

FINAL

**LANDFILL METHANE GAS CONFIRMATION SURVEY
REPORT FOR NINE LANDFILLS**

**FORT MONMOUTH, OCEANPORT,
MONMOUTH COUNTY, NEW JERSEY**

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LIST OF ACRONYMS

ACRONYM	DEFINITION
CO ₂	carbon dioxide
CWA	Charles Wood Area
FTMM	Fort Monmouth
FS	feasibility study
GEM	gas extraction monitor
GSP	gas sampling point
GVP	gas vapor probe
LEL	lower explosive limit
MP	Main Post
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
PID	photo-ionization detector
QA	quality assurance
QC	quality control
RI	remedial investigation

1.0 INTRODUCTION

This report presents the results of the methane gas confirmation survey for the nine landfills (FTMM-02, FTMM 03, FTMM-04, FTMM-05, FTMM-08, FTMM-12, FTMM-14, FTMM-18, and FTMM-25) located at Fort Monmouth (FTMM) in Oceanport, Monmouth County, New Jersey. Eight of the FTMM landfills are located at the Main Post (MP), and one landfill (FTMM-25) is located in the Charles Wood Area (CWA). The locations of the eight landfills at the MP are depicted on **Figure 1**, and the landfill located at CWA is shown on **Figure 2**.

An initial methane gas survey was performed at the request of the New Jersey Department of Environmental Protection (NJDEP) (NJDEP, 2014) and in accordance with the June 19, 2015 *Landfill Boundary Refinement and Methane Gas Survey* letter from the U.S. Army (Army) to NJDEP. The NJDEP acknowledged the Army's June 19, 2015 letter in an email dated July 8, 2015. The results of the initial methane gas survey were contained in the *Landfill Boundary Refinement and Methane Gas Survey Report for Nine Landfills* report submitted to the NJDEP in January 2016.

NJDEP's April 21, 2016 letter (*Comments on the January 2016 Final Landfill Boundary Refinement and Methane Gas Survey Report for Nine Landfills*) provides a high level summary of the methane results and states that "based upon results indicating methane is present within most of the landfills, ..., additional monitoring is required." The NJDEP letter describes the additional monitoring, including the need for a confirmation round of sampling at the nine landfills and quarterly monitoring to begin immediately at select landfills. If the confirmation results are significantly different than the initial methane gas survey, the recommendations outlined in the letter for passive or active gas evacuation systems, and requirement and frequency of additional methane surveys should be reevaluated. The Army responded to the NJDEP's letter in a June 28, 2016 letter outlining the approach for the confirmation round of the methane gas survey, and requesting that a meeting be held between, FTMM and NJDEP to discuss the results, comments, and scope of subsequent methane gas surveys. A confirmation round of methane gas survey was performed at the nine landfills in July 2016 and this report provides a summary of the confirmation round survey.

1.1 REPORT ORGANIZATION

This report includes the following sections:

- Section 1 provides an introduction and the organization of the report;
- Section 2 presents the methodology of the methane gas confirmation survey program;
- Sections 3 through 11 provide the methane gas confirmation survey results and findings, summary tables and figures, for each landfill;
- Section 12 summarizes the findings for the landfills; and
- Section 13 presents the references used in preparation of this report.

2.0 LANDFILL METHANE GAS CONFIRMATION SURVEY

A methane gas survey confirmation round was performed at the nine landfills as required by NJDEP in their April 21, 2016 letter. This confirmation round supplements the initial methane gas survey results. To confirm the initial results, in July 2016 Parsons duplicated the soil gas locations of the methane gas survey conducted in the summer 2015, however, additional soil gas locations were installed as follows per the NJDEP April 21, 2016 letter:

- 1) At select strategic perimeter locations where adjacent interior sample results indicated the presence of methane in the 2015 sampling round;
- 2) To maintain a maximum interval of 300 feet between sampling points along the perimeter (also in accordance in with NJDEP 7:26-2A).
- 3) At select strategic locations within the landfill boundaries to account for nearby potential receptors i.e. in buildings (also in accordance in with NJDEP 7:26-2A); and
- 4) If a perimeter sample result indicates the presence of methane greater than 0%, then stepout locations were conducted outwardly and along the landfill perimeter.

The confirmation round did not include sampling at the following locations:

- 1) outside the landfill boundaries or outside FTMM property boundaries;
- 2) by any structures located proximal to each landfill; and
- 3) throughout the landfill interior or along natural barrier to gas migration (e.g. water bodies) unless there was an existing gas sampling point (GSP) location from the 2015 sampling round

Methane gas confirmation sampling was performed at a total of 158 locations for the nine landfills. At each location, the methane gas soil gas points were sampled using an AMS gas vapor probe (GVP) kit. The kit consists of steel GVP rods attached to a retractable GVP tip; 3/16-inch polyethylene tubing was pre-threaded through the rods and attached to the tip. The GVP tip has a retractable screened section that allows for remote reading of the landfill gas from the surface of the sampling location. The GVP assembly consisting of the rods, tubing and retractable tip was driven to a sampling depth of 3.5 feet bgs with a slide hammer using the same methodology as in the 2015 sampling round. At the desired sampling depth, the GVP tip was retracted, and the open end of the tubing at the surface was attached to a LANDTEC Gas Extraction Monitor-2000 (GEM-2000), which pumped and provided an instantaneous measurement of landfill gases at the GVP tip. Landfill gas readings were recorded once the tubing volume was purged and the readings had stabilized. Each gas sample was analyzed for percent methane, percent of methane lower explosive limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen. In some locations, the soil gas probe could not be driven to 3.5 feet bgs because the water table occurred shallower than this depth. At these locations, the soil gas probe was driven to a depth six inches above the water table, and variations on the depth of sample collection are noted on each landfill table. The barometric pressure status was noted during sampling.

If methane was detected greater than 0% at a location, then additional locations were added to investigate potential off-site migration of methane gas. A QA/QC methane gas sample was taken 1 per every 10 samples and at least one per landfill.

1 Details of the confirmation soil GSP ID and landfill gas results are presented in **Table 1**
2 through **Table 9** (please see the Table Section of this report). Summaries of the two methane gas
3 surveys (2015 initial survey and 2016 confirmation survey) are presented in **Table A** through
4 **Table I** in the text. Locations of the methane gas soil points, where methane gas was detected
5 (at 46 of 158 sample locations), and where methane was measured greater than 25 percent of the
6 LEL (at 26 of 158 sample locations) are presented on **Figure 3** through **Figure 11** (please see the
7 Figure Section of this report).

3.0 FTMM-02 RESULTS

A total of 27 landfill gas readings (including two QA/QC sample) were measured at 25 soil gas locations (thirteen existing locations, twelve new) at FTMM-02 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 1**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL in 2015 and 2016 are provided in **Figure 3**. The results are summarized in the **Table A** below.

Table A: FTMM-02 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	3 (M2SG2, M2SG3, and M2SG4)	9 (M2SG2, M2SG3, M2SG5, M2SG8, M2SG12, M2SG13, M2SG18, M2SG19, and M2SG22)
Methane detected above 25% of the LEL	2 (M2SG2, and M2SG3)	6 (M2SG2, M2SG3, M2SG12, M2SG13, M2SG18, and M2SG22)
Methane detected in the confirmation survey at 2015 initial survey locations	N/A	5 (M2SG2, M2SG3, M2SG8, M2SG12, M2SG13)
Methane detected at an interior GSP location	3 (M2SG2, M2SG3, and M2SG4)	8 (M2SG2, M2SG3, M2SG5, M2SG8, M2SG12, M2SG18, M2SG19, and M2SG22)
Methane detected at a perimeter GSP location	0	1 (M2SG13)

Notes:

1) N/A = Not applicable

In the initial survey, methane gas was detected at locations on the interior (M2SG2, M2SG3, M2SG4) within the west-central portion of the landfill. In the confirmation survey, methane gas was detected at locations on the interior (M2SG2, M2SG3, M2SG5, M2SG8) within the west-central portion of the landfill, and at selected interior locations (M2SG12, M2SG18, M2SG19, and M2SG22) adjacent to perimeter step-out locations. M2SG18, M2SG19, and M2SG22 were additional locations added in the confirmation survey. Methane gas was detected at one perimeter location (M2SG13) on the northern side of the landfill; however, Mill Creek provides a physical boundary to methane gas migration to the north. The collective methane gas surveys

1 indicate the area within the landfill where methane was found above 25 percent of the LEL is
2 limited to the interior locations; and methane gas was not detected at the outermost perimeter
3 locations.

4 FTMM-02 commenced operation for the general disposal of domestic and industrial wastes
5 in 1964 and ceased operation in 1968. The methane detections are most likely attributed to
6 methane gas generating conditions at the landfill, and to natural methane gas generating
7 conditions from the decomposition of organics in this area. FTMM-02 is covered with dense
8 patches of phragmites, and wetlands are a well-documented known emission source of natural
9 methane gas to the atmosphere (Couwenberg, 2009). The additional GSPs and stepout locations
10 (M2SG21, M2SG23, and M2SG24) were strategically placed based on the methane detections.
11 Soil gas locations on the perimeter (including stepouts) of the landfill did not have methane
12 detections and showed that landfill gases are not migrating off-site at FTMM-02.

4.0 FTMM-03 RESULTS

A total of nineteen (19) landfill gas readings (including two QA/QC samples) were measured at 17 soil gas locations (twelve existing locations, five new) at FTMM-03 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 2**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are provided in **Figure 4**. The results are summarized in **Table B** below.

Table B: FTMM-03 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	2 (M3SG1 and M3SG2)	2 (M3SG4 and M3SG14)
Methane detected above 25% of the LEL	1 (M3SG1)	1 (M3SG4)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	1 (M3SG4)
Methane detected at an interior GSP location	2 (M3SG1 and M3SG2)	1 (M3SG14)
Methane detected at a perimeter GSP location	0	1 (M3SG4)

In the initial survey, methane gas was detected in interior locations (M3SG1 and M3SG2) within the northwest portion of the landfill. In the confirmation survey, methane gas was detected at an interior location (M3SG14) added in the confirmation round within the central portion of the landfill. Methane gas was detected at one perimeter location (M3SG4) on the northern side of the landfill; however, Lafetra Creek provides a physical boundary to methane gas migration to the north. The collective methane gas survey indicates the area within the landfill where methane was found above 25 percent of the LEL is limited to one perimeter location at the landfill (M3SG4) bounded by a physical water body.

FTMM-03 commenced operation for the general disposal of domestic and industrial wastes in 1959 and ceased operation in 1964. The methane detections most likely are attributed to natural methane gas generating conditions from the decomposition of organics in this area of the landfill. FTMM-03 is covered with dense vegetation of phragmites, and wetlands are a well-documented known emission source of natural methane gas to the atmosphere (Couwenberg, 2009). The additional GSPs and stepout locations (e.g., M3SG17) were strategically placed based on the methane detections. Soil gas locations on the perimeter (including stepouts) of the landfill did not have methane detections and showed that landfill gases are not migrating off-site at FTMM-03.

5.0 FTMM-04 RESULTS

A total of 23 landfill gas readings (including three QA/QC samples) were measured at 20 soil gas locations (eleven existing locations, nine new) at FTMM-04 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 3**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are shown on **Figure 5**. The results are summarized in **Table C** below.

