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Preliminary Subsurface Methane Gas Investigation at **1123 – 1161 South Main St.**

Los Angeles, California

Prepared for

JADE Enterprises, LLC

Mr. Daniel Taban
888 South Figueroa Street, Suite 1900
Los Angeles, California 90017

November 29, 2018

1.0 Introduction: GeoKinetics has completed a subsurface methane gas investigation at the property located at 1123 - 1161 South Main Street, in the City of Los Angeles. The location of the subject property is shown in Figure 1 while a recent aerial photograph of the site is provided as Figure 2. We understand that a thirty story mixed-use building with three above ground parking levels is planned at the proposed project. The subject property is located in the Los Angeles Downtown Oil Field as it has been mapped by the California Department of Conservation, Division of Oil, Gas & Geothermal Resources (DOGGR). No oil wells are shown to exist at the property based upon our review of the DOGGR oil field map. The closest mapped oil well (Nasco Petroleum, LLC., "LA Unit" #12) is located approximately 800 feet southwest of the subject property. As a result, it is within a Methane Zone designated by LADBS. It will therefore be necessary to incorporate methane gas mitigation measures into the design of the proposed structure in accordance with LADBS requirements

Under the current building code, the nature and extent of the required mitigation measures are partially dependent upon the concentration and pressure of any methane gas that may be present at the site. The current investigation has been performed for the purpose of documenting the concentration and pressure of methane gas in the subsurface of the subject property such that appropriate mitigative improvements can be specified. This report presents the results of the subsurface gas investigation as well as associated methane mitigation recommendations in accordance with typical LADBS requirements.

2.0 Background: The presence of methane gas in the subsurface is common within former oil production areas and other locations where organic material - such as grass, leaves, wood, manure, etc. - are present in the soil. Biogenic methane is generated by the bacteriological digestion, or biodegradation, of organic matter in the absence of oxygen. Methane of thermogenic or petrogenic origin may also be present in surficial soils as a result of its upward migration from deeper oil and gas bearing zones. Our experience indicates methane gas is common and can be found in the soil at a relatively high percentage of building sites in southern California. Methane is not toxic, however it is combustible and potentially explosive at concentrations above 55,000 ppm in the presence of oxygen. This concentration is referred to as its Lower Explosive Level or LEL. Methane is lighter than air and therefore has a natural tendency to rise to the ground surface where it typically dissipates into the atmosphere. The presence of non-pressurized methane at shallow depths beneath the ground surface is normally not problematic. The rates at which the methane is generated and/or migrates towards the ground surface are slow enough such that the gas dissipates naturally under normal circumstances. However, as methane migrates to the ground surface, the

potential exists for its accumulation beneath slab-on-grade foundation systems or other relatively impermeable ground coverings. If the gas accumulates to high concentrations, and becomes pressurized, and a crack or other penetration is present in the floor slab of the structure, detectable levels of methane may enter the interior of the building. Improvements - such as sub-slab vent lines or gas membranes - are generally required by LADBS as a precautionary measure for new structures at Methane Zone sites.

3.0 Field Investigation: The field work associated with the methane gas investigation at the subject property included the installation and monitoring of three (3) multi-stage subsurface gas probes. The locations of these gas probes are shown in Figure 2. The subsurface gas probes were installed on November 9th, 2018 and they were subsequently monitored on November 12th and 14th, 2018. The gas probes were installed using direct push drilling equipment to minimize the disturbance to the subsurface environment. A schematic illustrating the general configuration of the gas probes is provided as Figure 3. The LADBS guidelines require that individual sampling tips be installed at depths of 5, 10, and 20 feet below the lowest floor level of the building. A schematic illustrating the general configuration of the gas probes is provided as Figure 3. The maximum depth was not able to be reached in boring P-2 due to refusal. Each sampling tip was embedded within a 12-inch interval of washed Monterey #3 sand. Bentonite clay seals were placed above and below each sand interval in order to isolate the gas sampling tips. Gas tight quick connect fittings were installed on the ends of the polyethylene tubing at the ground surface in order to seal the probes between monitoring events. Flush-mounted vaults were installed at the ground surface to protect the installations.

