To: Jim Ford, Natural Resource Damage Program

From: Josh Vincent, PE, Water & Environmental Technologies
John Trudnowski, PE, Water & Environmental Technologies

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Re: **Parrot Tailings Waste Removal Project, Waste Identification Criteria Development, and Implementation**

Parrot Tailings Waste Removal Project - Background

Past and ongoing studies have identified the Parrot Tailings Waste Removal Project (Parrot Project) as the primary source of arsenic, cadmium, copper, lead, and zinc to Butte's alluvial groundwater. Left in place, these historic mine wastes allow ongoing releases of contamination to Butte's alluvial groundwater, much of which eventually discharges to Silver Bow and Blacktail Creeks, which are the headwaters of the Clark Fork River. The groundwater leaving the Parrot Project area is more contaminated than the Berkley Pit. This contaminated groundwater discharge degrades the creeks by contaminating the instream sediments, instream sediment pore water, and surface water. State and EPA studies, and investigations have shown, and the recently executed BPSOU Consent Decree has acknowledged, that there are existing unacceptable impacts by groundwater contamination to Blacktail and Silver Bow Creeks that require remedial solutions.

In an effort to reduce this contaminant pathway and its long-term risks to the creeks, the Trustee for the State of Montana, the Governor, decided to implement the Parrot Project through the State's Natural Resource Damage Program (NRDP).

As a general principle, the State believes in mine waste removal as a long-term solution to protect its creeks and rivers statewide. Properly performed waste removal ensures for future generations that wastes will not be re-entrained in fluvial systems during floods or evulsions and that engineered systems will not fail, leaving problems to be dealt with in the future. The State's commitment to removing wastes is demonstrated by the hundreds of millions of dollars it has spent at mining sites such as the Upper Blackfoot Mining Complex ; Milltown Reservoir OU; Clark Fork River OU; Streamside Tailings OU; and now the Parrot Project.

Parrot Project - Waste Identification and Excavation Goals

The primary goals of the Parrot Project waste identification efforts were to identify the locations of the high-concentration wastes so that the excavation could focus on removal of the most contaminated wastes. These wastes were found in the tailings and black clay, which is the old floodplain soils of Silver Bow Creek before it was destroyed by mining and smelting activities.

These wastes are very leachable and are a few orders-of-magnitude higher in contaminant concentrations than the groundwater-saturated alluvial materials (i.e., the "Butte alluvial aquifer"), which at most only slightly exceeded the Waste Criteria for zinc by 10-20%. It was clear that these wastes, and not the alluvial aquifer, are the source of the highly-contaminated groundwater; accordingly, these were the wastes that needed to be removed.

Parrot Project - Waste Identification Criteria

The Parrot Project uses the numeric waste criteria developed for the Streamside Tailing OU Remedial Action in the late 1990's (Table 1).

Table 1: Parrot Project
Waste Identification Criteria:
(Source SSTOU*)

Arsenic	200 mg/kg
Cadmium	20 mg/kg
Copper	1,000 mg/kg
Lead	1,000 mg/kg
Zinc	1,000 mg/kg

*From Field Screen Criteria and Procedures Phase 7 and 8 Remedial Action, SSTOU Subareas 4, Reach R and S (Pioneer 2011). 4 of 6 contaminants need to be below the criteria for area to pass (see DEQ's "Field Screening Criteria and Procedures Remedial Action SSTOU Subarea 3, Reaches M, N, & O" (January 2013)

For the Streamside Tailings OU, if three of the six contaminant criteria listed were exceeded or any one contaminant was above 5,000 mg/kg then, the material was considered tailings, waste, or contaminated soil. For the Parrot Project, if any contaminant was above its criteria, then it was considered "waste" even though the Parrot Project is about a mile from Blacktail or Silver Bow Creeks.

Parrot Project - Implementation

Phase IIA excavation activities (north of Civic Center Road) were completed in 2018. Phase IIB (BSB shop demolition) was conducted during the spring of 2021, and Phase IIC excavation activities (south of Civic Center Road) are currently ongoing.

