APPENDIX K

Paleontological Resources Memorandum

DUDEK

MEMORANDUM

To:	Chuck Miller
From:	Sarah Siren, M.S., GISP, Senior Paleontologist
Subject:	Paleontological Resources Review – Otay Ranch Village 4 Project
Date:	9/16/16
cc:	Adam Giacinto, M.A., RPA
Attachment(s):	Geological Map ; Paleontological Records Search Results Letter

Dudek is providing this memo after completing a review of the potential for impacts to paleontological resources during construction of the Otay Ranch Village 4 Project located in the City of Chula Vista, San Diego County, California. The project site is relatively undeveloped. The majority of the project site is mapped as Oligocene age Otay Formation (approximately 29 million years old [Ma]) overlying early Cretaceous age (approximately 120-130 Ma) Santiago Peak Volcanics bedrock (Artim and Pickney, 1973; Deméré, 1988; Herzig and Kimbrough, 1991; Todd et al., 2004; Tan and Kennedy, 2002; Walsh and Deméré, 1991; see attached Geological Map). According to the San Diego County guidelines for paleontology (County of San Diego, 2007; Deméré and Walsh, 1993), and the records search results received from the San Diego Natural History Museum on August 29, 2016, the Oligocene age deposits have a moderate to high potential to yield paleontological resources (i.e. moderate to high resource importance), whereas Cretaceous age bedrock has a no potential to yield paleontological resources (McComas, 2016).

According to the records search conducted at the San Diego Natural History Museum (SDNHM), 39 paleontological localities are documented within a one-mile radius of the project boundaries (McComas, 2016; see attached Paleontological Records Search Results Letter). A large number of these localities (17) are documented nearby from the same geological units that occur beneath portions of the project site; specifically, the Oligocene age Otay Formation. These sedimentary deposits have the potential to yield scientifically significant vertebrate fossils.

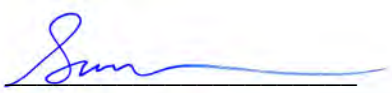
The Otay Formation consists of three informal members, of which, the middle gritstone member has been observed within the project site. There is also the potential to impact the upper sandstone-mudstone member during the construction activities within the project site. Both of

these members within the Otay Formation have yielded fossil localities during development for nearby construction projects (e.g., SR-125 Toll Road and Otay Ranch Village 7; McComas, 2016). These terrestrial deposits typically contain extinct vertebrate taxa, and other fauna characteristic of the Arikareean North American Land Mammal Age. Although no vertebrate fossils are documented within the project site, the undeveloped nature of the site and the depositional environment of the gritstone and sandstone-mudstone members would be conducive to preserve such remains. Prehistoric vertebrates recovered from the Otay Formation in this region include: reptiles (e.g., tortoises, lizards, and snakes), birds, and mammals (e.g., shrews, rodents, rabbits, dogs, foxes, nimravids, rhinoceros, camels, mouse-deer, and oreodonts; Deméré, 1988; Walsh and Deméré, 1991; McComas, 2016). There is also the potential to impact mapped, moderate sensitivity deposits within the Mission Valley Formation and unnamed Quaternary terrace deposits located at the southernmost extent of the project site. If encountered during construction, the Mission Valley Formation and Quaternary terrace deposits would require part-time paleontological monitoring, in addition to the full-time monitoring conducted during any excavations within the Otay Formation.

A paleontological resources mitigation program is recommended for excavation within moderate to high sensitivity geological units (e.g., Otay Formation, Mission Valley, and Pleistocene age terrace deposits) and should be implemented in accordance with the mitigation measures included at the end of this report. Excavation within lower sensitivity units (e.g, Holocene age alluvium and Santiago Peak Volcanics) does not require mitigation.

If you have any questions regarding this memo, please feel free to contact me (760.846.9326 or ssiren@dudek.com).

Sincerely,



Sarah A. Siren, M.S., GISP
Senior Paleontologist, Dudek

Enc. Geological Map; Paleontological Records Search Results Letter

Mitigation Measures:

Prior to the issuance of grading permits, the Applicant shall provide written confirmation to the City that a qualified paleontologist has been retained to carry out an appropriate mitigation program. (A qualified paleontologist is defined as an individual with an M.S. or Ph.D. in paleontology or geology who is familiar with paleontological procedures and techniques). A pre grade meeting shall be held among the paleontologist and the grading and excavation contractors.

