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Reference: 018064

July 2, 2019

Josh Sweet
Shadow Light Ranch, LLC
P.O. Box 250
Garberville, CA 95542

Subject: Water Storage Pond Embankment Stabilization, Shadow Light Ranch, APN 223-061-038, Garberville, California

Josh:

As requested, SHN is providing these recommendations for the stabilization and reconstruction of the embankment associated with a pond on your property (APN 223-061-038) near Garberville, in southern Humboldt County. We understand you are engaged in the state and county cannabis compliance process, and that the subject pond is under regulatory review; as such, its future remains uncertain. If the subject pond were to be approved to be retained, the recommendations included herein would be applicable.

The subject pond is located at latitude 40.092811 and longitude -123.768636. Discussion regarding the history and environmental setting of this pond is included in previous reports for the site, and is not included herein. Within the ongoing regulatory dialogue, the subject pond is referred to as the "lower" pond.

As discussed previously, the site is underlain by sedimentary bedrock materials associated with the Neogene Wildcat Group. Exposures of pebbly conglomerate occur near the subject embankment; fine sandstone and siltstone sediments also occur nearby (at the adjacent "upper" pond).

Existing Condition

Little is known about the construction of the existing embankment, because it was built by neighbors without permits and, to our knowledge, without engineering. We assume the embankment was built from the spoils derived from excavation of the pond it retains, which is relatively small (160 feet x 90 feet). Embankment height is estimated at 10 to 12 feet. The embankment is thought to have been built in 2006, based on Google Earth imagery. This suggests the pond is 13 years old, and on visual inspection the embankment appears to have retained its integrity (no repairs are evident, and we are not aware that any have occurred).

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The existing embankment deficiencies that require attention include the following:

- The outer embankment face is overly steep (on the order of 1:1 to 1½:1 [horizontal to vertical] in most areas).
- There is an erosion scar on the existing outboard embankment face at the outlet of an abandoned spillway (two disconnected side-by-side corrugated plastic pipes). The erosion scar extends from the crest to the toe of the embankment, is about 2 feet deep, and as much as 8 feet wide near the base of the slope.

Our recommendations for mitigating these deficiencies, are provided in the following section.

Reconstruction Recommendations

The outer embankment face needs to be reduced to a slope no steeper than 2:1. Reducing the slope gradient of the embankment face may occur by one of the following methods, which are depicted in Figure 1:

- adding additional fill material to the existing embankment face, thus maintaining the current crest position, but requiring the toe of the embankment to move outward from its current position;
- maintaining the current position of the embankment toe and laying the slope back, which would require moving the embankment crest back and rebuilding the embankment within the current pond footprint (thus reducing the size of the pond); or
- some combination of the two.

The relative benefit between the two alternatives may be dictated by the ability to move the embankment toe further down the slope (required for the first option) without encroaching on wetland soils or unstable slopes. The best solution may entail a combination of the two approaches. The project will require some field engineering, as the full scope of the reconstruction will not be apparent until the pond is drained.