The Parrot Project defines waste as the products or byproducts of hard rock mining, placer mining, and smelting operations including, but not limited to, mine tailings, contaminated waste rock, contaminated organic clay, and contaminated alluvium as determined by the Engineer in the field. Native soils/overburden mixed with or contaminated by tailings are considered impacted soils and are classified as waste. Overburden mixed with or contaminated by tailings is considered impacted soils and is classified as waste. Waste within the lithological horizons was identified during the design phase using a lithological model derived from historical and recent borehole data. The design model was used to develop initial volumes, grades, and removal elevations for bidding and planning purposes. However, it is common on mine waste removal projects that the actual lithology in the field over a large area such as the Parrot Project would vary, sometimes considerably, from the model in some areas. As a result, a soil screening procedure was developed in the *Butte Area One, Parrot Tailings Waste Removal Project (Revision 3 – Final, Update Phase IIB, IIC, and III) – Construction Management Quality Assurance Project Plan* (QAPP, Attachment B) to ensure all appropriate waste is removed and clean overburden is not cross-contaminated during removal activities. The soil screening procedure directs waste removal by collecting a combination of environmental, lithological, and geospatial data, including:

Environmental

- Contaminant concentration data for existing cover soils / overburden
- Contaminant concentration data from open excavation to verify waste removal
- Contaminant concentration data for imported soil cover material

Lithological

- Visual determination of tailings and black clay layers in relation to groundwater elevation to ensure that known waste layers are removed

Geospatial

Surveys to document soil sample locations

- LiDAR surveys to document the extent of waste removal

The soil screening procedure includes the acquisition of field and laboratory XRF data from excavation spoils of the various lithological horizons to identify the horizon boundaries and to support the segregation of clean backfill from waste. The soil screening procedure utilizes *in-situ* field portable XRF measurements to determine whether sampling media meets the waste criteria in Table 1. Together, project data identifies, documents, and quantifies which horizons represent "clean" material that may be segregated and used as backfill, and where the waste horizon is located.

This is accomplished by acquiring field XRF data at these interfaces and correlating it with changes in soil horizons (color/texture). Using *in-situ* field data and visual evidence of soil color/texture changes identifies the boundary where soils must be segregated as backfill, slag, and waste. Robust field XRF soil screening throughout the excavation and segregation process aids in confirming waste is not used as backfill. *In-situ* field measurements identify contaminated overburden material that lack visual or textural cues typical of the underlying waste material and promotes real-time soils routing. *In-situ* field measurements are also used to confirm that the excavation has reached its vertical limit when the uncontaminated groundwater-saturated alluvium horizon has been reached and the maximum amount of waste material has been removed. Due to the presence of groundwater, the protocol identifies a vertical elevation limit where excavation is stopped, once the black clay layer has been removed (the deepest lithological unit of known highly contaminated waste). A subset of all field XRF samples are submitted for independent laboratory XRF analysis, to ensure field instruments are operating within the parameters defined in the Parrot Project QAPP.

The current excavation extends from the existing ground surface to the bottom of the black clay layer, which ranges from approximately 11 to 34 feet below ground surface (bgs) throughout the excavation area. Waste is being removed along with underlying impacted alluvium in unsaturated areas to the design vertical excavation limit (March 2018 Groundwater Elevation). The March 2018 groundwater elevation was chosen as the vertical extent because it was the lowest groundwater elevation with a complete groundwater elevation data set across the site. The March 2018 groundwater elevation represents a conservative vertical extent that will allow full removal of waste below the black clay horizon.

Saturated waste found to extend below the vertical excavation limit will be dewatered and excavated until all visual evidence indicates it has been removed. In areas where waste has been completely removed before reaching the vertical excavation limit, the excavation will be discontinued if soil screening data demonstrates the alluvium is below action levels. If the alluvium is above action levels, it will be excavated to the vertical excavation limit. The workflow for this process is included in **Attachment A**.

Sampling Methods

The soil screening pass/fail criteria for classification of waste was adopted from the *Streamside Tailings Operable Unit Subarea 4 Reach T Remedial Action Investigation Sampling and Analysis Plan (SAP)*. The sampling methods described in the Parrot Project QAPP were adapted from the Environmental Protection Agency (EPA)-approved 2018 Anaconda NPL Site Institutional Control Program (ICP) QAPP, which contains detailed information on soil routing decision-making processes and field portable XRF procedures. The 2018 ICP QAPP was derived from the EPA-approved 2015 Anaconda NPL Site Community Soils, Residential Soils/Dust QAPP, which was developed to facilitate soil remediation within residential yard components. The 2015 Community Soils QAPP was based on the EPA's Superfund Lead-Contaminated Residential Sites Handbook published in 2003.