As discussed previously, the installations were monitored on November 12th and 14th, 2018. All monitoring was performed during periods of falling barometric pressure. The subsurface gas pressure relative to atmospheric, and the concentrations of methane, oxygen, and carbon dioxide, were measured in the subsurface probes during each monitoring event. The monitoring equipment that was utilized and the associated detection limits, or resolutions, are summarized in Table 1. As indicated, subsurface gas pressures were measured to the nearest 0.05 inches of water prior to each sampling event using a Magnahelic gauge while the barometric pressure was measured and recorded to the nearest 0.1 inches of mercury using a digital barometer. The gas probe methane, oxygen, and carbon dioxide concentrations were measured in the field using a portable, methane specific, LANDTEC GEM2000-PLUS infra-red gas analyzer. A volume of gas equivalent to approximately ten times that of the ¼-inch diameter polyethylene gas probe tube was extracted through the LANDTEC GEM2000-PLUS during the monitoring process. Steady state readings were generally obtained after

approximately two tubing volumes of gas had been extracted. The highest methane reading displayed in each instance was recorded. The LANDTEC GEM2000-PLUS was calibrated at the beginning and the end of each day of monitoring using a certified mixture of 15% methane, 15% carbon dioxide, and 70% nitrogen calibration gas (Note: all gas concentrations referred to in this report are on a volumetric basis). A Photovac Flame Ionization Detector (FID) was used to confirm combustible gas levels at selected probes where sufficient oxygen was present in the probe to operate the FID. The gas levels measured with both detectors were found to be consistent. Combustible gas concentrations in excess of 100 ppm were not detected with the FID.

Ambient gas levels in the air four feet above the ground surface were recorded at the site periodically during the monitoring. In each instance, the measured gas level fell within the following range:

Gas	Measured Range
Methane	<0.1%
Carbon Dioxide	<0.1%
Oxygen	20.7% – 20.8%

4.0 Results: The pressures and concentrations measured in each of the subsurface gas probes during the monitoring events are summarized in Table 2. As indicated, methane gas was not detected in any of the gas probe installations.

There were no elevated soil gas pressure readings measured in any of the gas probes above 0.00 inches of water. As such, there was no indication of elevated soil gas pressures associated with methane generation or migration.

The concentration of oxygen in the atmosphere at sea level is approximately 21%. The subsurface oxygen levels were found to be slightly depressed below typical atmospheric levels at each of the gas probe installations. The lowest subsurface oxygen level recorded at the site was 18.8% while the average oxygen concentration measured in the gas probes was approximately 19.6%. The average concentration of carbon dioxide in the atmosphere at sea level is approximately 0.03%. Subsurface carbon dioxide levels were slightly elevated above typical atmospheric levels in each of the gas probes. The highest carbon dioxide concentration measured at the site was 0.8% while the average carbon dioxide concentration measured in the gas probes was approximately 0.3%. The slightly depressed subsurface oxygen levels and slightly elevated carbon

dioxide levels suggest residual organic matter entrained within the near surface soils is being biodegraded under aerobic conditions.

Based upon the measured methane levels and the corresponding soil gas pressures, we conclude the property should be classified as a Level I site with a Design Methane Pressure of #2" of water in accordance with LADBS guidelines. A copy of the LADBS methane testing compliance form for this project is included as Attachment A for your reference.

As discussed previously, the property is shown to be located within a Methane Zone. The following primary methane mitigation measures are typically required by LADBS for new Level I slab-on-grade structures within the methane zone:

1. **Sub-Slab Vent System:** A series of perforated vent lines and an associated 2" thick gravel blanket must be installed beneath the floor slab of the proposed structure. The perforated vent lines are connected to solid vent piping that extends through the walls or pipe chases of the building to outlets above the roof line. A dewatering system (sump and pump) must be installed if the design high groundwater level for the project is not at least one foot below the lowest vent piping elevation. Based on the historic groundwater levels, no dewatering system is required.
2. **Impervious Membrane:** A continuous gas membrane is required below the floor slab of the building. This membrane must be sealed against footings, pilings, and utilities to form a gas-tight barrier beneath the building.
3. **Utility Trench Dams:** A section of impervious backfill consisting of compacted native soil or sand / cement slurry must be installed in utility trenches that extend beneath the perimeter of the building in order to prevent methane gas from migrating beneath the structure through sand bedding or backfill.
4. **Conduit Seals:** Gas tight seals must be installed on all conduits (e.g. electrical, cable T.V., telephone, etc.) that extend to the interior of the structure. The purpose of these seals is to prevent methane gas from entering subsurface cracks or discontinuities in the conduits and subsequently migrating to the interior of the building.

