Appendix E4

Paleontological Resources Assessment

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PALEONTOLOGICAL RESOURCES ASSESSMENT FOR PURE WATER SOUTHERN CALIFORNIA, LOS ANGELES COUNTY, CALIFORNIA

Results of an Analysis of Existing Data and Pedestrian Survey

October 2024

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Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed this paleontological resources assessment for The Metropolitan Water District of Southern California (Metropolitan) proposed Pure Water Southern California (Pure Water) program. Pure Water would be a partnership between Metropolitan and the Los Angeles County Sanitation Districts (Sanitation Districts) to develop and implement a regional recycled water program. This report addresses components of Pure Water that are being analyzed at the project level, which consist of the construction and operation of a new Advanced Water Purification (AWP) Facility, associated improvements located at the Sanitation Districts' A.K. Warren Water Resource Facility (Warren Facility), and Workforce Training Center (collectively called the Joint Treatment Site) in the City of Carson, and the construction and operation of an approximately 39-mile backbone pipeline from the Joint Treatment Site to the existing San Gabriel Canyon Spreading Grounds in the City of Azusa (referred to as the Project for this report). The Project area (or Paleontological Study Area) is situated primarily within urban areas and located in the cities of Carson, Long Beach, Lakewood, Cerritos, Bellflower, Norwalk, Downey, Santa Fe Springs, Duarte, Pico Rivera, Industry, El Monte, Baldwin Park, Irwindale, and Azusa, as well as unincorporated portions of Los Angeles County, California. As part of Pure Water, more specific or updated resource identification, impact analysis, and mitigation recommendations would occur in the future for components that are being addressed in the Environmental Impact Report (EIR) at the program level; those components are not addressed in this technical report.

Pure Water Southern California is subject to compliance with the California Environmental Quality Act (CEQA) requirements regarding its potential significant impacts on unique paleontological resources, with Metropolitan acting as the CEQA lead agency. The Program is also subject to the National Environmental Policy Act (NEPA) requirements regarding its potential to adversely impact paleontological resources. As part of the environmental review process, a paleontological resources assessment was conducted to assess potential adverse impacts of the proposed Project on paleontological resources.

This paleontological resource investigation consisted of an analysis of existing data with a museum records search from the Natural History Museum of Los Angeles County of the Paleontological Study Area and vicinity, a review of the most recent geologic mapping and relevant scientific literature, and a windshield and pedestrian field survey of the Paleontological Study Area (completed on September 28, 2022). This research was used to assign paleontological potential rankings of the Society of Vertebrate Paleontology (2010) to the geologic units present in the Paleontological Study Area, either at the surface or in the subsurface. Following this, Project plans were reviewed to identify potential impacts to paleontological resources and develop appropriate mitigation recommendations.

The results of the survey and analysis of existing data conducted indicate that 12 geologic units are present in the Paleontological Study Area: late Holocene-aged active sedimentary deposits, which are mapped individually as active alluvium and alluvial fan deposits and active wash deposits and are both assessed as having low paleontological potential; young sedimentary deposits, which are mapped individually as Holocene-aged young alluvium and alluvial fan deposits and Holocene- to late Pleistocene-aged young wash deposits and are both assessed as having low-to-high paleontological potential, increasing with depth; Pleistocene-aged older alluvium and alluvial fan deposits, which are assessed as having high paleontological potential; late to middle Pleistocene-aged old shallow marine deposits on wave-cut surfaces (marine terrace deposits), which are assessed as having high paleontological potential; the late Pleistocene-aged Palos Verdes Sand, Lakewood Formation, and La Habra Formation, which are each assessed as having high paleontological potential; the Pliocene-aged Fernando Formation, which is assessed as having high paleontological potential; the Sycamore Canyon Member of the Puente Formation, which is assessed as having high paleontological potential; and tonalite of San Gabriel Reservoir, which is assessed as having no paleontological potential.

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Abbreviations

AWP	Advanced Water Purification
Bgs	Below ground surface
CEQA	California Environmental Quality Act
DPR	Direct Potable Reuse
EC	Environmental Commitments
EIR	Environmental Impact Report
HELIX	HELIX Environmental Planning, Inc.
I-210	Interstate 210
ICS	International Commission on Stratigraphy
IPR	Indirect Potable Reuse
Joint Treatment Site	Area encompassing modifications to portions of the existing A.K. Warren Water Resources Facility and a new Advanced Water Purification Facility and Workforce Training Center
LACM	Natural History Museum of Los Angeles County
Ma	Million years ago
Metropolitan	Metropolitan Water District of Southern California
MGD	Million gallons per day
MM	Mitigation Measure
NEPA	National Environmental Policy Act
Paleontological Study Area	Footprint of the backbone pipeline and Joint Treatment Site of the Metropolitan Water District of Southern California Pure Water Southern California Program
PBDB	Paleobiology Database
PL	Public Law
PMMP	Paleontological Monitoring and Management Plan
The Program	Metropolitan Water District of Southern California Pure Water Southern California Program
The Project	Construction and operation of the backbone pipeline and Joint Treatment Site of the Metropolitan Water District of Southern California Pure Water Southern California Program
PRPA	Paleontological Resources Preservation Act
Sanitation Districts	Los Angeles County Sanitation Districts
SR-60	California State Route 60
Stantec	Stantec Consulting Services Inc.

SVP	Society of Vertebrate Paleontology
UCMP	University of California Museum of Paleontology
USC	United States Code
USDI	United States Department of the Interior
USGS	United States Geological Survey
Warren Facility	A.K. Warren Water Resource Facility

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	Full-time observation of construction activities in high potential geologic units by a paleontological monitor, under supervision of the project paleontologist.
Paleontological Resource	Any fossilized remains, traces, or imprints of organisms preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include— (A) any materials associated with an archaeological resource (as defined in section 3(1) of the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470bb(1)); or (B) any cultural item (as defined in section 2 of the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001)). [Paleontological Resources Preservation Act; Sec. 6301: Definitions]
Project Paleontologist	An individual 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]
Paleontological Spot Check	A short inspection of excavations and subsurface conditions conducted by the paleontological monitor at set times.

1.0 Introduction

1.1 PURPOSE OF THE REPORT

Stantec Consulting Services Inc. (Stantec) has completed this paleontological resources assessment for The Metropolitan Water District of Southern California (Metropolitan) proposed Pure Water Southern California (Pure Water) program. Pure Water would be a partnership between Metropolitan and the Los Angeles County Sanitation Districts (Sanitation Districts) to develop and implement a regional recycled water program. This report addresses components of Pure Water for which sufficient information is available at this time to conduct a project-level analysis, which consist of: modifications to the Sanitation Districts' existing A.K. Warren Water Resource Facility (Warren Facility), a new Advanced Water Purification (AWP) Facility, and a Workforce Training Center (collectively referred to as the Joint Treatment Site improvements) in the city of Carson; and an approximately 39-mile backbone pipeline and its appurtenances from the Joint Treatment Site to the existing San Gabriel Canyon Spreading Grounds in the City of Azusa (referred to as the Project for this report).

Pure Water is subject to compliance with the California Environmental Quality Act (CEQA) requirements regarding its potential significant impacts on unique paleontological resources, with Metropolitan acting as the CEQA lead agency. Pure Water is also subject to the National Environmental Policy Act (NEPA) requirements regarding its potential to adversely impact paleontological resources. As part of the environmental review process, a paleontological resources assessment was conducted to assess potential impacts of the proposed Project on paleontological resources.

1.2 PROJECT DESCRIPTION

1.2.1 Background

Metropolitan is a public agency and regional water wholesaler made up of 26 member agencies serving approximately 19 million people in the counties of Los Angeles, Orange, San Diego, Ventura, Riverside, and San Bernardino. Metropolitan imports water from the Colorado River via the Colorado River Aqueduct and from Northern California via the State Water Project to supplement local water supplies. In addition to importing water, Metropolitan supports its member agencies in developing local water conservation, recycling, storage, and resource management programs.

The Sanitation Districts consist of 24 independent special districts that form a regional public agency that collects and treats wastewater for over 5.5 million people in Los Angeles County. The Sanitation Districts' Warren Facility in the city of Carson is one of eleven wastewater treatment plants in their system and is one of the largest wastewater treatment plants in the world. The Warren Facility provides primary and secondary treatment for approximately 260 million gallons per day (MGD) of wastewater, which currently is discharged to the Pacific Ocean.

1.2.2 Description of Proposed Project Components

Pure Water is a partnership between Metropolitan and the Sanitation Districts to develop and implement a regional recycled water program. Specifically, Pure Water would involve purification of cleaned wastewater from the Warren Facility at a new AWP Facility to produce approximately 150 MGD of sustainable, high-quality water and distribution of this water predominantly for indirect and direct potable reuse.

Proposed facilities to implement Pure Water include modifications to the existing Warren Facility, a new AWP Facility located at the Warren Facility (including direct potable reuse [DPR] treatment facilities and a pump station), a Workforce Training Center, pipelines, pump stations, service connections, groundwater recharge improvements, and operation, maintenance, and ancillary facilities, as needed. This paleontological study addresses improvements at the Joint Treatment Site as well as the backbone pipeline.

Pure Water would require construction and operation of various facilities at the Joint Treatment Site, which is bounded by West Lomita Boulevard to the south, South Main Street to the east, and developed portions of the Warren Facility to the north and west. Work would include a new full-scale AWP Facility and modifications to the existing Warren Facility to connect to the AWP Facility. The Joint Treatment Site would also include a Workforce Training Center and space to support public tours and administrative services. Construction activities associated with these facilities would include demolition of an existing Sanitation Districts' warehouse and maintenance basin; closure of existing oil wells; site clearing; excavation; installation, upgrade, or relocation of utilities; modifications to or construction of new biological treatment processes; installation of equipment, paving, landscaping, and associated site improvements; construction of buildings and other facilities; and storage of materials and equipment.

The backbone pipeline would extend approximately 39 miles from the AWP Facility to the existing San Gabriel Canyon Spreading Grounds in the city of Azusa. The southern 25 miles would be 7-foot-diameter pipe and the northern 14 miles would be 9-foot-diameter pipe. The backbone pipeline would be buried under public roadways and in rights-of-way situated along the San Gabriel River that currently are held by Southern California Edison, LADWP, Los Angeles County Flood Control District, U.S. Army Corps of Engineers, and private parties. The backbone pipeline would have the capacity to convey approximately 150 MGD (7-foot portion) to 300 MGD (9-foot portion) of purified water and would deliver some of this water at various locations along the way.

Construction activities for the pipelines would be temporary in nature and would utilize a variety of methods based on the characteristics of each portion of the alignment. These methods would include trench excavation and backfill, as well as several different trenchless methods. To the extent feasible, trenchless methods would be used to minimize impacts to the San Gabriel River, major drainage channels, the transportation system, sensitive resources, and areas with limited rights-of-way.

1.3 PROJECT LOCATION

For the purposes of this technical report, the footprint of the backbone pipeline and Joint Treatment Site are identified as the Paleontological Study Area and are the subject of this assessment. The backbone pipeline would be constructed through urban areas within the cities of Carson, Long Beach, Lakewood, Cerritos, Bellflower, Norwalk, Downey, Santa Fe Springs, Duarte, Pico Rivera, Industry, El Monte, Baldwin Park, Irwindale, and Azusa, as well as unincorporated portions of Los Angeles County (Figure 1).

The Paleontological Study Area is located in portions of the Azusa, Baldwin Park, El Monte, Whittier, Los Alamitos, Long Beach, and Torrance U.S. Geological Survey (USGS) 7.5-minute series topographic quadrangles (Figure 2, Figure 3). Specifically, the Paleontological Study Area alignment begins in the city of Carson, south of the intersection of Main Street and East Sepulveda Boulevard, and traverses generally northward, paralleling Interstate 605 (I-605) and the San Gabriel River. The alignment terminates at the north end of the San Gabriel Canyon Spreading Grounds at San Gabriel Canyon Road in the city of Azusa.

The remaining portions of the overall Pure Water program, including DPR treatment at a satellite facility or the Weymouth Water Treatment Plant, the groundwater recharge facilities and service connections, and the two backbone conveyance system pump stations that do not yet have determined locations will only be addressed at the program level in the current environmental review process and are not included in the analysis in this technical report.

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Figure 1. Project Vicinity Map

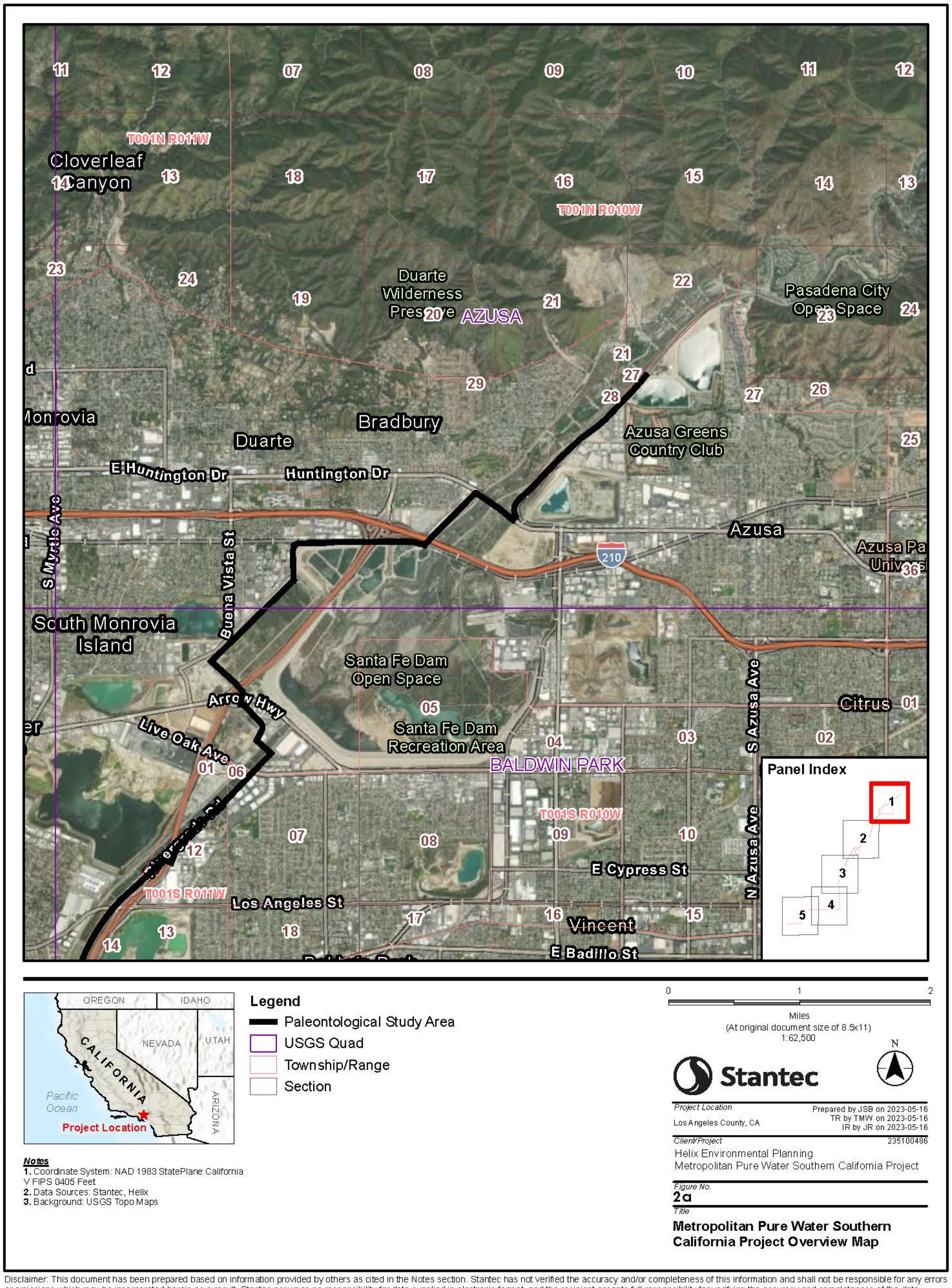

Figure 2a. Paleontological Study Area Overview Map (1 of 5)

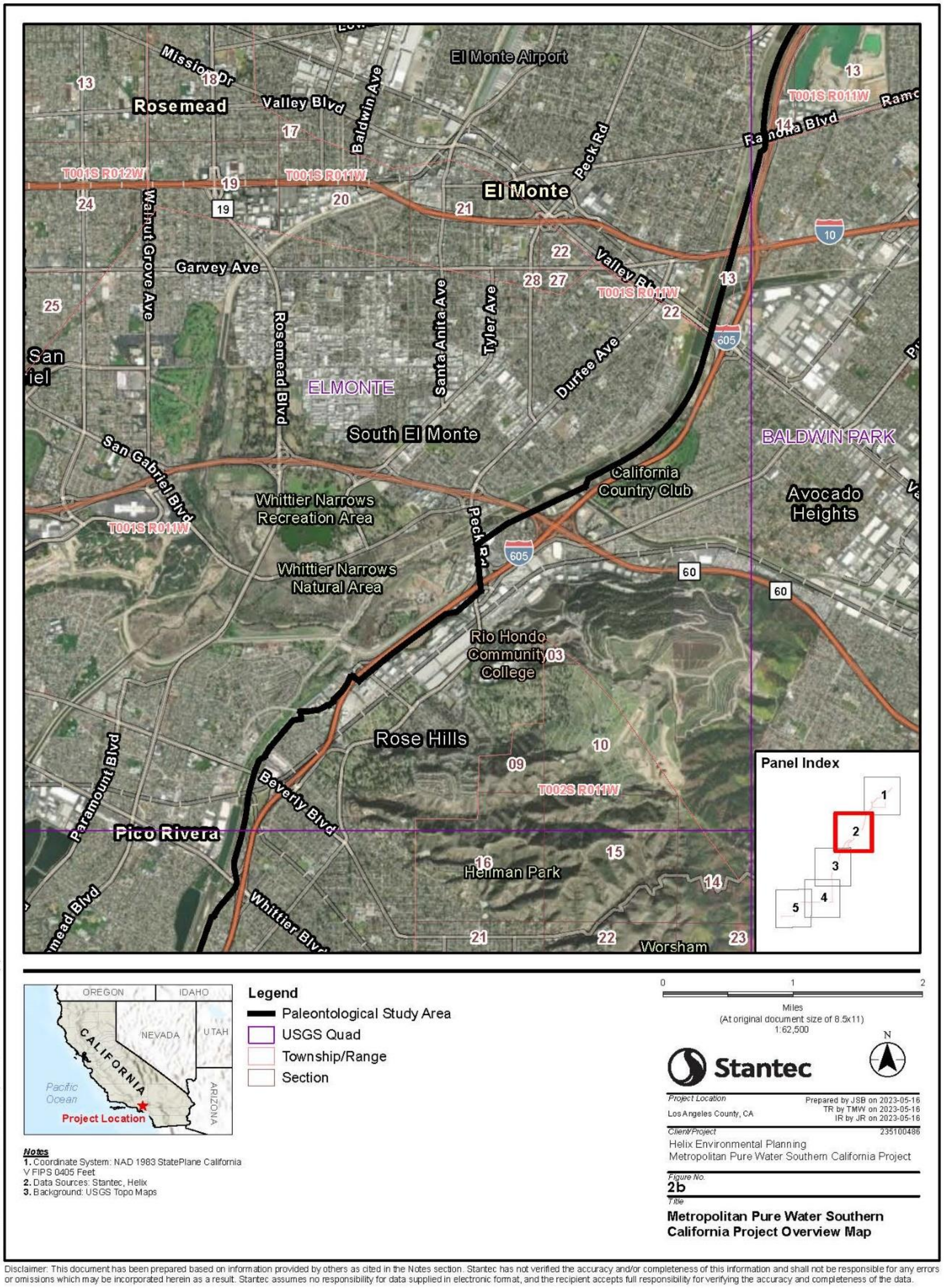

Figure 2b. Paleontological Study Area Overview Map (2 of 5)

