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CONSTRUCTION COMPLETION REPORT- LANDFILL GAS SYSTEM MODIFICATIONS

REFUSE HIDEAWAY LANDFILL
BRRTS NO. 02-13-000849
CONSTRUCTION PROJECT NO. RRSP
7562 U.S. HIGHWAY 14
MIDDLETON, WISCONSIN 53562

Prepared for:

The Wisconsin Department of Natural Resources
Madison, Wisconsin

May 2015

Reviewed by:

Jennifer A. Shelton
Associate

Prepared by:

Charles Burgis
Environmental Engineer I

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CONSTRUCTION COMPLETION REPORT – LANDFILL GAS SYSTEM MODIFICATIONS

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1 INTRODUCTION

The Wisconsin Department of Natural Resources Bureau for Remediation and Redevelopment (WDNR) procured services from Leggette, Brashears & Graham, Inc. (LBG) for upgrading the landfill gas (LFG) extraction system at the Refuse Hideaway Landfill (Site). The objective of the project was to restore the collection of LFG from South branch wells GW4 and GW5. This report summarizes the construction activities completed by Terra Engineering & Construction Corporation (Terra) during the LFG extraction system upgrade project. The system upgrades generally consisted of the following:

- Replacing the redundant 6-inch diameter header that connected the South branch to the Central branch at the western extent of the collection system;
- Connecting the GW5 lateral wells to the new GW9/GW5 header;
- Installing two 6-inch flanged PVC butterfly valves to control flow from GW4 and GW5; and,
- Repositioning and/or replacing fencing around the existing gas/leachate extraction wells.

1.1 Site Location

The Site is located at 7562 U.S. Highway 14 in the Town of Middleton, Dane County, Wisconsin. The landfill is within the southwest quarter of the northwest quarter of Section 8 of Township 7 North, Range 8 East in the Town of Middleton. A Site location map is included as **Figure 1**. The latitude and longitude of the property are as follows:

Latitude: 43.0981992; Longitude: -89.5783898

1.2 Brief Facility History

The 23-acre landfill was filled with approximately 1.2 million cubic yards of municipal, commercial, and industrial waste during the period of 1974 to 1988. In 1986, the volume of waste deposited was nearing the landfill's design capacity and preparatory work was initiated to cease landfill operations. The presence of landfill seeps in 1986 and other operational issues prompted the WDNR to begin regulatory actions against the owner. The site was closed under court order in 1988 when volatile organic compounds were detected in private wells southwest of the Site. In addition, methane gas was migrating from the waste.

1.3 Remedial Actions

The landfill was covered in October 1988 with a cover consisting of layers of clay, general soil, and topsoil. The WDNR, through the Environmental Repair Program, constructed an active LFG extraction and combustion system and a leachate recovery system, which became operational on September 1, 1991. The LFG recovery system consists of a blower/flare station, a LFG collection network, and gas monitoring locations. The blower/flare station includes one centrifugal LFG blower, an enclosed flare (off-line), a pedestal flare (on-line), and associated controls and appurtenances. The LFG collection network consists of 13 extraction wells, 3 collection branches, 4 drip legs, and associated gas header piping. The LFG recovery system withdraws gas from the landfill in order to control surface emissions and subsurface migration. Odors and emissions are controlled by combusting the gas at the flare. The location of extraction wells and the general configuration of the pre-construction piping network are depicted on **Figure 2**.

The leachate collection system was upgraded in 1996 and currently consists of pneumatic pumps installed in nine of the extraction wells. The purpose of leachate extraction is to lower leachate head levels and reduce the potential for groundwater contamination. A compressor located near the blower/flare station supplies air to the pneumatic pumps. The leachate is stored onsite in a 25,000-gallon underground storage tank. Leachate is subsequently removed from the tank and transported to the Madison Metropolitan Sewerage District for treatment and disposal.

2 LFG COLLECTION SYSTEM OPERATIONAL ISSUES

The gas header collection network consists of the North, Central, and South branches. The branches are also connected together by a manifold at the blower/flare station and also by redundant

header segments at their western extremities to provide redundancy. The South branch gas header connects the LFG extraction blower to the collection wells on the southern slope of the landfill (GW1, GW2, GW3, GW4, and GW5). The South branch gas header also serves as a leachate collection header from GW5 to dripleg DL-1, where the dripleg removes the leachate and condensate from the gas header and conveys it to the leachate tank via a different pipe segment.

Even with the LFG extraction system in operation, issues have been encountered with stressed vegetation and LFG emanating through the landfill cover in the GW5 area. Activities have been conducted in an attempt to capture additional LFG and maintain a sufficient vacuum at the South branch extraction wells. For example, lateral wells were installed and connected to the GW5 wellhead during 1993. Based on conversations with WDNR personnel, the lateral piping within a segment of the South branch was repositioned at least once to address low points that had developed due to settlement within the landfill.

