Appendix E
Paleontological Resources Technical Report

PALEONTOLOGICAL RESOURCES TECHNICAL REPORT FOR THE CITY OF SEAL BEACH HOUSING ELEMENT AND ZONING CODE UPDATES PROJECT, ORANGE COUNTY, CALIFORNIA

An analysis of existing data in support of CEQA review

October 25, 2024

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Stantec Project Number:
2042665000

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Executive Summary

Stantec Consulting Services Inc. (Stantec) conducted a paleontological resources assessment on behalf of the City of Seal Beach (the City) for the City's Housing Element and Zoning Code Updates Project (the Project) composed of eight separate sites totaling 83.45 acres throughout Seal Beach in Orange County, California. Proposed updates to the Housing Element include the identification of eight Housing Opportunity Sites and the Main Street Program, a modification of the existing Main Street Specific Plan to provide additional residential developments at currently unspecified locations.

This paleontological study was conducted in support of California Environmental Quality Act (CEQA) review of the Project, including the eight specific Housing Opportunity Sites and the Main Street Program area. The proposed Project is subject to CEQA requirements regarding the Project's potential impacts on paleontological resources, with the City serving as the lead agency for the Project. As part of CEQA compliance, a paleontological resources assessment was conducted to assess potential impacts of the proposed Project on paleontological resources.

This assessment consisted of an analysis of existing data including a museum records search from the Natural History Museum of Los Angeles County and a review of the most recent geologic mapping, relevant scientific literature, and the online collections of the University of California Museum of Paleontology. This research was used to assign paleontological potential rankings of the Society of Vertebrate Paleontology (2010) to the geologic units present in the Project area, either at the surface or in the subsurface.

The results of this study indicate that four geologic units are likely present in the Project area: beach and paralic estuarine deposits, which are assessed as having low paleontological potential; unit 2 of young alluvium which is assessed as having low-to-high paleontological potential, increasing with depth, and old shallow marine deposits on a wave-cut surface, which are assessed as having high paleontological potential. Additionally, older Pleistocene-aged marine formations with high paleontological potential such as the San Pedro Formation, Palos Verdes Sand, the Lomita Marl, and the Timms Point Silt may be present in the subsurface, underlying the other units. Should fossils with scientific importance be encountered during one of the resulting development projects from the updates to the Housing Element, the damage or destruction of the resources would constitute an indirect adverse impact of this Project.

In order to reduce such impacts to less than significant, Stantec recommends a qualified paleontologist meeting professional standards as defined by Murphey et al. (2019) be retained as the designated Project Paleontologist to review project-specific construction plans and develop a project-specific paleontological mitigation program. The mitigation program should include the following components:

- For each development the Project Paleontologist should develop and oversee the implementation of a Paleontological Monitoring and Mitigation Plan tailored to specific construction plans and geotechnical studies, should these be available, that identifies when or under what conditions paleontological monitoring should be implemented. The plan should include provisions for worker training, roles and qualifications of paleontology staff following those of Murphey et al. (2019),

depths and locations for monitoring, types of work to be monitored, monitoring procedures, requirements for final reporting of the results of the mitigation program, and fossil discovery protocols for work stoppage, assessment, and possible salvage and curation, in the event a fossil is found during construction.

- Fulltime paleontological monitoring is warranted when work occurs in the geologic units assessed as having high paleontological potential in this study: when over 5 foot in depth in unit 2 of the young alluvium, or at any depth in old shallow marine deposits on a wave-cut surface, the San Pedro Formation, the Paleo Verdes Sand, the Lomita Marl, and the Timms Point Silt. Work into previously disturbed sediments, beach deposits, paralic estuarine deposits, or the upper 5 feet unit 2 of the young alluvium does not require monitoring. After the initiation of the monitoring work, the Project Paleontologist may reduce the frequency or depths of monitoring should low paleontological potential sediments be identified in the monitoring area.
- The Project Paleontologist should develop a Worker's Environmental Awareness Program training that communicates requirements and procedures for the inadvertent discovery of fossils during construction, to be delivered by the paleontological monitor to the construction crew prior to the onset of ground disturbance.
- In the event that paleontological resources are encountered during construction activities, work should stop in a safe radius of the finds, usually 50 feet, while the paleontological monitor documents the find. If a monitor is not onsite at the time of discovery, such as for an inadvertent discovery in an area of low paleontological potential, work should stop until the Project Paleontologist can assess the find. The Project Paleontologist shall assess the find. Should the Project Paleontologist assess the find as scientifically important, the find shall be collected and curated in an accredited repository along with associated data such as photographs, GPS coordinates, lithological descriptions, and depth data, as well as curation fees.

Acronyms / Abbreviations

bgs	Below ground surface
CEQA	California Environmental Quality Act
City	City of Seal Beach
GIS	Geographic Information System
LACM	Natural History Museum of Los Angeles County
Ma	Million years ago
PRC	Public Resources Code
Project	Housing Element and Zoning Code Updates Project
RHD	Residential High Density
RHNA	Regional Housing Needs Assessment
Stantec	Stantec Consulting Services Inc.
SVP	Society of Vertebrate Paleontology
UCMP	University of California Museum of Paleontology

Glossary

Paleontological Monitor	An individual who has academic training (B.S., B.A., M.A., or M.S.) with an emphasis in paleontology or demonstrated equivalent experience (a minimum of two years of cumulative professional or nonprofessional work in laboratory preparation, curation, or field work related to paleontology, as well as documented self-taught knowledge of the discipline of paleontology). [Murphey et al. 2019]
Paleontological Monitoring	Observation of construction activities by a paleontological technician, under supervision of the Paleontological Principal Investigator. Monitoring may be fulltime (observation of the entire duration of a particular activity) or consist of a spot check (observation of a portion of the activity or of an area following the activity).
Paleontological Resource	Fossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years) [Society of Vertebrate Paleontology 2010]
Project Paleontologist	Someone with an advanced academic degree (M.A., M.S. or Ph.D.) with an emphasis in paleontology or demonstrated equivalent professional experience (e.g., minimum of 3 years [or 75 projects] of project experience with paleontological mitigation is considered equivalent to a graduate degree), in combination with 2 years (or 50 projects) of demonstrated professional experience and competency with paleontological resource mitigation projects at the level of field supervisor. [Murphey et al. 2019]

1 Introduction

Stantec Consulting Services Inc. (Stantec) conducted a paleontological resources assessment on behalf of the City of Seal Beach (the City) for the City's Housing Element and Zoning Code Updates Project (the Project) on eight separate sites totaling 83.45 acres of land throughout the City, in Orange County, California. This paleontological study was conducted in support of the City's Housing Elements Updates in compliance with state mandated requirements for local governments to identify adequate sites for housing to meet existing and projected housing needs for various income-levels in the community.

This paleontological study was conducted in support of California Environmental Quality Act (CEQA) review of the Project, including the eight specific Housing Opportunity Sites and the Main Street Program area. The proposed Project is subject to CEQA requirements regarding the Project's potential impacts on paleontological resources, with the City serving as the lead agency for the Project. As part of CEQA compliance, a paleontological resources assessment was conducted to assess potential impacts of the proposed Project and the resulting increase in development on paleontological resources.

