March 13, 2026

Mr. Dylan Smith
Chiquita Canyon Landfill
29201 Henry Mayo Drive
Castaic, California 91384

REVISED COMPREHENSIVE GLOBAL STABILITY STUDY WORK PLAN
CHIQUITA CANYON LANDFILL
CASTAIC, CALIFORNIA

Dear Mr. Smith:

This Revised Comprehensive Global Stability Study Work Plan (Revised Work Plan) was prepared by Geo-Logic Associates, Inc. (GLA) to address the February 23, 2026 Department of Toxic Substances Control (DTSC) comments on the December 17, 2025 Comprehensive Global Stability Work Plan (Work Plan). The Revised Work Plan also addresses Work Plan comments from the California Department of Resources Recycling and Recovery (CalRecycle) and the County of Los Angeles Department of Public Health, acting as the Local Enforcement Agency (LEA).

ORIGINAL WORK PLAN

The December 2025 Work Plan was prepared by GLA to describe the means and methods to address the DTSC October 15, 2025 directive that Chiquita Canyon, LLC (Chiquita) complete an analysis of "*global slope stability modeling [sic] identifying which slopes are most likely to be vulnerable to instability from the SET event and the criteria used for the analysis*," including "*an analysis of global slope stability that is inclusive of the recent placement of Tank Farm 13 at the toe of the CCL main canyon slope in Cell 8B (on top of existing waste that can be consumed by the SET event), and when the Tank Farm 13 is no longer located in Cell 8B, how this will affect slope stability*." The DTSC directive was apparently informed by CalRecycle's slope stability work plan recommendation in its September 12, 2025 letter to DTSC that states:

> *The CCL should complete a comprehensive global stability study for areas where critical infrastructure is located (e.g., temporary Tank Farm 13 located in Cell 8B) assuming the reaction encompasses the entire waste management unit. The CCL's consultant GLA, in a presentation to USEPA in 2024, indicating that if the reaction expanded to the interface of Module*

> *4/5, certain slope stability factors start dropping below the acceptable factor of safety.*[1]

The purpose of the December 2025 Work Plan was to address the DTSC requirement to complete static and seismic stability analyses of global stability that is inclusive of the Tank Farm 13 area and the CalRecycle recommendation to address areas where critical infrastructure is located. As described in more detail in the Work Plan, the analyses would be based on GLA's understanding of previous and current site conditions, site observations, available site data, and previous stability analyses performed for different phases of construction at the Chiquita Canyon Landfill (the Landfill). The analyses would also address stability of existing alternatives and alternatives that may be proposed in response to DTSC's October 15, 2025 letter.

DTSC REQUIREMENTS

On February 23, 2026, DTSC provided "*comments and recommendations to be incorporated into a revised comprehensive global stability study work plan for DTSC approval.*" The DTSC correspondence attached a CalRecycle letter that included additional comments and recommendations and DTSC noted "*All these comments must be addressed in order for DTSC to approve the work plan.*" On March 6, 2026, Chiquita received additional comments on the Work Plan from the LEA that are identical to the CalRecycle comments. The DTSC and CalRecycle/LEA comments are incorporated in this Revised Work Plan. To provide additional context, the DTSC and CalRecycle/LEA comments are identified verbatim in Attachment 1 in *italics*, with GLA's response immediately below.

PURPOSE OF REVISED WORK PLAN

The purpose of the Revised Work Plan is to address the DTSC requirement to complete static and seismic stability analyses of global stability that is inclusive of the Tank Farm 13 area and the CalRecycle recommendation to address areas where critical infrastructure is located. In accordance with the CalRecycle comments (see Attachment 1), the Revised Work Plan adds an assessment of the eastern Landfill slopes in addition to the northern, western, southern, and Tank Farm 13 slopes. The analyses will also

[1] As described in Chiquita's November 21, 2025 response to DTSC's October 15, 2025 correspondence, CalRecycle's comment did not accurately represent the information presented in the October 2024 presentation to the USEPA. CalRecycle also apparently did not consider information in the December 9, 2024 GLA "Information to Address Regulatory Agency Western and Southern Slope Stability Evaluation Comments" report that presented analyses using considerably more information than the analyses that were discussed at the October 2024 meeting. These analyses extended the reaction area to the boundary of Module 4 and Module 5, and the results showed acceptable static safety factors and seismic displacements for all conditions that were analyzed.

address stability of existing alternatives and alternatives that may be proposed in response to DTSC's October 15, 2025 letter.

DATA SOURCES

The analyses will be based on GLA's understanding of previous and current site conditions, site observations, available site data, and previous stability analyses performed for different phases of construction at the landfill. This information includes site-specific landfill design, constructing, and testing information; published information regarding municipal solid waste (MSW) shear strength; published information regarding liner component shear strength; published relevant case histories, relevant geologic and seismologic information; and site-specific data that has included:

- Site topographic maps.
- The results of surface crack and fissure mapping performed at the site.
- Leachate removal information.
- Leachate level measurements.
- LFG monitoring well boring logs.
- LFG monitoring well pressure data.
- Temperature probe data.
- Relevant observations from regular site surveys, special site surveys by GLA staff, construction observations, and other similar sources site construction.
- Landfill containment system information including material property data for the different materials.

These data sources are referenced, and relevant site-specific data are included in the following reports:

- GLA (2024a) West and North Slope Stability Analyses; February 2024.
- GLA (2024b) West and North Slope Stability Analysis (DRAFT); March 2024.
- GLA (2024c) Evaluation of Los Angeles Regional Water Quality Control Board Denial of Cell 8B Final Construction Quality Assurance Report; June 2024.
- GLA (2024d) Master Development Plan Stability Analyses; August 2024.
- GLA (2024e) Information to Address Regulatory Agency Western and Southern Slope Stability Evaluation Comments; December 2024.

A consolidated reference list for these reports follows the detailed response to comments in Attachment 1. As a general practice, each successive analysis has incorporated newly available site data and any additional published information considered relevant to the analyses being performed. Potentially applicable published information identified by DTSC and/or CalRecycle/LEA will be reviewed and incorporated, as appropriate. This information will include, but not be limited to:

- Ghazizadeh, S., and Bareither, C A. (2020), “Temperature Effects of Internal Shear Behavior in Reinforced GCLs.”, J. Geotech. Geoenvir. Engrg., ASCE, 146(1), 14 pp.
- Stark, T.D., N. Huvaj-Sarihan, and G. Li, "Shear Strength of Municipal Solid Waste for Stability Analyses," Environmental Geology J., Springer Pub., http://dx.doi.org/10.1007/s00254-008-1480-0, 57(8), 2009, 1911-1923.