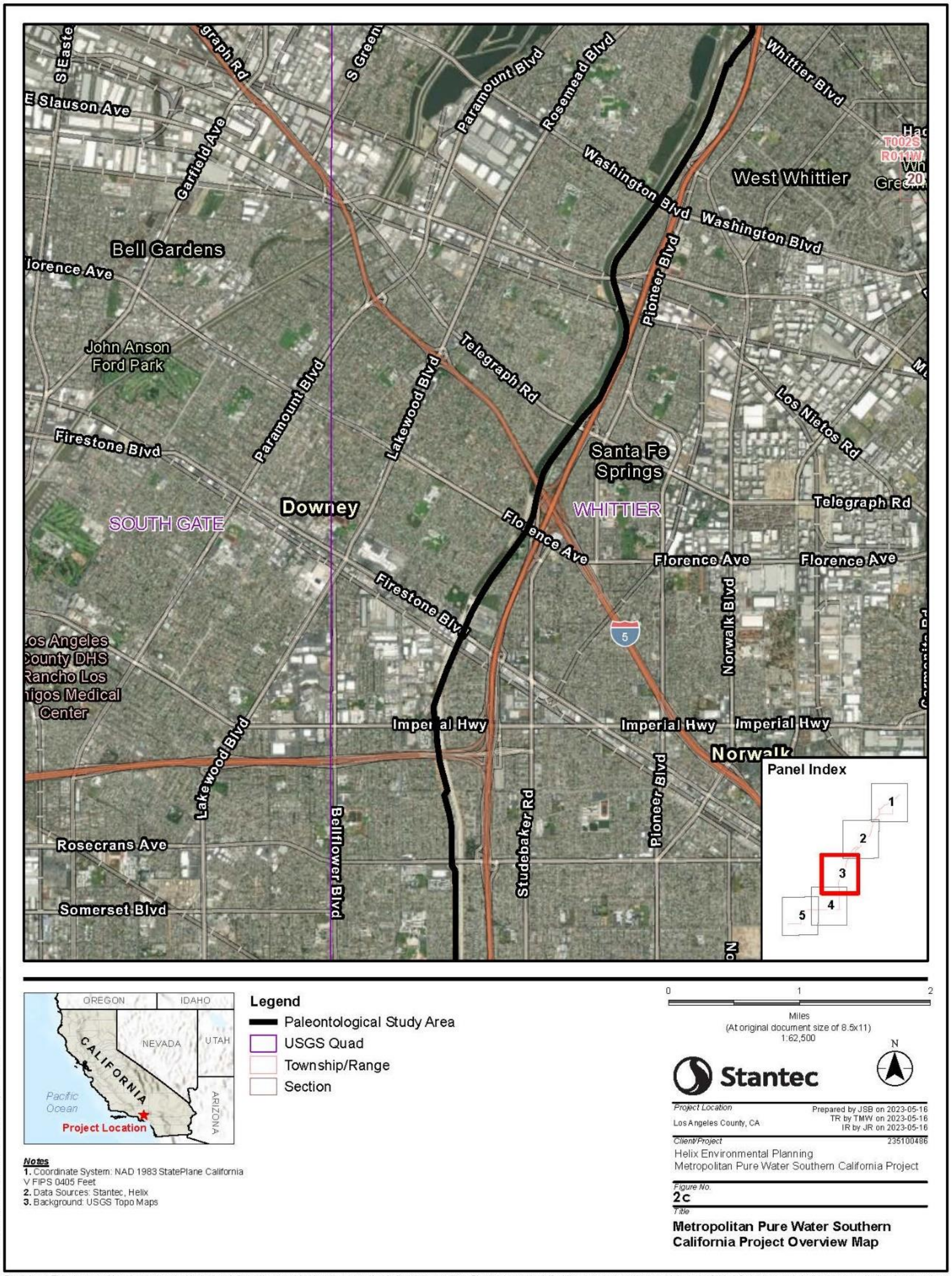

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Figure 2c. Paleontological Study Area Overview Map (3 of 5)

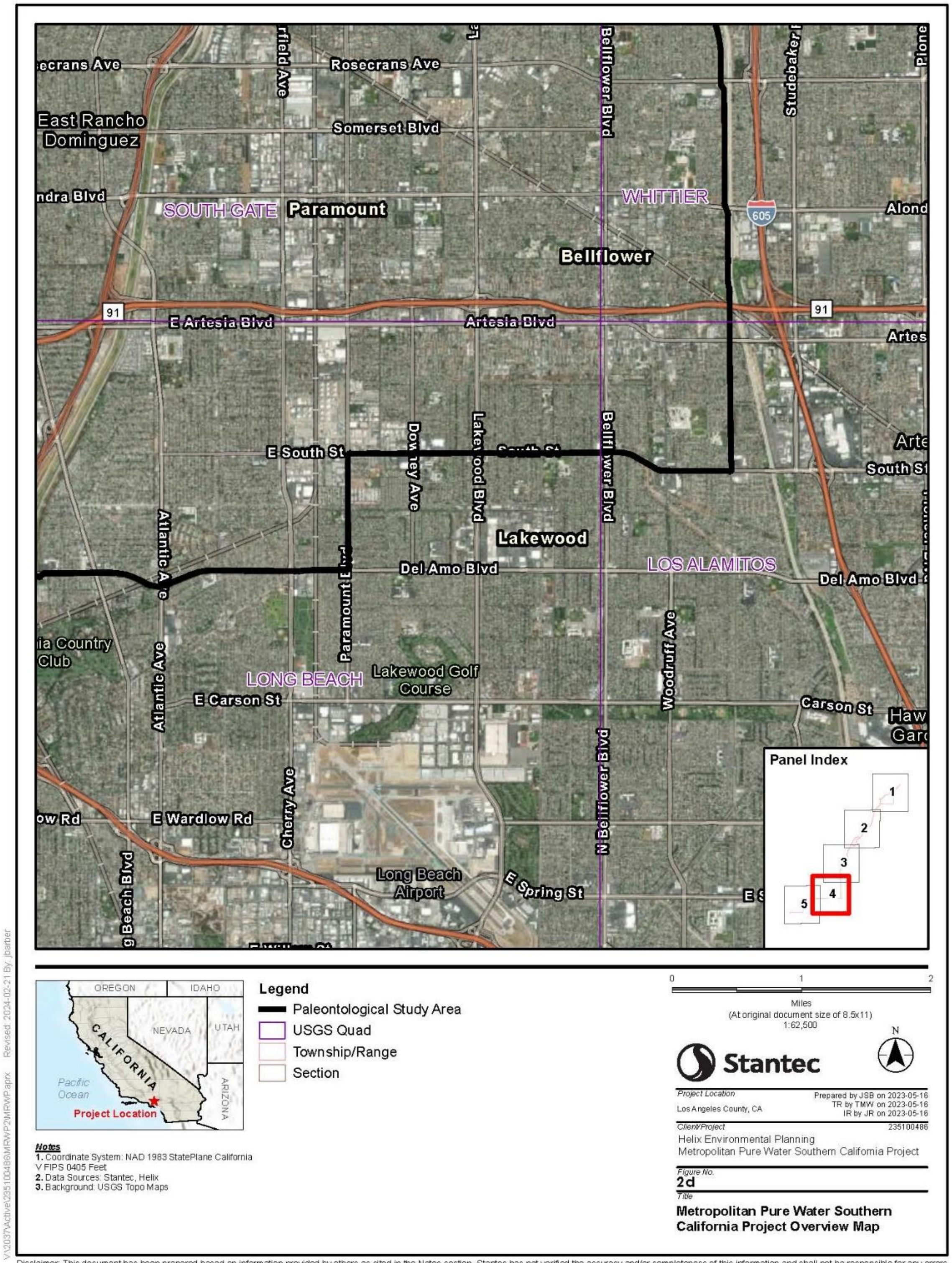

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Figure 2d. Paleontological Study Area Overview Map (4 of 5)

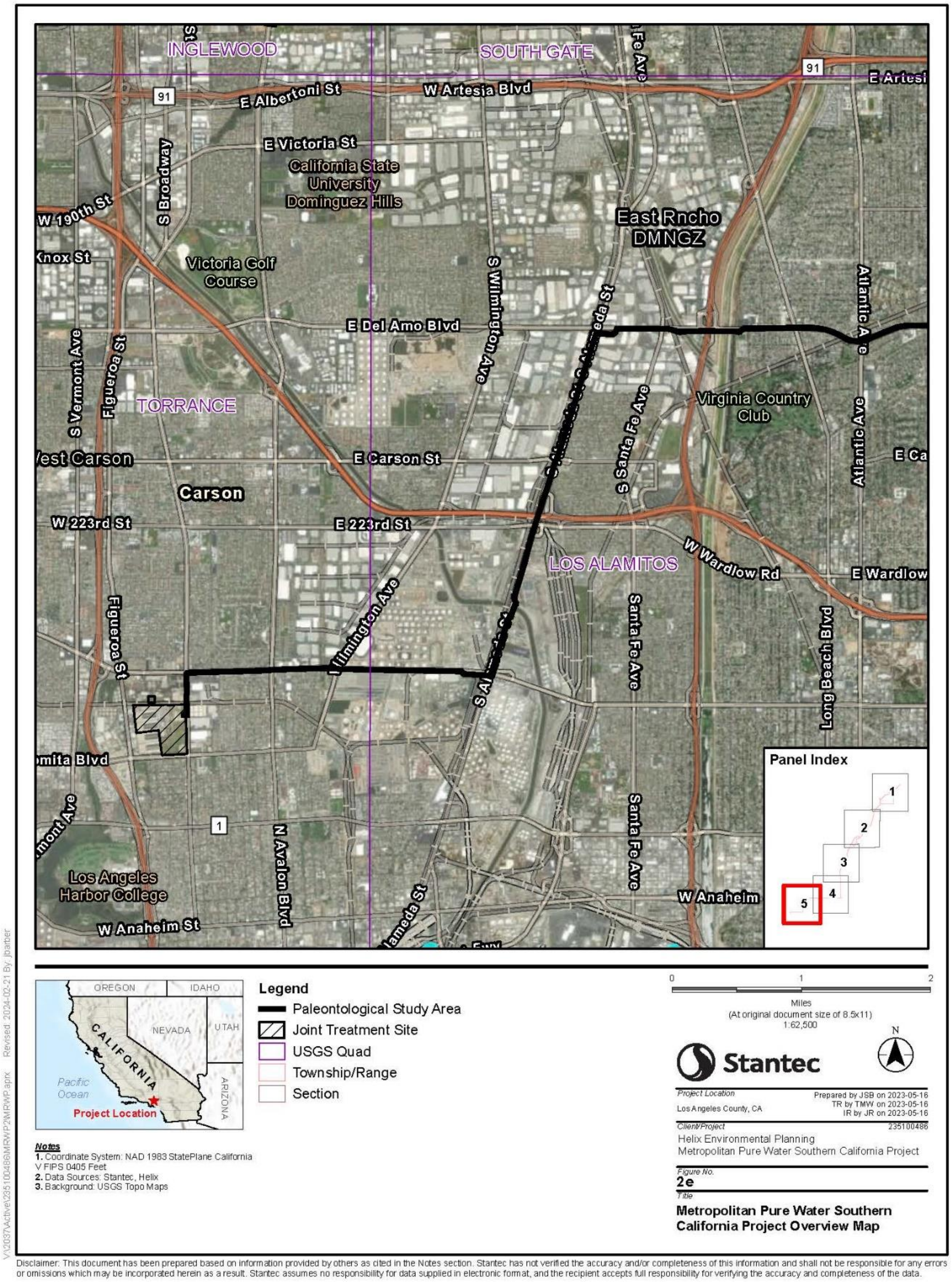

Figure 2e. Paleontological Study Area Overview Map (5 of 5)

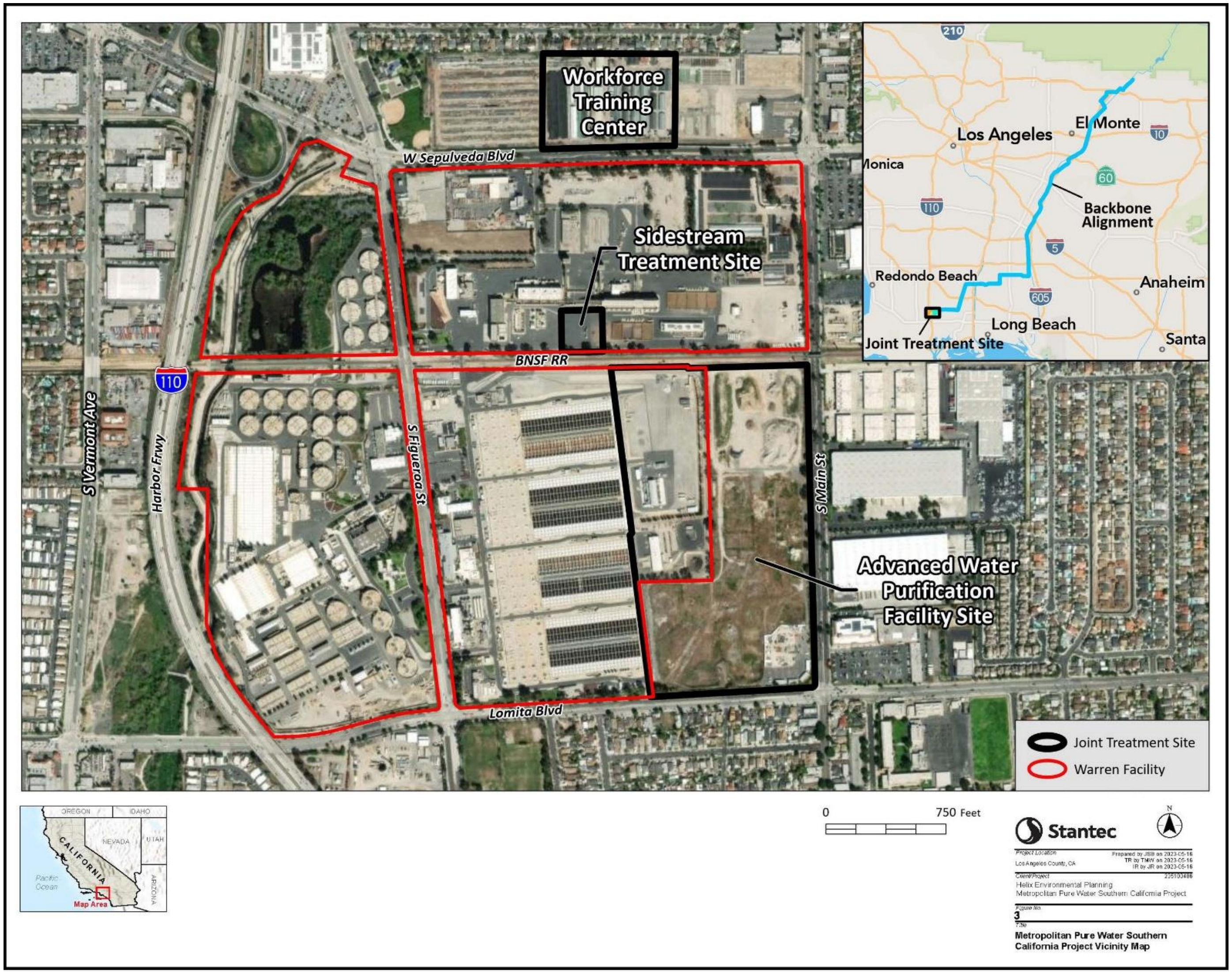

Figure 3. Joint Treatment Site

1.4 PALEONTOLOGICAL RESOURCES

Fossils are any evidence of ancient life. This includes the remains of the body of an organism, such as bones, skin impressions, shell, or leaves, as well as traces of an organism's activity, such as footprints or burrows, called trace fossils (U.S. Department of the Interior [USDI] 2000). In addition to the fossils themselves, geologic context is an important component of paleontological resources, and includes the stratigraphic placement of the fossil as well as the lithology of the rock in order to assess paleoecologic setting, depositional environment, and taphonomy.

Some fossils have scientific and educational value, and as such are protected by federal, state, and local regulations as nonrenewable natural resources. Once damaged, destroyed, or improperly collected, fossils lose their scientific and educational value. Scientific importance may be attributed to the actual fossil specimen, to fossil context (e.g., location in time and space, association with other fossils, or association with geologic events), or to fossil preservation. Fossils that have such scientific importance are considered to be paleontological resources. The Paleontological Resources Preservation Act (PRPA) defines paleontological resources as:

> any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include— (A) any materials associated with an archaeological resource (as defined in section 3(1) of the Archaeological Resources Protection Act of 1979 (16 United States Code [USC] 470bb(1)); or (B) any cultural item (as defined in section 2 of the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001)). [PRPA; Sec. 6301: Definitions].

It should be noted that the definition of the term "paleontological resources" in the PRPA limits paleontological resources to fossilized remains that are of paleontological interest and inform the history of life on earth, and therefore under the PRPA's definition not all fossils are considered paleontological resources. Although the PRPA does not apply to this Project, it is used here to provide a definition for paleontological resources, which is not directly addressed by NEPA.

Additionally, the standards of the Society of Vertebrate Paleontology (SVP) provide industry standards on what constitutes significance when assessing fossils:

> 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].

The determination of scientific or paleontological 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). Numerous paleontological studies have developed criteria for the assessment of significance for paleontological resource discoveries (e.g., Eisentraut and Cooper 2002, Murphey et al.

2019, Murphey and Daitch 2007, 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.

Further guidance specific to CEQA can be found in Scott and Springer (2003). Those authors stated that significant paleontological resources include “fossil remains of large to very small aquatic and terrestrial vertebrates, remains of plants and animals previously not represented in certain portions of the stratigraphy, and fossils that might aid stratigraphic correlations, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimatology, and the relationships of aquatic and terrestrial species” (2003:6). Furthermore, they also advised that impacts might be considered less than significant if dense concentrations of plant and/or invertebrate fossil remains were “so locally abundant that the impacts to the resources do not appreciably diminish their overall abundance or diversity” (2003:6).

