

July 3, 2024

Board of County Commissioners  
Deschutes County  
1300 NW Wall Street  
Bend, OR 97703

**Subject: Moon Pit Land Acquisition and Resource Development**  
**Re: On-Site Material Characteristics**

Dear Deschutes County Commissioners:

Delve Underground completed a Preliminary Geotechnical Feasibility Report (Appendix K) as part of the Phase 2 Final Solid Waste Management Facility (SWMF) Site Evaluations and presented the results in a report dated February 2024.<sup>1</sup> This technical letter was developed to provide the Deschutes County Commissioners with additional specifics regarding the subsurface materials at the Moon Pit and their commercial viability. To this end, we discuss the general types of materials (soil and rock) that are present, how they could be used commercially, and as on-site purposes associated with the landfill. Additional specifics are also provided regarding the commercial value as well as potential future use of various products that could be quarried on site.

### Previous Report Summary

The following provides a summary of conditions at the existing site based on our findings and review of reports prepared by Mark V. Herbert & Associates (MHA) dated April 8, 1993, and Siemens and Associates (SA) dated August 6, 1996.<sup>2, 3</sup> Both reports are included as Appendix E in our report and were part of a previous phase of evaluating landfill locations in the 1990s.

- The MHA assessment was limited to the excavation of test pits (32 total) but no soil borings, limiting the ability to characterize the underlying bedrock. Based on the results of this investigation, potential marketable products were determined to be topsoil, drain rock, pea gravel, coarse concrete aggregate, concrete sand, asphalt aggregate, and select structural backfill.
- MHA estimated 630,00 CY of topsoil, 725,000 CY of sand and gravel, 807,000 CY of silty gravel with sand, and 240,000 CY crushable rock. Note that the northwest area considered was

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<sup>1</sup> Delve Underground. 2024. Phase 2 Final SWMF Site Evaluation – Moon Pit: Preliminary Geotechnical Feasibility Report. Prepared for Deschutes County, Delve Underground project no. 6491.0, report dated February 2024.

<sup>2</sup> Mark V. Herbert & Associates (MHA). 1993. Moon Ranch Gravel Pit Evaluation, Deschutes County, Oregon. Prepared for Matt Day, report dated April 8, 1993.

<sup>3</sup> Siemens & Associates. 1996. Deschutes County Final Landfill Site Evaluation – Site “L”, Horse Ridge, Oregon – Results of Onsite Soil and Rock Investigation. Prepared for David Evans and Associates Inc., project no. 996021, report dated August 6, 1996.



approximately 281 acres at the time of the 1993 investigation, and the entirety of the property is now being considered, which totals approximately 440 acres.

- The Moon Pit was originally operated as a sand and gravel quarry. As these materials were depleted, operations transitioned to a rock quarry where bedrock is first blasted and then processed by crushing to produce salable materials. Some of the sand and gravel material is still present on site, particularly to the northwest.
- In 1996, SA advanced 22 auger borings to characterize the site as a potential landfill. These borings were not advanced significantly into the bedrock. The results were used to further define the extent of the sands and gravels and evaluate the site's viability as a landfill.
- Review of seismic surveys and cross sections compiled by SA indicated an irregular bedrock contact with varying depths of sediment accumulation within the northwest portion of the site at the time of exploration.
- Presently, shallow bedrock is persistent throughout the site and covered with a thin (less than 10-foot thick) veneer of undifferentiated alluvium and loess (wind deposited silt and fine sand). Thicker amounts of alluvium may be present where it has not been mined out in the northwestern portion of the site.
- Bedrock exposed in the quarry exposures in the site's southern portion consisted of a complex sequence of basaltic lava flows and cinder-filled interbeds. Both lava flow and interbeds generally varied between 2 and 10 feet thick.
- Bedrock exposed in the northwestern portion of the site by mining was highly weathered and not of commercial grade. Following the discovery of low-quality material beneath the sand and gravel, operations shifted to the southern portion of the site. The extent of these materials is unknown. This material is likely still usable for daily cover at the landfill.
- On-site materials will require laboratory testing to assess whether materials meet the specification of intended use per Oregon Standard Specifications for Construction (OSSC).

Table 1 summarizes materials present on site and anticipated uses of these materials included within our 2024 report.

