings disposal sites considered by NDM and PLP, demonstrating the extensive analysis done in order to minimize environmental impacts and risks.

The analysis tested a wide range of alternatives. The proposed sites were selected on the following basis:

- the proposed Bulk and Pyritic TSFs are located at the head of tributaries of the North Fork Kaktuli (NFK) river, where minimal anadromous habitat values exist;
- the proposed TSF sites are proximal to appropriate sources of construction material;
- the proposed WMP is downstream of much of the site infrastructure, facilitating water capture;
- the proposed SCP is immediately downstream of the Bulk TSF main embankment and proximal to the WMP, facilitating water capture and transfer;
- the proposed MWP is adjacent to the open pit, reducing pumping and related power requirements and greenhouse gas (“GHG”) emissions; and
- all the proposed facilities are proximal to each other, reducing pumping energy consumption and footprints and related GHG emissions.

4.2.2 Hydrology

The water management plan for the proposed Pebble mine is built on three data components:

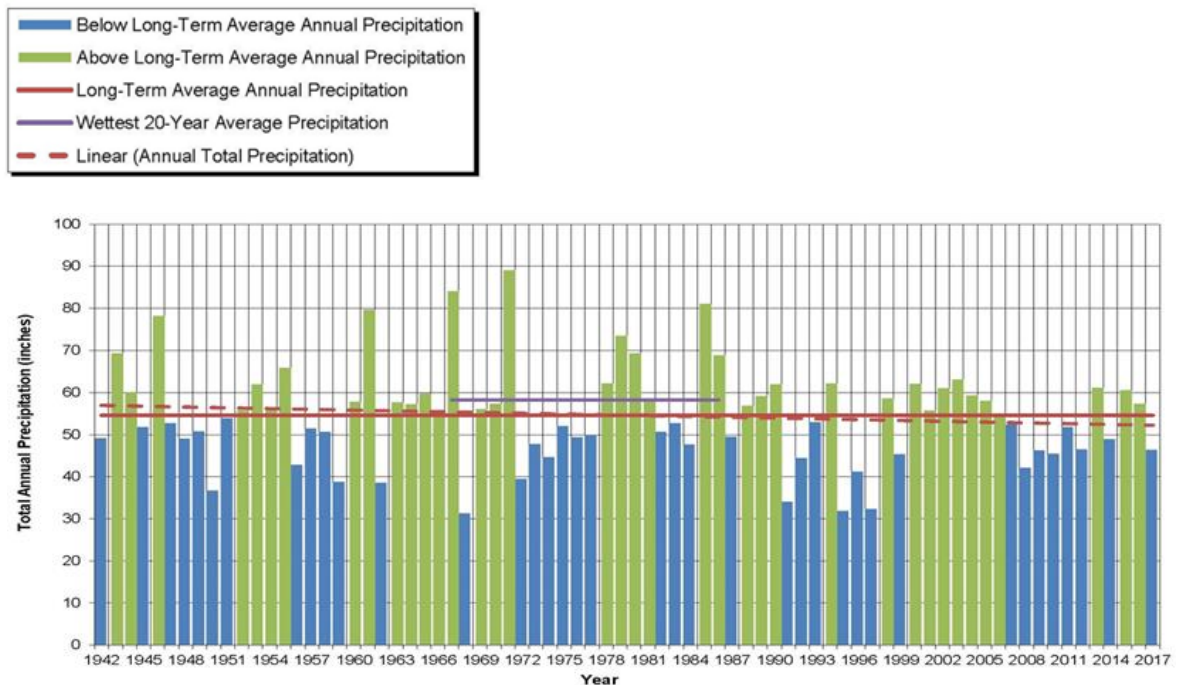
- meteorological data collected from six stations at the project site, including one site in continuous operation since 2004;

- gauging at twenty-six continuous sites on the main stems and tributaries of the three streams that drain the project site; and
- a 76-year meteorological record at the Iliamna airport, supplemented by records at other stations in the area.

In addition to these data, snow depths were measured regularly during the period 2004 to 2008.

These data were correlated to create the 76-year synthetic record for precipitation and stream flow at the Pebble site shown in Figure 4.

Figure 4: Pebble 76 Year Synthetic Precipitation Record



Pebble’s robust 76-year precipitation record ensures the proposed project’s design has anticipated and can safely accommodate even the most extreme weather events.

This robust data set allowed PLP to design the proposed Pebble mine to the wettest 20 years in the record, and to estimate the Probable Maximum Flood (PMF) with a high level of certainty. That PMF is defined as a 100-year return, 24-hour rainfall event on top of the melting of a 100-year return snowpack. While this scenario is technically possible, the likelihood of its occurrence is extraordinarily remote.

Based on the synthetic historical record, the Pebble Project site averages 54.6 inches per year of precipitation with significant variation between years. The record has enabled analysis of this variability, which has been integrated into the proposed water management plan.

4.2.3 Water Management

The water management plan for the proposed Pebble mine is carefully integrated with the waste and tailings management plans. This includes:

- separate water and tailings management facilities;
- designed using the 76-year hydrologic record; and
- systems designed with surge capacity and redundancy.

Testing conducted on the bulk tailings at the proposed Pebble mine (~88% of the total) show they are not acid generating and do not require submersion. The key component of the proposed water management plan is the separation of the Bulk TSF from the associated water. The main embankment of the proposed Bulk TSF is designed as a flow-through structure. Water will drain through the embankment and be captured in the seepage collection pond. That water will be pumped to the proposed WMP where it can be used in the milling processes or treated and released.

Reducing the water held in the proposed Bulk TSF is one of the most important safety factors. Storing water behind a TSF is an important contributing factor in TSF failures that have occurred recently. Allowing the water to seep through the proposed Bulk TSF embankment at Pebble will also facilitate compaction of the impounded tailings. Water that does not drain through the embankment will be pumped to the WMP, which will be the primary water storage facility. The result will be that, in all but the PMF conditions on top of the wettest 20 years in the 76-year cycle, the tailings beach between the proposed TSF embankments and the small residual pond will be at least 2,000 feet wide.

The water that does pass through the proposed Bulk TSF main embankment will be captured by the SCP and from there transferred to the WMP. Seepage capture and pump back facilities will be located downstream of the south embankment and eastern reach of the Bulk TSF.

The current state-of-the-practice for pyritic tailings is to store them under water to prevent oxidation and acid generation. Thus, there will be a retained pond over the proposed Pyritic TSF at Pebble. PLP has used similar design factors with regard to the proposed Pyritic TSF pond (PMF, wettest 20 years), and any excess water will be pumped to the WMP.

Contact water from the area between these facilities and from the area of the process plant will drain to the WMP.

Mine water at the proposed Pebble mine will be managed separately, and consists of precipitation falling onto the open pit and groundwater pumped from the perimeter of the facility. This water will be directed to the MWP. The system is designed to handle a 10-year return storm; precipitation in excess of this will be allowed to accumulate in the pit.

The mine plan for the proposed Pebble mine has redundant capacity to manage WTP failures and extreme flood events. This capacity includes the ultimate failsafe of allowing water to accumulate in the open pit.

