

**NORTHMET PROJECT –
DAM SAFETY PERMITS**

**FINDINGS OF FACT, CONCLUSIONS,
AND ORDER OF COMMISSIONER**

November 1, 2018

Table of Contents

I. EXECUTIVE SUMMARY	1
II. ENVIRONMENTAL SETTING OF THE PLANT SITE	3
III. ENVIRONMENTAL REVIEW OF THE PROPOSED NORTHMET PROJECT	3
A. History of Environmental Review Process	3
B. Summary of Analysis Within the FEIS	5
C. Summary of FEIS Socioeconomic Analysis	7
D. FEIS Consideration of Other Potential Environmental Impacts	7
IV. SUMMARY OF PROPOSED DAM LOCATIONS AND CONSTRUCTION	9
V. APPLICATION AND COMMENT PROCESS	9
A. PolyMet Submits Dam Safety Permit Applications	9
B. DNR Engaged Outside Experts to Review the Proposed Project and Provide Recommendations	13
C. DNR Evaluated the Proposed Buttress Modification and Also Considered Whether an SEIS Was Needed.	13
D. DNR Circulated the Applications to Government Entities for Comment.	14
i. DNR Outreach	14
ii. Comments from DNR Fish and Wildlife (FAW)	15
E. DNR Circulated Draft Permits for Public Comment	15
VI. CONCERNS RAISED BY PUBLIC COMMENTERS	15
A. Concerns Relating to Both the FTB Dam and the HRF Dam	17
i. Concerns that PolyMet Should Provide Additional Evidence Before DNR May Issue Permits	17
ii. Concerns About Factors of Safety	19
iii. Concerns About Freeboard and Overtopping	20
iv. Concerns Regarding Seepage from the Basins	21
v. Concerns Relating to Earthquakes	21
vi. Concerns about Environmental Impacts	23
B. Concerns Regarding the FTB Dam	24
i. Concerns that the FEIS Should Have Been Supplemented	24
ii. Concerns Regarding Buttress Design	26
iii. Concerns Regarding Peat Underlying Area of FTB Buttress	27

iv. Concerns About Peat and Slime Within the FTB Basin	27
v. Concerns About Consideration of the Mount Polley Dam Failure.....	29
vi. Concerns that Bentonite Will Negatively Affect Dam Stability.....	31
vii. Concerns About Timing of Bentonite Pilot Testing	32
viii. Concerns About Comments by Outside Consultant	32
ix. Concerns About a Potential FTB Dam Breach and Dam Breach Analysis.....	33
x. Concerns about Wet Closure of the FTB	36
xi. Concerns that the FTB Dam Safety Permit Should Require Dry Stacking	37
C. Concerns Regarding HRF	40
i. Concerns Regarding HRF Dam Breach	40
ii. Concerns Regarding Hazard Classification	41
iii. Concerns Regarding HRF Dam Design	42
iv. Concerns Regarding Liquefaction Analysis	43
v. Concerns Regarding the HRF Liner, Foundation, and Other Issues	43
VII. DNR HAS CORRECTLY CLASSIFIED THE PROPOSED FTB AND HRF DAMS.....	48
VIII. THE APPLICATIONS SATISFY MINNESOTA RULE § 6115.0410	48
A. Subpart 1 Does Not Apply to the NorthMet Dam Safety Permits.....	48
B. The Permit Applications Satisfy Subparts 2 and 3	48
C. PolyMet Paid the Required Filing Fee Under Subpart 4.....	49
D. Barr Satisfies the Requirements for a Professional Engineer Proficient in Dam Safety Engineering Under Subpart 5	49
E. PolyMet Has Satisfied the Final Design Report Requirements for the FTB and HRF Dam Safety Permits Under Subparts 6 and 7.....	49
F. PolyMet’s Application Satisfies the Permitting Requirements for the FTB and HRF Dam Safety Permits Under Subpart 8.....	50
G. The Applications Satisfy Subpart 8	51
1. The Applications Satisfy the Subpart 8 Requirements Applicable to Both the FTB and HRF Dams.....	51
2. The FTB Dam Application Satisfies the Subpart 8 Requirements Applicable to Class I Dams	52
3. The HRF Dam Application Satisfies the Subpart 8 Requirements Applicable to Class II Dams.	52
4. Both the HRF and FTB Dam Applications Satisfy Subpart 8 Requirements.	53

5. Subparts 9 through 13 Apply to PolyMet as Permittee and are Incorporated into the Permits.	53
IX. THE CHANGE FROM CDSM TO A MODIFIED BUTTRESS DOES NOT REQUIRE AN SEIS.	54
X. DNR HAS CONSIDERED ADDITIONAL REQUIREMENTS WITH RESPECT TO THE DAM SAFETY PERMIT APPLICATIONS.	54
XI. DNR HAS DETERMINED THAT THE ISSUANCE OF THE PERMITS COMPLIES WITH MERA.	Error! Bookmark not defined.

LIST OF ACRONYMS AND ABBREVIATIONS

BIF	Biwabik Iron Formation
BWCA	Boundary Waters Canoe Area Wilderness
CDSM	Cement Deep Soil Mixing
CPT	Cone Penetration Testing
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DNR	Commissioner of the Minnesota Department of Natural Resources
EAW	Scoping Environmental Assessment Worksheet finalized on March 30, 2005
EIS	Environmental Impact Statement
EOR	Emmons & Olivier Resources, Inc.
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ERM	Environmental Resources Management
EWR	Division of Ecological and Water Resources
FAW	Division of Fish and Wildlife
FEIS	Final Environmental Impact Statement
FTB	Flotation Tailings Basin
GLIFWC	Great Lakes Indian Fish and Wildlife Commission
HRF	Hydrometallurgical Residue Facility
KP	Knight-Piesold
LTVSMC	LTV Steel Mining Company
MERA	Minnesota Environmental Rights Act
MGD	Million gallons per day
MGS	Minnesota Geological Survey
MPARS	MnDNR Permitting and Reporting System
MPCA	Minnesota Pollution Control Agency
NGO	Non-Governmental Organization
NPDES	National Pollutant Discharge Elimination System
NSPS	New Sources Pollution Standards
PD	Project Description
PMP	Probable Maximum Precipitation
PSHA	Probabilistic Seismic Hazard Analysis
QAPP	Quality Assurance Project Plan
ROD	Record of Decision
SDEIS	Supplemental Draft Environmental Impact Statement
SDS	State Disposal System
SEIS	Supplemental Environmental Impact Statement
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
WWTF	Waste Water Treatment Facility
WWTS	Waste Water Treatment System

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

In the Matter of the Applications for Dam Safety Permits

2016-1380

2016-1383

FINDINGS OF FACT, CONCLUSIONS, AND ORDER OF COMMISSIONER

for the NorthMet Mining Project

After review and due investigation and consideration of comments, and based on the information and statements contained in the permit applications submitted by Poly Met Mining, Inc., the applicant's description of work proposed to be undertaken, and supplemental information in the administrative record contained within the MNDNR Permitting and Reporting System ("MPARS") or otherwise available to the Minnesota Department of Natural Resources, the Commissioner of the Minnesota Department of Natural Resources ("DNR") now makes the following:

FINDINGS OF FACT

I. EXECUTIVE SUMMARY

1. Poly Met Mining, Inc. (PolyMet or Applicant), on July 19, 2016 applied for a Floatation Tailings Basin Dam Safety Permit and on July 20, 2016 a Hydrometallurgical Residue Facility Dam Safety Permit (Collectively referred to as "Applications"). Both dams are part of its proposed NorthMet mining project (Project or NorthMet Project) located south of the city of Babbitt and north of the city of Hoyt Lakes in St. Louis County, Minnesota. The NorthMet Project seeks to develop a mine and associated processing facilities for the extraction of copper, nickel, and platinum group elements from the NorthMet Deposit within the Duluth Complex in Northeastern Minnesota. The Project underwent joint federal-state environmental review, which culminated in the DNR issuing an unchallenged Record of Decision ("ROD") deeming the Final Environmental Impact Statement ("FEIS") adequate in March 2016.

2. As illustrated in Attachment 1, the proposed NorthMet Project includes an open pit mining area ("Mine Site") located approximately six miles south of Babbitt. The processing of ore will not occur at the Mine Site, but, rather, will take place at the former LTV Steel Mining Company's ("LTVSMC") processing plant located near the city of Hoy Lakes ("Plant Site") approximately 8 miles from the Mine Site. The Mine Site and the Plant Site are connected by a Transportation and Utility Corridor ("Corridor").

3. PolyMet requests these dam safety permits for the construction and operation of dams for a proposed flotation tailings basin (FTB) and a proposed hydrometallurgical residue

facility (HRF) located at the Plant Site for its proposed Project. DNR dam safety engineers have reviewed the progression of the design of the proposed flotation tailings basin and the proposed hydrometallurgical residue facility for over 10 years. To supplement its own review, DNR sought top experts to assess and comment on the proposed design, operation, and maintenance of the proposed dams.

4. The existing LTVSMC tailings basin will serve as the foundation for the PolyMet tailings basin. Tailings from the Plant will be pumped in a slurry form to the flotation tailings basin. The tailings will be deposited in the tailings basin at multiple locations in and around the tailings basin. The tailings will settle out in the basin and the decanted water will be pumped back to the plant for reuse in the plant process. A perimeter embankment (FTB Dam) made up of primarily coarse tailings will be constructed around the basin to contain the tailings slurry. The FTB Dam will be constructed via upstream construction in multiple lifts over the proposed 20-year life of operations.

5. The HRF will be built on and near the LTVSMC existing emergency basin southwest of the LTVSMC tailings basin. The HRF is planned to be built approximately 2 years after the start of plant operations. Wastes from multiple sources will be deposited in the HRF, primarily from the hydrometallurgical plant. The HRF will be a double lined storage facility. The perimeter embankment (HRF Dam) will be constructed using well-compacted construction materials via the downstream method.

6. The dam safety permits that PolyMet seeks in this proceeding relate solely to the authorization of the FTB and HRF Dams under Minn. R. 6115.0300 to 6115.0520. The FTB Dam and HRF Dam will not be constructed in “public waters,” as defined in Minn. Stat. § 103G.005, subd. 15. The dams will be constructed near the Plant Site on or adjacent to the existing LTVSMC tailings basin. *See* FEIS Figure 4.2.2-2. The FTB Dam will be constructed on top of the east cells of the LTVSMC tailings basin. The HRF Dam will be constructed on the site of the LTVSMC emergency basin and some adjacent natural ground. Construction and operation of these dams, as planned and permitted, will not change or diminish the course, current or cross section of a public water nor does it involve the construction, reconstruction, modification or removal of a dam on a public water within the meaning of Minn. Stat. § 103.245, subd. 1. Thus, the FTB Dam and the HRF Dam do not require a separate public waters work permit and are not subject to other statutory or regulatory requirements applicable to public waters.

7. A multitude of other permits and regulatory requirements apply to the NorthMet Project. Mining and reclamation of the mining area are regulated under a Permit to Mine issued by the DNR pursuant to Minn. Stat. § 93.481 and Minn. R. Ch. 6132. The FTB and HRF discussed in this proceeding, in addition to being subject to a dam safety permit also are subject to regulation by the DNR under a Permit to Mine. Water and air quality issues associated with the Project are regulated by the Minnesota Pollution Control Agency (“MPCA”) pursuant to National Pollutant Discharge Elimination System (“NPDES”) and State Disposal System (“SDS”), and Air Emissions Permits. Appropriation of water for the NorthMet Project is subject to DNR permitting under Minn. Stat. §§ 103G. 255 to 103G.301 and Minn. R. 6115.0600 to 6115.0930. Monitoring and mitigation for direct and indirect wetland impacts are regulated under the Permit to Mine in accordance with the State Wetland Conservation Act and under a

wetlands permit issued by the United States Army Corps of Engineers (“USACE”) under section 404 of the Clean Water Act, 33 U.S.C. § 1344. Any take of a state-listed species resulting from the NorthMet Project requires a taking permit from the DNR pursuant to Minn. Stat. § 84.0895, subd. 1.

8. As detailed below, the DNR concludes that PolyMet has met its burden of proof, that substantial evidence supports DNR’s Findings of Fact, and that under Minnesota law, PolyMet is entitled to issuance of the requested Dam Safety Permits, subject to the terms and conditions therein and the provisions of Minnesota law. (Collectively, the FTB Permit and HRF Permit are referenced herein as the “Permits” or “Dam Safety Permits”).

II. ENVIRONMENTAL SETTING OF THE PLANT SITE

9. As shown on the attached Attachment 1, the NorthMet Project Mine Site is located approximately six miles south of Babbitt and two miles south of a currently operating the Peter Mitchell Mine, an open pit taconite mine owned by Northshore Mining Co. Ore will not be processed at the Mine Site, rather it will be transported eight miles to the Plant Site for processing.

10. The Plant Site is located in the St. Louis River Watershed¹, within the Lake Superior Basin. Flows at the Plant Site drain to the Embarrass River, with the exception of Second Creek, which is part of the Partridge River watershed. Both the Embarrass River and the Partridge River flow into the St. Louis River, which eventually flows into Lake Superior. The Plant Site is separated from the Rainy River Watershed by the Laurentian Divide. Since the watercourses at issue in the NorthMet Project are not part of the Rainy River Watershed within the Hudson Bay Basin, they do not flow to the Boundary Waters Canoe Area Wilderness (“BWCA”).

III. ENVIRONMENTAL REVIEW OF THE PROPOSED NORTHMET PROJECT

History of Environmental Review Process

11. Joint federal-state environmental review of the proposed NorthMet Project began in 2004. At the outset of environmental review, the DNR and the USACE were co-lead agencies (“Co-lead Agencies”) in preparing the EIS for the proposed NorthMet Project. The United States Forest Service (“USFS”) initially participated in the environmental review process as a cooperating agency. The Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa and Grand Portage Band of Chippewa participated in the environmental review process as cooperating agencies. The Great Lakes Indian Fish & Wildlife Commission (“GLIFWC”) and the 1854 Treaty Authority assisted the Bands in their roles as cooperating agencies throughout environmental review. See FEIS ES-7 through 10; §1.5.

¹ A watershed is an area of land that is drained by a river and its tributaries into a body of water, or a common outlet. A watershed boundary, or divide, separates watersheds such that impacts to surface water resources in one watershed cannot affect surface water resources in another watershed.

12. On May 30, 2005, the DNR and the USACE finalized a Scoping Environmental Assessment Worksheet (“EAW”) and Draft Scoping Decision Document for the Project. A Notice of Availability of the Scoping EAW and Draft Scope was published in the EQB Monitor on June 6, 2005. This initiated a 30-day scoping period. A public scoping meeting was held in Hoyt Lakes on June 29, 2005. On July 1, 2005, USACE published a Notice of Intent to Prepare an EIS for the proposed NorthMet Mining Project in the Federal Register. On October 25, 2005, the DNR and the USACE issued a Final Scoping Decision Document for the proposed NorthMet Mining Project. *See* FEIS ES-8

13. On April 24, 2006, the DNR published a Draft Environmental Impact Statement (“DEIS”) preparation notice in the EQB Monitor. Poly Met submitted an initial Project Description (“PD”) for the proposed NorthMet Mining Project on April 26, 2006. The PD was revised in January 2007 and a supplemental PD was submitted in July 2007. The PD was further revised through June 2009. On October 27, 2009, the DNR and the USACE issued a DEIS for the proposed NorthMet Mining Project. Notification of the publication of the DEIS was published in the EQB Monitor and the Federal Register on November 2 and November 6, 2009 respectively. This opened a public comment period on the DEIS. In addition, the DNR and the USACE convened a public meeting in Aurora and another in Blaine to gather public comments on the DEIS. The agencies received approximately 2,800 comments on the DEIS.

14. On February 18, 2010, the United States Environmental Protection Agency (“EPA”) submitted comments on the DEIS and assigned it a rating of EU-3 (Environmentally Unsatisfactory – Inadequate Information). In mid-2010, the DNR, the USACE and the USFS determined that a land exchange proposed action should be included in environmental review of the proposed NorthMet Mining Project. The USFS thus joined the DNR and the USACE as a Co-lead Agency for environmental review purposes. The Co-lead Agencies then developed a Supplemental Draft EIS for the proposed NorthMet Mining Project. The EPA became a cooperating agency for development of the Supplemental Draft EIS in order to participate in resolving issues identified in its February 2010 comment letter.

15. On December 5, 2013, the DNR released the Supplemental DEIS for public comment. A 90-day public comment period ran from December 14, 2013 and closed on March 13, 2014. In addition, public meetings were held in Duluth, Aurora, and St. Paul in January 2014. Over 58,000 comments were submitted on the SDEIS.

16. On November 6, 2015, the Co-lead Agencies released the Final Environmental Impact Statement (FEIS) on the proposed NorthMet Mining Project. The FEIS responded to all substantive comments received during the public review of the DEIS and the SDEIS. In addition, the public had an additional opportunity to review and submit comments when the FEIS was issued.

17. On March 3, 2016, the DNR issued its Record of Decision (“ROD”) concluding that the FEIS was adequate under MEPA. Notice of the ROD was published in the EQB Monitor on March 14, 2016. The ROD was not appealed, and it is no longer subject to judicial review. *See* Minn. Stat. § 116D.04, subd. 10 (certiorari review of an adequacy decision must be initiated within 30 days of publication of notice of the final decision in the EQB Monitor).

18. On January 9, 2017, the USFS issued a Final Record of Decision authorizing a land exchange between PolyMet and the USFS for lands at the Mine Site. Pursuant to a land exchange agreement with the USFS dated August 31, 2017, PolyMet took fee title to the Mine Site on June 28, 2018. To date, the USACE has not issued a Final Record of Decision because it has yet to make a final decision on the federal wetlands permit. See e.g. FEIS ES-55.

19. The FEIS was included within PolyMet's Application as Reference 1. The environmental review documents, including the FEIS and state ROD are publicly available at: https://www.dnr.state.mn.us/input/environmentalreview/Poly_Met/index.html and are incorporated by this reference.

Summary of Analysis Within the FEIS

20. The purpose of the FEIS is to inform the public and decision-makers of the proposed actions, assess potential environmental consequences, identify potential mitigation measures and reasonable and feasible alternatives, and to address the no-action alternative. The FEIS analyzed existing conditions in the area of the NorthMet Project and its surrounding environment. The FEIS described in detail impacts, including cumulative and indirect impacts on the natural and human environment from the NorthMet Project.

21. The FEIS comprehensively discussed and analyzed the potential health and socioeconomic effects of the NorthMet Project, including effects associated with the dam safety permits. See FEIS §§ 4.2.14, 5.2.14, 6.2.14. The FEIS specifically analyzed potential human health impacts of the NorthMet Project, including how the Project could affect air quality, surface and groundwater quality, including effects to drinking water and food sources. See FEIS § 7.3.4. The FEIS also evaluated the potential environmental consequences of the proposed NorthMet Project on the affected environment, including direct and indirect effects on water resources, wetlands, vegetation, wildlife, and aquatic species. *Id.* §§ 5.2.2-5.2.6. The FEIS similarly assessed the potential cumulative impacts of the proposed NorthMet Project at the resource level. *Id.* §§ 6.2.2-6.2.6.

22. During the course of the environmental review process, the Co-lead Agencies, considered many alternatives and mitigation measures. The alternatives and measures the Co-lead Agencies considered included those relating to siting, technology, and modifications to designs and layouts. In conjunction with this process, the Permittee made numerous refinements to incorporate benefits and avoid or mitigate potential impacts. These measures would produce substantial environmental and other benefits. The full alternatives analysis discussion is located in Section 3.2.3 of the FEIS (starting on page 3-143). Project refinements made and considerations undertaken in connection with the 2013 SDEIS process include, among other things:

- removal of the existing LTVSMC Coal Ash Landfill from within the FTB footprint prior to inundation
- additions to the seepage capture systems for the FTB
- modification to the stream augmentation plan such that only treated mine water will be discharged to three streams downstream from the FTB
- stability enhancements to strengthen the existing LTVSMC tailings basin dams
- wet vs. dry cover closure options for the FTB

- siting for tailings disposal: in mine pit, greenfield, or alternate brownfield sites

23. After addressing alternatives for the FTB location and design, consulting with other agencies, and considering public input, the DNR concluded that locating the tailings basin on a brownfield site with wet closure had certain advantages over both dry stacking and dry closure.² The DNR made this determination based on a number of factors, including that wet closure improves ongoing water quality from the legacy site, minimizes additional impact to “undisturbed” locations (i.e., wetlands, water, and landforms), and has cost advantages. In view of all of these factors, the DNR concluded that PolyMet’s proposed use of wet closure would comply with applicable law pertaining to environmental considerations, public health, and public welfare, as well as other applicable regulatory requirements.

