APPENDIX F

Geotechnical Study

GEOTECHNICAL STUDY
IN SUPPORT OF EIR

for

Carol Kimmelman Athletic and Academic Campus
Carson, California

Prepared For:

The Carol Kimmelman Center, LLC.
2121 East 7th Place
Los Angeles, CA 90021

Prepared By:

Langan Engineering and Environmental Services, Inc.
515 South Flower Street, Suite 2860
Los Angeles, California 90071

23 April 2019
Langan Project No. 700060401

LANGAN

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TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

Langan Engineering and Environmental Services, Inc. (LANGAN) has prepared this report at the authorization of The Carol Kimmelman Center, LLC to provide geotechnical analysis in support of an Environmental Impact Report (EIR) for the proposed Carol Kimmelman Athletic and Academic Campus (Project) at 340 Martin Luther King Jr. Street, Carson, California.

Provided herein is a brief site description, a description of the proposed project, an overview of available geotechnical information, and preliminary geotechnical analysis for the proposed structures and athletic fields. As discussed in more detail, a building-specific geotechnical investigation should be performed as part of the building permit phase to confirm the preliminary geotechnical concepts presented in this report for the specific structure(s).

2.0 PROJECT OVERVIEW

2.1 Site Description

The Project area is approximately 87 acres (Site) of the northeastern portion of the existing approximately 187 acre Victoria Golf Course. The County of Los Angeles (County) owns the Site, which the County currently leases for the operation of a golf course. Prior to the Victoria Golf Course's current use as a County golf course, it was the site of a portion of the former Ben K. Kazarian (BKK) landfill, which operated as a Class II municipal solid waste landfill from 1948 to 1959. The California Department of Toxic Substances Control (DTSC) is overseeing the former landfill's remediation. The entire former landfill site is divided into Operable Units (OU) focused on two separate remediation operations, of which the Victoria Golf Course site is OU-2. Refer to Figure 1 for a site vicinity map.

2.2 Proposed Development

The Project involves the redevelopment of the Site for public recreation purposes. Project components would include a tennis center, soccer center, learning center and various support buildings. Features of the Project include:

Tennis Center:

- The tennis center component would occupy approximately 28 acres developed with a 23,000 square foot welcome center, a spectator venue with up to 12 hard courts and 1,200 seats, 50 tennis courts of various sizes, a 5,000 square foot administration building, a 13,000 square foot player development building, and outdoor training spaces including a 100-meter sprint track, basketball courts, a training turf, a maintenance facility, and vehicle/ bus parking.

Learning Center:

- Adjacent to the tennis center would be an approximately 25,000 square foot learning center that would include classrooms, quiet rooms, staff support for homework, counseling, and tutoring.
- The welcome center and learning center will be located in the main entrance area within the northern portion of the Site.

Soccer Center:

- The soccer center component would occupy approximately 58 acres developed with eight full-sized grass soccer fields and two multi-purpose fields.

Other Improvements:

- Additional site improvements would include asphalt paved parking lots and two additional overflow parking areas between the fields and South Avalon Boulevard.
- Miscellaneous support buildings, including maintenance facilities, restrooms, and sheds, will be constructed throughout the Site.

Based on preliminary conceptual designs, the foundations for the tennis courts and soccer fields would consist of:

- The hard tennis courts will likely be built on post-tensioned slabs. Clay courts typically consist of a minimum 1-inch-thick fast-dry surface material over minimum 4-inch stone on a compacted subgrade. The tennis courts are assumed to have four 25-foot tall light poles on each side of the courts, with 35-foot-high light poles at the exhibition courts.
- Natural and synthetic-turf fields may be developed. The natural-turf fields would be expected to consist of a 12- to 18-inch section including about 10-inches of root-zone soil mix overlying a minimum of 4 inches of course gravel layer. Perforated pipes would be installed in a network of gravel-filled trenches beneath the course gravel layer. The artificial pitch would consist of synthetic turf over a layer of crumbled rubber or sand and rubber infill. Beneath the infill is a 6-inch aggregate layer (permeable rock). A network of perforated PVC pipes would be installed in gravel-filled trenches beneath the aggregate layer. Per FIFA regulations, the natural turf would be placed fairly flat, and the "cultivation and laser grading within the soil profile may be acceptable when the grades vary up to about +/- 50 mm." The soccer fields would have approximately six 60-foot-tall light poles for up to five fields.

3.0 AVAILABLE INFORMATION REVIEW

3.1 Document Review

LANGAN reviewed reports, maps and other public available information from the United States Geological Survey (USGS), California Geological Survey (CGS), City of Carson, Federal Emergency Management Agency (FEMA), California Division of Oil, Gas, & Geothermal Resources (DOGGR), Los Angeles County Department of Public Works (DPW's) and Department of Toxic Substance Control (DTSC). A summary of the available information reviewed is provided below.

3.2 Site Development History

Prior to 1947, the Site was a low-lying land referred to as Dominguez Slough, Dominguez Lagoon, Laguna Dominguez, Laguna Dominguez Slough and Garden Valley Slough. Historical topographic maps indicate that the ground surface formerly ranged from about el 26 (elevation in feet above mean sea level) in the northwest corner to about el 10 near the center of what would become a landfill. The Site was transected by a number of 200 to 500 feet wide drainage channels.

The June 2014 report titled Final Remedial Investigation and Feasibility Study for Soil and Soil Gas Media by Leighton Consulting (RI/FS report) states the land was leased for use as a municipal and industrial waste landfill from 1948 to 1960. Landfilling consisted of excavation to about el 1 to 2 (a depth of about 8 to 25 feet), and placement of refuse and liquid waste in a series of trenches separated by haul roads. The historical data in the RI/FS report provides the following description:

> *"The predominance of trenches appear to have been about 30 to 50 feet wide and up to several hundred feet long. Some of the trenches are over 200 feet wide and one was over 1,400 feet long ... Analysis of the topography of the northeast quadrant (of the Victoria Golf Course) suggests that for the more numerous trenches, the width is on the order of 40 to 50 feet with at least an 8 to 10-foot wide "spine" (of natural ground) left between adjacent trenches. This is reflected by the hill-and-valley topography across the driving range and the 4th and 9th fairways."*

The County of Los Angeles planned and built the Victoria Golf Course between 1962 and 1966. Differential settlement from the refuse was reported in a 1977 letter from the County of Los Angeles, Department of Park and Recreation to the Acting County Engineer. The letter reports uneven and "uncontrolled subsidence" within the Victoria Golf Course resulting in damage to irrigation systems and elimination of surface drainage.

In 1992, a topographic survey was performed at Victoria Golf Course for the County of Los Angeles. The topographic survey depicted settlement that was causing ponding of water and breakage of irrigation pipes. The differential settlement pattern reportedly followed the orientation of landfill trenching that was apparent from interpretation of historical aerial photographs. In December 1998, a grading plan for the refurbishment of off-site Cricket Fields (adjacent to the northwest end of the Project) indicated that 352,220 cubic yards of soil (up to one foot of soil cover) was added to the field to correct differential settlement.

3.3 Site Reconnaissance

A field reconnaissance was conducted on 30 July 2018 by LANGAN personnel and a Los Angeles County representative. The assessment of the Site, adjacent and surrounding properties was limited to identifying, if possible, any indications of settlement or collapsing soils, noting the general condition of the existing sidewalks and buildings, identifying existing utility lines, and noting the general description of adjacent streets and surrounding properties.

The concrete golf cart paths and maintenance area walls within the limits of the Site generally showed minor or no cracks. Evidence of concrete cracking or settling was noted in areas including part of the golf cart paths on the east side of the Site, parallel to South Avalon Boulevard; on the golf cart paths north side of the Site; north and east of the driving range; and on part of a concrete path that traverses the Dominguez Branch Channel in northwest side of the Site. Per discussions with the golf course facility staff, the concrete cart paths were installed approximately 8 to 10 years ago and the soil at the driving range was excavated approximately 2 to 3 years ago to plant new grass. The facilities staff noted that with the exception of the field at Hole 15 on the western side of the golf course, the grass within the golf course does not grow well. The facilities staff also noted that the field at Hole 13, on the south end of the existing golf course, was particularly more prone to flooding after a heavy rain compared to other parts of the course.

Evidence of settlement was also noted from cracks and differential movement along Martin Luther King Jr. Street north of the Site. Across from the golf course, evidence of settlement at Victoria Park was observed from tilting and exposed light pole foundations.

3.4 Regional Geology

The Site is located in the northern portion of the Peninsular Ranges geomorphic province, which extends from the Los Angeles Basin south of the Santa Monica Mountains to the tip of Baja

California. The province is made of elongated northwest trending mountain ranges, separated by straight sided sediment floored valleys. Geologic units of the province consist of Jurassic and Cretaceous age basement rocks, overlain by an estimated 32,000 feet of marine and non-marine sedimentary strata, from the late Cretaceous to Holocene epochs (City of Carson, 2004).

3.5 Geologic Hazards Review

Our geologic hazard review was performed in general accordance with CGS Special Publication 117A, "Guidelines for Evaluating and Mitigating Seismic Hazards in California." The following subsections present the results of our review of the potential geologic hazards as they pertain to the Site.

- Regional Faulting – Recognized and mapped faults within a 100-kilometer (km) radius of the Site based on the CGS "2010 Fault Activity Map of California" (Fault Activity Map) and "An Explanatory Text to Accompany the Fault Activity Map of California" (Explanatory Text) are shown in Figure 2A and Figure 2B, respectively.

  Additionally, according to a search of the USGS 2008 California Seismic Source Model within 20 miles (32 km) of the Site, the closest known active faults capable of producing the strongest ground shaking at the Site are the Newport-Inglewood Faults approximately 1.5 miles (2.5 km) east of the Site; the Palos Verdes Fault approximately 5.7 miles (9.1 km) southwest of the Site; the Puente Hills Faults approximately 8.3 to 13.4 miles (13.3 to 21.6 km) northeast and east of the Site; and the Elysian Park (Upper) Fault approximately 14.9 miles (23.9 km) north of the Site. Refer to Appendix A for a summary of USGS 2008 California Seismic Sources, including individual fault segments and fault segment combinations along with closest rupture distances from the Site to the fault, mean characteristic moment magnitudes for each fault segment, slip rate, and fault length for individual fault segments.

- Regional Seismicity – A search of the CGS earthquake catalogue using the computer program *EQSearch* found 66 earthquakes with magnitude 5.0 or greater have occurred within a 100-km radius of the Site since 1800. In addition, a search of the USGS ANSS Comprehensive Earthquake Catalog (ComCat) using a web-based Earthquake Archive Search and URL builder tool, found that as of 18 July 2018, 33 earthquakes with magnitudes between 5.0 or greater have occurred within a 100-km radius of the Site since 1900. A summary of the *EQSearch* and USGS ANSS ComCat reported earthquake events are provided in Appendix A.

- Surface Rupture – The Site is not within a mapped Alquist-Priolo (AP) Earthquake Fault Zone as defined by the AP Act, as shown in Figure 3. Geologic review does not indicate the presence of active surface faulting within or adjacent to the Site.

- Liquefaction – Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium-dense sand and gravel, and low-plasticity silts below the groundwater table. According to the CGS, the Site is within a mapped, currently established liquefaction-potential investigation zone, as shown in Figure 3.

- Historical High Groundwater – Based on the SHZR 035, the historically highest groundwater at the Site is about 10 to 20 feet below ground surface, as shown in Figure 4. As noted above, the presence of groundwater may increase the susceptibility to liquefaction for loose to medium granular soils and low-plasticity silts when subjected to sufficient ground shaking. The Department of Water Resources shows a well approximately 1.5 miles southeast of the Site with groundwater depth measurements from 2014 to 2018 and it shows groundwater at an approximate depth of 65 feet.
- Landslides – According to the CGS and SHZR 035 Landslide Inventory, the Site is not within a mapped Earthquake-Induced Landslide Hazard Zone or a mapped landslide area, as shown in Figure 5.
- Seismic-Induced Ground Deformations – Seismic-induced ground deformations include ground-surface settlement, differential settlement and lateral spreading resulting from liquefaction and cyclic densification of unsaturated sands and gravels. The Site is mapped within a liquefaction potential investigation zone and is underlain by a landfill; therefore, differential seismic-induced ground deformations are expected.
- Lateral Spreading - Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a slope, by earthquake and gravitational forces.
- Flood Mapping – According to the City of Carson's Safety Element, the Site is not within a mapped 100-year flood zone, as shown in Figure 6. Based on the FEMA Flood Insurance Rate Map Number 06037C1935F (26 September 2008), the Site is partially in an area determined to be outside the 0.2 percent annual chance floodplain, and partially inside an area of 0.2 percent annual chance flood; 1 percent annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and protected by levees from 1 percent annual chance flood, as shown in Figure 7. Because of the Site's relative proximity to the Dominguez Branch Channel with special flood-hazard areas, it may be subject to flooding if flows exceed the channel design levels.
- Tsunami and Seiche – According to information and maps available from the California Department of Conservation, the Site is not within a mapped tsunami inundation- hazard zone, as shown in Figure 8.
- Subsidence – Land subsidence may be induced from withdrawal of oil, gas, or water from wells or from settlement of the landfill. According to a search of the DOGGR Well Finder online tool, no active oil, gas, or geothermal wells are mapped within the Site. According to our review of the available information from DOGGR, the Site is not considered to be subject to land subsidence from oil, gas, or water withdrawal from oil wells.
- Methane – According to the DPW's Solid Waste Information Management System, the Site is within the methane-producing BKK Landfill. Methane mitigation system may be required for enclosed, habited structures.