Additional information not identified by DTSC or CalRecycle/LEA that will be reviewed includes, but is not limited to:

- Akpinar, M.V., and Benson, C.H. (2005). *Effect of temperature on shear strength of two geosynthetic clay liner interfaces*. Geotextiles and Geomembranes, 23(6), 443–463.
- Karademir, T. (2011). *Elevated temperature effects on interface shear strength of geosynthetics*. Ph.D. Dissertation, School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, Georgia.
- Karademir, T., and Stark, T.D. (2014). *Elevated temperature effects on geosynthetic interface shear strength*. Proceedings, 10th International Conference on Geosynthetics, Berlin, Germany.
- Rowe, R.K., and Rimal, S. (2012). *Time and temperature effects on geomembrane strain from gravel indentations*. Canadian Geotechnical Journal, 49(12), 1417–1430.
- Koerner, R.M. (2012). *Designing with Geosynthetics*, 6th Edition. Xlibris Publishing, Bloomington, Indiana.
- Hsuan, Y.G., Koerner, R.M., and Lord, A.E. (2008). *Temperature effects on the mechanical behavior of high-density polyethylene geomembranes*. Geosynthetics International, 15(6), 376–387.

In GLA’s opinion, the available site-specific data, supplemented by relevant peer-reviewed studies and published technical literature, provide an adequate technical basis for comprehensive global stability evaluations. Should the analyses identify any data gaps that could materially influence the evaluation, those gaps will be identified and discussed in the stability analysis report, along with any recommended additional data collection or evaluation.

METHODS OF ANALYSIS

Basis of Analysis

Stability analyses will be based on parameter sets that are realistic, internally consistent, and supported by observed site conditions and accepted engineering principles. Parameters will not be selected in isolation or adjusted solely to satisfy prescriptive or outcome-driven expectations. Internal consistency is essential: if one assumption is adopted, the implications of that assumption must also be carried through the analysis. Selective or isolated conservatism that is not physically consistent with other adopted parameters does not provide meaningful insight into system behavior and will therefore be avoided.

In this context, GLA will evaluate the CalRecycle recommendation for GLA to assume that the reaction encompasses the entire waste management unit. Based on available site data, field observations, and operational history, there is no credible evidence indicating that this condition is present or reasonably likely to occur. Nonetheless, supplemental analyses will be performed that explicitly consider this specified condition. The significance of these results will be evaluated relative to observed site behavior, site history, and the internal consistency of the adopted assumptions. Where outcomes differ materially from analyses based on realistic, site-supported parameters, those differences will be clearly identified and attributed to the controlling assumptions rather than hypothetical conditions that are not reasonably foreseeable.

Analytical Methods

Static safety factors and yield accelerations will be calculated using the Morgenstern and Price (1965) limit equilibrium method as implemented by the computer program SLIDE2.[2] The Morgenstern-Price method satisfies force and moment equilibrium and the interslice function that returns the lowest static safety factor will be used for the analyses.[3] The yield acceleration is the horizontal seismic load that results in a safety factor of 1 for the slope being analyzed. Search routines that span the entire potential sliding surface being analyzed will be used to identify the surface(s) with the lowest static

[2] Morgenstern, N.R. and V.E. Price, 1965, The Analysis of the Stability of General Slip Surfaces; Geotechnique, Volume 15, Issue 1, March 1965, pp. 79-93.

[3] As discussed during the October 23, 2024 meeting referenced in footnote 1, sensitivity analyses show that the difference between safety factors calculated using the four different Morgenstern-Price interslice functions result in a maximum differential of 0.02, which is insignificant within the context of these evaluations.

safety factor. Both circular and non-circular sliding surfaces will be considered, although previous analyses have shown that non-circular surfaces have relatively lower safety factors.

Consistent with previous analyses, seismic displacements will be calculated based on a deterministic assessment of the magnitudes and bedrock spectral accelerations associated with maximum credible earthquakes (MCEs) on Holocene-active faults within 100 km of the landfill. Consistent with the December GLA report, the deformations will be calculated using the MCEs and bedrock accelerations on the Holser, San Gabriel, and San Andreas faults. Potential displacements associated with the Newport-Inglewood fault will also be considered to address the CalRecycle and LEA comments.

Previous displacement analyses used the Bray and Travasarou (2007) procedure because it is widely used in California and is generally considered a standard-of-practice approach for estimating earthquake-induced slope displacements in geotechnical engineering applications, including landfill stability evaluations. Although Bray and Macedo (2019) represents a more recent refinement of the Newmark-type displacement procedure, it has not yet been adopted as a universal standard of practice within the profession. Nevertheless, in the interest of addressing the DTSC comment and providing additional context for comparison, GLA will perform supplemental displacement estimates using the Bray and Macedo (2019) procedure and compare those results with the Bray and Travasarou (2007) analyses.

Material Properties for Analysis

The following material properties that were previously used in the GLA December 9, 2024 "Information to Address Regulatory Agency Western and Southern Slope Stability Evaluation Comments" report will be used for the analyses:

- **Degraded Municipal Solid Waste (MSW) Shear Strength**. As described in Attachment 1, the December GLA (2024e) report incorporated degraded municipal solid waste (MSW) shear strength parameters explicitly recommended by Dr. Timothy Stark, who was retained by the regulatory agencies as their technical expert.[4] GLA therefore assumes that DTSC accepts these parameters for use in the Comprehensive Global Stability analyses. The Stark-recommended degraded shear strength profile is shown in Attachment 1.

[4] Stark, Timothy D., 2024, Review Comments on May 7, 2024 GLA Report on West and North Slope Stability Analysis Update for Chiquita Canyon Landfill; memorandum to Weston Solutions, July 7, 2024. Although this memorandum is dated July 7, 2024, CalRecycle indicates it did not receive the report until August 21. CalRecycle transmitted the memorandum to the Los Angeles County Department of Public Health on September 4, 2024 and it was not provided to GLA for review until after this date.

- **Displaced Unaffected (or Non-Degraded) MSW Shear Strength**. The July 7, 2024 Stark Memo provided a recommended bilinear strength envelope for displaced, non-degraded MSW. This recommendation was adopted for the December GLA (2024e) report and will be carried forward for use as applicable in the Comprehensive Global Stability analyses.
- **In-Place and Unaffected (or Non-Degraded) MSW Shear Strength**. The Kavazanjian et al. (2013) MSW shear strength will be assumed for MSW outside of the reaction area that has not been affected by movement.[5] As described in more detail in Attachment 1, the shear strength envelope presented in Kavazanjian et al. (2013) was not developed solely from data obtained at the Operating Industries, Inc. (OII) Landfill. Although the OII investigation provided one of the most comprehensive datasets of large-scale MSW shear testing and is therefore frequently cited, the recommended strength relationships presented in the paper were developed through consideration of a broader body of information. Kavazanjian et al. (2013) synthesize results from multiple published MSW shear strength studies, including laboratory and field testing programs and back-analyses of landfill slope performance reported in the literature (e.g., Singh and Murphy, 1990; Landva and Clark, 1990; Kavazanjian et al., 1995; Stark et al., 2009; Zekkos et al., 2006–2010). Accordingly, the recommended shear strength envelope represents the collective behavior of MSW observed across numerous studies and landfill sites rather than conditions specific to the OII facility.
- **Liner Shear Strength**. The December GLA (2024e) analyses incorporated the residual shear strength parameters for liner systems potentially affected by the reaction and elevated temperatures, as recommended in the July 7, 2024 Stark Memorandum. These recommendations will be implemented in the evaluations described in this Revised Work Plan. For liner systems not affected by the reaction and elevated temperatures, large-displacement shear strengths will be used. Where site-specific laboratory test data are not available, liner shear strength parameters will be assessed using information from the published literature referenced previously in this Revised Work Plan and in Attachment 1.

