APPENDIX F:
PALEONTOLOGICAL TECHNICAL STUDY

THIS PAGE
INTENTIONALLY
LEFT BLANK

Paleontological Technical Study

UNITED STATES GYPSUM COMPANY EXPANSION/MODERNIZATION PROJECT

Bureau of Land Management

Prepared for: **Bureau of Land Management**
El Centro Field Office
1661 S. Fourth St.
El Centro, CA 92243

Prepared by: **Paleo Solutions, Inc.**
911 S. Primrose Ave., Unit N
Monrovia, CA 91016

Geraldine Aron, M.S. – Program Director
Courtney Richards, M.S. – Principal Investigator
Mathew Carson, M.S. – Report Author

PSI Report: CA18ImperialPAC01R

May 15, 2018

This page intentionally left blank.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 EXECUTIVE SUMMARY

This report presents the results of the paleontological technical study conducted by Paleo Solutions, Inc. (Paleo Solutions) in support of the United States Gypsum Company (USG) Expansion/Modernization Project (Project) in Plaster City, Imperial County, California. At the request of USG, Lilburn Corporation (Lilburn) has been contracted to prepare the environmental documentation and permitting requirements necessary to obtain the regulatory agency permits for the continued development of the Plaster City Quarry per the approved Mine Reclamation Plan. USG plans to continue quarry development, including removal of gypsum from deposits within an ephemeral desert wash tributary to Fish Creek, installation of a water supply line from the proposed off-site Quarry Well No. 3 to the quarry, and construction of a berm to retain floodwaters from entering the quarry during and after mining. Additionally, the Project involves the replacement of an existing water supply pipeline from the Ocotillo area to the Plaster City Plant. An additional route for the installation of a new water supply pipeline from the Plaster City Plant to the Dixieland area was also included as an alternative in the National Environmental Policy Act (NEPA) analysis The total Project area consists of three main components: the Plaster City Quarry (Quarry) and Well No. 3 water supply line located immediately northwest of the Fish Creek Mountains; an existing water supply pipeline (Pipeline) that runs nearly parallel to the Evan Hawes Highway, located immediately north of Interstate 8 (I-8), extending from the Plaster City Plant and the Ocotillo area to the west; and an alternative water pipeline between the Plaster City Plant and the Dixieland area to the east. The Quarry is situated on lands administered by the Bureau of Land Management (BLM) El Centro Field Office and the State of California Department of Parks and Recreation, and on lands classified as undetermined. The Pipeline is situated on lands administered by the BLM El Centro Field Office and on lands classified as undetermined only. The BLM is the lead agency under the NEPA, and Imperial County is the lead agency under the California Environmental Quality Act (CEQA).

The paleontological potential of the Project area was evaluated based on an analysis of existing paleontological data. The three components of the analysis of existing data included a geologic map review, a literature search, and a museum records search at the San Diego Natural History Museum (SDNHM). Geologic mapping by Dibblee and Minch (2008a-c) and Todd et al. (2004) indicates that the Project area and its half-mile buffer zone are underlain by Mesozoic-age (or older) undivided intrusive igneous rocks (gr); Miocene-age Split Mountain Group, Red Rock Formation (Tsr) and Elephant Trees Formation (Tse); Pliocene- to Miocene-age Fish Creek Gypsum (Tfc); Pliocene- to Miocene-age Imperial Group, Latrania Formation (Til) and undivided (Ti); Pleistocene- to Pliocene-age Palm Spring Group, undivided (QTp); Holocene-age Lake Cahuilla beds (Qlc); Holocene-age alluvial terrace deposits (Qt); and Holocene-age alluvium, undivided (Qa).

According to the record searches, there are no previously recorded fossil localities within the Project area. However, the San Diego Natural History Museum (SDNHM) reported one fossil plant locality within one mile of the Pipeline from the Palm Spring Group (McComas, 2018). Moreover, literature and database reviews identified numerous vertebrate, invertebrate, and plant fossils recovered from Miocene- to Pleistocene-age deposits elsewhere in Imperial County.

The Potential Fossil Yield Classification (PFYC) system was applied to the results of the analysis of existing data (BLM, 2008; 2016). Based on the geologic map, literature review, and results of a museum records search, the Imperial Group (undivided), the Imperial Group Latrania Formation, and the Palm Spring Group have a high potential for paleontological resources (PFYC 4). Additionally, the Red Rock Formation of the Split Mountain Group and the Lake Cahuilla beds have a moderate paleontological potential (PFYC 3). Although the Red Rock Formation has a moderate paleontological potential, the Elephant Trees Formation of the Split Mountain Group has an unknown paleontological potential (PFYC U). Quaternary alluvial terrace deposits and Quaternary alluvium (undivided) are generally considered too young to contain scientifically significant paleontological resources; however, these sediments may overlie older geologic units with higher paleontological potential, which may be impacted at shallow depth. Thus, Quaternary alluvial terrace deposits and Quaternary alluvium (undivided) have a low paleontological potential (PFYC 2). Fish Creek Gypsum deposits of the Elephant Tree Formation are also classified as low paleontological potential (PFYC 2) because only microfossils have been recorded from thin marine claystones interbedded within the gypsum deposits, suggesting large macrofossil preservation is unlikely. Lastly, undivided intrusive igneous rocks have a very low paleontological potential (PFYC 1) because they form from the cooling of molten rock; therefore, they have no potential for fossil preservation.

Excavations in the Project area that impact Miocene-age Split Mountain Group, Red Rock Formation and Elephant Trees Formation; Pliocene- to Miocene-age Imperial Group, Latrania Formation and undivided; Pleistocene- to Pliocene-age Palm Spring Group, undivided; and Holocene-age Lake Cahuilla beds may well result in an adverse direct impact on scientifically important paleontological resources. Excavations entirely within previously disturbed sediments, artificial fill, Fish Creek Gypsum, alluvium (undivided), or alluvial terrace deposits are unlikely to uncover significant fossil vertebrate remains; furthermore, any recovered resources from previously disturbed sediments or artificial fill will lack stratigraphic context. However, younger deposits may shallowly overlie older *in situ* sedimentary deposits. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts to paleontological resources throughout portions of the Project area, with exceptions for areas underlain by Mesozoic-age undivided intrusive igneous rocks, which have a very low paleontological potential.

Due to the presence of moderate to high paleontological potential within the Project area, mitigation of potential adverse effects resulting from construction-related ground disturbance is recommended. A pre-construction pedestrian field survey is recommended in order to locate any surficial fossil localities and verify the geologic units underlying the Project area. All appropriate permits and permissions would need to be acquired prior to surveying. Only areas mapped as moderate, high, and unknown potential (PFYC 3, 4, and U) geologic units should be intensively surveyed. Areas mapped as very low and low potential (PFYC 1 and 2) geologic units should be confirmed as mapped. Following the survey, a paleontological resource monitoring and mitigation program (PRMMP) should be prepared by a BLM-permitted paleontologist and approved by the BLM and Imperial County. The PRMMP should provide detailed recommended monitoring locations; a description of a worker training program; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. A curation agreement with a BLM-approved fossil repository must also be obtained. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a Qualified Paleontologist.

2.0 INTRODUCTION

This report presents the results of the paleontological technical study conducted by Paleo Solutions in support of the USG Expansion/Modernization Project (Project) in Plaster City, Imperial County, California. At the request of USG, Lilburn has been contracted to prepare the environmental documentation and permitting requirements necessary to obtain the regulatory agency permits for the continued development of the Plaster City Quarry per the approved Mine Reclamation Plan. This paleontological technical study was required by the BLM as the lead agency under NEPA and by Imperial County as the lead agency under CEQA, and it was completed in compliance with NEPA, BLM policies and procedures, CEQA, and best practices in mitigation paleontology (Murphey et al., 2014).

2.1 PROJECT LOCATION

The total Project area consists of three main components: the Plaster City Quarry (Quarry) and Well No. 3 water supply line located immediately northwest of the Fish Creek Mountains; an existing water supply pipeline (Pipeline) that runs nearly parallel to the Evan Hawes Highway, located immediately north of Interstate 8 (I-8), extending from the Plaster City Plant and the Ocotillo area to the west; and an alternative water pipeline between the Plaster City Plant and the Dixieland area to the east (Figure 1). The Quarry is situated on lands administered by the BLM El Centro Field Office and the State of California Department of Parks and Recreation, and on lands classified as undetermined. The Pipeline is situated on lands administered by the BLM El Centro Field Office and on lands classified as undetermined only.

Lands administered by the BLM within the bounds of the Quarry are situated in Sections 16 through 17, 19 through 20, 28 through 30, and 32 through 34 of Township 13 South, Range 9 East; and Sections 3 through 4 of Township 14 South, Range 9 East, encompassing approximately 187 acres of the Quarry. BLM-administered land within the Pipeline corridor consist of Sections 12 through 15 and 21 through 22 of Township 16 South, Range 10 East; and Sections 7 through 11 of Township 16 South, Range 11 East, encompassing approximately 316 acres of the Pipeline. Total BLM-administered land intersecting the combined Project area is approximately 503 acres (Table 1).

Lands administered by the State of California Department of Parks and Recreation within the bounds of the Quarry are situated in Section 24 Township 13 South, Range 8 East; and Sections 17 through 19 of Township 13 South, Range 9 East, encompassing approximately 18 acres of the Quarry. The Pipeline corridor does not transect or insect State-administered lands (Table 1).

The remainder of the Project area is situated within privately owned/undetermined property of the Quarry and Pipeline areas. Privately owned/undetermined property of the Quarry is situated on Sections 15 through16, 19 through 22, 28 through 30, and 32 through 33 of Township 13 South, Range 9 East, encompassing approximately 1,205 acres of the Quarry. Privately owned/undetermined property of the Pipeline is situated on Section 36 of Township 16 South, Range 9 East; Sections 21 and 28 through 31 of Township 16 South, Range 10 East; Sections 8 through 9 and 11 through 12 of Township 16 South, Range 11 East; and Section 7 of Township 16 South, Range 12 East. Total Project area classified as privately owned/undetermined property consists of approximately 258 acres (Table 1).

Geologic mapping by Dibblee and Minch (2008a-c) and Todd et al. (2004) indicates that the Project area and its half-mile buffer zone are underlain by Mesozoic-age (or older) undivided intrusive igneous rocks (gr); Miocene-age Split Mountain Group, Red Rock Formation (Tsr) and Elephant Trees Formation (Tse); Pliocene- to Miocene-age Fish Creek Gypsum (Tfc); Pliocene- to Miocene-age Imperial Group, Latrania Formation (Til) and undivided (Ti); Pleistocene- to Pliocene-age Palm Spring Group, undivided (QTp); Holocene-age Lake Cahuilla beds (Qlc); Holocene-age alluvial terrace deposits (Qt); and Holocene-age alluvium, undivided (Qa). See Appendix A for the distribution of the geologic units throughout the Project area.

2.2 PROJECT DESCRIPTION

USG plans to continue quarry development, including removal of gypsum from deposits within an ephemeral desert wash tributary to Fish Creek, installation of a water supply line from the proposed off-site Quarry Well No. 3 to the quarry, and construction of a berm to retain floodwaters from entering the quarry during and after mining. Additionally, the Project involves the replacement of an existing water supply pipeline from the Ocotillo area to the Plaster City Plant. An additional route for the installation of a new water supply pipeline from the Plaster City Plant to the Dixieland area was also included as an alternative in the NEPA analysis. After consultation with the BLM, ACOE, and USFWS, it was determined that a SEIS was necessary to address issues of potential environmental concern and supplement the previously approved Final EIR/EIS.

