

# **Appendix F**

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## **Sea Level Rise Hazard Report**



Geotechnical • Geologic • Coastal • Environmental

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WO S7649

Thomas Safran & Associates  
11812 San Vicente Blvd, Suite 600  
Los Angeles, CA 90049

ATTENTION: Mr. Blake Coddington

SUBJECT: Sea Level Rise Hazard Discussion for 3221 -3233 Thatcher Avenue, Venice,  
Los Angeles, California.

Dear Mr. Coddington:

In accordance with your request and authorization, GeoSoils, Inc. (GSI) is pleased to provide this discussion regarding the potential coastal hazards, for the proposed residential project, Thatcher Yard, Venice. The purpose of this report is to provide the hazard information typically requested by the California Coastal Commission (CCC). Our scope of work includes a review of the State of California Sea-Level Rise (SLR) Policy Guidance document (March 2018), CCC SLR Guidance Update (November 2018), a discussion of the proposed development plans, a site inspection, and preparation of this letter report.

## INTRODUCTION

The proposed project is a multi-family residential project including below grade parking. Figure 1, downloaded from Google Maps (Bird's Eye View), shows the site in relation to the adjacent properties. The proposed finished first floor (FF) elevations of various residential buildings vary based upon the adjacent grades (sidewalks and driveway). The lowest the FF at elevation ~+12.0 feet North American Vertical Datum (NAVD88) will be along Princeton Drive and Oxford Avenue, to the north and west portions of the site. The highest FF at elevation ~+17 feet NAVD88 will be along the eastern portion of the site on Thatcher Avenue. The site is located 1.25 miles from the Pacific Ocean to the west, and about 500 feet to Marina del Rey to the south.

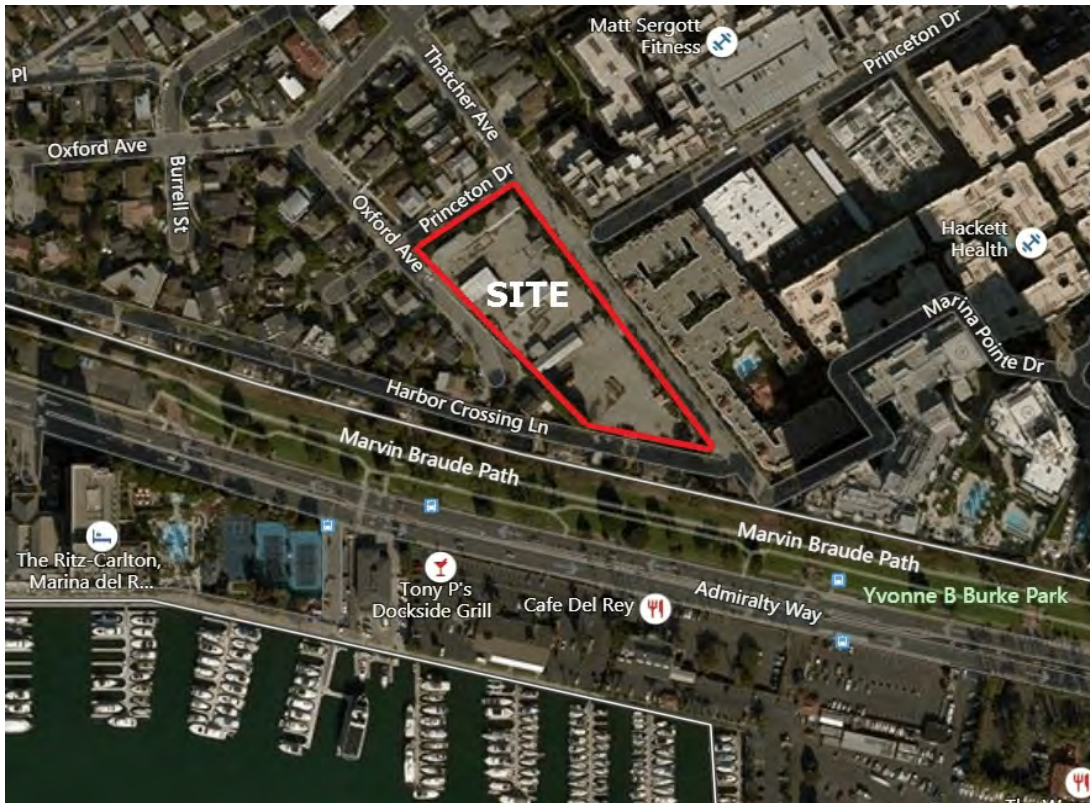


Figure 1. Subject site, adjacent properties, and Marina del Rey to the south.

