cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

PALEONTOLOGICAL ASSESSMENT FOR THE TERRACES PROJECT IN THE CITY OF MURRIETA, RIVERSIDE COUNTY, CALIFORNIA

Prepared for:
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Cogstone Project Number: 5455
Type of Study: Paleontological Assessment
Paleontological localities: None within the project boundaries, several within one mile
USGS Quadrangle: Murrieta 7.5'
Area: 39.1 acres
Key Words: negative survey, sandstone member of the middle Pleistocene Pauba Formation – high sensitivity for fossils, late Pleistocene(?) to Holocene young alluvial channel deposits – low sensitivity for fossils

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MANAGEMENT SUMMARY

The purpose of this study is to determine the potential effect on cultural and paleontological resources of the proposed The Terraces Project (project) for the City of Murrieta, Riverside County, California. The City of Murrieta is the lead municipal agency under the California Environmental Quality Act.

The proposed project would construct 900 apartment units on a 37.8-acre site (30 units/acre) located north of Murrieta Hot Springs Road, west of Interstate 15, east of the existing Sparkman Court corridor and south of Vista Murrieta Road in the City of Murrieta. The site is bordered to the south by Murrieta Hot Springs Road and undeveloped land, to the west by the Interstate 15 corridor, to the north by Vista Murrieta Road and single-family residences and to the east by Sparkman Court and office research park uses. Planned vertical impacts will be in excess of 10 feet during grading.

The project is mapped as the sandstone member of the middle Pleistocene Pauba Formation and late Pleistocene(?) to Holocene young alluvial channel deposits. Just to the north of the property is mapped the upper part of the late Pliocene to Pleistocene "unnamed sandstone." These sediments may appear in the deepest cuts near to the northernmost property corner.

The paleontological record search revealed hundreds of fossils are known from the Pauba Formation and unnamed sandstone near the project location. No paleontological resources were observed during the intensive pedestrian survey.

Based on the records search localities, both the Pauba Formation and the unnamed sandstone are assigned a high potential for fossil resources (Potential Fossil Yield Classification (PFYC) 4) while the young alluvial channel deposits are assigned a low sensitivity (PFYC 2).

Mitigation Measure PC1. A Paleontological Resources Management Plan shall be prepared and implemented by a Riverside County Certified Paleontologist for this project. At minimum it shall include: (1) paleontological resources awareness training for all earthmoving personnel, (2) specify paleontological personnel qualifications, (3) identify the Western Science Center as the repository for fossils recovered, (4) take into account the latest information on cut depth and location and specify where monitoring shall be required, (5) require full-time monitoring of the Pauba Formation and (if encountered) unnamed sandstone sediments, (6) specify fossil recovery procedures and locality documentation, (7) specify laboratory procedures, (8) require a detailed catalogue of specimens recovered with identification by experts, and (9) require a final report with the catalogue and all specialists reports as appendices.

If unanticipated fossil resources are unearthed during construction excavations, the contractor shall cease all earth-disturbing activities within a 25-foot radius of the area of discovery until the discovery can be evaluated by a Riverside County Certified Paleontologist.

INTRODUCTION

PURPOSE OF STUDY

The purpose of this Paleontological Assessment is to determine the potential effect on paleontological resources of the proposed The Terraces Project (project) in the City of Murrieta, Riverside County, California (Figure 1). The City of Murrieta is the lead municipal agency under the California Environmental Quality Act (CEQA).

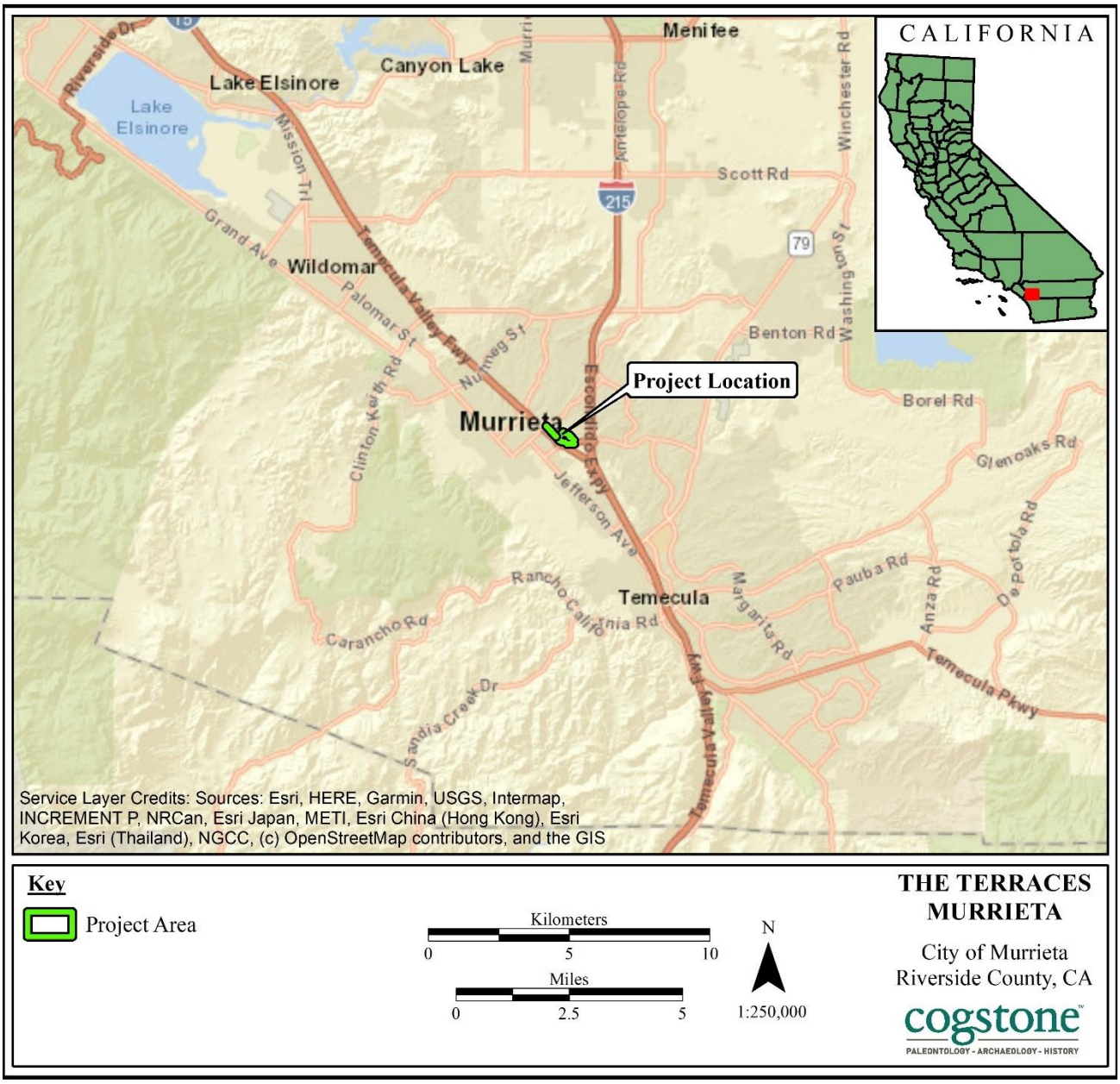

Figure 1. Project vicinity map

PROJECT DESCRIPTION

The proposed project would construct 899 apartment units on a 38.7 gross (31.39 net) acre site located north of Murrieta Hot Springs Road, west of Interstate 15, east of the existing Sparkman Court corridor and south of Vista Murrieta Road in the City of Murrieta, California (APNs 910-031-001, -002, -003, -004, -005, -007, -008, -009, -010, -015, -017, -018, -021, -022, -023, -024, -025 and -026; 949-190-012, -013, -014, -015, -016 -017, -018 and -019) (Figures 2 – 4). The site is bordered to the south by Murrieta Hot Springs Road and undeveloped land, to the west by the Interstate 15 corridor, to the north by Vista Murrieta Road and single-family residences, and to the east by Sparkman Court and office research park uses.