There are exceptions in the City Methane Ordinance (Ordinance No. 175790) that allow some of the requirements outlined above to be omitted, or modified,

under certain conditions. These possible exceptions should be considered as the building plans are developed in order to determine the specific mitigative measures that will be required for the project.

5.0 Closing: This investigation has been performed with the degree of skill and care ordinarily exercised by engineers practicing in this, and similar, localities. No other warranty, expressed or implied, is given regarding the conclusions or professional opinions presented in this report. The scope of this report is limited to the matters expressly covered herein. This report is presented for the sole use of Jade Enterprises, LLC and may not be relied upon by any other party without written authorization from GeoKinetics. All recommendations, findings, and conclusions presented in this report are based upon facts and circumstances as they existed at the time this report was prepared. A change in any fact or circumstance upon which this report is based may necessitate re-evaluation and/or modification of the recommendations, findings, and conclusions presented herein. Due to the nature of this type of investigation, uncertainty exists with respect to the subsurface conditions that are present between boring / sampling locations. The subsurface methane concentrations at the site could vary over time and may change in response to site modifications. The methane levels identified in this report represent the concentrations that were measured at the time of the current investigation. Higher or lower concentrations could occur in the future. If the level of inherent uncertainty is unacceptable, additional sampling and/or testing should be considered.

We hope this information is helpful to you. Please do not hesitate to contact the undersigned if you have any questions or comments.

Sincerely,
GEOKINETICS, INC.