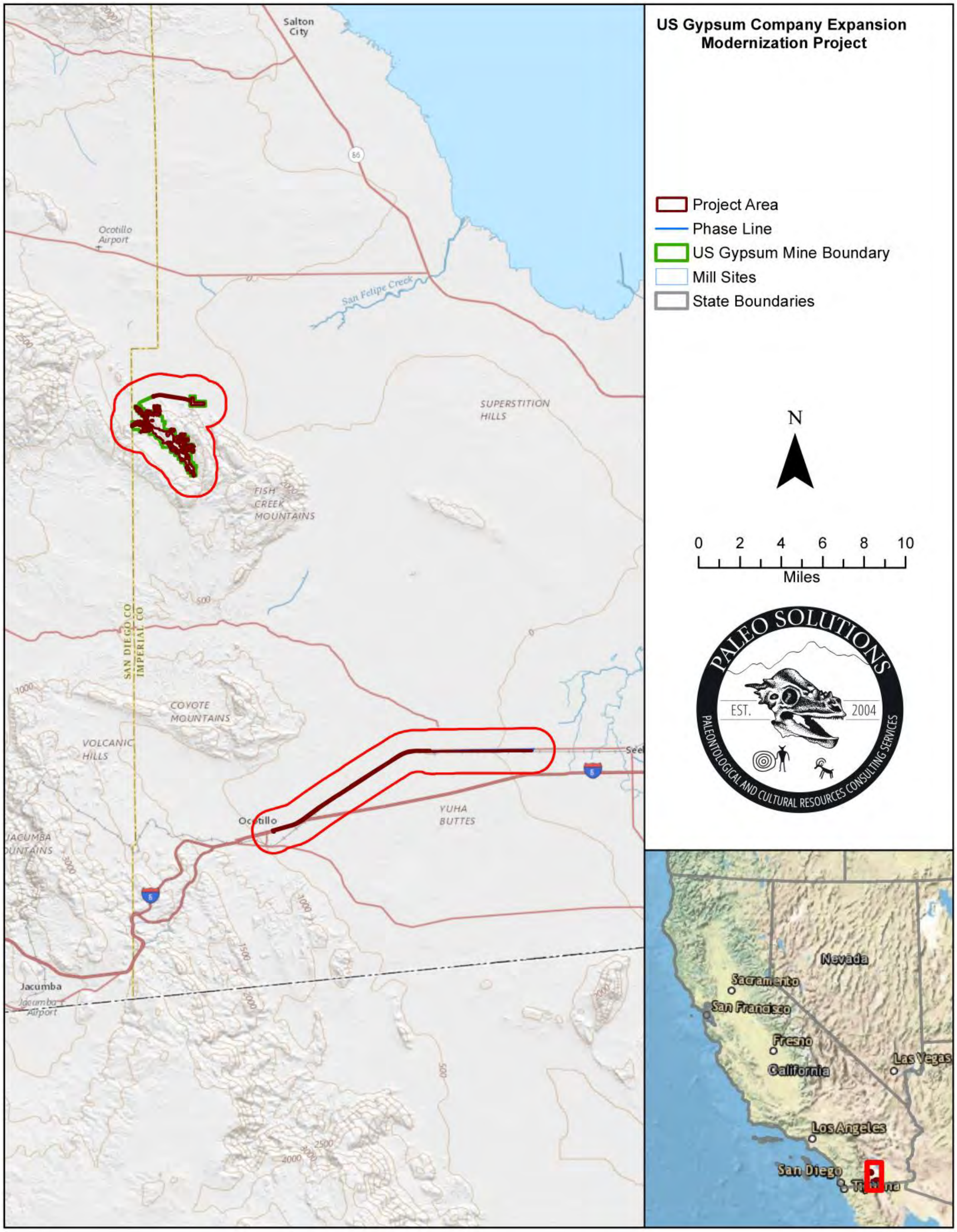

Figure 1. Project location map.

Table 1. United States Gypsum Company Expansion/Modernization Project Summary

Project Name	USG Expansion/Modernization Project				
Project Description	USG plans to continue quarry development, including removal of gypsum from deposits within an ephemeral desert wash tributary to Fish Creek, installation of a water supply line from the proposed off-site Quarry Well No. 3 to the quarry, and construction of a berm to retain floodwaters from entering the quarry during and after mining. Additionally, the Project involves the replacement of an existing water supply pipeline from the Ocotillo area to the Plaster City Plant. An additional route for the installation of a new water supply pipeline from the Plaster City Plant to the Dixieland area was also included as an alternative in the NEPA analysis. After consultation with the BLM, ACOE, and USFWS, it was determined that a SEIS was necessary to address issues of potential environmental concern and supplement the previously approved Final EIR/EIS.				
Project Area	The total Project area consists of three main components: the Plaster City Quarry (Quarry) and Well No. 3 water supply line located immediately northwest of the Fish Creek Mountains; an existing water supply pipeline (Pipeline) that runs nearly parallel to the Evan Hawes Highway, located immediately north of Interstate 8 (I-8), extending from the Plaster City Plant and the Ocotillo area to the west; and an alternative water pipeline between the Plaster City Plant and the Dixieland area to the east.				
Total Acreage	1,981.03				
Location (PLSS) and Land Owner/ Managing Agency	**Quarter-Quarter**	**Section**	**Township**	**Range**	**Surface Management**
	T 49	15	T13S	R9E	Undetermined
	T 46, T 49	16	T13S	R9E	BLM, Undetermined
	L 2, L 3, L 4, L 6, NESW, NWSW, SWSW, T 46	17	T13S	R9E	BLM, State of California Department of Parks and Recreation
	L 13, NESE, NESW, NWSE, SESW, SWSE	18	T13S	R9E	State of California Department of Parks and Recreation
	L 6, L 7, L 8, L 10, L 17, L 18, L 19, L 20, L 21, L 25, L 26, L 17, L 28, M 6806, NENE, NENW, NESW, NWNE, SENW, T 67, T 68, T 69	19	T13S	T9E	BLM, State of California Department of Parks and Recreation, Undetermined
	NWNW, SWNW, T 69	20	T13S	R9E	BLM, Undetermined
	T 49	21	T13S	R9E	Undetermined
	T 49	22	T13S	R9E	Undetermined
	NESW, NWSE, NWSW, SENW, SESE, SESW, SWNE, SWNW, SWSE, SWSW	28	T13S	R9E	BLM, Undetermined
	L 1, L 4, L 5, L 7, L 8, L 9, NWSW, SESE, SESW, SWSE, T 69, T 70, T 71, T 72	29	T13S	R9E	BLM, Undetermined
	L 5, L 7, L 8, L 25, L 26, L 28, L 29, SWNE, T 67, T 69	30	T13S	R9E	BLM, Undetermined
	L 1, L 2, NENW, NWNE, T 78	32	T13S	R9E	BLM,

					Undetermined
	L 1, L 2, L 3, L 4, L 7, L 9, L 11, L 12, L 13, NENE, NESE, NESW, NWNE, NWSE, NWSW, SENE, SWNE, T 78	33	T13S	R9E	BLM, Undetermined
	L 1	34	T13S	R9E	BLM
	L 4, SWNW	3	T14S	R9E	BLM
	L 1, L 5, L 7, L 8, SENE, SWNE	4	T14S	R9E	BLM
	L 1, L 2, T 39, T 72	36	T16S	R9E	Undetermined
	NESE, SESE, SESW, SWSE	12	T16S	R10E	BLM
	NENW, NWNE, NWNW, SWNW	13	T16S	R10E	BLM
	NESW, NWSE, SENE, SESW, SWNE, SWSW	14	T16S	R10E	BLM
	SESE	15	T16S	R10E	BLM
	L 16, T 38, T 39, T 41	21	T16S	R10E	BLM, Undetermined
	L 1, L 3, L 4, NENE, NWNE, SENW, SWNE, T 39	22	T16S	R10E	BLM
	L 3, T 41	28	T16S	R10E	Undetermined
	L 1, L 11, L 12, T 44, T 46, T 49	29	T16S	R10E	Undetermined
	T 49	30	T16S	R10E	Undetermined
	L 5, L 6, T 49, T 63	31	T16S	R10E	Undetermined
	L 5, NESE, NESW, NWSE	7	T16S	R11E	BLM
	NESE, NESW, NWSE, NWSW, SENE, SENW, SWNE	8	T16S	R11E	BLM, Undetermined
	NESE, NESW, NWSE, NWSW, SENE, SENW, SWNE, SWNW	9	T16S	R11E	BLM, Undetermined
	NESE, NESW, NWSE, NWSW, SENE, SENW, SWNE, SWNW	10	T16S	R11E	BLM
	NESE, NESW, NWSE, NWSW, SENE, SENW, SWNE, SWNW	11	T16S	R11E	BLM, Undetermined
	NESE, NESW, NWSE, NWSW, SENE, SENW, SWNE, SWNW	12	T16S	R11E	BLM, Undetermined
	L 2, L 3, NESW, SENW	7	T16S	R12E	Undetermined

Land Owner	**Surface Management Agency**	**Acres**
	Federal (BLM)	502.25
	State of California Department of Parks and Recreation	17.87
	Privately Owned/Undetermined	1,460.91
Topographic Map(s)	USGS Borrego Mountain SE (1959), Carrizo Mountain NE (1960), Plaster City (1976), Painted Gorge (1976), and Coyote Wells (1976), California 7.5' Topographic Quadrangles	
Geologic Map(s)	• Dibblee, T.W., and Minch, J.A., 2008a, Geologic map of the Borrego & Borrego Mountain 15 minute quadrangles, San Diego and Imperial Counties, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-409, scale 1:62,500. • Dibblee, T.W., and Minch, J.A., 2008b, Geologic map of the Coyote Wells & Heber 15 minute quadrangles, Imperial County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-405, scale 1:62,500. • Dibblee, T.W., and Minch, J.A., 2008c, Geologic map of the Plaster City & Brawley 15 minute quadrangles, Imperial County, California: Dibblee Geological Foundation, Dibblee	

<table>
<tr><td></td><td colspan="4">Foundation Map DF-406, scale 1:62,500.
• Todd, V.R., Alvarez, R.M., 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.</td></tr>
<tr><td rowspan="11">Mapped Geologic Unit(s) and age(s)</td><td>Geologic Unit</td><td>Map Symbol</td><td>Age</td><td>Paleontological Potential (PFYC)</td></tr>
<tr><td>Quaternary alluvium, undivided</td><td>Qa</td><td>Holocene</td><td>2 (Low)</td></tr>
<tr><td>Quaternary alluvial terrace deposits</td><td>Qt</td><td>Holocene</td><td>2 (Low)</td></tr>
<tr><td>Lake Cahuilla beds</td><td>Qlc</td><td>Holocene</td><td>3 (Moderate)</td></tr>
<tr><td>Palm Spring Group, undivided</td><td>QTp</td><td>Pleistocene – Pliocene</td><td>4 (High)</td></tr>
<tr><td>Imperial Group, Latrania Formation</td><td>Til</td><td>Pliocene – Miocene</td><td>4 (High)</td></tr>
<tr><td>Imperial Group, undivided</td><td>Ti</td><td>Pliocene – Miocene</td><td>4 (High)</td></tr>
<tr><td>Fish Creek Gypsum</td><td>Tfc</td><td>Pliocene – Miocene</td><td>2 (Low)</td></tr>
<tr><td>Split Mountain Group, Elephant Trees Formation</td><td>Tse</td><td>Miocene</td><td>U (Unknown)</td></tr>
<tr><td>Split Mountain Group, Red Rock Formation</td><td>Tsr</td><td>Miocene</td><td>3 (Moderate)</td></tr>
<tr><td>Undivided intrusive igneous rocks</td><td>gr</td><td>Mesozoic or older</td><td>1 (Very Low)</td></tr>
<tr><td>Previously Documented Fossil Localities within the Project area</td><td colspan="4">No fossil localities have been previously recorded from the Project area; however, SDNHM contains records of 1 fossil locality from the Palm Spring Group within 1-mile of the Pipeline.</td></tr>
<tr><td>Recommendation(s)</td><td colspan="4">Due to the presence of moderate to high paleontological potential within the Project area, mitigation of potential adverse effects resulting from construction-related ground disturbance is recommended. A pre-construction pedestrian field survey is recommended in order to locate any surficial fossil localities and verify the geologic units underlying the Project area. All appropriate permits and permissions would need to be acquired prior to surveying. Only areas mapped as moderate, high, and unknown potential (PFYC 3, 4, and U) geologic units should be intensively surveyed. Areas mapped as very low and low potential (PFYC 1 and 2) geologic units should be confirmed as mapped. Following the survey, a PRMMP should be prepared by a BLM-permitted paleontologist and approved by the BLM and Imperial County. The PRMMP should provide detailed recommended monitoring locations; a description of a worker training program; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. A curation agreement with a BLM-approved fossil repository must also be obtained. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a Qualified Paleontologist.</td></tr>
</table>

3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): "Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are used to:

- Study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Study patterns and processes of evolution, extinction, and speciation; and
- Identify past and potential future human-caused effects to global environments and climates."

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to BLM Instructional Memorandum (IM) 2009-011, a "Significant Paleontological Resource" is defined as:

> "Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate

> coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities" (BLM, 2008).

Vertebrate fossils, whether preserved remains or track ways, are classified as significant by most state and federal agencies and professional groups (and are specifically protected under the California Public Resources Code). In some cases, fossils of plants or invertebrate animals are also considered significant and can provide important information about ancient local environments.

The full significance of fossil specimens or fossil assemblages cannot be accurately predicted before they are collected, and in many cases, before they are prepared in the laboratory and compared with previously collected fossils. Pre-construction assessment of significance associated with an area or formation must be made based on previous finds, characteristics of the sediments, and other methods that can be used to determine paleoenvironmental and taphonomic conditions.