24. The DNR acknowledges that there are concerns, and trade-offs, associated with locating the FTB at a legacy site and with wet closure, including the need for long-term treatment and maintenance of dam stability. Indeed, all alternatives have benefits and costs; there is no ideal solution that eliminates risks and impacts.

25. As more fully discussed in the *In the matter of the NorthMet Project Permit to Mine Application dated December 2017, Findings of Fact, Conclusions, and Order of Commissioner* (November 1, 2018)(“Permit to Mine Findings of Fact”) Part VIII.A (ii) DNR’s Consideration of Tailings Storage and Closure Alternatives, the DNR extensively considered concerns about wet closure raised during the environmental review and permitting processes. The DNR concluded that wet closure, coupled with the bentonite amendment, seepage capture systems, and robust monitoring as required under the Permit to Mine, the Dam Safety Permits, and other requirements, is the most effective and workable means of achieving reclamation, from a technological, economical, and practical standpoint. This conclusion is based on predictive modeling, problem assessment, examination of alternative practices, and input from appropriate regulatory authorities.

26. The DNR relies on the environmental review analyses in the FEIS in its consideration of the Applications. In addition, the Dam Safety Permits and the other permits applicable to the Project will require monitoring for impacts to public health, public safety, and the environment. In the event actual or potential impacts are identified through required monitoring, the various permits needed for the Project will require development and implementation of appropriate adaptive management or mitigation strategies. Continued monitoring and reporting is required under the various permits even in the event of periods of temporary idle or shutdown.

27. The ROD concluded that the FEIS adequately analyzed significant environmental impacts associated with the NorthMet Project, appropriately presented alternatives and analyzed their impacts, responded to public comments, and presented methods by which adverse environmental impacts associated with the Project could be mitigated.

² In support of its dam safety permit applications and the Permit to Mine Application, PolyMet also conducted detailed technical analysis, including more than ten years of waste characterization and geotechnical studies, and developed its dam designs with concurrent review by the DNR.

Summary of FEIS Socioeconomic Analysis

28. The FEIS study area for socioeconomics is the Arrowhead region of northeastern Minnesota. This region includes all of Cook, Lake, and St. Louis counties. The socioeconomic analysis addresses the geography of the Mine Site, Transportation and Utility Corridor, and the Plant Site as well as the non-federal tracts included in the Land Exchange Proposed Action. FEIS § 4.2.10. The FEIS also addresses effects on tribal members who exercise usufructuary rights in the 1854 Ceded Territory to hunt, fish, and gather in the area analyzed. The FEIS specifically analyzes the effects for the Fond du Lac (St. Louis and Carlton counties), Grand Portage (Cook County), and Bois Forte (St. Louis and Koochiching counties) Bands both on and off reservation where information was available. *Id.*

29. During typical year operations, the FEIS estimated that the Project will generate nearly 1,000 total direct, indirect, and induced jobs, increasing employment in the study area by approximately one percent. *See* FEIS § 5.2.10. The Proposed Action is estimated to create up to 500 direct jobs during peak construction and 360 direct jobs during operations. While some specific skilled employees would only be involved temporarily and would relocate from outside the region, the majority of jobs related to the Proposed Action are to be filled by those currently living in the Arrowhead region. FEIS ES at 40 and 41; § 5.2.10. The direct jobs generated would also generate additional indirect and induced employment. These induced employment jobs are estimated to include 332 additional construction-phase jobs and 631 additional operations-phase jobs.

30. The analysis in the FEIS also estimated that during a typical year during the operations phase of the project, total value added would be roughly \$330 million. *See* FEIS § 5.2.10 at Table 5.2.10-2.

31. The Proposed Action would also create a slightly increased demand for housing and public services in the surrounding cities and towns near the Plant Site, thus collaterally effecting the Environmental Justice populations at a minor level. *Id.* § 5.2.10.

32. During operations, approximately \$231 million per year in direct value would be added through wages and rents, and \$332 million per year in direct output related to the value of the extracted minerals and approximately \$80 million per year in federal, state, and local taxes. These direct economic contributions would create indirect and induced contributions estimated at \$99 million in value added and \$182 million in output. FEIS at § 5.2.10

FEIS Consideration of Other Potential Environmental Impacts

33. The Dam Safety Permit Applications include additional information on potential environmental issues and plans to address potential environmental or historic preservation issues, including information and plans prepared in connection with other permitting processes. *See* FTB and HRF Permit Applications, Air Quality Management Plan, Wetland Data Package, Wetland Permit Application, NPDES-SDS Permit Application, Water Modeling Data Package, Waste Characterization Data Package. *See* Section 4.0 of Applications. DNR has reviewed this information in the context of the dam safety permit process to evaluate whether the Applications satisfy all applicable dam safety permitting requirements, including, without limitation, those

relating to environmental impacts, potential hazards to health, and safety, public welfare, public benefit, and economic and socioeconomic impacts.

34. In addition, the DNR, the MPCA and the USACE have completed or are in the process of permit reviews that evaluate potential environmental impacts of the NorthMet Project and are exercising their regulatory authorities under federal and Minnesota law to assure that the Project will comply with all applicable environmental and natural resources requirements.

35. The MPCA is the state agency responsible for adopting and enforcing water quality standards in Minnesota under the Federal Clean Water Act (CWA). *See In re Cities of Annandale and Maple Lake NPDES/SDS Permit Issuance for the Discharge of Treated Wastewater*, 731 N.W.2d 502, 510 (Minn. 2007) (“Under state and federal law, the MPCA is the Minnesota state agency charged with enforcing and administering the CWA and its attendant regulations.”). The NorthMet Project is subject to the CWA and PolyMet has applied for required federal and state discharge permits, which are under the jurisdictional authority of the MPCA and not the DNR. To date, the MPCA has not issued any permits to PolyMet, but a draft NPDES/SDS permit has been published for public comment. *See* <https://www.pca.state.mn.us/sites/default/files/wq-wwprm1-51z.pdf>. The 103-page draft NPDES/SDS permit imposes numerous requirements upon PolyMet and strictly control discharges from the dams. The draft NPDES/SDS permit provides that “[e]xcept for discharges from outfalls specifically authorized by this permit, overflows, discharges, spills, or other releases of wastewater or materials to the environment, whether intentional or not, are prohibited.” (Draft NPDES/SDS Permit § 6.16.36). In addition, the Draft NPDES/SDS Permit further imposes construction of seepage capture systems to collect seepage from the FTB, treatment of seepage water, and monitoring of surface and groundwater

36. MPCA is also the entity charged with oversight of air quality regulatory standards in Minnesota. MPCA will regulate air emissions associated with the Project pursuant to applicable law, including through air emissions permit requirements. All active project areas will be subject to a Fugitive Dust Control Plan approved by the MPCA.

37. The FTB Dam Safety Permit (“FTB Permit”) and HRF Dam Safety Permit (“HRF Permit”) are informed by the associated environmental review and other permitting efforts for the NorthMet Project. As prescribed in Minn. R. 4410.0300, subp. 3, the detailed environmental analysis, mitigation measures, and changes to the Project that emerged from the EIS process are to be used “as guides in issuing, amending, and denying permits and carrying out other responsibilities of government units to avoid or minimize adverse environmental effects and to restore and enhance environmental quality.” The related federal and state environmental permitting and regulatory approval processes provide additional bases for the FTB and HRF Permits and for the DNR’s Findings and Conclusions

38. Based on its review of all of this information, DNR has concluded that the likely environmental impacts of the proposed FTB and HRF Dams were identified in the environmental review process and were adequately considered in said process. *See generally* ROD.

IV. SUMMARY OF PROPOSED DAM LOCATIONS AND CONSTRUCTION

39. The PolyMet FTB will be located on top of the Cells 1E and 2E of the existing LTVSMC tailings basin. The FTB Dam will be constructed on the perimeter of the tailings basin in multiple stages using LTVSMC bulk tailings, which consist primarily of coarse tailings with small amounts of finer grained tailings. The dam will be constructed using the upstream method, meaning that as the dam goes up in height, its centerline will move toward the center of the basin. The downstream face of the dam will have a slope of 4.5 horizontal to 1 vertical (4.5H:1V).

40. The Flotation Tailings Basin will be constructed to contain tailings over the twenty-year life of mine operations. At the end of that twenty-year period, the FTB Dam will be constructed to its final height of approximately 250 feet.

41. The FTB Dam will include a rock buttress constructed on the downstream face of the FTB Dam, which will augment the FTB Dam's stability. PolyMet will construct a seepage collection system downstream of the rock buttress and around much of the tailings basin to collect seepage water, preventing it from flowing into the surrounding environment. PolyMet will construct an emergency overflow channel on the east end of the tailings basin to prevent overtopping of the dam in the event that unforeseen circumstances lead to higher-than-expected water levels within the basin. The FTB Dam will also include a "bentonite amendment," which is a thin layer of soil that will be "amended" to incorporate a small percentage of bentonite. This bentonite layer will limit oxygen reaching the PolyMet flotation tailings by creating a layer of saturated soil between the tailings and the surrounding air.

42. PolyMet will construct the HRF on both natural ground and on the former LTVSMC emergency basin south of Cell 2W. The HRF will be a double lined storage facility with a drainage collection system to dewater the basin at the end of operations and will include a collection system for any leakage that might find its way through the upper liner.

43. PolyMet will construct the HRF Dam in stages on the perimeter of the HRF basin using traditional construction materials and/or LTVSMC coarse tailings. As proposed, when the final stage of the HRF Dam is completed, the HRF Dam will be 90 feet high.

V. APPLICATION AND COMMENT PROCESS

PolyMet Submits Dam Safety Permit Applications

44. As set forth in paragraph 1, PolyMet applied for Dam Safety Permits for its FTB and HRF Dams on or about July 20, 2016.

45. As required by Minn. R. 6115.0410, subp.5, PolyMet retained Barr Engineering Co. (Barr) to design, plan, and engineer the Project and to prepare the Project applications, including the Dam Safety Applications and supporting materials. Tom Radue, P.E., is the engineer of record, who certified that the plans, specification, and reports comprising the dam safety application materials were prepared by him or under his direct supervision. Mr. Radue is

a qualified Minnesota registered professional engineer, and is proficient in dam safety engineering. Permit to Mine Appendix 1.10.

46. DNR dam safety engineers have reviewed the progression of the design of the proposed FTB and the proposed HRF including the associated dams for over 10 years. As set forth in ¶¶ 63 through 65, the DNR hired a team of nationally recognized external experts to assess and comment on the proposed design, operation, and maintenance of the proposed dams.

47. The FTB Application includes a report that outlines the references that contain the information required in Minn. R. 6115.0410, including the FTB Management Plan and the FTB Geotechnical Data Package. The FTB Management Plan contains several attachments, including plan drawings, specifications, a hydrologic study, an instrumentation and monitoring plan, a contingency action plan, dam break analysis, and the bentonite pilot study.

48. PolyMet completed the MPARS online application form for the FTB Application. MPARS assigned the permit application the number 2016-1380 (Permit 2016-1380).

49. The HRF Application included a report that outlines the references that contain the information required in Minn. R. 6115.0410, including the HRF Management Plan and the HRF Geotechnical Data Package. The HRF Management Plan contains several attachments, including plan drawings, specifications, an instrumentation and monitoring plan, a contingency action plan, and a dam break analysis.

50. PolyMet completed the MPARS online application form for the HRF Application. MPARS assigned the permit application the number 2016-1383 (Permit 2016-1383).

51. The information in the FTB and HRF Applications includes the name and address of the prospective owner; the purpose of the project; the location, type, size and height of the dams; and the storage capacity of the impoundments as required by Minn. R. 6115.0410, subp. 2.

52. PolyMet submitted preliminary reports, including a general statement indicating the effect of the project on the environment; maps showing the specific location of the project; a report outlining the topographical and geologic surface conditions; a cross section of the dam showing elevations, proposed impoundment levels and top width; log borings; preliminary design assumptions; preliminary cost estimates; future plans on ultimate project size including the impoundment area; and a general description of all other activities and elements related to and part of the total dam project. The Applications includes the information required for an initial application and preliminary report pursuant to Minn. R. 6115.0410, subp. 2 and 3.

53. Among other things and as required by Minn. R. 6115.0410, subps. 2 through 7, the Applications contains:

- a statement of the overall project purpose and need;
- location, type, size, and height of the dams;
- storage capacity of the impoundments;

- maps;
- subsurface investigations;
- dam cross sections;
- boring logs;
- design assumptions, operational aspects, tentative conclusions, and references;
- cost estimates;
- description of dam related activities;
- a general description of the project, geologic considerations, hydrologic studies, geotechnical information, construction materials, and waste generation;
- analytical determinations, details, operational aspects, pollution controls, closure considerations, and inspection programs;
- plans and specifications;
- a description of the Project's operations; and
- facts relevant to the entire life of the impoundment; and

See generally, FTB and HRF Permit Applications.

54. The DNR reviewed the application materials that PolyMet submitted for the Permits pursuant to Minn. R. 6115.0410, subp. 6, and accepted these materials by invoicing PolyMet for the required Permit Application fees.

55. On August 16, 2016, the DNR received a permit application fee of \$150 for each of the dam safety permit applications as required by Minn. Stat. § 103G.301.

56. As discussed in greater detail in ¶¶ 63 through 65 below, the DNR retained outside geotechnical experts, including Emmons & Olivier Resources, Inc. (“EOR”), to assess and comment on the proposed design, operation, and maintenance of the NorthMet Dams. These expert reviewers provided comments on the proposed dam designs from mid-2016 through mid-2017, culminating in a May 15th, 2017 dam safety geotechnical report. Based on these reports and in response to feedback from DNR and its outside experts, PolyMet made various changes to its proposals for the FTB and HRF Dams.

57. In December 2016, PolyMet proposed removing the previously planned “cement deep soil mixing zone” and adding a modified buttress to the design of the FTB Dam.

58. On May 16, 2017, the DNR received an updated permit application, including an updated management plan, and updated geotechnical data package, as well as an instrumentation and monitoring plan, contingency action plan, template for pilot testing of the bentonite amendment, and seepage containment drawings for FTB Application 2016-1380.

59. On May 16, 2017, the DNR received an updated Application that included an updated management plan, for HRF Application 2016-1383.

60. The DNR circulated the revised FTB and HRF Applications to local government entities. The DNR also circulated these applications for review and comment to the three tribal cooperating agencies for the EIS: Bois Forte Band of Chippewa, the Grand Portage Band of Lake Superior Chippewa, and the Fond du Lac Band of Lake Superior Chippewa..

61. For both the FTB and HRF Applications, PolyMet submitted the materials required by Minn. R. 6115.0410, subp. 6 for the Final Design Report, including plans and specifications for the dam, the initial inspection fee, and the following:

A. “[A] general description of the project, such as its service life, production rates, required storage and area(s); geological considerations such as physiography, topography, geology, seismicity, groundwater conditions, and maps; hydrologic studies such as physical features, climatology, design, storm and design flood characteristics, flood routing, water-material balance, free-board requirements, dam-break flood; geotechnical information, such as rock-soil sampling and logging, geophysical investigations, field and lab testing, instrumentation data; considerations of construction materials and their properties, such as quantities required, borrow and aggregate locations and volumes, field and lab work and investigations, concrete, waste materials generation and placement techniques, investigation of the stored waste materials such as generations, transportation, mechanical/chemical/special testing, disposal practice” Minn. R. 6115.0410, subp. 6A.

B. “[A]nalytical determinations, such as seepage and underseepage studies, stability, deformation and settlement analysis; analytical and design details of facilities, such as dam, foundation, impoundment, abutments, spillways (for the purpose of these rules, spillway means any facility appurtenant to the dam available to discharge excess water and/or waste from the impoundment) or decant facilities, diversions, outlet works, instrumentation; operational aspects, such as impoundment operating criteria, initial filling criteria, responsibility and coordination, emergency procedures and warning systems: air, water, and solid pollution controls, sedimentation, and erosion controls: operational and postoperational maintenance and abandonment considerations; surveillance and inspection programs” Minn. R. 6115.0410, subp. 6B.

C. “[A] detailed cost estimate.” Minn. R. 6115.0410, subp. 6C.

62. As required by Minn. R. 6115.0410, subp. 7, PolyMet submitted plans and specifications. These plans and specifications included drawings drafted appropriately for scaling and later construction. PolyMet also submitted specifications outlining the rights, duties, and responsibilities of the owner, designer, and contractor; and of the prescribed order of work,

along with technical provisions describing approved work methods, equipment, materials, desired end results, and special conditions. *See* FTB and HRF Management Plans.

DNR Engaged Outside Experts to Review the Proposed Project and Provide Recommendations

63. To supplement its own review, DNR hired a team of nationally recognized external experts to assess and comment on the proposed design, operation, and maintenance of the proposed dams. DNR retained Environmental Resources Management (ERM) and its sub-consultant Knight-Piesold (KP) to assist in the technical review of the proposed project. ERM and KP are multi-national companies with experience in mine planning and mine development. Geotechnical experts at ERM and KP provided technical guidance to DNR dam safety experts during the environmental review process. DNR separately hired Emmons Olivier Resources, Inc. (EOR) experienced in mining geotechnical engineering. The EOR team included sub consultant, Dirk Van Zyl, PhD, PE.

64. EOR is a nationally recognized group of environmental and design professionals located in Oakdale, Minnesota. Their subcontractor, Dr. Van Zyl previously served on the review panel investigating the Mount Polley dam failure. He consults worldwide on tailings basin design, and has authored or co-authored over 120 papers on mining topics, including tailings basin management. *See* EOR Memorandum of Dirk Van Zyl, Steve Gale, et al., to Jason Boyle on Dam Safety Permit Application Review (May 15, 2017) (“EOR Report”) at 1-2.

65. The outside expert permit review team also included Steve Gale, PE, a geotechnical engineer with over 30 years of experience and special expertise on Minnesota’s Iron Range. Mr. Gale regularly consults on tailings basin design, management, and closure, including dam safety analysis and permitting. EOR Report at 1-2.

66. The outside expert team reviewed PolyMet’s Applications and related technical documents. They also visited the Project site to review the areas for the proposed FTB and HRF and associated dams. During this visit, they met with PolyMet’s designers to discuss the Project design. The team summarized its findings in the EOR Report.

DNR Evaluated the Proposed Buttress Modification and Also Considered Whether an SEIS Was Needed.

67. During the Application review process DNR’s independent expert team raised potential concerns with implementation of CDSM for the FTB Dam. *See* EOR Report at 3-4. The experts noted that, to their knowledge, CDSM has not been used before in a tailings dam. *Id.* at 3-4. EOR further indicated that if CDSM was used, close ongoing monitoring should be undertaken to assure that this system was working effectively. *Id.* at 3-4. Further, ongoing monitoring of the effectiveness of the CDSM “columns” intended to stabilize the dam materials beneath the surface of the dam. *Id.* at 3-4

68. On December 30, 2016 PolyMet submitted a Technical Memo in which it proposed strengthening the buttress for the Cell 2E North Dam to achieve the required stability for the FTB dam, (Modified Buttress Proposal), rather than creating the cement deep soil mixing

(CDSM) zone previously proposed. *See generally*, Barr Engineering Co. Technical Memorandum from Tom Radue, P.E., to Jason Boyle, PE, MNDNR: “Tailings Basin Cell 2E North Dam – Modified Buttress as Alternative to Cement Deep Soil Mix Zone” (December 30, 2016)(“Barr Technical Memo on Modified Buttress”). PolyMet indicated that several additional factors contributed to its reconsideration of the initial CDSM design. PolyMet noted that the enhanced buttress design is a relatively simple solution in comparison to the complexity of CDSM. Replacing CDSM with an enhanced buttress will also add flexibility to the construction process, as the enhanced buttress could be built over a longer period of time. Finally, changing to an enhanced buttress will not create meaningful additional wetland or water quality impacts. *See Barr Technical Memorandum on Modified Buttress at 1.*

69. The DNR evaluated the proposed Project change against the criteria set forth in Minn. R. 4410.3000, subp. 3A setting forth the criteria regarding the need to prepare a supplemental EIS (“SEIS”). DNR determined preparation of an SEIS was not warranted. *See* DNR Division of Ecological and Water Resources Memorandum, to Randall Doneen, Supervisor, Environmental Policy & Review Unit, from Bill Johnson, Planning Director, re: NorthMet Mining Project/Elimination of CDSM Zone from Project Assessment of EIS Supplement Requirement (March 21, 2017) (Johnson Buttress SEIS Memo) at 1.