Leachate and Landfill Gas Pressures

Leachate and landfill gas (LFG) pressures within municipal solid waste landfills are inherently laterally and vertically discontinuous due to heterogeneous waste placement,

[5] Kavazanjian, E., Matasovic, N. and R.C. Bachus, 2013, 11TH Peck Lecture: Predesign Geotechnical Investigation for the OII Superfund Site Landfill; Journal of Geotechnical and Geoenvironmental Engineering, ASCE, November 2013.

intermittent low-permeability layers, preferential flow paths, and active gas extraction. Accordingly, stability analyses necessarily rely on simplified, representative pressure surfaces that are intended to reasonably bound site conditions rather than replicate localized, transient features.

Previous stability evaluations for the landfill have incorporated both leachate levels and LFG pressures in the stability analyses, and sensitivity analyses have been performed to evaluate the potential effects of variations in these pressures on calculated factors of safety and estimated displacements. The same analytical approach will be used in the current evaluation. Representative leachate elevations and LFG pressures will be developed based on available monitoring data and relevant field observations, and sensitivity analyses will be performed to evaluate conditions reflecting historically observed maximum leachate levels and LFG pressures, as appropriate. Stability analyses will be performed using the SLIDE2 software package, which includes the capability to explicitly incorporate gas pressures in the stability modeling. Accordingly, the methods used in the current analyses will be consistent with those applied in previous landfill stability evaluations and will address the potential influence of both leachate and LFG pressures on stability conditions.

WORK PLAN COMPONENTS

Data Collection and Review

The objective of this task will be to collect and review site data collected since the last stability evaluations were completed in the fourth quarter of 2024 and to use that information to identify representative cross sections and stability models. Data sources will include (but not be limited to):

- Current site topography based on the most recent (2025) Propeller aerial surveys. Earlier site topography will also be reviewed and incorporated if judged to be relevant to the analyses.
- Any known or anticipated construction-related activities that alter site topography will be considered and incorporated in the analyses.
- The results of surface crack and fissure mapping performed at the site.
- Leachate removal information.
- Leachate level measurements.
- LFG monitoring well boring logs.
- LFG monitoring well pressure data.

- Temperature probe data.
- Relevant design and construction information for Tank Farm 13.
- Landfill containment system information including material property data for the analyses.

Cross Sections, Material Properties, and Pressures

The information will be reviewed, compiled, and used to identify representative cross sections for analysis. Based on current site understanding, one or more east-to-west cross sections will be identified to evaluate stability of the western slopes, one or more west-to-east cross sections will be identified to evaluate stability of the eastern slopes, one or more north-to-south cross sections will be identified to evaluate stability of the northern slopes, and two or more cross sections will be identified to evaluate the southern slope of the landfill, including Tank Farm 13. The section locations will be selected to represent the most critical combinations of slope height, slope inclination, critical infrastructure, material property variation, and pressure conditions. The subsurface materials along each cross section will be evaluated based on the available data and fluid levels incorporated in the analyses will be estimated as summarized above. As part of this task, sequential topographic data, surface fissure and cracking mapping, and site observations regarding leachate seepage will be used to identify zones of previous instability, if any.[6]

Documentation and Recommendations

The results of the analyses will be documented in a report that will summarize the data used for the analyses and the analysis results. Relevant data, site information, and analysis output will be appended to the report. Principal uncertainties associated with the analyses will be identified, and if warranted, the report will include recommendations for additional investigations to assess subsurface MSW properties, fluid levels, internal pressures, and/or short-term stabilization measures. In accordance with CalRecycle and LEA comments, the report will be provided to DTSC in draft form and will not be finalized until DTSC comments are addressed. The final report will be signed and stamped by two licensed GLA professionals.

TIMELINE

An approximate timeline for each of the associated tasks is shown in the attached schedule. This schedule assumes a four-week DTSC Work Plan review and approval

[6] If reasonably well-characterized, zones of instability or previous sliding, if any, can be used with other site information to assess subsurface stratigraphy and possible zones of degraded MSW, the distribution of subsurface fluids, and to back-calculate shear strengths.

period. The schedule also includes a four-week DTSC Draft Report review and comment period. Shorter or longer review, approval, and comment periods will shift the report submittal date accordingly. This timeline is approximate and may change based on other factors or unanticipated circumstances.

Please contact the undersigned at (415) 699-8073 if you have questions or need additional information.

