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W11b

1-22-0292

(Russell and Vickie Clanton)

May 8, 2024

EXHIBITS

EXHIBIT NO. 1

Application No. 1-22-0292
CLANTON
Project Location

Phone: (707) 441-8855 **Email:** info@shn-engr.com **Web:** shn-engr.com
812 W. Wabash Avenue, Eureka, CA 95501-2138

Reference: 021073

August 13, 2021

Russell and Vickie Clanton
1200 Stagecoach Road
Trinidad, CA 95570

Subject: Geologic Hazard Assessment and Coastal Bluff Setback Analysis, 1200 Stagecoach Road, Trinidad, Humboldt County; APN 515-231-001

1.0 Introduction and Project Description

This report presents the results of a focused slope stability evaluation conducted by SHN at the above-referenced project site for the purpose of establishing a bluff development setback. The subject parcel is in the unincorporated area of Trinidad at 1200 Stagecoach Road and is located atop a west-northwest facing coastal bluff, which descends approximately 160 feet from the top-of-bluff to the shoreline (Figure 1). The parcel is identified as Assessor's parcel number (APN) 515-231-001and contains an assessed lot size of 2.08 acres.

As part of our assessment, we have also considered the hazards posed to the site due to strong earthquake ground shaking and seismically induced slope deformation. Included with this report are seismic design criteria in accordance with the California Building Code (CBC, 2019) and American Society of Civil Engineers 7-16 (ASCE, 2016), including seismic site class, seismic design category, and design spectral response accelerations.

1.1 Background

No proposed site development plans have been provided to SHN at this time. We understand from communications with the owners' design consultant that a new residential structure is being considered for the site.

The subject parcel is developed with a single-story residence located at the bluff top. Recent and recurring retreat of the upper bluff face is actively undermining the foundation of the exterior deck on the west edge of the structure. The resulting deformation to the deck has rendered portions of it unsafe for use.

The main residence was originally constructed in the 1940s, according to publicly available information from the assessor's office. Our review of aerial photographs dating back to 1948 indicates that the western edge of the residence was originally located as much as 70 feet from the bluff edge. Two detached structures are located to the northeast and east of the main residence and are connected by exterior walkways.

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Application No. 1-22-0292 CLANTON **Geo Assessment (excerpts)** (Pg. 1 of 16)

The local area consists of mostly similar-sized to larger parcels that are elongated in the east-west direction and developed with residential structures. All existing developments along Stagecoach Road are served by private water sources or small community water systems, and private onsite wastewater disposal systems as no municipal water or sewer exists in the local area.

1.2 Executive Summary

SHN recommends that any proposed site developments be setback a minimum of 117 feet from the bluff edge, defined as the line of intersection between the steeply sloping bluff face and the flat or more gently sloping bluff top. The current bluff edge is located at the western edge of the main residence. The setback should be surveyed in the field from the bluff edge at the time of the proposed future developments to account for any bluff retreat that may occur after the submittal of this report.

The recommended building setback is meant to ensure that minimum slope stability standards are maintained for the design life of any proposed developments. Inherent in this analysis is the assumption that factors affecting slope stability including the steepness and profile of the slope, ground water conditions, and the geometry of the bluff will remain relatively constant throughout the design life of the development. It is further assumed the future bluff retreat rate will be of generally comparable magnitude to the historical rate and that the nature of erosion processes at the site will remain unchanged.

2.0 Purpose and Scope of Work

The purpose of our investigation is to provide geotechnical information to assist you and your design team in addressing California Coastal Commission (CCC) regulations regarding the development of your coastal bluff property. The CCC mandates that coastal bluff-top developments be sited in a manner that 1) minimizes the risk to life and property in areas of high geologic hazard, 2) ensures stability and structural integrity, and 3) neither creates nor contributes significantly to erosion, geologic instability, or destruction of the site or surrounding area.

In developing our conclusions and recommendations, SHN staff have visited the site in 2013 and 2019 during consultations with the previous landowners and have also worked for the landowner on the neighboring parcel to the south. As part of the current investigation, we have conducted geologic reconnaissance and landslide mapping, and drilled hand-augered boreholes. We have also reviewed readily available geologic literature, maps, historical aerial stereographic and oblique photographs, and other reports and documents in our files relevant to this site.

In particular, our investigation was designed to address the following geotechnical/geologic issues:

- the geologic setting of the site,
- potential geologic hazards,
- strength and index characteristics of the onsite soil and bedrock materials for stability analyses,
- gross stability of the coastal bluff,

- assessment of historical bluff retreat rates, and
- recommended development setbacks based on projected bluff retreat during 75-year design life of any proposed structure.

SHN's investigation and stability analysis were performed in general accordance with the guidelines of California Coastal Commission Memorandum W11.5 "Establishing Development Setbacks from Coastal Bluffs," dated January 16, 2003, in order to satisfy the conditions for approval of a Coastal Development Permit for future site development. The recommended development setbacks from the top of the coastal bluff provided in this report are intended to safeguard all future developments from landsliding and bluff retreat for the duration of the structure's 75-year life span.

3.0 Field Investigation and Laboratory Testing

A geologic reconnaissance was performed on the subject property and immediately adjacent areas on May 26, 2021, by a professional geologist. The field investigation included mapping of the bluff face and terrace slope to characterize the geologic/geomorphic conditions. Subsurface investigation included the excavation of two borings to depths ranging from 8 feet to 10 feet. The auger borings were advanced using a hand auger due to access limitations. The earth materials encountered were logged and field classified in general accordance with the Manual-Visual Classification Method (ASTM D 2488). The locations of the auger borings relative to the approximate property boundaries and existing structures are as shown on Figure 2. Final logs of the test borings are presented in Appendix 1, and were prepared based on the field logging, examination of samples in the laboratory, and the results of laboratory testing.

Selected soil samples were tested in SHN's certified soils testing laboratory in Eureka, California, to determine strength and index properties of the subsurface materials. The laboratory testing program included dry density, in-place moisture content and consolidated undrained (TXCU) shear strength. Results of the laboratory tests are provided at the corresponding sample depths on the soil boring logs (Appendix 1) and in full in Appendix 2.

4.0 Geology and Site Conditions

4.1 Geologic Setting

The area between Trinidad Head to the south and Patrick's Point to the north is characterized by a thick sequence of highly deformed and relatively low strength bedrock upon which younger Quaternary age sediments were deposited. Coastal bluff retreat, a process that has occurred for several hundreds of thousand years and continues today, has formed the steep coastal bluffs that extend along the entire Trinidad area coastline.

Locally, the project site is situated at the western terminus of an approximately 1/2-mile wide, gently sloping coastal terrace that extends eastward from the bluff edge to U.S. Highway 101. The terrace underlying the project site is the lowest in elevation of a sequence of well-preserved wave-cut abrasion platforms and overlying terrace sediments that were deposited during previous sea level high stands

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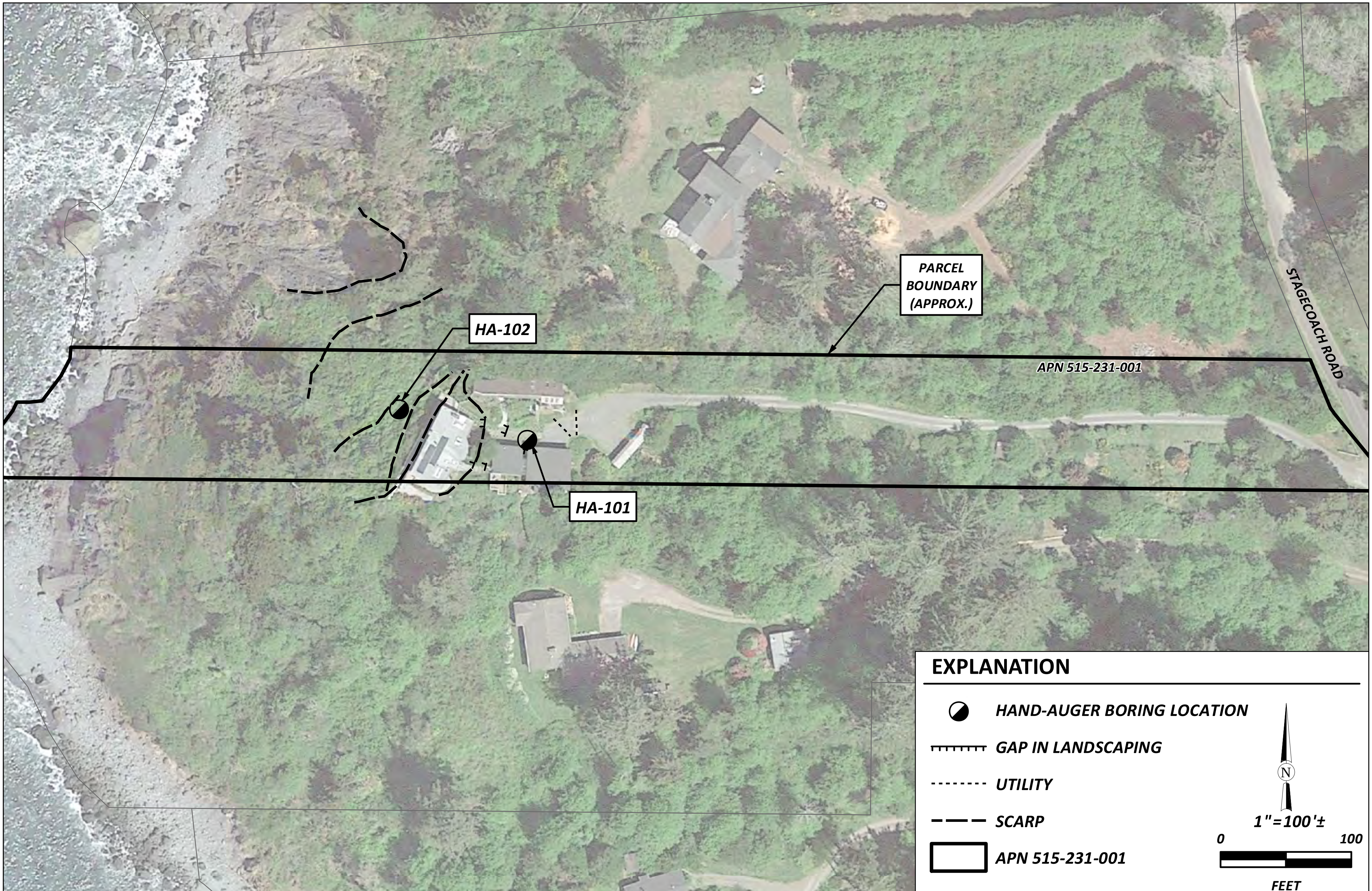

IMAGE SOURCE: GOOGLE EARTH, DATED 4/30/2019
PARCEL DATA SOURCE: COUNTY OF HUMBOLDT GIS, 2021

Russell and Vickie Clanton
Coastal Bluff Stability Analysis
1200 Stagecoach Road, Trinidad, California

Site Plan with Existing Features

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July 2021	Figure2_SitePlan	Figure 2

during the late Pleistocene. The current elevations of the wave-cut abrasion platforms and terrace surfaces are the result of tectonic uplift associated with collision and subduction of the Gorda Plate beneath the North American Plate along the Cascadia subduction zone (CSZ).

The project site is underlain by Late Cretaceous to Late Jurassic age Franciscan Complex mélange of the Central Belt and a relatively thin veneer of Pleistocene age marine terrace deposits (Figure 3; CGS, 2012). The Franciscan Complex mélange consists of a tectonic mixture of penetratively sheared argillite and graywacke that forms a matrix around more coherent masses of greywacke and isolated blocks of greenstone, chert, and serpentinite, as well as exotic blocks of blueschist and other high grade metamorphic rock. Individual rock blocks can range in size from gravel-sized fragments to very large blocks that are several hundreds of feet in diameter. Mélange displays extreme textural variability; therefore, it is challenging to characterize its strength conditions across a site with a high degree of confidence.

Our field observations indicate the lithologies of the individual rock blocks comprising the mélange underlying the site to be highly variable and all supported by a penetratively sheared matrix (matrix-supported mélange). The lower bluff face displays desiccation and raveling of the clay-rich matrix, as well as a line of seepage and springs directly above beach elevation. The steeper sections of the bluff face display tension cracks in brittle and intact bedrock exposures. Qualitatively, the exposures in the lower bluff face appear to display evidence of recent and ongoing slope movements due to the abundance of low-strength clay-rich mélange matrix.

Overlying Franciscan Complex bedrock are Pleistocene age shallow marine sediments deposited on a wave-cut platform developed into the bedrock. Bluff face exposures and hand-augered boreholes drilled at the site indicate the thickness of the terrace deposits to be about 10 feet or more. The terrace surface is interpreted to be correlated with the “Patrick’s Point Terrace,” which is inferred to be about 64,000 years old (Carver and Burke, 1992) based on global sea level curves. The terrace sediments are predominantly composed of silty sand and poorly grade sand. The basal section of the terrace deposit contains a layer of fine to coarse gravels with a sandy matrix in direct contact with the underlying bedrock wave-cut platform.

4.2 Site Conditions

The subject parcel is approximately 930 feet long by about 90 feet wide and is bounded on the east by Stagecoach Road, on the north and south by adjoining residential lots, and on the west by the Pacific shoreline. The bluff top portion of the parcel between the bluff edge and Stagecoach Road is approximately 750 feet in length and ranges in elevation from about 160 feet to 200 feet above sea level. Our review of public records indicates that the main residence was built in the 1940s.

From the top-of-bluff currently located at the western edge of the residence’s foundation, the upper coastal bluff face descends steeply toward the rocky shoreline at an average slope gradient of 60 percent. The bluff face is highly irregular in both plan and profile view and displays a concave upward profile. The slope contains numerous leaning and swept evergreens, which attests to the highly unstable nature of the bluff face. Both the face of the bluff slope and outboard edge of the marine terrace surface (top edge of bluff) display evidence of historical and active landsliding based on the irregular topography, and the presence of abrupt grade breaks, arcuate head scarps, bare soil areas, and displaced trees.

