Regional Connector Transit Corridor
Draft Environmental Impact Statement/
Draft Environmental Impact Report

APPENDIX Z

CULTURAL RESOURCES – PALEONTOLOGICAL

State Clearinghouse Number: 2009031043

Regional Connector Transit Corridor Paleontological Resources Technical Memorandum

April 6, 2010

Prepared for

Los Angeles County Metropolitan Transportation Authority

One Gateway Plaza

Los Angeles, CA 90012

State Clearinghouse Number: 2009031043

This technical memorandum was prepared by:

CDM
523 West Sixth Street, Suite 400
Los Angeles, CA 90014
(213) 457-2200
www.cdm.com

SWCA Environmental Consultants
625 Fair Oaks Avenue, Suite 190
South Pasadena, California 91030
(626) 240-0587
www.swca.com

TABLE OF CONTENTS

Figures

Tables

ACRONYMS

APE	Area of Potential Effects
CEQA	California Environmental Quality Act
FTA	Federal Transit Administration
LACM	Natural History Museum of Los Angeles County
LADWP	Los Angeles Department of Water and Power
LRT	Light Rail Transit
LRTP	Long Range Transportation Plan
mya	Million Years Ago
NEPA	National Environmental Policy Act
OPLA	Omnibus Public Lands Management Act
PRA	Paleontological Resources Preservation
PRPA	Paleontological Resources Preservation Act
PRMPP	Paleontological Resources Monitoring and Mitigation Plan
SVP	Society of Vertebrae Paleontology
TSM	Transportation Management System

1.0 SUMMARY

1.1 Background

This technical memorandum discusses the results of a Paleontological Resource analysis of the proposed Regional Connector Transit Corridor project. The study was performed to evaluate the paleontological sensitivity of the project area and vicinity, assess potential project-related impacts to paleontological resources, and provide recommendations. This analysis included a records search conducted at the Natural History Museum of Los Angeles County on February 5, 2008 and a literature review.

This study was conducted in accordance with the professional guidelines established by the Society of Vertebrate Paleontology (SVP) (1995). This technical memorandum will be filed with the Federal Transit Administration (FTA), Metro, CDM, and SWCA. All records related to the project will also remain on file at Metro and the South Pasadena office of SWCA.

1.2 Summary of Findings

According to geologic mapping published by Yerkes and Graham (1997a; 1997b) and records maintained by the Natural History Museum of Los Angeles County, the project area is underlain by the following geologic units, from oldest to youngest: (1) Miocene Puente Formation, (2) Pliocene Fernando Formation, (3) Quaternary terrace deposits, and (4) Quaternary alluvium. Museum records revealed that at least 12 previously recorded vertebrate fossil localities have been documented either along the proposed project alignment or within a 2-mile radius from the same sedimentary deposits underlying the project.

The combined results of the museum records search and literature review indicate that the geologic units underlying the project area have a paleontological sensitivity ranging from low to high. Therefore, construction of the project may potentially result in an adverse impact to nonrenewable fossil resources and will require implementation of paleontological resources mitigation measures, where feasible.

1.3 Mitigation and Monitoring

A qualified paleontologist would design and implement a Paleontological Resources Monitoring and Mitigation Plan (PRMPP) during any ground disturbances related to the proposed project, where feasible. All significant fossils recovered during construction monitoring would be prepared, stabilized, identified, and permanently curated in an approved repository or museum (such as the Natural History Museum of Los Angeles County).

2.0 INTRODUCTION

2.1 Project Description

The proposed project area extends 1.9 miles through downtown Los Angeles and would provide enhanced Metro service throughout four distinct travel corridors that span more than 50 miles across Los Angeles County (Figure 2-1). The proposed alternatives include from 1.6 to 1.9 miles of new dual tracks in downtown Los Angeles and would provide a direct link between the Metro Gold, Blue, and Expo Lines by bridging the gap in the regional light rail network between 7th Street/Metro Center Station and the Little Tokyo/Arts District Station. This would allow for direct trains from East Los Angeles to Culver City and from Long Beach to Pasadena.

The project also includes construction of several new stations downtown that would allow passengers on the Metro Gold, Blue, and Expo Lines to reach multiple destinations in the central business district without transferring. The following alternatives were evaluated:

- No Build Alternative
- Transportation System Management (TSM)Alternative
- At-Grade Emphasis Light Rail Transit (LRT) Alternative
- Underground Emphasis LRT Alternative
- Fully Underground LRT Alternative- Little Tokyo Variation 1
- Fully Underground LRT Alternative- Little Tokyo Variation 2

Each of these alternatives are described in the following sections.

2.1.1 No Build Alternative

Transit service under the No Build Alternative is focused on preserving existing services and projects. The No Build Alternative does not include any major service improvements or new transportation infrastructure beyond what is listed in Metro's 2009 Long Range Transportation Plan (LRTP).

By the projection year of 2035, the Metro Expo Line to Santa Monica, the Metro Purple Line to Westwood, the Metro Crenshaw Line, and the Metro Gold Line extensions to Azusa and about I-605 will have opened, and a number of bus routes will have been reorganized and expanded to provide connections with these new rail lines. All bus and rail lines would operate using a fleet of vehicles similar to those currently in service or identified for purchase in the LRTP. The transit network within the project area would otherwise be largely the same as it is now.

2.1.2 Transportation System Management (TSM) Alternative

The TSM Alternative includes all the provisions of the No Build Alternative, plus two new express shuttle bus lines linking the 7th Street/Metro Center and Union Stations. These buses would run frequently, perhaps just a few minutes apart, especially during peak hours. Enhanced bus stops would be located every two to three blocks to maximize coverage of the area surrounding the routes. Rail service would remain the same as described for the No Build Alternative. The two new shuttle bus routes are illustrated on Figure 2-2.

2.1.3 At-Grade Emphasis Light Rail Transit (LRT) Alternative

2.1.3.1 Overview

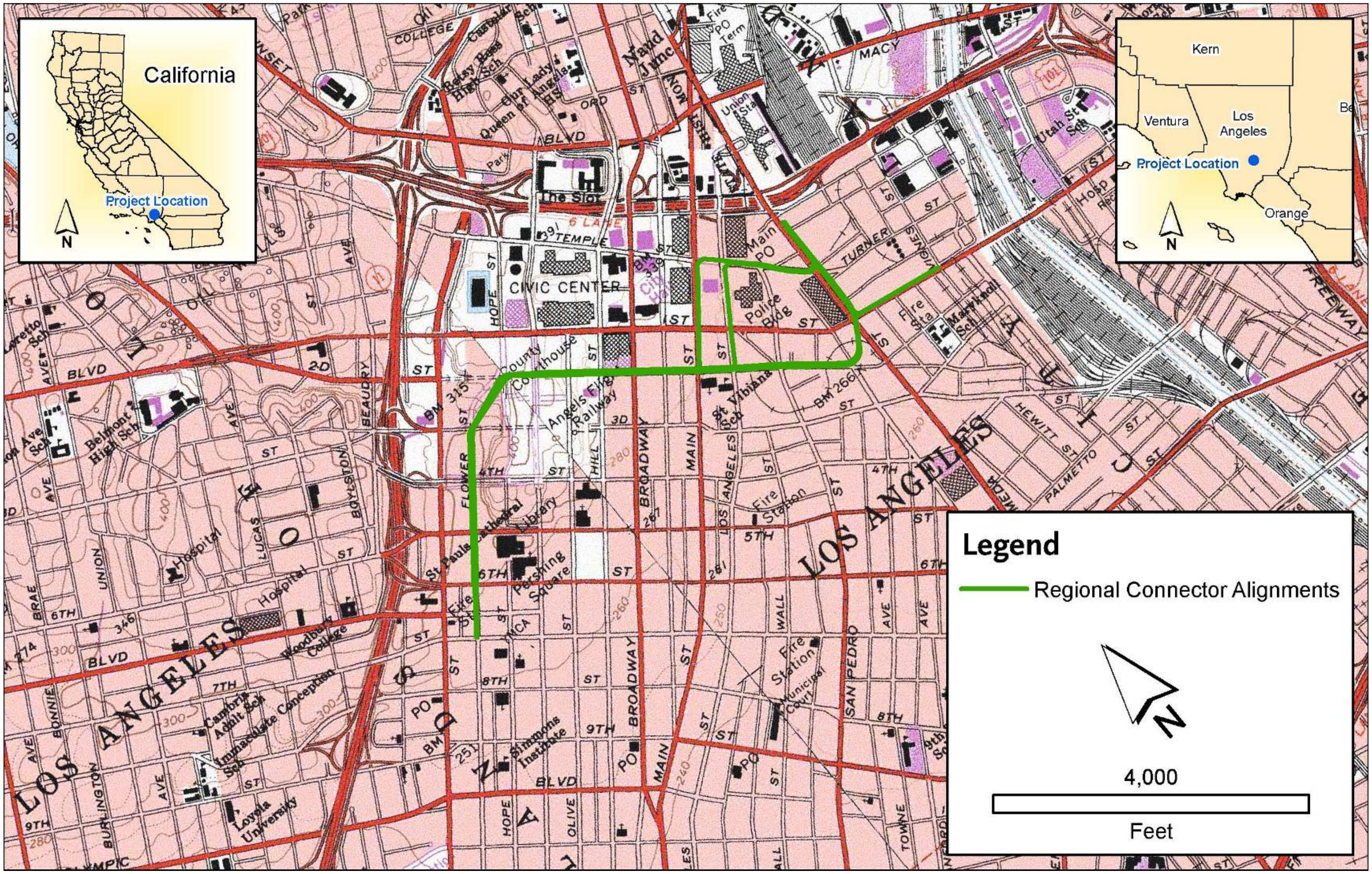
The At-Grade Emphasis LRT Alternative would provide a direct connection from the existing underground 7th Street/Metro Center Station to the Metro Gold Line at Temple and Alameda Streets with three new station locations proposed. This alignment includes a combination of underground and at-grade segments, with 46 percent of the route underground. New stations would serve the Civic Center, Grand Avenue, and Financial District.

Conversion of 2nd Street to a pedestrian-friendly transit mall is assumed. To implement this alternative, the number of traffic lanes and on-street parking spaces on 2nd Street would be reduced. As a result, traffic would be likely to divert to adjacent parallel streets such as 1st and 3rd Streets, but the roadway capacity along these streets would remain unchanged, as with the No Build Alternative. Traffic congestion along these streets would likely increase. Figure 2-3 illustrates the At-Grade Emphasis LRT Alternative.

2.1.3.2 Route Configuration

From the existing platform at the 7th Street/Metro Center Station, the tracks would extend north underneath Flower Street to a new underground station just south of 5th Street. The tracks would then continue north, surface just south of 3rd Street, cross 3rd Street at grade, and veer northeast through a portal in the hillside to an underground station at 2nd and Hope Streets. Tunnel construction would be constrained by existing buildings.

At 2nd and Hope Streets, a new pedestrian bridge would be constructed to connect the station to Upper Grand Avenue. The tracks would continue northeast, punch through the wall of the existing 2nd Street tunnel, and then travel east in the 2nd Street tunnel toward Hill Street.