The project consists of 11, four-story apartment buildings and 12 two-story carriage unit buildings in two phases. Phase I consists of buildings B1 and B6-B11 containing 634 one-, two- and three-bedroom units ranging in size from 743 square feet to 1,292 square feet. A total of 24 two-story, one-bedroom/one-bathroom (1,052 square feet) carriage units will also be constructed in Phase I. A total of 1,135 parking spaces (312 garage spaces, 216 tandem spaces, 22 parallel and 585 open stall) will be provided. A leasing center, clubhouse, swimming pool and various walking paths and green space areas will be provided throughout the Project. A dog park and other outdoor open space area will be provided at the northeast corner of the Site. Phase 2 consists of 241 one- and two-bedroom units in Buildings B2-B5 and 379 parking spaces (86 garage, 86 tandem, 14 parallel and 193 open stalls). In total, the Project will provide 359 one-bedroom/one-bathroom units, 482 two-bedroom/two-bathroom units and 58 three-bedroom/two-bathroom units.

The main project entrance will be on Monroe Avenue north of Murrieta Hot Springs Road. Secondary access will be provided from Vista Murrieta Road along the northern site boundary. A 28-foot wide, paved and gated emergency vehicle access will be constructed along the southern site boundary between Sparkman Court and the Interstate 15 northbound on-ramp. The project will be required to construct a full width segment of Monroe Avenue in the Sparkman Court corridor from Walsh Center Drive southeast to the existing Eastern Municipal Water District (EMWD) wastewater lift station and then half width improvements will be required from that point south. These improvements will terminate just north of the intersection with Murrieta Hot Springs Road. The project will be required to pay a fair share of costs to install a new traffic signal at the intersection of Sparkman Court (Monroe Avenue) and Murrieta Hot Springs Road. Further, half width frontage improvements (i.e., paving the road and adding curb/ gutter/ sidewalk) along Vista Murrieta Road between old Monroe Avenue northwest of the site to the new Monroe Avenue alignment at the northeast corner of the site will be required.