70. On March 21, 2017, the DNR determined that the elimination of the CDSM zone and increased buttressing proposed by PolyMet did not result in substantial changes that affect the potential significant environmental effects of tailings management at the Plant Site. The DNR further determined that such changes did not appear to generate significant environmental effects that were not considered in the FEIS or affect the availability of prudent and feasible alternatives with lesser environmental effects. The DNR concluded that preparation of a supplemental EIS (“SEIS”) was not warranted as a result of this change.

DNR Circulated the Applications to Government Entities for Comment.

i. DNR Outreach

71. On or about May 16, 2017, the DNR requested comments within 30 days on the Applications from (1) the City of Babbitt; (2) the North St. Louis County Soil and Water Conservation District; (3) the United States Army Corps of Engineers (USACE); (4) St. Louis County; (5) the DNR Division of Fish and Wildlife (“FAW”); (6) the DNR Division of Ecological and Water Resources (“EWR”); and (7) the City of Hoyt Lakes. *See* Minn. Stat. § 103G.301, subd. 7. In addition, the DNR requested comment on the Applications from the following tribal entities: Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, and Grand Portage Band of Lake Superior Chippewa.³

72. The City of Babbitt, the North St. Louis County Soil and Water Conservation District, the USACE, St. Louis County, the City of Hoyt Lakes, the DNR Division of Ecological and Water Resources, the Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, and Grand Portage Band of Lake Superior Chippewa did not submit any response to the DNR’s request for comments.

³ These Bands served as cooperating agencies during the environmental review of the NorthMet Project.

ii. Comments from DNR Fish and Wildlife (FAW)

73. DNR FAW was the only entity that provided comments on the Applications. On June 19, 2017, after the comment period closed, FAW submitted comments on both dam safety permit applications.

74. On the HRF Application (Permit 2016-1383), FAW noted concerns about the potential impacts on water quality far into the future. FAW concerns include the longevity of the liner and the ability to repair or replace the liner. *See* DNR Fish and Wildlife Comment Letter.

75. On the FTB Application (Permit 2016-1380), FAW noted that the tailings basin is less concerning than the HRF as it has a storage history and treatment system, and is not dependent upon a liner.

76. FAW's comments do not identify specific issues pertaining to the applicable dam safety permitting standards.

77. Water quality impacts fall within the jurisdiction of the MPCA. The Project requires an NPDES/SDS Permit to address water quality issues. A condition of both Permits is that PolyMet obtain all required permits including any NPDES/SDS permit required for the Project. Water quality issues associated with the HRF will be addressed by the MPCA through the NPDES/SDS permitting process.

78. In addition, the Permit to Mine Findings of Fact has examined non-dam safety related issues pertaining to the liner used in the HRF Basin. *See e.g.* Permit to Mine Findings of Fact at ¶¶ 604 and 782.

DNR Circulated Draft Permits for Public Comment.

79. On September 15, 2017, the DNR posted the proposed draft Permits for the FTB Dam and the HRF Dam as well as a timeline for the overall permitting process, a fact sheet, the May 15, 2017 EOR team memorandum, and the Applications on the DNR's Project permitting website (https://www.dnr.state.mn.us/polymet/permitting/water_app.html).

80. Although not required by statute or rule, DNR provided a public review and comment period on the proposed draft Permits for the NorthMet Project from September 15, 2017 through October 16, 2017. Notice of the public review and comment period occurred on September 15, 2017, when the DNR issued a GovDelivery notice and news release notifying the public of this open comment period. Prior to this public comment period, the DNR issued GovDelivery notices informing recipients of the Applications and notifying of their availability on the permitting website.

VI. CONCERNS RAISED BY PUBLIC COMMENTERS

81. The DNR received over 5,000 public comments. The vast majority of these comments were form letters. Form letters were identified when two or more unrelated individuals submitted identical or substantively identical submissions, or when a submission was

determined to consist entirely (or nearly so) of text provided for the purpose of mass e-mailing. Within the form letter submissions, there were numerous form letter variants consisting of standard form letter text that was altered through deletion or addition of sender-composed text.

82. Not all submissions contained substantive comments on the draft Permits. For example, many commenters offered opinions as to whether the NorthMet Project should or should not proceed, with minimal or no additional content relating to the draft Permits.

83. Given the large number of submissions and individual comments received during this public comment process, the DNR grouped similar comments into themes and considered those themes individually in lieu of discussing each individual comment. The DNR developed documents detailing this review on a theme-by-theme basis, which are contained within the administrative record and incorporated herein by reference.

84. In addition to the general standard form comments received from public commenters, the DNR received comprehensive substantive comments on the draft Permits from environmental non-governmental organizations (“NGOs”), a tribal government, and a tribal organization. These comments raise and elaborate on the same concerns identified by many of the form letter comments. The DNR reviewed and considered these comments and discusses them in greater detail below.

85. The DNR received a comment letter dated October 16, 2017, objecting to the draft Permits from WaterLegacy, a Minnesota Environmental NGO.

86. The DNR received a comment letter dated October 16, 2017, raising concerns related to the draft Permits from the Fond du Lac Band of Lake Superior Chippewa Indians (“Fond du Lac Band”).

87. The DNR received a comment letter dated October 16, 2017, raising concerns related to the draft Permits from the 1854 Treaty Authority.

88. The DNR received a comment letter on October 16, 2017, related to the draft Permits from the Minnesota Center for Environmental Advocacy, Center for Biological Diversity, Save Our Sky Blue Waters, Friends of the Boundary Waters Wilderness, Sierra Club North Star Chapter, Save Lake Superior Association, Wetland Action Group, Duluth for Clean Water, Minnesota Division Izaak Walton League of America, and Friends of the Cloquet Valley State Forest (collectively “Consolidated NGOs”).

89. Many of the comments submitted to the DNR reflected identical or similar concerns. Many comments also reflect issues raised in other permitting or regulatory proceedings and are addressed in connection with those proceedings. Because commenters have raised many of the same substantive concerns, the DNR considered the substance of these comments in a thematic fashion rather than on a commenter-by-commenter basis. Because comments on the FTB and HRF draft Permits overlap or reiterate comments provided in other regulatory proceedings, the DNR also incorporates by reference information, findings, conclusions, and other record materials in other regulatory proceedings pertaining to the NorthMet Project, including, without limitation, the DNR’s permitting processes for the Permit to Mine and the

water appropriations permits, as well as the MPCA's air quality and water quality permitting proceedings.

Concerns Relating to Both the FTB Dam and the HRF Dam

i. Concerns that PolyMet Should Provide Additional Evidence Before DNR May Issue Permits

a. General Informational Concerns

90. Commenters expressed concerns that the DNR did not have all the appropriate information to make a permitting decision. They express particular concern that, as is customary in a dam safety permitting decision, DNR would receive important information on the Project after permit issuance. Commenters argued that the DNR must obtain all such information on the dam design and construction before issuing the Permits. Commenters also expressed concern about Project additional plan details and approvals that will occur after issuance of the dam safety permits. *See Consolidated NGO Comments at 37-42.*

91. Commenters assert that the DNR is not allowed to approve permits subject to later changes. *See Consolidated NGO Comments at 38.* Commenters cite to the dam safety permitting regulations on final design reports set forth in Minn. R. 6115.0410 subp. 6.

92. Contrary to Commenters' assertions, Minn. R. 6115.0410, subp. 9 requires that for waste disposal dams such as the HRF and FTB dams DNR undertake a stepped approval of the various stages of design and construction. This process requires that the DNR issue a dam safety permit based on a finding of adequacy of the Application but recognizes there will need to be a series of impoundment approvals for various stages of construction.

93. Commenters argue that phased approval is not appropriate for this Project.

94. The phased approval is expressly authorized by Minn. R. 6115.0410, subp. 9 and in particular subpart 9A (3) through (5). This phased approval is necessary when permitting dams with long-term continuous construction and to assure that new technologies can be incorporated into the design and construction to maximize public health, safety and welfare. For example, the final development of the FTB tailings basin design might be adjusted based on additional information developed as part of further site investigations, materials testing, or other site-related activities. In particular, assuring long-term protection of health, safety, public welfare, and the environment requires developing new information over time and adapting post-permitting activities to on-site conditions.

95. DNR's dam safety regulations provide the flexibility to adjust DNR's directives to fit the conditions of the project and to meet its regulatory obligations even after a permit is issued. As information about the site, project implementation, environmental conditions, or other factors may change, or as additional details are developed, DNR has the ability to adjust requirements to assure adequate protection of dam integrity and stability, and, in turn, protection of public health and safety and the environment. DNR's permitting authority provides the means to continue to impose whatever requirements may be necessary over time to assure compliance with all applicable regulations. *See, e.g., Minn. R. 6115.0410, subp. 9(A)(2) (addressing*

alteration, modifications, additions to approved designs, plans, and specifications); subp. 9(A)(4) (if the “commissioner finds that changes are necessary to protect health, safety, welfare, and the environment, the commissioner shall order the owner to revise designs, plans, and specifications.”); Subp. 12 (providing for impoundment approvals to be issued at future stages of project); Minn. R. 6115.0500 (permit may be canceled or modified at any time if deemed necessary for protection of public interests; if DNR determines a dam is unsafe or needs repair or alteration, DNR shall notify owner to make the repairs, alterations, or to remove the dam as required).

96. PolyMet has supplied the documentation of the design requirements for both the HRF and the FTB dams as required by Minn. R. 6115.0410, subp. 6.

1. Inadequate Materials Data

97. Commenters raised a number of concerns regarding the tailings at the LTVSMC site that will be under portions of the FTB Dam and tailings basin. They express the concern that PolyMet has collected and analyzed only a limited amount of fine tailings from the existing LTVSMC site materials for material testing and, therefore, there is limited knowledge on which to base a permit decision. Commenters also raise concerns about the lack of direct testing to measure the undrained shear strength of those tailings

98. PolyMet reported that it was unable to effectively measure actual undrained shear strength of fine tailings. Therefore, this property was estimated using other standard engineering techniques, as actual testing of the fine tailing is not the only scientifically acceptable method to determine material properties. The shear strength of the saturated fine tailings was estimated from Cone Penetration Testing (“CPT”), which is commonly relied upon for characterization of material properties. See FTB Geotechnical Data Package at § 5.2. The results from this process were sufficient to determine material strengths for use in design and construction of the dam. To enhance the available data, PolyMet will undertake additional sampling and testing, as directed in the special conditions that are included in the FTB Dam Safety Permit. This is an express condition of the FTB Permit. *See* Permit Condition 29.

99. At least one commenter expressed concerns that PolyMet failed to get samples of glacial till during its 2014 investigation.

100. This comment appears to have confused descriptions of an investigation from 2007 with the 2014 investigation. The commenter cited to page 20 of the FTB Geotechnical Data Package, which discusses a 2007 attempt to obtain glacial till samples. *See* Water Legacy Comments at 6; *cf.* Geotechnical Data Package at 20. In 2014, as later sections of the Geotechnical Data Package make clear, PolyMet was able to obtain glacial till samples and did so. *See* Geotechnical Data Package at 52. PolyMet performed testing for the “friction angle” of the material, which relates to shear strength. In addition, shear strength data and friction angle data were obtained from field SBT testing. *See* Geotechnical Data Package, Attachment C at 27.

101. Commenters were concerned that PolyMet secured very little boring data from the center of the tailings basin and that data were limited to two test locations.

102. Borings from the center of the tailings basin provide virtually no useable information needed for perimeter dam construction. The Commenter provides no indication as to why additional sampling from the “center” of the tailings basin should be considered important, or what is meant by the “center” of the tailings basin.

103. Commenters raised concerns about the information available on the NorthMet tailings, which will be placed in the FTB impoundment.

104. NorthMet tailings will form the foundation of the future lifts for the FTB Dam. As the NorthMet Project is not yet in operation, samples from actual tailings are not available. The best available information must come from pilot test samples. PolyMet, therefore, attempted to replicate future tailings by undertaking a pilot test using materials from the mine site and produced tailings for laboratory analysis. The samples obtained from the pilot testing provide a sufficient representation of the NorthMet project tailings to support DNR consideration of permeability and other material issues at this stage of the process. As a condition of the Permit, DNR will require that PolyMet perform additional material testing on NorthMet tailing within four months after commencement of processing operations. *See Permit Condition 41.* This data will be analyzed by the DNR to confirm the validity of the assumptions used at the time of permitting. Based on the results additional modeling will be required and if necessary changes in the design and FTB Permit will be required.

105. DNR has put in place additional requirements to confirm these results when the NorthMet plant is in operation. The FTB Permit includes a Condition that requires verification sampling and analysis of tailings from the Plant. *See Permit Condition 41.* PolyMet will sample the NorthMet tailings and will analyze those samples within four months of initial operation of the NorthMet beneficiation plant. This testing will be used to confirm the validity of the material properties shown by the pilot plant samples. If material properties differ from the original design properties, PolyMet will update its seepage and stability models to reflect the new material information from this testing.

ii. Concerns About Factors of Safety

106. The Factor of Safety, as it applies to the FTB Dam and the HRF Dam, is the ratio of the resisting forces (shear strength of the dam materials) to the driving forces (applied load such as seismic activity, embankment construction, or other loading) along a potential failure surface. FEIS § 5-627. A factor of safety of 1.0 represents equilibrium between the estimated resisting shear strength and the applied shearing load along a specific plane of potential movement, or in other words the resisting forces are equal to the driving forces.

107. Commenters noted the concern that one of PolyMet’s technical documents referred to a Safety Factor of 1.07 relating to a particular scenario in which local erosion could trigger liquefaction. *See Geotechnical Data Package, Table 7-9.* Commenters noted that this is below the minimum agreed-upon Factors of Safety from the Geotechnical Modeling Work Plan. *See FTB Application, Appendix B, Attachment A.* DNR agrees that a higher Factor of Safety of 1.10 is applicable to this scenario. DNR informed PolyMet that it will be required to demonstrate that the FTB Dam will meet a Factor of Safety of at least 1.10 under the specified liquefaction triggering scenario. PolyMet conducted more detailed analyses, which

demonstrated that the Dam will meet a Factor of Safety of 2.07 for this scenario. *See* Memo from Tom Radue, P.E. to Christie Kearney, “PolyMet NorthMet Project Flotation Tailings Basin Slope Stability Update for Erosion Case Triggering Analysis“, April 2, 2018.

108. Commenters contended that DNR’s Factors of Safety, set forth in the Geotechnical Modeling Work Plan, are not sufficiently protective. DNR has established these Factors of Safety after lengthy consideration of many expert opinions, and references, including standards by the U.S. Army Corps of Engineers and others used by the U.S. Mining Safety and Health Administration. Commenters’ discussion of specific Factors of Safety did not articulate sound bases for deviating the standards that DNR has established after its review of expert opinions.

109. Commenters also raised concerns that Barr did not analyze all Factors of Safety for the HRF Dam design.

110. A Factor of Safety analysis was completed for the steady-state conditions of the dam – i.e., for normal operations and conditions (“the effective stress strength conditions”). This analysis showed that the HRF Dam, as designed, would achieve a Factor of Safety of 2.27, which exceeds the required factor of safety of 1.50 for this condition. DNR reviewed this analysis and considered the appropriate safety requirements at this stage for the HRF Dam and has concluded that additional Factor of Safety analyses are not necessary at this time to satisfy permitting requirements. Given the nature of the HRF Dam, the other Factor of Safety scenarios that DNR is requiring for the FTB Dam (i.e., liquefaction, undrained condition) are not realistic conditions for the HRF Dam. Notwithstanding the forgoing, DNR is requiring that PolyMet conduct additional Factors of Safety analyses and submit results to DNR for approval prior to HRF construction. Permit Condition 29B.

iii. Concerns About Freeboard and Overtopping

111. Commenters raised general concerns that both Dams may not be sufficient to contain precipitation from large storm events in light of climate change. Both dams are designed to contain the “probable maximum precipitation” (“PMP”) for the location, as established by the National Weather Service, NOAA. The PMP event would be over 30 inches of rain in a 72 hour period. The HRF Dam will have a minimum of 6 feet of freeboard, and up to a maximum of 36 feet of freeboard, while the FTB Dam will have a minimum of 9 feet of freeboard. *See* Permit Conditions 48 and 44. DNR has concluded that both Dam designs provide more than sufficient freeboard to contain waters from a PMP event. In addition, both basins will have the ability to pump water out as needed, including after operations are ceased; this ability is financially assured under the Permit to Mine. DNR also retains the ability to impose additional dam safety requirements as needed. DNR concluded during the FEIS that the excess capacity in the FTB and the HRF, coupled with these additional ongoing management options, would be sufficient to address concerns about potential additional precipitation associated with climate change. *See* FEIS at § A-122.

iv. Concerns Regarding Seepage from the Basins

112. Commenters raised general concerns about seepage from the LTVSMC tailings areas and potential seeps from the NorthMet FTB and HRF.

113. Seepage is a natural process in which water flows through pore spaces between soil particles. All embankment dams seep. Seepage is not a dam safety concern unless the seepage is uncontrolled or of sufficient volume and velocity to carry soil particles with it. There are currently several small seeps from the LTVSMC Tailings Basin. Most of these seeps are small but a few are larger and are monitored by the Minnesota Pollution Control Agency (MPCA), which is the Minnesota agency with authority over water discharges and water quality under the Clean Water Act and Minnesota law. Water from one seep is collected and returned to the basin. Barr Engineering has designed a robust seepage collection system to collect seepage from the FTB basin and route it either back in the FTB basin or to a water treatment plant. FTB Application, Appendix C-Seepage Containment Drawings; Water Management Plan at §§ 2.1.4, 4.1.4.

114. For the HRF, Barr has designed a leakage collection system to collect any water that might find its way through the liner. The leakage from this facility into underlying groundwater or adjacent water would be negligible due to the leachate collection system constructed beneath the HRF that would feed collected water back into the HRF basin. *See* FEIS § 5.2.2.3.3. FEIS pp. 5-178 to 223. *See* HRF Permit Application, Residue Management Plan, pages 8-16, § 2.2.2.

115. The NorthMet Project is also subject to the Federal Clean Water Act and PolyMet has applied for the required NPDES/SDS permits. MPCA will address water discharge and water quality issues, through its NPDES/SDS permitting process. MPCA previously released a Draft NPDES/SDS Permit for public comment. *See* <https://www.pca.state.mn.us/sites/default/files/wq-wwprm1-51z.pdf> .

116. DNR has considered the existing site conditions and the potential for seepage during the life of the NorthMet Project, as well as the application materials, dam design, and other record information. Various required design features and permit requirements will address potential seepage and seepage-related issues. *See, e.g.*, FTB Application Appendix C, Seepage Containment Drawings. Based on this and other record information, DNR finds that seepage will be adequately addressed to ensure compliance with dam safety requirements.

v. Concerns Relating to Earthquakes

117. Commenters raised concerns that earthquakes may destabilize, deform, or otherwise damage one or both Dams. DNR has considered seismic issues in reviewing the planned design and construction of both the FTB Dam and the HRF Dam.

118. The area of the NorthMet project is not at material risk of earthquakes or meaningful seismic activity. “Northern Minnesota is not an active seismic zone.” FTB Geotechnical Data Package, at 9. *See also* U.S. Geological Survey, Seismic Hazard Map, Attachment 2.

119. Commenters raised the concern that faults have been identified in the vicinity of the FTB and the HRF. There is no evidence these faults are active. Indeed, there are no known active faults in the area of the Project. Most of the faults referenced by commenters are short faults in the gabbro that may simply be thermal contraction cracks from the original cooling of the rock.

120. The larger “fault” that commenters referenced, which is directly beneath the HRF, is an “inferred fault,” which means that the presence of the fault has been inferred based upon the topography of the surface land, but not confirmed by the Minnesota Geological Survey (“MGS”). Other geologists have reviewed the site and have found no evidence of the fault. *See* HRF Geotechnical Data Package at 6, 39 (inferred fault has not been confirmed and is not depicted in recent geologic mapping of the area).

121. Commenters, also suggested that the Probabilistic Seismic Hazard Analysis model (PSHA) predictive methodology used by PolyMet to compute the potential “peak ground acceleration” of a seismic event, for a return period of approximately 2,475 years, is not the current best practice.

122. DNR’s geotechnical consultants, Knight-Piésold, reviewed PolyMet’s seismic analysis in detail during the EIS process. The EIS concluded that a significant earthquake is unlikely in Minnesota and that “a seismic design event (2,475-year return period) is not likely to trigger liquefaction in the Tailings Basin materials.” *See* FEIS at Geotechnical Theme 05, p. A-373. The methodology that was used to conduct the seismic analysis is one that is commonly used by scientists for a low seismic zone like Minnesota. The FEIS also considered seismic deformation and found that dam stability will not be affected. *See* EIS at Geotechnical Theme 05, p. A-373.