3.6 Available Document Information

The following table summarizes reports that were reviewed by LANGAN and that pertain or are in proximity to the Site:

Document	Summary of Document Findings
Leroy Crandall and Associates (1976), Report of Foundation Investigation Proposed Blimp Hangar and Administration Building Goodyear Blimp Base 19200 Main Street Carson, California dated 21 December 1976	Leroy Crandall and Associates performed a foundation investigation for a blimp hangar and administration building approximately 200 feet northwest of the Site on November and December 1976. The foundation investigation consisted of nine bucket-auger borings. Two borings were drilled to a depth of 15 feet in the location of a proposed administration building, and seven borings were drilled to a depth of 24 to 66 feet at a proposed hangar location. Fill was encountered to a depth of 3 to 6 feet and consisted of silty clay, silty sand, silt and clay. Waste was encountered from a depth of 3 to 25 feet. Native material was encountered beneath fill or waste and consisted of clay, silt, silty sand, and sand. "Water seepage" was encountered at depths of 16 to 28 feet. Groundwater was encountered at depths of 34.5 to 48 feet. Shallow foundations were recommended for the proposed administration building with an allowable bearing of 3,000 pounds per square foot (psf). Driven piles were recommended through existing fill, waste and into native material for support of the blimp hangar.
H.V. Lawmaster & Co., Inc., (1978), Foundation Investigation Report, Proposed Storage Building, Los Angeles Blimp Base, Main Street, North of San Diego Freeway (I-405), Carson, California, dated 8 May 1978	H.V. Lawmaster performed a field investigation in April 1978 for a one-story steel frame building approximately 200 feet northwest of the Site. The field investigation consisted of drilling four bucket-auger borings to a depth of 10 to 31 feet. Waste was not encountered in any of the borings. Fill was encountered in one boring to a depth of 10 feet and consisted of sandy clay and silt with organic matter. Native material was described as silty clay, clayey silt with various amounts of sand. Fine sand was encountered from 25 to 30 feet. Shallow foundations were recommended with an allowable bearing capacity of 2,000 psf. Coarse aggregate and perforated pipes were recommended below the floor slab as a methane mitigation system.
H.V. Lawmaster & Co., Inc., (1978), Project: Proposed New Storage Building, Los Angeles	H.V. Lawmaster performed a field investigation in May and June 1978 to

Blimp Base, Carson, California, Subject: Delineation of Dump Site, dated 24 May 1978	delineate waste approximately 200 feet northwest of the Site. The field investigation consisted of three borings and seven test pits. Borings were drilled to a depth of 16 to 25 feet. Test pits were excavated to a depth of 10 to 14 feet.
H.V. Lawmaster & Co., Inc., (1983), Re; Results of Soil Borings and Tests at Goodyear Airship Operations Center, Carson, California, dated 23 May 1983	H.V. Lawmaster performed a field investigation in May 1983 approximately 200 feet northwest of the Site. The field investigation consisted of drilling two bucket-auger borings to a depth of 25 feet. The first boring encountered fill to a depth of 23 feet followed by "natural" soil. Fill was described as clayey sand, clay and silt with small wood particles and [gaseous] odor. Native material was described as clayey sand with silt and sandy clay. The second boring encountered fill to a depth of 8 feet, waste from 8 to 24 feet, and natural soil from 24 to 25 feet. Fill was described as silty clay and clayey sand. Native material was described as silty clay.
Ecology and Environmental, Inc., (1994), CERCLA Screening Site Inspection, Field Investigation Team Zone II, Appendix D, Site Reconnaissance Interview and Observation Report, dated 23 April 1994	A review letter regarding subsidence at the Victoria Golf Course states that three feet of fill material was placed over the entire site to meet the conditions of an Industrial Waste Permit. The letter states that major decomposition and settlement occurred within one year of placement. Golf course irrigation required to keep the grass and vegetation in an acceptable condition was described has having an effect on the decomposition rate and settlement of the landfill. A site reconnaissance by Bechtel Environmental, Inc., of the Victoria Golf Course reported that the Victoria Golf Course has exhibited land subsidence with ground levels differing by 2 to 5 feet in certain areas creating swales for hundreds of yards. The land subsidence appeared to trend in the direction in which trenches were excavated. An average of 3 feet of fill material was placed on top of the BKK Landfill as a cap. Drainage ditches had been constructed throughout the golf course however subsidence had

	rendered nearly all of them non-functional. Water ponding was observed in the southeastern portion of Victoria Golf Course with diameters ranging from 1 foot to 30 yards.
Applied Geosciences, Inc., (1995), Environmental Considerations for Improvements, Victoria Golf Course, 340 East 192nd Street, Carson, California, dated 20 March 1995	Plate A – Landfill History shows limit of wastes for different years including 1952, 1956, 1957, 1958 and 1966. The limits of wastes generally encompass the entire Site with the exception of the northern portion and some areas that extend into the Site on the east.
ATC Environmental, Inc., (1996), Draft Focused Environmental Impact Report, Victoria County Golf Course, Section 3.0, Discussion of Environmental Issues, dated 14 August 1996	The report states that the amount of subsidence at the Victoria Golf Course ranged from inches to several feet. Subsidence in the northeast quarter was from 4 to 5 feet. Most prominent subsidence was located in the northeast quadrant where closely spaced, narrow waste filled trenches were created. The linear gully-like features were evident in other areas with orientations dependent upon the underlying trenches. Erosion and down cutting in the landfill cover was evident in the northeast. Landfill materials were anticipated to reach a maximum depth of 20 feet because excavations were stopped at 0 to 2 feet above mean sea level (msl) and the top of trench fill was at 20 feet above msl. DTSC personnel noted that the depth to the trash base ranges from 25 to 30 feet and trash thickness averages around 20 feet. The report states that data indicating refuse has been encountered up to 30 feet suggests that some excavations extended to 10 feet below msl. The thickness of soil cover was unknown however the landfill permit required 2 feet of soil cover while the County of Los Angeles reported that trenches were topped off with enough cover (3 feet) to prevent odor, infiltration, and vectors. The report concluded that ultimate settlement potential for soil cover is 20 percent of original thickness and 30 to 50 percent of original

	thickness for waste material. It was assumed that landfill trenches were 20 to 30 feet deep with ultimate settlement of 6 to 15 feet. It was also assumed that cover soil with a thickness of 0 to 20 feet would have an ultimate settlement of 5 feet. The range of potential ultimate settlement for any given area should be 6 to 20 feet. Observations indicate that approximately 2 to 10 feet of subsidence has occurred at various locations and therefore 4 to 10 feet of potential subsidence remained. The report states "other studies" indicate that the rate of settlement is approximately 1 percent of total fill thickness per year. The rate is assumed to apply from mid-point of operations (estimated as 1955) and applied to a range of trash and soil thickness of 20 to 50 feet. Figure 3.1-2 – Boundaries of Landfilling Activity between 1951 and 1958 appears to show the limit of wastes to generally encompass the entire Site with the exception of the northern portion and some portions of the east.
Hushmand Associates, Inc. (Hushmand), (2006), "Geotechnical Evaluation of Concrete Pad and Caissons Used for Anchoring of Goodyear Blimp, Gardena, Los Angeles County, California (Revision 1), dated July 2006.	Hushmand performed a field investigation in December 2006 approximately 200 feet northwest of the Site to evaluate a circular concrete pad supported with caissons. The field investigation consisted of hand-augering four borings to a depth of 6 feet. Dense, silty clayey sand was encountered to a depth of 3.5 feet and stiff lean clay from 3.5 to 6 feet. The circular concrete pad was supported by square caissons with dimensions of 3.25 feet for depth, 3.25 feet for length and width; however, the existing caissons were replaced with new caissons with the same dimensions.
Leighton Consulting, Inc., (2014), "Final Remedial Investigation and Feasibility Study for Soil and Soil Gas Media, Former BKK Landfill, Carson Dump Operable Unit 2, City of Carson, California," dated 10 June 2014.	Leighton performed a field investigation between December 2006 and October 2007 at OU-2 to characterize the hydrogeologic setting, soil and soil gas. The field investigation consisted of pushing 74 Cone Penetration Tests (CPTs), drilling 3 coreholes, installing 22 groundwater wells, installing 75 soil-gas wells, and drilling 234 soil borings

	using direct-push equipment (geoprobes). Depth of soil cover was approximately 2 to 15 feet (el 27.5 to 11.5). Depth to the bottom of waste was encountered from approximately 10.5 to 36.5 feet (el 15.5 to -4.5 feet). Encountered waste thickness was from 1 to 25 feet, and groundwater depth was from 9 to 43 feet (el 7 to -16 feet).
Burns McDonnell, (2016), "Remedial Action Plan for Soil and Landfill Gas Media, Former BKK Landfill, Carson Dump, Operable Unit 2, 340 East 192nd St., 19202 South Main St., 19200 South Main St., City of Carson, California 90248" dated June 2016	Burns McDonnell performed a field investigation between December 2006 and August 2008 at OU-2 to define the nature, magnitude and extent of potentially hazardous substances. The field investigation consisted of drilling three stratigraphic boreholes, 123 direct-push borings, pushing 74 CPTs, installing 22 groundwater monitoring wells and 75 soil-gas probes. The depth to the top of the waste zone was from 1.5 to 15 feet (el. 27.5 to 11.5 feet) and the base of the waste zone was from 10.5 to 36.5 feet (el. 15.5 to 4.5 feet). The volume of waste was estimated as 4.356 million cubic yards and was reported as mixed with soil. The percentage of soil versus waste was assumed as 20 percent soil and 80 percent waste.

4.0 GEOLOGIC HAZARDS AND MITIGATION FINDINGS

4.1 General Subsurface Conditions

Based on the available information, the Site is underlain by 1.5 to 15 feet of soil cover (el 27.5 to 11.5 feet) consisting of sandy silt, clayey sand, sandy clay and clay with the predominant soil type as sandy clay. The RI/FS report concluded that the existing soil cover, if monitored and maintained, can be an effective cap for lateral and vertical containment of waste materials. Waste material underlies the soil cover and the depth to the bottom of the waste ranged from 10.5 to 36.5 feet (el 15.5 to -4.5) with thickness ranging from approximately 1 to 25 feet. The RI/FS report described waste material as wood, glass, brick, paper, straw, cardboard, concrete, rubber, wire cable, asphalt, metal, plastic and fabric fragments with stained black/brown/gray soil. The RI/FS reports that native soil underlies fill in the northern portion of the Site and underneath waste material where waste material was encountered. The BKK landfill predates the use of engineered liners and therefore a liner was not encountered beneath the waste. The depth of fill in the northern portion was not reported however the depth to native soil beneath waste material was reported as 10.5 to 36.5 feet (el 15.5 to -4.5 feet). Native soil was described as sandy silt, sandy clay, clay and fat clay. Groundwater was reported at a depth from 9 to 43 feet (el 7 to -16 feet).

Differing information regarding the limits of the former landfill has been found in available literature. Figures prepared by the Department of Water Resources and Bryan A Stirrat and Associates dated June 1988 show the limit of waste at Victoria Golf Course appears to include the southern portion of the Site with the north and northwestern portion excluded from the limit of waste. The RI/FS report shows the limit of waste includes most of the southern and northwestern portion of the Site and excludes the northern, parts of the eastern and southeastern portions of the Site. Figures prepared by Applied Geosciences, Inc., and ATC Environmental, Inc., show the limit of wastes generally encompass the Site with the exception of the northern portion and some areas on the east. The figures are attached in Appendix B.