### DATUM & INFORMATION

The datum used in this report is NAVD88, which is about -2.59 feet Mean Sea Level (MSL), and is +0.18 feet Mean Lower Low Water (MLLW). The units of measurement in this report are feet (ft), pounds force (lbs), and seconds (sec). Site elevations, relative to NAVD88, were taken from the site topographic map prepared by Fine Line Systems, dated April 2017. Proposed development plans were provided by Thomas Safran & Associates, the project developer. The existing site and development is in the FEMA X zone with no base flood elevation (BFE). The preliminary FIRM (not effective at this date) has the site mapped in the FEMA X Zone with no BFE. The National Oceanographic and Atmospheric Administration (NOAA) National Ocean Survey tidal data station closest to the site is the Santa Monica station (NOAA, 2013).

The approximate elevations are as follows:

Highest Water November 30, 1982	8.3 feet
Mean Higher High Water	5.23 feet
Mean High Water	4.48 feet
Mean Sea Level (MSL)	2.59 feet
Mean Low Water	0.74 feet
NAVD88	0.0
Mean Lower Low Water	-0.18 feet

## HAZARD ANALYSIS

There are typically three different potential coastal hazards for coastal development: shoreline movement/erosion, waves and wave runup, and flooding. Because the site is over 1.25 miles from the ocean, the hazards of shoreline erosion and wave runup flooding are not possible. The site is too far away for shoreline erosion and wave runup to impact the site.

### Current Flooding Hazard

Some areas of Venice and Marina del Rey are relatively low lying and currently prone to flooding. The United States Geological Survey (USGS) has also developed a model called the Coastal Storm Modeling System (CoSMoS) for assessment of the vulnerability of coastal areas to SLR and the 100-year storm, [http://walrus.wr.usgs.gov/coastal\\_processes/cosmos/](http://walrus.wr.usgs.gov/coastal_processes/cosmos/). The modeling can be used to assess the flooding vulnerability of the site to different SLR scenarios. Figure 2 provides the CoSMoS output for the current (no SLR) vulnerability of the site and area to flooding. Figure 2 shows that the subject site is well away from the shoreline, and not impacted by the marina, and the low lying areas of Venice. Green areas denote flood prone areas with no estimated flood depth. This is consistent with the current FEMA pending preliminary FEMA flood insurance rate map designation as an area of low flood risk.



Figure 2. CoSMoS output for the site and general area with no SLR.

## Future Flooding Levels Due to Sea Level Rise

### SEA LEVEL RISE

There has recently been new information with regards to the estimates and probability of sea level rise (SLR). The California Coastal Commission (CCC) had initially adopted the National Research Council (NRC) 2012 SLR estimates of 16.56 inches to 65.76 inches over the time period from 2000 to 2100. The NRC is no longer considered the best available science for assessing the magnitude of SLR in the marine science communities. The California Ocean Protection Council (OPC) adopted an update to the State's Sea-Level Rise Guidance in March 2018. This is the SLR data used in the CCC November 2018 SLR Policy Guidance update. These new estimates are based upon a 2014 report entitled "Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites" (Kopp et al., 2014). This update included SLR estimates and probabilities for Santa Monica, the closest SLR estimates to Venice. The report provides Santa Monica SLR estimates based upon various carbon emission scenarios known as a "representative concentration pathway" or RCP. Figure 3 provides the March 2018 OPC data (from the Kopp et al., 2014 report) with the latest SLR adopted estimates (in feet) and the probabilities of those estimate to meet or exceed the 1991-2009 mean, based upon the best available science.

		Probabilistic Projections (In feet) (based on Kopp et al. 2014)				H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE	1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...	5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...	
			Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.4	0.3 - 0.5	0.6	0.8	1
	2040	0.6	0.4 - 0.8	0.9	1.2	1.7
	2050	0.8	0.6 - 1.1	1.3	1.9	2.6
Low emissions	2060	0.9	0.6 - 1.2	1.5	2.3	
High emissions	2060	1.1	0.8 - 1.4	1.8	2.6	3.8
Low emissions	2070	1.0	0.7 - 1.4	1.9	3.0	
High emissions	2070	1.3	1.0 - 1.8	2.3	3.4	5.1
Low emissions	2080	1.2	0.8 - 1.7	2.3	3.8	
High emissions	2080	1.7	1.1 - 2.3	2.9	4.4	6.5
Low emissions	2090	1.3	0.8 - 2.0	2.7	4.6	
High emissions	2090	2.0	1.3 - 2.8	3.5	5.5	8.1
Low emissions	2100	1.5	0.9 - 2.3	3.1	5.5	
High emissions	2100	2.3	1.5 - 3.3	4.3	6.8	10.0

Figure 3. Latest SLR estimates from the State of California, 2018.