The amount of deformation to the exterior deck noted since our previous site visits indicates that the top of bluff has very recently been subject to slope instability and suggests that the top of bluff is actively retreating landward at a relatively rapid rate. Of particular concern is the presence of subtle head scarps near the east edge (landward) of the residence and in the landscaped areas as shown in Figure 2. Deformation of the ground surface at these locations record down-to-the-west offsets on the order of several inches. Active landsliding on the adjoining parcel to the south is also occurring as evidenced by the presence of a head scarp in the driveway parking area displaying down-to-the-west movement and deformation to that residence's foundation. It appears that the noted ground deformation and failure mechanisms affecting both parcels are global in nature and not merely isolated or localized features.

We suspect these head scarp features deforming the terrace ground surface to be evidence for incipient deep-seated movement underlying the main residence at the subject parcel. It should therefore be anticipated that the structural integrity of the residence will become compromised in the near future if slope movement continues. Although it is difficult to predict, the remaining lifespan of the existing residence should be considered relatively short. It should also be acknowledged that recurring and/or sudden movement on the underlying failure surface would pose a significant hazard to the health and safety of its occupants.

4.3 Near-Surface Soils

The near-surface soils in the vicinity of the existing main residence beginning at the ground surface consists of up to 5 feet of gravelly fill overlying late Pleistocene age marine terrace deposits. Decomposed bedrock is present at about 10 feet or more below ground surface.

The marine terrace deposits are composed of medium dense silty sand (SM) to clayey sand (SC) grading downward to medium dense poorly graded sand (SP) and poorly graded sand with gravel (SP). The terrace sediments are interpreted to be laterally continuous based on the similar soil profiles encountered in both soil borings and the gentle, uniformly sloping ground surface between Stagecoach Road and the bluff edge.

5.0 Geologic Hazards

5.1 Faulting and Seismicity

The Trinidad fault is the closest active fault to the subject parcel and is located more than 2,000 feet south of the site. The Trinidad fault is a northwest-striking and northeast-dipping thrust fault located in both the onshore and offshore portions of the CSZ fold and thrust belt. The main segment of the Trinidad fault can be traced from east of Fieldbrook Valley, northwestward to the coast where projects offshore in the vicinity south of the Martin Creek coastal drainage. The trace of the fault is well expressed as a southwest-facing scarp that displaces the 64,000-year-old Patrick's Point terrace,

vertically separating the relatively flat terrace surface by about 60 feet (Woodward-Clyde Consultants, 1980). The fault is well exposed in the coastal bluff, where thick terrace sand beds are thrust over colluvial deposits along two main fault strands. The upper-bound earthquake considered capable of being generated by the Trinidad fault has an estimated magnitude (Mw) of 7.5 (USGS, 2008).
The subject parcel is not located in an Alquist-Priolo Earthquake Fault Zone based on the State of California Special Studies Zones Trinidad Quadrangle (CDMG, 1983; CGS, 2002; Bryant and Hart, 2007). Based on a review of available geologic maps, and aerial and light detection and ranging (LiDAR) imagery, there appears to be no geomorphic evidence to suggest that a fault lineament projects through the subject parcel. Therefore, the potential for surface fault rupture to occur at the site is considered remote.

Other than the Trinidad fault, the CSZ represents the most significant potential seismic hazard to the subject parcel and north coast region in general. A great subduction event would have a rupture length of up to about 700 miles along the coast from Cape Mendocino to British Columbia, may be up to magnitude 9, and would be associated with extensive tsunami inundation of low-lying coastal areas. Paleoseismic studies along the subduction zone suggest that great earthquakes are generated along the zone every 300 to 500 years with 13 known events having occurred in the previous 6,000 years. The last large subduction earthquake occurred in 1700 (Personius and Nelson, 2005). A great subduction earthquake would generate long duration, very strong ground shaking at the project site and throughout the Pacific Northwest. Ground acceleration parameters related to seismic design of any proposed residential structures at the site are presented in the following section.

5.1.1 Seismic Design Parameters–Spectral Response

The geotechnical-related parameters to be used for seismic design in accordance with the 2019 CBC provisions are evaluated as described in Section 1613.3 of the 2019 CBC. The spectral response accelerations for the Risk-Targeted Maximum Considered Earthquake (MCER) were obtained from the Structural Engineers Association of California/California Office of Statewide Health Planning and Development (SEAOC/OSHPD) “Seismic Design Maps” website (2021) for the coordinates of 41.0814° N latitude and -124.1550° W longitude. The code-based spectra are developed using two spectral response coefficients, S_S and S_1, corresponding to periods of 0.2 and 1.0 second, respectively. These bedrock spectral ordinates are adjusted for Site Class with the short- and long-period site coefficients, F_a and F_v, respectively, based on subsurface conditions.

Based on the materials underlying the site, we classify the geologic subgrade as a Site Class C (very dense soil and soft rock), in accordance with Table 20.3-1 in ASCE 7-16 (ASCE, 2016). The site coefficient values, obtained from Section 1613 of the 2019 CBC, were used to calculate the adjusted spectral response accelerations based on the Site Class, Risk Category (II), and site location. The recommended design spectral response acceleration parameters are provided in Table 1.

Table 1. ASCE 7-16 Spectral Acceleration Parameters

Parameter	0.2 Second	1 Second
Maximum Considered Earthquake Spectral Acceleration (MCER)	S_S = 2.718	S_1 = 1.102
Site Class	C	
Site amplification factor	F_a = 1.2	F_v = 1.4
Site-modified spectral acceleration	S_{MS} = 3.262	S_{M1} = 1.543
Numeric seismic design value	S_{DS} = 2.174	S_{D1} = 1.028
Seismic Design Category (SDC)	E	
MCEG peak ground acceleration (PGA)	1.223	
Site amplification factor at PGA (F_{PGA})	1.2	
Site modified peak ground acceleration (PGA_M)	1.467	

The above Site Class and corresponding site coefficient values are applicable for any proposed residential structure(s) that will be designed and permitted under the current 2019 CBC, and which we assume will have a fundamental period of vibration equal to or less than 0.5 seconds (ASCE 7-16). The code values provided also assumes that the proposed residential structure(s) will not be seismically isolated or incorporate a damping system.

5.2 Liquefaction

Liquefaction is a soil behavior phenomenon in which soil strength is rapidly decreased due to high excess pore-water pressure generated by strong earthquake ground motions. Recently deposited and geologically young Holocene age sediments composed of non-cemented granular materials and located below the groundwater surface are most susceptible. Older Pleistocene age sediments that have been subjected to repeated seismic cycles are not susceptible to liquefaction and its associated strength loss.

The project site is underlain by late Pleistocene age (~64,000 years old) marine terrace deposits and Cretaceous to Jurassic age Franciscan Complex bedrock. No previously identified evidence of liquified soils have been observed in fault trench or soil test pit exposures within the local Trinidad area based on previous investigations. Based on the age and degree of consolidation of the materials underlying the site, the potential for soil liquefaction to occur is considered remote.

5.3 Lateral Spreading

Lateral spreading is defined as lateral earth movement of liquefied soils, or competent strata riding on a liquefied soil layer, downslope toward an unsupported slope face, such as a coastal bluff or an inclined slope face. Due to the low liquefaction hazard, we judge the potential for lateral spreading to occur at the site to be negligible.

5.4 Landsliding

Slope failures affecting the site predominantly consist of earthflows deforming the low-strength, pervasively sheared mélange matrix that is visible in lower bluff exposures. Translational/rotational slides and shallow debris slides are also present and are interpreted to be confined to shallow depths within the upper sections of mélange and overlying terrace sediments.

Earthflow movement at the site is the result of relatively slow, plastic deformation or flow of the cohesive (clay-rich) materials comprising the matrix of the mélange. The displaced mass appears to be internally deformed, particularly when viewed from the shoreline and in the oblique aerial photographs. Because of the block-in-matrix texture of the mélange, earthflows appear to be largely confined to the sheared, clay-rich matrix. In many instances the mélange matrix appears to be creeping around large, relatively stable rock blocks. The blocks that appear to be unaffected are likely due to their depth of penetration relative to the depth of the slide plane. Deep-seated rotational failures are less common at the site due to the predominantly cohesive nature of the sheared matrix. Shallow rotational slumps are present along the top edge of the coastal bluff within the terrace sediments where the underlying mélange matrix has been transported downslope by earthflow movement.

Historical and recently active landsliding is evident along the entirety of the bluff face directly downslope of the residence and continuing to the shoreline. Youthful head scarps are present along the entire length of the top of bluff in proximity to the western edge of the residence. The entirety of the bluff face displays hummocky topography with back-tilted evergreen trees exhibiting bent trunks, which we interpret to be indicative of long-term soil creep. The upper bluff edge displays near vertical coalescing head scarps that are actively deforming the foundation supporting the exterior deck. Evidence of rotational/translational sliding is present along the top edge of the bluff in the form of down-dropped and tilted blocks containing back tilted trees, as well as tension cracks and fissures. At select locations, the scarps and tension cracks appear to have formed across the root zone of mature evergreen trees suggesting that they are very recent features. The upper terrace surface landward of the bluff top residence exhibits subtle benched topography, which we interpret to be evidence for rotational failures occurring withing the terrace sediments and possibly within the underlying mélange bedrock.

5.0 Determination of Future Bluff Retreat

The determination of what constitutes an adequate setback is a critical component for the proposed coastal bluff development. The coastal bluff at the project site is a dynamic and evolving landform that has retreated landward a significant distance since the main residence was originally constructed. Establishing an appropriate development setback from the top of bluff is challenging in that the bluff is subject to erosion at the base of the slope and landsliding at the top of slope. The mechanisms of coastal bluff retreat at the site are complex but can be grouped into two broad categories: 1) bluff retreat may occur suddenly and catastrophically through slope failure involving the entire bluff, or 2) more gradually through grain-by-grain erosion by marine and subaerial processes. For both processes, the setback must be adequate to ensure safety over the design life of the development.

In order to ensure that this is the case, a development setback line is established such that it places the proposed structure(s) a sufficient distance from the unstable bluff and considers bluff retreat over the life of the development, thus assuring stability over its design life. The goal is to ensure that by the time the bluff retreats sufficiently to threaten the development, the structures themselves are obsolete. Replacement development can then be appropriately sited behind a new setback line. The deterministic approach presented in the following sections is based on established geologic and engineering principals as required by current CCC policy related to bluff top development.

5.1 Quantitative Slope Stability Analysis

A quantitative slope stability analysis was performed to establish a minimum setback from the edge of the coastal bluff and to demonstrate a factor of safety greater than or equal to 1.5 for the static condition and greater than or equal to 1.1 for the seismic condition. The effect of seismic loading on slope stability was assessed using a pseudostatic horizontal seismic coefficient of 0.2 g (acceleration of gravity) applied in the direction of failure.

The slope stability analyses were undertaken through a cross-section modeling worst case geologic and slope gradient conditions at the site using the computer program "Slide2" published by Rocscience, Inc. The analyses include postulated failure surfaces such that both the overall stability of the slope and the stability of the surficial units were examined. The surface profile and cross-sectional area used in the analyses were configured from LiDAR data provided by the California Coastal Conservancy. The location of the slope profile line is denoted as A-A' in Figure 4.

A three-layer model was used to represent the subsurface conditions encountered at the site. The upper layer consists of granular soil within the marine terrace deposit. The lower layer consists of Franciscan Complex mélange bedrock. The third layer consists of low strength slide debris mantling the bluff face. The stratigraphic contact between the marine terrace unit and bedrock is assumed to be dipping gently to the west in cross-section, based on the depth to bedrock encountered in our borings and the depth of the terrace/bedrock contact exposed in the bluff face.

The groundwater surface was modeled as sloping toward the upper bluff face and assumes a potentiometric surface for the highest potential ground water conditions of about 5 feet below ground surface. Circular failure surfaces were sought through a search routine to analyze the factor of safety along postulated critical failure surfaces using various equilibrium methods including Bishop Simplified, Spencer, and GLE/Morgenstern-Price. Shear strength parameters and unit weights were determined from laboratory tests that included triaxial shear tests performed on a relatively undisturbed sample collected from the terrace materials.

Intact samples from the bedrock were not obtained due to the high number of blow counts required to drive the sampler, resulting in poor sample recovery. Therefore, the shear strength parameters and unit weights used for the bedrock materials underlying the site are derived from previous laboratory testing of Franciscan Complex mélange samples collected from five separate sites in the local area. Residual strengths from laboratory tests on earthflow materials within the Franciscan Complex mélange were used to represent disturbed and remobilized bedrock materials mantling the bluff face. Strength values were determined in accordance with the procedures outlined in ASTM-International (ASTM) test methods D2937, D2166, and D6528. The averaged laboratory strength and index parameters used in the current slope stability analyses are summarized in Table 2.

Table 2. Estimated Bedrock Strength and Index Parameters

Parameter	Earthflow Material		Mélange	
	No. of Tests	Average Value	No. of Tests	Average Value
In-place moist unit weight, pcf[a]	49	138	37	144
Unconfined compression, psf[b]	12	2,290	3	3,450
Consolidated undrained, direct shear, peak, cohesion, psf			8	1,413
Consolidated undrained direct shear, peak, friction angle, degrees			8	31.4
Consolidated undrained, direct shear, residual, cohesion, psf	8	108		
Consolidated undrained direct shear, residual, friction angle, degrees	8	20.8		
N-value, blows per foot	139	21.2	86	69

[a] pcf: pounds per cubic foot
[b] psf: pounds per square foot

Based on the slope stability analyses the potential failure surfaces possessing a factor of safety of greater than or equal to 1.5 for the static condition and greater than or equal to 1.1 for the seismic condition lie a horizontal distance of 25 feet from the currently failing bluff edge. Graphical representations of the slope stability analyses based on the GLE/Morgenstern-Price method which produced the most conservative results, are provided in Appendix 3.