4.2 Seismic Hazard

The Site is in a currently established seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. Because of the Site's proximity to several nearby active faults, moderate to strong ground shaking could occur from an earthquake on any nearby fault. Seismic ground shaking has the potential to significantly impact the Project. Compliance with applicable building code requirements would reduce the potential for structures on the Site to sustain significant damage during an earthquake event and reduce impacts related to ground shaking to less than significant.

Based on the geologic and special studies zone map review, an indication of active faulting within or adjacent to the Site is not shown, therefore surface rupture is anticipated to have a less than significant impact on the Project.

Based on the historical high groundwater and CGS, liquefaction potential at the Site should be evaluated and mitigation measures, as required, should be implemented, as necessary, based on the design geotechnical investigation for the applicable structures. In areas of high liquefaction potential, mitigation could include ground improvement or deep foundations extending through the potentially liquefiable soils and structurally-supported floor slabs for buildings. In areas of moderate liquefaction potential, mitigations could include special foundation design procedures, such as extra reinforcement and strengthening of building foundations and floor slab systems. Areas with low potential for liquefaction may not require any specific foundation treatment or ground improvement. Liquefaction has the potential to significantly impact the Project. With site-specific liquefaction hazard studies and applicable liquefaction mitigation, impacts related to liquefaction would be reduced to less than significant. The Dominguez Channel is approximately 500 feet from the Site and the adjacent creek has an invert above the potential liquefiable soil, therefore the potential for lateral spreading is expected to be low.

According to the CGS, no earthquake induced landslide investigation zones or landslides are mapped within the Site. Landslides are anticipated to have a less than significant impact on the Project.

The Site is within a mapped liquefaction potential investigation zone and is underlain by a landfill; therefore, differential seismic-induced ground deformations are anticipated. Potential ground deformations should be mitigated at Project building areas; the mitigations should be developed based on the design geotechnical report, but could include ground improvement such as dynamic compaction, pile support of structures, use of mat foundations or stiffened slabs, etc. With site-specific geotechnical studies and applicable mitigations in compliance with applicable building code requirements, impacts related to liquefaction would be reduced to less than significant.

4.3 Expansive Soils

Based on the review of geotechnical reports for adjacent sites, summarized in Section 3.6, laboratory results for surficial soils had a very low to low expansion potential. Laboratory testing should be performed as part of the geotechnical investigation to confirm the expansion potential of surficial soils. Expansive potential soils are anticipated to have a less than significant impact on the Project.

4.4 Soil Corrosion

Based on the review of geotechnical reports for adjacent sites, summarized in Section 3.6, laboratory results for surficial soils had a low to moderate water-soluble sulfate concentration. However, since this site is a former landfill, the subsurface materials could be corrosive to concrete and ferrous metals. Laboratory testing should be performed as part of the geotechnical investigation to confirm the corrosive potential of surficial soils and subsurface soils that will be in contact with site element foundations. The mitigation of corrosive soils could include use of specific types of pipe, insulation, coatings, and cathodic protection or concrete admixtures. Corrosion potential soils are anticipated to have a less than significant impact on the Project if mitigated through site specific testing and design in accordance with American Concrete Institute and Caltrans Corrosion Design Standards.

4.5 Sedimentation and Erosion

The Site should be graded to ensure positive drainage away from the locations of the proposed development. Proper drainage should be maintained at all times.

Ponding or trapping of water in localized areas can cause differing moisture levels in the subsurface soil. Erosion protection and drainage-control measures should be implemented for construction during inclement weather. During rainfall, backfill operations may need to be restricted to allow for proper moisture control during fill placement. With compliance with applicable building code requirements, sedimentation and erosion are anticipated to have a less than significant impact on the Project.

4.6 Oil Wells and Methane Gas

According to a search of the DOGGR Well Finder online tool, no active oil, gas, or geothermal wells are mapped within the Site. The Site is a former landfill, so a methane mitigation system may be required for enclosed, habited structures. With compliance to applicable County requirements for building mitigation systems, impacts related to methane gas would be less than significant.

4.7 Settlement

The soil fill and the landfill material underlying the site have been placed in a heterogeneous manner and could experience additional differential settlement due to the variable and compressible nature of the material. The amount of settlement expected from the landfill is highly variable and is a function of the depth, type of waste, age of the waste, organic content and water content of the material disposed of. This landfill is fairly mature, and based on the historic data, a significant amount of settlement (up to 10 feet reported) may have already occurred from decomposition. Due to the way the landfill was constructed, larger differential settlements could be anticipated between the areas underlain by landfill material and those underlain only by soils. The landfill operations in this area reportedly stopped in 1960; therefore, the material has been decomposing for over 58 years. Based on the age of the landfill, the

primary settlement of the waste is expected to have occurred; however, additional decomposition (and associated settlement) is anticipated to occur over the life of the Project. Based on LANGAN's conceptual rough grading plan, after ground improvement, additional fill (up to 7 feet) is anticipated to be required to meet grade in some portions of the Site. The load from the new fill is anticipated to cause additional settlement. Structures located over the landfill may require deep foundations extending through the landfill. Downdrag loads resulting from decomposition and settlement of the landfill would be added to the design loads for the piles.

5.0 PRELIMINARY EVALUATION

Proposed structures outside the limits of waste are anticipated to be supported on shallow foundations and slab-on-grade. For structures proposed within the limits of waste, deep foundations that bypass the waste and founded in the native soil could be used. Considering the reported waste thickness, existing and proposed additional soil cover, the piles would need to be embedded in native soils that reportedly exist about 10 to 35 feet below future grade.

The proposed fields and tennis courts are lightly loaded, so typically they would be expected to be supported on improved subgrade as long as some future settlement of these areas would be considered acceptable. With ground improvement consisting of dynamic compaction (DC), the tennis courts could be supported on a mat foundation to reduce differential settlements between areas underlain by landfill material and area not underlain by landfill material. Alternatively, the tennis courts could be supported with post-tension structural slabs spanning between pile-supported grade beams. Support of natural fields would not need ground improvement, however more frequent maintenance may be required.

Proposed light poles can be supported on individual piles or on the court mat with ground improvement. Proposed hardscape (sidewalks, paved parking) could be supported on improved ground. Proposed utilities are expected to be supported on improved ground or structurally supported.

5.1 Seismic Design

Seismic design of structures can be designed in accordance with the provisions of ASCE/SEI 7-10 and 2016 California Building Code. Based on the available subsurface information, and in accordance with the seismic provisions of these codes, the following preliminary seismic design parameters are recommended for structures outside the limit of waste:

- Mapped Spectral response accelerations S_S and S_1: 1.627g and 0.605g, respectively.
- Site Class D
- Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters at short periods, S_{MS}, and at one-second period, S_{M1}: 1.627g and 0.907g, respectively.
- Design Earthquake (DE) spectral response acceleration parameters at short period, S_{DS}, and at one-second period, S_{D1}: 1.085g and 0.605g, respectively.
- MCE_R Design Peak Ground Acceleration (PGA_M) of 0.614g.

MCE_R = Risk-Targeted Maximum Considered Earthquake

The limit of waste is classified as Site Class F and seismic design of buildings within the limit of waste will require a site specific response analysis.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Site Preparation

Prior to work on the Site, the landscaping, utilities and structures for the Victoria Golf Course will need to be removed and disposed of in accordance with state and local regulations. Removal of the soil cover should be limited to reduce the potential to expose landfill refuse. Prior to mobilization of ground improvement equipment, the site should be graded and proof rolled as necessary to prepare a working surface for construction equipment.

6.2 Ground Improvement

Dynamic Compaction is a ground improvement method for densifying soils, particularly in sites with old fill and landfills. One of the primary targets for dynamic compaction is to reduce differential settlement that potentially can occur. Generally the setup for this method involves a crane capable of lifting large tampers, formed from steel and/or concrete, and then dropping the weight in a specified grid pattern. Depending on the size of the crater created from dropping the tamper, additional passes over the grid may be required.

Depths of improvement vary depending on subsurface conditions and equipment used. Ground improvement grids should extend a minimum of 5 to 10 feet beyond the proposed improvement footprint. Depending on the drop weight used, subsurface improvements can range from 10 to 30 feet generally with improvements at greater depths depending on the number of passes, weight of tamper, and pre-determined grid setup. Crater depths of varying thickness are created as the weight is dropped. The craters will need to be filled in with compacted soil.

The most common techniques used for confirmation of ground improvement following DC verification include in-situ density using Standard Penetration Test (SPT) and Cone Penetrometer Testing (CPT). The verification test should include in-situ testing prior and after dynamic compaction. If the above verification methods prove unreliable or not feasible, onsite plate load testing after ground improvement can be performed to estimate bearing capacity and settlement.

6.3 Fill Material and Compaction Criteria

Soil fill should be placed over 3 percent of their optimum moisture content, and compacted to the following maximum dry density in accordance with ASTM D1557 (Modified Proctor): 95 percent on building areas and areas sensitive to differential settlement and 90 percent in other areas.

7.0 DESIGN PHASE STUDIES

At this time, we recommend performing the following studies:

1. A geotechnical engineer should prepare a geotechnical study that complies with all applicable state and local code requirements. Each of the potential geologic hazards described in this report should be addressed, recommendations provided in the design-level report implemented, as necessary. The design-level geotechnical report should include all applicable recommendations in this report. To summarize, the following actions are recommended:
    a. Geotechnical investigation to delineate the lateral and vertical limits of waste, determine the groundwater and native soil depth.
    b. Analyze the potential for liquefaction, settlement, expansive and corrosive soils.

c. Develop precise recommendations for soil improvement and foundation design.
d. As needed, a site specific response analysis and ground motion design for buildings proposed within the limits of waste. Including a geophysical investigation beneath the proposed building footprint to determine the waste characteristics needed for a dynamic analysis.
e. Review structural loading, and confirm or refine preliminary foundation types, bearing capacities, and anticipated settlements.
f. Review of final demolition plans, civil and grading plans, structural plans and loads, perform final foundation analyses, and develop final foundation recommendations.

8.0 LIMITATIONS

This report has been prepared to assist the design of the proposed Project and to support the Environmental Impact Report. The conclusions and recommendations provided in this report are preliminary and based on a "desk study" of information from others, which we have relied upon as being accurate and representative of the conditions at the Site. A design level geologic and geotechnical study (including field and laboratory testing) is recommended to develop formal design and construction recommendations.

9.0 REFERENCES

9.1 Publications

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9.2 Reports

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9.3 Plans

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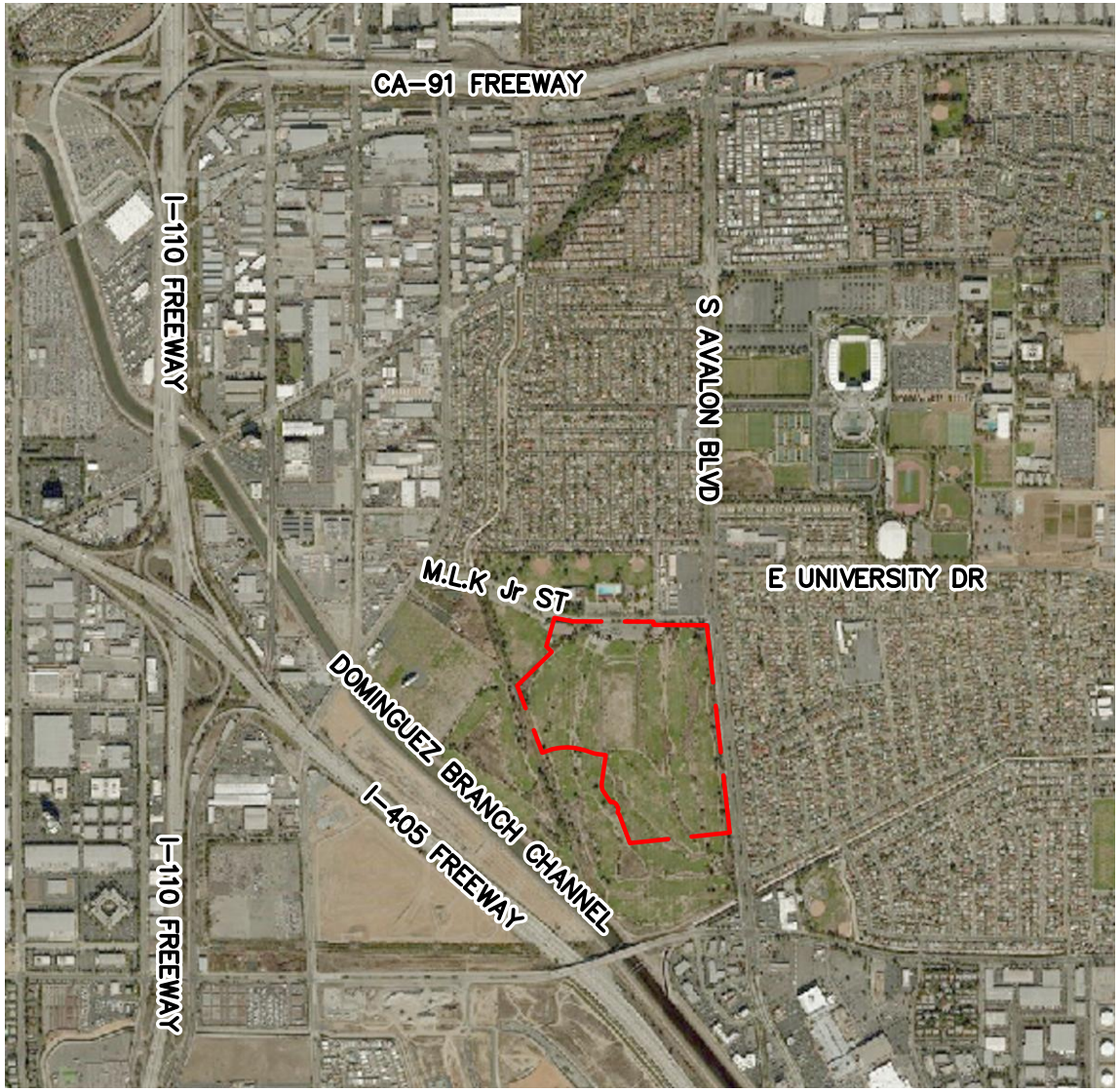
FIGURES



