

3 April 2025

Project No. 2381

City of Capitola, Public Works
Attention: Jessica Kahn, Public Works Director
420 Capitola Ave
Capitola, California 95010
Phone: (831) 475-7300
jkahn@ci.capitola.ca.us

Re: Updated geological investigation of recent coastal bluff failure
Grand Avenue footpath near intersection with Oakland Avenue and Saxon Avenue
Capitola, California 95010

Dear Jessica:

This letter presents an update to the prior results of our limited geological investigation of the ongoing bluff failure that has undermined portions of the footpath along Grand Avenue between its intersection with Oakland Avenue and Saxon Avenue (see Plate 1). This is update focuses on the most recent failure of the bluff this spring centered around where a storm drain culvert daylights in the coastal bluff.

The reader should refer to our prior letter written for this area in 2023 for a detailed explanation of the long term and short term processes that are impacting the coastal bluff in this area. Nothing that has happened recently has changed our understanding of the ongoing retreat at this location.

EXISTING CONDITIONS

The coastal bluff appears to have recently failed further at this location, centered roughly around where a plastic corrugated CMP daylights out of the top of the bluff face. Pieces of the CMP lie within the landslide debris on the beach, so it is clear that landsliding tore off a portion of the CMP.

What is unclear is precisely what precipitated the failure and what the CMP role was in that failure, due to landsliding destroying the evidence. It is also unclear at this point as to whether the bedrock failed due to notching at the base of the bluff intersecting a bluff parallel joint set because the base of the bluff is covered with landslide debris and beach sand at this location. We would normally look to see if there is still an existing notch in the base of the bluff, or if the bluff face is flush with no notch indicating a recent failure.

An arcuate erosional scar has developed around the remnant of CMP within the blanket of soil (Marine Terrace Deposits) that lies atop the bedrock shelf. This is likely due to ongoing

erosion from storm water out of the CMP hitting the Marine Terrace Deposits soil and eroding them.

The Marine Terrace Deposits are very steep, nearly vertical, at the location of the recent landsliding (see photo below and the geological cross section on Plate 1).



WHAT WILL HAPPEN TO THIS SITE IN THE FUTURE?

If left alone, the Marine Terrace Deposits at this site will continue to erode back to an average angle of 38 degrees where they are over steepened, laying back to approximately where the drop inlet is located on the landward edge of the footpath. This may come about in one to three rainy seasons, particularly in the area centered on the CMP. Since this region is subject to wet and dry cycles that can last for years, we need to assign a range of years to the concept of one to three rainy seasons. The conservative analysis would assume that we will have back-to-back wet seasons for the next several years, which may lay back the marine terrace deposits to the angle of repose. A more liberal analysis would assume that we will enter a drought period of three to five years, followed by wet year. Using those ranges implies that the top of the bluff may retreat significantly within one to six years.

During the course of this investigation, the concept of plugging the drop inlet that feeds the CMP was explored to try and arrest the ongoing erosion that is occurring around the CMP. It appears that a large area drains toward the drop inlet and that there are no other nearby storm drains in the area. If the drop inlet is plugged, storm water will pond in the vicinity of the drop inlet. If no provision is made to remove the ponded water (i.e. pumped out to a different drop inlet or storm drain) the ponded water will percolate into the soil on the inboard side of the footpath. This in turn will saturate the blanket of soil (the Marine Terrace



Deposits) that lies atop the uplifted bedrock shelf and will likely trigger a much larger and extensive failure of the Marine Terrace Deposits out of the face of bluff.

This is a situation where a choice must be made regarding the size of the failure that the drainage is causing. At this point, the existing damaged culvert that lies seaward of the drop inlet is eroding the area right around and below the outfall, causing the Marine Terrace Deposits to retreat in that location. As noted above, plugging the drop inlet may trigger a much more extensive failure of the bluff. Hence, if the smallest possible area to be affected is desired, we would recommend NOT plugging the culvert at this time.