A paleontological monitor shall be onsite at all times during the original cutting of previously undisturbed sediments of highly sensitive geologic formations (i.e., Otay Formation and Quaternary alluvial and terrace deposits) to inspect cuts for contained fossils. (A paleontological monitor is defined as an individual who has experience in the collection and salvage of fossil materials.) The paleontological monitor shall work under the direction of a qualified paleontologist. The monitor shall be onsite on at least a half-time basis during the original cutting of previously undisturbed sediments of moderately sensitive geologic formations (e.g., unnamed river terrace deposits and the Mission Valley Formation) to inspect cuts for contained fossils. However, neither of these rock units have been mapped within the project site and are therefore not anticipated to be impacted during construction.

- The monitor shall be onsite on at least a quarter-time basis during the original cutting of previously undisturbed sediments of low sensitivity geologic formations (e.g., Lindavista Formation and Santiago Peak Volcanics [metasedimentary portion only] to inspect cuts for contained fossils. However, these deposits have not been mapped within the project site and are therefore not anticipated to be impacted during construction. The monitor shall periodically (every several weeks) inspect original cuts in deposits with an unknown resource sensitivity (i.e., Quaternary alluvium).

- In the event that fossils are discovered in unknown, low, or moderately sensitive formations, the Applicant shall increase the per-day field monitoring time. Conversely, if fossils are not discovered, the monitoring, at the discretion of the City's Deputy City Manager/Development Services Director or its designee, shall be reduced. A paleontological monitor is not needed during grading of rocks with no resource sensitivity (i.e., Santiago Peak Volcanics, metavolcanic portion).

When fossils are discovered, the paleontologist (or paleontological monitor) shall recover them. In most cases, this fossil salvage can be completed in a short period of time. However, some fossil specimens (such as a complete whale skeleton) may require an extended salvage time. In these instances, the paleontologist (or paleontological monitor) shall be allowed to temporarily

direct, divert, or halt grading to allow recovery of fossil remains in a timely manner. Because of the potential for the recovery of small fossil remains such as isolated mammal teeth, it may be necessary in certain instances and at the discretion of the paleontological monitor to set up a screen-washing operation on the site.

Prepared fossils along with copies of all pertinent field notes, photos, and maps shall be deposited in a scientific institution with paleontological collections such as the San Diego Natural History Museum. A final summary report shall be completed. This report shall include discussions of the methods used, stratigraphy exposed, fossils collected, and significance of recovered fossils.

References Cited:

County of San Diego, 2007. *Guidelines for Determining Significance, Paleontological Resources*. Department of Planning and Land Use, Department of Public Works. March 19, Modified January 15, 2009.

Deméré, T.A. 1988. Early Arikareean (late Oligocene) vertebrate fossils and biostratigraphic correlations of the Otay Formation at EastLake, San Diego County, California. In, M.V. Filewicz and R.L. Squires (eds.), Paleogene Stratigraphy, West Coast of North America. Society of Economic Paleontologists and Mineralogists, Pacific Section 58:35-43.

Deméré, T.A., and S.L. Walsh. 1993. Paleontological Resources, County of San Diego: Prepared for the Department of Public Works, County of San Diego, p. 1-60.

Herzig, C.T., and D.J. Kimbrough. 1991. Early Cretaceous zircon ages prove a non-accretionary origin for the Santiago Peak Volcanics, northern Santa Ana Mountains, California. Geological Society of America, Cordilleran Section, Abstracts with Programs 23:35.