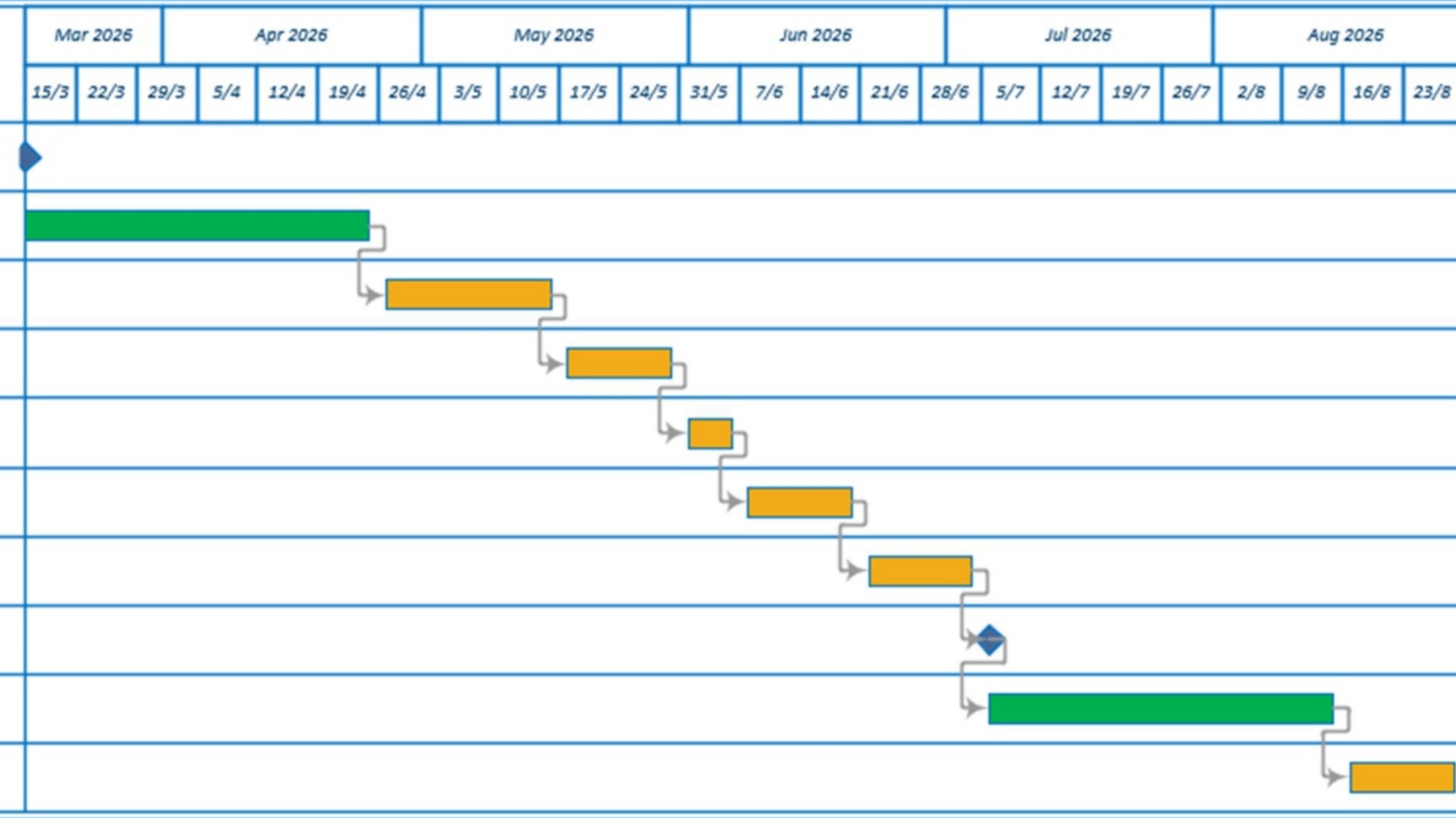
Very truly yours,

Geo-Logic Associates, Inc.

Richard A. Mitchell, PG, CEG
Principal Engineering Geologist

CERTIFIED ENGINEERING GEOLOGIST
RICHARD A. MITCHELL
1371
STATE OF CALIFORNIA

ID	Task Name	Start	Finish	Duration
1	REVISED WORK PLAN SUBMITTAL	3/16/2026	3/16/2026	0d
2	AGENCY REVIEW AND APPROVAL	3/16/2026	4/24/2026	30d
3	DATA COLLECTION, REVIEW, EVALUATION, AND SUMMARIES	4/27/2026	5/15/2026	15d
4	IDENTIFY CROSS SECTIONS AND BUILD MODELS	5/18/2026	5/29/2026	10d
5	RUN ANALYSES AND SCENARIOS	6/1/2026	6/5/2026	5d
6	PREPARE DRAFT REPORT	6/8/2026	6/19/2026	10d
7	INTERNAL REVIEW & REVISE REPORT	6/22/2026	7/3/2026	10d
8	SUBMIT DRAFT REPORT FOR AGENCY REVIEW	7/6/2026	7/6/2026	0d
9	AGENCY REVIEW AND COMMENT	7/6/2026	8/14/2026	30d
10	REVISE AND SUBMIT FINAL REPORT	8/17/2026	8/28/2026	10d



Attachment 1
INFORMATION TO ADDRESS DTSC, CALRECYCLE, AND LEA
COMPREHENSIVE STABILITY WORK PLAN REVIEW COMMENTS
Chiquita Canyon Landfill

DTSC FEBRUARY 23, 2026 COMMENTS

General Comments

1. *Estimate Reduced Shear Strength of Municipal Solid Waste (MSW) due to SET Event: Include estimated Post-SET MSW shear strength properties for analysis profiles slices that intersect areas of documented SET effects at high temperature. Respondents shall provide MSW shear strength parameters that are representative of conditions near the end of/following an SET event from either (1) site-specific MSW sampling and shear strength testing from CCL; (2) technical references; or (3) other proposed parameters approved by DTSC.*

All GLA stability analyses performed in 2024 to assess the western and southern slopes of the landfill incorporated reduced shear strengths for degraded MSW potentially affected by the reaction. These reports include:

- GLA (2024a) West and North Slope Stability Analyses; February 2024.
- GLA (2024b) West and North Slope Stability Analysis (DRAFT); March 2024.
- GLA (2024c) Evaluation of Los Angeles Regional Water Quality Control Board Denial of Cell 8B Final Construction Quality Assurance Report; June 2024.
- GLA (2024d) Master Development Plan Stability Analyses; August 2024.
- GLA (2024e) Information to Address Regulatory Agency Western and Southern Slope Stability Evaluation Comments; December 2024.

Prior to the December GLA (2024e) report, the shear strength of degraded municipal solid waste (MSW) was based on published literature values. The December GLA report incorporated degraded MSW shear strength parameters explicitly recommended by Dr. Timothy Stark. Dr. Stark was retained by the regulatory agencies as their technical expert, and his recommendations regarding degraded MSW shear strength parameters were therefore incorporated into the analyses. Figure 4 from the December GLA report is included with this attachment and illustrates both the degraded MSW profile assumed in the earlier GLA analyses (GLA 2024a, 2024b, 2024c, and 2024d) and the Stark-recommended degraded MSW profile used in the December analyses. Use of the Dr. Stark-recommended profile was identified in the original Work Plan and is retained in the Revised Work Plan. GLA therefore assumes that DTSC accepts these parameters for use in the analyses.

2. *SET Event Effects on Liner Geotextile, Geomembrane, and Geosynthetic Clay Liner (GCL) Interface Shear Strength: When considering analysis profiles slices that*

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intersect areas of documented SET event effects with high temperatures, evaluate the potential adverse thermal effect on shear strength properties of geotextiles and geomembranes (e.g., degradation of peak strength of GCLs). DTSC notes that at some locations, the high or highest SET-event-induced MSW temperatures are at the greatest depths of the probe array and are at much higher temperatures. DTSC notes at select temperature monitoring probe (TP) locations (based on readings from CCL temperature probes in SCS RMC® on January 8, 2026), the deepest temperature readings are the highest, and exceed 200° Fahrenheit (F), including TP-03 at 232°F, TP-09 at 207°F, TP-21 at 253°F, and TP-25 at 202°F.