4.2.4 Water treatment

The amount of precipitation at the proposed Pebble mine site requires discharge of excess water to maintain the site water balance. Alaskan and federal laws stipulate strict conditions as to the quality of discharge water over a wide range of possible contaminants. As the first step in meeting these conditions, PLP completed static and dynamic testing of samples. These data were augmented by consultants' databases to define the chemistry of surplus water at the proposed project.

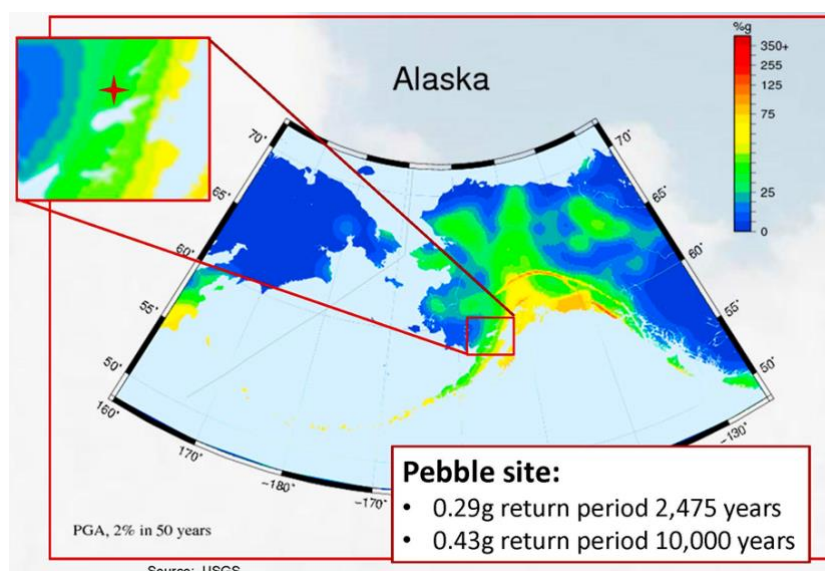
This analysis determined that site water can be split into two sources: open pit dewatering and the water draining off the site and tailings. PLP analyzed the geochemistry for each source and used that information to develop their respective water treatment schemes.

Both water treatment plants at the proposed Pebble mine use proven technology. The plants are split into multiple trains, which reduces the scale of each train and provides sufficient redundancy to address potential WTP failures and necessary repairs or maintenance, as well as extreme weather events.

4.2.5 Seismicity

The tailings design process at Pebble had as one of its fundamental considerations seismic conditions in Alaska. This issue has been subject to considerable analysis, and will be augmented during the Alaska Dam Safety Program process, which in turn leads to permits for construction.

Figure 5: USGS Seismic Risk



The above seismic risk map for Alaska demonstrates the Pebble Project site is in an area of considerably lower seismic risk than many other areas of the State.

PLP's analysis began with a review of the existing U.S. Geological Survey ("USGS") analysis of seismic risk. Figure 5, the USGS mapping of seismic risk, shows the likelihood of seismic impacts (indicated as peak ground acceleration). Peak ground acceleration essentially means that 'the higher the acceleration, the greater the force exerted by the seismic event.'

Figure 5 was developed using all seismic event data collected in Alaska to 2007 and is color-coded based on a 2% likelihood of the shown acceleration exceeding that value in a fifty-year period. The map inset shows the Pebble location and indicates the 2%, 50-year exceedance at the Pebble site, based on measured events, to be 0.29g (*i.e.* 29% of the acceleration due to gravity), much lower than other regions of the state because of the project's distance from the major sources of seismicity. Based on the underlying data, in 10,000 years, there is a 100% likelihood the Pebble site will experience a ground acceleration of 0.43g.

This work is based on probabilities, using existing data. The next step for the Pebble Partnership was to assess potential earthquake sources, the maximum energy that could be released from each of these sources, and the impact at Pebble given the intervening distances. Many sources were evaluated, with four incorporated into the proposed Pebble design:

- a repeat of the 1964 Valdez 9.2 magnitude earthquake, one of the largest seismic events ever recorded anywhere on the planet, resulting in an estimated ground acceleration at Pebble of 0.16g;
- an 8.0 magnitude intra-slab event near the west coast of Cook Inlet, similar to the 2018 earthquake near Anchorage but at a much higher intensity (estimated ground acceleration of 0.61g at Pebble);
- a 7.5 magnitude rupture along a splay of the Lake Clark Fault within approximately 6 to 7 miles of the project site, for which there is limited evidence of the splay existing and no evidence of any movement for the past 10,000 years (estimated ground acceleration of 0.57g at Pebble); and
- an undiscovered fault immediately below the proposed tailings facilities rupturing with a 6.5 magnitude (estimated ground acceleration of 0.56g at Pebble).

The expected accelerations from these events are much higher than the 0.43g, 10,000-year return noted in the probabilistic analysis. These higher values were used to establish seismic design criteria for the proposed Pebble mine.

To be clear, Pebble assumed a fault exists *directly under the tailings facilities at the proposed mine*, even though such a fault does not exist. We further assumed that non-existent fault would suffer a very large (6.5 magnitude) earthquake. We used those assumptions in our design criteria for the proposed Pebble mine to ensure that TSFs and other mine facilities can withstand seismic events at site that are larger than events that have been observed to date, and are not remotely likely to occur.

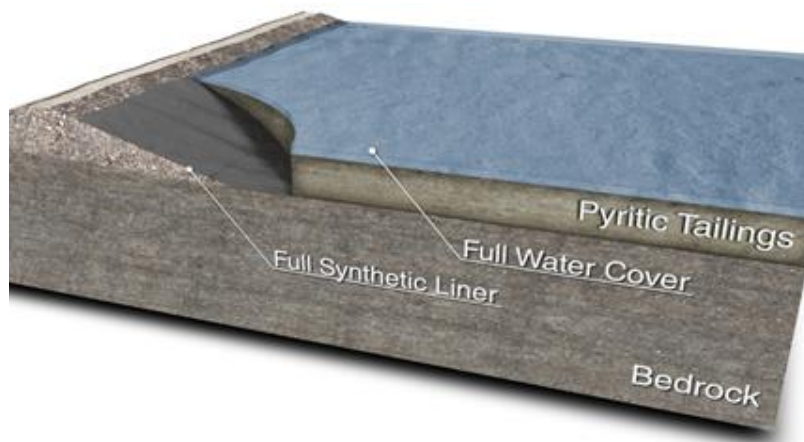
4.2.6 Tailings design

The state-of-the-practice approach to tailings disposal taken at the proposed Pebble mine has focused on four key aspects of design:

- tailings geochemistry;
- water management;
- embankment stability; and
- closure.

The geochemistry of tailings dictates how they must be stored to prevent potential acid generation. Given that the geochemical properties of the bulk and pyritic tailings at the proposed Pebble mine are different, they are to be separated for storage and closure. The Bulk TSF main embankment will be a flow-through structure, facilitating separation of the tailings and associated water and enabling consolidation post-closure. The PAG TSF will be lined and the tailings kept under water until closure, when they will be relocated to the bottom of the open pit for permanent subaqueous storage. The configuration of the proposed PAG TSF is shown in Figure 6.