Table C: FTMM-04 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	2 (M4SG1 and M4SG4)	8 (M4SG1, M4SG4, M4SG11, M3SG15, M4SG16, M4SG17, M4SG19, and M4SG20)
Methane detected above 25% of the LEL	1 (M4SG4)	7 (M4SG1, M4SG4, M4SG11, M3SG15, M4SG17, M4SG19, and M4SG20)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	2 (M4SG1 and M4SG4)
Methane detected at an interior GSP location	2 (M4SG1 and M4SG4)	2 (M4SG1 and M4SG4)
Methane detected at a perimeter GSP location	N/A	6 (M4SG11, M3SG15, M4SG16, M4SG17, M4SG19, and M4SG20)

In both the initial and confirmation surveys, methane gas was detected at one location (M4SG4) on the interior of the landfill east of Mill Creek, and at one interior location (M4SG1) northwest of Mill Creek. In the confirmation survey, methane gas was detected at several perimeter locations (M4SG11, M4SG15, M4SG16, M4SG17, M4SG19, and M4SG20) on the northern side of the landfill, adjacent to North Drive and west of Mill Creek. The methane gas survey results indicate the area within the landfill where methane was found above 25 percent of the LEL is limited to the interior (M4SG1 and M4SG4) with the exception of the locations adjacent to North Drive in the northwest corner of the landfill.

FTMM-04 commenced operation for the general disposal of domestic and industrial wastes in 1955 and ceased operation in 1956. The methane detections are most likely attributed to methane gas generating conditions at the landfill. Northwest of Mill Creek, soil gas locations on

1 the northern perimeter had methane detections (e.g., M4SG11), and stepouts were performed
2 along the landfill perimeter adjacent to North Drive at 25-ft intervals until methane was not
3 detected (M4SG18) or a water barrier (Mill Creek) was encountered (M2SG20). The methane
4 gas survey showed that landfill gases were detected near North Drive in the northwestern portion
5 of FTMM-04. However, the FTMM-03 landfill is located adjacent to North Drive, and results
6 from the southeastern portion of this landfill (near FTMM-04) indicate that no methane was
7 detected in this area (M3SG9 and M2SG16), and beyond the FTMM-03 landfill is Lafetra Creek.
8 In addition, there are several test pits indicating the presence of landfill solid waste in the vicinity
9 of the methane gas detections. In accordance with the *Final Landfill Boundary Refinement for*
10 *FTMM-04 only*, this material may be excavated and relocated within the proposed landfill
11 boundaries which may potentially eliminate the methane gas source from the perimeter of
12 FTMM-04.

6.0 FTMM-05 RESULTS

A total of eleven (11) landfill gas readings (including one QA/QC sample) were measured at ten soil gas locations (six existing locations, four new) at FTMM-05 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 4**; variations to the depth of sample collection are also noted in the table. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are shown on **Figure 6**. The results are summarized in **Table D** below.

Table D: FTMM-05 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	0	1 (M5SG6)
Methane detected above 25% of the LEL	0	0
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	0
Methane detected at an interior GSP location	0	1 (M5SG6)
Methane detected at a perimeter GSP location	0	0

In the initial survey, methane gas was not detected in the GSP. In the confirmation survey, methane gas was detected at one location (M5SG6) on the southwestern interior portion of the landfill and east of Mill Creek. The methane gas survey results indicate there are no areas within the landfill where methane was found above 25 percent of the LEL. The methane gas survey showed that landfill gases are not migrating off-site at FTMM-05.

7.0 FTMM-08 RESULTS

A total of sixteen (16) landfill gas readings (including one QA/QC sample) were measured at 15 soil gas locations (13 existing locations, 2 new) at FTMM-08 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 5**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are shown in **Figure 7**. The results are summarized in **Table E** below.

Table E: FTMM-08 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	2 (M8SG4 and M8SG6)	4 (M8SG1, M8SG3, M8SG4, and M8SG6)
Methane detected above 25% of the LEL	1 (M8SG6)	2 (M8SG3 and M8SG6)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	4 (M8SG1, M8SG3, M8SG4, and M8SG6)
Methane detected at an interior GSP location	2 (M8SG4 and M8SG6)	4 (M8SG1, M8SG3, M8SG4 and M8SG6)
Methane detected at a perimeter GSP location	0	0

In the initial survey, methane gas was detected at two locations located on the interior (M8SG4 and M8SG6) of the landfill. In the confirmation survey, methane gas was detected at four locations located on the interior (M8SG1, M8SG3, M8SG4 and M8SG6) of the landfill. The collective methane gas survey indicates the area within the landfill where methane gas was found above 25 percent of the LEL is limited to the interior (M8SG3 and M8SG6).

FTMM-08 commenced operation for the general disposal of domestic and industrial wastes in 1962 and ceased operation in 1981. The methane detections are attributed to methane gas generating conditions at the landfill, and natural methane gas generating conditions from the decomposition of organics in this area of the landfill. FTMM-08 is covered with dense vegetation along the perimeter of the landfill. The additional GSP and stepout locations (M8SG14 and M8SG15) were strategically placed based on the methane detections. Soil gas locations on the perimeter (including stepouts) of the landfill did not have methane detections and showed that landfill gases are not migrating off-site at FTMM-08.

8.0 FTMM-12 RESULTS

A total of 35 landfill gas readings (including four QA/QC samples) were measured at 31 soil gas locations (15 existing locations, 16 new) at FTMM-12 as part of the confirmation methane gas survey. Sampling was conducted in July and October 2016. The landfill gas readings are presented in **Table 6**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are shown in **Figure 8**. The results are summarized in **Table F** below.

Table F: FTMM-12 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	4 (M12SG1, M12SG2, M12SG9, and M12SG13)	13 (M12SG1, M12SG2, M12SG3, M12SG4, M12SG5, M12SG6, M12SG9, M12SG13, M12SG14 M12SG19, M12SG20, M12SG22, and M12SG28)
Methane detected above 25% of the LEL	3 (M12SG1, M12SG2, and M12SG13)	7 (M12SG1, M12SG2, M12SG5, M12SG6, M12SG13, M12SG19, and M12SG22)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	9 (M12SG1, M12SG2, M12SG3, M12SG4, M12SG5, M12SG6, M12SG9, M12SG13, and M12SG14)
Methane detected at an interior GSP location	4 (M12SG1, M12SG2, M12SG9, and M12SG13)	8 (M12SG1, M12SG2, M12SG3, M12SG4, M12SG5, M12SG6, and M12SG9, and M12SG13)
Methane detected at a perimeter GSP location	0	5 (M12SG14, M12SG19, M12SG20, M12SG22, and M12SG28)

In the initial survey, methane gas was detected at locations located on the interior (M12SG1, M12SG2, M12SG9, and M12SG13) and not detected at perimeter locations. In the confirmation survey, methane gas was detected at locations located on the interior (M12SG1, M12SG2,

M12SG3, M12SG4, M12SG5, M12SG9, and M12SG13) and perimeter locations (M12SG14, M12SG19, M12SG20, M12SG22, and M12SG28). The collective methane results indicate three areas within the landfill where methane was found above 25 percent of the LEL and are limited to a western area (M12SG1 and M12SG2), central area (M12SG5 and M12SG6), and eastern area (near Murphy Drive) primarily on the interior of the landfill (M12SG13). Methane was detected at select perimeter locations in the western area (M12SG19) and in the eastern area (M12SG22). Soil gas locations on the perimeter had methane detections (e.g., M12SG14, M12SG20, M12SG22), and additional stepout locations were strategically placed based on the detections. Additional soil gas locations were performed along the landfill perimeter adjacent to Murphy Drive and Moonshot Drive at 25-ft intervals until methane was not detected (e.g., M12SG23, M12SG24, M12SG28, and M12SG29).

FTMM-12 commenced operation for the general disposal of domestic and industrial wastes in 1950 and ceased operation in 1956. The methane detections are most likely attributed to methane gas generating conditions at the landfill, and to natural methane gas generating conditions from the decomposition of organics in this area. FTMM-12 is covered with dense vegetation of phragmites, and wetlands are a well-documented known emission source of natural methane gas to the atmosphere (Couwenberg, 2009). The methane gas survey showed that landfill gases are potentially migrating off-site toward Oceanport Creek at FTMM-12 east of M12SG22 near Murphy Drive in the eastern portion of FTMM-12; however, the creek is a large water body which provides a physical boundary for methane gas migration.

The methane gas survey showed that landfill gases indicate the potential for migration near a building east of M12SG19 in the western portion of FTMM-12. M12SG19 is located adjacent to a roadway and at the FTMM-12 boundary. On October 10, 2016, Parsons collected two additional stepout samples east and across the roadway of M12SG19 and no methane gas was detected at these locations. This additional information suggests that landfill gas is not be migrating off-site at the western portion of FTMM-12.

9.0 FTMM-14 RESULTS

A total of 22 landfill gas readings (including two QA/QC samples) were measured at 20 soil gas locations (15 existing locations, 6 new) at FTMM-14 as part of the confirmation methane gas survey. Sampling was conducted in July 2016. The landfill gas readings are presented in **Table 7**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are provided in **Figure 9**. The results are summarized in **Table G** below.

Table G: FTMM-14 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	4 (M14SG4, M14SG7, M14SG8, and M14SG9)	6 (M14SG3, M14SG4, M14SG5, M14SG8, M14SG9, and M14SG10)
Methane detected above 25% of the LEL	2 (M14SG4 and M14SG9)	2 (M14SG4 and M14SG10)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	6 (M14SG3, M14SG4, M14SG5, M14SG8, M14SG9, and M14SG10)
Methane detected at an interior GSP location	3 (M14SG4, M14SG8, and M14SG9)	6 (M14SG3, M14SG4, M14SG5, M14SG8, M14SG9, and M14SG10)
Methane detected at a perimeter GSP location	0	0

In the initial survey, methane gas was detected predominantly at locations located in the central interior portion of the landfill (M14SG4, M14SG8, and M14SG9). In the confirmation survey, methane gas was detected predominantly at locations located in the central interior portion of the landfill (M14SG3, M14SG4, M14SG5, M14SG8, M14SG9, and M14SG10). The collective methane results indicate the areas where methane was found above 25 percent of the LEL are limited to the north-central interior portion of the landfill (M14SG4 and M14SG10).

FTMM-14 commenced operation for the general disposal of domestic and industrial wastes in 1965 and ceased operation in 1966. The methane detections most likely are attributed to natural methane gas generating conditions from the decomposition of organics in this area of the

1 landfill. FTMM-14 is covered with dense vegetation of phragmites, and wetlands are a well-
2 documented known emission source of natural methane gas to the atmosphere (Couwenberg,
3 2009). The additional GSPs and stepout locations (M14SG20 and M14SG21) were strategically
4 placed based on the methane detections. Soil gas locations on the perimeter of the landfill
5 including M14SG14 and M14SG18 and the stepout locations did not have methane detections
6 showing that landfill gases are not migrating off-site at FTMM-14.