The Workplan should provide technical literature references, or information from product manufacturers that estimate the shear strength properties of side-slope bottom liner interfaces during or following an exposure to the estimated elevated MSW, leachate and landfill gas temperatures typical of the CCL SET event. And, based on technical literature and product vendor data, whether additional adverse, accelerated chemical effects on geotextiles/geomembranes/GCL may occur from contact with leachate or landfill gas at elevated SET temperatures. Also, evaluate whether higher SET-related temperatures warrant "de-rating" of the peak and residual interface shear strength estimated for floor and side slope bottom liners, respectively. If so, apply these "de-rated" shear strength liner interface properties to the stability analysis.

Available technical literature indicates that the GCL internal shear strength typically exceeds its interface strength. However, at higher temperatures (e.g., from a SET event), some GCLs exhibit reduced internal shear strength.[1] For those areas of CCL with side-slope GCL bottom liners, CCL should evaluate the likelihood of whether the estimated elevated MSW/leachate temperatures at depth - associated with the CCL SET event - might reduce the GCL bottom liner's internal shear strength such that the GCL internal shear strength becomes weaker than the GCL interface shear strength. If so, include a GCL residual internal shear strength ("de-rated" for SET-induced higher temperature of GCL) in the stability analysis.

Potential effects of elevated temperatures on the shear strengths of geosynthetic materials underlying the landfill have been considered in previous analyses (see, for example, the GLA December 2024e report addressing western and southern slope stability). These potential effects will continue to be evaluated based on information available in the published technical literature and data obtained from existing temperature monitoring probes. The evaluation will consider the magnitude of the heat source and the proximity of elevated

[1] *Ghazizadeh, S., and Bareither, C A. (2020), "Temperature Effects of Internal Shear Behavior in Reinforced GCLs.", J. Geotech. Geoenvir. Engrg., ASCE, 146(1), 14 pp.*

temperatures to the nearest side slope or base liner system to determine whether temperature-related reductions in geosynthetic shear strength are warranted. In addition to the GCL reference identified by DTSC, other technical resources that will be considered include, but are not limited to:

Akpinar, M.V., and Benson, C.H. (2005). *Effect of temperature on shear strength of two geosynthetic clay liner interfaces*. Geotextiles and Geomembranes, 23(6), 443–463.

Karademir, T. (2011). *Elevated temperature effects on interface shear strength of geosynthetics*. Ph.D. Dissertation, School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, Georgia.

Karademir, T., and Stark, T.D. (2014). *Elevated temperature effects on geosynthetic interface shear strength*. Proceedings, 10th International Conference on Geosynthetics, Berlin, Germany.

Rowe, R.K., and Rimal, S. (2012). *Time and temperature effects on geomembrane strain from gravel indentations*. Canadian Geotechnical Journal, 49(12), 1417–1430.

Koerner, R.M. (2012). *Designing with Geosynthetics*, 6th Edition. Xlibris Publishing, Bloomington, Indiana.

Hsuan, Y.G., Koerner, R.M., and Lord, A.E. (2008). *Temperature effects on the mechanical behavior of high-density polyethylene geomembranes*. Geosynthetics International, 15(6), 376–387.

3. *Account for New Soil Surcharge Loads: The Workplan must propose evaluating the degree of estimated settlement that typically occurs at an MSW and that which will occur as a result of the SET event in the study. Also, the Workplan must propose evaluating where new soil surcharge placement is estimated to be needed to reestablish grades for positive drainage, and that the study will account for these new estimated soil surcharge loads on the applicable stability profiles.*

The Revised Work Plan does not include evaluation of additional soil surcharge loads because no soil surcharge placement is currently planned or contemplated. The stability analyses will evaluate existing conditions and anticipated landfill configurations based on currently available grading information. While settlement of municipal solid waste is a well-recognized behavior, the magnitude and spatial distribution of settlement associated with future events cannot be reliably predicted at this stage and there are no design plans indicating that soil will be placed to reestablish grades for drainage. Accordingly, evaluating new soil surcharge loads would require purely hypothetical assumptions regarding both settlement magnitude and the location and thickness of potential soil placement. Such assumptions would not meaningfully inform the stability evaluation. Nevertheless, as is common practice in landfill stability analyses, sensitivity evaluations may be performed to illustrate the potential effects of generalized surcharge loading where appropriate.

4. *<u>Account for Displacement of Liner Systems vs. Final Cover</u>: The Work Plan should include displacement analysis and should differentiate, and separately estimate magnitudes of displacement of liner systems, versus displacement of final cover.*

The requested differentiation between displacements of liner systems and final cover is not directly relevant to the evaluation of overall landfill stability addressed in this Revised Work Plan. Because final grading plans have not yet been developed and the final cover system has not yet been selected, a meaningful analysis of final cover stability cannot be performed at this time.

<u>Engineering Comments – ESPO (Peter Gathungu)</u>

1. *<u>Methods of Analysis. Analytical Methods</u>: It is stated in the first sentence in the second paragraph that the Bray and Travasarou (2007) procedure will be used to calculate seismic displacements consistent with previous analyses. DTSC notes that more recent/updated procedures/models, such as Bray & Macedo (2019), are available and may be more appropriate. While consistency with previous analyses may be informative, DTSC requires the use of updated procedures which are based on more robust data. However, Bray and Travasarou (2007) may be used in addition to the updated procedures.*

The Bray and Travasarou (2007) procedure is widely used in California and is generally considered a standard-of-practice approach for estimating earthquake-induced slope displacements in geotechnical engineering applications, including landfill stability evaluations. This method has therefore been the basis for displacement evaluations performed by our firm and many others on similar projects. While Bray and Macedo (2019) represents a more recent refinement of the Newmark-type displacement procedure, it has not yet been adopted as a universal standard of practice within the profession. Selection of appropriate analytical methods is typically an engineering judgment made by the engineer of record based on project conditions and accepted professional practice. Nevertheless, in the interest of addressing the DTSC comment and providing additional context for comparison, we will perform supplemental displacement estimates using the Bray and Macedo (2019) procedure and compare those results with the Bray and Travasarou (2007) analyses.

2. *<u>Methods of Analysis. Analytical Methods</u>: It is stated in the first sentence in the second paragraph that maximum credible earthquakes (MCEs) associated with Holocene-active faults with 50 kilometers of the landfill will be used in determination of seismic displacements. MCEs must account for Holocene-active faults within a 100-kilometer radius of the landfill as defined in 22 California Code of Regulations (CCR) Section 66260.10 and 27 CCR Section 20164. The Work Plan must be revised so that the MCE complies with above regulation citations.*

The deterministic seismic hazard evaluation focused on seismic sources within approximately 50 km of the site because ground motions at the site are controlled by nearby faults with the highest combinations of magnitude and site peak ground acceleration (PGA). As summarized in previous report tables, the Holser (1.8 km, M6.8, PGA ≈0.60g), Santa Susana (8.2 km, M6.9, PGA ≈0.51g), Northridge (7.8 km, M6.9, PGA ≈0.42g), San Gabriel (6.4 km, M6.4, PGA ≈0.37g), and Southern San Andreas (32 km, M8.2, PGA ≈0.19g) faults dominate the ground motion estimates because they produce the largest expected shaking at the site. Faults located at greater distances generally produce substantially lower spectral accelerations due to attenuation of seismic waves with distance and therefore do not meaningfully influence the controlling deterministic ground motions. Nevertheless, in response to the DTSC comment, additional regional faults within 100 km of the site will be identified and reviewed to confirm that they do not control the deterministic hazard for the site.