4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

This section of the report presents the regulatory requirements pertaining to paleontological resources that apply to this Project.

4.1 FEDERAL REGULATORY SETTING

If any federal funding is used to wholly or partially finance a project, it is sited on federal lands, involves a federal permit, and/or includes a perceived federal impact, federal laws and standards apply, and an evaluation of potential impacts on paleontological resources may be appropriate and/or required. The management and preservation of paleontological resources on public and federal lands are prescribed under various laws, regulations, and guidelines.

4.1.1 National Environmental Policy Act (16 USC Section 431 et seq.)

The National Environmental Policy Act of 1969, [NEPA] as amended (Public Law [Pub. L.] 91-190, 42 United States Code [USC] 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258 § 4(b), Sept. 13, 1982) recognizes the continuing responsibility of the Federal Government to "preserve important historic, cultural, and natural aspects of our national heritage . . ." (Sec. 101 [42 USC § 4321]) #382). With the passage of the Paleontological Resources Preservation Act (PRPA) (2009), paleontological resources are considered to be a significant resource and it is therefore now standard practice to include paleontological resources in NEPA studies in all instances where there is a possible impact.

4.1.2 Antiquities Act of 1906

The Antiquities Act of 1906 (16 USC 431-433) states, in part:

> That any person who shall appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

Although there is no specific mention of natural or paleontological resources in the Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR 3]), the term "objects of antiquity" has been interpreted to include fossils by the National Park Service (NPS), the BLM, the Forest Service (FS), and other federal agencies. Permits to collect fossils on lands administered by federal agencies are authorized under this Act. However, due to the large gray areas left open to interpretation due to the imprecision of the wording, agencies are hesitant to interpret this act as governing paleontological resources.

4.1.3 Federal Land Management and Policy Act (FLMPA) (43 USC 1701)

Federal law including the Federal Land Management and Policy Act (FLMPA) of 1976 (43 USC 1701) includes objectives such as the evaluation, management, protection and location of fossils on BLM-managed lands, defines fossils, and lays out penalties for the destruction of significant fossils. Also, NEPA requires the preservation of "historic, cultural, and natural aspects of our national heritage." Most recently, the Omnibus Public Lands Act refines NEPA and FLMPA guidelines and strictures, as well as outlines minimum punishments for removal or destruction of fossils from Federal/public lands (see below).

4.1.4 Paleontological Resources Preservation Act (PRPA)

Paleontological Resources Preservation, Title VI, Subtitle D in the Omnibus Public Lands Act of 2009, Public Law 111-011 Purpose: The Secretary (Interior and Agriculture) shall manage and protect paleontological resources on Federal land using scientific principles and expertise. With the passage of the PRPA, Congress officially recognizes the importance of paleontological resources on federal lands (U.S. Department of the Interior, US Department of Agriculture) by declaring that fossils from federal lands are federal property that must be preserved and protected using scientific principles and expertise. The PRPA provides:

- Uniform definitions for "paleontological resources" and "casual collecting";
- Uniform minimum requirements for paleontological resource use permit issuance (terms, conditions, and qualifications of applicants);
- Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from Federal lands; and
- Uniform requirements for curation of federal fossils in approved repositories.

4.2 STATE REGULATORY SETTING

4.2.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4th, 2013. One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (State CEQA Guidelines Section 15064.5 and Appendix G, Section V, Part C).

4.2.2 State of California Public Resources Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources.

These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological "sites" or "features" from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, "state lands" refers to lands owned by, or under the jurisdiction of, the state or any state agency. "Public lands" is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

4.3 LOCAL REGULATORY SETTING

4.3.1 Imperial County

Imperial County's General Plan (1993) has no mention of paleontological resources, nor a cultural resources entry that might apply to paleontological resources.

5.0 METHODS

This paleontological analysis of existing data included a geologic map review, a literature search, and museum records search of the Project area. The goal of this report is to evaluate the paleontological potential of the Project area and make recommendations for the mitigation of adverse impacts on paleontological resources that may occur as a result of the proposed Project. Mathew Carson, M.S., performed the background research and authored this report, which was reviewed by Paleontological Principal Investigator Courtney Richards, M.S. Geraldine Aron, M.S., oversaw all aspects of the Project as the Program Director. GIS maps were prepared by Nathan Dickey, M.S.

Paleo Solutions will retain an archival copy of all Project information including field notes, maps, and other data.

5.1 ANALYSIS OF EXISTING DATA

Paleo Solutions reviewed geologic mapping of the Project area by Dibblee and Minch (2008a-c) and Todd et al. (2004). The literature reviewed included published and unpublished scientific papers, including a review of paleontological resources within the BLM El Centro Field Office administrative area conducted by Donohue and Deméré (2015), conducted on behalf for the BLM El Centro Field Office, and records of fossil localities maintained in the Paleobiology Database (PBDB, 2018). Paleontological museum records search results from the SDNHM (McComas, 2018) were analyzed and incorporated into this paleontological investigation.

5.2 CRITERIA FOR EVALUATING PALEONTOLOGICAL POTENTIAL

The PFYC system was developed by the BLM (BLM, 2016). Because of its demonstrated usefulness as a resource management tool, the PFYC has been utilized for many years for projects across the country, regardless of land ownership. It is a predictive resource management tool that classifies geologic units on their likelihood to contain paleontological resources on a scale of 1 (very low potential) to 5 (very high potential). This system is intended to aid in predicting, assessing, and mitigating paleontological resources. The PFYC ranking system is summarized in Table 2.

Table 2. Potential Fossil Yield Classification (BLM, 2016)

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
1 = Very Low	Geologic units are not likely to contain recognizable paleontological resources.

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
Potential	Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units.
	Units are Precambrian in age.
	Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances.
2 = Low	Geologic units are not likely to contain paleontological resources.
	Field surveys have verified that significant paleontological resources are not present or are very rare.
	Units are generally younger than 10,000 years before present.
	Recent eolian deposits
	Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely
	Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances.
3 = Moderate Potential	Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.
	Marine in origin with sporadic known occurrences of paleontological resources.
	Paleontological resources may occur intermittently, but these occurrences are widely scattered
	The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate.
	Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Opportunities may exist for hobby collecting. Surface-disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources.
4 = High Potential	Geologic units that are known to contain a high occurrence of paleontological resources.
	Significant paleontological resources have been documented but may vary in occurrence and predictability.
	Surface-disturbing activities may adversely affect paleontological resources.
	Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present.
	Illegal collecting activities may impact some areas.
	Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary.
5 = Very High Potential	Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources.
	Significant paleontological resources have been documented and occur consistently
	Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities.
	Unit is frequently the focus of illegal collecting activities.
	Management concern is high to very high. A field survey by a qualified paleontologist is almost always 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.
U = Unknown	Geologic units that cannot receive an informed PFYC assignment
	Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
	the actual paleontological resources of the unit or area is unknown.
	Geologic units represented on a map are based on lithologic character or basis of origin, but have not been studied in detail.
	Scientific literature does not exist or does not reveal the nature of paleontological resources.
	Reports of paleontological resources are anecdotal or have not been verified.
	Area or geologic unit is poorly or under-studied.
	BLM staff has not yet been able to assess the nature of the geologic unit.
	Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity.

6.0 ANALYSIS OF EXISTING DATA

The Project area is situated within the Colorado Desert Geomorphic Province, bound on the east by the Colorado River, on the west by the Peninsular Ranges Geomorphic Province, and to the south by the Gulf of California in Mexico. Being an extension of the Gulf of California, the Colorado Desert Geomorphic Province is mostly below sea level and formed as a result regional subsidence related to crustal extension and transtension that produced a number of fault-bounded basins that were filled with sediments from the Miocene to the Pleistocene, most notably from heavy sediments loads deposited by the Colorado River, leading to the closure of the Gulf of California near the end of the Pliocene (Norris and Webb, 1990; Dorsey, 2005; California Geological Survey, 2015). The surface elevation ranges from 350 feet above sea level near the San Bernardino-Riverside county line to 235 feet below sea level at the lowest part of the Salton Basin (Norris and Webb, 1990); the portion of the Colorado Desert Geomorphic Province situated below sea level is approximately 90 miles by 25 miles and has been used extensively for agriculture.

Within the geomorphic province, the Salton Trough, a large structural depression extending from San Gorgonio Pass (near Palm Springs) to the delta of the Colorado River in the Gulf of California in Mexico, is the dominant feature within the province and includes the Salton Basin, an area that includes all the drainage areas to the Salton Sea as well as the Salton Sea itself.

Structurally, faults of the Colorado Desert Geomorphic Province trend northwest-southeast, with the San Andreas fault system being prominent in the Coachella Valley and along the northeast side of the Salton Sea. The Salton Basin is characterized as a complex rift resulting from the northwesterly movement of the Peninsular Ranges away from the North American continent, resulting in significant seismic activity within the province over the past 10 million years (Atwater, 1970; Lonsdale, 1989; Norris and Webb, 1990; Stock and Hodges, 1989; Powell et al., 1993; DeMets, 1995; Dickinson, 1996; Atwater and Stock, 1998; Axen and Fletcher, 1998; Dorsey, 2005). Additionally, structural folds are prominent in the Colorado Desert, ranging from small-scale to large-scale. Examples include the Indio and Mecca hills, which contain young anticlinal structures and small, tightly folded strata near faults, and the San Felipe and Superstition mountain chains, which show similar anticlinal structural features (Norris and Webb, 1990).

Along the western margin of the Colorado Desert Geomorphic Province, the Fish Creek Mountains reside on the west side of the Imperial Valley, south of San Felipe Creek, and consist of rugged northeast and east facing slopes, approximately 2,400 feet above the Salton Trough (Todd et al., 1987). The Quarry portion of the Project area is located within the northwest portion of the Fish Creek Mountains, and its basement rocks consist of gneisses, marbles, and granitic rocks, correlative to the Mesozoic-age crystalline rocks of the Peninsular Ranges to the west. During the Paleogene, the crystalline basement rocks of the Fish Creek Mountains area were exposed and eroded. By the Miocene, the paleoenvironment shifted from that of erosion to deposition of nonmarine sediments in an arid to semiarid environment (Norris and Webb, 1990). Throughout the western Salton Trough area, the Miocene-aged Red Rock Formation (classified as part of the Anza Formation by Todd et al., 2004) is the oldest known sedimentary geologic unit, which consisted of fanglomerate deposits of lenticular beds, large fresh clasts of granitic rock, and its coarse pebbly conglomerate and sandstone beds (Norris and Webb, 1990). Stratigraphically in the western Salton Trough near the Fish Creek Mountains, the Anza Formation is overlain by the Miocene-age Split Mountain Group, which consists of marine and nonmarine sediments and abundant gypsum deposits (described separately in the following sections), and the subsequent Miocene- to Pliocene-age Imperial Group, which consists of marine sediments. After the Colorado River delta closed the connection of the Salton Trough to the developing Gulf of California, the Pliocene- to Pleistocene-age Palm Spring Group, which consists of nonmarine sediments, was deposited near the center of the Salton Basin. During the Holocene when the Colorado River tributaries periodically changed their courses across the delta, a shallow freshwater lake, Lake Cahuilla, intermittently formed along the base of the Santa Rosa Mountains on the west side of the Salton Sea, which is noticeable by travertine coating on cliff faces throughout the area, with beach deposits, sand spits, and mouth bars along the base of the Santa Rosa Mountains (Norris and Webb, 1990). According to Norris and Webb (1990), unlike the ancient lakes in the Mojave Desert, which formed as a result of melting glaciers, Lake Cahuilla likely formed as a result of Colorado River flooding independent of glaciation, with the last filling occurring between approximately A.D. 900 and 1400.

6.1 LITERATURE SEARCH

Geologic mapping by Dibblee and Minch (2008a-c) and Todd et al. (2004) indicates that the Project area and its half-mile buffer zone are underlain by Mesozoic-age (or older) undivided intrusive igneous rocks (gr); Miocene-age Split Mountain Group, Red Rock Formation (Tsr) and Elephant Trees Formation (Tse); Pliocene- to Miocene-age Fish Creek Gypsum (Tfc); Pliocene- to Miocene-age Imperial Group, Latrania Formation (Til) and undivided (Ti); Pleistocene- to Pliocene-age Palm Spring Group, undivided (QTp); Holocene-age Lake Cahuilla beds (Qlc); Holocene-age alluvial terrace deposits (Qt); and Holocene-age alluvium, undivided (Qa). The geologic distributions of the geologic units in the Project area, as mapped by Dibblee and Minch (2008a-c) and Todd et al. (2004), are presented in Appendix A.