A review of a small subset of monthly operation and maintenance reports revealed that vacuum could not be applied to the South branch in the early 2000's. Furthermore, the redundant line connecting GW5 to GW9 through Control Valve 1 (CV1) was unable to provide vacuum to the South branch from the Central branch.

In August 2010, a vacuum truck evacuated the South branch header and vacuum was temporarily restored to the South branch wells. The successful restoration of vacuum to the South branch utilizing a vacuum truck suggested that leachate and/or condensate was likely accumulating in low spots in the piping and blocking off vacuum from the blower. The low spots could be attributed to landfill settlement as the waste decays. As leachate levels rose following the vacuum truck event, leachate pumps were brought back on-line in wells GW4 and GW5 in October 2010. Leachate subsequently filled low spots in the South branch and completely cut off vacuum to the wells. Since vacuum was also cut off from all the South branch wells once the GW4 and GW5 leachate pumps were brought back on-line, it is assumed there is a low spot(s) between the drip leg and GW1 in addition to other potential low spots along the South branch. Lateral wells (GW5-LE and GW5-LW) did not regain suction during the vacuum truck extraction event suggesting that condensate/leachate had accumulated in the solid pipe segments connecting the lateral wells to the GW5 wellhead.

Despite previous efforts, a sufficient vacuum could not be maintained through either the South branch header or the redundant pipe segment that connects the extremities of the Central and

South branches while leachate recovery pumps are operational in GW4 and GW5. Elevated methane concentrations remained in the GW5 area and pressure was observed on a consistent basis within the GW5 lateral extraction wells indicating a build-up of LFG under the landfill cover.

3 OBJECTIVES OF LFG SYSTEM MODIFICATIONS PROJECT

The objectives of the gas system modification project were as follows:

1. Restore the ability to collect LFG in the southwestern portion of the landfill near gas wells GW4 and GW5;
    a. Connect GW4 and GW5 to the western extent of the Central branch header;
    b. Upgrade GW5 lateral stickup sampling ports (GW5-LESP and GW5-LWSP, add GW5-LWMSP stickup) and connect the laterals to the central branch header;
    GW5-LESP: Gas well #5 lateral east sample port
    GW5-LWSP: Gas well #5 lateral west sample port
    GW5-LWMSP: Gas well #5 lateral west middle sample port
2. Reposition/replace the existing fences around the gas/leachate extraction wells and remove unnecessary equipment; and,
3. Seal any sources of air leaks at the wellheads (e.g. former electrical connections, wellhead access ports no longer used).

4 OBSERVATION OF CONSTRUCTION ACTIVITIES

4.1 September 2, 2014

Terra initiated site work by excavating two trenches. A north/south trench was excavated between GW9 and GW5 for the installation of the GW9/GW5 header. An east/west trench was advanced east from the GW9/GW5 header trench to GW4. The trenches were excavated to a depth greater than the design plans as the contractor did not observe an intact clay liner in this area of the landfill. The fence surrounding GW4 was removed to allow access to the wellhead. High density polyethylene (HDPE) piping arrived on site. A majority of the 6-inch diameter SDR 17 HDPE piping was laid out and fused together into two different segments. The fused piping was placed in the trenches.

4.2 September 3, 2014

Excavation activities continued in the GW5 area and west toward the lateral well GW5LW. While excavating in the vicinity of GW5 to unearth the connection to the first half of the GW5LW, refuse was encountered and extracted. Saturated conditions were evident at a depth of approximately 10 feet below grade where the horizontal laterals terminated near GW5 and water was apparently draining into the excavation. The crushed stone surrounding the laterals did not drain the water to the underlying refuse as anticipated. Due to the saturated conditions and the greater than expected depth of the GW5 lateral well connections, the design was modified. Field Order #1 was issued for the relocation of the GW5 lateral well connections. The design modification eliminated the need for prolonged dewatering of the excavation in the GW5 area. The design modification may also reduce the severity of future water blockages at the lateral well connections.

Instead of tying into the GW5LW (first half) at the saturated GW5 wellhead area, plans were revised and the proposed tie in location was shifted upslope and northwest along the GW5LW (first half) perforated pipe. The proposed tie-in location for the GW5LW (second half) was also shifted from the southeastern end of the perforated pipe to the northwest end of the perforated pipe (the tie in location and sample port are identified as GW5-LWSP on **Figures 3 and 4**).

Terra placed welded piping within the trenches using native material as bedding (see photographs included in **Appendix I**). LBG documented the relative placement and elevation of the piping by recording global positioning system (GPS) points along the GW9/GW5 header and the piping installed between GW4 and the GW9/GW5 header. The trenches were backfilled.

During the construction, Terra severed a compressed air line running between GW5 and GW9. By energizing the compressor, LBG and Terra confirmed that the severed line was part of the leachate recovery compressed air system. The line was repaired and pressure-tested by Terra.