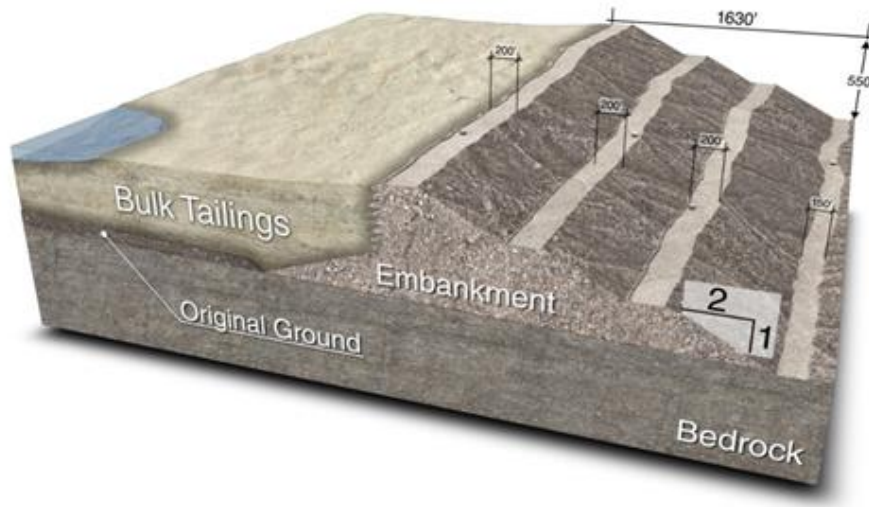
Figure 6: Pyritic TSF



The proposed Pebble mine design includes a fully lined tailings storage facility for potentially acid generating tailings to provide additional protections against groundwater contamination.

While maintaining a water cover is critical to preventing acid generation from pyritic tailings, it has become apparent with recent failures around the world that the presence of excess water in a tailings facility can significantly increase the likelihood and consequences of failure. Accordingly, the Bulk TSF at the proposed Pebble mine has been designed to minimize the amount of water in the facility. This will be accomplished by: using the WMP as water storage separate from the Bulk TSF; the flow through properties of the main embankment; and, controlling the impounded water by pumping. The 76-year synthetic precipitation record at Pebble provides this component of the proposed project design with an element of certainty with respect to design events. The proposed Bulk TSF main embankment is shown in Figure 7.

Figure 7: Bulk TSF Main Embankment



The bulk tailings storage facility at the proposed Pebble mine is keyed into bedrock, employs a slope that provides an additional factor of safety, and allows water to flow through it, which significantly lessens the likelihood and potential consequences of any failure event.

The primary consideration of the proposed tailings embankment designs is their stability. The understanding of seismic conditions is critical in this regard, but proposed designs at Pebble incorporate a number of other features intended to enhance their safety.

As seen in Figure 7, the proposed embankment slope has been flattened with a series of buttresses. The resulting overall slope of 2.64 to 1 has a static factor of safety of 1.9 (versus the industry standard of 1.5). Further, the proposed embankments will be founded on bedrock (seen in both Figures 6 and 7), eliminating the possibility of an undiscovered weak soil layer. Independent investigation of the causes of the Mt Polley TSF failure in British Columbia in 2014 concluded that a weak soil layer underlying the embankment, and insufficient pre-development geotechnical investigation, were underlying factors that contributed to the failure event.

The fourth aspect considered was closure. The closure plan for the proposed Pebble mine includes several components to ensure long-term safety and to minimize long-term environmental impact. The relocation of the PAG tailings and waste rock to the pit bottom ensures these materials will pose neither long-term stability nor geochemistry concerns. The proposed Bulk TSF will be covered and drainage directed to a spillway to minimize the water flowing through these tailings. This will reduce geochemistry concerns and enable the tailings to consolidate post-closure, further enhancing their stability. These two factors will enable the removal of the WMP, eliminating it as an ongoing safety concern. This closure plan means there will be no need for permanent, long-term water treatment or monitoring of the bulk tailings, a significant environmental benefit as compared to other similar mines.

4.3 Greenhouse Gas Emissions and Climate Change

The design and operational considerations for the proposed Pebble mine discussed above address those environmental challenges most stakeholders have told Pebble are of greatest concern to them. Nonetheless, NDM and PLP recognize and support transparency and reporting as two of the most important underpinnings of ESG. We similarly recognize the significant importance that climate change and related considerations play as an issue of concern throughout the environmental arena today. As such, potential emissions of GHGs from construction and operation through closure of the proposed Pebble mine were estimated and disclosed in the Final EIS. In furtherance of our support of transparency and reporting, we reprint those estimates here.

For a number of reasons, the GHG emission estimates below are likely overestimated for any given year. For example, emissions during the construction period represent a ‘worst-case construction year’¹⁶ scenario – including emissions associated with construction of the proposed transportation corridor, which are expected to last just one year during the four-year construction phase.¹⁷

Total CO ₂ Emissions (tons/year)				
	Construction	Operations	Closure	Grand Total
Mine Site	411,748	1,240,477	664,753	
Transportation Corridor	126,823	30,126	38,333	
Port	46,678	1,332	25,344	
TOTALS	585,249	1,271,935	728,430	2,585,614

In addition, the Final EIS notes that even reasonably foreseeable future actions (including the possibility of an expanded project footprint in future) would contribute very small amounts of additional GHGs.

“Total GHGs are expected to increase due to [reasonably foreseeable future actions (RFFAs)]; . . . From a global perspective (which is the scale for climate change), the net change in GHGs resulting from RFFA impacts would be extremely small; less than 0.006 percent.”¹⁸

The GHG estimates cited above are Scope 1 emissions (those associated with on-site fuel use and energy generation) and Scope 2 emissions (those associated with purchased energy), as defined by the *Greenhouse Gas Protocol*.

It is worth noting that the copper produced by the proposed Pebble mine will make an important contribution to reducing GHGs globally by supporting clean and renewable power generation technologies and applications, including wind turbines, solar energy and electric vehicles.

¹⁶ Pebble Project, Final Environmental Impact Statement, United States Army Corps of Engineers, July 2020, Appendix K, Section 4.20: Air Quality, p. K4.20-2.

¹⁷ Ibid at p. K4.20-5.

¹⁸ Pebble Project, Final Environmental Impact Statement, United States Army Corps of Engineers, July 2020, Chapter 4: Environmental Consequences, p. 4.20-20.

5 SOCIAL

5.1 Social Resources

The Pebble deposit has substantial resources of metals necessary for a sustainable future. It would produce materials essential for a reduced carbon economy.

The Pebble deposit is one of the most significant accumulations of metals ever discovered in the United States or anywhere in the world. It is both the world's largest undeveloped copper deposit and largest undeveloped gold deposit. It also contains commercially important quantities of other strategic metals – including molybdenum, silver and rhenium.

Principally, however, Pebble will be a copper mine with 60-65% of the value of its production derived from the 'green metal.' Due to its superior properties as a thermal and electrical conductor, copper is an essential material for developing clean and renewable energy systems for a lower carbon future – including solar, wind, tidal, biomass and geo-thermal energy. Copper also plays a critical role in modern homes and buildings, transportation systems (including hybrid and electric vehicles), infrastructure, health care, electronics and communications, along with virtually every other aspect of contemporary life.

Perhaps most importantly, power systems using copper generate, transmit and use energy with higher efficiency, thus reducing greenhouse gas emissions and optimizing lifecycle costs. A project such as Pebble, with its potential to generate ~10% or more of U.S. domestic copper needs over decades of production, can provide a solid foundation for a more sustainable, low-carbon future in the United States.