1.1 Project Description

California State law requires each city and county to adopt a General Plan for its physical development. The City's most recent General Plan was adopted in December 2003. The Housing Element is one of seven State-mandated General Plan elements, which is required to be updated every eight years. The City is preparing the Housing Element Update to comply with the legal mandate requiring each local government to identify adequate sites for housing to meet the existing and projected housing needs for varying income-levels in the community. It is intended to provide the City with a comprehensive strategy for promoting the production of safe, decent and affordable housing and affirmatively furthering fair housing during the housing cycle.

The Housing Element, which integrates and updates supporting socioeconomic, demographic, and household data, is specifically intended to accommodate the City's Regional Housing Needs Assessment (RHNA) allocation of 1,243 new dwelling units. The RHNA allocated regional housing needs by income-level among member jurisdictions. This assessment report evaluates the potentially significant, adverse, and beneficial impacts to paleontological resources that may result from the Project, which involves implementation of the Housing Element and Zoning Code Update, including establishment of the new zoning designation and rezoning of sites resulting from Project implementation which would result in increased densification of residential uses.

The Housing Element Update identifies Housing Opportunity Sites throughout the City that have the potential for providing additional housing to meet the City's RHNA allocation. The sites are broken into two categories: (a) underutilized sites that do not require zoning code changes and (b) sites where zoning modifications are proposed. The Housing Element Update identifies eight Housing Opportunity Sites, two of which are underutilized sites that do not require rezoning and the remaining six sites are proposed for zoning modifications. Out of the six Housing Opportunity Sites proposed for rezoning, five would be rezoned to Mixed Commercial/Residential High Density (RHD), a new zoning designation that is

proposed to be implemented. The remaining site would be rezoned to the City's existing RHD-33 zoning designation.

In addition to the Housing Opportunity Sites, the Housing Element Update includes a proposal of the Main Street Program which is analyzed in this report. The Housing Element Update's Main Street Program does not identify specific housing opportunity sites but would modify the existing Main Street Specific Plan to allow for residential units to be developed at select properties located within the Main Street Specific Plan area.

The assessment contained herein assumes the development of the eight Housing Opportunity Sites totaling approximately 83.45 acres (with a developable acreage of 35.05 acres) at 100 percent of the maximum allowable density resulting in the potential for 1,491 new dwelling units to be developed within the City. Additionally, though 100 percent buildout under the Main Street Program would allow for development of up to 163 new dwelling units, it is unlikely that 100 percent buildout within the Main Street Program area would occur and therefore, the assessment contained herein assumes the development under the Main Street Program at 70 precent of maximum buildout resulting in the potential for 115 new dwelling units to be developed within the Main Street Program area.

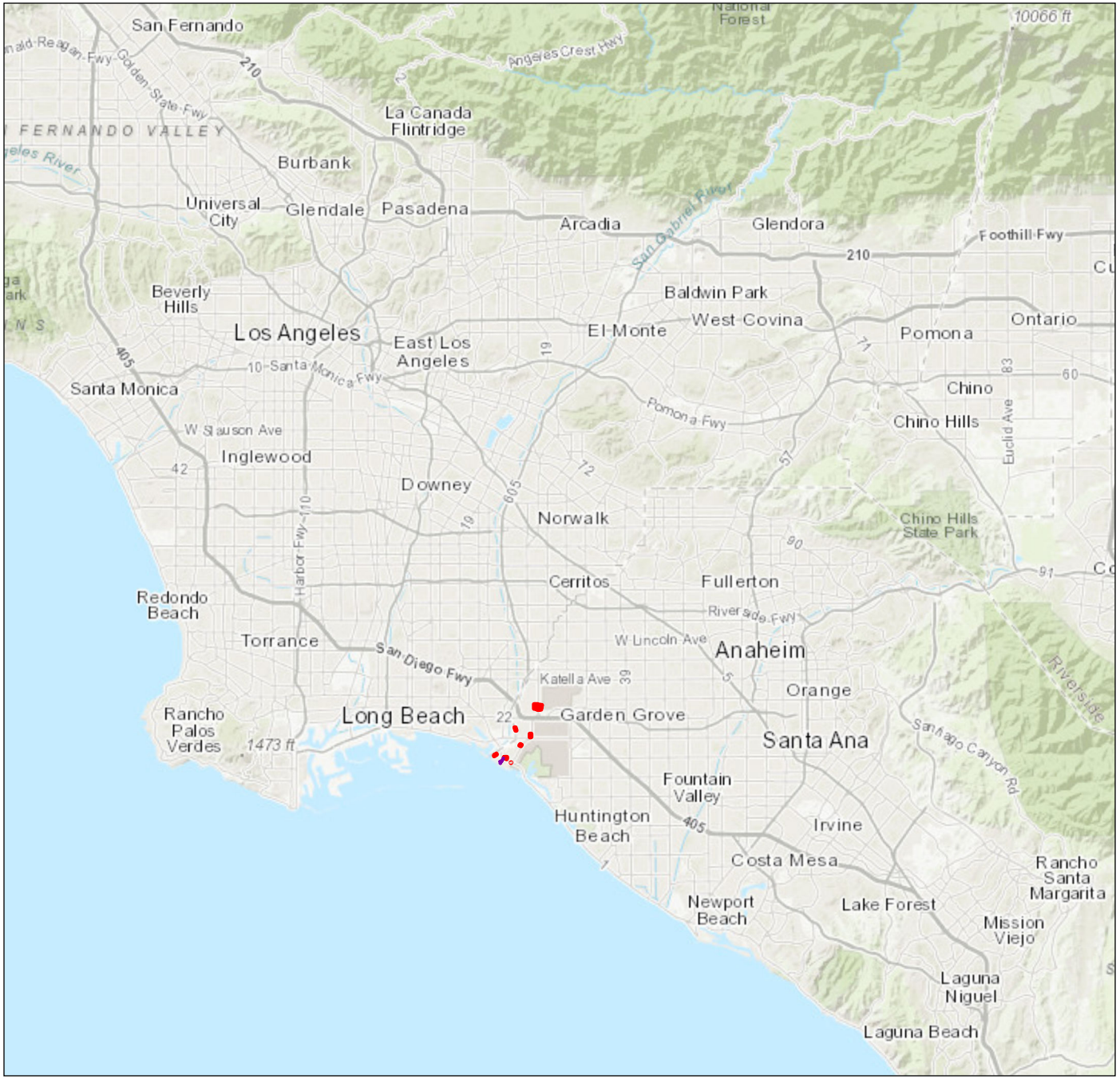
1.2 Project Location

The City is located at the northwestern edge of Orange County, California. The City borders the City of Long Beach and Los Angeles County to the northwest, the Orange County Cities of Los Alamitos to the north, Westminster to the east, Huntington Beach to the southeast, and the Pacific Ocean to the southwest (Figure 1). The Project area is currently comprised of eight Housing Opportunity Sites dispersed throughout the City and totaling 83.45 acres (Figure 2). However, the majority of the Housing Opportunity Sites would only allow for development within portions of the overall Housing Opportunity Site due to existing development and therefore, the total developable acres for the Housing Opportunity Sites is 35.05 acres. Additionally, the Project area includes the Main Street Program area. The Main Street Program falls within the boundaries of the existing Main Street Specific Plan area located within the City. Development potential for the Main Street Program is not based on potential developable acreage but rather the number of units that could be developed at select locations within the Main Street Program area.