6.1.1 Intrusive Igneous Rocks (Undivided) (gr)

Igneous rocks are crystalline or non-crystalline rocks that form through the cooling and subsequent solidification of lava or magma. Intrusive (plutonic) igneous rocks form below the earth's surface, and extrusive (volcanic) rocks form on the earth's surface. Lava and magma are formed by the melting of pre-existing plutonic rocks in the earth's crust or mantle due to increases in temperature, changes in pressure, or changes in geochemical composition. Extreme temperatures in the environments in which intrusive igneous rocks form prevent the preservation of fossils. The formation of extrusive igneous rocks as a result of volcanic processes is associated with extremely high temperatures that also generally prevent the preservation of fossils. Therefore, Mesozoic-age intrusive igneous rocks (undivided) have a very low paleontological potential (PFYC 1).

6.1.2 Split Mountain Group – Red Rock Formation (Tsr)

The Miocene-age Red Rock Formation, referred to as the Anza Formation by Todd et al. (2004), consists of alluvial sandstones and conglomerates. Near Table Mountain, the Red Rock Formation is approximately 300 feet thick and consists of yellowish- to reddish-brown, weakly stratified, friable, medium- to coarse-grained sandstones and conglomeratic sandstones (Donohue and Deméré, 2015). However, in the vicinity of Split Mountain Gorge, the Red Rock Formation is considerably thicker, greater than 1,700 feet thick, and consists of reddish-brown arkosic sandstones and fanglomerates (Woodard, 1974; Donohue and Deméré, 2015). Overall, the Red Rock Formation varies in its lithology, ranging from greenish-gray, to orange or reddish-brown, to light gray in color, massive to thickly bedded, arkosic fine- to coarse-grained sandstones and sandy conglomerates (Woodard, 1963, 1974; Winker, 1987; Todd et al., 2004; Donohue and Deméré, 2015). Stratigraphically, basement rocks unconformably underlie the Red Rock Formation, and the Elephant Trees Formation unconformably overlies the Red Rock Formation.

The Red Rock Formation has yielded several scientifically significant fossil localities, particularly in the vicinity of Table Mountain and Ocotillo Canyon. Fossils recorded from the Red Rock Formation include bones and teeth of Miocene-age land mammals, such as rodents, rabbits, and camels from near Table Mountain, and a dentary with teeth and isolated postcrania of a small camelid, cf. *Protolabis* sp., from Ocotillo Canyon, approximately 16 feet from the contact of the Alverson Formation (Deméré and Borce, 2015; Donohue and Deméré, 2015). The PBDB (2018) does not contain paleontological resources from the Red Rock Formation. Based on the limited exposures of the Red Rock Formation, which have yielded fragmentary but scientifically significant vertebrate fossils, the Red Rock Formation has a moderate paleontological potential (PFYC 3).

6.1.3 Split Mountain Group – Elephant Trees Formation (Tse)

The Miocene-age Elephant Trees Formation, previously known as the Elephant Trees Member of the Split Mountain Formation, is a coarse-grained debris flow and sheet flood deposit, with pronounced lateral thickening (Winker, 1987; Winker and Kidwell, 1996; Dorsey, 2005). This geologic unit conformably to unconformably overlies the sandstone lithology of the Red Rock Formation, with the presence of normal faults, alluvial fan deposits, and braided stream deposits indicating sedimentation in an active rift basin during the late Miocene (Ker, 1982, 1984; Winker, 1987; Winker and Kidwell, 1996; Dorsey, 2005). According to Dibblee and Minch (2008a-c), the Elephant Trees Formation, which they call the Split Mountain Formation, consists of middle Miocene, nonmarine sedimentary rocks of granite and gneiss-breccia, gray to brown, massive to bedded, clast-supported boulder- to pebble-conglomerate and sandstone, with andesite agglomerate and basic andesite, as well as local minor oxidized beds. Todd et al. (2004) also designate the Elephant Trees Formation as the Split Mountain Formation, which they describe as having four members: 1) a lower member of dark gray, very coarse boulder and cobble fanglomerate composed of angular blocks of quartz diorite and metamorphic rocks; 2) the Fish Creek Gypsum, which is interbedded locally with sandstone and shale of the overlying marine arenite member (the Fish Creek Gypsum is described below); 3) intercalated, lensing quartz arenite and olive-green micaceous shale containing middle of late Miocene-age marine fossils; and 4) massive gray fanglomerate of megabreccia that is lithologically similar to the basal gray fanglomerate but containing schist clasts and larger quartz diorite blocks (Norris and Webb, 1990). According to McComas (2018), the exact age of the Elephant Trees Formation has not been constrained, but likely spans most of the Miocene (Todd et al., 2004; Dorsey, 2005; Dibblee and Minch, 2008a-c).

Previous investigators have not recorded fossil localities within the Elephant Trees Formation; however, according to Donohue and Deméré (2015) and McComas (2018), any fossils recovered from this formation would significantly improve geologic dating of this formation. Additionally, the PBDB (2018) does not contain fossil locality records from the Elephant Tree Formation. The Elephant Trees Formation has an unknown potential for paleontological resources (PFYC U).

6.1.4 Fish Creek Gypsum (Tfc)

The late Miocene-age Fish Creek Gypsum is a belt of pure gypsum in the northwestern Fish Creek Mountains, with thickness ranging from 100 to 200 feet (Norris and Webb, 1990; Todd et al., 2004; Dibblee and Minch, 2008a-c), and has been described as the second stratigraphic subunit of the Split Mountain Formation of Dibblee and Minch (2008a-c) (i.e., the Elephant Trees Formation). The geologic unit consists of gypsum and anhydrite, white, laminated to massive, and locally containing a 5-foot thick bed of celestite. According to Todd et al. (2004), the evaporite deposits rest unconformably on basement rocks or transitional marine mudstones, intertongued laterally with the fanglomerate deposits and overlain by locally derived turbidites of the Elephant Tree Formation (Kerr and Kidwell, 1991; Todd et al., 2004); however, Dorsey (2005) designates these turbidites as part of the overlying Imperial Group. The interpretation of the depositional environment of the Fish Creek Gypsum varies among marginal-marine evaporite setting, restricted shallow marine basin, or marine basin with precipitation of gypsum from hydrothermal vent systems (Winker, 1987; Dean, 1988, 1996; Jefferson and Peterson, 1998; Dorsey, 2005). Index microfossils recovered from interbedded marine claystones suggest that the Fish Creek Gypsum was deposited between 3.4 to 6.3 million years ago (Dean, 1996; Dorsey, 2005).

The PBDB (2018) does not contain fossil localities records from the Fish Creek Gypsum subunit of the Elephant Trees Formation. Because previous studies have only recorded microfossils from thin claystones interbedded within this unit, the Fish Creek Gypsum has a low potential for paleontological resources (PFYC 2).

6.1.5 Imperial Group – Latrania Formation (Til)

The Miocene- to Pliocene-age Latrania Formation, along with the Fish Creek Gypsum, record a rapid tectonically-controlled transgression of marine waters. According to Winker and Kidwell (1996), the Latrania Formation is a marine turbidite section located in the lower Imperial Group that marks the northern proto-Gulf of California termination of the Miocene marine transgression into the southernmost developing-subsident Salton Trough region. The Latrania Formation consists of carbonate sandstones discontinuously overlying turbidite sandstones of the Split Mountain Group (Donohue and Deméré, 2015). The Latrania Formation is rich in macroinvertebrates from coralgal sediments (Donohue and Deméré, 2015). According to previous researchers, the Latrania Formation has yielded marine and terrestrial vertebrates of Hemphillian North American Land Mammal Age (NALMA).

According to Deméré (2006) and Rugh (2013a, 2014b), the Latrania Formation contains locally diverse and abundant assemblages of marine invertebrate fossils, such as mollusks, echinoderms, and colonial corals, particularly in the Coyote Mountains and Fish Creek Mountains (Donohue and Deméré, 2015). Fossil localities yielding vertebrates are more rare within the Latrania Formation, but vertebrate fossils recorded include marine sharks, rays, bony fish, as well as dolphins, baleen whales, and sea cows (Deméré, 1993, 2006; Roeder, 2013; Donohue and Deméré, 2015). The PBDB (2018) contains 100+ marine invertebrate fossils from the Latrania Formation. Taxa include: corals; bivalves, including clams, oysters, scallops, and mussels; gastropods; and echinoids, including sand dollars and sea urchins. Thus, the fossiliferous shallow marine deposits of the Latrania Formation have a high potential for paleontological resources (PFYC 4).

6.1.6 Imperial Group - Undivided (Ti)

The Miocene- to Pliocene-age Imperial Group (undivided) consists of shallow, brackish marine clastic sedimentary rocks, with a total thickness of 3,600 feet. According to Dibblee and Minch (2008a-c) and Todd et al. (2004), the Imperial Group consists of claystone, light grayish-tan to yellow, conchoidally fractured, weathered to yellowish-gray clay soil, and contains interbedded sandstone, buff to gray in color, laminated, friable to hard, with hard, dark brown oyster reef fossil fauna. The Imperial Group has a gradational contact with the underlying Split Mountain Group. The Imperial Group has been subdivided in various ways by previous investigators but summarized by Dorsey (2005) as containing a thick, grading-upward succession of marine fossiliferous claystone, siltstone, sandstone, and minor limestones, which have been grouped by Winker (1987) and Todd et al. (2004) as representing two facies sequences: an older, pre-deltaic sequence and a younger deltaic sequence. Todd et al. (2004) summarizes the pre-deltaic sequence in stratigraphic order as fossiliferous shallow-marine fan-deltas; subaqueous sediment gravity and debris flows; and submarine fan turbidite sequences. The younger deltaic sequence consists of prodelta clays and silts; upward shoaling marine delta front facies with sandstone and coquina; transitional lagoons, brackish marshes, and tidal flats; and delta plain nonmarine facies (Todd et al., 2004).

In addition to the numerous fossil localities of the Latrania Formation, the undivided geologic units of the Imperial Group also contain several significant fossil resources, including fossil invertebrates and vertebrates. Invertebrate fossil taxa include corals, mollusks, and echinoderms; vertebrate fossil taxa include marine vertebrates, such as sea turtle, toothed whales, baleen whales, seals, sea lions, walruses, and terrestrial vertebrates, such as crocodylians, terror birds, pelican, raccoons, ground sloth, horses, camelids, and proboscideans (Jefferson et al., 2012; Donohue and Deméré, 2015). Additionally, nearly 200 fossils have been recorded from undivided units of the Imperial Group according to the records contained in the PBDB (2018). Fossil localities from undivided Imperial Group strata have yielded stony corals; bivalves, including clams, scallops, and oysters; numerous gastropods; arthropods, such as crabs and barnacles; and echinoids, such as sand dollars, pencil urchins, and sea urchins. The PBDB (2018) also contains records of shark (*Odontaspis* sp., *Squalus* sp., and *Carcharodon arnoldi*), marlin fish (Istiophoridae), sea turtle (Cheloniidae), seal (Pinnipedia), walrus (*Valenictus* sp.), dugong (Dugongidae), and toothed whale (Odontoceti). The fossiliferous deposits of the Imperial Group (undivided) suggest that this geologic unit has a high potential for paleontological resources (PFYC 4).

6.1.7 Palm Spring Group – Undivided (QTp)

Pliocene- to Pleistocene-age Palm Spring Group (undivided) consists of stream-laid sediments accumulated as deltaic deposits draining from rising Peninsular Range terrane (Dibblee and Minch, 2008a-c). The Palm Spring Group is predominantly exposed along the north side of the Coyote Mountains, but it also has excellent exposures within the Fish Creek Mountains, forming a discontinuous belt along its lower flanks. The Palm Spring Group consists of light gray to greenish-gray to tan bedded arkosic sandstones and interbedded light red clays, with many sandstones strata containing calcareous concretions of various shapes, with sporadic dark gray petrified hardwood, with grain well preserved (Dibblee and Minch, 2008a-c). Woodard (1963) described more than 3,000 meters of interbedded siltstone, claystone, arkosic sandstone, pebble conglomerate, and fresh-water limestone representing alluvial floodplain deposits marginal to the retreating Gulf of California. Later studies by Winker (1987) refined the paleoenvironmental interpretation of the Palm Spring Group, which consisted of fluvial and alluvial fan deposits and minor lacustrine deposits representing interfingering, laterally gradational deltaic and basin-marginal alluvial sedimentary facies. Laterally, the Palm Spring Group becomes coarser proximal to the surrounding mountain ranges, classified as the Canebrake Conglomerate (Woodard, 1963; Todd et al., 2004). The Palm Spring Group locally unconformably overlies the Imperial Group; however, some portions of both geologic packages intertongue (Dibblee and Minch, 2008a-c). Overall, the Palm Spring Group records the significant environmental changes that occurred in the area during the Pliocene to Pleistocene. Deposits of the Palm Spring Group formed by growth of the large Colorado River delta, which documents a wide variety of ancient depositional environments, including basin margin bajadas as preserved in the

Canebrake conglomerate and Hueso Formation; outwash play lakes as preserved in the Tapiado Claystone; locally derived streams as preserved in the Olla Formation; and distributary channels as preserved in the Arroyo Diablo Formation (McComas, 2018).

