TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.
HEADQUARTERS: P.O. BOX 33695 DENVER, COLORADO 80233-0695 303-452-6111

November 9, 2020

Mr. Zach Trujillo
Environmental Protection Specialist
Colorado Division of Reclamation, Mining & Safety
Department of Natural Resources
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Colowyo Coal Company L.P.
Permit No. C-1981-019
Technical Revision No. 144
West Taylor Fill Piezometer

Dear Mr. Trujillo,

Tri-State Generation and Transmission Association Inc. (Tri-State), is the parent company to Axial Basin Coal Company, which is the general partner to Colowyo Coal Company L.P. (Colowyo). Therefore, Tri-State on behalf of Colowyo technical revision 144 (TR-144) to Permit No. C-1981-019.

TR-144 proposes to remove monitoring of the West Taylor Fill piezometer and replace the piezometer monitoring with quarterly aerial drone flights. The West Taylor Fill piezometer is collapsing in several locations, and Colowyo has had a geotechnical evaluation done of the fill to ensure quarterly aerial drone flights would be acceptable method of monitoring the long term stability of the West Taylor Fill.

Also included in this technical revision are a proposed public notice, and a change of index sheet to ease incorporation of this technical revision into the permit document. If you should have any additional questions or concerns, please feel free to contact Tony Tennyson at (970) 824-1232 at your convenience.

Sincerely,

DocuSigned by:
Daniel Casiraro
B70D69F114324DE...

Daniel J. Casiraro
Senior Manager
Environmental Services

DJC:TT:der

Enclosure

cc: Jennifer Maiolo (BLM-LSFO)
Chris Gilbreath (via email)
Tony Tennyson (via email)
Angela Aalbers (via email)
File: C. F. 1.1.2.127 - G471-11.3(21)d

CHANGE SHEET FOR PERMIT REVISIONS, TECHNICAL REVISION, AND MINOR REVISIONS

Mine Company Name: **Colowyo Coal Company**
Permit Number: **C-1981-019**
Date: **November 9, 2020**
Revision Description: **TR-144 West Fill Piezometer**

Volume Number	Page, Map or other Permit Entry to be REMOVED		Page, Map or other Permit Entry to be ADDED		Description of Change
1					No Change
2A					No Change
2B					No Change
2C					No Change
2D					No Change
2E					No Change
3					No Change
4					No Change
4					No Change
5A					No Change
5B					No Change
6					No Change
7					No Change
8					No Change
9					No Change
10					No Change
12	Rule 4, Page 9 (1 page)		Rule 4, Page 9 (1 page)		West Fill Piezometer text has been replaced.
13			Exhibit 21 5 pages (insert at end of Exhibit 21)		West Fill Piezometer Report has been inserted into Exhibit 21.
14					No Change
15					No Change
16					No Change
17					No Change
18A					No Change
18B					No Change
18C					No Change
18D					No Change
19					No Change

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20			No Change
21	Map 10B	Map 10B	Map 10B has been updated.
22			No Change

1. Inspections will be conducted at least quarterly during the construction period and during the following specific construction periods.

    a. removal of topsoil and organic material
    b. placement of underdrain system
    c, installation of surface drain system
    d. placement of fill material to insure that the largest rocks are reaching the bottom of the dump face and that the formation of voids that adversely affect mass stability are prevented and
    e. revegetation

The purpose of the inspections is two fold. First, these inspections will document and certify that the construction plan is being followed. Secondly, during the above phases of the construction, a key emphasis of all inspections will be to implement routine contingencies as situations warrant. For example, perhaps a section of underdrain should be reworked, or the spoil dump raised to provide optimum gravity spoil sorting. Inspections and implementation of contingencies during these critical phases of fill construction will be a routine but very important component of fill inspections.

2. Each certified inspection report will be provided to the Division within two weeks after each required inspection. Each report will certify that the fill has been constructed as specified in the minimum design approved by the Division. The reports will include a description of any appearances of instability, structural weakness and other hazardous conditions observed during the inspection.

3. Certified reports addressing the underdrain system will include color photographs taken during and after construction, but before the underdrain is covered with spoil.