As noted in our 2023 letter, the fate of the bluff and the retreat is always tied to what is happening at the base of the bluff with respect to notching and formation of sea caves. We have not factored in the collapse of the bluff bedrock or the landsliding and subsequent retreat that would occur at this site in the event of a large magnitude earthquake. If that process is factored in and occurs within the time period of one to six years, the amount of bluff retreat may be even greater.

FINDINGS

Turning to Plate 1, the reader may note that our projected one to six year bluff retreat line continues to impinge upon the seaward end of the residential properties. The prior projections in the 2023 letter have only been driven further landward by this recent event. This implies that even if the footpath is pushed landward and snugged up against those properties, it may be undermined and threatened in less than a decade.

The marine terrace deposits exposed in the upper bluff are in a very fragile state with respect to landsliding. The usage of heavy equipment within 15 feet of the top of the bluff, particularly if the soils are wet, may trigger further landsliding of the marine terrace deposits.

Plugging the drop inlet may trigger larger catastrophic landsliding out of the Marine Terrace Deposits, unless the resulting ponded storm water is not allowed to seep into the soil and is transported in a hard pipe out of the area.

Any drainage improvements made to current CMP arrangement may only have an effective shelf life of 10 years or less, depending upon the next series of failures in the bedrock and the Marine Terrace Deposits.

RECOMMENDATIONS

1. The City should consider the effective life of the footpath when contemplating short term and long term expenditures for keeping the footpath open. In the long term, the City will need to protect the entire bluff from further erosion and landsliding with very expensive top-to-bottom armoring methods if they want to keep the existing alignment of the footpath open.



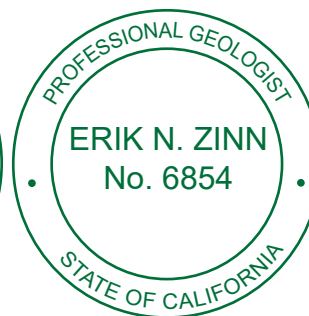
2. Any work performed on the footpath between Oakland Avenue and Saxon Avenue should be done by hand within 15 feet of the top of the bluff. The use of heavy vibratory equipment should be avoided if possible, to lessen the possibility of triggering further landsliding of the bluff. If heavy equipment is used, the work should only be performed when the marine terrace deposits are dry, typically late spring (May) through fall (October).

3. If improvements to the currently damaged CMP are pursued, we recommend that a Civil Engineer be retained to design drainage improvements with input from Pacific Crest Engineering. It is essential to understand the process of retreat at this location and what will drive the failure of any design implemented at this location.

This concludes our geological letter regarding the impacts of landslide and bluff top retreat for the Grand Avenue footpath between its intersection between Saxon Avenue and Oakland Avenue. Please do not hesitate to contact us if you have any questions about this letter or our work or need further assistance.

Sincerely,


PACIFIC CREST ENGINEERING INC.



Erik N. Zinn
Principal Geologist
P.G. #6854, C.E.G. #2139


Attachments: Plate 1 – Site Map & Geologic Cross Section






Pacific Crest
ENGINEERING INC.
SITE MAP & GEOLOGIC CROSS SECTIONS
City of Capitola
Grand Avenue Footpath
Between Saxon Ave. and Oakland Ave.

