



Kensington Mine 2017 Environmental Audit

Coeur Alaska, Inc.

Juneau, Alaska

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Abbreviations and Acronyms

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
APDES	Alaska Pollutant Discharge Elimination System
ARD	acid rock drainage
Audit Team	HDR Audit Team
COD	Certificate to Operate a Dam
EMP	Tailings Storage Facility Ecological Monitoring Plan
EPA	U.S. Environmental Protection Agency
FHP	Fish Habitat Permit
gpm	gallons per minute
GPPTP	Graphitic Phyllite Package Treatment Plant
GPTTF	Graphitic Phyllite Tailings Treatment Facility
HDPE	high-density polyethylene
IWMDP	Integrated Waste Management and Disposal Plan
M	million
MWTP	Mine Water Treatment Plant
NPDES	National Pollutant Discharge Elimination System
O&M Manual	Operations and Maintenance Manual
POA	Plan of Operations Approval
POO	Plan of Operations
PSI	Periodic Safety Inspection
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RTP	Recycle Tailings Pond
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
SPLP	Standard Precipitation Leaching Procedure
SPCC	Spill, Prevention, Control, and Countermeasure
SWPPP	Stormwater Pollution Prevention Plan
TSA	technical systems audit
TTF	Tailings Treatment Facility
TTFTP	Tailings Treatment Facility Treatment Plant
TWUA	Temporary Water Use Authorizations
TWUP	Temporary Water Use Permit
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
WMP	Waste Management Permit
WQS	water quality standards
WTP	Water Treatment Plant



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1.0 Purpose and Objectives

HDR, Inc. conducted an environmental compliance audit of Kensington Mine, located near Juneau, Alaska, for Coeur Alaska (Kensington) and the Alaska Department of Natural Resources (ADNR) and Alaska Department of Environmental Conservation (ADEC). This Environmental Compliance Report outlines the audit purpose and approach, audit findings, any systematic observations, and recommendations for improvement.

Kensington Mine's Waste Management Permit (WMP), Reclamation Plan Approval, and Certificate to Operate a Dam (COD) authorizations require an environmental audit prior to renewal of the permit. The audit is to be an objective, systematic, and documented review of the conditions, operations, and practices related to permit requirements and facility management conducted under only these authorizations. No prior environmental audit has been completed at the mine.

The environmental compliance audit at Kensington Mine was conducted to compare and evaluate facility operations against available permits and state regulations. Program areas and permits included in the audit scope are summarized in Table 1. The audit results will be used by Kensington and the State of Alaska to assist in updating, renewing, or issuing authorizations and permits; in updating policies, plans, and procedures; and in determining compliance with permits and authorizations.

The objectives of the audit were as follows:

- Assess the facility's environmental compliance performance.
- Identify potential corrective actions for noncompliance observations.
- Identify common or systematic environmental issues across the facility.
- Provide an overall assessment of environmental performance, including recommendations for resolving system-wide areas of noncompliance.
- Provide an overall assessment of, and recommendations for, agency oversight.
- Assess the adequacy of financial assurance for reclamation, closure and long-term operation, maintenance and inspection of post-closure facilities.

2.0 Permits and Authorizations

The HDR Audit Team (Audit Team) was composed of the following personnel:

Molly Reeves, CPG, Hydrogeologist

Nicholas LaFronz, P.E., Senior Geotechnical Section Manager

Paul McLarnon, Power Market Lead/Solid Waste Specialist

Michael Murray, PhD, Resources Group Manager/Reclamation and Soils Specialist

The Audit Team reviewed compliance with the state permits and authorizations listed in Table 1, as required under the WMP and the Reclamation Plan Approval.

Table 1. Environmental Programs and Permits Included in Audit

Program Area/Permit	Site Location	Permit	Issue Date	Expiration Date
Waste Management Permit	Underground mine workings, Development rock stockpiles, Tailings Treatment Facility, Paste disposal Hazardous chemical storage and containment, Treatment plant effluent and sludge, and Graphitic phyllite storage and disposal.	2013DB0002	9/20/2013	9/19/2018
Reclamation Plan Approval	Mine Site	J20133158	5/3/2013	5/3/2018
Certificate to Operate Dam	Lower Slate Lake Dam	FY2015-13-AK00308	2/13/15	12/31/17

The Audit Team reviewed the following permits and authorizations, which represent the main regulatory drivers for the mine environmental management program:

- ADEC Waste Management Permit
 - Integrated Waste Management and Disposal Plan, November 2013
 - Quality Assurance Project Plan (QAPP) and Freshwater Monitoring Plan (FWMP), June 2017
 - Tailings Storage Facility Ecological Monitoring Plan (EMP), May 2005
 - Tailings Treatment Facility – ARD Remediation Plan, June 2013
- Reclamation and Closure Plan Approval
 - Reclamation and closure plan update for the Kensington Gold Project, Borough of Juneau, Alaska, April 2013
- Certificate of Approval to Operate a Dam (COD) for Kensington Dam
 - Operations and Maintenance Manual for the Lower Slate Lake Dam, Revision 3, January 2015
 - Emergency Action Plan, Lower Slate Lake Tailings Dam, December 2012
 - Stage 3 Dam Crest Raise Detailed Design Package, Final Design Report, Lower

Slate Lake Tailings Dam, March 2017

- Periodic Safety Inspection Report No. 2, Lower Slate Lake Tailings Dam, December 2014
- Draft Periodic Safety Inspection Report No. 3, Lower Slate Lake Tailings Dam, July 2017
- 2016 Annual Performance Report, Lower Slate Lake Tailings Dam, October 2016

As agreed to by Kensington, ADNR, and ADEC, environmental related permits and plans not covered by the Audit Team review include:

- Alaska Pollutant Discharge Elimination System (APDES) Water Discharge Permit (AK0050571)
- Water Use Authorizations
- U.S. Environmental Protection Agency (EPA) Hazardous Waste
- Spill, Prevention, Control, and Countermeasure (SPCC) Plan
- Stormwater Pollution Prevention Plan (SWPPP)
- U.S. Army Corps of Engineers (USACE) 404 Permit
- Potable Water Supply
- Sewage Treatment
- Toxics Release Inventory
- Federal Aviation Permits
- ADEC Air Quality Control Permit

Kensington maintains an environmental database management system for all environmental data related to the project. Data requests were provided to the Audit Team as requested to facilitate record auditing primarily while on site. Key permits were obtained from the ADNR and ADEC project files prior to the field audit. Kensington provided additional correspondence items as requested. The implementation of each of the document terms was checked during the field audit and found to be generally in compliance.

3.0 Approach and Methodology

The audit methodology can be generally broken into three main tasks: pre-audit activities, onsite audit, and post-audit reporting.

3.1 Pre-audit Activities

The pre-audit activities were performed prior to the facility visits. Activities included review of available project permits and plans and participation in a project kickoff meeting prior to the onsite visits.

Permit and Plan Review. The intention of the preliminary review was to obtain a high-level understanding of the applicable permits and plans in place at the time of the permit review. The Audit Team gathered available mine permits, plans, and agency authorizations from online resources, from ADEC and ADNR office visits, and directly from Kensington to ensure the latest versions were reviewed.

Project Kickoff Conference Call. A project kickoff conference call was performed on August 8, 2017, with the mine permitting team composed of ADNR, ADEC, Alaska Department of Fish and Game (ADF&G), U.S. Forest Service (USFS) Tongass Office, Kensington Environmental Lead, and the Audit Team. This call provided a general overview of the assessment process, scope of permits and authorizations that the audit would address, and overall project schedule.

3.2 Onsite Audit Activities

The Audit Team performed the onsite audit of the Kensington Mine from September 12-13, 2017 and participated in the following: site kickoff meeting, site walk-through, review of provided documents, interviews, and daily debrief meetings.

Site Kickoff Meeting. Upon arrival at the site, the Audit Team attended a site-specific safety training, and a site kickoff meeting facilitated by Kensington Mine staff and the Audit Team. Attendees included the Kensington Environmental Team and facility and department managers. The purpose of the meeting was to review the scope and purpose of the audit, introduce personnel involved in conducting the audit, and define the schedule for the audit for tours and interviews.

Site Walk-through. The Audit Team participated in a tour of the mine guided by the Kensington Mine Environmental Manager, Kevin Eppers. The Dam Certification review by the Audit Team Geotechnical Engineer was guided by the Tailings Treatment Facility (TTF) Operational Manager, Dan King. During the walk-through, the Audit Team viewed facilities and activities specific to the environmental permits. Field observations were discussed with the site personnel during the site walk-through and during interviews. In addition to the mine site-wide tour, individual Audit Team members toured specific facilities with facility managers or specific Environmental Team personnel with operational knowledge of the facilities and operations. Facilities that were inspected included the following:

- Mine Water Treatment Plant (aka Mine sump WTP)
- Comet Development Rock Facility
- Underground paste plant
- Hazardous waste storage facilities
- Graphitic phyllite storage areas
- Graphitic phyllite package treatment plant (aka Seep WTP or acid rock drainage (ARD) treatment plant)
- Naturally occurring graphitic phyllite exposed during operations and seepage collection sumps
- Secondary containment
- All of the WMP monitoring locations
- Dam crest elevation and upstream geomembrane liner
- TTF impoundment operating water level
- TTF water treatment plant (WTP)
- Operating status of the Dam and TTF appurtenances, including:
 - Diversion and reclaim water pipelines (Appendix A Photos A, B, C, D, E, F and G)
 - Barge water reclaim and return system including flow meter and water level transducer (Appendix A Photos H, I, J, L and L)
 - Fresh water diversion flow Parshall Flume including totalizing flow meter (Appendix A Photos M, N and O)
 - Stage 2 Dam and Interim Spillway (Appendix A Photos P, Q, R, S, T, U, V and W)
 - Dam foundation and dam embankment vibrating wire piezometers (Appendix A Photo X)
 - Downstream 96-inch diameter, 40-foot deep lift station (HDPE manhole collection sump), seepage return line, and totalizing flow meter (Appendix A Photos Y, Z, AA and BB), and
 - Acid Rock Drainage (ARD) seepage collection system downstream of the Dam toe, including geomembrane-lined sump, piping, and lift station sump (manhole) (Appendix A Photos CC, DD, EE, FF, GG, HH and II).

Interviews. The Audit Team conducted interviews with Kensington Mine representatives with responsibilities of overseeing environmental regulatory requirements. The purpose of these interviews was to obtain an understanding of the environmental programs and procedures for compliance with permits and plans, and to assess how well those programs are understood and implemented.

Records and Document Review. The Audit Team reviewed applicable permits that were readily available and organized onsite. The auditors made observations of operational activities within the context of applicable permits and environmental requirements, taking note of any compliance gaps. Additional documents provided by Kensington that were reviewed included but were not limited to waste logs, various inspection reports, Environmental Database EQWin, and filing system.

Daily Briefing Sessions. The Audit Team participated in a daily briefing session with Environmental Team personnel. The auditors reviewed the day's progress and any specific observations.

3.3 Post-audit Activities

Following the audit, observations were summarized in this Environmental Audit Report and interviews were conducted with agency personnel. The Audit Team interviewed various agency personnel, primarily those who manage the WMP, financial assurance, and dam safety and engineering.

4.0 Interviews

4.1 Agency Interviews

The Audit Team interviewed agency personnel regarding the following aspects of the audit purpose and Kensington's permits:

- audit scope,
- various aspects of the authorizations to understand the intent of permit language,
- request additional reporting or correspondence,
- request a status update on submitted documents,
- gather information regarding the agency perspective on the mine compliance and ongoing ability to meet obligations and agency requests, and
- to gauge adequacy of State oversight.

The regulatory agency personnel for this project were of significant help to the Audit Team on all of these accounts. Table 2 lists the interviews with agency personnel conducted by the Audit Team and includes a brief summary of the interaction.



Table 2. Audit Interviews with Agency Personnel

Name and Title	Agency or Company	Date	Summary
Allan Nakanishi	ADEC	Phone Call dated 10/17/17 Emails dated 11/3/17 and 9/12/17	<ul style="list-style-type: none"> • Updating the Integrated Solid Waste Management Plan to incorporate the use of sediment bags at the Comet MWTP and MWTP Sediment Disposal, Spent Carbon Filters from the TTF Water Treatment Plan and other general waste management practices occurring at the facility. • Discussed the findings of the Tailings Treatment Facility Studies (ADF&G 2016). Findings of the study should be factored into the closure plan but it was not clear if the closure plan should be modified to remove the sediment cap currently planned for the TTF. • ADEC did not expect any major compliance issues from the audit but does expect that findings of the audit will result in minor modifications to the permit and plan of operations that will address operations that were not anticipated at the time these documents were drafted. • ADEC is not aware of any on going issues or problems • Clarification of tailings geochemistry sampling and analysis requirements <p>Reporting of monitoring results and ADEC review of analytical results reporting and trend review. ADEC's review of the analytical results is a qualitative review.</p>
Kate Kanouse	ADF&G	Phone Call Dated 10/20/17	Discussed the biological monitoring program at the mine and recommendations moving forward for renewal of the permits.



<p>Mr. Charles F. Cobb, P.E., Dam Safety Engineer</p>	<p>ADNR Dam Safety</p>	<p>Phone Call dated 11/07/2017</p>	<ul style="list-style-type: none"> • The COD is a recurring certificate based on a Periodic Safety Inspection (PSI) performed every three years, and has an expiration date tied to performance of the PSI and associated report. The current version of the Operations and Maintenance (O&M) Manual (Revision 3) is dated January 29, 2015. The Draft 2017 PSI Report was submitted by Kensington Mine in June 2017; he reviewed the draft report and provided comments, and subsequently approved the Final 2017 PSI Report in September 2017 (Final 2017 PSI Report is dated October 3, 2017). • Renewal of the COD by ADNR Dam Safety is pending. Once he confirms with KGM that the current O&M manual does not require revision and is still in force with no changes, with the Final 2017 PSI Report having been approved, he will renew the COD. The renewed COD will include requirements (special conditions) that the recommendations in the Final 2017 PSI Report are to be followed. A draft certificate will be issued with current terms and conditions, which allows the Kensington Mine to review and comment on the requirements, and clarify the deadlines for any action items as being feasible. • The current PSI did not identify any critical dam safety issues. There was nothing in the PSI of great concern to Mr. Cobb. He indicated that the dam design is robust, inspections were adequate, and there are no identified compliance issues from the Dam Safety standpoint. • Piezometric head levels in the dam embankment and foundation as measured by the vibrating wire piezometers spike due to freeze-up of the seepage manhole sump outlet pipe when the pump is not operating. Mitigation of this issue by the Kensington Mine is understood to be in process, but was not yet complete as of the September Audit Team site visit. • The trigger levels for piezometric head in the embankment need to be reviewed and revised to reflect the values in the Stage 3 Dam raise stability analysis. • Daily manual readings are currently used to detect the piezometric level spikes. Kensington Mine staff should consider installing an automated system with alarms for the trigger levels. This is not included in the current recommendations in the 2017 PSI Report. • Calibration of the totalizing flow meters have not been calibrated in the past and don't require periodic calibration, per the Audit Team's communications with Kensington Mine staff. The collected flow data is input to the site water balance and is critical to understanding the operation of the TTF. At Mr. Cobb's recommendation, the Audit Team reviewed the flowmeter manufacturer's Reference Manual for the Rosemount 8700 Series Magnetic Flowmeter Sensors contained in the O&M Manual (Revision 3, Appendix A2). The Reference Manual indicates that the Rosemount flowmeter sensors are wet calibrated at the factory and that no further calibration is necessary during or subsequent to installation. The flowmeter sensors appear to include an internal sensor calibration test to verify the sensor calibration status. • Water Treatment Plant (WTP) capacity is limiting the ability to treat and discharge water. Mr. Cobb is not so concerned from a dam safety perspective given the capacity of the Stage 2 Interim Spillway to protect the dam, but an unplanned spillway discharge would be an operational upset. The additional stored water in the TTF encroaches on the 200-yr, 24-hr storm surge storage between elevations 697.3 feet and the invert
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			<p>elevation of 709 of the Stage 2 Interim Spillway, and stores more water atop the tailings than necessarily needed. The benchmark WTP treat and discharge rate is understood to be 700 gallons/minute. Once the Stage Dam 3 raise is complete, there will be additional water storage buffer. The Kensington Mine needs to pay close attention to the TTF water balance for rest of 2017 year and into spring 2018 until the Stage 3 raise is completed.</p> <ul style="list-style-type: none"> • Knight Piesold did not perform an adequate geotechnical investigation to characterize the subsurface conditions in the abutment areas to support design of the extension to the grout curtains, so ADNR has periodically required through permit conditions in the COD that the Kensington Mine perform supplemental investigation of the abutments, for example for the Stage 3 Dam raise. • ARD seepage effects on the structural integrity of the shotcrete sidewalls of the Stage 2 Interim Spillway, including degradation and spalling of the shotcrete from the walls. He believes that this issue was addressed by the Stage 3 Dam raise design, including relief underdrains for the Stage 3 Spillway which will divert collected seepage into the seepage collection sump, and covering the Stage 2 Interim Spillway bottom and walls with structural concrete or roller compacted concrete. With these changes, the ARD seepage should not report to the plunge pool in the future, maintaining separation of the affected seepage from fresh water. • Requested of Kensington that the some consideration of closure be included in the Stage 3 Dam raise design, and was able to get discussion of concepts for closure included as part of Stage 3. Mr. Cobb indicated that another modification to the dam needs to be planned for as part of final closure. He indicated that the dam is currently designed like an operational water storage dam with steep downstream slope, and he perceives that a high degree of post-closure maintenance for an indefinite service life will be needed for the current dam configuration. Reinvasion of vegetation such as large spruce trees onto the dam slope, and clogging of the final closure spillway with woody debris, likely will occur. Mr. Cobb's closure plan recommendations include flattening the downstream dam slope with available Kensington Mine waste rock, and constructing a high-capacity self-cleaning final spillway with robust spillway abutments, to create a passive system with high factor of safety and low maintenance needs post-closure. He recognizes that a mine expansion is under consideration by Kensington Mine that would affect the dam and TTF.
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4.2 Mine Interviews

The Audit Team interviewed various Kensington Mine personnel who are responsible for environmental management program tasks. Table 3 lists the interviews and brief summaries of the interview purpose.



