Kensington Gold Mine, Juneau Ranger District, Tongass National Forest

September 10 and 11, 2014

Background

Kensington Gold Mine is located in Berners Bay, north of Juneau, Alaska, on the Juneau Ranger District. It was randomly selected in 2014 for Best Management Practices (BMP) review using the National BMP Monitoring Protocol. On September 11, 2014, Katherine Prussian (Forest Service Hydrologist), Brad Orr (Juneau District Ranger), Quentin Smith (Forest Service Engineer), Curtis Caton (Forest Service Minerals Specialist), Sheila Jacobson (Forest Service Fish Biologist), Pete Schneider (Forest Service Fish Biologist), Shilo Williams (Alaska Department of Environmental Conservation [DEC]), and Jeff Hoagland (DEC) performed a Soil and Water BMP review of the Kensington Mine. Matt Reece (Forest Service Minerals Specialist), Will Collingwood (DEC), and David Wilfong (Alaska Department of Natural Resources) also were also part of the office portion of this review but did not participate in the field review. Coeur Environmental Manager, Kevin Eppers, coordinated the transportation on-site, and answered questions from the BMP team. This is the first time the Tongass National Forest has attempted to evaluate BMPs at an active mine using the national protocol. A draft monitoring form was pilot tested by the Interdisciplinary Team (IDT).

The National BMP monitoring protocol suggest using the Mineral A form for the Kensington Mine review. Using this protocol, the group gathered at the Juneau Ranger District on September 10th for 4 hours to discuss the protocol and review the documents. During this review, we looked through planning documents, discussed the history of the mine relative to soil and water practices, and completed the initial 4 pages of the Mineral A form. The following day, the group went to the Kensington Mine for a field review. At the mine, we visited the camp facilities, wastewater treatment facilities, settling ponds, the tailings pond, two leachate locations, graphitic phyllite waste sites (burritos), the mine, several roads and bridges, and the waste dump sites (Comet and Jualin). The focus of the review was the effects of mine operations on soil and water resources. The following topics were considered and discussed: erosion and sedimentation, fuels or hazardous chemicals, heavy metals and/or leachate, sanitary waste, and waterbody alterations. Some photos and dialog from the site visit are included below.

The documents utilized in the review, but not limited to, were the Environment Impact Statement and Record of Decision, Stormwater Pollution Prevention Plan (SWPP) and its amendments, the General Permit, the Kensington Plan of Operations, Kensington BMP Plan, the Quality Assurance and Protection Plan (QAPP), 2013 ADF&G Aquatic Studies Technical Report No. 14-01, Reclamation Plan, and the Tongass Land and Resource Management Plan.

Erosion and Sedimentation

Erosion and sedimentation are often associated with roads, stream crossings, and any exposed soils or rock such as tailings, waste rock piles, rock pits, etc. At Kensington, road runoff and stormwater are addressed in the Stormwater Protection Plan, also known as the SWPP, which identifies freshwater and stormwater routing, settling ponds, outfalls and other erosion control items.

In most cases, stormwater runoff is routed to drainage ditches, settling ponds, then out through a stilling well and released at designated outfalls. The field review included a subset of drainage ditches and settling ponds. The settling ponds were filtered, surrounded by HDPE liner with silt curtains, and water was released via a stilling well (Photo 2). The settling pond used for snow was an exception – no filter, geotextile, nor stilling well (Photo 6). Several sections of silt fencing were full or failing, and in need of maintenance (Photos 4, 11 and 14). Sediment accumulated in the diversion ditch near Bridge 2 (Johnson Creek) had been cleaned out; however, the sediment was placed along the ditch (Photo 1). These sediments need to be removed and disposed of appropriately (BMP Plan C-64).

Kensington Photo 1. Drainage ditch along the main road near Bridge 2 across Johnson Creek. Solids from the ditch are excavated and placed on the banks of the ditch.