4.3 September 4, 2014

Rain prevented Terra from conducting work at the Site. Based on weather data from Weather Underground (wunderground.com/history), approximately 1.91 inches of rain fell in the Madison area on September 4, 2014.

4.4 September 5, 2014

A trench was excavated perpendicular to the new GW9/GW5 header toward the GW5-LWSP stickup location (**Figure 4**). Refuse was removed in the vicinity of GW5-LWSP in order to access

the lateral pipe invert. Approximately 100 feet of 4-inch diameter HDPE pipe was installed. LBG personnel collected GPS points along the pipe route, refuse was placed back into the excavation near GW5-LWSP, and the trench was backfilled.

Terra personnel repositioned the fences around the gas/leachate wellheads. Each fence was repositioned with the use of a backhoe and cleared of excess vegetation so that the gates can freely swing open and closed. Outdated electrical boxes and equipment were removed from the wellheads. The pneumatic pump regulators, which are associated with the air lines for each well pump, were secured to the wellhead piping.

Terra began excavating to connect to the GW5-LW (first half). However, Terra found the proposed area for the connection and stickup too saturated. The stickup location was moved again, approximately 15 feet farther to the northwest along the lateral line. The moisture conditions in this area were deemed acceptable by Terra. Terra excavated a trench to this area from the new GW9/GW5 header. The GW5-LWMSP stickup was connected to the perforated lateral piping and approximately 50 feet of 4-inch diameter HDPE piping was installed to connect the stickup to the GW9/GW5 header.

During the afternoon, Terra personnel began excavating along the perforated lateral GW5LE (first half). The area close to GW5 remained saturated. The first half segment of the GW5EL was not connected to the system because the lateral was under water and the GW5 well screen should be able to provide a sufficient radius of influence in the immediate vicinity of GW5. The initial excavation along the GW5LE lateral pipe was backfilled. The location of the connection to the GW5-LE (second half) was moved to the northeast end of the GW5LE lateral pipe (see GW5-LESP location on **Figure 4**).

4.5 September 8, 2014

A trench was excavated from the GW5LESP stickup location to the GW9/GW5 header. The GW5-LESP stickup was connected to the perforated lateral piping for GW5-LE (second half). Approximately 25 feet of 4-inch diameter HDPE piping was installed to connect the GW5LESP stickup to the GW9/GW5 header. Terra pressure tested the recently installed piping to approximately 20 pounds per square inch (psi). No loss of pressure was observed after approximately 30 minutes. GPS data was recorded by LBG along the pipes connecting to the GW5-LESP and GW5-LWMSP stickups.

Terra personnel continued to reposition the gas/leachate wellhead fences and remove non-operational electrical boxes.

4.6 September 9, 2014

Control valves were installed at GW4 and GW5 so that vacuum to each wellhead can be controlled. Sampling ports were also installed at the three GW5 lateral stickups. Remaining excavations in the vicinity of GW4, GW5, GW5-LWMSP, and GW5-LE were backfilled. Terra began removing the electrical boxes and other equipment from the Site. Terra contacted CGC, Inc. to conduct compaction testing. CGC, Inc. conducted compaction tests near the GW4 and GW5 wellheads and the three new GW5 lateral stickups.

Terra indicated that the scope of work was substantially complete so LBG personnel conducted a site inspection on the afternoon of September 9, 2014. With a vacuum applied to GW4 and GW5, several air leaks were evident at the wellheads, due in part to the removal of the non-operational electrical components. With WDNR approval, a change order was issued to Terra to address air leaks at the wellheads.

4.7 September 19, 2014

Terra personnel addressed air leaks in the LFG extraction piping at the wellheads. A majority of the air leaks were attributed to ports where old electrical lines had previously entered the wellheads or where sampling ports had once been installed. An air leak was observed in the abovegrade piping that connected GW4 to the South branch header. With the connection of GW4 to the Central branch via the GW9/GW5 header, the GW4 connection to the South branch header was removed and capped off.

5 SYSTEM START-UP

Following the completion of construction activities, the LFG extraction system was brought online on September 9, 2014. LFG concentrations at the GW4 and GW5 wellheads, the GW5 lateral stickups, and the blower station were monitored. With vacuum applied to the new header system, methane was detected at trace levels within the GW4 and GW5 wells, but at elevated levels within the GW5 lateral stickups. Ambient oxygen levels were observed in wells GW4 and GW5, while lower levels were recorded in the GW5 lateral stickups. At the blower station, moderate methane levels were observed (15.5 percent) but elevated oxygen levels (12.1 percent) required wells GW4

and GW5 to be taken offline until methane concentrations increased and oxygen concentrations diminished.

Further system monitoring in subsequent weeks revealed that methane would build up in GW4 and GW5 to high concentrations (50 to 70 percent) when no vacuum was applied to the wells. However, the methane levels were not sustainable when a constant vacuum was applied to the wells. Oxygen concentrations followed the inverse trend of methane (very low concentrations with no vacuum applied and near ambient concentrations once a vacuum was applied for an extended duration). The GW5 laterals displayed inconsistent (but higher) methane levels under vacuum. With a constant vacuum being applied to the lateral wells from the Central branch, oxygen levels were elevated at the lateral stickups during September.