Table 3. Audit Interviews with Kensington Mine Personnel

Name and Title	Role	Date	Summary
Kevin Eppers, Environmental Manager	Responsible for environmental permits at mine site	9/12-13/17, additional follow-up emails	Completed mine tour with him. Audit Team completed daily summaries with him. He was available for questions throughout site visit and following the visit.
Pete Strow, Sr. Environmental Coordinator and Quality Assurance Officer	Responsible for ensuring all monitoring complies with permits and QAPP, dam inspections, management of the environmental database, training, sampling, routine technical assessments of the sample collection, analysis, and data reporting	9/12-13/17, additional follow-up emails	Completed TTF and TTF dam tour with him. Audit Team completed daily summaries with him. He was available for questions throughout site visit and following the visit. Responded to all QAPP questions as the Quality Assurance Officer.
Dominick Hoy, Senior Mine Geologist	Oversees sampling of non-mineralized rock	9/13/17	Development rock sampling strategy and methodology.
Cassandra Joos, Sr. Environmental Coordinator	Sr. Environmental Coordinator	9/12-13/17	Completed mine tour with her. Audit Team completed daily summaries with her and she was available for questions throughout site visit.
Neal Wagner	Restoration Science & Engineering	10/20/17	Neal Wagner is working with the Kensington Mine to update the SPCC Plan for the facility. Revisions to the SPCC associated with the mill bench and other locations were at the facility were discussed.
Dan King, Tailings Treatment Facility (TTF) Operational Manager	Responsible for TTF operations and monitoring, including: quarterly inspections; reporting of monitoring data; updating of precipitation, temperature, diversion flows, inflows and outflows to/from the TTF, seepage flows beneath the dam, and Johnson Creek flow, and input of water level and flow data into GoldSim water balance model; bathymetric surveys of the TTF subaqueous tailings surface; accompanying third-party consultant on Periodic Safety Inspections and Annual Inspections; and reviewing and exercising the EAP.	9/12-13/17	Completed TTF and LSL dam tour with Mr. King. He was available for questions from the Audit Team throughout the site visit.

5.0 Compliance with Permits and Authorizations

5.1 Waste Management Permit

The WMP addresses disposal of waste from the Kensington Mine, hazardous chemical storage and containment, and surface water containment systems used to prevent the discharge of wastewater, reclamation and closure activities related to all facilities specified in the waste management permit, and financial responsibility.

5.1.1 Mill Tailings

The WMP authorizes (Section 1.1.1) 4.5 million (M) tons of tailings from the mill to be disposed of in the TTF. As described in the Integrated Waste Management and Disposal Plan (IWMDP) and observed by the Audit Team, tailings flow by gravity as slurry from the mill facility to the TTF through a 3.5 mile long doubled-walled, high-density polyethylene (HDPE) pipeline. Annual reports include the tonnage of tailings placed in the TTF and calculates the volume using average density to provide volume of material placed by the end of each year and comparison against the maximum storage. The last reported remaining tailings storage volume was in the 2016 annual report. In the 2016 annual report, the maximum Stage 2 storage references a Knight Piesold figure from the TFF Operations and Maintenance Manual that displays the volume available in the TTF based on the maximum tailings level for Stage 2 of 684 feet which equates to 63M cubic feet of storage capacity or 2.92M tons of tailings.

According to the 2016 annual report to ADEC (dated February 27, 2017), as of December 2016 the mine had placed 2,191,740 tons or 47,286,731 cubic feet of tailings in the TTF and had 15,713,269 cubic feet of storage remaining. Table 10 of the Annual report provides the monthly tonnage of tailings disposed at the TTF, with an average of 30,156 tons. This amount equates to an average of 650,615 cubic feet per month disposed of at the TTF, and therefore as of the time of the audit report the total storage remaining at the facility is approximately 9.2M cubic feet. At a rate of the average monthly tailings disposal for 2016, the TTF will be at maximum capacity of Stage 2 by approximately December 2018. The tailings authorized for discharge into the TTF (4.5M tons) in the WMP (September 2013) appears to match the recently approved TTF design Stage 3 maximum capacity (May 2017 maximum capacity of 4.5M tons). Kensington intends to build Stage 3 in 2018.

The WMP authorizes (Sections 1.1.1 and 1.2.6) 3M tons of tailings from the mill to be disposed of underground provided they are encased in paste to prevent leaching or movement of material post-placement in the underground stopes. According to the IWMDP, a portion (up to 40%) of the mill tailings will be mixed with cement and used as structural backfill within the underground working of the mine. As observed by auditors tailings are pumped to a paste backfill plant at the 900 foot level of the mine. In the plant tailings are mixed with cement to form a paste and directed to open stopes within the mine. The WMP does not require reporting of the amount of tailings disposed of underground; however the annual reports do include the water balance, which includes the percent of tailings sent to the paste plant on a daily basis. An average of 35% of the tailings produced in 2016 were sent to the paste plant. The total volume of tailings disposed of underground is not provided in the reporting to ADEC and it is recommended that

this be an added reporting requirement in the permit because the permit authorizes a tonnage of tailings to underground (3M tons). Using the 2016 reported tonnage disposed of at the TTF, and the estimated percentage (35%) of tailings that went to the paste plant in the reported Water Balance, the Audit Team estimates that approximately 195,000 tons of tailings were disposed of underground in 2016. If this were representative of most years, Kensington would have disposed of on the order of 1M tons of tailings underground at the end of 2017.

Kensington appears to be generally in compliance with the tailings disposal authorized in the WMP and described in the IWMDP.

5.1.2 Development Rock

The WMP authorizes development rock disposal at the development rock stockpiles as well as underground. Development rock is sampled and analyzed, which is described in the monitoring program section to follow. The WMP Section 1.10.5.5 states that annual reports should include the log of development rock waste volumes disposed of at the disposal sites and should include the dates of disposal, estimated quantities disposed, and a description of the waste. The Annual reports do include a log of volumes of development rock in tons per month disposed of in surface stockpiles. The log does not include the description of waste, where it originated in the mine, or where it was ultimately disposed (which development rock storage area). There are no specific limits on development rock volumes in the WMP, other than the WMP Permit Section 1.6.10 requirement that disposal of waste quantities may not exceed the design capacity of the disposal facility. It is not clear how ADEC would regulate Section 1.6.10 without the permittee reporting the volume of development rock disposed to each specific facility. It is recommended that a future permit specify that the annual reporting include waste volumes to each specific waste facility; and that Kensington begin to report the development rock disposal log by specific disposal facility.

According to WMP Section 1.2.7, sediments from the underground sumps are authorized to be disposed of in the Comet development rock facility. This material is also sampled and described in the monitoring program section to follow. The Environmental Manager indicated that when the underground sumps are cleaned out, sediments are disposed of either at the Comet development rock facility, an underground stope, or added to the paste backfill.

Kensington appears to be generally in compliance with the development rock disposal authorized in the WMP and described in the IWMDP.

5.1.3 Graphitic Phyllite and Graphitic Phyllite Seepage Waters

Graphitic phyllite rock, which produces acid rock drainage, is naturally occurring in the area of the TTF dam. Construction activities are associated with the dam and excavated graphitic phyllite. The Audit Team visited each graphitic phyllite storage area. The Audit Team observed four storage cells at three sites where graphitic phyllite is currently being stored awaiting disposal in the mine workings:

- **Mud Dump** - An area known as the Mud Dump contains two temporary storage cells. The cells are lined and covered with a 60-mil HDPE liner. Each temporary storage cell at this location contains a double liner system under the storage cell that is equipped with a

water collection system that allows water from between the liners and under the cell to be collected for disposal

- **Pit 4** – There are two graphitic phyllite storage cells located at Pit 4. One cell is a small staging area where graphitic phyllite from Pit 7 is staged prior to being fed into the pug plant and then taken underground for disposal. This temporary storage cell has a bottom liner consisting of 60-mil HDPE and is covered with a polyethylene plastic sheet when not in use.

A second cell (above the pug plant) is contained in a 60 mil HDPE liner at the base and is covered with a 60 mil HDPE liner. There is no collection sump at this location.

- **Pit 7** - Pit 7 is located on the TTF Road to Slate Lake. This temporary storage cell has a bottom liner consisting of 60-mil HDPE and is covered with a polyethylene plastic sheet when not in use.

All of these sites are authorized in the WMP Section 1.3. Graphitic phyllite is temporarily stockpiled until it can be mixed with cement and diorite (development rock) and is then placed in underground stopes for permanent disposal. The Audit Team observed all of the containment areas and liners were functioning. The Audit Team observed that Pit 7 had exposed graphitic phyllite (because it was actively being transported) and was missing runoff controls (e.g., berms) such that runoff in contact with graphitic phyllite had the potential to flow away from Pit 7 (Appendix A Photo JJ). The Audit Team recommended to the Environmental Manager during the Audit Site visit that berms or similar runoff controls be established at the site to contain stormwater in contact with the graphitic phyllite.

The WMP also states that graphitic phyllite is stored at the downstream side of the dam's east abutment. That material has been moved and disposed of underground. WMP Section 1.3.4 requires that once that material was removed, diorite was to be placed on the exposed in situ graphitic phyllite with 2 feet of soil cover over the diorite downgradient of the TTF dam. However, section 1.3.6 states that surfaces of graphitic phyllite not permanently exposed at closure may be covered temporarily by dental concrete. Kensington covered exposed graphitic phyllite surfaces at the downstream end of the dam with dental concrete. No diorite cover was observed, as stated in Section 1.3 of the WMP. The concrete had been recently applied to the downstream east side of the dam during the audit site visit, but the Audit Team observed seepage through the concrete and iron-stained flow paths from the concrete of a few gallons per minute (gpm) that infiltrated towards the center of the drainage. These minor flows are presumably contaminated surface flows and may have reported to the TTF dam seepage sump and/or may have found a preferential flow path to shallow groundwater continuing down the Slate drainage after infiltration. The mine Environmental Manager stated that dam seepage collected in the dam seepage sump is pumped back to the TTF pond. The Audit Team understands that any graphitic phyllite seepage is required to be treated at the Graphitic Phyllite Package Treatment Plant (GPPTP). Therefore, handling of this relatively small amount of seepage is not in compliance with required seepage handling; yet if all of the seepage infiltrates to the seepage sump, the seepage is not released from containment. The WMP requires water quality and flow monitoring of the dam seepage sump, as further described in Section 5.1.8, Monitoring Program. Any seepage that infiltrates and does not report to the dam seepage sump

would be a release from containment. It is the Audit Team's recommendation that while surface water seepage from this east side of the dam abutment is potentially reporting to the dam seepage sump, that the dam seepage sump water goes to the GPPTP rather than back to the TTF.

The observed condition by the Audit Team of the temporary graphitic phyllite cover on the eastern side of the downstream end of the dam is inadequate to ensure seepage and runoff does not escape containment (WMP Section 1.3.3). The Audit Team's recommendation is to add a crushed diorite cover to the exposed graphitic phyllite surfaces or a similar alternative because the shotcrete/dental concrete application does not appear to function as needed to contain seepage.

On the west side of the downstream end of the dam, shotcrete was applied to exposed graphitic phyllite. Seepage continues to flow through and around the shotcrete, and seepage is captured in a concrete-lined sump; water is then sampled, flow monitored, and is ultimately pumped to the GPPTP. The WMP requires water quality and flow monitoring of the effluent, as further described in Section 5.1.8, Monitoring Program.

In addition, there is graphitic phyllite exposed at the north end of the TTF in contact with TTF surface water. On June 18, 2013 ADEC issued Kensington a Notice of Violation (NOV) for failure to comply with the APDES permit. The violation was the discharge of acidic, metal-laden seepage waters from waste rock directly into the TTF. The graphitic phyllite rock was placed at the north end of the TTF after it was excavated during construction of Phase II of the dam. While the APDES permit is not a component of this audit, the activity of deposition of graphitic phyllite material, a material identified in the WMP as acid generating, in an unlined facility may also be in violation of the WMP Section 1.3.3, which requires that all seepage and runoff from the graphitic phyllite rock shall be managed to prevent it from escaping containment. While graphitic phyllite has been moved to temporary storage area and/or permanent underground disposal, unknown amounts remain and seepage is still occurring from the location. The seepage from the graphitic phyllite discharged into the TTF at the time of the NOV, and as observed by the Audit Team, is currently is collected via a berm and is pumped to a small lined pond. The WMP permits residual seepage from this area to be disposed through land application in a diorite-filled trench according to the Tailings Treatment Facility – ARD Remediation Plan dated June 10, 2013. However, the Environmental Manager stated in an interview that it is collected and delivered to the GPPTP. Because the TTF is an unlined facility, there is potential for the acidic, metal-laden seepage to infiltrate to groundwater and be transported down the Slate drainage, and/or discharge to the TTF. The WMP requires the seepage at the north end of the TTF be sampled quarterly, when accessible, until deemed non-acid generating. The Audit Team recommends that flow monitoring also be added as a monitoring requirement to the WMP to understand the volume of contaminated water produced and if the trend is decreasing.

The WMP Section 1.2.6 authorizes graphitic phyllite to be disposed of underground provided it is encased in paste and placed in a stope that is below the lowest predicted static water level at that location. At closure, the Comet Portal (850-foot level) will remain open and water will discharge out this portal; therefore, the predicted groundwater level post-closure is below the 850-foot level in the mine. A bulkhead will be installed at the Kensington Portal (900-foot level),

and the water on this side will build up and flow toward Comet Portal. According to the Environmental Manager, all of the graphitic phyllite permanent underground disposal is in the down-ramp of the mining operation, which is located below the 850-foot level. Permanent disposal of the graphitic phyllite underground is in compliance with the WMP.

5.1.4 Graphitic Phyllite Package Treatment Plant Effluent

The WMP authorizes treated water from the GPPTP to be pumped into the TTF infiltration gallery within the TTF footprint for land application. The Audit Team did not visually confirm this during the site visit. The WMP requires water quality and flow monitoring of the effluent, as further described in Section 5.1.8, Monitoring Program.

5.1.5 Treatment Plant Sludge

The sludge generated at the Mine Water Treatment Plant (MWTP) and the MWTP pond sediments are authorized for disposal at the Comet development rock pile (see Golder Associates Technical memo 073-93714.000). The MWTP sludge is actually a filter press “cake” composed of dewatered sediments. The WMP requires that MWTP sludge be placed far enough back from the face of the rock pile to ensure the solids are not carried by infiltrating water to the face of the pile. A berm shall be installed along the outside perimeter of the stockpile to ensure that solids are not transported off-site by surface water. The Audit Team observed the filter cake had been disposed on the face of the development rock pile with little to no berm in front. The Audit Team recommended that the berm be replaced and maintained in these locations where filter cake is disposed. However, while the berm at the development rock pile base was inadequate, any runoff would flow down the road and eventually to the road berm.

Sludge generated at the Tailings Treatment Facility Treatment Plant (TTFTP) is authorized for disposal by the WMP to the TTF or underground within paste backfill. Sludge generated at the GPPTP shall be disposed of within paste backfill to the mine (WMP Section 1.5.4). GPPTP sludge may also be temporarily stored in a covered containment area before disposal. According to site visit observations by the Audit Team and interview questions with the Environmental Manager, Kensington is disposing of TTFTP and GPPTP treatment plant sludge in permitted locations authorized in the WMP.

5.1.6 Secondary Containment

According to WMP Section 1.6, information on engineering changes to the mill, waste treatment seepage collection systems, or new waste streams that discharge into the TTF must be submitted to ADEC prior to any such change or discharge. The Audit Team conducted visual inspection of secondary containment of bulk storage tanks located at the Mill and also interviewed mine site personnel.

According to WMP Section 1.6.2, the Kensington Mine must provide and maintain secondary containment for all mill reagent and water treatment chemical piping and chemical mix tanks containing hazardous or toxic materials. Secondary containment is considered to be 110 percent of the largest tank within a containment area or the total volume of manifold tanks. The permittee must design and install secondary containment structures in a manner that ensures spills will not escape from the structures. Secondary containment structures must be covered, or

best management practices must be incorporated into the management of the structures to remove precipitation water, such that 110 percent of the capacity of the largest tank or container is always present. To prevent the discharge or loss of contained material, facilities shall be maintained in good working condition at all times by the permittee.

During interviews with mine staff the Audit Team confirmed at the mine maintains written communication with ADEC regarding engineering changes to the mill and waste treatment processing including the introduction of a new chemical into the mill process or waste treatment streams.

The Audit Team confirmed that secondary containment is in place for mill reagents. Mill reagents inspected during the audit were located in a covered area in the mill building, the reagents were stored in drums that were in good working order and the reagent drums were contained within a two separate curbed concrete containment areas each with a sump capable of maintaining 110 percent containment of the largest drum. Any reagent material that is captured in the sumps is used in the milling process rather than being sent off site for disposal.

The secondary containment for bulk storage fuel containers at the mill are of sufficient volume to be 110 percent of the largest tank (the Audit Team reviewed specifications in the SPCC Plan). Tanks located outdoors were either covered with a roof to prevent secondary containment areas from filling with water and/or were double walled. Based on visual inspection and review of the SPCC Plan, the Audit Team found that secondary containment surfaces, if present, were impermeable for hazardous substances being stored.