5.2 Long-Term Bluff Retreat

The long-term bluff retreat rate is defined as the average value of bluff retreat as measured over a given time interval. Coastal bluff retreat tends to be temporally episodic and typically occurs in response to large climatic events. Despite the episodic nature of coastal bluff retreat, it is necessary to identify the future long-term bluff retreat rate in order to establish appropriate development setbacks.

Long-term coastal bluff retreat rates at the project site were established by examining time series stereo-pair aerial photographs spanning from 1948 to 2000. Both original and high-resolution scans of the aerial photographs were reviewed and obtained at the California Geological Survey office in Eureka, California, and from the SHN digital archives originally acquired from the Humboldt County Department of Public Works. The most recent satellite image available on Google Earth, dated 2019, in conjunction with our recent field observations, was also used to provide a total period of record spanning 73 years. Select aerial photographs were rubber-sheeted and aligned with the 2019 Google Earth image to compare the historical positions of the bluff edge relative to its current position.

The accuracy associated with defining the position of the former bluff edge is highly dependent on the resolution and scale of the aerial photographs and, therefore, varies for different photo years due to image quality. Additional error in the analysis is introduced due to the parallax associated with the view angle of the aerial photographs which distorts the scale. We acknowledge, therefore, that our measurements likely contain a measurement error of at least ±10 feet. The amount of total error inherent in our analysis is minimized to the extent possible by rubber-sheeting select aerial photographs onto the most recent 2019 satellite imagery and measuring the former position of the bluff edge relative to its current position using the graphical measuring tools provided by Google Earth. We have determined this method to be more accurate as compared to scaling off the original hard copies of the photographs and comparing to landmarks such as roadways and rock outcrops.

From our analysis, we conclude that the position of the bluff edge at the project site has retreated as much as 70 feet since 1948. Based on the cumulative amount of bluff retreat measured, we estimate the long-term coastal bluff retreat rate to be 1 foot per year (foot/year).

5.3 Impacts of Sea Level Rise

Global sea level has repeatedly risen and fallen as much as 400 feet in response to the alternating accumulation and decline of large continental ice sheets as the climate warmed and cooled in naturally occurring 80,000- to 120,000-year astronomical cycles (Imbrie and Imbrie, 1986; Lambeck and others, 2002 in USGS, 2009). Geologic evidence of global sea level change records sea level low-stands that occur during glacial maximums and sea level high-stands associated with interglacial warm periods.

During the penultimate interglacial warm period that occurred about 125,000 years ago and lasted a duration of about 10,000 to 12,000 years, global sea level was at least 20 feet higher than present (Imbrie and Imbrie, 1986). During the peak of the Last Glacial Maximum (LGM) about 18,000 to 20,000 years ago, global sea level was approximately 400 feet lower than present day. As a result, the coastline at that time was more than 6 miles seaward of its current location.

Following the LGM, Earth entered the present interglacial warm period. During the initial melting of the continental ice sheets, global sea level rose very rapidly at rates as high as 2 inches/year and at a mean annual rate of about 0.4 inches/year between about 15,000 and 6,000 years ago. The average rate of sea level rise has slowed considerably over the past 6,000 years. During the past century, approximately 5 to 8 inches of sea level rise has occurred at a mean annual rate of about 0.05 to 0.08 inches/year.

The recently updated Ocean Protection Council (OPC), State of California Sea-Level Rise Guidance document (2018) presents three primary sea-level rise projections for a range of risk aversion levels from low to extreme. For the current project, the Medium-High Risk Aversion is considered. Projected sea-level rise derived for the Medium-High Risk Aversion for the North Spit at Humboldt Bay ranges from 6.3 feet to 7.6 feet for the year 2100 (Table 4, page 48 of the 2018 guidance document) and is thus used to assess potential impacts to the project site. This range of projected sea level rise is more than about 10 to 14 times greater than the amount observed during the past century and is considered highly conservative.

Erosion rates and coastal retreat affecting rocky coastlines have been observed to be at least an order of magnitude less than on shorelines consisting of poorly consolidated Pleistocene sediments (USGS, 2009). The application of geometric models that calculate erosion and coastal retreat rates for sandy bluffs and foredune backed beaches (Komar and others, 1999) are, therefore, not applicable to the project site. Retreat of rocky coastlines is driven by a combination of wave-driven cliff-base erosion, subaerial weathering, and mass wasting processes, whose effects are predominantly dependent on lithology. Recent studies using cosmogenic exposure dating (Swirad and others, 2020) suggest that 1) over long timescales on the order of thousands of years, cliff retreat rates along rocky coastlines remain relatively steady, and 2) coastal profiles generally retain a stable shape while migrating landwards. We are, therefore, of the opinion that projected sea level rise of about 6 feet to 8 feet may result in a minor increase of the previously determined bluff retreat rate during the 75-year economic lifespan of any proposed developments, but it is unlikely to be a substantial increase.

The historical bluff retreat of 1 foot/year determined for the site, to some degree, already accounts for rising sea levels during the past century. However, due to the uncertainty in determining the effects of projected sea level rise on the erosion rates associated with rocky coastlines, we conservatively allow for a 10 percent increase to the long-term bluff retreat rate, which yields an estimated rate of future bluff retreat of about 1.1 foot/year.

6.0 Recommended Bluff Development Setback

To define the total development setback, we have followed CCC guidelines and combined the three aspects of the setback determined in Section 5 including 1) the setback to ensure safety from landsliding, 2) the setback for long-term bluff retreat, and 3) the potential effects of projected sea level rise on the long-term bluff retreat rate. The resulting development setback is intended to ensure that minimal slope stability standards are maintained for the design life of any future site improvements including all permanent structures, exterior decks attached to a structure, and wastewater disposal fields. Therefore, the following findings form the basis of our development setback recommendation:

1) The distance from the bluff edge to the predicted failure plane with a factor of safety greater than or equal to 1.5 for the static condition and greater than or equal to 1.1 for the seismic condition established by quantitative slope stability modeling is determined to be 25 feet.
2) The maximum long-term bluff retreat rate since 1948 is determined to be 1 foot/year.
3) The rate of future bluff retreat is conservatively estimated to be 10 percent greater than the historical rate, or about 1.1 feet/year due to the effects of projected sea level rise and shall be applied over the 75-year economic lifespan of any future site developments.

Combining the three aspects of the setback determination noted above yields a minimum development setback of 107 feet. To account for the uncertainty inherent in the methodologies used for our analyses, we further recommend a 10-foot buffer be added to the development setback in accordance with the CCC methodology. Therefore, the final coastal bluff development setback is recommended to be no less than 117 feet from the bluff edge. The recommended setback is intended to account for future landward retreat of the bluff edge and the potential for deep-seated failure surfaces to form on the terrace surface landward of the existing residence.

Phone: (707) 441-8855 Email: info@shn-engr.com Web: shn-engr.com
812 W. Wabash Avenue, Eureka, CA 95501-2138

Reference: 021073.100

March 1, 2024

California Coastal Commission
North Coast District Office
Attn: Catherine Mitchell
1385 8th Street, Suite 130
Arcata, CA 95521

Subject: Review of Site Development Plan for Compliance with Bluff Development Setback Recommendations—Proposed Residence, 1200 Stagecoach Road, Trinidad, Humboldt County; APN 515-231-001

Dear Catherine Mitchell,

The following is being provided by SHN on behalf of Coastal Development Permit applicants, Russell Clanton and Vickie Hawkins-Clanton, for the proposed residential development located at 1200 Stagecoach Road on Assessor's parcel number (APN) 515-231-001. This letter is to verify in writing that the locations of the proposed development is in substantial conformance with and meets the intent of SHN's recommended coastal bluff development setbacks provided in our report titled "Geologic Hazard Assessment and Coastal Bluff Setback Analysis, 1200 Stagecoach Road, Trinidad, Humboldt County; APN 515-231-001" dated August 13, 2021.

Project Description

The proposed project includes developing a 2.08-acre bluff-top parcel with a new two-story residence and attached garage with second-story storage space. The proposed building footprint including the first-floor area and attached garage area total 2,256 square feet (sf). The total amount of first- and second-floor conditioned space will be 2,573 sf. The total amount of unconditioned space will be 1,246 sf.

SHN has reviewed the most recent site development plan prepared by Elevation H Design dated December 20, 2023, and provided with this letter for reference (see Site Plan, Attachment 1). The site plan indicates that the northwest and southwest corners of the proposed structure will be set back from the coastal bluff edge a minimum horizontal distance of 80 feet and 100 feet, respectively, in order to maintain a buffer from a mapped wetland located to the east of the proposed structure. Based on a meeting conducted at the site on February 26, 2024, with SHN, the project site owner, and Elevation H Design in attendance, it is our understanding that the proposed building footprint relative to the bluff edge has not changed and is as shown in the December 2023 document attached herein.

Background Info

SHN previously conducted a geologic hazard assessment and quantitative slope stability analysis at the project site in accordance with the guidelines set forth in California Coastal Commission (CCC) Memorandum W11.5 *Establishing Development Setbacks from Coastal Bluffs*. The site assessment and stability analysis were undertaken to establish development setbacks from the top of the coastal bluff to safeguard the proposed development from any future landsliding and/or bluff retreat for the duration of the structure's 75-year lifespan. Based on our analysis, it was conservatively determined that a development setback of 117 feet be considered such that by the time the bluff retreats thereby threatening the development, the structure itself would be obsolete. Replacement development could then be appropriately sited behind a new setback line. This deterministic approach was based on established geologic and engineering principles required by CCC policy related to bluff top developments.

In calculating the development setback, we combined three aspects that incorporated the range of bluff retreat mechanisms including: 1) deep-seated landsliding, 2) bluff retreat due to surficial erosion processes, and 3) the effects of projected sea level rise on the long-term bluff retreat rate. The findings presented below formed the basis of our previously recommended development setback of 117 feet:

1) Based on quantitative slope stability modeling, the potential failure surfaces with a factor of safety of greater than or equal to 1.5 for the static condition and greater than or equal to 1.1 for the seismic condition were calculated to intersect the ground surface a horizontal distance of 25 feet from the current bluff edge.
2) Review of historical aerial photographs dating back to 1948 indicated the bluff edge has retreated a maximum of 70 feet to its current position yielding a long-term bluff retreat rate of 1 foot per year or less.
3) The effect of projected sea level rise on future bluff retreat was conservatively estimated to incur an additional 10 percent of bluff retreat as compared to the measured historical rate, or about 1.1 feet/year, and was applied over a 75-year period.

Combining the three aspects of the setback determination yielded a development setback of 107 feet. An additional 10 feet was added to account for the uncertainty inherent in the analyses used as required by the CCC. A final bluff development setback of 117 feet was, therefore, recommended. Subsequently, and based on verbal communications with CCC Geologist Joseph Street, it was agreed that the recommended bluff development setback could be reduced slightly while still maintaining a relatively high degree of safety for life and property. A reduced bluff development setback was determined to be necessary in order to develop the site and provide a buffer from a mapped wetland located landward of the proposed building footprint.

Conclusions and Recommendations

As noted above, we recently performed a site visit on February 26, 2024, to verify the locations of the proposed building footprint relative to the current bluff edge. The distance from the bluff edge to the proposed northwest and southwest building corners was measured with a surveyor's tape and was determined to be a minimum of 80 feet and 100 feet, respectively, as indicated on the site plan. It is our professional opinion, therefore, that the currently proposed bluff development setbacks are adequate to safeguard the proposed residence and its inhabitants from the hazards associated with active landsliding and long-term bluff retreat during the structure's 75-year design life.

For an added factor of safety, SHN recommends that the proposed residential structure be supported on a monolithic reinforced concrete mat foundation. The intent of the mat foundation is to mitigate the potentially adverse effects related to differential ground settlement resulting from strong earthquake ground shaking and/or localized slope movements. Recommendations related to the design and construction of the mat foundation will be provided in a separate foundation soils report prepared by SHN.

Please call me at (707) 441-8855 if you have any questions.

Sincerely,

SHN

PROFESSIONAL GEOLOGIST
GIOVANNI ANTHONY VADURRO
Exp. 5/30/25
No. 2554
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

3/1/24

Giovanni A. Vadurro, CEG 2554
Engineering Geologist

GAV:ame

Attachment 1. Site Development Plan (prepared by Elevation H Design dated December 20, 2023)

AQUATIC RESOURCES DELINEATION REPORT

APN 515-231-001-000
Trinidad, Humboldt County, CA

Updated April 15, 2023

March 3, 2022

Prepared for

Vicki and Russ Clanton
1200 Stagecoach Road
Trinidad, CA. 95570

Prepared by

Joe Seney, Wetland Scientist

California Professional Soil Scientist #243

In Conjunction with

Naiad Biological Consulting

EXHIBIT NO. 3

Application No. 1-22-0292
CLANTON
Wetland Assessment (excerpts) (Pg. 1 of 8)

Executive Summary

Landowners and associated contractors are evaluating residential house design alternatives. The landowner requested assistance in identifying and mapping of aquatic resources, including wetlands, within the Project Area as part of the anticipated compliance requirements. Wetland scientist Joe Seney conducted an investigation of aquatic resources and delineated wetlands on Humboldt County parcel APN 515-231-001-000 on February 25th and 27th , and March 2nd, 2022. Mapping and report were updated on April 15, 2023.