10.0 FTMM-18 RESULTS

A total of 10 landfill gas readings (including one QA/QC sample) were measured at 9 soil gas locations (5 existing locations, 4 new) at FTMM-18 as part of the confirmation methane gas survey. Sampling was conducted in July and October 2016. The landfill gas readings are presented in **Table 8**. The soil gas sampling locations and the locations where methane gas was detected and exceeded 25 percent of the LEL are provided in **Figure 10**. The results are summarized in **Table H** below.

Table H: FTMM-18 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	0	2 (M18SG7 and M18SG10)
Methane detected above 25% of the LEL	0	1 (M18SG10)
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	1 (M18SG7)
Methane detected at an interior GSP location	0	1 (M18SG7)
Methane detected at a perimeter GSP location	N/A	1 (M18SG10)

In the initial survey, methane gas was not detected in the GSP. In the confirmation survey, methane gas was detected at one interior location (M18SG7) and one perimeter location (M18SG10) in the landfill. The collective methane results indicate the areas within the landfill where methane was found above 25 percent of the LEL are limited to a location along the southwest perimeter (M18SG10). Stepouts were strategically placed based on the methane detection and performed along the landfill perimeter adjacent to asphalt parking lot at 25-ft intervals (M18SG12 and M18SG13) until methane was not detected.

FTMM-18 commenced operation for general disposal of domestic and industrial wastes at an unknown date and ceased operation in 1971. The methane detections maybe attributed to methane gas generating conditions at the landfill; however, Parkers Creek provides a physical boundary to methane gas migration to the west, north and east. The methane detections most likely are attributed to natural methane gas generating conditions from the decomposition of organics in this area of the landfill. FTMM-18 is covered with dense vegetation including phragmites, trees, and bushes. Wetlands are a well-documented known emission source of natural methane gas to the atmosphere (Couwenberg, 2009).

The methane gas survey showed that landfill gases were potentially migrating off-site at FTMM-18 to the south of M18SG10, which is located adjacent to a parking lot and at the FTMM-18 boundary. On October 10, 2016, additional stepout locations were conducted south of M18SG10 and no methane gas was detected at location performed in the parking lot. This

- 1 additional information suggests that landfill gas is not be migrating off-site at the southern
- 2 portion of FTMM-18.

11.0 FTMM-25 RESULTS

A total of 11 landfill gas readings (including one QA/QC samples) were measured at 12 soil gas locations (seven existing locations, five new) at FTMM-25 as part of the confirmation methane gas survey. Sampling was conducted on July 20, 2016. The landfill gas readings are presented in **Table 9**. The soil gas sampling locations and the locations where methane gas was detected exceeded 25 percent of the LEL are provided in **Figure 11**. The results are summarized in **Table I** below.

Table I: FTMM-25 Methane Gas Summary		
Methane Gas Summary	2015 Initial Survey (locations)	2016 Confirmation Survey (locations)
Methane detected	1 (M25SG4)	1 (M25SG4)
Methane detected above 25% of the LEL	1 (M25SG4)	0
Methane detected in the confirmation survey at 2015 initial survey existing locations	N/A	1 (M25SG4)
Methane detected at an interior GSP location	1 (M25SG4)	1 (M25SG4)
Methane detected at a perimeter GSP location	N/A	0

In both the initial and confirmation surveys, methane gas was detected at one location in the interior of the landfill (M25SG4). The collective methane results indicate there is one area within the landfill near M25SG4 where methane was found above 25 percent of the LEL, which was in the interior portion east of Shrewsbury Creek.

FTMM-25 commenced operation for the general disposal of domestic and industrial wastes in 1955 and ceased operation in 1966. The methane detections are most likely attributed to methane gas generating conditions at the landfill and natural methane gas generating conditions from the decomposition of organics in this area of the landfill. The methane gas survey showed that landfill gases are not migrating off-site at FTMM-25.

12.0 SUMMARY OF FINDINGS

Methane gas was detected at a total of 46 gas sampling locations out of 158 locations at the nine FTMM landfills, and 26 of those sampling locations exceeded 25 percent of the methane LEL in the confirmation round.

- The 46 locations with methane gas detections were at landfills: FTMM-02 (9), FTMM-03 (2), FTMM-04 (8), FTMM-05 (1), FTMM-08 (4), FTMM-12 (13), FTMM-14 (6), FTMM-18 (2) and FTMM-25 (1).
- The 26 locations with methane greater than 25% of the LEL were at six landfills: FTMM-02 (6), FTMM-03 (1), FTMM-04 (7), FTMM-08 (2), FTMM-12 (7), and FTMM-14 (2), and FTMM-18 (1).
- Methane gas was detected at 32 interior locations: FTMM-02 (8), FTMM-03 (1), FTMM-04 (2), FTMM-05 (1), FTMM-08 (4), FTMM-12 (8), FTMM-14 (6), FTMM-18 (1) and FTMM-25 (1). Of the 32 interior locations, sixteen were greater than 25% of the LEL; FTMM-02 (5), FTMM-04 (2), FTMM-08 (2), FTMM-12 (5), FTMM-14 (2).
- Methane gas was detected at fourteen (14) perimeter locations; FTMM-02 (1), FTMM-03 (1), FTMM-04 (6), FTMM-12 (5), and FTMM-18 (1). Of the fourteen perimeter locations, ten (10) were greater than 25% of the LEL; FTMM-02 (1), FTMM-03 (1), FTMM-04 (5), FTMM-12 (2), and FTMM-18 (1).

When methane gas was detected at a sampling location, stepouts were performed to determine the extent of the methane gas. At six of the nine FTMM landfills, none of the landfill gas readings at sampling locations (including stepouts) on the perimeter of the landfill boundaries had methane detections. This demonstrates that landfill gases are not migrating off-site at those landfills and no further monitoring is requested for these six landfills.

At three of the FTMM landfills, FTMM-04, FTMM-12, and FTMM-18 methane was detected on the perimeter of the landfills. At FTMM-04, methane gas survey showed that landfill gases could potentially extend off-site near North Drive in the northwestern portion of FTMM-04. However, the FTMM-03 landfill results located near North Drive indicate that no methane was detected in this area. At FTMM-12 and FTMM-18, methane was detected along the landfill perimeters where additional step-outs were not performed during the confirmation survey due to adjacent roadways/parking lots and the landfill boundaries. The methane gas survey showed that landfill gases have the potential to migrating off-site at FTMM-18 to the south of M18SG10, and to the east of M12SG22 and M12SG19 at FTMM-12. Additional methane gas sampling was performed on October 10, 2016 at these GSP locations in the direction of the potential receptors, and methane gas was not detected. This additional information suggests that landfill gas is not be migrating off-site at the western portion of FTMM-12 and the southern portion of FTMM-18.

Based on a review of NJDEP 7:26-2A, the detection of 25 percent of the LEL of combustible landfill gases, at the perimeter of the sanitary landfill property, or any concentration of any landfill gases within any structures shall trigger the construction of an active gas collection and venting system. Passive gas venting systems may be designed and constructed initially as a preventive measure against sanitary landfill gas migration.

1 The methane gas survey confirmation round results were used to further validate, along with
2 the summer 2015 results that methane gas concentrations do not exceed twenty-five percent of
3 the LEL along the perimeters and the need for passive or active venting is not required for at
4 least seven of the nine FTMM landfills (excluding FTMM-12 and FTMM-18). At those landfills
5 where confirmation round results indicate that methane gas is not detected along the perimeter of
6 the landfill, then FTMM assumes that follow on surveys, if required, would be limited to only
7 the perimeter soil gas locations to maintain that no migration of methane gas exists beyond the
8 landfill limits.

9 The April 21, 2016 *Comments on the January 2016 Final Landfill Boundary Refinement*
10 *and Methane Gas Survey Report for Nine Landfills* letter from NJDEP, outlined the following
11 recommendations:

- 12 • FTMM is to begin conducting quarterly methane surveys immediately at the
13 perimeter of landfills FTMM-02, FTMM-12 and FTMM-14.
- 14 • Quarterly methane surveys should be performed at landfills FTMM-03, FTMM-04
15 and FTMM-8 upon completion of installation of the final cover system.
- 16 • Quarterly gas monitoring continues for at least 8 sampling events.
- 17 • Future decisions regarding the need for installation of a venting system or the
18 reduction or discontinuance of further monitoring may be made based on the results
19 of the quarterly surveys.

20 FTMM recommends that a meeting be held to discuss the information presented in this
21 report to discuss the collective results from the initial and confirmation rounds. Based on the
22 collective results, FTMM would like the opportunity to discuss the NJDEP comments and
23 NJDEP recommendations from the April 2016 letter listed above. In particular, where the intent
24 of the confirmation sampling is to validate no migration beyond the landfill perimeters, FTMM
25 would like to further discuss and obtain clarification on N.J.A.C. 7:262A.8(h)9 and the
26 requirements in regard to the need for sampling points along structures. As part of this
27 discussion, it should also be noted that some of the structures proximal to the landfills will likely
28 be demolished in the near future.