For tanks located outside that are not covered and have a containment area susceptible to water accumulation from rain or snow, the practice is to inspect secondary containment systems for accumulation of precipitation, and if no sheen is observed, personnel pump or drain the accumulated water onto the ground. If a sheen is observed, then stormwater within the secondary containment is removed using the following procedures and the volume of water pumped is documented in a discharge log:

- Faint sheen: absorb oil with absorbent pads prior to discharge.
- Heavy sheen or floating product: absorb oil with absorbent pads or have oil skimmed/vacuumed from water surface prior to discharge.
- If there is a visible sheen on top of the water, 1-2 inches of water is left in the containment sump above the pump intake.

Drum storage at the mine site occurs within lined connex shelters as well as a recently constructed covered storage area at the maintenance shop which is used for the storage of lubricants and other liquids. The covered storage area contains a concrete sloped floor with a sump capable of maintaining 110 percent containment of the largest container.

The audit team conducted an interview with Restoration Science and Engineering (RSE) who is the contractor working on updating that SPCC plan for Kensington. RSE noted that the 30,000 gallon tank located at the Mill needs verification that an overflow prevention valve is present and that the 290 gallon Fire Water Diesel Tank at the Mill needs an overflow protection valve installed.



The most recent inspection report (October 2017) showed that overfill protection was present on both of these tanks.

The most recent monthly inspection report showed that three tanks / drums on site (not at the Mill) were not supported by secondary containment which consisted of the following:

- 3 drums located at the helipad connex were noted as being out of containment
- MB 9 lube cube storage connex and MB1 transmission fluid storage connex were noted as not having secondary containment, roof was noted as leaking. The inspection report noted that no petroleum products were in the tanks.

The current SPCC plan indicates that AST-KM 1 MWTP 1,000 gal Diesel Tank has secondary containment in place, which is not consistent with the monthly inspection report. It is recommended that Kensington verify secondary containment for AST-KM 1 MWTP 1,000 gal Diesel Tank.

The Audit Team reviewed the ADEC Spills Data base from August 2012 through October 2017. The majority of spills were small in volume, generally ranging from 2 to 35 gallons from mobile vehicles where secondary containment was not feasible. The most recent spill occurred on October 5, 2017 where 20 gallons of diesel fuel was released from a vehicle. The largest spills noted over the past 5 years are described in Table 4.

Table 4. Significant Spills in the Past Five Years

Spill Type	Date	Quantity (gallons)	Final Action and Date
Ferric Chloride	3/12/12	300	Closed 9/17/12
Diesel Fuel	2/17/13	300	Closed 2/19/13
Diesel	1/17/14	600	Closed 1/22/14
Diesel	12/23/16	200	Closed 1/20/17

5.1.7 Disposal Limitations

The WMP places waste disposal limitations on specific waste materials consisting of wastewater, mine tailings, development rock, waste water treatment plant sediments and sludge, underground drainage sump sediments and other wastes meeting the conditions in the WMP.

Certain wastes generated on site are restricted from being disposed of at the mine site and must be managed using methods other than disposal depending on the type of waste. Table 5 lists waste categories that shall not be disposed of in the TTF or the mine site along the waste management practice employed by the mine. Additional information describing how specific wastes are managed at the mine facility is provided in Section 5.2



Table 5. Restricted Waste Disposal

WMP Section Number	WMP Restriction	Kensington Practice	Audit Team Information Resource
1.2.2.1	Hazardous wastes, as defined by 40 C.F.R. Part 261, and radioactive material, explosives, strong acids, untreated pathogenic waste, glycol, solvents, oily wastes, waste oil, greases, paints, chemical wastes, transformers, and packing material or associated equipment, laboratory wastes and unused chemicals, uncombusted household waste, untreated sewage solids, and asbestos waste; however, this prohibition does not preclude disposal of Bevill excluded waste, natural minerals found in mine rock or residual wastes included as byproducts of the beneficiation process which may be disposed into the tailing area or mine, as long as they are in quantities that would not cause significant impact on mine closure, reclamation, or water quality.	Wastes listed in Section 1.2.2.1 of the WMP that are not permitted for disposal at the mine site facility are shipped off site by a contractor (Clean Harbors) for disposal at a permitted facility.	Interview (C. Joos)
1.2.2.2	Contaminated soils, spill boom, liners used for the containment of spilled materials, chemicals used in the cleanup of spills or other chemicals used in the beneficiation process unless approved under Condition 1.2.5 of the WMP.	At the time of the Audit no contaminated soils were being stored or treated. Items such as used spill boom, liners used for the containment of spilled materials, chemicals used in the cleanup of spills or other chemicals would be shipped off site by a contractor for disposal at a permitted facility.	Interview (C. Joos)

5.1.8 Monitoring Program

5.1.8.1 SNOW AND RAINFALL

The WMP Table 1-1 provides the required monitoring for rainfall as monthly and snowfall as cumulative monthly. The IWMDP also describes the rain and snowfall with the same frequencies and without additional description or meteorological station information. The Kensington quarterly reports to ADEC include tables of monthly rain and cumulative snowfall going back to first quarter 2013. Kensington is compliant with this monitoring requirement.

5.1.8.2 WATERS (MINE WATER, TTF POND, SEEPS, EFFLUENT)

The WMP requires water sampling and analysis for monitoring different types of waters. Table 6 displays the monitoring frequency and analysis and/or flow monitoring required.



Table 6. Water Monitoring required in the WMP (WMP Table 1-1)

Facility/Type of Water Monitored	Sample Analysis	Flow Measurement	Frequency
Dam seepage sump	Suite A	Mean flow	Monthly
TTF pond	Suite A	None	Quarterly
Upper Slate Lake /TTF Bypass	None	Max/min gpm	Weekly
Graphitic phyllite seeps – below the dam	Suite A	None	When observed
Graphitic phyllite seeps –northwest end of TTF	Suite A	None	Quarterly when accessible
GPPTP effluent	Suite A	Monthly Mean	Monthly
Mine drainage to MWTP	Suite A	Mean gpm	Monthly
Pit 3 standing water	Suite A	None	Quarterly

The WMP requires that the waters in Table 6 be analyzed for the list of parameters in WMP Table 1-2, referred to as Suite A list of parameters. Kensington quarterly reports provide the monthly analytical results in table format for the dam seepage sump samples, the TTF pond samples, the GPPTP effluent, the graphitic phyllite seeps at the north and south end of the TTF, and the mine drainage to MWTP. Kensington quarterly reports display sampling results since September 2013 and are consistent with the Suite A list of parameters required in the permit. Graphitic phyllite seeps below the dam (east and west sampled and reported separately) are collected once per year, in September. The WMP permit states monitoring frequency is “when observed”, and a footnote adds “no more than annually”. Kensington samples the graphitic phyllite seepage on the north end of the TTF, referred to as the ARD Sump in reports, on a weekly basis. The Pit 3 standing water is monitored by Kensington on a bimonthly basis, and the Audit Team reviewed inspection reports that document the inspection. Inspection forms and Kensington quarterly reports to ADEC report the Pit 3 standing water as consistently dry, thus no water quality data is provided.

WMP Section 1.10.4 requires that quarterly and annual reports include information necessary to determine data validity, data variations, and trends. Additionally, the QAPP states that the evaluation of water quality monitoring result trends will be ongoing, and reported, to identify if there are any natural or operational activities at the mine site, responsible for changes in water quality. The quarterly and annual reports reviewed by the Audit Team included only the water quality data tables providing concentrations of constituents by date. The Audit Team reviewed both annual reports to ADEC for WMP compliance and also annual reports to ADNR and USFS for annual reporting. No interpretation of the data or graphs are provided that would allow for the agency report reviewer to evaluate data trends or significant data variations. This is the case for all of the water data provided in the quarterly reports. In addition, no information regarding data validity is provided. This could include quality control sample results and data flags, which are not provided. There is no discussion in the quarterly report regarding the process of data validation or collection or results of quality control sampling and analysis in the field or in the laboratory.

The Audit Team asked ADEC’s Mr. Nakanishi how Kensington reports are reviewed for compliance given the data format Kensington provides to ADEC. Mr. Nakanishi stated that the



agency does a qualitative review of the summary tables unless a statistical analysis of the data is determined to be necessary to determine non-compliance. The Audit Team recommends that Section 1.10 of the WMP be revised to require the Permittee to submit the monitoring reports to include the analytical data tables, the original baseline analysis, and graphs of the data to evaluate trends. This reporting change would allow the agency to appropriately review compliance with the monitoring requirement with a focus on the intent and objective of the monitoring.

Table 6 provides the flow monitoring requirements from the WMP for surface waters. The Audit Team reviewed quarterly and annual reports to ADEC. The reports provided the flow monitoring required by the WMP at the frequency required. While data provided in the tables does not appear to have a trending change in flows at any of these surface waters, graphs of the data would be significantly more helpful. The Audit Team recommends that Section 1.10 of the WMP be revised to require the Permittee to submit the monitoring reports to include the flow data tables and graphs of the flow data to evaluate trends. This reporting change would allow the agency to appropriately review compliance with the monitoring requirement with a focus on the intent and objective of the monitoring.

5.1.8.3 SEDIMENT

The WMP requires sediment sampling and analysis for mine sump sediments on a quarterly basis. The WMP requires Standard Precipitation Leaching Procedure (SPLP) analyses, but does not list the parameters to be analyzed in the leachate. The IWMP only lists that the mine sump sediments will be analyzed for SPLP on a quarterly basis, and the QAPP references Table 4 for parameters. The QAPP Table 4 list of parameters is the same as the WMP Table 1-2 list of Suite A parameters.

The Kensington quarterly reports to ADEC include the mine sump sediments and lists concentrations of parameters going back to September 2013. While there is no mention of the SPLP method on the sediments in the reporting, the list of parameters analyzed is consistent with the WMP Table 1-2 Suite A (and QAPP Table 4) parameters, except that all metals were analyzed for total concentrations, and analysis did not include chloride, turbidity, dissolved oxygen, temperature, or conductivity. In addition, analyses included nitrate as N instead of nitrate+nitrite as N. The Audit Team recommends that the WMP be revised to include the specific parameters for which mine sump sediment leachate (from SPLP) should be analyzed, and that the QAPP, IWMDP, and Plan of Operations (POO), as well as future laboratory analyses, be modified to be consistent across all documents.

WMP Table 1-1 states that monitoring can be reduced to annually after 8 quarterly samples show no significant increase in constituents and must revert to quarterly should annual results show significant increases. The Audit Team recommends that Kensington reduce monitoring to annually given the stable constituent concentrations observed since September 2013.

Ultimately, mine sump sediments are disposed on the Comet development rock facility. It is assumed that the intent of monitoring the mine sump sediments is to determine trends of the sediment that may impact water quality. Kensington quarterly reports to ADEC include tables of SPLP leachate concentrations going back to 2013, but no graphs are provided of the data to review the data for trends. No data validation or quality control information is presented (WMP

Section 1.10.4). The mine sump sediment baseline geochemistry used to determine that the sediments could be disposed on development rock piles is not provided for comparison. The Audit Team recommends that Section 1.10 of the WMP be revised to require the Permittee to submit the monitoring reports to include the analytical data tables, the original baseline analysis for comparison, and graphs of the data to evaluate trends.

5.1.8.4 GEOCHEMISTRY

Development Rock

The WMP Table 1-1 provides the required geochemistry sampling and analysis of development rock as “Development rock – Section 4.2 of POO.” The POO Section 4.2 describes that development rock will be collected quarterly as a 5-kilogram grab sample for ABA and MWMP analyses and includes the list of parameters that will be analyzed in the MWMP leachate. In addition to the POO, the IWMDP also describes that the development rock will be collected quarterly as a 5-kilogram grab sample for ABA and MWMP analyses. The IWMDP states that development rock MWMP leachate will be analyzed for the list of parameters in Table 3 of the IWMDP, which includes the same list as the POO but also includes dissolved manganese and hardness. The QAPP also describes the development rock sampling and analysis and includes the same methods of analysis as the POO, but includes chloride, dissolved oxygen, temperature, conductivity, and turbidity.

The Audit Team interviewed the Environmental Manager, the Environmental Coordinator, Pete Strow, and the Senior Mine Geologist, Dominic Hoy, who described that the rock samples are collected by the ore control geologists underground from each of the active areas of mining on a monthly basis to create a monthly representative composite sample. A quarterly composite sample is then made utilizing the three monthly samples. According to quarterly reports submitted to ADEC, Kensington has the development rock analyzed for ABA and has MWMP leachate analyzed for the same list of parameters as in the POO Section 4.2. The list of parameters that Kensington reports to ADEC does not include the dissolved manganese or hardness that are called out in the IWMDP. Kensington reports arsenic under the symbol “Ar” instead of “As”. It is recommended that the IWMDP be revised for consistency with the POO, including determination if manganese and hardness are needed.

The Senior Mine Geologist, Dominic Hoy, confirmed that development rock is sampled from all areas of active mining including the Jualin exploration portal. The IWMDP has no description or mention of the Jualin exploration, and it is recommended that the description of development rock sampling be revised to reflect that all areas of active mining should be sampled, as is currently conducted.

The WMP Section 1.10.5.6 requires that annual reports include the development rock analyses as in Section 2.4 of the IWMDP. Annual reports to ADEC to comply with this requirement, with the exception of the dissolved manganese and hardness, as described above. The WMP Section 1.10.5.2 requires annual reports to include a summary of rock sample analyses being conducted under the POO Section 4.2. The annual reports do include the table of analytical results but no summary is provided. The WMP Section 1.10.4 states that quarterly and annual reports shall include information necessary to determine data validity, data variations, and trends. Additionally, The POO states that results of the quarterly waste rock geochemical testing

will be compared against baseline conditions and presented in the annual environmental report submitted to the USFS and the ADNR. Kensington quarterly reports to ADEC include tables of ABA and MWMP leachate concentrations going back to first quarter 2013. No graphs are provided of the data to review the data for trends. No data validation or quality control information is presented. Review of the data requires significant table review time to determine if values are trending; whereas graphs would allow for rapid review. The development rock baseline geochemistry is not provided for comparison with operations geochemistry. A reviewer would have to find the baseline documentation and then compare each value to the waste rock baseline geochemistry. Addition of this information on the reported tables as well as on the graphs would make for rapid review of this permit condition. The Audit Team asked ADEC's Mr. Nakanishi how Kensington reports are reviewed for compliance with this given the format of data that Kensington provides to ADEC. Mr. Nakanishi stated that the agency does a qualitative review of the summary tables unless a statistical analysis of the data is determined to be necessary to determine non-compliance. The Audit Team recommends that Section 1.10 of the WMP be revised to require the Permittee to submit the monitoring reports to include the analytical data tables, the original baseline analysis, and graphs of the data to evaluate trends. This reporting change would allow the agency to appropriately review compliance with Section 1.7.4.2.

Tailings

The WMP Table 1-1 provides the required monitoring, including the requirement for the geochemistry sampling and analysis of tailings. Table 1-1 lists the tailings monitoring site as "Tailings – POO Appendix 4a Pg 4 – 7", with a frequency of quarterly. The POO Appendix 4A is the Tailings Storage Facility Ecological Monitoring Plan, and pages 4-7 of the document include monitoring of water quality, annual and quarterly tailings sampling, and benthic sampling. Therefore, the WMP requirement for tailings sampling is not clear in the WMP. Mr. Nakanishi clarified in an interview that ADEC intends for the requirement to be for the quarterly tailings monitoring that is described in a brief paragraph on page 6 (the second paragraph of the section under the heading "Tailings Geochemistry") of the Tailings Storage Facility Ecological Monitoring Plan, which describes that tailings will be collected quarterly as a 5-kilogram grab sample for ABA and MWMP analyses and includes the list of parameters that will be analyzed in the MWMP leachate. Under this same Tailings Geochemistry heading on page 6 of the Monitoring Plan, annual sampling of tailings is described that does not apply to the WMP Table 1-1. In addition, the other pages (page 4, 5, and 7) in "Tailings – POO Appendix 4a Pg 4 – 7" include water quality monitoring and benthic sampling and thus are not applicable to the quarterly tailings sampling requirement in the WMP. The required tailings sampling description from the WMP is not accurate and requires clarification. The Audit Team recommends that this monitoring requirement language be edited during the next permit issuance.

In addition to the Tailings Storage Facility Ecological Monitoring Plan, the IWMDP also describes that the tailings solids will be collected quarterly as a 5-kilogram grab sample for ABA and MWMP analyses. The IWMDP states that tailings MWMP leachate will be analyzed for the list of parameters in Table 3 of the IWMDP. The QAPP Section B1.4 describes tailings geochemistry sampling as collected quarterly as a 5-kilogram composite sample for ABA and MWMP analyses and refers to Table 4 as the parameters for MWMP leachate analyses.

The Audit Team interviewed the Environmental Manager and Environmental Coordinator who described that the tailings samples are collected by the assay lab technicians from the sampling port at the mill every hour for 24 hours to build a 24-hour composite. According to quarterly reports submitted to ADEC, Kensington has the tailings analyzed for ABA and has MWMP leachate analyzed for the list of parameters in Table 7. The WMP Section 1.7.4.2 lists the tailings analyses as “Constituent levels measured include aluminum, ammonia, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, nitrate, pH, selenium, silver, sulfate, total dissolved solids (TDS), zinc, meteoric water mobility procedure, and acid base accounting.” The structure of the sentence is not clear if the list of parameters is for the MWMP leachate or a total metals analysis from the tailings (i.e., acid digest). It is recommended that this sentence be reworded to state “the tailings will be analyzed for ABA, and MWMP leachate will be analyzed for” (assuming that is the intent). Kensington reports arsenic under the symbol “Ar” instead of “As”. The list of tested analytes is consistent with the WMP list of parameters in Section 1.7.4, and is also consistent with the Tailings Storage Facility Ecological Monitoring Plan (EMP) list of parameters except that the EMP does not include pH. The list of constituents described in the IWMDP and the QAPP differ from the Tailings Storage Facility Ecological Monitoring Plan and those actually analyzed. Furthermore, Section 4.2 of the POO states that tailings will be analyzed for “...ABA and metal mobility analysis. Analysis will be for similar metals analyzed in the ecological risk assessment including aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver and zinc. The samples will be digested with nitric acid (USEPA 3050 and then analyzed using ICP-MS (USEPA 6020).” Method 3050 is for acid digest of sediments. Thus the POO does not include mention of MWMP or analysis of leachate, but only whole sediment analysis. It is recommended that these documents be revised for consistency, including determination if manganese is needed and whether the best nutrient analysis is nitrate as N or nitrate+nitrite as N. In addition, the QAPP should be amended to describe the sampling and compositing procedure, identify who collects and composites the samples, and what laboratory analyzes the samples.