This survey was conducted in accordance with the three-parameter method of the U.S. Army Corps of Engineers Wetland Delineation Manual and the 2010 Regional Supplement: Western Mountains, Valleys and Coast Region and a one-parameter method due to the Project Area location within the California Coastal Zone. The State of California - North Coast Regional Water Quality Board has jurisdiction and permit authority over "Waters of the State", which includes "isolated wetlands" Wetlands within the Project Area were mapped based on the presence of all three USACE parameters; hydric soil, wetland hydrology and hydrophytic vegetation. Wetland-upland boundaries were determined when at least one of the three parameters was no longer present.

The average annual precipitation recorded at the Eureka Weather Station, California is 39.26 inches, with approximately 95% falling in the wet season. From December 1st , 2021 through February 2022, the area received 9.66 inches of precipitation compared to the usual 19.32 inches, 50 percent of the 2000-2022 normal. Over the past three months, January and February 2022 were significantly drier than normal.

There are two jurisdictional three-parameter wetlands (0.54 acre) within the Project Area; both are classified as Palustrine Emergent Herbaceous, Seasonally Saturated/Ponded wetlands. I mapped 503 linear feet of water ditches – drainage pipe within the parcel using LiDAR derived one-foot contours. There are 242 feet of open ditch and 361 of feet of drainage pipe. Assigned setbacks are 100 feet for three-parameter wetlands and 0 feet for the ditch (Class IV) and drainage pipe. The wetland setback is not 100 ft to the north and south due to parcel size constraints. Sample plot locations were selected based on varying plant communities as well as landscape position and slope shape. Nine upland locations are on planar to convex positions and five in concave positions.

Wetland hydrology indicators identified during field work were surface water ponding (A1), groundwater (A2) and soil saturation (A3) within 12 inches of the soil surface. In wetlands plots, I observed groundwater with a median depth of nine inches and saturated soil with a median depth of five inches. For non-wetland plots, I observed groundwater with a median depth of 19 inches and saturated soil with a median depth of 16 inches. Of the 14 locations I described soils, ten soil profiles met the hydric soils definition. The hydric soil indicators identified were Depleted Below Dark Surface (A11), Depleted Below Thick Dark Surface (A12), Loamy Mucky Mineral (F1), Depleted Matrix (F3) and Redox Dark Surface (F6). All wetland plots displayed wetland hydrology and hydric soils, as a result existing plant communities by default are considered to have hydrophytic plant communities.

Introduction

Landowners and associated contractors are evaluating residential house design alternatives. The landowner requested assistance in identifying and mapping of aquatic resources, including wetlands, within the Project Area as part of the anticipated compliance requirements. Wetland scientist Joe Seney conducted an investigation of aquatic resources and delineated wetlands on Humboldt County parcel APN 515-231-001-000 on February 25th and 27th, and March 2nd, 2022. Mapping and report were updated on April 15, 2023.

The parcel is located in Humboldt County, California, in the town of Trinidad (Figure 1). This parcel is located approximately two air miles north of Trinidad town center, within the Trinidad 7.5-minute USGS Quadrangle. The Project Area is approximately 1.55 acres in size.

Wetland Scientist Qualifications

The aquatic resources delineation for this Report was conducted by Joe Seney, a contracted wetland/soil scientist. Joe has over 28 years of experience working as a wetland/soil scientist for the USDI National Park Service, USDA National Resources Conservation Service and USDA Forest Service. In addition, he has taught soils and hydrology courses at Humboldt State University since 2007. Joe has an MSc. in Earth Sciences and a PhD (unfinished) in Soils with a supporting field of Plant Ecology.

Methods

The survey was conducted in accordance with the three-parameter method of the U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual and the 2010 Regional Supplement: Western Mountains, Valleys and Coast Region (Version 2.0) and a one-parameter method due to the Project area location within the California Coastal Zone (Version 2.0) (USACE, 1987 and 2010). The US Army Corps of Engineers and North Coast Regional Water Quality Board regulates wetlands and other waters under section 404 of the Clean Water Act (CWA). The USACE defines "wetlands" as those areas that exhibit hydric soils, hydrophytic vegetation, and wetland hydrology. For purposes of identifying wetlands protected under the CWA when requesting a Nationwide or Individual CWA Permit from the USACE, wetland maps should be no more than five years old. The Army Corps of Engineers also has jurisdiction and permit authority over other "Waters of the U.S." – those additional aquatic systems such as streams, rivers, and mudflats, which are also protected by the CWA. The State of California has jurisdiction and permit authority over "Waters of the State", which includes "isolated wetlands" (California State Water Resources Control Board, 2019). In addition, I used LiDAR derived one-foot contours to delineate potential wetlands within the Project Area.

Climate

Climate exerts an influence on soil, hydrology, and vegetation at regional, local, and micro-scales. Regionally, cool, wet winters and nearly rainless summers characterize the climate of Humboldt County, California. Precipitation in the region follows a very strong seasonal pattern of a wet season (October to April) and a dry season (May to September). The average annual precipitation recorded at the Eureka Weather Station, California is 39.26 inches, with approximately 95% falling in the wet season. From December 1st , 2021 through February 2022, the area received 9.66 inches of precipitation compared to the usual 19.32 inches, 50 percent of the 2000-2022 normal. Over the past three months, January and February 2022 were significantly drier than normal (Table 1).

Wetland Hydrology

Presence or absence of wetland hydrology is one of the three parameters used by the 1987 USACE manual (along with hydric soils and hydrophytic vegetation) to delineate wetland boundaries. Although wetland hydrology indicators are important in delineating wetlands, they are the least credible compared to soil and vegetation indicators due to variability of seasonal and local weather patterns that influence hydrology. Wetland hydrology exists at a site when it is flooded, ponded, or has groundwater within 12 inches of the ground surface for 14 or more consecutive days during the growing season in at least 5 out of 10 years. Wetland hydrology is the most seasonal and transitory of the three parameters.

The USACE manual describes primary and secondary wetland hydrology "indicators" that allow delineators to evaluate hydrology throughout the growing season, even late in the dry season when saturation in the upper part of the soil may no longer be present. Examples of primary indicators include surface water, a high-water table (groundwater within 12 inches of soil surface), saturated soil, oxidized iron along live root channels or on live root surfaces, sparsely vegetated concave surfaces, water-stained leaves and iron deposits. Examples of secondary indicators include presence of a "dry season water table" between 12 and 24 inches below the ground surface, a shallow aquitard, a dense layer within 24 inches of the soil surface, the FAC Neutral Test, and "geomorphic position" of the site (e.g., toe slopes, drainageways, depressions, and swales). The presence of one primary or two secondary indicators confirms wetland hydrology.

Hydric Soils

The 1987 *Wetlands Delineation Manual* (USACE 1987) suggests evaluating existing soil maps before conducting in-field wetland delineations. Soils mapped in the Project Area are primarily the Timmons Soil Series (non-hydric), the Lepoil Soil Series (non-hydric) and Huntsinpillar (hydric) (USDA-NRCS, 2022 online access). Soils are derived from uplifted Pleistocene marine and non-marine sediments.

The Project Area is located on wave cut platform (marine terrace), which consist of a thin veneer of marine sediments, approximately 1 to 10 feet thick, overlain on weakly consolidated claystone (clayey matrix) with large pieces of more resistant rocks, mostly sandstone floating within the clayey matrix. Seeps are present at the contact between loamy marine sediments and the underlying dense clay, forcing groundwater to the soil surface. The pump house is located at this contact (Images 1A through 1E and 2A through 2E). Depth to the parcels domestic well is eight feet.

Timmons soils are very deep (>60" to bedrock) well drained (non-hydric), with redoximorphic features related to wet season saturation starting at a depth of >40 inches. Soil textures are loam, silt loam, or fine sandy loam in the very dark brown or dark brown surface horizons, and reddish yellow clay loam or sandy clay loam to a depth of 60 inches.

Lepoil soils are very deep (>60" to bedrock) well drained (non-hydric), with redoximorphic features related to wet season saturation starting at a depth of >40 inches. Soil textures are loam, silt loam, or fine sandy loam in the very dark brown or dark brown surface horizons, and yellowish brown or dark yellowish brown clay loam, loam or sandy clay loam to a depth of 60 inches.

Huntsinpillar soils are very deep (>60" to bedrock) very poorly drained (hydric soil), with redoximorphic features related to wet season saturation starting near the soil surface. Soil textures are clay loam or loam in the very dark grayish brown or black surface horizons, and dark grayish brown or olive gray clay, silty clay or clay loam to a depth of 60 inches. Huntsinpillar soils are found in seeps, depressions and swales.

Hydric soils are one of the three parameters used to delineate wetlands. Most hydric soils exhibit characteristic, identifiable morphologies that result from anaerobic conditions and persist in the soil during both saturated (reduced) and dry (oxidized) conditions in the upper 12 inches of soil. Examples include a mottled color pattern resulting from reduction and reoxidation of iron or manganese, and accumulation of organic matter due to increased plant production and slow decomposition rates in saturated environments. Hydric soil field indicators display characteristic morphologies as a result of the accumulation or loss of iron, manganese, sulfur, or carbon compounds in a saturated and anaerobic environment (USACE, 2010).

A soil pit was dug at each sampling location to a depth of between 15 to 20 inches. For each soil profile examined I determined soil horizons, soil texture, soil moist color, described redoximorphic features present, and documented depth to groundwater and soil saturation if present. (NRCS, 2018).

Hydrophytic Vegetation

Predominance of "hydrophytic" (wetland) vegetation is one of the three parameters used to identify wetlands (Image 2). According to the USACE wetland delineation procedures, calls regarding presence or absence of hydrophytic vegetation are based on the "wetland indicator status" of each dominant species in the plant community being evaluated. Lichvar and others (2016) classified plant species into indicator status categories ranked from wettest to driest as follows: Obligate (OBL), Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU), Upland (UPL), and Not Listed (NI). Plant communities are considered to be hydrophytic (wetland vegetation) if greater than 50 percent of the plant cover by dominant species are ranked as OBL, FACW, or FAC (Dominance Test). The FAC-Neutral Test was calculated and used as a Wetland Hydrology secondary indicator, and is essentially the same as the Dominance Test, but it disregards dominant facultative plant species. See Table 2 for the list of plant species identified during field work.

Results

This survey was conducted in accordance with the three-parameter method of the U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual and the 2010 Regional Supplement: Western Mountains, Valleys and Coast Region (Version 2.0) (USACE, 1987 and 2010). The State of California - North Coast Regional Water Quality Board has jurisdiction and permit authority over "Waters of the State", which includes "isolated wetlands" (California State Water Resources Control Board, 2019). Wetlands within the parcel were mapped based on the presence of all three USACE parameters, hydric soil, wetland hydrology and hydrophytic vegetation for determining wetlands. Wetland-Upland boundaries were determined when one of the three parameters was no longer present. In addition, I mapped one-parameter wetlands (which include all three-parameter wetlands) (Figure 2 & 3).

There are two jurisdictional three-parameter wetlands (0.54 acre) within the Project Area (Figure 2); both are classified as Palustrine Emergent Herbaceous, Seasonally Saturated/Ponded wetland.

Assigned setbacks are 100 feet for three-parameter wetlands and 0 feet for the ditch (Class IV) and drainage pipe (California State Water Resources Control Board, 2019). The wetland setback is not 100 ft to the north and south due to parcel size constraints (Figure 3). Sample plot locations were selected based on varying plant communities as well as landscape position and slope shape. Nine upland locations are on planar to convex positions (plots 1,2,5,7,8,9,10,11 & 14) and five in concave positions (plots 3,4,6,12 & 13).

Hydrography and Wetland Hydrology

I mapped 503 linear feet of water ditches – drainage pipe within the parcel using LiDAR derived one-foot contours. There are 242 feet of open ditch and 361 of feet of drainage pipe (Figure 2, Images 1A through 1E & Images 2A through 2E).

Wetland hydrology indicators identified during field work were the present of surface water ponding (A1), groundwater (A2) and soil saturation (A3) within 12 inches of the soil surface.

In the wetland plots (Plots # 3, 4, 5, 6, 7, 9, 10, 11, 12, & 13), I observed groundwater with a median depth of nine inches and saturated soil with a median depth of five inches. For non-wetland plots (Plots # 1, 2, 8 & 14), I observed groundwater with a median depth of 19 inches and saturated soil with a median depth of 16 inches. Other wetland hydrology indicators observed were D2 Geomorphic position, D3 Shallow aquitard, and D5 FAC neutral test (Tables A1, A2 & A3).