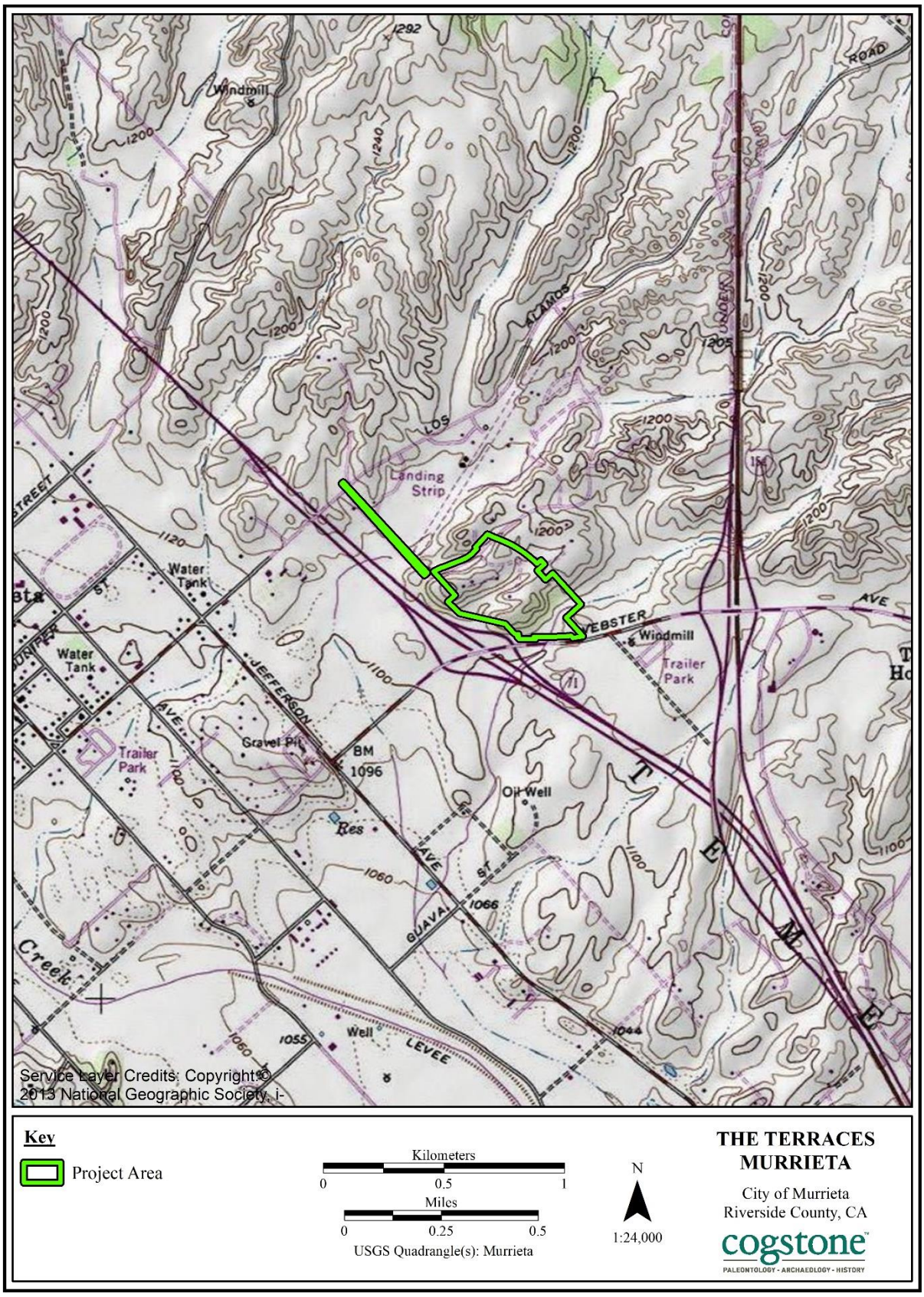

Figure 2. Topographic map of the study area

Figure 3. Aerial map of the study area

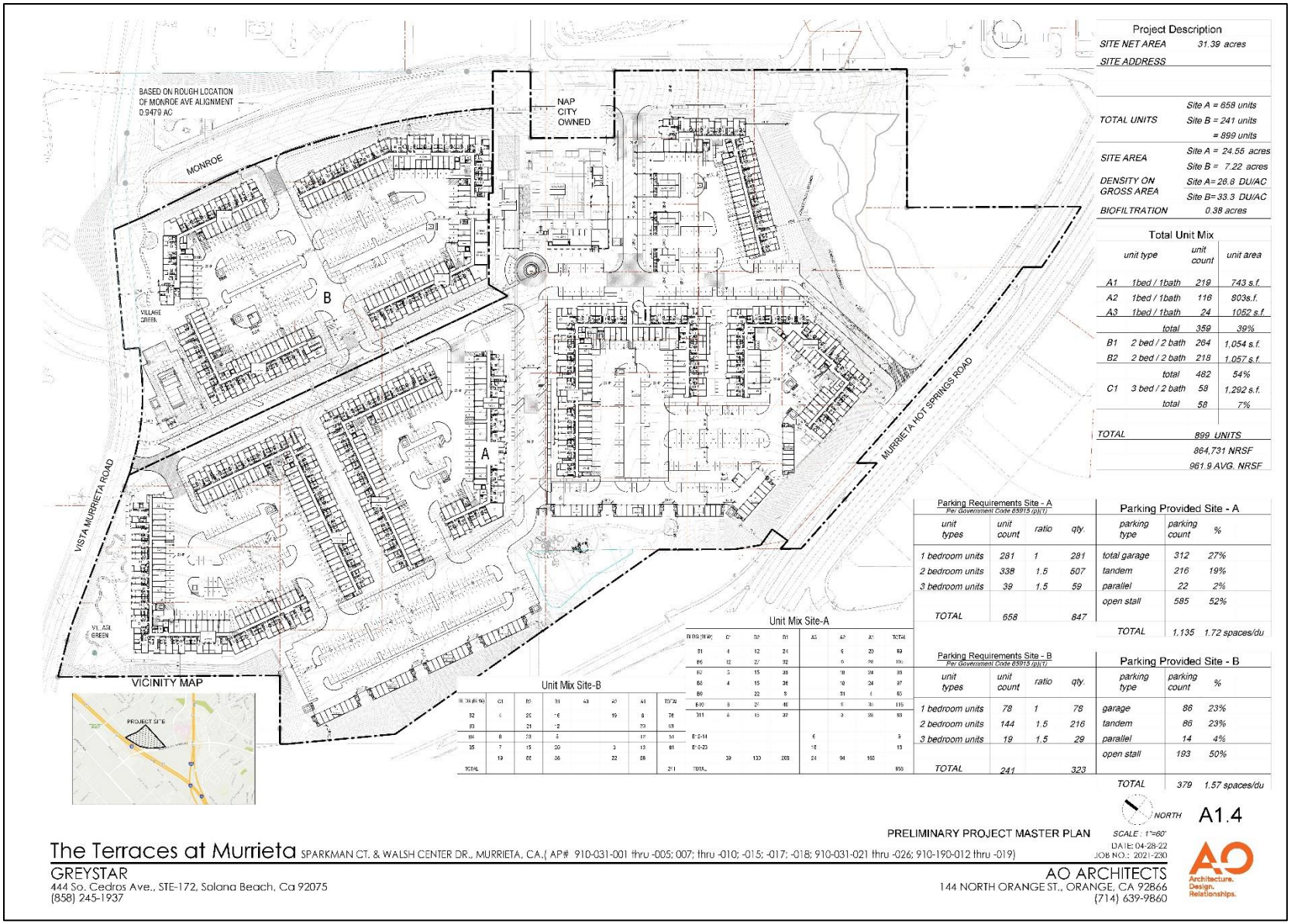

Figure 4. Project plan, April 2022

EMWD will provide water and sewer service to the **S**ite. The Project will extend existing sewer lines to the **S**ite from an existing mainline located north of Sparkman Court/Monroe Avenue lift station. A new 18" water main will be installed in the old Monroe Avenue alignment from the northwest corner of the **S**ite at the Vista Murrieta Road intersection north to Los Alamos Road. Construction will utilize an open trench on either side of an existing at-grade jurisdictional crossing. Directional drilling will be used to install the waterline under the jurisdictional feature to avoid directly impacting this resource. Wet and dry utility improvements will occur while road improvements are being installed to minimize the need for road closure and overall construction-related impacts to neighboring residents.

Offsite runoff will be treated with modular wetland systems. Onsite Project runoff will be treated with a combination of modular wetland systems and biofiltration basins. Both off- and on-site stormwater will be mitigated for hydromodification with underground basins. The total area dedicated to an on-site stormwater management system will be approximately 0.38 acres.

The proposed Project contains two drainage features. Drainage 1 as it is referred to herein, is located at the southeastern corner of the **S**ite. This area will not be affected by the Project. Drainage 2 is located in the northern portion of the **S**ite. The Project will remove this drainage which totals 0.06 acres and 795 linear feet of US Army Corps of Engineers/Regional Board non-wetland waters and 0.06 acres and 795 linear feet of California Department of Fish and Wildlife **(**CDFW**)** jurisdictional streambed/riparian habitat. The applicant will purchase mitigation credits through the Riverpark Mitigation Bank at a ratio of 3:1 for a total of 0.18 acres to compensate for the loss of non-wetland jurisdictional resources comprising Drainage 2.

Project construction is scheduled to begin in late 2023 with Phase I completed in early 2026. Build out of Phase II is expected by 2028.

Planned vertical impacts will be in excess of 10 feet during grading.

PROJECT PERSONNEL

Cogstone Resource Management Inc. (Cogstone) conducted the paleontological resources studies. A brief resume of the principal investigator is appended (Appendix A). Additional qualifications of key Cogstone staff are available at http://www.cogstone.com/key-staff/.

- Eric Scott served as the task manager and reviewed this report for quality control. Eric has an M.A. in Anthropology, with an emphasis in biological paleoanthropology from University of California, Los Angeles, and more than 38 years of professional experience in California paleontology.

- Kim Scott served as the Principal Paleontologist for the project and wrote portions of this report. Kim is a Riverside County Qualified Principal Paleontologist, has an M.S. in Biology with an emphasis in paleontology from California State University, San Bernardino, a B.S. in Geology with an emphasis in paleontology from the University of California, Los Angeles, and over 25 years of experience in California paleontology and geology.
- Logan Freeberg prepared the geographic information system (GIS) maps used throughout this report. Logan has a B.A. in Anthropology from the University of California, Santa Barbara and a certificate in GIS from California State University, Fullerton, as well as 18 years of experience in California archaeology.
- Mike Morris conducted the paleontological survey. Mike has a B.S. in Biology with an emphasis in paleontology from the University of California, Irvine, and over 10 years of experience in California paleontology and geology.
- Debbie Webster provided technical editing. Debbie has more than 21 years of experience in technical writing.

REGULATORY ENVIRONMENT

STATE LAWS AND REGULATIONS

CALIFORNIA ENVIRONMENTAL QUALITY ACT; PALEONTOLOGICAL RESOURCES

CEQA declares that it is state policy to: "take all action necessary to provide the people of this state with...historic environmental qualities." It further states that public or private projects financed or approved by the state are subject to environmental review by the state. All such projects, unless entitled to an exemption, may proceed only after this requirement has been satisfied. CEQA requires detailed studies that analyze the environmental effects of a proposed project. In the event that a project is determined to have a potential significant environmental effect, the act requires that alternative plans and mitigation measures be considered. If paleontological resources are identified as being within the proposed project study area, the sponsoring agency must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the resource.