WMP Section 1.7.4.2 states that tailings shall be tested on a quarterly basis to ensure there are no significant deviations from the original tailings analysis (baseline) which may affect monitoring, closure requirements, water quality, or any other permit condition. In addition, WMP Section 1.10.4 states that quarterly and annual reports shall include information necessary to determine data validity, data variations, and trends. Kensington quarterly reports to ADEC include tables of ABA and MWMP leachate concentrations going back to first quarter 2013. No graphs are provided of the data to review the data for trends. No data validation or quality control information is presented. Review of the data requires significant table review time to determine if values are trending; whereas graphs would allow for rapid review. The tailings baseline geochemistry is not provided for comparison with operations geochemistry. A reviewer would have to find the baseline documentation and then compare each value to the tailings baseline geochemistry. Addition of this information on the reported tables as well as on the graphs would make for rapid review of this permit condition. The Audit Team asked ADEC’s Mr. Nakanishi how Kensington reports are reviewed for compliance with this given the data format provided by Kensington to ADEC. Mr. Nakanishi stated that the agency does a qualitative review of the summary tables unless a statistical analysis of the data is determined to be necessary to determine non-compliance. The Audit Team recommends that Section 1.10 of the



WMP be revised to require the Permittee to submit the monitoring reports to include the analytical data tables, the original baseline analysis, and graphs of the data to evaluate trends. This reporting change would allow the agency to appropriately review compliance with Section 1.7.4.2. Specifically, the QAPP should describe the sampling and compositing procedure, identify who collects and composites the samples, and what laboratory analyzes the samples.

Table 7. Parameters for Analysis in Tailings MWMP Leachate

Document Describing Tailings Geochemistry Monitoring	Quarterly Data Reported to ADEC	WMP Section 1.7.4	Tailings Storage Facility Ecological Monitoring Plan (Page 6)	IWMDP Addendum to the Freshwater Monitoring Plan for the Kensington Gold Project (Oct 2013) Table 3	QAPP Table 4	POO Section 4.2
Analytical Methods	ABA and MWMP leachate for parameters listed below	ABA and MWMP. The list of parameters (below) provided is unclear if for sediment analysis or MWMP leachate analysis	ABA and MWMP leachate for parameters listed below	ABA and MWMP leachate for parameters listed below	ABA and MWMP leachate for parameters listed below	ABA and metal mobility analysis; digested with nitric acid (USEPA 3050 and then analyzed using ICP-MS (USEPA 6020)
List of Parameters for Tailings Analysis	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum (total)	Aluminum
	Arsenic	Arsenic	Arsenic	Arsenic	Arsenic	Arsenic
	Cadmium	Cadmium	Cadmium	Cadmium	Cadmium	Cadmium
	Chromium	Chromium	Chromium	Chromium (total)	Chromium (total)	Chromium
	Copper	Copper	Copper	Copper	Copper	Copper
	Iron	Iron	Iron	Iron	Iron (total)	Iron
	Lead	Lead	Lead	Lead	Lead	Lead
	Mercury	Mercury	Mercury	Mercury	Mercury (total)	Mercury
	--	--	--	Manganese	Manganese	--
	Nickel	Nickel	Nickel	Nickel	Nickel	Nickel
	Selenium	Selenium	Selenium	Selenium	Selenium	Selenium
	Silver	Silver	Silver	Silver	Silver	Silver
	Zinc	Zinc	Zinc	Zinc	Zinc	Zinc
	Sulfate	Sulfate	Sulfate	Sulfate	Sulfate	--
--	--	--	Hardness (total)	Hardness (total)	--	
Ammonia	Ammonia	Ammonia	Ammonia	Total Ammonia as N	Ammonia as N	--



Document Describing Tailings Geochemistry Monitoring	Quarterly Data Reported to ADEC	WMP Section 1.7.4	Tailings Storage Facility Ecological Monitoring Plan (Page 6)	IWMDP Addendum to the Freshwater Monitoring Plan for the Kensington Gold Project (Oct 2013) Table 3	QAPP Table 4	POO Section 4.2
	Nitrate as N	Nitrate as N	Nitrate as N	Nitrate as N	Nitrate + Nitrite as N	--
	Total Dissolved Solids	Total Dissolved Solids	Total Dissolved Solids	--	Total Dissolved Solids	--
	pH	pH	--	--	pH	--
	--	--	--	--	Chloride, Dissolved Oxygen, Temperature, Conductivity, Turbidity	--

5.1.8.5 WATER BALANCE

The IWMDP describes that Kensington has prepared a site-wide water balance that models the primary elements of the mine that include the underground mine, the mill, the TTF, the MWTP (aka Comet WTP), and the TTFTP. The WMP Section 1.10.5.3 requires that the water balance be provided in the annual report to ADEC, including:

- inflow in the form of process water in tails,
- precipitation and run-on,
- seepage return water,
- the TTFTP effluent,
- any other water directed to the facility, and
- outflows including the TTFTP effluent and water returned to the mill.

The following are the components of the water balance that Kensington reports to ADEC in annual reporting:

- Ore moisture content (mill unprotected flash report)
- Ore concentrate Moisture Content (mill unprotected flash report)
- Tailings moisture content (assumed value)
- Water consumed in paste backfill paste plant production log" column BU
- Paste backfill moisture content (paste plant production log column AA)
- Percent of tailings to Paste Plant (paste plant production log column BV)

- Percent of tailings to TTF (calculated)
- Dry tons to mill (paste plant production log AD)
- Dry tons of concentrate (paste plant production log AF)
- Pebble return tons (paste plant production log AE)
- Tons per day of tailings dry (paste plant production log BX)
- Water added from 1140 Sump (paste plant prod log column BT)

Kensington annual reports do not provide specific TTF water balance components required in the WMP, including:

- inflow in the form of process water in tails (this value may be provided in reporting but the data labels are not equivalent to be certain),
- precipitation and run-on,
- seepage return water,
- the TTFTP effluent, or
- outflows including the TTFTP effluent and water returned to the mill.

The Audit Team recommends that future annual reports by Kensington account for the specific water balance components required in Section 1.10.5.3 of the WMP.

5.1.8.6 BIOLOGICAL

Several biological survey programs occur at the mine related to fish, macro invertebrates, and wildlife, as well as casual observations by the mine staff during daily operations. Each of the monitoring programs is discussed below.

Section 1.7.4.3 of the WMP states that a mine tailings habitability shall be conducted during the term of the permit with results of the study presented before the summer of 2017. As a result of this requirement the Alaska Department of Fish and Game with financial support from Coeur Alaska, Inc. completed a study to evaluate tailings geochemistry, macro invertebrate colonization of submerged tailings, and basic waste quality in the Upper Slate Lake. The study determined that the tailings are non-acid generating, aquatic macro invertebrates inhabit the tailings, and Upper Slate Lake water quality is similar to baseline water quality for Lower Slate Lake. The study also documented several macroinvertebrate sources that will seed the TTF at reclamation. These conditions will provide suitable Dolly Varden char (*Salvelinus malma*) habitat in the TTF at reclamation (Willson-Naranjo and Kanouse 2016). The results of this study suggest that upland soils in the TTF will provide levels of primary production at suitable densities to support a fish population in the littoral zone of the TTF. The study also suggests that tailings located at the bottom of the TTF will also support macroinvertebrates, though at lower densities. The current reclamation plan for the TTF calls for the installation of a 4-inch cap of organic material over the tailings. However, based on the results of the habitability study, ADF&G may suggest that the TTF reclamation plan be modified to remove the 4-inch organic soil cap (Kanouse 2017, personal communication).

Two fish monitoring surveys occur at Kensington Mine. One survey occurs in Upper Slate Lake to count spawning Dolly Varden, and the other is a foot survey in Slate Creek, Sherman Creek, and Johnson Creek to count spawning salmon. In addition to the fish spawning surveys, and in accordance with Section 1.6.15 of the WMP, wildlife transect surveys are occurring during the open water season in the area surrounding the TTF. Based on interview discussions with ADF&G (Kanouse 2017, personal communication) the utility of the results from the fish spawning surveys and wildlife transect study is limited and is not providing value to the overall monitoring program at the mine. As such, ADF&G may request that these surveys be dropped from the Kensington Mine biological monitoring program.

Kensington implements a Wildlife Monitoring Plan that includes that seasonal wildlife monitoring surveys within the Slate Lake Basin.

For approximately two weeks during the herring spawn each spring, the mine employs a marine mammal observer (MMO) to count marine mammals in Berners Bay. The MMO rides the ferry that transports workers to and from the mine and records marine mammal observations during that time. The results of the survey are provided to the National Marine Fisheries Service.

5.1.9 Laboratories and Sample Analysis Procedures

There are no onsite laboratories that analyze materials or water for compliance with the permits in the scope of the audit.

5.2 Integrated Waste Management and Disposal Plan

The IWMDP describes procedures for managing solid wastes and hazardous materials generated at the Kensington Gold Mine facilities, the temporary storage and final disposal of graphitic phyllite materials excavated during construction of the TTF, and deposition of mill tailings.

During the audit, the IWMDP was reviewed with mine staff for the purpose of determining if the current procedures for waste management on site were consistent with the procedures contained in the waste management plan. It is important to note that the IWMDP was written in 2013 and it was found that some procedures contained in the plan have been modified “in practice” and did not always align with what is in the IWMDP. The reasons for these changes appear to be driven in large part by practicability based on actual waste management operations and methods versus the waste management operations and methods that were initially anticipated to occur at the time the waste management plan was written. The following sections provide an overview of specific methods contained in the IWMDP in comparison to the waste management practices occurring on site.

Some discrepancies between the QAPP and IWMDP were described earlier in the report (Section 5.1.8, Monitoring Program) and will not be restated in this section.

5.2.1 Waste Management Priorities

The IWMDP lists five priorities that the mine should consider to prevent and/or minimize waste generation. These five priorities are:



1. The potential of materials excavated, mined, or milled to adversely affect water quality
2. Waste source reduction
3. Recycling
4. Waste treatment; and
5. Waste disposal

The IWMDP goes on to list several strategies the mine is to follow to accomplish the five priorities listed above. The strategies are listed below and along with the observed practice at the mine.

Waste Prevention / Minimization Strategy	Audit Finding
Geochemical characterization of materials to be excavated, mined, or milled.	The mine is following the geochemistry monitoring plan and permit requirements.
Operations that generate waste would be reviewed to identify opportunities for reducing waste and the opportunities would be implemented whenever possible.	The mine facility employs a full time staff position dedicated to environmental coordination and compliance. One of responsibilities for the Environmental Coordinator, Cassandra Joos, is to identify and reduce waste generation at the site.
The properties for materials would be reviewed prior to purchase and every effort would be made to minimize the use of hazardous materials and those that would be classified as hazardous waste once they can no longer be used for their intended purpose.	The mine appeared to be following this strategy. Though the mine is considered a Large Quantity Generator of hazardous waste ($\geq 2,204$ lbs. / month), the range of hazardous wastes generated on site was narrow and consisted mainly of non-aqueous waste generated by the Assay Lab.
Methods for reusing and recycling materials would be promoted and implemented whenever possible to reduce waste.	Since all municipal solid waste generated by surface operations is shipped off site for disposal, reasonable efforts were being made to reduce the volume of waste generated and recycle or reuse materials where possible. This included items such as, but not necessarily limited to, scrap steel and aluminum, oxygen and acetylene bottles, used tires, and batteries as well as used coolant and used oil.
Non-hazardous solid wastes that are permitted for disposal on site would be disposed of at onsite, permitted, solid waste landfills regulated by ADEC and in accordance with 18 AAC 60 or applicable Kensington permits.	Non-hazardous solid waste disposal at the mine site was consistent with the requirements of 18 AAC 60 and Section 1.2 Limitations of the WMP.
Materials that cannot be managed onsite would be sent offsite for recycling, reuse, treatment and/or disposal to appropriate facilities.	Observations during the audit confirmed that this waste management strategy was being complied with.

5.2.2 Purchasing of Materials

The IWMDP provides guidance on the procedures for the purchase of materials that consists of the following:

- Minimize the generation of hazardous wastes by avoiding the purchase of materials that would be regulated as hazardous wastes when the materials are no longer required for their intended purpose.
- To the extent practical, materials will be purchased in containers (e.g., totes or drums) that can be returned to the vendor.

- The Material Safety Data Sheets (MSDSs) for new materials to be purchased will be reviewed to ascertain if the materials require special management under RCRA, Emergency Planning and Community Right to Know Act (EPCRA), Comprehensive Environmental Responsibility and Compensation Liability Act (CERCLA), Clean Air Act, and Toxic Substances Control Act (TSCA) (See EPA's "List of Lists").
- For materials requiring special handling and/or that would be classified as a hazardous waste if disposed, Kensington will evaluate if a suitable substitute is available that is considered "less hazardous". Less hazardous can include a waste that would not be classified as a hazardous waste if disposed, would not require special handling under the above-noted Acts, would generate less waste when disposed, can be reused or recycled or is generally considered to have less of an impact on the environment (e.g., a material with less discharges to the environment when treated and/or disposed).

The Audit Team found that the mine is following the procedures above. The stimulus to minimize the purchase of materials that, once used, could become hazardous waste is influenced by the requirement and associated cost of shipping all hazardous waste off site for disposal. As a result, the Environmental Coordinator, Cassandra Joos, tracks incoming and outgoing materials including chemicals that could become part of the mine's waste stream. This information helps to ensure proper characterization of the materials for disposal, recycling or reuse. The mine also coordinates with vendors where it is practicable to return materials to vendors in containers such as totes and drums.

5.2.3 Waste Minimization

The IWMDP provides a number of efforts to minimize waste generation and as well as recycling and reuse of materials that the Audit Team found Kensington to be implementing. Some examples of methods listed in the IWMDP include:

- *The use of primarily eco-friendly solvents in parts washers (e.g., Orange-Sol™ or SimpleGreen®).* The use of SimpleGreen or Orange-Sol in parts washers is not occurring at the mine facility. The current practice at the mine site is to use products such as PB B'laster or similar solvents in the parts washers and then manage the spent solvents as a hazardous waste. The reason provided for this was that products such as SimpleGreen or Orange-Sol are not effective.
- *The use of low mercury, fluorescent lamps ("green end cap") and recycling of lamps and bulbs.* The use of low mercury, fluorescent lamps ("green end cap") and recycling of lamps and bulbs is occurring on site. Used fluorescent lamps are managed as a Universal Waste and shipped off site for disposal.
- *Recycling or reuse of materials such as antifreeze, batteries, reusable light vehicle tires, scrap metal, and used oil.* Antifreeze, batteries, reusable light vehicle tires, scrap metal, and used oil are shipped off site for disposal or recycling. In the case of tires, they are retreaded by a contractor and put back in to service at the mine.
- *Returning containers to vendors or recycling them as scrap metal, which prevents the need for disposal of containers in landfills; appropriate container management, including*

the provision of secondary containment and proper labeling. Containers at the mine were well managed which was evidenced by the observation that there appeared to be a minimal number containers and those present were being used for a specific purpose.

- *Prevention of mixing of hazardous wastes with non-hazardous wastes through waste segregation, established procedures, and personnel training.* Observations at the time of the audit found no evidence of mixing hazardous waste with non-hazardous waste. All waste types were segregated and labeled. Based on interview conversations with the Environmental Coordinator, training occurs with personnel on an annual basis and immediately with new employees. If employees are not sure what do with particular waste materials, they are instructed to contact the Environmental Coordinator.

5.2.4 Waste Segregation

Waste management at Kensington is to include appropriate segregation of wastes to ensure they are properly managed according to the applicable regulations and the specific waste handling procedures as follows:

- *Wastes destined for the incinerator (e.g., putrescible food waste, oily waste) would be placed in incinerator dumpsters. These dumpsters would be kept closed to prevent attracting wildlife.* The Audit Team observed that all dumpsters on site have a lid and are labeled in accordance for their intended use. Putrescible food waste is processed in a solid waste incinerator located on site. It is noted that because of changing air quality regulations, use of the incinerator at the mine will no longer occur after December 17, 2017. The mine is considering the use of a trash compactor to handle waste that would otherwise be incinerated.
- *Inert wastes destined for disposal underground will be taken directly to the designated underground site.* Based on Audit Team discussion with mine site staff, waste are not taken underground for disposal. If a waste is generated during underground operations and it is permissible for underground disposal, it will be disposed of underground and backfilled with paste. With the exception of Graphitic Phyllite and ash from the burn pit, wastes generated on the surface are shipped off site for disposal rather than taken underground.

The mine operates an open burn pit for inert wastes such as wood (pallets mainly) and paper based products (cardboard). Once burned the ash remains in the burn pit for disposal.