Kevin J. Lea, RCE
Senior Project Engineer

attachments



**Table 1. Gas Probe Monitoring
Equipment & Parameters**

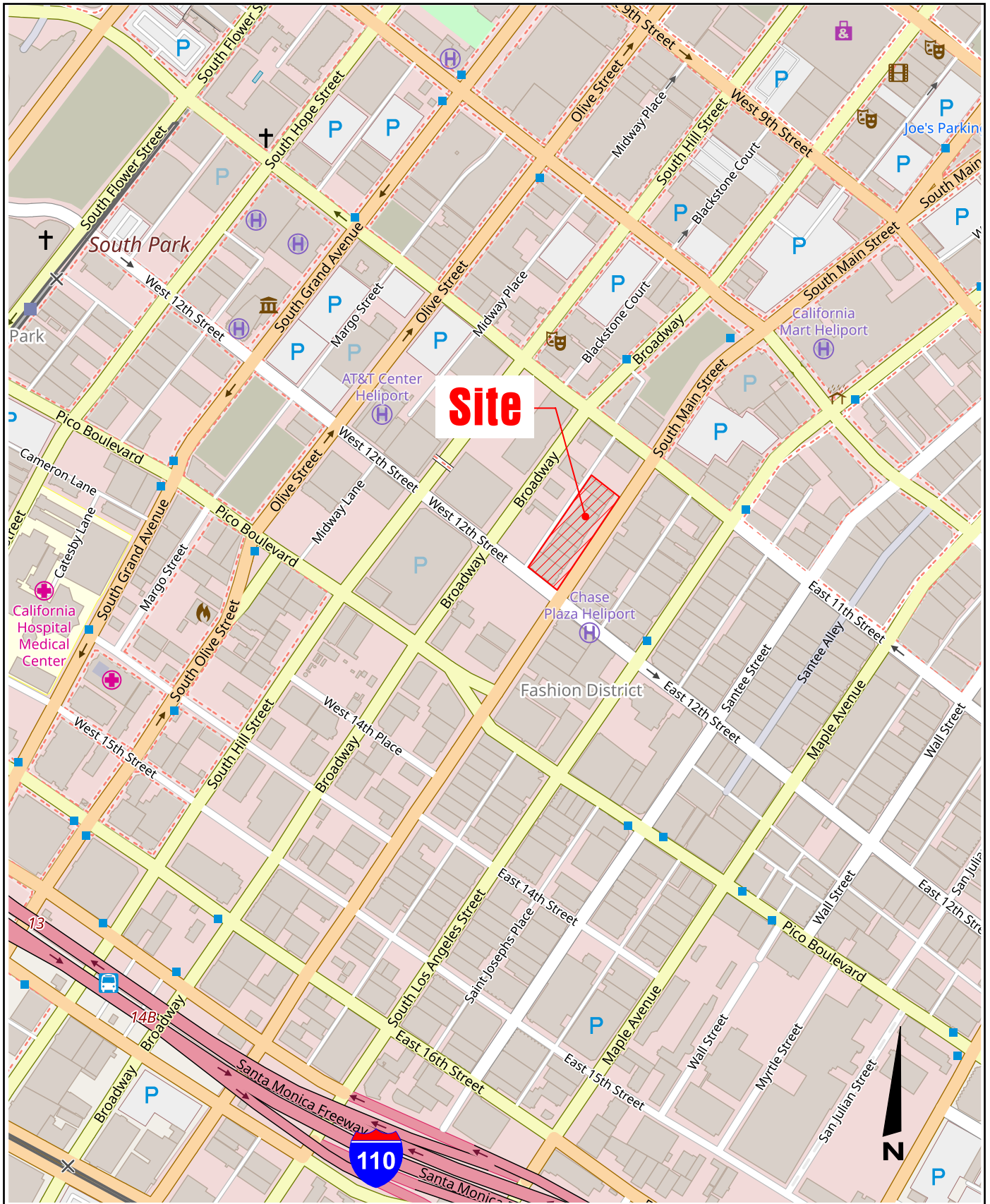
Parameter	Equipment	Detection Limit or Resolution	Range
Barometric Pressure	Digital Barometer	0.1" of Hg	25 to 36 in Hg
Gas Probe Pressure	Pressure Gauge	0.1" of H ₂ O	-5 to +5 in H ₂ O
Methane Concentration	LANDTEC GEM2000-PLUS Infrared Gas Analyzer	0.1%	0.1% to 100%
	FID	0.1 ppm	0.1 to 1,000 ppm
		1 ppm	1 to 10,000 ppm
Carbon Dioxide Concentration	LANDTEC GEM2000-PLUS Infrared Gas Analyzer	0.1%	0.1% to 50%
Oxygen Concentrations	LANDTEC GEM2000-PLUS Infrared Gas Analyzer	0.1%	0.1% to 25%

**Table 2 - Methane Investigation
1123-1161 S. Main St., Los Angeles, California
Multi-Stage Gas Probe Monitoring Results**

GAS PROBE #	MONITORING DATE	PROBE DEPTH (feet)	GAS CONCENTRATION (%)			GAS PROBE PRESSURE (IN H ₂ O)	BAROMETRIC PRESSURE (IN Hg)
			CH ₄ %	CO ₂ %	O ₂ %		
P-1	11/12/2018	5	0.00	0.2	20.6	0.00	29.92
	11/14/2018		0.00	0.2	19.8	0.00	29.99
	11/12/2018	10	0.00	0.2	20.1	0.00	29.92
	11/14/2018		0.00	0.3	19.6	0.00	29.99
	11/12/2018	19	0.00	0.3	20.0	0.00	29.92
	11/14/2018		0.00	0.4	19.4	0.00	29.99
P-2	11/12/2018	5	0.00	0.3	20.0	0.00	29.92
	11/14/2018		0.00	0.3	19.2	0.00	29.99
	11/12/2018	10	0.00	0.2	19.7	0.00	29.92
	11/14/2018		0.00	0.3	19.1	0.00	29.99
	11/12/2018	15	0.00	0.2	19.6	0.00	29.92
	11/14/2018		0.00	0.2	18.9	0.00	29.99
P-3	11/12/2018	5	0.00	0.3	19.7	0.00	29.92
	11/14/2018		0.00	0.3	19.3	0.00	29.99
	11/12/2018	10	0.00	0.3	19.6	0.00	29.92
	11/14/2018		0.00	0.4	19.2	0.00	29.99
	11/12/2018	20	0.00	0.7	19.4	0.00	29.92
	11/14/2018		0.00	0.8	18.8	0.00	29.99