3. *<u>Methods of Analysis. Material Properties for Analysis</u>: It is stated in the third bullet - In-Place and Unaffected (or Non-Degraded) MSW Shear Strength - that "[t]he Kavazanjian et al. (2013) MSW shear strength will be assumed for MSW outside of the reaction area that has not been affected by movement". The Kavazanjian et al. (2013) MSW (municipal solid waste) shear strength is based on investigation at the Operating Industries, Inc. (OII) Superfund Site Landfill where landfill operations occurred from 1948 to 1984 and as such the nature of MSW at OII may not be representative of MSW at CCL as the types of waste placed in landfills are expected to vary over time. The Work Plan must be revised to discuss the representativeness of OII data for use at CCL.*

The shear strength envelope presented by Kavazanjian et al. (2013) in the Rankine Lecture/Peck Lecture paper was not developed solely from data obtained at the Operating Industries, Inc. (OII) Landfill. While the OII site investigation provided an extensive and well-documented dataset of large-scale direct shear tests and waste characterization that contributed meaningfully to the understanding of MSW shear strength behavior, the recommended shear strength relationships presented in Kavazanjian et al. (2013) were developed through consideration of a much broader body of information. The paper synthesizes results from multiple published MSW testing programs, including laboratory and field shear tests reported in the technical literature, as well as back-analyses of landfill slope performance and failures documented in prior studies. These datasets include, among others, the MSW shear strength work reported by Singh and Murphy (1990), Landva and Clark (1990), Kavazanjian et al. (1995), Stark et al. (2009), and Zekkos et al. (2006–2010). The recommended envelope is therefore intended to represent the collective behavior of MSW observed across numerous landfills and studies rather than conditions unique to the OII facility. The OII testing program is frequently cited because it represents one of the most comprehensive field-based MSW shear strength datasets available; however, the strength relationships presented in Kavazanjian et al. (2013) reflect a synthesis of multiple independent datasets and case histories and have been widely adopted in the geotechnical literature and engineering practice as representative of typical MSW shear strength behavior. The Revised Work Plan includes this discussion.

4. *Methods of Analysis - Leachate and Landfill Gas [LFG] Pressures: It is stated in this section that the most recent leachate elevation data, and LFG pressures estimated based on relevant field observations will be used in the analyzed cross sections. DTSC requires that sensitivity analysis includes the use of past observed highest/maximum leachate levels and gas pressures, given the varying conditions, spatial and temporal, that are likely to be encountered at the landfill. In addition, the analysis methods, including software, used for stability evaluation must have the capability to accommodate gas pressures.*

Previous stability evaluations for the landfill have incorporated both leachate levels and LFG pressures in the stability analyses, and sensitivity analyses have been performed to evaluate the potential effects of variations in these pressures on calculated factors of safety and estimated displacements. The same analytical approach will be used in the current evaluation. Representative leachate elevations and LFG pressures will be developed based on monitoring data and relevant field observations, and sensitivity analyses will be performed to evaluate conditions reflecting historically observed maximum leachate levels and LFG pressures, as appropriate. Stability analyses will be performed using the SLIDE2 software package, which includes the capability to explicitly incorporate gas pressures in the stability modeling. Accordingly, the methods used in the current analyses will be consistent with those applied in previous landfill stability evaluations and will address the potential influence of both leachate and LFG pressures on stability conditions.

5. *<u>Work Plan Components - Data Collection and Review</u>: The objective of the data collection task is stated to be review of site data collected since the last stability evaluations were completed in the fourth quarter of 2024. We recommend the Work Plan be revised to include discussion of site data collected prior to the stability evaluations completed in the fourth quarter of 2024, including site data used in landfill design and the approved closure plan or site closure documents, if available, as well as the adequacy of that site data.*

This information has been included by reference in all previous stability reports, and a comprehensive list of previous references is included at the end of this attachment. The adequacy of the data is addressed in the Revised Work Plan.

6. *<u>Work Plan Components - Data Collection and Review</u>: The first bullet in this section states that current (2025) and earlier site topography will be reviewed and incorporated in the site data used for slope stability evaluations. DTSC requires that any known or anticipated construction-related activities, including known or anticipated construction-related activities that alter site topography, are also considered and incorporated into a revised work plan.*

Any known or anticipated construction-related activities that alter site topography will be considered and incorporated as described in the Revised Work Plan.

7. *<u>Work Plan Components - Documentation and Recommendations:</u> The text states that if warranted, recommendations for additional investigations for the assessment of subsurface MSW properties, fluid levels, internal pressures, and/or short-term stabilization measures will be included in the global slope stability report. The additional investigations to assess MSW properties, fluid levels, and internal pressures are likely to take an extended period. DTSC recommends the currently available data is reviewed and validated to determine if it is adequate to complete the global slope stability evaluation. If the available data is determined to be inadequate and therefore additional investigations are warranted, CCL must commence planning and implementation of the additional investigations.*

This recommendation is acknowledged.

CALRECYCLE JANUARY 9, 2026 AND LEA MARCH 6, 2026 COMMENTS

General Comments

1. *The purpose of this global stability study is to provide a detailed stability analysis of the current SET Event and to identify potential issues should it continue to expand. Because CCL has elected not to construct any containment barrier(s) to prevent additional expansion of the SET Event and has placed critical environmental infrastructure (i.e., the temporary leachate storage and treatment system) at the toe*

of the slope in Canyon D, Cell 6, and Cell 8, the CCL shall locate the critical cross-section for each slope and determine if the slope will be stable based on both static and seismic forces.

The preliminary cross sections identified in the Work Plan address this comment. As described in the Revised Work Plan, additional cross sections will be considered and/or the existing cross sections may be relocated based on information developed during the data review portion of the analysis.

2. *Stability analyses shall be based on accepted engineering practice, information gathered from academic and/or industry publications, and realistic past case studies, such as the Countywide and Bridgeton Landfills, that account for actual field conditions.*

All previous analyses have addressed this comment. The analyses performed for this investigation will continue to consider all relevant information.