Source: USGS

Figure 2-1. Project Location

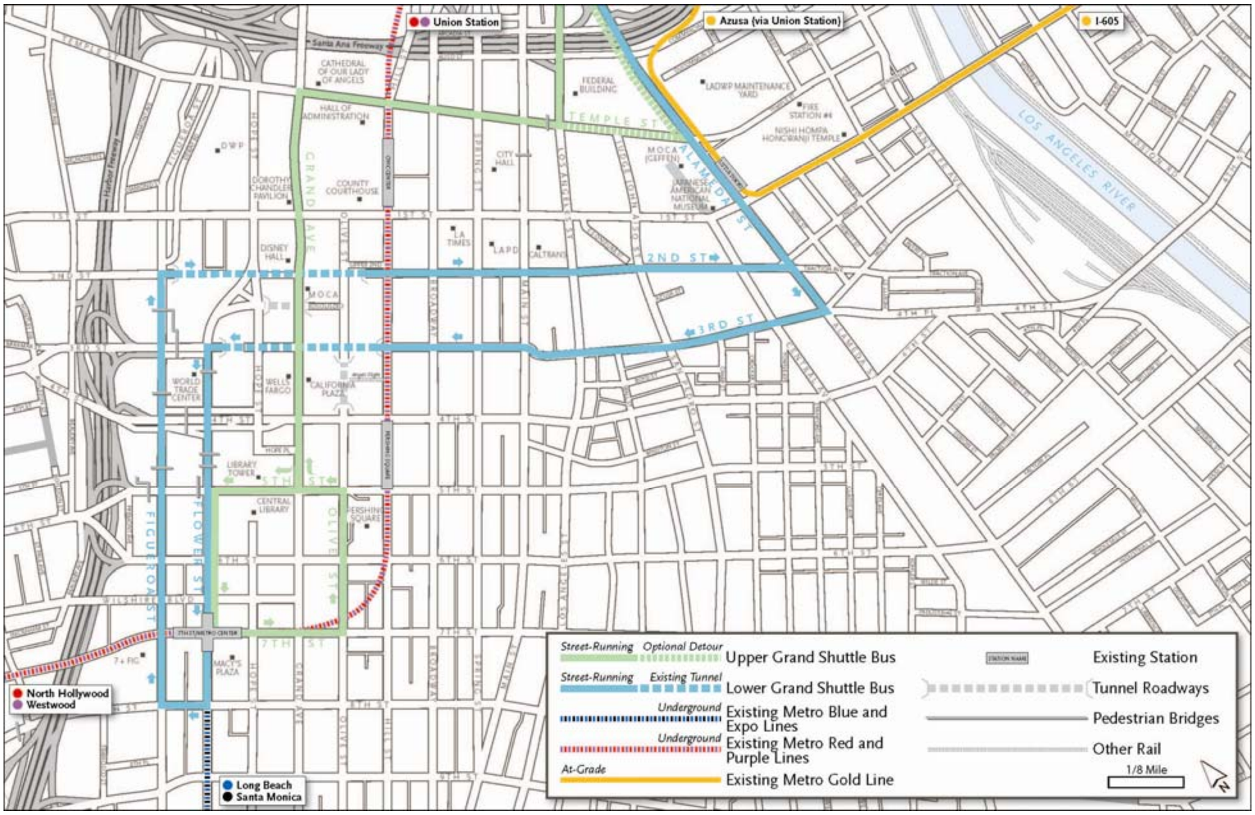


Figure 2-2. TSM Alternative

Trains would proceed east on 2nd Street to Main Street. At Main Street, the alignment would split into two single-track alignments. One track (for northbound trains) would continue east to Los Angeles Street and then north to Temple Street. The other track (for southbound trains) would travel north on Main Street and then west on Temple Street. Both tracks would have an at-grade station just north of 1st Street.

At Temple and Los Angeles Streets, the two tracks would rejoin and proceed west on Temple Street to Alameda Street, where the tracks would join the Metro Gold Line in a three-way junction.

A vehicular underpass and pedestrian overpass are proposed along Alameda Street to route through traffic beneath the rail tracks and Temple Street traffic. This would minimize potential conflicts between rail, vehicular, and pedestrian traffic, and reduce delays at the intersection of Temple and Alameda Streets. Temple Street and the rail tracks would remain at grade, and the existing at-grade segment of Alameda Street would be lowered to pass under Temple Street. The pedestrian bridge could potentially have endpoints located on each of the intersection's four corners.

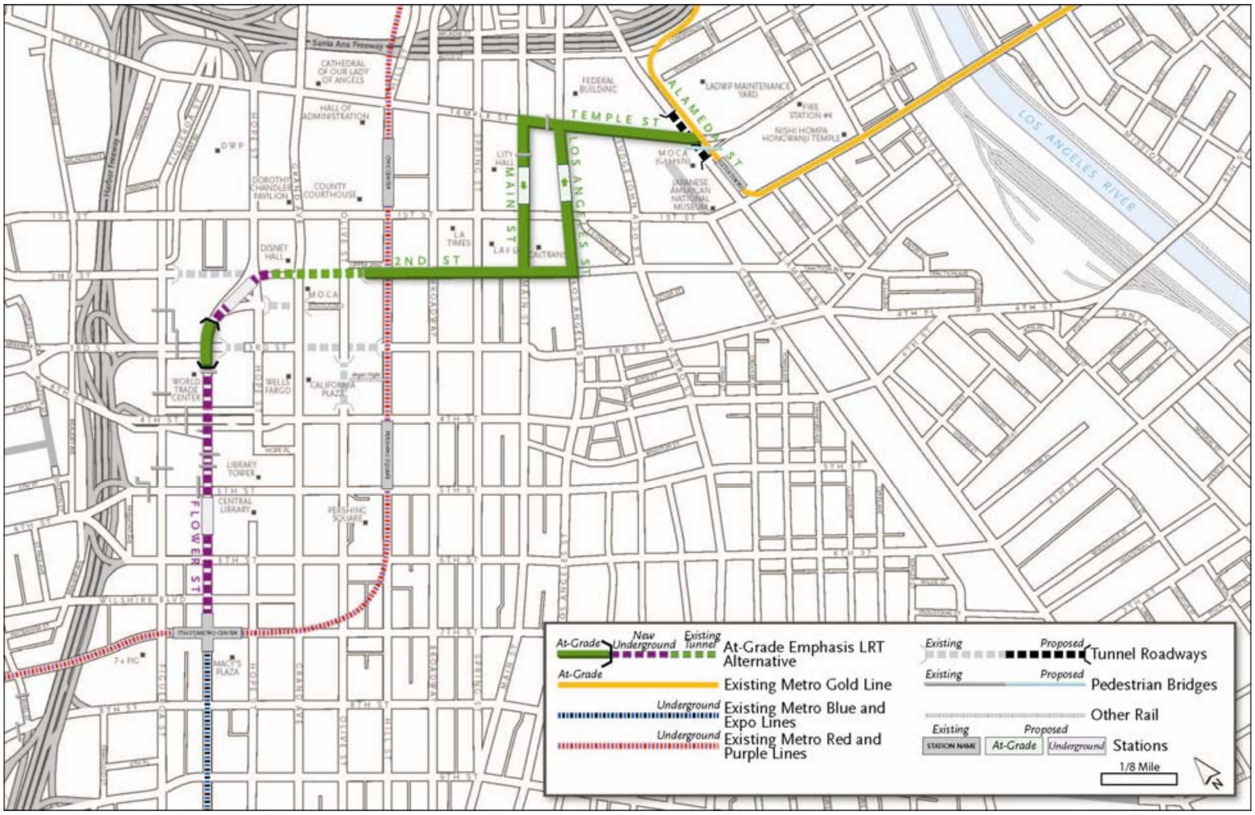


Figure 2-3. At-Grade Emphasis LRT Alternative Alignment and Configuration

Locations of new light rail right-of-way and stations proposed for the At-Grade Emphasis LRT Alternative are identified in the following sections. It should be noted that this report analyzes maximum potential effects and impacts for each proposed project facility. Thus, ultimate effects and impacts may be smaller in magnitude than the impacts discussed herein.

New light rail right-of-way

- Underground double track beneath Flower Street from the 7th Street/Metro Center Station to a new portal between 4th and 3rd Streets
- At-grade double track on Flower Street from the portal between 4th and 3rd Streets to 3rd Street, then across the intersection of 3rd and Flower Streets to a new portal into the hillside on the northeast corner
- Underground double track from the portal on the northeast corner of 3rd and Flower Streets to a new portal through the southern wall of the 2nd Street tunnel
- At-grade double track in the 2nd Street tunnel and on 2nd Street, from the new portal in the 2nd Street tunnel to Main Street

- At-grade single southbound-only track on Main Street between 2nd and Temple Streets, and on Temple Street between Main and Los Angeles Streets
- At-grade single northbound-only track on 2nd Street between Main and Los Angeles Streets, and on Los Angeles Street between 2nd and Temple Streets
- At-grade double track on Temple Street between Los Angeles and Alameda Streets

New stations

- Underground station on Flower Street just south of 5th Street
- Underground station just southwest of 2nd and Hope Streets
- At-grade southbound-only station on Main Street just north of 1st Street
- At-grade northbound-only station on Los Angeles Street just north of 1st Street

2.1.4 Underground Emphasis LRT Alternative

2.1.4.1 Overview

The Underground Emphasis LRT Alternative would provide a direct connection from 7th Street/Metro Center Station to the Gold Line tracks at the Little Tokyo/Arts District Station with three new station locations. The alignment would extend underground from the 7th Street/Metro Center Station under Flower Street to 2nd Street. The tracks would then proceed east underneath the 2nd Street tunnel and 2nd Street to a new portal on the parcel bounded by 1st Street, Alameda Street, 2nd Street, and Central Avenue.

It is expected that property would need to be acquired to construct the portal and stage construction of the tunnels beneath 2nd Street. The tracks would then connect to the Gold Line tracks.

The Underground Emphasis LRT Alternative would be located primarily underground except for a single at-grade crossing at the intersection of 1st and Alameda Streets in the same type of three-way junction as proposed for the At-Grade Emphasis LRT Alternative. Tunnel construction would be constrained by existing buildings. Figure 2-4 illustrates this alternative.