CALIFORNIA PUBLIC RESOURCES CODE RELATED TO PALEONTOLOGICAL RESOURCES

Section 5097.5: No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands (lands under state, county, city, district or public authority jurisdiction, or the jurisdiction of a public corporation), except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

Section 30244: This section requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

CALIFORNIA ADMINISTRATIVE CODE, TITLE 14, SECTION 4307

This section states that "No person shall remove, injure, deface or destroy any object of paleontological, archaeological or historical interest or value."

LOCAL LAWS AND REGULATIONS

FINAL ENVIRONMENTAL IMPACT REPORT, MURRIETA GENERAL PLAN

All future improvements and development within the City would be subject to compliance with the Final Environmental Impact Report (EIR) of the Murrieta General Plan 2035, section 5.9 on

Cultural Resources (hereafter City, 2011)[1]. The City of Murrieta follows CEQA for archaeological and paleontological resources. The issues presented in the Initial Study Environmental Checklist (Appendix G of the CEQA Guidelines) have been utilized as thresholds of significance in this Section. Accordingly, archaeological and paleontological impacts resulting from the implementation of the proposed General Plan 2035 may be considered significant if they would result in the following:

- Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5.
- Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5.
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
- Disturb any human remains, including those interred outside of formal cemeteries. (City, 2011 page 5.9-20)

PALEONTOLOGICAL RESOURCE PRESERVATION

The San Bernardino County Museum Earth Sciences Division has classified the majority of the City and the Sphere of Influence as having a high potential for containing significant, nonrenewable paleontological resources. Three major Pleistocene age formations in the Murrieta area have yielded extensive fossil remains. Future development associated with implementation of the proposed General Plan 2035 could indirectly result in impacts to undiscovered paleontological resources through remediation, demolition, or construction activities. All future improvements and development within the City would be subject to compliance with the Final EIR of the Murrieta General Plan 2035, section 5.9 on Cultural Resources (hereafter City, 2011), Conservation Element Goal CSV-7 and the associated policies, and Mitigation Measures CR-1 and CR-2, which would ensure impacts to paleontological resources or unique geologic features are reduced to a less than significant level (City, 2011 pages 5.9-26 to -27).

Future development associated with implementation of the proposed General Plan 2035 could indirectly result in impacts to undiscovered paleontological resources through remediation, demolition, or construction activities. All future improvements and development within the City would be subject to compliance with the proposed General Plan 2035 Conservation Element Goal CSV-7 and the associated policies, and Mitigation Measures CR- and CR-2, which would ensure impacts to paleontological resources or unique geologic features are reduced to a less than significant level (City, 2011 page 5.9-27).

The issues presented in the Initial Study Environmental Checklist (Appendix G of the CEQA Guidelines) have been utilized as thresholds of significance in this Section. Accordingly,

[1] Online at

resources impacts resulting from the implementation of the proposed General Plan 2035 may be considered significant if they would result in the following:

- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature (City, 2011 page 5.9-20).

Goal CSV-7 Paleontological resources are conserved as a record of the regions natural history.
Policies
CSV-7.1 Continue development review procedures that protect paleontological resources.
CSV-7.2 Encourage local display and educational use of paleontological resources (City, 2011 page 5.9-27).

City Paleontological Mitigation Measures
CR-1 Future development projects shall … be evaluated for compliance with the California Environmental Quality Act (CEQA) and where feasible, avoidance of … resources. If… it is determined that there is a potential for impacts to … resources, further … resources analysis by a qualified professional(s), as defined in Mitigation Measure CR-2, may be required by the City (City, 2011 page 5.9-24).

CR-2 In the event that cultural resources (archaeological, historical, paleontological) resources are inadvertently unearthed during excavation and grading activities of any future development project, the contractor shall cease all earth-disturbing activities within a 100-foot radius of the area of discovery. If not already retained due to conditions present pursuant to Mitigation Measure CR-1, the project proponent shall retain a qualified professional (i.e., … paleontologist, …), subject to approval by the City of Murrieta to evaluate the significance of the find and appropriate course of action (refer to Mitigation Measures CR-1 and CR-3). If avoidance of the resources is not feasible, salvage operation requirements pursuant to Section 15064.5 of the CEQA Guidelines shall be followed. After the find has been appropriately avoided or mitigated, work in the area may resume (City, 2011 page 5.9-24).

PALEONTOLOGICAL RESOURCES SIGNIFICANCE CRITERIA

Only qualified, trained paleontologists with specific expertise in the type of fossils being evaluated can determine the scientific significance of paleontological resources. Fossils are considered to be significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;
2. 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 therein;
3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;
4. The fossils demonstrate unusual or spectacular circumstances in the history of life;
5. 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.

As so defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important. Significant fossils can include remains of large to very small aquatic and terrestrial vertebrates or remains of plants and animals previously not represented in certain portions of the stratigraphy. Assemblages of fossils that might aid stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, and paleoclimatology are also critically important (Scott and Springer 2003; Scott et al., 2004).

BACKGROUND

GEOLOGICAL SETTING

The proposed project site is situated within Temecula Valley, along the eastern edge of the Peninsular Range Geomorphic Province. Bounded on the east by the Salton Trough and on the west by the Pacific Ocean, the Peninsular Range Geomorphic Province is characterized by large scale faults, mountains, and valleys subparallel to the San Andreas Fault Zone. The Temecula Valley is an extensional basin of the northwest-southeast trending Elsinore Fault Zone. The Elsinore Fault Zone is one of the larger fault zones that parallel the San Andreas Fault Zone and extends from Corona, California in the north to the Sonora Province of Mexico, southeast of Ocotillo, California. Much of the energy of the San Andreas Fault Zone is being transferred westwards to the Elsinore Fault Zones. Although the trend of the Peninsular Ranges is similar to the Coast Ranges, the basement rocks of granite are more similar to the Sierra Nevada Range.

STRATIGRAPHY

Kennedy et al. (2003) and Morton and Miller (2006) mapped the project as the sandstone member of the middle Pleistocene Pauba Formation and late Pleistocene(?) to Holocene young alluvial channel deposits (Figure 5). Just to the north of the property is mapped the upper part of the late Pliocene to Pleistocene "unnamed sandstone." These sediments may appear in the deepest cuts near to the northernmost property corner.

Pauba Formation, sandstone member

The oldest unit in the project area is the sandstone member of the middle Pleistocene Pauba Formation (Qpfs). Mann (1955, p.3) describes the formation as "hardpan lithified-fanglomerates, yellow and red arkoses, brown silts and diatomite." Kennedy (1977) indicated that the formation consists of moderately well indurated, light brown, crossbedded sandstones and siltstones, or well indurated, grayish brown, poorly sorted fanglomerates and mudstones. Kennedy et al. (2003) and Morton and Miller (2006) describe the upper member of the Pauba Formation as moderately indurated, brown, cross-bedded sandstone with a few cobble to boulder beds present. The high level of oxidation (red and brown colors) is characteristic of the Pauba Formation.

The Pauba Formation overlies the unnamed sandstone and contains a late Irvingtonian North American Land Mammal Age (NALMA) fauna (Reynolds and Reynolds, 1990a and 1990b in Morton and Miller, 2006). Eric Scott (2022 personal communication) updated the age of the formation to exclude a previously reported bison; a species which is indicative of the Rancholabrean NALMA. The late Irvingtonian NALMA ranges from approximately 400,000 to 250,000 years old (Bell et al. 2004).