Specifically, the Project area is located in portions of Section 31, Township 04 South, Range 11 West and Sections 1, 11, 12, 13, and 14, Township 04 South, Range 12 West, as depicted on the Los Alamitos and Seal Beach, California United States Geological Survey 7.5-minute series topographic quadrangles.

1.3 Paleontological Resources

Fossils are any evidence of ancient life, defined by the Society of Vertebrate Paleontology (SVP) (2010) as being over 5,000 years in age, or middle Holocene. While CEQA does not define a significance threshold for paleontological resources, the standards of the SVP (2010) are often used in the absence of a legal definition. The SVP defines scientifically important fossils as:



Stantec

Sites

Main Street Program

N

0 3.5 7 Miles

(At original document size of 8.5x11)
1:500,000

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Data Sources: City of Seal Beach 2024.
3. Background: World Topographic Map: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
World Ocean Base: Esri, GEBCO, Garmin, NaturalVue
World Ocean Reference: Esri, GEBCO, Garmin, NGS

Project Location
City of Seal Beach, California

Prepared by KDLP on 2024-10-22
IR by TJ on 2024-10-22

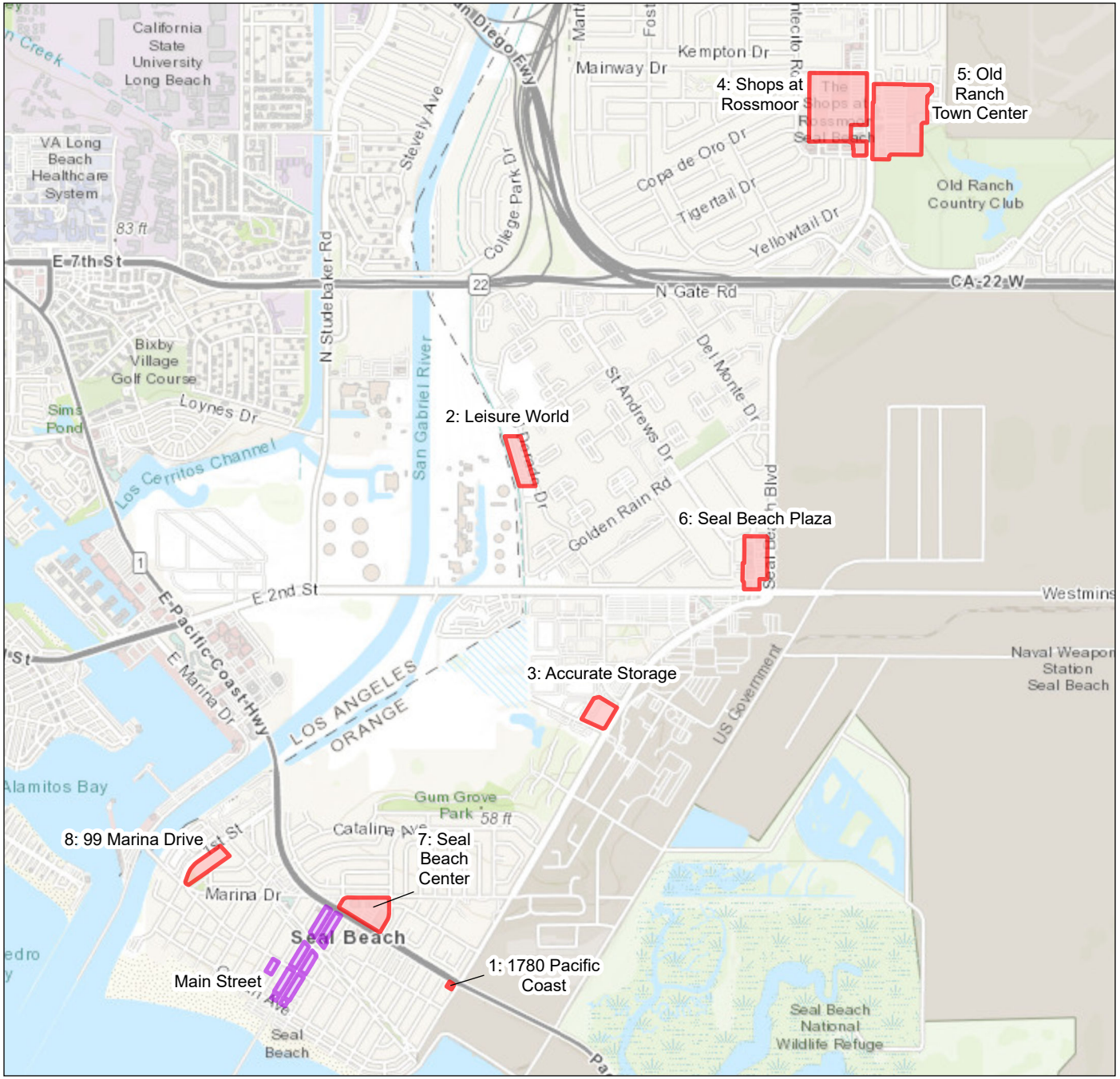
Client/Project 204266500

City of Seal Beach
Housing Element and Zoning Code Updates Project

Figure No.
1

Title
Project Vicinity

V:\1858\Active\204266500_SealBeachHousingElement\03_data\gis_cad\gis\Prn\SealBeach_Oct2024\SealBeach_Oct2024.aprx Revised: 2024-10-22 By: kdelapena



Stantec

Sites

Main Street Program

N

0 0.2 0.4 Miles

(At original document size of 8.5x11)

1:32,000

Notes

1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet

2. Data Sources: City of Seal Beach 2024.

3. Background: World Topographic Map: City of Long Beach, County of Los Angeles, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA

World Ocean Base: Esri, GEBCO, Garmin, NaturalVue

Project Location

City of Seal Beach, California

Prepared by KDLP on 2024-10-22

IR by TJ on 2024-10-22

Client/Project 204266500

City of Seal Beach

Housing Element and Zoning Code Updates Project

Figure No.

2

Title

Project Area

V:\1858\Active\204266500_SealBeachHousingElement\03_data\gis_cad\gis\Prn\SealBeach_Oct2024\SealBeach_Oct2024.aprx Revised: 2024-10-22 By: kdelapena

> identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years). [SVP 2010: 11].

Using this definition, the concept of scientific importance is included in the definition of paleontological resources; thus, not all fossils are considered to be paleontological resources. The threshold for scientific importance varies with factors such as geologic unit, geographic area, the current state of scientific research, and may also vary between different agencies (Murphey et al. 2019). Paleontological studies have developed criteria for the assessment of scientific importance of fossil discoveries (e.g., Murphey et al. 2019, Scott and Springer 2003). In general, these studies assess fossils as scientifically important if one or more of the following criteria apply:

- The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct.
- The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events, through biochronology or biostratigraphy and the correlation with isotopic dating.
- The fossils provide ecological data, such as the development of biological communities, the interaction between paleobotanical and paleozoological biotas, or the biogeography of lineages.
- The fossils demonstrate unusual or spectacular circumstances in the history of life.
- The fossils provide information on the preservational pathways of paleontological resources, including taphonomy, diagenesis, or preservational biases in the fossil record.
- The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.
- The fossils inform our understanding of anthropogenic affects to global environments or climate.