5.2 Needs and Welfare of the People

As a significant, long-life development project, Pebble would make an important contribution to employment and wages, government revenues and overall economic activity (GDP) at both the national and state levels. However, its most profound economic contributions would be felt in the villages and boroughs of southwest Alaska, a region characterized by: high levels of unemployment; few full-time, year-round jobs; one of the highest costs of living in the United States; many of the social ills associated with low income and depressed socioeconomic conditions; and, high levels of out-migration.

Among the most compelling demonstrations of the need for a stable, year-round source of jobs and economic activity in the Bristol Bay region is the ongoing loss of population. Between the last two U.S. census dates, the Lake & Peninsula Borough and Bristol Bay Borough – which collectively encompass more than 20 small, largely Alaska Native villages in the Pebble Project area – lost 17% and 30% of their population bases, respectively, as residents left the region in search of better jobs and opportunities for their families.

5.3 Employment and Workforce Development

Pebble has the potential to change all that. The proposed Pebble mine would create ~2,000 jobs during its four-year construction phase and as many as 850 full-time jobs during mine operations. In sharp contrast with most current employment opportunities in Bristol Bay, Pebble jobs would be both year-round and well paid, with average compensation for mine workers expected to exceed \$100,000/year.

The Pebble Partnership has invested in programs to prepare local people for future employment at the proposed Pebble mine, and will continue to do so. Local workforce development programs have included job training, scholarships funds, partnerships with colleges and training institutions, apprenticeship/ internship programs, and development of a comprehensive, long-term workforce development strategy.

All of these programs are intended to maximize the number of people from local villages who are trained and qualified to work at Pebble. By prioritizing local workforce development and local hire, the Pebble Partnership's goal is to keep as much of the economic activity and wealth generated at Pebble within the region as possible, and thereby enhance the sustainability of local communities and the Alaska Native culture they support.

PLP employs other practices to maximize local hire and the economic and cultural benefits it generates. These include flexible work schedules so local residents can continue to participate in traditional, seasonal subsistence practices – such as fishing, hunting and gathering.

PLP would also fly workers from their home villages in Bristol Bay to the proposed Pebble mine and camp site for their work rotation, and return them to their home villages once complete. In this way, the employment and wealth generation created at the proposed Pebble mine will contribute to the economic sustainability of communities throughout the vast 40,000 square mile Bristol Bay region.

5.4 Contracting and Business Development

Direct employment at the proposed Pebble mine is not the sole economic impact the project will have in the region. Based on the experience of other mines in Alaska, every 'direct' job at Pebble can be expected to generate an 'indirect' job in companies/businesses that provide products or services to Pebble, or an 'induced' job based on the spending of mine employee wages. Considering both direct jobs and spinoff opportunities, the proposed Pebble mine has the potential to generate employment and related economic benefits throughout the region.

The Pebble Partnership has invested significant time, money and effort to work with and develop local companies, particularly Alaska Native corporations. By providing contract opportunities and mentorship, PLP's goal is to help these businesses become increasingly more important contractors to the Pebble Project at each stage of its development, and thereby enhance the project's economic footprint in the region.

At the beginning of NDM and PLP's exploration activities in southwest Alaska, Alaska Native village corporations like Iliamna Natives Ltd., Alaska Peninsula Corporation, Kijik Corporation, Pedro Bay Corporation, Igiugig Native Corporation and others were engaged to provide contract services – such as food services, ground transportation, accommodation and housekeeping. As the project progressed and the relationship between the parties matured, so have the complexity and value of contract services local businesses provide – to include such things as fuel distribution, aviation services, medical services, security, environmental services, surveying and reclamation.

In the future, the Pebble Partnership's goal is to continue to cultivate Alaska Native corporations to serve as significant contractors at the proposed mine site and (in particular) along the project's transportation corridor. PLP's partnerships with these corporations have allowed them to develop expertise that they are currently using to take advantage of economic opportunities that do not involve Pebble.

The proposed transportation infrastructure (including roads, pipelines, port sites and associated facilities) for the proposed Pebble mine traverses lands owned by several Alaska Native village corporations. In negotiating right-of-way agreements with these landowners, the Pebble Partnership has sought to enshrine its commitment to local business development by providing 'preferred contractor status' to Alaska Native village corporations – in particular, for project services that occur in whole or in part on Alaska Native lands.

The Pebble Partnership is also advancing plans with Alaska Native corporations whereby they (individually or in a consortium) may provide significant contract services across the proposed project's transportation infrastructure – including, potentially, truck transport, logistics, facilities maintenance, port and marine services, among others. In addition to jobs created directly by the Pebble Partnership, these Alaska Native corporation contractors would also become significant sources of local employment – including for their Alaska Native shareholders.

5.5 Revenue Sharing

Once the proposed Pebble mine enters the construction and operations phases, its economic impact – through employment, the circulation of wages, and spending on contractors and service providers – will resonate throughout the Bristol Bay community. However, the Pebble Partnership has also taken steps to ensure that every full-time, adult resident of the region can participate directly in the wealth generated by the future mine through a revenue sharing program known as the *Pebble Performance Dividend*.

Established in June 2020, the *Pebble Performance Dividend LLP* holds a 3% Net Profits Royalty Interest in the Pebble Project and will distribute payments to adult residents of Bristol Bay villages that have subscribed as participants. The program would distribute a guaranteed minimum annual payment of US\$3 million each year the proposed mine operates beginning at the outset of project construction, with future payments following capital payback expected to be significantly greater.

The Pebble Partnership's 'dividend' program is intended to mirror Alaska's Permanent Fund, which distributes an annual dividend to full-time residents of Alaska each year based on revenue derived from natural resource activity in the state, including mining. Like the Permanent Fund, the *Pebble Performance Dividend* would help residents and families in rural villages in southwest Alaska remain in their home communities and pursue traditional, subsistence-based lifestyles.

5.6 Sustainability

It is often said that mining, like other resource extraction industries, is by definition *not sustainable*. While this is strictly true, because mineral deposits are finite, there has also developed an understanding within progressive mining and resource companies that extractive industries can generate 'sustainable' economic and social benefits by investing in the development of human capital. This is clearly the Pebble Partnership's long-term goal in southwest Alaska.

Through workforce development initiatives, PLP intends to maximize local employment at all levels within its operation, and help develop a generation of Bristol Bay residents with the professional and technical skills that will make them employable at other industrial sites in the region and the state.

Through business development initiatives with Alaska Native village corporations and other local companies, PLP intends to help develop increasingly large and profitable local enterprises with the skills and competitiveness to outlast the Pebble Project, and provide contract services to other in-state and out-of-state projects and companies long after the proposed Pebble mine has closed and been reclaimed.

It is by developing the human capital of the Bristol Bay region that PLP intends to provide long-term, sustainable opportunities for employment, contracting and wealth generation for local people and local communities. By building a sustainable economic capacity, the proposed Pebble mine can also contribute to the long-term sustainability of the Alaska Native culture and traditions the region fosters today.