Young alluvial channel

Less than 126,000 years old, these late Pleistocene(?) to Holocene young alluvial channel deposits (Qya) cross a portion of the property. The fluvial deposits cover canyon bottoms and channels and consist of unconsolidated, sands, silts, and clay bearing alluvium (Kennedy et al. 2003). The survey revealed that this channel is still active so part or all of these deposits are less than 10,000 years old.

"Unnamed sandstone, upper part"

Although not mapped at the surface, the unnamed sandstone may occur in the deepest cuts near to the northern corner of the property (Figure 5).

Kennedy (1977) describes the unnamed sandstone as a pale-greenish yellow, caliche-rich, friable sandstone. Kennedy et al. (2003) and Morton and Miller (2006) note the sediments of the upper part of this formation as pale greenish grey, friable to well indurated deposits. The sediments transition from cobble and boulder conglomerates at the bottom of the formation to a medium grained sandstone that typically has caliche at the top. Crude and discontinuous bedding is also characteristic of this part of the unit (QTsw; Kennedy et al. 2003; Morton and Miller 2006).

The upper unit of the formation (QTsw) contains a vertebrate fauna of the Irvingtonian NALMA, which ranges from 1.9 million to 250,000 years old (Scott and Cox 1993; Pajak, Scott, and Bell 1996). The lower part of the unnamed sandstone (QTcw) contains a vertebrate fauna that is

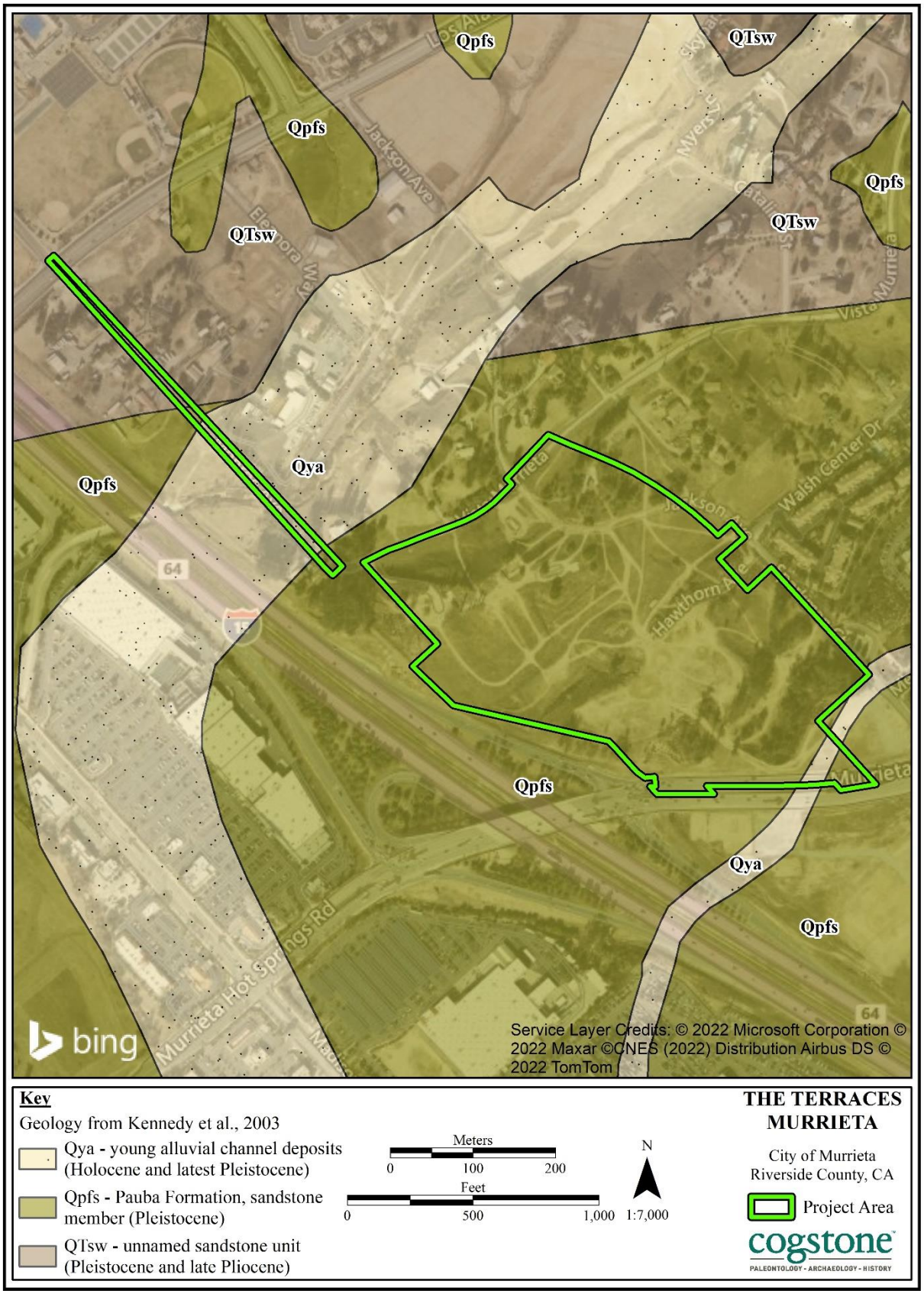

Figure 5. Project geology

middle to late Blancan NALMA which is 3 to 2 million years old. Based on the fossils present, the unnamed sandstone is middle Pleistocene to Pliocene in age. A kaolin deposit interstratified with exposures of the upper unit of the sandstone has been correlated with the widespread Bishop ash (Kennedy 1977; Pajak, Scott, and Bell 1996). The Bishop ash also occurs in the Chaney Hill area of Murrieta in this formation and has been radiometrically dated to the middle Pleistocene Epoch, ± 0.758 million years BP (Merriam and Bischoff 1975; Morton and Miller 2006); however it is structurally isolated from areas where fossils are know from and cannot be correlated with the localities (Pajak, Scott, and Bell 1996).

RECORD SEARCH

A record search of the project area and a one-mile radius was obtained from the Western Science Center in Riverside County (Radford 2021; Appendix B). Online records from the University of California Museum of Paleontology database (UCMP 2022), and the Paleobiology Database (PBDB 2022) were searched for fossil records as well as print sources.

PAUBA FORMATION

The Western Science Center has numerous fossils from the Pauba Formation in Murrieta and Temecula. The University of California Museum of Paleontology database has no records from the Pauba Formation. However, the Paleobiology Database (PBDB 2022) records 28 published localities with approximately 1000 fossils from the Pauba Formation (Table 1). This formation provides an important record of late Irvingtonian taxa and has yielded at least 24 taxa of fossil vertebrates. This formation is considered to have a high potential for containing significant, non-renewable paleontologic resources (updated from City, 2011 page 5.9-19).

Large vertebrates recovered from the Pauba Formation include ground sloths (†[2]*Paramylodon harlani*), mammoths (†*Mammuthus* sp. cf. *M*. columbi, †*M*. sp. cf. *M*. meridiaonalis), mastodons (†*Mammut* americanum), saber-toothed cats (†*Smilodon fatalis*), coyotes (*Canis latrans*), tapirs (†*Tapirus californicus*), horses (†*Equus bautistensis*), peccary (†?*Tayassuidae*), camels (†*Camelops* sp.), llamas (†*Hemiauchenia macrocephalia*), deer (cf. *Odocoileus* sp.), big horned sheep (*Ovis* sp. cf. *O. canadensis*) and pronghorn (cf. *Antilocapra* sp.). Fish, rodents, rabbits, and bats are also present in the fauna (Bowden and Scott 1992; Jefferson 1991a, 1991b; Pajack 1993, 1994; Pajak, Scott, and Bell 1996; Scott 1992; Table 1).