According to McComas (2018), the Palm Spring Group has yielded diverse and well-preserved fossil remains of over 100 species of Pliocene to Pleistocene terrestrial vertebrates, such as turtles, snakes, lizards, hawk, eagle, vulture, ground sloth, shrews, rodents, mastodon, camel, llama, and horse. Additionally, numerous aquatic vertebrates have been recorded, including bony fish (McComas, 2018). Fossil plants, predominantly petrified wood, including large logs, have been recorded from the Palm Spring Group (McComas, 2018). In the badlands near Plaster City, fossil localities have yielded petrified wood, land plant leaf impressions, bones and teeth of land mammals, and shells and tests of estuarine invertebrates (Donohue and Deméré, 2015). Records of fossil localities within the PBDB (2018) include birds, such as waterfowl (*Brantadorna downsi*), bufflehead (*Bucephala albeola fossilis*), stiff-tailed duck (*Oxyura bessomi*), coot (*Fulica americana*), pheasant (*Agriocharis anza*), vulture (*Neophrontops vallecitoensis*). Sediments of the Palm Spring Group have the potential to preserve scientifically significant fossils; thus, the Palm Spring Group has a high paleontological potential (PFYC 4).

6.1.8 Lake Cahuilla Beds (Qlc)

Near the base of the Santa Rose Mountains along the west side of the Salton Sea resides the former Lake Cahuilla deposits, with its fossil waterline demarcated by travertine encrustation on rock faces along the base of the Santa Rose Mountains (Norris and Webb, 1990). Lake Cahuilla was a former freshwater lake that periodically occupied a major portion of the Salton Trough during the latest Pleistocene to Holocene (McComas, 2018). According to Dibblee and Minch (2008a-c), the Lake Cahuilla beds consists of a thin series of tannish-gray claystones, sands, and gravels, rich with fossils. The ancient Lake Cahuilla's shoreline was approximately 30 to 40 feet above sea level on average, and remnants of beaches, sand spits, and bay-mouth bars can be seen along the base of the Santa Rose Mountains (Norris and Webb, 1990). The Lake Cahuilla beds record a series of lakes and fluvial systems, which formed by changes in the flow path of the Colorado River during the earliest Holocene. Although Lake Cahuilla beds are Holocene in age, they record the geologic changes that occurred in the transition from the latest Pleistocene through the latest Holocene.

According to Jefferson (2006) and McComas (2018), the Lake Cahuilla beds have yielded abundant freshwater mollusks, ostracods, fish, and vertebrates, providing paleoclimatic and paleoecological information. Whistler et al. (1995) reported that land animal fossils recorded from Lake Cahuilla sediments include freshwater fishes, such as desert pupfish, bonytail chub, stickleback, and razorback sucker; terrestrial reptiles, such as horned lizards, spiny lizards, brush lizards, shovel-nosed snakes, night snakes, gopher snakes, ground snakes, sidewinder, and rattlesnake; and terrestrial mammals, such as cottontail rabbit, pocket mouse, kangaroo rat, ground squirrel, and wood rat (Hubbs and Miller, 1948; Hubbs et al., 1960; Whistler et al., 1995; Roeder and Calvano, 2014; Donohue and Deméré, 2015). The PBDB (2018) does not contain any fossil localities from Lake Cahuilla beds; however, these beds have the potential to produce scientifically significant fossils that span the late Pleistocene to the early Holocene. The Lake Cahuilla beds have a moderate paleontological potential (PFYC 3).

6.1.9 Alluvial Terrace Deposits (Qt)

Holocene-age alluvial terrace deposits consist of patchy deposits of dissected, flat-lying alluvium near the lower flanks of the Fish Creek Mountains. According to Todd et al. (2004), these deposits consist of poorly consolidated silt, sand, and gravel that form desert pavement terraces coated with desert varnish. Dibblee and Minch (2008a-c) combine the older and younger terrace deposits, with older terraces composed of boulder to pebble gravel and sand, locally folded and faulted, and younger terraces composed of gravel and sand, locally undifferentiated from the surrounding alluvium. Holocene-age (less than 11,000 years old) sediments are typically too young to contain fossilized material (Society of Vertebrate Paleontology [SVP], 2010), but they may overlie sensitive older (e.g., Pleistocene- and Pliocene-age) deposits at variable depth. Alluvial terrace deposits are assigned low paleontological potential (PFYC 2) at the surface using BLM (2016) guidelines. However, they have an unknown paleontological potential in the subsurface since there is potential for these deposits to be conformably underlain by older, paleontologically sensitive geologic units.

6.1.10 Alluvium – Undivided (Qa)

Holocene-age alluvial deposits consist of variable compositions of unconsolidated clay, silt, sand, and gravel in valley areas (Dibblee and Minch, 2008a-c). Alluvium typically is unindurated and undissected at the surface and may be locally undifferentiated from Lake Cahuilla deposits and alluvial terrace deposits. Holocene-age sediments are typically too young to contain fossilized material (SVP, 2010), but they may overlie sensitive older deposits at variable depth. Alluvial (undivided) deposits are assigned low paleontological potential (PFYC 2) at the surface using BLM (2016) guidelines. However, they have an unknown paleontological potential in the subsurface since there is potential for these deposits to be conformably underlain by older, paleontologically sensitive geologic units.

6.2 PALEONTOLOGICAL RECORD SEARCH RESULTS

The purpose of the record searches was to determine whether any museum fossil localities occur within or adjacent to the Project area and ascertain the abundance and taxonomic diversity of fossils collected from the same geologic units elsewhere in Imperial County to assist with the determination of the paleontological potential of the Project area.

A museum records search was conducted by SDNHM, who responded to Paleo Solutions' request on April 9, 2018 (McComas, 2018). According to SDNHM, only one fossil locality, which yielded fossil plant material, has been recorded within one mile of the Project area. This locality, SDNHM 6530, consists of fossilized plant debris from the Arroyo Diablo Formation of the Palm Spring Group located one mile north [redacted] of the pipeline between Ocotillo and the Plaster City Plant (McComas, 2018).

The results of the SDNHM museum records search are presented in the confidential Appendix B.

8.0 IMPACTS TO PALEONTOLOGICAL RESOURCES

Impacts on paleontological resources can generally be classified as either direct, indirect or cumulative. Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing as the result of surface disturbing actions including construction excavations. In areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact surface and subsurface paleontological resources of scientific importance. Without mitigation, these fossils and the paleontological data they could provide if properly recovered and documented, could be adversely impacted (damaged or destroyed), rendering them permanently unavailable to science and society.

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

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

Excavations in the Project area that impact Miocene-age Split Mountain Group, Red Rock Formation (Tsr) and Elephant Trees Formation (Tse); Pliocene- to Miocene-age Imperial Group, Latrania Formation (Til) and undivided (Ti); Pleistocene- to Pliocene-age Palm Spring Group, undivided (QTp); and Holocene-age Lake Cahuilla beds (Qlc) may well result in an adverse direct impact on scientifically important paleontological resources. Excavations entirely within previously disturbed sediments, artificial fill, Fish Creek Gypsum (Tfc), alluvial terrace deposits (Qt), or alluvium (undivided) (Qa) are unlikely to uncover significant fossil vertebrate remains; furthermore, any recovered resources from previously disturbed sediments or artificial fill will lack stratigraphic context. However, younger deposits may shallowly overlie older *in situ* sedimentary deposits. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts to paleontological resources throughout portions of the Project area, with exceptions for areas underlain by Mesozoic-age undivided intrusive igneous rocks, which have a very low paleontological potential.

9.0 RECOMMENDATIONS

Due to the presence of moderate to high paleontological potential within the Project area, mitigation of potential adverse effects resulting from construction-related ground disturbance is recommended. A pre-construction pedestrian field survey is recommended in order to locate any surficial fossil localities and verify the geologic units underlying the Project area. All appropriate permits and permissions would need to be acquired prior to surveying. Only areas mapped as moderate, high, and unknown potential (PFYC 3, 4, and U) geologic units should be intensively surveyed. Areas mapped as very low and low potential (PFYC 1 and 2) geologic units should be confirmed as mapped. Following the survey, a PRMMP should be prepared by a BLM-permitted paleontologist and approved by the BLM and Imperial County. The PRMMP should provide detailed recommended monitoring locations; a description of a worker training program; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. A curation agreement with a BLM-approved fossil repository must also be obtained. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a Qualified Paleontologist.

REFERENCES

Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America: Geological Society of America Bulletin, v. 81, p. 3513-3536.

Atwater, T., and Stock, J., 1998, Pacific-North America plate tectonics of the Neogene southwestern United States – An update: International Geology Review, v. 40, p. 375-402.

Axen, G.J., and Fletcher, J.M., 1998, Late Miocene-Pleistocene extensional faulting, northern Gulf of California, Mexico and Salton Trough, California: International Geology Review, v. 40, p. 217-244.

Bureau of Land Management (BLM), 2008, Assessment and Mitigation of Potential Impacts to Paleontological Resources: BLM Instruction Memorandum, no. 2009-011.

Bureau of Land Management (BLM), 2016, Potential Fossil Yield Classification system: BLM Instruction Memorandum, no. 2016-124 (PFYC revised from USFS, 2008).

California Geological Survey, 2015, Geological Gems of California State Parks: Colorado Desert Geomorphic Province, *in* Fuller, M., Brown, S., Willis, C., and Short, W., eds., Prepared by the California Geological Survey, Department of Conservation for California State Parks, Geogem Note 53, 4 p.

Dean, M.A., 1988, Genesis, mineralogy and stratigraphy of the Neogene Fish Creek Gypsum, southwestern Salton Trough, California: M.S. thesis, San Diego State University, 150 p.

Dean, M.A., 1996, Neogene Fish Creek gypsum and associated stratigraphy and paleontology, southwestern Salton Trough, California, *in* Abbott, P., and Seymour, D., eds., Sturzstroms and Detachment Faults Anza-Borrego Desert State Park California: South Coast Geological Society Annual Field Trip Guide Book Number 24, p. 123-148.

Deméré, T.A., 1993, Fossil mammals from the Imperial Formation (upper Miocene/lower Pliocene, Coyote Mountains, Imperial County, California), *in* Reynolds, R.E., and Reynolds, J., eds., Ashes, Faults, and Basins, San Bernardino County Museum Association Special Publication 93, no. 1, p. 82-85.

Deméré, T.A., 2006, Chapter 2: The Imperial Sea: Marine Geology and Paleontology, *in* Jefferson, G.T., and Lindsay, L., eds., Fossil Treasures of the Anza-Borrego Desert: Sunbelt Publications, San Diego, p. 29-41.

Deméré, T.A., and Borce, B., 2015, First report of early Miocene land mammals from the Red Rock Formation, southern Coyote Mountains, Imperial County, California, *in* Wagner, R., ed., Geology of the Coyote Mountains, Southern California: San Diego Association of Geologists fieldtrip guidebook, Sunbelt Publications, El Cajon, California, p. 89-94.

DeMets, C., 1995, A reappraisal of seafloor spreading lineations in the Gulf of California: Implications for the transfer of Baja California to the Pacific plate and estimates of the Pacific-North America motion: Geophysical Research Letters, v. 22, p. 3545-3548.

Dibblee, T.W., Jr., and Minch, J.A., 2008a, Geologic map of the Borrego and Borrego Mountain 15-minute quadrangles, San Diego and Imperial counties, California: Dibblee Geological Foundation, Map DF-409, scale 1:62,000.

Dibblee, T.W., JR., and Minch, J.A., 2008b, Geologic map of the Coyote Wells and Heber 15-minute quadrangles, Imperial County, California: Dibblee Geological Foundation, Map DF-405, scale 1:62,500.

Dibblee, T.W., JR., and Minch, J.A., 2008c, Geologic map of the Plaster City and Brawley 15-minute quadrangles, Imperial County, California: Dibblee Geological Foundation, Map DF-406, scale 1:62,500.

Dickinson, W.R., 1996, Kinematics of transrotational tectonism in the California Transverse Ranges and its contribution to cumulative slip along the San Andreas transform fault system: Geological Society of America Special Paper 305, 46 p.