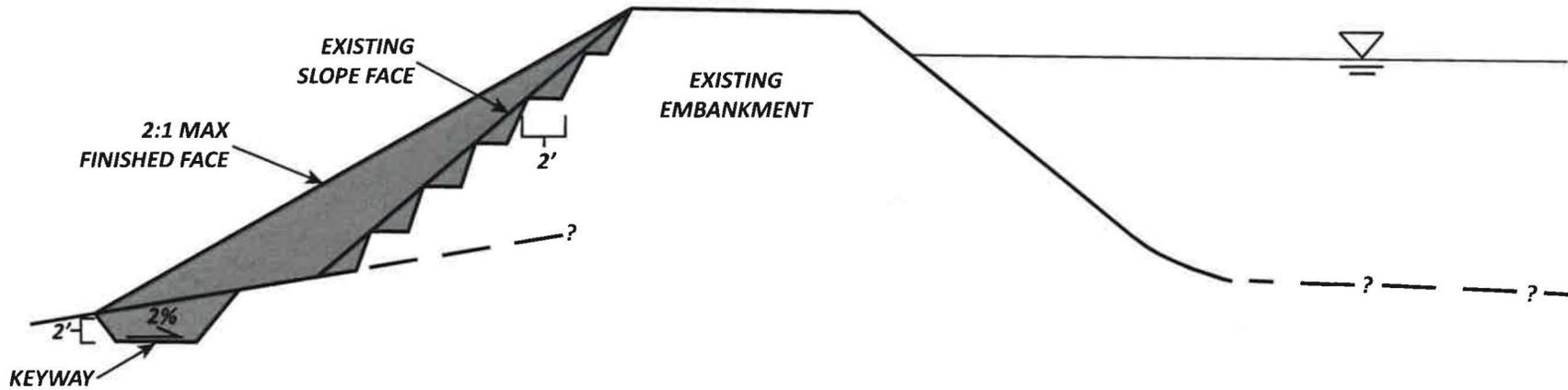
Either of these approaches will result in the removal of the erosion scar described above and mitigation of any hazard associated with it.

Regardless of the approach to reconstruction of the pond embankment, the following recommendations will apply:

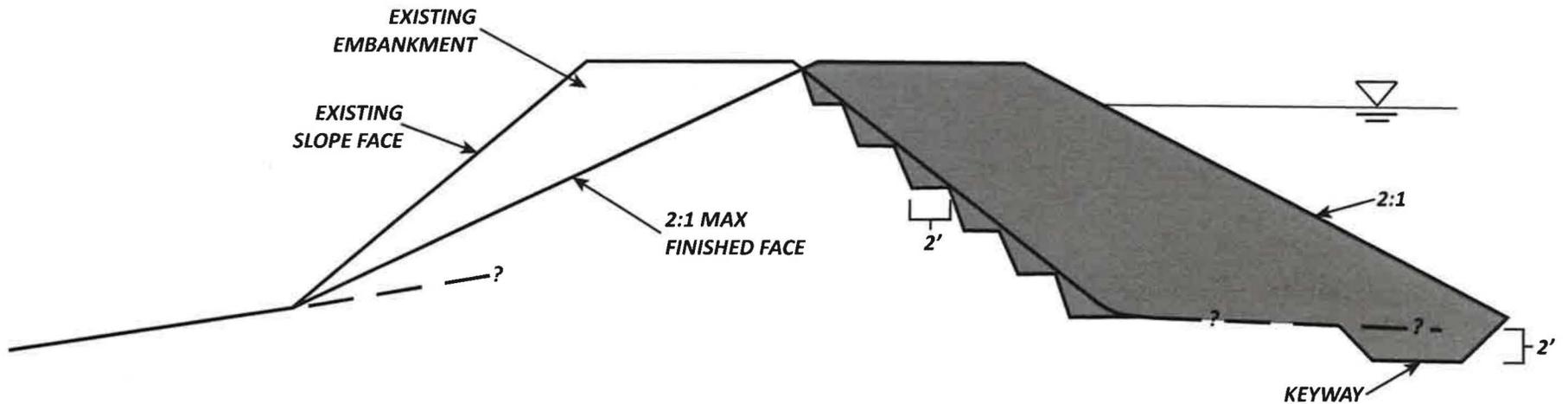
- Drain the pond prior to the onset of the project. The earthwork described herein cannot be achieved with water in the pond. Earthwork inside the existing pond will require adequate moisture conditioning (drying) to obtain suitable subgrade conditions.
- Strip and remove all existing vegetation and root systems from the embankment face and any additional footprint areas that may receive fills, plus an additional 5 feet outward.
- Remove the abandoned spillway pipes if the existing crest position is to be maintained.