NOTES:

1. BACKGROUND AERIAL IMAGE OBTAINED FROM BING MAPS ON 23 JULY 2018.
2. CONCEPTUAL SITE PLAN AND SITE LIMITS REFERENCED FROM PLAN TITLED, "CONCEPTUAL SITE PLAN & PROGRAM, KIMMELMAN FOUNDATION SPORTS & ACADEMIC COMPLEX, CARSON, CA," PREPARED BY MEIS, DATED 11 JANUARY 2018.

LEGEND:

APPROXIMATE SITE LIMITS

PRIVILEGED AND CONFIDENTIAL - PREPARED AT REQUEST OF COUNSEL

2000 1000 0 2000

SCALE IN FEET

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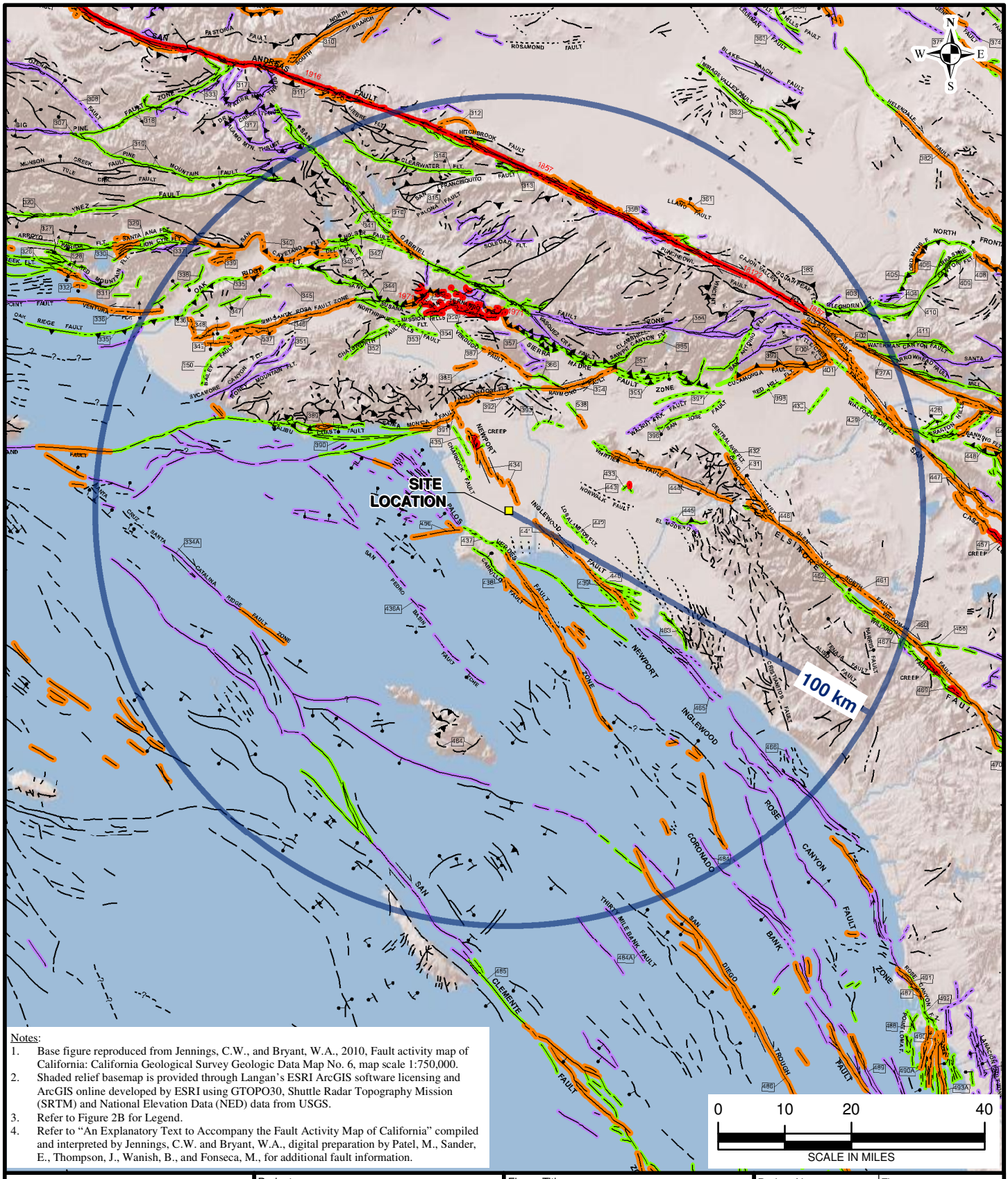
Figure Title

SITE VICINITY MAP

Project No.	700060401
Date	APRIL 2019
Scale	1" = 2000'
Drawn By	AJT

Figure No. **1**

Filename: \\langan.com\data\IRV\data4\700060401\Project Data\CAD\01\2D-DesignFiles\Geotechnical\700060401 Boring Location Plan.dwg Date: 4/12/2019 Time: 07:24 User: atran Style Table: Langan.stb Layout: SITE VICINITY MAP



Notes:

1. Base figure reproduced from Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
2. Shaded relief basemap is provided through Langan's ESRI ArcGIS software licensing and ArcGIS online developed by ESRI using GTOPO30, Shuttle Radar Topography Mission (SRTM) and National Elevation Data (NED) data from USGS.
3. Refer to Figure 2B for Legend.
4. Refer to "An Explanatory Text to Accompany the Fault Activity Map of California" compiled and interpreted by Jennings, C.W. and Bryant, W.A., digital preparation by Patel, M., Sander, E., Thompson, J., Wanish, B., and Fonseca, M., for additional fault information.

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Figure Title

CGS FAULT ACTIVITY MAP OF CALIFORNIA LEGEND

Project No.	700060401
Date	APRIL 2019
Scale	1 inch = 20 miles
Drawn By	BJS
Figure	2A

Path: \\langan.com\data\IRV\data4\700060401\Project Data\ArcGIS\MXD\Geotech_Figures\CGS_Fault_Map.mxd Date: 10/18/2018 User: bsaylor Time: 11:11:58 AM

LEGEND:

Site Location

Fault Age

The age classifications are based on geologic evidence to determine the youngest faulted unit and the oldest unfaulted unit along each fault of fault seciton

- Historic
- Holocene
- Late Quaternary
- Quaternary
- 100 km

Pre Quaternary Faults

- fault, certain
- fault, approx. located
- fault, concealed
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, approx. located, queried
- fault, certain, barball
- fault, concealed, barball
- fault, approx. located, barball

Quaternary Faults

- fault, certain
- fault, approx. located
- fault, approx. located, queried
- fault, inferred, queried
- fault, concealed
- fault, concealed, queried
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, concealed
- dextral fault, certain
- dextral fault, approx. located
- dextral fault, concealed
- sinistral fault, certain
- sinistral fault, approx. located
- sinistral fault, concealed
- thrust fault, certain (2)
- thrust fault, approx. located (2)
- thrust fault, concealed (2)
- fault, solid, barball
- fault, dashed, barball
- fault, dotted, barball
- dextral fault, solid, barball
- fault, dotted, queried, ballbar
- fault, dotted, queried, ballbar (2)
- fault, solid, dip
- fault, dashed, dip
- fault, dotted, dip
- reverse fault, solid
- reverse fault, dashed
- reverse fault, dotted

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Figure Title
CGS FAULT ACTIVITY MAP OF CALIFORNIA LEGEND

Project No.	700060401
Date	APRIL 2019
Scale	NOT TO SCALE
Drawn By	BJS

Figure
2B

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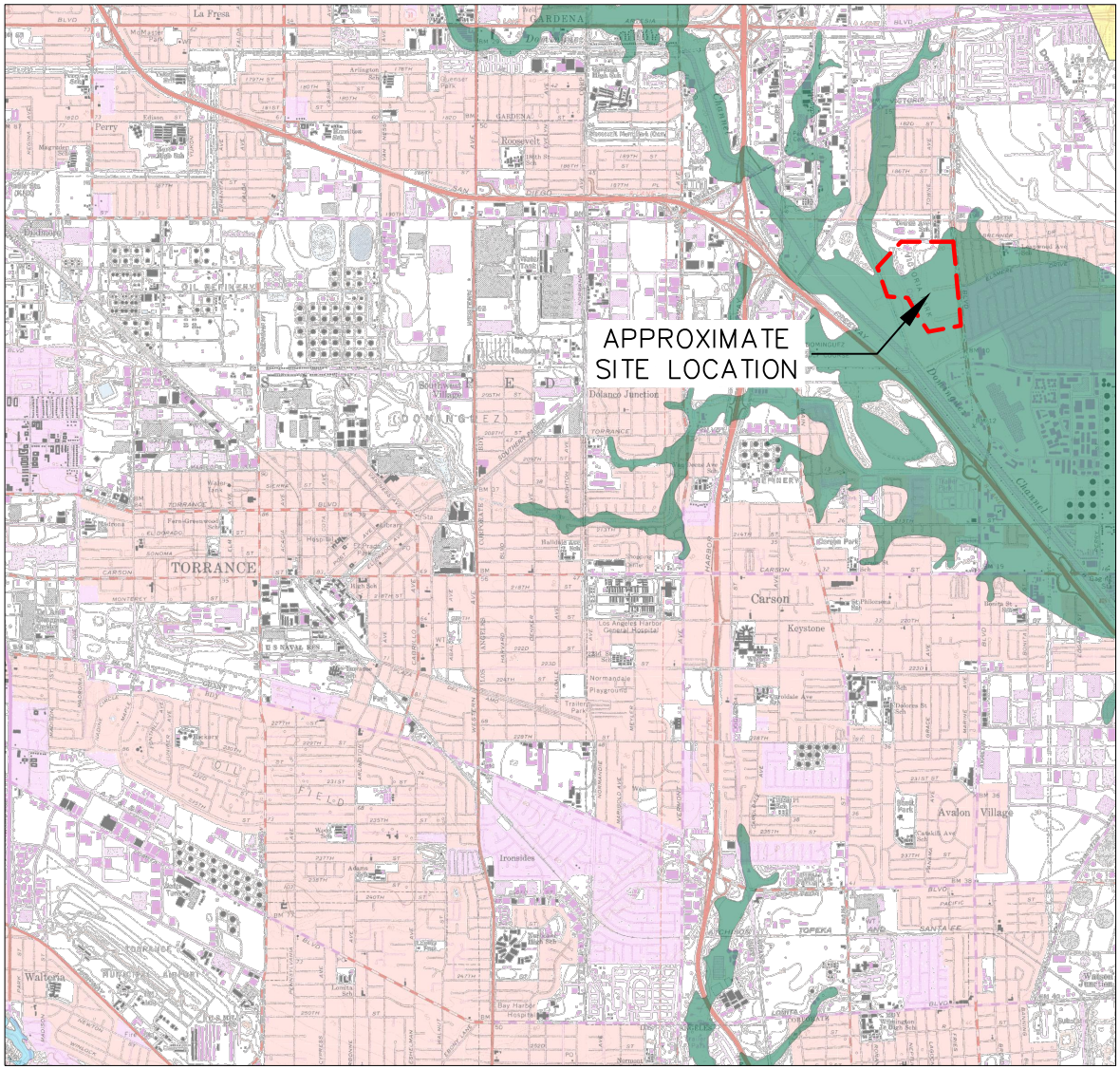

NOTES:

1. BACKGROUND REFERENCED FROM "CALIFORNIA GEOLOGICAL SURVEY, EARTHQUAKE ZONES OF REQUIRED INVESTIGATION, TORRANCE QUADRANGLE," PREPARED BY STATE OF CALIFORNIA, DEPARTMENT OF CONSERVATION, DATED 25 MARCH 1999.