The GW5 lateral wells were connected directly to the new GW9/GW5 header system without individual valves for several reasons: High methane concentrations were observed historically at the lateral well sample ports; project costs would be minimized if additional valves were not installed and fused to the underground piping at each lateral well segment; and inflatable sewer balls could be installed within the lateral well stickups to block off vacuum to the lateral wells if it was deemed necessary.

The compaction test results were provided to LBG on September 26, 2014. The results of the compaction tests indicated that the trench backfill met the specified 85 percent compaction density required for pipe bedding and cover materials (**Appendix II**). The average density for the six samples was 91.5 percent. Four of the six samples passed the 90 percent compaction density required for clay cover materials; however, the material encountered during construction was not classified strictly as clay. The material was a mixture of clay, sand, gravel and rock. Cracks in the landfill surface in the immediate vicinity of GW4 and GW5 were observed during October 2014. The cracks likely resulted from some settlement in excavation area. Vegetation began to establish itself on the disturbed areas prior to winter. No other issues associated with the landfill cover were noted in the months following the excavation.

6 CONCLUSIONS

Historically, elevated methane concentrations have been evident at the GW4 and GW5 wellheads. In order to address methane emanating from the landfill cover and stressed vegetation, lateral wells were installed in the vicinity of GW5 during 1993. Apparent blockages of condensate

and leachate within the header system prevented a vacuum from being applied to the South branch wells via the South branch or the Central branch. Segments of the South branch header were apparently excavated and the slope of the pipe was re-established. Despite these historical efforts, a sustained vacuum could not be maintained at the South branch wells or lateral wells. Stressed vegetation and elevated methane concentrations remained in the vicinity of GW4 and GW5.

Upgrades to the LFG collection system were installed to address the lack of vacuum extraction points on the southwest side of the landfill. The construction of the LFG extraction system upgrades was completed in five working days. The contractor excavated the trench for the header pipe to a depth greater than the design plans because the contractor did not see evidence of unearthing the clay cover. LBG approved other modifications to the design due to greater than anticipated depth of the lateral wells in the vicinity of GW5, saturated soil conditions, and the inability for water to drain from the crushed rock at bottom of the trench near GW5 into the underlying refuse. Three out of the four perforated lateral well segments were connected to the new GW9/GW5 header system. The first half segment of the GW5EL was not connected to the system because the lateral was under water and the GW5 well screen would be able to provide influence in the immediate vicinity of GW5. The connections to the lateral wells and the associated stickups were relocated up slope to avoid the saturated area around GW5. Leaks became apparent at the GW4 and GW5 wellheads after a vacuum was successfully applied to the wells upon substantial completion of the project. The air leaks were addressed.

Following the completion of the construction activities, vacuum was observed at the GW4 and GW5 wellheads and at the sample ports on the lateral well stickups. Monitoring data indicated that sustained levels of methane could not be maintained from the wells in this area. Wells GW4, GW5 and the lateral wells may need to be cycled on and off based on future gas concentrations. Cycling the wells should minimize the migration of methane through the landfill cover and to promote the growth of vegetation while trying to minimize oxygen concentrations in the LFG. Inflatable packers may be installed in the stickups for the lateral wells to block off the lateral wells from the system's vacuum while methane concentrations are allowed to increase.

FIGURES

U.S.G.S TOPOGRAPHIC
7.5 MINUTE QUADRANGLE

DATE:	01/30/14
REVISION:	0
DISK:	j:\\RefuseHideaway\Figures
FILE:	Area Location.dwg
DRAWN:	ALB
CHECKED:	JAS

PREPARED BY:

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REFUSE HIDEAWAY LANDFILL
7562 U.S. HIGHWAY 14
MIDDLETON, WISCONSIN 53562