3. *The CCL is using a containment strategy (i.e., removing heat via typical gas extraction wells) that has not been effective at other SET Events. Current data from CCL demonstrate that the SET Event is expanding outside CCL's Data-Driven Reaction Boundary identified in September and December of 2025, and there is no barrier to contain it within the currently identified boundary. Once the entire facility is covered with a geomembrane, field observations of cracks and fissures indicative of slope instability will no longer be possible. As a result, CCL must use slope stability analyses to identify locations where, if specific slope instability metrics are observed, CCL could implement countermeasures, such as an earthen slope buttress or pressure relief system, to stabilize the waste mass so a slope failure similar to one that occurred on the western slope does not occur.*

The statements regarding the effectiveness of containment strategies, the potential expansion of the SET event, and the need for potential future countermeasures represent regulatory observations and operational considerations rather than elements of the analytical methodology. Because this work plan is intended to describe the technical approach, data sources, and analytical methods that will be used to evaluate slope stability, inclusion of these broader operational or policy considerations is outside the scope of the work plan. The results of the stability analyses will, however, provide information that can be used to evaluate and support potential mitigation measures should such actions be required.

General Comments

1. *Page 3. Include the Newport-Inglewood Fault in the analysis.*

The Newport-Inglewood fault was identified and considered in all previous GLA analyses (see the seismic hazard table included with this attachment). This fault is 49 km from the landfill and has a moment magnitude of 7.50. However, due to its distance from the site, the resultant site ground motions associated with an earthquake on this fault are small (the site PGA associated with the MCE is only 0.094g). Therefore, this fault is less critical than the closer faults. However, if CalRecycle and the LEA believe it necessary, displacements associated with rupture of the Newport-Inglewood fault can be performed.

2. *Page 4 – In-Place and Unaffected Municipal Solid Waste (MSW) Shear Strength: Include non-degraded MSW strength parameters[2] in the PLAN. Based on field case histories, this MSW shear strength does not use a cohesion value, which impacts stability at low vertical stresses.*

See the above response to DTSC comments regarding MSW shear strength and the text in the Revised Work Plan.

3. *Page 4 - Liner Shear Strength: Apply residual interface strength to all side slope bottom liner interfaces.*

See the above response to DTSC comments regarding residual shear strength and the text in the Revised Work Plan.

4. *Page 4 and 5 - Leachate and Landfill Gas Pressures: Replicate localized and transient features that are likely to cause slope instability during a SET Event, similar to what occurred in the western slope area. These localized, transient, and high liquid and gas pressures should be used, and, where data are unavailable, gas pressure should be determined using the ideal gas law and measured temperatures.*

Leachate and LFG pressures will be evaluated as described in the responses to the DTSC comments and in the Revised Work Plan. Use of the ideal gas law to estimate landfill gas pressure solely from measured temperature is of limited applicability because pressure is not a function of temperature alone. Application of the ideal gas law requires additional assumptions regarding gas volume and gas mass, both of which are expected to vary within the landfill due to gas generation, migration, extraction, changing waste void space, and liquid/vapor phase interactions. Accordingly, measured field pressures and site observations provide a more reliable basis for evaluating landfill gas pressures.

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[2] *Stark, T.D., N. Huvaj-Sarihan, and G. Li, "Shear Strength of Municipal Solid Waste for Stability Analyses," Environmental Geology J., Springer Pub., http://dx.doi.org/10.1007/s00254-008-1480-0, 57(8), 2009, 1911-1923.*

5. *Page 5 - Data Collection and Review: Include liquid and gas pressures as data sources. Use an inverse analysis of the west slope failures to estimate gas and liquid pressures to use on the east and south slopes.*

Liquid and LFG pressures will be based on site-specific data to the extent practicable. Implementation of an inverse (back-analysis) approach is not practical under the current conditions because the key inputs required for a meaningful back-calculation are not well defined. Inverse analyses typically rely on identification of a reasonably well-constrained failure surface and reasonably representative pore pressure conditions at the time of failure. In the areas of concern at the site, no clearly defined or continuous failure surface has been identified. In addition, available information indicates that leachate levels and LFG pressures are localized and transient, varying spatially and temporally within the waste mass. Under these conditions, it is not possible to uniquely define the geometry of a potential failure mechanism or the pore pressure distribution required to perform a reliable back-calculation. As a result, an inverse analysis would require numerous assumptions regarding failure surface geometry and localized pressure conditions, which could lead to non-unique or non-representative results. For this reason, forward stability analyses that evaluate a range of plausible pressure conditions and potential failure geometries provide a more technically defensible approach for assessing stability.

6. *Page 5 - Cross Sections, Material Properties, and Pressures: GLA must determine the critical cross-section for both the east and south sides of the landfill. While a general representational cross-section is valuable for comparison purposes, multiple cross-sections should be selected to identify the critical cross-section (i.e., the cross-section that yields the lowest factor of safety and highest seismically induced permanent deformation).*

This comment is incorporated in the Revised Work Plan.

7. *Page 6 - Documentation and Recommendations: GLA should provide a draft report and afterwards present their findings to the DTSC before finalizing the report so comments and changes can be incorporated.*

This comment is incorporated in the Revised Work Plan.

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Table 1
SUMMARY OF HOLOCENE- ACTIVE FAULTS WITHIN 50 KILOMETERS OF THE SITE
Chiquita Canyon Landfill
Castaic, California

FAULT	DISTANCE (km)	MAXIMUM OR CHARACTERISTIC MAGNITUDE (M_w)	EQUALLY WEIGHTED MEDIAN PEAK ACCELERATION (g)	MEDIAN PEAK GROUND ACCELERATION (g)			
				1	2	3	4
Holser	1.8	6.80	0.60	0.630	0.437	0.697	0.626
Santa Susana	8.2	6.90	0.51	0.485	0.443	0.600	0.502
Northridge	7.8	6.90	0.42	0.457	0.399	0.395	0.415
San Gabriel	6.4	7.30	0.37	0.369	0.335	0.391	0.365
Oak Ridge (Connected)	7.8	7.40	0.36	0.355	0.305	0.365	0.405
Oak Ridge (Onshore)	7.8	7.20	0.35	0.346	0.290	0.383	0.380
San Cayetano	10	7.20	0.28	0.275	0.245	0.299	0.309
Simi-Santa Rosa	14	6.90	0.24	0.254	0.231	0.241	0.228
Garlock	49	7.72	0.19	0.216	0.188	0.175	0.184
Southern San Andreas	32	8.20	0.19	0.207	0.184	0.165	0.191
Sierra Madre (Connected)	21	7.30	0.18	0.191	0.159	0.171	0.194
Santa Ynez (Connected)	28	7.40	0.15	0.148	0.147	0.142	0.144
Sierra Madre (San Fernando)	21	6.70	0.13	0.141	0.124	0.143	0.128
Santa Ynez (East)	28	7.20	0.13	0.133	0.137	0.133	0.128
Santa Monica	36	7.40	0.12	0.123	0.115	0.178	0.135
Verdugo	28	6.90	0.11	0.114	0.106	0.117	0.112
Anacapa-Dune	36	7.20	0.11	0.115	0.102	0.104	0.118
Sierra Madre	37	7.20	0.10	0.103	0.095	0.099	0.106
Newport-Inglewood	49	7.50	0.09	0.095	0.090	0.087	0.088
Pitas Point	46	7.30	0.09	0.095	0.082	0.084	0.096
Malibu Creek	42	7.00	0.08	0.080	0.085	0.046	0.073
Ventura-Pitas Point	42	7.00	0.07	0.077	0.069	0.075	0.074
Puente Hills	50	7.00	0.07	0.075	0.066	0.072	0.074
Pleitas	51	7.10	0.07	0.070	0.069	0.071	0.073
Hollywood	42	6.70	0.07	0.065	0.073	0.075	0.058
Mission Ridge-Arroyo Parida-Santa Ana	47	6.90	0.07	0.067	0.066	0.069	0.065
Elysian Park	48	6.70	0.06	0.066	0.057	0.065	0.058