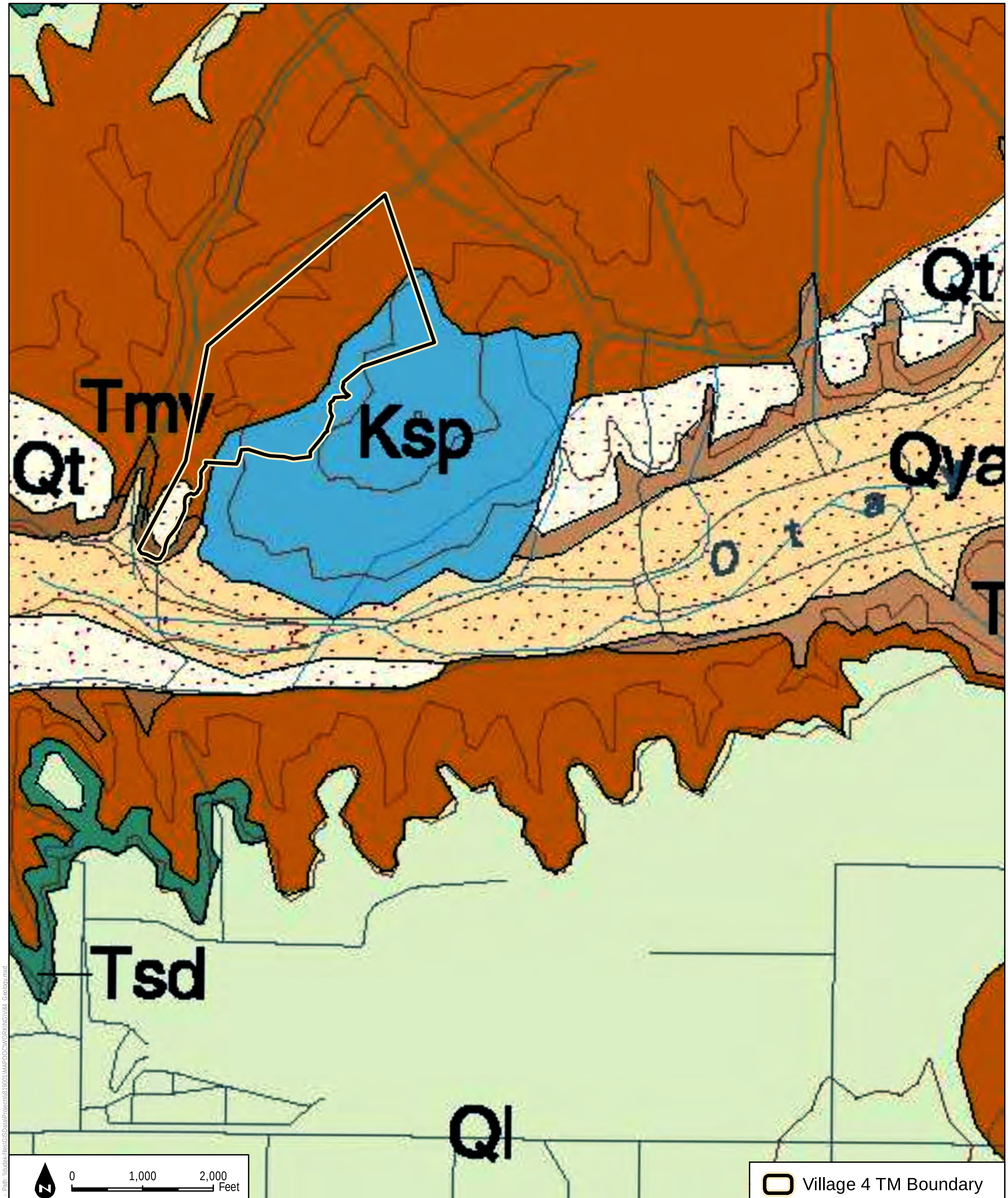
Korth, W. W. 1994. The Tertiary record of rodents in North America, New York Plenum Press, p.319.

McComas, K. 2016. *Paleontological Record Search – Otay Ranch Village 4 Project*. Unpublished letter report by the San Diego Natural History Museum. August 29, 2016.

Tan, S.S. and M.P. Kennedy, 2002. Geologic map of the Otay Mesa 7.5-minute quadrangle, San Diego County, California: A digital database.: California Geological Survey, Preliminary Geologic Maps , scale 1:24,000.

Todd, V.R., R.M. Alvarez, and Techni Graphic Systems, Inc., 2004. Preliminary geologic map of the El Cajon 30' X 60' quadrangle, southern California: U.S. Geological Survey, Open-File Report OF-2004-1361, scale 1:100,000.

Walsh, S.L., and T.A. Deméré. 1991. Age and stratigraphy of the Sweetwater and Otay formations, San Diego County, California. In, P.L. Abbott and J.A. May (eds.), Eocene Geologic History San Diego Region. Society of Economic Paleontologists and Mineralogists, Pacific section, Vol. 68:131-148.