Soils

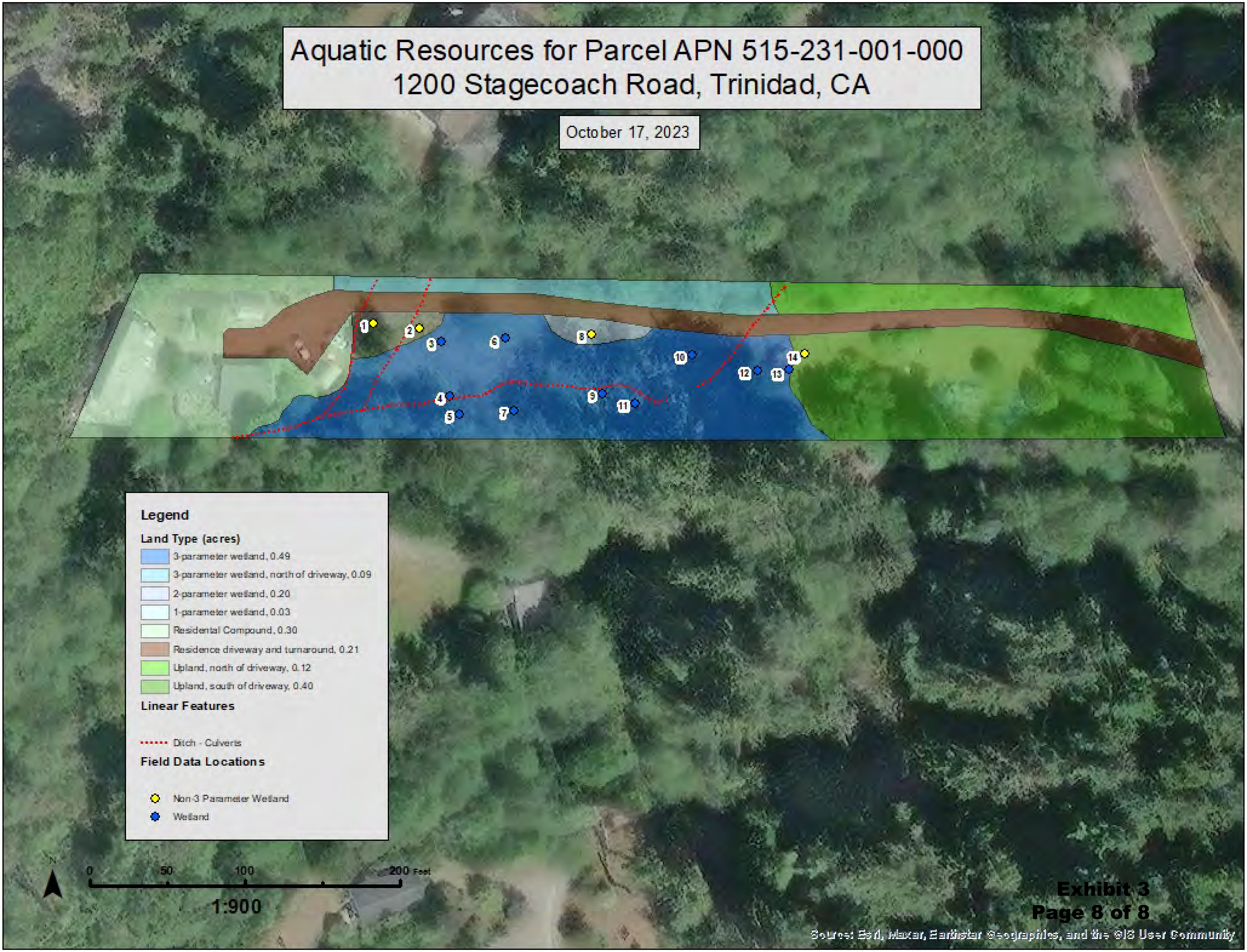
Of the 14 locations I described soils, ten soil profiles met the hydric soils definition (Appendix B). The hydric soil indicators identified were Depleted Below Dark Surface (A11), Depleted Below Thick Dark Surface (A12), Loamy Mucky Mineral (F1), Depleted Matrix (F3) and Redox Dark Surface (F6) (Tables A1, A2 & A3). The surface layers are a very dark brown or very dark grayish brown loam or mucky loam approximately 3 to 8 inches thick. Two subsurface layers to a depth of 20 inches were observed, the upper layers are very dark gray to very dark grayish brown clay loam approximately 5 to 10 inches thick and the lower layer are yellowish white to gray clay or silty clay 0 to 6 inches thick (Images 3B & 3C).

Four non-hydric soil profiles were described. The surface layers (forming in fill) are a very dark brown or very brown gravelly loam approximately 6 to 12 inches thick (Tables A1, A2 & A3). Subsurface layers to a depth of 20 inches are dark brown to very dark grayish brown clay loam (Image 3A).

Vegetation

Of the 15 locations I conducted a plant survey, 12 locations met the requirement (passed the Dominance Test) for Hydrophytic vegetation, and three passed the FAC Neutral Test, which is a secondary indicator of wetland hydrology (D5). All wetland plots displayed wetland hydrology and hydric soils, as a result existing plant communities by default are considered hydrophytic (Figure 2, Images 1A through 1E & Images 2A through 2E).

Dominate plants within the three-parameter wetland are creeping bentgrass (*Agrostis stolonifera, FAC),* common rush (*Juncus effusus, FACW),* bluegrass (*Poa pratensis, FAC),* panicled bulrush *(Scirpus microcarpus, OBL),* wax myrtle (*Morella californica, FACW),* red alder (*Alnus rubra, FAC), Festuca spp* (FAC-FACU?), and Sitka spruce (*Picea sitchensis, FAC)* (Table 2).


Aquatic Resources for Parcel APN 515-231-001-000
1200 Stagecoach Road, Trinidad, CA
October 17, 2023
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Legend
Land Type (acres)
3-parameter wetland, 0.49
3-parameter wetland, north of driveway, 0.09
2-parameter wetland, 0.20
1-parameter wetland, 0.03
Residental Compound, 0.30
Residence driveway and turnaround, 0.21
Upland, north of driveway, 0.12
Upland, south of driveway, 0.40
Linear Features
Ditch - Culverts
Field Data Locations
Non-3 Parameter Wetland
Wetland
N
0
50
100
200 Feet
1:900
Exhibit 3
Page 8 of 8
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Remediation Area Revegetation with Native Plants

APN 515-231-001-000

Trinidad, Humboldt County, California

September 30, 2022

Prepared for

Vicki and Russ Clanton
1200 Stagecoach Road
Trinidad, CA. 95570

Prepared by

Joe Seney, Natural Resources Scientist
California Professional Soil Scientist #243

Looking west towards existing vegetation, primary residence, and other buildings.

EXHIBIT NO. 4

Application No. 1-22-0292
CLANTON
Remediation Plan (excerpts) (Pg. 1 of 5)

Introduction

This document provides a Remediation Area Revegetation Plan (RAR), planting of native plant species for approximately 9,000 sq. ft. to be implemented by Russ and Vicki Clanton at their 1200 Stagecoach Road, Trinidad, CA., as a result of relocating the primary residence, workshop and small apartment on the parcel, and demolition of the art shack. The Objective of this remediation project is to revegetate approximately 9,000 sq ft of coastal bluff with plant species commonly found in Coastal scrub and Coastal prairie plant communities. Our goal is to reestablish native-plant dominated herbaceous and shrub high functioning habitat for migratory birds and small mammals.

Site Information

The parcel is located in Humboldt County, California, in the town of Trinidad (Figures 1 & 2). This parcel is located approximately two air miles north of Trinidad town center, within the Trinidad 7.5-minute USGS Quadrangle. The parcel is approximately 1.54 acres in size. The area to be remediated is approximately 9,000 sq. ft. adjacent to the bluff (Figure 3).

Climate

Climate exerts an influence on soil, hydrology, and vegetation at regional, local, and micro-scales. Regionally, cool, wet winters and nearly rainless summers characterize the climate of Humboldt County, California. Precipitation in the region follows a very strong seasonal pattern of a wet season (October to April) and a dry season (May to September). The average annual precipitation recorded at the Eureka Weather Station, California is 39.26 inches, with approximately 95% falling in the wet season.

Vegetation

Dominate plants within the remediation area are primarily ornamentals, native trees, ferns, non-native grasses and other non-native herbs and shrubs (Figure 4).

Geology & Soils

The Project Area is located on wave cut platform (marine terrace), which consist of a thin veneer of marine sediments, approximately 1 to 10 feet thick, overlain on weakly consolidated claystone (clayey matrix) with large pieces of more resistant rocks, mostly sandstone floating within the clayey matrix. Seeps are present at the contact between loamy marine sediments and the underlying dense clay, forcing groundwater to the soil surface.

Soils are very deep (>60” to bedrock) well drained (non-hydric), with redoximorphic features related to wet season saturation starting at a depth of >40 inches. Soil textures are loam, silt loam, or fine sandy loam in the very dark brown or dark brown surface horizons, and reddish yellow clay loam or sandy clay loam to a depth of 60 inches.

Soils in the adjacent wetland are very deep (>60” to bedrock) very poorly drained (hydric soil), with redoximorphic features related to wet season saturation starting near the soil surface. Soil textures are clay loam or loam in the very dark grayish brown or black surface horizons, and dark grayish brown or olive gray clay, silty clay or clay loam to a depth of 60 inches. Huntsinpillar soils are found in seeps, depressions and swales.

Natural Resources Scientist Qualifications

This Report was prepared by Joe Seney, a contracted wetland/soil scientist. Joe has over 28 years of experience working as a wetland/soil scientist for the USDI National Park Service, USDA National Resources Conservation Service and USDA Forest Service. In addition, he has taught soils and hydrology courses at Humboldt State University since 2007. Joe has an MSc. in Earth Sciences and a PhD (unfinished) in Soils with a supporting field of Plant Ecology.

Remediation Area Revegetation Plan Implementation Schedule

Native plants selected for revegetating this site are commonly found plants in Coastal Scrub and Coastal Prairie communities along the North Coast of California (Table 1). Approximately 60 percent of the area will be planted with plant species from Coastal scrub community and 40 percent from the Coastal Prairie community.

We will locally source plants and seed if possible. All plants will be set in “clumps” to mimic natural vegetation patterns based on landscape position, slope shape, soil properties and shading. In addition, creating healthy vertical structure (number of plant layers) and horizontal patchiness (increase number of micro-habitats) are primary objectives.

Species planted or seeded will be determined by local availability.

1. March-April 2023

    a. Removal of all vegetation from remediation project area.
    b. Topsoil, to a depth of 18 to 24 inches will be removed and stored onsite for later use.
    c. Remediation project area soil surface will be prepared for building relocation (April 2023).
    d. Cover soil surface with mulch and erosion control wattles if necessary.
    e. After buildings have been moved, Topographic complexity will be enhanced by using an excavator/dozer to build small hummocks, swales and terracettes.
    f. Stored topsoil will be placed.
    g. Planting will start in April if soil is moist.
    h. Depending of climate and soil conditions, watering and erosion control may be needed.
    i. Collection photo documentation of each phase.

Remediation Area Revegetation Plan Implementation Schedule (cont.)

2. May - October 2023

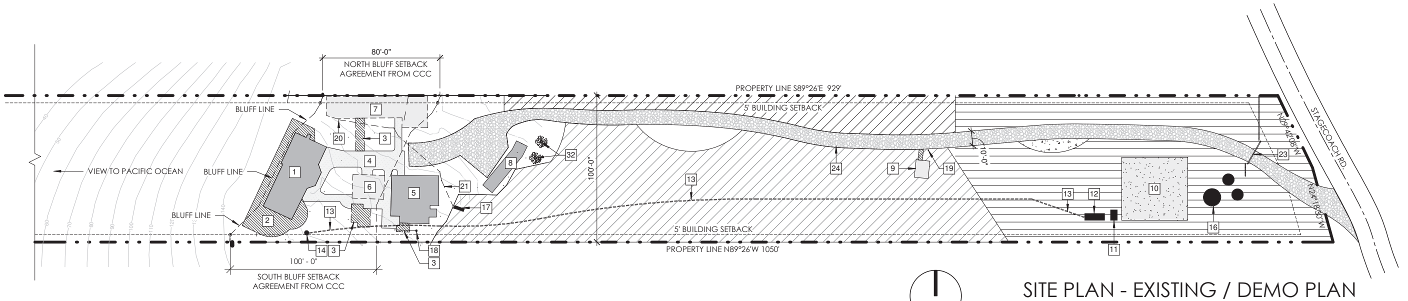
a. Depending of climate and soil conditions, watering and erosion control may be needed.
b. Additional mulching may be needed.
c. Collection photo documentation.
d. Conduct invasive species removal.
e. Additional planting or seeding as needed.

3. November 2023 - October 2028

a. Depending of climate and soil conditions, watering and erosion control may be needed.
b. Additional mulching may be needed.
c. Collection photo documentation.
d. Conduct invasive species removal.
e. Additional planting or seeding as needed.
f. In June 2024 determine plant cover by the line intercept method (4 randomly placed transects) to completed annually (every June).
g. After five years the goal is to have cover of native species greater than 80 percent; bare ground of less than 20 percent, and less than 20 percent non-native invasive species present.

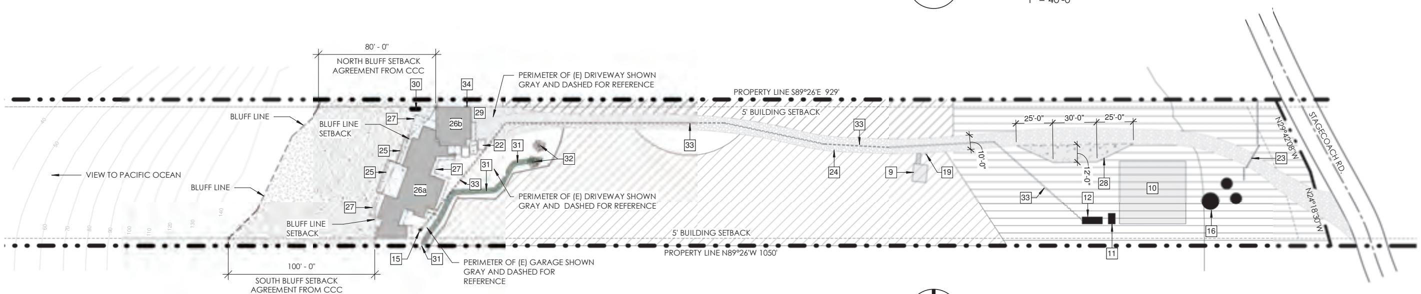
Table 1. Potential Plant Species for Remediation Area Revegetation from Coastal Scrub & Prairie Communities.

