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Reference: 017190

December 1, 2017

Trinidad Civic Club
Memorial Lighthouse Preservation Committee
P.O. Box 295
Trinidad, CA 95570

Subject: Project Description to Support an Emergency Coastal Development Permit Application for Relocation of the Trinidad Memorial Lighthouse-Revision 1

To the Committee:

Introduction

The purpose of this document is to provide the necessary information to support an emergency Coastal Development Permit application for the proposed relocation of the Trinidad Memorial Lighthouse (TML), located in Trinidad, California. The TML was built at the site in 1949, and is owned and managed by the Trinidad Civic Club, a non-profit organization that serves as caretakers of the site, the TML, and adjacent historical and memorial features. As previously described and discussed at a series of City Council and Civic Club meetings, the TML is threatened by an encroaching landslide that has reached the edge of the foundation slab. The lighthouse is vulnerable in its current location, and continued landslide movement has the potential to undermine the structure, possibly in the short term (during the coming rainy season). It is the intent of the Civic Club to temporarily relocate the TML farther east on the site to increase the setback from the landslide. This relocation will occur under an "Emergency Coastal Development Permit"; this report is intended to provide the necessary supporting information to allow review by the pertinent regulatory/permitting agencies and stakeholders.

The information in this report is supported by previous geologic investigations at the site and in the vicinity. Previous geologic reporting relative to the City of Trinidad's stormwater infiltration system provided useful background data relative to regional geology (GHD, 2013). Once landsliding became a significant hazard (to the TML and to Edwards Street), SHN was engaged by the City of Trinidad to provide site specific geologic investigation. That investigation included advancement of four subsurface geotechnical borings and installation of three slope inclinometers and a piezometer. That work has been presented in a landslide mitigation assessment report to the City (SHN, 2017a) and in several meetings over the past several months. SHN was subsequently retained by the Civic Club to evaluate mitigation options and to develop the project described herein. These efforts were presented in reports focused on identification of mitigation strategies (SHN, 2017b) and geotechnical considerations of mitigation options (SHN, 2017c).

Site Conditions

The TML is located on a small topographic bench recessed into the coastal bluff directly south of the intersection of Trinity Street and Edwards Street in downtown Trinidad (Figure 1). The coastal bluff throughout the region is a dynamic geologic feature that is subject to frequent landsliding. Geology at the site is described more fully in SHN's geotechnical report (2017c), but generally consists of about 45 feet of granular marine terrace sediments overlying the regional bedrock unit, *mélange* of the Franciscan Complex. Mass wasting processes along the bluff are driven by the relatively slow "flow" of the low strength *mélange* at the toe of the bluff as material is removed by the ocean. This flow propagates uphill over time as the bluff is reshaped, eventually removing the support from, and destabilizing, the overlying semi-consolidated terrace sediments. Once over-steepened, the granular terrace sediments tend to fail relatively rapidly during an episodic "pulse" when the bluff edge retreats and a new, "stable" bluff geometry develops. Review of historical aerial photography indicates the appearance of a "bulge" of material at the toe of the bluff below the TML in the mid-1960s; it appears that the effects of this bulge have propagated up the slope in the intervening decades and have now resulted in the episode of retreat at the upper bluff edge that is threatening the TML.

Landsliding along the edge of Edwards Street and adjacent to the TML became apparent over the past few winters, although it was not until the most recent (2016/2017) rainy season that significant movement occurred. Through last winter, it became apparent that the head of the subject landslide was encroaching into the shoulder of Edwards Street directly west of the TML (Figure 1). A series of scarps and open fissures developed along the head of the slide that damaged concrete walkways and other hardscape on the TML site (which required emergency remediation). The head scarp has advanced to the edge of the concrete walkway surrounding the TML, such that additional lateral expansion of the slide would directly undermine the base of the TML.