5.7 Non-Financial Benefits

There are other non-financial values the proposed Pebble mine would bring to the Bristol Bay region to benefit local people and communities. These include:

- the development of new transportation infrastructure, including a port and road system, that would materially reduce local transportation costs, as well as costs for fuel, groceries, equipment and supplies. (Currently, the villages of southwest Alaska experience one of the highest costs of living in the United States);
- the development of new energy infrastructure that has the potential to lower the cost of energy for homes and businesses throughout the region. (Currently, the cost of power is a significant deterrent to economic development and

- diversification in Bristol Bay, including the addition of new value-added fish processing businesses); and
- a substantial (~300%) increase to Lake & Peninsula Borough tax revenues, which would allow the local government to vastly expand public services in the areas of education, infrastructure and more.

The Final EIS makes these benefits of the proposed project quite clear.

“Reduced transportation costs would likely lower the high cost of living for the communities near the transportation corridor (i.e., Newhalen, Iliamna, Nondalton, and Kokhanok). The natural gas pipeline would also provide opportunities for adjacent communities to lower their winter heating costs, a positive impact.”¹⁹

While new regional infrastructure and tax revenues associated with the proposed Pebble mine would clearly provide non-monetary benefits to local communities, it is also important that the project does not disrupt or come at the expense of existing activities. These include subsistence fishing, hunting and gathering activities, which generate a substantial proportion of local residents’ diets, and possess important cultural value.

It is also important that the proposed Pebble mine in no way undermines the long-term biological or economic health of the Bristol Bay commercial salmon fishery, which represents a dominant proportion of the region’s private sector economy today. Finally, it must not harm southwest Alaska’s sport/recreational fishery.

Our view is the Final EIS prepared by the USACE makes clear the proposed Pebble mine, if appropriately built and operated, poses low to no risk to the long-term health and productivity of Bristol Bay fish and wildlife populations or the important economic, social and cultural activities that rely on them.

When it comes to *subsistence resources*, the Final EIS found that potential impacts to fish and wildlife from the proposed Pebble mine are not expected to impact harvest levels, because there would be no decrease in resource abundance. As noted previously, the Pebble Partnership plans to incorporate flexible work schedules for local employees to allow workers from Bristol Bay communities to continue to participate in traditional, seasonal subsistence activities.

When it comes to *commercial fisheries*, the Final EIS found the proposed Pebble mine would not cause any population-level effects on commercial fishing resources, nor any change in harvest levels. Nor are changes to the wholesale value of Bristol Bay sockeye salmon or other commercial species likely to occur, nor changes to processor operations. In fact, it is PLP’s view the introduction of new transportation and power infrastructure in the region has the potential to enhance the economic performance of the Bristol Bay commercial fishery.

Similarly, when it comes to *recreational fisheries*, the proposed Pebble mine is expected to have no population-level effect on the fisheries resources targeted by commercial lodges and outfitters, or individual fishers. Given the sheer size of the Bristol Bay region – at 40,000 square

¹⁹ Pebble EIS: The Final Environmental Impact Statement, United States Army Corps of Engineers, July 2020, p. 4.3-3.

miles, it is about the same size as the State of Ohio – there is clearly more than enough room for fishing lodges and individual recreationalists to continue to access the wilderness experience they currently enjoy.

5.8 Environmental Justice

As noted previously, a significant proportion of residents of Bristol Bay communities are affected by low incomes, unemployment and seasonal employment, and among the highest costs of living in the United States. About 70% are of Alaska Native descent.

That the proposed Pebble mine has the potential to make such a dramatic contribution to the economic health and well-being of the region, even stem the tide of out-migration, while protecting traditional subsistence and other existing economic opportunities, means its contribution to ‘environmental justice’ can be profound.

Pebble will contribute to ‘environmental justice’ through:

- generating high-wage, year-round employment within minority and low-income communities;
- reducing transportation and energy costs, and thereby lowering the cost of living for minority and low-income communities;
- generating revenues for local and state governments to fund enhanced public services in the areas of health, education, social supports and more for the benefit of minority and low-income communities; and,
- providing training, employment, contracting and other economic opportunities for minority and low-income communities while developing the human capital of the region in order to make the economic benefits generated sustainable over time.

5.9 Community and Social Engagement

When it comes to managing environmental and social impacts and performance, Northern Dynasty and the Pebble Partnership are guided by two key international standards – the *United Nations’ Sustainable Development Goals* (“UNSDG”)²⁰ and ICMM’s Mining Principles²¹.



The intersection between the *UN’s Sustainable Development Goals* and ICMM’s Mining Principles – that is, precisely how a well-planned and operated modern mine at Pebble can contribute to the realization of the United Nation’s aspirational goals – is demonstrated below:



²⁰ See <https://sustainabledevelopment.un.org/?menu=1300>

²¹ See <https://www.icmm.com/mining-principles>

In addition to all the ways in which the proposed Pebble mine is being designed and advanced in order to maximize benefits for residents of Bristol Bay and other project stakeholders with an interest in the land and resources of Southwest Alaska (See Section 5.1 Social Resources), the Pebble Partnership also manages an active program of community and stakeholder outreach.

The objectives of stakeholder outreach programs undertaken by the Pebble Partnership have been and are to:

- advise residents of nearby communities and other regional interests about work programs and other activities being undertaken in the field;
- provide information about the proposed development plan for the Pebble mine, including potential environmental, social and operational effects, proposed mitigation and environmental safeguards;
- allow the Pebble Partnership to better understand and address stakeholder priorities and concerns with respect to development of the Pebble Project;
- encourage stakeholder and public participation in the USACE-led EIS permitting process for the proposed Pebble mine; and
- facilitate economic and other opportunities associated with advancement and development of the Pebble Project for local residents, communities and companies.

In addition to meeting with stakeholder groups and individuals, and providing project briefings in communities throughout Bristol Bay and the State of Alaska, the Pebble Partnership's outreach and engagement program includes:

- workforce and business development initiatives intended to enhance economic opportunities for regional residents and Alaska Native corporations;
- initiatives to develop partnerships with Alaska Native corporations, commercial fishing interests and other in-region groups and individuals;
- outreach to elected officials and political staff at the national, state and local levels;
- outreach to third-party organizations and special interest groups with an interest in the Pebble Project, including business organizations, community groups, outdoor recreation interests, Alaska Native entities, commercial and sport fishery interests, conservation organizations, among others; and
- in prior years, meetings of the Pebble Project Advisory Committee, a group comprised of prominent Alaskan and national figures assembled in 2017 to provide independent, external advice on the proposed Pebble mine as it advanced into federal permitting.

Through these various stakeholder initiatives, Northern Dynasty and the Pebble Partnership seek to advance a science-based project design that is responsive to stakeholder priorities and concerns, provides meaningful benefits and opportunities to local residents, businesses and Alaska Native village corporations, and energizes the economy of southwest Alaska.

6 GOVERNANCE

Good governance requires strong leadership to ensure that the values of the Company (Northern Dynasty) are reflected in everyday operations and business decisions. It also means having the structures and processes in place to facilitate decision-making and actions that advance the interests of both the Company and our stakeholders.

6.1 Board of Directors

Northern Dynasty's Board of Directors consults with management in guiding the Company's business, operations and strategies and provides oversight of the Company's activities.

One of the Board's primary responsibilities is to provide risk oversight with respect to the Company's policies and practices and their implementation throughout the organization and in the Company's operations.