LEGEND:

- APPROXIMATE SITE LIMITS
- AP ZONE BOUNDARY
- LIQUEFACTION INVESTIGATION ZONES
- EARTHQUAKE–INDUCED LANDSLIDE ZONES

PRIVILEGED AND CONFIDENTIAL - PREPARED AT REQUEST OF COUNSEL

5000 2500 0 5000

SCALE IN FEET

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Figure Title

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONES AND SEISMIC HAZARD ZONES MAP

Project No.	700060401
Date	APRIL 2019
Scale	1" = 5000'
Drawn By	AJT

Figure No. **3**

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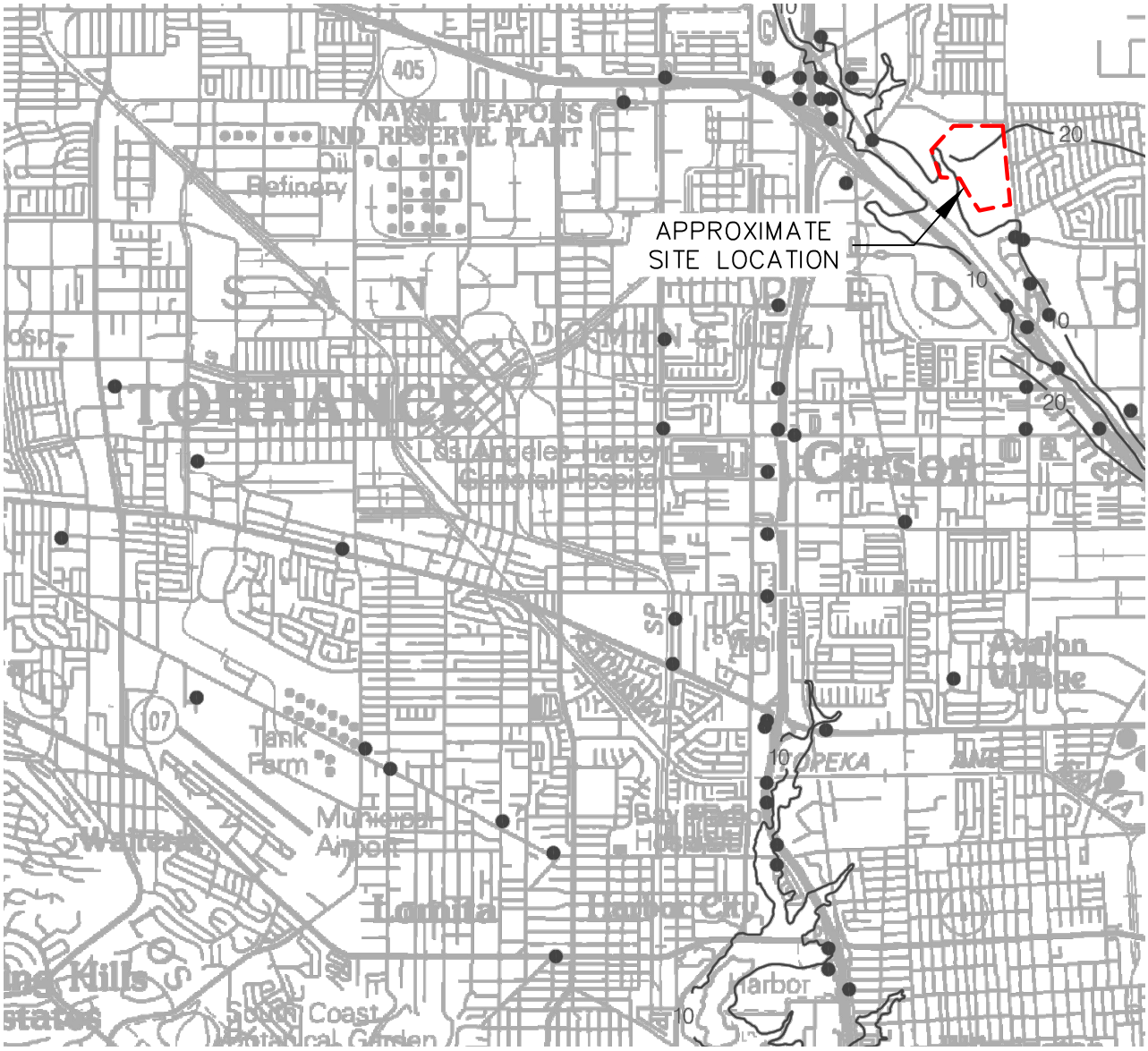

NOTES:

1. BACKGROUND REFERENCED FROM "SEISMIC HAZARD ZONE REPORT FOR THE TORRANCE 7.5-MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA – PLATE 1.2," PREPARED BY STATE OF CALIFORNIA, DEPARTMENT OF CONSERVATION, DATED 1998.

LEGEND:

APPROXIMATE SITE LIMITS

30 DEPTH TO GROUNDWATER (IN FEET)

5000 2500 0 5000

SCALE IN FEET

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Figure Title

HISTORICALLY HIGHEST GROUNDWATER CONTOURS

Project No.	700060401
Date	APRIL 2019
Scale	1" = 5000'
Drawn By	AJT

Figure No. **4**

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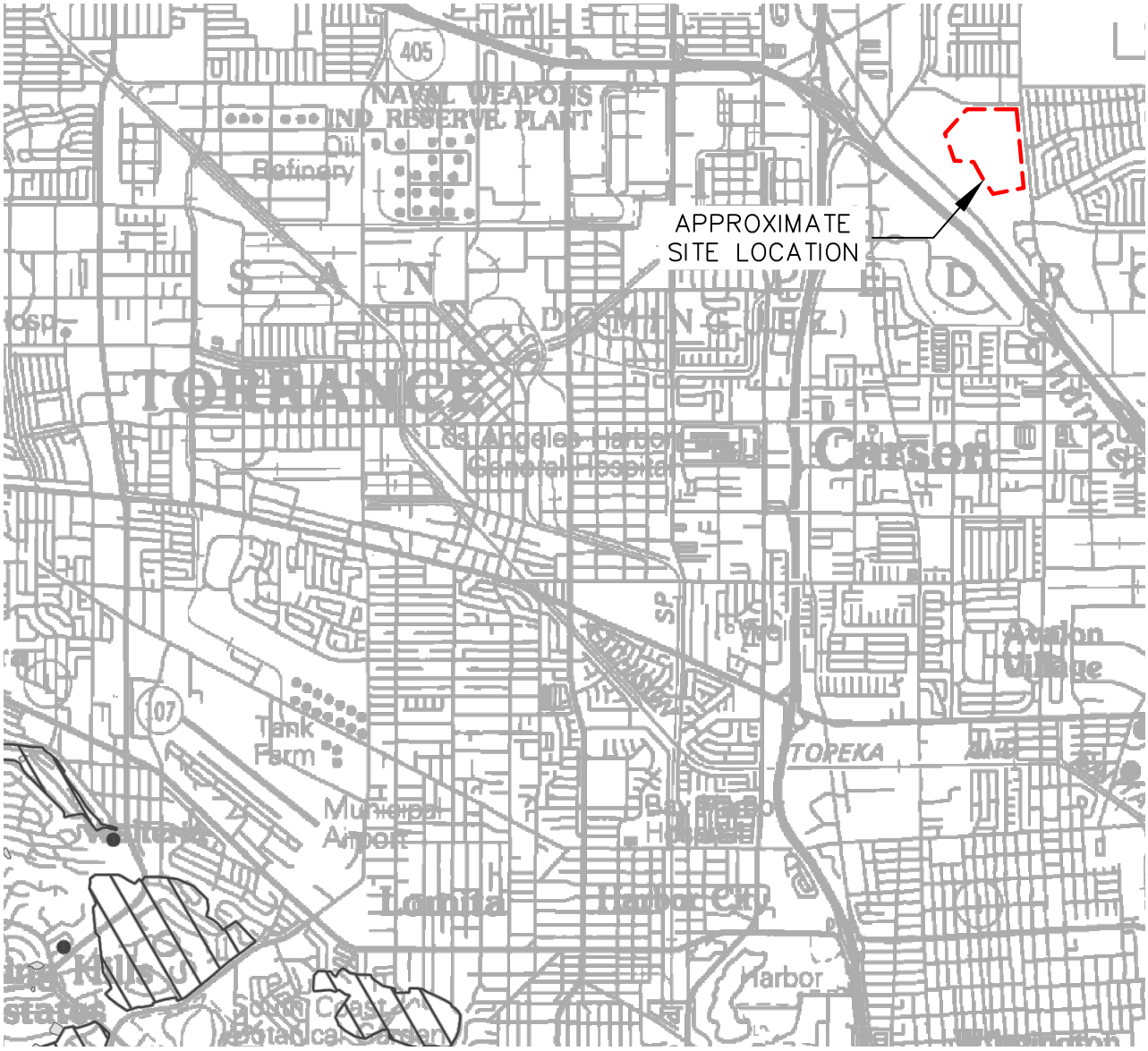

NOTES:

1. BACKGROUND REFERENCED FROM "SEISMIC HAZARD ZONE REPORT FOR THE TORRANCE 7.5-MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA – PLATE 2.1," PREPARED BY STATE OF CALIFORNIA, DEPARTMENT OF CONSERVATION, DATED 1998.

LEGEND:

- APPROXIMATE SITE LIMITS
- LANDSLIDE
- AREAS OF SIGNIFICATION GRADING

5000 2500 0 5000

SCALE IN FEET

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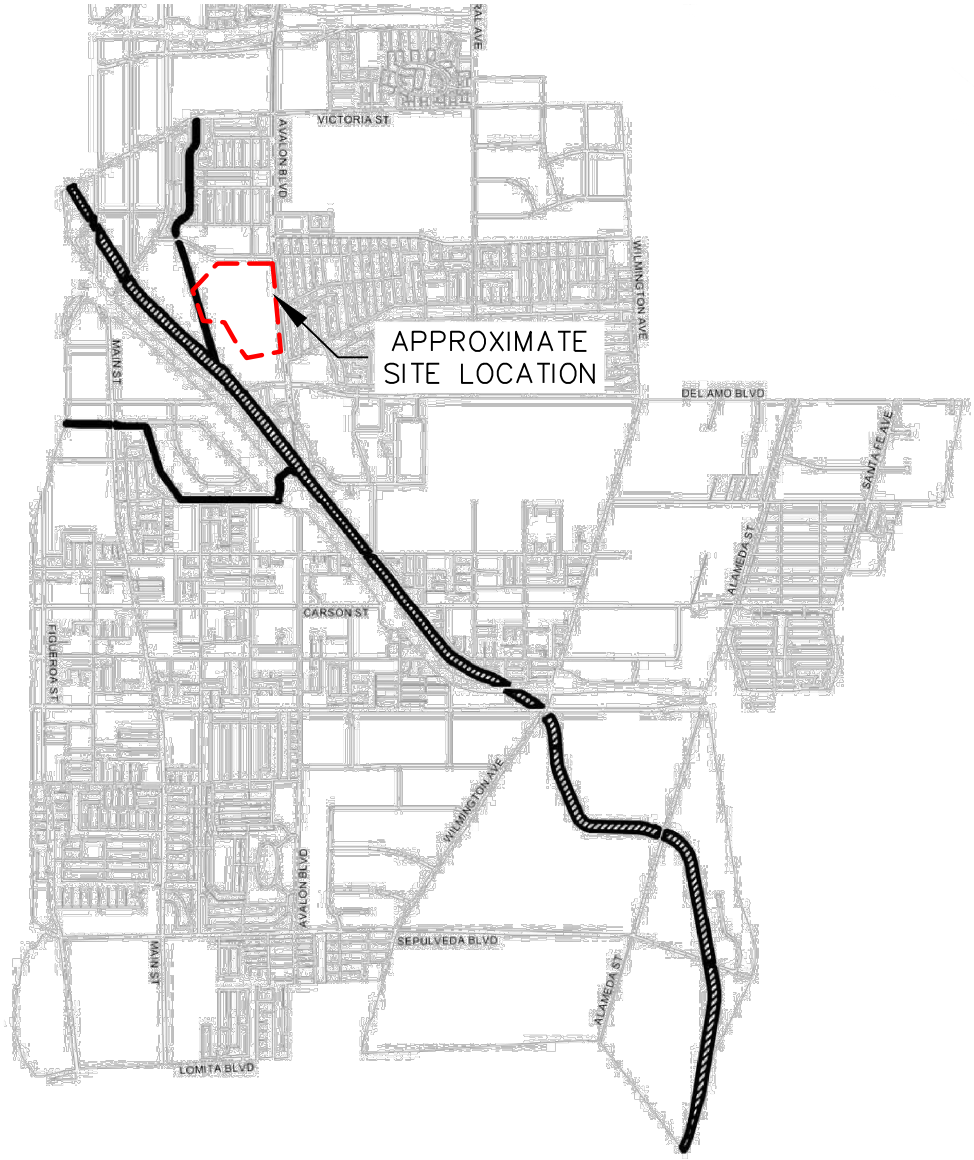
Figure Title: LANDSLIDE INVENTORY