2.0 Regulatory Framework

California has enacted multiple laws and regulations that provide for the protection of paleontological resources. This investigation was conducted to meet these requirements regarding paleontological resources on the lands proposed for development.

2.1 State of California

2.1.1 CALIFORNIA ENVIRONMENTAL QUALITY ACT

CEQA (Public Resources Code [PRC] Sections 21000 et seq) requires that before approving most discretionary projects, the Lead Agency must identify and examine any significant adverse environmental effects that may result from activities associated with such projects. As updated in 2016, CEQA separates the consideration of paleontological resources from cultural resources (PRC Section 21083.09). The Appendix G checklist (Title 14, Division 6, Chapter 3, California Code of Regulations 15000 et seq.) requires an answer to the question, “Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?” Under these requirements, Stantec has conducted a paleontological resources assessment to determine impacts of the proposed project on paleontological resources within the Project area.

2.1.2 PUBLIC RESOURCES CODE

The California PRC (Chapter 1.7, Section 5097) includes additional state-level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, define the removal of paleontological sites or features from state lands as a misdemeanor, and prohibit the removal of any paleontological site or feature from state land without permission of the applicable jurisdictional agency.

2.1.3 CALIFORNIA COASTAL ACT

The California Coastal Act (PRC Division 20) requires reasonable mitigation measures where development would adversely impact archaeological or paleontological resources that have been designated by the State Historic Preservation Officer (Section 30244).

2.2 City of Seal Beach

2.2.1 GENERAL PLAN

The City’s General Plan (2003) includes paleontological resources in the Cultural Resources Element, the purpose of which is to preserve historic, archaeologic, and paleontological resources within the City. The City requires assessment of development proposals for potential impacts to significant paleontological resources pursuant to Section 15064.5 of CEQA. If a project involves earthwork, the City requires a study

conducted by a professional paleontologist to assess if paleontological assets are present and if the project will significantly impact the resources. If significant impacts are identified, the City requires the project to either be modified to avoid impacting the paleontological materials or require measures to mitigate the impacts.

3.0 Professional Standards

A variety of professional guidelines have been developed that outline protocols and practices for conducting mitigation paleontology. In particular, some studies have focused on establishing best practices for conducting mitigation paleontology, including resource assessments and surveys, monitoring and other forms of mitigation, and data and fossil recovery in a mitigation context, which differs from academic paleontology in the constraints of working on construction sites and schedules as well as the purpose of mitigation paleontology as a tool for regulatory compliance (Landon 2006; Murphey et al. 2019; Scott and Springer 2003; SVP 2010). Furthermore, a robust body of scientific literature exists outlining best practices for paleontological data collection and management of fossils and fossil localities, some of which is authored by agency representatives (Lucas et al. 2006 and references therein; Santucci and McClelland 2001 references therein; Santucci and Koch 2003; Santucci et al. 2009).

This study conforms to these industry best practices.

4.0 Methodology

The paleontological resources assessment reported herein consisted of an analysis of existing data incorporating a museum records search from the Natural History Museum of Los Angeles County (LACM) and a review of the scientific literature, geologic mapping, and the online database of the University of California Museum of Paleontology (UCMP). To assess if paleontological resources are likely to be encountered in any given area, the paleontological potential of the geologic units present in the area is assessed. Paleontological potential is derived from the known fossil data collected from the geologic unit as a whole, not just from a specific survey or study. Paleontological potential of a geologic unit consists of both (a) the potential for yielding abundant vertebrate fossils or for yielding scientifically important fossils, whether large or small, vertebrate, invertebrate, plant, or trace fossils and (b) the importance of recovered evidence for new and scientifically important taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data (SVP 2010).

The paleontological assessment presented here was conducted by Stantec Principal Paleontologist Alyssa Bell, Ph.D. Background research was conducted by Paleontologist Ceara Purcell, M.S. Geographic Information System (GIS) maps were drafted by GIS Technician Kayla de la Pena, B.S. This report was authored by Dr. Bell with the assistance of Ms. Purcell and reviewed by Paleontologist Matthew Cline, M.S. Stantec's work in support of the Project was managed by Anna Radonich, B.S., who coordinated Stantec's work and provided quality assurance and control.

4.1 Analysis of Existing Data

In order to assess the paleontological potential of the Project area, the most recent geologic mapping of the Project area was consulted to identify the geologic units present at the surface or likely present in the subsurface. A records search was requested from the LACM on January 24, 2024, with results received on January 28, 2024 (Appendix A). The search returned the closest known paleontological localities of the LACM to the Project sites from geological units present in the Project area, either at the surface or in the subsurface. A review of the scientific literature was conducted to determine the history of each of the geologic units mapped as present at the surface or likely present in the subsurface of the Project area for preserving paleontological resources. A search was conducted of the UCMP's online database on January 26, 2024, and updated on October 18, 2024 for Pleistocene-aged localities from Los Angeles and Orange Counties. The UCMP's database does not provide specific geographic locations beyond the county the fossils were recovered from but does include locality names that can sometimes be used to infer the general area of the locality.

4.2 Paleontological Potential

The results of the analysis of existing data were used to assign the paleontological potential rankings of the SVP (2010) to the geologic units likely present in the Project area. These rankings are designed to inform the development of appropriate mitigation measures for the protection of paleontological resources and are widely accepted as industry standards in paleontological mitigation (Murphey et al. 2019; Scott and Springer 2003). These rankings are as follows:

> **High Potential.** Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Rock units classified as having high potential for producing paleontological resources include, but are not limited to, sedimentary formations that are temporally or lithologically suitable for the preservation of fossils (e. g., middle Holocene and older, fine-grained fluvial sandstones, argillaceous and carbonate-rich paleosols, cross-bedded point bar sandstones, fine-grained marine sandstones, etc.), some volcaniclastic formations (e. g., ashes or tephras), and some low-grade metamorphic rocks.
>
> **Undetermined Potential**. Rock units for which little information is available in the literature or museum records concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study and field work is necessary to determine if these rock units have high or low potential to contain significant paleontological resources.
>
> **Low Potential**. Rock units that are poorly represented by fossil specimens in institutional collections or, based on general scientific consensus, only preserve fossils in rare circumstances (e. g., basalt flows or Recent colluvium) have low paleontological potential.

No Potential. Some rock units have no potential to contain significant paleontological resources, for instance high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites).

4.3 Paleontological Impacts Assessment

Following the assessment of paleontological potential, an impacts assessment was conducted comparing anticipated development activities resulting from the proposed Housing Element Updates with mapped geologic units and their paleontological potential. As specific activities are not known at this time, the impacts assessment conducted is restricted to generalities of possible ground disturbance. Where potential adverse impacts from Project activities were identified, mitigation recommendations were developed to reduce those impacts to less than significant.