The residential project has an expected design life of 75 years. Using Figure 3, interpolating and averaging between the "Likely Range" and the "5% probability," and the low and high emission numbers, the probable SLR (above the 1991 to 2009 mean) in the year 2095 is approximately 3.1 feet. Based upon the 2018 OPC SLR report, probable SLR for the project over the design life is 3.0 feet or less. Figure 3 also shows that there is a 0.5% chance the SLR could be in the range of 5.05 feet to 6.15 feet in the year 2095. The average of this range is 5.6 feet of SLR in the year 2095.

The 2018 CCC SLR Guidance also provides a table (Table G-9) for the projected SLR in Santa Monica. This table only looks at the more onerous RCP scenarios, which are possible, but not statistically probable SLR estimates. Table G-9 provides a 0.5% probability of 5.5 feet of SLR in the year 2090 and 6.8 feet in the year 2100. The SLR estimate for the year 2095 can be interpolated to be 6.15 feet.

The City of Los Angeles recognizes that there are areas in the Venice community that are vulnerable to flooding due to SLR. The City has taken steps towards developing a plan to mitigate this vulnerability. In May 2018 the City released a Venice Sea Level Rise Vulnerability Assessment completed by Moffatt & Nichol funded in part by the CCC. The site is not within these vulnerable areas. The USGS CoSMoS program can be used to establish SLR thresholds for flooding of the site, if no community/regional flooding mitigation action is taken. The areas shown in green are prone to flooding, where as the areas in shades of blue are actually flooded. The key on the left side of each figure explains the flood depth estimates. Figure 4 provides the CoSMoS output for 150 cm (4.9 feet) of SLR in the site area. It shows that with 4.9 feet SLR the site does not flood. Figure 5 shows the CoSMoS output for 175 cm (5.7 feet). It basically shows the large area of Venice that is vulnerable to SLR in the future. The site proper is prone to flooding but this is based upon the current site elevations, which are at about +11 feet NAVD88. The proposed lowest FF is +12 feet NAVD88, so the development may not actually flooded with 5.7 feet SLR. Finally, Figure 6 provides the CoSMoS output for the next increment of SLR allowed in the program, 200 cm or 6.6 feet. This output shows a very large area of Venice is flooded, including the site. However, based upon the flood depth legend, the flooding appears to be less than 2 feet. The existing and proposed FF elevations (except the parking garage) are 2 feet or more above the adjacent street flow lines.



Figure 4. CoSMoS output for 4.9 feet of SLR at the site in the Venice Area.

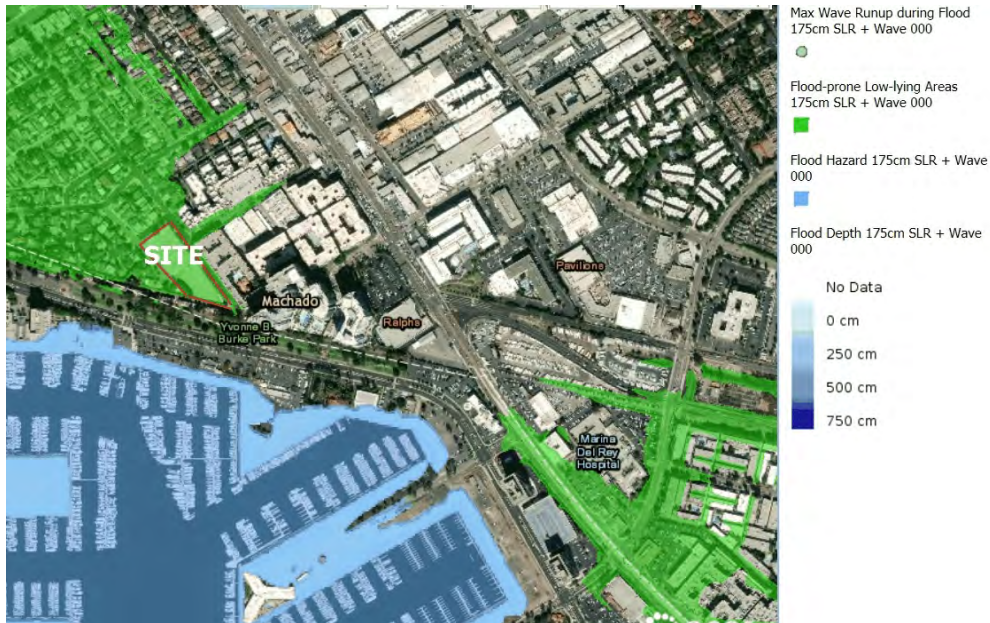


Figure 5. CoSMoS output for 5.7 feet of SLR at the site in the area.