Kensington Photo 2. Settling pond collecting road runoff. Notice the triple filter and HDPE liner around the perimeter. A standpipe at the far end of the pond drains the runoff onto the hillslope below which flows into the surface water creek.

Kensington Photo 3. A settling pond at the base of a hill. The settling pond was capturing runoff from the stormwater drainage ditch. A portion of the road runoff was not routing to the settling pond. Note the runoff along the edge of the road that routes to the bridge. Improved road grading could route more of the road runoff to the drainage ditch and /or settling pond.

Kensington Photo 4. A silt fence which was full and not capturing all flow.

Kensington Photo 5. An example of silt fencing around a curve that was keeping road runoff and turbidity from reaching surface waters.

Kensington Photo 6. An old settling pond which was no longer sealed and was leaking. This pond is currently used for snow dumping. The sediments from the snow are not properly filtered using this settling pond.

The SWPP indicates freshwater and stormwater drainage in Figures 1-12. In most cases (of those visited) the plan had been implemented on the ground. An exception was noted near the lower batch plant area just up-road of the Johnson Creek Bridge 2 crossing. In this location there is a culvert which flows directly into Johnson Creek. There is a silt fence across the stream mid-way down the slope (Photo 10). The silt fence was put in place to reduce the velocity of the water and prevent erosion from occurring early in the spring when there is no vegetation present. The SWPP shows no direct runoff (freshwater nor stormwater drainage) going into Johnson Creek at this location. Instead, stormwater is routed to the Batch Plant fines pond, then to outfall 5, and freshwater is routed to Outlet #5.

Turbid waters were identified in wetland ponds downstream of a settling pond and adjacent to Johnson Creek (Photo 10). The source of the sediment was not confirmed; however, likely sources included the road or the settling pond (both located within 50 feet of turbid waters). The turbid waters were within the riparian area of Johnson Creek.

All bridges had filter material across the entire bridge; however, sediment was reaching surface waters (below the bridge) in two locations (Photos 7 and 9). In both cases, road runoff was directed to the bridge with no relief, hence the runoff transports sediments to the bridge, where it settles out and may work its way through the filter.

Kensington Photo 7. Bridge over Upper Sherman Creek, a resident fish stream.

Kensington Photo 8. Bridge over South Fork of Sherman Creek, a resident fish stream.

Kensington Photo 9. Bridge over Johnson Creek, a resident fish stream.

Kensington Photo 10. Turbid waters adjacent to Johnson Creek, just upstream of the Johnson Creek bridge. Exact source of this turbidity was difficult to determine, but could have been the road runoff or settling pond.

The log stringer bridges on the Comet side (No Name Creek and Sherman Creek) were in various stages of structural failure (which could be lending to the sedimentation under the bridge). A 2013 report (Quentin Smith) indicates structural concerns of these bridges and suggests replacement for both safety and water quality purposes. Kevin Eppers said the bridges are identified for replacement; however, had no idea when they would be replaced. Coeur did not receive copies of the 2013 report and have not seen water quality impacts in their routine water quality testing, so they assumed the bridges were not of an immediate concern.

Kensington Photo 11. Failed silt fencing on a creek draining directly into Johnson Creek. The source was a culvert draining from the batch plant area. The silt fence was put in place to reduce the velocity of the water and prevent erosion from occurring early in the spring when there is no vegetation present.

Kensington Photo 12. The bench at the lower end of the development rock pile.

Turbidity and road sedimentation was seen at the termination of the inboard ditch in the Slate Cove area. The ditch ended in the parking lot for the marine facility. Stormwater drainage in this area is designed (per SWPP) to terminate into a French drain infiltration area. It appeared to be either not implemented or not fully effective because

runoff and sediment were entering the marine waters of Slate Cove in this location (no photo). A settling pond or some sort of improved filtration in this location would reduce sedimentation into Slate Cove.

