REVELL COASTAL
Surf. Sand. Sustainability.

568 Bethany Curve
Santa Cruz, CA 95060
Phone: 831-854-7873
Email: revellcoastal@gmail.com
Website: *www.revellcoastal.com*

MEMORANDUM

Date: September 24, 2018

To: Bret McNulty, City of Goleta Planning Department

From: David Revell, PhD

Subject: Review of Coastal Hazards Analysis for Bacara Resort and Spa

---

Summary of Key Findings

In general, the new proposed location is in a much better location and elevation to minimize exposure to future coastal hazards for the 50year life of the project. However, the proposed relocation site may still be exposed to coastal erosion during the life of the project.

The Coastal Hazards Analysis for the Bacara Resort and Spa contains the following shortcomings:

1. Coastal Hazard Analysis does not appropriately include potential coastal erosion caused by an acceleration of historic erosion rates from sea level rise or storm induced erosion associated with a 100 year wave event.
2. Only uses a 2% annual chance storm (~50 year wave event) as opposed to the regulatory 1% annual chance storm (~100 year event).
3. Coastal Hazard Analysis does not include latest scientific information on sea level rise
4. Coastal Hazard Analysis does not consider the City of Goleta Vulnerability and Fiscal Impact Report.
5. Extreme wave analysis in Table 2 is flawed for many of the directions. It is not possible to generate some of the wave heights from certain directions given the presence of the Channel Islands to the South and East.

Project Description

The proposed site is located in Goleta, California, approximately 11 miles west of Santa Barbara, on the Santa Barbara Channel. The proposed Beach House location is to the east of the Tecolote Canyon Creek under a Monterey Shale formation bluff along an existing access road. The proposed site is setback approximately 100 feet from the back of the beach and foundation elevations for the two proposed buildings are +23.3 feet North American Vertical Datum of 1988 (NAVD88) and +25.5 feet NAVD88. The analysis used the lower elevation of 23.3 NAVD for analysis of potential impacts.

For the analysis a project design life of 50 years was assumed which is reasonable for this size project.

Identified Issues

Consideration of FEMA

While the Anchor QEA report mentions the new production FEMA FIRM maps, it is important to note that FEMA does not consider sea level rise in the Flood Insurance Rate Maps (FIRMs) mapping nor do they include coastal storm erosion in the mapping of the new high velocity (VE) zones (FEMA 2005).

REVELL COASTAL
Surf. Sand. Sustainability.

568 Bethany Curve
Santa Cruz, CA 95060
Phone: 831-854-7873
Email: revellcoastal@gmail.com
Website: *www.revellcoastal.com*

Lack of Coastal Erosion Analysis

The Anchor study only provides estimates of long term coastal erosion based on extrapolation of historic erosion from a limited statewide study by USGS (Hapke et al 2006 referenced in the Anchor QEA report as CNRA 2017 - link in references is broken). The published USGS shoreline change rates referenced calculated a long term erosion trend between 1852 and 1998. This study does not include any acceleration of erosion from sea level rise or potential storm induced erosion. More recent studies of coastal erosion and beach change (Revell 2007, Revell et al 2011, Barnard et al 2009, ESA 2015, and City of Goleta 2015), show that this stretch of coast has experienced higher longer term erosion than those presented in the Anchor analysis. The most recent study updated the USGS study to 2009 and calculated long term erosion rates of 0.65 feet/year at the site (ESA 2015) which do not include acceleration for sea level rise.

The Anchor analysis states that the 100 year storm is beyond the structure's lifespan, however a 100 year storm has a 1% chance of occuring in any given year and the occurrence of such a storm in one year does not mean that a similar storm could not occur in any other year. FEMA maps the wave run up elevation associated with the 1% annual chance storm event, but not the erosion. The existing study also does not provide any actual calculation of storm induced coastal erosion from a FEMA 1% annual chance storm event (16 ft NAVD total water level identified to reach an elevation in 2069 of 18.4 feet in Table 6). Wave run up causes coastal erosion, but the two are separate processes. Wave run up causes temporary flooding and can be cleaned up, while erosion usually results in the permanent loss of land. The Anchor analysis references COSMOS 1.0[1] potential erosion distance of 87.9' to 100.1 feet. As the COSMOS model does not explicitly map coastal erosion, it is unclear how this number was arrived upon.

Coastal erosion hazard modeling conducted as part of the County of Santa Barbara Coastal Resiliency project projected accelerated historic erosion caused by 27.2 inches of sea level rise and the potential extent of storm erosion caused by a wave run up associated with a 100 year wave event[2]. This model was used in both the Santa Barbara County Vulnerability Assessment and the City of Goleta Vulnerability Assessment and Fiscal Impact report. The results are shown for 27.2 inches of sea level rise in Figure 1 for this site. These recent models show that the Project may be subject to additional long term and storm induced coastal erosion within the project life expectancy.