Project No. 700060401
Date APRIL 2019
Scale 1" = 5000'
Drawn By AJT

Figure No. 5

Filename: \\langan.com\data\IRV\data4\700060401\Project Data\CAD\01\2D-DesignFiles\Geotechnical\700060401 EIR Desk Study.dwg Date: 10/18/2018 Time: 10:26 User: lvazquez Style Table: Langan.stb Layout: 5



NOTES:

1. BACKGROUND REFERENCED FROM "CITY OF CARSON GENERAL PLAN, SAFETY ELEMENT, EXHIBIT SAF-1, FLOOD ZONE MAP," PREPARED BY GIS DATA, CITY OF CARSON, DATED 22 OCTOBER 2002.

LEGEND:

APPROXIMATE SITE LIMITS

100-YEAR FLOOD ZONE

5000 2500 0 5000

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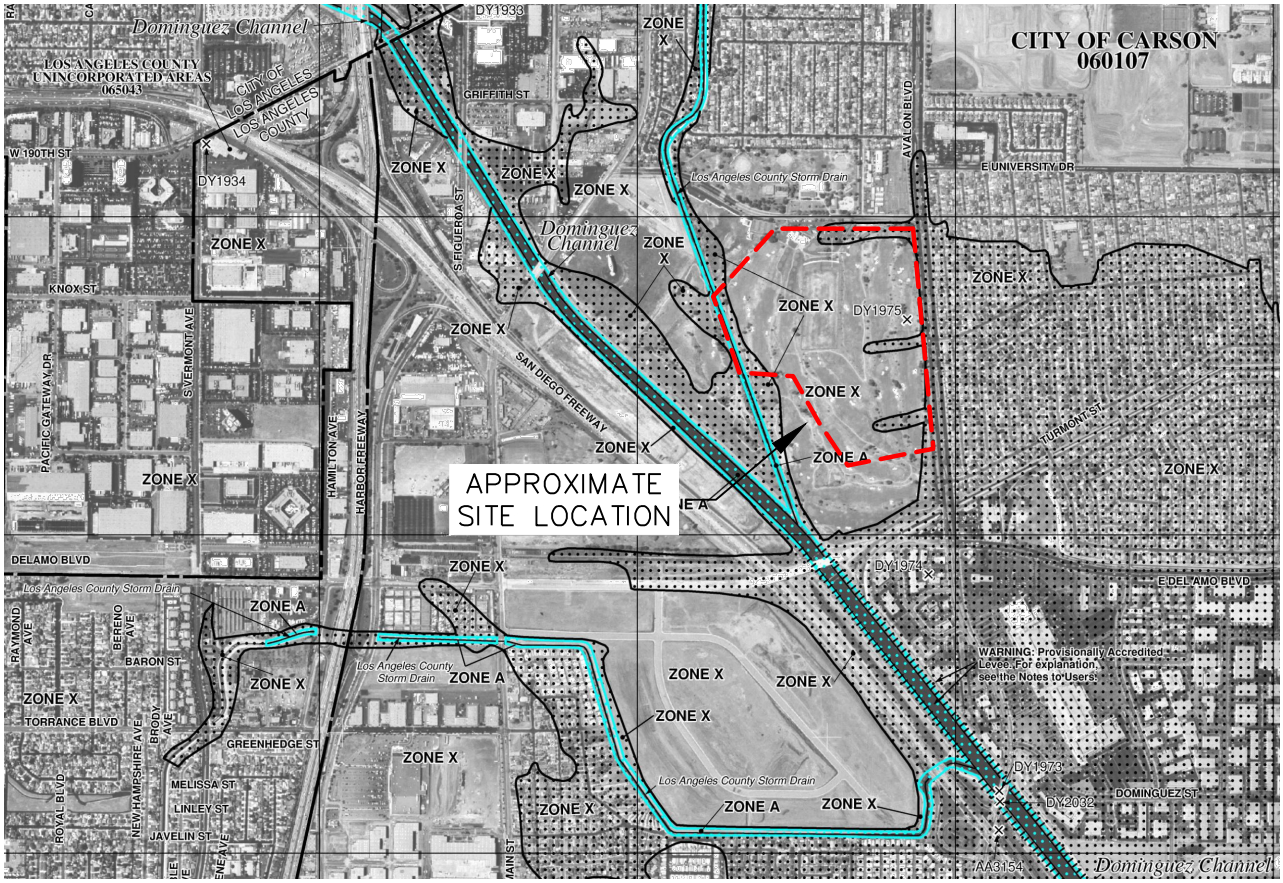
Figure Title
FLOOD ZONE MAP

Project No. 700060401
Date APRIL 2019
Scale 1" = 5000'
Drawn By AJT

Figure No. 6

Filename: \\langan.com\data\IRV\data4\700060401\Project Data\CAD\01\2D-DesignFiles\Geotechnical\700060401 EIR Desk Study.dwg Date: 10/18/2018 Time: 10:27 User: lvazquez Style Table: Langan.stb Layout: 6



NOTES:

1. BACKGROUND REFERENCED FROM "FLOOD INSURANCE RATE MAP, LOS ANGELES COUNTY, CALIFORNIA, AND INCORPORATED AREAS – PANEL 1935 OF 2350, MAP NUMBER 06037C1935F," PREPARED BY FEDERAL EMERGENCY MANAGEMENT AGENCY, DATED 26 SEPTEMBER 2008.

LEGEND:

- APPROXIMATE SITE LIMITS
- ZONE X — AREAS OF 0.2 PERCENT ANNUAL CHANCE FLOOD; AREAS OF 1 PERCENT ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1 PERCENT ANNUAL CHANCE FLOOD
- ZONE X — AREAS DETERMINED TO BE OUTSIDE THE 0.2 PERCENT ANNUAL CHANCE FLOODPLAIN
- SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1 PERCENT ANNUAL CHANCE FLOOD

2000 1000 0 2000

SCALE IN FEET

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Project	Figure Title	Project No.	Figure No.
CAROL KIMMELMAN ATHLETIC AND ACADEMIC CAMPUS CARSON LOS ANGELES COUNTY CALIFORNIA	FLOOD INSURANCE RATE MAP	700060401 Date: APRIL 2019 Scale: 1" = 2000' Drawn By: AJT	7

NOTES:

1. BACKGROUND REFERENCED FROM "LOS ANGELES COUNTY TSUNAMI INUNDATION WITH USGS 24K QUADS," PREPARED BY STATE OF CALIFORNIA, DEPARTMENT OF CONSERVATION, DATED 1 MARCH 2009.

LEGEND:

- APPROXIMATE SITE LIMITS
- MAPPED AREAS
- AFFECTED USGS QUADS
- INUNDATION LINE

PRIVILEGED AND CONFIDENTIAL - PREPARED AT REQUEST OF COUNSEL

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ABU DHABI ATHENS DOHA DUBAI ISTANBUL LONDON PANAMA

Langan Engineering & Environmental Services, Inc.

Project	CAROL KIMMELMAN ATHLETIC AND ACADEMIC CAMPUS CARSON LOS ANGELES COUNTY CALIFORNIA
Figure Title	TSUNAMI INUNDATION MAP
Project No.	700060401
Date	APRIL 2019
Scale	NOT TO SCALE
Drawn By	AJT
Figure No.	8

Filename: \\langan.com\data\IRV\data4\700060401\Project Data\CAD\01\2D-DesignFiles\Geotechnical\700060401 EIR Desk Study.dwg Date: 10/18/2018 Time: 10:29 User: lvazquez Style Table: Langan.stb Layout: 8

APPENDIX A
Seismic Hazard Evaluation Results

TABLE A.1 - USGS 2008 CALIFORNIA SEISMIC SOURCE MODEL PARAMETERS

Fault Name	Distance from Site (km)	Direction from Site	Mean Characteristic Moment Magnitude	Mean Slip Rate (mm/yr)	Fault Length (km)
Newport-Inglewood, alt 1	2.5	East	7.20	1.0	65
Newport Inglewood Connected alt 1	2.5	East	7.20	1.3	208
Newport Inglewood Connected alt 2	3.0	Northeast	7.50	1.3	208
Palos Verdes Connected	9.1	Southwest	7.70	3.0	285
Palos Verdes	9.1	Southwest	7.30	3.0	99
Puente Hills (LA)	13.3	Northeast	7.00	0.7	22
Puente Hills (Santa Fe Springs)	13.7	East	6.90	0.7	11
Puente Hills (Coyote Hills)	21.6	East	6.90	0.7	17
Elysian Park (Upper)	23.9	North	6.70	1.3	20
Elsinore;W+GI+T+J+CM	26.0	Northeast	7.85	n/a	241
Elsinore;W	26.0	Northeast	7.03	2.5	46
Elsinore;W+GI	26.0	Northeast	7.27	n/a	83
Elsinore;W+GI+T	26.0	Northeast	7.48	n/a	124
Elsinore;W+GI+T+J	26.0	Northeast	7.77	n/a	199
Santa Monica Connected alt 2	26.3	Northwest	7.40	2.4	93
Santa Monica, alt 1	26.9	Northwest	6.40	1.0	14
Santa Monica Connected alt 1	26.9	Northwest	7.30	2.6	79
Hollywood	28.4	Northwest	6.70	1.0	17
Raymond	30.1	North	6.80	1.5	22
Malibu Coast, alt 2	30.4	Northwest	7.00	0.3	38
Malibu Coast, alt 1	30.4	Northwest	6.70	0.3	38
Anacapa-Dume, alt 2	31.8	West	7.20	3.0	65

Notes:

1. Seismic source model parameters obtained from USGS 2008 National Seismic Hazard Maps - Source Parameters on 18 July 2018.
2. Search results include sources within 20 mi (32 km) of the Site.

TABLE A.2 - USGS ANSS COMPREHENSIVE CATALOG SEARCH RESULTS

Date [1,3]	Latitude [1,3]	Longitude [1,3]	Approximate Magnitude [1,3]	Magnitude Type [2]	Approximate Distance from Site (km) [1,3]
3/29/2014	33.9325	-117.9158	5.10	mw	34
7/29/2008	33.9485	-117.7663	5.44	mw	48
4/26/1997	34.3690	-118.6700	5.07	ml	68
6/26/1995	34.3940	-118.6690	5.02	ml	70
3/20/1994	34.2310	-118.4750	5.24	ml	46
1/29/1994	34.3060	-118.5790	5.06	ml	58
1/19/1994	34.3780	-118.6190	5.07	ml	66
1/19/1994	34.3790	-118.7120	5.06	ml	71
1/18/1994	34.3770	-118.6980	5.24	ml	70
1/17/1994	34.3260	-118.6980	5.58	ml	65
1/17/1994	34.3400	-118.6140	5.20	ml	62
1/17/1994	34.2750	-118.4930	5.89	ml	51
1/17/1994	34.2130	-118.5370	6.70	mw	47
6/28/1991	34.2700	-117.9930	5.80	mw	53
2/28/1990	34.1440	-117.6970	5.51	ml	62
12/3/1988	34.1510	-118.1300	5.02	ml	36
10/4/1987	34.0740	-118.0980	5.25	ml	29
10/1/1987	34.0610	-118.0790	5.90	mw	29
9/4/1981	33.5575	-119.1195	5.45	ml	85
1/1/1979	33.9165	-118.6872	5.21	ml	39
2/21/1973	33.9790	-119.0502	5.30	mw	73
2/9/1971	34.4160	-118.3700	5.30	mh	63
2/9/1971	34.4160	-118.3700	5.80	mh	63
2/9/1971	34.4160	-118.3700	5.80	mh	63
2/9/1971	34.4160	-118.3700	6.60	mw	63
9/12/1970	34.2548	-117.5343	5.22	ml	81
11/14/1941	33.7907	-118.2637	5.12	ml	7
5/31/1938	33.6993	-117.5112	5.23	ml	72
3/11/1933	33.6238	-118.0012	5.29	mh	36
3/11/1933	33.7667	-117.9850	5.02	mh	28
3/11/1933	33.6308	-117.9995	6.40	mw	35
3/10/1922	34.2430	-119.0970	6.50	mw	87
4/21/1918	33.6470	-117.4330	6.70	mw	81

Notes:

1. Earthquake Catalog Search results obtained from USGS ANSS Comprehensive Catalog on 18 July 2018.
2. Refer to USGS ANSS Comprehensive Catalog and USGS Earthquake Hazards Program for additional information on magnitude types.
3. Earthquake Catalog search results include earthquake events within 100 km of the Site with magnitudes of 5.0 or greater since 1900.