Donohue, S.L., and Deméré, T.A., 2015, Paleontological Resources of the Bureau of Land Management El Centro Field Office Administrative Area, Imperial County and eastern San Diego County, California: Prepared by PaleoServices at the San Diego Natural History Museum for the Bureau of Land Management, El Centro Field Office.

Dorsey, R.J., 2005, Stratigraphy, tectonics, and basin evolution in the Anza-Borrego Desert Region: Geology, p. 26.

Hubbs, C.L., and Miller, R.R., 1948, The Great Basin, Part II: The zoological evidence: University of Utah, Bulletin 38, p. 18-144.

Hubbs, C.L., Bien, G.S., and Suess, H.E., 1960, La Jolla natural radiocarbon measurements: American Journal of Science, Radiocarbon Supplement 2, p. 197-223.

Imperial County, 1993, General Plan: Conservation and Open Space Element Update (updated 2016).

Jefferson, G.T., 2006, Chapter 2: The fossil birds of Anza-Borrego, *in* Jefferson, G.T., and Lindsay, L., eds., Fossil Treasures of the Anza-Borrego Desert, Sunbelt Publications, San Diego, California, p. 151-158.

Jefferson, G.T., Murray, L.K., and Keeley, S.D., 2012, The Pliocene fossil record of Anza-Borrego Desert State Park, western Salton Trough, California, *in* Reynolds, R.E., ed., Searching for the Pliocene: Southern Exposures: The 2012 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, p. 77-87.

Jefferson G.T., and Peterson, D., 1998, Hydrothermal origin of the Fish Creek Gypsum, Imperial County, southern California, in Lindsay, L., and Hample, W.G., eds., Geology and geothermal resources of the Imperial and Mexicali Valleys: San Diego Association of Geologists, San Diego, California, p. 40-51.

Kerr, D.R., 1982, Early Neogene continental sedimentation, western Salton Trough, California: M.S. Thesis, San Diego State University, San Diego, California, 138 p.

Kerr, D.R., 1984, Early Neogene continental sedimentation in the Vallecito and Fish Creek Mountains, western Salton Trough, California: Sedimentary Geology, v. 38, p. 217-246.

Kerr, D.R., and Kidwell, S.M., 1991, Late Cenozoic sedimentation and tectonics, western Salton Trough, California, in Walawender, M.J., and Hanan, B.B., eds., Geological Excursions in Southern California and Mexico: Department of Geological Sciences, San Diego State University, San Diego, California, p. 397-416.

Lonsdale, P., 1989, Geology and tectonic history of the Gulf of California, *in* Winterer, E.L., HUssong, D.M., and Decker, R.W., eds., The Eastern Pacific Ocean and Hawaii: Geological Society of America, Boulder, Colorado, p. 499-522.

McComas, K., 2018, Paleontological Records Search – US Gypsum Company Expansion Modernization Project Supplemental EIS Project: San Diego Natural History Museum (SDNHM), letter memorandum received 9 April, 2018.

Murphey, P.C., 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, scale 1:500,000, 468 p. and 6 maps.

Murphey, P.C., Knauss, G.E., Fisk, L.H., Demere, T.A., Reynolds, R.E., Trujillo, K.C., and Strauss, J.J., 2014, A foundation for best practices in mitigation paleontology: Proceedings of the 10th Conference on Fossil Resources: Dakoterra, v. 6, p. 243-285.

Norris, R.M., and Webb, R.W., 1990, Geology of California, 2nd ed., John Wiley & Sons, N.Y.

Paleobiology Database (PBDB), 2018, Accessed April 13, 2018. Available online: https://paleobiodb.org/

Powell, C.L., II, 1993, Macrofossils from the Imperial Formation in the Ocotillo Wells State Vehicle Recreation Area, Imperial and San Diego counties, California: U.S. Geological Survey, Open File Report 93-562, p. 1-7.

Roeder, M.A., 2013, New records of fish from the southern exposures of the Imperial Formation of San Diego County, California, in Reynolds, R.E., ed., Raising Questions in the Central Mojave Desert: The 2013 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, p. 169-170.

Roeder, M.A., and Calvano, G., 2014, Records of freshwater bony fish from the latest Pleistocene to Holocene Lake Cahuilla beds of western Imperial County, California, in Reynolds, R.E., ed., Not a Drop to Drink: The 2014 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, p. 94-99.

Rugh, N.S., 2014a, Imperial Group invertebrate fossils – Part 1: The science of the proto-gulf, in Reynolds, R.E., ed., Not a Drop to Drink: The 2014 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, p. 130-137.

Rugh, N.S., 2014b, Imperial Group invertebrate fossils – Part 2: The Kidwell collection, in Reynolds, R.E., ed., Not a Drop to Drink: The 2014 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, p. 138-143.

Society of Vertebrate Paleontologists (SVP), 2010, Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources, 11 p. Online: http://vertpaleo.org/PDFS/68/68c554bb-86f1-442f-a0dc-25299762d36c.pdf

Stock, J.M., and Hodges, K.V., 1989, Pre-Pliocene extension around the Gulf of California and the transfer of Baja California to the Pacific plate: Tectonics, v. 8, p. 99-115.

Todd, V.R., Alvarez, R.M., and Techni Graphics 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.

Todd, V.R., Detra, D.E., Kilburn, J.E., Griscom, A., Kruse, F.A., and Campbell, H.W., 1987, Mineral resources of the Fish Creek Mountains Wilderness Study Area, Imperial County, California: U.S. Geological Survey Bulletin 1711-C, 14 p.

Whistler, D.P., Lander, E.B., and Roeder, M.A., 1995, A diverse record of microfossils and fossil plants, invertebrates, and small vertebrates from the late Holocene Lake Cahuilla beds, Riverside County, California, *in* Remeika, P., and Sturz, A., eds., Paleontology and Geology of the Western Salton Trough Detachment, Anza-Borrego Desert State Park, California, p. 109-118.

Winker, C.D., 1987, Neogene stratigraphy of the Fish Creek-Vallecito section, Southern California: Implications for early history of the northern Gulf of California and Colorado Deta: Ph.D. Thesis, Department of Geosciences, University of Arizona, 494 p.

Winker, C.D., and Kidwell, S.M., 1996, Stratigraphy of a marine rift basin: Neogene of the western Salton Trough, California, *in* Abbott, P.L., and Cooper, J.D., eds., Field Conference Guide 1996: Pacific Section American Association of Petroleum Geologists, GB 73, Pacific Section SEPM Book 80, p. 295-336.

Woodard, G.D., 1963, The Cenozoic succession of the west Colorado Desert, San Diego and Imperial counties, Southern California: Ph.D. Thesis, Department of Geology, University of California, Berkeley, California, U.S.A.

Woodard, G.D., 1974, Redefinition of Cenozoic stratigraphic column in Split Mountain Gorge, Imperial Valley, California: American Association of Petroleum Geologists, Bulletin 58, p. 521-539.

APPENDIX A. OVERVIEW AND GEOLOGIC MAPS OF THE PROJECT AREA

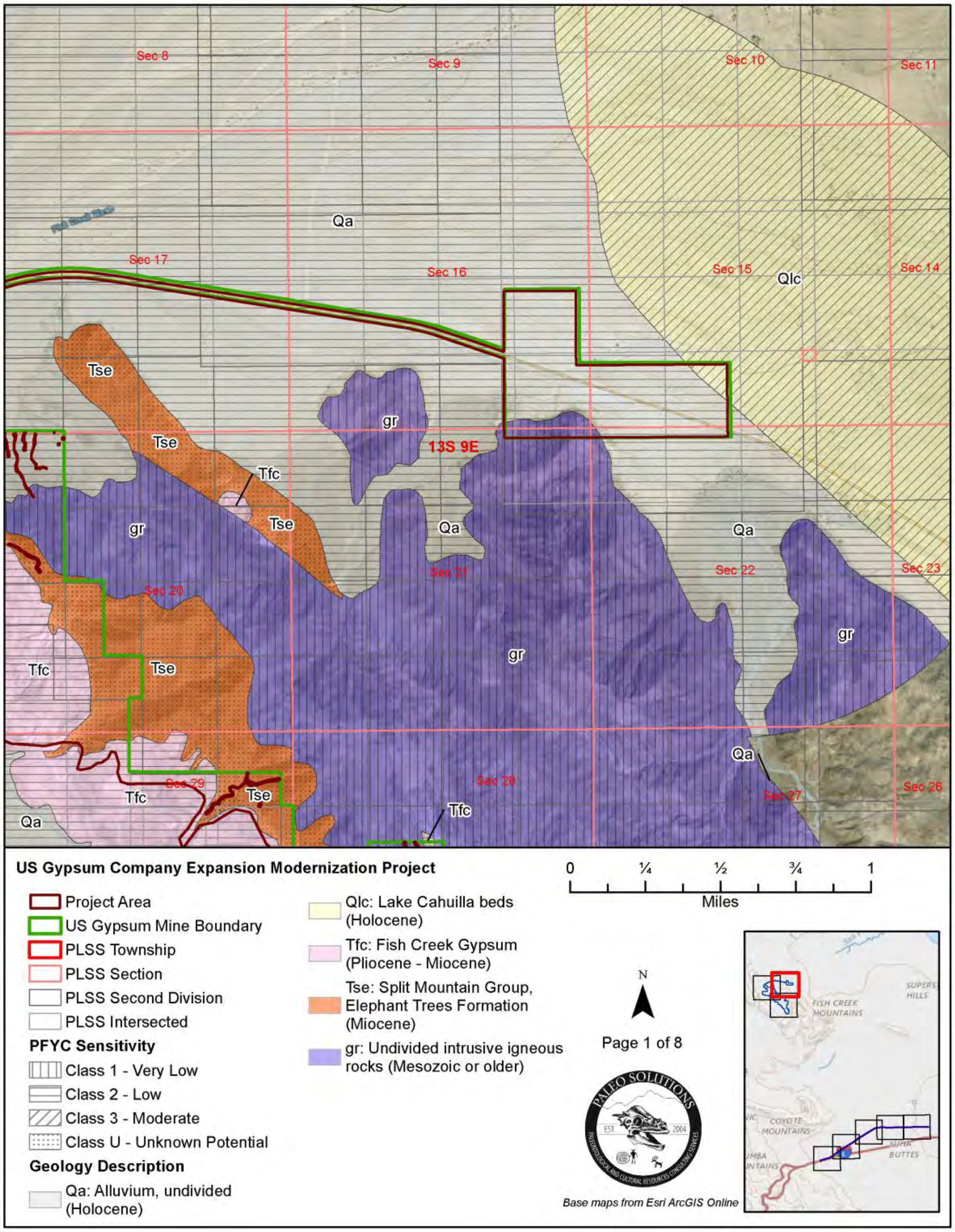

Figure A-1. Geologic Map of the Project area – Page 1.