A similar landslide is apparent directly adjacent to the east side of the Civic Club parcel, as well, indicating that the site has active landslides in close proximity on both sides (Figure 1). The slide to the east has displaced a previous survey monument placed at the southeast corner of the Civic Club parcel, indicating that this slide is encroaching on the site as well. These closely spaced landslides appear to be separated by a narrow, apparently bedrock-controlled ridge. Due to the extreme heterogeneity of the underlying Franciscan *mélange* (bedrock blocks of varying sizes entrained within a sheared, plastic matrix), mass wasting is often strongly influenced by the presence or absence of buried rock blocks. Where buried rock blocks are present, resistant areas on the bluff develop, with landslides often forming ("flowing") around these features. Geophysical data (GHD, 2012) suggests that a buried bedrock block is present beneath Edwards Street, just southeast of the TML. Geomorphic evidence suggests that a second rock block, or continuation of the same rock block, occurs in the mid-bluff area beneath a flat segment of the Axel Lindgren Memorial Trail, directly south from the TML parcel.

Evaluation of the TML indicates it is a concrete structure with modest reinforcement. Cores were cut from the walls and floor, and tested for compressive strength. A magnetic rebar locator was used to identify the distribution of steel reinforcement in the lighthouse, indicating a thin gauge metal mesh was used as the sole reinforcement in the structure.

Conclusion

Based on the existing geologic condition at the site and the likelihood of continued mass wasting over the coming rainy season, we have concluded that the TML is vulnerable in its current location and should be reinforced or relocated. If some form of emergency mitigation is not enacted in the near future (before substantial rainfall), the TML may be undermined such that it would be structurally damaged or, ultimately, topple onto the landslide.

Analysis of Mitigation Options

A variety of mitigation options have been considered for the TML. All assume that the desired outcome of the project is for some version of the TML to remain at the site, even if only as a temporary solution. Removal of the TML from the site is not considered a viable option, as it is not consistent with the interests of the applicants (the Civic Club). The mitigation options generally fit into four categories:

1. Slope reinforcement
2. Underpinning the lighthouse in its current location
3. Re-building a new lighthouse structure (to hold the existing lens and cupola) farther east on the current pad
4. Re-locating the existing lighthouse structure farther east on the current pad

Analysis of mitigation options must consider the site location within the Coastal Zone and in an area surrounded by culturally sensitive lands (Tsurai Study Area). Relative to location within the Coastal Zone, it is apparent that re-occupation of the existing site in any way can only be a temporary solution. The site is not a "stable" geologic venue per California Coastal Commission standards (viable for at least 75 years), and it will presumably not be possible to attain a long-term Coastal Development Permit to maintain the TML at the site in perpetuity. Relative to the culturally sensitive nature of the site, it is apparent that any soil disturbance will be viewed as a significant impact that will ultimately lead to an appeal of the Coastal Development Permit application.

Slope Reinforcement. Various methods were evaluated to reinforce and stabilize the slope directly adjacent to the TML. Driven spiral soil nails, drilled and grouted soil nails, and a soldier pile and tie-back retaining wall were all considered, but ultimately rejected due to the extreme level of disturbance that would be required. Each of these methods would be highly intrusive, and most would require removal of vegetation over a large part of the slope. Due to the cultural sensitivity of the surrounding lands, this approach was quickly determined to be infeasible.

Underpinning the Lighthouse. This mitigation option would be intended to stabilize the TML in its current location by constructing deep piles to develop a subsurface barrier to the advancing slide plane. This would be a temporary solution, due to the proximity adjacent to the active slide. Heavy equipment access would be required to achieve this mitigation. This approach was deemed infeasible due to the high level of ground disturbance associated with the method, and the uncertainty about the longevity that could be achieved.

Re-building the Lighthouse. This mitigation option entails construction of a new lighthouse “base” structure to house the existing cupola and lens, farther east on the existing site. A new base could be constructed out of lighter, stronger materials, made as a replica of the TML, so that if the TML needs to be re-located again in the future, it would be relatively easy to do so. The “re-build” approach is generally equivalent to the “re-location” option outlined below in terms of impacts, assuming a low impact foundation can be developed. This is a less desirable solution than re-location of the existing lighthouse to the Civic Club, however, due to the historical significance of the structure. This option is currently being considered as a secondary alternative should the desired option, re-location, not be feasible or if the lighthouse structure does not survive re-location.