13.0 REFERENCES

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Table 1
FTMM-02: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M2SG1	Interior	O/C	7/5/2016	0.0	0.0	7.1	12.2	29.73	S	
M2SG2	Interior	O/C	7/5/2016	1.8	36.0	8.3	15.2	29.74	S	
M2SG3	Interior	O/C	7/6/2016	33.1	OOOR	7.3	0.3	29.76	S	
M2SG3QA	Interior	O/C	7/6/2016	32.8	OOOR	6.8	1.4	29.76	S	QA/QC
M2SG4	Interior	O/C	7/5/2016	0.0	0.0	6.7	79.0	29.75	S	
M2SG5	Interior	O/C	7/6/2016	0.4	9.0	0.7	18.9	29.83	S	
M2SG6	Interior	O/C	7/5/2016	0.0	0.0	5.1	14.2	29.76	S	
M2SG7	Interior	O/C	7/6/2016	0.0	0.0	1.9	18.1	29.82	S	
M2SG8	Interior	O/C	7/5/2016	0.02	4.0	0.0	19.8	29.75	S	
M2SG9	Perimeter	O/C	7/5/2016	0.00	0.0	10.9	8.6	29.75	S	
M2SG10	Perimeter	O/C	7/6/2016	0.00	0.0	0.3	20.1	29.76	S	Sampled at 2.0' bgs
M2SG11	Perimeter	O/C	7/5/2016	0.00	0.0	12.0	6.7	29.75	S	
M2SG12	Interior	O/C	7/6/2016	34.2	OOOR	6.1	2.0	29.76	S	
M2SG12QA	Interior	O/C	7/6/2016	34.3	OOOR	6.0	1.9	29.76	S	QA/QC
M2SG13	Perimeter	O/C	7/5/2016	2.70	55.0	14.7	1.6	29.76	S	
M2SG14	Perimeter	C	7/5/2016	0.00	0.0	10.0	8.6	29.74	S	
M2SG15	Perimeter	C	7/5/2016	0.00	0.0	1.2	19.1	29.71	S	Sampled at 2.5' bgs
M2SG16	Perimeter	C	7/6/2016	0.00	0.0	6.7	13.5	29.91	S	
M2SG17	Perimeter	C	7/6/2016	0.00	0.0	8.6	11.5	29.76	S	
M2SG18	Interior	C	7/6/2016	58.9	OOOR	15.0	0.4	29.83	S	
M2SG19	Interior	C	7/6/2016	0.40	8.0	4.3	13.1	29.82	S	
M2SG20	Perimeter	C	7/5/2016	0.00	0.0	1.1	18.8	29.75	S	
M2SG21	Perimeter	C	7/13/2016	0.00	0.0	3.9	17.3	30.12	S	Stepout
M2SG22	Interior	C	7/13/2016	48.90	OOOR	13.4	2.8	30.12	S	Stepout
M2SG23	Perimeter	C	7/13/2016	0.00	0.0	7.7	10.2	30.11	S	Stepout
M2SG24	Perimeter	C	7/13/2016	0.00	0.0	1.3	18.4	30.11	S	Stepout
M2SG25	Perimeter	C	7/21/2016	0.00	0.0	1.2	18.9	30.11	F	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 2
FTMM-03: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M3SG1	Interior	O/C	7/11/2016	0.0	0.0	3.2	17.4	30.12	S	
M3SG1QA	Interior	O/C	7/11/2016	0.0	0.0	3.3	17.2	30.12	S	QA/QC
M3SG2	Interior	O/C	7/11/2016	0.0	0.0	7.1	11.1	30.1	S	Sampled at 2.5' bgs
M3SG3	Interior	O/C	7/11/2016	0.0	0.0	14.4	5.7	30.1	R	
M3SG4	Perimeter	O/C	7/11/2016	22.1	OOR	9.8	2.1	30.1	S	
M3SG5	Perimeter	O/C	7/12/2016	0.0	0.0	0.7	19.4	30.2	S	
M3SG6	Perimeter	O/C	7/11/2016	0.0	0.0	6.3	11.9	30.1	S	
M3SG7	Interior	O/C	7/12/2016	0.0	0.0	0.2	19.4	30.2	S	
M3SG8	Perimeter	O/C	7/12/2016	0.0	0.0	1.7	18.6	30.2	S	
M3SG9	Interior	O/C	7/12/2016	0.0	0.0	2.5	17.1	30.17	S	
M3SG10	Perimeter	O/C	7/11/2016	0.0	0.0	7.6	10.9	30.12	S	
M3SG10QA	Perimeter	O/C	7/11/2016	0.0	0.0	5.6	13	30.12	S	QA/QC
M3SG11	Perimeter	O/C	7/11/2016	0.0	0.0	0.0	20.2	30.12	S	
M3SG12	Perimeter	O/C	7/12/2016	0.0	0.0	0	21.1	30.12	S	
M3SG13	Perimeter	C	7/11/2016	0.0	0.0	4.6	15.1	30.12	S	
M3SG14	Interior	C	7/12/2016	0.4	6.0	0.4	19.9	30.12	S	
M3SG15	Perimeter	C	7/12/2016	0.0	0.0	0.7	18.9	30.17	S	
M3SG16	Perimeter	C	7/12/2016	0.0	0.0	1.4	18.8	30.17	S	Sampled at 2.5' bgs
M3SG17	Perimeter	C	7/13/2016	0.0	0.0	1.7	17.5	30.09	S	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 3
FTMM-04: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M4SG1	Interior	I/C	7/8/2016	1.3	29.0	4.6	12.5	29.83	S	Sampled at 3.0' bgs
M4SG2	Interior	I/C	7/8/2016	0.0	0.0	0.3	19.1	29.82	S	
M4SG3	Perimeter	I/C	7/8/2016	0.0	0.0	0.4	19.1	29.82	S	
M4SG4	Interior	I/C	7/8/2016	2.4	46.0	1.7	13.4	29.82	S	
M4SG4QA	Interior	I/C	7/8/2016	3.1	61.0	2.1	11.9	29.82	S	QA/QC
M4SG5	Interior	I/C	7/8/2016	0.0	0.0	2.0	13.0	29.83	S	
M4SG6	Perimeter	I/C	7/8/2016	0.0	0.0	2.8	13.6	29.83	S	
M4SG7	Perimeter	I/C	7/8/2016	0.0	0.0	2.7	16.7	29.81	S	
M4SG8	Perimeter	I/C	7/8/2016	0.0	0.0	1.9	18.0	29.81	S	
M4SG8QA	Perimeter	I/C	7/8/2016	0.0	0.0	1.3	18.7	29.81	S	
M4SG9	Perimeter	I/C	7/8/2016	0.0	0.0	2.2	16.5	29.82	S	
M4SG10	Perimeter	I/C	7/8/2016	0.0	0.0	0	18.6	29.83	S	Sampled at 2.0' bgs
M4SG11	Perimeter	C	7/8/2016	7.0	OOR	7.8	2.2	29.83	S	
M4SG12	Perimeter	C	7/8/2016	0.0	0.0	5.1	11.7	29.83	S	
M4SG13	Perimeter	C	7/8/2016	0.0	0.0	1.0	14.9	29.82	S	
M4SG14	Perimeter	C	7/8/2016	0.0	0.0	1.9	16.9	29.81	S	
M4SG15	Perimeter	C	7/15/2016	20.9	OOR	15.6	3.4	29.92	S	Stepout
M4SG16	Perimeter	C	7/15/2016	0.3	6.0	2.2	17.3	29.92	S	Stepout
M4SG17	Perimeter	C	7/15/2016	2.4	49.0	10.5	8.7	29.92	S	Stepout
M4SG18	Perimeter	C	7/15/2016	0.0	0.0	0.4	19.2	29.92	S	Stepout
M4SG19	Perimeter	C	7/15/2016	8.6	OOR	5	6.1	29.91	S	Stepout
M4SG20	Perimeter	C	7/15/2016	3.7	74.0	3.4	12.9	29.91	S	Stepout
M4SG20QA	Perimeter	C	7/15/2016	4.6	92.0	4.5	10.6	29.91	S	QA/QC

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 4
FTMM-05: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M5SG1	Perimeter	I/C	7/18/2016	0.0	0.0	3.5	14	30.06	F	
M5SG2	Perimeter	I/C	7/18/2016	0.0	0.0	1.4	17.5	30.10	F	
M5SG3	Interior	I/C	7/18/2016	0.0	0.0	0.9	18.5	30.06	F	Sampled at 3.0' bgs
M5SG4	Interior	I/C	7/18/2016	0.0	0.0	3.2	14.4	30.13	S	Sampled at 3.0' bgs
M5SG5	Perimeter	I/C	7/18/2016	0.0	0.0	0.2	19.4	30.13	S	Sampled at 2.0' bgs
M5SG6	Interior	I/C	7/18/2016	0.5	11.0	0.1	19.7	30.13	S	Sampled at 1.5' bgs
M5SG7	Perimeter	C	7/18/2016	0.0	0.0	2.1	14.6	30.13	S	
M5SG8	Perimeter	C	7/18/2016	0.0	0.0	1.5	16.9	30.13	S	Sampled at 3.0' bgs
M5SG8QA	Perimeter	C	7/18/2016	0.0	0.0	1.7	16.4	30.13	S	QA/QC
M5SG9	Perimeter	C	7/18/2016	0.0	0.0	3.5	15.2	30.10	F	
M5SG10	Perimeter	C	7/20/2016	0.0	0.0	2.3	18.8	30.10	F	Sampled at 2.0' bgs

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 5
FTMM-08: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M8SG1	Interior	I/C	7/7/2016	3.3	7.0	20.8	0.3	29.86	S	
M8SG2	Interior	I/C	7/7/2016	0.0	0.0	1.2	18.7	29.84	S	
M8SG3	Interior	I/C	7/7/2016	41.6	OOOR	9.0	2.9	29.77	F	
M8SG3QA	Interior	I/C	7/7/2016	40.8	OOOR	9.3	2.8	29.77	S	QA/QC
M8SG4	Interior	I/C	7/7/2016	0.1	2.0	15.1	5.3	29.82	S	
M8SG5	Interior	I/C	7/7/2016	0.0	0.0	2.8	16.1	29.79	S	Sampled at 2.5' bgs
M8SG6	Interior	I/C	7/7/2016	19.2	OOOR	9.3	11.6	29.82	S	
M8SG7	Interior	I/C	7/7/2016	0.0	0.0	4.2	14.8	29.65	F	
M8SG8	Interior	I/C	7/7/2016	0.0	0.0	0.0	19.2	29.8	S	Sampled at 2.0' bgs
M8SG9	Perimeter	I/C	7/7/2016	0.0	0.0	1.2	18.5	29.87	S	
M8SG10	Perimeter	I/C	7/7/2016	0.0	0.0	4.2	15.3	29.82	S	
M8SG11	Perimeter	I/C	7/7/2016	0.0	0.0	2.8	17.3	29.77	F	
M8SG12	Perimeter	I/C	7/7/2016	0.0	0.0	2.8	17.3	29.79	F	
M8SG13	Perimeter	I/C	7/7/2016	0.0	0.0	0.8	19.1	29.82	S	
M8SG14	Perimeter	C	7/21/2016	0.0	0.0	2.2	17.1	29.82	S	Stepout
M8SG15	Perimeter	C	7/21/2016	0.0	0.0	0.8	19.1	29.82	S	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 6
FTMM-12: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M12SG1	Interior	I/C	7/13/2016	14.7	00R	2.6	11.9	30.09	S	Sampled at 2.5' bgs
M12SG2	Interior	I/C	7/14/2016	4.3	86.0	9.6	7.8	29.95	S	Sampled at 2.5' bgs
M12SG3	Interior	I/C	7/14/2016	0.3	7.0	0.6	17.4	29.95	S	
M12SG4	Interior	I/C	7/14/2016	0.6	13.0	17.3	1.1	29.95	S	
M12SG4QA	Interior	I/C	7/14/2016	0.1	2.0	16.7	1.1	29.95	S	QA/QC
M12SG5	Interior	I/C	7/14/2016	17.3	00R	7.9	8.9	29.87	F	
M12SG5QA	Interior	I/C	7/14/2016	23.2	00R	11.7	4.5	29.86	F	QA/QC
M12SG6	Interior	I/C	7/12/2016	30.6	00R	5.9	5.5	30.10	F	
M12SG7	Interior	I/C	7/12/2016	0.0	0.0	0.0	20.3	30.12	F	Sampled at 2.5' bgs
M12SG8	Interior	I/C	7/12/2016	0.0	0.0	0.0	20.2	30.12	F	Sampled at 2.0' bgs
M12SG9	Interior	I/C	7/12/2016	0.1	4.0	0.2	19.5	30.13	F	Sampled at 2.0' bgs
M12SG10	Perimeter	I/C	7/13/2016	0.0	0.0	1.8	18.1	30.09	S	
M12SG11	Perimeter	I/C	7/14/2016	0.0	0.0	0.5	19.4	29.87	F	
M12SG12	Perimeter	I/C	7/14/2016	0.0	0.0	17	14.1	29.94	S	
M12SG13	Interior	I/C	7/12/2016	2.5	48.0	0	21.0	30.12	F	Sampled at 1.75' bgs
M12SG14	Perimeter	I/C	7/12/2016	0.4	8.0	4.2	2.4	30.10	F	
M12SG14QA	Perimeter	I/C	7/12/2016	0.2	4.0	2.9	16.7	30.10	F	
M12SG15	Perimeter	I/C	7/14/2016	0.0	0.0	1.1	18.2	29.86	F	Sampled at 3.0' bgs
M12SG16	Perimeter	C	7/13/2016	0.0	0.0	0.4	20.1	30.08	F	Sampled at 2.5' bgs
M12SG17	Perimeter	C	7/14/2016	0.0	0.0	0.0	21	29.86	F	
M12SG18	Perimeter	C	7/12/2016	0.0	0.0	1.0	18.3	30.12	S	Sampled at 1.5' bgs