Latest State guidance on sea level rise

The Anchor QEA report does not include discussion of much of the more recent literature on sea level rise, including the 2018 State guidance on Sea Level Rise (OPC 2018). The modeling of coastal hazards for Santa Barbara County (Revell Coastal and ESA 2016) as used in the City of Goleta Sea Level Rise Vulnerability and Fiscal Impact Report (City of Goleta 2015). This results in an underestimation of the potential level of sea level rise by 2070.

Extreme Wave Height Analysis

Results from the extreme wave height analysis found in Table 2 of the Anchor QEA report is misleading. While details of the extreme value analysis methodology are lacking, the results shown in Table 2 are not possible for 4 of the 6 wave wave directions reported in the table. The possibility of waves from the east or south of the reported magnitude are not possible given the presence of the Channel Islands to the south, sheltering most of these directions. The most easterly direction is also highly unlikely given the limited fetch distance between the Ventura County Coast and the study site. While these directions are not particularly relevant to the proposed study site, the discrepancy is noted here.

[2] http://longrange.sbcountyplanning.org/programs/coastalresiliencyproject/documents/FinalVulnAssessmentTechnicalReport.pdf

REVELL COASTAL
Surf. Sand. Sustainability.

568 Bethany Curve
Santa Cruz, CA 95060
Phone: 831-854-7873
Email: revellcoastal@gmail.com
Website: *www.revellcoastal.com*

Figure 1. Projected long term and storm induced coastal erosion with 27.2 inches of sea level rise http://maps.coastalresilience.org/california)

Project Considerations

1. Additional setback of at least 30 feet to avoid future coastal erosion impacts is recommended.
2. Retaining wall for the eastern bluff slope should be carefully engineered not to contribute to landsliding on the adjacent slope.
3. Any excavated sediments from construction should be tested for contamination and sediment grain size compatibility with the beach. Suitable clean sediments should be allowed to be placed on the beach in front of the development. Contaminated sediments should be off hauled to an appropriate offsite disposal site.
4. Complete removal of the existing emergency revetment should be required.

REVELL COASTAL
Surf. Sand. Sustainability.

568 Bethany Curve
Santa Cruz, CA 95060
Phone: 831-854-7873
Email: revellcoastal@gmail.com
Website: *www.revellcoastal.com*

References Reviewed

Barnard, P.L., Revell, D.L., Hoover, D., Warrick, J., Brocatus, J., Draut, A.E., Dartnell, P., Elias, E., Mustain, N., Hart, P.E. and Ryan, H.F., 2009. Coastal processes study of Santa Barbara and Ventura County, California: U.S. Geological Survey Open-File Report 2009-1029, 926 pp., http://pubs.usgs.gov/of/2009/1029/

City of Goleta 2015. 2015 City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report. Adopted by City Council, December 2015.

FEMA, 2005. "Final Draft Guidelines: Coastal Flood Hazard Analysis and Mapping for the Pacific Coast of the United States." Prepared for the U.S. Department of Homeland Security.

FEMA, 2016. Preliminary Flood Insurance Rate Map Panel 1341 of 1835. Map Number 06083C1341H. December 15, 2016.

Hapke, C., D. Reid, D. Richmond, P. Ruggiero, and J. List. 2006. National Assessment of Shoreline Change, Part 3: Historical Shoreline Change and Associated Land Loss Along Sandy Shorelines of the California Coast. Santa Cruz, California: U.S. Geological Survey Open-file Report 2006-1219, 79p.

Ocean Protection Council 2018. State of California Sea Level Rise Guidance, 2018 Update

Revell, D.L. 2007. Long Term and Storm Event Changes in the Santa Barbara Sandshed. PhD Dissertation. Earth Science Department, University of California, Santa Cruz. March. 148 pp.

Revell, D.L., R.Battalio, B. Spear, P. Ruggiero, and J. Vandever, (2011). A Methodology for Predicting Future Coastal Hazards due to Sea-Level Rise on the California Coast. Climatic Change 109:S251-S276. DOI 10.1007/s10584-011-0315-2.

Revell Coastal and ESA. 2016. Santa Barbara County Coastal Hazard Modeling and Vulnerability Assessment: Technical Report for Coastal Hazards Mapping. Prepared for Revell Coastal and Santa Barbara County. http://longrange.sbcountyplanning.org/programs/coastalresiliencyproject/documents/FinalVulnAssessmentTechnicalReport.pdf

NRC (National Research Council), 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington, Past, Present, and Future.