Background	11/12/2018	In	0.00	0.0	20.8	-	29.92
	11/14/2018		0.00	0.0	20.7	-	29.99
	11/12/2018	Out	0.00	0.0	20.7	-	29.92
	11/14/2018		0.00	0.0	20.7	-	29.99

- Level I: 0 - 100 ppm (0% to 0.01%)
- Level II: 101 - 1,000 ppm (>0.01% to 0.1%)
- Level III: 1,001 - 5,000 ppm (>0.1% to 0.5%)
- Level IV: 5,001 to 12,500 ppm (>0.5% to 1.25%)
- Level V: Greater than 12,500 ppm (>1.25%)



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Project Name: Jade Enterprises - 1123 - 1161 South Main
 Date: November 2018

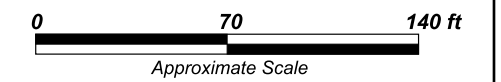
Site Location Map
 1123 - 1161 South Main Street
 Los Angeles, California

Figure 1



Legend

- P-3** ● Approximate Gas Probe Location and Designation
- ND** Methane Concentration Below Detection Limit in Parts per Million (ppm)



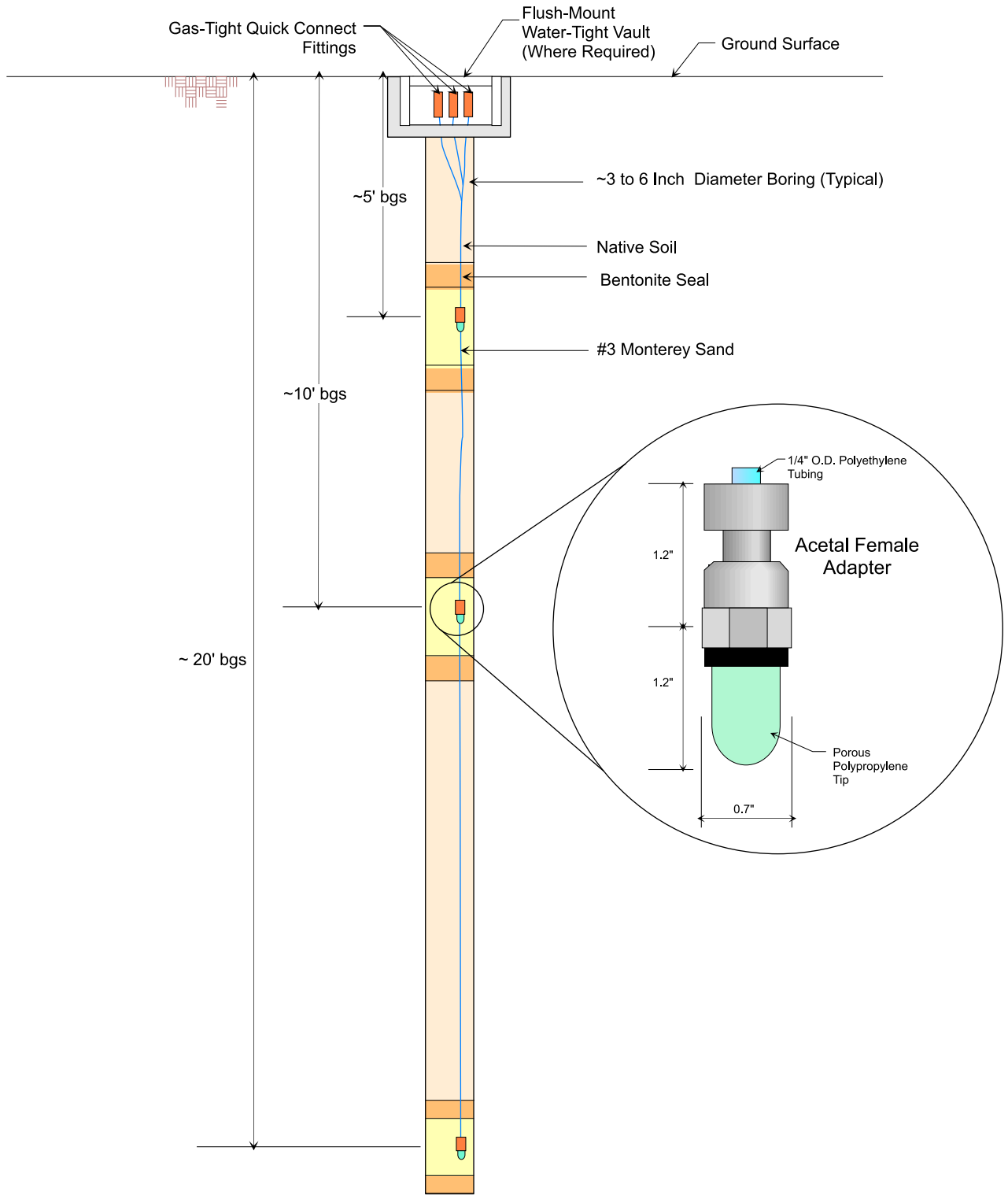
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**Aerial Photograph with Approximate
 Gas Probe Locations and
 Maximum Methane Concentrations**