Sediment and waste rock from the Comet Portal Development rock pile extend into Ophir Creek (Photos 12-14). The Comet Portal development rock pile is an extension of the pre-existing Kensington development pile. This large, steep, waste rock pile extends to the edge of the Ophir Creek, a resident fish (Dolly Varden char) stream (see ADF&G Aquatic Studies at Kensington Mine, 2013 for more information). The riparian area for this channel type (alluvial fan) would generally be 100-140 feet in width. A topographic bench was evident (Photo 12); however there was no buffer between the surface waters of Ophir Creek and the base of the development pile (Photo 13).

The SWPP (Figure 12, SWPP) show silt fencing extending approximately 1000 feet along the toe of the Comet development rock pile. There was some silt fencing in this location; however, it was not maintained and had partially fallen down. The extent of the silt fencing appeared to be less than the designed length in Figure 12 of the SWPP. Maintenance of the silt fencing may reduce potential for silts and sediment to enter Ophir Creek.

Stormwater drainage, as seen in Figure 12 of the SWPP, is supposed to be routed across the base of the Comet Development Pile to a catchment basin near the Comet settling ponds. There was no evidence of an effective stormwater diversion across the base of the development pile; rather it appears that drainage from the development pile flows downhill into Ophir Creek and the adjacent wetlands. The bench at the lower end of the development rock pile.

Kensington Photo 13. Silt fencing between the rock pile and Ophir Creek. Ophir Creek appears to be an alluvial fan type channel which carries a high volume of rock naturally. There is no effective buffer between the rock pile and Ophir Creek.

Kensington Photo 14. This photo shows and the lack of riparian buffer between Ophir Creek and the development rock pile. The people are standing on the bench at the lower end of the rock pile. Ophir Creek is in the trees on the right side of the photo.

Fuels or Hazardous Chemicals

All of the fuel storage areas seen on the field trip included secondary containment. However, in some cases the secondary containment contained water which minimizes the volume of secondary containment available. These sites need to be drained daily or covered from rainfall to maintain effective use of the secondary containment.

Kensington Photo 15. Fuel storage facilities

Kensington Photo 16. Fuel storage facilities. Notice the water in the secondary containment. The tank is dual walled and does not require secondary containment. The low volume containment is not intended to capture a leak from the tank. It's intended to capture a spill during the filling of the tank. The water is extracted prior to filling the tank.

Kensington Photo 17. The secondary containment in this picture was no longer working; however, Kevin said that the container was no longer used for hazardous materials storage.

A fuel spill had occurred on the ramp leading to Lynn Canal beach on the Comet Side. This spill was reported on July 24, 2014 (personal communication Shilo Williams, DEC). The contaminated material had been excavated and was stockpiled nearby. Results of soil samples taken on August 13, 2014 led to additional excavation. The contaminated soils were covered, and Kevin said they were waiting for agency direction regarding disposal of the material.

Kensington Photo 18. Fuel spill in the tidal area of Lynn Canal. The contaminated material is under the white cover (upper left portion of photo) and the excavated site was covered by the black material (middle of photo).

Kensington Photo 19. Beach along Lynn Canal. Photo taken from the ramp where the spill occurred.

Heavy Metals and/or Leachate

Leachate was seen in the Lower Slate Lake area of the mine. Lower Slate Lake is used for tailings deposition. The lake is dammed to accommodate tailings, while freshwater and stormwater are diverted around the lake. Two of the three (planned) levels of the dam have been implemented. A third level is planned to be constructed in the future. Timber harvest has occurred around the perimeter of the lake and an access road was developed. There was no evidence of excessive erosion in the harvested area, nor along the road. The road had been contoured along the western edge. There is an access road to the north end of Lower Slate Lake tailings treatment facility (TTF), along the eastern edge of the lake, and to the dam and lime treatment plant on the south end of the lake.

The TTF is designed to settle out solids from the slurry that is resultant of the milling process (Photo 20). The TTF serves as a subaqueous deposition of tailings to produce an anoxic environment, which stabilizes the tailings. Some process water is recycled back to the mill from the TTF and some water is treated and discharged under ADEC permits into Slate Creek.