After construction, the South Taylor fills will be monitored quarterly for the following items and reports will be submitted quarterly. Monitoring will continue until such time that Division allows relinquish of quarterly monitoring.

1. Quarterly review of fill surface topographic contours obtained from aerial drone measurements to detect large movements.

2. On a quarterly basis, a certified report by a registered engineer will be completed taking into consideration any changes and will note any evidence of surficial slope failure or the formation of springs or seeps on the face of the fill.

4.10 – 4.12 DISPOSAL OF EXCESS SPOIL

These sections are addressed in Volume 1.

4.13 CONTEMPORANEOUS RECLAMATION

All reclamation efforts, including backfilling, grading, topsoil replacement and revegetation, of land disturbed by the mining activities in the South Taylor pit shall occur as contemporaneously as practicable with mining operations. Colowyo has formally requested a variance for a delay in contemporaneous reclamation in the South Taylor mining area due to the unachievable requirements listed in Rule 4.14.1(1)(d), which the Division has approved.

AGAPITO ASSOCIATES, INC.
Mining & Civil Engineers & Geologists

TECHNICAL MEMORANDUM

AAI Project No: 227-44

To: Brian Coates and Doug White (Colowyo)
From: Samrat Mohanty (AAI)
Date: October 29, 2020
Subject: Geotechnical Evaluation of West Taylor Fill Piezometer

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At the request of Colowyo Coal Company (Colowyo), Agapito Associates, Inc. (AAI) has evaluated the geotechnical condition of a piezometer installation in the West Taylor Fill, while assessing the necessity for continued groundwater level monitoring. The West Taylor Fill site is located to the northwest of the South Taylor Pit, to the southeast of the West Pit, and was constructed in the Taylor Creek Valley in 2009. The backfilled area is triangular in shape with the maximum east-west width approximately 1,200 feet (ft) and covering approximately 1,100 ft along the valley axis, which trends north-south (Figure 1). The valley floor gradient varies between 1:10 (v:h) to 1:5, whereas fill was placed with a surface slope of 19º. The maximum fill thickness is approximately 300 ft along the valley axis line (Figure 2).

The West Taylor Fill has a central underdrain, which runs along the valley axis and receives drainage from two tributary underdrains to the south. The fill area also has two surface side drains flanking the east and west edges, respectively. The underdrains utilize blocks of sandstone and shales, whose heights vary from 4 to 8 ft and widths vary from 10 to 16 ft. The purpose of the underdrain and side drains is to prevent pore pressure buildup underneath the fill surface, where a thin clay layer was found during previous geotechnical investigations.[1,2] The underdrain is also meant to intercept seeps encountered along the valley.

Following the fill placement, a piezometer was installed close to the center of the triangular fill area to monitor in-fill water levels and ensure that the underdrain was functioning as intended. The piezometer was installed by drilling 250 ft below ground surface (bgs) down to the bedrock. The piezometer constituted of a 2-inch (outer diameter) PVC pipe (Schedule 8) from the surface down to 250 ft bgs with the bottom 50-ft segment perforated with 0.02-inch slots. At the time of installation, during the summer of 2012, the water level was at 225 ft bgs. The piezometer water level trend is presented in Figure 3. Cumulative quarterly precipitation data is also included in the figure. After reviewing the pertinent background data, the author performed a site reconnaissance of the fill area on September 14, 2020, which coincided with Colowyo's own quarterly inspection of the fill and piezometer. Overall, the monitored water level in the piezometer has been very stable with minor seasonal variations, especially following spring melts during the 2017–2019 period when water levels temporarily rose up to 25 ft from the baseline. On the day of the inspection, the water level was at 222.75 ft bgs. No large spikes have been observed this year due to the relatively dry conditions prevailing over western Colorado.