123. Commenters also suggested that DNR should have required “dynamic modeling” of the tailings basin. Precisely what Commenters mean by “dynamic modeling” is not clear. Typically, dynamic modeling is used to describe a process that predicts what would happen in the event of seismic deformation. Analysis contained in the FTB Geotechnical Data Package, however, already predicts the effects of assumed deformation on the FTB Dam. A seismic liquefaction screening evaluation was conducted for the FTB site showing even if there were a seismic event, it would not trigger liquefaction. The Geotechnical Data Package also contained a further “deformation analysis,” which showed that if a seismic event were assumed to liquefy the tailings, the dam would deform a small amount (0.024 feet) but the dam would not fail. FTB Geotechnical Data Package at 110.

124. The DNR has considered issues relating to potential seismic activity, including earthquakes, in the context of the FTB Dam and HRF Dam, including the issues raised by Commenters. The DNR finds that significant seismic events are unlikely to occur in the Project area and further finds that, even if seismic events were to occur, they would not be likely to materially affect the stability or integrity of the FTB and HRF Dams.

vi. Concerns about Environmental Impacts

125. Commenters raised general concerns about the environmental impacts of a potential dam breach. In particular, commenters focused on potential impacts to waters, suggesting generally that a dam breach could have impacts on wetlands, surface waters, ground water, fisheries, and even municipal water supplies.

126. As discussed at Section VI.B.v and ix of these Findings, the potential for a breach of the FTB Dam or HRF Dam is remote. The FEIS examined the environmental impacts of the project and concluded that the potential risk of a dam breach was mitigated by the ongoing oversight and management requirements that will apply. *See* FEIS A-380. The Dams will satisfy all required Factors of Safety and will be subject to ongoing operational and maintenance requirements, inspections, monitoring, and other requirements designed to ensure their ongoing integrity. DNR has considered the potential impacts of breaches and releases from the FTB and the HRF. PolyMet's Dam Breach analysis for the FTB was conservative and impacts from such a breach would be expected to be less far-reaching than discussed in that analysis. *See* Section VI.B.v and ix. DNR is also requiring further analyses from PolyMet. PolyMet is required to comply with all applicable requirements, including dam safety and environmental statutes and regulations. PolyMet is also required to provide financial assurance designed to assure such compliance "perpetually" or for as long as the dams are in operation, as provided under the dam safety regulations. *See* Minn. R. 6115.390, Subps. 1 and 2 (Providing "unless the dam is removed, the owner shall perpetually maintain the dam and appurtenances so as to ensure the integrity of the structure," and "[t]he commissioner may impose such requirements as may be necessary prior to the ultimate termination of the owner's operation to ensure that the owner will be financially responsible for carrying out the activities required for perpetual maintenance, and that adequate funding will exist.")

127. PolyMet will be obligated to comply with all applicable environmental requirements, including all requirements pertaining to water quality and protection of surface water and groundwater. The 103-page draft NPDES /SDS permit imposes numerous requirements upon PolyMet and strictly controls discharges. In addition, MPCA, as well as other regulatory entities, have the authority to require response and remediation in the unlikely event that a breach were to occur and impacts to waters were identified. *See* Minn Stat. §§ 115.07 through 115.071; Minn. Stat. § 115B.03. For example, in addition to the specific requirements governing planned discharges, the draft NPDES/SDS permit provides that "[e]xcept for discharges from outfalls specifically authorized by this permit, overflows, discharges, spill, or other releases of wastewater or materials to the environment, whether intentional or not, are prohibited." *See* Draft NPDES/SDS Permit § 6.16.36.

Concerns Regarding the FTB Dam

i. Concerns that the FEIS Should Have Been Supplemented

128. Water Legacy and the Consolidated NGOs contended that DNR should have prepared a Supplemental EIS (SEIS) to address a minor modification to the design for the Flotation Tailings Basin (FTB) dam buttress.⁴

129. As discussed in ¶¶ 66 through 70, PolyMet submitted a Technical Memo in which it proposed strengthening the buttress for the Cell 2E North Dam to achieve the required stability for the FTB dam, (Modified Buttress Proposal), rather than creating the cement deep soil mixing (CDSM) zone previously proposed.

130. Commenters maintained that this modification was sufficient to trigger the need for a Supplemental EIS.

131. The DNR evaluated the proposed Project change against the criteria set forth in Minn. R. 4410.3000, subp. 3 A setting forth the criteria regarding the need to prepare an SEIS. DNR determined preparation of an SEIS was not warranted. *See* DNR Division of Ecological and Water Resources Memorandum, to Randall Doneen, Supervisor, Environmental Policy & Review Unit, from Bill Johnson, Planning Director, re: NorthMet Mining Project/Elimination of CDSM Zone from Project Assessment of EIS Supplement Requirement (March 21, 2017) (Johnson Buttress SEIS Memo) at 1.

132. On March 21, 2017, the DNR determined that the elimination of the CDSM zone and increased buttressing proposed by PolyMet did not result in substantial changes that affect the potential significant environmental effects of tailings management at the Plant Site. The DNR further determined that such changes did not appear to generate significant environmental effects that were not considered in the FEIS or affect the availability of prudent and feasible alternatives with lesser environmental effects. The DNR concluded that preparation of a supplemental EIS (“SEIS”) was not warranted as a result of this change

133. In addition, DNR concluded that the FTB Dam, as modified, will still meet all required Factors of Safety. Barr configured the modified buttress to achieve slope stability and to assure that DNR’s required Factors of Safety will be met. *See* Barr Technical Memo on Modified Buttress at 2. DNR has reviewed Barr’s information, including its computational modeling on the revised buttress design and dam conditions, and concludes that slope stability and other required elements will be sufficient to achieve the required Factors of Safety for the dam configuration at the end of operations.

⁴ DNR engaged outside experts on dam safety, including Dirk Van Zyl and Steve Gale. Dr. Van Zyl is a well-known expert, is on the faculty of the University of British Columbia, consults worldwide with mining companies on tailings basin design, and serves on several review panels, including the review panel that investigated the Mt. Polley dam failure. Mr. Gale has over 30 years of experience as a geotechnical engineer and consults on all aspects of tailings basin design, management and closure, including dam safety analysis and permitting. He has worked on many of the basins on Minnesota’s Iron Range.

134. The greater volume of material to be used in the enhanced buttress remains less than the volume of material modeled for purposes of water quality impacts under the Final EIS. Thus, the potential water quality impacts of the Project as modified to include the larger buttress and to eliminate CDSM are within the range of impacts analyzed in the FEIS. Thus, “elimination of the CDSM Zone and increasing the north buttress material to 3,230,000 cubic yards does not affect the potentially significant adverse effects to water quality evaluated in the final EIS for the NorthMet Mining Project.” *See, e.g.,* Johnson Buttress SEIS Memo at 3-4. *See also* Barr Technical Memo on Modified Buttress at 5.

135. Changing the buttress also changes the timing of buttress construction and related air emissions. Although changing the timing of buttress construction from Mine Year 2 to Mine Year 2 through Year 7 lengthens the duration of air emissions, the change in maximum air emissions for the modified project is less than the maximum emissions that were analyzed in the FEIS. This is the only potentially significant impact affected by the proposed elimination of the CDSM and use of increased buttress material. *See, e.g.,* Johnson Buttress SEIS Memo at 1-2; Barr Technical Memo on Modified Buttress at 1, 4.

136. Changing the volume of material and the timing of buttress construction means that associated air emissions sources will operate at different rates over the duration of the Project. Although rates will vary from the FEIS air impacts analysis, the maximum annual emissions for the enhanced buttress are less than the maximum emissions evaluated and modeled for the FEIS. Thus, as MPCA found, changing from a CDSM approach to an enhanced buttress design does not change the potentially significant adverse effects to air quality evaluated in the FEIS for the NorthMet Mining Project. *See, e.g.,* Johnson Buttress SEIS Memo at 5; Barr Technical Memo on Modified Buttress at 4-5 and Figure 8. *See also* Barr Technical Memo on Modified Buttress at 1 (“This extended period of construction also reduces potential air quality impacts.”).

137. Increasing the size of the buttress does not change the source of the construction materials for the buttress, i.e., the rock stockpiles at Area 5 of the Project site. *See* Johnson Buttress SEIS Memo at 2. Stockpile materials from the former (LTVSMC) Area 5 were evaluated in the FEIS and are the likely material for the rock buttress and fill. *See* FEIS at 3-105; Johnson Buttress SEIS Memo at 2 and Johnson Buttress SEIS Memo at 2, Barr Technical Memo on Modified Buttress at 3. Thus, the modified buttress has no effect on the assumptions and conclusions in the FEIS regarding the construction materials for the buttress.

138. The expanded buttress will continue to be within the confines of the Flotation Tailings Basin Seepage Containment System. The expanded buttress will not result in additional mining roads, changes in the rates of production, changes in plant emissions, changes in dewatering, or other changes to the Project as it was evaluated in the Final EIS. *See, e.g.,* Johnson Buttress SEIS Memo at 2; Barr Technical Memo on Modified Buttress at 1.

139. The Department also evaluated potential differences in water quality and wetlands impacts. The FEIS had already considered potential water quality impacts from a buttress that would have been larger than the now-planned expanded buttress. The FEIS showed no additional impacts from the larger buttress. The FEIS also examined wetland impacts associated with fill and excavation that totaled 148.4 acres. The larger buttress would increase direct

impacts to wetlands by 3 acres over the amount considered in the FEIS. The DNR evaluated this information and the findings in the FEIS and concluded that it was unlikely that potential impacts from the larger buttress would substantially differ from the impacts already anticipated in the FEIS. Johnson Buttress SEIS Memo at 3-6.

140. The Department considered two conditions to determine whether a Supplemental EIS (SEIS) should be undertaken. Whether:

- substantial changes have been made in the proposed project that affect the potential significant adverse environmental effects of the project; or
- there is substantial new information or new circumstances that significantly affect the potential environmental effects from the proposed project that have not been considered in the final EIS or that significantly affect the availability of prudent and feasible alternatives with lesser environmental effects.

Minn. R. 4410.3000, subp. 3A (1) and (2); Johnson Buttress SEIS Memo at 1.

141. The DNR determined that the proposed replacement of CDSM with increased buttressing for the Cell 2E North Dam does not result in substantial changes that affect the potential significant adverse environmental effects of current and future tailings management and stability through closure and reclamation. The Department also determined that this change does not generate significant environmental effects that have not been considered in the previous EIS, nor will it significantly affect the availability of prudent and feasible alternatives with lesser environmental effects. *See* Johnson Buttress SEIS Memo at 6.

ii. Concerns Regarding Buttress Design

142. Commenters have raised concerns that details of the buttress design will not be complete and approved prior to permit issuance.

143. The key elements of the buttress design have already been determined and are detailed in the FTB Application. For example, the Geotechnical Work Plan, which is part of the FTB Application, sets forth DNR's required Factors of Safety, and additional conditions that must be satisfied. These design elements are supplemented by the conditions in the FTB Permit, which specify requirements governing the buttress design.

144. The FTB Permit requires PolyMet to provide a subsurface exploration plan, which will dictate how PolyMet will investigate conditions of the buttress foundation. *See* FTB Permit Condition 30. The Permit also requires that PolyMet demonstrate the buttress design will meet required factors of safety for progressive localized failure. This requirement addresses the need to prevent potential localized deformities from spreading or expanding to create structural weaknesses that threaten the integrity of the FTB Dam. *See* FTB Permit Condition 30.

145. The Permit also requires a factor of safety for each stage of construction. *See* FTB Permit Condition 30.

146. The Permit also specifies that the DNR must approve plans for any toe drain and underdrain to be constructed. *See* FTB Permit Condition 30.

147. Finally, all aspects of the buttress design are subject to the DNR's authority to approve the overall dam design, which must meet regulatory requirements. *See* FTB Permit Condition 30.

148. The DNR must approve each of these items prior to dam construction. *See* FTB Permit Condition 30.

149. As with many aspects of the design and construction of a project of this size and complexity, approval of various aspects of buttress design and construction involves an iterative process between the permitting authority and the applicant. This process does not and should not stop at the moment the permit is issued. As additional information becomes available, the DNR may require further information or impose additional requirements. The DNR may require design modifications if necessary to meet regulatory requirements. Minn. R. 6115.0410, subp. 12 allows for a series of impoundment approvals for various stages of construction of waste disposal dams.

iii. Concerns Regarding Peat Underlying Area of FTB Buttress

150. Commenters raised concerns about the presence of peat in the soils of the area where the buttress will be located and indicated that the DNR should require removal of peat soils below the area of the planned buttress prior to construction of the buttress.

151. The plan drawings provide for removal of the peat in this area. Drawing No. FTB-009 (Flotation Tailings Basin North Dam Typical Cross Section) contains the direction "remove peat from buttress foundation area" and cross references the notes on Drawing No. FTB-008. *See* FTB Application, Appendix A - FTB Management Plan, Attachment A – Support Drawings. That drawing (Flotation Tailings Basin North Dam Mine Year 20 Layout) contains the note "Peat to be removed from buttress foundation area under the direction of a geotechnical engineer."⁵ Thus, DNR and PolyMet have addressed concerns about peat removal in the area below the planned buttress.

iv. Concerns About Peat and Slime Within the FTB Basin

152. Commenters raised concerns that peat, which is present beneath portions of the LTVSMC basin, and very fine particles of crushed rock known as "slimes," which are present in the LTVSMC tailings and will be present in the NorthMet tailings, may cause the FTB Dam to become unstable. The DNR has examined the information in the FTB Application regarding the strength and stability of the planned FTB Dam, including information on the LTVSMC tailings and the NorthMet tailings. Barr modeled the stability of the FTB Dam based on materials testing.

⁵ Peat removal is to be performed "under the direction of a geotechnical engineer" to ensure that the operation will be executed in accordance with the best professional judgment of an engineer qualified to assess circumstances at the site and direct appropriate action.

This modeling indicates that the materials in the existing basin are sufficiently stable to support the FTB Dam.

153. In addition, the FTB Permit requires PolyMet to undertake additional materials testing, as well as to satisfy numerous additional review and approval conditions to confirm that the FTB Dam will meet or exceed required Factors of Safety and other Dam Safety mandates. The dams will be inspected and monitored on a regular basis for stability. FTB Permit Conditions 29 and 41.

154. DNR exhaustively reviewed and analyzed PolyMet's geotechnical analysis. DNR specifically examined the following: sampling procedures; testing procedures; field and lab results; materials characterization and properties; and other information used to demonstrate the stability of the FTB Dam. DNR also met with its own outside expert consultants, as well as with PolyMet's consultants, to discuss the various testing methodologies, sampling, and results, in support of the FTB Permit.

155. DNR has considered the specific site conditions in evaluating the potential effects of peats and slimes. Those conditions support the modeling results.

156. Peat occurs naturally in the Project area and is present in some areas under the LTVSMC basin. It should be noted that, as discussed above, the peat in the area of the new buttress, which is not located under LTVSMC tailings, will be removed prior to construction of the buttress. The tailings placed in the LTVSMC basin have compressed the peat in those areas for decades.

157. When parent rock containing ore is crushed and iron is removed, a mixture of sand-, silt-, and clay-sized particles remains. At the LTVSMC facility, these "tailings" were sent in slurry form through a pipeline and discharged ("spigotted") into the LTVSMC basin. The LTVSMC operation often spigotted from the same point for long periods of time. As tailings are discharged, heavier particles settle out more quickly, closer to the discharge point. Less heavy particles settle out further away from the discharge point. Because LTVSMC spigotted from a single location for long periods of time, fine particles accumulated near the opposite embankment of the basin. These very fine (i.e., silt- and clay-sized) tailings are known as "slimes." FTB Permit Application, Appendix B – FTB Geotechnical Data Package, at 8.

158. These particles were deposited in the LTVSMC basin at different times during that facility's operation (approximately 1957 through 2001). Thus, much of this material will also have been compressed by later deposits of tailings. Even the latest-deposited layers will have settled over time. Typically, as tailings settle, they gain strength of .5% to 1% per year for the first 100 years, through, for example, secondary compression and cementing of particles. *See* Evan Contreras, K. Schimpke, R. Ver Strata, (Barr Engineering) "Strength Gain of Fine Tailings/Slimes Resulting from Secondary Compression," Proceedings "Tailings and Mine Waste" (2015). *See also* Geotechnical Data Package at 94, 112.

159. The FTB Basin and Dam will be constructed on top of the LTVSMC basin and dam. The LTVSMC basin and dam, in turn, were built upon natural ground, which included a layer of peat in some areas. The materials under the existing LTVSMC basin and dam, including

the peat and “slimes,” have been compressed for decades by the LTVSMC tailings. Barr has tested these materials for strength and has used these results in calculating slope stability. Barr’s modeling indicates that the FTB Dam will be stable and will meet or exceed the required Factors of Safety. In addition, Barr has calculated the expected gain in strength of the FTB Dam after its anticipated closure in approximately twenty years. *See also* Geotechnical Data Package at 94, 112.

160. Commenters also raised concerns about “slimes” that will be part of the NorthMet tailings.

161. The FTB Dam will be constructed primarily of LTVSMC tailings. However, NorthMet slimes will exist below the LTVSMC dam lifts after lift 1 as the lifts progress upstream toward the interior of the basin. This is a common occurrence in upstream construction. The process of constructing the exterior dams will compact, compress, and dewater the PolyMet slimes so that a stable foundation is formed for each successive lift over the course of basin development. *See* FTB Geotechnical Data Package, Large Figure 11; FTB Management Plan, Attachment A – Support Drawings, FTB-009, FTB-010, and FTB-019. This is because each successive “lift” of the Dam will be constructed partially on the preceding lift, and partially on PolyMet tailings. PolyMet will “spigot” (i.e., discharge from a pipe) tailings into the FTB Basin near the FTB Dam in accordance with a DNR-approved spigotting plan, required as part of the FTB Dam Operation and Maintenance Plan (FTB Dam O&M Plan). *See* FTB Permit Condition 33 (required spigotting plan must include details on pumps and pipelines, when spigot will be moved, and emergency shutdown procedures). Spigotting will be located to maximize the presence of coarser-size tailings, and minimize the presence of “fine tailings” and “slimes,” in the area that will underlie the FTB Dam lifts.

162. Based on all of the foregoing and other evidence in the record, the DNR has considered the presence of the peat and slimes under the existing and future dams and basins, including comments regarding the potential negative effects of peats and slimes on the strength and stability of the FTB Dam, and has concluded that the FTB Dam will meet or surpass required Factors of Safety and other dam safety permitting requirements.

v. Concerns About Consideration of the Mount Polley Dam Failure

163. Commenters raised generalized concerns that dam failures at other locations, including well-publicized failures at the Mount Polley Dam, in British Columbia, and the Samarco Dam, in Brazil, suggest that the NorthMet Dams would be likely to fail. Commenters expressed concerns about wet closure and the “upstream construction method” in light of dam failures at Mount Polley and Samarco.

164. Many of these comments did not identify specific issues or concerns with the NorthMet dam design. Others noted design features that the NorthMet Dams would have in common with one or more of the failed dams as evidence that the NorthMet Dams would also be likely to fail. The fact that other dams have failed, however, does not provide reliable bases for concluding that the NorthMet Dams would be likely to fail.

165. The DNR has evaluated the Applications and supporting materials and has determined that the FTB and HRF Dams as planned will meet applicable Factors of Safety and satisfy permitting requirements intended to ensure the safety and stability of the dams. Nothing in the comment information about these other dam failures undermines the technical support for the Permits.

166. The DNR also fully considered and reviewed the technical investigation report on the Mount Polley failure, as part of its review of the Applications. Together with its external consultant EOR, and a team of top geotechnical dam safety experts, the DNR assessed the design, construction, operation, and maintenance of the proposed NorthMet dams. This team included experts in mining geotechnical engineering with both Minnesota and worldwide experience. The group included a member of the review panel that previously investigated the Mount Polley dam failure in British Columbia. As DNR has explained: “DNR and its team determined that the proposed NorthMet dams contain significant differences in design from the Mount Polley dam, including: the slopes of the proposed NorthMet dams are flatter (less steep and therefore more stable); the foundation conditions at the PolyMet site have been researched in greater depth and are much better understood; and long-term construction plans are better developed for dam raises and future operations.” See DNR Fact Sheet at https://www.dnr.state.mn.us/polymet/permitting/dam_safety.html . See Geotechnical Data Package, FTB Management Plan; Mount Polley Independent Expert Investigation and Review Report.