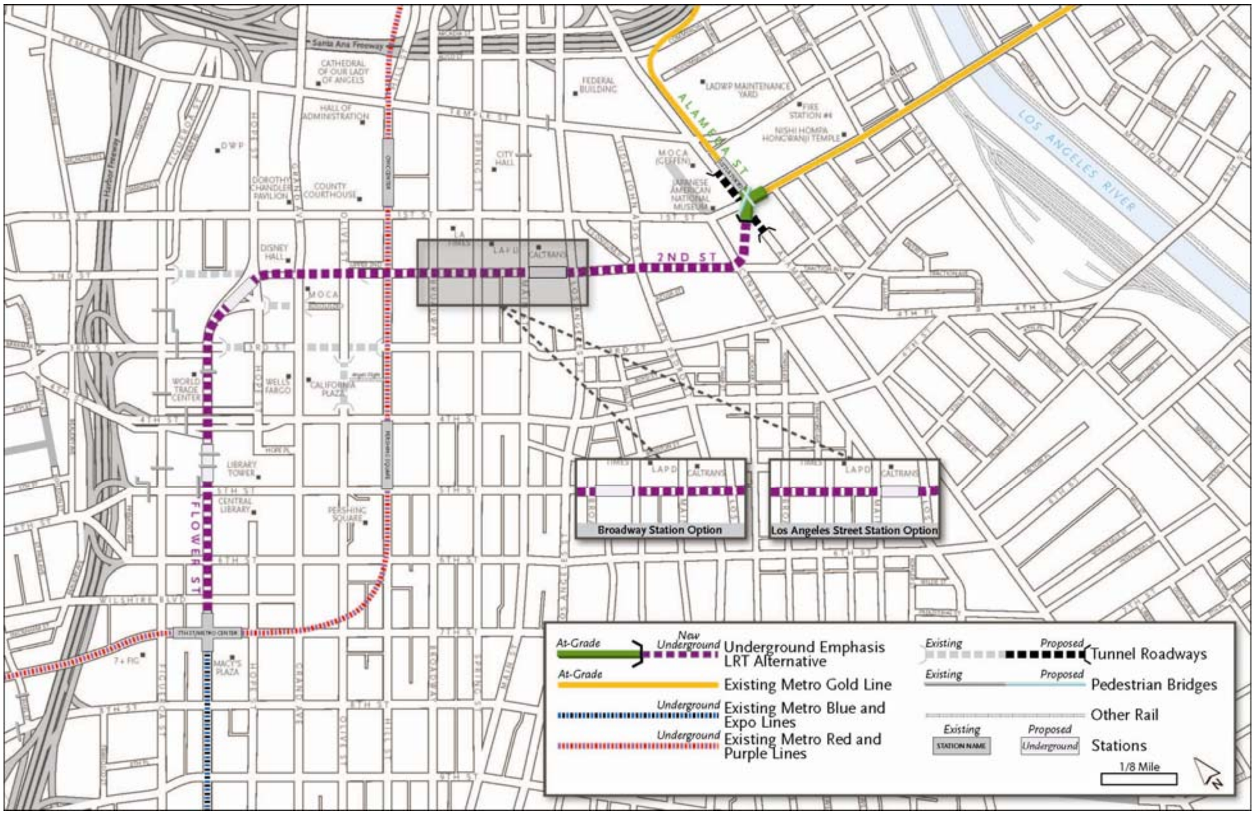


Figure 2-4. Underground Emphasis LRT Alternative Alignment and Configuration

2.1.4.2 Route Configuration

The Underground Emphasis LRT Alternative alignment would extend north from the existing platform at the 7th Street/Metro Center Station. Tracks would run underneath Flower Street to the next proposed station, just north of 5th Street. The tracks would then continue north underneath Flower Street and veer northeast near the intersection of 3rd and Flower Streets.

A new underground station would be located just southwest of the intersection of 2nd and Hope Streets. At this location, a new pedestrian bridge may be constructed to connect the station to Upper Grand Avenue. The tracks would then head east underneath 2nd Street to the next proposed station.

There are two options for a station on 2nd Street. The Broadway Station option would place an underground station on 2nd Street between Broadway and Spring Street. The Los Angeles Street Station option would include an underground station between Main and Los Angeles Streets.

The tracks continue east under 2nd Street to Central Avenue, where they would veer northeast and surface in the lot bounded by 1st, Alameda, and 2nd Streets, and Central Avenue. The tracks would then come to the surface through a portal within this block and enter an at-grade three-way junction at the intersection of 1st and Alameda Streets.

A new underpass would carry car and truck traffic along Alameda Street beneath 1st Street and the rail junction, and a new overhead pedestrian bridge structure would eliminate most potential conflicts between pedestrians and trains. The proposed pedestrian overpass could potentially have endpoints at each of the four corners of the intersection.

Crossovers would possibly be located just north of the proposed station at 5th and Flower Streets and just east of the proposed station on 2nd Street (whether it is between Broadway and Spring Street or between Main and Los Angeles Streets). Crossovers may not be needed at both of these locations, and may ultimately be placed in locations that are not adjacent to stations. Underground crossover locations require cut-and-cover construction; tunnel-boring machines cannot be used to construct underground crossovers.

Locations of new light rail right-of-way, stations, and crossovers proposed for the Underground Emphasis LRT Alternative are identified in the following sections. It should be noted that this report analyzes maximum potential effects and impacts for each proposed project facility. Thus, ultimate effects and impacts may be smaller in magnitude than the impacts discussed herein.

New light rail right-of-way

- Underground double track beneath Flower Street from the existing platform at the 7th Street/Metro Center Station to 3rd Street
- Underground double track curving northeast from the intersection of 3rd and Flower Streets toward 2nd and Hope Streets
- Underground double track beneath the 2nd Street tunnel and 2nd Street from Hope Street to Central Avenue
- At-grade double track from the portal on parcel bounded by 1st Street, Alameda Street, 2nd Street, and Central Avenue to a three-way junction at the intersection of 1st and Alameda Streets

New stations

- Underground station on Flower Street just north of 5th Street
- Underground station just southwest of the intersection of 2nd and Hope Streets
- Underground station on 2nd Street either between Broadway and Spring Street (Broadway Station option) or between Main and Los Angeles Streets (Los Angeles Street option)

New crossovers

Locations are preliminary and crossovers may not be placed at both. The two locations proposed for new crossovers include:

- Underground just north of the station at 5th and Flower Street
- Underground just east of the station on 2nd Street, either between Broadway and Spring Street or between Main and Los Angeles Streets

2.1.5 Fully Underground LRT Alternative – Little Tokyo Variation 1

2.1.5.1 Overview

The Fully Underground LRT Alternative - Little Tokyo Variation 1 would provide four new stations and a direct connection from 7th Street/Metro Center Station to the existing Metro Gold Line tracks to the north and east of 1st and Alameda Streets. The alignment would extend underground from the 7th Street/Metro Center Station under Flower Street to 2nd Street. The tracks would then proceed east underneath the 2nd Street tunnel and 2nd Street to Central Avenue. Tunnel construction would be constrained by existing buildings.

A new underground station would be located just southwest of the intersection of 2nd and Hope Streets. At this location, a new pedestrian bridge would possibly be constructed to connect the station to Upper Grand Avenue. The bridge would begin at street level near the station entrance and cross above the intersection and along Kosciuszko Way to reach Upper Grand Avenue.

The tracks would head east underneath 2nd Street to the next proposed station at Broadway. The proposed 2nd Street/Broadway station would be located under 2nd Street approximately between Broadway and Spring Street. From the new station, the tracks would continue east underneath 2nd Street to Central Avenue, where they would veer northeast to a new station, potentially located within the property currently occupied by Office Depot and other small commercial uses.

Crossovers would possibly be located just north of the proposed station at 5th and Flower Streets and just east of the proposed station at 2nd Street and Broadway.

At 2nd Street and Central Avenue, the tracks would continue underground heading northeast under 1st and Alameda Streets. A three-way junction would be constructed underground beneath the 1st and Alameda intersection. To the north and east of the junction, trains would rise to the surface through two new portals to connect to the Metro Gold Line heading north to Azusa and east to I-605.

From the junction, one set of tracks would continue underground beneath the proposed Nikkei Center parcel (the parcel on the northeast corner of 1st and Alameda Streets), along the eastern side of the existing Little Tokyo/Arts District Station. These tracks would travel under Temple Street before surfacing through a portal in the LADWP yard and rising to connect to the existing Metro Gold Line LRT bridge over US 101.

The other set of tracks leaving the three-way junction would rise to the east within 1st Street through a new portal to join the existing at-grade Metro Gold Line tracks. This second portal would be located between Alameda and Vignes Streets. 1st Street would be widened to the north to accommodate the portal. Widening 1st Street would be initiated at Alameda and continue east, tapering down significantly as the alignment crosses Hewitt Street to join the existing 1st Street LRT tracks about one and half blocks west of the 1st Street Bridge. .

Additional property would need to be acquired in order to stage construction of both portals, connect to the Gold Line LRT Bridge, and construct the tunnels beneath 2nd Street and the Nikkei Center property. The Fully Underground Alternative – Little Tokyo Variation 1 would be located entirely underground from the 7th Street/Metro Center Station to east of the intersection of 1st and Alameda Streets. Figure 2-5 illustrates this alternative.

2.1.5.2 Route Configuration

Locations of new light rail right-of-way, stations, and crossovers proposed for Fully Underground LRT Alternative – Little Tokyo Variation 1 are identified in the following sections. It should be noted that this report analyzes maximum potential effects and impacts for each proposed project facility. Thus, ultimate effects and impacts may be smaller in magnitude than the impacts discussed herein.

New light rail right-of-way

- Underground double track beneath Flower Street from the existing platform at the 7th Street/Metro Center Station to 3rd Street
- Underground double track curving northeast from the intersection of 3rd and Flower Streets toward 2nd and Hope Streets
- Underground double track beneath the 2nd Street tunnel and 2nd Street from Hope Street to Central Avenue, then to 1st and Alameda
- Underground three-way junction beneath the intersection of 1st and Alameda Streets
- Underground double track from the three-way junction to the portal located within a widened 1st Street between Vignes and Alameda Streets; then at-grade double track connecting to the existing Metro Gold Line Eastside Extension tracks toward I-605
- Underground double track from the three-way junction running north beneath the proposed Nikkei Center parcel and Temple Street, just east of the existing Little Tokyo/Arts District Station, to a new portal at the LADWP site; then at-grade double

track rising from the portal on a new ramp structure to connect to the existing Metro Gold Line bridge over US 101

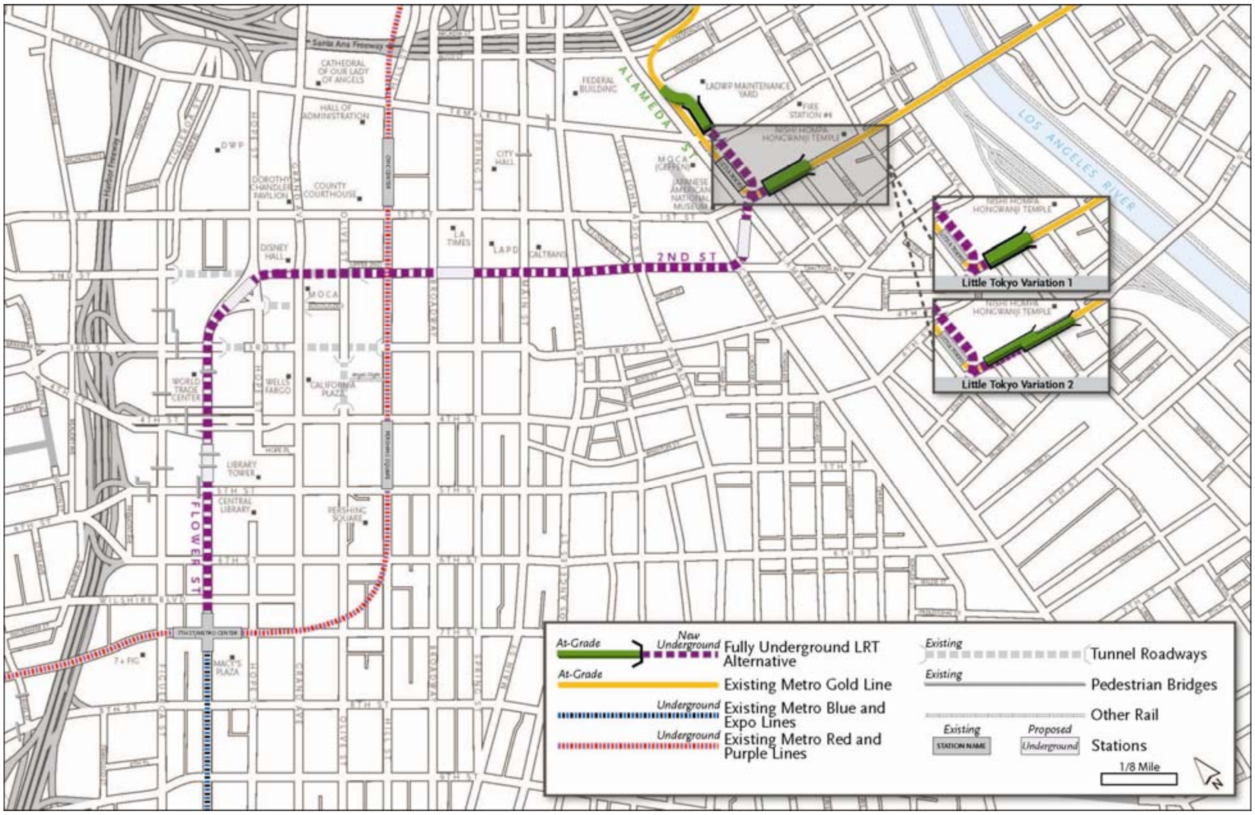


Figure 2-5. Fully Underground LRT Alternatives – Little Tokyo Variation 1 and Little Tokyo Variation 2 Alignment and Configuration

New stations

- Flower/5th/4th Street Station: Underground station on Flower Street just north of 5th Street
- 2nd/Hope Street Station: Underground Station just southwest of the intersection of 2nd and Hope Streets
- 2nd/Broadway Station: Underground station on 2nd Street between Broadway and Spring Street
- 2nd/Central Avenue Station: Underground station just northeast of the intersection at 2nd and Central. This station may include a small building at ground level on the southwest corner of 1st and Alameda streets to house ventilation fans

New crossovers

Underground crossover locations require cut-and-cover construction; tunnel boring machines cannot be used to construct underground crossovers. These construction methods are discussed in detail in the Description of Construction Technical Memorandum.