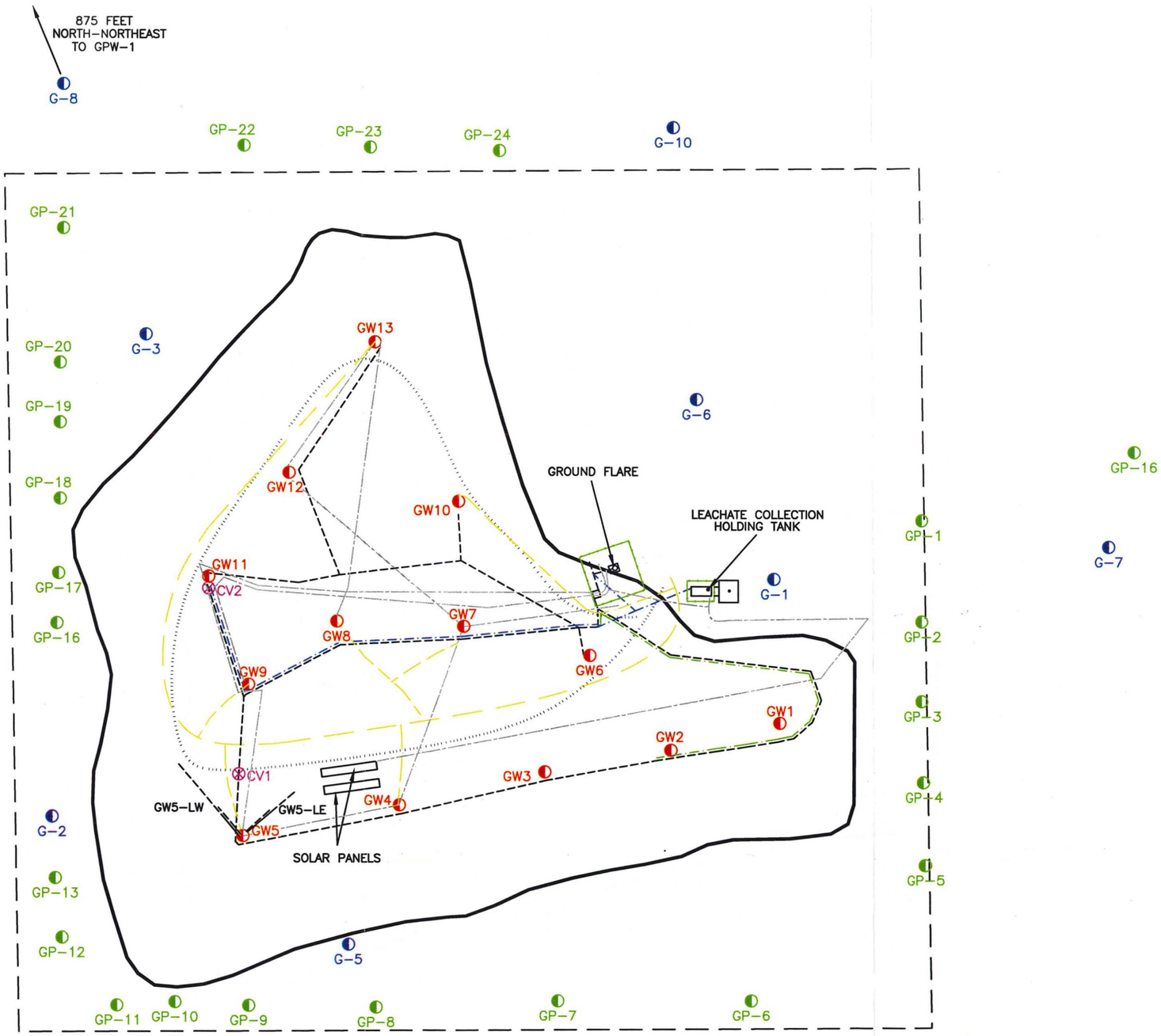
AREA LOCATION MAP

FIGURE:

1

LEGEND

- GW9 — EXISTING LEACHATE/GAS EXTRACTION WELL LOCATION
- G-8 — GAS PROBE LOCATION ("G" SERIES)
- GP-16 — GAS PROBE LOCATION ("GP" SERIES)
- CV1 — CONTROL VALVE LOCATION
- PROPERTY BOUNDARY
- FILL LIMITS
- GAS HEADER PIPE
- LEACHATE CONVEYANCE PIPE
- LEACHATE CONVEYANCE PIPE (NEVER PUT IN SERVICE)
- FENCE LINE
- ACCESS ROAD
- ELECTRICAL
- AIR LINE



N

0 180

SCALE IN FEET

NOTE: ALL LOCATIONS ARE APPROXIMATE

NOTE: FENCES AROUND WELLHEADS ARE NOT SHOWN. FENCE ENCLOSURES MEASURING 4'x7' ARE LOCATED AT ALL LEACHATE/GAS EXTRACTION WELL LOCATIONS EXCEPT GW5.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
REFUSE HIDEAWAY LANDFILL
MIDDLETON, WI