167. Mount Polley and Samarco are two very different dams from the dams proposed by PolyMet. Like most tailings basin dams, Mount Polley and Samarco are “valley dams.” Samarco was constructed using the upstream construction method while Mount Polley was constructed using a modified centerline construction method. Mount Polley suffered a foundation failure due to an unknown clay layer in the foundation; it did not fail due to upstream construction. Although the FTB Dam will be constructed using the upstream construction method, unlike Samarco and Mount Polley, the FTB Dam is not a valley dam but a ring-dike dam. Valley dams exhibit greater height and head at the base than ring-dike dams increasing the probability of dam failure.

168. “Upstream construction” is a commonly used construction method for tailings dams. Attachment 3 shows a cross section of a tailings dam and illustrates how upstream construction works. Attachment 3 also illustrates centerline and downstream construction. As Attachment 3 shows, tailings dams are typically built in stages. Each stage involves construction of a trapezoidal layer, referred to as a “lift.” The first lift is constructed on the existing surface. In “upstream construction,” tailings are deposited along the basin edge of each lift before the next lift is built. Each successive lift is built primarily on the preceding lift. A portion of the new lift projects beyond the edge of the underlying lift, resting upon the tailings deposited in the basin. Thus, as the dam is built, it projects further into the basin.

169. Selecting a construction approach is not a one-size-fits-all determination. As is common for any major project, key design and construction decisions for a dam are likely to depend upon the facts and circumstances pertaining to that particular project. This is particularly true for deciding whether upstream construction, downstream construction, or centerline construction would be preferable for a particular dam. See, e.g., U.S. EPA, “Design and

Evaluation of Tailings Dams,” at 18 (1994); <http://www.tailings.info/storage/containment.html> . For example, the mill size of the tailings available, and the amount of material available for dam construction may be relevant, as well as the location of the dam and the surrounding environment. Cost may also be a factor.

170. PolyMet’s selection of upstream construction is consistent with this type of multi-factor decision making process. One of the advantages of PolyMet’s upstream approach for the FTB is that it minimizes the impact on wetlands. Using downstream construction at the FTB would mean building a dam that would project a substantial distance into nearby wetlands. In addition, the configuration of the existing tailings basin embankments would make using downstream construction more difficult. In many cases, the availability of construction materials may influence selection of a construction approach. That is the case with respect to the FTB Dam. FTB Management Plan at 8. PolyMet must excavate the LTVSMC coarse tailings from the perimeter of the existing LTVSMC 2W dam to obtain the material that will be used to build the new FTB Dam, and the supply of these materials is limited. *Id.* Each of these factors also weigh against the use of centerline construction, albeit not as significantly.

171. In this case, PolyMet’s FTB Application and supporting materials provide the engineering and technical data necessary to show that the FTB Dam will be structurally sound. *See* FEIS at 5-646, 657-661. In addition, the FTB Dam will be subject to continuing oversight, operation and maintenance requirements, financial assurances and other requirements aimed at assuring continuing compliance with all applicable dam safety requirements. *See* FEIS at 5-646, 657-661.

vi. Concerns that Bentonite Will Negatively Affect Dam Stability

172. Commenters expressed concerns about PolyMet’s plan to amend the soils on the side slopes of the FTB Dam with bentonite. This will be done to limit oxygen and water infiltration to the FTB. *See* FTB Management Plan at 8. Specifically, commenters raised the concern that this bentonite amendment could destabilize the FTB Dam. The DNR reviewed whether this bentonite use would affect the stability of the FTB Dam. *See* Geotechnical Data Package in Application at 70-71. The Geotechnical Data package includes analysis of the potential effect of bentonite on seepage, on dam veneer stability, and on overall dam stability. *See* FTB Geotechnical Data Package at 61-62, 70-71. This analysis evaluated the use of a bentonite layer consisting of three percent bentonite mixed with LTVSMC coarse tailings (as proposed in the FTB Application) on the side slopes of the FTB Dam, FTB GDP at 70-71. Based on its consideration of this analysis and other information in the record, the FTB Dam will satisfy the required Factors of Safety and other dam safety requirements.

173. The FTB Permit and the Permit to Mine each require that PolyMet undertake pilot and field testing to confirm that bentonite will function as intended. *See* FTB Permit Condition 31; Permit to Mine Condition 88, 89, 89a through 89g. The objectives of the pilot and field testing are to verify that construction methods can consistently create a layer that will meet specifications, to assess how well the bentonite layer maintains a zone of saturation over time, and to observe how other outside factors may affect the zone of saturation (such as cracking, settlement, plant root penetrations, freeze-thaw cycles, water chemistry, and ice scour.) *See* Bentonite Amendment Template for Pilot/Field Testing (FTB Management Plan, Attachment I)

at 2-3. If pilot or field testing shows that bentonite must be used in a different manner than previously considered (e.g., if a ten percent bentonite mixture must be used) then DNR will require additional dam stability analysis. *See, e.g.*, FTB Permit Condition 31; Permit to Mine Condition 88, 89, 89a through 89g.

vii. Concerns About Timing of Bentonite Pilot Testing

174. The FTB Permit conditions require PolyMet to undertake pilot testing for the use of bentonite in and around the FTB and the FTB Dam prior to deposition of NorthMet tailings in the basin. Permit Condition 31. Commenters also raised concerns about the timing of pilot testing for the bentonite amendment suggesting that pilot testing should be completed before a permit is issued.

175. Requiring this pilot testing prior to permit issuance is neither necessary nor appropriate. As indicated above, ample evidence already supports the use of bentonite, and demonstrates that the FTB Dam will meet or exceed the required Factors of Safety. As discussed above, pursuant to Minn. R. 6115.0410, subp. 9, this type of dam project employs an iterative approach that requires ongoing DNR review, approval and oversight of all aspects of the design. This process allows for additional information gathering, including testing and analyses, in order to verify design assumptions and assure implementation of the best available technology as it becomes available. In fact, often approvals may be necessary in order to allow additional testing, information gathering, or plan assessment or modification to proceed. This type of ongoing engagement and iterative approval process is beneficial, is commonly used, and is fully consistent with Minnesota statutory and regulatory scheme.

viii. Concerns About Comments by Outside Consultant

176. Commenters raised concerns based on communications from Mr. Don Sutton, a consultant retained by DNR to review the stockpile design and financial assurance requirements related to the Permit to Mine. *See* January 23, 2012 email from Don Sutton to Dana Dostert. For example, Mr. Sutton suggested that the stair step design would encourage surface erosion and “gulying,” and connected this erosion to a potential dam breach. He also characterized the “stair step” surface of the dam face as “geomorphologically unstable.”

177. DNR undertook additional discussions with Mr. Sutton to ensure that DNR’s technical staff reviewing the Permit to Mine and dam safety applications understood the basis for his statements and the scope of his concerns in detail. DNR has considered and understands Mr. Sutton’s concerns related to the operation and maintenance intensive design of wet closure and the necessary robust financial assurance. Having taken that information into account, DNR concludes that wet closure can be managed to ensure the ongoing safety and stability of the dam and compliance with all legal requirements.

178. The DNR has examined potential erosion issues that could occur at the FTB Dam. Different dam face structures may present different potential erosion challenges. For example, a stair step design may more easily collect water on its horizontal surfaces; but, at the same time, that design can also tend to limit the downward extension of small erosional features, that would extend more quickly on a smooth dam face.

179. As a general matter, surface erosion rarely affects slope stability. That is particularly true where, as here, the scale of the structure and the distances involved are significant. For any type of dam face, however, creating a relatively stable surface, and maintaining the surface to protect against any significant erosion is essential. For this reason, Minnesota's dam safety regulations expressly provide for perpetual maintenance of permitted dam structures, and the FTB Permit includes several conditions to address inspection and maintenance. *See* FTB Permit Conditions 28, 33 through 35 and 38. In addition, the Permit to Mine requires long-term maintenance expressly aimed at prevention of erosion and requires financial assurance to ensure the DNR's capacity to execute this long-term maintenance in the event PolyMet fails to do so.

180. Commenters also raised concerns, based on Mr. Sutton's statements, that the use of bentonite may increase surface erosion.

181. As set forth in ¶ 179, ongoing inspection and maintenance requirements will address any significant erosion effects. The Bentonite Pilot/Field testing required by Permit Condition 31 will specifically examine this issue.

182. Commenters have also cited Mr. Sutton's concerns about construction on top of the existing tailings.

183. While the FTB Dam will be constructed using the upstream construction method, it is true that the FTB Dam will be built upon tailings. Nevertheless, the modeling for the FTB Dam, which includes specific information about the conditions in the area of the dam, the materials to be used, and the dam design, and incorporates conservative assumptions, demonstrates that the FTB Dam will meet or exceed required Factors of Safety and will otherwise satisfy dam safety requirements as discussed above. Dam safety regulations and requirements, as well as the FTB Permit conditions, further assure the FTB Dam's long-term stability.

ix. Concerns About a Potential FTB Dam Breach and Dam Breach Analysis

184. Commenters raised concerns about a potential breach of the FTB Dam and the underlying assumptions and modeling of the Dam Breach Analysis.

185. In addition to the DNR, multiple outside experts have reviewed the FTB Dam's design in detail. The evidence demonstrates that the FTB Dam design is sound and meets all the regulatory requirements. It is very unlikely that the FTB Dam would breach. PolyMet will construct the FTB Dam using materials with well-defined properties. The downstream embankment of the FTB Dam will be constructed with a particularly flat downstream slope (in comparison to most other dams), adding additional stability. The liquefaction analysis for the FTB Dam used conservative assumptions and found no meaningful risk to dam stability from liquefaction. The DNR's analysis has found that, as designed, the FTB Dam will meet or exceed required Factors of Safety. Proper maintenance will ensure long-term stability. The FTB Permit will require detailed instrumentation, monitoring, and inspection of the dam for as long as it exists.

186. The DNR has undertaken a robust evaluation of the proposed design and construction of the FTB Dam and has concluded that the dam will satisfy all applicable requirements, including mandatory Factors of Safety. The DNR's adaptive management approach will enhance DNR's ability to protect public safety and the environment. Long-term monitoring, operation, and management requirements will further assure the safety and stability of the FTB Dam. PolyMet's financial assurance obligations, including its obligations to provide for ongoing maintenance of the facility and to obtain environmental insurance provide further protection.

187. DNR and its consultants have reviewed and DNR has accepted the FTB Dam design. As proposed, the FTB Dam design has the demonstrated capacity to safely store a large flood, withstand an earthquake, resist static liquefaction, and withstand other unlikely events and occurrences. PolyMet's Application included a dam breach analysis that considered the potential impacts of a dam breach. The Dam Breach Analysis identifies 34 properties that could be at risk in the potential event of a dam breach. *See* FTB Management Plan, Attachment H – Flotation Tailings Basin Dam Break Analysis “Dam Breach Analysis” and FTB Management Plan Section 3.0 at 20.

188. The potential for breach of the FTB Dam is an extremely unlikely event, particularly in light of the numerous regulatory requirements and ongoing monitoring and controls that will be in place. The FEIS concluded that the impact for failure of the FTB Dam was not required due to the low probability of occurrence that would be mitigated “through application of design and safety requirements, including adaptive management procedures.” *See* FEIS at 5-628. *See also* FEIS at A-370 to 381 (addressing comments on stability risks).

189. The DNR is requiring PolyMet to update the Contingency Action Plan (CAP) for the FTB. *See* FTB Permit Condition 32. The CAP will incorporate the results of the Dam Breach Analysis, including a list of residences and businesses potentially impacted by a dam break. *See* Dam Breach Analysis at 8. It is likely that many of these homes would actually be outside of the lateral and/or vertical extent of the inundation area were most realistic modeling feasible.” Management Plan for the FTB, Version 7, at Section 3.3, page 20. Newer models are being developed that will refine the potential risks of a dam breach. PolyMet has submitted an initial draft of the CAP. *See* FTB Management Plan, Attachment F. The DNR is requiring further refinement of the CAP, including requiring revised dam breach models, a field survey of elevations of properties at risk, and maintain a table of emergency contact information including addresses and phone numbers. *See* Permit Condition 32. The DNR concludes that significant construction or other development of areas closer to the Project site, and potentially within direct reach of a release from a breach of the FTB Dam, is unlikely. The region surrounding the Project is rural and sparsely populated. PolyMet will own much of the land around the NorthMet Project. In addition, much of the area north of the Project area, which will be the area most likely area to receive material released by a breach of either the FTB Dam or HRF Dam, consists largely of wetlands and areas unsuitable for further development.

1. The Dam Breach Analysis is Conservative.

190. For the reasons detailed below, DNR finds that the current dam breach analysis presents a highly conservative estimate of the potential impacts of a breach of the FTB Dam. *See, e.g.*, FTB Management Plan, Attachment H (Dam Breach Analysis) at 7.

a. Location of Assumed Breach

191. The analysis posits a breach at the location that would likely have the greatest potential impacts. The analysis focused on the north side of the FTB Basin because this side would have the shortest warning time for potentially affected downstream properties. *See* Dam Breach Analysis at 4. In addition, a breach at this location would have greater potential to impact properties, and the only likely potential to impact structures or homes. *See* Dam Breach Analysis at 4. The breach location analyzed is also at the tallest portion of the Dam (*i.e.*, where the land outside, at the base of the dam, is lowest), so that a breach from here would produce the largest breach wave.

192. Commenters argued that DNR should have examined a breach of the south portion of the FTB Dam as well as the north portion of the FTB Dam.

193. DNR considered the potential impacts of a breach from the FTB Dam and concluded that a potential breach from the North portion of the Dam would be likely to have the greatest potential impact. The natural ground outside the Southern portion of the FTB Dam is higher than areas outside the Northern Dam. Thus, a breach of the Southern portion of the FTB Dam would be smaller and water flowing out of the breach would be lower in energy than that from a potential breach of the Northern portion of the FTB Dam. If the Southern portion of the FTB Dam were breached, the water would flow into downstream wetland and mine pits and would be impeded by a railroad and a highway embankment (all of which are on mining property). Eventually, some of the breach waters could flow into the Partridge River. DNR has preliminarily considered the area of this potential zone of impact, and has concluded that a breach from the Southern portion of the FTB Dam likely poses a lesser risk to human health and safety than a breach of the Northern portion of the FTB dam. DNR therefore has focused at this stage on a potential breach of the North portion of the FTB Dam.

194. In addition, however, as the project proceeds, DNR is requiring further dam breach analysis to be undertaken. FTB Permit Condition 32 requires PolyMet to model breaches at several locations around the basin as agreed upon by DNR. *See* FTB Dam Permit at Condition 32.

b. Assumptions About Content of Material Released

195. Commenters suggested that the Dam Breach Analysis does not sufficiently show the potential impacts of a breach because PolyMet's computer modeling used water to simulate a release that would actually contain both water and tailings.

196. Water is what is known as a "Newtonian liquid," which means that it behaves according to Newtonian principles of physics. By contrast, non-Newtonian fluids (Bingham fluids) have a higher viscosity, which makes them behave more like a slurry. Modeling the

release using the assumption that the material from an FTB breach would move like a Newtonian liquid maximizes the volume of a potential breach wave and minimizes the time of travel of the breach wave, producing a “worst case downstream scenario” for a dam breach. For example, tailings, which are considerably heavier than water, would settle out of a release quickly, with larger tailings settling out more quickly (i.e., closer to the dam) and finer tailings settling out more slowly, (i.e., further from the dam). *See* Dam Breach Analysis at 7. This would reduce the volume of material spreading out away from the FTB Dam, reduce the height of the breach wave, and reduce the distance the material would travel. Thus, the Dam Breach Analysis provides a highly conservative representation of the potential flood impacts of a breach.

c. Assumptions About Amount of Water in the Dam

197. The Dam Breach Analysis was based on the assumption that the FTB breach would occur at the same time as a probable maximum precipitation event, which would mean that the FTB Dam would contain more water than it ordinarily would. In reality, a probable maximum precipitation event is extremely rare. *See* Flotation Tailings Basin Management Plan Page 12 section 2.5.

198. Commenters expressed concern that the Dam Breach analysis did not address overtopping. Barr’s analysis showed that overtopping is unlikely to occur because there is an emergency overflow spillway, there is sufficient freeboard, and PolyMet will have the ability to draw water out of the basin via the reclaim water pumps should it prove necessary. *See* Dam Breach Analysis at 5, FTB MP at 23 and 30. In addition, modeling results for an overtopping scenario would be unlikely to differ significantly from a dam failure that assumes a piping failure scenario. Thus, DNR has concluded overtopping is so unlikely that additional modeling is not justified.

199. Commenters maintain that DNR cannot determine the hazard classification of the FTB Dam based on the current dam breach analysis. Based on the information DNR has examined, including the current dam breach analysis information, DNR has classified the FTB Dam as a Class I dam, which requires it to meet the highest safety standards under Minnesota’s dam safety regulations. Additional data, even in the unlikely event that such data were to show greater potential impacts, would not change the classification of the FTB Dam, nor would it change the regulatory standards under which the FTB Dam is evaluated. Thus, additional dam breach analysis information would have no effect on the classification of the FTB Dam, and existing information is sufficient to classify the FTB Dam.

x. Concerns about Wet Closure of the FTB

200. Commenters object to a potential “wet closure” of the FTB. Commenters contend that allowing wet closure of the FTB would violate dam safety regulations requiring the DNR to determine the stability of the dam based on “prudent current environmental practice,” under Minn. R. 6115.0410, subp. 8(F) and that wet closure poses an unreasonable risk to the public.

201. Nothing in the dam safety regulations requires “dry closure” or prohibits “wet closure.” *See generally* Minn. R. 6115.0300 to 6115.0520. The DNR has authority to require permit applicants to design, construct, and maintain dams in accordance with requirements under

Minnesota Law, in order to receive a dam safety permit. If permit applicants demonstrate that their application and supporting materials satisfy those standards, DNR must issue a dam safety permit to the applicant. Minn. Stat. § 103G.315, subd. 3. Thus, DNR may not dictate design choices among alternatives that otherwise satisfy legal requirements.

202. For this Project, wet closure and dry closure each could provide benefits and could present engineering, environmental, or other challenges. DNR has evaluated various closure options, including both wet and dry closure. A wet closure scenario will reduce the sulfate load and sulfate concentrations and will be the most protective of wild rice. Wet closure options also provide an acceptable Factor of Safety. Once the chemical oxidation of the PolyMet tailings has ceased, the wet cap will no longer be required and the associated water pond can be drained. *See* FEIS at 3-156.

203. The dam safety regulations expressly anticipate “perpetual maintenance” of dams, providing that “the owner shall perpetually maintain the dam and appurtenances so as to ensure the integrity of the structure.” Minn. R. 6115.0390, subp. 1.

204. DNR has evaluated PolyMet’s FTB Application, including its proposed design for wet closure, against the applicable dam safety legal requirements (i.e. factors of safety, inspections, maintenance, and financial assurance) and has concluded that it meets those requirements.

205. The Geotechnical Data Package includes an analysis of the long-term stability of the FTB Dam. That analysis shows that the FTB Dam will remain stable so long as the required monitoring and maintenance is performed, and in fact, the Factors of Safety for the dam will increase over time, as materials in the dam are subject to secondary compression and dewatering. *See* Geotechnical Data Package at 89 to 91.

206. Numerous additional regulations and permit conditions provide for ongoing maintenance, monitoring, inspections, financial assurances, and other requirements aimed at assuring that the FTB Dam remains structurally sound.

207. The FTB Permit also includes a condition that requires PolyMet to investigate “Future Closure Considerations ... such as a dry cap or other technologies that may provide additional benefits such as a shorter post-closure monitoring and maintenance period while ensuring no loss of dam safety.” *See* FTB Permit Condition 45.

208. Thus, the DNR finds that the FTB Permit, taking into consideration the anticipated “wet closure” of the FTB, satisfies the permitting standards and other requirements of the applicable dam safety regulations. *See* Minn. R. 6115.0410.

xi. Concerns that the FTB Dam Safety Permit Should Require Dry Stacking

209. Commenters suggest that PolyMet should use “dry stacking” to dispose of tailings instead of placing them in the FTB. “Dry stacking,” also referred to as “dry cake” or “filtered tailings,” would involve using a filter press to remove water from the tailings while the tailings are still at the beneficiation plant. These tailings with reduced water content would then be transported to a tailings basin.