Locations are preliminary and crossovers may not be needed at both of these locations; and ultimately they may be placed in locations that are not adjacent to stations. The two locations for new crossovers include:

- Underground just north of the station at 5th and Flower Streets.
- Underground just east of the station on 2nd Street, between Broadway and Spring Street.

2.1.6 Fully Underground LRT Alternative – Little Tokyo Variation 2

2.1.6.1 Overview

The Fully Underground LRT Alternative - Little Tokyo Variation 2 would provide four new stations and a direct connection from 7th Street/Metro Center Station to the existing Metro Gold Line tracks to the north and east of 1st and Alameda Streets. The alignment would extend underground from the 7th Street/Metro Center Station under Flower Street to 2nd Street. The tracks would then proceed east underneath the 2nd Street tunnel and 2nd Street to Central Avenue. Tunnel construction would be constrained by existing buildings.

A new underground station would be located just southwest of the intersection of 2nd and Hope Streets. At this location, a new pedestrian bridge would possibly be constructed to connect the station to Upper Grand Avenue. The bridge would begin at street level near the station entrance and cross above the intersection and along Kosciuszko Way to reach Upper Grand Avenue.

The tracks would head east underneath 2nd Street to the next proposed station at Broadway. The proposed 2nd Street/Broadway station would be located under 2nd Street approximately between Broadway and Spring Street. From the new station, the tracks would continue east underneath 2nd Street to Central Avenue, where they would veer northeast to a new station, potentially located within the property currently occupied by Office Depot and other small commercial uses.

As the tunnels turn northeast from 2nd Street, the northbound tunnel would descend and the southbound tunnel would rise so that the southbound tunnel would be stacked on top of the northbound tunnel. A new proposed underground station near 2nd Street and Central Avenue would have two underground levels, each with a single-track platform. The northbound track with trains towards Azusa and I-605 would be on the lower level, and the southbound track with trains towards Long Beach and Santa Monica would be on the upper level.

The tracks would continue from the new station under the 1st and Alameda intersection into a new two-level underground junction. Separating from the junction, one track from the lower level (northbound) and one track from the upper level (southbound) would continue underground beneath the proposed Nikkei Center parcel (the parcel on the northeast corner of 1st and Alameda Streets), along the eastern side of the existing Little Tokyo/Arts District Station. These tracks would travel under Temple Street before surfacing in the LADWP yard and rising to connect to the Metro Gold Line LRT bridge over US 101. The portal would be connected to the 1st and Alameda junction by a new cut-and-cover tunnel crossing beneath Temple Street and the property proposed for the Nikkei Center (the parcel on the northeast corner of 1st and Alameda Streets). This would allow trains to continue along the Metro Gold Line.

A second track (westbound) leaving the upper level of the junction would rise to the east within 1st Street between Alameda and Hewitt Streets and link to the existing Metro Gold Line track. A second track (eastbound) leaving the lower level of the junction would rise to the east within 1st Street between Hewitt and Vignes Streets, adjacent to the westbound track, and link to the existing Metro Gold Line track.

Two portals, each containing one track, would rise to the east within the middle of a widened 1st Street to allow a connection to the Metro Gold Line towards I-605. The portal containing the westbound track would be located between Alameda and Garey Streets. The portal containing the eastbound track would be located adjacent to the westbound track between Hewitt and Vignes Streets.

1st Street would be widened to the north to accommodate the westbound portal. Widening 1st Street would be initiated at Alameda and continue east, tapering down significantly as it crosses Hewitt Street, where the new tracks would feed into the existing 1st Street LRT tracks, about half a block west of the 1st Street Bridge. 1st Street would also be widened to the south between Hewitt and Vignes Streets to accommodate the eastbound track portal. Widening this street would taper down as it approaches Vignes Street. No modification to the 1st Street Bridge would be necessary.

Additional property would need to be acquired to stage construction of both portals, connect to the Gold Line LRT Bridge, and construct the tunnels beneath 2nd Street and the Nikkei Center property. The Fully Underground Alternative – Little Tokyo Variation 2 would be located entirely underground from the 7th Street/Metro Center Station to east of the intersection of 1st and Alameda Streets. Figure 2-5 illustrates this alternative.

2.1.6.2 Route Configuration

Locations of new light rail right-of-way, stations, and crossovers proposed for Fully Underground LRT Alternative – Little Tokyo Variation 2 are identified in the following sections. It should be noted that this report analyzes maximum potential effects and impacts for each proposed project facility. Thus, ultimate effects and impacts may be smaller in magnitude than the impacts discussed herein.

New light rail right-of-way

- Underground double track beneath Flower Street from the existing platform at the 7th Street/Metro Center Station to 3rd Street
- Underground double track curving northeast from the intersection of 3rd and Flower Streets toward 2nd and Hope Streets
- Underground double track beneath the 2nd Street tunnel and 2nd Street from Hope Street to Central Avenue
- Two-level underground structure with a northbound single track on the lower level and a southbound single track on the upper level from 2nd Street and Central Avenue to 1st and Alameda Streets
- Underground two-level junction beneath the intersection of 1st and Alameda Streets
- Two-level underground structure leading from the two-level junction to two single-track portals located within the median of a widened 1st Street (eastbound portal between Hewitt and Vignes Streets, westbound portal between Alameda and Hewitt Streets); then at-grade double track connecting to the existing Metro Gold Line Eastside Extension tracks toward I-605
- Two-level underground structure leading from the two-level junction, running north beneath the proposed Nikkei Center parcel and Temple Street, just east of the existing Little Tokyo/Arts District Station, to a new portal in the LADWP site (tracks would begin to transition to side-by-side tunnels on a single level as they pass beneath the Nikkei parcel); then at-grade double track rising from the portal on a new ramp structure to connect to the existing Metro Gold Line bridge over the U.S.-101 freeway

New stations:

- Flower/5th /4th Street Station: Underground station on Flower Street just north of 5th Street
- 2nd/Hope Street Station: Underground Station just southwest of the intersection of 2nd and Hope Streets
- 2nd/Broadway Station: Underground station on 2nd Street between Broadway and Spring Street

- 2nd/Central Avenue Station: Underground two-level station just northeast of the intersection at 2nd and Central. Each level would have a single-track platform. Northbound trains to Azusa and Eastbound trains to I-605 would use the lower level. Southbound trains to Long Beach and westbound trains to Santa Monica would use the upper level. This station may include a small building at ground level on the southwest corner of 1st and Alameda Streets to house ventilation fans.

New Crossovers

Underground crossover locations require cut-and-cover construction; tunnel boring machines (TBMs) cannot be used to construct underground crossovers. These construction methods are discussed in detail in the Description of Construction technical memorandum.

Both locations are preliminary and crossovers may not be placed at either one. The two locations for new crossovers include:

- Underground just north of the station at 5th and Flower Streets
- Underground just east of the station on 2nd Street, between Broadway and Spring Street

3.0 METHODOLOGY FOR IMPACT EVALUATION

Paleontological resource sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. Due to the nature of the fossil record, paleontologists cannot know either the quality or quantity of fossils present in a given geologic unit prior to natural erosion or human-caused exposure. No field surveys were conducted for the proposed project; therefore, it is necessary to assess the sensitivity of rock units based on their known potential to produce scientifically significant fossils elsewhere within the same geologic unit (both within and outside of the project area) or a unit representative of the same depositional environment.

3.1 Regulatory Framework

Fossils are classified as nonrenewable scientific resources and are protected by various laws, ordinances, regulations, and standards across the country. The Society of Vertebrate Paleontology (SVP) (1995) has established professional standards for assessment and mitigation of adverse impacts to paleontological resources. This paleontological assessment was conducted in accordance with the regulations and standards that are applicable to paleontological resources within the project area. These regulations and standards are summarized in the following sections.

3.1.1 Federal

Federal protection for scientifically significant paleontological resources applies to projects if any construction or other related project impacts occur on federally owned or managed lands, involve the crossing of state lines, or are federally funded. The following federal protections may apply to paleontological resources within the project area:

- American Antiquities Act of 1906 (6 United States Code [USC] 431 433). Establishes a penalty for disturbing or excavating any historic or prehistoric ruin or monument or object of antiquity on federal lands as a maximum fine of $500 or 90 days in jail.

- The National Environmental Policy Act of 1969, 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 Section 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." (Section 101 [42 USC Section 4321]) (No. 382).

- National Historic Preservation Act of 1966 (PL 89 665; 80 Stat. 915, 16 USC 470 et seq.). Provides for the survey, recovery, and preservation of significant paleontological data when such data may be destroyed or lost due to a federal, federally licensed, or federally funded project.

- Federal Land Management and Policy Act of 1976 (43 USC 1712[c], 1732[b]); Section 2, Federal Land Management and Policy Act of 1962 [30 USC 611]; Subpart 3631.0 et seq.), Federal Register Vol. 47, No. 159, 1982. Defines significant fossils as: unique, rare, or particularly well preserved; an unusual assemblage of common fossils; being of high scientific interest; or providing important new data concerning (1) evolutionary trends, (2) development of biological communities, (3) interaction between or among organisms, (4) unusual or spectacular circumstances in the history of life, or (5) anatomical structure.

- Paleontological Resources Preservation Act (PRPA). Enacted as a result of the passage of the Omnibus Public Lands Management Act (OPLA) of 2009, PL 111-011. PL 111-011, Title VI, *Subtitle D. Paleontological Resources Preservation* (OPLA-PRA). The PRPA sets forth regulations and provisions pertaining to paleontological resources on all federally administered lands.

3.1.2 State

- California Environmental Quality Act. Guidelines for the Implementation of CEQA, as amended March 29, 1999 (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.) define procedures, types of activities, persons, and public agencies required to comply with CEQA, and include as one of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section XIV, Part a) including the following: "Will the proposed project directly or indirectly destroy a significant paleontological resource or unique geologic feature?"

- Public Resources Code (Chapter 1.7), Sections 5097.5 and 30244. These statutes prohibit removal of any paleontological site or feature on public lands without permission of the jurisdictional agency, define the removal of paleontological sites or features as a misdemeanor, and require reasonable mitigation of adverse impacts to paleontological resources from developments on public (state) lands.