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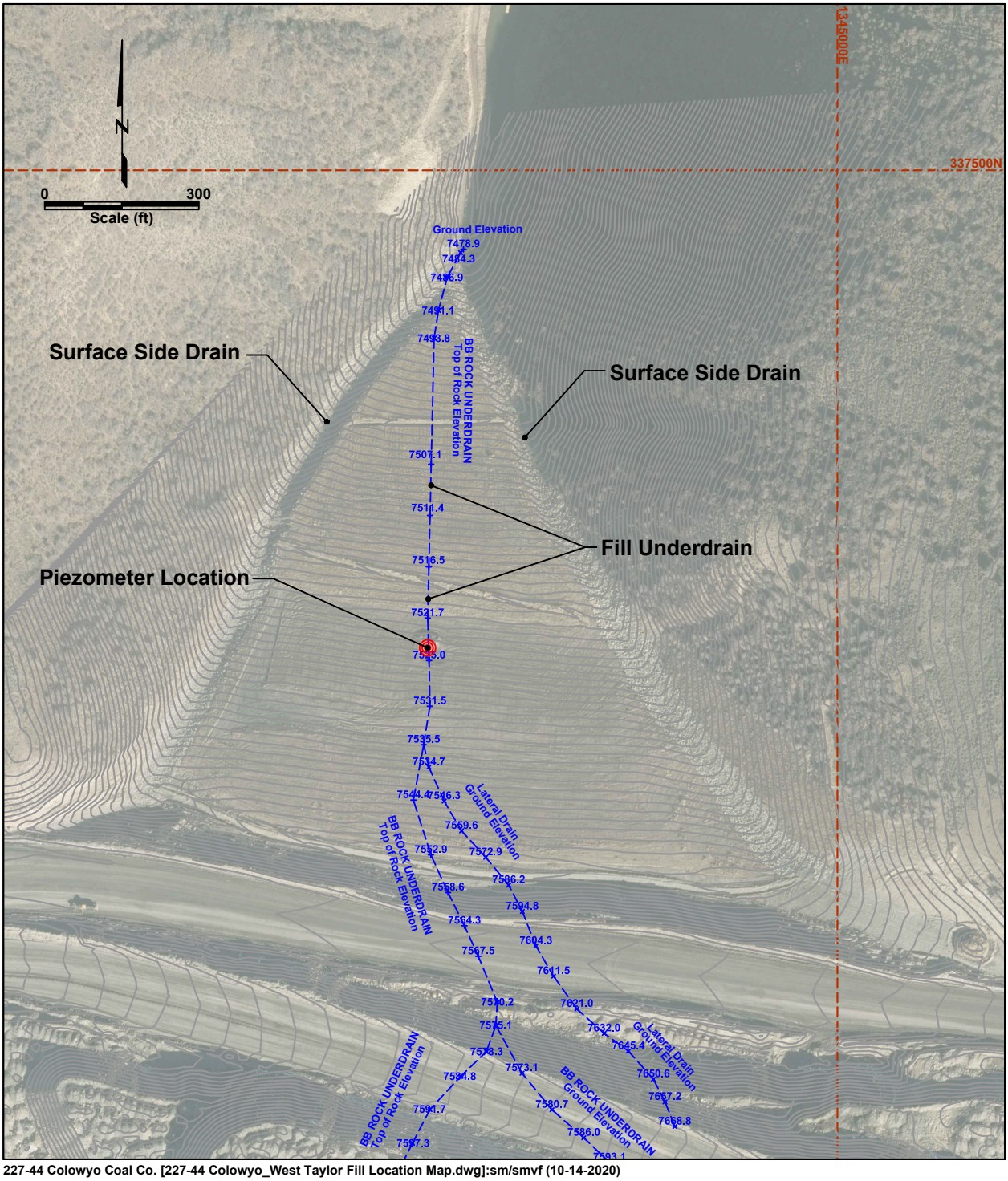
[1] Shannon & Wilson, Inc. (2006), "Geotechnical Study, South Taylor Excess Spoil Fills, Rio Tinto Energy America, Colowyo Coal Mine," July, 69pp.

[2] Shannon & Wilson, Inc. (2010), "Revised, Addendum No. 3 to Geotechnical Study for Excess Spoil Temporary Spoil Fill Stability, South Taylor Mine Area, Colowyo Mine, Moffat and Rio Blanco Counties, Colorado," April 15, 33pp.