A geologic unit known to contain scientifically important paleontological resources is considered sensitive to adverse impacts if there is a high probability that earth-moving or ground-disturbing activities in that rock unit will either disturb or destroy paleontological resource remains directly or indirectly. This definition of sensitivity differs fundamentally from the definition for archaeological resources as follows:

> It is extremely important to distinguish between archaeological and paleontological (fossil) resource sites when defining the sensitivity of rock units. The boundaries of archaeological sites define the areal extent of the resource. Paleontological sites, however, indicate that the containing sedimentary rock unit or formation is fossiliferous. The limits of the entire rock formation, both areal and stratigraphic, therefore define the scope of the paleontological potential in each case. [SVP 2010: 2].

Many archaeological sites contain features that are visually detectable on the surface. In contrast, fossils are often contained within surficial sediments or bedrock and are therefore not observable or detectable unless exposed by erosion or human activity.

In summary, in the absence of observable paleontological resources on the surface, paleontologists must assess the potential of geologic units as a whole to yield paleontological resources based on their known potential to produce those resources elsewhere. Monitoring by experienced paleontologists greatly increases the probability that fossils will be discovered during ground-disturbing activities and that, if these remains are scientifically important, successful mitigation and salvage efforts may be undertaken to prevent adverse effects to these resources.

1.4.1 Professional Standards

The SVP (2010), the Bureau of Land Management (1998, 2008, 2016), and a number of scientific studies (Eisentraut and Cooper 2002; Murphey et al. 2019; Scott and Springer 2003) have developed guidelines for professional qualifications, conducting paleontological assessments, and developing mitigation measures for the protection of paleontological resources. These guidelines are broadly similar, and include the use of museum records searches, scientific literature reviews, and, in some cases, field surveys to assess the potential of an area to preserve paleontological resources. Should that potential be high, accepted mitigation measures include paleontological monitoring, data recordation of all fossils encountered, collection and curation of significant fossils and associated data, and in some cases screening of sediment for microfossils.

This study has been conducted in accordance with these guidelines and the recommendations provided herein meet these standards.

2.0 Regulatory Framework

The following sections describe specific laws, ordinances, and regulations that are applicable to the Project. This investigation was conducted to meet these requirements regarding paleontological resources for the Project.

The Project is subject to state and federal regulations that pertain to paleontological resources.

2.1 STATE OF CALIFORNIA

2.1.1 California Environmental Quality Act

In California, unique paleontological resources, sites, and geologic features, particularly with regard to fossil localities, are afforded protection under a number of state environmental statutes, including CEQA. Under CEQA, a lead agency must determine if the project would result in the direct or indirect destruction of a unique paleontological resource or site or unique geologic feature, and if such impacts would be significant (Title 14, Division 6, Chapter 3, California Code of Regulations [CCR] 15000 et seq.). The CEQA lead agency is responsible for ensuring that feasible mitigation measures are implemented in an effort to reduce impacts to a less-than-significant level.

Under these requirements, Stantec has conducted a paleontological resources assessment to determine impacts of the proposed Project on unique paleontological resources within the Paleontological Study 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 non-federal public 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.

2.2 FEDERAL REGULATIONS

The Project is subject to Federal regulations as a result of anticipated permitting requirements from the United States (U.S.) Army Corps of Engineers as well as federal funding requirements.

2.2.1 National Environmental Policy Act

NEPA, as amended (Public Law [PL] 91-190, 42 USC 4321–4347, January 1, 1970, as amended by PL 94-52, July 3, 1975, PL 94-83, August 9, 1975, and PL 97-258 4(b), Sept. 13, 1982), recognizes the continuing responsibility of the federal government to “preserve important historic, cultural, and natural aspects of our national heritage…” (Sec. 101 [42 USC 4321], #382). The passage of the PRPA (see below) in 2009 made paleontological resources widely recognized natural resources that must be considered under NEPA analyses, and it is therefore now standard practice to include paleontological resources in NEPA studies in all instances where there is a possible impact.

2.2.2 Paleontological Resources Preservation Act

The PRPA directs the USDI and U.S. Department of Agriculture to manage and protect paleontological resources on federal land using “scientific principles and expertise” (Sec. 6302), including plans for inventory, monitoring, and the scientific and educational use of paleontological resources. To formulate a consistent paleontological resources management framework, the PRPA incorporates most of the recommendations from the report of the Secretary of the Interior titled “Assessment of Fossil Management on Federal and Indian Lands” (USDI 2000). The PRPA officially recognizes the scientific importance of paleontological resources by declaring that these resources from designated federal lands are federal property that must be preserved and protected. The PRPA codifies pre-existing policies of the Bureau of Land Management, National Park Service, U.S. Forest Service, Bureau of Reclamation, and U.S. Fish and Wildlife Service, and provides for uniform:

- criminal and civil penalties for illegal removal, transport, and sale as well as theft and vandalism of fossils from federal lands (Sections 6306, 6307, and 6308);
- minimum requirements for the issuance of paleontological resource-use permits (terms, conditions, and qualifications of applicants) (Section 6304);
- protection of locality data (Section 6309);
- definitions for “paleontological resources” and “casual collecting” (Section 6301); and
- requirements for curation of federal fossils in approved repositories (Section 6305).

2.2.3 Federal Land Policy and Management Act

The Federal Land Policy and Management Act (FLPMA) of 1976 (43 USC 1712[c], 1732[b]); sec. 2, FLPMA of 1962 [30 USC 611]; Subpart 3631.0 et seq., Federal Register Vol. 47, No. 159, 1982) does not refer specifically to paleontological resources. However, paleontological resources are understood and recognized in policy as scientific resources, as recognized with the passage of the PRPA. Under the FLPMA, federal agencies are charged to:

- manage public lands in a manner that protects the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, archaeological, and water resources, and, where appropriate, preserve and protect certain public lands in their natural condition (Section 102);
- periodically inventory public lands so that the data can be used to make informed land-use decisions (Section 102); and
- regulate the use and development of public lands and resources through easements, licenses, and permits (Section 302).

3.0 Geologic Setting

The Paleontological Study Area is located within the Peninsular Ranges geomorphic province, a region characterized by northwest-trending fault-bounded mountain ranges, broad intervening valleys, and low-lying coastal plains (Yerkes et al. 1965). The Peninsular Ranges extend approximately 920 miles from the Los Angeles Basin to the southern tip of Baja California and vary in width from approximately 30 to 100 miles (Yerkes et al. 1965). The Peninsular Ranges formed as a volcanic island arc collided with the west coast of North America and was accreted onto the margin of the continent, resulting in the expansion of the continent westward (Harden 2004). The Peninsular Ranges are part of a larger subduction zone that extends all along western North America (Norris and Webb 1990). The core of the Peninsular Ranges formed as the core of a magmatic arc in the Mesozoic that resulted from active subduction along the Pacific Plate boundary (Harden 2004). Bedrock units include pre-Cretaceous igneous rocks of the Southern California Batholith overlain by younger sedimentary units that are marine through the Miocene and then slowly transition to entirely terrestrial units in the Pleistocene (Norris and Webb 1990).

Locally, the Paleontological Study Area crosses the Los Angeles Basin. The Los Angeles Basin is a northwest-trending alluviated structural basin bounded on the north by the Santa Monica Mountains and the Elysian, Repetto, and Puente Hills and on the east and southeast by the Santa Ana Mountains and San Joaquin Hills (Yerkes et al. 1965). The Los Angeles basin developed as a result of tectonic forces and the San Andreas fault zone, with subsidence occurring 18 – 3 million years ago (Ma) (Critelli et al. 1995). While sediments dating back to the Cretaceous (66 Ma) are preserved in the basin, continuous sedimentation began in the middle Miocene (around 13 Ma) and continues today, resulting in thousands of feet of accumulation (Yerkes et al. 1965). Most of these sediments are marine, until sea level dropped in the Pleistocene and deposition of the alluvial sediments that compose the uppermost units in the Los Angeles Basin began (Norris and Webb 1990).

4.0 Methodology

The paleontological resource assessment reported herein consisted of 1) a desktop analysis incorporating a museum records search from the Natural History Museum of Los Angeles County (LACM) and review of the scientific literature and geologic mapping; and 2) a pedestrian field survey of portions of the Paleontological Study Area. 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. This is determined by rock type, history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological potential is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey. Following the assessment of paleontological potential, Project plans were reviewed to assess the Project's potential to adversely affect paleontological resources.

For this assessment, three maps at a scale of 1:100,000 were utilized (Campbell et al. 2014, Morton and Miller 2006, Saucedo et al. 2016). These maps were selected because they provide sufficient resolution of the Paleontological Study Area geology and have similar geologic unit names, descriptions, and ages that can be correlated across map boundaries. For the purposes of this assessment, many of the Quaternary units were compiled into groups based on similar lithologic descriptions and ages and given a single name in order to reduce the discrepancies in nomenclature between the three maps. The grouping of units was only done in cases where the paleontological potential would not be changed and thus would not affect the proposed mitigation recommendations for those units and locations.

The paleontological resources assessment presented in this report was conducted under the supervision of Alyssa Bell, Ph.D., who authored this report with assistance from Joey Raum, B.S. who also conducted the paleontological survey. This report was reviewed by Cara Corsetti, M.S. and Geraldine Aron, M.S. GIS graphics were generated by Jeffrey Barber, B.S.

4.1 METHODS: ANALYSIS OF EXISTING DATA

In order to assess the potential of the Paleontological Study Area to preserve paleontological resources or unique paleontological resources, the most recent geologic mapping was consulted to identify all geologic units present at the surface or likely present in the subsurface. The scientific literature was then consulted to investigate the history of each of these units for preserving fossils. A records search of the Paleontological Study Area and vicinity was requested from the LACM on May 31, 2022, with the results received from the LACM on June 12, 2022 (Appendix A). The search returned the closest known paleontological localities of the LACM to the Paleontological Study Area from geologic units that are present at the Paleontological Study Area, either at the surface or in the subsurface. Additionally, the Paleobiology Database (PBDB), an open access online database, and the online database of the University of California Museum of Paleontology (UCMP) were searched for paleontological localities in Los Angeles County from relevant geologic units. The UCMP database does not provide location information, instead providing search results by county.

4.2 METHODS: PEDESTRIAN SURVEY

In order to evaluate the sedimentological characteristics of the surficial geologic units in the Paleontological Study Area and assess previously recorded paleontological localities within the Paleontological Study Area, Stantec conducted a pedestrian field survey of portions of the Paleontological Study Area on September 28, 2022.

Stantec identified the portions of the Paleontological Study Area in which: 1) geologic units with the potential to preserve fossils are mapped as present at the surface; 2) aerial imagery indicates the surface is not presently developed; and 3) Project activities are planned that would involve activity at or within the surface as the target of pedestrian survey. The evaluation removed areas from the pedestrian survey where the surface has no potential to preserve paleontological resources, as well as areas where Project activities would be limited to existing roadways or developed surfaces, as activities in these areas are unlikely to impact paleontological resources. The pedestrian survey was conducted on foot, with the paleontologist walking those portions of the Paleontological Study Area and recording observations of lithology, as well as searching for any fossils that might be exposed on the surface (Figure 4).

The remainder of the Paleontological Study Area received a windshield survey. The windshield survey consisted of driving the portions of the Paleontological Study Area with low potential for fossil preservation at the surface and confirming the geologic mapping and aerial imagery were correct, and that these areas are unlikely to preserve paleontological resources at the surface. When observations from the windshield survey indicated a pedestrian survey was warranted, (i.e., that surficial sediments had high paleontological potential) the paleontologist conducted a pedestrian survey of that area.

Data were recorded on survey forms with the use of an Apple iPad tablet running Field Maps by ArcGIS and Wildnote, paired to an Arrow-100 GNSS GPS receiver with 0.5- to 4.0-meter accuracy.

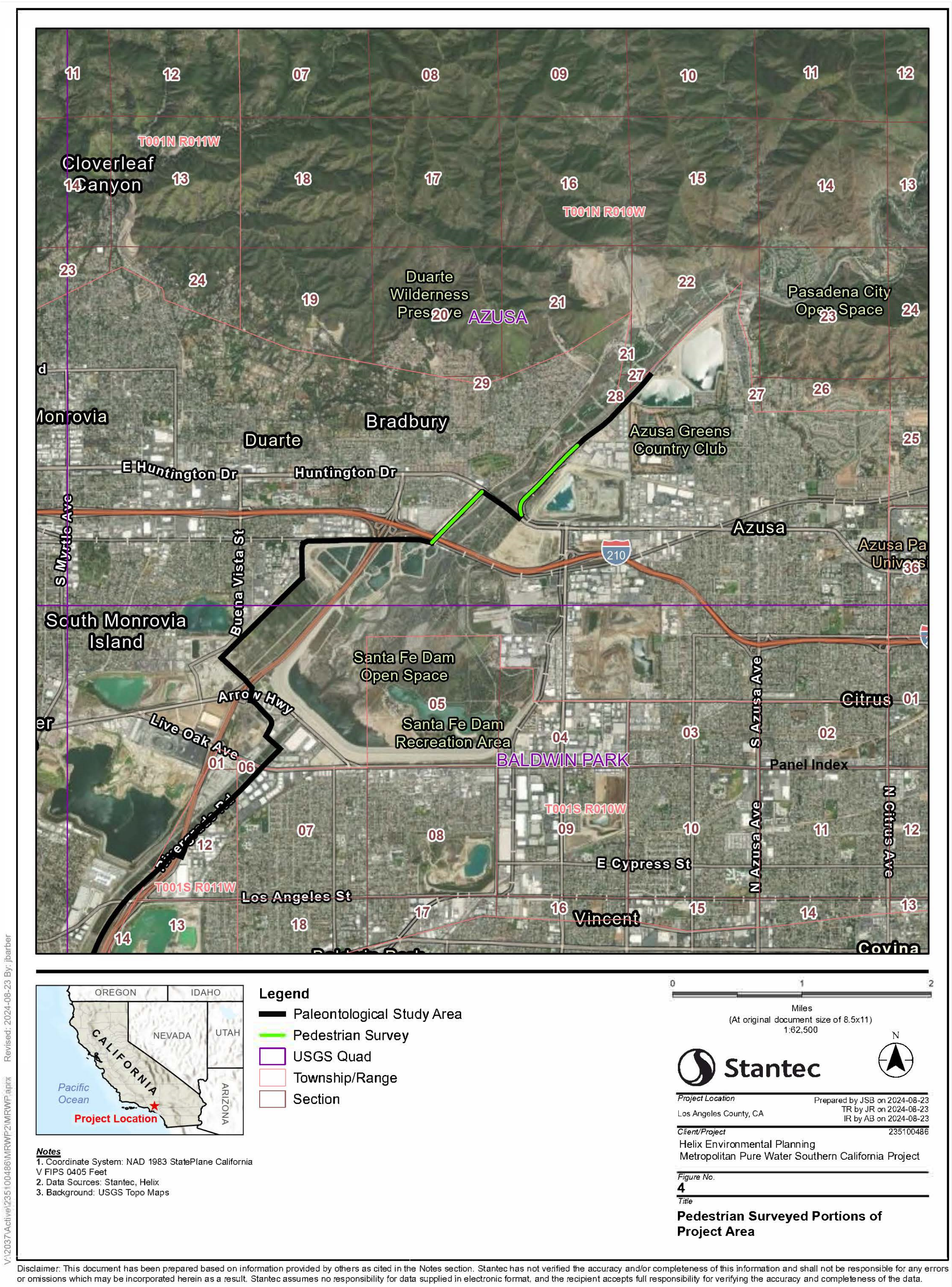

Figure 4. Pedestrian Survey Areas Map

4.3 METHODS: PALEONTOLOGICAL POTENTIAL

The results of the desktop analysis and field survey were used to assign the paleontological potential rankings of the SVP (2010) to the geologic units present in the Paleontological Study 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, such as high-grade metamorphic rocks (i.e., gneisses and schists) and plutonic igneous rocks (i.e., granites and diorites).

4.4 METHODS: ASSESSMENT OF ADVERSE IMPACTS OR EFFECTS

Impacts to unique paleontological resources under CEQA or effects to paleontological resources under NEPA can be classified as direct, indirect, or cumulative. Direct adverse impacts or effects to paleontological resources could result from the damage or destruction of these resources by surface disturbing actions including construction excavations. Therefore, in areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to cause significant impacts or adverse effects to paleontological resources, by damaging or destroying them and rendering them permanently unavailable to science and society. Under NEPA, positive direct effects can be considered to result when paleontological resources are identified during construction and appropriately documented and salvaged, thus ensuring the specimens are protected for future study and education. CEQA, however, does not consider positive impacts.

Indirect adverse impacts or effects can occur as a result of human activities that increase erosion potentially causing indirect impacts or effects to surface and subsurface paleontological resources as the result of exposure, transport, weathering, and reburial.

Cumulative adverse impacts or effects 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 would represent a significant cumulative adverse impact or effect because it could result in the destruction of nonrenewable, unique paleontological resources and the associated irretrievable loss of scientific information.

Positive effects, per NEPA, can result from the preservation of paleontological resources identified during construction, a direct effect, or following Project activities, an indirect effect. By successfully identifying, salvaging, and curating paleontological resources in a federally accredited repository, they are preserved in perpetuity and may contribute to scientific understanding and public education and awareness.

CEQA does not include a specific definition of “unique paleontological resource or site,” nor does it establish thresholds for significance. As a result, the criteria for scientific importance described in Section 1.4 are used in determining the significance of impacts. Based on those criteria, any identifiable vertebrate fossil remains would be considered unique under CEQA. Identifiable invertebrate and plant fossils would be considered unique if they meet the criteria presented in Section 1.4. Direct or indirect impacts on such remains would be considered significant. Determinations shall take into account the abundance and densities of fossil specimens or newly and previously recorded fossil localities in exposures of the rock units present at a project site. The assessment of adverse effects conducted here takes into consideration all planned Project activities in terms of aerial and subsurface extents, including the possibility of subsurface geologic units having a different paleontological potential than surficial units. For example, younger surficial sediments (alluvium, lacustrine, eolian, etc.) usually have low potential to preserve paleontological resources at the surface due to their young age; yet sediments increase in age with depth and so these surficial deposits often overlie older units that have higher paleontological potential. In areas with this underlying geologic setting surficial work may be of low risk for affecting paleontological resources while activities that require excavations below the depth of the surficial deposits would be at greater risk of affecting paleontological resources. For this reason, the assessment of adverse effects takes into consideration both the surface and subsurface geology and is tailored to Project activities.

5.0 Results

5.1 RESULTS: ANALYSIS OF EXISTING DATA

Geologic mapping by Campbell et al. (2014), Morton and Miller (2006), and Saucedo et al. (2016) indicates the surface of the Paleontological Study Area consists of seven geologic units: late Holocene-aged active sedimentary deposits, which are mapped individually as active alluvium and alluvial fan deposits and active wash deposits; young sedimentary deposits, which are mapped individually as Holocene-aged young alluvium and alluvial fan deposits and Holocene- to late Pleistocene-aged young wash deposits; Pleistocene-aged older alluvium and alluvial fan deposits; late to middle Pleistocene-aged old shallow marine deposits on wave-cut surfaces (terrace deposits); and the Pliocene-aged Fernando Formation (Figure 5). Six additional units mapped within the Project vicinity, and likely present underlying portions of the Paleontological Study Area at unknown depths, are the late Pleistocene-aged Palos Verdes Sand, Lakewood Formation, and La Habra Formation; the Sycamore Canyon Member of the Miocene-aged Puente Formation, and the Tonalite of San Gabriel Reservoir (Figure 5). These geologic units range in age from the Recent to the Cretaceous and are described below.