3.1.3 Local

The Conservation Element of the City of Los Angeles General Plan (adopted September 2001) specifically addresses paleontological resources in Section 3 of Chapter 2. The Plan's paleontological objective is to "protect the city's archaeological and paleontological resources for historical, cultural, research and/or educational purposes." Moreover, its policy is to "continue to identify and protect significant archaeological and paleontological sites and/or resources known to exist or that are identified during land development, demolition or property modification activities."

3.1.4 Professional Standards

The SVP has established standard guidelines (SVP 1995) that outline professional protocols and practices for conducting paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing professional vertebrate paleontologists adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically provided in its standard guidelines. State regulatory agencies with paleontological regulations and standards typically accept and use the professional standards set forth by the SVP.

As defined by the SVP (1995:26), significant nonrenewable paleontological resources are defined as:

> Fossils and fossiliferous deposits here restricted to vertebrate fossils and their taphonomic and associated environmental indicators. This definition excludes invertebrate or paleobotanical fossils except when present within a given vertebrate assemblage. Certain invertebrate and plant fossils may be defined as significant by a project paleontologist, local paleontologist, specialists, or special interest groups, or by lead agencies or local governments.

As defined by the SVP (1995:26), significant fossiliferous deposits are defined as:

> A rock unit or formation which contains significant nonrenewable paleontologic resources, here defined as comprising one or more identifiable vertebrate fossils, large or small, and any associated invertebrate and plant fossils, traces and other data that provide taphonomic, taxonomic, phylogenetic, ecologic, and stratigraphic information (ichnites and trace fossils generated by vertebrate animals, e.g., trackways, or nests and middens, which provide datable material and climatic information). Paleontologic resources are considered to be older than recorded history and/or older than 5,000 years, BP [before present].

Based on the significance definitions of the SVP (1995), all identifiable vertebrate fossils are considered to have significant scientific value. This position is adhered to because vertebrate fossils are relatively uncommon, and only rarely will a fossil locality yield a statistically significant number of specimens of the same genus. Therefore, every vertebrate fossil found has the potential to provide significant new information on the taxon it represents, its paleoenvironment, and/or its distribution. Furthermore, all geologic units in which vertebrate fossils have previously been found are considered to have high sensitivity. Identifiable plant and invertebrate fossils are considered significant if found in association with vertebrate fossils or if defined as significant by project paleontologists, specialists, or local government agencies.

A geologic unit known to contain significant fossils is considered to be "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 fossil remains directly or indirectly. This definition of sensitivity differs fundamentally from that 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. Paleontologic 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 paleontologic potential in each case. [SVP, 1995]

Many archaeological sites contain features that are visually detectable on the surface. In contrast, fossils are contained within surficial sediments or bedrock and are therefore not observable or detectable unless exposed by erosion or human activity. Monitoring by experienced paleontologists greatly increases the probability that fossils will be discovered during ground-disturbing activities and that, if these remains are significant, successful mitigation and salvage efforts may be undertaken to prevent adverse impacts to these resources.

3.2 Paleontological Sensitivity

Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined by rock type, past history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological sensitivity is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey. In its "Standard Guidelines for the Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources," the SVP (1995:23) defines three categories of paleontological sensitivity (potential) for sedimentary rock units:

- High Potential. Rock units from which vertebrate or significant invertebrate fossils or suites of plant fossils have been recovered and are considered to have a high potential for containing significant nonrenewable fossiliferous resources. These units include, but are not limited to, sedimentary formations and some volcanic formations that contain significant nonrenewable paleontologic resources anywhere within their geographical extent and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical; and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas that contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas that may contain new vertebrate deposits, traces, or trackways are also classified as significant.

- Low Potential. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils. Such units will be poorly represented by specimens in institutional collections.
- Undetermined Potential. Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials.

It should be noted that highly metamorphosed rocks and granitic rock units do not generally yield fossils and therefore have low potential to yield significant nonrenewable fossiliferous resources.

In general terms, for geologic units with high potential, full-time monitoring typically is recommended during any project-related ground disturbance. For geologic units with low potential, protection or salvage efforts typically are not required. For geologic units with undetermined potential, field surveys by a qualified paleontologist are usually recommended to specifically determine the paleontologic potential of the rock units present within the study area.

4.0 AFFECTED ENVIRONMENT

The project is located within the City of Los Angeles in Los Angeles County, California. Specifically, the Direct Area of Potential Effects (APE) extends in a northeasterly direction from the intersection of Flower and 7th Streets to the Gold Line Extension project at Alameda Street between 1st and Temple Streets within downtown Los Angeles (Figure 4-1). The project crosses several communities of downtown Los Angeles, including the Bunker Hill, Civic Center, and Little Tokyo communities.

This area is highly urbanized with commercial and public use development. Most of the native vegetation has been removed and replaced by non-native trees and grasses. Elevations range from 250 to 270 feet (76 to 82 meters) above mean sea level. The nearest natural water source includes the now-channelized course of the Los Angeles River, located approximately 0.72 mile (1.1 km) east of the project area.

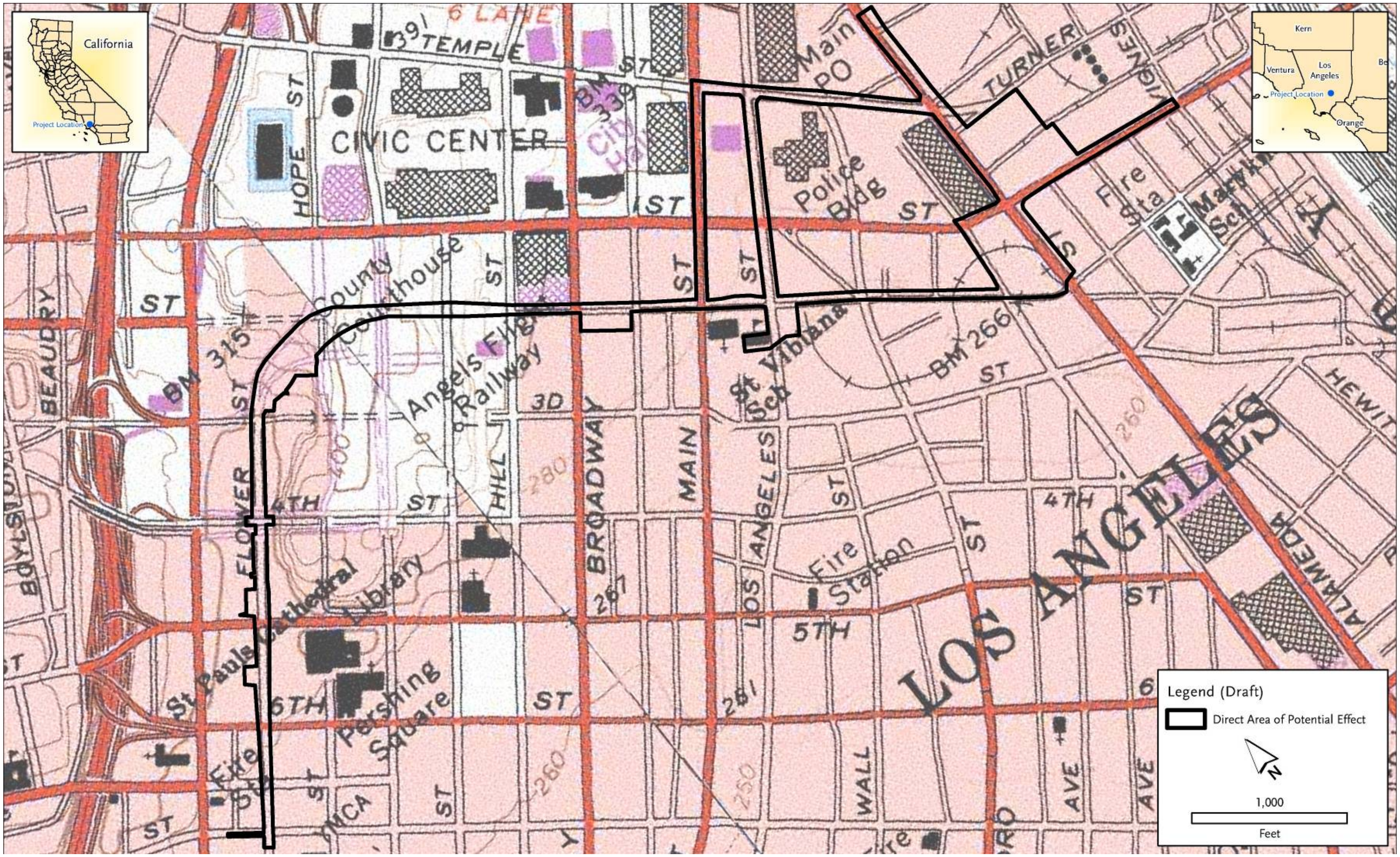
4.1 Resource Assessment Guidelines

For this project, a paleontological collections records search was conducted by the Vertebrate Paleontology Section of the Natural History Museum of Los Angeles County. A detailed review of museum collections records was performed to identify any known vertebrate fossil localities within at least 1 mile of the proposed project and to identify the geologic units within the project area and vicinity. In addition, the following published geologic maps were consulted:

- Preliminary geologic map of the Hollywood 7.5-minute quadrangle, southern California: a digital database: U.S. Geological Survey, Open-File Report OF-97-431, scale 1:24,000 (Yerkes and Graham 1997)
- Preliminary geologic map of the Los Angeles 7.5-minute quadrangle, southern California: a digital database: U.S. Geological Survey, Open-File Report OF-97-432, scale 1:24,000 (Yerkes and Graham 1997)

4.2 Geologic Setting

The project area is situated in the southwestern block of the Los Angeles basin. The Los Angeles basin is one of many basins making up the Neogene continental borderland of southern California. It extends from the Santa Ana Mountains in the north to the San Joaquin Hills to the south, and includes the southern foothills of the San Gabriel Mountains, the Puente Hills, and the Palos Verdes Hills. The southwestern block is mostly submerged by the Pacific Ocean, but is exposed in the low plain extending from Santa Monica southeast to Long Beach (Yerkes et al. 1965).



Source: USGS

Figure 4-1. Project Area of Potential Effect

The Los Angeles basin is a structural depression that has been the site of discontinuous deposition since the Late Cretaceous and of continuous subsidence and primarily marine deposition since the middle Miocene. This and other sedimentary basins formed during the Miocene and Pliocene as a result of an early San Andreas-type phase of transform motion along the western margin of North America.

At least three cycles of shallow marine transgression and regression created embayments and floodplains along the ancient coastline. During much of the middle Miocene, a northwest-trending marine embayment covered the site of the Los Angeles basin. Rivers that drained the highlands to the north and east transported and deposited huge volumes of coarse-grained sandstone and sandy cobble-boulder conglomerate into the embayment (Yerkes, et al. 1965).

Deposition continued until the end of the Pliocene, at which time the Palos Verdes Hills were an island, and large parts of the Santa Monica Mountains, the Puente Hills, the Santa Ana Mountains, and much of the southwest portions of the basin were exposed. In the early Pleistocene, the Palos Verdes Hills and southwestern areas again subsided and marine deposition resumed (Yerkes, et al. 1965).

4.3 Site-specific Geology

According to geologic mapping and museum collections records, the proposed project is immediately underlain by the following geologic units, from oldest to youngest: (1) Miocene Puente Formation, (2) Pliocene Fernando Formation, (3) Quaternary terrace deposits, and (4) Quaternary alluvium. These geologic units and their paleontological resource sensitivity are discussed in the following sections and depicted on Figure 4-2 and Figure 4-3 (respectively).