The foundation of these guidance documents requires one subsample per 625 ft^2 to characterize soil Contaminant data within each soil horizon or defined depth interval. The Parrot Project QAPP requires collection of an eight-point composite sampling within each 100-ft by 50-ft excavation component, with a sample frequency of one composite sample for every 400 cubic yards (CY) excavated. The eight sub-samples within the 5,000 ft^2 excavation component matches the 625 ft^2 per subsample EPA guidance requirement exactly.

For the Parrot Project, excavation monitoring and waste removal verification sampling is performed using various approaches depending on the work sequence(s) outlined in the excavation plan. The approaches identified in the Parrot Project QAPP include collection of samples during active excavation, sampling of stockpiles material, or *in-situ* measurements of soil horizons. Previous investigations at the Parrot Project site have revealed that subsurface lithology is a blend of waste types, and the vertical distribution of the various waste forms is not uniform. To ensure sample flexibility, opportunity samples (grab samples) are also utilized to aid in soil characterization. The general approaches outlined in the Parrot Project QAPP have been implemented on-site as described below.

Active Excavation: (Direct Haul)

As different lithological units are excavated (Overburden/Quartz Monzonite Fill/Slag/Tailings/Organic Clay/Alluvial Sediments), *in-situ* XRF field measurements are collected from the active excavation for each haul truck loaded. *In-situ* field measurements are acquired from the bucket of the excavator and simultaneously, a subsample of the material used to produce the i*n-situ* field measurement is collected to create a confirmation sample of the excavated material. This process is repeated ten times, to create ten *in-situ* field measurements and one composite sample, characterizing the soil for ten haul trucks. This sampling methodology provides real-time analytical data for soils routing while maintaining the required sampling frequency of one composite confirmation sample per 400 CY of excavated material. All composite confirmation samples undergo sample preparation and soil processing to increase XRF analytical accuracy. When the excavation encounters a change in lithological unit or soils differ in color, texture, or composition, grab samples are collected to characterize the encountered/underlying material. Grab samples aid in confirming when different soil stratums are reached and help dictate excavation elevations. Grab samples are analyzed *in-situ* to aid in the real-time soil routing decisions and also undergo sample preparation and processing to maintain data quality standards.

It is important to note, *in-situ* field measurements are the least reliable means of acquiring XRF data but vital for the real-time soils routing decision making process necessary on-site. By combining *in-situ* field measurements with prepared and processed composite samples, data quality objectives outlined in the Parrot Project QAPP are maintained. The work sequence outlined in the excavation plan relies heavily on direct hauling and permanently placing excavated material; therefore, real-time soil characterization is vital to ensure proper soils routing.

Active Excavation: (Confirmation of Waste Removal/Vertical Extent)

Following the removal of waste material where the excavation has reached the vertical elevation limit, the footprint of the excavation area is divided into 100-ft by 50-ft sampling components and within each component, eight evenly spaced subsamples are created using ArcGIS software. The eight subsamples within each grid are combined into a single composite sample that undergoes preparation, processing, and field XRF analysis. During sample collection, field personnel visually inspect the excavation floor for waste left in place. If any subsamples contain black clay material, or it is evident that the alluvial sediments have not been reached, the area is over-excavated until all visible waste is removed. If the field XRF analysis identifies exceedances of the criteria within the alluvium, the alluvium is removed to the March 2018 Groundwater elevation.

Stockpiles:

If the work sequence better lends itself to collection of samples from stockpiled material, the stockpile is divided into equal parts, using a pre-defined ArcGIS grid, and one eight-point composite sample is collected from each segment of the stockpile, representing approximately 400 CY of material. The volumes are estimated from the ongoing surveys, which ensures representative samples of all staged material are collected and analyzed.

Results

The soil screening procedure discussed above has successfully identified and routed waste to allow for efficient excavation activities and has prevented backfill cross-contamination. Not only has the soil screening procedure confirmed waste horizons, but it has also identified isolated waste pockets and contaminated overburden that would have been considered clean backfill with the lithological model only. The soil screening process has provided a real-time process to identify waste that allows efficient excavation and waste removal.

Attachments:

A. Parrot Tailings Waste Removal Project Decision Tree
B. Parrot Project QAPP

ATTACHMENT A

Parrot Tailings Waste Removal Project Decision Tree