5.1.1 Active Sedimentary Deposits

Active sedimentary deposits in the Paleontological Study Area are comprised of active alluvium and alluvial fan deposits (denoted by Qaa in Figure 5) as well as active wash deposits (denoted by Qwa in Figure 5). These sediments are relatively young in age, dating from the late Holocene to the Recent, and may be underlain by older sedimentary deposits (see below) at undetermined depths.

Active alluvium and alluvial fan deposits are mapped at the surface in the northern portion of the Paleontological Study Area, along the western side of the Santa Fe Dam Open Space Area between Arrow Highway and Interstate 210 (I-210) (Figure 5). These sediments consist of unconsolidated deposits of silty, sandy, and cobbly alluvium deposited by streams in valleys (Morton and Miller 2006).

Active wash deposits are mapped at the surface in the northern and central portions of the Paleontological Study Area in the San Gabriel River beginning at the Paleontological Study Area’s northern terminus near San Gabriel Canyon Road and extending south to Firestone Boulevard, as well as in the southern portion of the Paleontological Study Area along East Lomita Boulevard (Figure 5). These sediments consist of unconsolidated sand and gravel deposits in active washes and stream channels, namely the San Gabriel River (Morton and Miller 2006). These young deposits have fresh flood scours and channel-and-bar morphology and have little to no soil development (Morton and Miller 2006). As these sediments range in age from the present to less than 5,000 years old, they are too young to preserve fossils, but are likely underlain by older units with higher potential in the subsurface.

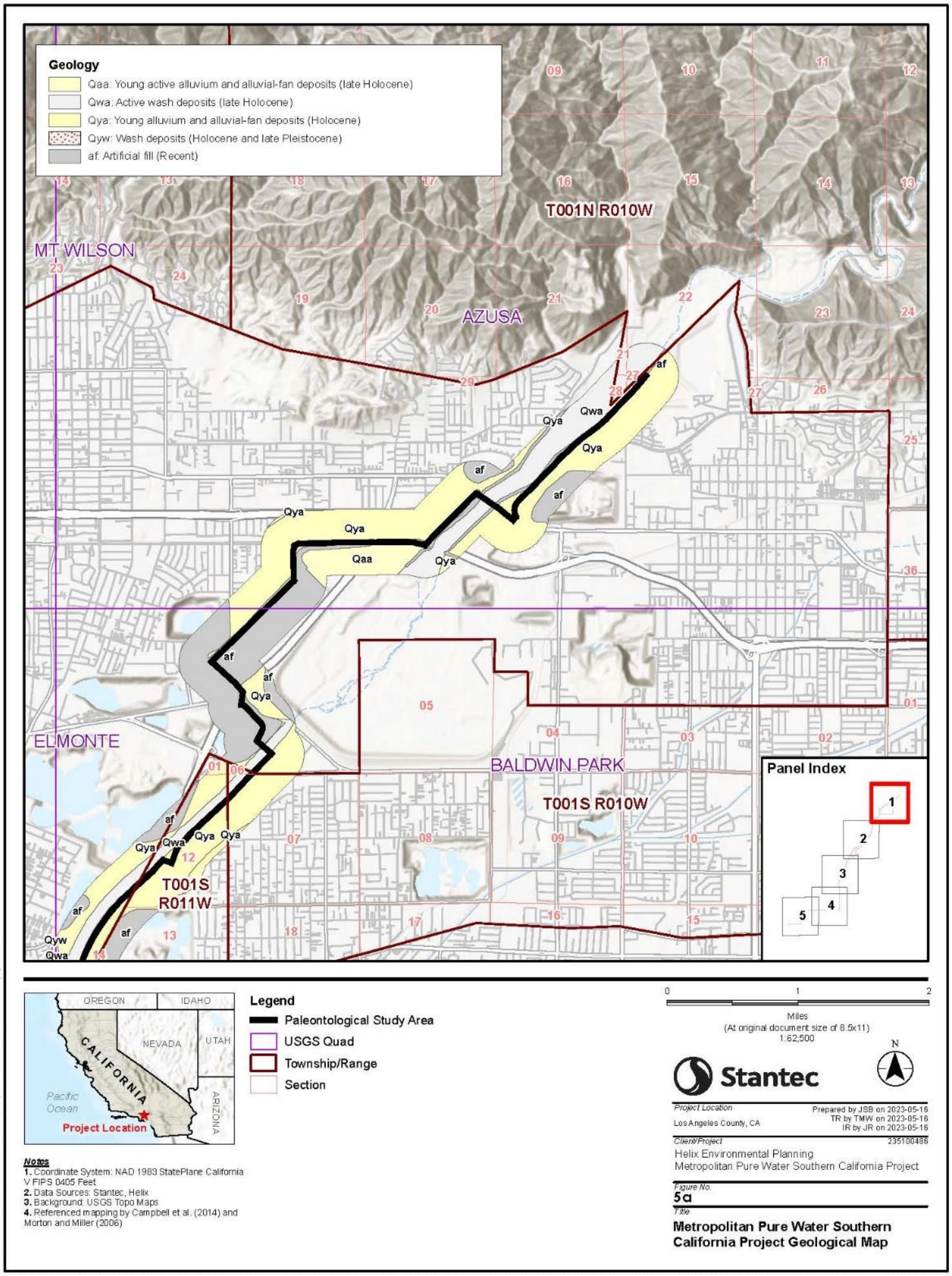

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Figure 5a. Geologic Map of Paleontological Study Area (1 of 5)

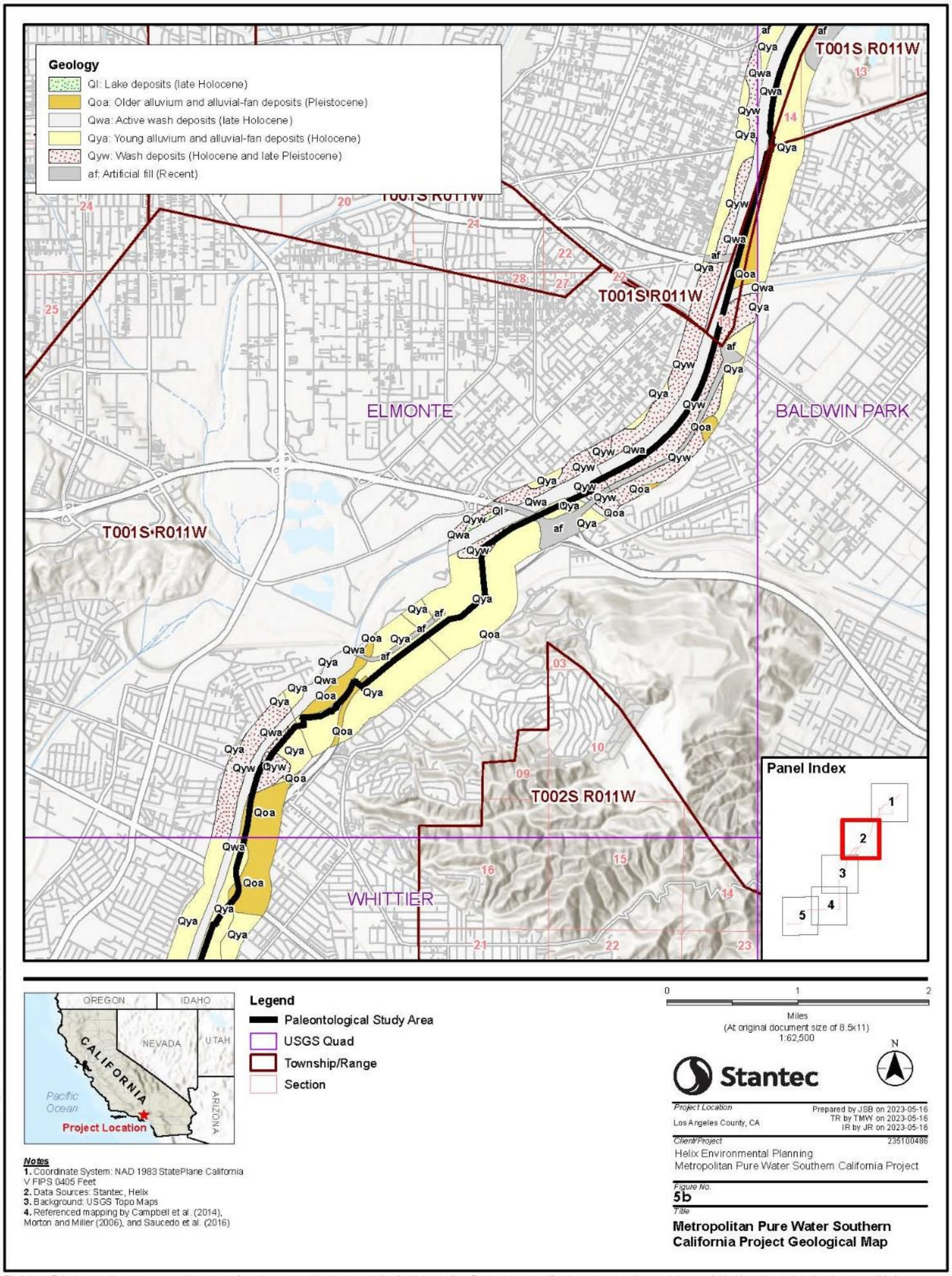

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Figure 5b. Geologic Map of Paleontological Study Area (2 of 5)

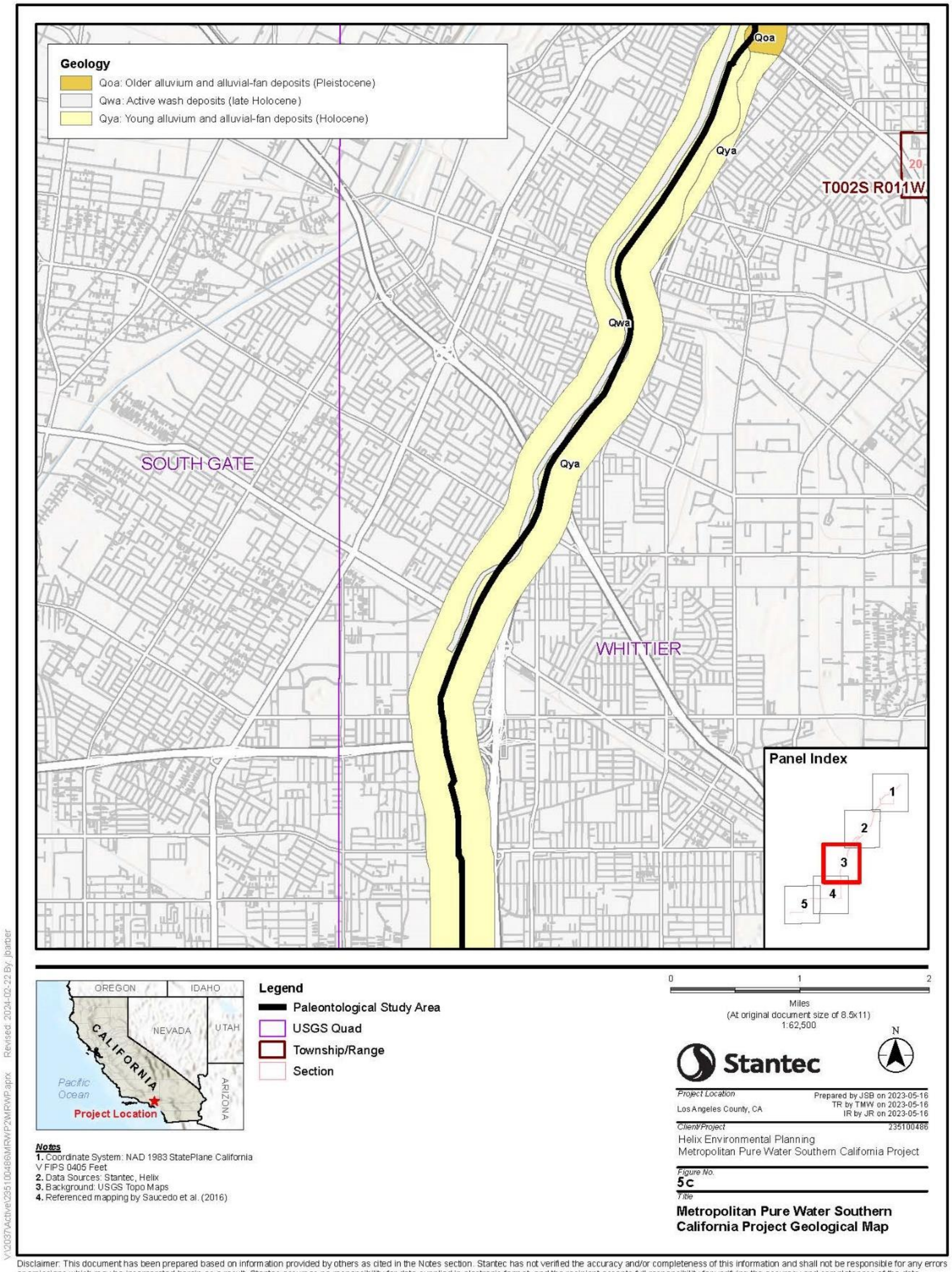

Figure 5c. Geologic Map of Paleontological Study Area (3 of 5)

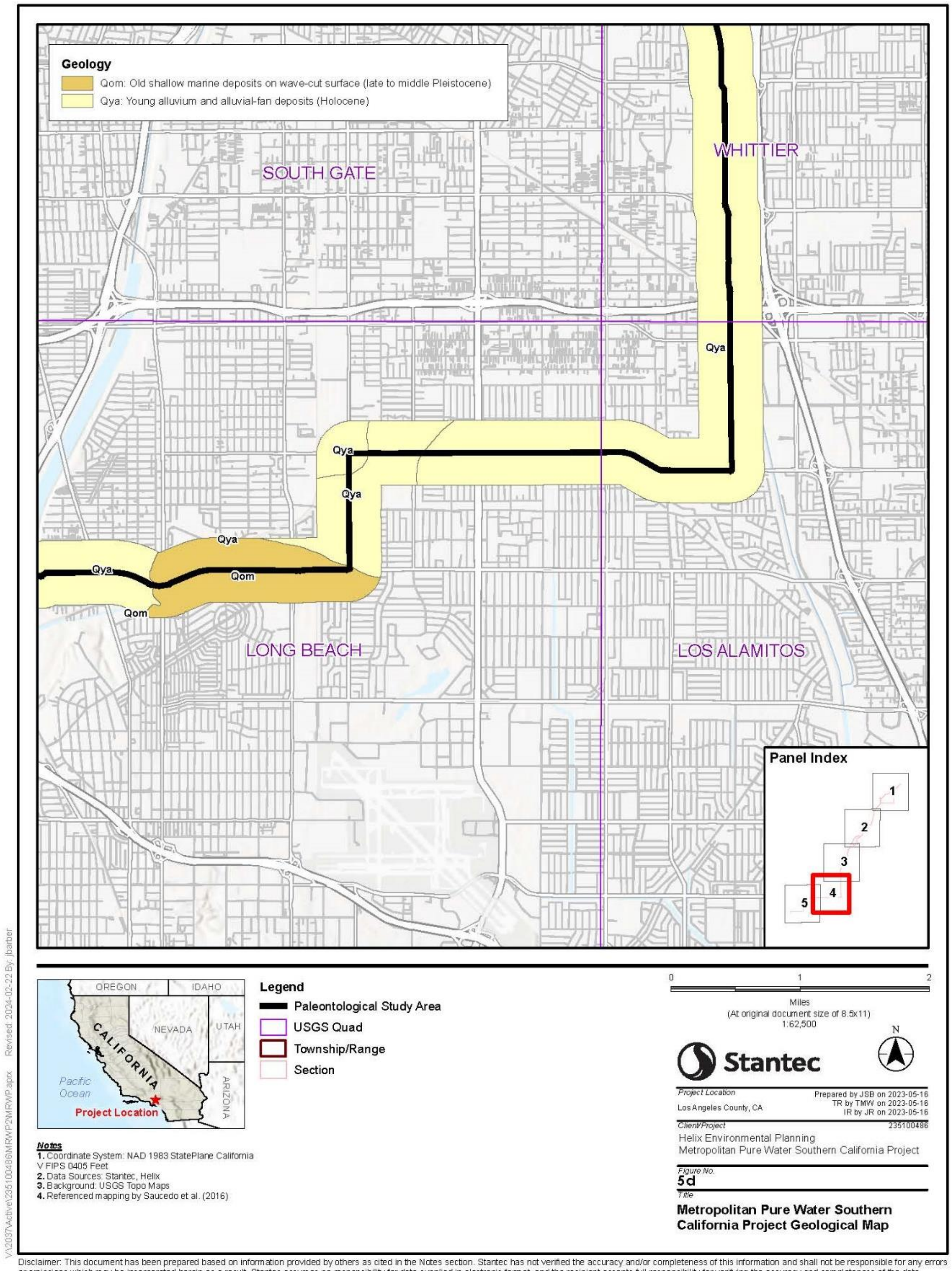

Figure 5d. Geologic Map of Paleontological Study Area (4 of 5)