4.3.1 Puente Formation

The Puente Formation is middle to late Miocene (14 to 5 million years ago [mya]) in age, and was named in 1907 for its exposures in the Puente Hills (Yerkes 1972). The Puente Formation is isochronous (deposited at the same time) with the Monterey and Modelo Formations but consists of more terrigenous sediments because of the basin's proximity to the continental borderlands. Critelli (1995) suggests that an intrabasinal bathymetric ridge probably separated these formations.

The Puente Formation was deposited during an accumulation of sedimentary strata between 14 and 10 mya (Bjorklund 2002). Around 7 mya, north-south contractions formed the Whittier fault and the Puente Hills anticline. Today, the half-dome shape is reflected in the distribution of four members of the Puente Formation (Yerkes 1972). The oldest member, the La Vida Member, outcrops just north of the Whittier fault zone and forms the core of the half dome. In decreasing age, the Soquel, Yorba, and Sycamore Canyon Members outline this core in concentric half circles. According to Dibblee (1989), the Yorba Member underlies the project area in the vicinity of the intersection of Flower and 3rd Streets and Hope and 2nd Streets (Figure 4-2).

The Yorba Member of the Puente Formation is as much as 2,950 feet thick and is generally made up of thin-bedded diatomaceous siltstone and mudstone as well as interbedded sandstone (Critelli et al. 1995; Yerkes 1972). Within the study area, the Yorba Member is described as a gray to light-brown silty clayey shale with interbedded fine to coarse-grained sandstone and lenses of diatomaceous shale (Dibblee 1989; Yerkes and Graham 1997b). This deep basin deposit is well known for its abundant and diverse assemblage of fossil fish (Eisentraut and Cooper 2002).

The Puente Formation is known to produce significant paleontological resources, including fossilized remains of sharks, fish, and marine and terrestrial mammals, as well as some of the most complete collections of marine algae and terrestrial flora. It has been assigned a high paleontological resource sensitivity (Eisentraut and Cooper 2002; McLeod 2008) for its proven potential to yield scientifically significant fossil resources.

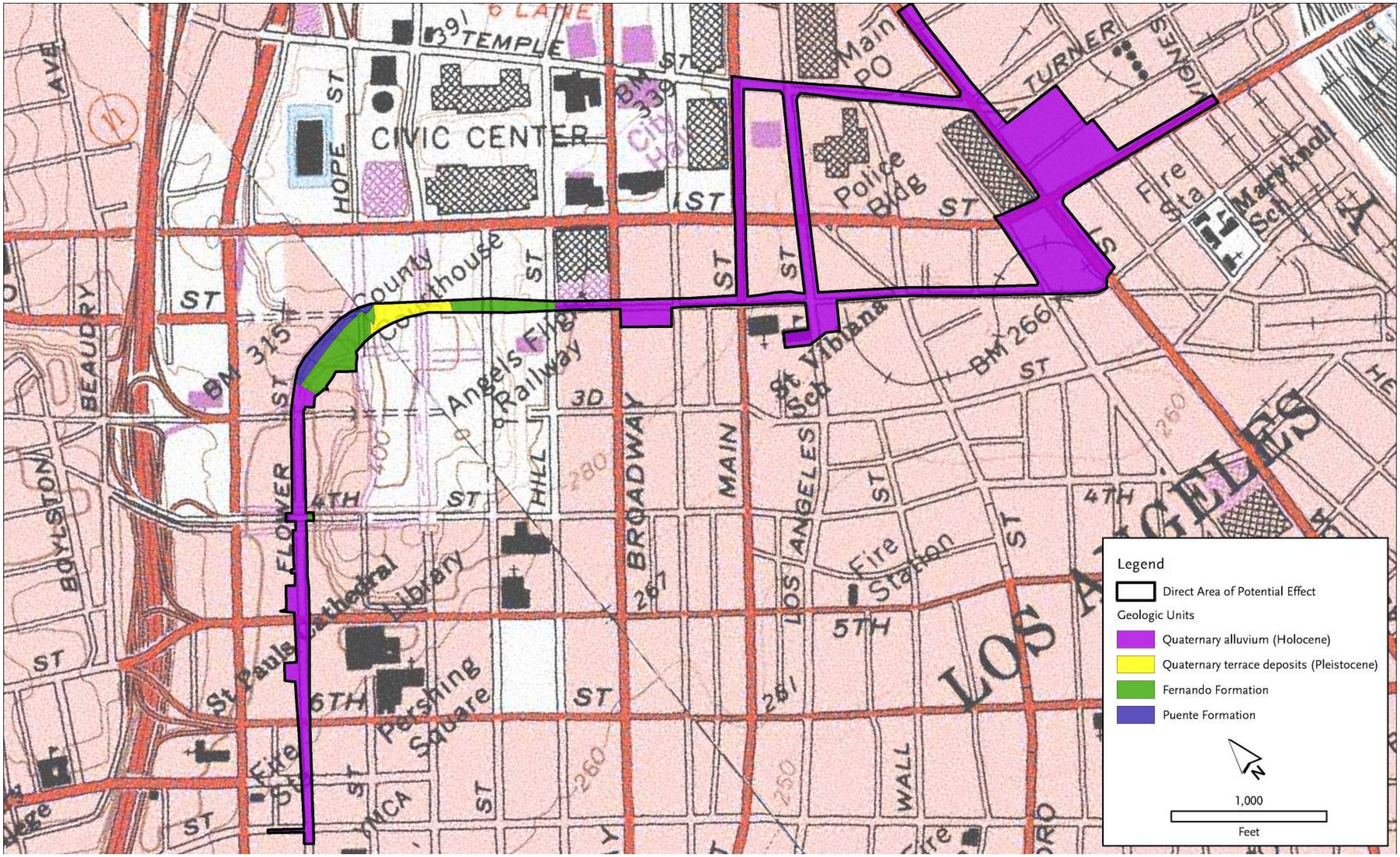
4.3.2 Fernando Formation

The Pliocene (5 to 1.8 mya) age Fernando Formation is present in the eastern Puente Hills and much of the northeastern Los Angeles basin. The formation has been divided into two members, the Pico and the Repetto Members, which are separated by an erosional unconformity.

The Repetto Member (lower member) generally consists of a light grayish-brown to olive-brown siltstone, massive to poorly bedded, and micaceous. Several thin lenticular pebble conglomerate beds are interbedded with the fine-grained strata and form prominent outcrops. The presence of this coarse-grained material within generally fine-grained strata suggests these coarse marginal basin deposits were carried to the deeper basin center by turbidity currents.

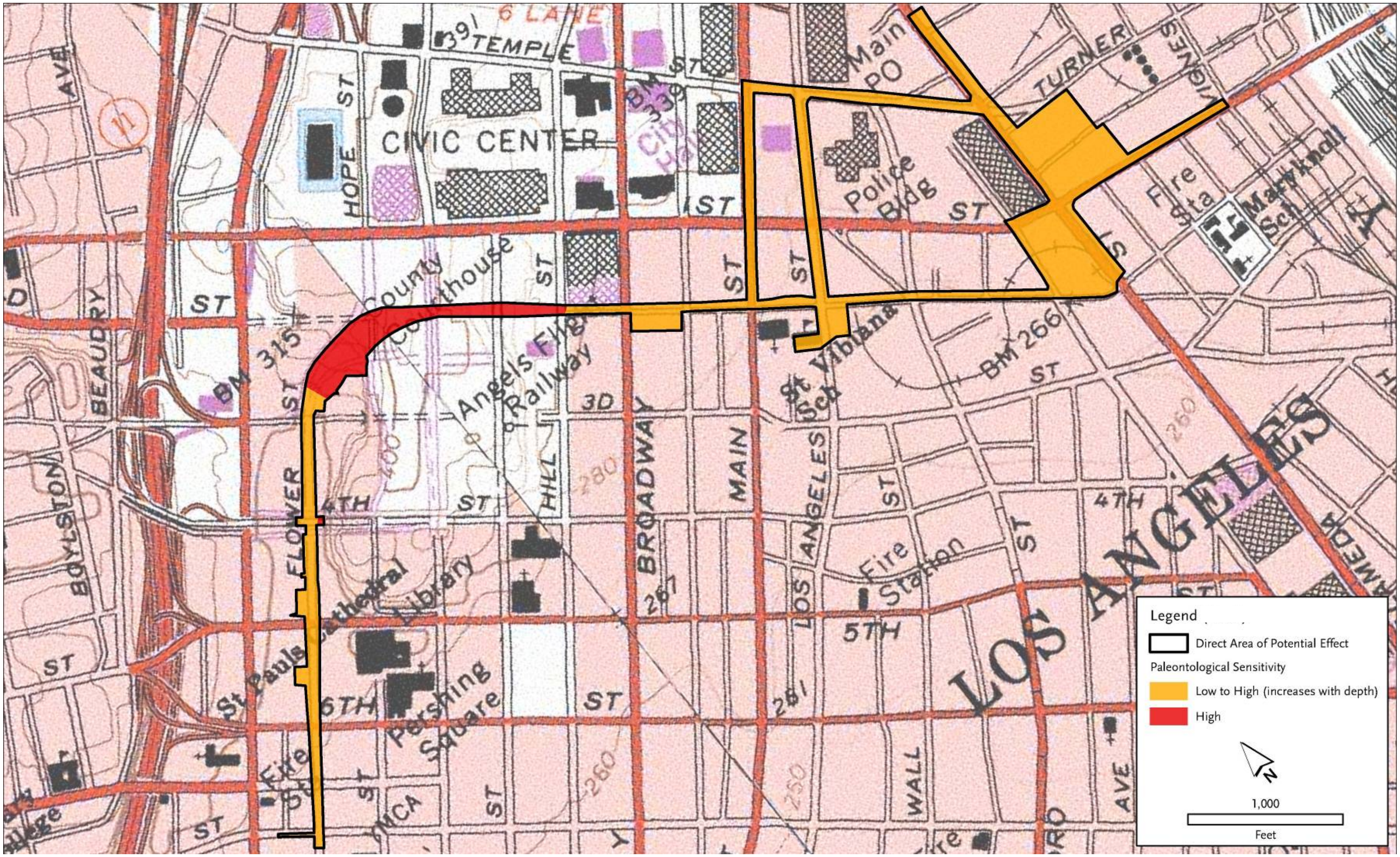
Within the project area, the Repetto Member is described as gray to greenish-gray, partly sandy, and vaguely bedded to massive marine claystone and siltstone (Dibblee 1989, 1991; Yerkes and Graham 1997). It outcrops within the project area in the vicinity of the intersection of Flower and 3rd Streets and Hope and 2nd Streets and, according to museum records, is present immediately beneath Quaternary alluvium along Flower Street (Figure 4-2).

In addition to numerous invertebrate fossils collected from the Fernando Formation, some marine vertebrate material has also been documented, including fossilized specimens of great white shark, dolphin, herring, hake, lanternfish, mackerel, swordfish, flounder, and whale (McLeod 2005). The presence of these fossils within this geologic unit, as well as its proven potential to yield vertebrate remains in the vicinity of the study area, has resulted in the designation of the Fernando Formation as having a high paleontological sensitivity.