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) 00R = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 6
FTMM-12: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M12SG19	Perimeter	C	7/15/2016	7.4	OOR	2.9	5.9	29.91	S	
M12SG20	Perimeter	C	7/18/2016	0.3	6.0	7	18.8	30.13	S	
M12SG21	Perimeter	C	7/18/2016	0.0	0.0	0.4	19.2	30.13	S	Stepout
M12SG22	Perimeter	C	7/15/2016	4.9	98.0	3.3	12.1	29.92	S	Stepout
M12SG23	Perimeter	C	7/15/2016	0.0	0.0	0.2	17.6	29.92	S	Stepout
M12SG24	Perimeter	C	7/15/2016	0.0	0.0	2.6	13.8	29.92	S	Stepout
M12SG25	Interior	C	7/15/2016	0.0	0.0	3.5	12.6	29.92	S	Stepout, sampled at 2.0' bgs
M12SG26	Perimeter	C	7/18/2016	0.0	0.0	7.6	6.3	30.13	S	Stepout
M12SG26QA	Perimeter	C	7/18/2016	0.0	0.0	8.1	5.9	30.13	S	QA/QC
M12SG28	Perimeter	C	7/19/2016	0.2	4.0	0.1	17.0	30.13	S	Stepout
M12SG29	Perimeter	C	7/19/2016	0.0	0.0	3.2	14.4	30.13	F	Stepout
M12SG30	Perimeter	C	7/19/2016	0.0	0.0	0.7	19.7	30.12	F	Stepout
M12SG31	Perimeter	C	7/19/2016	0.0	0.0	0.5	19.7	30.12	F	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 7
FTMM-14: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M14SG1	Interior	I/C	7/21/2016	0.0	0.0	4.7	16.1	30.20	S	
M14SG2	Perimeter	I/C	7/21/2016	0.0	0.0	3.6	17.5	30.20	S	
M14SG3	Interior	I/C	7/21/2016	0.5	11.0	0.8	19.6	30.20	S	Sampled at 3.0' bgs
M14SG4	Interior	I/C	7/21/2016	16.5	OOOR	13.2	4.6	30.12	S	
M14SG5	Interior	I/C	7/21/2016	3.3	6.4	4.0	14.8	30.20	S	Sampled at 3.0' bgs
M14SG6	Interior	I/C	7/21/2016	0.0	0.0	1.9	17.7	30.20	S	
M14SG7	Interior	I/C	7/20/2016	0.0	0.0	0.3	19.5	30.23	F	Sampled at 3.0' bgs
M14SG7QA	Interior	I/C	7/20/2016	0.0	0.0	0.2	19.7	30.23	F	QA/QC
M14SG8	Interior	I/C	7/21/2016	1.1	2.2	3.0	16.2	30.11	S	Sampled at 2.0' bgs
M14SG9	Interior	I/C	7/21/2016	0.1	2.0	4.1	15.0	30.20	S	Sampled at 3.0' bgs
M14SG9QA	Interior	I/C	7/21/2016	0.0	0.0	5.2	14.2	30.20	S	QA/QC
M14SG10	Interior	I/C	7/21/2016	5.2	OOOR	1.9	18.7	30.12	S	
M14SG11	Perimeter	I/C	7/21/2016	0.0	0.0	0	20.6	30.11	S	Sampled at 2.0' bgs
M14SG12	Perimeter	I/C	7/21/2016	0.0	0.0	0	20.4	30.11	S	
M14SG13	Perimeter	I/C	7/21/2016	0.0	0.0	0	20.5	30.11	S	
M14SG14	Perimeter	I/C	7/21/2016	0.0	0.0	2.9	17.3	30.11	S	
M14SG15	Interior	I/C	7/20/2016	0.0	0.0	0.9	18	30.23	F	Sampled at 2.5' bgs
M14SG17	Perimeter	C	7/21/2016	0.0	0.0	0.2	20.1	30.20	S	
M14SG18	Perimeter	C	7/21/2016	0.0	0.0	1.0	19.4	30.11	S	
M14SG19	Perimeter	C	7/20/2016	0.0	0.0	1.8	18.3	30.23	F	Sampled at 2.5' bgs
M14SG20	Perimeter	C	7/21/2016	0.0	0.0	1.7	18.4	30.15	F	Stepout
M14SG21	Perimeter	C	7/21/2016	0.0	0.0	2.1	17.8	30.14	S	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 8
FTMM-18: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M18SG3	Interior	I/C	7/19/2016	0.0	0.0	0.8	19	30.14	S	
M18SG4	Interior	I/C	7/19/2016	0.0	0.0	0.3	19.5	30.14	S	Sampled at 3.0' bgs
M18SG5	Interior	I/C	7/19/2016	0.0	0.0	0.2	19.8	30.14	S	
M18SG7	Interior	I/C	7/19/2016	0.3	6.0	1.6	19.1	30.14	S	Sampled at 2.5' bgs
M18SG7QA	Interior	I/C	7/19/2016	0.2	4.0	0.5	19.7		S	QA/QC
M18SG9	Perimeter	I/C	7/19/2016	0.0	0.0	0.2	20.0	30.14	S	
M18SG10	Perimeter	C	7/19/2016	3.0	60.0	0.4	18.8		S	
M18SG11	Perimeter	C	7/19/2016	0.0	0.0	1.6	18.7	30.15	S	Stepout
M18SG12	Perimeter	C	7/19/2016	0.0	0.0	3.4	14.5	30.15	S	Stepout
M18SG13	Perimeter	C	7/19/2016	0.0	0.0	0.3	20.0	30.15	S	Stepout

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

Table 9
FTMM-25: Landfill Confirmation Round Methane Gas Survey Results
Landfill Methane Gas Confirmation Survey Report for Nine Landfills
Fort Monmouth, New Jersey

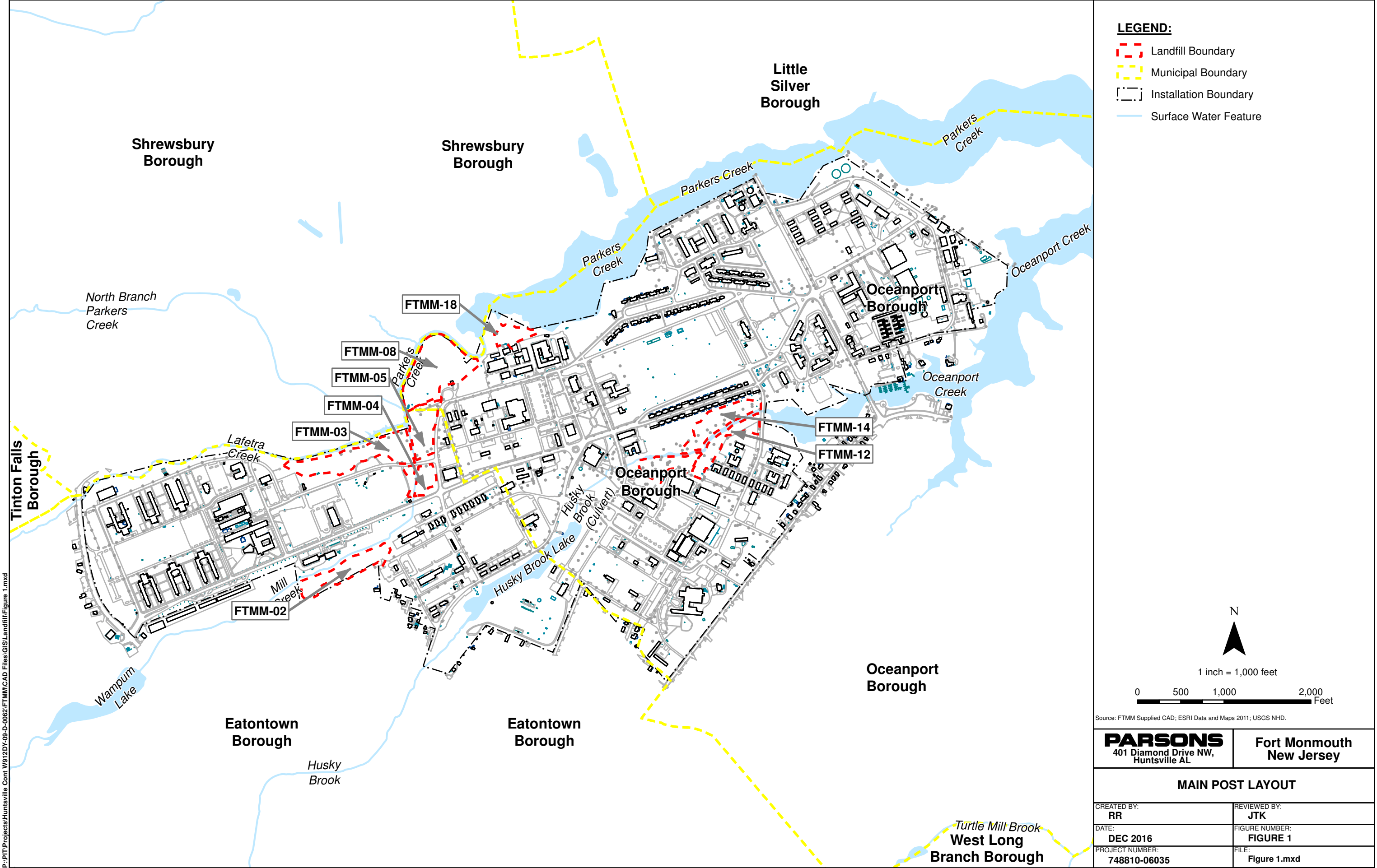
Soil Gas Sampling Point	Location	Sample Round	Date	Percent Methane	Percent of LEL	Percent Carbon Dioxide	Percent Oxygen	Barometric Pressure	Barometric Pressure	Comments
M25SG1	Perimeter	I/C	7/20/2016	0.0	0.0	0.5	20.2	30.26	S	
M25SG1QA	Perimeter	I/C	7/20/2016	0.0	0.0	0.4	20.1	30.26	S	QA/QC
M25SG2	Perimeter	I/C	7/20/2016	0.0	0.0	1.8	19.1	30.25	S	
M25SG3	Interior	I/C	7/20/2016	0.0	0.0	1.4	19.3	30.25	S	
M25SG4	Interior	I/C	7/20/2016	3.0	5.7	1.2	16.7	30.25	S	
M25SG5	Interior	I/C	7/20/2016	0.0	0.0	1.3	19.0	30.25	S	
M25SG6	Perimeter	I/C	7/20/2016	0.0	0.0	1.7	18.9	30.25	S	
M25SG7	Perimeter	I/C	7/20/2016	0.0	0.0	0.8	19.7	30.25	S	
M25SG8	Perimeter	C	7/20/2016	0.0	0.0	0.9	19.8	30.25	S	
M25SG9	Perimeter	C	7/20/2016	0.0	0.0	6.0	14.4	30.26	S	
M25SG10	Perimeter	C	7/20/2016	0.0	0.0	0.9	19.7	30.25	S	
M25SG11	Perimeter	C	7/22/2016	0.0	0.0	1.0	19.5	30.12	S	
M25SG12	Perimeter	C	7/22/2016	0.0	0.0	1.1	19.6	30.12	S	

