



Carlin Environmental Consulting, Inc.

AssessmentXRemediationXMitigation Design

2522 Chambers Road, # 100
Tustin, California 92780
714-508-1111

GeoTek, Inc.
710 E. Parkridge Ave. Suite 105
Corona, CA 92879

February 24, 2016

Attention: Ed LaMont

Subject: Methane Related Services For the Former Abacherli Dairy Site, City of Menifee, Riverside County, California.

In accordance with your request, it is Carlin Environmental Consulting, Inc.'s (CEC) pleasure to provide environmental consulting services related to methane issues at the Abacherli Site in the City of Menifee, California (Figure 1). The subject investigation was conducted for the purpose of providing preliminary information regarding methane beneath the site with the goal of providing guidance during grading and/or development of the site. However, the investigation conducted cannot replace the Requirements of the County of Riverside, which requires testing on a lot-by-lot basis after rough grading has been completed.

The County of Riverside protocols require that minimum methane mitigation measures be incorporated into the construction plans for approval by the County's Building and Safety Staff where previous dairy, livestock or related activities have occurred. The actual mitigation measures are dependent on testing that can only be conducted 30-days after the site has been graded. The County has minimum standards for methane mitigation depending on the level of methane encountered. Methane mitigation must be provided on the foundation plans and approved by the appropriate agency. During construction the methane design engineer is required to certify and approve the installation of the mitigation measures on each lot or cluster of lots.

Methane production beneath the ground surface is controlled by several factors. It is produced in an anaerobic (oxygen depleted) environment where there is sufficient organic material present. Near the ground surface (upper three feet) there is little