Source: USGS

Figure 4-2. Geologic Map



Source: USGS

Figure 4-3. Paleontological Sensitivity Map

4.3.3 Quaternary Terrace Deposits

Older alluvium consists of stream channel or floodplain deposits of Pleistocene (1.8 mya to 10,000 years BP) or early Holocene (10,000 years BP to Recent) age that are no longer part of an active stream channel or its flood banks. Older alluvium in coastal southern California is usually found capping slopes and in areas of higher elevations along ridges and slopes, commonly above modern streambeds in a terrace sequence. These terrace deposits are formed by down-cutting of active stream channels and subsequent abandonment of the old channel/floodplain, resulting in a stair-step sequence of older terraces located above modern stream channels. Older alluvium generally consists of clayey sands and silts, with local concentrations of pebble to cobble conglomerate. Within the project area, Quaternary terrace deposits outcrop in the vicinity of Grand Avenue and 2nd Street (Figure 4-2).

Throughout southern California, older non-marine alluvium and terrace deposits have produced Pleistocene-age fossils from numerous localities. Sixty Pleistocene localities, exclusive of Rancho La Brea, were reviewed by Miller (1971), and many localities have been discovered since then.

Pleistocene taxa from alluvial and terrace deposits include amphibians (toad, frog, newt), reptiles (pond turtle, desert tortoise, fence lizard, alligator lizard, rattlesnake, gopher snake), birds (duck, hawk, burrowing owl, quail, coot, sparrow), and mammals (shrew, ground sloth, jack rabbit, cottontail rabbit, ground squirrel, pocket gopher, pocket mouse, kangaroo rat, deer mouse, mouse, wood rat, vole, muskrat, coyote, dire wolf, weasel, sabertooth cat, mammoth, mastodon, horse, camel, antelope, deer, bison) (Miller 1971). Older alluvium (sediments not part of an active stream channel) can provide important paleoecological data even if it does not contain the remains of extinct organisms. Older alluvium (non-marine terrace deposits) has been assigned a high paleontological resource sensitivity.

4.3.4 Quaternary Alluvium

Quaternary alluvium of Holocene age underlies the majority of the project area, from 7th and Flower Streets north to approximately 3rd and Flower Streets and from the intersection of Hill and 2nd Streets eastward (Figure 4-2). This unit consists of unconsolidated floodplain deposits of clay, silt, sand, and gravel (Dibblee 1989, 1991) that may overlie "older alluvium" of Pleistocene age at depths as shallow as 3 meters (Yerkes and Graham 1997b). Older alluvial sediments may be slightly to moderately consolidated, but are generally only distinguishable through relative dating and stratigraphic position. The Holocene-age alluvial deposits present in the western portion of the project area are estimated to be 1,000 to 10,000 years BP, and the alluvial deposits to the east are less than 1,000 years BP (Yerkes and Graham 1997b).

Holocene-age deposits contain the remains of modern organisms and are generally too young to contain fossils. Fossil localities in older Quaternary alluvium deposits throughout southern

California have yielded terrestrial vertebrates such as mammoths, mastodons, ground sloths, dire wolves, short-faced bears, saber-toothed cats, horses, camels, and bison. Fossilized invertebrates and plant remains have also been collected from this unit. Younger alluvium is determined to have a low potential for paleontological resources, but is often underlain by older alluvium, which is determined to have a high potential for paleontological resources.

4.4 Museum Records Search Results

Museum collections records maintained by the Natural History Museum of Los Angeles County (LACM) were searched, and 12 previously recorded vertebrate fossil localities were discovered either along the proposed project area or within a 2-mile radius (Table 4-1). These significant vertebrate fossil localities were discovered within the same geologic units that are present within the proposed project area (Table 4-1). These localities yielded fossil specimens of mastodon, mammoth, shark, ray, and fish from Quaternary older alluvium, the Fernando Formation, and the Puente Formation. The depth at which these localities were discovered ranges from 5 to 60 feet below the surface (McLeod 2008).

Table 4-1. Previously Discovered Paleontological Resources In and Around the Direct APE

LACM Locality Number(s) and Approximate Location	Geologic Formation	Age	Taxa
LACM 5845; Western Avenue and Beverly Boulevard	Quaternary alluvium	Pleistocene	*Mammutidae* (fossil mastodon)
LACM 3250; east of Vermont Avenue near Madison Avenue and Middlebury Street	Quaternary alluvium	Pleistocene	*Mammuthus* (fossil mammoth)
LACM 6971; 6th and Flower Streets; LACM 4726; 4th and Hill Streets	Fernando	Pliocene	*Myliobatis* (eagle ray), *Carcharodon carcharias* (white shark), *Isurus oxyrinchus* (bonito shark), *Carcharhinus* (requiem shark), *Semicossyphus* (sheepshead)
LACM 3868; Wilshire Boulevard and Lucas Avenue	Fernando Formation	Pliocene	*Carcharodon sulcidens* (white shark)

Table 4-1. Previously Discovered Paleontological Resources In and Around the Direct APE			
LACM Locality Number(s) and Approximate Location	**Geologic Formation**	**Age**	**Taxa**
LACM 5961; 1st and Hill Streets	Puente Formation	Late Miocene	*Cyclothone* (bristlemouth fish)
LACM 6198- 6203; Wilshire Boulevard from intersection of Alvarado Street west to past Vermont Avenue	Puente Formation	Late Miocene	*Osteichthyes* (bony fish), *Cetacea* (whale)

5.0 IMPACTS

Surface fossils may be located, evaluated, and salvaged by paleontologists during a field survey prior to a surface-disturbing action. The project area surface is largely obscured by urbanization and a field survey was not warranted. However, subsurface fossils that are not visible cannot be located and evaluated prior to ground disturbance.

Any estimates of adverse impacts to subsurface fossils can be predicted only by determining the number and types of fossils that occur in the study area, based on projections derived from similar areas. The existence of subsurface fossils can be definitively determined only by monitoring excavations during surface-disturbing actions.

Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing, typically in construction-related excavations. In areas containing paleontologically sensitive geologic units, surface disturbance has the potential to adversely impact an unknown quantity of surface and subsurface fossils. Without mitigation, these fossils, as well as the paleontological data they could provide if properly salvaged and documented, could be adversely impacted (destroyed), rendering them permanently unavailable.

Direct adverse impacts can typically be mitigated to below a level of significance by implementing paleontological mitigation. Mitigation also creates a beneficial effect because it results in the salvage of fossils that may never have been unearthed via natural processes. With mitigation, these newly salvaged fossils become available for scientific research, education, display, and preservation into perpetuity at a public museum.

Indirect adverse impacts typically include those effects that result from continued implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given project area. They also occur as the result of constructing new access roads in areas that were previously less accessible. This increases public access and therefore increases the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. No indirect impacts are expected as the result of this project because the area of potential effect is highly urbanized.

Cumulative impacts on the environment can result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions on the cumulative effects area. They can result from individually minor, but collectively significant, actions taken over a period of time.

The incremental loss of paleontological resources over a period of time as a result of project-related ground disturbance has the potential to result in significant cumulative effects because it could result in destruction of nonrenewable paleontological resources and irretrievable loss of scientific information. However, when paleontological monitoring and mitigation is implemented prior to and during project construction, fossils are protected and information is obtained. By implementing monitoring and mitigation where feasible, the cumulative effects to paleontological resources resulting from the project would be negligible. Further, any scientifically significant fossils discovered prior to or during ground disturbances related to the proposed project would benefit the scientific community by increasing knowledge associated with the fossils.

5.1 No Build Alternative

5.1.1 Construction Impacts

The No Build Alternative, in which the project area would remain in its existing condition, would not result in construction impacts to paleontological resources because no ground disturbance would occur.

5.1.2 Operational Impacts

The No Build Alternative would not result in operational impacts to paleontological resources.

5.1.3 Cumulative and Indirect Impacts

The No Build Alternative would not result in impacts to paleontological resources. Therefore, the No Build Alternative would not contribute to a cumulative impact on these resources.

5.2 Transportation System Management (TSM) Alternative

5.2.1 Construction Impacts

The TSM Alternative may have the potential to adversely affect paleontological resources within the project area during ground disturbance related to construction of bus stop facilities. These facilities will be constructed every two to three blocks, but their precise locations have not yet been established. Should the facilities be constructed in areas of high sensitivity (See Figure 4-3), any excavations at the surface or at depth will have the potential to impact paleontological resources. Should the facilities be constructed in areas of sensitivity ranging from low to high (See Figure 4-3), any excavations occurring to a depth of 5 feet or greater below the ground surface will have the potential to impact paleontological resources. Implementation of the proper mitigation measures (Section 6.1) would reduce potential adverse impacts to a less than significant level.

5.2.2 Operational Impacts

The TSM Alternative would not result in operational impacts to paleontological resources.

5.2.3 Cumulative and Indirect Impacts

Construction of the TSM Alternative has the potential to directly affect paleontological resources within the project area should excavations related to the construction of new bus stations occur in paleontologically sensitive geologic units. Implementing the proper mitigation measures (Section 6.1) would reduce potential adverse impacts to a less than significant level. Therefore, the TSM Alternative would not contribute to a cumulative impact on these resources.

5.3 At-Grade Emphasis LRT Alternative

5.3.1 Construction Impacts

The At-Grade Emphasis LRT Alternative has the potential to adversely impact paleontological resources at the surface and at depth within the project area as a result of ground disturbance related to construction of new underground tunnel segments between 7th and Hope Streets and at new proposed stations at Flower/6th/5th Street, 2nd/Hope Street, Main/1st Street, and Los Angeles/1st Street. Any ground disturbances in areas of high sensitivity (See Figure 4-3) will have the potential to impact paleontological resources at the surface and at depth; areas of ground disturbance in areas of sensitivity ranging from low to high have the potential to impact paleontological resources at a depth of 5 feet or greater below the ground surface. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level.

5.3.2 Operational Impacts

The At-Grade Emphasis LRT Alternative would not result in operational impacts to paleontological resources.

5.3.3 Cumulative and Indirect Impacts

The At-Grade Emphasis LRT Alternative has the potential to adversely impact paleontological resources within the project area as a result of ground disturbance related to constructing new underground TBM segments on Flower Street between 7th and Hope Streets and at new stations at Flower/6th/5th Street, 2nd/Hope Street, Main/1st Street, Los Angeles/1st Street. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level thus reducing any cumulative impact on paleontological resources.

5.4 Underground Emphasis LRT Alternative

5.4.1 Construction Impacts

The Underground Emphasis LRT Alternative involves ground disturbance and therefore has the potential to adversely impact paleontological resources within the project area. This disturbance would result from excavations related to construction of a new underground tunnel along most of the alignment; new underground stations at Flower/5th/4th Street, 2nd/Hope Street, 2nd Street station (either at Broadway or at Los Angeles Street); an automobile underpass on Alameda Street between 2nd Street and Temple Street; and a proposed pedestrian bridge at the intersection of Alameda and 1st Streets. Any ground disturbances in areas of high sensitivity (See Figure 4-3) will have the potential to impact paleontological resources at the surface and at depth; areas of ground disturbance in areas of sensitivity ranging from low to high have the potential to impact paleontological resources at a depth of 5 feet or more below the ground surface. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level. In areas where new underground TBM segments would be constructed, mitigation for paleontological resources will not be feasible and are thus unavoidable.

5.4.2 Operational Impacts

The Underground Emphasis LRT Alternative would not result in operational impacts to paleontological resources.

5.4.3 Cumulative and Indirect Impacts

The Underground Emphasis LRT Alternative involves ground disturbance, and therefore has the potential to adversely affect paleontological resources within the project area. This disturbance would result from excavations to construct a new underground tunnel along the alternative's alignment, three new underground stations, an automobile underpass, and a pedestrian bridge. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level thus reducing any cumulative impact on paleontological resources. In areas where proper mitigation measures cannot be implemented, such as in areas where new underground TBM segments would be constructed, cumulative impacts may not be avoidable as a result of the Underground Emphasis LRT Alternative.