PRE-CONSTRUCTION SITE MAP

FILE: SITEMAP.DWG | DATE: SEPTEMBER 2009 | FIGURE: 2

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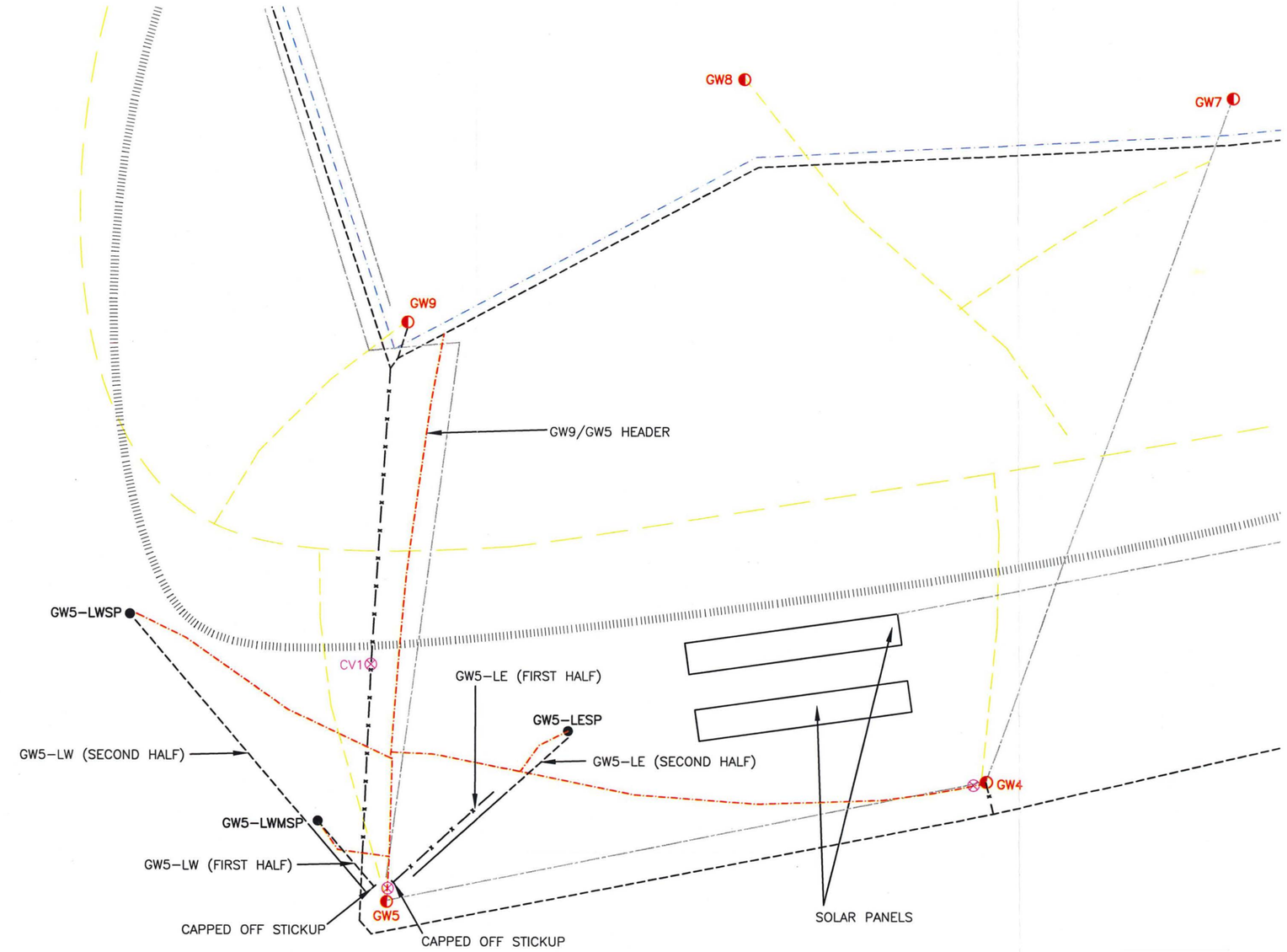
REVISED 5/14

LEGEND

- GW9 — LEACHATE/GAS EXTRACTION WELL LOCATION
- GW5–LWSP — LATERAL WELL SAMPLE PORT LOCATION
- CV1 — CONTROL VALVE LOCATION
- GAS HEADER PIPE
- LEACHATE CONVEYANCE PIPE
- ACCESS ROAD
- ELECTRICAL
- AIR LINE
- NEW GAS HEADER PIPING
- PIPING NO LONGER CONNECTED TO LFG COLLECTION NETWORK



N

0 50

SCALE IN FEET

NOTE: ALL LOCATIONS ARE APPROXIMATE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
REFUSE HIDEAWAY LANDFILL
MIDDLETON, WI

POST–CONSTRUCTION GW4 AND GW5
LANDFILL GAS PIPING

FILE: PM_SB_Z.dwg | DATE: May 2015 | FIGURE: 4

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APPENDICES

APPENDIX I:

CONSTRUCTION PHOTOGRAPHS

PHOTO:	*DATE:*	*SUBJECT:*
1	**9/3/2014**	**GW-4 During Construction (Looking Northwest)**

PHOTO:	*DATE:*	*SUBJECT:*
2	**9/3/2014**	**GW-5 During Construction (Looking South)**