210. Some commenters appear to confuse “dry stacking” and “dry closure,” which are different. Dry closure in this instance would involve dewatering the tailings basin, either by intentionally breaching the dam or by pumping the water from the basin after operations were completed, leaving the tailings in place. The basin would be revegetated. Dry closure will be further evaluated as a condition of the FTB Permit.

211. Dry Stacking is a newer technology designed to allow mining companies to develop mineral deposit in areas where there are insufficient water supplies to sustain the processing of mined ore. By removing and returning the water from the tailings at the plant, the mine operator is essentially able to reuse that processing water, though some make-up water is necessary due to losses in the tailings and plant processing. In an arid climate, a conventional slurry and tailings pond can result in a 50% water loss, making plant operations unsustainable. Dry stack tailings are generally in very remote arid or arctic environments.

212. In a dry climate, dry stacking has significant environmental benefits. Among those benefits are reduced seepage of contaminated waters, reduced foot print of the storage facility, and potentially easier closure requirements. A perimeter seepage collection ditch and lined storage pond is usually associated with a dry stack, but a large perimeter dam would be unnecessary in most applications. Therefore, there is little risk of a dam failure.

213. By contrast, however, in wetter regions, dry stacking may not be appropriate. In a wet climate, dry stacking has major environmental disadvantages. Maintaining dry stacked tailings as “dry” in areas with substantial precipitation and/or a high water-table is difficult. Once exposed to rain or snow, the dry stack becomes wet, so most of the benefits of dry stacking are lost. Dry stacked tailings that become wet again (but are not submerged) are subject to oxidization and leaching of heavy metals. As precipitation then intermittently washes through the tailings, those heavy metals and other constituents may be washed into surrounding soils and nearby water bodies. Seepage water will also flow into the underlying groundwater, potentially contaminating local water supplies. To prevent seepage from this wet stack carrying pollutants into surrounding areas, seepage collection and water treatment systems would be required. In addition, stacks in a wet climate will be more subject to fluvial erosion. A perimeter dam may be required to prevent the movement of contaminated sediments and waters off-site. Construction of a perimeter dam reintroduces issues associated with maintenance of a dam for long-term storage of tailings, including the possibility of dam failure.

214. Another potential environmental challenge for dry stacking of tailings is the generation of fugitive dust. If tailings are dry, they are easily entrained in the air and carried by the wind, given their small particle-size. While wet tailings can be transported in slurry form through a pipeline, dry stack tailings must be transported by other means – generally by truck or conveyer belt. These transportation processes are likely to result in emissions of airborne fugitive dust. This dust may contain reactive materials, such as sulfur, or heavy metals leached from the “dry” tailings. Trucks and other heavy equipment required for other phases of dry stacking would also create additional air emissions.

215. Further fugitive dust emissions from dry tailings are likely to occur from storage or disposal areas. In wet climates, fugitive dust containing reactive minerals could pose a

significant risk to the surrounding environment. Fugitive dust released into the forests, lakes and communities of northeast Minnesota would pose environmental risks.

216. Commenters cite to statements by Michael Davies to support their contentions that dry stacking should be used for the NorthMet Project. As Mr. Davies makes clear, however, “dry stacking” of tailings is not appropriate for all circumstances. Dry stacking may provide distinct advantages in arid regions, where water conservation is essential for project operations. For similar reasons, in arctic regions, where water handling becomes highly problematic in winter, dry stacking may be preferable. Dry stacking may also provide advantages in areas of high seismicity. *See, e.g.,* Davies, Michael P., Lighthall, Peter C., Rice, Steve, Martin, Todd E., 2002. Design of Tailings Dams and Impoundments, Presented at the Annual General Meeting of the Society for Mining, Metallurgy, and Exploration: Tailings and Mine Waste Practices (Keynote Address), Phoenix, 2002 at pp. 10-11.

217. The DNR has considered the facts and circumstances of the Proposed NorthMet Project and has evaluated the feasibility, as well as the potential advantages and disadvantages of dry stacking and has concluded that dry stacking would not be appropriate at this location and for this Project. Dry stacking presents a particular disadvantage for the proposed NorthMet Project because it would undermine the ability to address existing contamination and repurpose a former disposal site and would require the use of a “greenfield” site at a new location for tailings handling and disposal.

218. Dry Stacking would require the development of a new green field site for the tailings basin because it would not be feasible to construct a dry stack disposal area at the location of the existing LTVSMC tailings basin. The use of dry stack technology would require a different location for deposition of the PolyMet tailings. This would increase the footprint effects of the proposed project. In addition, use of a separate dry stack tailings basin would not address LTVSMC tailings basin legacy issues. Given this fact, at the scoping stage of the environmental review process, DNR determined that it would not evaluate alternative sites for the for a dry stack tailings basin because it had not identified an alternative site that would likely have significant environmental benefits over the proposed site and an alternative site might not be feasible or achievable in the time frame of the project. *See* FEIS at A-315

219. Implementing dry stacking for the PolyMet tailings would involve logistical and environmental challenges even beyond the greenfield site requirement discussed above. Because the NorthMet facility would not be in an arid climate, dry stacking the PolyMet tailings would present the challenges associated with storing dry stacked tailings in a wet climate. The PolyMet tailings would not be submerged, and would be exposed to the air, so would be likely to oxidize, and to create reactive materials, including sulfuric acid. This, in turn, would be likely to lead to leaching out of heavy metals. Heavy rains, snow melt, or wind could then mobilize these constituents, transporting them into nearby soils, surface waters, or other areas.

220. Dry stacking is also management-, equipment-, and energy-intensive. Dry Stacking requires specialized filter presses and pumps that can remove sufficient water to leave a tailings product with about 18% water. These presses are slow to operate, so companies often need multiple presses. Once the tailings have left the presses, the tailings must be transported by conveyer or truck. Truck transport also can be difficult in a wet and/or snowy climate, where

roads may become unusable. Conveyers pose their own reliability issues in a cold wet climate. Once the tailings have been placed at the new site, they are subject to further management. They must be leveled, compacted, and then treated for dust suppression. These additional equipment and management requirements, as well as the increase in energy consumption associated with implementing dry stack in these circumstances would also substantially increase costs.

Concerns Regarding HRF

i. Concerns Regarding HRF Dam⁶ Breach

221. Commenters raised concerns regarding the potential consequences of a breach of the HRF Dam, including the effects on the environment and public health, and suggested that such consequences had not been disclosed. Some commented that the DNR should have performed a dam breach analysis. Some commenters contended that the HRF should be classified as a Class I hazard dam.

222. The DNR has considered the potential for a breach of the HRF Dam. Such a breach is highly unlikely in view of the location, design, planned construction, use and other conditions and circumstances pertaining to the HRF Dam. *See, e.g.*, FEIS at § 5-628; A-370 to 381. PolyMet will construct the HRF using a geo-membrane and geo-synthetic liner. PolyMet will also use well-compacted, well-defined, construction materials. The DNR will require monitoring during construction to assure adherence to the approved plans and specifications. The HRF Dam will be founded on existing silty sand, glacial till, gravel, and Giants Range granite, so that it will have a stable foundation. *See* FEIS at A 5.2.14.2.3 (summary of geotechnical stability themes); FEIS A-370 to 381; HRF Geotechnical Data package at 28;

223. The potential for a breach of the HRF Dam would be so remote, particularly in view of the ongoing review, monitoring, and management obligations associated with the facility, that the FEIS declined to examine the potential environmental impacts of such a breach. FEIS at FEIS at § 5-628.

224. Barr Engineering completed a dam break analysis for the HRF Dam. Barr examined how the HRF dam could fail, and found “no plausible HRF Dam failure scenarios.” *See, e.g.* HRF Management Plan, Attachment L (HRF Dam Break Analysis) at 4.

225. In addition, in reviewing the HRF Application, and in view of comments on a potential breach of the HRF Dam, DNR’s dam safety experts considered the potential consequences of such a breach, taking into consideration the topography of the site, the capacity of the HRF, the materials involved, the character of the surrounding areas and how those areas could be affected, and other relevant factors. DNR personnel concluded that, in light of all of

⁶ Like the FTB, the HRF is governed by a variety of regulatory permits and requirements. The HRF Permit addresses dam safety statutory and regulatory requirements. Requirements under other regulatory schemes are addressed by other permitting regimes and are addressed in documentation supporting other permits. Where issues overlap or are related, these Findings may refer or incorporate information or findings from these other permitting processes.

these factors, the potential consequences of a failure of the HRF would be mostly limited to the downstream wetland, and potentially Heikkilla Lake.

226. The HRF Basin will contain a relatively small volume of water relative to its capacity. Solids within the materials deposited in the HRF will precipitate to the bottom of the basin. Water on top of these solids will be drawn off and sent to the plant for reuse. Thus, the HRF will not accumulate large volumes of water over time. *See, e.g.*, Permit Application at 2;

227. If a breach were to occur, most water and residue would flow into a wetland to the northwest. Some water and residue could potentially flow into Heikkilla Lake to the north under certain unlikely circumstances. Materials flowing towards the unnamed wetland would mostly remain in that wetland and would not enter the Embarrass River. Materials flowing to the north could enter Heikkilla Lake, which outflows into the Embarrass River. A significant volume of materials from a dam breach would not reach either the unnamed wetland or Heikkilla Lake as those materials would be captured by the existing topography. *See e.g.* HRF Dam Safety Permit Application, Large Figure 1 (HRF Location). It is highly likely that most of the water and residue released would be either be contained within the wetland or Heikkilla Lake, and that very little residue would make its way to any flowing stream or river. Any water from the HRF that reached a flowing water body would be diluted very quickly. DNR identified no structures or residential areas that would be impacted in the downstream wetland complex or at Heikkilla Lake.

228. In addition, the HRF Permit requires that PolyMet conduct a dam breach analysis, which will more precisely analyze these consequences. HRF Permit Condition 30. Should the results of that analysis indicate that additional requirements or permit modifications are necessary, DNR retains authority to impose them.

229. Because the DNR has identified the HRF Dam as a Class II dam and has found that no structures have been identified to be at risk in the event of a breach, the HRF Dam does not require a Contingency Action Plan (CAP). Nevertheless, the DNR has required PolyMet to prepare CAP for the HRF. The CAP will address the potential of a dam failure at the HRF in order to minimize any potential effects. The CAP must contain applicable elements of FEMA requirements for emergency action plans. *See* HRF Permit Condition 30. These guidelines, in turn, require performance of a dam breach analysis. *See* U.S. Federal Emergency Management Agency (FEMA) “Federal Guidelines for Emergency Action Planning for Dams,” (FEMA Publication No. P-64). PolyMet has prepared a draft of that plan. *See* HRF Management Plan, Attachment K. PolyMet’s compliance with this permit condition provision is subject to DNR approval. *See* HRF Permit Condition 30. Thus, DNR finds that the potential risks to the public from an HRF Dam breach would be minimal.

ii. Concerns Regarding Hazard Classification

230. The DNR analyzed the factors relevant to determining a hazard classification pursuant to the applicable dam safety regulations and found that the HRF Dam was appropriately categorized as Class II. A dam qualifies as a Class II dam if “failure, misoperation, or other occurrences or conditions would probably result in: possible health hazard or probable loss of high-value property, damage to secondary highways, railroads or other public utilities or limited

direct or indirect economic loss to the public other than that described in Class III[.]” Minn. R. 6115.0340. Losses to the public described in Class III are described as rural buildings and local county and township roads.

231. Under Minn. R. 6115.0340, a Class I dam is one where “failure, misoperation, or other occurrences or conditions would probably result in . . . any loss of life or serious hazard, or damage to health, main highways, high-value industrial or commercial properties, major public utilities, or serious direct or indirect, economic loss to the public[.]”

232. DNR has considered the likely effects of a potential HRF dam breach and has concluded that any such breach would be unlikely to result in any of the specified Class I consequences. Based on its review of the information pertaining to the HRF Dam and the surrounding areas, the DNR has not identified a probable loss of life, or serious hazard, damage to health, or other damages linked to a Class I designation. Thus, the HRF dam is more appropriately categorized as a Class II dam than as a Class I.

233. Although it is arguable whether a breach of the HRF Dam would “probably” result in any of the consequences triggering Class II designation (i.e., “possible health hazard or probable loss of high value property,” or property or economic damage), the DNR concludes that applying a Class II designation is appropriate in view of all the facts and circumstances.

234. Even though the HRF Dam falls within the Class II dam category, the design of the HRF dam in fact meets the standards of a Class I dam, providing additional safety measures beyond those required under Minn. R. 6115.0410, subp 8. Accordingly, even if circumstances were to change and the facts were to show that the HRF Dam should be reclassified as a Class I dam, the HRF Dam design would already satisfy those Class I dam safety requirements of Minn. R 6115.0410, subp.8.

iii. Concerns Regarding HRF Dam Design

235. Commenters raised concerns that the design of the HRF Dam is not specific and has not been analyzed. Commenters also raised concerns that a full stability analysis was not undertaken for the HRF Dam. As discussed above, the scale and nature of this project means that planning for construction and implementation requires an iterative process between and among regulators and the Applicant. Necessarily, some elements and aspects of the project design will be refined on an ongoing basis as others are completed and as additional information becomes available. For example, some aspects of the HRF Dam will be determined by refinements to the design of the liner system for the HRF Basin. These design elements for the liner system must be approved by MPCA. As MPCA approves those elements, additional detail on the HRF Dam design will be provided for DNR’s review and approval.

236. PolyMet ran models to determine Factors of Safety, and the potential for slope failure and deformation of the foundation and liner. *Id.* § 5.2.14.2.3. The calculated Factors of Safety for dam stability and for liner sliding exceed required standards. *See* HRF Management Plan at 19.

iv. Concerns Regarding Liquefaction Analysis

237. Commenters objected that a liquefaction analysis has not been completed for the HRF Dam.

238. Nothing about the HRF Dam or its foundation suggests that a liquefaction analysis is necessary or appropriate. If an embankment is constructed in such a way that it may be subject to liquefaction, then a liquefaction analysis may be appropriate. Here, however, that is not the case. The HRF Dam will be constructed on an area with silty sand, glacial till, and granite and is an area of shallow bedrock, which provides a highly stable foundation. *See* FEIS at § 5.2.14.2.2 and A-370. Thus, the foundation of the HRF Dam should not be subject to liquefaction. *Id* at § 5.2.14 at 5-646. In addition, the HRF basin will be lined, so that the material in the embankment will be protected from seepage from the HRF basin and should remain unsaturated. The material in the HRF Dam will also be compacted to achieve the necessary density to assure adequate shear strength. HRF Application, Residue Management Plan at p. 7. Consequently, the materials in the embankment should not be subject to the conditions in which liquefaction would occur (e.g., when material is saturated and undrained, when material is not compacted). *See* HRF Management Plan, HRF Dam Break Analysis, Attachment L.

239. Some commenters contended that “full dynamic modeling” should be required for the HRF Dam.

240. The DNR does not agree that full dynamic modeling is appropriate for this structure. Full dynamic modeling is generally used in circumstances where a dam is prone to damage from earthquakes. The HRF Dam will be located in an area that is not an active seismic zone. *See* Geotechnical Data Package at 9; FEIS § 5.2.14 at § 5-646. *See e.g.*, FEIS Appendix A: A.5.9.

241. In addition, the HRF Dam will be constructed of compacted borrow material, using the downstream construction method. This design will be highly resistant to earthquakes as well as being stable under ordinary conditions.

v. Concerns Regarding the HRF Liner, Foundation, and Other Issues

242. Comments on the HRF Permit also raised generalized concerns about the integrity of the liner for the HRF, the foundation underlying the basin area of the HRF, and other issues not bearing on the safety or integrity of the HRF Dam and not pertaining to dam safety regulatory requirements.

243. In considering the HRF dam safety permit application, DNR has examined the issues relevant to that permit under the applicable statutes and regulations. The DNR has made the findings and reached the conclusions required for consideration of and decisions on the HRF permit application. As appropriate, the DNR has addressed some HRF-related issues, including those pertaining to the liner for the HRF and the foundation under the basin, within its other permitting and regulatory programs and processes, including, for example, the Permit to Mine process.

244. The MPCA, as the agency with authority over water treatment and water quality issues, as discussed above, is addressing issues associated with review and permitting of the HRF basin, including issues pertaining to the HRF Basin liner.

245. The DNR adopts by reference here the Findings and Conclusions, Permits, approvals, and other relevant regulatory records and decision materials of these and any other relevant regulatory programs and processes applicable to the NorthMet Project including but not limited to the following permits and their associated Findings of Fact, Conclusions of Law and Orders: the NorthMet Permit to Mine, Water Appropriation Permits, and the Draft NPDES/SDS Permit dated October 2018.

246. To the extent that any of these general comments may be relevant to other permitting or regulatory programs or processes overseen by regulatory entities other than the DNR, those programs and processes have or will address them. The DNR relies on the MPCA's regulatory processes and those of other authorized regulatory bodies with respect to those issues within their authority.

ANALYSIS OF STATUTORY AND REGULATORY REQUIREMENTS

247. Minnesota Statutes § 103A.205 provides:

It is the policy of the state to promote the retention and conservation of all water precipitated from the atmosphere in the areas where it falls, as far as practicable. Except as otherwise expressly provided, all . . . departments . . . of the state or political subdivisions having any authority or means for constructing, maintaining, or operating dams or other works or engaging in other projects or operations affecting precipitated water shall use the authority, as far as practicable, to effectuate the policy in this section.

The DNR has taken into consideration the policy set forth in this statute and, except as otherwise expressly provided, has used the applicable authority, as far as practicable to effectuate this policy.

248. The purpose of Minn. R. 6115.0300 to 6115.0520 is to “regulate the construction and enlargement of dams, as well as the repair, alteration, maintenance, operation, transfer of ownership, and abandonment, in such a manner as to best provide for public health, safety, and welfare.” Minn. R. 6115.0300. In reviewing the FTB and HRF Applications, the DNR has taken into consideration the purpose of the dam safety regulations and has applied the Dam Safety regulations so as to best provide for public health, safety and welfare.

249. In the application of these parts, the DNR shall be guided by the policies and requirements declared in Minnesota Statutes, section 84.083, and chapters 103A, 103B, 103E to 103G, and 116D.” See Minn. Rules 6115.0300. The DNR has reviewed the Permit Applications to determine compliance with the applicable Minnesota Dam Safety requirements and has also been guided by the policies and requirements in these additional specified statutes.

250. Minnesota’s dam safety rules are intended to be implemented in a manner consistent with the goals and objectives of applicable federal and state environmental quality programs and policies. *See* Minn. R. 6115.0300. “To achieve this purpose,” the Commissioner has set forth “minimum standards and criteria for dam classification and identification of hazards to health, safety, and welfare for permits for dam projects.” Minn. Rules 6115.0300 to 6115.0520. The DNR has applied the standards and criteria set forth in these regulations in its review of the FTB and HRF Applications. In doing so, the DNR has considered the goals and objectives of applicable federal and state environmental quality programs and policies.

251. Regulation of the operation and maintenance of a dam for public health, safety, and welfare is vested in the Commissioner. Minn. Rules 6115.0380, subp. 1. *See also* Minn. R. 6115.0300 to 0420, Minn. R. 6115.0450, Minn. R. 6115.0480, and Minn. R. 6115.0500. The DNR has the authority to issue permits for the FTB and HRF Dams. *Id.* In reviewing the FTB and HRF Applications, in making these Findings and Conclusions, and in issuing final decisions on the FTB and HRF Permits, the Commissioner of the DNR is exercising this regulatory authority in accordance with this and other applicable provisions of Minnesota law, taking into consideration public health, safety, and welfare.

252. The owner of a dam is required to operate and maintain the dam in conformity with Minn. R. 6115.0380, subp. 1 (requiring dam owners to design, construct, operate, and maintain dams to protect the public health, safety, and welfare). The DNR has applied the applicable regulatory standards in reviewing the FTB and HRF Applications. As set forth in Sections V through VII of this Findings of Fact, DNR’s review of the Applications and supporting documents, together with the FTB and HRF Permits and conditions demonstrate that PolyMet will be required to operate and maintain the FTB and HRF Dams in conformance with the applicable dam safety regulations, assure that the dams are designed and will be constructed and operated in a manner to protect public health, safety and welfare.