The Board of Directors reviews, evaluates and discusses with members of management whether the risk management processes designed and implemented are adequate in identifying, assessing, managing and mitigating material risks facing the Company.

To support its risk oversight and business and operational strategy guidance and oversight responsibilities, the Board has four standing committees, namely:

- *Audit and Risk Committee;*
- *Compensation Committee;*
- *Nominating and Governance Committee; and*
- *Sustainability Committee.*

The members of each of the four committees are all independent directors. Each of the *Audit and Risk Committee*, the *Compensation Committee*, the *Nominating and Governance Committee* and the *Sustainability Committee* regularly reports to the plenary Board at Board of Director meetings. The *Sustainability Committee* has signed off on this report and has recommended to the Board the approval of the report. Northern Dynasty's Board of Directors has also approved this report.

6.2 Governance Manual

The Company has adopted a revised *Corporate Governance Policies and Procedures Manual* (the "Governance Manual") dated July 31, 2020. The *Governance Manual* mandates the Board to: (i) assume responsibility for the overall stewardship and development of the Company and monitoring of its business decisions; (ii) identify the principal risks and opportunities of the Company's business and ensure the implementation of appropriate systems to manage these risks; (iii) oversee ethical management and succession planning, including appointing, training and monitoring of senior management and directors; and (iv) oversee the integrity of the Company's internal financial controls and management information systems.

The *Governance Manual* also includes written charters for each committee and contains a code of ethics.

A copy of the *Governance Manual* is available for review on the Company's website under Corporate Governance at northerndynastyminerals.com.

6.2.1 *Audit and Risk Committee*

The *Audit and Risk Committee* charter provides that the Audit and Risk Committee shall carry out its responsibilities under applicable laws, regulations and stock exchange requirements with respect to the employment, compensation and oversight of the Company's independent auditor, and other matters under the authority of the Committee. The Committee also shall assist the Board of Directors in carrying out its oversight responsibilities relating to the Company's financial, accounting and reporting processes, the Company's system of internal accounting and financial controls, the Company's compliance with related legal and regulatory requirements, and the fairness of transactions between the Company and related parties.

The Committee is also involved in compliance with The *Extractive Sector Transparency Measures Act*. The Company recognizes the need to be transparent in regards to its payments to governments in Canada and abroad, and so publicly discloses, on an annual basis, specified payments made to all governments, to play its part in social responsibility and keeping governments accountable.

This Committee also monitors the whistleblower service. As directed in the *Governance Manual*, employees are encouraged to report questionable acts or possible violations directly to the Chair of the *Audit and Risk Committee* or the Chair of the *Nominating and Governance Committee*. If the report is to remain anonymous, the employee may leave a message on the whistleblower hotline, or an electronic report on the whistleblower website, and these reports will be sent directly to the Chairs.

6.2.2 *Compensation Committee*

The *Compensation Committee* charter provides that the *Compensation Committee* shall assist the Board of Directors in carrying out its responsibilities relating to executive and director compensation, so that the function of the *Compensation Committee* includes the review, on an annual basis, of the compensation paid to the Company's executive officers and directors, review of the performance of the Company's executive officers and making recommendations on compensation to the Board.

The *Compensation Committee* also administers the Company's share option plan and periodically considers the grant of share options.

6.2.3 *Nominating and Governance Committee*

The *Nominating and Governance Committee* charter provides that the *Nominating and Governance Committee* shall assist the Board of Directors in carrying out its responsibilities relating to stewardship and governance, so it has been given the responsibility of developing and recommending to the Board the Company's approach to corporate governance and of assisting members of the Board in carrying out their duties. The Committee also reviews with the Board

the rules and policies applicable to governance of the Company to assure that the Company remains in full compliance with proper governance practices. The Committee also evaluates and recommends to the Board the size of the Board and the persons put forth as nominees for the election or appointment as directors of the Company.

It is also important for the board to assess its performance when exercising its responsibilities. Hence, the Committee orchestrates self-assessments by the board and its committees. These are mandated by the *Governance Manual* and overseen by the Committee. The results are then tabulated and shared with the entire board for discussion

6.2.4 Sustainability Committee

The *Sustainability Committee* charter provides that the principal purpose of the *Sustainability Committee* is to review and monitor on behalf of the Board of Directors the policies and practices of the Company, as they relate to the environment, the health and safety of employees in the workplace, and sustainable development and social responsibility objectives.

6.3 Code of Ethics

Northern Dynasty's Board of Directors has adopted a formal ethics policy which is contained in the *Governance Manual* and which is available for download from the Company's website under Corporate Governance at northendynastyminerals.com.

The Company's policy is to conduct its business in accordance with the highest ethical and legal standards. The Code of Ethics is designed to deter wrongdoing and to promote:

- honest and ethical conduct, including the ethical handling of actual or apparent conflicts of interest;
- full, fair, accurate, timely and understandable disclosure in reports and documents that the Company submits to regulatory authorities and communicates to the public;
- compliance with applicable governmental laws and regulations;
- prompt internal reporting of violations of the Code to appropriate persons identified in the Code; and
- accountability for adherence to the Code.

The Code applies to all employees, officers, and directors of the Company and its subsidiaries. Because Hunter Dickinson Services Inc. ("HDSI") employees and officers provide substantial services to the Company, the Code also applies to all employees, officers and directors of HDSI.

The Code of Ethics includes Sections dealing with the following:

- Avoiding Questionable or Illegal Practices
- Honesty and Fair Dealing
- Policy to Prevent the Corruption of Public Officials
- Avoiding Conflicts of Interest
- Giving or Accepting Gifts

- Outside Activities and Political Contributions
- Securities Transactions and Blackouts
- Whistleblower Hotline

In addition, the Board has implemented an annual procedure whereby directors and officers sign off on, and ratify that they have read and understand, the Company’s code of ethics and that they are unaware of any violations thereof.

6.4 HDSI

Hunter Dickinson Services Inc., through its employees and contractors, provides geological, corporate development, administrative and management services to, and incurs third party costs on behalf of, Northern Dynasty and its subsidiaries at annually set hourly rates pursuant to an agreement dated July 2, 2010, which hourly rates do not exceed the fair market value of such services.

HDSI is a subsidiary of Hunter Dickinson Inc., which has adopted the following policy of Principles of Responsible Mineral Development that can be reviewed on its website at www.hdimining.com.

6.4.1 Principles of Responsible Mineral Development

At HDI, we are committed to working shoulder to shoulder with our stakeholders to achieve the responsible development of our projects and to contribute to the sustainable development of the communities in which we work.

All our activities are guided by the following principles:

Health and Safety	We operate in a responsible manner so that our activities protect the health and safety of our employees and contractors, and of the communities in which we work.
Stakeholder Engagement	We engage with governments, communities, indigenous peoples, organizations, groups and individuals on the basis of respect, fairness, transparency, and meaningful consultation and participation.
Community Development	We establish productive local partnerships to contribute to achieving development goals identified by communities in which we work, to address local priorities and concerns, and to have communities derive substantive benefits from our activities.