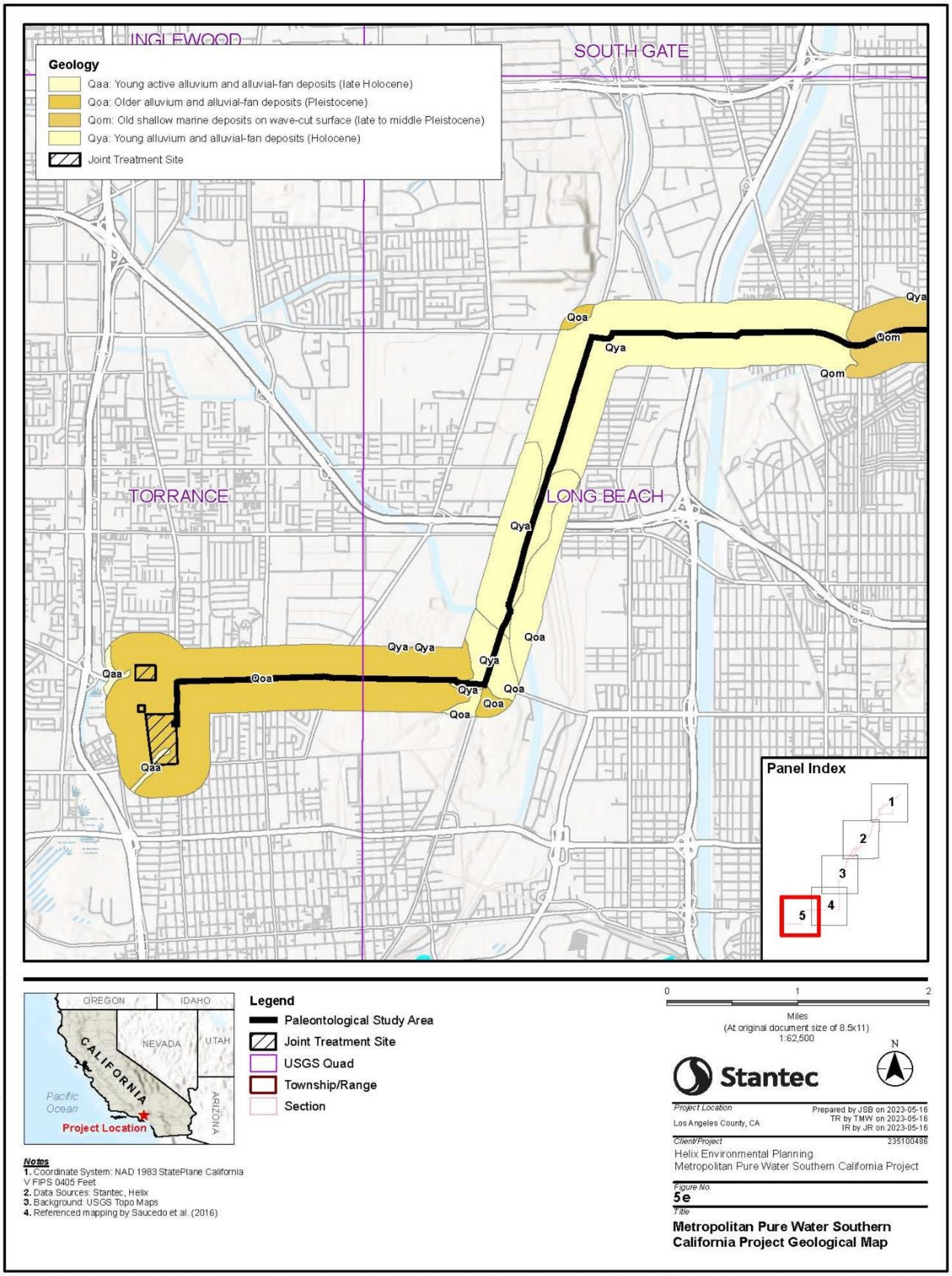

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Figure 5e. Geologic Map of Paleontological Study Area (5 of 5)

5.1.2 Young Sedimentary Deposits

Young sedimentary deposits in the Paleontological Study Area are comprised of young alluvium and alluvial fan deposits (denoted by Qya in Figure 4) as well as young wash deposits (denoted by Qyw in Figure 5). Young alluvium and alluvial fan deposits are mapped at the surface in portions of the entire Paleontological Study Area (Figure 4), making up the majority of the surficial sediments. The range of depths within the Paleontological Study Area is not known for these units. These sediments consist of varying proportions of unconsolidated clay, silt, sand, pebbly, cobbly sand, and boulders and have slightly to moderately dissected surfaces and slight to moderate pedogenic soil development (Campbell et al. 2014, Morton and Miller 2006, Saucedo et al. 2016). These sediments are relatively young in age, dating from the Holocene to the Recent, which ranges from the present to less than 11,700 years old, and as such are too young to preserve fossils at the surface; but as sediments increase in age with depth, the deeper layers of this unit are of an age to preserve fossils (i.e., over 5,000 years in age [SVP 2010]).

Young wash deposits are mapped at the surface in the northern central portion of the Paleontological Study Area, between Whittier Boulevard and Los Angeles Street (Figure 5). The range of depths within the Paleontological Study Area is not known for this unit. These sediments consist of unconsolidated to slightly consolidated sand and gravel deposits in marginal parts of active and recently active washes and ephemeral river channels of axial-valley streams (Morton and Miller 2006). Young wash deposits are older than active wash deposits and differ by the absence or modification of flood scours, modified channel-bar morphology, and immature soil horizons (Morton and Miller 2006). These sediments are relatively young in age, dating from the Holocene to the late Pleistocene, up to 129,000 years old (International Commission on Stratigraphy [ICS] 2022), and as such the deeper layers are of an age to preserve fossils (i.e., over 5,000 years old). These deposits are likely underlain by older Quaternary sediments such as the older alluvium and alluvial fan deposits described below at undetermined depths.

Early Holocene and late Pleistocene sediments in Southern California have an extensive record of scientifically significant fossil preservation, including in the vicinity of the Paleontological Study Area. The records of LACM (2022) include one locality that lies within the Paleontological Study Area, within the backbone alignment at the intersection of Carson Street and Alameda Street in the city of Carson, that is recorded from unnamed Pleistocene-aged sediments. This locality yielded a fossil from a mammoth (*Mammuthus*), which was discovered 30 feet below the ground surface (bgs) (Table 1). There are five additional localities recorded from equivalent sediments of Pleistocene-aged units within the Paleontological Study Area vicinity (LACM 2022). The nearest locality is within approximately 0.1 mile west of the southern portion of the Paleontological Study Area, in the city of Carson, and produced fossil elephant (*Proboscidea*) and camel (*Camelidae*) from 24 feet bgs (Table 1). The next closest locality is approximately 0.5 mile west of the southwestern terminus of the Paleontological Study Area, also in the city of Carson, and produced fossil camel (*Camelidae*) from between 12 and 14 feet bgs (Table 1). The next two localities, one of which is approximately 1.3 miles south of the southern portion of the Paleontological Study Area (backbone alignment), in the city of Lakewood, and one of which is approximately 2.1 miles northwest of the southern portion of the Paleontological Study Area in the city of Compton. Both produced fossil mammoth (*Mammuthus*), from 19 feet bgs and 5 feet bgs, respectively (Table 1). The last included locality is approximately 5.25 miles west of the central portion of the Paleontological Study Area in the city of Bell, and produced fossil fish (*Gasterosteus*), snake (*Colubridae*), rodents (*Thomomys, Microtus*, *Reithrodontomys*), and rabbit (*Sylvilagus*) from 30 feet bgs (Table 1).

Additionally, environmental compliance reporting from the JWPCP Biogas Pipeline Project indicates that two fossil localities yielding two vertebrate fossils (a bony fish and a ray) and a collection of invertebrate fossils (arthropods, sponges, mollusks, echinoids, and bryozoans) were reported from excavations 14 to 28 feet in depth into the Palos Verdes Sand underlying younger alluvium at the intersection of Sepulveda Boulevard and Figueroa Street within the City of Carson (Paleo Solutions 2021). This intersection is adjacent to but outside of the southwestern most end of the Project area. These fossils were submitted to the LACM for curation but have not yet been accessioned into the database and so were not returned with the search results.

A review of the online PBDB (2022) and UCMP (2022) databases shows that 15 fossil localities are documented from Pleistocene-age terrestrial deposits in Los Angeles County, and these have preserved specimens including a variety of reptiles and birds as well as classic Ice Age fauna such as camel, bison, tapir, ground sloth, elephant, mammoth, mastodon, and saber-toothed cat.

A review of the scientific literature indicates that across Los Angeles County and neighboring Riverside County, Pleistocene fossils representing a rich Ice Age fauna are often found in similar Quaternary-aged sediments. 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 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 amphibians such as frogs and salamanders and reptiles such as snakes (Hudson and Brattstrom 1977) and birds (Collins et al. 2018, Jones et al. 2008, Miller 1941). These fossils are important for understanding the prehistory 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).

5.1.3 Older Alluvium and Alluvial Fan Deposits

Older alluvium and alluvial fan deposits are mapped at the surface in the northern central portion of the Paleontological Study Area, between Whittier Boulevard and Ramona Boulevard, and in the southern portion of the Paleontological Study Area, between Main Street and Alameda Street (denoted by Qoa in Figure 5). Additionally, these older sediments may also be present underlying the adjoining active and young sedimentary deposits. The range of depths within the Paleontological Study Area is not known for this unit. These sediments are similar to the alluvium and alluvial fan deposits described above, but older, dating from the Pleistocene, which ranges from 11,700 to 2.58 Ma, and as such are weakly indurated and dissected by water erosion (Campbell et al. 2014, Morton and Miller 2006, Saucedo et al. 2016).

These sediments are largely the same as the deeper, Pleistocene-aged layers of the younger sediments described above and so will have the same paleontological record as described above. Additionally, the LACM search (2022) yielded localities from the La Habra Formation and the Lakewood Formation, both of which are terrestrial Pleistocene units. These localities are all recorded from within 5 miles of the Paleontological Study Area. It should be noted that the “Lakewood Formation” was established as broadly including late Pleistocene-aged units from across the Los Angeles Basin, including the marine Palos Verdes Formation and terrace deposits as well as nonmarine alluvial deposits (Department of Water Resources 1961). This report will treat these distinct lithofacies separately.

5.1.4 Marine Terrace Deposits

Marine terrace deposits are mapped at the surface in the southern portion of the Paleontological Study Area between Atlantic Avenue and North Lakewood Boulevard (Qom in Figure 5). These sediments may also be present underlying the adjoining young alluvium and alluvial fan deposits in the southern portion of the Paleontological Study Area, along Del Amo Boulevard. The range of depths within the Paleontological Study Area is not known for this unit. These sediments date from the Pleistocene, ranging from 11,700 to 773,000 years old, and are poorly sorted, moderately permeable, reddish-brown interfingered strandline, beach, estuarine, and colluvial deposits composed of siltstone, sandstone, and conglomerate that rest on the now emergent wave-cut abrasion platforms preserved by regional uplift (Saucedo et al. 2016). Locally, they may include older alluvium and alluvial fan-deposits (Saucedo et al. 2016).

Marine terrace deposits are well known to preserve scientifically significant fossils in Southern California, including in the vicinity of the Paleontological Study Area. A review of the scientific literature indicates these deposits have also yielded a diverse fauna of nearshore marine invertebrates such as crabs, snails, bivalves, gastropods, and echinoids (Kennedy 1975, Morton and Miller 2006, Valentine 1989, Woodring 1957) and both marine and terrestrial vertebrates, such as sharks, bony fish, whales, amphibians, reptiles, birds, antelopes, mammoth, dire wolves, rodents, and bison (Barnes and McLeod 1984, Fitch 1967, Kennedy 1975, Woodring 1957). This extensive fossil record, in particular the diverse invertebrate assemblage, has been important for reconstructing changes in shallow marine ecosystems as the climate has changed since the Pleistocene (DeBusk et al. 2009, Jacobs 2005, Powell and Stevens 2000).

5.1.5 Palos Verdes Sand

The Palos Verdes Sand dates to the late Pleistocene, deposited around approximately 130,000 years ago (Arnold and Arnold 1902). This unit has a stratigraphic thickness ranging between several inches and 15 feet, and consists of loosely consolidated, coarse-grained sand and gravel with silty sand and silt (Woodring et al. 1946). The Palos Verdes Sand is the youngest marine terrace deposit in the San Pedro area and was deposited in shallow sand bottoms, approximately 150 feet deep or less (Kennedy 1975). The Palos Verdes Sand is named from exposures in the Palos Verdes Hills, which are located west and southwest of the Paleontological Study Area (Woodring et al. 1946). The unit is not formally mapped in the Paleontological Study Area, although a comparison of the mapping by Saucedo et al. (2016) with the study conducted by Woodring et al. (1946) indicates that the Palos Verdes Sand is correlative to the marine terrace deposits mapped by Saucedo et al. (2016), which are present in the Paleontological Study Area. Further, these sediments may also be present underlying the adjoining young alluvium and alluvial fan deposits in the southern portion of the Paleontological Study Area, along Del Amo Boulevard.

The Palos Verdes Sand preserves scientifically significant fossils, including the most diverse assemblage of fossil marine fish of any Cenozoic period in the western United States (Long 1993). The records of the LACM (2022) indicate they have six localities from the Palos Verdes Sand. Two localities are located approximately 0.3 mile south of the southwestern terminus of the Paleontological Study Area in the city of Carson and produced marine fossils of toothed whale (*Odontoceti*), cartilaginous fish (*Condrichthyes*), ray (*Myliobatoidea*), and invertebrates (*Mollusca*) from an unknown depth (Table 1). The additional four localities from the Palos Verdes Sand are located approximately 0.9 mile west-northwest of the southwestern terminus of the Paleontological Study Area in Harbor City, and produced a fossil assemblage of lagoonal invertebrates, including the bivalves *Anadara*, *Anomia*, and *Podesmus*, as well as the gastropods *Odostomia* and *Nassarius* from an unknown depth (Table 1).

Furthermore, a review of the online PBDB (2022) and UCMP (2022) databases shows that 159 invertebrate localities are documented from the Palos Verdes Sand in Los Angeles County, as well as four vertebrate fossil localities, the latter of which have preserved specimens including ray, shark, bony fish, desmostylian, and rodents.

5.1.6 La Habra Formation

The La Habra Formation is not mapped at the surface in the Paleontological Study Area but is anticipated to be present in the subsurface underlying the central Paleontological Study Area in the vicinity of Whittier to Lakewood. The range of depths within the Paleontological Study Area is not known for this unit. The La Habra Formation is a sequence of late Pleistocene-aged nonmarine mudstones, sandstone, and silty conglomerate (Saucedo et al. 2016). The mudstone is friable, gray to brown, and sandy to pebbly (Morton and Miller 2006). The sandstone is grayish to reddish brown, massive or crudely bedded, and not well cemented (Morton and Miller 2006). A basal conglomerate and pebbly-sandstone is gray to brown, and massive to crudely bedded (Morton and Miller 2006).

The La Habra Formation is known for the preservation of scientifically significant fossils. The records of the LACM (2022) indicate they have records of one locality 5 miles east of the Paleontological Study Area in Whittier where a horse was discovered from 2 feet bgs. The scientific literature reports a diverse assemblage of mammals, reptiles, birds, and freshwater and terrestrial invertebrates from the La Habra Formation (Gilbert 1998, Powell and Stevens 2000).

5.1.7 Fernando Formation

The Fernando Formation dates to the Pliocene, deposited from approximately 2.9 to 2 Ma (Yeats et al. 1994), and consists of marine siltstone, sandstone, pebbly sandstone, and conglomerate (Morton and Miller 2006). These units are mapped in the northern central portion of the Paleontological Study Area along the western margin of the Puente Hills, between Beverly Boulevard and California State Route 60 (SR-60) (denoted by Tfu and Tfl in Figure 5). Additionally, the Fernando Formation may also be present underlying the adjoining sedimentary deposits in this vicinity. The range of depths within the Paleontological Study Area is not known for this unit. The Fernando Formation is divided into two members in the Los Angeles Basin, an upper and a lower member. The lower member of the Fernando Formation, which is equivalent to the Repetto Member of Wissler (1943), ranges from a massive to crudely bedded, micaceous, brownish siltstone that contains some thin interbeds of pebbly conglomerate (Morton and Miller 2006, Saucedo et al. 2016) to a pebble-cobble conglomerate in a sandstone matrix that fines upwards into a coarse sandstone and then a silty sandstone (Campbell et al. 2014, Schoellhamer et al. 1981), with the conglomeratic bed locally mapped as a subunit (denoted as Tflc in Figure 5).

The upper member of the Fernando Formation consists of massive light-gray friable siltstone, light yellowish-brown fine- to medium-grained sandstone, and light brown to reddish-brown pebbly conglomerate in the Los Angeles basin (Campbell et al. 2014, Saucedo et al. 2016). The upper member of the Fernando Formation is primarily marine but nonmarine conglomerate beds are included in the upper part of the section and mapped locally as a separate unit (denoted as Tfuc in Figure 5) (Campbell et al. 2014).

The Fernando Formation has an extensive record of preserving scientifically significant fossils, including invertebrates such as mollusks, echinoids, and bryozoans (Groves 1992, Morris 1976, Woodring 1938), fish (Huddleston and Takeuchi 2006), squid (Clarke et al. 1980), and a number of unidentified megafossils (Schoellhamer et al. 1981). A review of the UCMP online database (2022) indicates that numerous holotype invertebrate specimens, including the gastropod *Siphonalia gilberti* and bivalve *Arca camulosensis*, are documented from the Fernando Formation within Los Angeles County. The records of the LACM (2022) indicate they have 35 localities from the Repetto Member of the Fernando Formation, which is correlative to the lower member of the Fernando Formation. All localities are located approximately 0.75 mile southeast of the central portion of the Paleontological Study Area in the Puente Hills from unknown depths (Table 1). These preserved herring (*Ganolytes*), hake (*Merluccius*), rattail (*Coelorhynchus*), lanternfish (*Lampanyctus*, *Diaphus*), white shark (*Charcharodon carcharias*), marine mammals (Cetacea), and invertebrates.

5.1.8 Puente Formation, Sycamore Canyon Member

The Sycamore Canyon Member of the Puente Formation is not mapped at the surface within the Paleontological Study Area but is mapped at the surface immediately east of the northern central portion of the Paleontological Study Area along the western margin of the Puente Hills, between Beverly Boulevard and Rio Hondo Community College (denoted as Tpnsc in Figure 5). Therefore, this unit may be present in the subsurface in this area, potentially underlying the Fernando Formation or the surficial sediments. The range of depths within the Paleontological Study Area is not known for this unit. The Sycamore Canyon Member consists of marine sandstone and pebble conglomerate that records the deposition of submarine fans at bathyal depths during the early Pliocene and Miocene (Critelli et al. 1995). The member is highly variable laterally, with thick-bedded to massive medium- and coarse-gained sandstone, thin-bedded and poorly bedded siliceous siltstone, and lenses of massive conglomerate (Morton and Miller 2006).

The Sycamore Canyon Member of the Puente Formation, sometimes elevated to formation status, has an extensive record of fossil preservation across Southern California. A review of the PBDB (2022) indicates that five localities are documented from the Puente Formation in Los Angeles County. Three of these localities are approximately 7 miles east of the northern portion of the Paleontological Study Area in San Dimas and Covina and the additional two localities are each approximately 13 miles from the central portion of the Paleontological Study Area: one to the east in Diamond Bar and one to the northwest at the intersection of Wilshire Boulevard and Vermont Avenue in Los Angeles. These localities collectively yielded scientifically significant fossils, including an indeterminate Hipparionine horse (*Hipparionini* indet.) and the holotype specimen for the marsupial *Sternbergia waitei*, as well as numerous species of fish, such as anglerfish, pipefish, and other prehistoric bony fish (PBDB 2022). In addition to these localities, the Puente Formation has been well-documented as preserving a wide range of important fossils, such as cephalopods (Saul and Stadum 2005), crustaceans (Feldmann 2003), fish (Carnevale et al. 2008, Huddleston and Takeuchi 2006), and other marine and terrestrial vertebrates (Barboza et al. 2017, Leatham and North 2017). One particularly interesting site has been published from which a possible mass death assemblage of decapod crustaceans was collected along with land plants, bivalves, fish, and marine mammals as a result of mitigation activities at the Corona Country Club Estates in the city of Corona, California (Feldman 2003, Lander 2002), approximately 30 miles east of the southern portion of the Paleontological Study Area.