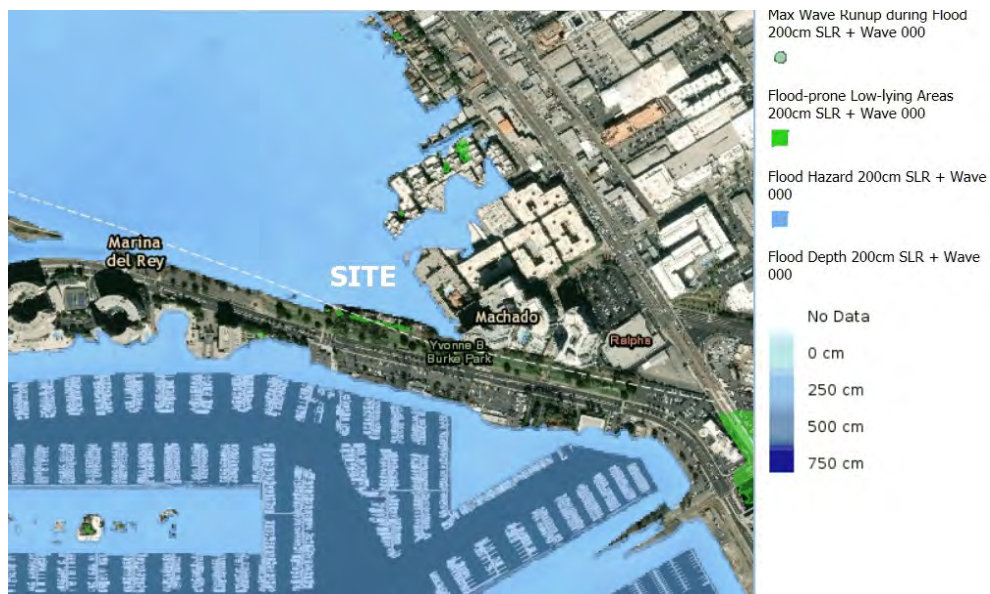


Figure 6. CoSMoS output for 6.6 feet of SLR at the site in the Venice Area.

## Tsunami

Tsunami are waves generated by submarine earthquakes, landslides, or volcanic action. The maximum tsunami runup in the Venice Beach open coast area is less than 1 meters in height. Any tsunami that approaches the site in will be modified, and reduced in height by the development and tide gates as it travels towards the site. Due to the infrequent nature and the relatively low 500-year recurrence interval tsunami wave height, and the

elevation of the proposed improvements, the site is reasonably safe from tsunami hazards.

It should be noted that the site is mapped just outside the limits of the California Office of Emergency Services tsunami inundation map, Venice Quadrangle (State of California, 2009). The tsunami inundation maps are very specific as to their use. Their use is for evacuation planning only. The limitation on the use of the maps is clearly stated in the **PURPOSE OF THIS MAP** on every quadrangle of California coastline. In addition, the following paragraph is taken from the CalOES Local Planning Guidance on Tsunami Response concerning the use of the tsunami inundation maps.

*Inundation projections and resulting planning maps are to be used for emergency planning purposes only. They are not based on a specific earthquake and tsunami. Areas actually inundated by a specific tsunami can vary from those predicted. The inundation maps are not a prediction of the performance, in an earthquake or tsunami, of any structure within or outside of the projected inundation area.*

The CalOES maps model the inundation of a tsunami with an approximate 1,000 year recurrence interval (0.1% event). The CalOES modeling output is shown in Figure 7 and reveals that the site is not within the tsunami inundation zone. The City of Los Angeles has clearly marked tsunami evacuation routes for the entire area.