Figure 2



Note: Probe Depths May Vary From One Installation to Another Due to sub-surface Conditions.
 Not to Scale

Attachment A

Methane Gas Investigation Compliance Certificate

FORM 1 - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 1: Certification Sheet

Site: 1123 – 1161 South Main Project

Address: 1123 – 1161 South Main Street & 111 West 12th Street, Los Angeles, California.

Legal Description: Tract 2289; APN # 5139017029 (Lots 38 to 41), # 5139017018 (Lot 37), # 5139017017 (Lot 36), # 5139017016 (Lot 35) & # 5139017015 (Lot 34)

Building Use: Residential / Commercial

<p>Name of Engineer: Glenn D. Tofani GeoKinetics</p> <p>Mailing Address: 77 Bunsen Irvine, CA 92618</p> <p>Telephone: (949) 502-5353</p> <p>Testing Laboratory: GeoKinetics License # 10234</p>	<p>Registered Civil / Soil Engineer Stamp:</p>
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I hereby certify that I have tested the above site for the purpose of methane mitigation, and that all procedures were conducted by a City of Los Angeles licensed testing agency in conformity with the requirements of the LADBS Information Bulletin P/BC 2002-101. Where the inspection and testing of all or part of the work above is delegated, full responsibility shall be assumed by the licensed engineer or geologist whose signature is affixed thereon.

Signed: *Glenn D. Tofani* **Date:** 11-26-18

Required Data:

- Project is in a METHANE ZONE
- Depth to ground water observed during testing was: >20 feet below existing ground surface.
- Depth of Historical High Ground Water Table Elevation* is ~115 ft below existing ground surface.
- Design Methane Concentration**: < 100 parts per million in volume (ppmv).
- Design Methane Pressure***: ≤ 2 inches of water column.
- Methane Design Level: 1

De-watering:

- De-watering is Not required.
- Pump discharge rate N/A gallons per minute.
- Reference geology or soil report: N/A

Additional Investigation:

- Additional investigation was Not conducted.

Latest Grading on Site:

- Date of last grading on site was: Years ago
- Explanation of the effect on soil gas survey results by grading operations: N/A
- Building Excavation: Not Yet Initiated

Notes:

- * Historical High Ground Water Table Elevation Shall mean the highest recorded elevation of ground water based on historical records and field investigations as determined by the engineer for the methane mitigation system.
- ** Design Methane Concentration shall mean the highest recorded measured methane concentration from either shallow soil gas test or any gas probe set on the site.
- *** Design Methane Pressure shall mean the highest total pressure measured from any Gas Probe Set on the site.