5.1.9 Tonalite of San Gabriel Reservoir

The Tonalite of San Gabriel Reservoir is Cretaceous in age, formed between 145 and 65 Mya. This unit is not mapped at the surface within the Paleontological Study Area but is mapped at the surface immediately east and west of the northern Paleontological Study Area along the foothills of the San Gabriel Mountains (denoted as Ksgr in Figure 5). Therefore, this unit is likely present in the subsurface underlying the young surficial sediments in this area at potentially shallow depths, as assessed by the proximity of the tonalite mapped at the surface. The range of depths within the Paleontological Study Area is not known for this unit. Tonalite is a plutonic igneous rock that forms from the slow cooling and crystallization of magma in the crust.

Table 1. Natural History Museum of Los Angeles County Records Search Summary

Locality Number	Geologic Unit	Age	Taxa	Approximate Location
LACM VP 3319	Unknown	Pleistocene	Mammoth (*Mammuthus*)	Within Paleontological Study Area: intersection of Carson Street and Alameda Street; 30 feet bgs.
LACM VP 4129	Unknown	Pleistocene	Elephant (*Proboscidea*), camel (*Camelidae*)	Approximately 0.1 mile west of the southern Paleontological Study Area: south of 223rd Street and west of Alameda Street; 24 feet bgs.
LACM VP 3823	Unknown	Pleistocene	Camel (*Camelidae*)	Approximately 0.5 mile west of the southwestern Paleontological Study Area: southeast corner of Figueroa Street and Sepulveda Boulevard; 12 to 14 feet bgs.
LACM VP 3660	Unknown	Pleistocene	Mammoth (*Mammuthus*)	Approximately 1.3 miles south of southern Paleontological Study Area: intersection of Cover Street and Pixie Avenue, Lakewood; 19 feet bgs.
LACM VP 3382	Unknown	Pleistocene	Mammoth (*Mammuthus*)	Approximately 2.1 miles northwest of southern Paleontological Study Area: northeast of intersection of Artesia Boulevard and Williams Avenue, Compton; 5 feet bgs.
LACM VP 7702	Unknown	Pleistocene	Fish (*Gasterosteus*), snake (Colubridae), rodents (*Thomomys*, *Microtus*, *Reithrodontomys*), rabbit (*Sylvilagus*)	Approximately 5.25 miles west of the central Paleontological Study Area: intersection of 26th Street and Atlantic Boulevard, Bell Gardens; 30 feet bgs.
LACM VP 3347	La Habra Formation	Pleistocene	Horse (*Equus*)	Approximately 5 miles east of the south-central portion of the Paleontological Study Area: 11204 Bluefield Lane; Whittier; 2 feet bgs.
LACM VP 7493	Lakewood Formation	Pleistocene	Camel (*Camelidae*)	Approximately 3.9 miles south of the southern portion of Paleontological Study Area: 30 yards south of Pacific Coast Highway and 10 yards west of Grand Avenue, Long Beach; 8.5 feet bgs.
LACM VP 3085, LACM IP 77	Palos Verdes Sand	Pleistocene	Fish (*Chondrichthyes*), ray (*Myliobatoidea*), toothed whale (*Odontoceti*), invertebrate (*Mollusca*)	Approximately 0.3 mile south of the southwestern Paleontological Study Area: intersection of Lomita Boulevard and Main Street; unrecorded depth encountered during excavations for sewer outfall.

Locality Number	Geologic Unit	Age	Taxa	Approximate Location
LACM IP 147, 4734, 4806, 20338	Palos Verdes Sand	Pleistocene	Bivalve (*Anadara*, *Anomia*, *Podesmus*), Gastropods (*Odostomia*, *Nassarius*), additional invertebrates	Approximately 0.9 mile west-northwest of the southwestern Paleontological Study Area: 200 feet south of intersection of Sepulveda Boulevard and San Pedro; within road cut at unknown depth.
LACM VP 6350-6362, LACM IP 16968-16991	Fernando Formation, Repetto Member (correlative to the lower member of the Fernando Formation)	Pliocene	Herring (*Ganolytes*), hake (*Merluccius*), rattail (*Coelorhynchus*), lanternfish (*Lampanyctus*, *Diaphus*), white shark (*Charcharodon carcharias*), marine mammal (*Cetacea*), invertebrates	Approximately 0.75 mile southeast of the central Paleontological Study Area: Puente Hills Landfill; unknown depth.

5.2 RESULTS: PEDESTRIAN SURVEY

The survey was conducted on September 28, 2022, covering the entire extent of the Paleontological Study Area, with emphasis on areas where fossil-bearing units might be present at the surface as well as the location of the one previously recorded LACM locality within the Paleontological Study Area (LACM VP 3319). Approximately 85 percent of the Paleontological Study Area was surveyed by windshield since the entire alignment, with the exception of a portion of the northern area, is covered by existing infrastructure such as paved roads, sidewalks, fences, railways, manmade channels, buildings, and landscaping (Figure 6). The portions of the Paleontological Study Area that were pedestrian surveyed are illustrated in Figure 4. One undisturbed geologic unit was observed during the survey: active wash deposits. Four geologic units were mapped as present in the Paleontological Study Area but were obscured by existing infrastructure: active wash deposits; young sedimentary deposits (young alluvium and alluvial fan deposits and young wash deposits); older sedimentary deposits (older alluvium and alluvial fan deposits and old shallow marine deposits); and the lower member, lower member conglomerate, and upper members of the Fernando Formation. No fossil localities were recorded during the survey. The single geologic unit observed is described below.

5.2.1 Active Wash Deposits

Active wash deposits were observed during the pedestrian survey in the northern portion of the Paleontological Study Area, within the bed of the San Gabriel River (dry). These observations corroborate mapping in this area. The sediments were gray-brown colored, loosely consolidated, and moderately sorted, with grain sizes ranging from very fine- to fine-grained sand with scant (approximately 1 to 3 clasts per 25 square feet) subrounded to rounded pebbles composed of plutonic rocks (Figure 6G and 6H). Additionally, numerous (approximately 10 to 20 clasts per 25 square feet) rounded plutonic cobbles were scattered throughout the river bottom, although these were derived from the manmade embankments.

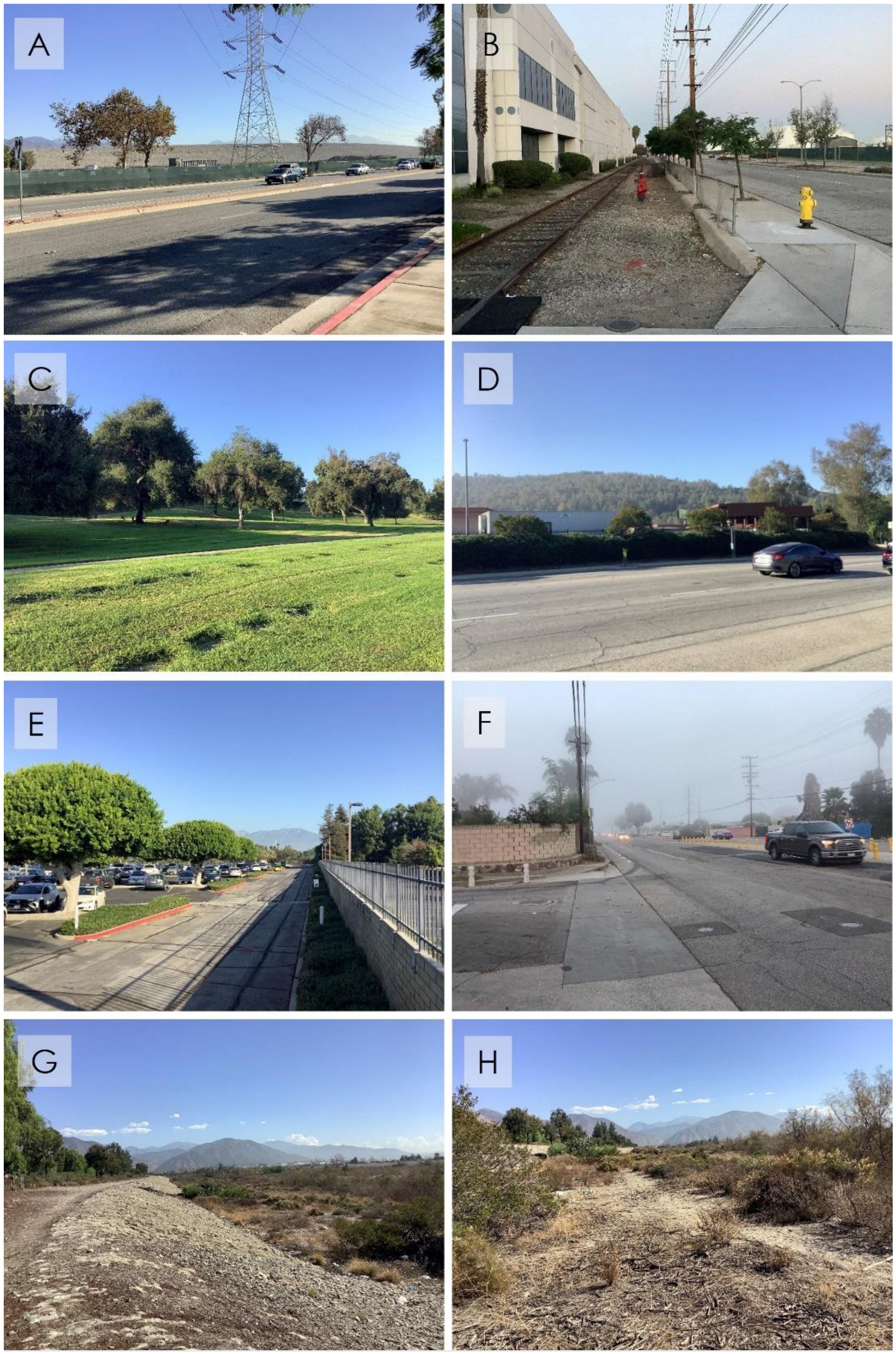

Figure 6. Paleontological Study Area covered by various infrastructure: (A) Santa Fe Dam area, view northeast; (B) Sepulveda Boulevard, view west; (C and D) Puente Hills area (Rose Hills Cemetery), views southeast and south, respectively; (E) San Jose Creek Water Reclamation Plant, view west; (F) East Del Amo Boulevard, view west; and (G and H) native active wash deposits exposed in the northern Paleontological Study Area in the San Gabriel River, view northeast.

5.3 RESULTS: PALEONTOLOGICAL POTENTIAL OF GEOLOGIC UNITS IN THE PALEONTOLOGICAL STUDY AREA

In order to assess the paleontological potential of the geologic units present at the surface or in the subsurface, Stantec conducted a desktop analysis and field survey, as described above. These investigations were used to assign the paleontological potential rankings of the SVP (2010) to the geologic units present in the Paleontological Study Area, both at the surface and in the subsurface. The results of this assessment are described below for each of the geologic units in the Paleontological Study Area (Table 2, Figure 7).

5.3.1 Active Sedimentary Deposits

Active sedimentary deposits, which are mapped individually as active alluvium and alluvial fan deposits and active wash deposits, present in the Paleontological Study Area date to the late Holocene, which ranges from the present to less than 5,000 years old. As defined by the SVP (2010), fossils must be over 5,000 years in age, corresponding to the middle part of the Holocene. Therefore, the active sedimentary deposits in the Paleontological Study Area are too young to preserve paleontological resources. However, these sediments likely overlie high potential units (described below) at an undetermined depth in portions of the Paleontological Study Area.

5.3.2 Young Sedimentary Deposits

Young alluvium and alluvial fan deposits present in the Paleontological Study Area date to the Holocene, which ranges from the present to 11,700 years old. Young wash deposits in the Paleontological Study Area date from the Holocene to the late Pleistocene, indicating they range from Recent in age to as much 290,000 years old (ICS 2022). Therefore, the upper layers of young sedimentary deposits are too young to preserve paleontological resources; but as sediments increase in age with depth, the deeper layers of these units are of an age to preserve paleontological resources. Therefore, areas mapped as young alluvium and alluvial fan deposits and young wash deposits should be considered to have low-to-high paleontological potential, increasing with depth.

5.3.3 Older Alluvium and Alluvial Fan Deposits

Older alluvium and alluvial fan deposits date from the Pleistocene, which ranges from 11,700 to 2.58 Ma, making this unit old enough to preserve fossils. Due to the abundant yield of fossils, most notably significant (e.g., diagnostic) vertebrate specimens found within the Paleontological Study Area, documented from Pleistocene-aged terrestrial deposits such as these, areas mapped as older alluvium and alluvial fan deposits should be considered to have high paleontological potential.

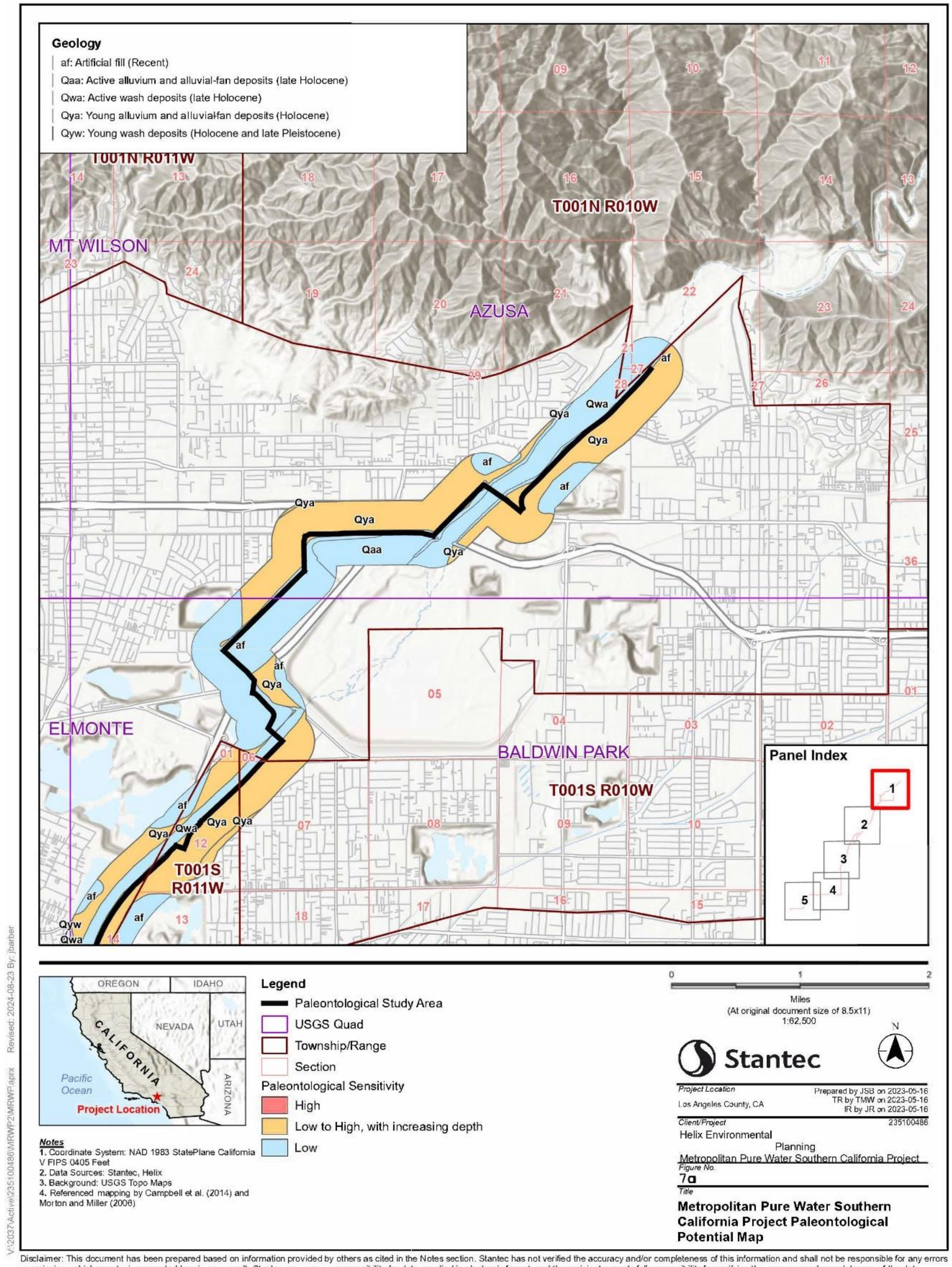

Figure 7a. Paleontological Potential Map of the Paleontological Study Area (1 of 5)

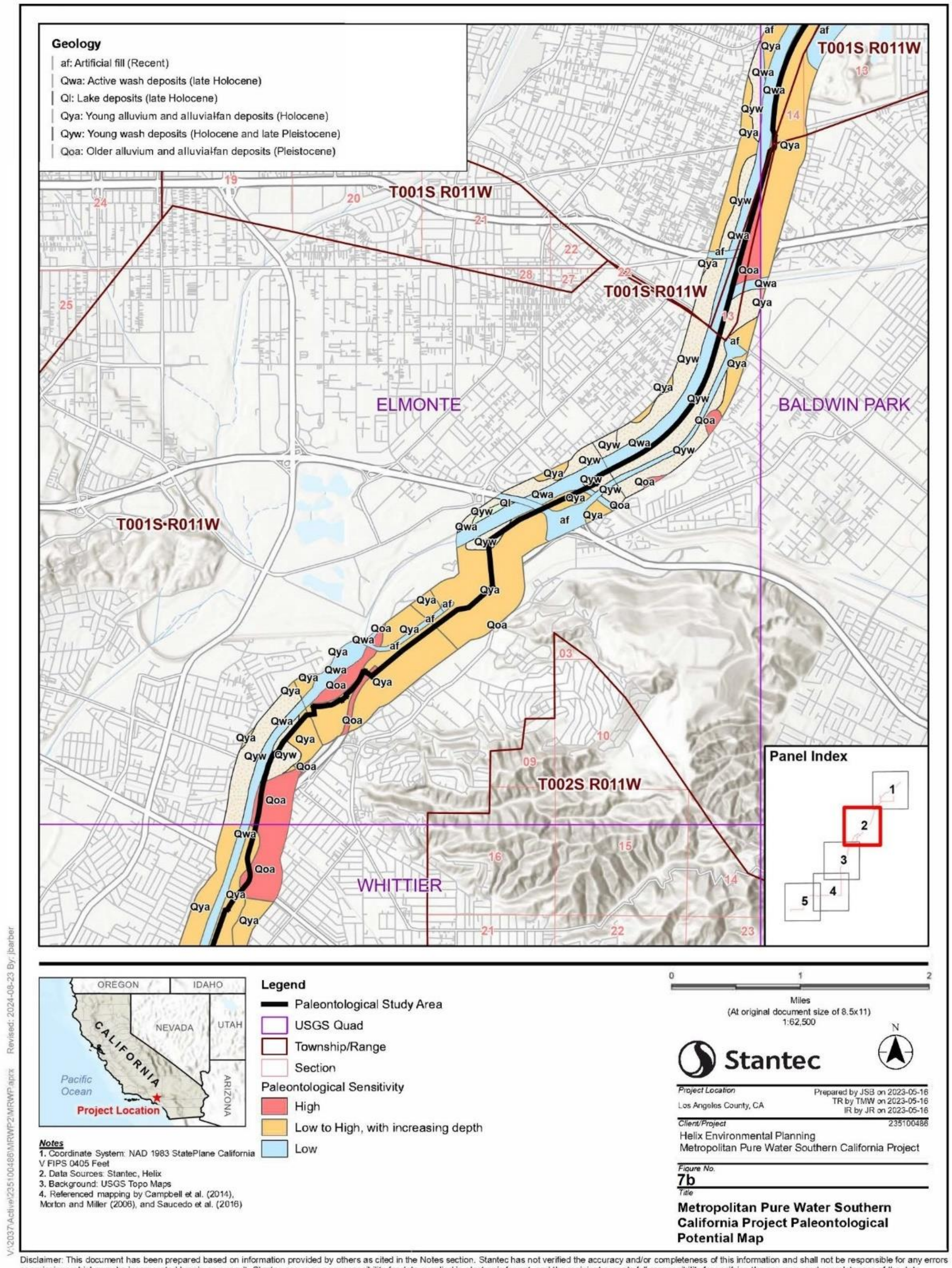

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Figure 7b. Paleontological Potential Map of the Paleontological Study Area (2 of 5)