**Table 1. Summary of Onsite Materials and Potential Uses**

Geologic Unit	ASTM Soil Classification	Estimated Thickness (feet)	Anticipated Use <sup>1</sup>
Alluvium/Loess <sup>2</sup>	Silty SAND (SM)	1 – 5.5	Daily cover
	Well-graded GRAVEL with sand and cobbles (GW)		
	Well-graded SAND with silt (SW-SM)		
Colluvium <sup>3</sup>	Well-graded GRAVEL (GW)	>6	Daily cover
Bedrock (extremely weathered) <sup>4</sup>	Well-graded GRAVEL with silt and SAND (GW-GM)	1 – 4	Daily cover for gravel-sized or finer; crush/screen oversize rock clasts for drain rock, structural fill, and road base
	Well-graded GRAVEL with sand (GW)		
	Silty SAND with gravel and cobbles (SW)		
Bedrock <sup>5</sup> (unweathered)	N/A	Unknown	Crush for drain rock, structural fill, and road base

Notes:

<sup>1</sup> Anticipated uses are assumed. No laboratory testing has been performed and bedrock quality is currently unknown. Laboratory testing is required for approval of on-site use.

<sup>2</sup> Alluvium and loess accumulation throughout the undisturbed areas of the site and overlies bedrock, and old alluvial gravels previously mined in the northwest portion of the site. These old alluvial gravels may be locally thicker in this area.

<sup>3</sup> Colluvium limited to areas adjacent to fault scarp and only encountered in TP-3 and TP-4.

<sup>4</sup> Bedrock encountered within test pits represents the upper weathering profile and contains varying amounts of sand and fines. Bedrock quality is currently unknown and requires evaluation and laboratory testing to determine durability and quality.

<sup>5</sup> Bedrock quality determination is beyond the scope of this exploration although visual observations of cuts and other exposures suggest high variability ranging from poor to moderate.

## Discussion

The following are additional considerations with respect to the viability of existing on-site materials for commercial and on-site use:

- Commercially viable materials have been mined at this site for decades. Current mining operations are in the southeast portion of the property. However, no lab results or quantities have been provided to date to indicate the quality of materials mined. Materials produced are likely used for road base, chip and seal, structural fill, and asphalt concrete aggregate. These materials could also be potentially used for on-site development and operational purposes.
- The area associated with Phase 1 of the landfill development (northwest portion) has the highest uncertainty with respect to material quality and quantity. Bedrock mining was attempted in one location but discontinued due to low-quality rock. Additional site characterization will provide additional clarity on ground conditions. While some material may

not be commercially viable, it is anticipated it could be used for on-site purposes, primarily daily cover.

- An additional consideration for Deschutes County is the operation of this quarry as a “resource” to contractors bidding on County projects. The quarry could be made available to prospective contractors to mine and process crushed rock for these types of projects. This may increase the competition between contractors as those without proximal quarries would be able to process materials themselves versus purchase products from potential competitors. The Oregon Department of Transportation maintains numerous quarries across the state for this purpose.
- The current location of the Moon Pit limits its commercial value due to longer haul costs. Projects where these products will be particularly competitive include roadway work on US 20 between Bend and Burns as well as county and city projects in southeast Bend. Future expansion in the area is anticipated to be focused to the east of Bend, including the SE Area Plan Development and Stevens Tract Property Development. This may increase the marketability of materials produced at Moon Pit. Other potential projects that will need large quantities of import include canal piping projects and the City of Bend Go Bond transportation projects such as the Reed Market railroad overpass fill.
- While specifics regarding the market value of the quarry are limited due to the lack of specifics regarding rock quality, the appraised value will be based on documentation of materials produced and quality control data provided by the seller.

#### **Additional Site Characterization**

Additional site characterization would be required to understand the subsurface conditions, lateral extent of deposits, and recover materials for laboratory testing. A future exploration program should be performed after negotiations of land acquisition have begun. We recommend exploration of the Phase 1 area be prioritized due to the higher level of uncertainty of material quantities and properties in this location.

Sincerely,



Shaun Cordes, RG, CEG  
Associate Engineering Geologist



James Schick, RG, CEG  
Principal Engineering Geologist

cc: File  
Encl.