Environment and Society	We apply environmental and social best management practices in the planning, design and implementation of our activities, from exploration through to closure of our mining operations. We meet or exceed regulatory requirements in the jurisdictions in which we work.
Resource Use	We use land, water and energy resources responsibly; strive to maintain the integrity and diversity of ecological systems; and apply integrated approaches to land use.
Human Rights	We respect human rights principles, as well as local cultures, customs and values, in our dealings with employees, communities and other stakeholders.
Labor Conditions	We provide fair treatment, non-discrimination and equal opportunity for our employees, and comply with labour and employment laws in the jurisdictions in which we work. We strive for excellence in relations between management and employees.

HDI integrates these *Principles of Responsible Mineral Development* in its corporate management and decision-making, and works to continually improve performance. From project acquisitions and exploration through to mine closure, we assess the financial, social and environmental benefits and risks of our business decisions. Our goal is international best practice in all our operations, in Canada and around the world.

7 THE FINAL ENVIRONMENTAL IMPACT STATEMENT

Before submitting its application for permit under the federal CWA, NDM and PLP developed perhaps the most robust environmental baseline document ever prepared in the mining industry, and listened to the concerns of a broad range of project stakeholders – federal, state and local governments, Alaskans from all walks of life, and many others. NDM and PLP demonstrated the attention paid to those concerns in the proposed mine plan put forward in its December 2017 permit application.

The USACE undertook an exhaustive permit review under the CWA and NEPA (“National Environmental Policy Act”). That permitting process involved eight federal and three state cooperating agencies, plus the Lake & Peninsula Borough and federally recognized tribes. This review was the first time an independent, expert regulatory body had comprehensively reviewed a development plan put forward by Pebble Project proponents. The most important product of that review was the Final EIS released in July 2020. The Final EIS is the most relevant and defensible science-based assessment of the proposed Pebble mine ever developed.

As the following verbatim passages from the Final EIS show, the document describes a project of merit that will:

- protect clean water, healthy fisheries & other environmental values; and
- create tremendous socioeconomic benefits for Alaska’s people and governments.

7.1 Fish

NDM and PLP have long stated that the Pebble Project must co-exist with important fisheries in the Bristol Bay region. The Final EIS for the proposed Pebble mine demonstrates this standard can be met. The Final EIS concludes that the proposed project will have no impact on returning salmon and that salmon harvests would not be compromised.

“Impacts to Bristol Bay salmon are not expected to be measurable” (Final EIS at 4.24-47)

“Overall, impacts to fish and wildlife would not be expected to impact harvest levels. Resources would continue to be available because no population level decrease in resources would be anticipated.” (Final EIS Executive Summary at 51)

The Final EIS also concludes the proposed Pebble mine’s potential effects on fish and fisheries will be undetectable at the level of the Bristol Bay region as a whole (~40,000 sq. miles), within the two large drainage areas in which project facilities are located (~23,000 sq. miles), or even within the direct project area (~10 sq. miles):

“There would be no measurable change in the number of returning salmon and the historical relationship between ex-vessel values and wholesale values. In addition, there would be no changes to wholesale values or processor operations expected for Alternative 1a.” (Final EIS Executive Summary at 87)

“Under normal operations, the alternatives would not be expected to have a measurable effect on fish numbers or result in long-term changes to the health of the commercial fisheries in Bristol Bay.” (Final EIS at 4.6-3)

“The mine site area is not connected to the Togiak, Ugashik, Naknek, and Egegik watersheds and is not expected to affect fish populations or harvests from these watersheds.” (Table 4.6-1, Final EIS at 4.6-4)

“The mine site is not expected to affect Cook Inlet commercial fisheries.” (Final EIS at 4.6-4)

“This alternative would not be expected to have measurable effects on the number of adult salmon, and therefore would have no impact to commercial fisheries.” (Table 4.6-1, Final EIS at 4.6-4)

“Alternative 1a would not have measurable effects on the number of adult salmon returning to the Kvichak and Nushagak river systems as a result of project construction and operations, due the limited lineal footage of upper Kaktuli River fish habitat affected by placement of fill.” (Final EIS at 4.6-9)

“Considering the physical characteristics and current fish use of habitat to be removed, the consequently low densities of juvenile Chinook and coho observed in the affected tributaries, and the few numbers of spawning coho observed (see Section 3.24, Fish Values), impacts to anadromous and resident fish populations from these direct habitat losses would not be measurable, and would be expected to fall within the range of natural variability.” (Final EIS at 4.24-46)

“Other salmon fisheries in Alaska exist in conjunction with non-renewable resource extraction industries. For example, the Cook Inlet salmon fisheries exist in an active oil and gas basin and have developed headwaters of Anchorage and the Matanuska-Susitna areas. The Copper River salmon fishery occurs in a watershed with the remains of the historic Kennecott Copper Mine and the Trans Alaska Pipeline System in the headwaters of portions of the fishery. Both fisheries average higher prices per pound than the Bristol Bay Salmon Fishery.” (Final EIS Executive Summary at 86)

7.2 Benefits to the Region

The Final EIS clearly shows the proposed Pebble mine would have a positive impact on socioeconomic conditions in the region – notably through employment for the communities around Iliamna Lake, and in helping drive down the cost of goods by enhancing transportation infrastructure for local communities. The proposed Pebble mine is forecast to create 850 direct, high-wage jobs and 2,000 total jobs, and is widely expected to have a dramatic and positive impact, both regionally and state-wide.

The Final EIS points to a range of other positive socioeconomic benefits:

“Communities near the mine site and ferry/port terminals would likely see a beneficial impact of higher employment rates.” (Final EIS Executive Summary at 47)

“The increase in job opportunities, year-round or seasonal employment, steady income, and lower cost of living described above would have beneficial impacts on the EIS analysis area, especially for communities in the LPB, during construction and operations of the project.” (Final EIS Executive Summary at 54)

“The project could reduce or eliminate the current local population decline because of the increase in employment opportunities and indirect effects on education and infrastructure; it could also lead some prior residents to return to communities.” (Final EIS Executive Summary at 48)

“Overall, the project would provide long-term beneficial impacts to the economy from employment and income in the region and state.” (Final EIS at 4.3-10)

“Reduced transportation costs would lower the cost of living for these communities, all of which are minority and low income.” (Final EIS Executive Summary at 53)

“The project is likely to reduce transportation costs (thereby reducing the cost of living) to communities near the transportation corridor, should arrangements be made to allow controlled public use of the mine and port access roads and spur roads.” (Final EIS Executive Summary at 48)

“Reduced transportation costs would likely lower the high cost of living for the communities near the transportation corridor (i.e., Newhalen, Iliamna, Nondalton, and Kokhanok). The natural gas pipeline would also provide opportunities for adjacent communities to lower their winter heating costs, a positive impact.” (Final EIS at 4.3-3)

“It would be anticipated that residents of the communities surrounding Iliamna Lake would continue to provide most of the local workforce for construction and operations of the project. Therefore, employment through the project would have beneficial economic effects on minority and low-income communities lasting for the life of the project.” (Final EIS Executive Summary at 53)

“In addition, indirect employment opportunities would increase from the services that would be needed to support construction and operations activities (e.g., air services, goods, and supplies).” (Final EIS at 4.3-5)

“Alternative 1a would provide year-round operations employment, which would help reduce the impacts of the seasonal employment fluctuations that are prevalent in the region.” (Final EIS at 4.3-5)