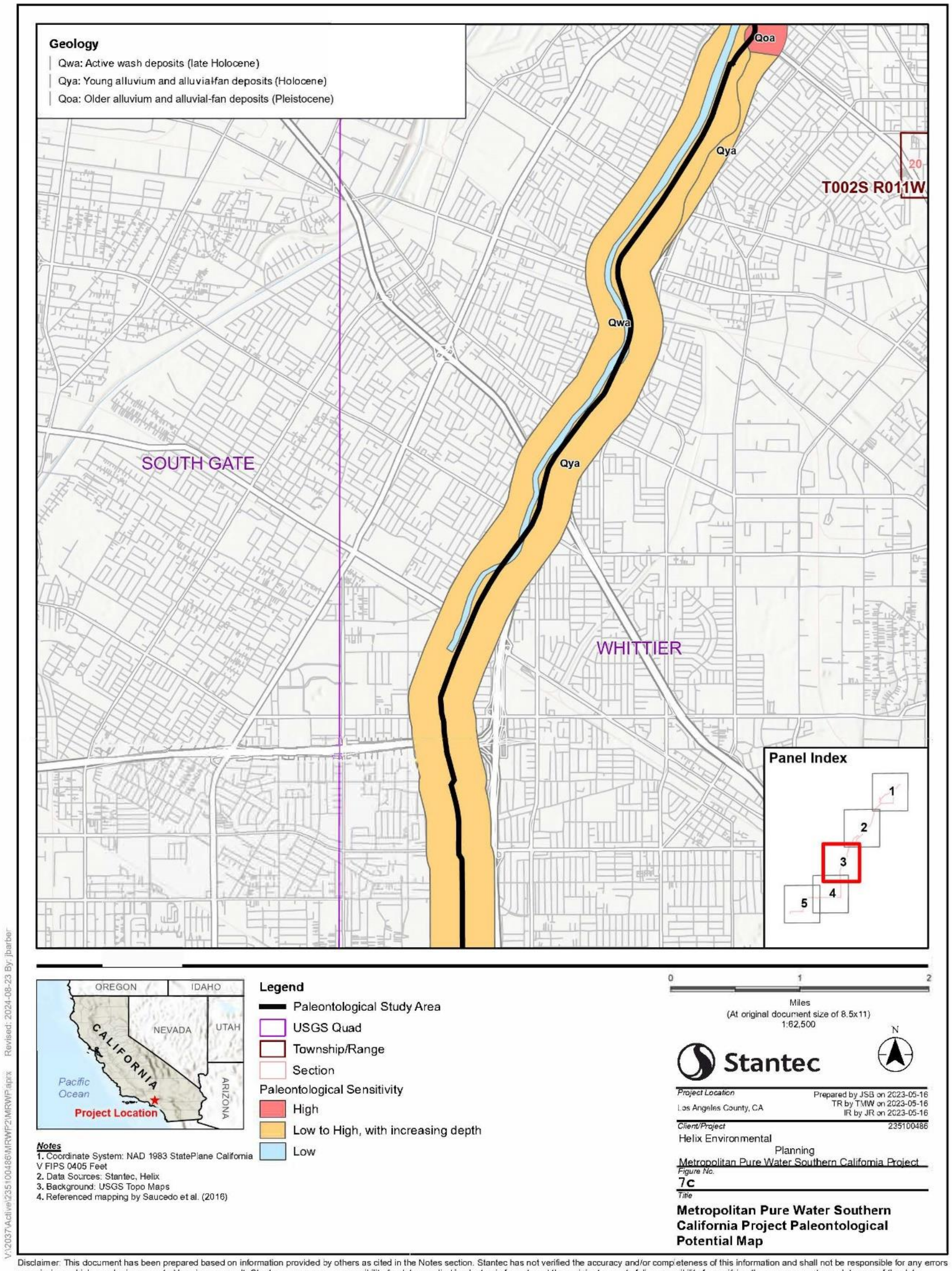

Figure 7c. Paleontological Potential Map of the Paleontological Study Area (3 of 5)

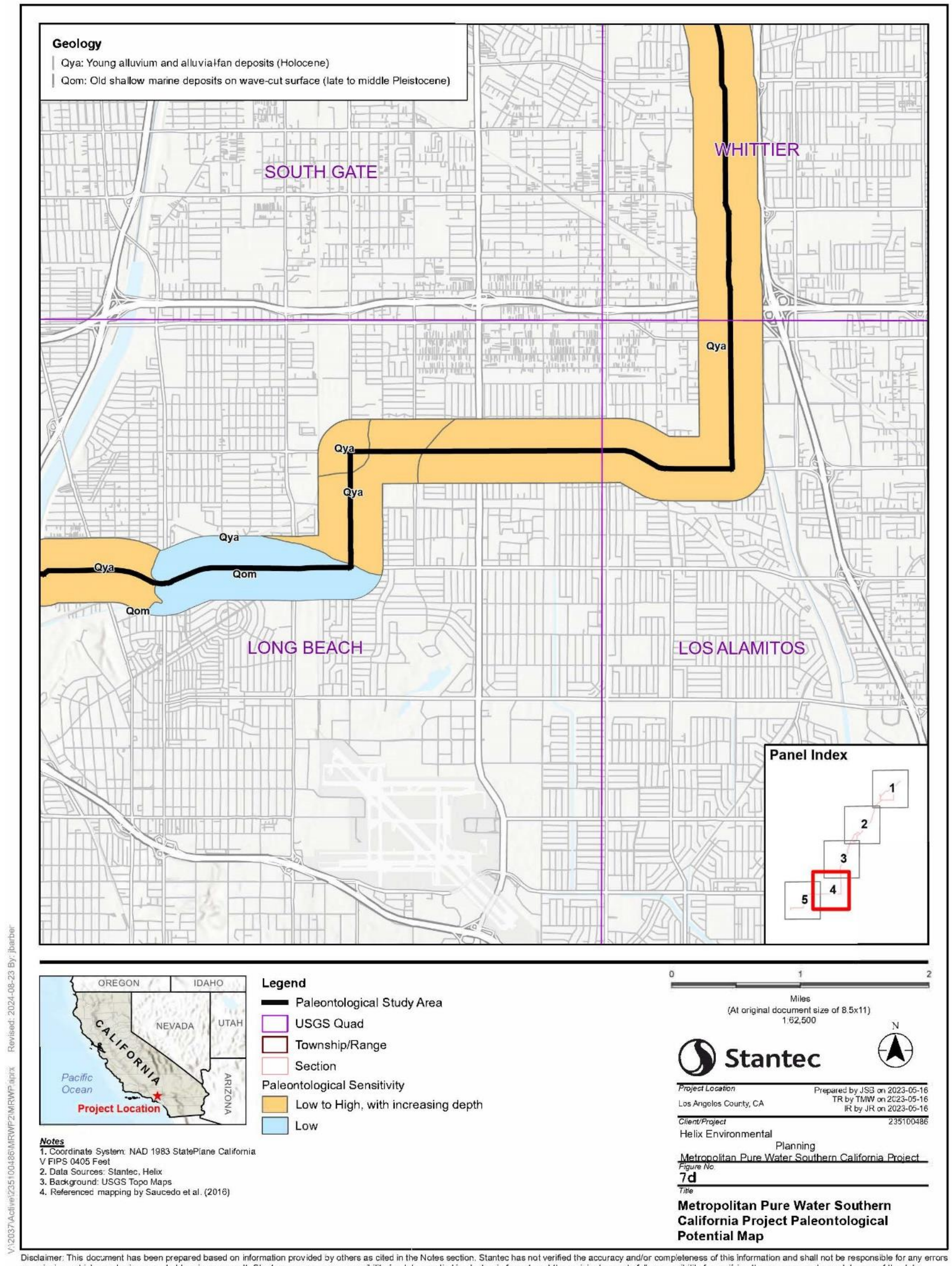

Figure 7d. Paleontological Potential Map of the Paleontological Study Area (4 of 5)

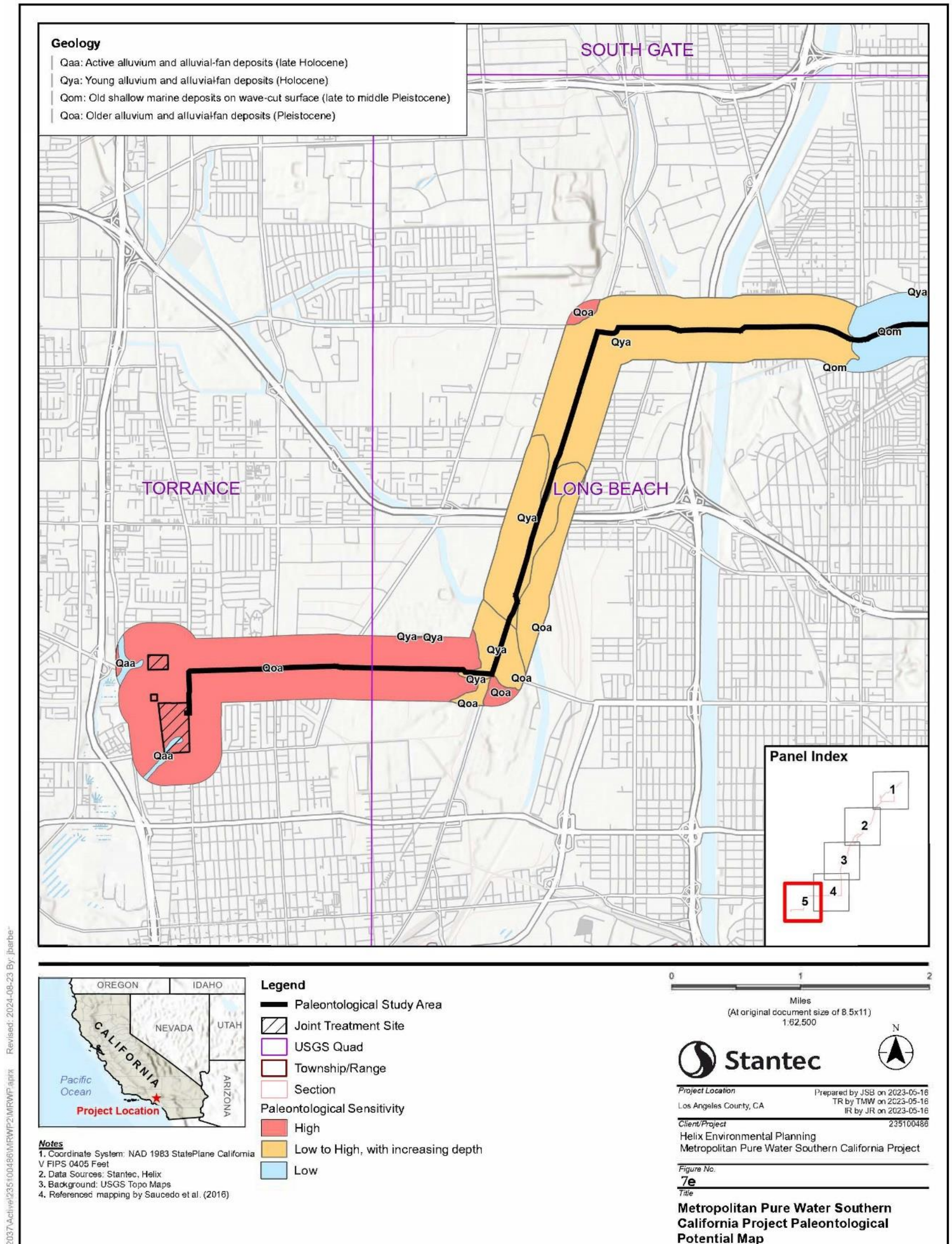

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Figure 7e. Paleontological Potential Map of the Paleontological Study Area (5 of 5)

Table 2. Geologic Unit Paleontological Potential within Paleontological Study Area

Geologic Unit	Age	Occurrence within Paleontological Study Area	Surficial Paleontological Study Area Length (linear miles)	Paleontological Potential*	Paleontological Resources Summary
Active sedimentary deposits: Active alluvium and alluvial fan deposits	Late Holocene	Mapped at the surface in the northern Paleontological Study Area, along the western side of the Santa Fe Dam Open Space Area between Arrow Highway and I-210; no native exposures during survey, covered by existing infrastructure.	0.848	Low	Too young to preserve paleontological resources.
Active sedimentary deposits: Active wash deposits	Late Holocene	Mapped at the surface in the northern and central Paleontological Study Area in the San Gabriel River beginning at the Paleontological Study Area's northern terminus near San Gabriel Canyon Road and extending south to Firestone Boulevard; observed during the survey between West Foothill Boulevard and the northern terminus of the Paleontological Study Area.	11.396	Low	Too young to preserve paleontological resources.
Young sedimentary deposits: Young alluvium and alluvial fan deposits	Holocene	Mapped at the surface in portions of the entire Paleontological Study Area; not observed during survey, covered by existing infrastructure.	25.582	Low-to-high, increasing with depth	Too young at the surface to preserve paleontological resources, deeper layers can preserve terrestrial vertebrate and invertebrate fossils.
Young sedimentary deposits: Young wash deposits	Holocene to late Pleistocene	Mapped at the surface in the northern central Paleontological Study Area, between Whittier Boulevard and Los Angeles Street; not observed during survey, covered by existing infrastructure.	0.550	Low-to-high, increasing with depth	Too young at the surface to preserve paleontological resources, but deeper layers can preserve terrestrial vertebrate and invertebrate fossils.

Geologic Unit	Age	Occurrence within Paleontological Study Area	Surficial Paleontological Study Area Length (linear miles)	Paleontological Potential*	Paleontological Resources Summary
Older sedimentary deposits: Older alluvium and alluvial fan deposits; includes nonmarine sediments sometimes referred to as the “Lakewood Formation”	Pleistocene	Mapped at the surface in the northern central Paleontological Study Area, between Whittier Boulevard and Ramona Boulevard, and in the southern Paleontological Study Area between Main Street and Alameda Street; not observed during survey, covered by existing infrastructure.	5.761	High	Terrestrial Ice Age fauna are documented from within the Paleontological Study Area (one locality) and vicinity (eight localities) as well as throughout the Los Angeles Basin.
Older sedimentary deposits: Marine terrace deposits	Late to middle Pleistocene	Mapped at the surface in the southern Paleontological Study Area between Atlantic Avenue and North Lakewood Boulevard; not observed during survey, covered by existing infrastructure.	1.596	High	Abundant marine vertebrate and invertebrate fossils as well as terrestrial vertebrate fossils.
Palos Verdes Sand	Late Pleistocene	May be encountered at shallow depths beneath younger surficial deposits in the southern portion of the Paleontological Study Area.	None	High	Abundant marine vertebrate and invertebrate fossils as well as terrestrial vertebrate fossils, including six localities from within 1 mile of the Paleontological Study Area (LACM 2022).
Lakewood Formation	Late Pleistocene	May be encountered at shallow depths beneath younger surficial deposits in the central portion of the Paleontological Study Area.	Subsurface only	High	Documented terrestrial vertebrate and invertebrate fossils, including within 4 miles of the Paleontological Study Area (LACM 2022).
La Habra Formation	Late Pleistocene	May be encountered at shallow depths beneath younger surficial deposits in the southern-central portion of the Paleontological Study Area.	Subsurface only	High	Documented terrestrial vertebrate and invertebrate fossils, including within 5 miles of the Paleontological Study Area (LACM 2022).

Geologic Unit	Age	Occurrence within Paleontological Study Area	Surficial Paleontological Study Area Length (linear miles)	Paleontological Potential*	Paleontological Resources Summary
Fernando Formation, Upper and Lower Members	Pliocene	Mapped in the northern-central Paleontological Study Area along the western margin of the Puente Hills, between Beverly Boulevard and SR-60; may be present in the subsurface beneath adjoining surficial sedimentary deposits in this vicinity; not observed during survey, covered by existing infrastructure.	0.249	High	35 localities yielding marine vertebrate and invertebrate fossils from within 1 mile of the Paleontological Study Area (LACM 2022); rich marine fossil record across the Los Angeles Basin.
Puente Formation, Sycamore Canyon Member	Early Pliocene to Miocene	Mapped at the surface immediately east of the northern-central Paleontological Study Area, along the western margin of the Puente Hills, between Beverly Boulevard and Rio Hondo Community College; may be present in the subsurface in this vicinity, potentially underlying the Fernando Formation and the surficial sedimentary deposits; not observed during survey.	Subsurface only	High	Numerous marine vertebrate and invertebrate fossils as well as terrestrial vertebrate fossils from across the Los Angeles Basin.
Tonalite of San Gabriel Reservoir	Cretaceous	Subsurface, northern portion of the Paleontological Study Area potentially underlying the active and young surficial sedimentary deposits.	Subsurface only	None	None

* *Assessed using the SVP (2010) scale*

5.3.4 Marine Terrace Deposits

Marine terrace deposits range from 11,700 to 773,000 years in age, dating to the late to middle Pleistocene and making this unit old enough to preserve fossils. Due to the abundant yield of fossils, most notably significant (e.g., diagnostic) vertebrate specimens, documented from Pleistocene-aged marine deposits such as these, areas mapped as marine terrace deposits should be considered to have high paleontological potential.

5.3.5 Palos Verdes Sand

The Palos Verdes Sand dates to the late Pleistocene, deposited approximately 130,000 years ago, making this unit old enough to preserve fossils. Due to the abundant yield of fossils, most notably significant (e.g., diagnostic) vertebrate specimens from localities within 0.5 mile of the Paleontological Study Area, documented from this unit, the Palos Verdes Sand should be considered to have a high paleontological potential.

5.3.6 La Habra Formation

The La Habra Formation dates to the late Pleistocene, making this unit old enough to preserve fossils. Due to the documented recovery of fossils, including significant vertebrate specimens from localities within 5 miles of the Paleontological Study Area, the La Habra Formation should be considered to have a high paleontological potential.

5.3.7 Fernando Formation

The Fernando Formation has an extensive record of preserving paleontological resources, including localities documented within one mile of the Paleontological Study Area. These localities collectively yielded numerous marine fossils such as fish, shark, marine mammals, and invertebrates. Given the extensive record of fossil preservation in the Fernando Formation, it is assessed here as having high paleontological potential.