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SOURCE: USGS Preliminary geologic map of the El Cajon 30'x60' quadrangle, southern California, 2004

Geology Map

Otay Village 4

SAN DIEGO NATURAL HISTORY MUSEUM
BALBOA PARK - SAN DIEGO SOCIETY OF NATURAL HISTORY - ESTABLISHED 1874

29 August 2016

Ms. Sarah Siren
Dudek
605 Third Street
Encinitas, CA 92024

RE: Paleontological Record Search – Otay Ranch Village 4 Project

Dear Ms. Siren:

This letter presents the results of a paleontological record search conducted for the Otay Ranch Village 4 project, located in the southeast portion of the City of Chula Vista, San Diego County, CA. The approximately 74-acre project area lies along the northwest slope of Rock Mountain, 1.2 miles west of the South Bay Expressway (SR 125), and 1.7 miles south of the intersection of Olympic Parkway and La Media Road. Published geological reports (e.g., Kennedy and Tan, 1977; Tan and Kennedy, 2002) that cover the project area reveal that the project site is primarily underlain by the Oligocene-age (approximately 29 million years old) Otay Formation. The southeast corner of the project site is underlain by Jurassic- and Cretaceous-age (approximately 201 to 66 million years old) metavolcanic rocks.

The San Diego Natural History Museum (SDNHM) has thirty-nine recorded fossil localities (see attached descriptions) within a mile radius of the project site (see attached map). Seventeen of these localities were discovered in the fluvial deposits of the Otay Formation, and produced trace fossils (e.g., burrows and coprolites) and fossilized remains of terrestrial vertebrates (e.g., reptiles, birds, carnivorous mammals, rodents, rabbits, and artiodactyls). The remaining twenty-two localities are from the Pleistocene-age (approximately 10,000 to 750,000 years old) Bay Point Formation and the late Pliocene to early Pleistocene-age (approximately 3.5 to 1.5 million years old) San Diego Formation; these geologic units are not anticipated to be impacted by construction.

Within the Otay Formation, localities are known from both the upper sandstone-mudstone member and the lower gritstone member in the vicinity of the project site. The upper sandstone-mudstone member has produced important vertebrate fossil remains, and is therefore assigned a high paleontological sensitivity. The lower gritstone member has produced fossils at only a few known localities, and is assigned a moderate paleontological sensitivity. The Jurassic- and Cretaceous-age metavolcanic rocks underlying the southeast corner of the project site have no paleontological sensitivity due to the high temperature and pressure conditions involved in the formation of these rocks. Given the high and moderate paleontological sensitivity of the Otay Formation in San Diego County (Deméré and Walsh, 1993), as well as the known SDNHM fossil localities in close proximity to the project site, any proposed excavation activities that extend deep enough to encounter previously undisturbed Otay Formation deposits have the potential to impact paleontological resources preserved in these deposits. For these reasons,

implementation of a complete paleontological resource mitigation program during ground-disturbing activities is recommended.

The information contained within this paleontological record search should be considered private and is the sole property of the San Diego Natural History Museum. Any use or reprocessing of information contained within this document beyond the scope of the Otay Ranch Village 4 project is prohibited.

If you have any questions concerning these findings please feel free to contact me at 619-255-0321 or kmccomas@sdnhm.org.