253. The DNR is authorized to impose recordkeeping and reporting requirements on PolyMet. Under Minn. R. 6115.0380, Subpart 2, DNR may require PolyMet to “keep records and report on maintenance, operation, staffing, and engineering and geologic investigations and any other data necessary to protect the public health, safety, and welfare.” Minn. Rules 6115.0380, subp. 2. In addition, PolyMet must “fully and promptly advise the Commissioner of DNR of any unusual or alarming circumstance or occurrence affecting the dam.” Minn. Rules 6115.0380, subp. 2. The FTB and HRF Permits impose various recordkeeping and reporting requirements on PolyMet. *See generally*, FTB Permit, HRF Permit. The DNR also has authority to impose additional reporting and recordkeeping requirements, and to require additional information from PolyMet. *See* FTB Permit, HRF Permit, Minn. Rules 6115.0510. (“When necessary to assess the safety of a dam or proposed project, the applicant or owner may be required to submit additional information at personal expense. Whenever information or conditions required by these parts is unnecessary, the commissioner shall waive those provisions and shall allow appropriate revisions to make the requirements less burdensome.”)

254. Minnesota’s dam safety regulations also direct that dam owners “shall perpetually maintain the dam and appurtenances to ensure the integrity of the structure until such time that it is removed.” Minn. R. 6115.0390, subp. 1. The DNR’s dam safety permits for the FTB Dam and the HRF Dam will require PolyMet to comply with this provision and to maintain the Dams in perpetuity or until they are no longer in use. *See* FTB Permit Conditions 33, 34, and 47.; HRF Permit Conditions 31, 32, and 43.

255. Under the Minnesota dam safety regulations, dam owners may be required to provide financial assurance for “carrying out the activities required for perpetual maintenance” of the dam. Minn. R. 6115.0390, subp. 2. The FTB and HRF Permit Conditions require that PolyMet comply with the financial assurance and environmental insurance requirements set forth in the Permit to Mine for the NorthMet Mine. *See* FTB Permit Condition 25; HRF Permit Condition 27.

256. The Commissioner of DNR is required to make findings of fact on issues necessary for determination of applications considered. Orders made by the commissioner must be based upon findings of fact made on substantial evidence. Minnesota Statutes § 103G.315, subd. 2. In making these Findings of Fact, the DNR has evaluated the relevant environmental review documents and associated supporting documentation, the Application and associated documentation, public comments, and all applicable documentation compiled and prepared by the DNR and its agent relevant to the statutory and regulatory analysis necessary to make a ruling on the FTB and HRF Applications discussed herein. In these Findings and Conclusions, the Commissioner makes all findings necessary for making final rulings on the FTB and HRF Permit Applications.

257. The DNR has the authority to impose conditions on dam safety permits. Minn. Stat. § 103G.315, subd. 1. *See also* subd. 6, subd. 8. The FTB and HRC Permits impose conditions on PolyMet’s proposed construction, operation, and maintenance of the FTB and HRF Dams, consistent with Minnesota Dam Safety Permit requirements.

258. Applications for dam safety permits must be in writing on a form prescribed by the Commissioner. *See* Minn. Stat. § 103G.245, subd. 3; Minn. R. 6115.0240. PolyMet submitted FTB and HRF Permit Applications in writing in the form required under the Dam Safety Permit regulations.

259. The permit “applicant has the burden of proving that the proposed project is reasonable, practical and will adequately protect public safety and promote the public welfare.” Minn. Stat. § 103G.315, subp. 6.

260. If the DNR concludes that the plans of an applicant are reasonable, practical, and will adequately protect public safety and promote the public welfare, then the DNR must grant the permit. Minn. Stat. § 103G.315, subd. 3.

261. As required by Minn. R. 6110.0410, subps. 3 and 8, the DNR has evaluated the applicable requirements for issuance of dam safety permits under Minnesota law, including requirements based on potential environmental impacts. *See* ¶¶ 20 through 38, 117 through 141. ¶¶ 184 through 199, and ¶¶ 209 through 229. .

262. The term “public waters” is defined in Minn. Stat. § 103G.005, subd. 15, which sets forth a series of categories of water bodies that are public waters, none of which describe the planned sites for the FTB Dam or the HRF Dam. *See* Minn. Stat. § 103G.005, subd. 15 (defining “public waters”). Neither of the dams will be located on public waters. *Cf. See* Application Large Figure 1 and Attachment 1. *See also* FEIS at Figure 4.2.2-2 (identifying areas of public waters in the area of the planned NorthMet Project and not including the sites for the FTB Dam or the HRF Dam).

263. Because neither of the Dams are located on a public water, the FTB Dam and the HRF Dam do not require a public waters work permit. *See* Minn. Stat. § 103G.245, subd. 1.

264. Minn. Stat. 103G.315, subd. 13 provides that the Commissioner shall set the time period within which construction authorized in permits must be completed. Minn. Stat. § 103G.315, subd. 13 and subd. 14. As required by statute, the DNR has established a 27-year permit term for both dam safety permits to provide for dam construction, 20 year mining operations, and reclamation. Here, the Commissioner finds good cause to establish the time periods set forth in the FTB and HRF Permits, and also concludes that the time periods set forth in those Permits are reasonable, in accordance with the provisions of both Minn. Stat. § 103G.315, subd. 13 and subd. 14. *See* Permits.

265. Minn. Stat. § 103G.315, subd. 14(a) specifies permits granted in connection with the mining, production, or beneficiation of copper, copper-nickel, or nickel are irrevocable for the term of the permits without the consent of the permittee, except for breach or nonperformance of a permit condition. Subd. 14(b) goes on to provide that notwithstanding the time limits in Minn. Stat. § 103G.315, subd. 13, the Commissioner may allow and prescribe in the permit any time the Commissioner considers reasonable, notwithstanding the limitation under subdivision 13, limitations of time contained in this section for beginning or completing construction or operations under the permit, or exercising the rights granted under the permit. The FTB permit and the HRF permit are granted in connection with the mining, production or beneficiation of copper, copper-nickel, or nickel within the meaning of Minn. Stat. 103G.315, subd. 14(a). Thus, the Commissioner may set any time limit that the Commissioner finds reasonable for exercising the rights granted under the FTB Permit and the HRF Permit. Here, the Commissioner concludes that the Permit conditions governing the term of the FTB Permit and the term of the HRF Permit are reasonable. The Commissioner also finds good cause supports the permit conditions governing the term of the FTB Permit and the HRF Permit. Thus, the term limit conditions in both the HRF Permit and the FTB Permit are lawful under the provisions of both Minn. Stat. § 103G.315, subd. 13 and subd. 14

VII. DNR HAS CORRECTLY CLASSIFIED THE PROPOSED FTB AND HRF DAMS.

266. Minnesota's dam safety regulations require all proposed dams to be classified by the Commissioner as Class I, Class II, or Class III. Minn. Rules 6115.0340. The Commissioner has reviewed the information required to determine the appropriate classification of the FTB Dam and the HRF Dam. ¶¶ 230 through 234. The Commissioner has classified the FTB Dam as Class I and has classified the HRF Dam as Class II. *See* ¶¶ 230 and 234. These classifications are appropriate in view of all of the information considered and the requirements in the Dam Safety regulations

VIII. THE APPLICATIONS SATISFY MINNESOTA RULE 6115.0410

Subpart 1 Does Not Apply to the NorthMet Dam Safety Permits

267. Minn. R. 6115.0410, subpart 1 pertains to "Waivers for Class III Dams," and specifies when provisions may be waived for Class III dams that are sponsored by a governmental agency in certain circumstances. *See* Minn. R. 6115.0420. DNR has determined that the FTB Dam and HRF Dam are not Class III dams and neither is sponsored by a governmental agency. This provision is therefore not implicated by the Application or the Permits addressed in these Findings.

The Permit Applications Satisfy Subparts 2 and 3

268. The Applications submitted through MPARS meet the requirements set forth in Minn. Stat. § 103G.245, subp. 3, that the application be in writing.

269. As required by Minn. R. 6115.0410, subp. 2, the Applications contain the name and address of the prospective owner of the dam, the purpose of the project, the location, type, size and height of the dams, and the storage capacity of the impoundments.

270. Dam safety permit applications must also include preliminary report materials including a general statement indicating the effect of the project on the environment; maps showing the specific location of the project; a report outlining the topographical and geologic surface conditions; a cross section of the dam showing elevations, proposed impoundment levels and top width; logs of soil borings; preliminary design assumptions; preliminary cost estimates; future plans on ultimate project size including the impoundment area; and a general description of all other activities and elements related to and part of the total dam project. Minn. R. 6115.0410, subp. 3.

271. The Applications filed in MPARS included the information required under Minn. R. 6115.0410, subp. 3.

272. The DNR reviewed the application materials that PolyMet submitted for the FTB Dam and the HRF Dam pursuant to Minn. R. 6115.0410, subp. 6, and accepted these materials by invoicing PolyMet for the required Permit Application fees.

273. Minn. R. 6115.0410, subp. 2, requires that permit applications for waste impoundment dams include facts necessary for the issuance of a permit which extends throughout the life of the impoundment period.

274. Both the FTB Dam and the HRF Dam are used for impoundments that will contain mine processing waste and neither is subject to the exception under Minn. Rules 6115.0320, Subp. 5(d) excepting certain artificial barriers that contain waste from the definition of “dam”. Both the FTB Dam and the HRF Dam are thus subject to the Permit Application requirements for waste impoundment dams under Minn. R. 6115.0410, subp. 2.

275. DNR reviewed the FTB and HRF Applications in detail for the purpose of evaluating the Permits under the applicable Minnesota dam safety requirements and found that they included the information necessary to issue permits which extend throughout the lives of the impoundments. The DNR finds that subpart 2 of Minn. R. 6115.0410 is satisfied.

PolyMet Paid the Required Filing Fee Under Subpart 4.

276. Minn. R. 6115.0410, subp. 4 requires that the application must include a filing fee. As indicated in MPARS, PolyMet paid the required filing fee on August 16, 2016.

Barr Satisfies the Requirements for a Professional Engineer Proficient in Dam Safety Engineering Under Subpart 5

277. Minnesota Rule 6115.0410, subp. 5, requires that a permit applicant retain a qualified Minnesota registered professional engineer, who is proficient in dam safety engineering. PolyMet retained Barr, and Tom Radue. *See* ¶ 45. The engineer that prepared the application is Tom Radue, who is a qualified Minnesota registered professional engineer, and is proficient in dam safety engineering. *Id.* The DNR concludes that PolyMet has satisfied the requirements of Minn. R. 6115.0410, subp. 5

PolyMet Has Satisfied the Final Design Report Requirements for the FTB and HRF Dam Safety Permits Under Subparts 6 and 7.

278. Minnesota Rule 6115.0410, subp. 6 requires that, upon acceptance of and agreement with the preliminary report, the permit applicant shall submit the final design report together with plans and specifications for the dam. The DNR uses this information to evaluate whether the proposal is consistent with the requirements of Minn. R. 6115.0410, subp. 8.

279. Minnesota Rule 6115.0410, subp. 7 provides additional detail on the format and content of “plans and specifications” referenced under Subpart 6:

Plans shall consist of a bound portfolio of the drawings with all sheets being of the same size, and shall be of such scale that specifications can be drafted, and construction accomplished. Specifications shall contain:

- A. general provisions, specifying the rights, duties, responsibilities of the owner, designer, contractor; the prescribed order of work;

- B. technical provisions describing approved work methods, equipment materials, and desired end results; and
- C. special conditions.

280. For both its FTB Application and HRF Application, PolyMet submitted all the materials required for the Final Design Report and the initial inspection fee, to the DNR on May 16, 2017. The Final Design Report included all of the required elements in Minnesota Rule 6115.0410, subp. 6 as well as the information specified in Minnesota Rule 6115.0410, subp. 7. *See* Paragraph 44 through 62.

PolyMet’s Application Submittals Contain the Material Reuired by Minn. R. 6116.0410, Subpart 8.

281. Minnesota Rule 6115.0410, subp. 8 sets forth the standards for dam safety permits. Approval or denial of a permit “shall be based on the potential hazards to the health, safety, and welfare of the public and the environment including probable future development of the area downstream or upstream.” In addition, an applicant “may be required to take measures to reduce risks, and the commissioner shall furnish information and recommendations to local governments for present and future land use controls to minimize risks to downstream areas.” *Id.*

282. The DNR has evaluated the potential hazards to the health, safety, and welfare of the public and the environment associated with the facilities proposed in the HRF Dam Permit Application and the FTB Dam Permit Application within the meaning of Minn. R. 6115.0410, subp. 8. *See* ¶¶ 67 through 70, ¶¶ 106 through 127, and ¶¶ 142 through 246. *See generally* FEIS.

283. The social and economic consequences of the NorthMet Project were detailed and analyzed in environmental review and referenced in the Application. *See* FEIS at § 5.2.10; *see* ROD at 50. *See* ¶¶ 28 through 32.

284. Based on its review and analysis, as detailed throughout these Findings and Conclusions, the DNR concludes that issuance of the Permits is appropriate under the standards in Minn. R. 6115.0410, subp. 8.

285. The DNR has concluded that any hazards to the health, safety, and welfare of the public and the environment that would potentially be associated with the HRF and FTB Dams, including any arising from probable future development, are not likely to be significant. *See* ¶¶ 106 through 124, ¶¶ 163 through 171, ¶¶ 184 through 199, and ¶¶ 209 through 234.

286. Under Minn. R. 6115.0410, subp. 8, for both Class I and Class 2 dams, DNR must also “determine if the proposal is adequate with respect to”:

- C. The need in terms of quantifiable benefits.

- D. The stability of the dam, foundation, abutments, and impoundment under all conditions of construction and operation, including consideration of liquefaction, shear, or seepage failure, overturning, sliding, overstressing and excessive deformation, under all loading conditions including earthquake. This determination must be based on current, prudent engineering practice, and the degree of conservatism employed must depend on hazards.
- E. Discharge and/or storage capacity capable of handling the design flood based on current, prudent engineering practice and the hazard classification.
- F. Compliance with prudent, current environmental practice throughout its existence.

287. As outlined in ¶¶ 281 through 287, the DNR has considered whether the proposed Dam Permits are adequate within the meaning of Minn. R. 6115.0410, subp. 8.

The Applications Satisfy Minn. R. 6115.0410, Subpart 8

1. The Applications Satisfy the Subpart 8 Requirements Applicable to Both the FTB and HRF Dams.

288. DNR has considered the need for the FTB Dam and HRF Dam in terms of the quantifiable benefit, taking into consideration the anticipated socio-economic benefits, as well as the benefits of addressing the materials previously abandoned on the LTVSMC property, and the benefits of utilizing a brownfield site, rather than a greenfield site, for the NorthMet operation. See ¶¶ 22, 23, 28 through 32, and 113. Based on this analysis, the DNR concludes that the Permits will provide significant quantifiable economic and socioeconomic benefits, addressing the needs of the local community by providing jobs, tax revenue, and other benefits, and will also contribute substantially to the needs of the community and the environment by addressing existing site conditions arising from prior mining-related activity, including seepage from the LTVSMC tailings.

289. DNR has also extensively examined the “stability of the dam, foundation, abutments, and impoundment,” under all the conditions as required by Minn. R. 6115.0410, subp 8D. The DNR has concluded that the HRF and FTB Dam proposals are adequate with respect to these stability requirements on current, prudent, engineering practice, and employs a degree of conservatism appropriate to hazards, as set forth in detail in these findings. See ¶¶ 63 through 70, ¶¶ 97 through 110, ¶¶ 117 through 124, ¶¶ 142 through 173, ¶¶ 176 through 183, ¶¶ 200 through 208, and ¶¶ 235 through 241.

290. The DNR has determined the FTB Dam and HRF Dam, as proposed and permitted, are adequate with respect to discharge and/or storage capacity capable of handling the design flood based on current, prudent engineering practice and the hazard classification. See ¶ 111

291. The DNR has determined the FTB and HRF Dams, as proposed and permitted, will satisfy the requirements of Minn. R. 6115.0410, subp. 8, and be adequate with respect to compliance with prudent, current environmental standards and with sound engineering practices throughout its existence. The FTB and HRF Dam Safety Permits will also require ongoing monitoring, and maintenance to ensure the stability of the Dam and the adherence to permitting requirements in perpetuity, or until closure of the Dams and termination of the Dam permits. DNR is requiring financial assurances designed to provide for long-term maintenance of the NorthMet Project facility, including the FTB and HRF Dams. *See* ¶¶ 81 through 246.

2. The FTB Dam Application Satisfies the Subpart 8 Requirements Applicable to Class I Dams

292. For Class I dams, Minn. R. 6115.0410, subp. 8, also specifies that the commissioner “shall determine if the proposal is adequate with respect to: a showing of lack of other suitable feasible and practical alternative sites, and economic hardship which would have a major adverse effect on population and socioeconomic base of the area affected.”

293. The DNR has identified the FTB Dam as a Class I Dam, and has evaluated the FTB Application, to determine if it is adequate with respect to “a showing of lack of other suitable feasible and practical alternative sites, and economic hardship which would have a major adverse effect on population and socioeconomic base of the area affected” as required by Minn. R. 6115.0140, subp. 8. *See* ¶ 268.

294. The DNR, in environmental review, considered whether other suitable feasible and practical alternative dam sites exist to determine whether the proposal is adequate, in accordance with Minn. Rules § 6115.0410, subp. 8. In considering whether other suitable feasible and practical alternative sites exist the DNR considered the fact that much of the infrastructure at this site is already in place. Rather than creating an entirely new mine processing site, this proposal will reuse an existing site. *See* FEIS at § 3.1.1.5. The DNR concludes that the FTB Permit Application is adequate with respect to a lack of other suitable feasible and practical alternative sites. The FTB will be constructed on the area of the former LTVSMC tailings basin, which is preferable to greenfield site or another non-mining-related site.

295. As set forth in ¶¶ 22, 23, 28 through 32, and 113, the DNR has considered the economic and socioeconomic impacts of the Project and finds that the Project will provide substantial economic and socioeconomic benefits, and that, were the Project not to be implemented, the surrounding community would suffer economic hardship in view of the failure to provide jobs, tax revenue and other benefits attributable to the Project, in satisfaction of the requirements under Subpart 8 with respect to these issues.

3. The HRF Dam Application Satisfies the Subpart 8 Requirements Applicable to Class II Dams.

296. For Class II dams, Minn. R. 6115.0410, subp.8B, requires that the commissioner determine if the proposal is adequate with respect to: a showing of lack of other suitable feasible

and practical alternative sites and that the dam will benefit the population or socioeconomic base of the area involved.

297. The DNR has determined that the HRF Dam is a Class II Dam. *See* ¶¶ 199 and 230 through 234.- DNR has, therefore, considered the HRF Application to determine “if the proposal is adequate with respect to: a showing of lack of other suitable feasible and practical alternative sites and that the dam will benefit the population or socioeconomic base of the area involved.” Minn. R. 6115.0410, subp. 8 Consistent with its determination as to the lack of other suitable feasible and practical alternative sites for the FTB Dam, the DNR determines that there is a lack of other suitable feasible and practical alternative sites for the HRF Dam. The HRF would be constructed primarily on the area of the former LTVSMC emergency basin. *See* ¶¶ 5-6, 39-43. In addition, the DNR finds that the Project will provide substantial economic and socioeconomic benefits and that the proposal satisfies the requirements with respect to these issues under Minn. R. 6115.0410, subp.8. *See* ¶¶ 22, 23, 28 through 32, and 113

298. Although the DNR is not required to do so, the DNR has required the Applicant to take measures to reduce risks of the HRF Dam. For example, DNR is requiring the Applicant to implement a Contingency Action Plan (CAP) to address potential emergencies relating to the Project. *See* HRF Permit Condition 30

4. Both the HRF and FTB Dam Applications Satisfy Subpart 8 Requirements.

299. The DNR has evaluated the FTB am and HRF Applications in accordance with the requirements of Subpart 8. Based on its consideration of the Applications and the other information in the record, the DNR concludes that the FTB and HRF Applications fulfill all the applicable requirements of Minn. R. 6115.0410, subp. 8.

5. Minnesota Rule 6115.0410, Subparts 9 through 13 Apply to PolyMet as Permittee and are Incorporated into the Permits.

300. Minnesota Rule 6115.0410, subps. 9 through 13 apply to dam projects after permitting and impose specific requirements on permittees. The rule also requires inspections of construction and other work, requires the permittee to place markers in the area of each dam, and submit construction reports

301. Minnesota Rule 6115.0410, subp. 10 requires submission of as built plans and data, including supplementary drawings or descriptions of the dam as actually constructed, and “any other items which may be of permanent value bearing on the adequacy and permanency of the dam.”

302. Minnesota Rule 6115.0410, subp. 11 requires a formal statement from the designer or professional engineer in charge of construction inspection. The statement represents that to the best of that individual’s knowledge, the dam was completed in accordance with

approved designs, plans, and specifications. In addition, Subpart 11 requires that the permittee file an affidavit of costs.

303. Minnesota Rule 6115.0410, subp. 12, provides for “impoundment approvals” to allow adequate time for inspection after construction and before impoundment.