Common Name	Scientific Name	Life Form
Bracken fern	*Pteridium aquilinum*	Fern
Coastal wood fern	*Dryopteris arguta*	Fern
Common grapefern	*Sceptridium multifidum*	Fern
Gold-back fern	*Pentagramma triangularis ssp. Triangularis*	Fern
Lady fern	*Athyrium filix-femina var. cyclosorum*	Fern
Leather-leaf fern	*Polypodium scouleri*	Fern
Licorice fern	*Polypodium calirhiza*	Fern
Brome fescue	*Festuca rubra*	Grass
California oatgrass	*Danthonia californica*	Grass
California fescue	F*estuca californica*	Grass
Coastal fescue	*Festuca elmeri*	Grass
Hall's bentgrass	*Agrostis hallii*	Grass
Meadow barley	*Hordeum brachyantherum ssp. brachyantherum*	Grass
Mountain brome	*Bromus carinatus var. carinatus*	Grass
Reedgrass	*Calamagrostis nutkaensis*	Grass
Tuffed hairgrass	*Deschampsia cespitosa ssp. Holciformis*	Grass
Blue dicks	*Dichelostemma capitatum*	Herb
California poppy	*Eschscholzia californica*	Herb
Cow parsnip	*Heracleum lanatum*	Herb
Coastal golden yarrow	*Eriophyllum staechadifolium*	Herb
Douglas iris	*Iris douglasiana*	Herb
False lily of the valley	*Maianthemum dilatatum*	Herb
Fireweed	Chamerion angustifolium ssp. Circumvagum	Herb
Seacoast angelica	*Angelica lucida*	Herb
Seaside Daisy	*Erigeron glaucus*	Herb
Sticky Monkey Flower	*Mimulus aurantiacus*	Herb
Western blue-eyed grass	*Sisyrinchium bellum*	Herb
Blueblossom	*Ceanothus thyrsiflorus var. repens*	Shrub
California blackberry	*Rubus ursinus*	Shrub
Coast silk-tassel	*Garrya elliptica*	Shrub
Coyote brush	*Baccharis pilularis*	Shrub
Pink-flowering currant	*Ribes sanguineum var. glutinosum*	Shrub
Salal	*Gaultheria shallon*	Shrub
Salmonberry	*Rubus spectabilis*	Shrub
Thimbleberry	*Rubus parviflorus*	Shrub
Yellow bush lupine	*Lupinus arboreus*	Shrub
Wax myrtle	*Morella californica*	*Tree*



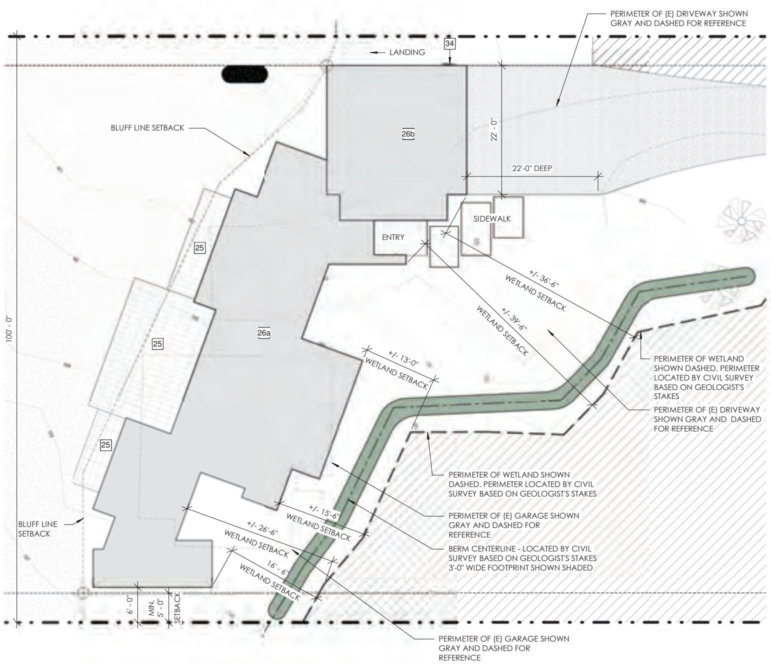
SITE PLAN - EXISTING / DEMO PLAN

1" = 40'-0"



SITE PLAN - PROPOSED PLAN

1" = 40'-0"



SITE PLAN - PROPOSED ENLARGED PLAN

1" = 10'-0"

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TOTAL REDUCTION IN AREAS - EXISTING TO PROPOSED

EXISTING DRIVEWAY AREA

GRAVEL DRIVEWAY	**8024 SF**

NEW DRIVEWAY AREA

MIN. SRA TURNOUT AREA:	660 SF
TOTAL DRIVEWAY AREA:	**8,684 SF**

660 SF INCREASE IN AREA OF PERMEABLE DRIVEWAY TO MEET SRA REQUIREMENTS

EXISTING DECKING/HARDSCAPE AREA

(E) DECK OFF (E) HOUSE	1430 SF
(E) DECKING (PREVIOUSLY REMOVED)	390 SF
TOTAL (E) DECKING TO BE REMOVED	**1820 SF**

NEW DECKING AREA

PROPOSED FIRST FLOOR DECKING:	**495 SF**

1325 SF REDUCTION IN AREA OF DECKING

EXISTING HARDSCAPE AREA

TOTAL (E) HARDSCAPING TO BE REMOVED	**1425 SF**

NEW HARDSCAPING AREA

NEW PERMEABLE HARDSCAPING: (ENTRYWAY, SIDEWALK, LANDING OFF GARAGE)	**189 SF**

***1236 SF REDUCTION IN AREA OF HARDSCAPING**

EXISTING STRUCTURES AREA

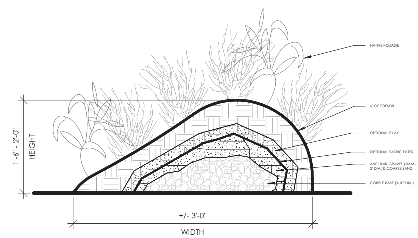
(E) RESIDENCE	1300 SF
(E) GUEST HOUSE	360 SF
(E) GARAGE	1000 SF
(E) STORAGE BLDG	1150 SF
(E) WOOD SHED	300 SF
TOTAL (E) STRUCTURES TO BE REMOVED	**4,110 SF**

NEW RESIDENCE AREA

FIRST FLOOR FOOTPRINT (CONDITIONED):	1650 SF
SECOND FLOOR FOOTPRINT (CONDITIONED):	923 SF
TOTAL PROPOSED CONDITIONED SF:	**2,573 SF**
2-CAR GARAGE (UNCOND.)	*606 SF*
STORAGE ABOVE GARAGE(UNCOND.)	*640 SF*

CONCLUSION

THE PROPOSED FIRST FLOOR FOOTPRINT (1650 SF)AND GARAGE (606 SF) TOTAL 2,256 SF. THIS IS THE ONLY BUILDING AREA, BOTH CONDITIONED AND UNCONDITIONED, ON THE GROUND LEVEL. WHEN COMPARING THIS AREA TO ALL THE EXISTING BUILDING AREA THAT WAS ON THE GROUND LEVEL (4,110 SF) WE HAVE REDUCED THE TOTAL GROUND LEVEL FOOTPRINT BY 45%. THE AREA THAT WILL NO LONGER BE COVERED BY THE REMOVED BUILDINGS WILL BE PART OF THE REMEDIATION EFFORTS ON THIS SITE.



5 BERM DETAIL
1" = 1'-0"

KEYNOTES

1. (E) SINGLE FAMILY RESIDENCE TO BE REMOVED: 1,300 SF - SEE SEPARATE DEMOLITION NOTES PROVIDED BY OTHERS
2. (E) DECK OFF MAIN HOUSE TO BE REMOVED (SHOWN HATCHED): 1,430 SF - SEE SEPARATE DEMOLITION NOTES PROVIDED BY OTHERS
3. (E) DECKING PREVIOUSLY REMOVED (SHOWN HATCHED): 390 SF
4. (E) CONCRETE AND BRICK HARDSCAPING TO BE REMOVED: +/- 1,425 SF
5. (E) 2-CAR GARAGE, ART STUDIO, & FULL BATH TO BE REMOVED: 1,000 SF - SEE SEPARATE DEMOLITION NOTES PROVIDED BY OTHERS
6. PREVIOUSLY REMOVED GUEST HOUSE WITH SINGLE BEDROOM AND BATHROOM: +/-360 SF
7. PREVIOUSLY REMOVED STORAGE BUILDING: +/-1,150 SF
8. (E) WOOD & STORAGE SHED TO BE REMOVED: +/- 300 SF - SEE SEPARATE DEMOLITION NOTES PROVIDED BY OTHERS
9. (E) PUMP HOUSE TO REMAIN: ± 64 SF
10. (E) LEACH FIELD TO REMAIN - (5) 45' LINES
11. (E) 750 GAL. PUMP TANK TO REMAIN
12. (E) 1500 GAL. SEPTIC TANK TO REMAIN
13. (E) 2" PVC SEPTIC LINE
14. (E) SANITARY LID TO 500 GAL. SEPTIC TANK W/ GRINDER PUMP TO BE ABANDONED
15. (N) SEPTIC TANK W/ GRINDER PUMP
16. (E) WATER STORAGE TANKS - (2) 500 GAL. TANKS & (1) 1,000 GAL. TANK TO REMAIN
17. (E) PROPANE TANK TO BE REMOVED AND RELOCATED
18. (E) UTILITY POLE TO BE REMOVED BY PG&E
19. (E) WATER HYDRANT
20. (E) GAS VALVE - TO BE REMOVED AND RELOCATED
21. (E) GAS LINE TO BE REMOVED
22. (N) PERVIOUS SIDEWALK
23. (E) PROPERTY GATE TO REMAIN
24. (E) GRAVEL DRIVEWAY TO REMAIN
25. (N) PERMEABLE DECKING

26a (N) SINGLE-FAMILY RESIDENCE

26b (N) TWO-CAR GARAGE

27. OUTLINE OF (N) ROOF AND 2ND FLOOR ABOVE
28. (N) SRA TURNOUT PER HUMBOLDT COUNTY CODE SECTION 3112-8 AND 14 CCR 1273.06.
29. CONNECT (E) DRIVEWAY TO (N) GARAGE w/ PERVIOUS DRIVEWAY MATERIAL (DASHED LINE SHOWS EXTENT OF (E) DRIVEWAY FOR REFERENCE)
30. NEW PROPANE TANK
31. CENTERLINE OF 1'-6" HIGH BERM PLANTED WITH NATIVE PLANTS AND SHRUBS - CENTERLINE WAS LOCATED BY CIVIL SURVEY BASED ON GEOLOGIST'S STAKES
32. (E) REDWOOD TREES
33. (N) PVC SEPTIC LINE INSTALLED UNDER (E) DRIVEWAY (WHERE OCCURS)
34. ELECTRICAL PANEL AND METER

GENERAL NOTES

1. PROJECT TO BE CONSTRUCTED UNDER ALTERNATE OWNER BUILDER PERMIT (AOB).
2. REQUIRED COUNTY SETBACKS FOR RA ZONING DISTRICT LESS THAN 2.5 ACRES ARE 20' FRONT SETBACK, 10' REAR SETBACK, AND 5' SIDE SETBACKS.
3. EXISTING RESIDENCE WAS CONSTRUCTED IN 1945.
4. NO KNOWN EASEMENTS EXIST ON THE SITE.
5. SITE PLANS ARE APPROXIMATE AND FOR GENERAL REFERENCE ONLY. SITE DATA SHOWN IS BASED ON TOPOGRAPHIC SURVEY DATED 11.02.2023 AND HUMBOLDT COUNTY GIS.
6. ANY NEW SITE HARDSCAPING SHALL BE PERMEABLE MATERIALS.

SITE PLAN LEGEND

3 PARAMETER HERBACEOUS WETLAND (3 PHW)

UPLAND AREA

PROPOSED RESTORATION / REMEDIATION AREA (>5,500 SF) - SEE BIOLOGICAL REPORT

ELEVATION H DESIGN
coast 2 coast architecture

STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

CLIENT

RUSS CLANTON & VICKIE HAWKINS-CLANTON

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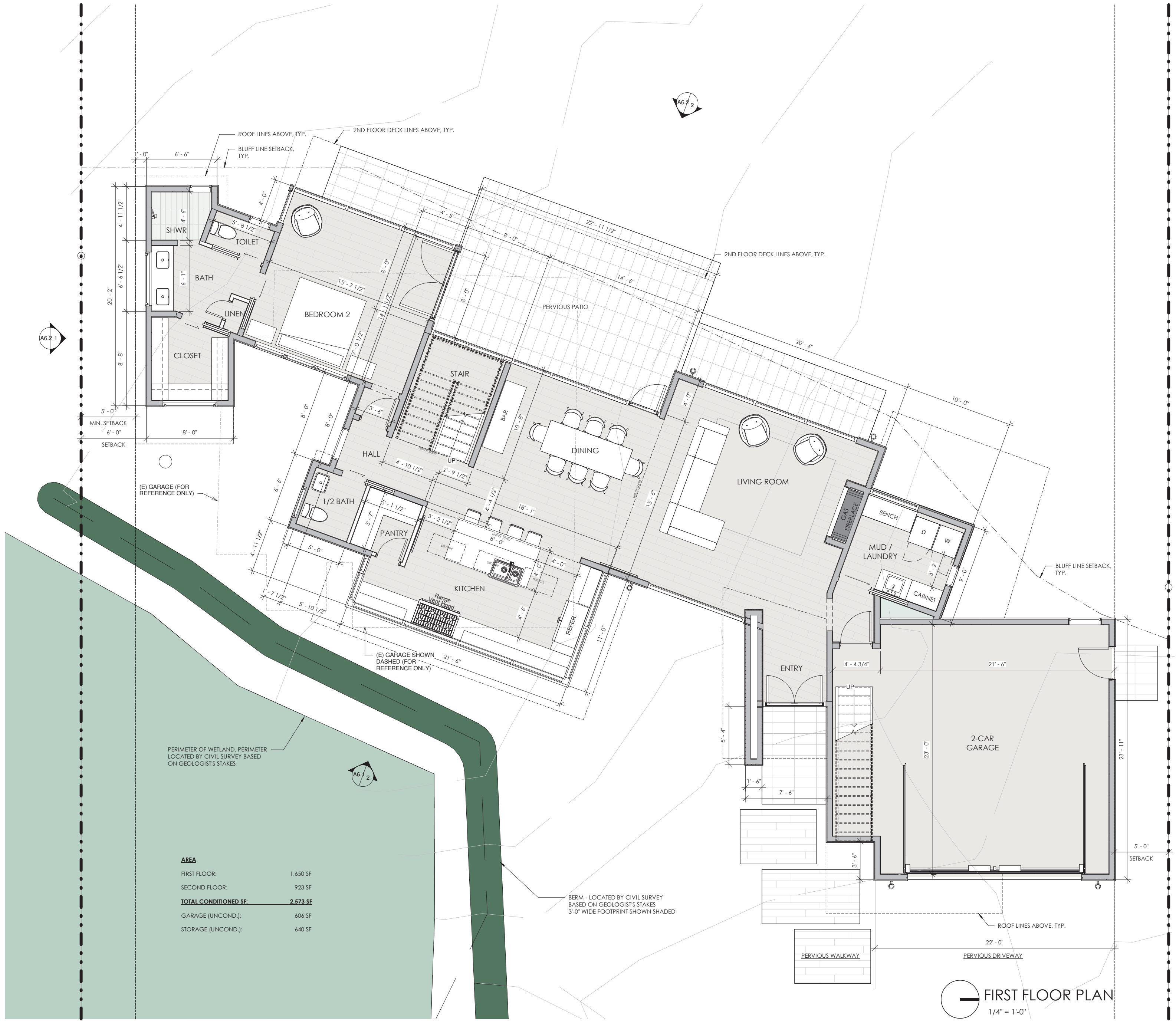
SITE PLAN