Re-location of the Existing Lighthouse. This option was initially considered infeasible due to the logistics of the effort, but consultation with additional contractors has resulted in a determination that it is likely to be possible to re-locate the existing structure with minimal impacts. Specifically, initial opinions were that the structure was too heavy to lift with a crane positioned on Edwards Street; however, subsequent contractor opinions have concluded that the structure can be moved by crane (assuming it is strong enough to survive the lifting). The TML would be cut from its existing base, lifted with a crane, and set upon a newly built foundation pad farther east on the Civic Club property. No heavy equipment access to the site would be required. A key design element of this approach is the intent to construct a foundation pad above-grade, which would not require soil disturbance. Re-location is the preferred option to the Civic Club; below we present a detailed discussion of the “re-location” option. As described above, this is a temporary solution only, as the site will not satisfy the California Coastal Commission’s criteria for a “stable” geologic site. Therefore, part of this approach will be a written agreement with the appropriate agency and the agreement will include a provision that, if threatened in the future, the TML will be removed from the site altogether and relocated to a new venue.

Below, we provide a detailed description of the proposed approach to re-location of the existing TML structure.

Project Description for Re-location of the TML

Re-location of the TML will consist of the following steps. As shown on Figure 2, the new (temporary) location for the lighthouse is essentially in line with the descending steps along the adjacent Axel Lindgren Memorial Trail. The approach has been developed specifically to avoid disturbance to site soils due to cultural sensitivity. To that end, no heavy equipment access will be required and the foundation will be developed entirely above grade to avoid excavation. The project described herein will require temporary

closure of the area to the public, including the parking area along Edwards Street, which will be used as the contractor staging area. Temporary closure of Edwards Street east of the intersection with Trinity Street will be necessary during portions of the proposed work when the crane is in use.

Construct a New Reinforced Concrete Foundation. A new reinforced foundation will be constructed to support the relocated lighthouse. The location of the new foundation will require the removal of the existing historic bell prior to the development of the new foundation. The foundation will be poured entirely above grade to avoid the need to excavate soil, as is typical in foundation construction (they are usually embedded to provide lateral resistance to sliding). The proposed foundation will be 14 feet x 14 feet x 8 inches. Concrete will be pumped from a concrete mixer truck positioned on Edwards Street, so no equipment access to the site will be required. A concrete washout pool will be onsite to contain pump and concrete truck washout. The above-grade foundation will need to be anchored to resist wind and earthquake forces. We intend to utilize commercially available displacement nails or anchors, as these are typically driven into the soil and do not generate cuttings (again, this method was selected to reduce soil disturbance).

Remove Existing Structure from its Current Base. The existing lighthouse will be cut from its existing foundation. This will entail saw-cutting the perimeter of the structure 1 inch above the existing slab. Excess cuttings and water mixture from the saw cutting will be vacuumed and removed from the site. The existing slab will be left in place for the foreseeable future; it will eventually be broken up and removed from the site.

Lift the Lighthouse With a Crane onto the New Foundation. A crane company will be subcontracted to develop an I-beam framing system with interior and exterior supports, and to lift the lighthouse from the existing foundation to the new foundation farther to the east. The crane will be positioned on Edwards Street; heavy equipment access to the site will not be required. The lighthouse will then be anchored to the new foundation via a bracket system to be developed by the contractor.

Additional cosmetic repairs to the exterior of the lighthouse will be completed to mask the cut line.

If the lighthouse does not survive the lift, it will be removed from the site and the "re-build" option will be pursued. That is, a new base would be constructed on the new foundation to house the existing lens and cupola.

Temporary Status of the Re-location

As the site is not considered geologically "stable" for long-term occupancy per the criteria of the California Coastal Commission, the re-location of the TML to another part of the site must be temporary in nature. As such, the Civic Club is willing to enter into a formal agreement (presumably with the City of Trinidad) such that the TML will be moved off the site entirely when or if it becomes threatened by future landsliding. Once the TML has been successfully re-located, it will have been demonstrated that the structure can be moved. A monitoring program will be established such that a clearly defined "threshold" will be

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determined; if this threshold is reached, the TML will be removed from the site. This threshold may be a specific spatial reference (landsliding passes a certain point on the ground) or a response in one of the on-site inclinometers.

There may be long-term options for re-location of the TML, but as no viable alternative currently exists, the Civic Club desires to keep the TML at the current site for the time being.