Notes:

- 1) O = Original Round; C = Confirmation Round
- 2) OOR = Out of Range. Percent of Lower Explosive Limit was greater than 100% and out of the range of the instrument.
- 3) A LANDTEC Gas Extraction Monitor-2000 (GEM-2000) provided an instantaneous measurement of landfill gases. Each gas sample was analyzed for percent methane, percent of methane Lower Explosive Limit (LEL), percent CO₂ (Carbon Dioxide), and percent oxygen.
- 4) For barometric pressure; S = Steady, R= Rising, and F = Falling

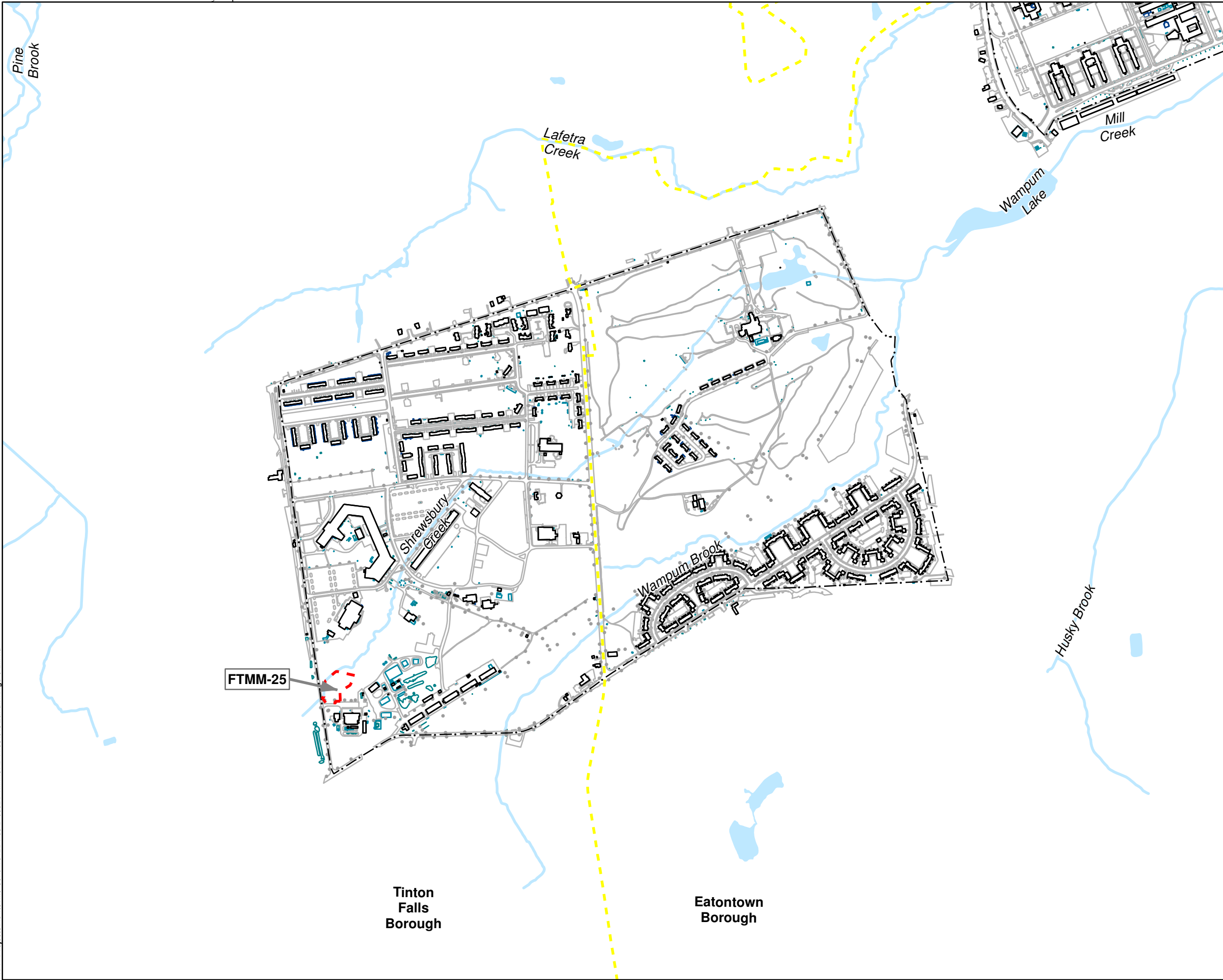
FIGURES

1		
2	Figure 1	Main Post Layout
3	Figure 2	Charles Wood Area Layout
4	Figure 3	FTMM-02 Landfill Initial and Confirmation Round Methane Gas Survey Results
5	Figure 4	FTMM-03 Landfill Initial and Confirmation Round Methane Gas Survey Results
6	Figure 5	FTMM-04 Landfill Initial and Confirmation Round Methane Gas Survey Results
7	Figure 6	FTMM-05 Landfill Initial and Confirmation Round Methane Gas Survey Results
8	Figure 7	FTMM-08 Landfill Initial and Confirmation Round Methane Gas Survey Results
9	Figure 8	FTMM-12 Landfill Initial and Confirmation Round Methane Gas Survey Results
10	Figure 9	FTMM-14 Landfill Initial and Confirmation Round Methane Gas Survey Results
11	Figure 10	FTMM-18 Landfill Initial and Confirmation Round Methane Gas Survey Results
12	Figure 11	FTMM-25 Landfill Initial and Confirmation Round Methane Gas Survey Results



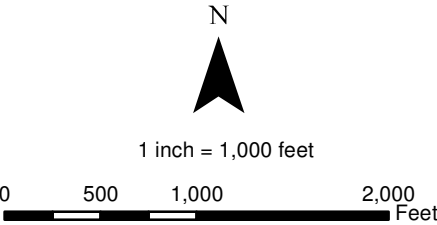
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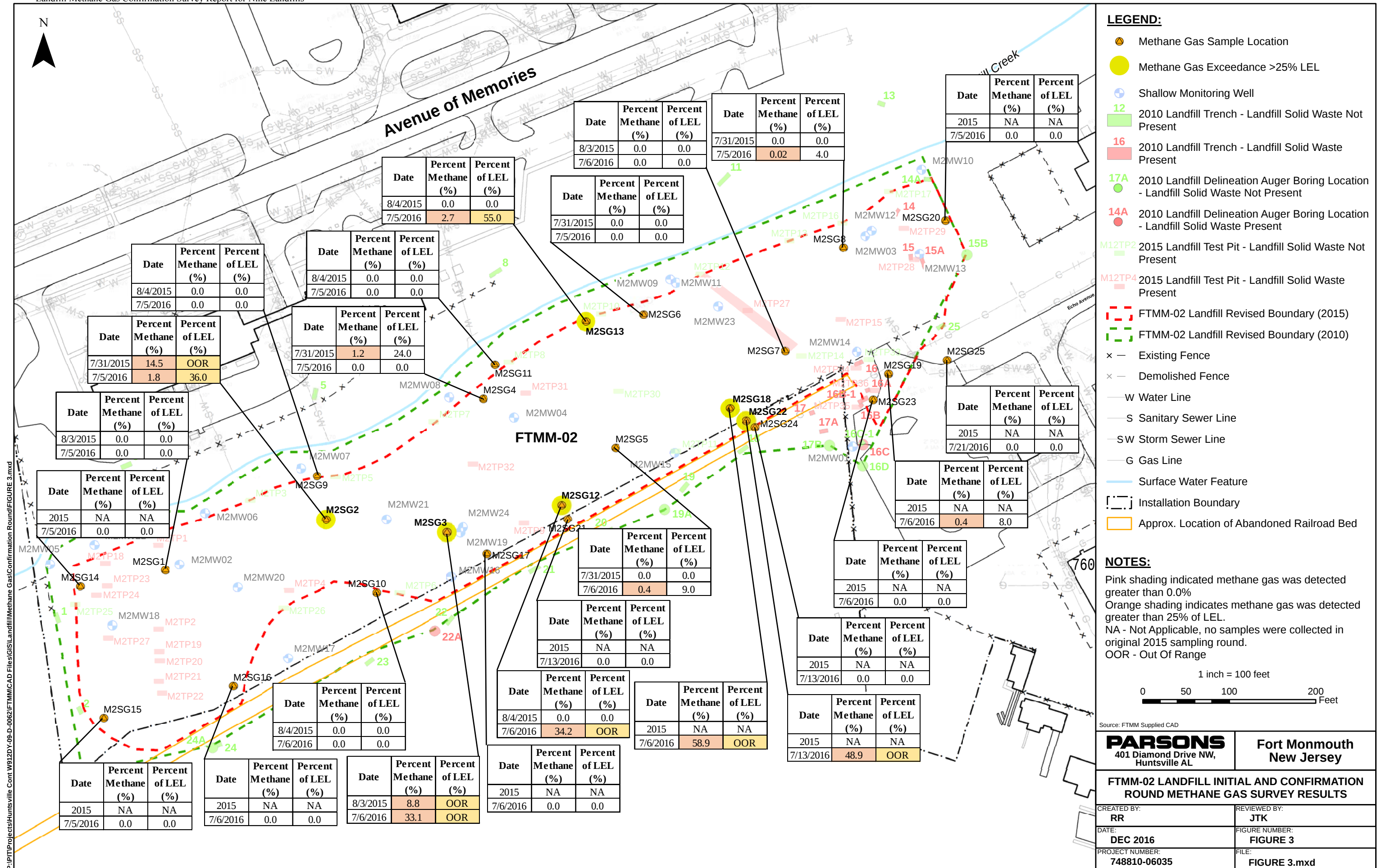
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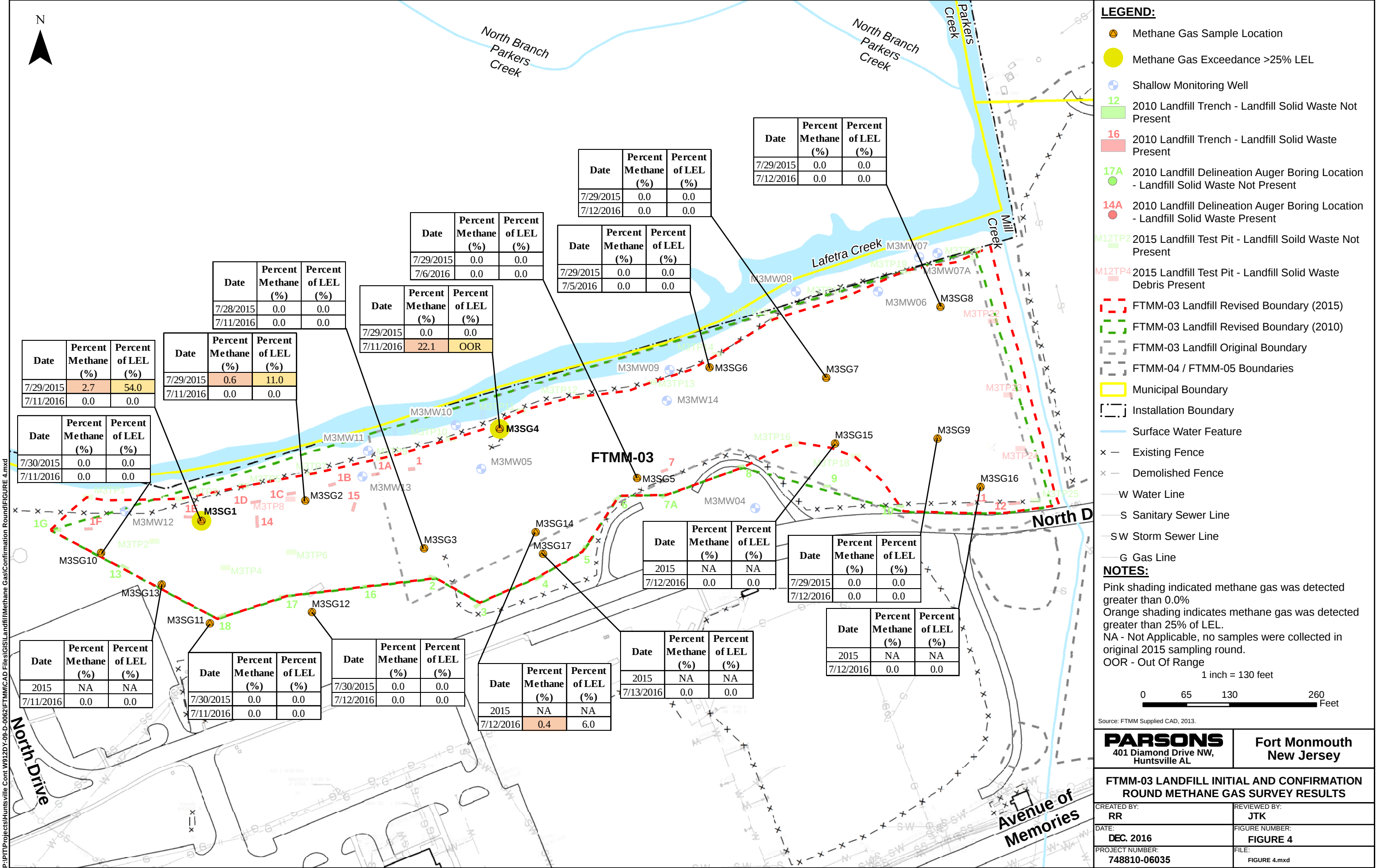
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- Municipal Boundary
- Installation Boundary
- Surface Water Feature