Sincerely,

Katie McComas
Paleontology Collections Assistant
Department of Paleontology

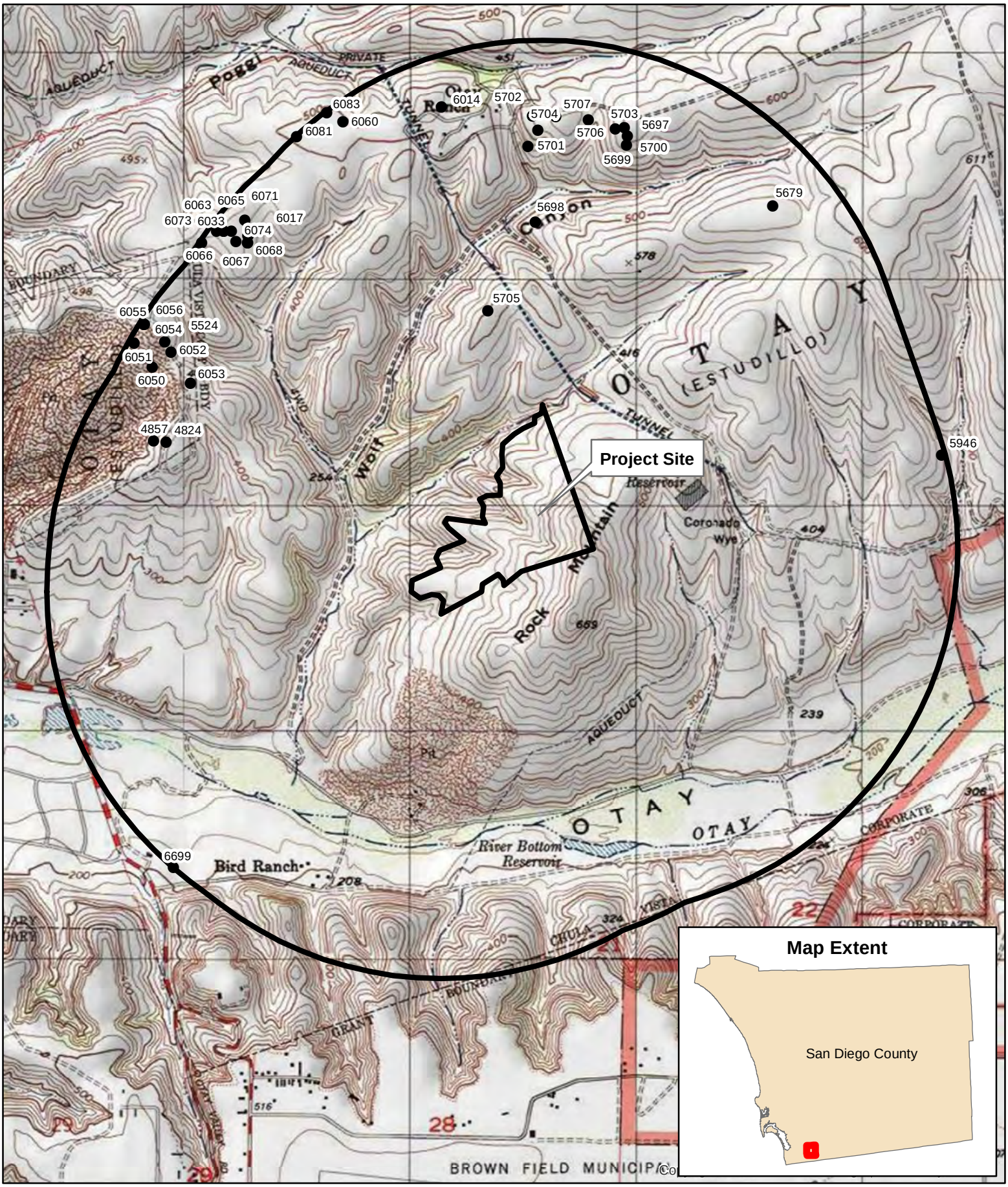
Enc: Figure 1
Appendix

Literature Cited:

Demeré, T.A. and Walsh, S.L. 1993. Paleontological Resources, County of San Diego. Prepared for the San Diego Planning Commission: 1-68.

Kennedy, M.P. and Tan, S.S. 1977. Geology of National City, Imperial Beach, and Otay Mesa quadrangles, southern San Diego metropolitan area, California. California Division of Mines and Geology, Map Sheet 29, 1:24,000 scale.

Tan, S.S and Kennedy, M.P. 2002. Geologic Map of the Otay Mesa 7.5-minute Quadrangle, San Diego County, California. California Geological Survey, Preliminary Geologic Map Series, 1:24,000 scale.



SDNHM fossil localities within one mile of the Otay Ranch Village 4 Project, City of Chula Vista (Base maps: USGS Topographic Maps of the Otay Mesa and Imperial Beach 7.5' Quadrangles, CA).