Impacts to paleontological resources can be classified as direct, indirect, or cumulative. Impacts can also be considered as adverse impacts or as beneficial impacts. Direct adverse impacts on paleontological resources are the result of damage or destruction of these nonrenewable resources by surface disturbing actions including construction excavations. Therefore, in areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact paleontological resources by damaging or destroying them and rendering them permanently unavailable to science and society. Beneficial direct impacts, however, may result when paleontological resources are identified during construction and appropriately documented and salvaged, thus ensuring the specimens are protected for future study and education.

Indirect impacts typically include those effects which result from the continuing implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given project area. Human activities that increase erosion can also cause indirect impacts to surface and subsurface fossils as the result of exposure, transport, weathering, and reburial.

Cumulative adverse impacts can result from incrementally minor but collectively significant actions taking place over time. The incremental loss of paleontological resources over time from construction-related surface disturbance or vandalism and unlawful collection would represent a significant cumulative adverse impact, because it would result in the destruction of non-renewable paleontological resources and the associated irretrievable loss of scientific information.

The impact assessment conducted here takes into consideration potential development activities and the geology of the eight Housing Opportunity Sites as well as the Main Street Program area, including the possibility of subsurface geologic units having a different paleontological potential than surficial units. For example, younger surficial sediments (alluvium, lacustrine, eolian, etc.) have low potential to preserve paleontological resources due to their age; yet sediments increase in age with depth and so these surficial deposits often overly older units that have high paleontological potential. In areas with this underlying geologic setting surficial work may be of low risk for impacting paleontological resources while activities that require excavations below the depth of the surficial deposits would be at greater risk of impacting paleontological resources. For this reason, and because specifics of future development such

as depths of ground disturbance are not known at this time, this impact assessment takes into consideration both the surface and subsurface geology of the Project sites overall.

5.0 RESULTS

5.1 Geologic Setting

The Project area is located in the Los Angeles Basin, a structural depression approximately 50 miles long and 20 miles wide in the northernmost Peninsular Ranges geomorphic province and just to the south of the Transverse Ranges geomorphic province (Ingersoll and Rumelhart 1999). The Los Angeles Basin developed as a result of tectonic forces and the San Andreas fault zone, with subsidence occurring 18 to 3 million years ago (Ma) (Critelli et al. 1995). Sediments dating back to the Cretaceous (66 Ma) are preserved in the basin, but continuous sedimentation did not begin until the middle Miocene (around 13 Ma) (Yerkes et al. 1965). Thousands of feet of accumulation have resulted from sediments eroding into the basin from the surrounding highlands since that time (Yerkes et al. 1965). Until sea level dropped in the Pleistocene, most sediments deposited in the basin were marine. Following sea level fall, depositional of terrestrial alluvial sediments began, forming the uppermost units in the Los Angeles Basin.

The Los Angeles Basin is subdivided into four structural blocks. The Project occurs in the roughly rectangular Southwestern Block, most of which is beneath the Pacific Ocean, that extends 28 miles from the northwest to the southeast and is bound in the northwest by the Santa Monica Mountains (Yerkes et al. 1965). In the Southwestern Block sediments are about 20,500 feet thick (Yerkes et al. 1965). The coastal margin of the Southwestern Block, where the Project is located, is characterized by a series of emergent marine wave-cut terraces capped by paralic deposits, or interfingering marine and continental sediments (Saucedo et al. 2016).

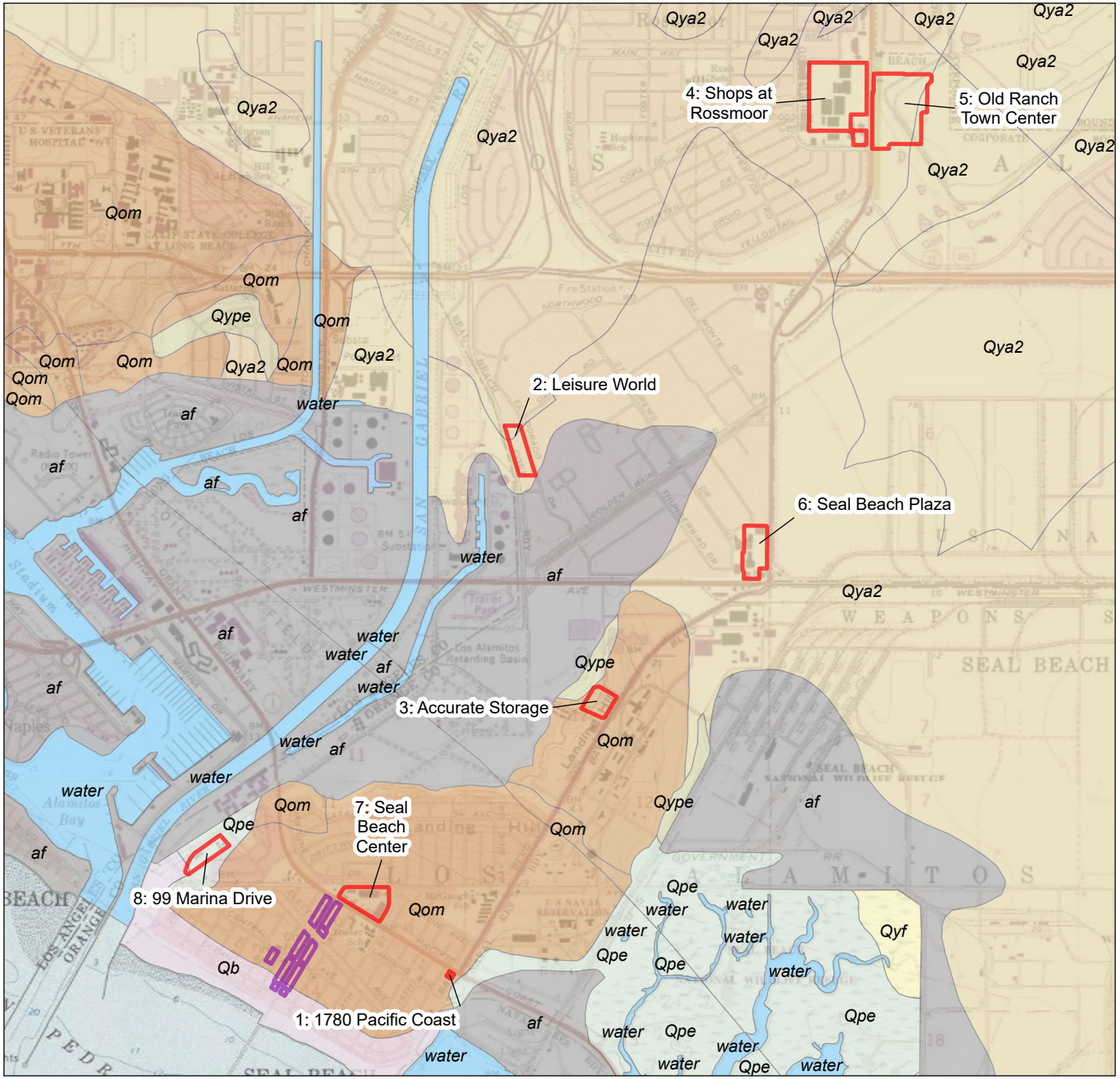
5.2 Project Area Geology and Paleontology

Geologic mapping by Saucedo et al. (2016) indicates the surface of the Project area consists of recent beach deposits, Holocene to late Pleistocene alluvial deposits and paralic estuarine deposits as well as middle to late Pleistocene shallow marine deposits on wave-cut terraces (Figure 3). The San Pedro Formation is also likely present in the subsurface (Table 1). These geologic units are described below.

