APPENDIX IV.F

Technical Memorandum Summarizing Potential Methane Issues (December 2009)

Technical Memorandum Summarizing Potential Methane Issues Associated with Proposed Future Construction Activities at Loyola Marymount University Los Angeles, California

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Prepared by

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December 18, 2009

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SUBJECT: TECHNICAL MEMORANDUM SUMMARIZING POTENTIAL METHANE ISSUES ASSOCIATED WITH PROPOSED FUTURE CONSTRUCTION ACTIVITIES AT LOYOLA MARYMOUNT UNIVERSITY - LOS ANGELES, CALIFORNIA

Dear Ms. Doehne:

As requested this represents an overview of the anticipated methane issues associated with any proposed construction activities at the above listed site. The Loyola Marymount University (LMU) Campus is shown in Figure 1 and a recent aerial photograph of the Campus is provided as Figure 2. The LMU Campus is located approximately ½ mile east of the Playa Del Rey Oil Field as it has been mapped by the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR)[1] and over 1,000 feet west of the Superior Oil Co., "Inglewood Extension", #1 Oil Well. Figure 1 shows the approximate location of the campus and historic wells. The entire LMU Campus is located either in a Methane Zone or a Methane Buffer Zone as designated by the Los Angeles Department of Building and Safety (LADBS)[2]. The approximate limits of the Methane and Methane Buffer Zones are shown in Figure 2 based upon the LADBS assessment map[3].

Naturally occurring methane is found in soil and can be formed by thermal decomposition of buried organic material often associated with the formation of coal and oil (thermogenic), or by the microbial decomposition of organic material in the absence of oxygen (biogenic). Thus, the presence of methane gas in the subsurface is common where organic material - such as grass, leaves, wood, manure, hydrocarbons, etc. - are present in the soil. Methane may also be present

[1] California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) maps W1-5 and 120, dated June 29, 2006 and October 24, 2003, respectively.
[2] Los Angeles Department of Building and Safety, Ordinance No. 175790, Division 71 Methane Seepage Regulations, Section 91.7103.
[3] Los Angeles Department of Building and Safety, Ordinance No. 175790, Division 71 Methane Seepage Regulations, Section 91.7103, Map A-20960, dated September 21, 2003.

in the shallow subsurface as a result of its migration from deeper oil and gas bearing zones.

Methane is not toxic; however it is combustible and potentially explosive at concentrations between approximately 50,000 parts per million (ppm) and 150,000 ppm in the presence of oxygen. This lower concentration is referred to as its Lower Explosive Level or LEL and the higher concentration is referred to as its Upper Explosive Level or UEL. 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 subsurface methane associated with the biodegradation of low levels of organic material in the soil is normally not problematic. The rates at which the organic material is decomposed and methane is generated 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. 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 a building.

Pursuant to Division 71 of the Los Angeles Building Code, the LADBS requires testing for methane gas for any new construction at a "Methane Zone" or "Methane Buffer Zone" property[4]. Site testing to measure the concentration and pressure of methane gas must be conducted under the supervision of a licensed Architect or registered Engineer or Geologist, and must be performed by a testing agency approved by LADBS. Current LADBS guidelines require a minimum of one shallow (4 ft. deep) gas probe for each 10,000 ft^2 of land area and one deep multi-stage gas probe for each 20,000 ft^2 of land area[5]. Each building site is given a classification ranging from I (low methane level and pressure) to V (high methane level or pressure) based upon the concentrations and pressures at which methane is detected during the testing activities. Under the current city regulations, the required methane mitigation measures for a new structure are dictated primarily by this site classification[6].

Methane mitigation improvements are required by LADBS for all new structures on Methane Zone properties. The following measures are typically required for Methane Zone sites where the maximum measured methane level in the subsurface does not exceed 1,000 ppm (i.e. Level I and II sites):

[4] Los Angeles Department of Building and Safety, Ordinance No. 175790, Division 71 Methane Seepage Regulations, Section 91.7104.1 Site Testing.
[5] LADBS Information Bulletin / Public Code Reference 91.7104.1, Document P/BC 2002-101, Site Testing Standards for Methane.
[6] Los Angeles Department of Building and Safety, Ordinance No. 175790, Division 71 Methane Seepage Regulations, Section 91.7104.1 Site Testing.