[2] † - the taxon is extinct, although there may be living relatives in same genus or family

Table 1: Taxa previously reported from the Pauba Formation

Common Name	Taxon	Found within 1 mile of the study
amphibian	Amphibia	X
pond turtle	*Actinomys* sp.	X
reptile	Reptilia	X
bird	Aves	
mole	*Scapanus* sp.	
mole	Talpidae	
shrew	*Sorax* sp.	
bat	Chiroptera	
cottontail rabbit	*Sylvilagus sp.*	
jackrabbit	*Lepus* sp.	X
rabbit	Leporidae	
squirrel	Sciuridae	
kangaroo rat	*Dipodomys sp.*	
pocket mouse	*Perognathus* sp.	
Botta's pocket gopher	*Thomomys bottae*	
pocket gopher	*Thomomys* sp.	
vole	*Microtus* sp.	
wood rat	*Neotoma sp.*	
deer mouse	*Peromyscus* sp.	
New World mice	?Cricetidae	
Harlan's ground sloth	†*Paramylodon harlani*	X
giant ground sloth	†*Paramylodon* sp.	X
giant ground sloth	cf. Xenarthra	X
coyote	*Canis latrans*	
dog	*Canis* sp.	X
sabre-toothed cat	†*Smilodon fatalis*	
skunk	*Mustela* sp.	
carnivore	?Carnivora	
yesterday's camel	†*Camelops hesternus*	X
camel	†*Camelops* sp	X
peccary	?Tayassuidae	
pronghorn	‡ *Antilocapra* sp.	
pronghorn	‡ Antilocapridae	
deer	cf. *Odocoileus* sp.	
bighorn sheep	*Ovis* sp. cf. *O. canadensis*	
Bautista horse	†*Equus bautistensis*	X
Mexican horse	†*Equus conversidens*	X
Scott's horse	†*Equus scotti*	X
horse	†*Equus* sp.	X
California tapir	†*Tapirns californicus*	
Pacific mastodon	†*Mammut pacificus*	X
mastodon	†*Mammut* sp.	X
Columbian mammoth	†*Mammuthus* sp. cf. *M. columbi*	
southern mammoth	†*Mammuthus* sp. cf. *M. meridianalis*	
mammoth	†*Mammuthus* sp.	X

UNNAMED SANDSTONE

It is possible that the unnamed sandstone will be impacted in deep cuts in the northern portion of the project.

The Western Science Center has hundreds of fossils from the unnamed sandstone from projects off California Oaks Road and Madison Road in Murrieta, and the Harveston Lake Community Development in Temecula (Radford 2016). The University of California Museum of Paleontology database (2022) has no records from the unnamed sandstone. However the Paleobiology Database (2022) records 109 published localities with thousands of fossils from the unnamed sandstone. Many of these localities were reviewed in Pajak, Scott, and Bell (1996) and they noted 12 fossil localities which produced 1,347 specimens near the project location from the unnamed sandstone.

Vertebrate fossils recovered from the unnamed sandstone include ground sloths (†*Megalonyx leptostomus or M. wheatleyi*), mammoths (†*Mammuthus* sp.), mastodons (†*Mammut* sp.), badger (*Taxidea* sp.), cat (Felidae), coyotes (?*Canis latrans, Canis* sp.), fox (*Vulpes* sp. cf. *V. velox, Vulpes* sp.), short-faced bears (†*Arctodus simus*), tapirs (†*Tapirus californicus*), horses (†*Equus bautistensis,* †*E. scotti*), peccary (*Platagonus bicalcacaratus*), camels (†*Camelops* sp., †Camelidae), llamas (†*Hemiauchenia* sp.), deer (*Odocoileus* sp.), pronghorn (*Antilocapra* sp.) and other artiodactyls (?*Tetrameryx* sp.). Fish, amphibians, reptiles, rodents, rabbits, bats and invertebrates are also present in the fauna. The rodents are especially abundant and in many cases temporally-diagnostic (Jefferson 1991a; Pajak, Scott, and Bell 1996; Reynolds et al. 1991; Scott 1992, 1998, 1999; Scott and Cox 1993). The formation has also yielded remains of the extinct giant teratorn †*Aiolornis incredibilis;* the largest flying bird known from North America (Campbell, Scott, and Springer 1999).

Paleontological localities in the unnamed sandstone portions of the City and the Sphere of Influence contain a diverse middle to early Pleistocene fauna. The late Irvington localities from the lower unit are among the most important sites in California from this NALMA. The unit has produced at least 45 vertebrate taxa and additional invertebrate taxa. This formation has a high potential for containing significant, non-renewable paleontological resources (updated from City, 2011 page 5.9-19).

SURVEY

METHODS

The survey stage is a crucial part of the project's environmental assessment phase. Its purpose is to confirm that field observations conform to the geological maps of the project area. Sediments are assessed for their potential to contain fossils. Additionally, if paleontological resources have previously been recorded from the region, the survey will verify the exact location of those resources, the condition or integrity of each resource, and the proximity of the resource to the project area.

Mike Morris of Cogstone performed a paleontological field surveys of the project area on December 20, 2021 and June 27, 2022. All undeveloped and potentially native ground surface areas within the ground disturbance portion of the project area were examined when it was safe to do so. Known areas of fill were not examined. When such were present, existing ground disturbances (e.g., cutbanks, ditches, animal burrows, etc.) were visually inspected. Photographs of the project area, including ground surface visibility and items of interest, were taken with a digital camera.

RESULTS

During the pedestrian surveys, no paleontological resources were recorded. Overgrowth on the surface limited visibility to less than 90% overall (Figure 6).

The area mapped as alluvial channel (Qal) is still an active stream channel (Figure 7). Active channel sediments are less than 10,000 years old and as such are too young to contain fossils that were deposited concurrently with the sediments. However, because this channel has incised older, fossil bearing deposits, the sediments may contain fossils which are not *in situ*.

Pauba Formation sediments of the study area tended towards light yellowish to reddish brown silty sands (Figure 8).

A supplementary pedestrian survey was conducted to survey sediments associated with the addition of a new 18" water main for the project that will be installed in the old Monroe Avenue alignment from the northwest corner of the **S**ite at the Vista Murrieta Road intersection north to Los Alamos Road (Figures 9). Much of this area was paved over. Sediments were primarily light brown to beige fine to coarse grained sands (Qal) within the streambed area (Figure 10).