Solids are removed from the water treatment system by a filter press. The solids are temporarily stored near the water treatment facility until they can be deposited underground, incased in a cement mixture that is engineered specifically for the working stopes (Photos 21 and 22). The solids were contained on three sides; however, open to one side and covered by a plastic tarp. The tarp was not maintained and water was getting into the solids storage area. While these solids are classified as non-hazardous (per Kevin Eppers), they should be better contained to reduce exposure to rainfall and potential for transport into local waters.

Kensington Photo 20. Inside the tailings treatment facility water treatment plant.

Kensington Photo 21. Solids containment outside the TTF. These solids are stockpiled, and then transported for cement mixture and placed underground for stope filling.

Kensington Photo 22. The tarp was not maintained and water was getting into the solids storage area.

Leachate[1] was discovered around Lower Slate Lake during Phase I of construction. Leachate was not expected in this location, thus not discussed in the EIS or operating plan. There have been numerous follow-up investigations and documents regarding the leachate. Because leachate has been identified at the areas excavated for dam construction, Coeur received support from Golder Associates Inc. to evaluate and characterize excavated overburden materials at the Kensington mine. A subsequent graphitic phyllite plan was composed in 2013 by DEC (waste management). Acid base accounting was conducted to predict the acid generation characteristics of material and is based on the relative difference between net acid generation potential and net neutralization potential of the material. Kinetic testing (humidity cell testing) did not provide an accurate representation of field conditions. Therefore, a series of barrel tests are currently being conducted with 4 differing amounts of sulfur (Photo 29). This barrel test is intended to determine a timeframe for the acidification to occur in the rock. In the meantime, the 'potentially acid producing' leachate (ARD graphitic material) is being stored in fully enclosed, impermeable, plastic 'burritos' (Photo 25). No water appeared to be infiltrating the enclosed material.

This BMP review noted that visible leachate associated runoff was being routed to a sump at the north end of Lower Slate Lake (Photo 32). The sump was designed to accommodate the runoff; however, already this year, the sump was inundated due to rising water levels in the TTF, and had to be moved. Runoff from the sump is pumped to a holding tank, then another holding tank, and then transported to the lime treatment facility. After treatment, the treated water is released into an infiltration gallery located adjacent to the TTF. We did not visit the infiltration gallery.

Leachate was seen visually around the southern portion of the lake on the west side (Photos 24, 30 and 31). There was no evidence of leachate from the east side which was designed as storage for graphitic phyllite material (Photos 23 and 26). The west side was covered with shotcrete to minimize the exposure to water and air. Lines of leachate were seen along the shotcrete. Surface water runoff from both sides were collected below the dam and transported to the lime treatment facility for treatment (Photo 26).

[1] Leachate is the water that has percolated through the graphitic phyllite (a mineral).

Kensington Photo 23. Natural hillslope along the eastern edge of Lower Slate Lake dam, where leachate was discovered.

Kensington Photo 24. Hill slope with shotcrete covering where leachate was discovered during Phase I of the dam.