227-44 Colowyo Coal Co. [227-44 Colowyo_West Taylor Fill Location Map.dwg]:sm/smvf (10-14-2020)

Figure 1. West Taylor Fill Location Map

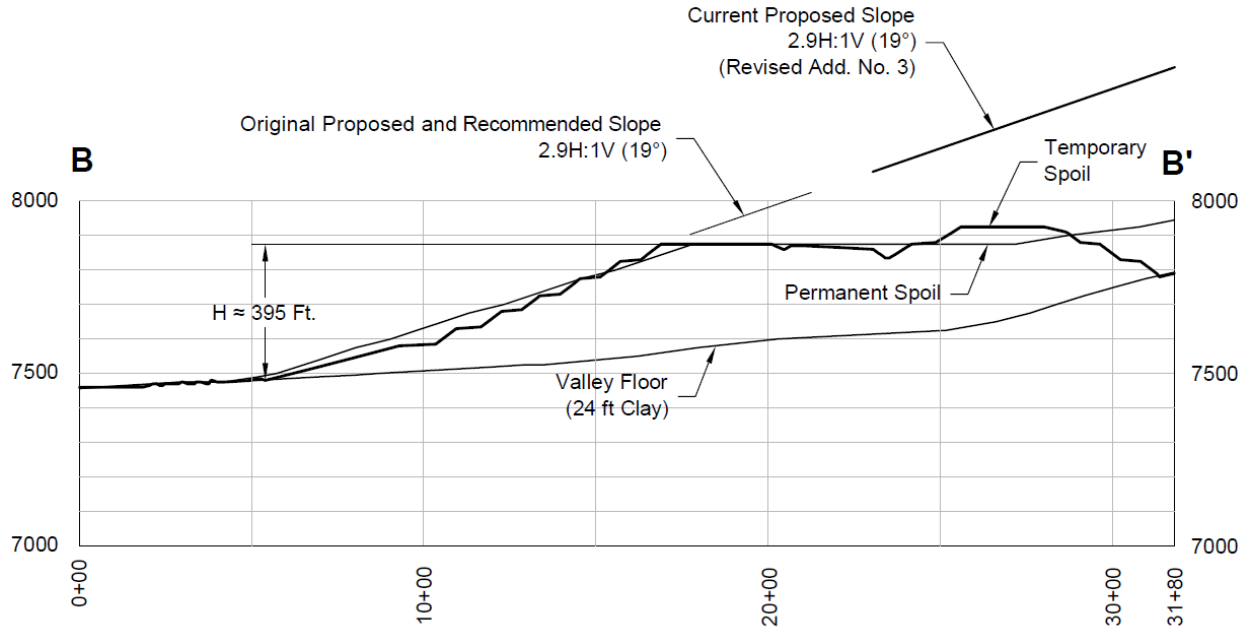


Figure 2. West Taylor Fill Schematic Section[2]