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*                       *
*    E Q S E A R C H    *
*                       *
*     Version 3.00      *
*                       *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 700060401

DATE: 07-23-2018

JOB NAME: CAROL KIMMMELMAN ATHLETIC AND ACADEMIC CENTER

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
   MINIMUM MAGNITUDE: 5.00
   MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
   SITE LATITUDE: 33.8539
   SITE LONGITUDE: 118.2726

SEARCH DATES:
           START DATE: 1800
           END DATE: 2018

SEARCH RADIUS:
           62.2 mi
           100.1 km

ATTENUATION RELATION: 14) Campbell & Bozorgnia (1997 Rev.) - Alluvium
   UNCERTAINTY (M=Median, S=Sigma): M   Number of Sigmas: 0.0
   ASSUMED SOURCE TYPE: SS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
   SCOND: 0 Depth Source: A
   Basement Depth: 5.00 km   Campbell SSR: 0   Campbell SHR: 0
   COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 3.0

EQSEARCH Output.OUT

EARTHQUAKE SEARCH RESULTS

Page 1

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	33.8500	118.2670	03/11/1933	1425 0.0	0.0	5.00	0.166	VIII	0.4(0.7)
DMG	33.7830	118.2500	11/14/1941	84136.3	0.0	5.40	0.157	VIII	5.1(8.1)
DMG	33.7830	118.1330	10/02/1933	91017.6	0.0	5.40	0.091	VII	9.4(15.1)
T-A	34.0000	118.2500	01/10/1856	0 0 0.0	0.0	5.00	0.058	VI	10.2(16.4)
T-A	34.0000	118.2500	03/26/1860	0 0 0.0	0.0	5.00	0.058	VI	10.2(16.4)
T-A	34.0000	118.2500	09/23/1827	0 0 0.0	0.0	5.00	0.058	VI	10.2(16.4)
MGI	34.0000	118.3000	09/03/1905	540 0.0	0.0	5.30	0.076	VII	10.2(16.4)
DMG	33.7500	118.0830	03/11/1933	230 0.0	0.0	5.10	0.048	VI	13.0(21.0)
DMG	33.7500	118.0830	03/11/1933	910 0.0	0.0	5.10	0.048	VI	13.0(21.0)
DMG	33.7500	118.0830	03/11/1933	323 0.0	0.0	5.00	0.044	VI	13.0(21.0)
DMG	33.7500	118.0830	03/13/1933	131828.0	0.0	5.30	0.058	VI	13.0(21.0)
DMG	33.7500	118.0830	03/11/1933	2 9 0.0	0.0	5.00	0.044	VI	13.0(21.0)
MGI	34.0800	118.2600	07/16/1920	18 8 0.0	0.0	5.00	0.035	V	15.6(25.1)
DMG	33.7000	118.0670	03/11/1933	85457.0	0.0	5.10	0.038	V	15.9(25.5)
DMG	33.7000	118.0670	03/11/1933	51022.0	0.0	5.10	0.038	V	15.9(25.5)
MGI	34.0000	118.5000	11/19/1918	2018 0.0	0.0	5.00	0.033	V	16.5(26.5)
DMG	34.0000	118.5000	08/04/1927	1224 0.0	0.0	5.00	0.033	V	16.5(26.5)
DMG	33.6830	118.0500	03/11/1933	658 3.0	0.0	5.50	0.049	VI	17.4(28.0)
PAS	34.0610	118.0790	10/01/1987	144220.0	9.5	5.90	0.067	VI	18.1(29.1)
PAS	34.0730	118.0980	10/04/1987	105938.2	8.2	5.30	0.039	V	18.1(29.2)
MGI	34.0000	118.0000	12/25/1903	1745 0.0	0.0	5.00	0.029	V	18.6(29.9)
MGI	34.1000	118.1000	07/11/1855	415 0.0	0.0	6.30	0.086	VII	19.7(31.6)
PAS	33.9190	118.6270	01/19/1989	65328.8	11.9	5.00	0.025	V	20.8(33.5)
DMG	33.9500	118.6320	08/31/1930	04036.0	0.0	5.20	0.028	V	21.6(34.8)
DMG	33.6170	118.0170	03/14/1933	19 150.0	0.0	5.10	0.025	V	22.0(35.4)
DMG	33.6170	117.9670	03/11/1933	154 7.8	0.0	6.30	0.067	VI	24.0(38.6)
PAS	33.9440	118.6810	01/01/1979	231438.9	11.3	5.00	0.021	IV	24.2(39.0)
DMG	33.5750	117.9830	03/11/1933	518 4.0	0.0	5.20	0.023	IV	25.4(40.9)
GSP	34.2310	118.4750	03/20/1994	212012.3	13.0	5.30	0.022	IV	28.5(45.8)
GSP	34.2130	118.5370	01/17/1994	123055.4	18.0	6.70	0.074	VII	29.0(46.7)
DMG	34.2000	117.9000	08/28/1889	215 0.0	0.0	5.50	0.023	IV	32.0(51.5)
GSP	34.2620	118.0020	06/28/1991	144354.5	11.0	5.40	0.021	IV	32.1(51.7)
DMG	34.3080	118.4540	02/09/1971	144346.7	6.2	5.20	0.017	IV	33.0(53.1)
GSB	34.3010	118.5650	01/17/1994	204602.4	9.0	5.20	0.015	IV	35.1(56.5)
GSP	34.3050	118.5790	01/29/1994	112036.0	1.0	5.10	0.014	III	35.7(57.5)
DMG	34.3000	118.6000	04/04/1893	1940 0.0	0.0	6.00	0.030	V	36.0(58.0)
GSP	34.1400	117.7000	02/28/1990	234336.6	5.0	5.20	0.014	III	38.3(61.6)
MGI	33.8000	117.6000	04/22/1918	2115 0.0	0.0	5.00	0.011	III	38.8(62.4)
DMG	34.4110	118.4010	02/09/1971	14 244.0	8.0	5.80	0.023	IV	39.2(63.0)
DMG	34.4110	118.4010	02/09/1971	14 1 8.0	8.0	5.80	0.023	IV	39.2(63.0)
DMG	34.4110	118.4010	02/09/1971	14 041.8	8.4	6.40	0.039	V	39.2(63.0)
DMG	34.4110	118.4010	02/09/1971	141028.0	8.0	5.30	0.015	IV	39.2(63.0)
GSP	34.3260	118.6980	01/17/1994	233330.7	9.0	5.60	0.018	IV	40.7(65.4)
GSP	34.3780	118.6180	01/19/1994	211144.9	11.0	5.10	0.011	III	41.2(66.3)
GSP	34.3690	118.6720	04/26/1997	103730.7	16.0	5.10	0.011	III	42.3(68.0)
DMG	34.0000	119.0000	09/24/1827	4 0 0.0	0.0	7.00	0.059	VI	42.9(69.0)
MGI	34.0000	119.0000	12/14/1912	0 0 0.0	0.0	5.70	0.018	IV	42.9(69.0)
GSP	34.3770	118.6980	01/18/1994	004308.9	11.0	5.20	0.012	III	43.5(70.1)
GSP	34.3940	118.6690	06/26/1995	084028.9	13.0	5.00	0.010	III	43.6(70.2)
GSB	34.3790	118.7110	01/19/1994	210928.6	14.0	5.50	0.015	IV	44.1(70.9)
DMG	33.6990	117.5110	05/31/1938	83455.4	10.0	5.50	0.014	IV	45.0(72.4)
MGI	34.0000	117.5000	12/16/1858	10 0 0.0	0.0	7.00	0.055	VI	45.4(73.0)
DMG	34.0650	119.0350	02/21/1973	144557.3	8.0	5.90	0.020	IV	46.0(74.1)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	34.5190	118.1980	08/23/1952	10 9 7.1	13.1	5.00	0.009	III	46.1(74.2)
DMG	34.3000	117.6000	07/30/1894	512 0.0	0.0	6.00	0.020	IV	49.3(79.3)
PAS	33.6710	119.1110	09/04/1981	155050.3	5.0	5.30	0.011	III	49.7(80.1)
DMG	34.3700	117.6500	12/08/1812	15 0 0.0	0.0	7.00	0.048	VI	50.4(81.0)
DMG	34.2700	117.5400	09/12/1970	143053.0	8.0	5.40	0.011	III	50.8(81.8)
DMG	33.7000	117.4000	05/13/1910	620 0.0	0.0	5.00	0.008	II	51.2(82.4)
DMG	33.7000	117.4000	05/15/1910	1547 0.0	0.0	6.00	0.019	IV	51.2(82.4)
DMG	33.7000	117.4000	04/11/1910	757 0.0	0.0	5.00	0.008	II	51.2(82.4)
DMG	34.3000	117.5000	07/22/1899	2032 0.0	0.0	6.50	0.028	V	53.9(86.7)
DMG	34.2000	117.4000	07/22/1899	046 0.0	0.0	5.50	0.011	III	55.4(89.1)
MGI	34.1000	117.3000	07/15/1905	2041 0.0	0.0	5.30	0.009	III	58.2(93.7)
DMG	34.0000	117.2500	07/23/1923	73026.0	0.0	6.25	0.020	IV	59.4(95.7)
DMG	33.9000	117.2000	12/19/1880	0 0 0.0	0.0	6.00	0.015	IV	61.6(99.1)

****

-END OF SEARCH- 66 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2018

LENGTH OF SEARCH TIME: 219 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 0.4 MILES (0.7 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.0