- *Dumpsters will be marked in a manner such that Kensington personnel would be able to distinguish between incinerator and landfill dumpsters.* Dumpsters on site at the time of the audit were labeled to distinguish between incinerator items, or other items per the dumpsters' intended use (Appendix A Photo KK).
- *Hazardous wastes will be placed in containers at Satellite Accumulation Areas (for less than 55 gallons of waste) or placed in containers, appropriately labeled, and brought directly to a Hazardous Waste Accumulation Area.* Satellite Accumulation Areas (SAA) were noted by the Audit Team at the Comet WWTP, Assay Lab, TTF, and the Mill

(Appendix A Photos LL and MM). There is also an SAA at the Jualin SWTP which was not inspected during the audit. In addition to the SAAs there are nine aerosol can disposal areas located throughout the mine facility. The Hazardous Waste Satellite Accumulation Area at the Comet WWTP contained used ultra low range chlorine test kits. The used test kits were contained in sealed 5-gallon buckets, labeled as hazardous waste with Department of Transportation shipping information, generator information, EPA ID Waste No., and start date (once full) 5 gallon buckets were placed in secondary containment. The Hazardous Waste Satellite Accumulation Area at the Assay Lab consisted of a 55-gallon steel drum containing used crucibles, slag, and other non-aqueous wastes generated during the assay process. The drum was labeled as described above and clearly identified as a Satellite Accumulation Area. The Hazardous Waste Satellite Accumulation Area at the mill site is shown in the Appendix A.

- *Universal Wastes (lamps, batteries, mercury-containing equipment) will be placed in containers at Universal Waste Accumulation Areas according to the procedures outlined in WMP Section 2.13.* The Audit Team inspected the Universal Waste Accumulation Area is located within a connex trailer (Appendix A Photo NN). Items such as used lead acid batteries, alkaline batteries, florescent light bulbs, and portable hand tool batteries are observed in the Universal Waste Accumulation Area.
- *Materials to be recycled will be placed in segregated containers designated for the specific type of material and managed as outlined in Section 4.0.* Materials such as lead acid batteries, used tires, compressed gas cylinders, filters, scrap metal, used lubricants and anti freeze were observed by the Audit Team in segregated containers and labeled accordingly (Appendix A Photo OO).

5.2.5 Container Management

Containers at the mine site are being managed to ensure the safety of personnel and the environment. Staff at the mine site are given annual training, and new staff upon arrival, that includes container management, labeling, secondary containment and container maintenance.

5.2.5.1 PROCEDURES FOR EMPTYING CONTAINERS

The IWMDP discusses the management of empty containers largely concerning containers that once held hazardous or acutely hazardous waste.

- During the audit interview, the Environmental Coordinator clarified that when the facility has a container holding hazardous waste routine operations dictate that the container is not to be emptied.
- Standards for containers that once held non-hazardous waste are reused on site or shipped back to the vendor for reuse. Most lubricants are shipped and stored in 350 intermediate bulk containers (IBC), are also known as Lube Cubes (Appendix A Photo PP). The Lube Cube tanks are returned to the vendor once they are empty, refilled and shipped back to the mine. This does not completely eliminate the need for other containers such as 55-gallon drums, but it helps to reduce the number of empty

containers (i.e., drums) and aligns well with the Container Management strategies contained in the IWMDP.

5.2.6 Onsite Waste Management

Solid waste management facilities at the Kensington Gold Project include inert solid waste landfills (underground), burn pit, and the TTF. Potentially reactive material (i.e., graphitic phyllite) will be managed in temporary stabilization cells and stockpiles until final disposal of the material within the underground mine. The Audit Team found that Kensington was compliant with onsite solid waste management requirements.

5.2.6.1 INERT SOLID WASTE DISPOSAL

Inert solid waste that is generated under ground is disposed of in underground stopes that are backfilled with paste. With the exception of the open burn pit, inert solid waste generated as a result of surface operations is shipped off site for disposal.

5.2.6.2 GRAPHITIC PHYLLITE TEMPORARY STOCK PILES

Graphitic phyllite is temporarily stockpiled at the mine until it can be mixed with paste and is then placed in underground stopes for permanent disposal. Graphitic phyllite storage is addressed in Section 5.1.3.

5.3 Certificate to Operate Dam

The ADNR-issued COD for the Lower Slate Lake Dam and Attachment A - Special Conditions, include both specific operational requirements, and also require operation, monitoring, inspection, and maintenance of the dam in accordance with the best practices and procedures described in the Operations and Maintenance Manual for the Lower Slate Lake Dam (Revision 3, dated January 29, 2015) (O&M Manual). Each permit Special Condition or referenced O&M Manual requirement is listed below, along with the Audit Team's review activity and audit of the Kensington Mine compliance with the permit requirement.

During the site visit, the Audit Team compared observed TTF facilities described in the O&M Manual, Kensington Mine records, and submittals to ADNR Dam Safety. Key observed site conditions included the following:

- Dam is currently at Stage 2 crest elevation of 715 feet.
- Upstream dam slope geomembrane liner extends up to the current crest elevation of 715 feet.
- Operating water level in the TTF was measured at 699.1 feet on September 10, 2017. This is above the TTF lake trigger level (understood to represent the 200-year, 24-hour storm surge storage elevation) of 697.3 feet in the O&M Manual and the COD. The Audit Team was informed at the time of the site visit that this lake level situation was reviewed and discussed in the course of the June 2017 Periodic Safety Inspection performed by Golder Associates (Golder), and is included in the 2017 Periodic Safety Inspection Report by Golder (see discussion below). It is understood that the water level is

measured by staff gage on the lake, located on the reclaim barge walkway, and confirmed by survey.

- Current configuration and operational status of TTF facilities, including the Interim Spillway; vibrating wire piezometers in the dam embankment and foundation; barge water reclaim system; diversion and reclaim water pipelines; diversion flow Parshall Flume; seepage return line; and the large-diameter HDPE Seepage Collection Sump (96-inch, 40-foot deep large-diameter manhole downstream of the dam toe), were reviewed during the site visit with the Kensington Mine TTF Operational Manager and the Senior Environmental Coordinator/Quality Assurance Officer.

Records of inspections after seismic and precipitation events: The Audit Team interviewed the TTF Operational Manager regarding occurrence of any reportable seismic events or precipitation events. The TTF Operational Manager reported that during his tenure at the Kensington Mine, the TTF has not experienced any reportable seismic events or precipitation events which required separate, unique inspections.

Records of inspections, monitoring data, and routine maintenance: The Audit Team interviewed the TTF Operational Manager and Senior Environmental Coordinator/Quality Assurance Officer regarding inspections, including daily, weekly, quarterly, and periodic safety inspections (PSIs). Daily and weekly inspections are performed by the Senior Environmental Coordinator/Quality Assurance Officer. Example completed Daily Inspection Form, Weekly Visual Inspection Checklist, and Piezometer Data Collection Sheet were provided to the Audit Team for review.

Daily inspections include the following activities and are documented on a Daily TTF Inspection Form:

- Visual check that all TTF components are functioning properly.
- Visual check that damage due to weather, malfunction, or vandalism has not occurred.
- Recorded various data, including tailings throughput, supernatant pond water level elevation, pumping rate at reclaim barge, water diverted at intake structure or overflow weir (flow rate and total flow), and seepage flow at the large-diameter HDPE Seepage Collection Sump (flow rate and total flow) and the ARD Seepage Lift Station Sump (manhole) downstream of the dam toe.
- Visual observations of the dam, impoundment, tailing tremie discharge pipe, HDPE Seepage Collection Sump, diversion water conveyance pipe discharge channel, and reclaim barge.
- Visual observations of the GPTTP and Infiltration Gallery, including inspecting for evidence of leakage from the GPTTP effluent pipes, and surface discharge from the Infiltration Gallery.

Weekly inspections are documented on a Weekly Visual Inspection Checklist which includes the following:

- Supernatant pond water level (recorded elevation).

- Visual observations of the dam slopes, abutments, geomembrane, impoundment, and seepage at the HDPE Seepage Collection Sump.
- Visual observation of the interim spillway, including verifying that the spillway cross section is clear.
- Visual observations of the dam and TTF appurtenances, including vibrating wire piezometers, stream gages, water level transducers, flow-meters and totalizer readings, reclaim barge, tailings tremie pipe, WCP channel, and diversion ditches, including verifying that the channel and ditch cross sections are clear.

Piezometric head readings for the 12 vibrating wire piezometers located in the dam embankment and foundation are recorded on a Piezometer Data Collection Sheet as follows:

- Weekly piezometer readings under normal operating conditions.
- More frequent readings if the piezometers show sudden or unexplained changes in piezometric head level.
- Vibrating wire piezometer readings that appear to be discrepant are rechecked.
- Certain vibrating wire piezometers within the dam foundation indicate periodic ‘spike’ readings above trigger piezometric head levels. These spike readings are understood to be the result of shut down of the pump-back pump in response to periods of pump inactivity and freezing of the pump-back flow outlet pipe just outside the manhole. The recorded piezometric head appears to quickly drop to a normal level after the pump is restarted and flow resumes. The Draft June 2017 Periodic Safety Inspection Report (prepared by Golder; see below section on periodic safety inspections) recommended that the system operation be improved by: (1) repairing the heat trace on the seepage return water pipeline, and (2) installing a drain valve which would allow water to drain during periods of pump inactivity and prevent pipe freeze-up. The Kensington Mine Senior Environmental Coordinator/Quality Assurance Officer indicated during the site visit that implementing this repair solution was in process by Kensington Mine personnel.
- Vibrating wire piezometer data is transmitted to the TTF Operational Manager and the Kensington Mine Environmental Manager and to Golder for compilation, review and summary reporting.

Based on data provided by the Kensington Mine Senior Environmental Coordinator/Quality Assurance Officer, calibration of the Geokon vibrating wire piezometer electronic readout unit was last performed by the manufacturer in January 2016. The Audit Team recommended that the readout unit be calibrated as soon as possible to verify accurate readings and operation, and further that the unit be calibrated at minimum annually.

Regarding calibrations of totalizing flow meters, this question was posed to the Kensington Mine Senior Environmental Coordinator/Quality Assurance Officer subsequent to the site visit. He indicated that the Kensington Mine Electrical Foreman stated that the flow meters have not been calibrated in the past and do not require periodic calibration. The Audit Team reviewed the flowmeter sensors manufacturer’s Reference Manual for the Rosemount 8700 Series Magnetic Flowmeter Sensors contained in the O&M Manual (Revision 3, Appendix A2). The reference

manual indicates that the Rosemount flowmeter sensors are wet calibrated at the factory and that no further calibration is necessary during or subsequent to installation. Further, the flowmeter sensors appear to include an internal sensor calibration test to verify the sensor calibration status.

Seepage Monitoring & Data Collection: The HDPE Seepage Collection Sump is monitored daily by the Kensington Mine environmental technicians, including recording flow rate and total seepage flow. Seepage monitoring data are provided to the Kensington Mine Environmental Manager and to Golder for compilation, review, and summary reporting, including in the Periodic Safety Inspection report.

The ARD Seepage Lift Station Sump (manhole) downstream of the dam toe is monitored for flow rate and sampled for water quality testing. It is understood that the Water Treatment Plant operators also monitor this seepage since the flow is pumped back to the GPTTP for treatment.

ARD seepage from the Stage 2 Interim Spillway sidewalls is collected in the plunge pool, pumped over to a lift station, and transferred to the GPTTP.

Quarterly Inspections of the TTF: The Audit Team interviewed the TTF Operational Manager regarding quarterly inspections of the TTF. Quarterly inspections are performed by the TTF Operational Manager and recorded using the Weekly Visual Inspection Checklist as described above. Any maintenance issues identified in the course of the inspections are brought to the attention of Kensington Mine Mill Maintenance Manager or the Surface Operations Manager as appropriate to be rectified.

Routine Maintenance: The Audit Team interviewed the TTF Operational Manager regarding routine facility maintenance. The Kensington Mine Mill Maintenance Manager maintains and keeps maintenance records for pumps, pipes, controls, and other appurtenances. The Kensington Mine Surface Operations Manager maintains and keeps records for those elements not covered by Kensington Mine Mill Maintenance. The TTF Operational Manager indicated that to his knowledge, there are no routine operation and maintenance procedures which deviate from or are not included in the current version of the O&M Manual, or that should be included in an update to the O&M Manual. The TTF Operational Manager indicated that maintenance issues identified in the course of the TTF inspections are routed to the Kensington Mine Mill Maintenance Manager or Kensington Mine Surface Operations Manager as appropriate to be rectified.

Regarding calibrations of totalizing flow meters, this question was posed to the Kensington Mine Senior Environmental Coordinator/Quality Assurance Officer subsequent to the site visit. He indicated that the Kensington Mine Electrical Foreman stated that the flow meters have not been calibrated in the past and do not require periodic calibration.

Site Water Balance Model: The Site Water Balance Model is updated monthly by the Kensington Mine Project Engineer with precipitation, snow pack, and stream flow measurements collected on-site. Based on interviews by the Audit Team, the TTF Operational Manager records and updates monthly precipitation and temperature; diversion flows, inflows and outflows to/from the TTF; seepage flows beneath the dam; and Johnson Creek flows. These data are input into the GoldSim water balance computer model. The TTF Operational

Manager indicated that snowpack is monitored by Kensington Mine Avalanche Crew technicians and he noted that he does not input snowpack into the water balance; rather, snow water equivalent is input to the model. The next water balance model update for data through August 2017 was in process by the TTF Operational Manager at the time of the Audit Team site visit.

Bathymetric Surveys of the TTF: The Audit Team interviewed the TTF Operational Manager and Senior Environmental Coordinator/Quality Assurance Officer regarding bathymetric surveys of the TTF subaqueous impounded tailings surface. The bathymetric surveys are performed twice each year by the TTF Operational Manager and the data transmitted to the Kensington Mine Environmental Manager for summary reporting. The most recent bathymetric survey was performed on June 1, 2017. The TTF Operational Manager utilizes the bathymetric data to calculate impounded volume and estimate tailings in-place density. Further, the raw data are provided to a consultant (Golder) for use in generating cross sections of the stage/elevation of the subaqueous impounded tailings surface. The data also are provided to the Kensington Mine Surface Operations Manager for use in reviewing and adjusting the position of the tailing tremie pipe, in order to maximize storage volume and maintain the minimum required 9-foot depth of water over the tailings.

The Senior Environmental Coordinator/Quality Assurance Officer indicated that physical probe surveys of the subaqueous tailings surface in impoundment are performed from atop the reclaim barge at irregular intervals.

Annual Inspections and Annual Performance Report: Annual inspections of the dam are to be performed, and Annual Performance Reports are to be prepared and submitted by October 30 of each year. The TTF Operational Manager indicated that annual inspections are performed and Performance Reports prepared by a consulting engineer, most recently by Golder in 2017. During the 2017 annual inspection, Golder field staff were accompanied by the TTF Operational Manager. Previous annual inspections were performed by a consultant (AECOM in 2015, and Knight Piesold in 2016) accompanied by a Kensington Mine representative. The 2015 Annual Performance Report was prepared and submitted by AECOM (dated October 14, 2015). It is understood that the 2017 Annual Performance Report has not yet been submitted by Golder. The Audit Team reviewed submitted the annual performance reports, which include all of the reporting components required in the COD.

Periodic Safety Inspections: Based on the Audit Team's interview with the TTF Operational Manager, and on review of provided records, Periodic Safety Inspections (PSIs) are performed every three years, most recently in June 2017, and previously in June 2014. The Audit Team was provided with copies of the Final PSI Report for the June 2014 inspection. The most recent PSI was performed in June 2017 by consultant (Golder) personnel accompanied in the field by the TTF Operational Manager. The Draft June 2017 PSI report was submitted to ADNR Dam Safety Section (Mr. Charles Cobb). As of the date of the Audit Team site visit, review comments from Mr. Cobb on the draft report had not yet been received by the Kensington Mine. A copy of the Draft PSI Report for the June 2017 inspection was provided by the TTF Operational Manager.

It is noted that the Draft PSI Report for June 2017 indicated a few issues of concern as follows:

- Interim Spillway shotcrete sidewalls degrading and spalling from effects of subsurface seepage and ARD, and observed debris from the sidewalls in the spillway channel. Golder indicated that over the short term, and before the planned Stage 3 Dam raise in 2018, Stage 2 Interim Spillway sidewall degradation was deemed not likely to impact stability and function of the spillway.
- Piezometric surface in the dam foundation periodically rises above trigger elevations in response to periods of pump inactivity (caused by freezing pipes), and quickly lowers to a normal level after the pump is restarted. Golder recommended that Kensington Mine personnel mitigate the freeze-up issue and improve the seepage pump-back system by repairing the heat trace on the return water pipe and installing a drain valve, as discussed above during the Audit Team visit.
- TTF lake level is rising faster than the planned rate of rise, attributed primarily to low water treatment rates. The current (2017) Kensington Mine water balance model indicates that the mean lake level will exceed the 200-year, 24-hour storm storage elevation of 697.3 feet before the Stage 3 raise in 2018. The PSI Report indicates that Kensington Mine personnel understand this risk and are actively evaluating alternatives to improve water treatment rates and manage the TTF to ensure that Stage 2 Interim Spillway discharge does not occur. As noted above, at the time of the site visit the Audit Team was informed that the operating water level was measured at 699.1 feet on September 10, 2017.

Other recommendations which were identified in the 2017 PSI Report by Golder, and which were discussed during the Audit site visit and in subsequent communications with the Audit Team, include the following:

- Verify calibration requirements and perform calibrations for flumes and flow meters as required/recommended by the manufacturer (see above discussion regarding calibration of flow meters).
- Although not discussed during the site visit, it is understood that the accuracy of survey monuments utilized for monitoring dam settlement was not acceptable to Golder. Golder recommended that fully functioning survey be installed on the dam and an accurate monitoring system be implemented concurrent with the Stage 3 Dam raise construction.

Supplement/Addendum to the O&M Manual, prepared concurrent with each dam raise:

The O&M Manual indicates that changes to the manual may result from the following:

- Evolution of design through capacity changes, operational efficiencies, closure requirements, performance feedback and life-cycle changes.
- Incorporation of as-built records of construction.
- Variation of performance from design.
- Changes in site management organization, facility description, roles and responsibilities, and operating and reporting procedures.
- Suggestions for improvement.

- Succession planning/training.
- Regulatory changes.