- Sub-slab vent lines connected to vent risers routed through the roof of the structure;

- An impervious gas membrane;

- A dewatering system if the proposed sub-slab vent lines are to be located within 1 foot of the historical high groundwater table; and

- Utility trench dams and conduit seals;

For Methane Zone properties with maximum measured methane levels in excess of 1,000 ppm but below 12,500 ppm (i.e. Level III and IV sites), or with maximum measured methane levels below 5,000 ppm with over 2 inches of water pressure (i.e. Level I, II and III sites) a gas detection system located in the lowest occupied space is also required. This system must be configured to activate the building's mechanical ventilation system and subsequently an alarm system, if elevated levels of methane are detected on the interior of the structure.

For Methane Zone properties with maximum measured methane levels between 5,001 and 12,500 ppm with greater than 2" of water pressure (i.e. Level IV sites) or with maximum methane levels in excess of 12,500 ppm (i.e. Level V sites), the sub-slab vent piping system must be provided with a mechanical blower. The blower is to be activated by a gas sensor located in one of the vent risers when elevated levels of methane are detected in the vent lines. Table 1A summarizes the methane mitigation measures required for Methane Zone properties[7].

No Methane mitigation improvements are required by LADBS for all new structures on Methane Buffer Zone properties where the maximum measured methane level in the subsurface does not exceed 1,000 ppm (i.e. Level I and II sites). For Methane Buffer Zone properties with maximum measured methane levels between 1,001 and 5,000 ppm (Level III sites), Utility trench dams and conduit seals are required to be installed.

For Methane Buffer Zone properties with maximum measured levels between 5,001 and 12,500 ppm (Level IV sites), or with maximum measured methane levels below 5,000 ppm with over 2 inches of water pressure (i.e. Level I, II and III sites), the following mitigation measures are also required:

- Sub-slab vent lines connected to vent risers routed through the roof of the structure;

[7] Los Angeles Department of Building and Safety, Ordinance No. 175790, Division 71 Methane Seepage Regulations, Section 91.7104.2 Methane Mitigation Systems.

- An impervious gas membrane;

- A dewatering system if the proposed sub-slab vent lines are to be located within 1 foot of the historical high groundwater table; and

- A gas detection system located in the lowest occupied space.

For Methane Buffer Zone properties with maximum measured methane levels between 5,001 and 12,500 ppm with greater than 2" of water pressure (i.e. Level IV sites) or with maximum methane levels in excess of 12,500 ppm (i.e. Level V sites), the sub-slab vent piping system must be provided with a mechanical blower. The blower is to be activated by a gas sensor located in one of the vent risers when elevated levels of methane are detected in the vent lines. Table 1B summarizes the methane mitigation measures required for Methane Buffer Zone Properties.

The LADBS methane testing and mitigation requirements described above are relatively conservative and provide a high level of safety for new construction.

Elevated levels of methane gas have not been previously detected on the LMU Campus. A methane gas investigation was conducted by GeoKinetics for the then proposed William H. Hannon library project in April of 2007. A total of 5 subsurface methane gas probes were installed and monitored in conjunction with that investigation. The locations of these previously installed gas probes are shown in Figures 2 and 3, while the gas probe configuration is shown in Figure 4. As indicated in Figures 2 and 3, methane gas was not detected in any of the five gas probes. The equipment that was used to screen for the presence of methane gas had an effective detection limit of 100 ppm. The William H. Hannon Library site was classified as a Level I site in accordance with LADBS standards.

It is our understanding that the Department of Toxic Substances Control (DTSC) has determined that an abandoned oil well is located on Jefferson Boulevard to the west of the project site. The reported location of this well is shown in Figure 1. We understand the DTSC has suggested that the well may be located within 1,000 feet of the LMU Campus. Based upon our initial review of the DOGGR field maps (Map #'s 120 and W1-5) the oil well in question, "Cooperative Development Co., Ltd., Community #1" appears to be located approximately 1,000 feet northwest of the northwestern edge of the site boundary. It is possible that an area near the current heli-pad lies within this 1,000 foot limit, but no other part of the LMU Campus would be within the 1,000 foot radius. It should also be noted that a second oil well, "The Superior Oil Co., Inglewood Extension #1", is shown to be located approximately 1,000 feet east of the northeast edge of the campus boundary on the same DOGGR field maps. The location of this well was confirmed by the "Notice of Intention to Drill New Well" log for that well as provided by DOGGR. No portion of the LMU Campus appears to lie within the 1,000 foot radius of this well.