5.5 Fully Underground LRT Alternative - Little Tokyo Variation 1

5.5.1 Construction Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 1 involves ground disturbance, and therefore has the potential to adversely impact paleontological resources within the project area. This disturbance would result from excavations to construct four new stations and an entirely underground tunnel located from the 7th Street/Metro Center Station to east of the intersection of 1st and Alameda Streets. Any ground disturbances in areas of high sensitivity (See Figure 4-3) will have the potential to impact paleontological resources at the surface and at depth; areas of ground disturbance in areas of sensitivity ranging from low to high have the potential to impact paleontological resources at a depth of 5 feet or more below the ground surface. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level. In areas where new underground TBM segments would be constructed, mitigation for paleontological resources will not be feasible and are thus unavoidable.

5.5.2 Operational Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 1 would not result in operational impacts to paleontological resources.

5.5.3 Cumulative and Indirect Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 1 involves ground disturbance, and therefore has the potential to adversely impact paleontological resources within the project area. This disturbance would result from excavations to construct four new stations and an entirely underground tunnel. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level thus reducing any cumulative impact on paleontological resources. In areas where proper mitigation measures cannot be implemented, such as in areas where new underground TBM segments would be constructed, cumulative impacts may not be avoidable as a result of the Fully Underground LRT Alternative- Little Tokyo Variation 1.

5.6 Fully Underground LRT Alternative - Little Tokyo Variation 2

5.6.1 Construction Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 2 involves ground disturbance, and therefore has the potential to adversely impact paleontological resources within the project area. This disturbance would result from excavations to construct four new stations, a two-level junction beneath the 1st and Alameda intersection, and an entirely underground tunnel located from east of the 7th Street/Metro Center Station to the intersection of 1st and Alameda Streets. Any ground disturbances in areas of high sensitivity (See Figure 4-3) will have the potential to impact paleontological resources at the surface and at depth; areas of ground disturbance in areas of sensitivity ranging from low to high have the potential to impact paleontological resources at a depth of 5 feet or greater below the ground surface. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level. In areas where the new underground tunnel will be constructed, mitigation for paleontological resources will not be feasible and are thus unavoidable.

5.6.2 Operational Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 2 would not result in operational impacts to paleontological resources.

5.6.3 Cumulative and Indirect Impacts

The Fully Underground LRT Alternative - Little Tokyo Variation 2 involves ground disturbance and therefore has the potential to adversely impact paleontological resources within the project area. This disturbance would result from excavations to construct new stations, tunnel, and a two-level junction. In areas where proper mitigation measures (Section 6.1) can be implemented, potential impacts can be reduced to a less than significant level thus reducing any cumulative impact on paleontological resources. In areas where proper mitigation measures cannot be implemented, such as in areas where new underground TBM segments would be constructed, cumulative impacts may not be avoidable as a result of the Fully Underground LRT Alternative- Little Tokyo Variation 2.

6.0 POTENTIAL MITIGATION MEASURES

6.1 Construction Impact Mitigation Measures

The following mitigation measures have been developed in accordance with the SVP (1995) standards and guidelines and meet the paleontological requirements of CEQA. These mitigation measures have been used throughout California and have been demonstrated to be successful in protecting paleontological resources while allowing timely completion of construction.

- MM-P-1. A qualified paleontologist would produce a Paleontological Monitoring and Mitigation Plan for the proposed project and supervise monitoring of construction excavations. Paleontological resource monitoring would include inspection of exposed rock units during active excavations within sensitive geologic sediments. The monitor would have authority to temporarily divert grading away from exposed fossils to professionally and efficiently recover the fossil specimens and collect associated data.

- MM-P-2. All project-related ground disturbances that could potentially affect the Puente Formation, Fernando Formation, and Quaternary older alluvium and terrace deposits would be monitored by a qualified paleontological monitor on a full-time basis (where feasible) because these geologic sediments are determined to have a high paleontological sensitivity (Figure 4-3). Very shallow surficial excavations (less than 5 feet) within Quaternary younger alluvium would be monitored on a part-time basis to ensure that underlying sensitive units are not adversely affected (Figure 4-3). Construction monitoring during any tunneling activity is not warranted as any potential fossil specimens present within sensitive geologic units would be crushed and destroyed by the nature of tunneling methodology.

- MM-P-3. At each fossil locality, field data forms would be used to record pertinent geologic data, stratigraphic sections would be measured, and appropriate sediment samples would be collected and submitted for analysis.

- MM-P-4. Due to the likelihood of the presence of microfossils, matrix samples would be collected and tested within the Puente Formation and Fernando Formation. Testing for microfossils would consist of screen-washing samples (approximately 30 pounds) to determine if significant fossils are present. Productive tests would result in screen-washing of additional bulk matrix up to a maximum of 2,000 pounds per locality to ensure recovery of a scientifically significant sample.

- MM-P-5. Recovered fossils would be prepared to the point of curation, identified by qualified experts, listed in a database to facilitate analysis, and reposited in a designated paleontological curation facility (such as the Natural History Museum of Los Angeles County).

- MM-P-6. The paleontologist would prepare a final monitoring and mitigation report to be filed, at a minimum with Metro and the repository.

6.2 Operational Impacts Mitigation Measures

No mitigation is required because operational impacts to paleontological resources are not expected for any of the project alternatives.

7.0 CONCLUSIONS

The potential for direct and indirect effects to paleontological resources is best estimated by the amount of ground disturbance within paleontologically sensitive units associated with a proposed action. Thus, the potential for project-related impacts to paleontological resources increases as the amount of surface disturbance within paleontologically sensitive geologic formations increases.

Construction of the project or alternatives could require substantial excavations in the paleontologically sensitive Puente Formation, Fernando Formation, and Quaternary older alluvium and terrace deposits. Implementing proper mitigation measures, including construction monitoring where feasible, would reduce potential impacts to paleontological resources to below the level of significance. However, tunneling operations cannot be mitigated for paleontological resources because construction monitoring is not feasible. The potential to impact unknown paleontological resources within sensitive geologic units as a result of tunneling would be unpredictable and in essence, unavoidable. Without mitigation, these fossils, as well as the paleontological data they could provide if properly salvaged and documented, could be adversely impacted (destroyed), rendering them permanently unavailable.

7.1 NEPA Findings

The results of this analysis indicate that the geologic units underlying the project area are paleontologically sensitive and that construction of each of the build alternatives has the potential to impact previously undiscovered (buried) paleontological resources. By implementing the mitigation measures identified in Section 6.0, the potential direct and cumulative effects to paleontological resources resulting from the TSM Alternative, the At-Grade Emphasis LRT Alternative, the Underground Emphasis LRT Alternative, the Fully Underground LRT Alternative – Little Tokyo Variation 1, or the Fully Underground LRT Alternative - Little Tokyo Variation 2 would be negligible.

Furthermore, scientifically significant fossils discovered prior to or during ground disturbances related to the project would benefit the scientific community by increasing knowledge associated with the fossils. No cumulative effects would result from the No Build Alternative because no ground disturbance would occur.

7.2 CEQA Determinations

The CEQA threshold of significance for a significant impact to paleontological resources is reached when a project is determined to "directly or indirectly destroy a significant paleontological resource or unique geologic feature." In general, for project areas that are underlain by paleontologically sensitive geologic units, the greater the amount of ground disturbance, the higher the potential for significant impacts to paleontological resources.

By implementing the mitigation measures identified in Section 6.0, potential construction impacts to paleontological resources resulting from the TSM Alternative, the At-Grade Emphasis LRT Alternative, the Underground Emphasis LRT Alternative, and the Fully Underground LRT Alternative – Little Tokyo Variation 1, the Fully Underground LRT Alternative – Little Tokyo Variation 2 could be reduced to below the level of significance with the exception of areas where tunneling operations cannot be mitigated for paleontological resources. Should construction monitoring not be feasible, as would be the case during any tunneling activities, then the potential to impact unknown paleontological resources within sensitive geologic units would be unavoidable. Considering the CEQA threshold of significance with regard to paleontological resources, unavoidable impacts could occur should potentially unknown fossil resources be destroyed as a result of tunneling activities. Accordingly, a CEQA statement of overriding considerations with respect to paleontological resources would be necessary should the Underground Emphasis LRT Alternative, Fully Underground LRT- Little Tokyo Variation 1, or Fully Underground LRT – Little Tokyo Variation 2 be selected. No significant impacts would result in the No Build Alternative because no ground disturbance would occur.

8.0 REFERENCES CITED

Bjorklund, T., et al. 2002. Miocene rifting in the Los Angeles basin: Evidence from the Puente Hills half-graben, volcanic rocks, and P-wave tomography. Geology 30:451–454.

Critelli, S., et al. 1995. Petrofaces and provenance of the Puente Formation (middle to upper Miocene), Los Angeles Basin, Southern California: implications for rapid uplift and accumulation rates. Journal of Sedimentary Research A65:656–667.

Dibblee, T. W., Jr. 1989. Geologic Map of the Los Angeles Quadrangle, Los Angeles County, California. Edited by Helmut E. Ehrenspeck. Dibblee Geological Foundation Map No. DF-22.

Dibblee, T. W., Jr. 1991. Geologic Map of the Hollywood and Burbank (South ½) Quadrangles, Los Angeles County, California. Edited by Helmut E. Ehrenspeck. Dibblee Geological Foundation Map No. DF-30.

Eisentraut, P. J., and J. D. Cooper. 2002. Development of a model curation program for Orange County's Archaeological and Paleontological Collections—Final Report. Submitted to the County of Orange.

McLeod, S. A. 2005. Natural History Museum of Los Angeles County. Unpublished collections data.

McLeod, S. A. 2008. Natural History Museum of Los Angeles County. Unpublished collections data.

Miller, W. E. 1971. Pleistocene vertebrates of the Los Angeles basin and vicinity (exclusive of Rancho La Brea): Bulletin of the Los Angeles County Museum of Natural History, no. 10, 124 p.

Murphey, P. C., and Daitch, D. 2007. Paleontological overview of oil shale and tar sands areas in Colorado, Utah and Wyoming. U.S. Department of Energy, Argonne National Laboratory. Report prepared for the U.S. Department of Interior Bureau of Land Management. 468 p. and 6 maps (scale 1:500,000).

Society of Vertebrate Paleontology (SVP). 1995. Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Guidelines. Society of Vertebrate Paleontology News Bulletin. 163:22–27.

United States Geological Survey (USGS). No Date. Topographic Maps.

Yerkes, R. F., and Graham, S. E. 1997a. Preliminary geologic map of the Hollywood 7.5' quadrangle, southern California: a digital database: U.S. Geological Survey Open-File Report OF-97-431. Scale 1:24000.

Yerkes, R. F., and Graham, S. E. 1997b. Preliminary geologic map of the Los Angeles 7.5' quadrangle, southern California: a digital database. U.S. Geological Survey Open-File Report OF-97-432. Scale 1:24000.

Yerkes, R. F., T. H. McCulloh, J. E. Schoellhamer, and J. G. Vedder. 1965. Geology of the Los Angeles Basin California—an Introduction. Geological Survey Professional Paper 420-A, 57 p.

Yerkes, R. F. 1972. Geology and Oil Resources of the Western Puente Hills Area, Southern California—Geology of the Eastern Los Angeles Basin, Southern California. Geological Survey Professional Paper 420-C, 63 p.