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APPENDIX: LOCALITY LIST

SAN DIEGO NATURAL HISTORY MUSEUM
DEPARTMENT OF PALEONTOLOGY

Locality Number	Locality Name	Location	Elevation	Geologic Unit	Era	Period	Epoch	North American Land Mammal Age	Depositional Environment
6699	Flat Rock	City of Chula Vista, San Diego County, CA	171	Bay Point Formation, unnamed nonmarine deposit	Cenozoic	Quaternary	late Pleistocene		fluvial
5524	Otay Landfill, Canyon 3, Phase 3B-Vert Site	City of Chula Vista, San Diego County, CA	453	San Diego Formation	Cenozoic	Neogene	Pliocene		marine
6060	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	460	San Diego Formation	Cenozoic	Neogene	late Pliocene	Blancan	shallow sandy bottom
4824	Otay Landfill, Canyon 3-Boring clam locality	City of Chula Vista, San Diego County, CA	445	San Diego Formation, member 1	Cenozoic	Neogene	Pliocene		marine deposit
6052	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	439	San Diego Formation, member 1	Cenozoic	Neogene	Pliocene		marine
6063	Otay Ranch Village 2 North - Phoload site #1	City of Chula Vista, San Diego County, CA	440	San Diego Formation, member 1	Cenozoic	Neogene	late Pliocene	Blancan	near shore rocky bottom
6065	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	442	San Diego Formation, member 1	Cenozoic	Neogene	late Pliocene	Blancan	continental shelf
6066	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	445	San Diego Formation, member 1	Cenozoic	Neogene	late Pliocene	Blancan	
6067	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	450	San Diego Formation, member 1	Cenozoic	Neogene	late Pliocene	Blancan	
6053	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	452	San Diego Formation, member 2a	Cenozoic	Neogene	Pliocene		marine
6068	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	450	San Diego Formation, member 2a	Cenozoic	Neogene	late Pliocene	Blancan	
6017	Otay Ranch Village 2 East	City of Chula Vista, San Diego County, CA	478	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene		marine, nearshore
6017	Otay Ranch Village 2 East	City of Chula Vista, San Diego County, CA	478	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene		marine, nearshore
6033	Otay Ranch Heritage Road	City of San Diego, San Diego County, CA	473	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene		marine
6054	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	469	San Diego Formation, member 2b	Cenozoic	Neogene	Pliocene		marine
6055	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	471	San Diego Formation, member 2b	Cenozoic	Neogene	Pliocene		marine
6056	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	473	San Diego Formation, member 2b	Cenozoic	Neogene	Pliocene		marine
6071	Otay Ranch Village 2 North - Oyster Bed	City of Chula Vista, San Diego County, CA	460	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene	Blancan	
6073	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	470	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene	Blancan	
6074	Otay Ranch Village 2 North	City of Chula Vista, San Diego County, CA	466	San Diego Formation, member 2b	Cenozoic	Neogene	late Pliocene	Blancan	
6081	Otay Ranch Village 2 North - trackways	City of Chula Vista, San Diego County, CA	466	San Diego Formation, member 2c	Cenozoic	Neogene	late Pliocene	Blancan	
6083	Otay Ranch Village 2 North - Tsunamigenic(?)	City of Chula Vista, San Diego County, CA	493	San Diego Formation, member 2c	Cenozoic	Neogene	late Pliocene	Blancan	
5679	McMillin Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	553	Otay Formation	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5698	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	425	Otay Formation, gritstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5946	SR 125 Toll Road	City of Chula Vista, San Diego County, CA	407	Otay Formation, gritstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
4857	Otay Landfill Canyon 3 Phase 3A, Microsite	San Diego County, CA	412	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	Oligocene	early Arikareean	fluvial
5697	Otay Ranch Village 7 - Micro Site	City of Chula Vista, San Diego County, CA	530	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5699	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	507	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5700	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	595	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5701	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	444	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5702	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	489	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5703	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	527	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5704	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	485	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5705	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	570	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5706	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	588	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
5707	Otay Ranch Village 7	City of Chula Vista, San Diego County, CA	591	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
6014	Otay Ranch Village 2 East	City of Chula Vista, San Diego County, CA	483	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene	early Arikareean	fluvial
6050	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	350	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene		fluvial
6051	Otay Landfill Canyon 3, Phase 3C	City of San Diego, San Diego County, CA	398	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene		fluvial