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

Sincerely,
GEOKINETICS, INC.

Glenn D. Tofani, GE/RCE/REA
Principal Engineer

Kevin J. Lea, RCE
Senior Project Engineer

attachments

Table 1A - MITIGATION REQUIREMENTS FOR METHANE ZONE (See note 1)

Site Design Level			Level I		Level II		Level III		Level IV		Level V
Design Methane Concentration (ppmv)			0 - 100		101 - 1,000		1,001 - 5,000		5,001 - 12,500		> 12,500
Design Methane Pressure (inches of water column)			≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	All Pressure
PASSIVE SYSTEM	De-watering System		X	X	X	X	X	X	X	X	X
	Sub-Slab Vent System	Perforated Horizontal Pipes	X	X	X	X	X	X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes	2"	2"	2"	3"	2"	3"	2"	4"	4"
		Vent Risers	X	X	X	X	X	X	X	X	X
	Impervious Membrane		X	X	X	X	X	X	X	X	X
ACTIVE SYSTEM	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane								X	X
		Mechanical Extraction System								X	X
	Lowest Occupied Space System	Gas Detection System		X		X	X	X	X	X	X
		Mechanical Ventilation		X		X	X	X	X	X	X
		Alarm System		X		X	X	X	X	X	X
	Control Panel			X		X	X	X	X	X	X
MISC. SYSTEM	Trench Dam		X	X	X	X	X	X	X	X	X
	Conduit or Cable Seal Fitting		X	X	X	X	X	X	X	X	X
	Additional Vent Risers (See note 4)										X

NOTES FOR TABLES 1A AND 1B:

1. Components required for this project are identified by an "X" in the column circled.
2. Table 1A - Mitigation Requirements for Methane Zone and Table 1B - Mitigation Requirements for Methane Buffer Zone are based on Table 71 and Chapter 71 of the Los Angeles Building Code.
3. De-watering not required when the maximum Historical High Ground Water Table Elevation, or projected post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.
4. The total quantity of installed Vent Risers shall be increased to double the calculated rate for the Passive System.

Table 1B - MITIGATION REQUIREMENTS FOR METHANE BUFFER ZONE (See note 1)

Site Design Level			Level I		Level II		Level III		Level IV		Level V
Design Methane Concentration (ppmv)			0 - 100		101 - 1,000		1,001 - 5,000		5,001 - 12,500		> 12,500
Design Methane Pressure (inches of water column)			≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	All Pressure
PASSIVE SYSTEM	De-watering System (See note 1)			X		X		X	X	X	X
	Sub-Slab Vent System	Perforated Horizontal Pipes		X		X		X	X	X	X
		Gravel Blanket Thickness Under Impervious Membrane		2"		3"		3"	2"	4"	4"
		Gravel Thickness Surrounding Perforated Horizontal Pipes		2"		3"		3"	2"	4"	4"
		Vent Risers		X		X		X	X	X	X
	Impervious Membrane			X		X		X	X	X	X
ACTIVE SYSTEM	Sub-Slab Vent System	Pressure Sensors Below Impervious Membrane								X	X
		Mechanical Extraction System								X	X
	Lowest Occupied Space System	Gas Detection System		X		X		X	X	X	X
		Mechanical Ventilation		X		X		X	X	X	X
		Alarm System		X		X		X	X	X	X
	Control Panel			X		X		X	X	X	X
MISC. SYSTEM	Trench Dam			X		X	X	X	X	X	X
	Conduit or Cable Seal Fitting			X		X	X	X	X	X	X
	Additional Vent Risers (See note 4)										X

NOTES FOR TABLES 1A AND 1B:

1. Components required for this project are identified by an "X" in the column circled.
2. Table 1A - Mitigation Requirements for Methane Zone and Table 1B - Mitigation Requirements for Methane Buffer Zone are based on Table 71 and Chapter 71 of the Los Angeles Building Code.
3. De-watering not required when the maximum Historical High Ground Water Table Elevation, or projected post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.
4. The total quantity of installed Vent Risers shall be increased to double the calculated rate for the Passive System.

GeoKinetics
Geotechnical & Environmental Engineers

Project Name: Loyola Marymount

Date: March 2009

Site Location Map

Figure 1

Legend

Limits of LMU Campus

P-2 ND — Approximate Gas Probe Location, Designation and Methane Concentration Below Detection Limit in Parts Per Million (ppm) from April 2007 Investigation.