“Because the higher cost of living in rural areas is primarily associated with the high transportation cost of food, fuel, and other supplies (ADOL 2008, 2017a), Alternative 1a has the potential to reduce transportation costs to communities near the transportation corridor, should arrangements be made to allow controlled public use of the mine and port access roads and spur roads.” (Final EIS at 4.3-6)

“Reduced transportation costs would lower the high cost of living for the communities near the transportation corridor, specifically Kokhanok, Iliamna, Newhalen, and potentially Nondalton. This would be a beneficial long-term impact, lasting the life of the project or until roads are decommissioned. It is possible that PLP, landowners, and the LPB could agree on continued use

of project transportation infrastructure after project closure and continue the beneficial contribution.” (Final EIS at 4.3-6)

“Local employment opportunities could offset current trends of outmigration in some communities and provide service fee revenue to maintain or even improve community infrastructure.” (Final EIS at 4.3-6 and 7)

“In addition, an increased revenue stream to the LPB, along with stabilization of population levels attributable to employment opportunities, could result in improvements to community health care facilities throughout the borough.” (Final EIS at 4.3-8)

“The proposed project could generate \$27 million annually (2011 dollars) in severance taxes paid to LPB during the operations phase.” (Final EIS at 4.3-11)

“The project would generate \$25 million annually in state taxes through construction, and \$84 million annually in state taxes and royalty payments during the operations phase. The project would generate \$27 million annually in severances taxes for the LPB during operations, and annual property tax revenue to the Kenai Peninsula Borough based on assessed value of project-related real property.” (Final EIS ES 47-48)

7.3 Water

Protecting water quality and water flows in the area surrounding the proposed Pebble mine is important to ensuring the project does not negatively affect fisheries resources or other ecosystem values. Extensive water modeling, based on years of data collection by PLP, demonstrates the project can meet its commitment to protect the fisheries and water resources of Bristol Bay. The Final EIS concludes:

“Therefore, the intensity of the impacts to surface water resources would be generally expected to result in changes in water quantity, likely within the limits of historic and seasonal variation.” (Final EIS Executive Summary at 63)

“There would be no effects on any community groundwater or surface water supplies from the changes in groundwater flows at the mine site.” (Final EIS Executive Summary at 67)

“An Alaska Pollutant Discharge Elimination System (APDES) permit stipulation requires treated water quality monitoring, to ensure discharged water meets applicable water quality criteria. Assuming these protections are adopted, direct and indirect impacts of treated contact waters to off-site surface water are not expected to occur.” (Final EIS Executive Summary at 70)

“The duration of impacts to surface water hydrology would vary from temporary to permanent. The geographic extent of the impact on the NFK and the SFK rivers may extend just below the confluence of the two rivers. After the flows combine at the confluence of the NFK and SFK rivers, discernable changes in flow would be unlikely and are expected to be within historic and seasonal variation in the Kaktuli River.” (Final EIS at 4.16-2)

“With few exceptions, predicted changes in habitat in the modeled portion of the upper mainstem Koktuli River (upstream of the Swan River) are near zero or positive, suggesting that project effects from flow changes would not negatively impact reaches downstream of the NFK and SFK confluence, or in UTC.” (Final EIS at 4.24-13)

7.4 Tailings

Critics of the Pebble Project have expressed concern about the potential for catastrophic failure of tailings storage facilities, and whether such risks were sufficiently studied in the Final EIS. However, the USACE concluded in the Final EIS that it could not credibly establish a failure mechanism that would lead to a catastrophic failure at the proposed Pebble mine.

The Final EIS looked at four recent TSF failures in other parts of the world and evaluated possible, yet highly unlikely, TSF spill scenarios at the proposed Pebble mine. Key findings from the Final EIS include:

“...the [EPA and Lynker] models assumed the release occurred from a water-inundated TSF, and based their release volume results on historic failure data that are not relevant to the proposed Pebble mine.” (Final EIS at K4.27-1)

“Most historic tailings dam failures have occurred from dams constructed by upstream methods, as opposed to the centerline and downstream constructed dams proposed by the Applicant.” (Final EIS Exec Summary at 103)

“The Applicant’s bulk TSF design is different than that of most other historic and current TSFs. The proposed design is especially distinct when compared to most historic mines that have experience large failures.” (Final EIS at K4.27-3)

“The Applicant’s design is distinct from most mine sites, in that it would separate bulk tailings from pyritic/PAG tailings. This design would serve to minimize the volume of tailings that require subaqueous storage.” (Final EIS at K4.27-5)

“The stability benefits of a dry closure are summarized by Cobb (2019b) as follows: “At the end of the operating life the risk is immediately reduced if the operational pond can be removed, resulting in a “dry” closure.” (Final EIS at K4.27-10)

“[T]he bulk TSF main embankment is planned to differ from the Mount Polley Dam in three main ways: 1) the bulk TSF embankment would be founded on bedrock without risk of overlying a weak soil layer; 2) tailings discharge into the bulk TSF would be with thickened tailings, not slurried tailings, thereby reducing the water volume in the bulk TSF; and 3) the supernatant pond on the bulk TSF surface would be kept small by pumping to the main WMP.” (Final EIS at K4.27-12)

“There is no relevant comparison between the Fundão dam and the proposed bulk TSF main embankment on the Pebble Project.” (Final EIS at K4.27-13)

“There is no relevant comparison between the Feijão dam and the proposed bulk TSF main embankment of the Pebble Project.” (Final EIS at K4.27-14)

“The [EPA & Lynker] models are not relevant to the bulk TSF main embankment because the model assumptions are based on historic failures from water-inundated TSFs, most of which stored conventional tailings slurries and not thickened tailings. The models therefore assumed a high volume of water involved in the release, which erodes, entrains, and/or mobilizes tailings, leading to a larger release of both fluid and solid tailings. However, the Applicant’s design would have only a small supernatant pond, and not a full water cover. Without a full water cover, bulk TSF tailings would not be triggered to experience static liquefaction and flow. Therefore, the modeled releases and resulting impacts [by EPA & Lynker] are an overestimation of a reasonable bulk TSF failure scenario.” (Final EIS at K4.27-16)

“This modeling [by EPA] is not relevant to a failure of the bulk TSF because the model assumes that a high volume of water is stored in the TSF, making overtopping the dam more probable” (Final EIS Appendix K4.27-18)

“The EPA then correctly argued that the record of past failures does not fully reflect current engineering, design, construction, operating, and monitoring practices, as would be used on the bulk TSF. EPA stated that some studies suggest that improved practices can reduce the failure rate by an order of magnitude or more.” (Final EIS at K4.27-18)

“The release scenarios in the Lynker study are based on data from historic TSF failures ... that date back to the 1970s. These early TSFs were mostly storing wet tailings slurries, predominantly built by upstream construction methods, and mostly under a relatively full surface water cover in traditional large “lagoon” type TSFs. Therefore, they are not applicable to the Pebble design with thickened tailings that would not be covered by water. Most historic failures were also from upstream dams, which are less stable than centerline or downstream dams. In addition, most of the failures involved dams founded on soil or tailings, instead of a bedrock foundation that is planned for the bulk TSF main embankment.” (Final EIS at K4.27-20)

ENVIRONMENTAL, SOCIAL AND GOVERNANCE REPORT

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