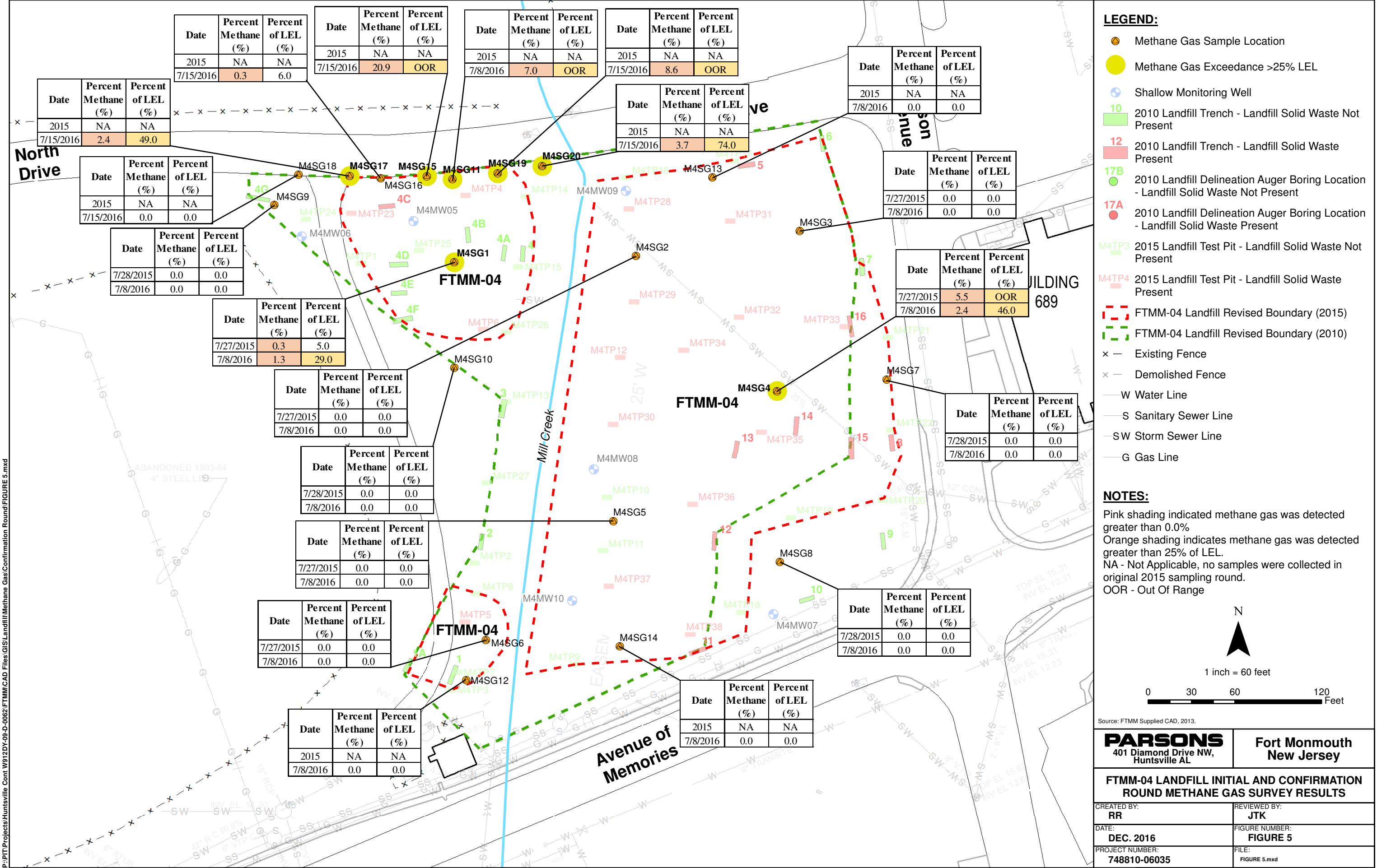


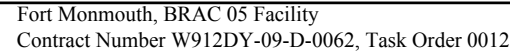
Source: FTMM Supplied CAD; ESRI Data and Maps 2011; USGS NHD.

PARSONS 401 Diamond Drive NW, Huntsville AL	Fort Monmouth New Jersey
CHARLES WOOD AREA LAYOUT	
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DATE: DEC. 2016	FIGURE NUMBER: FIGURE 2
PROJECT NUMBER: 748810-06035	FILE: Figure 2.mxd