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.166 g

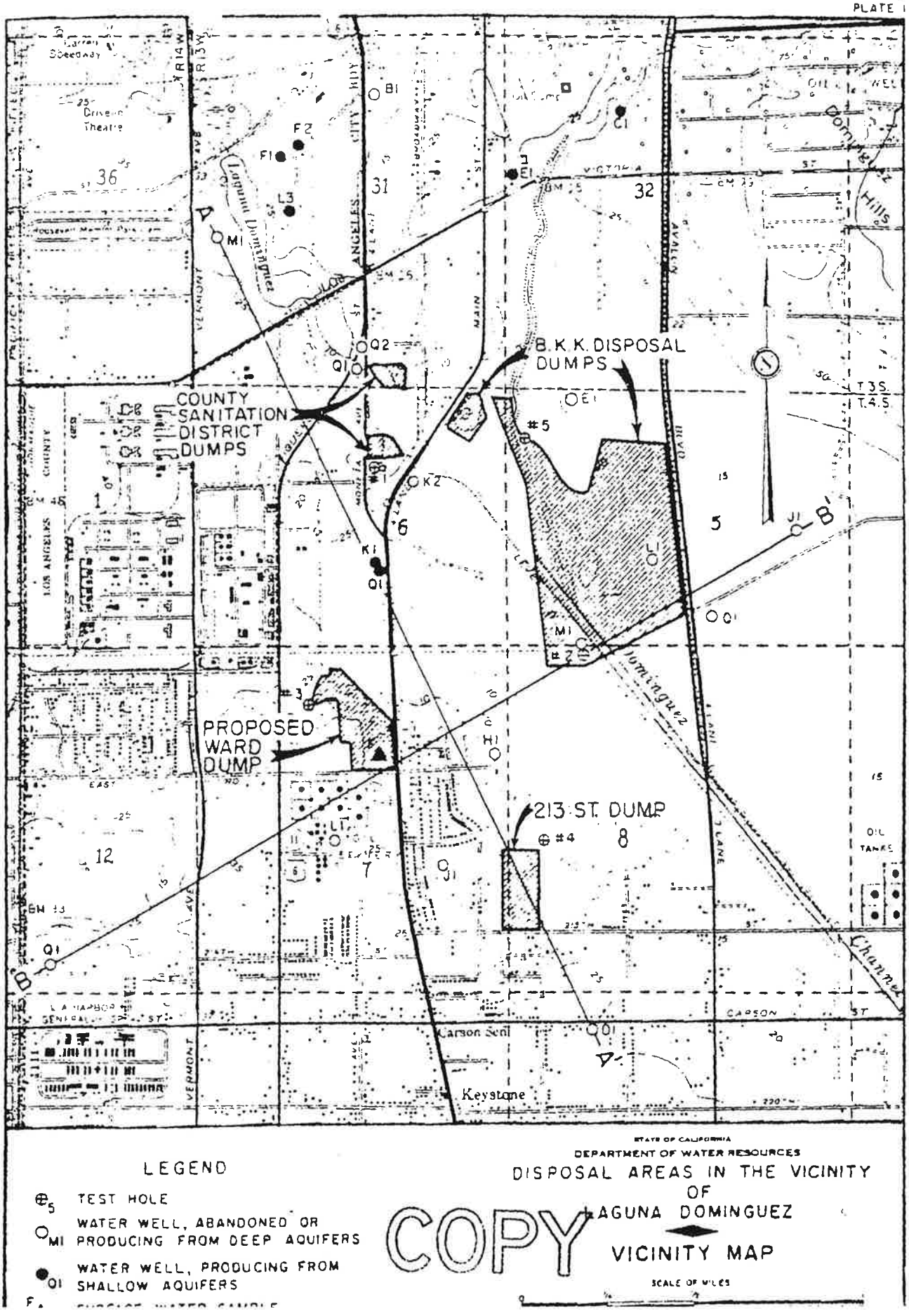
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
- a-value= 1.101
- b-value= 0.370
- beta-value= 0.852

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	66	0.30137
4.5	66	0.30137
5.0	66	0.30137
5.5	24	0.10959
6.0	13	0.05936
6.5	5	0.02283
7.0	3	0.01370

APPENDIX B
Limit of Waste Figures

PLATE 1



LEGEND

- ⊕5 TEST HOLE
- ○MI WATER WELL, ABANDONED OR PRODUCING FROM DEEP AQUIFERS
- ●O1 WATER WELL, PRODUCING FROM SHALLOW AQUIFERS
- F4 SURFACE WATER SAMPLE

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

DISPOSAL AREAS IN THE VICINITY OF LAGUNA DOMINGUEZ

VICINITY MAP

SCALE OF MILES

COPY

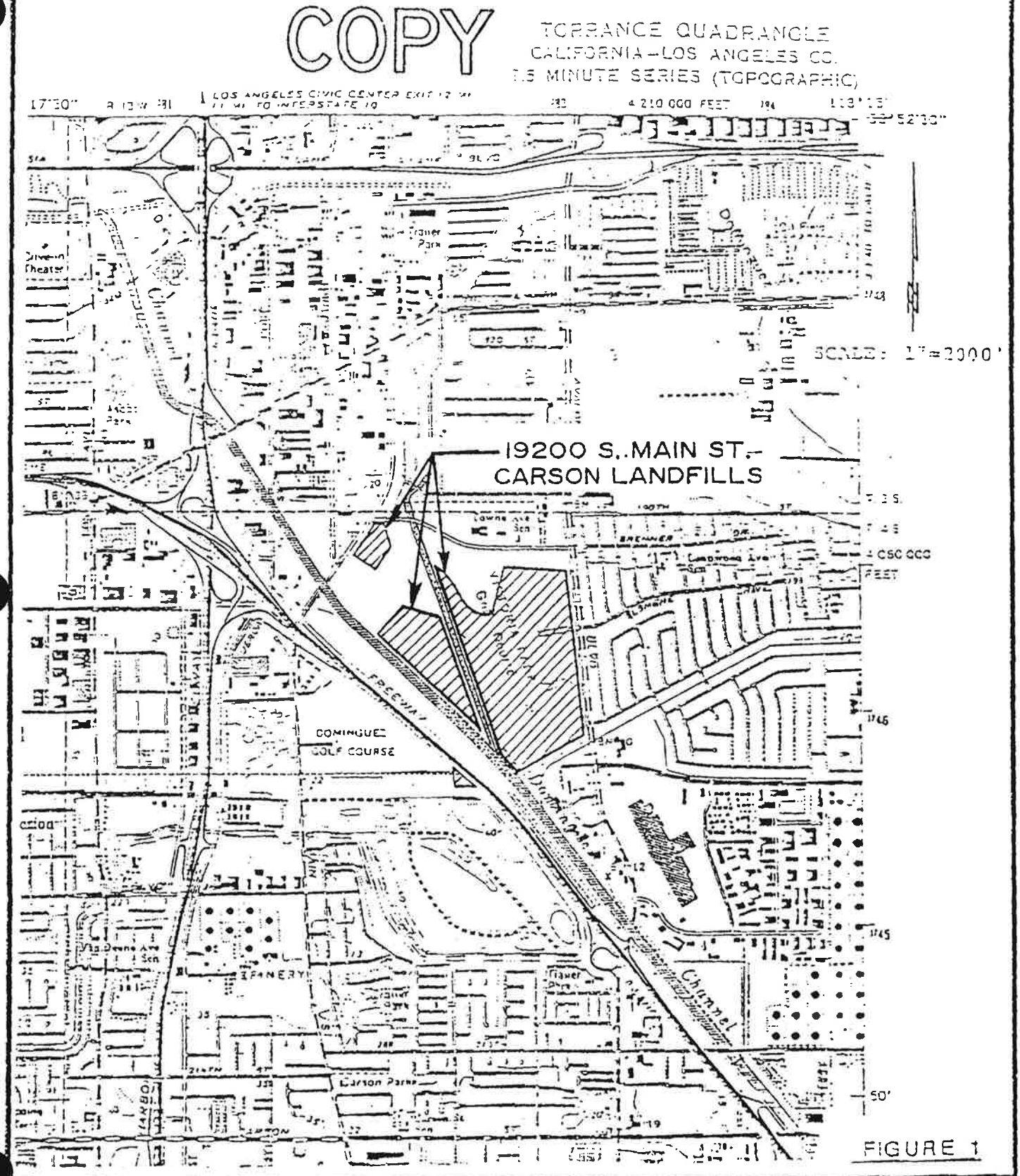


FIGURE 1

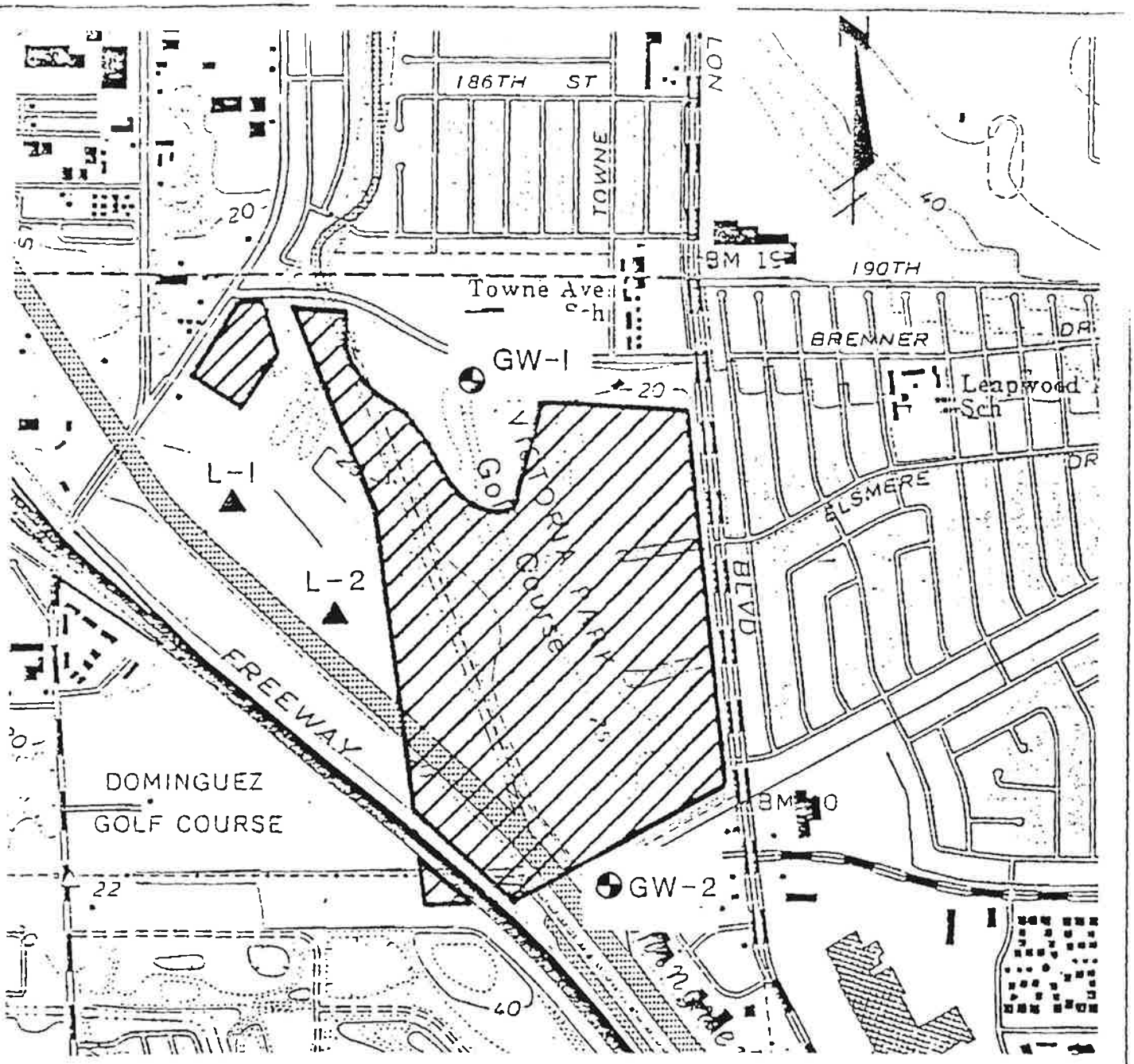
BAS

BRYAN A. STIRRAT & ASSOCIATES
CONSULTING CIVIL ENGINEERS

(714) 394-5009

SITE LOCATION MAP
19200 S. MAIN ST.
CARSON, CA

JOB NO.	8814
DATE	6/88
DRAWN BY:	DS
CHECKED BY:	



COPY

LEGEND

▲ L- LYSIMETER

◓ GW- GROUND WATER MONITORING WELL

NOTE:

LIMITS OF REFUSE IS BASED ON 1956 D.W.R. INVESTIGATION NO.57-4-7

FIGURE 2

BAS

[714] 594-5008

BRYAN A. STIRRAT & ASSOCIATES
CONSULTING CIVIL ENGINEERS

1199 FAIRWAY DR • P.O. BOX 7085 • INDUSTRY CA 91744

PROPOSED MONITORING LOCATIONS SWAT INVESTIGATION

JB NO.	
DATE	6/88
DRAWN BY:	RS
CHECKED BY:	

REMEDIAL INVESTIGATION - FIGURE 3.1-1

R.I. Sample and Well Locations

Leighton

FORMER BKK LANDFILL, OU-2, CARSON, CALIFORNIA

Geol: MKM/REW | Date: 05/11 | GIS: KVM

Map Saved as V:\Drafting\600872\104\GIS\June 2011\311_SamplesWells_Topo.mxd on 5/26/2011 10:50:18 AM
Author: kmanchikanti

LEGEND

Groundwater

- RI - 2 Well Cluster: UB and MB
- RI - 4 Well Cluster: UB, MB, L-MB, GA, and Stratigraphic Corehole
- RI - Hydropunch
- *Weston 2001 Monitor Well*

Soil Gas

- Building Perimeter Probe
- Landifll Perimeter Well

Multiple Media Samples

- RI – Grid and Off-Grid Boring
- RI – Supplemental Soil Cover Grid Boring
- RI - Surface Water and Soil Run-off

Former BKK Landfill

- Operable Unit-1
- Operable Unit-2
- Current Waste Limit, OU-2
- Goodyear Airship Operations Center
- See Plate II for Sample and Well Location Details

N

0 250 500 1,000 Feet

1 " = 500 '

Investigation Area Topography from Aerial Topographic Survery Dulin & Boynton, 2007