It is understood that Golder will prepare an amendment to the current O&M Manual subsequent to completing construction of the Stage 3 Dam raise, in order to capture any changes to O&M procedures which result from the Stage 3 raise. The TTF Operational Manager indicated that the Kensington Mine was in the process of soliciting General Contractors for the Stage 3 Dam raise, with a bid walk scheduled for late September 2017. The current schedule is for Stage 3 construction to begin in April 2018 (weather permitting), with an estimated completion of October 2018.

Emergency Action Plan (EAP): The COD requires that the EAP shall be reviewed, exercised and revised in accordance with a specified schedule. The EAP is currently at Revision 2 (dated January 2015). In Audit Team interviews, the TTF Operational Manager indicated that the EAP was reviewed and an orientation exercise performed in May 2017, as a Triennial Drill per the COD, and that documentation of the exercise was sent to ADNR Dam Safety (Mr. Charles Cobb). The TTF Operational Manager noted that the EAP needs to be revised to incorporate new Kensington Mine staff listed as responsible parties and persons to be notified, due to personnel changes at the Kensington Mine. He did not provide an anticipated schedule for completing these revisions. Otherwise, the TTF Operational Manager indicated that updates to the EAP were not needed after the training exercise in May 2017.

Application for Certificate of Approval to Modify a Dam: An Application for Certificate to Modify a Dam is required to be submitted to and approved by ADNR Dam Safety prior to construction of Stage 3 up to its Ultimate Design Height. An application was submitted by KGM, and the Certificate of Approval to Modify a Dam (to Stage 3 crest of 740 feet) was issued by ADNR on May 9, 2017. Stage 3 raise design reports were prepared by Golder for KGM; copies of the design report, geotechnical investigation plan, and construction plans were provided to the Audit Team. According to the Kensington Mine TTF Operational Manager, the Stage 3 Dam raise was scheduled for 2017 per the current O&M Manual. The Stage 3 raise is to be completed prior to the lake water level elevation reaching the Stage 2 maximum operating level of 697 feet. However, the current operating water level was measured at 699.1 feet on September 10, 2017. As noted above Stage 3 construction is scheduled to begin in April 2018 (weather permitting) and be complete by October 2018.

It is noted that the approved Certificate to Modify the Dam requires additional subsurface investigation of both dam abutments to support design of the extensions to the grout curtain, and detailed design and construction of the final closure spillway. The Kensington Mine TTF Operational Manager indicated that the Stage 3 Dam raise design includes subsurface geotechnical investigation and design of the grout curtain extensions and recommendations for foundation treatment.

Unusual Occurrences and Responses/Incident Reporting: The O&M Manual and EAP collectively include specific examples of unusual occurrences and appropriate response protocols. Unusual occurrences trigger the following actions:

- Inspection equivalent to a weekly inspection.

- Notifications of the Kensington Mine General Manager, Mill Manager and Responsible Party of the unusual condition.
- Further investigation and assessment if the unusual condition is an unusual occurrence or an emergency, as defined in the EAP, and followed by appropriate action.
- Written log of the unusual condition and the date, time, and nature of the unusual condition and any other pertinent information.

The O&M Manual and ADNR Dam Safety Program Guidelines provide definitions of an incident. Certain incidents at dams are to be reported to ADNR within 30 days. Required forms (Dam Incident Notification Form and Dam Incident Documentation Report) are to be prepared and submitted to ADNR.

5.4 Reclamation and Closure Plan and Approval

5.4.1 Regulatory Setting for Reclamation

Mine closure and reclamation activities, including reclamation and closure plan approval and financial assurance, is overseen by the ADNR, Division of Mining, Land and Water, under Alaska Statutes Chapter 27.19 (Reclamation) and Alaska Administrative Regulations in 11 AAC 97 (Mining Reclamation).

The Audit Team focused on Kensington's *2013 Reclamation and Closure Plan Update for the Kensington Gold Project*, April 2013, and amendments to the plan. The plan was approved by ADNR on May 3, 2013 (*Reclamation Plan Approval - J20133158*) with the effective dates of May 3, 2013 through May 3, 2018. The plan was also approved by the USFS, which, through a memorandum of understanding (MOU) with ADNR, holds the financial assurance bonds. The Audit Team focused on review of conditions and status of Reclamation Plan Approval, adequacy of the approved reclamation plan, and adequacy of the approved financial assurance.

5.4.2 Reclamation and Closure Plan Approval (J20133158)

The Audit Team reviewed the ADNR's *Reclamation Plan Approval* requirements and Kensington's status in meeting the approval conditions. Table 8 summarizes pertinent requirements and status. Table 9 summarizes plan amendments identified by the Audit Team and related activities requiring changes in bonding since 2013.



Table 8. Reclamation Plan Approval (J20133158) Conditions and Status

#	Requirements	Status
Financial Assurance		
1	Approval by ADNR and USFS of Financial assurance mechanism. Documentation needs to be approved to ADNR no later than June 30, 2013.	Total financial amount approved \$28,727,011 with additional \$684,115 posted in July 2015 for the Jualin exploration portal reclamation. The USFS is holder of the bond, per Kensington Bonding MOU dated April 30, 2017.
2	Lower State Lake Tailings Dam (\$695,000 for Long Term Care and Maintenance (LTCM)). Trust Fund required for LTCM. Once trust fund in place, \$695K can be reduced from finance assurance.	LTCM report in place. Trust fund has not been established and reduction has not been made from the financial assurance. The USFS is holding a lump sum of \$695,000 for LTCM.
Terms of Plan Approval		
3	Any changes in Reclamation Plan must be approved by ADNR.	See Table 9. Kensington to verify.
Authorized Officer		
4	ADNR notified of any changes to authorized officer since 2013	No change since 2013.
Monitoring Plan		
5	Are state and federally required monitoring results submitted to ADNR quarterly before 15 th day of month following quarter	Yes
Cultural		
6	Have any burial or human remains been discovered during mining activities under this approval (2013 to current)?	None reported by Kensington.
As-Built Maps		
7	Submit to ADNR annual "as-built" maps	Part of annual reports and up to date.
Inspection and Entry		
8	ADNR ADEC inspections between 2013 and current.	Inspections have been conducted by ADNR and USFS but mostly focused on operations, minimal reclamation has occurred site since 2013 as site is active and no permanent closure of facilities have occurred.
Modifications		
9	Amendments to the Reclamation Plan? Amendments may at discretion of ADNR, require bond review and update	See Table 9 regarding modifications since 2013.



Table 9. Amendments to 2013 Reclamation Plan

	Items	Status
1	Kensington Mine Plunge Pool Lift Station - J20133158.1	May 2015. No financial bonding posted for lift station (Kensington to verify).
2	Jualin Exploration Drift - J20133158.2	June 2015. Financial guarantee of \$684,115 posted in July 2015. Approved by ADNR and USFS
3	Fuel Depot 2016 (Parcel 14), September 2016	Updated plan (no amendment # assigned). Reclamation costs at \$143,444. Cost replaces 2013 plan for Parcel 14.
4	Avalanche Road	Built road access and put in berms for avalanche control. Approved by ADNR May 2014. Reclamation Plan revised (Figure 7 updated). The detailed estimation of the cost to reclaim the road to be included in the next regularly scheduled revision of the reclamation cost estimate (2018)
5	New waste dump, Pit 4 area	Design submitted to and approved by ADNR. Reclamation costs to be added to next regulatory schedule revision to reclamation plan (spring 2018). Construction of dump expected in summer 2018. If construction begins before updated reclamation plan approval, then bond will need to be updated.
6	GPTTF (moved location and updated since 2013)	Design submitted to and approved by ADNR. Reclamation costs to be added to next regulatory schedule revision to reclamation plan (2018)
7	New facilities: pug mill, cold storage structure	Design submitted to and approved by ADNR. Reclamation costs to be added to next regulatory schedule revision to reclamation plan (2018)

5.4.3 Reclamation and Closure Plan Components

For the purposes of reclamation bonding, there are three distinct phases of closure:

- **Phase I** reclamation and closure will cover the period after operations cease and reclamation is actively under way. This period would include any lag time between the end of operations and the two-year reclamation period. Activities covered by reclamation bond (note: the bond would only be used in the event of permittee default, otherwise reclamation costs could be covered by Coeur).
- **Phase II** will cover the period after final reclamation has been completed; monitoring and maintenance would be ongoing. Phase II would cover a 30-year post-closure period. Phase II bonding provided by the reclamation bond. (note: the bond would only be used in the event of permittee default, otherwise reclamation costs could be covered by Coeur).
- **Phase III** will cover the period when agencies have accepted the reclamation effort and release the bonds. Phase III would include the dam safety inspections required after the end of Phase II. Phase III financial assurance would be provided in accordance with the terms of the Record of Decision and is addressed in Long Term Care and Maintenance Plan. Financial assurance in form of a trust fund.

The *2013 Reclamation and Closure Plan Update for the Kensington Gold Project, Borough of Juneau Alaska* addresses the three phases of reclamation, with greatest emphasis provided for Phase 1 reclamation activities. The plan follows and meets the requirements of under Alaska Statutes Chapter 27.19 (Reclamation) and Alaska Administrative Regulations in 11 AAC 97 (Mining Reclamation).

Comments below are based on the Audit Team's review of the plan, site inspection, and interviews with Kensington personnel. The comments center on issues, concerns, and challenges in closure and reclamation and make recommendations for considerations in the 2018 update to the plan and finance assurance.

5.4.3.1 RECLAMATION AND CLOSURE PLAN AND FINANCIAL ASSURANCE UPDATES

In concert with the USFS and State of Alaska, the reclamation plan is to be updated every five years throughout the life of the project. The April 2013 plan and financial assurance is to be updated in 2018. Table 9 list items that require inclusion in the updated plan and financial assurance costs; however, Table 9 is not all inclusive but rather represents the major items identified during the audit.

5.4.3.2 TAILINGS TREATMENT FACILITY

Kensington disposes mine tailings in Lower Slate Lake, known as the tailings treatment facility (TTF) or tailings storage facility (TSF). As part of closure, the TTF will be reclaimed as a self-sustaining aquatic ecosystem lake (part of Lower Slate Lake but with a slightly larger footprint). The reclamation goal is for a hydraulic connection between Lower Slate Lake and Upper Slate Lake (via Mid-lake Slate Creek), including the restoration of the aquatic community between the two lakes including Dolly Varden. The current plan and associated cost estimates assumes that once tailings disposal is complete, Kensington would cap the deposited tailings with at least 10 centimeters (4 inches) of topsoil unless studies demonstrate the cap is not necessary to achieve the reclamation goal.

Since 2013, ADF&G Division of Habitat, ADEC, and USFS staff have worked with Kensington staff to study tailings geochemistry, macroinvertebrate colonization of submerged tailings, and basic water quality in Upper Slate Lake. The studies reveal the tailings are non-acid generating, aquatic macroinvertebrates inhabit the tailings, and Upper Slate Lake water quality is similar to baseline water quality for Lower Slate Lake. The conditions should provide suitable Dolly Varden habitat in the TTF at closure (Willson-Naranjo and Kanouse 2016). Thus, with agency approval, Kensington should be able to adjust its reclamation bonding to exclude the need for a cap in the 2018 plan update.

The TTF dam involves several crest raises and associated spillways during the operation of the mine and tailings facility. The spillway and crest rise for the Stage 1 of the TTF dam was constructed in 2010. The 2013 reclamation and closure plan primarily addresses Stage 2 of the tailings dam and includes a conceptual design and costs for the Stage 3 dam crest raise and spillway (Appendix C of the 2013 plan). Cost for constructing the crest and spillway for each dam stage is included in the capital cost for each stage of construction. The dam and spillway remain in place after closure. As per the 2013 Reclamation Plan, in the case of premature closure, prior to construction of the final dam stage, a budget is provided in the closure cost estimate to construct the final spillway. The inspection and maintenance of the TTF after closure is addressed in the Long-Term Care and Maintenance Plan and includes a long-term trust fund for conducting these activities. Kensington has completed final design package for Stage 3, *Stage 3 Dam Crest Raise Detailed Design Package* (Golder 2017). The 2018 plan update should reflect the Stage 3 design (cover premature closure and need to construct final spillway), in

addition, the *Long-Term Care and Maintenance Plan* and subsequent trust fund should be updated to reflect Stage 3 conditions.

5.4.3.3 GRAPHITIC PHYLLITE AND TTF DRAINAGE

During construction of the TTF dam and stripping of the dam borrow source, graphitic phyllite rock was encountered. As discussed in Section 5.1.4, geochemical reactions that occurred in the disturbed graphitic phyllite material resulted in low pH stormwater drainage. The drainage was characterized as low pH “seepage” containing dissolved metals. The seepage primarily occurred within the area of the east abutment of the TTF dam. Material excavated from this area was used to construct temporary fills and roads in the dam construction area. In order to address seepage that is collected from areas impacted by the graphitic phyllite, a water treatment facility was constructed and is being operated near the TTF water treatment system (there are two separate treatment systems). In addition, Kensington has been addressing storage and management of the excavated material and is using HDPE liners for material storage. Furthermore, Kensington has been treating the exposed graphitic phyllite surface with dental concrete as a treatment to prevent ARD. Based on the audit site inspection, and also discussions with site personnel, the effectiveness of dental concrete in preventing ARD warrants additional consideration and should be further addressed in the 2018 update.

Water from the TTF drainage system is being monitored and so far does not appear to be impacted from the graphitic phyllite material. If potential impacts from the drain system are detected during operations Kensington would evaluate the occurrence and need to be addressed during the 2018 revision of the plan.

Per the 2013 plan (Section 2.9.1), “a third party geochemical review will address the potential for acid mine drainage from all of the areas associated with the dam construction including the spillway. This review will consider potential impact during the post closure time period after removal of the dam seepage collection system. The long-term performance of dental grout to treat the surface of the graphitic phyllite deposit would be addressed. Kensington will complete this review and coordinate with the agencies prior to constructing the next dam phase.” At the time of the audit, a third party review was on-going but not complete. It is recommended that this be accounted for and that financial assurance contingencies be made in the 2018 update.

5.4.3.4 WATER TREATMENT FACILITIES

The mine has two permitted outfalls:

- Outfall 001 – Sherman Creek
- Outfall 002 - East Fork Slate Creek

Outfalls are associated with water treatment facilities.

Outfall 001 is associated with the MWTP and is used to remove suspended solids from mine water that discharges from the 850 Level Portal (Comet Portal). Water treatment at this location will be discontinued after water quality objectives are met for water draining from the mine. For the MWTP, the 2013 plan states, “This system is used to remove TSS from the mine water and will be operated during closure as long as influent monitoring indicates that treatment is

necessary”. It is unclear what assumption is made for closure cost purposes on how long the treatment would operate to meet water quality. Based on review of costs, 18 months is assumed for active treatment. The time required to treat suspended solids coming from the portal after placement of bulkhead should be further supported as part of the 2018 plan.

Outfall 002 is associated with the TTFTP that treats water in the tailings lake. This treatment system is also designed to primarily remove suspended solids.

Also, as described above, GPPTP has been constructed near the TTFTP for treating graphitic phyllite generated acid drainage near the east abutment of the TTF dam.

5.4.3.5 COMET PORTAL

A hydraulic bulkhead is planned at closure near the Jualin Portal that will flood the mine to an elevation that will result in mine water discharge to the Comet Portal located in the Sherman Creek Drainage. Per the 2013 plan, “The Kensington water treatment facilities would be operated after construction of the bulkhead is completed until water quality objectives are met for a period of four weeks. The water treatment plant would remain on -site in operational condition until the Forest Service and ADEC concur that treatment is no longer required and the treatment plant can be removed.” See comment above regarding assumptions made for length of treatment for the portal discharged water. The Audit Team did not review the technical assessment of the water balance assumed for the hydraulic bulkhead and anticipated flows, and assumptions regarding settling of suspended solids within the mine such that water quality standards would be met without active treatment. It is recommended that this information be provided (or referenced) in the updated 2018 plan.

5.4.3.6 RECLAMATION SUCCESS

Per the 2013 plan, “revegetation criteria will be used to quantify revegetation success where undisturbed reference sites and revegetation test plots will be used to evaluate revegetation performance for reclaimed areas. Annual monitoring would occur during each year until the reclamation trials meet reclamation success criteria. The schedule for monitoring may be adjusted or terminated based on the results indicated during monitoring upon approval of the [USFS] and ADNR. Kensington has prepared a Reclamation Test Plot Plan and will coordinate with the USFS and ADNR during test plot construction and monitoring, and to determine appropriate release criteria. Construction of the test plot is planned during the spring of 2013.”

The Reclamation Test Plot Plan has been completed and approved by the agencies (KC Harvey, Environmental, LLC 2012). The reference sites have been established to assess the existing percent areal cover as required in the release criteria. Three test plots have been established at Snowslide Gulch, a reclaimed area, to compare with the reference sites. Kensington is conducting reclamation monitoring and is documenting vegetative cover and site stability. Based on information reviewed for test plots, re-vegetation and the proposed seed mix as identified in the 2013 plan have not been overly successful, and at the time of the audit, there was uncertainty on seed mixes and next steps in test plot approach. Defining reclamation success is a key component to any reclamation plan, and it is recommended the Kensington and the agencies reevaluate this approach in the 2018 plan.



5.4.4 Financial Responsibility

5.4.4.1 PROOF OF FINANCIAL RESPONSIBILITY

Per Alaska Statutes Chapter 27.19 (Reclamation) and Alaska Administrative Regulations in 11 AAC 97 (Mining Reclamation), the permittee shall provide the ADNR with proof of financial responsibility for closure and reclamation of the mine and post closure monitoring. ADNR accepted proof of financial responsibility on June 28, 2013. Table 10 summarizes the financial assurance as of May 2013 (see ~~Table 10~~Table 9 for list of additional activities requiring bonding after May 2013).