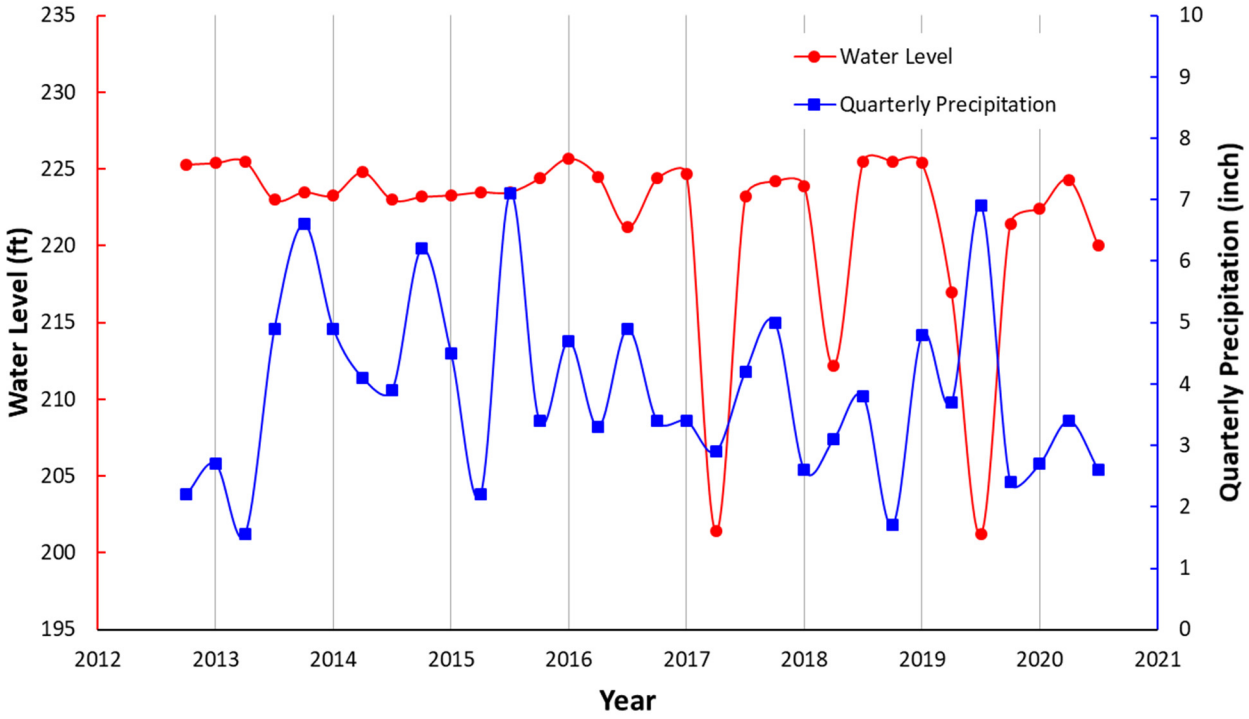


Figure 3. West Taylor Fill Piezometer Water Level Trend Since Installation

Since the first monitoring data collected in 2012, Colowyo recorded the water levels quarterly until 2018 when the piezometer well started showing signs of pinching. Colowyo has reported a total of three pinch points along the piezometer column (i.e., at approximately 90 ft, 120 ft, and 170 ft bgs). The pinch points have made measurements of the water level very difficult as the inspecting personnel need to undertake numerous attempts to maneuver the well water sounder past the pinch points. Due to the recent difficulties in accessing the groundwater level in the piezometer well, Colowyo requested that AAI ascertain if continued groundwater monitoring is required. The description of the problem prompted AAI to hypothesize that the pinching may be driven by differential displacements within the spoil matrix.

AAI's review of the background data indicated that the spoils are predominantly composed of sandstone/siltstone/mudstone gravels and boulders (~78%) with the rest being fines. The spoils were deposited in 30- to 100-ft lifts using end-dumping that likely produced size and density-based segregation vertically with coarse spoils travelling to the base of the fill and fine-light particles staying close to the surface. In pre-construction analysis performed by Shannon & Wilson[1], the spoils were assumed to be cohesionless with a friction angle of 30°. The foundation soil had clayey-sandy matrix with gravel-size rock fragments, which had a friction angle of 20° and a cohesion 850 pounds per square foot (psf). The bottom bedrock strength was assumed to be 40° with a cohesion of 3,000 psf. The above analysis was revised in 2010[2] by assuming a slightly weaker foundation layer. However, both studies report safety factor values of greater than 1.5, indicating long-term stability of the fill structure. The analyses were performed using the limit equilibrium method.

AAI has not attempted to recreate the analysis using its own unique simulation approach as it was beyond the scope of this task. However, AAI is confident that the segregation within a deep spoil volume, such as the West Taylor Fill, is adequate to create zones of variable geotechnical characteristics based on the burial depths. Given the deformation modulus of the spoils increase with depth, it is likely that the shallower zones have deformed more compared to the deeper zones. Also, the spoils at the very base are regularly being saturated by the flow in the underdrain, which is likely to lower the modulus value of the spoils surrounding the bottom most 25 ft of the well. Lastly, the underdrain itself likely has a very contrasting set of geotechnical behavior compared to the overlying spoils and underlying clayey foundation soils. Combined, all of the above factors make the differential downslope deformation of the piezometer well axis at various depths almost inevitable, leading to the pinching of the PVC well column at various depths below surface.

However, such behavior is not unusual and is not indicative of global instabilities deep within the spoil matrix. During site inspection, the author surveyed the fill surface, traversing from the toe to the crest level along the valley axis line, and no signs of a deeper global instability were observed (Figure 4). No tension cracks were observed close to crest, no side cracks were observed close to the east/west flanks, no heave zones were observed in the toe area, and no seeps were observed. The underdrains were observed to seep water, as intended, although the surface side drains were relatively dry.