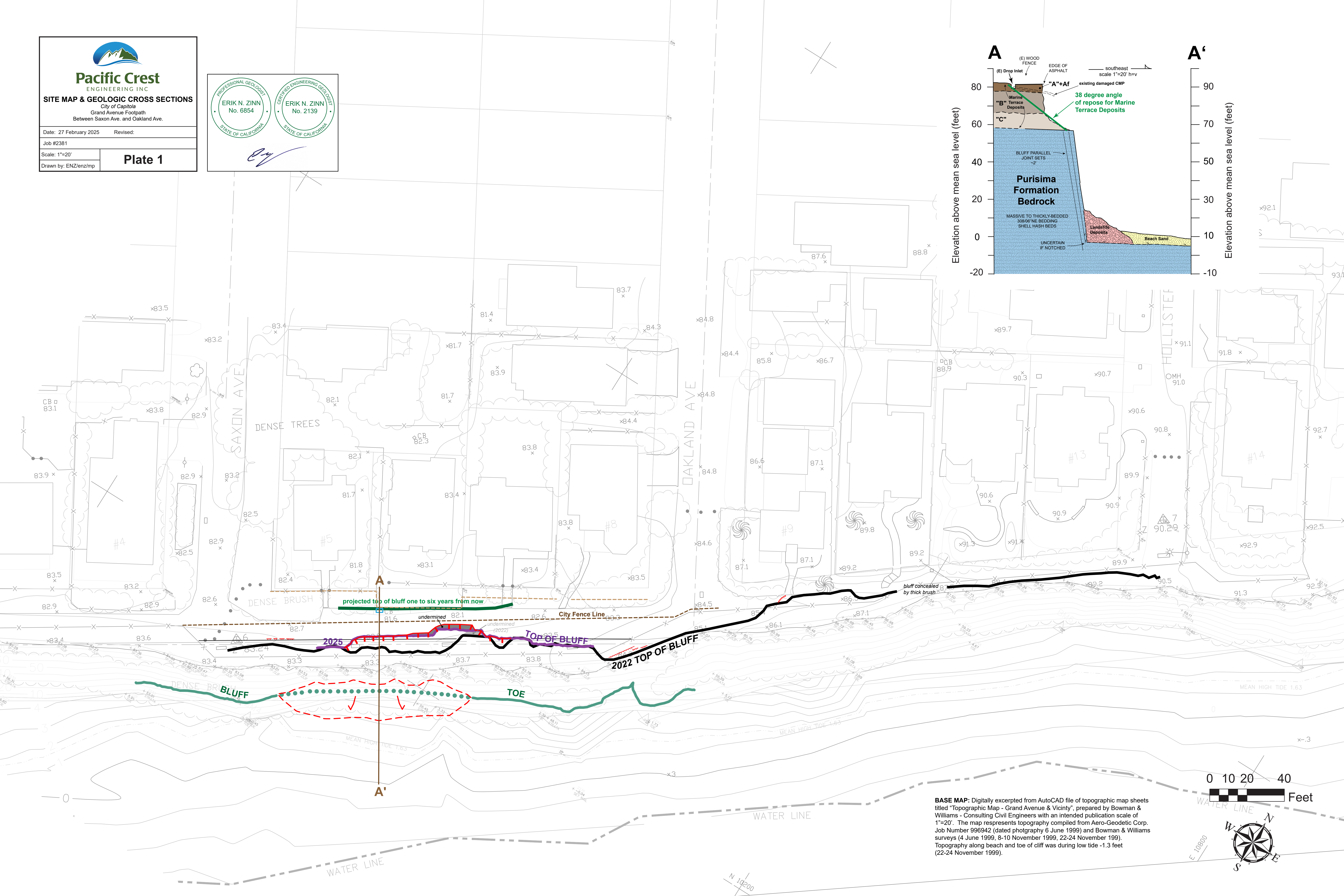

Date: 27 February 2025	Revised:
Job #2381	
Scale: 1"=20'	Plate 1
Drawn by: ENZ/enz/mp	



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BASE MAP: Digitally excerpted from AutoCAD file of topographic map sheets titled "Topographic Map - Grand Avenue & Vicinity", prepared by Bowman & Williams - Consulting Civil Engineers with an intended publication scale of 1"=20'. The map represents topography compiled from Aero-Geodetic Corp. Job Number 996942 (dated photography 6 June 1999) and Bowman & Williams surveys (4 June 1999, 8-10 November 1999, 22-24 November 1999). Topography along beach and toe of cliff was during low tide -1.3 feet (22-24 November 1999).