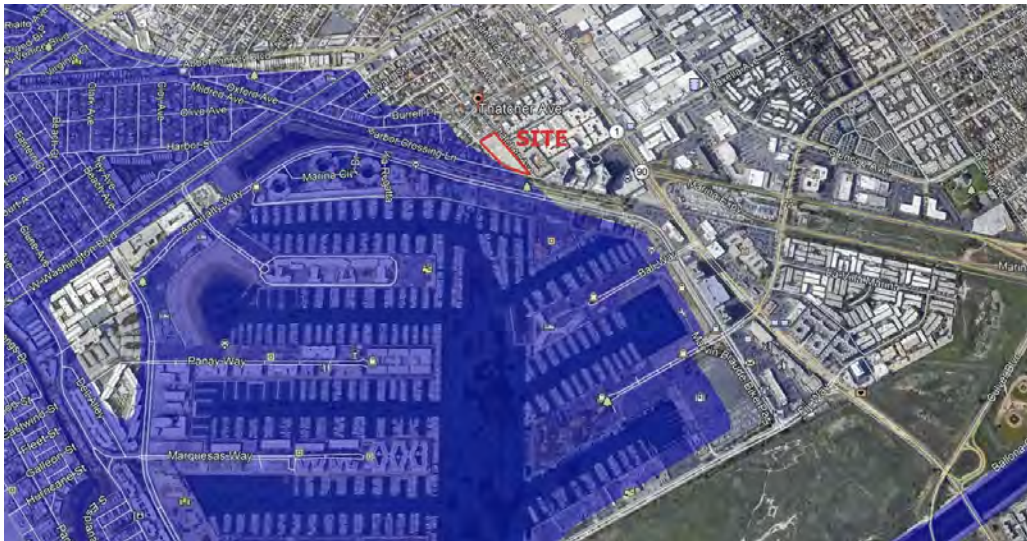


Figure 7. CalOES tsunami output for the site area.

## GROUNDWATER & SLR

In general, ocean tides impact groundwater elevations when the site is very near the ocean. The further away the site is from the ocean, the driving of the groundwater by the tide is typically attenuated. A scientific paper in the *Journal of Hydrology: Regional*



Studies (Hoover, et al., 2015) provides a study on the impact of sea level rise on groundwater for three California coastal sites: Arcata, Stinson Beach, and Malibu Lagoon. The paper, available online, concludes that “additional groundwater emergence/shoaling due to tidal forcing seems unlikely to be a major factor.” The study at the Malibu Lagoon included data on well (groundwater) tidal response that suggest only modest response. The report states that significant damping of tidal response with distance from the shoreline, with about 15% of the tidal signal visible in a well 60 meters (200 feet) from the shore and about 1% of the tidal signal visible in a well 115 meters (380 feet) from the shore.

The report concludes that direct marine inundation will be the dominant mechanism of inundation of low lying areas of the California Coast. This would be in areas where the level of the ocean is above the ground surface elevation and there is a path for ocean waters to travel into the area. The study also points out that in many low lying coastal areas transient events will produce more severe conditions than SLR impacts. Heavy rain can cause short-lived increase in groundwater levels from direct infiltration and up gradient areas. The project site is about 500 feet from Marina del Rey. At this distance, the groundwater is not noticeably impacted by the tides.

If there is up to 6 feet of SLR in 75 years, the future maximum groundwater elevation at the site would be the typical groundwater elevation plus at most .06 feet (1% of 6 feet SLR). The proposed lowest garage floor will be above this elevation. Groundwater may impact the garage foundation during construction. To prevent future groundwater issues, we recommend that all below grade foundations be waterproofed. The lowest habitable finished floor is at about ~+12 feet NAVD88 and with 6 feet of SLR in 75 years from today, the natural groundwater will still be well below that elevation at the site.

## CONCLUSIONS

- Using the latest SLR projections, the maximum (0.5%) SLR over the next 75 years is about 5.6 feet. It is possible but not probable that SLR could be 6.15 feet in 75 years.
- The site and adjacent areas are not currently vulnerable to flooding. The vulnerability of the site to flooding may be increased with SLR. However, based upon the CoSMoS modeling, SLR would need to be in excess of 6.0 feet before the buildings (with the exception of the below grade parking) may be subject to flooding. The site is too far away from the ocean to be subject to direct marine inundation.
- The lowest finished floor elevation (not parking garage floor) is over 2 feet above the adjacent streets flow lines and at elevation +12 feet NAVD88. This elevation is sufficient to mitigate the vulnerability of the development to emergent groundwater with SLR.

- There is no need for shore protection over the life of the development. In addition, there is no need for flood prevention measures for the development.

## RECOMMENDATIONS

The design and materials of the proposed development should be such that waterproofing could be retrofitted in the future, if necessary.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact me.

Respectfully submitted,

**GeoSoils, Inc.**  
David W. Skelly MS, PE  
RCE#47857



## REFERENCES

Daniel Hoover, Kingsley Odigie, Peter Swarzenski, and Patrick Barnard, 2017, "Sea-level rise and coastal groundwater inundation and shoaling at select site in California, USA," by, Journal of Hydrology: Regional Studies, published 2017.

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