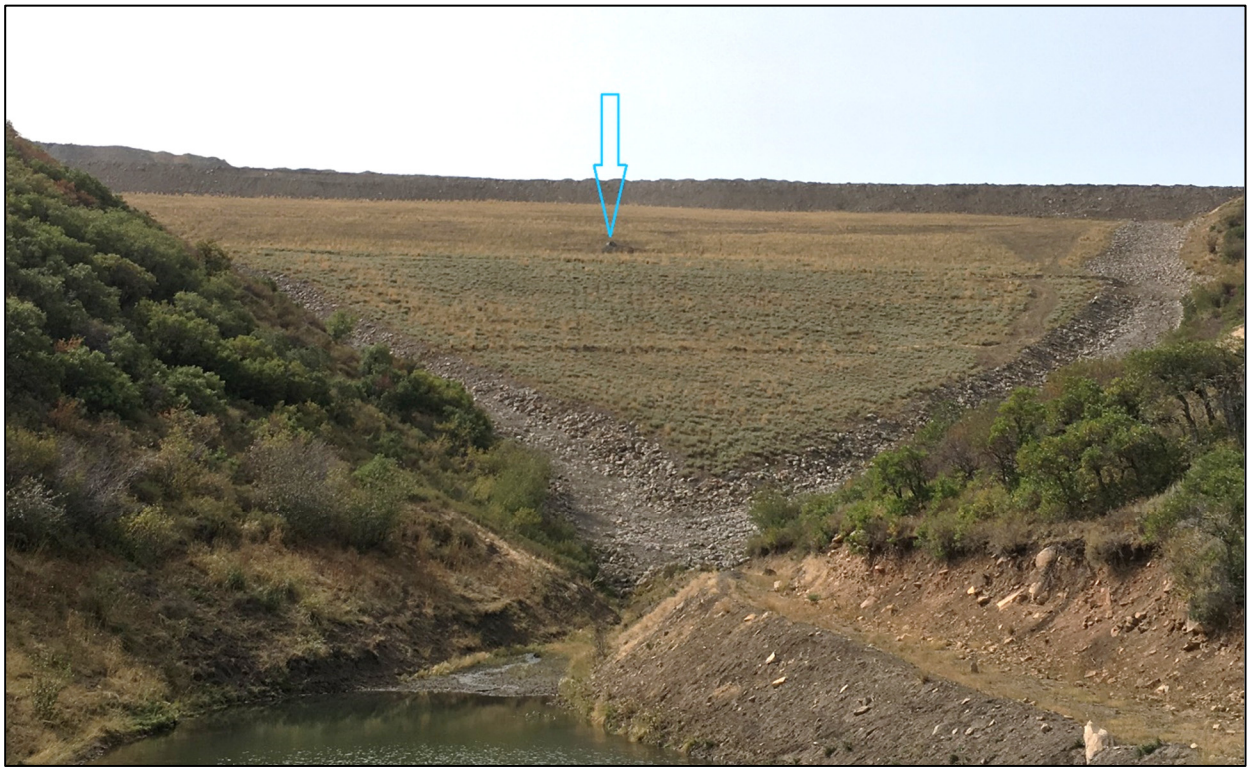


Figure 4. View of the West Taylor Fill, Looking South (Piezometer Location Marked)

In light of the data review and following the visit, AAI is of the opinion that the pinching of piezometer well column will likely get worse as differential deformation between spoil zones of varying geotechnical characteristics continues. Ultimately, the collection of water level measurements is likely to become impossible in the near to medium term. Given the ground conditions observed at the site, AAI is of the opinion that an indirect monitoring approach may be utilized, such as quarterly review of fill surface topographic contours obtained from aerial drone measurements to detect large movements. In summary, AAI is of the opinion that quarterly measurement of piezometric water level in the West Taylor Fill area may be discontinued given the data collection challenges, which can be more effectively substituted by study of remotely monitored topographic contours in addition to quarterly monitoring of general ground conditions of the fill.