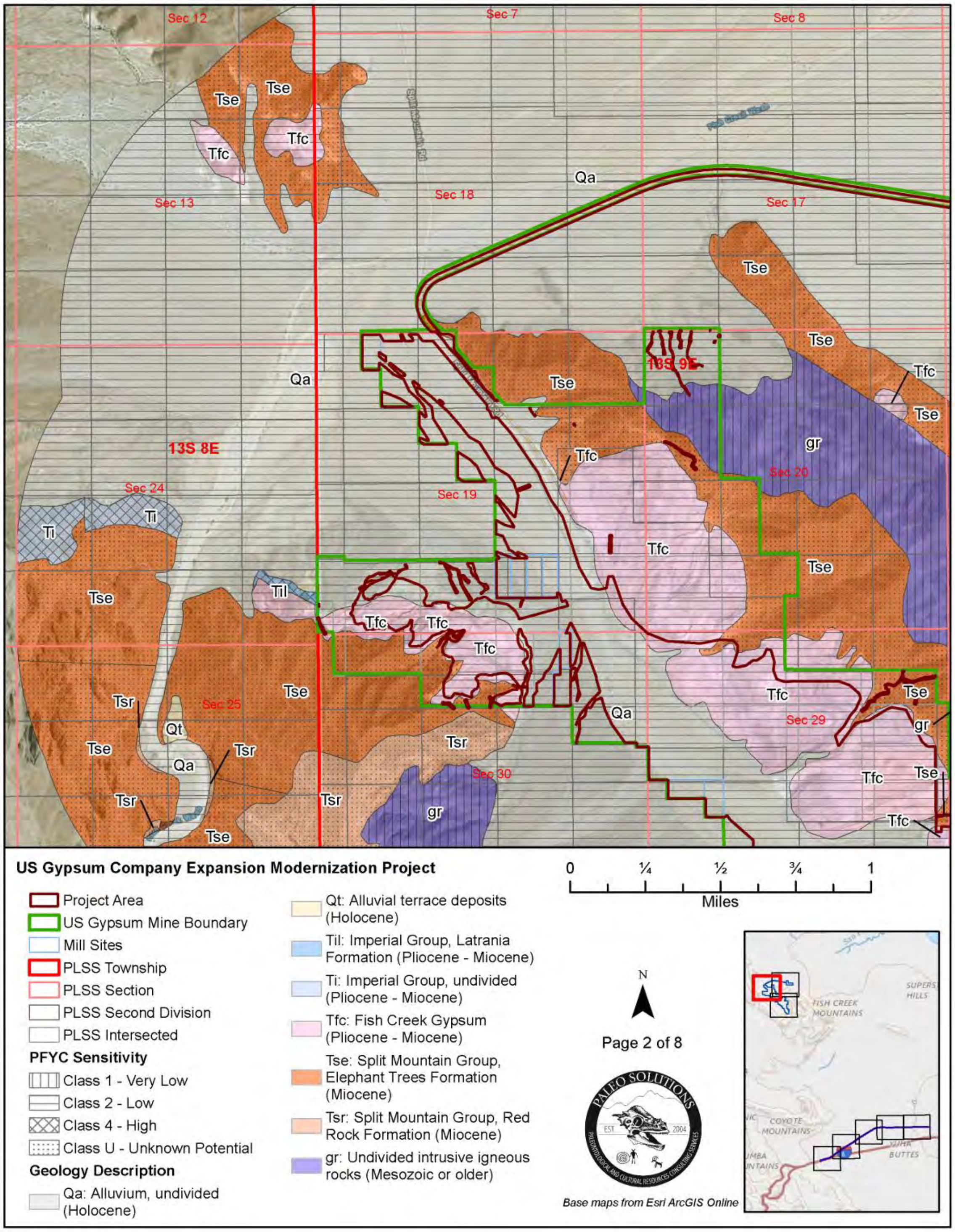

Figure A-2. Geologic Map of the Project area – Page 2.

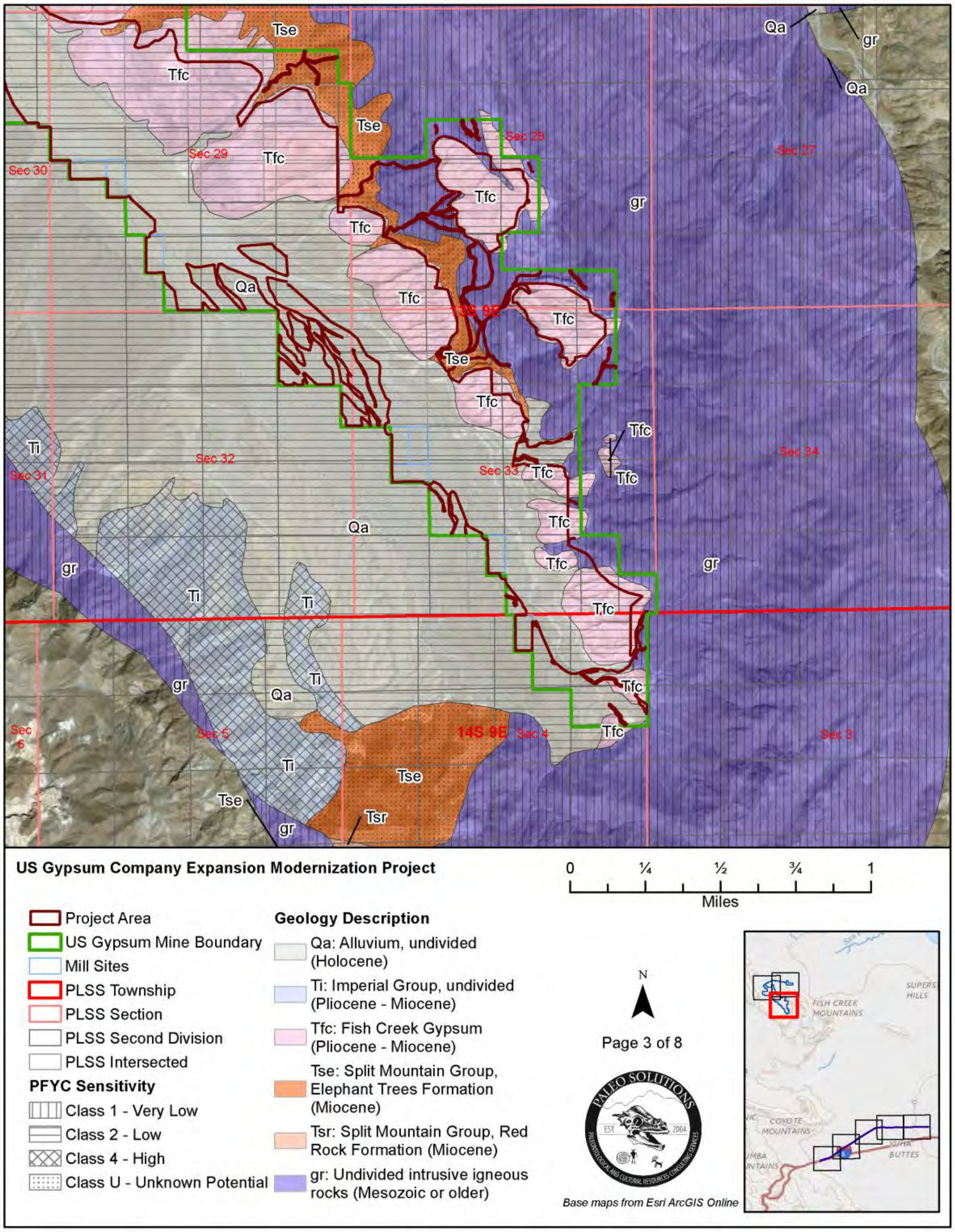

Figure A-3. Geologic Map of the Project area – Page 3.

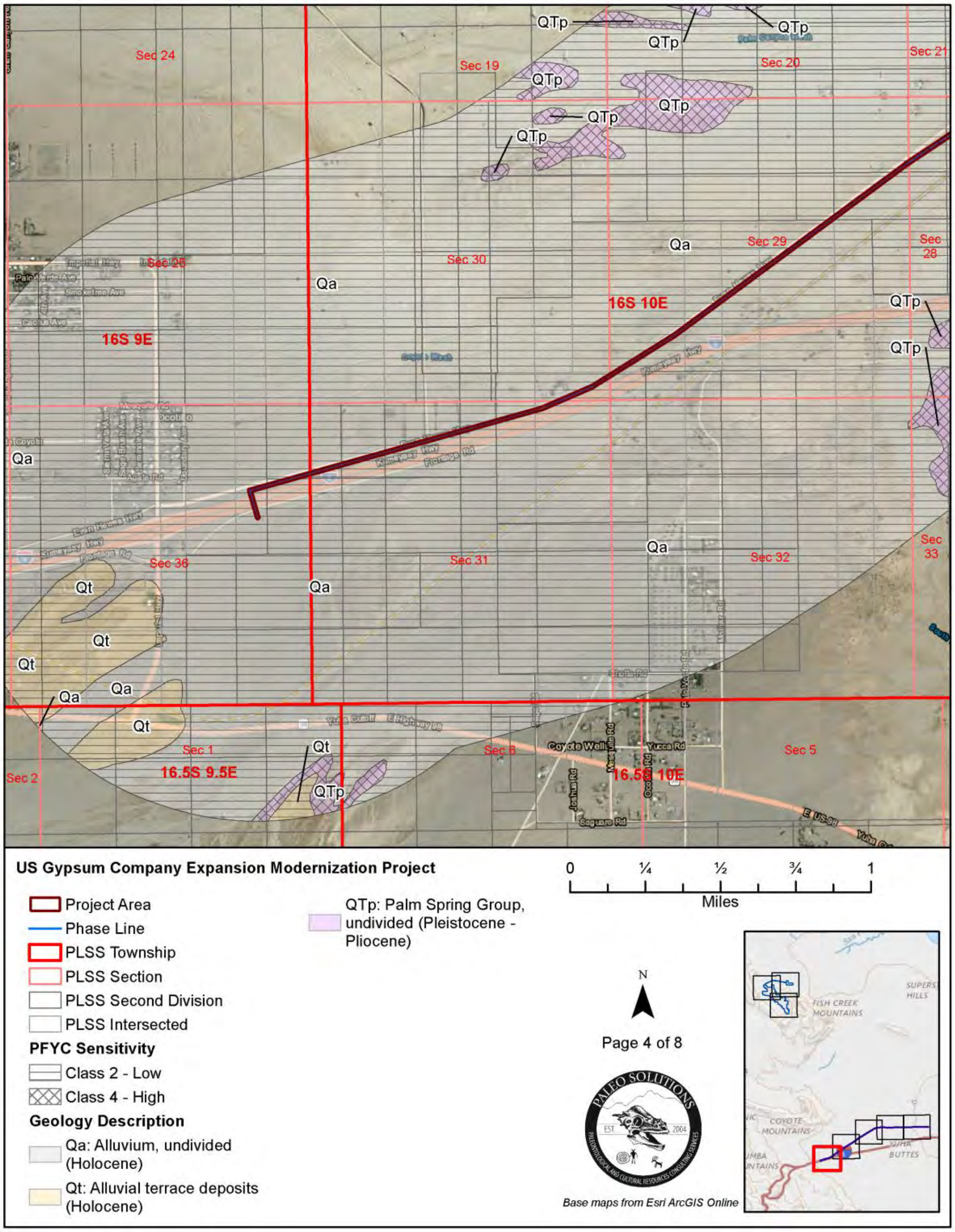

Figure A-4. Geologic Map of the Project area – Page 4.

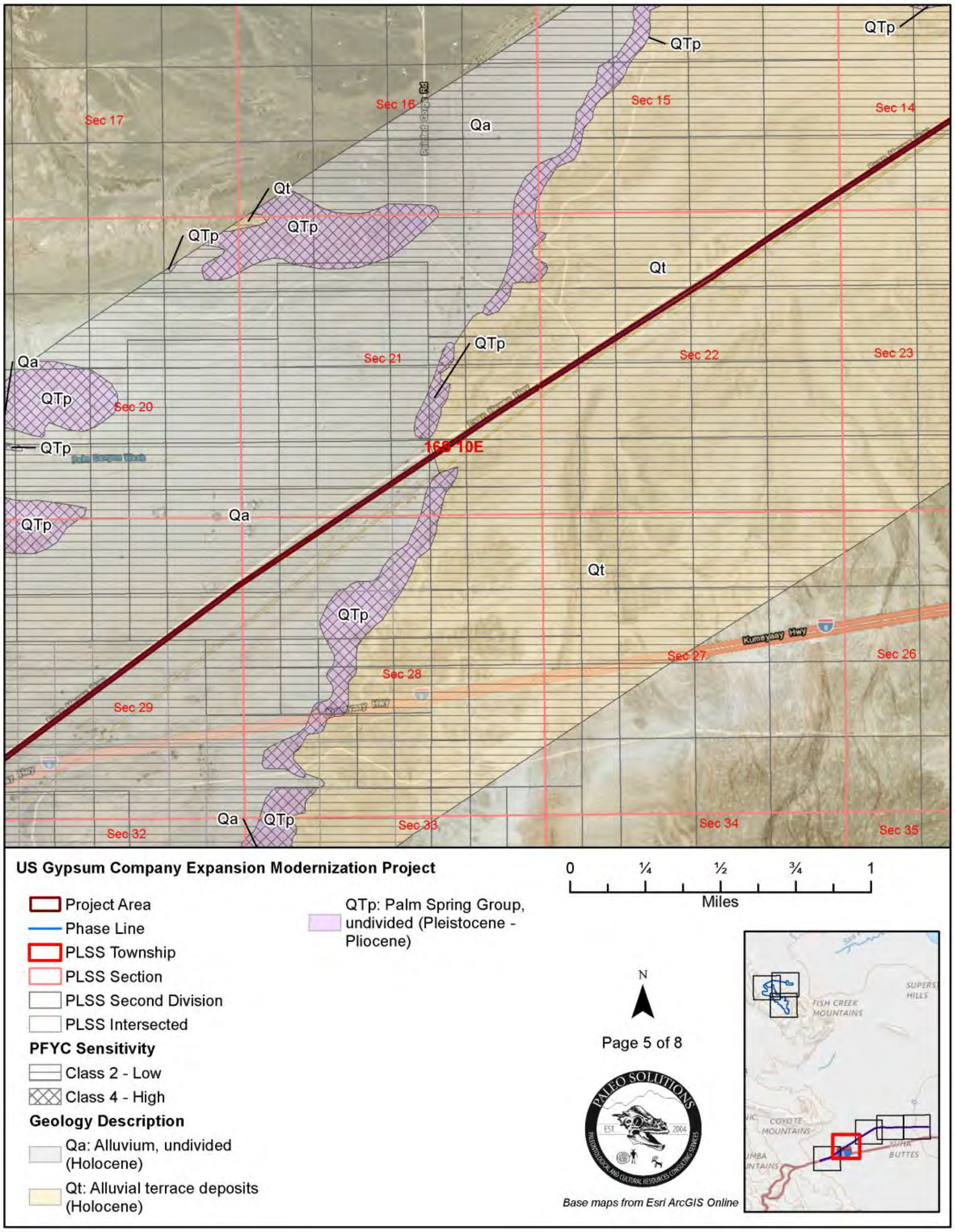

Figure A-5. Geologic Map of the Project area – Page 5.