Table 10. Mining Reclamation Financial Assurance for Kensington Gold Project (May 3, 2013)

Bond Type	Bond Number	Bond Amount
Bond Rider – National Union Fire Insurance Company	ESD7318759	\$10,337,561
Bond – Liberty Mutual Insurance Company	39S204970	\$9,194,725
Aspen American Insurance Company	SU27806	\$9,194,725
		\$28,727,011

5.4.5 Reclamation and Closure Costs Estimation

This evaluation was developed to assess whether the financial assurance amounts held by the state of Alaska are adequate to cover the costs of reclamation and closure as required by Alaska statutes and regulations. The State of Alaska is required to obtain financial assurances to ensure that the approved reclamation tasks are completed in the event Kensington fails to perform the necessary tasks as outlined in the Reclamation and Closure Plan.

Part of the *Reclamation Plan Approval* requires that the environmental audit include an evaluation of the adequacy of the approved financial assurance.

The 2013 plan and estimated reclamation costs were prepared for Kensington by KC Harvey in accordance with standard engineering cost estimation procedures and is consistent with methods commonly used by industry as well as state and federal agencies. Costs for individual reclamation tasks were based on unit costs to support a third party reclamation under varying years. General costs sources were as follows (from Appendix A in the plan):

- Wage rates: September 1, 2009 State of Alaska Department of Labor and Workforce Development Pamphlet
- Equipment rates and construction costs – local equipment rental company estimates, local barge and land craft operators, Caterpillar Performance Handbook, Edition 38 (2008), Custom Cost Evaluator program (2005), and Heavy Construction Costs Data (RS Means, 2005, 19th addition).
- Equipment Production Rates – Caterpillar Performance Handbook (2008).

All of the above referenced costs sources have been updated since 2013 and Kensington should utilize the most current sources for the 2018 update. It is unclear why Kensington utilized older versions of the above referenced documents for the 2013 estimate. However, Kensington

did utilize an inflation factor that accounted for changes over the 5-year cost period. Regardless, for the 2018 update, the most updated references should be utilized.

The Audit Team did not “re-estimate” the financial assurance estimates created by Kensington; rather, the Audit Team spot-checked calculations, and verified assumptions listed in the plan, and evaluated the overall adequacy of the approved financial assurance.

As stated above, Kensington performed cost estimates for reclamation and closure in accordance with standard cost estimation procedures and are consistent with methods commonly used by state and federal regulatory agencies. Assumptions, reclamation tasks, and associated costs are listed in the plan. Concerns regarding several of these assumptions and recommendations for 2018 updates are provided above (Section 5.4.3), mostly relating to closure and reclamation uncertainties with the following items (see Section 5.4.3 for discussion):

- Tailings Treatment Facility
- Graphitic Phyllite
- TTF Drainage System
- Water Treatment Facilities
- Jualin Portal
- Reclamation Success

5.4.5.1 COST ESTIMATION APPROACH

The Audit Team reviewed the approved 2013 financial assurance estimates. Overall, the cost estimate approach appears to be complete and consistent with mine activities reviewed during the audit.

Since 2013, Alaska has been evaluating approaches toward cost estimation and has published several documents on the subject including:

- Draft Mine Closure and Reclamation Cost Estimation Guidelines dated December 2013 (ADNR/ADEC 2013)
- Mine Closure and Reclamation Cost Estimation Guidelines: Indirect Costs Categories (ADNR/ADEC and prepared by DOWL, April 2015).

The first document remains in draft form and has not been adopted as official policy. The goal of the guidance is to provide a consistent methodology for estimating the amount of financial assurance required for the closure of a mine and the regulatory agencies to use when reviewing the closure cost estimates. The second document supplements the 2013 draft guidelines in that it assesses the variability that drives the ranges of indirect costs observed with reclamation and closure projects and then makes recommendations about what changes ADNR/ADEC should consider in order to improve the accuracy of the indirect costs portion of the guidelines.

The following discussion focuses on indirect costs, compares recommended indirect costs with Kensington’s 2013 estimates, and then makes recommendations for the 2018 update.

ADNR/ADEC define seven indirect cost categories for reclamation and closure:

- Contractor Profit – Calculated as revenue gained from reclamation/closure activities after accounting for contractor expenses, costs, and taxes.
- Contractor Overhead - Contractor overhead refers to all ongoing business expenses not including or related to direct labor, direct materials, or third-party expenses that are billed directly to a project.
- Performance and Payment Bond – Bond to protect owner (in this case the state) from contractor failure to perform contracted scope of work and also to cover payment to subcontractors and others receiving payments from the contractor. State of Alaska statutes (AS 36.25.010) require both a performance bond and a payment bond for construction of projects administered by the State of Alaska.
- Insurance – Liability insurance taken out by the contractor and required by the state.
- Contract Administration – Cost incurred by state (and cooperating federal agencies, if applicable) to oversee reclamation and closure activities.
- Engineering Redesign – Typically involves the updating of the mine’s reclamation and closure plan and POO. Often conducted to provide sufficient details to obtain bids from contractors for mine site reclamation and closure. Generally performed by an independent engineer contracted with state
- Contingency – Accounts for unknown or unforeseen costs arising during the reclamation and closure work. The two types of contingency costs are related to the scope of work and contractor bids.

Other indirect costs often reported (may show up in direct costs, or are not accounted for) include:

- Inflation proofing - The inclusion of additional anticipated project costs due to general economic inflation is often included in the indirect cost category when determining the total estimated reclamation and closure cost. This is more often shown below direct and indirect costs since inflation adjustments should account for both types of costs.
- Mobilization/demobilization – Typically this is included in direct costs (except for USFS, which guidelines include as indirect cost).

The 2013 Kensington indirect costs calculations were compared to the indirect costs recommended by ADNR/ADEC draft document *Draft Mine Closure and Reclamation Cost Estimation Guidelines* (DOWL recommended edits in Appendix A, April 2015) (Table 11).



Table 11. Comparison of Indirect Cost Percentages for Reclamation/Closure Costs between 2013 Kensington Gold Project, ADNR/ADEC Guidelines

Indirect Costs Category	2013 Kensington	AK Guidelines 2015 DOWL Draft ¹
	Percent of direct costs	
Contractor Overhead and Profit	5.0 (OH) 10 (profit)	4 to 8 (OH) 6 to 10 (profit)
Performance and Payment Bond	3.0	2.5 to 3.5
Insurance	1.5	1.5
Contract Administration	7	5 to 9
Engineering Re-Design	5	3 to 7
Contingency	12 (scope) 4 (bid)	6 to 11 (scope) 4 to 9 (bid)
Inflation Proofing (apply to both direct and indirect costs)	3.5	An inflation factor based on Anchorage CPI average over previous 5 years, and compounded for next 5 years
Mobilization/Demobilization	Part of direct costs	Part of direct costs

¹ Appendix A in Mine Closure and Reclamation Cost Estimation Guidelines: Indirect Cost Categories, prepared by DOWL for ADNR/ADEC, April 2015.

In summary:

- Contractor Profit – Kensington’s 2013 estimate was 10 percent, which is within the range for ADNR/ADEC guidelines.
- Contractor Overhead - Kensington’s 2013 estimate was 5.0 percent, which is within the range for ADNR/ADEC guidelines.
- Performance and Payment Bond - Kensington’s 2013 estimate was 3.0 percent, which is within the range for ADNR/ADEC guidelines.
- Insurance – Kensington’s 2013 estimate was the same as ADNR/ADEC guidelines.
- Contract Administration – Kensington’s 2013 estimate is within the ADNR/ADEC recommended range.
- Engineering Redesign – Kensington’s 2013 estimate was within the ADNR/ADEC guideline range.
- Contingency – Table 5.4.3-1 lists scope contingency as 12 percent, however, Appendix A in the plan uses 10 percent and based on the Audit Team’s calculations check, 12 percent was used. Kensington’s 2013 estimate for scope contingency was higher than the ADNR/ADEC guidelines (12 percent compared to 6 to 11 percent) and on the lower end for bid contingency (4 percent compared to 4 to 9 percent).
- Inflation - Kensington used a 5 year term for calculating inflation based on the approach outlined in the ADNR Guidelines for mine closure and reclamation cost estimation (ADNR 2009). A construction cost inflation rate of 3.5 percent was used for calculating inflation costs. The inflation rate was based on a 10 year average of the construction cost index data monitored by USACE, 2009.
- Mobilization/Demobilization - Kensington’s 2013 direct costs included estimates for barges and landing craft to mobilize construction equipment to the site, personnel transportation (ferry boat) and periodic deliveries (landing craft). Demobilization costs were included removing salvaged equipment and materials, and demobilization of

construction equipment. Cost also included removal of the marine terminal docks and piers. Estimated cost for post-closure activities included related transportation and mobilization costs.

Appendix A Section A4 in the 2013 plan list several of the indirect costs inconsistent with Table 5.4.3-1 in the same plan. However, the Audit Team reviewed the cost spreadsheets and verified that the cost assumptions in Table 5.4.3-1 (and as listed in Table 11 above) were used in the final cost calculations. In summary, Kensington's 2013 indirect costs estimates and assumptions are consistent with ADNR/ADEC draft guidelines and industry standards. However, given the remoteness of the mine site and limited seasonable timeframe for closure and reclamation activities, contingency estimates should be on the high end of the ADNR/ADEC range presented in Table 11. Kensington assumes a 12 percent contingency for scope, which is higher than the ADNR/ADEC range of 6 to 11; the Audit Team recommends Kensington utilize 11 percent for the 2018 update. The Audit Team recommends that the bid contingency be moved to 8 or 9 percent (the upper end of ADNR/ADEC range) given site location and seasonal limitations.

5.5 Quality Assurance Project Plan and Fresh Water Monitoring Plan

The most recent QAPP available for review is dated August 17, 2017. The QAPP & FWMP guides the monitoring activities for compliance with the WMP, APDES Waste Disposal Permit, and the Record of Decision issued by USFS. The QAPP & FWMP describes the technical quality guidelines that are employed during water treatment operations, data collection, and sample handling and analysis. The goal of this plan and of this sampling program is to generate unbiased data with known and traceable accuracy and precision. As discussed in other sections of this Audit Report, the QAPP requires an update to reflect current practices.

The QAPP states that the Quality Assurance (QA) Officer will perform a formal technical systems audit (TSA) each year. The TSA is intended to be a systematic, qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of the permit compliance system. The QA Officer may perform this audit or may hire a qualified firm. Elements of the TSA audit would include items such as:

- Review of personnel for training status, refresher training, and certifications as needed.
- Review of Standard Operating Procedures (SOP) for relevance and equipment updates.
- Assessment of data validation viability. Or, if so arranged, assessment of sub-contractor deliverables as data validation reports.
- Assessment of data collection procedures, storage systems, and backup systems as necessary.

The Audit Team interviewed the Kensington QA Officer who confirmed that annual TSAs are not being performed. However, an external laboratory audit was completed in 2013. The intent of the TSA audit would be of benefit to Kensington; therefore it is recommended that Kensington

begin to implement this TSA audit process. Alternatively, if audits are not going to be conducted, the section in the QAPP should be removed.

The Audit Team requested review of SOPs for sampling tasks. SOPs for field meters are provided in the QAPP (turbidity meter, pH meter, etc.); however, there are no SOPs that describe the sampling procedures associated with the sampling required in the WMP. Specifically, there are no sampling procedures for the collection of mine sump sediments or the collection of the waters in the sumps at the dam (dam seepage sump, graphitic phyllite seepage) or the TTF pond sampling, mine drainage, or GPPTP effluent. The equipment required to perform the sampling should be documented as well as the methodology to ensure consistency. It is recommended that the QAPP be revised to add sampling procedures for the WMP monitoring, or at least reference to separate sampling SOPs. It is recommended that Kensington create a master SOP list for environmental sampling and tests. This list should be included in the QAPP and also made available in the sample preparation shack. Furthermore, appropriate sampling, sample handling, and field equipment SOPs should be maintained in a binder at the shack and made available to field personnel.

According to the QAPP, it appears that the data validation process does not reject any data, but that data is qualified (i.e., flagged) when data quality objectives or hold times are not met. The QAPP states that 20 percent of all laboratory data will be reviewed by the QC Technician on a monthly basis and compared with the data quality objectives (DQOs). According to the QA Officer interviewed by the Audit Team, the process of data validation occurs when data is uploaded into Kensington's environmental database, EQWin. None of the data reported as part of compliance with the WMP had data qualifiers or flagged values. In addition, reporting to ADEC does not include any data for quality control samples to complete a review. Therefore, the Audit Team was unable to review if data validation is occurring or if the validation process follows the QAPP. The purpose of the quality control program is to take corrective action if sampling problems became apparent through the TSA audit or monthly data quality review. The Audit Team suspects that all quality control samples are associated with APDES monitoring. The Audit Team recommends that data quality objectives be added to the QAPP for the various types of samples required in the WMP (sediment, seepage, effluent, etc.). It is also recommended the data validation process be documented to reflect the methods, and document the findings for a monitoring period (quarterly). These validation findings could be reported along with the ADEC reporting.

Instruments are calibrated and calibration records are maintained in accordance with the QAPP.

For surface water samples, field duplicate samples are collected and inserted into the sample train at a frequency of once per each sampling event (this is equivalent to about 1 duplicate per 12 field samples). The QAPP's discussion regarding field quality control samples (e.g., field duplicate samples) is not clear whether seepage, seepage sump, TTF pond, and GPPTP effluent or Mine water are included in the frequency calculation. It is recommended that the QAPP be revised to separate the APDES surface water monitoring from the WMP seepage and other monitoring so that the quality assurance protocols and data quality objectives for each are understood.

Kensington uses several contract laboratories for testing of environmental samples; this information needs to be updated in the latest version of the QAPP.

The QAPP does not address the monitoring that is completed using the vibrating wire piezometers or the flow monitoring as required in the WMP. It is recommended that the QAPP be revised to include the vibrating wire piezometers, pressure transducers, and data loggers for the measurement and recordation of water levels in piezometers, water level at flumes, or flow in sumps. It is recommended that, at a minimum, the frequency of data download from the data loggers and reference to a separate SOP is included. The QAPP or the SOP should describe the data collection programming of the data logger, the equipment, frequency and process for data download, where data will be stored and how it will be managed, how data drift will be reviewed and corrected, how data will be corrected for barometric pressure, etc. The Audit Team determined through interviews and records provided by the Kensington Mine that calibration of the Geokon vibrating wire piezometer electronic readout unit was last performed by the manufacturer in January 2016. The O&M Manual Appendix E2, Instruction Manual for the Geokon Vibrating Wire Readout, specifies that the readout unit should be sent to the manufacturer for inspection, cleaning, and calibration at minimum annually (every 12 months).

The QAPP Section A7.1 lists the required training for staff collecting any field data. Training requirements are intended to ensure that all personnel have appropriate training and skills with training conducted on an annual basis. The QAPP states that personnel training records are documented in logs maintained in Kensington's environmental filing system. The Audit Team interviewed the QA Officer, who described the training that he conducts for the staff to ensure that each staff has been trained on each aspect of data collection before performing the task. However, there were no training records available for review. The Audit Team recommends that Kensington implement a training log.

Sample Preparation Shack

The Audit Team inspected Kensington's environmental sample preparation shack. The shack is used for storage of laboratory supplied sample containers, sample coolers, refrigerator for temporary storage of samples and reagents, freezer for ice, storage of reagents, storage and calibration of field meters (e.g., pH meter), storage of sample preservative chemicals (e.g., nitric acid), and storage of field sampling equipment and supplies. The Audit Team inspected the shack for appropriate labeling, calibration solution expirations dates, field meter storage and calibration log, chain of custody and records storage, sample tracking, organization, chemical storage, personal protective equipment available, and systems in place to minimize cross-contamination during sample preparation and laboratory testing. The Audit Team found the shack to be clean, with equipment and supplies well maintained, labeled, and calibration tracked.

It is recommended that Kensington update the QAPP to provide direction for reporting the background values in the reporting tables and report graphs, and include how the evaluation of trends will be completed and communicated in reporting.

Some discrepancies between the QAPP and other monitoring plans, reporting, or permits were described earlier in the WMP monitoring section of the report and will not be restated in this section.

6.0 Reliability and Integrity of Information Relating to Environmental Reporting and Compliance

Direct field observations and interviews with key mine personnel were completed to determine the reliability of reported information. The reliability and integrity of information for reporting and compliance is reasonable. Kensington has a QAPP that the Audit Team reviewed that includes some sampling protocols, data quality, training, and instrument calibration. The staff is well organized, knowledgeable, and well-trained on environmental management for mines. The Environmental Manager has regular discussions and planning meetings with the plant and maintenance supervisors as well as mine site staff throughout the overall facility. The Audit Team observed numerous environmental and safety best management practices throughout the mine tour, including recycling and reuse efforts, aerosol disposal stations, materials and storage management and the shipment of waste off site to the extent practicable. The Audit Team recognized a general knowledge and thoughtfulness for environmental requirements from staff throughout the property. The Environmental Team performs new hire environmental training for all personnel, which should begin to be better documented moving forward, tracking personnel in attendance and software-based tracking of personnel attendance at various environmental related trainings.

7.0 Adequacy of State Oversight to Protect State Resources

The Audit Team interviewed various agency representatives, as shown in Table 2 and reviewed inspection reports from ADEC and ADNR and Annual Agency Meeting Reports. The reports summarize their inspection tour and any finding/observations, and provide photographs. Inspections included construction activities and the general mine site. The regulatory agency personnel for this project appear knowledgeable and have ample understanding of mining practices, environmental mitigation measures, and the state regulations.

The water quality monitoring of the dam seepage, the TTF, GPPTP effluent, graphitic phyllite seeps, and the mine drainage to MWTP are all monitored for a specific purpose that is not well defined in the WMP, the QAPP, or the IWMDP. It is the Audit Team's recommendation that more emphasis in the WMP should be placed on how the Permittee should analyze the data after collection. Currently the monitoring is completed in compliance with the permit. However, how the data is being used to protect State resources is not clear given the lack of comparison against baseline values or trend analysis.