Beach deposits (Qb in Figure 3). Beach deposits are mapped in the southwestern portion of the map and underlie the southwestern edge of the Main Street Program area (Saucedo et al. 2016). These sediments are composed of unconsolidated, well-sorted fine- to coarse-grained sand that date from the late Holocene (Saucedo et al. 2016). Given their age, they are too young to preserve fossils and so are assigned low paleontological potential. However, they may be underlain at an unknown depth by older units with high paleontological potential.

Paralic estuarine deposits (Qpe in Figure 3). Paralic estuarine deposits are mapped in the southern portion of the Project area, underlying the 99 Marine Drive site (Saucedo et al. 2016). These sediments are unconsolidated loose to moderately dense fine-grained sand, silt, and clay deposited in an estuarine

setting that date to the late Holocene (Saucedo et al. 2016). As for beach deposits, they are too young to preserve fossils and so are assigned low paleontological potential. However, they may be underlain at an unknown depth by older units with high paleontological potential.



Stantec

- Sites
- Main Street Program

Geology

- water
- af: Artificial fill
- Qb: Beach deposits
- Qpe: Paralic estuarine deposits
- Qya_2: Young alluvium, Unit 2
- Qyf: Young alluvial fan deposits
- Qype: Young paralic estuarine deposits
- Qom: Old shallow marine deposits on wave-cut surface

N

0 0.2 0.4 Miles
(At original document size of 8.5x11)
1:32,000

Notes

1. Coordinate System: NAD 1983 StatePlane California II FIPS 0402 Feet
2. Data Sources: City of Seal Beach 2024, California Dept of Conservation, NGMDB
3. Background: USA Topo Maps: Copyright:© 2013 National Geographic Society, i-cubed
World Ocean Base: Esri, GEBCO, Garmin, NaturalVue
World Ocean Reference: Esri, GEBCO, Garmin, NGS

Project Location
City of Seal Beach, California

Prepared by KDLP on 2024-10-22
IR by AB on 2024-10-22

Client/Project 204266500

City of Seal Beach
Housing Element and Zoning Code Updates Project

Figure No.
3

Title
Geologic Map of the Project Area

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5.0 RESULTS

Table 1 Paleontological potential of geologic units within the Project area

Geologic Unit	Age	Occurrence within Project area	Paleontological Potential*
Beach deposits	Late Holocene	Surface - Main Street Program area	Low
Paralic Estuarine Deposits	Late Holocene	Surface - 99 Marina Drive	Low
Young alluvium Unit 2	Holocene and late Pleistocene	Surface - Shops at Rossmoor, Old Ranch Town Center, Leisure World, Seal Beach Plaza	Low-to-High, increasing with depth
Old shallow marine deposits on a wave-cut surface	Late to middle Pleistocene	Surface - Accurate Storage, Seal Beach Center, 1780 Pacific Coast, and the Main Street Program area	High
Older Pleistocene-aged Formations	Middle to early Pleistocene	Subsurface – possible across Project area	High

**ranking based on the SVP (2010) classifications*

Young alluvium, Unit 2 (Qya2 in Figure 3). Young alluvium, Unit 2 is mapped throughout the northeastern portion of the Project area, underlying the Shops at Rossmoor, Old Ranch Town Center, Leisure World, and Seal Beach Plaza sites (Saucedo et al. 2016). These sediments consist of poorly consolidated and poorly sorted flood-plain deposits of soft clay, silt, and loose to moderately dense sand and silty sand that date from the Holocene and late Pleistocene (Saucedo et al. 2016). As such, they range in age to over 11,700 years, the end of the late Pleistocene. As fossils are 5,000 years in age and older, the deeper portions of this unit, corresponding to the middle Holocene and older, are of an age to preserve fossils.

The locality search from the LACM (2024) provides data on the two Pleistocene-aged terrestrial fossil localities known to the LACM closest to the Project area from sediments similar to the alluvium of the Project area (Table 2). The closest of these is from Seal Beach, southeast of the Project area where a camel fossil was found on the beach, likely having eroded from alluvial sediments or terrace deposits (LACM 2024). The second is from Huntington Beach, where mammoth, bison, and invertebrate fossils were found at depths of 6 feet to 20 feet below ground surface (bgs). The online records search from the UCMP (2024) indicates they have 491 Pleistocene-aged fossil localities from Los Angeles County (exclusive of asphaltic localities at Rancho La Brea and microfossil localities) and 122 fossil localities from Orange County. While specific geologic information is not available online for most of these localities, 16 in Los Angeles County and three from Orange County appear to be from alluvial settings and likely represent a similar depositional environment to that of the older portions of the alluvium in the Project area. These sites yielded a variety of fossils, including invertebrates (seven localities), plants (six localities), and vertebrate fossils (seven localities) (UCMP 2024).

A review of the scientific literature indicates that Pleistocene-aged alluvial sediments are well known for the preservation of fossils representing a rich Ice Age fauna in the Los Angeles Basin and vicinity. These include animals still found in North America today, such as deer, bison, sheep, and horses; creatures no longer found in North America, such as camels, lions, cheetahs, and sloths; and extinct creatures such as

5.0 RESULTS

Table 2 Summary of the records search from the Natural History Museum of Los Angeles County

Locality Number	Geologic Unit	Age	Taxa	Approximate Location	Depth
LACM VP 3291	Unnamed formation	Pleistocene	Camel (*Camelops hesternus*)	Sunset Beach; approximately 1.2 miles southeast of the 1780 Pacific Coast site	Surface
LACM VP 65113	Unnamed formation	Pleistocene	Mammoth (*Mammuthus*), bison (*Bison*); uncatalogued invertebrates	5092 Wintersburg Avenue in Huntington Beach; approximately 5.4 miles southeast of the Seal Beach Plaza site	6 – 20 feet bgs
LACM VP 1121	Terrace deposits	Pleistocene	Mammoth (*Mammuthus*), sea otter (*Enhydrus*), horse (*Equus*)	Just south of Seal Beach; offshore from the Optional Site	15 feet below sea level
LACM VP 7739	Coastal deposits	Late Pleistocene	Invertebrates (snails; clams; tusk shells; barnacles; crabs; sea urchins); requiem shark (*Carcharhinus*), Spotted cusk eel (*Chilara*), croakers (*Genyonemus, Seriphus*), school shark (*Galeorhinus*), righteye flounder (*Glyptocephalus*), guitarfish (*Rhinobatos*), toadfish (*Porichthys*), perch (*Cymatogaster, Damalichthys*), bullhead shark (*Heterodontus*), ray (Dasyatis, *Myliobatus, Raja*), surfperch (*Embiotoca, Hyperprosopon, Micrometrus*), flatfish (*Citharichthys*), leopard shark (*Triakis*), slender sole (*Lyopsetta*), dogfish shark (*Squalus*), skate (*Squatina*), barracuda (*Sphyraena*)	Bluff Park (on the beach) in Long Beach; approximately 2.9 miles northwest of the 99 Marine Drive site	56 feet bgs
LACM IP 4865	Palos Verdes Sand	Pleistocene	Decapoda, sand dollar (*Dendraster*), gastropods (*Balcis, Californiconus, Calliostoma,* Cerithideopsid*, Chlorostoma, Crucinulum, Euclia, Hirtoscala, Turbonilla*), ichnofossils (*Helicotaphrichnus*), bivalves (*Coanicardita, Crepidula, Leukoma, Siliqua, Tellina*), (*Crucinulum*), and others	East side of Pacific Coast Highway; between Seventh and Colorado Streets in Long Beach; approximately 1.6 miles west of the Leisure World site	Surface