304. Minnesota Rule 6115.0410, subp. 13, requires permittee to submit performance reports for complex or hazardous dams. .

305. PolyMet will be subject to the requirements in Minn. R. 6115.0410, Subparts 9 through 13, as conditions of the FTB and HRF Dam Safety Permits. *See generally* FTB and HRF Permit Conditions.

IX. THE CHANGE FROM CDSM TO A MODIFIED BUTTRESS, REQUIRES AN SEIS

306. Minn. R. 4410.3000, subp. 3A, outlines the conditions the Responsible Government Units (RGUs) must consider to determine whether a proposed project should undergo preparation of a supplemental EIS after the final EIS has been determined adequate. As set forth in ¶¶ 67 through 70 and ¶¶ 129 through 141, the DNR has met this evaluated these factors and determined that an SEIS is not required.

X. DNR HAS CONSIDERED ADDITIONAL REQUIREMENTS WITH RESPECT TO THE DAM SAFETY PERMIT APPLICATIONS.

307. Minnesota Rule 6115.0490 requires Class I dam owners to prepare a contingency plan and file it with DNR for approval. The contingency plan should provide for notification of any persons whose lives, property, or health may be endangered by failure, misoperation or other circumstances or occurrence affecting the dam. PolyMet submitted contingency action plans (CAP) for both the FTB Dam HRF Dam to the DNR through MPARS. The permit conditions require PolyMet to regularly update the plans. *See* FTB Permit Condition 32 and HRF Permit Condition 30. These plans must be approved prior to dam construction.

308. Minnesota Rule 6115.0390, subp. 1, provides for termination of operations and perpetual maintenance and further requires that : “Unless the dam is removed, the owner shall perpetually maintain the dam and appurtenances so as to ensure the integrity of the structure until such time that it is removed. Minn. Rules 6115.0390, subp. 1. As of November 1, 2018, PolyMet is the owner of the LTVSMC facility where the FTP and HRF Dams will be located.

309. As owner of the LTVSMC facility, PolyMet is obligated to perpetually maintain the FTB and HRF Dams and appurtenances to ensure their integrity. As required by Minn. R. 6115.0390, subp. 2, the Permits require PolyMet to obtain financial assurance assures perpetual maintenance. *See* FTB Permit Condition 25 and HRF Permit Condition 27.

310. As set forth in ¶¶ 267 through 309, the DNR has determined that PolyMet has met its burden of proof under Minn. Stat. § 103G.315, subd. 6.

311. As set forth in ¶¶ 267 through 310, the DNR has determined that the Dams proposed in the Applications satisfy the requirements set forth in Minn. Stat. § 103G.315, subd. 3, and that, consequently, the Permits may be issued

XI. DNR HAS DETERMINED THAT THE ISSUANCE OF THE PERMITS COMPLIES WITH MERA.

312. The Minnesota Environmental Rights Act (“MERA”) requires the DNR to consider whether the conduct that is to be permitted will result in “pollution, impairment or destruction of natural resources.” Under MERA, no conduct that results in pollution, impairment, or destruction of natural resources shall be authorized unless there is no feasible and prudent alternative. Minn. Stat. § 116B.09, subd. 2. “Pollution, impairment, or destruction” under MERA “is any conduct by any person which violates, or is likely to violate, any environmental quality standard, limitation, rule, order, license, stipulation agreement, or permit of the state or any instrumentality, agency, or political subdivision thereof which was issued prior to the date of the alleged violation occurred or is likely to occur or any conduct which materially adversely affects or is likely to materially adversely affect the environment.” *Id.*, § 116B.02, subd. 5.

313. In reviewing the record and the Application, the DNR considered the quality and severity of any adverse effects of the proposed action on the natural resources that might be affected by Poly Met’s proposed dams, including any potential long-term adverse effects to those resources, the types of resources at issue, the potential significant consequential effects of the proposed dams on other natural resources, and the direct and consequential impacts of the proposed dams on the affected resources. *See State ex rel Schaller v. County of Blue Earth*, 563 N.W.2d 260, 267 (Minn. 1997).

314. The Dam Safety Permits require PolyMet to secure all required environmental authorizations and comply with all other applicable legal requirements, including with requirements enforced by other regulatory entities, including, without limitation, the MPCA, the DNR, the Cities of Hoyt Lakes and Babbitt, St. Louis County, the St. Louis County Soil and Water District, the USACE and the EPA.

315. As detailed herein, the construction, operation, and maintenance of the FTB and HRF Dams in accordance with their permits will comply with all applicable state and federal environmental protection standards, including, without limitation, the requirements of Minnesota Statutes Chapter 103G and Minnesota Rules, Chapter 6115 governing dam safety. The potential effects on natural resources resulting from the proposed NorthMet Project were extensively evaluated in the FEIS. The permit issued pursuant these Findings of Fact require PolyMet to secure all applicable permits and to comply with all other applicable legal requirements, including water quality requirements enforced by the MPCA. In light of the foregoing, the DNR concludes that the work authorized by these Permits, subject to these conditions contained

therein, will not result in pollution, impairment, or destruction of natural resources in violation of MERA.

316. As outlined in Paragraphs 269 through 316, the DNR has considered the proposed construction, operation, and maintenance under the Permits in accordance with MERA, and determines that the Permits satisfy the applicable statutory requirements

Based upon the above Findings of Fact, the DNR makes the following:

CONCLUSIONS

1. Minnesota Statutes § 103A.205 provides:

It is the policy of the state to promote the retention and conservation of all water precipitated from the atmosphere in the areas where it falls, as far as practicable. Except as otherwise expressly provided, all . . . departments . . . of the state or political subdivisions having any authority or means for constructing, maintaining, or operating dams or other works or engaging in other projects or operations affecting precipitated water shall use the authority, as far as practicable, to effectuate the policy in this section.

2. The DNR has the authority to issue dam safety permits pursuant to Minn. Stat. 103G.315 and Minn. R. subps. 6115.0300 through 6115.0520.

3. Minnesota Statutes 103G.315, subd. 2 requires that the DNR make findings of fact on issues necessary for determination of the applications considered. Orders by the DNR must be based upon findings of fact made on substantial evidence. *Id.*

4. As set forth in ¶¶ 267 through 312, the DNR has determined that PolyMet has met its burden of proof under Minn. Stat. § 103G.315, subd. 6.

5. As set forth in ¶¶ 39 through 312, and Paragraphs 1 the design, construction, operation and maintenance of the HRF Dam and the FTB Dam meet the requirement for the issuance of dam safety permits under Minn. Stat. 103G.315 and Minn. R. Sups. 6115.0300 through 6115.0520.

6. As set forth in ¶¶ 267 through 312, the DNR has determined that the FTB Dam and the HRF Dam proposed in the Applications satisfy the requirements set forth in Minn. Stat. § 103G.315, subd. 3, and that, consequently, the Permits may be issued.

7. The work authorized by the HRF Permit and the FTB Permits, subject to the terms and conditions therein, will not result in pollution, impairment, or destruction of natural resources. See Minn. Stat. § 116B.02, subd. 5.

8. The DNR has the discretion to waive a hearing on dam safety permit applications and or a permits to be issued or denied without a hearing, Minn. Stat. § 103G.311, subd. 4.

9. Any Findings of Fact that might properly be termed Conclusions and any Conclusions that might properly be termed Findings of Fact are hereby adopted as such.

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Based upon the foregoing Findings of Fact and Conclusions, the DNR now enters the following:

ORDER

1. The DNR hereby waives any public hearing on the Application for Dam Safety Permit Application 2016-1380 pursuant to Minnesota Statutes § 103G.311, subd. 4.

2. Based upon all the files, records, and proceedings in this matter and upon the DNR's Findings of Fact and Conclusions, Dam Safety Permit 2016-1380, is hereby issued to Poly Met Mining, Inc. to construct, operate and maintain an FTB Dam subject to the conditions set forth in the Permit.

3. PolyMet Mining, Inc., the Board of Supervisors of the North St. Louis County Soil and Water Conservation District, or the governing bodies of the City of Hoyt Lakes, the City of Babbitt or St. Louis County may file a demand for a hearing on the Application within 30 days after receiving mailed notice of this Order.

Approved and adopted this 1st day of November, 2018

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

/s/ Tom Landwehr
TOM LANDWEHR
Commissioner
Minnesota Department of Natural Resources

Based upon the foregoing Findings of Fact and Conclusions, the DNR now enters the following:

ORDER

1. The DNR hereby waives any public hearing on the Application for Dam Safety Permit Application 2016-1383 pursuant to Minnesota Statutes § 103G.311, subd. 4.

2. Based upon all the files, records, and proceedings in this matter and upon the DNR's Findings of Fact and Conclusions, Dam Safety Permit 2016-1383, is hereby issued to Poly Met Mining, Inc. to construct, operate and maintain an HRF Dam subject to the conditions set forth in the Permit

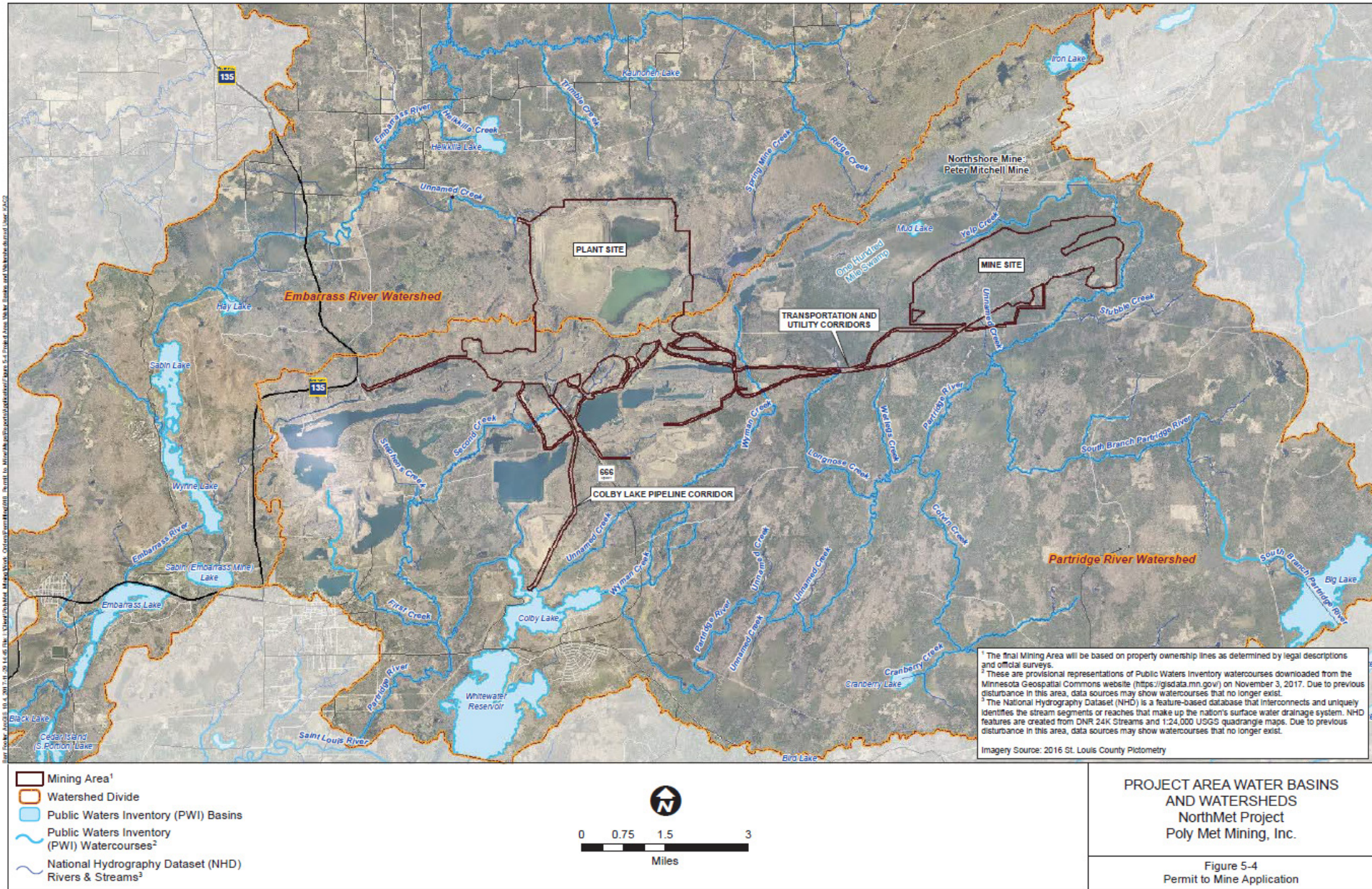
3. PolyMet Mining, Inc., the Board of Supervisors of the North St. Louis County Soil and Water Conservation District, or the governing bodies of the City of Hoyt Lakes, the City of Babbitt or St. Louis County may file a demand for a hearing on the Application within 30 days after receiving mailed notice of this Order.

Approved and adopted this 1st day of November, 2018

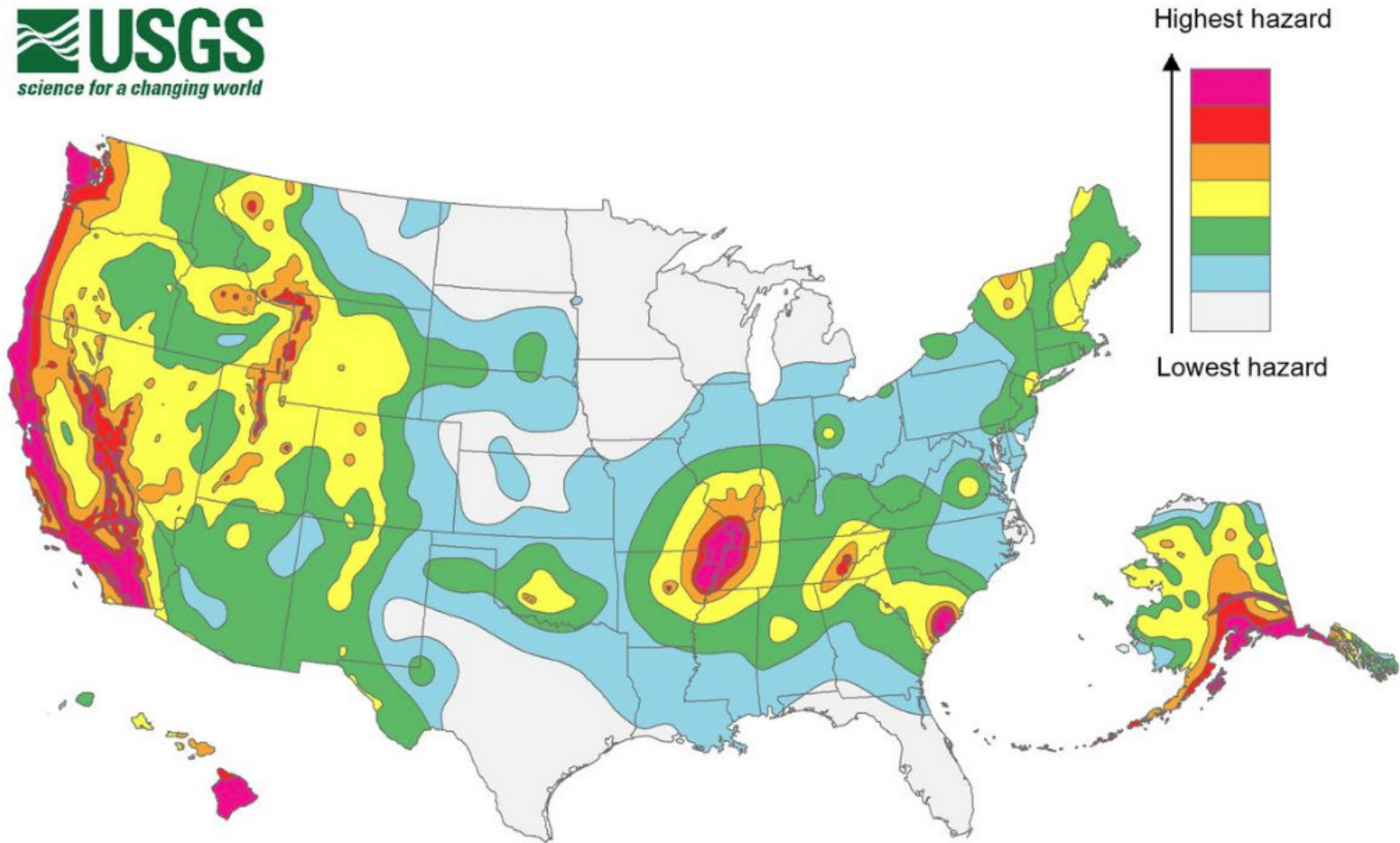
STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

/s/ Tom Landwehr
TOM LANDWEHR
Commissioner
Minnesota Department of Natural Resources

Attachment 1

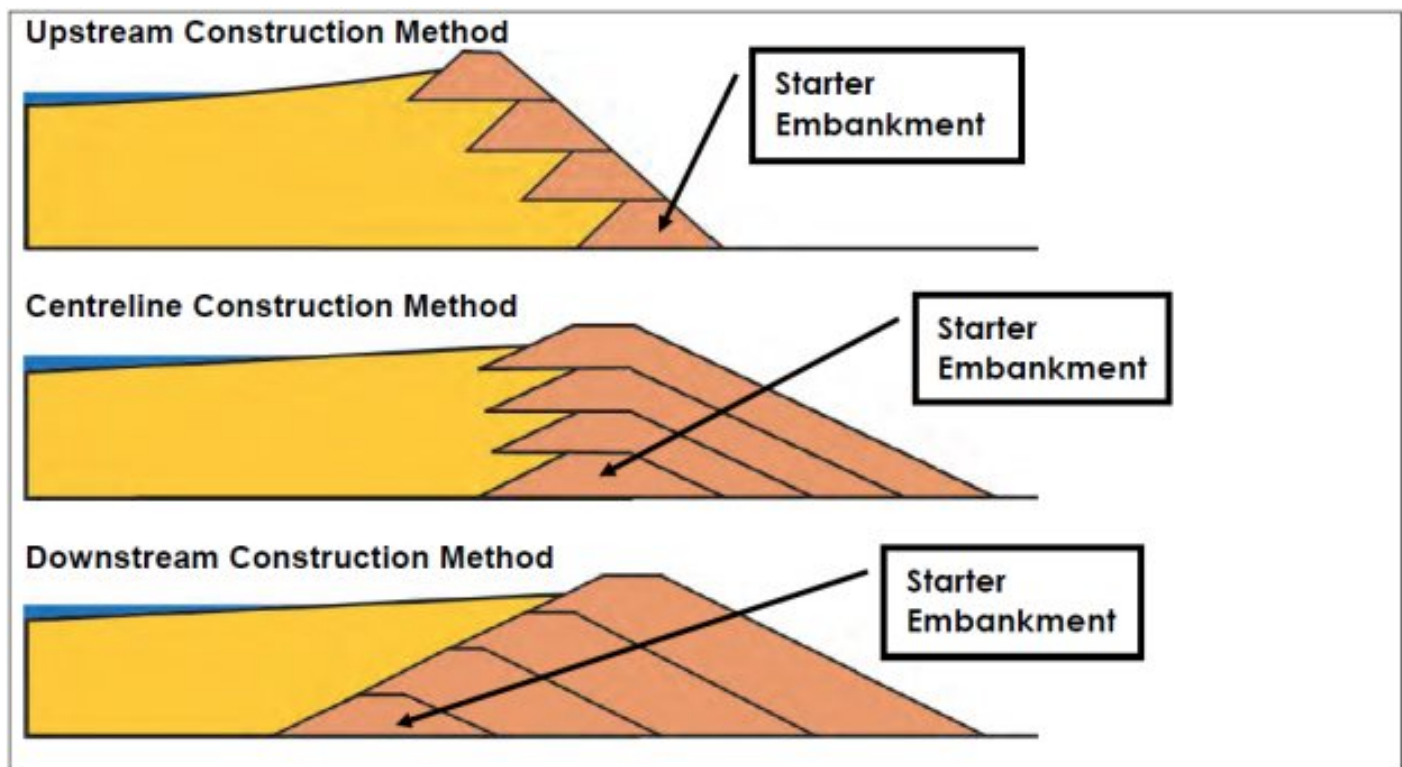


Attachment 2



<https://www.usgs.gov/media/images/2014-usgs-national-seismic-hazard-map-0>

Attachment 3



Source: Sisson Project Final Environmental Impact Assessment Report, Stantec Consulting Ltd.