We hope that this report provides the information necessary to conduct the necessary project review for issuance of the Emergency Coastal Development Permit. If you need any additional information, or clarification of the information presented herein, please do not hesitate to contact our office.

Respectfully submitted,

SHN Engineers & Geologists


Gary D. Simpson, CEG
Geosciences Director



GDS:dla

Appendix: 1. Figures 1 and 2

References

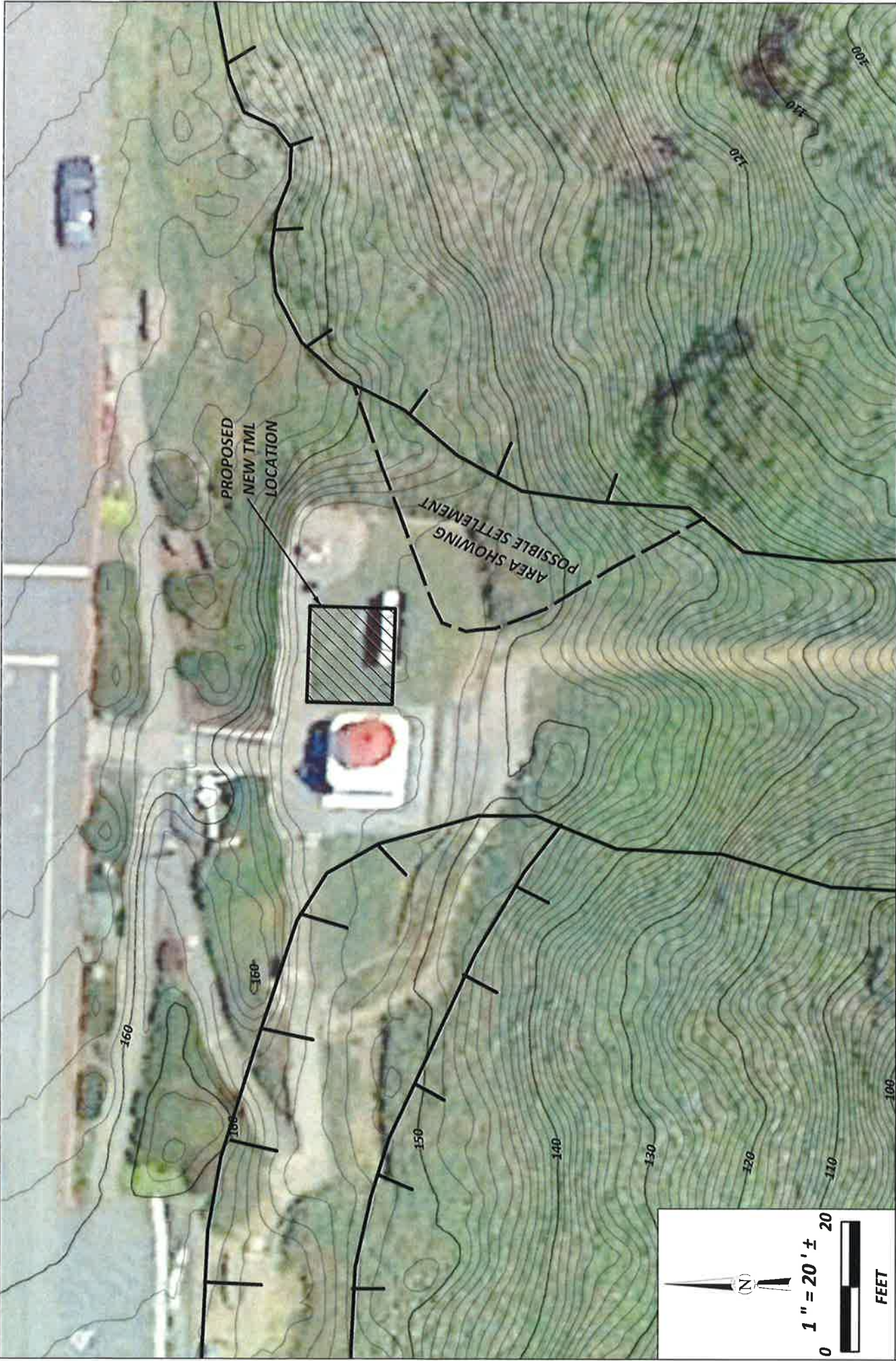
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Figures 1 and 2 **1**