mammoths, dire wolves, and saber-toothed cats (Jefferson 1991 a and b, Graham and Lundelius 1994, McDonald and Jefferson 2008, Miller 1971, Reynolds and Reynolds 1991). In addition to these iconic large animals, a wide variety of small animals can be preserved, including reptiles such as frogs, salamanders, snakes (Hudson and Brattstrom 1977), and birds (Collins et al. 2018, Jones et al. 2008,

Miller 1941). These fossils are important for recreating the history of Southern California, in particular studying climate change (e.g., Roy et al. 1996), extinction (e.g., Barnosky et al. 2004, Jones et al. 2008, Sandom et al. 2014, Scott 2010), and paleoecology (e.g., Connin et al. 1998, Trayler et al. 2015).

Given the record of paleontological resources recovered from middle Holocene and older alluvial deposits both near the Project area and more broadly across the Los Angeles Basin, these deposits are assessed as having low paleontological sensitivity at the surface, in the late Holocene portions of the unit, increasing to high paleontological potential in the older, deeper portions of the unit. The exact depth at which this transition occurs cannot be determined precisely in the Project area; however, the records of the LACM and reports in the scientific literature (i.e., Jefferson 1991a and 1991b, Reynold and Reynolds 1991) indicate that fossil have been found as shallowly as 5 feet to 6 feet bgs in the vicinity of the Project area.

Old shallow marine deposits on a wave-cut surface (Qom in Figure 3). These marine deposits, often referred to as terraces or terrace deposits, are mapped underlying the Accurate Storage, Seal Beach Center, 1780 Pacific Coast, and the Main Street Program area (Saucedo et al. 2016), but may be present more broadly in the subsurface, underlying the younger alluvial and paralic deposits. These deposits consist of terraces uplifted by regional tectonics, forming blocks of late to middle Pleistocene-aged marine and coastal sediments. These sediments are poorly sorted, moderately permeable, and reddish-brown, and represent interfingered strandline, beach, estuarine, and colluvial deposits composed of siltstone, sandstone, and conglomerate (Saucedo et al. 2016). They lie on uplifted emergent wave-cut abrasion platforms and may locally include older alluvium (Saucedo et al. 2016). These terraces are of an age to preserve fossils.

The results from the LACM (2024) include two localities from coastal or terrace deposits, the closest of which is just offshore from Seal Beach, where mammoth, bison, and otter fossils were recovered from 15 feet below sea level (LACM 2024). This type of intermixed coastal and terrestrial fauna is typical of older terrace deposits, given the interfingering of terrestrial and costal sediments that typically mantle them. An additional site is recorded in Bluff Park, northwest of the Project area, where a diverse fish and marine invertebrate fauna were recovered from 56 feet bgs. Of the UCMP (2024) localities for which depositional environment can be inferred, 87 in Los Angeles County and 46 in Orange County are from marine depositional settings, but it cannot be determined from available data how many are from formal geologic units, such as the Palos Verde Sand described below, as opposed to terrace deposits.

Pleistocene-aged marine terraces and associated coastal deposits have a rich fossil record from Ventura County along the southern California coast and into Baja California, as reported in the scientific literature (Kern 1971, 1977; DeDiego-Forbis et al. 2004). The vast majority of these fossils are marine invertebrate shell beds, but are vertebrate fossils are also reported (Bryant 1987). The scientific importance of these invertebrate fossils stems from the specificity of many types of marine invertebrates for water conditions such as depth and temperature in which they live (Kern 1977). Thus, the terrace deposits preserve fossils that allow scientists to reconstruct climate change, sea levels, tectonic processes, and depositional facies across space and time, using the taxonomic composition of the invertebrate fossils (Vedder and Norris 1963; Castillo et al. 2018; Kennedy et al. 1982; Grant et al. 1999). As the Pleistocene to Holocene transition was a time of great variation in sea level as the ice ages came to an end, such studies are

important for understanding how fauna respond to a changing environment (Kennedy et al. 1982; Muhs and Groves 2018).

Given the extensive record of paleontological resource discoveries from older terrace deposits, mapped as old shallow marine deposits on a wave-cut surface in the Project area, these deposits are assessed as having high paleontological potential.

Older Pleistocene-aged Marine Formations (not mapped in Figure 3). Underlying the coastal and alluvial deposits in the Project area and around the greater San Pedro Bay are a series of early to middle Pleistocene formations that form the oldest of the marine terraces. While not exposed at the surface in the Project area, they may be encountered in the subsurface at unknown depths. These units include the San Pedro Formation, Palos Verdes Sand, the Lomita Marl, and the Timms Point Silt, which preserve shallow marine seafloor environments. These units are well documented for the preservation of a diverse and abundant fauna, dominated by invertebrates but with marine vertebrates documented as well as occasional terrestrial vertebrates that washed out to sea for burial (Long 1993; Powell and Stevens 2000; Rodda 1957). The LACM (2024) reports the closest fossil locality from these units as a dense accumulation of invertebrates from the Palos Verdes Sand approximately 1.6 miles west of the Project area. The UCMP (2024) has records of close to 300 localities from these units, with thousands of specimens in the collections.

These units have high paleontological potential, as they are well documented for preserving a range of scientifically important fossils across the Los Angeles Basin.

5.3 Potential Impacts to Paleontological Resources from Project Activities

The Project proposes to update the Housing Element to include the identification of eight Housing Opportunity Sites and the Main Street Program, a modification of the existing Main Street Specific Plan to provide additional residential developments at currently unspecified locations. As the Project does not include any specific plans for ground disturbing activities, there are no direct adverse impacts to paleontological resources. However, particular projects conducted as a result of the rezoning and new zoning designations can be reasonably expected to include ground disturbance.

New ground disturbance that occurs in geologic units with high paleontological potential may encounter paleontological resources. Should this occur during one of the resulting development projects from the updates to the Housing Element, the damage or destruction of the resources would constitute an indirect adverse impact of this Project. Within the Project area, this could occur at any depth in the Seal Beach Center, Accurate Storage, 1780 Pacific Coast, or the Main Street Program area, and at depths greater than an estimated 5 feet at the other Project Sites. Should such adverse impacts occur, they would contribute to cumulative impacts from the Project, along with similar such impacts from other development projects that may take place in the same area, and which target similar geologic units.