N

0 400 800 Feet

Approximate Scale

GeoKinetics
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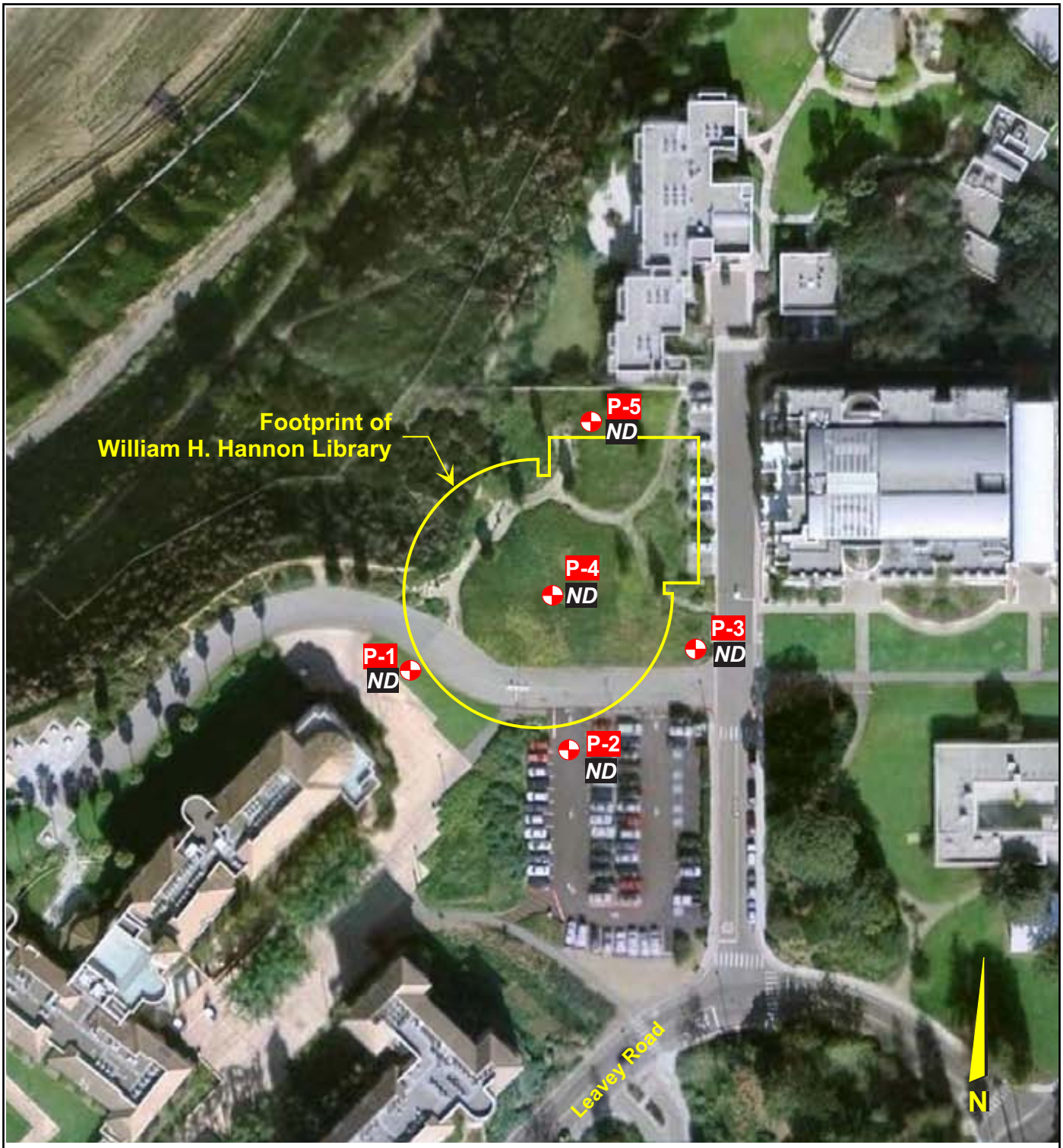
Project Name: Loyola Marymount

ate: March 2009

Site Plan with Methane and Methane Buffer Zones

Figure 2



Explanation

P-5 — Approximate Gas Probe Location and Designation

ND — Methane Concentration Below Detection Limit in Parts Per Million (ppm)