5.3.8 Puente Formation, Sycamore Canyon Member

The Sycamore Canyon Member of the Puente Formation has an extensive record of fossil preservation across Southern California, including localities within 7 miles of the Paleontological Study Area. Given the extensive record of fossil preservation in the Sycamore Canyon Member of the Puente Formation, it is assessed here as having high paleontological potential.

5.3.9 Tonalite of San Gabriel Reservoir

Tonalite forms from cooling magma and will therefore not contain fossils. The Tonalite of San Gabriel Reservoir is assessed here as having no paleontological potential.

5.4 RESULTS: ASSESSMENT OF POTENTIAL IMPACTS OR EFFECTS

The Project involves construction of an approximately 39-mile-long backbone pipeline and improvements at the Joint Treatment Site. This will entail ground disturbance consisting of grading, trenching, and excavating. Grading is planned for construction of improvements at the Joint Treatment Site, which would be constructed north of West Lomita Boulevard and west of South Main Street and is expected to extend to 30 feet bgs. This area is largely disturbed since it has undergone extensive development and hazardous soil remediation. However, the depth of previous disturbance is unknown. Trenching is planned to occur for the majority of the backbone pipeline and is expected to extend to 16.5 feet bgs. Trenchless sections of the pipeline are expected to be installed at depths of up to 45 feet bgs.

In assessing potential impacts or effects of the Project, it is important to note that fossils are preserved in the subsurface, and are encountered when exposed by natural processes like erosion or artificial processes like construction. Therefore, it cannot be determined whether or not paleontological resources are present in any particular area until such exposure occurs. For the purposes of assessments such as these, paleontologists instead rely upon the geologic units at the surface and in the subsurface, and the potential of these units to preserve fossils, as well as the nature of these fossils and what their scientific importance might be. The results of this study indicate that scientifically important fossils (i.e., unique paleontological resources for the purposes of CEQA or paleontological resources for the purposes of NEPA) have been recorded from some of the geologic units in the Paleontological Study Area, with these units assessed as having high paleontological potential. The following discussion of potential impacts is based on the high paleontological potential of these geologic units in the Project area.

5.4.1 Potential Impacts under CEQA

Should these activities encounter unique paleontological resources (see Section 1.4 for what constitutes a unique paleontological resource), their destruction could constitute a significant impact under CEQA.

There are no portions of the Paleontological Study Area where high potential geologic units are present at the surface, and so surficial and shallow ground disturbing activities have low potential to impact unique paleontological resources across the Paleontological Study Area. Project ground disturbing activities that are relatively shallow include clearing and minor grading associated with staging locations, minor excavation for utility connections, and fencing. Therefore, these activities are at low risk of impacting unique paleontological resources.

The majority of the Paleontological Study Area (approximately 26.13 linear miles, 53 percent) is mapped as alluvial sediments that have low potential at the surface increasing to high potential in the subsurface. Additionally, approximately 12.24 miles (25 percent) is mapped as geologic units that have low potential due to their age, but which overlie older units with high potential in most areas. In both of these types of areas, unique paleontological resources may be impacted when ground disturbing activities exceed both the depth of artificial fill and previously disturbed sediments as well as the depth of the younger, low potential sediments. The depth of artificial fill and disturbance cannot be determined with the available data but is likely to vary widely across the Paleontological Study Area. The analysis of existing data conducted here indicates that the depth of fossil discoveries from older surficial sediments ranges widely, but generally begins at around 5 feet bgs in areas mapped as younger surficial sediments (LACM 2022, Jefferson 1991 a and b, Reynolds and Reynolds 1991).

In these areas, the planned grading, trenching, and excavating may adversely impact unique paleontological resources, should they be encountered in the subsurface and be destroyed.

The following high potential units are likely present in the subsurface of portions of the Paleontological Study Area: middle Holocene and older surficial sediments (older alluvium and alluvial fan deposits and marine terrace deposits), the Palos Verdes Sand, and the La Habra, Lakewood, Fernando, and Puente Formations. Ground disturbance that impacts any of these units has the potential to impact unique paleontological resources.

In areas where these high potential units are mapped at the surface, impacts may occur once ground disturbance exceeds the depth of surficial disturbance or artificial fill. As described above, this depth cannot be determined at this time and is likely to be highly variable across the Paleontological Study Area. In areas mapped as any of these high potential units, all ground disturbance in excess of the depth of artificial fill or previous disturbance has the potential to impact unique paleontological resources. Project activities planned in these areas that involve excavations likely to exceed the depth of previous disturbance or artificial fill are grading, trenching, and excavating.

The destruction of unique paleontological resources would constitute a direct impact, per CEQA, should this occur during Project activities. Therefore, Stantec has developed recommendations for reducing impacts to unique paleontological resources in compliance with CEQA. It is not anticipated that the Project will pose indirect or cumulative adverse impacts or effects to paleontological resources, as the final Project will not entail increased exposure or erosion of native sediments beyond the duration of construction-related ground disturbance.

5.4.2 Potential Effects under NEPA

Should these activities encounter paleontological resources (see Section 1.4 for what constitutes a paleontological resource), their damage or destruction could constitute a direct adverse effect under NEPA.

There are no portions of the Paleontological Study Area where high potential geologic units are present at the surface, and so activities at the surface and in the subsurface within these units have low potential to affect paleontological resources across the Paleontological Study Area. The exact depth at which undisturbed high potential units are present cannot be determined and is likely to vary across the Paleontological Study Area. Project ground disturbing activities that are relatively shallow include clearing and minor grading associated with staging locations, minor excavation for utility connections, and fencing. Therefore, these activities are at low risk of affecting paleontological resources.

The majority of the Paleontological Study Area (approximately 26.13 linear miles, 53 percent) is mapped as alluvial sediments that have low potential at the surface increasing to high potential in the subsurface. Additionally, approximately 12.24 miles (25 percent) is mapped as geologic units that have low potential due to their age, but which overlie older units with high potential in most areas. In both of these types of areas, paleontological resources may be affected when ground disturbing activities exceed both the depth of artificial fill and previously disturbed sediments as well as the depth of the younger, low potential sediments. The depth of artificial fill and disturbance cannot be determined with the available data but is likely to vary widely across the Paleontological Study Area. The analysis of existing data conducted here indicates that the depth of fossil discoveries from older surficial sediments ranges widely, but generally begins at around 5 feet bgs in areas mapped as younger surficial sediments (LACM 2022, Jefferson 1991 a and b, Reynolds and Reynolds 1991).

In these areas, the planned grading, trenching, and excavating may adversely affect paleontological resources, should they be encountered in the subsurface and be damaged or destroyed. Should paleontological resources be identified and salvaged for curation in a repository, it would constitute a beneficial effect of the Project.

The following high potential units are likely present in the subsurface of portions of the Paleontological Study Area: middle Holocene and older surficial sediments (older alluvium and alluvial fan deposits and marine terrace deposits), the Palos Verdes Sand, and the La Habra, Lakewood, Fernando, and Puente

Formations. Ground disturbance that impacts any of these units has the potential to affect paleontological resources. As described above, the damage or destruction of the resources would constitute a direct adverse effect, while the salvage and curation of the resources would constitute a beneficial effect.

In areas where these high potential units are mapped at the surface, impacts may occur once ground disturbance exceeds the depth of surficial disturbance or artificial fill. As described above, this depth cannot be determined at this time and is likely to be highly variable across the Paleontological Study Area. In areas mapped as any of these high potential units, all ground disturbance in excess of the depth of artificial fill or previous disturbance has the potential to affect paleontological resources. Project activities planned in these areas that involve excavations likely to exceed the depth of previous disturbance or artificial fill are grading, trenching, and excavating.

The damage or destruction of paleontological resources would constitute a direct adverse effect, per NEPA, should this occur during Project activities. Therefore, Stantec has developed recommendations for avoiding or minimizing adverse effects to paleontological resources, in compliance with NEPA. It is not anticipated that the Project will pose indirect or cumulative adverse effects to paleontological resources, as the final Project will not entail increased exposure or erosion of native sediments beyond the duration of construction-related ground disturbance.

6.0 Recommendations and Management Considerations

As part of the current paleontological assessment, an analysis of existing data and field survey were conducted to evaluate the potential of the Paleontological Study Area to preserve paleontological resources, and for the likelihood of Project activities to adversely affect or pose impacts to these resources, should they be present. The results of this assessment show that 12 geologic units are present in the Paleontological Study Area and may be impacted by Project activities, of which nine have the potential to preserve fossils (see Table 2).

Project activities are anticipated to include grading, trenching, and excavating of depths of up to 45 feet bgs. This assessment indicates that geologic units with high paleontological potential are present in the subsurface of the Paleontological Study Area at undetermined depths. Spot-checks should be conducted to determine whether or not monitoring will be required in areas where the depths of these geologic units is unknown. Should Project-related activities encounter paleontological resources in these units, the destruction of unique paleontological resources would constitute a significant impact under CEQA and the damage or destruction of paleontological resources would constitute an adverse effect under NEPA. Table 3 lists the recommendations to minimize Project impacts to each of the geologic units, and Table 4 lists the recommendations to minimize impacts for each type of ground disturbing activity depending on paleontological potential.

Table 3. Recommendations per Geologic Unit

Geologic Unit	Paleontological Potential	Age	General Recommendations
Active sedimentary deposits: Active alluvium and alluvial fan deposits	Low	Late Holocene	Spot-check excavations below 5 feet bgs or the depth of previous disturbance; initiate full-time monitoring once high sensitivity units are observed.
Active sedimentary deposits: Active wash deposits	Low	Late Holocene	Spot-check excavations below 5 feet bgs or the depth of previous disturbance; initiate full-time monitoring once high sensitivity units are observed.
Young sedimentary deposits: Young alluvium and alluvial fan deposits	Low-to-High, increasing with depth	Holocene	Full time monitoring of excavations below 5 feet bgs or the depth of previous disturbance.
Young sedimentary deposits: Young wash deposits	Low-to-High, increasing with depth	Holocene to late Pleistocene	Full time monitoring of excavations below 5 feet bgs or the depth of previous disturbance.
Older sedimentary deposits: Older alluvium and alluvial fan deposits	High	Pleistocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Older sedimentary deposits: Old shallow marine deposits on wave-cut surfaces	High	Late to middle Pleistocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Palos Verdes Sand	High	Late Pleistocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.

Geologic Unit	Paleontological Potential	Age	General Recommendations
Lakewood Formation	High	Late Pleistocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
La Habra Formation	High	Late Pleistocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Fernando Formation, Upper and Lower Members	High	Pliocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Puente Formation, Sycamore Canyon Member	High	Early Pliocene to Miocene	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Tonalite of San Gabriel Reservoir	None	Cretaceous	No monitoring.

Table 4. Recommendations for Construction Activities

Construction Activity	Mapped Sensitivity	Recommendation
Grading	High	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Grading	Low-to-High, increasing with depth	Full time monitoring of excavations below 5 feet bgs or the depth of previous disturbance.
Grading	Low	Spot-check excavations below 5 feet bgs; initiate full-time monitoring once high sensitivity units are observed.
Trenching	High	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Trenching	Low-to-High, increasing with depth	Full time monitoring of excavations below 5 feet bgs or the depth of previous disturbance.
Trenching	Low	Spot-check excavations below 5 feet bgs; initiate full-time monitoring once high sensitivity units are observed.
Trenchless Methods (jack and bore, microtunneling, tunneling)	High	Spot-check spoils piles, if method allows for the observation of spoils.
Trenchless Methods (jack and bore, microtunneling, tunneling)	Low-to-High, increasing with depth	Spot-check spoils piles of work over 5 feet bgs, if method allows for the observation of spoils.
Trenchless Methods (jack and bore, microtunneling, tunneling)	Low	None
Excavating (including portal excavations for trenchless methods)	High	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Excavating (including portal excavations for trenchless methods)	Low-to-High, increasing with depth	Full time monitoring of excavations below 5 feet bgs or the depth of previous disturbance.
Excavating (including portal excavations for trenchless methods)	Low	Spot-check excavations below 5 feet bgs; initiate full-time monitoring once high sensitivity units are observed.
Miscellaneous shallow excavations (< 5 feet bgs)	High	Full time monitoring of ground disturbing activities that exceed the depth of previous disturbance.
Miscellaneous shallow excavations (< 5 feet bgs)	Low-to-High, increasing with depth	None
Miscellaneous shallow excavations (< 5 feet bgs)	Low	None

In order to reduce impacts to unique paleontological resources to less-than-significant, in compliance with CEQA, and to avoid or minimize adverse effects to paleontological resources, in compliance with NEPA, Stantec recommends the following:

6.1 ENVIRONMENTAL COMMITMENT

As part of the standard practices that Metropolitan employs for applicable projects, the following Environmental Commitment would be implemented to avoid adverse impacts to sensitive resources:

> The Contractor will attend an Environmental Awareness Training with Metropolitan's construction management team and designated environmental monitors (i.e., qualified biologist, archaeologist, Native American monitor, paleontologist, hazardous materials specialist, as applicable). An Environmental Awareness Training program will inform all employees of the sensitive resources known or with potential to occur in the local area; the sensitivity of the area in which they will be working; and environmental measures and requirements to comply with project approvals and environmental permits and regulations.

6.2 MITIGATION MEASURES (MMS)

6.2.1 PAL-MM-1: Paleontological Monitoring and Management Plan

Metropolitan shall retain a qualified paleontologist meeting professional standards as defined by Murphey et al. (2019) to oversee all aspects of paleontological monitoring and management as the designated Project Paleontologist. The Project Paleontologist, in conjunction with Metropolitan, shall develop and oversee the implementation of a Paleontological Monitoring and Management Plan (PMMP) tailored to Pure Water. The PMMP shall require full time paleontological monitoring of the duration of earthwork and ground disturbing activities into undisturbed geologic units with high paleontological potential by a qualified paleontological monitor meeting standards as defined by Murphey et al. (2019). In addition, the PMMP shall require that spot checking be conducted during ground disturbing activities impacting geologic units with low paleontological potential at the surface to determine if older, more sensitive sediments are impacted at depth and if additional monitoring is required. Testing of sediment samples for microvertebrate fossils where appropriate shall be included in the PMMP. The PMMP shall also address requirements for worker training; steps to follow in the event of a fossil discovery, whether by a paleontological monitor or by a member of the construction staff; assessment and treatment requirements for fossils, including curation, if fossils assessed as unique are encountered; and requirements for final reporting.

6.2.2 PAL-MM-2: Paleontological Resource Discovery

The paleontological monitor shall conduct monitoring in accordance with the approved PMMP. If a paleontological resource is encountered, the contractor shall immediately cease all work within 50 feet of the discovery, notify Metropolitan's Construction Manager, and protect the discovery area, as directed by the Construction Manager. The Project Paleontologist shall decide on the validity of the discovery and work with the Construction Manager to designate an area surrounding the discovery as a restricted area. The Contractor shall not enter or work in the restricted area until the Construction Manager provides written authorization. If the Project Paleontologist assesses the paleontological resource as unique, it shall be collected and curated in an accredited repository along with all necessary associated data as detailed in the PMMP.

These recommendations meet the standards of the SVP (2010) and conform to industry best practices (e.g., Murphey et al. 2019 and others). Based on the findings in this study and the implementation of the above recommendations, the Project would not cause an adverse effect to paleontological resources or significant impacts to unique paleontological resources. Therefore, no additional paleontological resources studies are recommended or required at this time. Should the Project location or plans change, this assessment will need to be revised to address those changes.

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APPENDIX A

Natural History Museum of Los Angeles County Records Search Results

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NATURAL HISTORY MUSEUM LOS ANGELES COUNTY

Research & Collections

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June 12, 2022

Stantec Consulting Services, Inc.
Attn: Alyssa Bell

re: Paleontological resources for the Metropolitan Recycled Water Program (Project # 235100486)

Dear Alyssa:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the Metropolitan Recycled Water Program project area as outlined on the portion of the Torrance, Long Beach, Los Alamitos, South Gate, Whittier, El Monte, Baldwin Park, and Azusa USGS topographic quadrangle map that you sent to me via e-mail on May 31, 2022. We do have fossil localities that appear to lie directly within or immediately adjacent to the proposed project area:

Locality Number	Location	Formation	Taxa	Depth
LACM VP 3319	Intersection of Carson St. & Alameda St	Unnamed formation (Pleistocene)	Mammoth (*Mammuthus*)	30 feet bgs

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

Locality Number	Location	Formation	Taxa	Depth
LACM VP 3085, LACM IP 77	Intersection of Lomita Blvd & Main St	Palos Verdes Sand	Fish (Condrichthyes); Rays (Myliobatoidea); Toothed whale (Odontoceti); Invertebrates (Mollusca)	Unrecorded (collected during excavations for sewer outfall)
LACM VP 3823	SE corner of Figueroa St & Sepulveda Blvd	Unidentified (Pleistocene; grey buff arenaceous silt)	Camel family (Camelidae)	12-14 feet bgs
LACM IP 147, 4734, 4806, 20338	Road cut on Vermont Avenue; 200 feet south of corner of Sepulveda Blvd.; San Pedro	Palos Verdes Sand	Invertebrates indicating a lagoon fauna (bivalves [*Anadara, Anomia, Podesmus*], gastropods [*Odostomia, Nassarius*] and others)	Unknown
LACM VP 4129	South of 223rd St. & west of Alameda Street	Undetermined (Pleistocene sand)	Elephant family (Proboscidea); camel family (Camelidae)	24 feet bgs
LACM VP 3382	NE of the intersection	Unknown formation	Mammoth (*Mammuthus*)	5 feet bgs

	of Artesia Blvd and Williams Ave., Compton	(Pleistocene; brown clay silt)		
LACM VP 3660	Cover St & Pixie Ave; Lakewood	Unknown formation (Pleistocene)	Mammoth (*Mammuthus*)	19 feet bgs
VPLACM6350-6362; LACM IP 16968-16991	Puente Hills Landfill	Fernando Formation; Repetto Member (massive clayey siltstone)	Herring *(Ganolytes)*, hake (*Merluccius*), rattail (*Coelorhynchus*), lanternfish *(Lampanyctus, Diaphus*), white shark (*Charcharodon carcharias);* marine mammals (Cetacea); Invertebrates (unspecified)	Unknown
LACM VP 7702	Intersection of 26th St and Atlantic Blvd, Bell Gardens	Unknown formation (Pleistocene; silt)	Fish (*Gasterosteus*); Snake (Colubridae), Rodents (*Thomomys, Microtus, Reithrodontomys)*; Rabbit (*Sylvilagus*)	30 feet bgs
LACM VP 3347	11204 Bluefield; Whittier	La Habra Formation (lacustrine silt with caliche and plant detritus)	Horse (*Equus*)	2 feet bgs
LACM VP 7493	30 yards south of Pacific Coast Highway & 10 yards west of Grand Avenue; Long Beach	Lakewood Formation	Camel family (Camelidae)	8.5 feet bgs

VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface

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

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

enclosure: invoice