Figure 6. Project looking to the south

Figure 7. Active stream channel inside of the study area

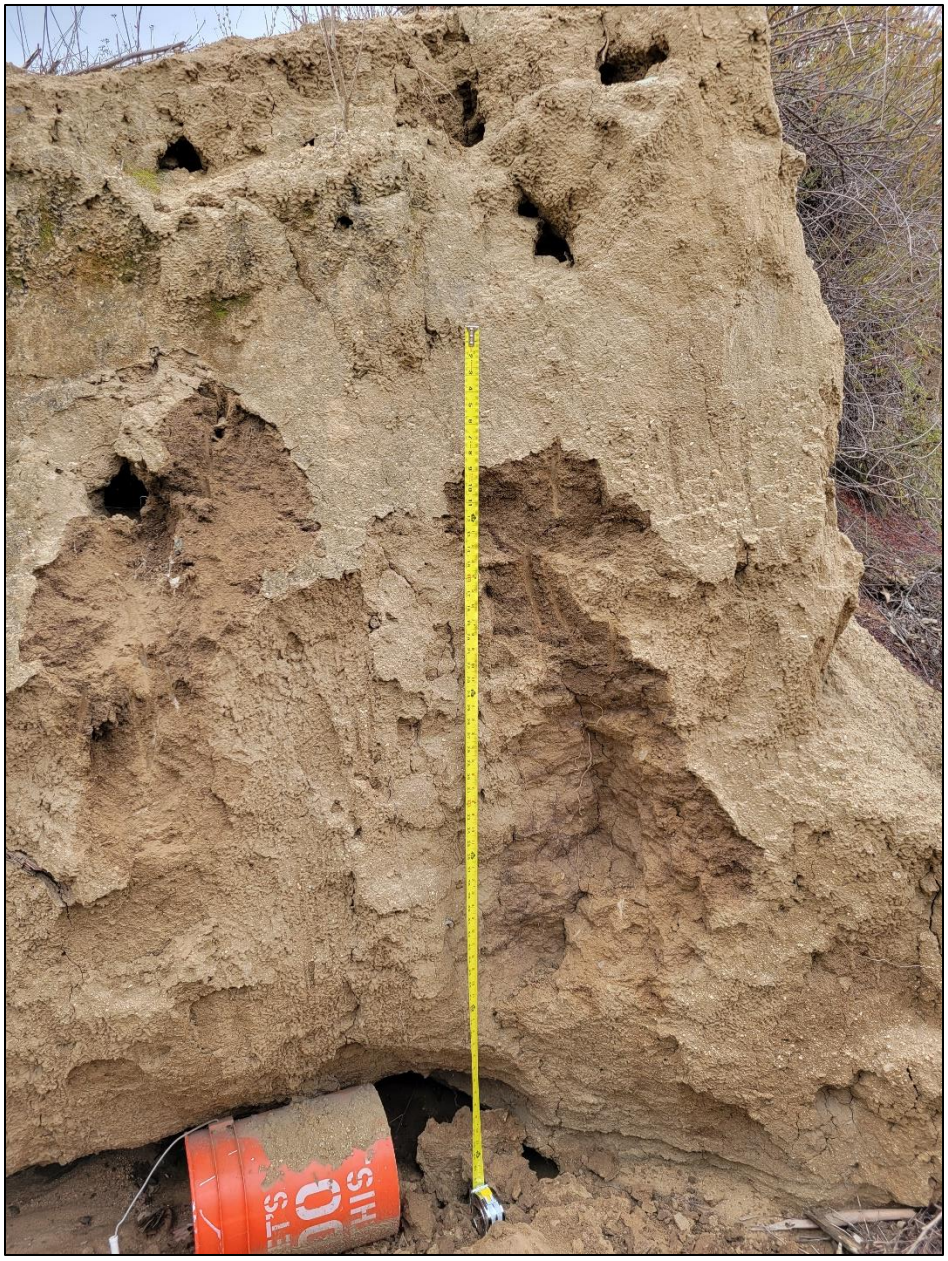

Figure 8. Pauba Formation, sandstone member silty sands

Figure 9. Northwest corner of project, beginning of proposed water main line

Figure 10. Sediments of young alluvial channel deposits within the streambed

PALEONTOLOGICAL SENSITIVITY

A multilevel ranking system was developed by professional resource managers within the Bureau of Land Management (BLM) as a practical tool to assess the sensitivity of sediments for fossils. The Potential Fossil Yield Classification (PFYC) system (BLM 2016; Appendix C) has a multi-level scale based on demonstrated yield of fossils. The PFYC system provides additional guidance regarding assessment and management for different fossil yield rankings.

Fossil resources occur in geologic units (e.g., formations or members). The probability for finding significant fossils in a project area can be broadly predicted from previous records of fossils recovered from the geologic units present in and/or adjacent to the study area. The geological setting and the number of known fossil localities help determine the paleontological sensitivity according to PFYC criteria.

Sediments that are close to their basement rock source are typically coarse; those farther from the basement rock source are finer. The chance of fossils being preserved greatly increases once the average size of the sediment particles is reduced to 5 millimeters in diameter or less. Moreover, fossil preservation also greatly increases after natural burial in rivers, lakes, or oceans. Remains left on the ground surface become weathered by the sun or consumed by scavengers and bacterial activity, usually within 20 years or less. So the sands, silts, and clays of rivers, lakes, and oceans are the most likely sediments to contain fossils.

Using the PFYC system, geologic units are classified according to the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts within the known extent of the geological unit. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher PFYC value; instead, the relative abundance of localities is intended to be the major determinant for the value assignment.

Based on the records search localities, both the Pauba Formation and the unnamed sandstone are assigned a high potential for fossil resources (PFYC 4) while the young alluvial channel deposits are assigned a low sensitivity (PFYC 2).

MITIGATION MEASURES

Mitigation Measure PC1. A Paleontological Resources Management Plan shall be prepared and implemented by a Riverside County Certified Paleontologist for this project. At minimum it shall include: (1) paleontological resources awareness training for all earthmoving personnel, (2) specify paleontological personnel qualifications, (3) identify the Western Science Center as the repository for fossils recovered, (4) take into account the latest information on cut depth and location and specify where monitoring shall be required, (5) require full-time monitoring of the Pauba Formation and (if encountered) unnamed sandstone sediments, (6) specify fossil recovery procedures and locality documentation, (7) specify laboratory procedures, (8) require a detailed catalogue of specimens recovered with identification by experts, and (9) require a final report with the catalogue and all specialists reports as appendices.

If unanticipated fossil resources are unearthed during construction excavations, the contractor shall cease all earth-disturbing activities within a 25-foot radius of the area of discovery until the discovery can be evaluated by a Riverside County Certified Paleontologist.

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APPENDIX A: QUALIFICATIONS

cogstone
PALEONTOLOGY - ARCHAEOLOGY - HISTORY

KIM SCOTT
Principal Investigator for Paleontology

EDUCATION

2013 M.S. Biology with paleontology emphasis, California State University San Bernardino
2000 B.S., Geology with paleontology emphasis, University of California, Los Angeles

SUMMARY QUALIFICATIONS

Ms. Scott has more than 25 years of experience in California as a paleontologist and sedimentary geologist. She has worked extensively in the field surveying, monitoring, and salvaging fossils on over 100 projects. In addition, she has special skills in fossil preparation (cleaning and stabilization) and in the preparation of stratigraphic sections and other documentation for fossil localities. She has written over 100 assessments, Paleontological Mitigation Plans, and monitoring compliance reports to all agency requirements. Ms. Scott serves as company safety officer and is the author of the company safety and paleontology manuals. She is a Member of the Society of Vertebrate Paleontology and the Geological Society of America.