6.0 Recommendations and Management Considerations

This assessment identifies possible indirect and cumulative adverse impacts that may result from this Project, should fossils with scientific importance, i.e., paleontological resources, be encountered during construction stemming from the updates to the Housing Element. Therefore, Stantec has developed mitigation recommendations for actions to reduce these potential impacts to less than significant, in accordance with CEQA requirements.

A successful mitigation program is one which provides for the identification and appropriate treatment of paleontological resources. Important components are therefore worker training, so the construction personnel are aware of their obligations and actions to take in the event they discover a fossil, as well as oversight by trained paleontologists. This oversight is typically through onsite monitoring of construction activities.

During monitoring, a paleontologist observes construction activities and halts construction temporarily to inspect the exposed sediments. If fossils are observed, the paleontologist will recognize them and stop work so that they can be assessed and, if found to meet criteria for scientific importance, salvage them for conservation and curation in a museum. Monitoring by experienced paleontologists greatly increases the probability that fossils will be discovered during ground-disturbing activities and that, if they are scientifically important, successful mitigation and salvage efforts may be undertaken to prevent adverse impacts to these resources.

The ability to apply monitoring as a successful mitigation tool is tied to the nature of the ground disturbing activity. Construction monitoring requires a paleontologist to be able to observe either cuts into the ground, such as the sidewalls of trenches or a graded ground surface, or to observe spoils piles, such as from drilling or trenching. Methods such as grading, trenching, mass excavation, and augering produce either cut surfaces or spoils, and so are appropriate targets for paleontological monitoring. Activities such as grubbing and landscaping do not typically involve sufficient ground disturbance to warrant monitoring, while methods such as hydro vacuum and very narrow diameter augering (under 12 inches) are unlikely to allow for the identification of scientifically important fossils.

The methods and depths of ground disturbance are currently undefined for particular development projects that may result from the update to the Housing Element. Therefore, Stantec recommends a qualified paleontologist meeting professional standards as defined by Murphey et al. (2019) be retained as the designated Project Paleontologist to review project-specific construction plans and develop a project-specific paleontological mitigation program. The mitigation program should include the following components:

- For each development the Project Paleontologist should develop and oversee the implementation of a Paleontological Monitoring and Mitigation Plan tailored to specific construction plans and geotechnical studies, should these be available, that identifies when or under what conditions paleontological monitoring should be implemented. The plan should include provisions for worker training, roles and qualifications of paleontology staff following those of Murphey et al. (2019), depths and locations for monitoring, types of work to be monitored, monitoring procedures,

requirements for final reporting of the results of the mitigation program, and fossil discovery protocols for work stoppage, assessment, and possible salvage and curation, in the event a fossil is found during construction.

- Fulltime paleontological monitoring is warranted when work occurs in the geologic units assessed as having high paleontological potential in this study: when over 5 foot in depth in unit 2 of the young alluvium, or at any depth in old shallow marine deposits on a wave-cut surface, the San Pedro Formation, the Paleo Verdes Sand, the Lomita Marl, and the Timms Point Silt. Work into previously disturbed sediments, beach deposits, paralic estuarine deposits, or the upper 5 feet of unit 2 of the young alluvium does not require monitoring. After the initiation of the monitoring work, the Project Paleontologist may reduce the frequency or depths of monitoring should low paleontological potential sediments be identified in the monitoring area.
- The Project Paleontologist should develop a Worker's Environmental Awareness Program training that communicates requirements and procedures for the inadvertent discovery of fossils during construction, to be delivered by the paleontological monitor to the construction crew prior to the onset of ground disturbance.
- In the event that paleontological resources are encountered during construction activities, work should stop in a safe radius of the finds, usually 50 feet, while the paleontological monitor documents the find. If a monitor is not onsite at the time of discovery, such as for an inadvertent discovery in an area of low paleontological potential, work should stop until the Project Paleontologist can assess the find. The Project Paleontologist shall assess the find. Should the Project Paleontologist assess the find as scientifically important, the find shall be collected and curated in an accredited repository along with associated data such as photographs, GPS coordinates, lithological descriptions, and depth data, as well as curation fees.

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APPENDIX A

Records Search Results from the Natural History Museum of Los Angeles County

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

Research & Collections

e-mail: paleorecords@nhm.org

January 28, 2024

Stantec Consulting Services Inc.
Attn: Ceara Purcell

re: Paleontological resources for the City of Seal Beach Housing Element and Zoning Code Updates Project (2042665000)

Dear Ceara:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the City of Seal Beach Housing Element and Zoning Code Updates project area as outlined on the portion of the Los Alamitos and Seal Beach USGS topographic quadrangle map that you sent to me via e-mail on January 24, 2024. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that may occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County (NHMLA).

Locality Number	Location	Formation	Taxa	Depth
LACM VP 3291	Sunset Beach at low tide, 50 yards north of Anderson Street & west of Pacific Coast Highway	Unknown Formation (Pleistocene)	Camel (*Camelops hesternus*)	Surface
LACM VP 1121	Just south of Seal Beach	Pleistocene terrace deposit	Mammoth (*Mammuthus*), sea otter (*Enhydrus*), horse (*Equus*)	15 feet below sea level
LACM VP 65113	5092 Wintersburg Road; Huntington Beach	Unknown formation (Pleistocene)	Mammoth (*Mammuthus*), bison (*Bison*); uncatalogued invertebrates	6 - 20 feet bgs
LACM IP 4865	Bluff on north side of the Stonebrook Apartment complex on the east side of Pacific Coast Highway; between	Palos Verdes Sand	Decapoda, sand dollar (*Dendraster*), gastropods (*Balcis, Californiconus*, *Calliostoma,* Cerithideopsid, *Chlorostoma, Crucinulum, Euclia, Hirtoscala, Turbonilla*), ichnofossils	Surface

Locality Number	Location	Formation	Taxa	Depth
	Seventh and Colorado Streets; city of Long Beach		(*Helicotaphrichnus*), bivalves (*Coanicardita*, *Crepidula*, *Leukoma, Siliqua*, *Tellina*), (*Crucinulum*), and others	
LACM VP 7739	Bluff Park (on the beach adjacent to the eastern half of the southern edge of the parking lot); Long Beach	Late Pleistocene* coastal deposits (dark gray massive sandy silt)	Invertebrates (snails; clams; tusk shells; barnacles; crabs; sea urchins); requiem shark (*Carcharhinus*), Spotted cusk eel (*Chilara*), croakers (*Genyonemus, Seriphus*), school shark (*Galeorhinus*), righteye flounder (*Glyptocephalus*), guitarfish (*Rhinobatos*), toadfish (*Porichthys*), perch (Cymatogaster, Damalichthys), bullhead shark (*Heterodontus*), ray (Dasyatis, *Myliobatus, Raja*), surfperch (*Embiotoca, Hyperprosopon, Micrometrus*), flatfish (*Citharichthys*), leopard shark (*Triakis*), slender sole (*Lyopsetta*), dogfish shark (*Squalus*), skate (*Squatina*), barracuda (*Sphyraena*)	56 feet bgs

VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface
** Locality is 25 feet below carbon-14 accelerator mass spectrometry date of 43180 +/-710 years*

This records search covers only the records of the NHMLA. It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

Alyssa Bell, Ph.D.
Natural History Museum of Los Angeles County

enclosure: invoice