A) ADD FILL TO THE EXISTING OUTBOARD SLOPE FACE TO CREATE 2:1 SLOPE



B) LAY EXISTING OUTBOARD SLOPE FACE BACK TO CREATE 2:1 SLOPE; ADD FILL TO INBOARD FACE



NOTE: DRAWINGS NOT TO SCALE



Shadow Light Ranch, LLC.
Embankment Details
Garberville, California

Embankment Repair Options - Lower Pond

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Figure1_EmbankmentDetails

Figure 1

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- All embankment fill should be free from woody debris, roots, organics, and rocks retained on the 4-inch sieve. A rock sorter and/or crusher may be required to remove/modify the oversized particles (rocks retained on a 4-inch sieve). Embankment fill should be comprised of greater than 50 percent fine-grained material (silts and clays), to prevent water seepage through the embankment. To the extent possible, blend the stockpiled material into a uniform mixture. The geotechnical engineer or qualified representative should be present during excavating and stockpiling, to ensure the adequacy of the excavated material. If the excavated material is deemed inadequate, then an alternate source must be determined (from either a borrow area elsewhere onsite, or soil imported from offsite).
- Regardless of the approach to the reconstruction of the embankment (adding to the existing outer embankment face versus laying it back), the geometry of the schematic drawing shown in the attached Figure 1 should be used as a guide. The schematic shows keyway- and bench-based construction, and defines the placement of compacted soil lifts. The ultimate design may vary depending on the approach chosen (fill soils may be placed on the outboard embankment face, the inboard embankment face, or both), but it will inevitably include some areas where new fills soils will contact existing fill or native soils. These areas should be adequately prepared and benched.
- For any subgrade area to receive fill, scarify the upper 12 inches of exposed subgrade soils, moisture-condition to a uniform moisture content of at least 2 percent above optimum, and compact to at least 90 percent relative compaction.
- Place embankment fill materials in horizontal layers no greater than 8 inches in loose thickness, moisture-condition to a uniform moisture content at least 2 percent above optimum, and compact to at least 90 percent relative compaction.
- Immediately following completion of pond earthwork, exterior slopes should be seeded/planted with suitable erosion-control vegetation (native grass, for example). Trees and large shrubs should not be planted on the embankment.
- Sufficient construction inspection and materials testing should be performed, as determined by the geotechnical engineer or qualified representative, to confirm that the ponds are constructed in accordance with our design and recommendations. At a minimum, the following should be tested for adequate compaction:
 - Scarified and compacted subgrade soils
 - Initial lift of embankment fill material
 - Middle lift of embankment fill material (that is, the lift that is halfway up the total design height of the embankment)
 - Final lift of embankment fill material
 - Further compaction testing may be required, depending on certain construction-phase items (such as the frequency of failing compaction tests).



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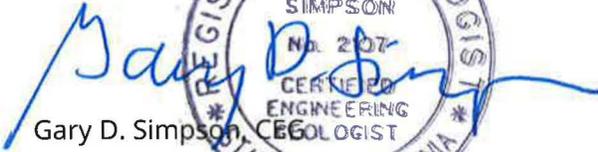
Limitations

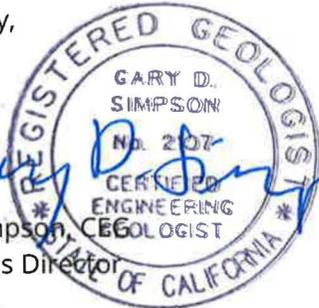
This report provides a focused discussion regarding a specific water retention pond on the Shadow Light Ranch. The discussion herein applies to the subject pond at the current time. If a significant lapse in time (>1 year) occurs before the work outlined herein is completed, we should review the site conditions to ensure that no modifications to the plan outlined herein are necessary. The recommendations included herein are not applicable elsewhere (on this property or any other property). The recommendations provided herein are based on an investigation of inherently limited scope, given that the subject pond was built previously, and the work done here is all retroactive.

We hope that this report provides the information that you need at this time. If you need additional information, or clarification of the information included herein, please do not hesitate to call our office at (707) 441-8855.

Respectfully,

SHN


Gary D. Simpson, CEG
Geosciences Director



GDS:lms