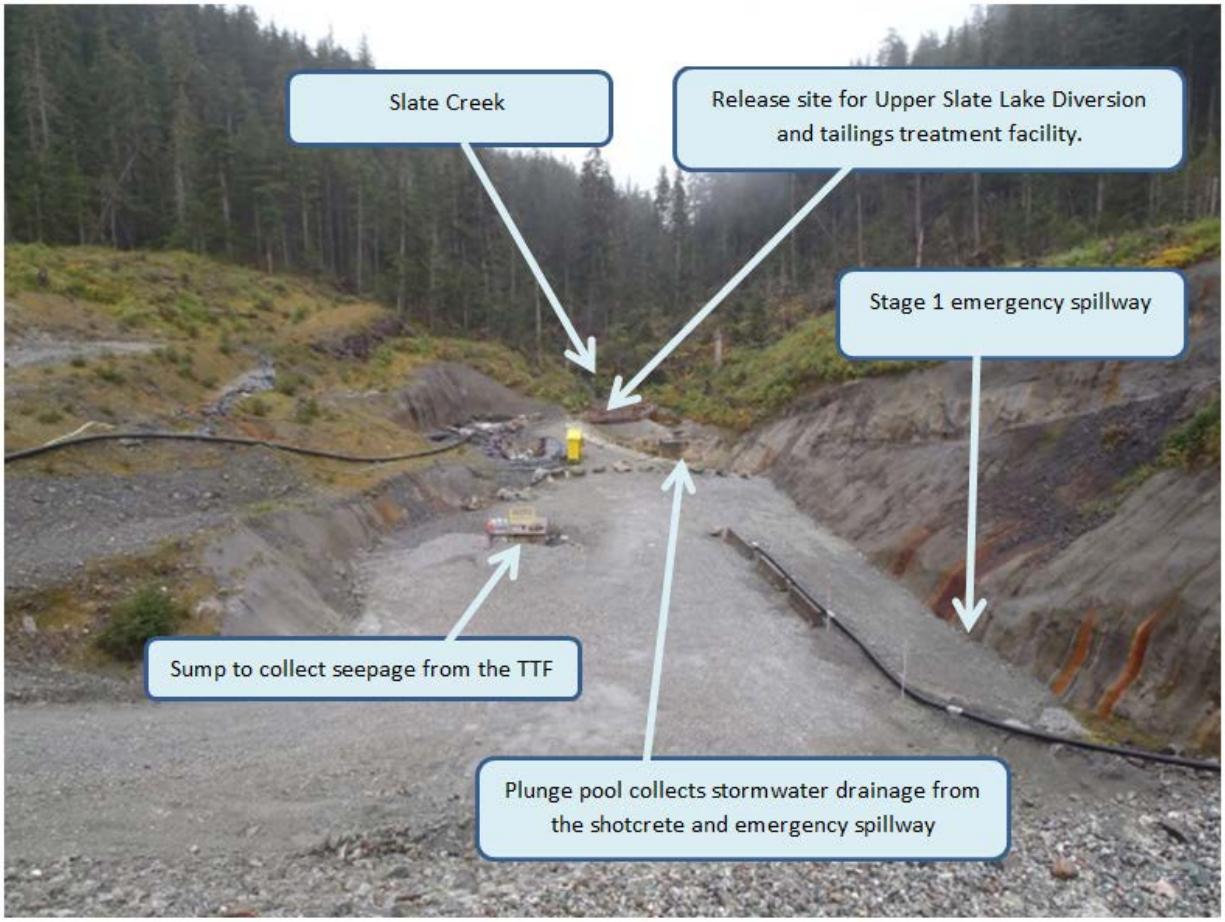
Kensington Photo 25. A 'burrito' of leachate material which is impervious to water and air.

Kensington Photo 26. An engineered storage pile of graphitic phyllite material. The pile is only open on the surface layer which is diorite and has an overall net neutralization effect. The green building is the lime treatment facility.

Kensington Photo 27. Emergency spillway at the west side of the dam. Shotcrete has been placed on the native material to minimize exposure to oxygen and water. Notice the leachate staining on the shotcrete and ponded water in the spillway.