NOTES:

1. Fault distances and MCE magnitudes based on USGS 2008 Seismic Hazard Mapping Program (Field et al., 2008; Petersen et al., 2008). The maximum (or characteristic) magnitude along a fault is estimated by using the mapped surface geology and recorded earthquake location and depth distributions to obtain fault length or area. Using the fault dimensions and, in some cases, estimates of where earthquake ruptures may initiate and terminate (segmentation models), the maximum or characteristic magnitudes are calculated from relationships that are dependent on fault length or area (Ellsworth, 2003).
2. Where applicable, near source directivity average factor calculated using the Abrahamson (2000)-Somerville (1997) method.
3. Attenuation relationships :

1. Norman A. Abrahamson, Walter J. Silva, and Ronnie Kamai, Summary of the ASK14 Ground Motion Relation for Active Crustal Regions, Earthquake Spectra, Volume 30, No. 3, pages 1025-1055, August 2014.
2. David M. Boore, Jonathan P. Stewart, Emel Seyhan, and Gail M. Atkinson, NGA-West2 Equations for Predicting PGA, PGV, and 5% Damped PSA for Shallow Crustal Earthquakes, Earthquake Spectra, Volume 30, No. 3, pages 1057-1085, August 2014; © 2014.
3. Kenneth W. Campbell and Yousef Bozorgnia, NGA-West2 Ground Motion Model for the Average Horizontal Components of PGA, PGV, and 5% Damped Linear Acceleration Response Spectra, Earthquake Spectra, Volume 30, No. 3, pages 1087-1115, August 2014.
4. Brian S.-J. Chiou and Robert R. Youngs, Update of the Chiou and Youngs NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra, Earthquake Spectra, Volume 30, No. 3, pages 1117-1153, August 2014.

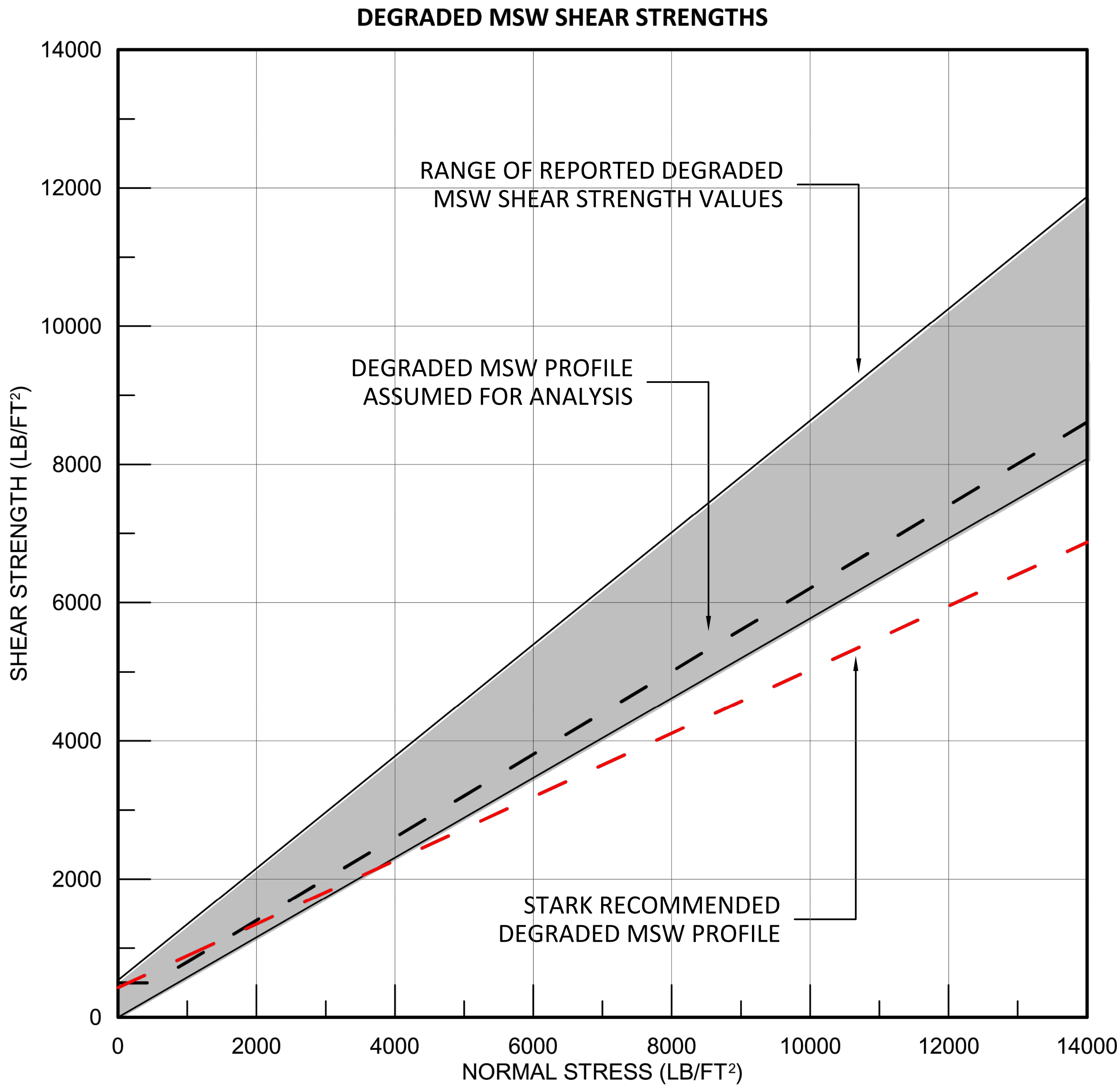

FIGURE 4

REPRESENTATIVE DEGRADED MSW STRENGTH

UPDATED STABILITY EVALUATION
CHIQUITA CANYON LANDFILL
LOS ANGELES COUNTY, CA

Geo-Logic ASSOCIATES

DRAWN BY: RM	DATE: SEPTEMBER 2024	JOB NO. RM22.1077