Modified from Google Earth

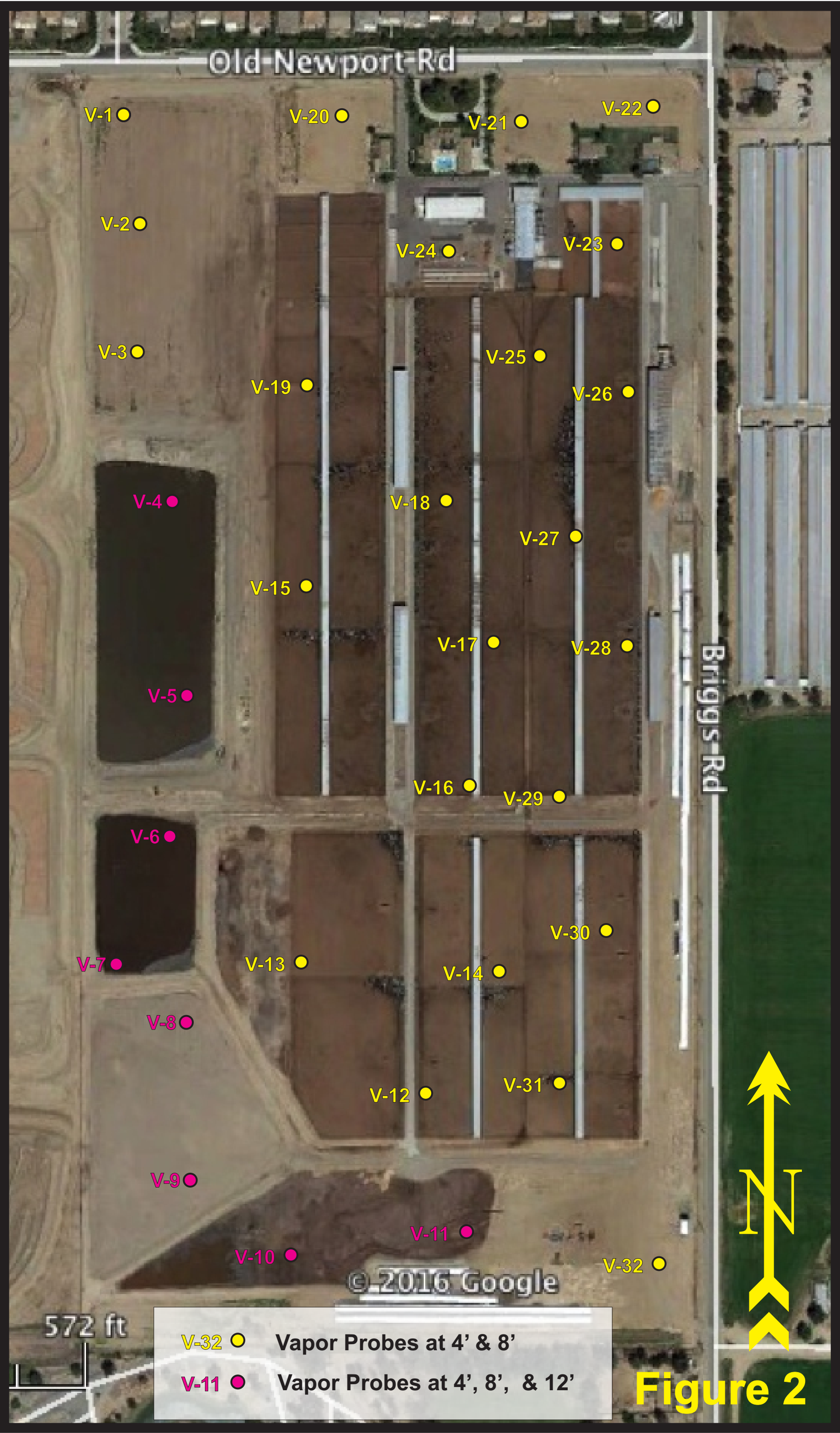
Site Location Map

methane production because the oxygen content is too high. This is especially true in sandier soils. With depth, the oxygen content decreases and therefore, the potential for methane production increases. Generally the organic content of soils decreases with depth as the amount of roots and other natural organic material decreases. For a typical dairy operation there is variable organic material beneath the surface due to the significant quantities of manure and urine produced by the livestock. The organics are flushed into the subsurface soils through rain and/or with the urine. The area where the waste products are either stockpiled and/or in the stock ponds have increased flushing of organics into the soils and therefore, the methane production is typically greatest in these areas.

Preliminary Methane Investigation

A preliminary Methane study is required by the County of Riverside, which identifies whether or not the project site, or portions of the site, were previously occupied by dairy operations and within a County of Riverside zone that requires special methane protocols. The subject site is rectangular shaped and approximately 75 acres in size. It is our understanding that the proposed development will consist of single-family homes sites along with associated improvements. CEC reviewed aerial photographs available from Google Earth dating 1994 to present and from Historicaerials.com, which has photographs available from 1967 to present. In addition regional and historical topographic maps were also observed.

Based on a preliminary review of readily available information it appears that approximately 85% of the site was utilized for previous livestock activities and will require evaluation and/or mitigation for methane. Figure 3 indicates those areas that have been identified to have been utilized for livestock related activities and those areas that did not have related activities (highlighted in green). The non-related activities areas include the residential structure areas, areas that were used primarily related to crops, and the site perimeter areas.



Field Testing for Methane

As requested, preliminary testing for methane was conducted at the site for the purpose of guiding future grading operations. Thirty-two probe sets were installed in a two-day period (Figure 2). This is approximately 1/2 probe per acre of land that was utilized for former dairy related activities. In the areas of former stock pens and other uses, the probes were set at depths of 4 and 8 feet below existing grade. In former pond areas a third probe was placed at a depth of approximately 12 feet below existing grades. The soil-gas probes were installed with a direct push rig that punches a hole in the ground. The tubing and gas probes are then placed in the hole and backfilled with sand surrounding the probes and bentonite plugs between the probe depths. The probe tubes are extended above the surface where they can be connected to a device that monitors/reads the amount of methane gas within the soil column. Each probe was monitored twice after the probes were installed in order to verify consistent results. The results of the methane monitoring are presented on Table 1.

Findings

Review of the site history and past uses at the site indicates three general areas present at the site. These are 1) Areas where there was not significant use for domestic animal /dairy related uses; 2) Areas where domestic animals were present and kept in pens and/or manure stored and spread; 3) Areas of stock ponds or desilting basins that collected the urine and other liquid waste from the animals at the site. The methane concentrations from the vapor probes were compared to these three use areas. Figure 3 indicates the maximum concentration measured (for either of the two readings) for the probes installed at each location. Analysis of the data in comparison to the past site usage indicates that for those areas that did not have domestic animal use (Area 1) had the lowest methane readings. In these areas (highlighted in green on Figure 3) the maximum concentration of methane detected was less than 200 parts per million (ppm). In Area 2, where the stock pens were located, the concentrations of methane were generally above 100 ppm and below 1,200 ppm. In the stock pond areas (Area 3

highlighted in red on Figure 3) methane concentrations were generally above 200 ppm and were as high as 50,000 ppm.