8.0 Adherence with Pollution Prevention Strategy

Kensington's IWMDP lines out specific priorities and strategies that the mine uses to prevent and minimize waste generation. These strategies are described in Section 5.2.1. The Audit Team observed that Kensington was implementing the waste prevention and minimization strategies throughout different areas of the mine. Kensington implements pollution prevention through providing and maintaining secondary containment for all mill reagent and water treatment chemical piping and chemical mix tanks containing hazardous or toxic materials. In addition, the temporary storage of the graphitic phyllite, Kensington's only acid generating material, in 60-mil HDPE liner containment was observed by the Audit Team as a significant pollution prevention practice. In addition, while baseline geochemical characterization of waste rock materials was shown to be non-acid generating with low metals leachate potential, frequent monitoring is performed on these materials to evaluate change in the geochemical characterization over time, including waste rock, tailings, and mine sump sediments. At the TTF, seepage and runoff collection systems are operated to ensure that the mine operates as a zero discharge facility except for the discharges permitted under APDES Permit No. AK0050571.

The 2013 reclamation and closure plan describes reclamation and closure principles that include pollution prevention strategies focused on implementing best management practices for drainage and erosion control, re-vegetation, and following the mine's SWPPP. Closure activities would be implemented immediately following cessation of mining activities including removal of chemicals, storage tanks, and other hazardous materials from the site for off-site disposal or reuse.

Kensington is attempting to address pollution prevention on the dam and closure planning by addressing the ARD seepage from the graphitic phyllite in the closure design. The ARD seepage is occurring from the existing Stage 2 interim spillway walls at the south end of the dam, which would flow down the spillway and report to the plunge pool. The Stage 3 dam raise is designed to address the seepage by constructing relief underdrains within the Stage 3 Spillway to collect and divert the seepage laterally into the HDPE Seepage Collection Sump, and covering the Stage 2 Interim Spillway bottom and walls with structural concrete or roller compacted concrete. This treatment is designed to eliminate seepage flow to the plunge pool and separate affected seepage from fresh water.

9.0 Conclusions

The Audit Team reviewed programs under the WMP, *Reclamation Plan Approval*, and COD. Kensington is generally in compliance with operations and reporting for all authorizations with only a few exceptions: TTF lake level, dam embankment piezometer head levels above compliance trigger levels, and annual reporting of water balance components. In addition to these few compliance items, the Audit Team has recommendations for improved environmental management, such as QAPP and IWMDP revisions for consistency across documents, observations and recommendations for improved reporting compliance, modifications to the 2018 reclamation cost update approach, and recommendations for ADEC revisions to the WMP to add clarity and purpose to monitoring requirements.

The reliability and integrity of information for reporting and compliance is reasonable. The Kensington staff is knowledgeable and well-trained on environmental management for mines. The Audit Team recognized a general knowledge and thoughtfulness for environmental requirements from staff throughout the property.

WMP

- The total volume of tailings disposed of underground is not provided in the reporting to ADEC and it is recommended that this be an added reporting requirement in the permit because the permit authorizes a tonnage of tailings to underground (3M tons).
- There are no specific limits on development rock volumes in the WMP, other than the WMP Permit Section 1.6.10 requirement that disposal of waste quantities may not exceed the design capacity of the disposal facility. However, Section 3.2.2 of the Reclamation Plan states: “During construction and operation of the mine, it is estimated that approximately 500,000 cubic yards of development rock will be produced and placed within Parcel 4.” It is not clear how ADEC would regulate Section 1.6.10, or track accumulation without the permittee reporting the volume of development rock disposed to each specific facility. It is recommended that a future permit specify that the annual reporting include waste volumes to each specific waste facility; and that Kensington begin to report the development rock disposal log by specific disposal facility.
- The Audit Team observed that Pit 7 had exposed graphitic phyllite (because it was actively being transported) and was missing runoff controls (e.g., berms) such that runoff in contact with graphitic phyllite had the potential to flow away from Pit 7. The Audit Team recommended to the Environmental Manager during the Audit Site visit that berms or similar runoff controls be established at the site to contain stormwater in contact with the graphitic phyllite.
- The Audit Team observed the filter cake had been disposed on the face of the development rock pile with little to no berm in front. The Audit Team recommended that the berm be replaced and maintained in these locations where filter cake is disposed. However, while the berm at the development rock pile base was inadequate, any runoff would flow down the road and eventually to the road berm.
- Kensington annual reports do not provide specific TTF water balance components required in the WMP, including:
 - inflow in the form of process water in tails (this value may be provided in reporting but the data labels are not equivalent to be sure),
 - precipitation and run-on,
 - seepage return water,
 - the TTFTP effluent, or
 - outflows including the TTFTP effluent and water returned to the mill.
- WMP Table 1-1 states that mine sump sediment monitoring can be reduced to annually after 8 quarterly samples show no significant increase in constituents and must revert to quarterly should annual results show significant increases. The Audit Team recommends

that Kensington reduce monitoring to annually given the stable constituent concentrations observed since September 2013.

- The Audit Team recommends that the WMP be revised to include the specific parameters for which mine sump sediment leachate (from SPLP) should be analyzed, and that the QAPP, IWMDP, and POO, as well as future laboratory analyses, be modified to be consistent across all documents.
- The Audit Team recommends that Section 1.10 of the WMP be revised to require the Permittee to submit the monitoring reports to include the analytical data tables, the original baseline analysis for comparison, and graphs of the data to evaluate trends.
- The Audit Team recommends that future annual reports by Kensington account for the specific water balance components as specified in Section 1.10.5.3 of the WMP. Current reporting of the water balance is included but specifically required components are not provided.
- WMP Table 1-1 requires tailings monitoring to include “Tailings – POO Appendix 4a Pg 4 – 7”. The required tailings sampling description from the WMP is not accurate and requires clarification. The Audit Team recommends that this monitoring requirement language be edited during the next permit update.
- It is recommended that the QAPP, IWMDP, and *Tailings Storage Facility Ecological Monitoring Plan* documents be revised for consistency, including determination if manganese is needed and whether the best nutrient analysis is nitrate as N or nitrate+nitrite as N for tailings monitoring. In addition, the tailings sample collection description as 24-hour composite needs to be described in each document. Specifically, the QAPP should describe the sampling and compositing procedure, identify who collects and composites the samples, and what laboratory analyzes the samples for tailings and development rock.
- The WMP Section 1.7.4.2 lists the tailings analysis in an ambiguous format. It is recommended that this sentence be reworded to state “the tailings will be analyzed for ABA and MWMP leachate will be analyzed for”.
- Kensington reports arsenic under the symbol “Ar” instead of “As”. This should be corrected in future reporting.
- Update the IWMDP to align with current waste management practices at the mine.
- Kensington does not currently report data validation information in ADEC reporting as required in WMP Section 1.10.4. It is recommended that data flags be included in reporting and the QAPP be revised to specify the data validation process including the specific data flags for each data quality objective. It is also recommended that reporting to ADEC describe the results of data validation and quality control to demonstrate data quality.
- The last contract laboratory performance audit was completed in 2013. It is recommended that an audit be completed of the current labs being utilized.

- It is recommended that Kensington initiate inclusion of the background values in the reporting tables and provide graphs.
- Evaluate the utility of conducting fish surveys in Upper Slate Lake and Lower Slate Creek. The time and funding associated with these tasks may be better served supporting other monitoring efforts at the mine.
- Evaluate the results of the ADF&G tailings treatment facility studies with respect to installing a 4-inch organic cap in the TTF at reclamation.
- Verify that an overflow protection valve is installed on the 30,000 gallon and the 290 gallon Fire Water Diesel Tanks located at the Mill.
- The environmental sample preparation shack was found to be clean, with equipment and supplies well maintained, labeled, and calibration tracked.

Certificate of Approval to Operate a Dam

- The operation of the HDPE Seepage Collection Sump pump-back system requires repair in order to prevent freeze-up of the outlet pipe and avoid elevated piezometric head levels that exceed trigger levels in the dam embankment. It was indicated to the Audit Team during the site visit that implementation of a repair solution was in process by Kensington Mine personnel.
- TTF lake level is rising faster than the planned rate of rise, attributed primarily to low water treatment rates. As noted above, at the time of the Site Visit the Audit Team was informed that the operating water level was measured at 699.1 feet on September 10, 2017, which exceeds the 200-year, 24-hour storm storage elevation of 697.3 feet; and the mine water balance model indicates that the mean lake level will exceed the 200-year, 24-hour storm storage elevation of 697.3 feet before the Stage 3 raise in 2018. The Stage 3 Dam raise is not scheduled to start until spring or summer 2018. It is recommended that Kensington increase throughput treatment and discharge at the TTFTP to reduce the incremental additional stored water in the TTF, and restore full storage volume for the 200-yr, 24-hr storm surge below the invert elevation of 709 of the Stage 2 Interim Spillway as required by the COD. The PSI Report indicates that Kensington Mine personnel understand this risk and are actively evaluating alternatives to improve water treatment rates.
- It is recommended that Kensington closely monitor the TTF impoundment water elevation and water balance for the remainder of 2017 and into 2018 until the Stage 3 Dam raise is completed, consistent with the above requirement to restore the design storm surge storage.
- It is recommended that Kensington develop more detailed plans for final closure of the TTF and dam, including consideration of modifications to the final dam and final spillway configurations to create a passive system with high factor of safety and low maintenance needs post-closure.

Reclamation Plan Approval and Financial Assurance

- The Reclamation and Closure Plan follows and meets the requirements of Alaska Statutes Chapter 27.19 (Reclamation) and Alaska Administrative Regulations in 11 AAC 97 (Mining Reclamation).
- The 2013 Reclamation and Closure Plan and financial assurance is to be updated in 2018. The Audit Team comments regarding 2018 plan update needs are provided (Section 5.4.4), mostly relating to closure and reclamation uncertainties with the following items (see Section 5.4.4 for discussion):
 - Tailings Treatment Facility
 - Graphitic Phyllite
 - TTF Drainage System
 - Water Treatment Facilities
 - Jualin Portal
 - Reclamation Success
- Kensington has been treating the exposed graphitic phyllite surface with dental concrete is a treatment to prevent ARD. Based on the audit site inspection, and also discussions with site personnel, the effectiveness of dental concrete in preventing ARD warrants further consideration and should be furthered addressed in the 2018 update. Per the 2013 plan (Section 2.9.1), “a third party geochemical review will address the potential for ARD from all of the areas associated with the dam construction including the spillway. This review will consider potential impact during the post closure time period after removal of the dam seepage collection system. The long-term performance of dental grout to treat the surface of the graphitic phyllite deposit would be addressed. Kensington will complete this review and coordinate with the agencies prior to constructing the next dam phase.” At the time of the audit, a third party review was on-going but not complete. It is recommended that this be accounted for and that financial assurance contingencies be made in the 2018 update.
- The 2013 estimated reclamation costs were prepared by Kensington in accordance with standard engineering cost estimation procedures and are consistent with methods commonly used by industry as well as state and federal agencies. The Audit Team did not “re-estimate” the financial assurance estimates created by Kensington, rather the Audit Team spot-checked calculations, and verified assumptions listed in the plan, and evaluated the overall adequacy of the approved financial assurance. In addition, the Audit Team reviewed indirect costs in the 2013 plan. Overall, Kensington’s indirect costs assumptions are consistent with ADNR/ADEC guidelines. Given the remoteness of the mine site and limited seasonal timeframe for closure and reclamation activities, the Audit Team recommends Kensington utilize 11 percent for scope contingency and a bid contingency to 8 or 9 percent for the 2018 update (the upper end of ADNR/ADEC

range). Other indirect assumptions used by Kensington in the 2013 plan are reasonable and should be carried forward in the 2018 update.

Quality Assurance Project Plan

- It is recommended that Kensington begin to implement the TSA audit process described in the QAPP. Alternatively, if audits are not going to be conducted, the section in the QAPP should be removed.
- The QAPP does not include sampling procedures for the collection of mine sump sediments or the collection of the waters in the sumps at the dam (dam seepage sump, graphitic phyllite seepage) or the TTF pond sampling, mine drainage, or GPPTP effluent. It is recommended that the QAPP be revised to add sampling procedures for the WMP monitoring, or at least reference to separate sampling SOPs. It is recommended that Kensington create a master SOP list for environmental sampling and tests.
- It is recommended that the QAPP be revised to include vibrating wire piezometer and pressure transducer (flume and flow) data management describing the data collection programming of the data logger, the equipment, frequency and process for data download, where data will be stored and how they will be managed, how data drift will be reviewed and corrected, and data correction for barometric pressure. It is recommended that the data measurement and recording frequency, as well as data download frequency be edited for consistency between the QAPP and TFF O&M Manual.
- Instruments are calibrated and calibration records are maintained in accordance with the QAPP.
- The QAPP's discussion regarding field quality control samples (e.g., field duplicate samples) is not clear on whether seepage, seepage sump, TTF pond, and GPPTP effluent or Mine water are included in the frequency calculation. It is recommended that the QAPP be revised to separate the APDES surface water monitoring from the WMP seepage and other monitoring so that the quality assurance protocols and data quality objectives for each are understood.
- Kensington uses several contract laboratories for testing of environmental samples; this information needs to be updated in the latest version of the QAPP.
- The QAPP Section A7.1 lists the required training for staff collecting any field data. There were no training records available for review. The Audit Team recommends that Kensington implement a training log.

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Appendix A
Site Photographs



Photo A North Diversion Structure north of Lower Slate Lake impoundment



Photo B Upper Slate Creek Diversion Dam



Photo C Upper Slate Creek Diversion Dam



Photo D Upper Slate Creek Diversion Dam



Photo E Diversion Outlet Pipes and lined channel below Lower Slate Lake Dam.



Photo F Diversion Outlet Pipes and lined channel below Lower Slate Lake Dam.



Photo G Diversion Outlet Pipes and lined channel below Lower Slate Lake Dam.



Photo H Lower Slate Lake Tailings Impoundment



Photo I Lower Slate Lake Tailings Impoundment



Photo J Lower Slate Lake Reclaim Water Line & Barge pump control shed, cabled log debris barrier behind



Photo K Lower Slate Lake Reclaim Water Line barge, Lower Slate Lake Dam upstream slope and Stage 2 Interim Spillway in background



Photo L Lower Slate Lake Reclaim Water Line barge, Lower Slate Lake Dam upstream slope and Stage 2 Interim Spillway in background



Photo M Parshall Flume for combined flow from Lower Slate Creek Diversion Dam & North Diversions at east (left) abutment of dam



Photo N Parshall Flume for combined flow from Lower Slate Creek Diversion Dam & North Diversions at east (left) abutment of dam.



Photo O Parshall Flume for combined flow from Lower Slate Creek Diversion Dam & North Diversions at east (left) abutment of dam.



Photo P Lower Slate Lake Dam crest at Stage 2 elev. 715, Stage 2 Interim Spillway in background, looking west-southwest.



Photo Q Stage 2 Interim Spillway west wall and west abutment wall below spillway and downstream of Stage 2 Dam toe, shotcrete spillway walls with ARD seepage staining on spillway & abutment walls, looking west.



Photo R Lower Slate Lake Dam Stage 2 upstream slope with exposed geotextile, looking west.



Photo S Lower Slate Lake Stage 2 Dam downstream slope and toe, looking west, Interim Spillway and west abutment wall in background



Photo T Lower Slate Lake Dam area downstream of east (left) abutment, shotcreted slopes (understood to have been excavated to rock) with staining from ARD seepage and collected seepage at toe of slope.



Photo U Lower Slate Lake Dam area downstream of east (left) abutment, shotcreted slopes (understood to have been excavated to rock) with staining from ARD seepage and collected seepage at toe of slope.



Photo V Lower Slate Lake Dam and Tailings Impoundment, looking upstream (north-northwest).



Photo W Lower Slate Lake Dam Stage 2 downstream slope. Seepage Collection Sump return pipeline along west groin of dam. Shotcrete west abutment wall with staining from ARD seepage.



Photo X Lower Slate Lake Dam Vibrating Wire Piezometer readout panel/switchbox (located at Seepage Collection Sump).



Photo Y Lower Slate Lake Dam Seepage Collection Sump.



Photo Z Lower Slate Lake Dam Seepage Collection Sump.



Photo AA Lower Slate Lake Dam Seepage Collection Sump.



Photo BB Lower Slate Lake Dam Seepage Collection Sump control station, incl. Geokon vibrating wire piezometer readout panel.



Photo CC Lower Slate Lake Dam Seepage Collection Sump return pipeline along west groin of dam. Shotcreted west abutment wall with staining from ARD seepage.



Photo DD Lower Slate Lake Dam collection channel along and downstream of west groin of dam below shotcreted west abutment wall.



Photo EE Lower Slate Lake Dam collection channel and sump along and downstream of west groin of dam below shotcreted west abutment wall.



Photo FF Lower Slate Lake Dam collection channel and sump along and downstream of west groin of dam below shotcreted west abutment wall.



Photo GG Geomembrane-lined ARD seepage collection sump and ARD seepage pump-back sump lift station (manhole) with sampling (safety) tripod and pump control panel.



Photo HH Geomembrane-lined ARD seepage collection sump downstream of Lower Slate Lake Dam.



Photo II ARD seepage collection sump and seepage pump-back sump lift station (manhole) with sampling (safety) tripod and pump control panel, downstream of Dam.



Photo JJ Pit 7 graphitic phyllite storage, missing a berm to capture runoff.



Photo KK Showing Labeled Containers



Photo LL Showing the SAA at the Mill



Photo MM showing an aerosol can disposal station, cans are punctured and discharged directly in to a 55 gallon drum containing a Hazardous Waste Label.



Photo NN Showing the Universal Waste Accumulation Area



Photo OO Showing Separate Containers for Lead Acid Batteries and Used Coolant



Photo PP Showing a Lube Cube (left)