0 100 200 ft

Approximate Scale

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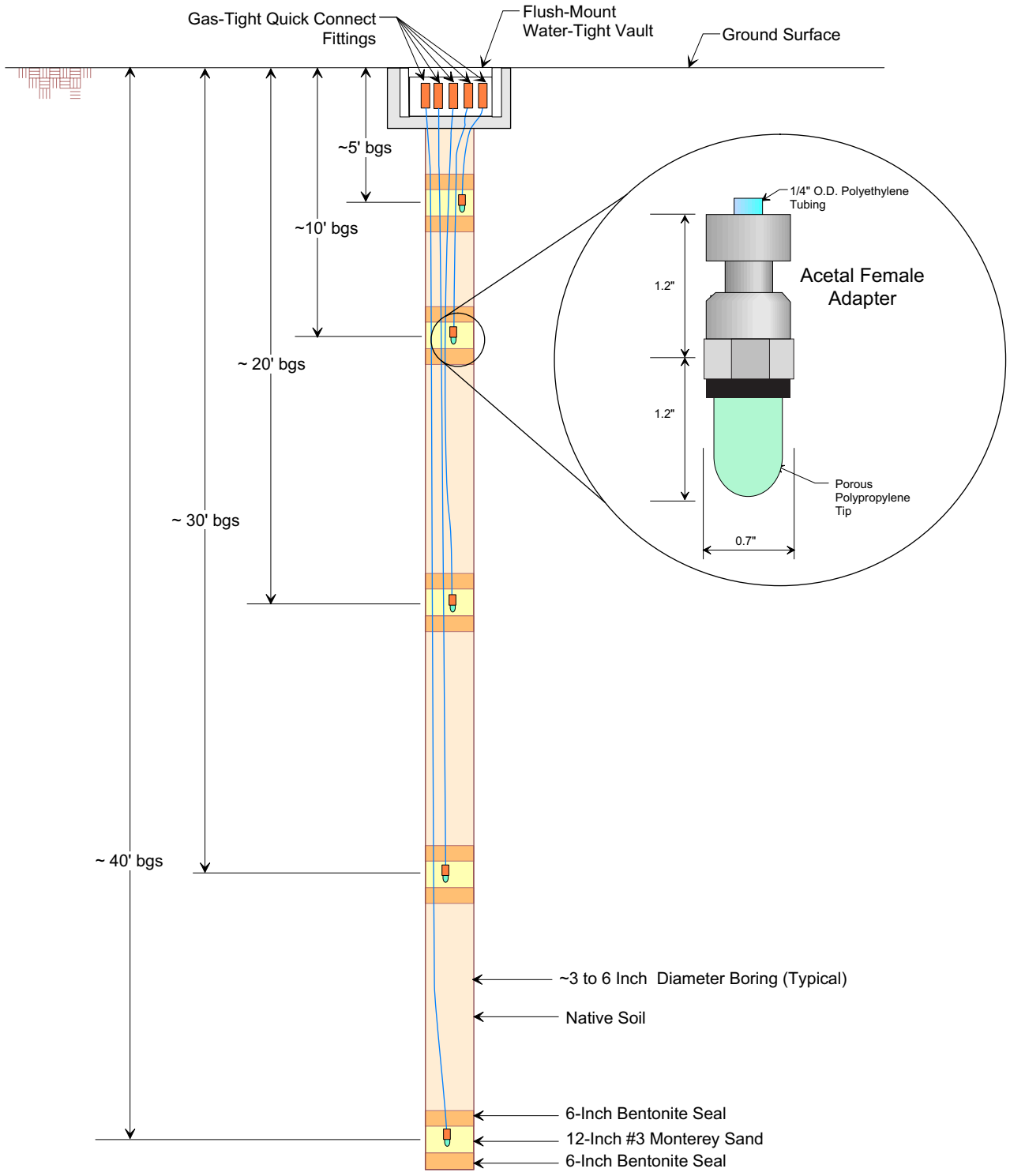
Date: March 2009

Site Plan with Gas Probe Locations and Maximum Measured Methane Levels before William H. Hannon Library Construction (April, 2007)

Figure 3



Note: Probe Depths May Vary From One Installation to Another Due to Sub-Surface Conditions.

Not to Scale

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Typical Configuration of Gas Probe Installation

Figure 4