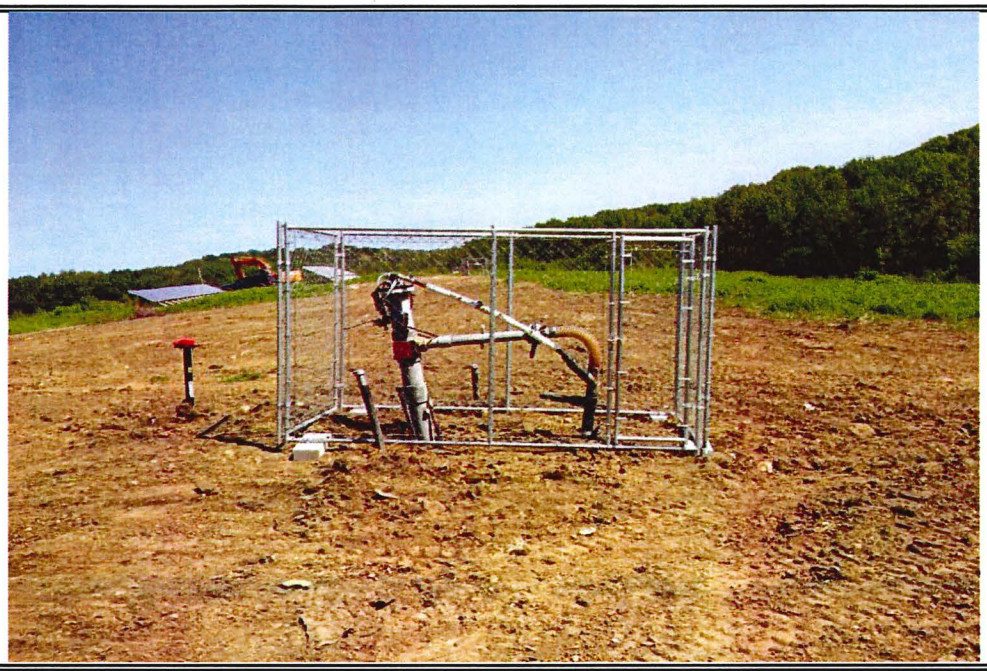


PHOTO:	DATE:	SUBJECT:
3	9/9/2014	GW-5 Post-Construction (Looking East)

PHOTO:	DATE:	SUBJECT:
4	9/11/2014	GW-5 and GW-5 Lateral West Middle Stickup Area Post Construction (Looking Southwest)

Job No.	C14387
Tested By	FHC
Date	9/17/14
Ticket No.	1900

CGC, Inc.

FIELD DENSITY TEST REPORT - NO. 1

CGC, Inc., 2921 Perry Street, Madison, WI 53713 - Phone (608) 288-4100 - Fax (608) 288-7887

PROJECT: Refuse Hideaway/Terra #1630
Middleton, Wisconsin

TO: Terra Engineering
2201 Vondron Road
Madison, WI 53704

ATTN: Mr. Chris Steinke

TEST METHODS: Moisture-density relationship of soils based on MODIFIED Proctor (ASTM D1557)
"METHOD" indicates: (N) Nuclear (ASTM D6938) or (S) Sand Cone (ASTM D1556)

Test No.	METHOD	Location	(1) Test Elevation (ft)	Distance Below Fill Surface (in)	Description of Material Tested	Moisture %	Dry Density lb/cu ft	Maximum Density lb/cu ft	Meas. Comp.	Spec. Comp.
9/9/14										
Well Trench Backfill										
1	N	3'E of GW #4	100.0	0	Brown Lean Clay, Little Sand and Gravel	14.6	112.0	127	88%	85%
2	N	95'E of GW #5	99.0	12	Brown Lean Clay, Little Sand and Gravel	17.0	114.1	127	90%	85%
3	N	12'N of GW #5	99.5	6	Brown Lean Clay, Little Sand and Gravel	16.7	120.4	127	95%	85%
4	N	15'S of GW #9	99.0	12	Brown Lean Clay, Little Sand and Gravel	16.2	119.0	127	94%	85%
5	N	30'N, 90'E of GW #5	98.7	14	Brown Lean Clay, Little Sand and Gravel	14.4	112.4	127	89%	85%

Test No.	METHOD	Location	(1) Test Elevation (ft)	Distance Below Fill Surface (in)	Description of Material Tested	Moisture %	Dry Density lb/cu ft	Maximum Density lb/cu ft	Meas. Comp.	Spec. Comp.
6	N	25'N of GW #5	99.3	8	Brown Lean Clay, Little Sand and Gravel	14.3	117.5	127	93%	85%

Comments: (1) Test elevations referenced to finished grade at EL 100.0 ft (assumed datum).

During our site visit on September 9, 2014, a total of six (6) field density tests were performed within cohesive soils placed as gas well trench backfill. In general, the test results met the required 85% compaction level at the elevations and locations tested based on modified Proctor methods (ASTM D1557). The required compaction level was provided by you. Rod probe penetrations (using a hand-held 5/8-in. diameter steel rod) typically ranged from 4 to 6 in. in the cohesive soils within the fill areas tested and adjacent non-tested areas, implying a fairly uniform compaction process.