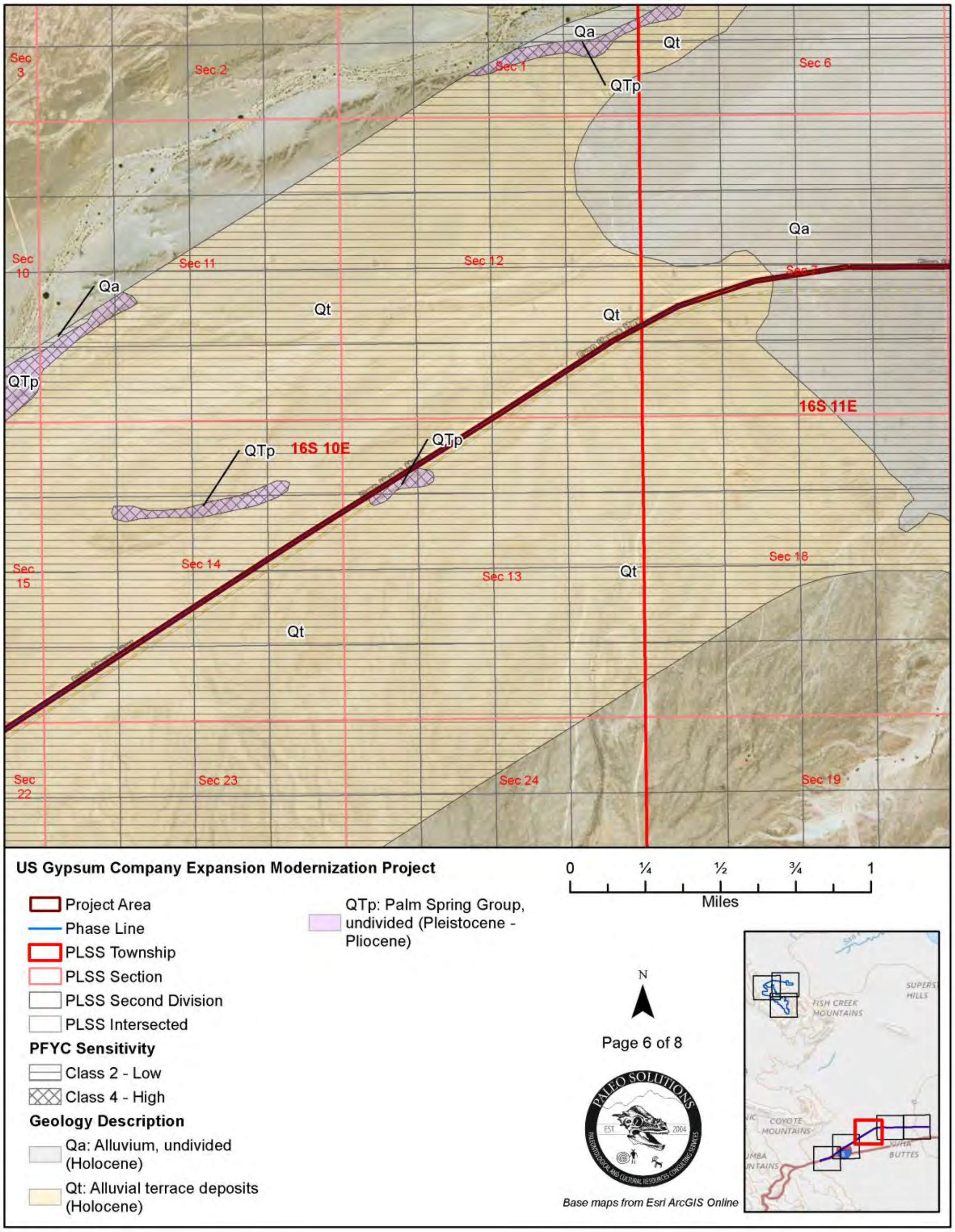

Figure A-6. Geologic Map of the Project area – Page 6.

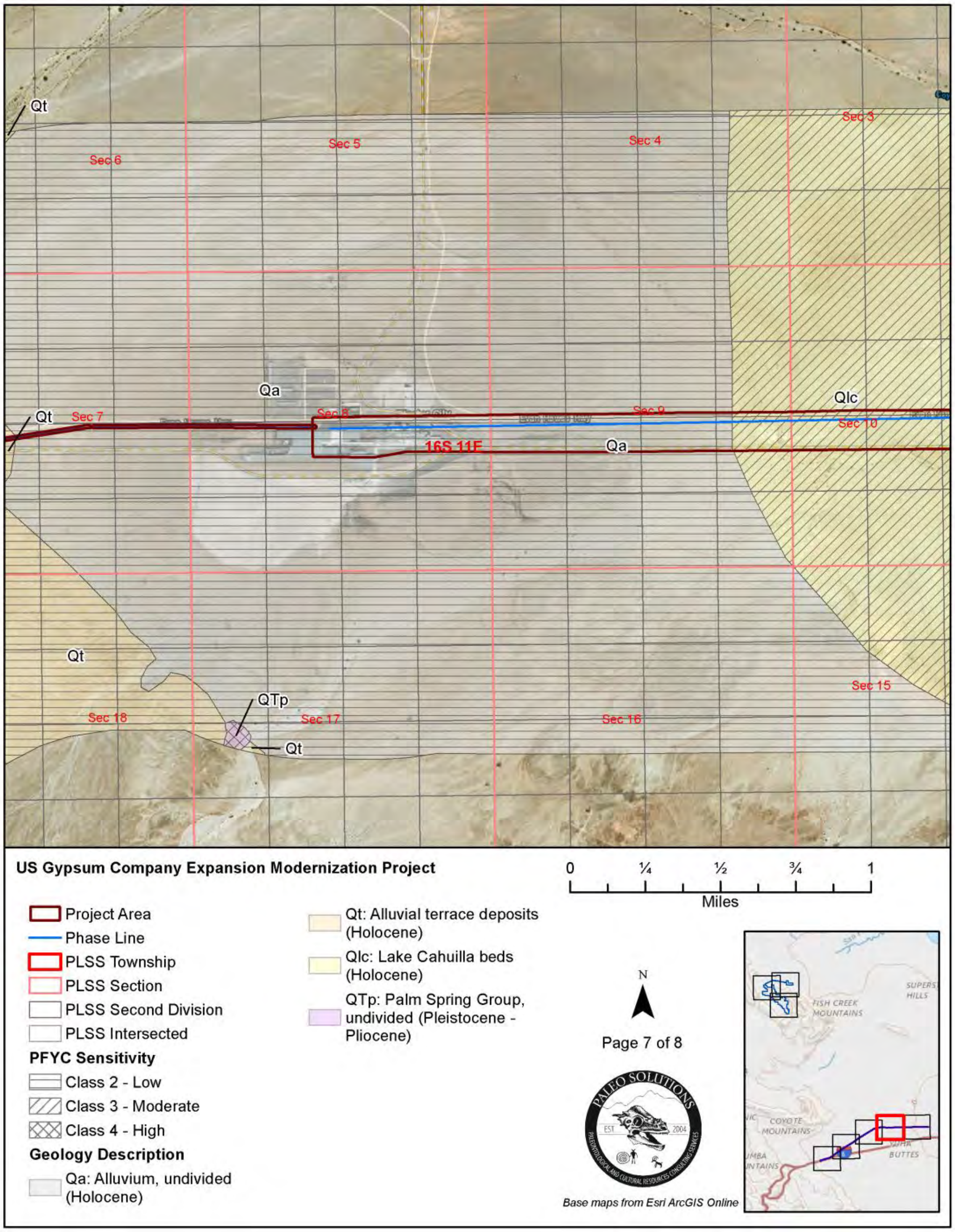

Figure A-7. Geologic Map of the Project area – Page 7.

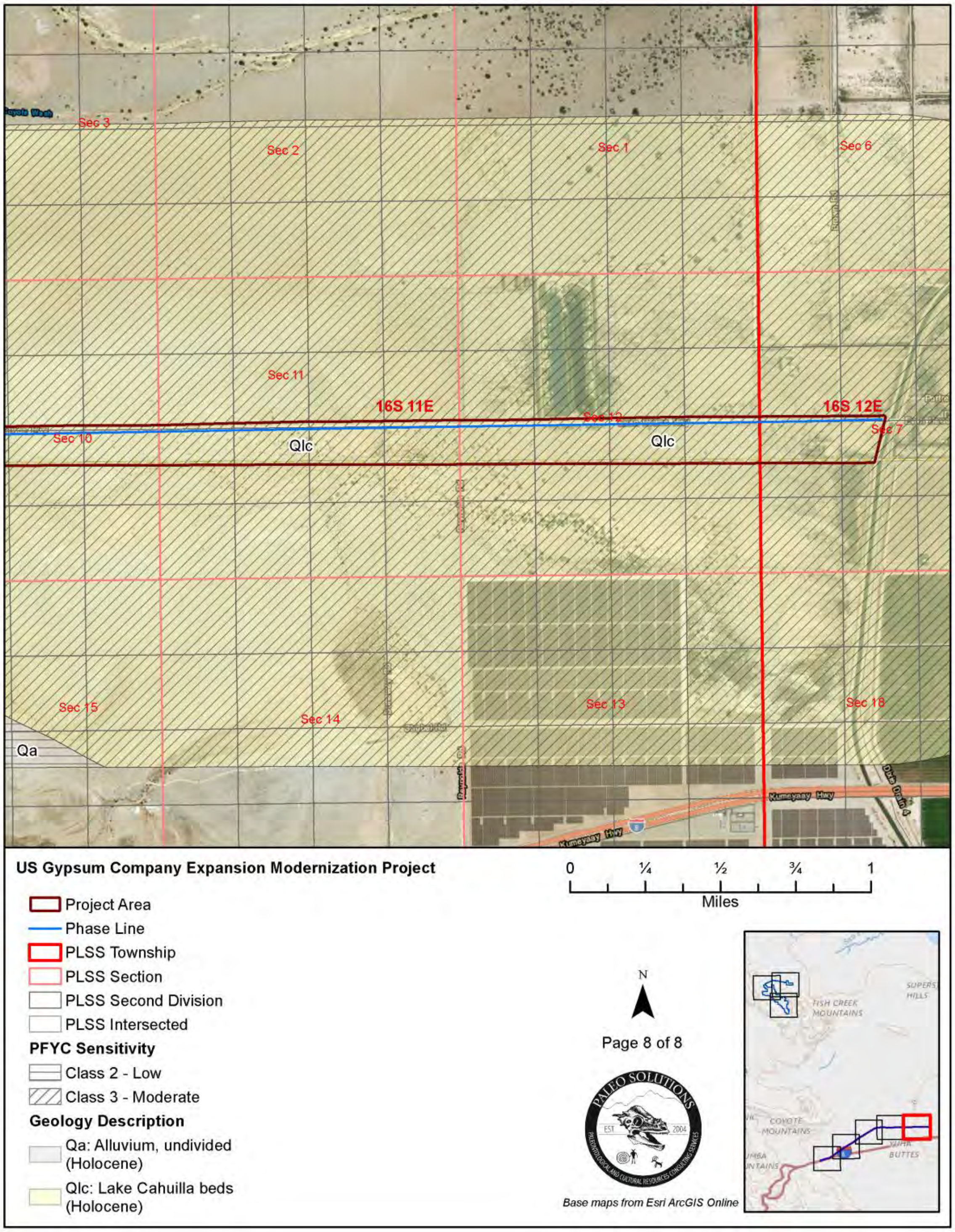

Figure A-8. Geologic Map of the Project area – Page 8.

APPENDIX B. MUSEUM RECORDS SEARCH RESULTS

Confidential Appendix Removed

THIS PAGE
INTENTIONALLY
LEFT BLANK