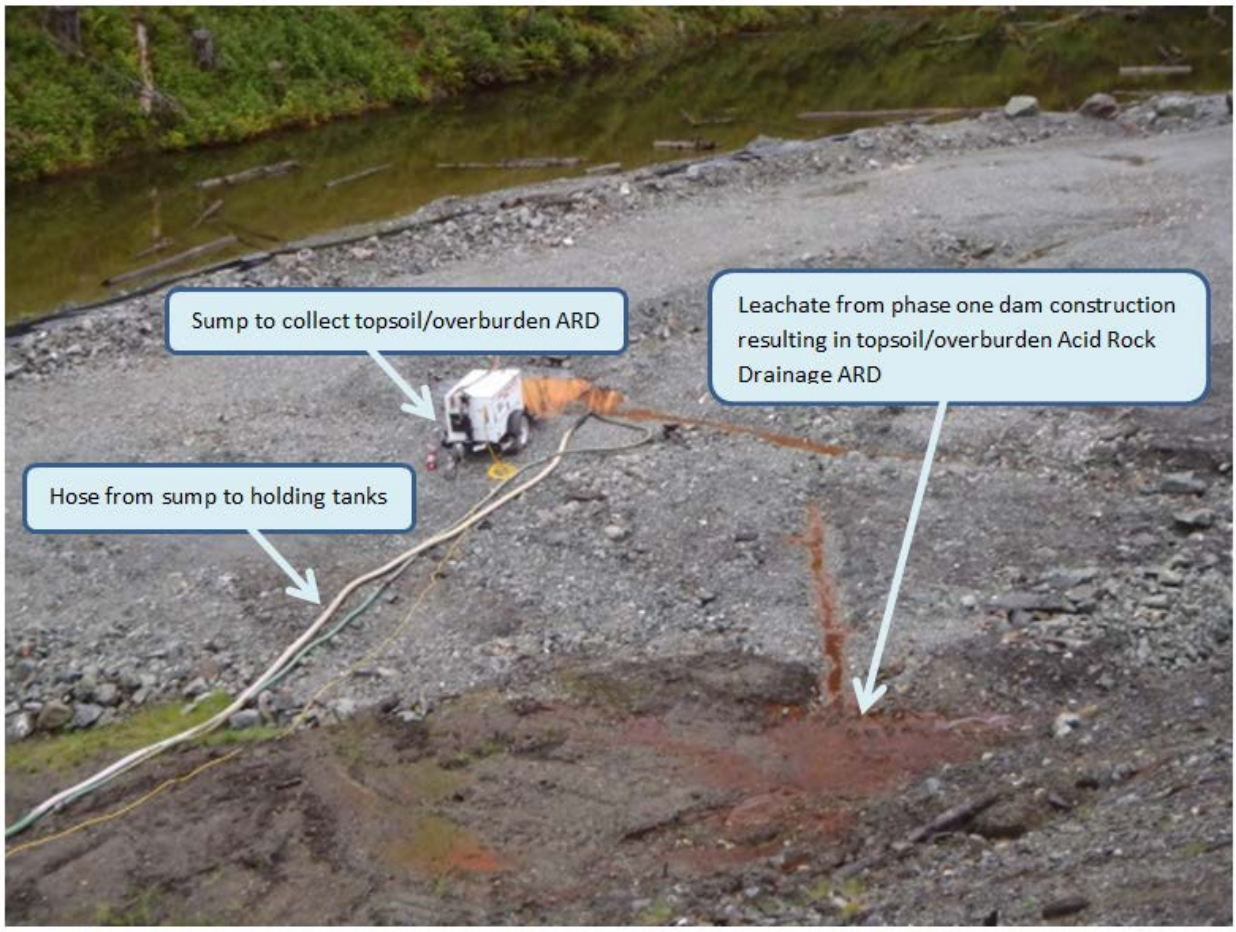
Kensington Photo 28. Leachate staining on the shotcrete at the upper end of the overflow channel. This pipe is from a 50-foot sump that is capturing seepage from fractures in the bedrock beneath the dam. The water is pumped from the sump back into the TTF.

Kensington Photo 29. Barrel testing site for graphitic phyllite weathering.



Kensington Photo 30. This photo includes the leachate runoff sumps, Lower Slate Lake Stage 1 emergency spillway, Slate Creek and the release site for Upper Slate Lake diversion and the treated wastewater. The left side of the photo is the collection sump. Seepage is collected and goes back to the TTF. On the right side of the photo is the emergency spillway for Phase I. Stormwater runs from the shotcrete, collects here in the emergency spillway, and is pumped to the graphitic batch treatment plant. Upper Slate Lake is routed through a pipe to the location just beyond these sumps (center back of the photo). This is also the location where the TTF disperses treated 'clean' water (meets Alaska Water Quality Standards). Water quality and other aquatic monitoring occur in Slate Creek just downstream of this photo.