EXHIBIT NO. 5

Application No. 1-22-0292
CLANTON
Project Plans (pg. 1 of 6)



FIRST FLOOR PLAN
1/4" = 1'-0"

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STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

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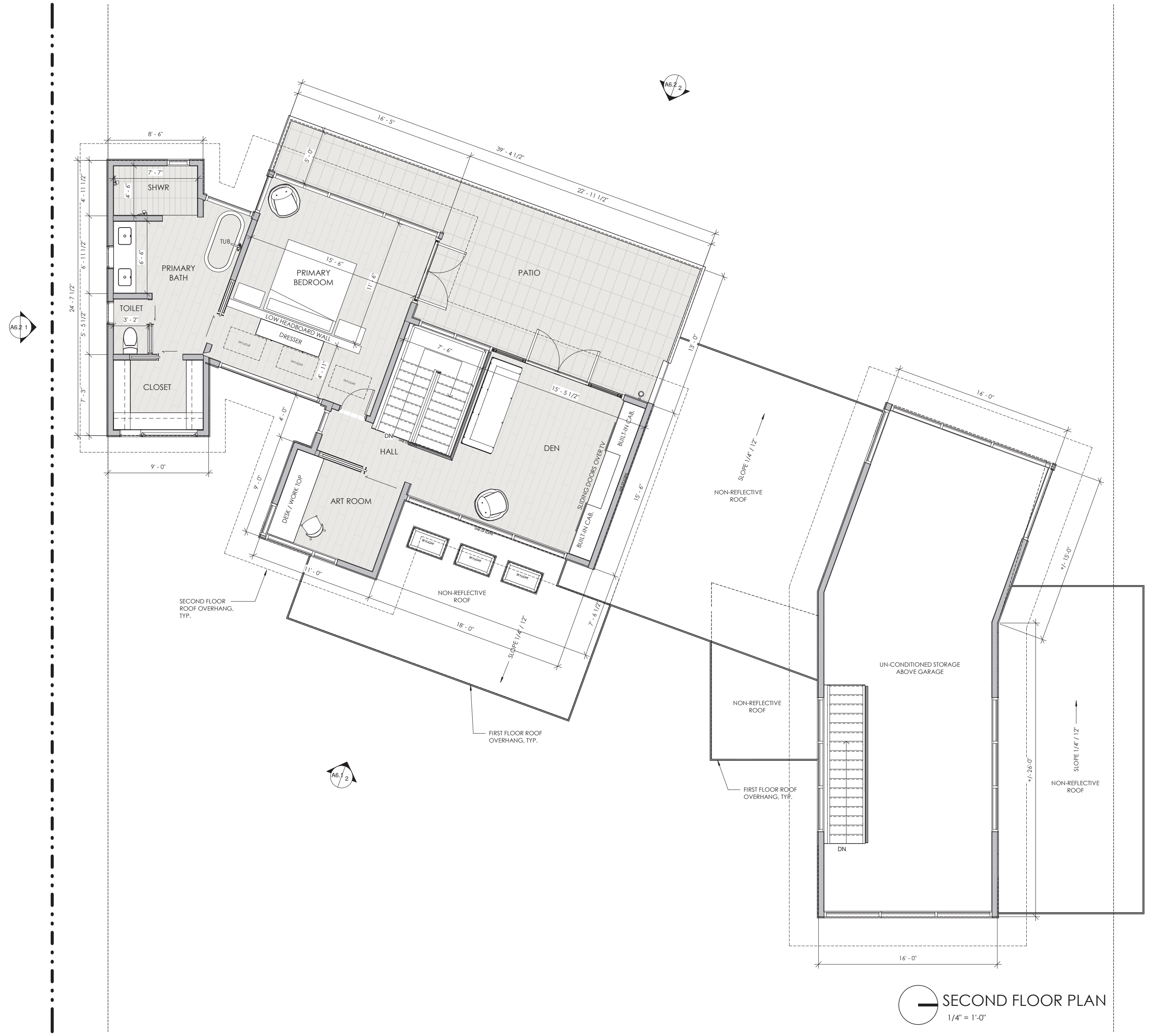
FIRST FLOOR PLAN

A2.1

Exhibit 5
Page 2 of 6



SECOND FLOOR PLAN
1/4" = 1'-0"

ELEVATION H DESIGN
coast 2 coast architecture

STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

CLIENT

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SECOND FLOOR PLAN

A2.2

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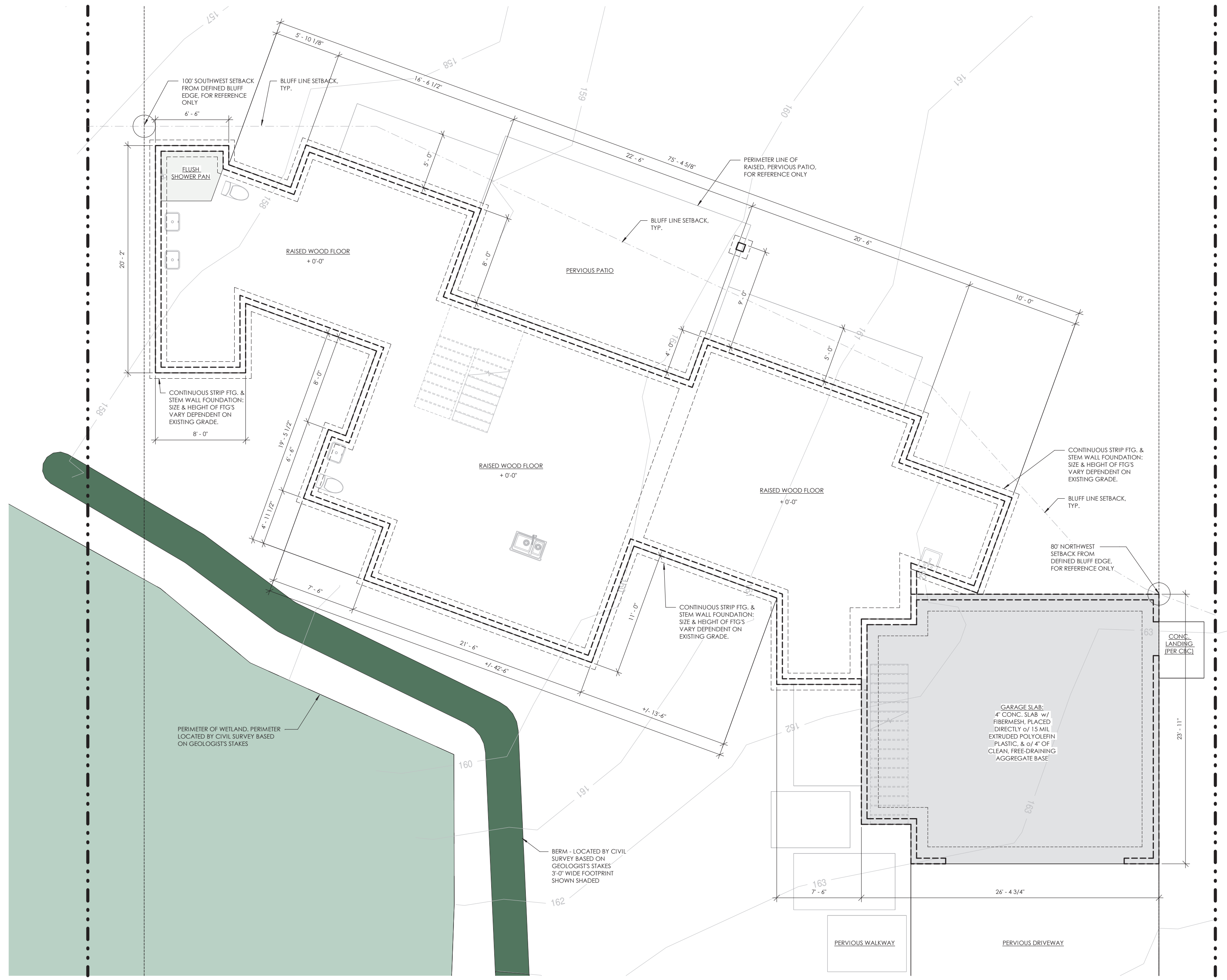

FIRST FLOOR FOUNDATION PLAN
1/4" = 1'-0"

ELEVATION H DESIGN
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STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

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PRELIMINARY FOUNDATION PLAN

A2.5

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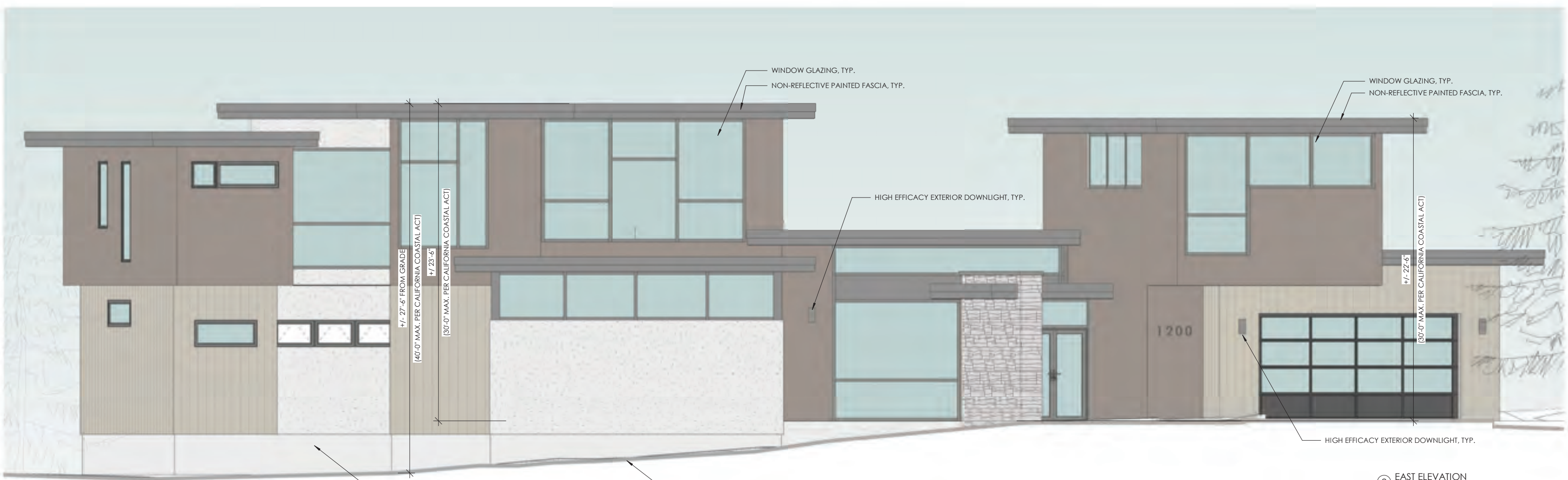
Exhibit 5
Page 4 of 6

1 NORTH ELEVATION
1/4" = 1'-0"



2 EAST ELEVATION
1/4" = 1'-0"

MATERIALS LEGEND

NOTE: VERIFY FINAL MATERIAL SELECTION AND COLOR w/ OWNER.