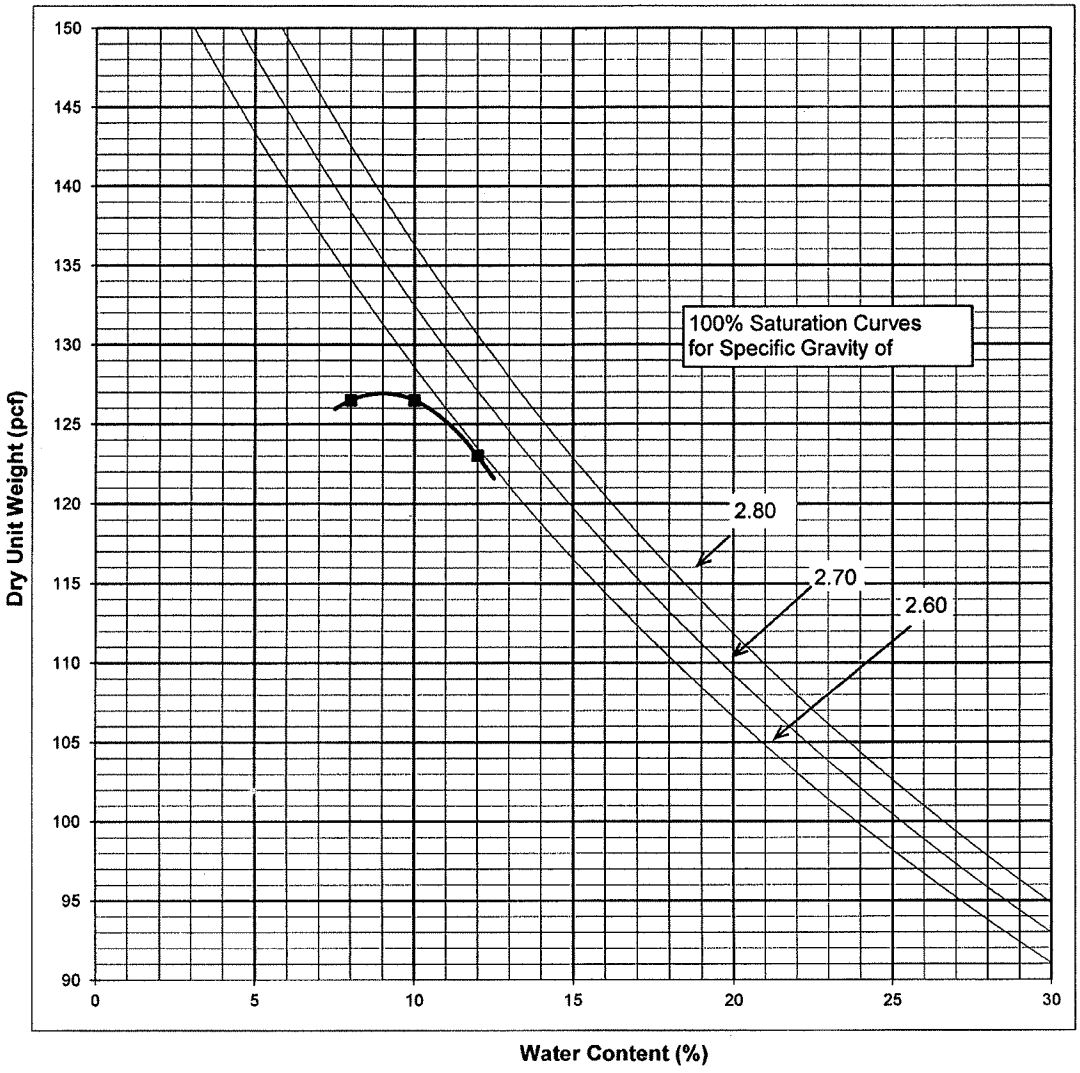
One sample of cohesive backfill was returned to our laboratory to develop a modified Proctor curve (attached). The maximum dry density information from the curve was used to calculate in-place compaction values.

We trust this report addresses your present needs. If you have any questions, please contact us.

Signed Eric C. Neuh Dated 9/17/14

Eric Neuhauser, P.E.

TEST REPORT



Specimen No.	Maximum Dry Unit Weight, pcf	Optimum Water Content, %	
1	127.0	9.0	
Specimen Description			
Brown Lean Clay, Little Sand and Gravel			
Corrected Maximum Dry Unit Weight, pcf	Corrected Optimum Water Content, %		
See above	na		
Test Method	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity
ASTM D1557, Method A	-	-	-	2.7 (est.)
Preparation Method / USCS	% Gravel	% Sand	% Fines	% Oversize
Dry / CL	7.2	-	-	-

PROJECT: Refuse Hideaway
Middleton, WI

PROJECT NUMBER: C14387

LABORATORY COMPACTION TEST

CGC, Inc. | CHECKED BY: FHC | REVIEWED BY: ECN | 9-9-14

File:14387.pc1