SELECTED PROJECTS

Temecula Gateway EIR, Riverside County, CA. A Planned Development Overlay/Zone Change and General Plan Amendment. Prepared an assessment report for a 9-acre parcel for the EIR. Sub to PMC. Co-Principal Investigator/Report Co-author. 2015

Interstate 15 (I-15) / Limonite Avenue Interchange Improvement Project, Caltrans District 8, Eastvale, Riverside County, CA. The proposed project would replace the existing Limonite Avenue OC and would widen the roadway from four lanes to six lanes. Prepared a Paleontological Mitigation Plan. Sub to Dokken Engineering. Co-Principal Investigator/Report Co-author. 2015.

Perris Valley Line Project, Metrolink - Riverside County Transportation Commission, Riverside County, CA. The project was a 24-mile extension of the Metrolink 91 Line. Managed paleontological monitoring for construction of four new stations, upgrading associated track and utility relocations to extend the Metrolink connection from Riverside through Moreno Valley to Perris. Prepared an abbreviated Paleontological Assessment, supervised all field activities and prepared the Paleontological Resources Monitoring Compliance Report. Sub to HDR Engineering. Project Manager and Principal Paleontologist. 2013-2016.

Avenue 66 Grade Separation Caltrans District 8, Mecca, Riverside County, CA. The project was to construct a grade crossing over Hammond Road, the Union Pacific Railroad (UPRR) and State Route 111 (SR-111). Preformed paleontological survey, wrote a combined Paleontological Identification and Evaluation report with a Paleontological Mitigation Plan. Sub to Dokken Engineering. Field and Lab Director/Report Co-author. 2013-2014.

WECC Path 42 Transmission Line Upgrades, **Southern California Edison, Riverside County, CA.** This project was for a 14.5 mile transmission line crossing BLM and private lands in the North Palm Springs area. Performed the paleontological survey, co-authored the Paleontological Assessment Report, supervised field crew and monitored. Field Director/Report Co-author. 2012-2015.

SR 91 Widening Project, Caltrans District 8, Riverside, Riverside County, CA. Caltrans widening from the Interstate 60/ State Route 91/ State Route 215 interchange to the Adams Street bridge (Post mile marker 15.6 to 21.6). Construction activities included the addition of two High Occupancy Vehicle (HOV) lanes (one for either direction), interchange reconfiguration, overhead replacement, and undercrossing widening and pavement restriping within the Right of Way (ROW). Supervised paleontological monitoring, monitored, prepared fossils, and prepared the mitigation report. Under contract to Applied Earthworks. Field and Laboratory Supervisor/Report Co-author. 2011-2012.

APPENDIX B: WESTERN CENTER RECORDS SEARCH

WESTERN SCIENCE CENTER

Cogstone
Logan Freeberg
1518 W Taft Avenue
Orange, CA 92865

January 6, 2021

Dear Mr. Freeberg,

This letter presents the results of a record search conducted for the Terraces Murrieta Project (Cogstone # 5455) in the city of Murrieta, Riverside County, California. The project site is located south of Vista Murrieta and Date Street, north of Murrieta Hot Springs Road, east pf Interstate 15 and west of Hancock Avenue, in an unsectioned portion of Township 7 South, Range 3 West on the *Murrieta, CA* USGS 7.5-minute quadrangle.

The geologic units underlying this project are mapped as alluvial deposits dating to the Pleistocene and sandstone deposits dating from the Pliocene to the Pleistocene, both of which are considered to be paleontologically sensitive (Dibblee & Minch, 2008). The Western Science Center does not have localities within the project area, but does have multiple localities within a one-mile radius of the project and just beyond that area associated with the Principe Collection, Haveston I & II Project and the Village Walk Project. Harveston I & II Project resulted in dozens of fossil localities and hundreds of Pleistocene fossil specimens. The Principe Collection is a salvage collection with localities identified only to the project area, but contains hundreds of fossil specimen throughout Murrieta including five projects within a one-mile radius that contained fossils identified as ancient horse (*Equus sp.*), tapir (*Tapirus merriami*), and camel (*Camelops sp.*). The Village Walk Project also falls within a one-mile radius of the project area and contains six localities that produced Pleistocene fauna including mastodon (*Mamut pacificus*), horse (*Equus sp.*), bison (*Bison sp.*), ground sloth (*Paramylodon sp.)* and canines (*Canis sp.*). The presence of Pleistocene megafauna within similarly mapped units indicates the paleontological sensitivity of the proposed project area.

Any fossils recovered from the Terraces Murrieta Project area would be scientifically significant. Excavation activity associated with development of the project area would impact the paleontologically sensitive Pleistocene and Pliocene units and it is the recommendation of the Western Science Center that a paleontological resource mitigation program be put in place to monitor, salvage, and curate any recovered fossils associated with the current study area.

If you have any questions, or would like further information about the Harveston I & II Project, Village Walk Project or the Principe Collection, please feel free to contact me at dradford@westerncentermuseum.org

Sincerely,

Darla Radford
Collections Manager

2345 Searl Parkway ♦ Hemet, CA 92543 ♦ phone 951.791.0033 ♦ fax 951.791.0032 ♦ WesternScienceCenter.org

APPENDIX C: PALEONTOLOGICAL SENSITIVITY RANKING CRITERIA

PFYC Description Summary (BLM 2016)	PFYC Rank
Very Low. The occurrence of significant fossils is non-existent or extremely rare. Includes igneous (excluding air-fall and reworked volcanic ash units), metamorphic, or Precambrian rocks. Assessment or mitigation of paleontological resources is usually unnecessary except in very rare or isolated circumstances that result in the unanticipated presence of fossils.	1
Low. Sedimentary geologic units that are unlikely to contain vertebrate or scientifically significant nonvertebrate fossils. Includes rock units less than 10,000 years old and sediments with significant physical and chemical changes (e.g., diagenetic alteration) which decrease the potential for fossil preservation. Assessment or mitigation of paleontological resources is not likely to be necessary.	2
Moderate. Units are known to contain vertebrate or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered and/or of low abundance. Common invertebrate or plant fossils may be found and opportunities may exist for casual collecting. Paleontological mitigation strategies will be based on the nature of the proposed activity. Management considerations cover a broad range of options that may include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Surface-disturbing activities may require assessment by a qualified paleontologist to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological resources.	3
High. Geologic units containing a high occurrence of significant fossils. Fossils must be abundant per locality. Vertebrates or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Mitigation plans must consider the nature of the proposed disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access that could result in looting. Detailed field assessment is normally required and on-site monitoring or spot-checking may be necessary during land disturbing activities. In some cases avoidance of known paleontological resources may be necessary.	4
Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate or scientifically significant invertebrate or plant fossils. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities. Paleontological mitigation may be necessary before or during surface disturbing activities. The area should be assessed prior to land tenure adjustments. Pre-work surveys are usually needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered.	5
Unknown. An assignment of "Unknown" may indicate the unit or area is poorly studied and field studies are needed to verify the presence or absence of paleontological resources. The unit may exhibit features or preservational conditions that suggest significant fossils could be present, but little information about the actual unit or area is known. Literature searches or consultation with professional colleagues may allow an unknown unit to be provisionally assigned to another Class, but the geological unit should be formally assigned to a Class after adequate survey and research is performed to make an informed determination.	U
Water or Ice. Typically used only for areas which have been covered thus preventing an examination of the underlying geology.	W, I