Conclusions and Recommendations

It is CEC's conclusion that the concentrations of methane measured in the subsurface probes match well with the previous site uses. Therefore, CEC's recommendations are specific to each of the three areas as discussed below.

Area 1 - Aerial photographs and methane readings both indicate that these areas were not used for significant domestic animal related uses, therefore these areas are considered exempt from methane mitigation and/or testing after grading has been completed. Care should be taken not to import fill from other portions of the site that has significant manure or organic content into this area. Prior to site development the proposed grading plan, which indicates the layout of individual lots, should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

Area 2 – This area (un-highlighted on Figure 3) has moderate methane concentrations beneath the surface. Due to the presence of domesticated animals, County regulations indicate that these areas must be tested on a lot-by-lot basis a minimum 30 days after grading has been conducted. In addition manure remnants were observed in the near surface within these former stock pen areas. CEC recommends that this near surface highly organic material be skimmed from these areas and removed offsite. Any former manure stockpiles should also be removed from the site.

Area 3 – The stock pond and desilting basin areas have collected urine and other waste products from the former daily operations and the subsurface soils have significant concentrations of organic material that have resulted in the production of methane. The production of significant methane was measured at depths of up to 12 feet. It is likely that that methane is being produced at depths greater than 12 feet. Remedial removals in former stock pond areas should be carefully observed during grading. Because the organics have been flushed deep into the native soils it may not be economically feasible



to remove all the organics that are producing significant methane. The near surface soils may not currently be producing the greatest quantities of methane, however this may be due to increased oxygen content, which is less favorable for methane production.

To develop the site into single-family residences will require significant grading to create level pads and associated improvements. A preliminary plan for the site also indicates the potential for a lake and/or deep drainage/desilting basin. To reduce the potential for methane production any highly organic manure stockpiles or the near surface remaining manure should be skimmed from the surface and removed offsite. Remedial removals in the stock pond areas should be based on visual observations to determine if highly organic rich layers are present. The methane testing conducted during this investigation suggests that remedial removals as deep as 10 feet below the former stock ponds would be prudent. However, ultimately the geotechnical consultant must also determine the appropriate remedial removal depths to provide a suitable foundation material.

As indicated previously, organic rich soils should not be placed within those areas that are designated as exempt from methane testing protocols (highlighted in green on Figure 3). County protocols also indicate that the organic content of fill materials beneath residential structures should be less than 1%.

Prior to site development the proposed grading plan which indicates the layout of individual lots should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

If you have any questions, comments, or addendums to this proposal, please feel free to contact Gary Carlin at any time at 714-508-1111.

Sincerely,

Carlin Environmental Services, Inc.

A handwritten signature in blue ink, appearing to read "Don Terres".

Don Terres

Project Geologist

P.G. 4349, CEG 1362

A handwritten signature in blue ink, appearing to read "G.T. Carlin".

Gary T. Carlin

President/Environmental Scientist

Table 1 - Menifee Project

Probe #	1st Reading - 2-2-16				2nd Reading - 2-3-16		
	4'	8'	12'		4'	8'	12'
1	120	100	x		95	160	x
2	110	180	x		110	140	x
3	75	190	x		50	190	x
4	2,450	50,000	3,800		2,350	49,000	2,700
5	360	7,050	1,250		160	4,400	900
6	35	800	3,800		400	290	1,200
7	1,250	7,800	15,750		590	3,600	4,900
8	800	5,780	5,250		Fail*	Fail*	Fail*
9	1,600	3,500	Fail*		Fail	4,500-Fail	Fail*
10	130	12,500	25,000		120	14,000-Fail	15,000-Fail
11	200	590	1,200		210	580	750
12	160	320	x		180	330	x
13	110	160	x		60	150	x
14	270	450	x		210	220	x
15	not read**	not read**	x		200	330	x
16	150	310	x		130	320	x
17	180	320	x		170	240	x
18	130	120	x		65	230	x
19	300	290	x		not read**	not read**	x
20	95	150	x		25	85	x
21	100	Fail*	x		85	Fail*	x
22	95	160	x		75	150	x
23	280	350	x		150	200	x
24	250	-	x		190	45	x
25	160	250	x		120	270	x
26	220	430	x		150	260	x
27	250	1,150	x		260	850-Fail	x
28	260	640	x		250	340	x
29	290	410	x		280	390	x
30	160	510	x		160	540-Fail	x
31	140	420	x		160	420	x
32	160	15	x		180	570	x

* Fail = Lack of Air in vapor Probe for Instrument to read

** Probe could not be located