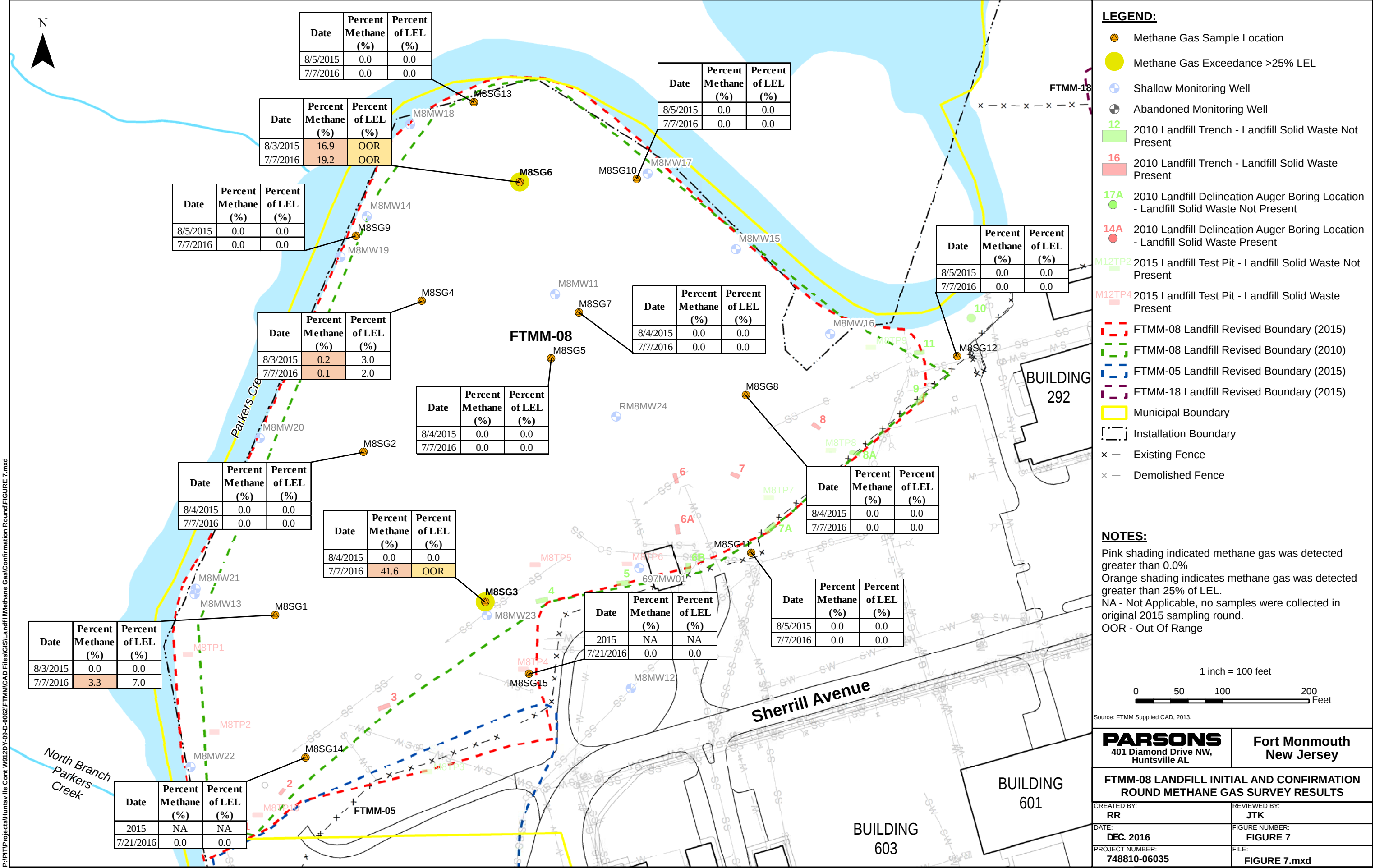


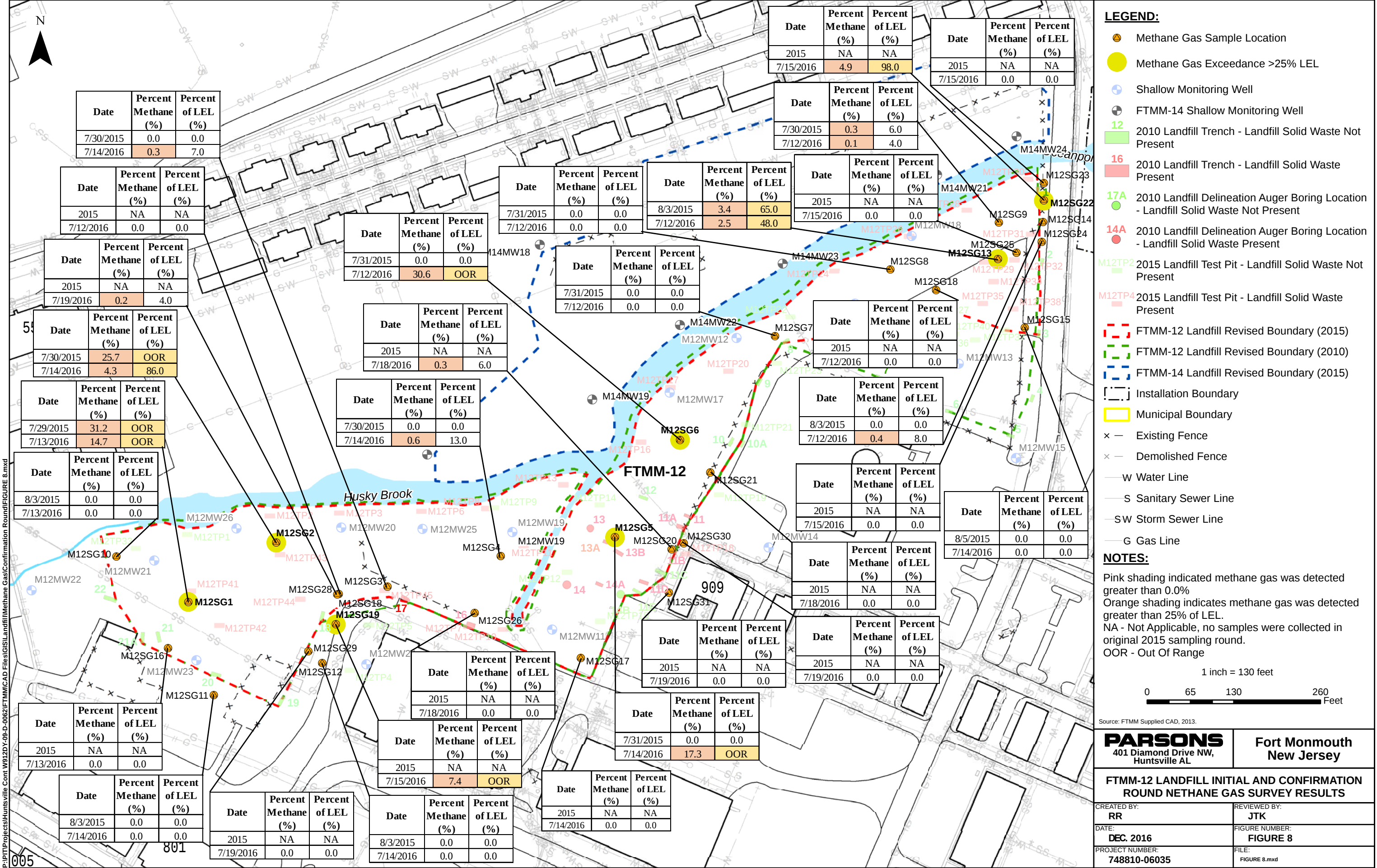


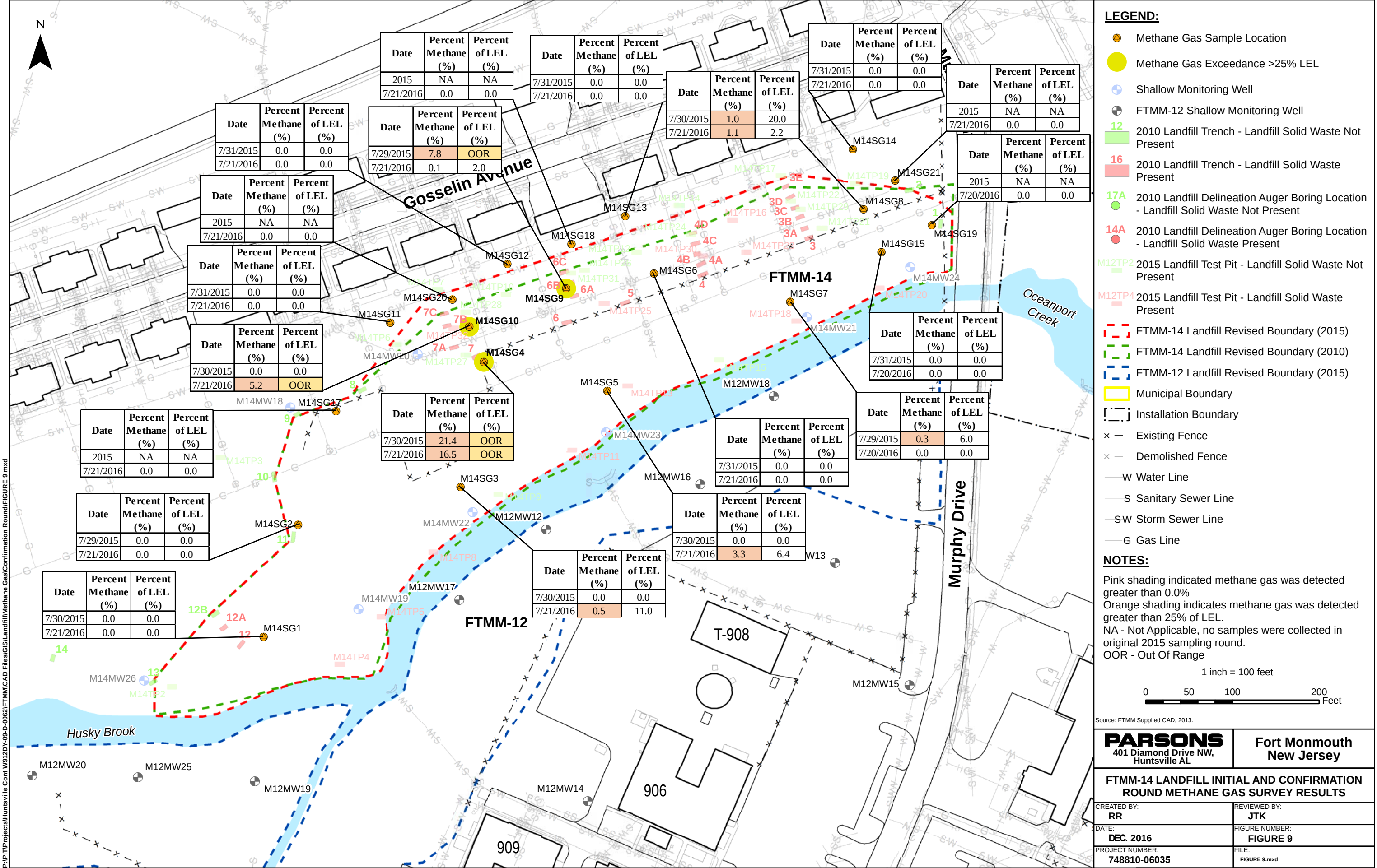


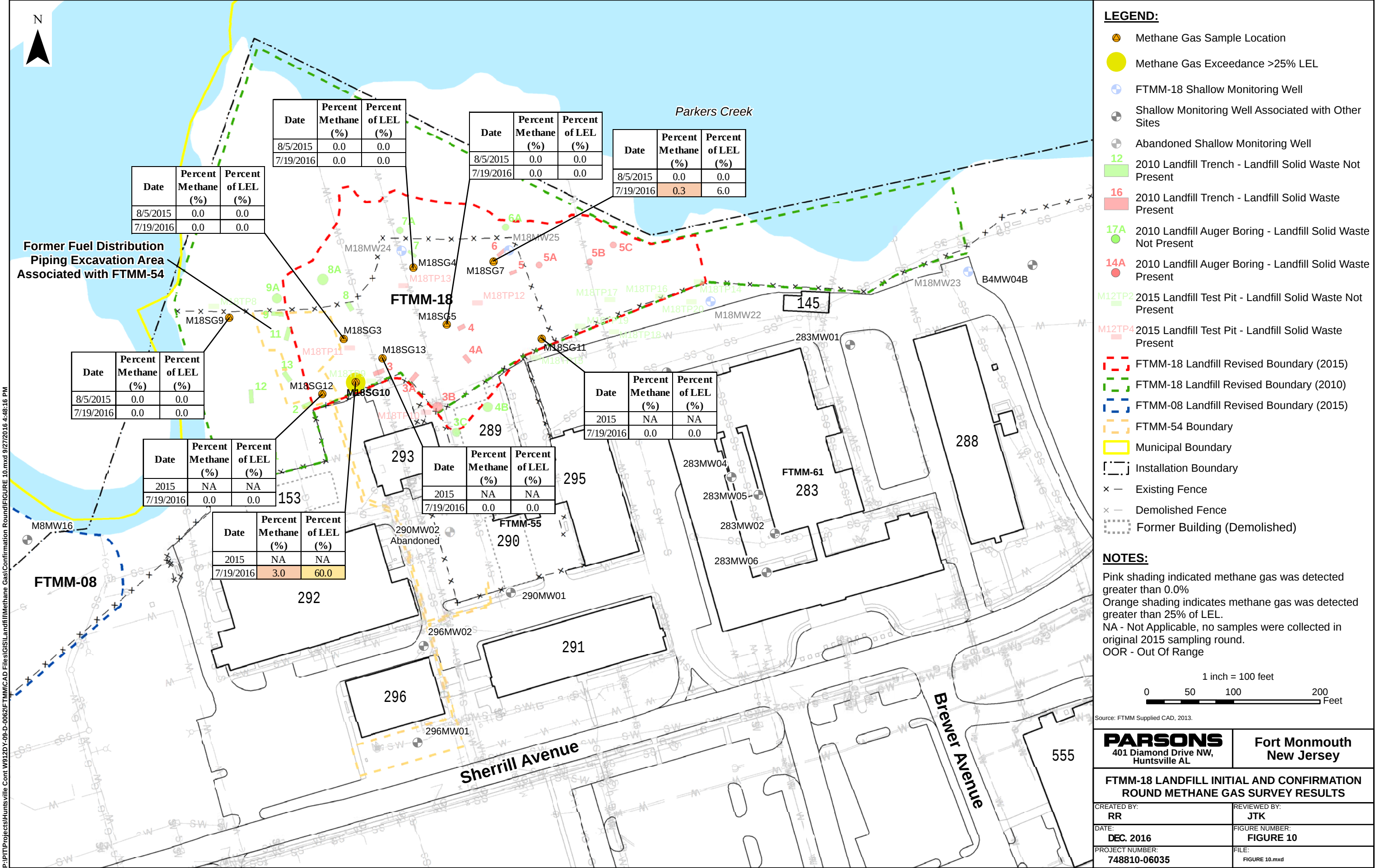
Source: FTMM Supplied CAD, 2013.

CREATED BY: RR	REVIEWED BY: JTK
DATE: DEC 2016	FIGURE NUMBER: FIGURE 6
PROJECT NUMBER: 748810-06035	FILE: FIGURE 6.mxd









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