- NON-REFLECTIVE, 2-COAT SAND FINISH ACRYLIC STUCCO O/ 1" RIGID FOAM - NATURAL EARTH TONE COLOR IS COMPATIBLE WITH ADJACENT NATIVE MATERIAL PALETTE
- NON-REFLECTIVE, STONE VENEER - STONE TO MATCH AND RESEMBLE ADJACENT NATURAL LANDSCAPE
- ENGINEERED WOOD SIDING - 'DASSO XTR' 1x6 COMPOSITE CLASS "A" WOOD. COLOR: "EPIC COGNAC" APPROVED FOR CALIFORNIA WUI AREAS o/ 7/16" EXPOSURE 1 OSB - LISTING # 8140-2032:0003 - COLOR OF WOOD IS COMPATIBLE WITH ADJACENT NATIVE MATERIAL PALETTE
- ENGINEERED WOOD SIDING - 'DASSO XTR' 1x6 COMPOSITE CLASS "A" WOOD. COLOR: "EARTH" APPROVED FOR CALIFORNIA WUI AREAS o/ 7/16" EXPOSURE 1 OSB - LISTING # 8140-2032:0003 - COLOR OF WOOD IS COMPATIBLE WITH ADJACENT NATIVE MATERIAL PALETTE

ELEVATION H DESIGN
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STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

CLIENT

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EXTERIOR ELEVATIONS

A6.1

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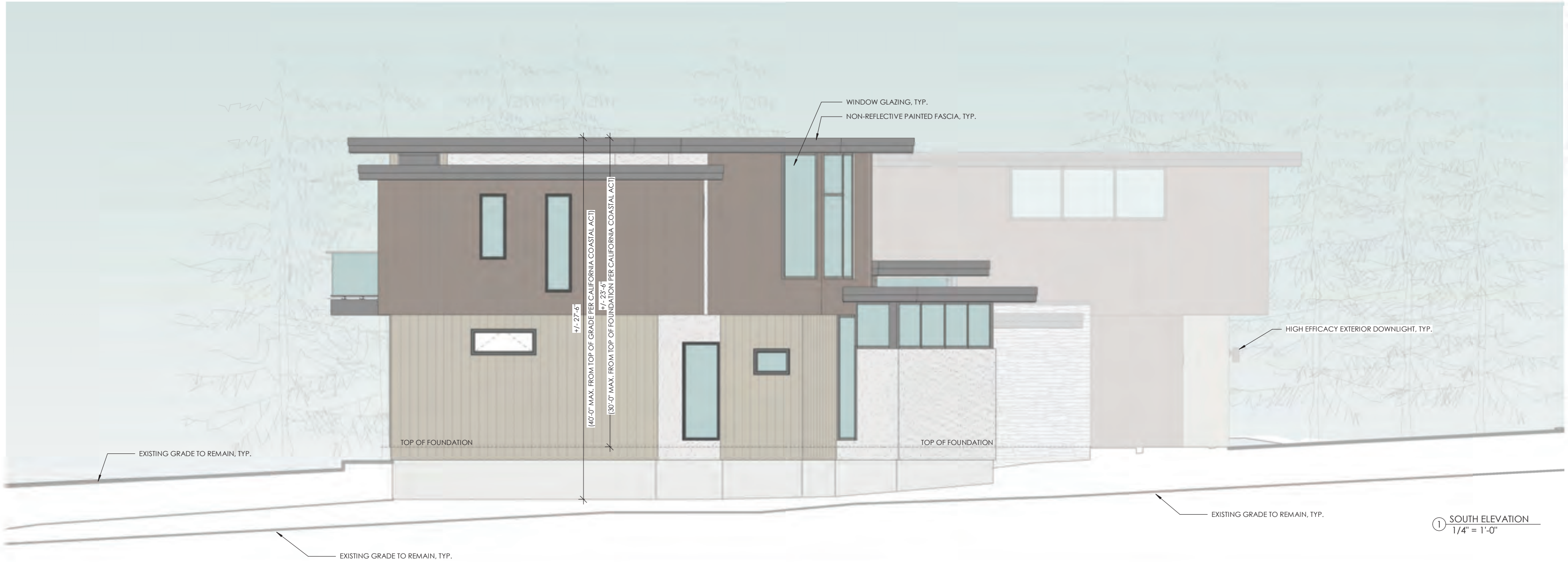

1 SOUTH ELEVATION
1/4" = 1'-0"

2 WEST ELEVATION
1/4" = 1'-0"

MATERIALS LEGEND

NOTE: VERIFY FINAL MATERIAL SELECTION AND COLOR w/ OWNER.

- NON-REFLECTIVE, 2-COAT SAND FINISH ACRYLIC STUCCO O/ 1" RIGID FOAM - NATURAL EARTH TONE COLOR IS COMPATIBLE WITH ADJACENT NATIVE MATERIAL PALETTE
- NON-REFLECTIVE, STONE VENEER - STONE TO MATCH AND RESEMBLE ADJACENT NATURAL LANDSCAPE
- ENGINEERED WOOD SIDING - 'DASSO XTR' 1x6 COMPOSITE CLASS "A" WOOD, COLOR: "EPIC COGNAC" APPROVED FOR CALIFORNIA WUI AREAS o/ 7/16" EXPOSURE 1 OSB - LISTING # 8140-2032:0003 - COLOR OF WOOD IS COMPATIBLE WITH ADJACENT NATIVE MATERIAL PALETTE
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ELEVATION H DESIGN
coast 2 coast architecture

STAGECOACH RESIDENCE

1200 STAGECOACH RD.
TRINIDAD, CA 95570

CLIENT

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EXTERIOR ELEVATIONS

A6.2

CALIFORNIA COASTAL COMMISSION
455 MARKET STREET, SUITE 300
SAN FRANCISCO, CA 94105-2219
VOICE (415) 904-5200

April 25, 2024

TECHNICAL MEMORANDUM

To: Catherine Mitchell, Coastal Program Analyst
Melissa Kraemer, Coastal Program Manager

From: Philip Johnson, P.G., C.E.G., Engineering Geologist
Joseph Street, Ph.D, P.G., Senior Environmental Scientist - Supervisor

Re: 1200 Stagecoach Road, Trinidad area of Humbolt County
CDP application 1-22-0292

The purpose of this memorandum is to respond to an application to demolish an existing residence and build a new residence set back from the bluff top at the subject property. To this end, we reviewed the following documents:

1. Geologic Hazard Assessment and Coastal Bluff Setback Analysis, 1200 Stagecoach Road, Trinidad, Humbolt County APN 515-231-001 (Report), prepared by SHN, dated August 13, 2021;

2. Foundation Soils Investigation Report – Proposed Residential Development, 1200 Stagecoach Road, Trinidad, Humbolt County, California (Report), prepared by SHN, dated March 3, 2023;

3. Review of Site Development Plan for Compliance with Bluff Development Setback Recommendations – Proposed Residence, 1200 Stagecoach Road, Trinidad, Humbolt County; APN 515-231-001 (Report), prepared by SHN, dated March 1, 2024.

The subject property is an elongate parcel oriented in an east-west direction that extends westward from Stagecoach Road to the Pacific shore. An existing residence is located at the top of the coastal bluff. Landslide movement has damaged the existing structure. The applicant proposes to demolish the existing residence and construct a new residence approximately 80 to 100 ft east of the coastal bluff.

SITE DESCRIPTION

The site is located within the seismically active Cascadia Subduction Zone region, north of the Mendocino Triple Junction. The site stratigraphy consists of Pleistocene terrace deposits overlying mélange of the Franciscan Complex. Our review of the available topographic mapping and aerial photographs indicates that the coastal bluff at the west end of the property contains multiple landslides as does the bluff southwest of the property. The bluff top edge in this area appears to be formed by the arcuate headsc of several landslides. It is our understanding that the landslide on the bluff at the west end of the property has reactivated, and scarps have appeared east of the bluff top, indicating retrogression of landsliding into a previously stable portion of the property. This new landslide movement behind the bluff top has damaged the existing residence located at the bluff top. Figure 2 of the Geologic Hazard Assessment and Coastal Bluff Setback Analysis report by SHN (2021) indicates that landslide-related scarps and possible ground cracks were mapped approximately 40 to 50 ft east of the bluff top. The mapped landslide features help to explain the cause of the distress to the existing structure.

DISCUSSION

The bluff retreat evaluation prepared by SHN (2021) indicates that the highest historical bluff retreat rate for the site is approximately 1 ft per year. Allowing for an increase in retreat due to sea level rise, they concluded that a rate of 1.1 ft per year would be appropriate. They also provided an estimate of 25 feet from the bluff edge to allow for factor of safety (FS) of 1.5. These calculations result in a structural setback value of 107 feet for a new structure with a 75-year design life. They recommended adding 10 ft to allow for uncertainty in the estimated bluff retreat rate, resulting in a total setback recommendation of 117 ft from the bluff top. They did not comment on the evidence of active landslide scarps and ground cracks east of the bluff top (and east of the estimated FS=1.5 line) in their discussion of the setback recommendations.

SHN (2021) also indicated that the landslides on the coastal bluffs are predominantly earth flows, though they acknowledged that translational or rotational landsliding may also occur within the underlying Franciscan Complex. However, the subsurface exploration for their investigation did not identify the basal rupture surface of the landslide that impacts the area of the existing residence, and that landslide does not appear to fit a shallow earthflow interpretation. Determination of depth to basal rupture surface requires a more robust drilling method (such as mud rotary continuous coring for instance) drilled to greater depths than the hand augering and direct push sampling utilized for the investigation by SHN (2021, 2023).

Slope stability analyses were performed for the referenced investigation. In order to complete a slope stability analysis for any landslide, several parameters are needed, including the topographic profile, the subsurface geology, the subsurface geometry of the landslide, groundwater pore pressures at the basal rupture surface of the landslide, shear strength values for the basal rupture surface of the landslide, and shear strength values for the materials beneath the landslide as well as within the landslide. In this case, it is also necessary to determine the shear strength of the materials upslope of the landslide in terms of both bulk rock strengths and the shear strengths of any shear zones or other zones and planes of weakness within the materials that have not yet become involved in landsliding. It is not unusual for landslide movement to follow existing planes of weakness within bedrock, and the mélange of the Franciscan Complex has a weak matrix that typically shows evidence of previous shearing, likely related to an origin within an accretionary prism. SHN (2021) performed a slope stability analysis that utilized bulk strengths for colluvium, terrace deposits, and Franciscan Complex bedrock. They did not identify the subsurface geometry of the landslide or collect samples of the basal rupture surface gouge for laboratory testing to determine shear strength values. The results of the analyses performed by SHN (2021) indicate that the FS for a landslide or earth flow on the bluff face (with a hypothetical subsurface geometry) is 1.0 under static conditions and 0.7

with seismic loads. They did not provide an analysis demonstrating their conclusions that FS=1.5 can be achieved with a setback of 25 ft from the bluff edge. Given that active landslide movement was observed farther east than 25 ft from the bluff edge, the identified FS=1.5 line does not appear valid. An actively failing slope cannot have a factor of safety greater than 1.0.

In a revision to their original setback recommendations, SHN (2024) indicated that a setback of approximately 80 to 100 ft from the bluff top would allow for a 75-year design life for a new structure. Given that landslide-related deformation was observed at the ground surface 40 to 50 ft east of the bluff top, the proposed setback of 80 to 100 ft from the bluff top appears to be in the approximate range of 40 to 50 feet east of the observed surface evidence of active landslide-related deformation.

The rate and magnitude of bluff retreat at the site over the next 75 years will be heavily dependent on future landslide activity, which will in turn be related in part to marine erosion occurring at the toe of the bluff. Sea level rise related to global climate change is expected to increase rates of coastal bluff erosion by driving the inland migration of the shoreline and reduced beach widths, and by increasing the frequency and energy with which waves strike the base of the bluffs. SHN (2021, 2023) has estimated that sea level rise may increase the long-term average rate of bluff retreat by 10%, and added an additional 10-foot buffer to their recommended development setback to account for uncertainties in this estimate. While acknowledged the high level of uncertainty associated with both the amount and rate of future sea level rise and its effects on bluff erosion in a given location, we note that many scientific projections of future bluff retreat suggest a much greater effect than the 10% increase assumed by SHN. For example, recent bluff retreat projections from the U.S. Geological Survey (based on an ensemble of process-based models) indicate that, on a statewide basis, sea level rise of 3.3 to 6.6 feet (1 – 2 meters) by 2100 could increase bluff retreat rates by a factor of two or more (>100% increase) (Limber et al. 2018[1]; Barnard et al. 2018[2]). SHN's approach does not provide a conservative estimate of the potential for future bluff retreat at this site over the next 75 years, particularly under higher-end sea level rise scenarios (>3.3 feet).

CONCLUSIONS

The data and analyses provided by the applicant's consultant do not sufficiently support a setback of 40 to 50 ft from the landslide that damaged the previous residence (80 to 100 ft from the bluff edge), if a 75-year design life is expected. Furthermore, the claim that a setback of 25 ft from the bluff edge could provide a factor of safety of 1.5 is contradicted by the consultant's field observations and the landslide-related damage to the existing residence.

---

[1] Limber, PW, Barnard, PL, Vitousek, S, and Erikson, LH, 2018. A model ensemble for projecting multi-decadal coastal cliff retreat during the 21st century. *Journal of Geophysical Research Earth Surface*, doi: 10.1029/2017JF004401.

[2] Barnard, P.L., Erikson, L.H., Foxgrover, A.C., Limber, P.W., O'Neill, A.C., and Vitousek, S., 2018, Coastal Storm Modeling System (CoSMoS) for Southern California, v3.0, Phase 2 (ver. 1g, May 2018): U.S. Geological Survey data release. https://doi.org/10.5066/F7T151Q4.

If the applicant constructs a new residence at the proposed location, they should be aware that the residence may experience severe and perhaps irreparable damage from landsliding. At a minimum, we recommend that special conditions be added to the coastal development permit that provide for the following (1) A deed restriction notification to buyers that this property has experienced active landsliding and the structure is at risk of damage due to landsliding; (2) the owner should retain a Certified Engineering Geologist to perform regular inspections of the site to monitor for signs of landslide movement and provide measurements of bluff retreat, and report the results to the owner; (3) future removal or relocation of all or portions of the structure if threatened by landslide movement or bluff retreat.

Lastly, while we understand the subject property faces several resource and infrastructure constraints that may limit options for siting the residence, the applicant should consider the benefits of constructing the proposed residence much farther east and closer to Stagecoach Road instead of the proposed location. In our opinion, this is by far the safest and most certain option for reducing the risk from geologic hazards.

Sincerely,

Philip L. Johnson, P.G. 6196, C.E.G. 2019, Engineering Geologist

Joseph Street, Ph.D, P.G. 9691, Senior Environmental Scientist - Supervisor