	Trinidad Civic Club Trinidad Memorial Lighthouse Trinidad, California	November 2017
TML Landslide Map SHN 017190		Figure 1

AIR PHOTO: GOOGLE EARTH, DATED 5/26/2016;
CONTOUR INTERVAL=1 FOOT (CALIFORNIA COASTAL
CONSERVANCY, 2009-2011)



 <p>Consulting Engineers & Geologists, Inc.</p>	<p>Trinidad Civic Club Trinidad Memorial Lighthouse Trinidad, California</p>	<p>AIR PHOTO: GOOGLE EARTH, DATED 5/26/2016; CONTOUR INTERVAL=1 FOOT (CALIFORNIA COASTAL CONSERVANCY, 2009-2011)</p>
November 2017	Figure2_TMLRelocationMap	TML Relocation Map SHN 017190 Figure 2



Reference: 017190

December 5, 2017

Trinidad Civic Club
Memorial Lighthouse Preservation Committee
P.O. Box 295
Trinidad, CA 95570

Subject: Response to Questions from the California Coastal Commission Regarding the Emergency Coastal Development Permit for Relocation of the Trinidad Memorial Lighthouse

To the Committee:

This letter provides additional information regarding the recently submitted project description for an Emergency Coastal Development Permit for relocation of the Trinidad Memorial Lighthouse (TML). The additional information is intended as the response to questions from the California Coastal Commission. We understand the questions were provided to Trever Parker, Trinidad City Planner during a conference call regarding the proposed lighthouse relocation.

The questions from the Coastal Commission are as follows:

- Why does the proposed new foundation need to be reinforced?
- Why can't the TML just be relocated off site?
- Why can't the TML be moved to the southeast corner of the site, as far away as possible from the landslide encroaching from the west?

Foundation Reinforcement

Despite the fact that the proposed relocation of the TML is a temporary solution (it will be moved again if threatened in the future), a reinforced foundation is required to support the 25 ton structure, even in the short term. Dynamic loading during earthquakes is the primary concern that requires the additional reinforcement. Without the reinforcement, the foundation may not support the structure during earthquake shaking. In order to provide adequate public safety, the reinforcement is required such that there is sufficient stability and durability in the event of a large earthquake.

Relocation Off Site

As of this time, the Civic Club has no viable alternative for relocating the structure off site. In the absence of a viable alternative, their intent is to use the existing site for as long as feasible. There is also concern about the structural integrity of the lighthouse, if an off-site move is attempted. The moving contractors we have spoken with have expressed concerns about even the short move across the site; they have cautioned against attempting a more substantial crane lift all the way to Edwards Street, because they infer there is a high potential for structural collapse.

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Relocation to the Southeast Corner of the Site

As described in the project description, the Civic Club site is bordered on both the west and east sides by active landslides. The landslide west of the site is the one currently encroaching on the TML, but it is apparent that the slide to the east is also a relevant geologic feature that should be avoided. That is, it is possible to go too far to the east on the site, such that a new geologic hazard is created. Our intent is to use the presence of apparent buried rock blocks in the underlying Franciscan Complex, which appear as resistant features in the landscape, to locate the TML in the most favorable location the site has to offer. One of these rock blocks was identified beneath Edwards Street in the geophysical survey completed prior to establishment of the City's stormwater infiltration system. Another block (or an extension of the same block) is present beneath the Axel Lindgren trail just south of the site. The proposed relocation point is in the middle of the site, along the alignment of the steps that comprise the Axel Lindgren trail.

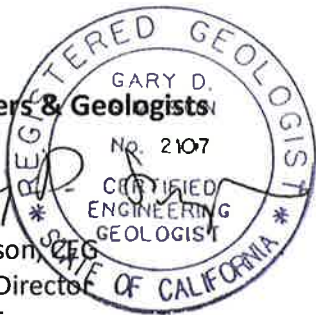
We hope that this letter provides the information that you need at this time. If you have any comments or concerns, please contact me directly.

Respectfully,

SHN Engineers & Geologists



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