Kensington Photo 31. Up close photo of the plunge pool, emergency spillway, Upper Slate Lake diversion release site, and Slate Creek. Notice the shotcrete overlying much of the bedrock in an effort to reduce infiltration and exposure to rainfall and stormwater.



Kensington Photo 32. Leachate was visually observed in this northern end of Lower Slate Lake. The excavated material is from Phase 1 construction of the dam. There is topsoil/overburden in this pile which is resulting in acid rock drainage (ARD). The sump located in this photo is designed to collect the ARD. Runoff is pumped to the holding tanks and eventually transported to the lime treatment facility. A sump was constructed up-gradient and the ARD leachate captured prior to the lower sump becoming inundated with water.

Trash or Human Sanitary Waste

We did not view any sanitary waste sites besides the outhouses located in the remote areas. Sewage from the office and camp location is treated and dispersed across a drain field on private land. The outhouses are pumped, and then sewage is transported to the Juneau sewage treatment facilities. Trash is burned at an incinerator and otherwise carried offsite.

Waterbody Alterations

Waterbody alterations at Kensington include diversion of Upper Slate Lake, pumping of groundwater for drilling, capture of groundwater underground, release of waters at designated outfalls, and routing of surface and subsurface waters along roads and other mine infrastructure. Much of the water alterations are addressed in the SWPP and were discussed in the erosion/sedimentation or leachate portions of this report. We did not visit any pumping locations. We did visit the inlet and flume along the Upper Slate Lake diversion. High rainfalls, and possibly underestimated seasonal runoff, have resulted in flooding of the road and diversion pipe in the Lower Slate Lake area. The road had been inundated with water on at least two occasions (personal communication, C. Caton) and Kevin had commented that flow capacity through the diversion pipe had been exceeded.

Kensington Photo 33. Cofferdam/inlet to Upper Slate Lake diversion.
Kensington Photo 34. Diversion pipe

Kensington Photo 35. Flume along diversion pipe
Kensington Photo 36. Water treatment facility on the Comet side. Notice the settling ponds in front of the buildings and the geo fabric bags on the mid-right side of the photo.

A water treatment facility is located on the Comet side (Photo 36). The source of this water is mine drainage and stormwater from the Comet development pile. This water is treated for solids and also for the chemicals used for flocculant. There are two flocculunt treatments – one outside and one inside the building. Solids are dredged from the ponds then placed in the black geo fabric bags (Photo 37). The geo fabric bags decant the water which is pumped back into pond 1. The sludge removed by the filter press in the water treatment plant is deposited back into the Comet development pile. The solids from the geo fabric super sacks are deposited on the Comet portal development rock pile and surrounded with diorite (Photos 12-14). Treated water is diverted to Sherman Creek outfall (Photos 38 and 39). At the time of the visit, there was visual sediment at the outfall; however, it was fairly localized in extent (Photo 40).

Kensington Photo 37. Filter bags of solids. These bags are manually brushed to keep the porous material from being clogged. The secondary containment captures the runoff which is then pumped back into the settling ponds. There were several spots where spillage was occurring around these bags. General housekeeping of the filter fabric would reduce risk of sedimentation into local waters.

Kensington Photo 38. These lines disperse the (Comet) treated water into Sherman Creek at Outfall 001. Water quality monitoring occurs just downstream of this location.

Kensington Photo 39. The waters were generally clear in this location with only minor turbidity noticed in few water locations.

Kensington Photo 40. Sediment instream at Sherman Creek outfall.

Other

Canada thistle, an invasive weed, was seen on the Comet Beach near the old administrative site. A white paper identifies additional invasive species that have been seen in the Comet Beach and Slate Creek Marine areas, and suggests strategies for eradication. It is currently in review at the Juneau Ranger District.